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FORM 6-K

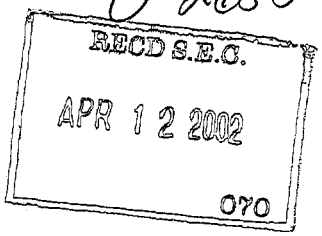


UNITED STATES
SECURITIES AND EXCHANGE COMMISSION
Washington, D.C. 20549

Report of Foreign Private Issuer

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

the Securities Exchange Act of 1934



For the period from March 27, 2002 to April 8, 2002

Metallica Resources Inc.

(Translation of registrant's name into English)

36 Toronto Street, Suite 1000
Toronto, Ontario M5C 2C5 Canada

(Address of principal executive office)

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

Form 20-F __X__ Form 40-F _____

PROCESSED
APR 15 2002
THOMSON
FINANCIAL

Indicate by check mark whether the registrant by furnishing the information contained in this Form is also thereby furnishing the information to the Commission pursuant to Rule 12g3-2(b) under the Securities Exchange Act of 1934.

Yes _____ No __X__

If "Yes" is marked, indicate below the file number assigned to the registrant in connection with Rule 12g3-2(b): 82-_____.

SIGNATURES

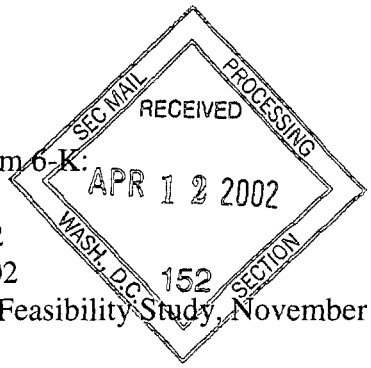
Pursuant to the requirements of the Securities Exchange Act of 1934, the registrant has duly caused the report to be signed on its behalf by the undersigned, thereunto duly authorized.

METALLICA RESOURCES INC.

By: _____

Name: Bradley J. Blacketor
Title: Chief Financial Officer

Dated: April 8, 2002



The following attached documents are filed under this Form 6-K:

Exhibit A: Press release No. 02-04 dated April 8, 2002
Exhibit B: Material Change Report Dated April 8, 2002
Exhibit C: Glamis Gold Ltd. Cerro San Pedro Project Feasibility Study, November 2000



METALLICA
RESOURCES INC

PRESS RELEASE

Press Release No. 02-04

METALLICA RESOURCES ANNOUNCES POSITIVE DRILL RESULTS AT THE EL MORRO PROJECT

DENVER, CO – April 8, 2002 - Metallica Resources Inc. (TSE: MR, NASDAQ OTC BB: METLF) reports that the current drilling program at its El Morro copper-gold project in Chile has extended the limits of the main La Fortuna deposit to the north and northwest as well as encountering additional significant mineralization in the El Morro area.

Noranda Chile Ltda, Metallica's joint venture partner at El Morro, has reported results on 4,112 meters of core in 9 holes and 4,364 meters of reverse circulation rotary (RVC) in 15 holes. Noranda currently has four core drills and one RVC drill working at the project and intends to drill a total of approximately 10,000 meters of core and 5,000 meters of RVC by the end of the campaign in mid-April. Included in this drilling is a 1,000 meter deep hole in the central part of the La Fortuna deposit designed to test the depth of the primary mineralized zone.

As previously reported, Noranda's objectives for this year's program are to:

- Test for an expansion of the inferred resource at the La Fortuna area to the north, northwest and at depth.
- Test known mineralization and geophysical targets that remain open in the El Negro and El Morro areas.
- Test new remote sensing, geophysical and geological targets throughout the property.

The core drill is being used for the expansion of the inferred resources and also in areas of known mineralization. The RVC drill is being used to test new exploration targets.

AREAS OF KNOWN MINERALIZATION

LA FORTUNA AREA

The La Fortuna area is the location of an inferred resource of 410 million tonnes grading 0.61 percent copper and 0.56 grams of gold per tonne, equating to approximately 5.5 billion pounds of copper and 7.4 million ounces of gold, at a cutoff grade of 0.4 percent copper. Holes DDHF-30 and DDHF-38 have extended the deposit to the north. Hole DDHF-30 returned 111 meters of secondary mineralization grading 0.80 percent copper and 0.40 grams of gold per tonne. Within this 111 meter interval is 65 meters grading 1.05 percent copper and 0.34 grams of gold per tonne. Below the secondary zone is 445 meters of primary mineralization grading 0.35 percent copper and 0.36 grams of gold per tonne. Hole DDHF-38, located approximately 200 meters northeast of hole DDHF-30, intersected 44 meters of secondary mineralization grading 1.51 percent copper and 0.47 grams of gold per tonne.

Rotary hole RCF-19, located approximately 500 meters north of the currently defined La Fortuna resource area, intersected 58 meters of secondary mineralization grading 0.32 percent copper and 0.02 grams of gold per tonne below 226 meters of overburden.

Core Drill Results

Hole	From (m)	To (m)	Length (m)	Cu %	Au g/t	Comments
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	184	248	65	1.01	0.34	Secondary Zone
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NORTHWEST EXTENSION OF THE LA FORTUNA AREA

Based on drill results from the 2001 campaign for hole DDHF-20, as well as geological and geophysical evidence, additional core drilling is being completed in an area approximately 700 meters northwest of the main La Fortuna resource area. Holes DDHF-33 and DDHF-34, along with hole DDHF-20, indicate the presence of a secondary copper zone that averages approximately 45 meters in thickness grading 0.52 percent copper and 0.17 grams of gold per tonne. Additional drilling has been completed in this area to better define this mineralization. Assays from these additional holes are pending.

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	74	346	272	0.02	0.21	Leached Zone
	346	404	58	0.30	0.11	Secondary Zone
	404	468	64	0.11	0.07	Primary Zone
	468	502	34	0.22	0.08	Primary Zone
	502	641	139	0.07	0.04	Primary Zone
DDHF-37	0	62	62	0.04	0.12	Leached Zone
	62	116	54	0.13	0.15	Leached Zone
	116	148	32	0.01	0.01	Leached Zone
	148	196	48	0.09	0.13	Secondary Zone
	196	412	212	0.05	0.07	Secondary Zone
	412	553	141	0.04	0.09	Primary Zone

No rotary holes have been drilled in the Northwest Extension area during this drilling campaign.

EL MORRO AREA

In its first drilling campaign on the El Morro project in 2000, Noranda drilled 12 core holes in the El Morro area totaling approximately 3,500 meters. Based on this drilling, a mineralized area of approximately 1,000 meters in length by 400 meters in width was projected. Using a copper cutoff grade of 0.35 percent copper, this mineralized area is approximately 130 meters thick and averages approximately 0.5 percent copper and 0.1 grams of gold per tonne.

During this drilling campaign, Noranda has drilled three RVC holes in the El Morro area. Rotary hole RDM-9, drilled within the northeast portion of the projected mineralized area, confirmed the mineralized area. This hole intersected 50 meters of secondary mineralization grading 0.91 percent copper and 0.58 grams of gold per tonne. The underlying primary mineralization returned 170 meters grading 0.45 percent copper and 0.27 grams of gold per tonne.

Rotary Drill Results

Hole	From (m)	To (m)	Length (m)	Cu %	Au g/t	Comments
RDM-8	0	294	294	0.01	0.02	Geology Pending
RDM-9	0	68	68	0.04	0.14	Leached Zone
	68	118	50	0.91	0.58	Secondary Zone
	118	288	170	0.45	0.27	Primary Zone
	288	400	112	0.08	0.04	Primary Zone
RDM-10	0	32	32	0.04	0.07	Geology Pending
	32	94	62	0.19	0.05	Geology Pending
	94	168	74	0.06	0.03	Geology Pending
	168	200	32	0.27	0.06	Geology Pending
	200	316	116	0.05	0.02	Geology Pending
	316	400	84	0.17	0.07	Geology Pending

No core holes have been drilled in the El Morro area during this drilling campaign.

EL NEGRO AREA

Prior to the 2002 drilling campaign, Noranda had drilled 16 core holes in the El Negro area totaling approximately 5,000 meters. Noranda has reported results from six additional holes in the El Negro area.

Core Drill Results

Two holes were drilled to test extensions to known mineralization at El Negro. The results from this drilling are as follows:

Hole	From (m)	To (m)	Length (m)	Cu %	Au g/t	Comments
DDHN-18	0	251	251	0.02	0.01	Geology Pending
DDHN-19	12	40	28	0.01	0.02	Primary Zone
	40	44	4	0.13	0.11	Fault Zone
	44	250	206	0.01	0.01	Primary Zone

Rotary Drill Results

Four RVC holes were drilled to test geophysical anomalies in the El Negro area. The results of this drilling are as follows.

Hole	From (m)	To (m)	Length (m)	Cu %	Au g/t	Comments
RCN-4	0	100	100	0.02	0.05	Geology Pending
RCN-5	4	138	138	0.01	0.02	Geology Pending
RCN-6	2	228	226	0.01	0.02	Geology Pending
RCN-7	0	122	122	0.05	0.03	Geology Pending
	122	132	10	0.55	0.02	Primary Zone
	132	250	118	0.07	0.02	Primary Zone

EXPLORATION AREAS

NORTH CAMP AREA

Two rotary holes were drilled to test a geophysical and geological target located approximately 1.5 kilometers northwest of La Fortuna. One of the holes, RCF-17, was re-entered and deepened with a core drill. The following are the results of the North Camp area drilling:

Rotary Drill Results

Hole	From (m)	To (m)	Length (m)	Cu %	Au g/t	Comments
RCF-17	0	50	50			Gravel – Not Assayed
	50	98	48	0.01	0.02	Leached Zone
	98	216	118	0.03	0.05	Leached Zone
	216	*400*	*184*			*See results for DDHF-36 below*
RCF-18	0	46	46	0.11	0.04	Leached Zone
	46	84	38	0.02	0.02	Leached Zone
	84	110	26	0.24	0.08	Secondary Zone
	110	194	84	0.09	0.11	Primary Zone

Core Drill Results

Hole	From (m)	To (m)	Length (m)	Cu %	Au g/t	Comments
DDHF-36	0	216	216			*See results for RCF-17 above*
	216	400	184	0.05	0.15	Primary

RENE MARTIN AREA

Two rotary holes were drilled to test a geophysical target approximately 1.5 kilometers south of the La Fortuna area. The results are as follows:

Rotary Drill Results

Hole	From (m)	To (m)	Length (m)	Cu %	Au g/t	Comments
RCTG-1	0	278	278			Gravel – Not Assayed
	278	324	46	0.02	0.05	Geology Pending
RCTG-2	0	260	260			Gravel – Not Assayed
	260	300	40	0.03	0.15	Geology Pending
	300	318	18	0.48	0.02	Fault zone, structure or lithologic contact
	318	342	24	0.07	0.03	Geology Pending
	342	362	20	0.18	0.03	Fault zone, structure or lithologic contact
	362	390	28	0.03	0.02	Geology Pending

No core holes have been drilled in the Rene Martin area during this drilling campaign.

CANTARITO AREA

One hole has been reported from the Cantarito area, which is located approximately 500 meters southeast of the La Fortuna resource area. The results are as follows:

Rotary Drill Results

Hole	From (m)	To (m)	Length (m)	Cu %	Au g/t	Comments
RCC-19	0	394	394	0.01	0.01	Geology Pending

No core holes have been drilled in the Cantarito area during this drilling campaign.

CERRO COLORADO AREA

Two holes were drilled to test a geophysical target located approximately two kilometers south of the El Negro area. The results are as follows:

Rotary Drill Results

Hole	From (m)	To (m)	Length (m)	Cu %	Au g/t	Comments
RCO-1	0	14	14	0.18	0.06	Leached Zone
	14	34	20	0.06	0.05	Primary Zone
	34	140	106	0.16	0.06	Primary Zone
	140	330	190	0.05	0.03	Primary Zone
RCO-2	0	88	88	0.11	0.04	Primary Zone
	88	304	216	0.08	0.04	Primary Zone

No core holes have been drilled in the Cerro Colorado area during this drilling campaign.

Bondar Clegg, of Coquimbo, Chile, using Gannet certified standards, has completed all of Noranda's analytical work on the project to date. The analytical method used is geochemical analysis for the copper and fire assay with an atomic absorption finish for the gold values. A quality control program, using project specific standards and blank samples, is ongoing. The qualified person responsible for the design and conduct of the work performed is Michael Donnelly for Noranda Inc.

Noranda is the project operator and can earn a 70 percent interest in the El Morro project by completing work commitments of US$10 million and making a cash payment to Metallica of US$10 million prior to September 2005. Noranda is also required to complete a bankable feasibility study by September 2007 and provide 91 percent of the capital required to develop the project.

Mr. Ritch Hall, Metallica's CEO, stated, "The drill results that we have received thus far are very encouraging. They extend the La Fortuna deposit to the north; extend the secondary copper mineralization 700 meters northwest of the known La Fortuna resource and substantiate the projected mineralized zone at El Morro."

Metallica Resources is a Canadian precious metals exploration and development company focused on Latin America. The company is well funded and has 28.5 million common shares outstanding. Visit Metallica Resources' web site at www.metal-res.com and send e-mail to metallica@metal-res.com.

CONTACT: Ritch Hall, President and CEO, (303) 796-0229, Ext. 304

THE STATEMENTS IN THIS PRESS RELEASE THAT ARE NOT HISTORICAL FACTS CONTAIN FORWARD LOOKING INFORMATION. THESE STATEMENTS ADDRESS FUTURE EVENTS INVOLVING KNOWN AND UNKNOW RISKS AND UNCERTAINTIES THAT COULD CAUSE ACTUAL RESULTS TO VARY MATERIALLY FROM PROJECTED RESULTS. THESE RISKS AND UNCERTAINTIES INCLUDE THOSE DESCRIBED IN METALLICA'S FORM 20-F.

DRILL HOLE COORDINATES-2002 DRILL CAMPAIGN

(April 8, 2002)

HOLE-ID	TARGET AREA	GRID EAST	GRID NORTH	COLLAR ELEV.	DIP	AZIMUTH	TOTAL DEPTH
DDHF-30	LA FORTUNA – N extension	413414	6833232	4132	-71	29	739
DDHF-38	LA FORTUNA – N extension	413507	6833410	4185	-70	30	291
RCF-19	LA FORTUNA – N extension	413690	6833765	4258	-90	0	400
DDHF-31	LA FORTUNA – NW extension	412708	6833375	4129	-70	30	603
DDHF-33	LA FORTUNA – NW extension	412846	6833638	4126	-68	30	600
DDHF-34	LA FORTUNA – NW extension	413198	6833567	4236	-60	211	641
DDHF-37	LA FORTUNA – NW extension	412645	6833630	4075	-70	31	553
RDM-08	EL MORRO	409675	6834800	3919	-70	190	294
RDM-09	EL MORRO	409035	6835169	3972	-70	210	400
RDM-10	EL MORRO	408695	6835253	3938	-70	180	400
DDHN-18	EL NEGRO	410784	6830874	3895	-68	55	251
DDHN-19	EL NEGRO	411400	6832500	3913	-69	216	250
RCN-04	EL NEGRO	411820	6830870	3872	-90	0	100
RCN-05	EL NEGRO	410984	6830461	3817	-90	0	138
RCN-06	EL NEGRO	411591	6830723	3867	-60	237	228
RCN-07	EL NEGRO	411486	6832378	3907	-68	213	250
RCF-17	LA FORTUNA - North Camp	411938	6833885	4064	-70	30	216
DDHF-36	LA FORTUNA - North Camp	411938	6833885	4064	-70	30	184
RCF-18	LA FORTUNA - North Camp	412280	6833670	4040	-68	30	194
RCTG-01	RENE MARTIN	413870	6831399	4129	-90	0	326
RCTG-02	RENE MARTIN	413706	6831149	4088	-90	0	390
RCC-19	CANTARITO	414269	6832683	4233	-68	32	394
RCO-01	CERRO COLORADO	410489	6829736	3915	-67	88	330
RCO-02	CERRO COLORADO	410491	6829542	3925	-70	170	304

Total Core 4,112 meters in 9 holes
Total RVC 4,364 meters in 15 holes

LA FORTUNA AREA

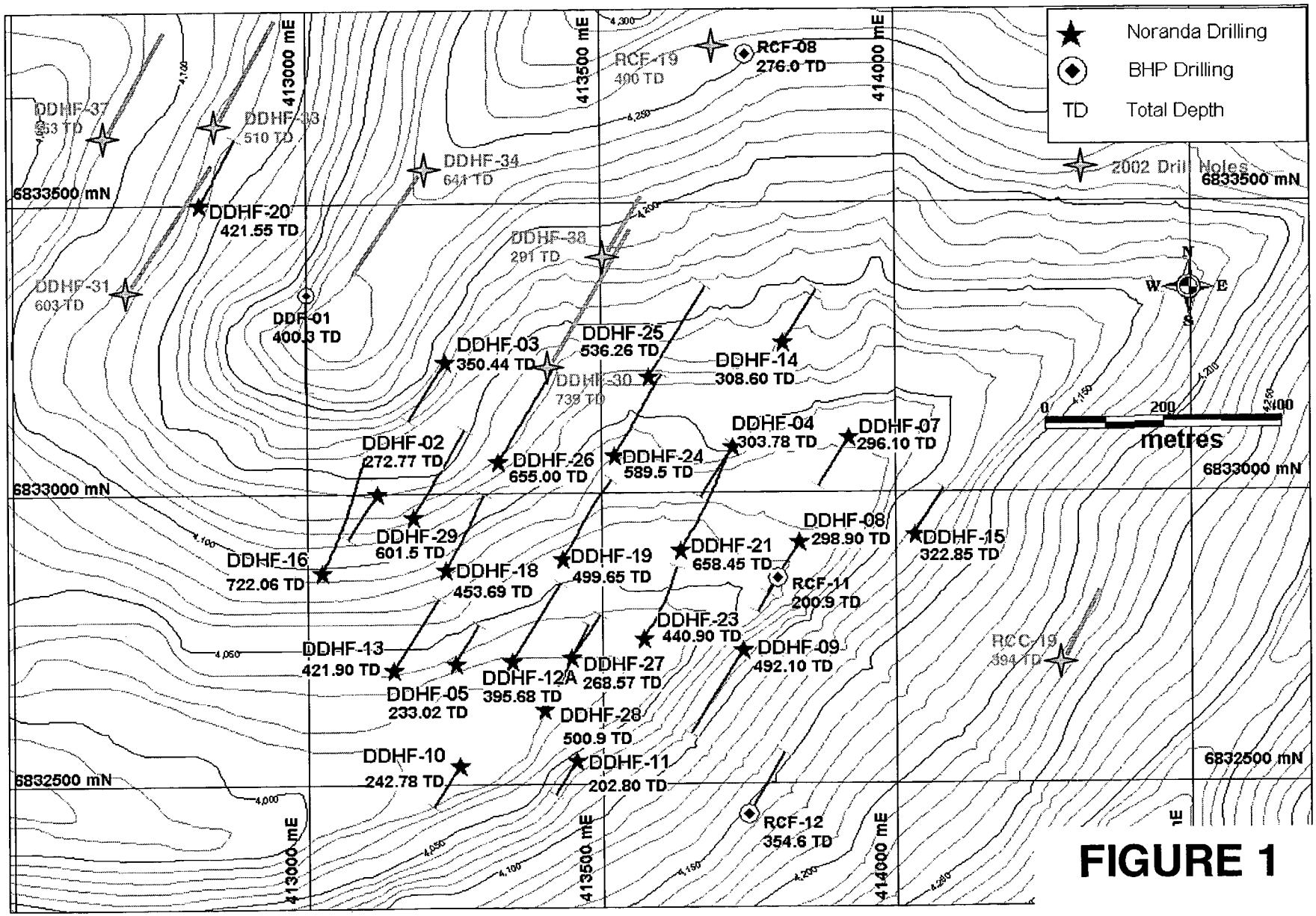


FIGURE 1

EL MORRO AREA

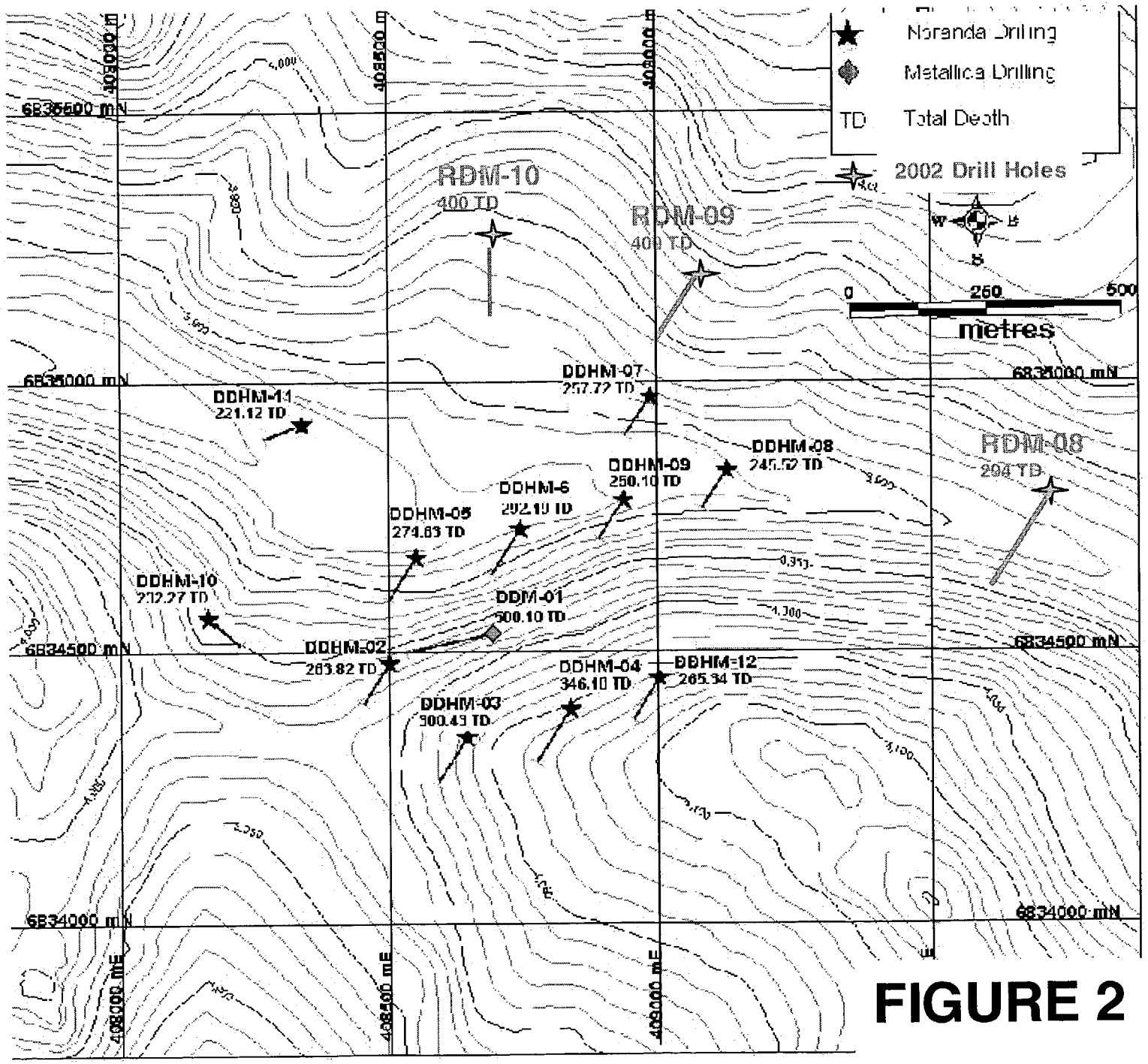


FIGURE 2

EL NEGRO AREA

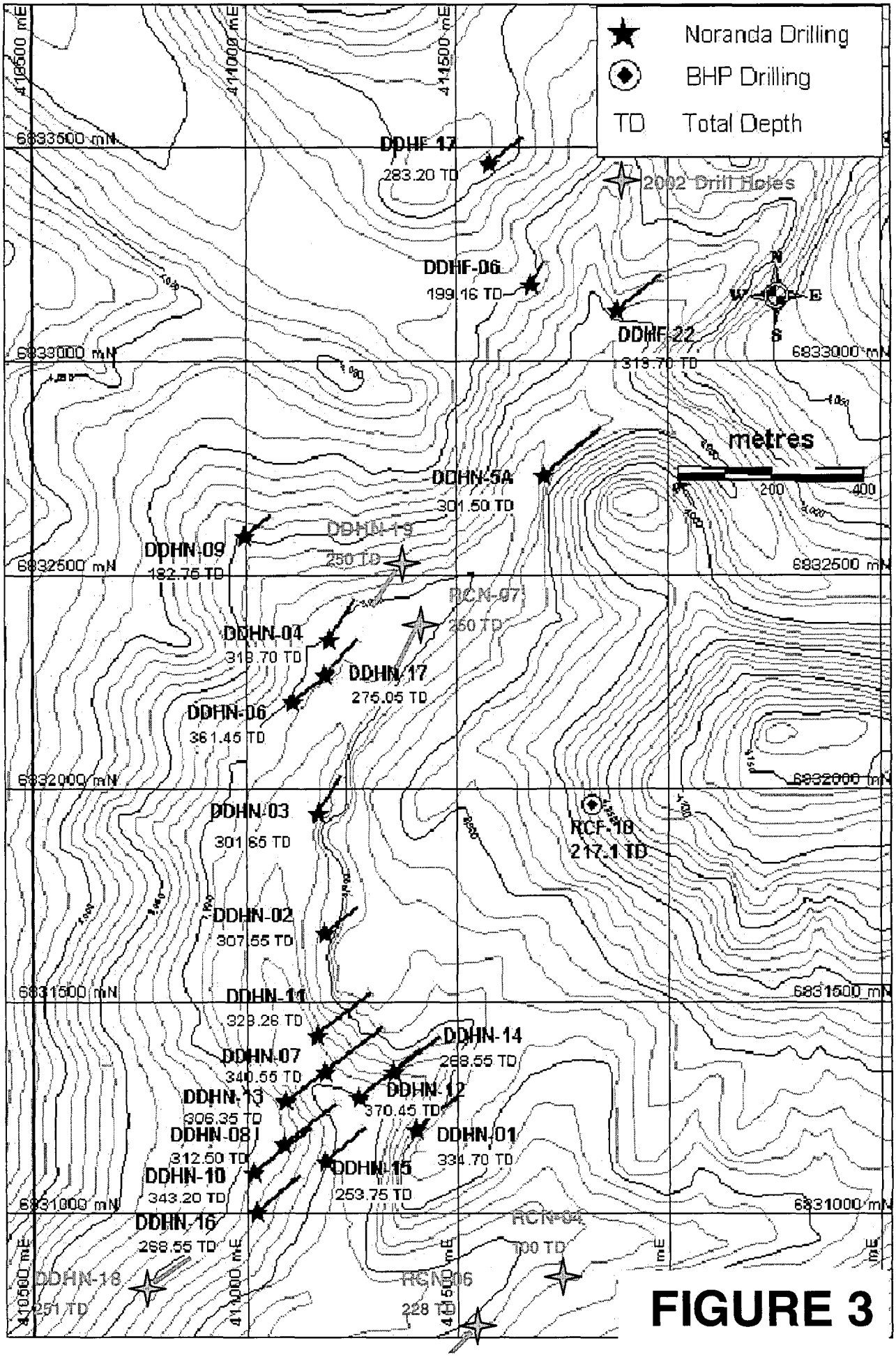


FIGURE 3

Exhibit B

METALLICA RESOURCES INC.
MATERIAL CHANGE REPORT UNDER SECTION 75(2) OF THE ONTARIO SECURITIES ACT

Item 1. Reporting Issuer:

Metallica Resources Inc.
c/o Metallica Management Inc.
3979 East Arapahoe Road, Suite 100
Littleton, Colorado 80122

Item 2. Date of Material Change

April 8, 2002

Item 3. Press Release

The press release attached as Exhibit "A" was released over Business Wire in the United States and BCE Emergis News Wire in Canada on April 8, 2002 pursuant to section 75(1) of the Act.

Item 4. Summary of Material Change

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Item 5. Full Description of Material Change

The material change is described in the press release attached as Exhibit "A".

Item 6. Reliance on Section 75(3) of the Act

not applicable

Item 7. Omitted Information

not applicable

Item 8. Senior Officers

The following senior officer of Metallica Resources Inc. may be contacted for additional information:

Mr. Richard J. Hall
Metallica Resources Inc.
c/o Metallica Management Inc.
3979 East Arapahoe Road, Suite 100
Littleton, Colorado 80122

Item 9. Statement of Senior Officer

The foregoing accurately discloses the material change referred to herein.

Dated at the Littleton, Colorado office on April 8, 2002.

"Richard J. Hall"
Richard J. Hall, President & CEO

METALLICA
RESOURCES INC

PRESS RELEASE

EXHIBIT #A

Press Release No. 02-04

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	346	404	58	0.30	0.11	**Secondary Zone**
	404	468	64	0.11	0.07	**Primary Zone**
	468	502	34	0.22	0.08	**Primary Zone**
	502	641	139	0.07	0.04	**Primary Zone**
DDHF-37	0	62	62	0.04	0.12	Leached Zone
	62	116	54	0.13	0.15	Leached Zone
	116	148	32	0.01	0.01	Leached Zone
	148	196	48	0.09	0.13	Secondary Zone
	196	412	212	0.05	0.07	Secondary Zone
	412	553	141	0.04	0.09	Primary Zone

No rotary holes have been drilled in the Northwest Extension area during this drilling campaign.

EL MORRO AREA

In its first drilling campaign on the El Morro project in 2000, Noranda drilled 12 core holes in the El Morro area totaling approximately 3,500 meters. Based on this drilling, a mineralized area of approximately 1,000 meters in length by 400 meters in width was projected. Using a copper cutoff grade of 0.35 percent copper, this mineralized area is approximately 130 meters thick and averages approximately 0.5 percent copper and 0.1 grams of gold per tonne.

During this drilling campaign, Noranda has drilled three RVC holes in the El Morro area. Rotary hole RDM-9, drilled within the northeast portion of the projected mineralized area, confirmed the mineralized area. This hole intersected 50 meters of secondary mineralization grading 0.91 percent copper and 0.58 grams of gold per tonne. The underlying primary mineralization returned 170 meters grading 0.45 percent copper and 0.27 grams of gold per tonne.

Rotary Drill Results

Hole	From (m)	To (m)	Length (m)	Cu %	Au g/t	Comments
RDM-8	0	294	294	0.01	0.02	Geology Pending
RDM-9	0	68	68	0.04	0.14	Leached Zone
	68	118	50	0.91	0.58	Secondary Zone
	118	288	170	0.45	0.27	Primary Zone
	288	400	112	0.08	0.04	Primary Zone
RDM-10	0	32	32	0.04	0.07	Geology Pending
	32	94	62	0.19	0.05	Geology Pending
	94	168	74	0.06	0.03	Geology Pending
	168	200	32	0.27	0.06	Geology Pending
	200	316	116	0.05	0.02	Geology Pending
	316	400	84	0.17	0.07	Geology Pending

No core holes have been drilled in the El Morro area during this drilling campaign.

EL NEGRO AREA

Prior to the 2002 drilling campaign, Noranda had drilled 16 core holes in the El Negro area totaling approximately 5,000 meters. Noranda has reported results from six additional holes in the El Negro area.

Core Drill Results

Two holes were drilled to test extensions to known mineralization at El Negro. The results from this drilling are as follows:

Hole	From (m)	To (m)	Length (m)	Cu %	Au g/t	Comments
DDHN-18	0	251	251	0.02	0.01	Geology Pending
DDHN-19	12	40	28	0.01	0.02	Primary Zone
	40	44	4	0.13	0.11	Fault Zone
	44	250	206	0.01	0.01	Primary Zone

Rotary Drill Results

Four RVC holes were drilled to test geophysical anomalies in the El Negro area. The results of this drilling are as follows.

Hole	From (m)	To (m)	Length (m)	Cu %	Au g/t	Comments
RCN-4	0	100	100	0.02	0.05	Geology Pending
RCN-5	4	138	138	0.01	0.02	Geology Pending
RCN-6	2	228	226	0.01	0.02	Geology Pending
RCN-7	0	122	122	0.05	0.03	Geology Pending
	122	132	10	0.55	0.02	Primary Zone
	132	250	118	0.07	0.02	Primary Zone

EXPLORATION AREAS

NORTH CAMP AREA

Two rotary holes were drilled to test a geophysical and geological target located approximately 1.5 kilometers northwest of La Fortuna. One of the holes, RCF-17, was re-entered and deepened with a core drill. The following are the results of the North Camp area drilling:

Rotary Drill Results

Hole	From (m)	To (m)	Length (m)	Cu %	Au g/t	Comments
RCF-17	0	50	50			Gravel – Not Assayed
	50	98	48	0.01	0.02	Leached Zone
	98	216	118	0.03	0.05	Leached Zone
	216	*400*	*184*			*See results for DDHF-36 below*
RCF-18	0	46	46	0.11	0.04	Leached Zone
	46	84	38	0.02	0.02	Leached Zone
	84	110	26	0.24	0.08	Secondary Zone
	110	194	84	0.09	0.11	Primary Zone

Core Drill Results

Hole	From (m)	To (m)	Length (m)	Cu %	Au g/t	Comments
DDHF-36	0	216	216			*See results for RCF-17 above*
	216	400	184	0.05	0.15	Primary

RENE MARTIN AREA

Two rotary holes were drilled to test a geophysical target approximately 1.5 kilometers south of the La Fortuna area. The results are as follows:

Rotary Drill Results

Hole	From (m)	To (m)	Length (m)	Cu %	Au g/t	Comments
RCTG-1	0	278	278			Gravel – Not Assayed
	278	324	46	0.02	0.05	Geology Pending
RCTG-2	0	260	260			Gravel – Not Assayed
	260	300	40	0.03	0.15	Geology Pending
	300	318	18	0.48	0.02	Fault zone, structure or lithologic contact
	318	342	24	0.07	0.03	Geology Pending
	342	362	20	0.18	0.03	Fault zone, structure or lithologic contact
	362	390	28	0.03	0.02	Geology Pending

No core holes have been drilled in the Rene Martin area during this drilling campaign.

CANTARITO AREA

One hole has been reported from the Cantarito area, which is located approximately 500 meters southeast of the La Fortuna resource area. The results are as follows:

Rotary Drill Results

Hole	From (m)	To (m)	Length (m)	Cu %	Au g/t	Comments
RCC-19	0	394	394	0.01	0.01	Geology Pending

No core holes have been drilled in the Cantarito area during this drilling campaign.

CERRO COLORADO AREA

Two holes were drilled to test a geophysical target located approximately two kilometers south of the El Negro area. The results are as follows:

Rotary Drill Results

Hole	From (m)	To (m)	Length (m)	Cu %	Au g/t	Comments
RCO-1	0	14	14	0.18	0.06	Leached Zone
	14	34	20	0.06	0.05	Primary Zone
	34	140	106	0.16	0.06	Primary Zone
	140	330	190	0.05	0.03	Primary Zone
RCO-2	0	88	88	0.11	0.04	Primary Zone
	88	304	216	0.08	0.04	Primary Zone

No core holes have been drilled in the Cerro Colorado area during this drilling campaign.

Bondar Clegg, of Coquimbo, Chile, using Gannet certified standards, has completed all of Noranda's analytical work on the project to date. The analytical method used is geochemical analysis for the copper and fire assay with an atomic absorption finish for the gold values. A quality control program, using project specific standards and blank samples, is ongoing. The qualified person responsible for the design and conduct of the work performed is Michael Donnelly for Noranda Inc.

Noranda is the project operator and can earn a 70 percent interest in the El Morro project by completing work commitments of US$10 million and making a cash payment to Metallica of US$10 million prior to September 2005. Noranda is also required to complete a bankable feasibility study by September 2007 and provide 91 percent of the capital required to develop the project.

Mr. Ritch Hall, Metallica's CEO, stated, "The drill results that we have received thus far are very encouraging. They extend the La Fortuna deposit to the north; extend the secondary copper mineralization 700 meters northwest of the known La Fortuna resource and substantiate the projected mineralized zone at El Morro."

Metallica Resources is a Canadian precious metals exploration and development company focused on Latin America. The company is well funded and has 28.5 million common shares outstanding. Visit Metallica Resources' web site at www.metal-res.com and send e-mail to metallica@metal-res.com.

CONTACT: Ritch Hall, President and CEO, (303) 796-0229, Ext. 304

THE STATEMENTS IN THIS PRESS RELEASE THAT ARE NOT HISTORICAL FACTS CONTAIN FORWARD LOOKING INFORMATION. THESE STATEMENTS ADDRESS FUTURE EVENTS INVOLVING KNOWN AND UNKNOW RISKS AND UNCERTAINTIES THAT COULD CAUSE ACTUAL RESULTS TO VARY MATERIALLY FROM PROJECTED RESULTS. THESE RISKS AND UNCERTAINTIES INCLUDE THOSE DESCRIBED IN METALLICA'S FORM 20-F.

DRILL HOLE COORDINATES-2002 DRILL CAMPAIGN

(April 8, 2002)

HOLE-ID	TARGET AREA	GRID EAST	GRID NORTH	COLLAR ELEV.	DIP	AZIMUTH	TOTAL DEPTH
DDHF-30	LA FORTUNA – N extension	413414	6833232	4132	-71	29	739
DDHF-38	LA FORTUNA – N extension	413507	6833410	4185	-70	30	291
RCF-19	LA FORTUNA – N extension	413690	6833765	4258	-90	0	400
DDHF-31	LA FORTUNA – NW extension	412708	6833375	4129	-70	30	603
DDHF-33	LA FORTUNA – NW extension	412846	6833638	4126	-68	30	600
DDHF-34	LA FORTUNA – NW extension	413198	6833567	4236	-60	211	641
DDHF-37	LA FORTUNA – NW extension	412645	6833630	4075	-70	31	553
RDM-08	EL MORRO	409675	6834800	3919	-70	190	294
RDM-09	EL MORRO	409035	6835169	3972	-70	210	400
RDM-10	EL MORRO	408695	6835253	3938	-70	180	400
DDHN-18	EL NEGRO	410784	6830874	3895	-68	55	251
DDHN-19	EL NEGRO	411400	6832500	3913	-69	216	250
RCN-04	EL NEGRO	411820	6830870	3872	-90	0	100
RCN-05	EL NEGRO	410984	6830461	3817	-90	0	138
RCN-06	EL NEGRO	411591	6830723	3867	-60	237	228
RCN-07	EL NEGRO	411486	6832378	3907	-68	213	250
RCF-17	LA FORTUNA - North Camp	411938	6833885	4064	-70	30	216
DDHF-36	LA FORTUNA - North Camp	411938	6833885	4064	-70	30	184
RCF-18	LA FORTUNA - North Camp	412280	6833670	4040	-68	30	194
RCTG-01	RENE MARTIN	413870	6831399	4129	-90	0	326
RCTG-02	RENE MARTIN	413706	6831149	4088	-90	0	390
RCC-19	CANTARITO	414269	6832683	4233	-68	32	394
RCO-01	CERRO COLORADO	410489	6829736	3915	-67	88	330
RCO-02	CERRO COLORADO	410491	6829542	3925	-70	170	304

Total Core 4,112 meters in 9 holes
Total RVC 4,364 meters in 15 holes

LA FORTUNA AREA

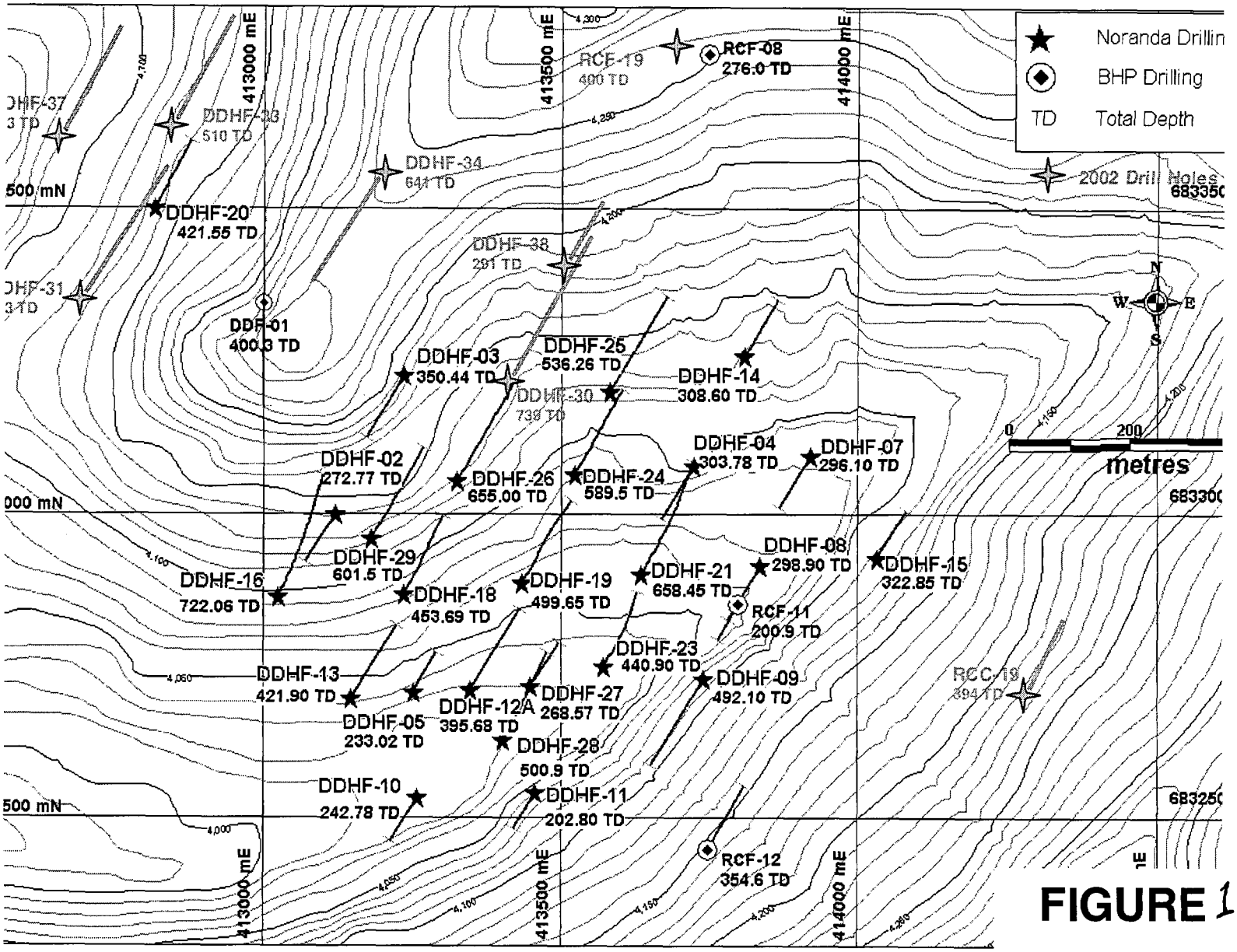


FIGURE 1

EL MORRO AREA

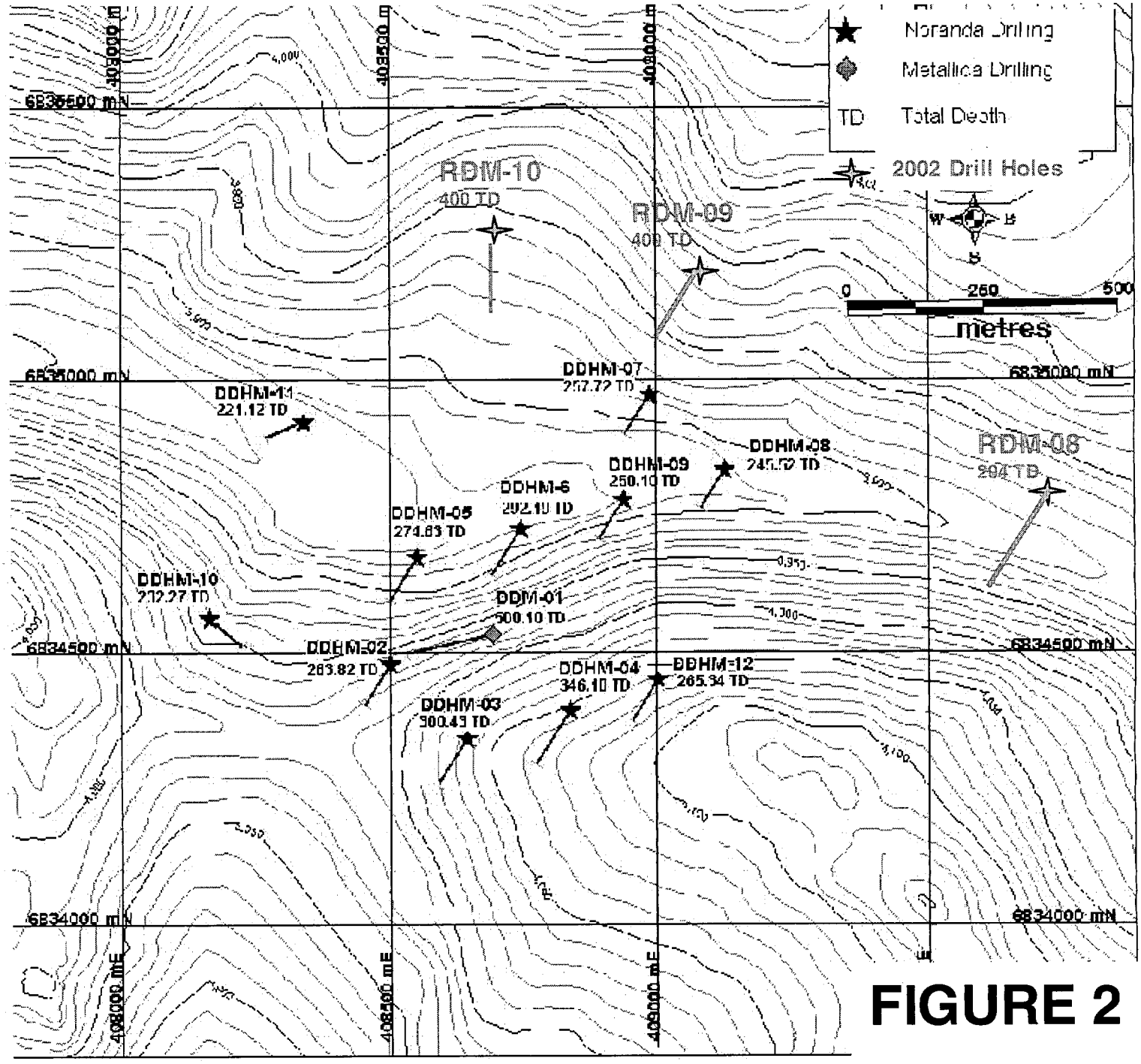


FIGURE 2

EL NEGRO AREA

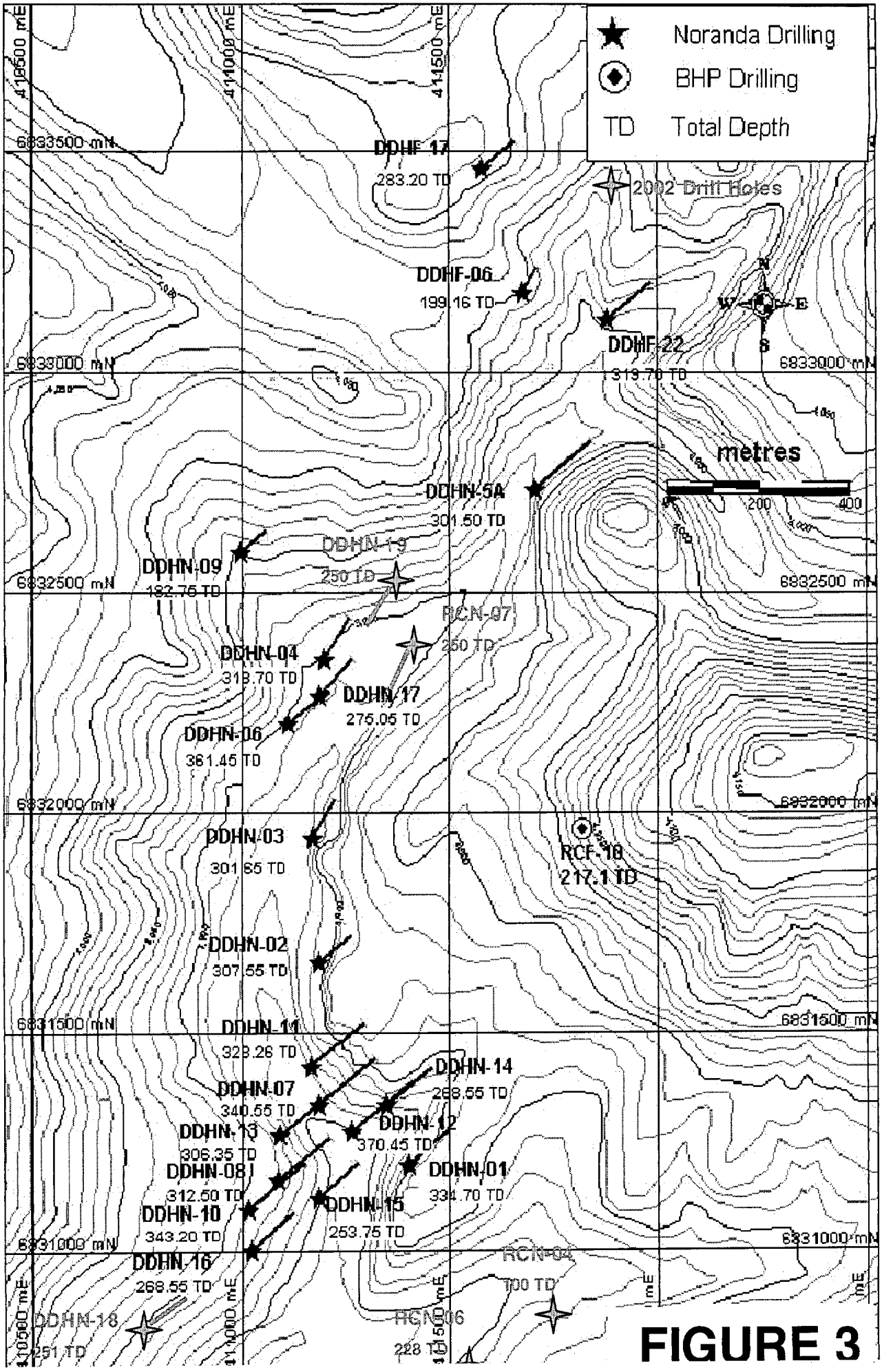


FIGURE 3

Glamis Gold Ltd.

Cerro San Pedro Project
Feasibility Study
November 2000

Project Location:

The project is located in the state of San Luis Potosi, approximately 400 km north of Mexico City, and 20 km east-northeast of the state capital of San Luis Potosi.

Feasibility Study Team:



William Dodge, Bachelor of Science in Mining Engineering, 1971
General Manager, Cerro San Pedro Project
General Oversight and Assemblage

Gary Boyle, Bachelor of Science in Mining Engineering, 1986
General Manager, Imperial Project
Ore Reserves and Mine Planning

Tim Haldane, P.Eng., Bachelor of Science in Metallurgical Engineering, 1978
Director of Process Engineering, Glamis Gold Ltd.
Process Design and Engineering

THIS REPORT HAS BEEN SUBMITTED TO THE:

- **ALBERTA SECURITIES COMMISSION**
- **BRITISH COLUMBIA SECURITIES COMMISSION**
- **ONTARIO SECURITIES COMMISSION**
- **COMMISSION DES VALEURS MOBILÉRES DU QUÉBEC**

IN APRIL 2002

Glamis Gold Ltd.

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1.0 EXECUTIVE SUMMARY

This run of mine feasibility study for the Cerro San Pedro Project has been completed with the purpose of improving economics by decreasing costs and simplifying operations.

At a gold price of $275 per ounce and $5.00 per ounce for silver, the run of mine option produces 870,391 gold equivalent ounces over an eight-year life at an average cash cost of $166 per gold equivalent ounce. The project requires an initial investment of $45 million to take it into production with a total investment over its life of $51 million. Assuming that the initial investment is 100% financed at 9.5%, the project yields a Net Present Value of $7.5 million at a 5% discount rate with an 8.4% Rate of Return.

Ore will be hauled directly from the pit to the leach pad via a 2-kilometer haul road. The leach pad will have the capacity for 50 million tonnes of ore and the precious metals are recovered from the pregnant heap leach solution in a typical Merrill-Crowe zinc precipitation plant.

Gold production is expected to reach 61,000 ounces the first year and then average 90,000 ounces for the next 6 years of production with the final year producing the remaining ounces for a grand total of 634,060 ounces of gold. On a gold equivalent basis, production is expected to reach 77,900 ounces the first year and then average 124,000 ounces for the next 6 years of production with the final year producing the remaining ounces for a grand total of 870,391 gold equivalent ounces.

Average unit operating costs over the life of the project are $0.65 per total tonne for mining (mining, maintenance, and engineering), $1.01 per ore tonne for processing, and $0.25 per ore tonne for administrative costs.

All federal, state, and municipal permits required for the project have been approved and the project has maintained compliance with all permit conditions. It is recommended that the necessary funding be provided for maintaining the Cerro San Pedro Project on a ready status until metal prices improve.

This Executive Summary section of the Feasibility Study is intended to provide a summary of the significant aspects of the Cerro San Pedro Project. The reader is encouraged to refer to individual sections and appendices to gain more information that may not be included in the Executive Summary. All references to costs in this feasibility study are United States dollars estimated as of third quarter 2000 with the currency rate at 1 US dollar = 9.4 Mexican pesos. This section is organized so that the subsection headings refer to

the section headings in the remainder of this feasibility study (e.g.; information in Section 1.3 is detailed in Section 3.0).

1.1 Introduction and Project Description

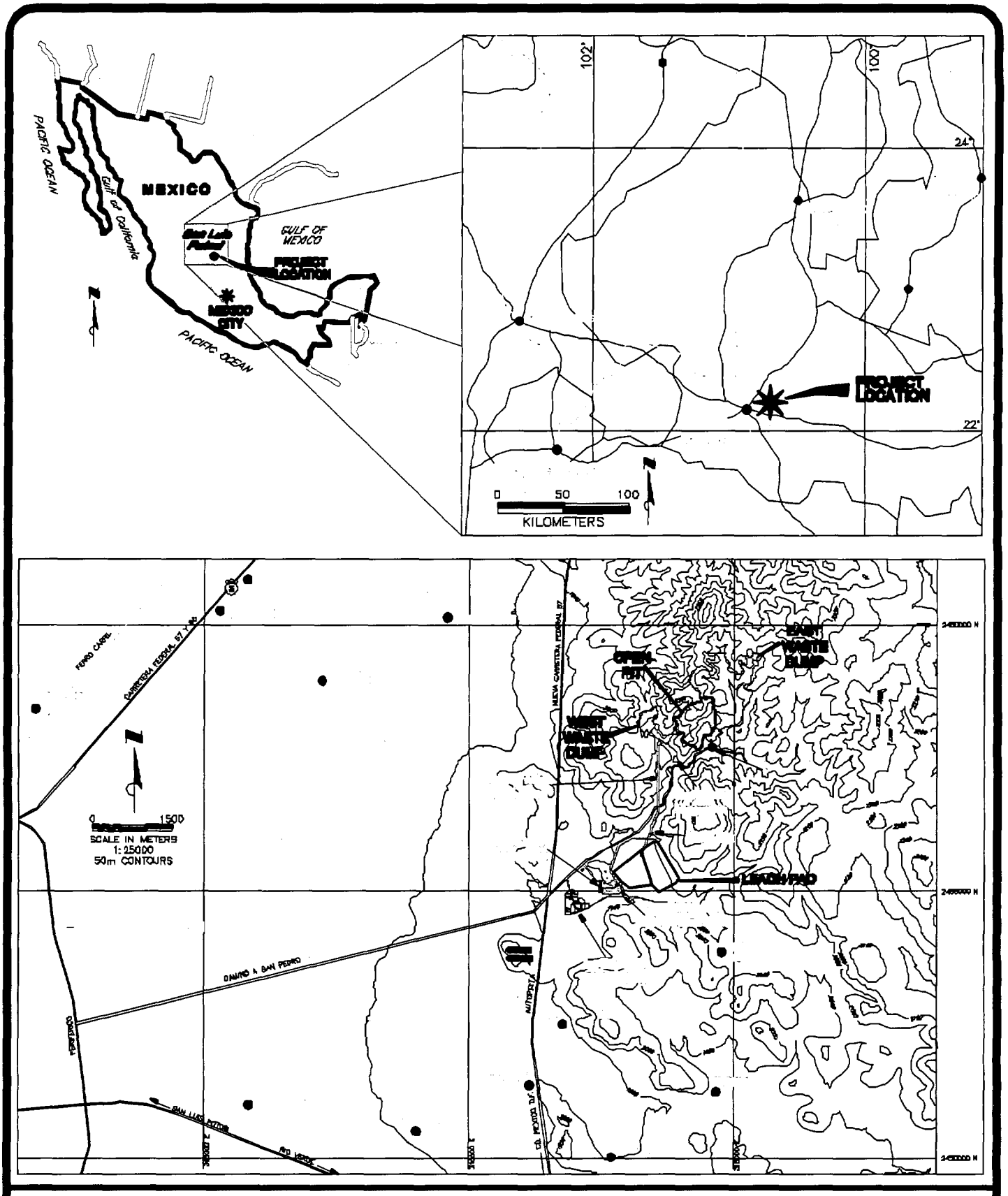
The Cerro San Pedro gold and silver heap leach project is located in semi-arid central Mexico in the state of San Luis Potosi (SLP) approximately 400 kilometers (km) north of Mexico City along the interstate highway connecting Mexico City with Monterrey. The site is located 20 km east-northeast of the city of SLP, which is the state capital with a population of approximately one million people . The site can be easily reached via a 10 km secondary road extending from the Periferico Oriente to the village of Cerro de San Pedro. The SLP airport has many daily flights to Mexico City and Monterrey. Figure 1.1 shows the location of the Cerro San Pedro project.

The Cerro San Pedro district has undergone several periods of significant mineral production over the past 400 years. In recent history, Asarco, Geocon, Bear Creek Mining, and Compania Fresnillo conducted exploration and development programs. Minera San Xavier (MSX), a wholly owned subsidiary of Metallica Resources, Inc. (Metallica), began its exploration activity at Cerro San Pedro in April 1995. Metallica elected to seek a major mining company as a joint venture partner to further evaluate the property and executed an agreement with Cambior in early 1998.

In May 2000, Glamis Gold Ltd. (Glamis) acquired Cambior's Mexican holding company and assumed the terms of the joint venture agreement executed by Cambior with Metallica. As part of that agreement, Glamis has evaluated the resources and mining reserves developed by Cambior for the feasibility study completed in November 1999, prior to performing the detailed work that provides the basis for this feasibility study.

Under terms of the joint venture agreement, Glamis can retain ownership of its 50 percent interest in the project by contributing $19,977,000 in equity to MSX by December 31, 2000.

Currently the joint venture controls 41 mineral concessions, totaling 9,295 hectares (ha). In addition to the mineral concessions, MSX has all the surface rights agreements in place for the operation. Originally MSX tried to establish an operating safety buffer zone encompassing much of the village of Cerro de San Pedro adjacent to the proposed pit and many properties within the buffer zone have been acquired.



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Figure 1.1 Location of the Cerro San Pedro Project

Obtaining control of all the property within the safety buffer zone, either through private negotiations or requesting a temporary occupation from the Federal Mining Bureau, is not considered practical and the state government will not support restricting public access to the village. Instead, the village will remain open to the public, and MSX will formalize an agreement with the State and Municipal authorities to ensure public safety for the village. The agreement will include a joint effort to ensure that the proper safety precautions are taken.

MSX will continue to acquire property within the safety buffer zone from owners who choose to engage in private negotiations. This will provide the property owners with one of the following alternatives:

- Sale with buyback option at end of project
- Sale without buyback option
- Relocation to a MSX house in Cerro de San Pedro outside safety buffer zone

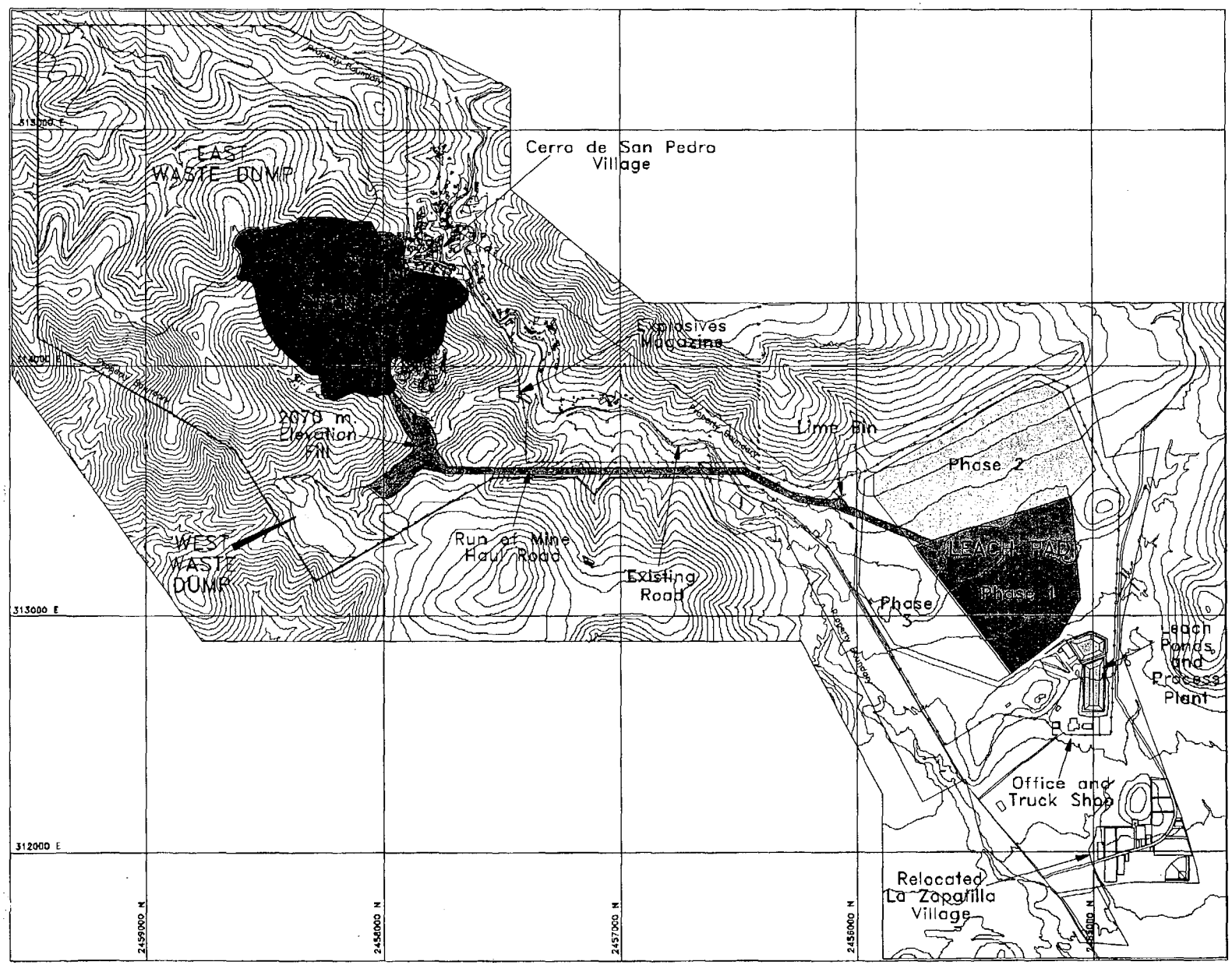
Table 1.1 summarizes the status of the property acquisitions in the buffer zone. MSX has also obtained the required power line rights of way and water rights to construct and operate the project. Figure 1.2 is a map of the project area showing the general layout of the proposed Cerro San Pedro Project and Figure 1.3 shows the southeastern margin of the proposed pit with respect to the buffer zone around the village of Cerro de San Pedro.

The small village of La Zapatilla is located in the middle of the proposed leach pad site. MSX has completed negotiations with all the permanent residents to acquire their properties and is in the process of building 20 houses in a new village two kilometers away for their relocation. The relocation will be completed in February 2000.

Water rights agreements with five parties for the annual use 992,000 cubic meters have been concluded and the National Water Commission has approved their transfer to the well site located approximately two kilometers from the leach pad.

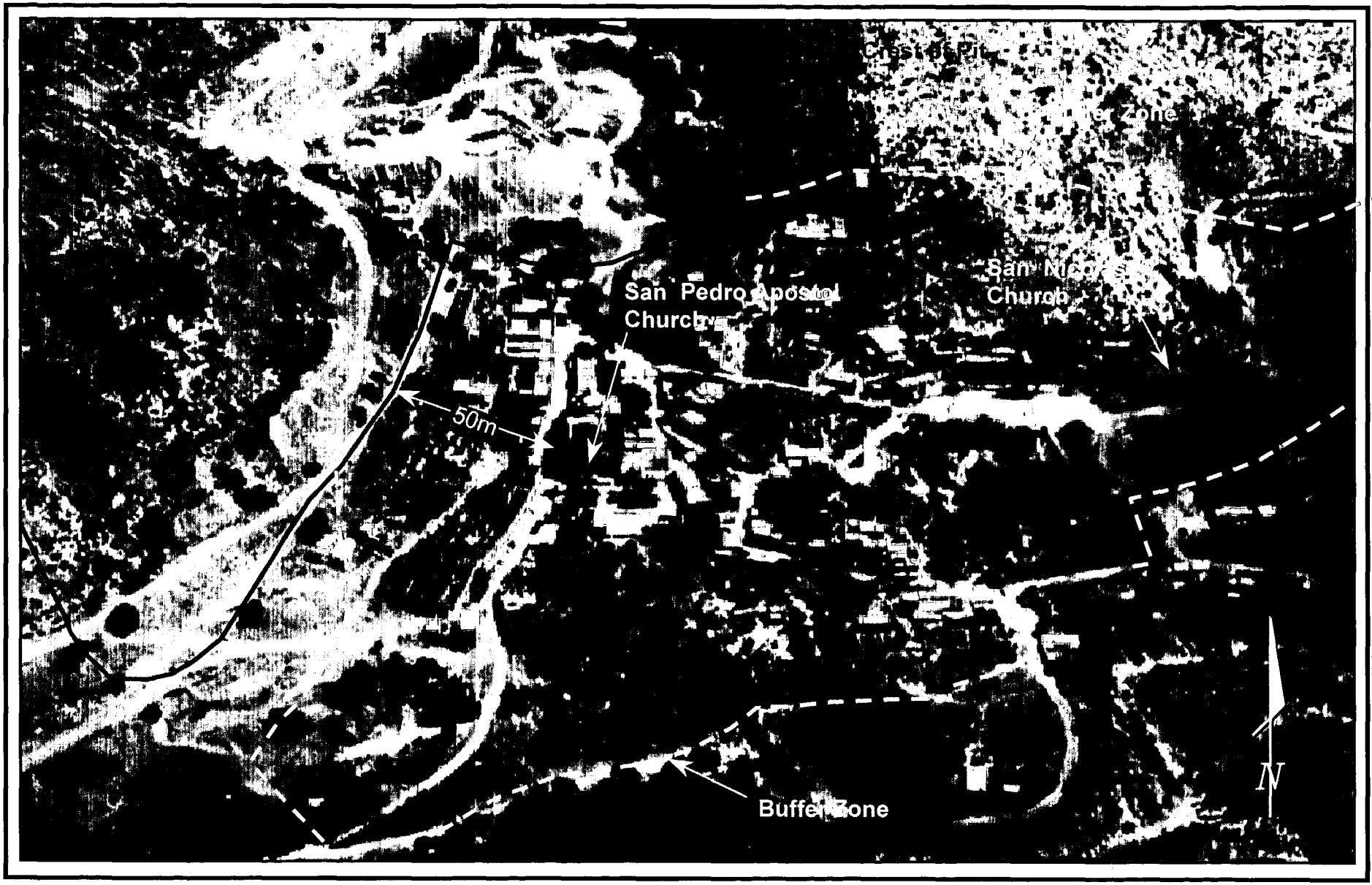
Table 1.1

Summary of Property Acquisitions in Buffer Zone				
Properties in Safety Buffer Zone	**# of Properties**	**# of ha**	**% of Total Properties**	**% of Total ha**
Private Properties Acquired	21	1.8	28	50
Public Properties Agreements	0	0	0	0
Subtotal Acquired	21	1.8	28	50
Private Properties – Not Acquired	45	1.3	61	36
Public Properties – No Agreements	8	0.5	11	14
Subtotal Not Acquired/No Agreements	53	1.8	72	50
Total Properties	74	3.6	100	100



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Figure 1.2 General Site Layout



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Figure 1.3 Photograph Showing Village of Cerro de San Pedro and Buffer Zone Boundary

1.2 Background Studies

Areas of study and primary sources of information for the feasibility study are summarized in Table 1.2. Reference to these sources of information will be made where relevant in the main body of this Feasibility Study.

Table 1.2

Sources of Information Used in the Feasibility Study		
Area	**Services Provided**	**Name of Company/Consultant**
Geology	Management	Minera San Xavier
	Assaying	Bondar Clegg
	Modeling, Resource Estimation	Minera San Xavier
	Deposit Geology	Mark Peterson, Consultant/Formerly Metallica
	Mineralogy/Petrography	Petrographic Consultants, Intl.
Mining	Mine Design/Engineering	Glamis / Mine Reserves Associates
	Model Verification	Independent Mining Consultants, Inc.
		GeoSight, Inc.
		Glamis / Mine Reserves Associates
	Previous Reserve Evaluations	Cambior
	Slope Stability	Brawner & Associates
Metallurgy	Management	Glamis
	Bottle Rolls, Columns, CN Sol.	McClelland Laboratories
	Diagnostic Testing/Reagent Work	Resource Development Inc. (RDI)
	Ore Characterization	METCON Research, Inc.
	Database/Statistical Analysis	Ron Radzieta / Zuker Geochemistry Group
	Solution Chemistry	Unifield Engineering
		Times Ltd. (Mudder)
		McClelland Laboratories
Processing	Management	Glamis
	Heap Modeling	Unifield Engineering
	Costing/Data Review	R. Hyyppa
	Leach Pad	Westec / Amec
	Merrill-Crowe Plant Design	Summit Valley Equipment & Engineering
Electrical and Communication	Management	Glamis / Minera San Xavier
	Electrical Power Line	Procoin / CFE
	13.8 kV Distribution Line	Cypesa / Procoin
	Main Substation	Cypesa
	Communication	Telmex / Glamis
Infrastructures	Management	Glamis / Minera San Xavier
	Housing	Constructora Rosval / Constructora y Edificadora B&F
	Access Road	Minera San Xavier
	Water Management	Sodinco Group

Table 1.2 (continued)

Sources of Information Used in the Feasibility Study		
Area	**Services Provided**	**Name of Company/Consultant**
Environmental	Management	Minera San Xavier
	Baseline/impact Analysis	Behre Dolbear de Mexico
	ARD Evaluations	Chemac Environmental Services
		Geochemica, Inc.
	Water Balance Modeling	Womack and Associates
		Water Management Consultants
	Closure Planning	Shepherd Miller
		Closure Strategy Group (CSG)
	Permitting	Minera San Xavier
Other	Socioeconomics	Minera San Xavier
	Taxation	Minera San Xavier / Glamis

1.3 Geology and Mineral Resources

The Cerro San Pedro district lies along the boundary between the Sierra Madre Oriental (Eastern Sierra Madre) fold belt and the Mesa Central volcanic plateau physiographic provinces. Current exploration in this historic district has resulted in the delineation of a large body of low-grade gold-silver mineralization amenable to modern bulk mining and heap leach extraction methods.

Lithology, Structure, and Mineralization

A complex deformation history, including of pre-mineral folding, thrusting, normal, reverse, and wrench faulting, accompanied by porphyry dike intrusion are considered to be the primary factors behind the localization of mineralization at Cerro San Pedro. District geology is characterized by complexly folded and faulted Cretaceous limestones that have been intruded by a large dike or plug of diorite to quartz diorite porphyry of late Cretaceous to early Tertiary age. Gold-silver mineralization occurs in association with disseminated iron oxides and sulfides hosted within the porphyry intrusive (Porphyry Oxide, Mixed and Sulfide) and its surrounding limestone host rocks (from oldest to youngest – the Begonia, Hospital, and Barreno Limestones). Porphyry Oxide-hosted mineralization is distributed in a well-developed zone of stockwork fracturing and pervasive hydrothermal alteration developed around the intersection between several systems of cross-cutting north, east, northeast, and northwest trending shear zones. These structures extend into the surrounding limestone country rocks as higher grade veins, chimneys, and mantos. A large body of Porphyry Mixed and Porphyry Sulfide-hosted Au-Ag-Zn sulfide mineralization also

underlies the main zone of Au-Ag Porphyry Oxide mineralization. The bulk of the potentially economic mineralization is hosted within the porphyry diorite rock type. Figure 1.4 is a plan view showing the geology of the Cerro San Pedro resource area. Figure 1.5 is a typical cross-section through the deposit showing the typically moderate westward dip of the porphyry dike.

Drill Data

The exploration program begun by Metallica 1995 and expanded on by Cambior in 1997, utilized the database that had been developed from previous companies since the 1970s. MSX's efforts focused on expanding the previously defined oxide resource hosted in both limestone as well as in the underlying quartz diorite porphyry. This expansion has been accomplished through a systematic program of detailed surface and underground geological mapping, geochemical sampling, metallurgical testing, and the completion of approximately 58,000m of exploration and delineation drilling. The resource estimate uses the results of 36 reverse circulation holes from exploration prior to MSX and 219 drill holes completed by MSX, 125 of which are reverse circulation and 94 are core holes. The deposit has been drilled overall on a 50m by 50m grid with a closer spacing in some areas. Assay intervals, typically of 2 m length, which had less than 30 percent recovery were not used for grade estimation. In addition, a total of 2,153 channel samples representing about 4,600 m were collected from numerous accessible underground workings.

The geological block model for Cerro San Pedro was constructed with respect to both structural and lithological (rock type) control. The assay results from drill holes and channel samples were composited to 5m lengths by respecting these rock and structural domain boundaries. Cambior used standard industry practice to limit or cap the high-grade outliers and to develop indicators to reflect the boundary between low-grade mineralization and unmineralized or barren materials. Validation of the geological and assay database was done using software tools, plots on sections and plan view maps to ensure information stored in the database occurs in the correct position and conforms with the geological interpretation. Verification of assay results used in the database was also performed. Since 1995, an assay verification program has been in-place which systematically re-assays every twenty-fifth sample.

Silver Bias / Adjustment

Assay validation work performed in 1999 on pulps and assay reject material suggested that Bondar-Clegg silver assays performed prior to 1997 were lower than comparable assays performed since that time. In order to confirm this trend and to provide a statistical basis to adjust the original assays, an extensive re-assay program was performed. Bondar-Clegg collected a total of 14 percent of the overall

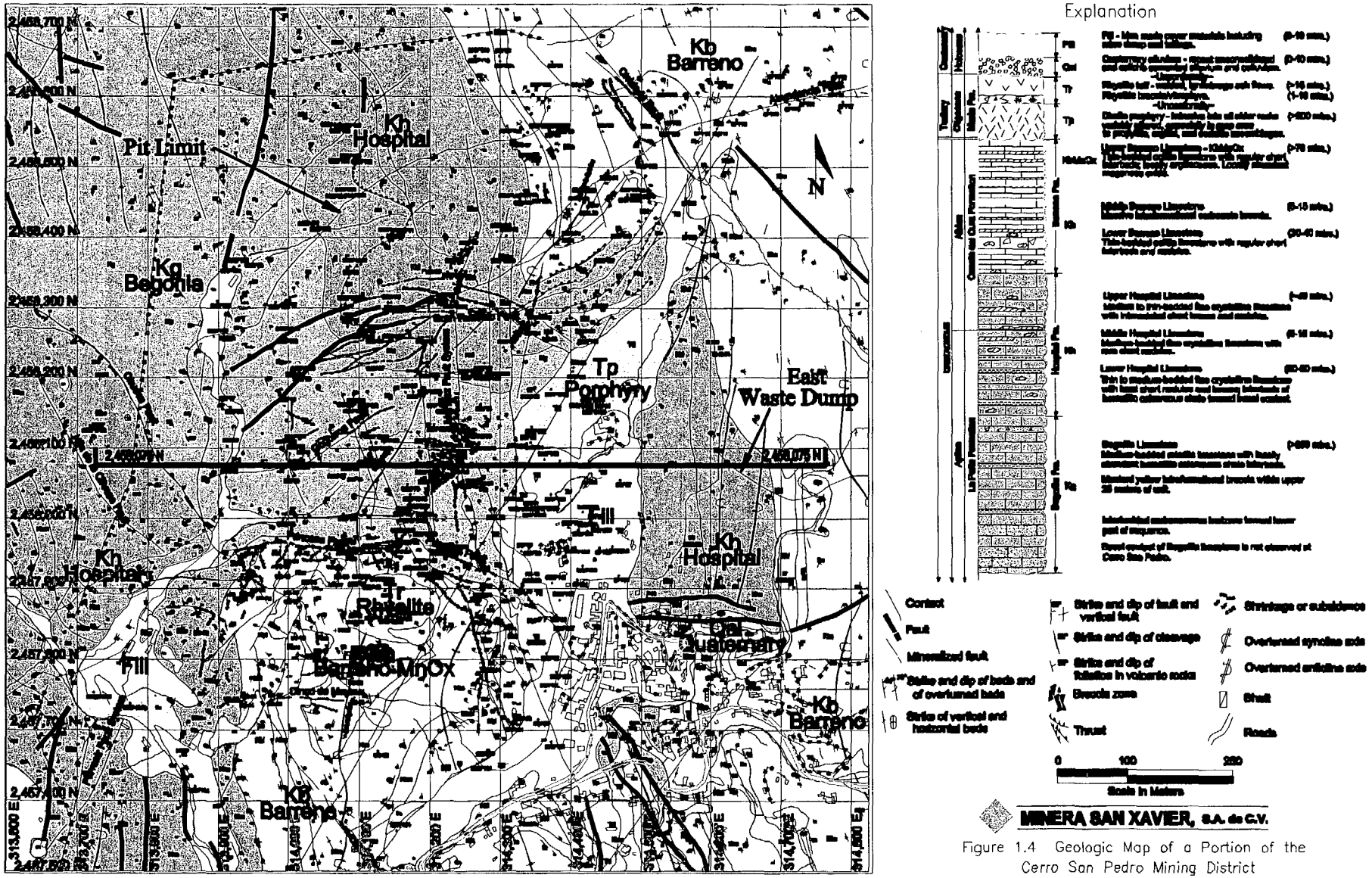
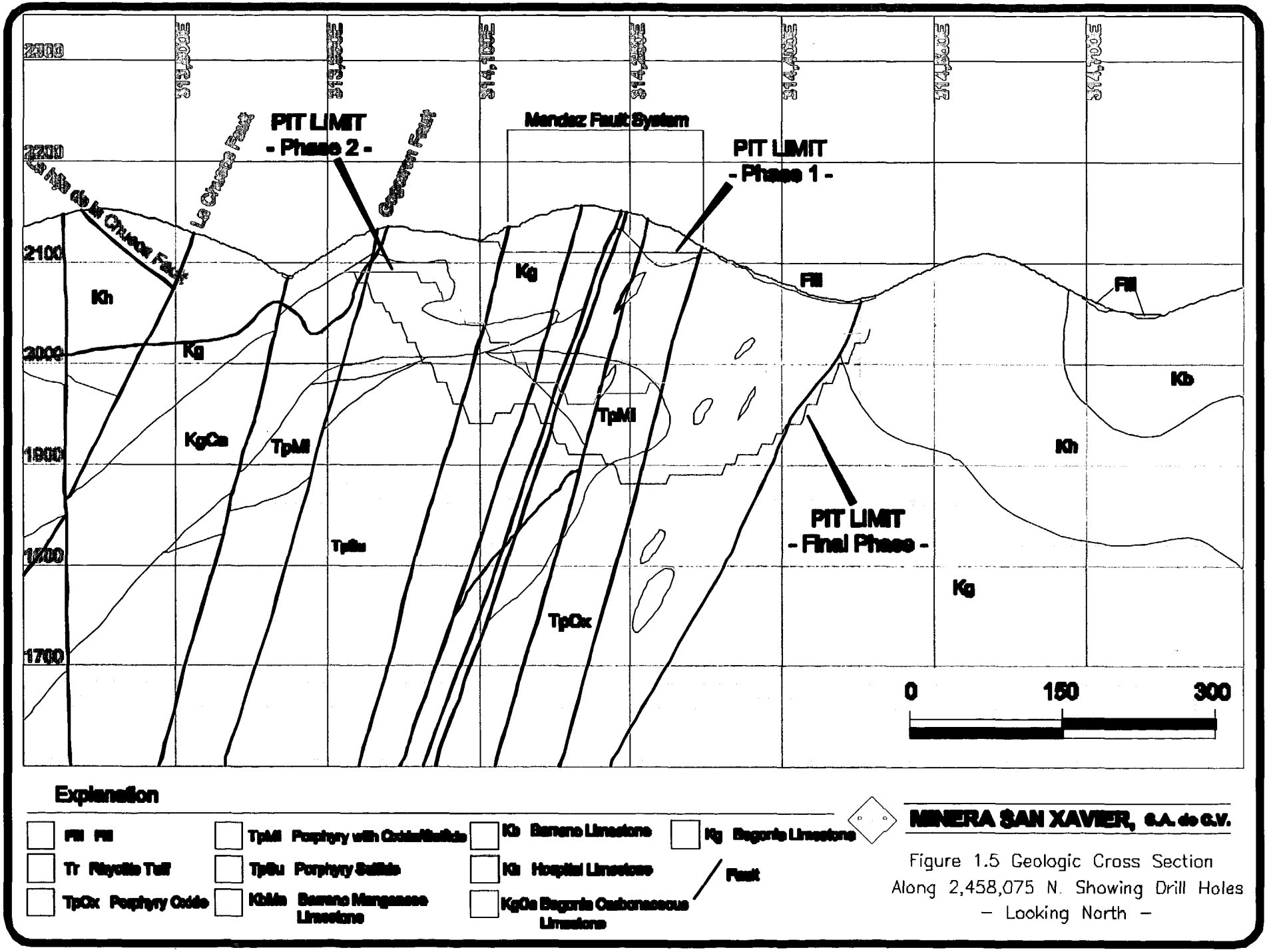


Figure 1.4 Geologic Map of a Portion of the Cerro San Pedro Mining District



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Figure 1.5 Geologic Cross Section
Along 2,458,075 N. Showing Drill Holes
– Looking North –

sample database within the conceptual pit limits, or some 2,120 samples, were collected and re-assayed in May-July 1999. Results confirmed no bias for Au, but a positive bias (averaging 28 percent) when compared with pre-1997 Ag assays. Another analysis was done which compared new assay results on 250 random samples by two different laboratories, one using the Ag procedure prior to September 1997 and one using the current procedure. Once again, no Au bias was observed, however, Ag was higher for the current technique. This work confirmed that the digestion technique used prior to September 1997 (agua regia) was insufficient to put all the Ag into solution for subsequent analysis by an AA instrument. An adjustment of approximately 30 percent was made to Ag values in the geologic database on samples assayed prior to September 1997, which resulted in raising the overall average Ag grade by 23 percent.

Mineral Resource Estimation Procedure

The resource has been evaluated using five different estimation techniques: ordinary kriging (OK), the inverse distance power cube (ID3), probability-assigned constrained kriging (PACK) with OK and PACK with ID3 and Restrictive Kriging (RK). Cross sections and bench level block model maps were compared for each method to determine the most representative method for estimating the CSP deposit. Cambior implemented the PACK method for estimating the Cerro San Pedro deposit The RK method is a MEDSYTEM equivalent of the PACK technique. Either of these restrictive kriging methods would best characterize the grade distribution for the CSP ore deposit.

Mineral Inventory

A mineral inventory for the RK estimating method was calculated for the model by rock type and is summarized in Table 1.3. Modeled voids for underground workings were accounted for in this inventory but no attempt was made to remove unmodeled voids, which is estimated to 600,000 tonnes.

Table 1.3

Glamis 2000 Model Mineral Inventory									
	0.20 g/t Au			0.30 g/t Au			0.40 g/t Au		
Rock Type	Ktonnes	Au	Ag	Ktonnes	Au	Ag	Ktonnes	Au	Ag
Barreno Ox	10,408	0.51	20.85	6,281	0.69	23.51	4,390	0.84	25.94
BarrenoMnOx	3,042	0.73	30.44	2,390	0.87	32.83	1,889	1.01	35.99
Hospital Ox	5,789	0.57	27.29	3,652	0.76	31.22	2,645	0.92	35.23
Begonia Ox	10,675	0.56	25.01	7,452	0.71	28.79	5,699	0.82	31.65
Begonia Carb	3,835	0.52	24.66	2,463	0.68	29.51	1,934	0.77	31.53
Porphyry Ox	89,353	0.48	15.87	58,709	0.60	19.30	40,494	0.71	22.08
Porphyry Mix	37,931	0.45	14.28	28,314	0.52	16.46	18,847	0.60	19.22
Porphyry Sulf	77,162	0.38	10.01	50,247	0.46	12.03	28,832	0.54	14.14
Rhyolite	191	0.64	17.34	181	0.66	17.69	166	0.69	18.24
Total	238,386	0.45	14.95	159,689	0.56	17.75	104,895	0.67	20.81

The RK resource is presented by Resource Classification in the Table 1.4. These resources do not reflect economic pit designs, but rather are limited to reporting a geologic resource.

Resource Classification

The resource estimate is classified on the basis of these parameters:

- **Measured:** All estimated blocks that had a minimum of two drillholes within one-half of the variogram range from the block center.

- **Indicated:** All estimated blocks that had a minimum of two drillholes within the variogram range from the block center.

- **Inferred:** All other estimated blocks.

All estimation parameters, such as mineralization controls, were respected.

Within the confines of an engineered pit, these measured, indicated, and inferred classifications would translate into proven, probable, and possible categories respectively. This classification scheme adheres to standards set forth by Canadian and American securities authorities. The Mineral Resource is summarized at various cutoff grades by classification in Table 1.4 below.

Table 1.4

Mineral Inventory By Classification

	0.20 g/t Au			0.30 g/t Au			0.40 g/t Au		
Rock Type	**Ktonnes**	**Au**	**Ag**	**Ktonnes**	**Au**	**Ag**	**Ktonnes**	**Au**	**Ag**
Measured	154,953	0.50	17.82	114,173	0.59	20.18	79,433	0.69	23.13
Indicated	61,849	0.38	10.12	33,866	0.49	12.55	18,546	0.61	14.84
Inferred	21,584	0.37	8.20	11,649	0.48	9.07	6,917	0.57	10.18
Total	238,386	0.45	14.95	159,689	0.56	17.75	104,895	0.67	20.81

Validation of Resource Estimate

Validating the resource model was performed by inspecting various plan and sectional areas of the model. Comparisons of exploration data composites with the block model grade estimates were made to insure structural domains where adhered to and that model grades represented the local composite grade data. The behavior of the RK estimating method shows a close relationship between the block grades and the assay composite grades, which demonstrates the model is valid and represents the Cerro San Pedro mineral deposit.

Five different estimation techniques have been used to estimate the CSP geological resources. Problems associated with the traditional modeling methods, such as Ordinary Kriging or Inverse Distance to a power, are that these methods tend to overly smooth grade and do not restrict unwanted interpolation of blocks without manually establishing physical limits, such as structural and/or rock boundaries. As such, tonnages may be overestimated and grades do not represent local information. The advantage of using the RK indicator kriging method is to limit the extent of grade interpolation within mineralized envelopes and to properly represent the grade within these mineralized zones. A comparison of the results between these resource estimation methods is presented in Table 1.5.

Table 1.5

Comparison of Mineral Resource Using Different Estimation Methods							
	Cutoff = 0.20 g/t Au						
Method	% Difference Tonnes	% Difference Ounces	Tonnes (000)	Au (g/t)	Ag (g/t)	Au Equiv. (g/t)	Ounces Au Eq (000)
Restrictive Kriging (MRA)	0%	0%	238,386	0.45	14.9	0.71	5,454
Pack with ID3 (Cambior)	*-17%*	*-7%*	*197,800*	*0.50*	*16.2*	*0.80*	*5,080*
Pack with OK (Cambior)	-16%	-10%	200,200	0.48	15.4	0.76	4,900
Inv Dist^3 (ID3) (Cambior)	-6%	<1%	224,200	0.47	15.8	0.76	5,480
Ordinary Kriging (Cambior)	-1%	<-1%	235,800	0.44	14.9	0.71	5,420

Independent Mining Consultants (IMC) was requested to determine if any grade dilution should be incorporated into the resource estimate. The IMC study is included as an appendix to this study. IMC does not foresee a requirement to apply a grade dilution factor or procedure to the Cerro San Pedro resource model. They further concluded that the model is probably somewhat conservative in grade, so that any further grade reduction due to dilution is not warranted.

Comparison with Previous Estimates

It is difficult to compare different resource estimates because the database information, estimation techniques, and grade interpolation parameters vary from one estimate to another. Comparing the Cambior

and Glamis/MRA models is not a true "apples to apples" comparison due to these variations. Differences between these models are: the method used to adjust high grade data for the silver bias correction, the use of exploration data with sample recovery between 15% and 35%, and the RK method of grade interpolation. The Glamis/MRA model did not negatively adjust higher grade silver data for the bias correction, as strict use of the polynomial correction equation would have performed. The bias proved to be real due to sample preparation not allowing all the available metal to be reported in the exploration.

1.4 Ore Reserves and Mine Planning

Mineable Reserves

Floating cone input parameters for this study used metallurgical recoveries, processing and mining costs derived from the results of Cambior metallurgical testing and historic Glamis operating parameters. Recovery, commodity prices, and operating costs criteria were varied to test the sensitivity of the resource to the key operating parameters. The base case commodity prices used were US $275 per ounce gold and $5.25 per ounce silver.

Mintec's MEDSYSTEM software, using a Lerchs-Grossmann (LG) algorithm, was used to evaluate a run of mine (ROM), and two crusher scenarios. In the ROM scenario, once the ore is loaded in the pit it is hauled directly to the leach pad with a stop in the haul for lime addition. In the crusher scenarios, the ore is hauled to a crusher facility near the pit to be single-stage crushed to –6 inches or three-stage crushed to –3/4 inches. The crushed ore is then transported to a load-out facility at the edge of the leach pad by conveyor and trucks are used to stack the crushed ore on the leach pad. Appropriate costs and metallurgical recovery differences were applied for each operating scenario. The ROM scenario was limited to two rock types for ore bearing material, Porphyry Oxide and Begonia Limestone, while the crusher scenarios considered all material above a breakeven equivalency cutoff. These two ore types are considered to have sufficient metallurgical test data to support corresponding ROM recovery estimates.

Evaluation Input Parameters

The input parameters used for the MEDSYSTEM LG Pit include mining, processing, incremental capital, G&A, commodity price, pit slope angle, and metallurgical recovery. A mining cost of $0.65 per tonne of material was applied to all rock types. Various costs were developed to represent three different process operating scenarios. An additional cost of $0.25 per tonne of ore material was also applied to account for incremental capital. These costs were based on Glamis operating parameters from the Glamis Rand Mining Company operation, experience, manufacturer data, and from previous analysis performed by Cambior,

MRA and IMC for Cerro San Pedro resource study. Pit slope criteria follow guidelines established by C.O. Brawner Engineering. Process input criteria was established by Glamis through internal and third party verification of the Cambior metallurgical test data for the various processing scenarios.

Each block in the model was evaluated to have a positive or negative value using the following criteria:

- The revenue per tonne of gold equivalency was calculated assuming the block was potentially ore material and applying the appropriate metallurgical recoveries and commodity price.

- The cost per tonne was calculated as the sum of the mining, processing, G&A, and incremental capital costs.

- The net value per tonne was calculated by subtracting the costs from the revenue.

Table 1.6 provides the detail for the LG input parameters used.

Table 1.6

Lerchs - Grossmann Input Parameters					
Commodity Price (US $ / oz)			**ROM**	**1 Stage Crush**	**3 Stage Crush**
	Gold		$ 275	$ 275	$ 275
	Silver		$ 5.25	$ 5.25	$ 5.25
Metallurgical Recovery (%)					
	Gold				
		Porphyry Oxide	75%	75%	78%
		Begonia Limestone	55%	55%	60%
	Silver				
		Porphyry Oxide	40%	41%	43%
		Begonia Limestone	25%	25%	25%
Unit Costs (US $)					
	Mining		**$ 0.65**	**$ 0.65**	**$ 0.65**
	Process				
		Leach	$ 0.728	$ 0.728	$ 0.728
		Merrill Crowe	$ 0.250	$ 0.250	$ 0.250
		Pad Haul	$ 0.029	$ 0.083	$ 0.083
		Incremental Capital	$ 0.250	$ 0.250	$ 0.250
		Stack/Spread	$ 0.064	$ 0.174	$ 0.556
		G&A	$ 0.260	$ 0.290	$ 0.290
	Total Process Costs		**$ 1.581**	**$ 1.775**	**$ 2.157**
Geotechnical Slope Angle (degrees)					
	NW, N, NE (wo haul road)		55	55	55
	E, SE, SW, W (w haul road)		45	45	45
Cutoff Grades (g/tonne Eqv Au)					
	Breakeven		0.34	0.37	0.41
	Internal		0.24	0.27	0.31

The various operating scenarios depart from the previous Cambior analysis. Glamis has extensive experience with ROM heap leach operations and their ability to apply highly productive and cost effective open pit mining operations was used as the basis for further evaluation of the Cerro San Pedro deposit, reflecting the current precious metals market. Table 1.7 summarizes the sensitivity evaluations performed and the respective input parameter for each of the cases.

Table 1.7

CASE ID	ORE DELIVERY TYPE	MINING COSTS	PROCESS COSTS	ROCK TYPES USED AS ORE	% RECOVERY Au	% RECOVERY Ag
1a	ROM	$ 0.65	$ 1.58	Porphyry	75%	40%
1b	ROM	$ 0.65	$ 1.58	Porphyry	70%	35%
2a	ROM	$ 0.65	$ 1.58	Porphry	75%	40%
				Begonia Lmstone	55%	25%
2b	ROM	$ 0.65	$ 1.58	Porphyry	70%	35%
				Begonia Lmstone	55%	25%
3a	-6in crush	$ 0.65	$ 1.78	Porphyry	72%	40%
				Begonia Lmstone	55%	25%
3b	-6in crush	$ 0.65	$ 1.78	Porphry	75%	41%
				Begonia Lmstone	55%	25%
4a	-3/4in crush	$ 0.65	$ 2.16	Porphyry	74%	42%
				Begonia Lmstone	55%	20%
				Barreno/Hospital Lmstone	30%	5%
4b	-3/4in crush	$ 0.65	$ 2.16	Porphyry	78%	43%
				Begonia Lmstone	60%	25%
				Barreno/Hospital Lmstone	30%	5%
5a	ROM (+10%mining cost)	$ 0.72	$ 1.58	Porphyry	75%	40%
				Begonia Lmstone	55%	25%
5b	ROM (+5%mining cost)	$ 0.68	$ 1.58	Porphyry	75%	35%
				Begonia Lmstone	55%	25%
5c	ROM (-5%mining cost)	$ 0.62	$ 1.58	Porphyry	75%	40%
				Begonia Lmstone	55%	25%
5d	ROM (-10%mining cost)	$ 0.59	$ 1.58	Porphyry	75%	35%
				Begonia Lmstone	55%	25%
6a	ROM ($300 gold)	$ 0.65	$ 1.58	Porphyry	75%	40%
				Begonia Lmstone	55%	25%
6b	ROM ($325 gold)	$ 0.65	$ 1.58	Porphyry	75%	40%
				Begonia Lmstone	55%	25%

Note : the process costs include G&A costs.

Economic Cone Results

The various scenarios were evaluated by comparing Net Values of the various Lerchs-Grossmann pit shells and the results are summarized in Table 1.8. The respective costs/recovery operating parameters were applied to each economic shell. The information generated from this analysis identified the pit shell basis with that generated the highest pit value and provides a basis for future operational flexibility as the precious metal market evolves.

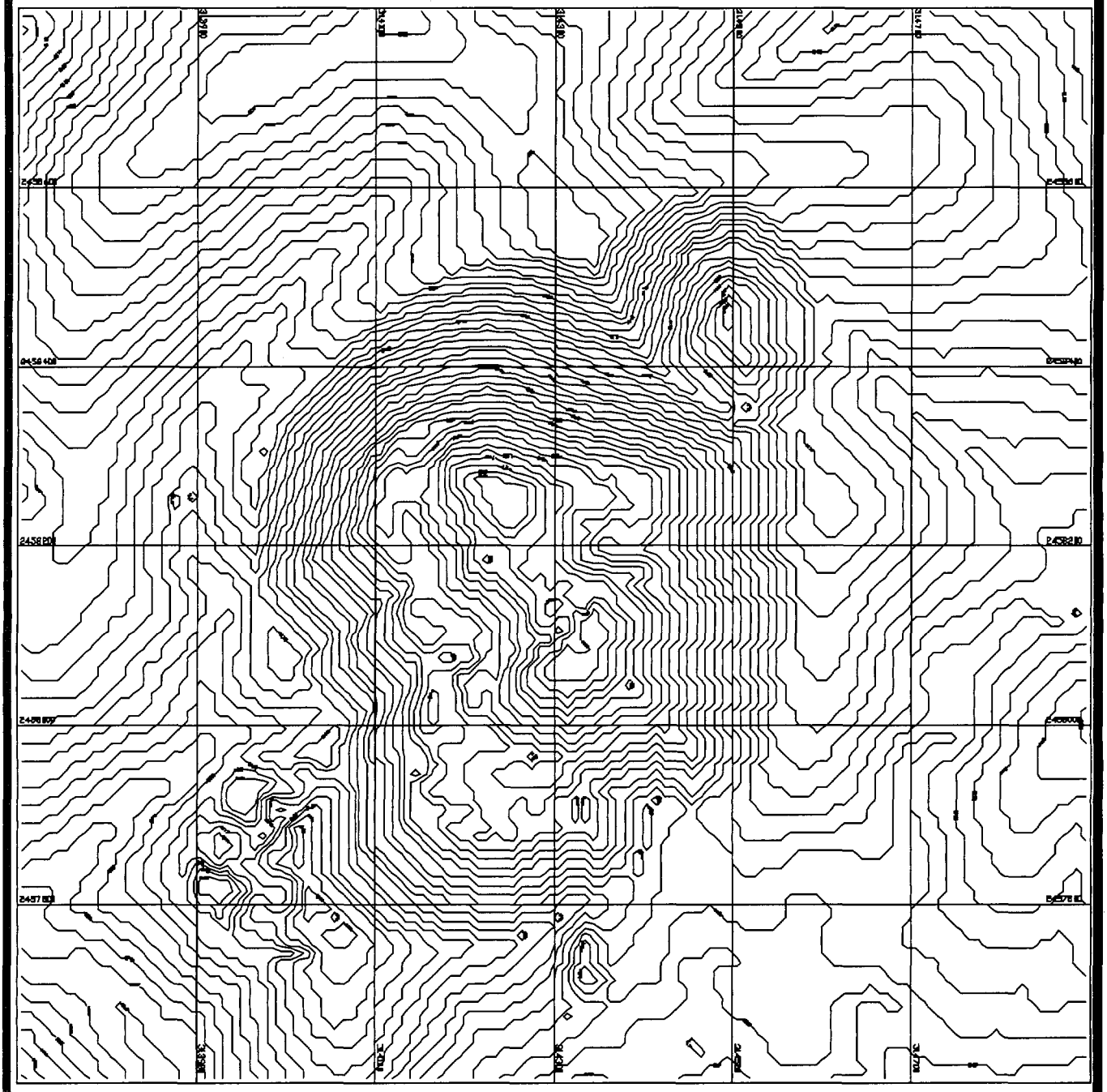
Table 1.8

Lerchs-Grossmann Net Value Pit Comparisons

Pit Shell CASE ID	Pit Shell Gold Price	Total Tonnes	Ore Tonnes	Ore Grade gm/tonne	Contained Ounces EQUIV gold basis	Recoverable Ounces	Pit Value Base $
CASE 1a	275	109,299,000	41,992,000	0.78200	1,055,757	791,818	80,358,212
CASE 1b	275	96,477,000	37,719,000	0.79600	965,304	675,713	63,514,895
CASE 2a	275	115,942,000	48,981,000	0.76600	1,206,277	904,708	96,042,413
CASE 2b	275	102,103,000	44,298,000	0.78400	1,116,583	781,608	78,584,392
CASE 3a	275	101,954,000	43,444,000	0.81200	1,134,166	816,599	80,964,421
CASE 3b	275	110,702,000	45,517,000	0.79900	1,169,260	876,945	88,183,345
CASE 4a	275	98,351,000	40,410,000	0.84800	1,101,731	815,281	72,988,442
CASE 4b	275	107,527,000	43,608,000	0.82600	1,158,076	903,299	84,321,411
CASE 5a	275	104,747,000	46,038,000	0.77600	1,148,600	861,450	89,264,657
CASE 5b	275	111,503,000	47,770,000	0.77000	1,182,597	886,948	92,333,195
CASE 5c	275	128,933,000	51,024,000	0.76700	1,258,232	943,674	99,276,229
CASE 5d	275	132,326,000	52,579,000	0.75700	1,279,673	959,755	103,446,985
CASE 6a	300	136,331,000	54,365,000	0.72800	1,272,452	954,339	111,789,917
CASE 6b	325	175,806,000	62,514,000	0.69900	1,404,899	1,053,674	129,398,189

Glamis concluded that the CASE 2a best represents a mineable base for the Cerro San Pedro mineral resource, based on the Net Value comparisons. This base case, used for designing and ultimate mineable pit is a non-discounted cone calculated at a sales price of US$275 per troy ounce gold and US$5.25 per troy ounce silver. The mining method represented in this case utilizes a bulk mining method, taking advantage of unit costs economies of scale. The ore types identified and used for this case exhibited reliable metallurgical characteristics, require a low capital investment process facility, and has a low unit operating cost for processing the material. The rock types considered ore were limited to Porphyry Oxide and Begonia Limestone. The LG pit shell generated by CASE 2a was used to establish the final pit geometry for design purposes.

Additional non-discounted cones were run at select metal prices for the equivalent gold value to define starter pit and phase pit geometries. The phased LG runs identified pre-stripping requirements for the project, targeted higher grade material as early in the mine life as possible, helped define the number of phases to consider for the project, and provided a test to insure adequate mining widths for the desired mining method. Figure 1.6 shows the geometry of the $275 gold LG pit shell.



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MINERA SAN XAVIER, S.A. de C.V.

Figure 1.6 Lerchs–Grossmann (LG)
Pit Shell

0 100 200
Scale In Meters

Evaluation Verification

Mine Reserves Associates verified the pit-optimization process for Glamis. MRA utilized the Cambior geologic model, the MRA generated grade model, and utilized the MEDSYSTEM LG evaluation software to generate economic shells. No significant difference was recognized between the various modeling techniques or by the evaluation software used. The results between verifications varied, but the variations were a result of testing the resource for different commodity price and by the material designation for ore types. The various methods revealed total material quantities of approximately 120 million total tonnes and 50 million tonnes of ore, when considering the Porphyry Oxide and Ilmestones with favorable metallurgical characteristics. Glamis proceeded confidently with its evaluation of the resource given the level of verification this deposit has received

Final Pit Design Parameters

Given the results of the LG evaluation that identified the CASE 2a economic shell as the most suitable scenario, a final mineable pit was developed by MRA with Glamis involvement. Slope angles used for design held to criteria established in C.O. Brawner Engineering report dated August 18, 1999, attached in Section 4.0 of the Appendix. Final highwall slope angle criteria also accounted for wall height and proximity to haul roads for overall highwall slope angles, and the time the wall would be exposed during active mining operations. The MRA design eliminated placing hall roads in the north or west sectors of the pit as means of minimizing stripping for the project. Although slightly flatter slopes of these walls were used as compared to previous Cambior designs, improved stripping requirements resulted. Road geometry considered adequacy for the expected equipment fleet to be used for width and performance characteristics up to the maximum gradeabilty. Maintaining haulage ramps to a maximum of 10% has been proven to maintain fleet performance and equipment longevity. Minimum pushback widths accounted for fleet access and mobility within the active mining areas. The key design parameters are shown in Table 1.9.

Pit design not only considered the purely operational concerns such as highwall slopes, ramp placement and phase pit geometry, but also encompassed protection of important historical buildings in the village Cerro de San Pedro. The pit exits at the 2070 slot on the west allows for ore delivery to the leach pad and to haul waste for initial haul road construction and to a secondary west waste stockpile area. The pit has another primary exit to the east at the 2120 elevation to allow delivery of waste to the primary east waste stockpile area. The final pit is designed respecting the protection boundary set by the Instituto Nacional de Antropologia e Historia (INAH) to protect historic structures. The pit design incorporates haul placement in the pit immediately adjacent to the INAH protection boundary to further buffer the village from long-term highwall exposure. In addition, design of the phased mine plan includes mining slots along the INAH

boundary. Mining during the early phase buffers the structures during later mining phases in the higher slopes above the INAH area. Incorporating protection for the INAH structures eliminates some economic ore on the eastern side of the mineralized area. Figure 1.7 shows the final pit design used in this study.

Table 1.9

Pit Design Parameters	
Parameter	**Value**
Slope Angles:	
Interramp – North & West	55 degrees
Interramp – East	52 degrees
Interramp – South	54 degrees
Bench Face Angle	75 degrees
Bench Height	10m
Vertical Interval between Catch Benches	20m
Catch Bench Width (toe to crest):	
North & West Wall	8.6m
East Wall	10.3m
South Wall	9.2m
Designed Road Width	32m
Designed Ramp Gradient	10 %
Minimum Designed Pushback	55m
Minimum Mining Width	30m

Mine Planning and Schedule

The final pit design was used to calculate the mineable reserves. Though economic pit shells considered only Porphyry Oxide and Begonia Limestone, the final mineable ore reported includes the Barreno and Hospital Limestones as well.

The Cerro San Pedro Pit was developed utilizing a 3D LG methodology based on a $275 per ounce gold price and $5.25 per ounce silver price. The large tonnage, low-grade nature of the deposit dictated the use of large-scale open pit mining methods for efficient and cost effective mine development. The pit was divided into three phases to provide early ore production and spread stripping throughout the mine life, build



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Figure 1.7 Final (Year 8) Design Pit on Vertical Air Photo Base

0 100 200

Scale In Meters

to a sustainable annual ore quantity and provide relatively even ore production over the life of the project. The phased designs ensure that access is logical and available to all intermediate mining areas, and that adequate operating space was provided to achieve the proposed production rates. Haulage profiles were determined and calculated for each bench from each phase to an advancing leach pad or waste dump location for each production year. The mining schedule was based on an average annual ore production of 7 million tonnes of ROM material, with a maximum total production not to exceed 20 million tonnes. The life of the mine spans nine years including Pre-production (PP) and partial production in Year 8. Average mining cost per tonne of material over the life of mine is $0.65.

The schedule was generated based on reserves within the designed pit phases using the following parameters and guidelines:

- An equipment fleet to take advantage of bulk unit cost economies, work within a minimum mining width of 55 meters, minimize loading machines, and keeping equipment needs constant through out the mine life.
- Minimize initial pre-stripping and construct a mine access road to the pit in the Pre-production period.
- Target of 750,000 tonnes of ore in Pre-production for bedding of the leach pad.
- Gradual ramp up of tonnage rates in Pre-production and Year 1.
- Target high grade and low stripping in early period and maintain consistent grades thereafter.
- Mine access road slot on 2070 bench as during pre-production activities.
- Minimize mining shift change over inefficiencies, by utilizing extended hour work shifts.
- No mining on Sundays as prescribed by project permitting.

The detailed mine schedule is summarized by year in Table 1.10.

Mine Equipment

Hydraulic shovels were chosen as primary loading units to reduce loading costs and increase productivity. The use of hydraulic shovels was chosen versus electric shovels to minimize the capital cost and power line network required for the mine site, provide the flexibility required in mining three phases, and provide a productive match with 172-tonne trucks. The 172-tonne haul trucks were selected as the largest practicable truck that would operate in the Cerro San Pedro resource and provide favorable unit costs due to the economies of scale.

Table 1.10

Annual Production Summary										
	Year									
	PP	1	2	3	4	5	6	7	8	TOTAL
Total Material (Ktonnes)	9,406	20,357	17,930	19,407	16,776	16,170	9,282	10,074	1,141	120,543
Waste Material (Ktonnes)	8,746	15,172	12,615	12,752	9,027	8,630	1,850	2,433	72	71,297
Ore Material (Ktonnes)	660	5,185	5,315	6,655	7,749	7,540	7,432	7,641	1,069	49,246
Grade gpt Ag	42.57	22.37	31.00	29.62	22.15	19.59	23.46	16.04	10.69	23.02
Oz Ag Stacked	903,365	3,729,182	5,298,112	6,337,381	5,518,387	4,748,034	5,605,403	3,940,955	367,378	36,448,197
Grade gpt Au	0.44	0.68	0.64	0.51	0.61	0.49	0.57	0.57	0.30	0.57
Oz Au Stacked	9,232	112,879	109,693	109,336	152,288	118,267	136,136	141,101	10,413	899,343
Strip Ratio	13.25	2.93	2.37	1.92	1.16	1.14	0.25	0.32	0.07	1.45

Note: Contractor to mine additional 741,000 tonnes in the Preproduction year to establish access to pit working faces.

Mine mobile equipment requirements were based on the annual mine production schedule for ore and waste, mine shift schedules, and equipment productivity estimates. Table 1.11 lists the major mine equipment fleet requirements.

Table 1.11

Major Mine Equipment Fleet Requirements									
Equipment Type	**PP**	**Yr-1**	**Yr-2**	**Yr-3**	**Yr-4**	**Yr-5**	**Yr-6**	**Yr-7**	**Yr-8**
Blast Hole Drill (171mm)	2	2	2	2	2	2	2	2	2
Secondary Drill (102mm)	1	1	1	1	1	1	1	1	1
Hydraulic Shovel ($17.2m^3$)	0	1	1	1	1	1	1	0	0
Hydraulic Shovel ($25.2m^3$)	1	1	1	1	1	1	1	1	1
Haul Trucks (172 tonne)	4	8	8	8	8	8	8	7	7
Water Trucks (68,000 lit)	2	2	2	2	2	2	2	2	2
Track Dozer (520 hp)	2	2	2	2	2	2	2	2	2
Tire Dozer (450 hp)	1	1	1	1	1	1	1	1	1
Motor Grader (4.88 m)	2	2	2	2	2	2	2	2	2

The mine work schedule will be two 10.5 hour shifts per day, 6 days per week. The mining operation will be idle on Sundays because of the close proximity of the village. If necessary, it will be possible to work on a restricted basis on Sundays, for example drilling or performing maintenance.

A truck shop complex that includes a three bay shop, a fuel/wash facility, maintenance offices, and warehouse will support the mine equipment fleet and other equipment. Most maintenance and repairs will be performed on site with company employees.

Mine Personnel

The mine personnel required to operate the Cerro San Pedro Mine are composed of the salaried staff in the mine operations, maintenance, and engineering departments as well as the daily rate personnel required to operate and maintain the equipment, and provide technical support such as grade control and surveying. Staffing levels for mining start at 100 during Pre-production and increase to 121 from Year 1 through Year 4 before decreasing to 99 by Year 8. A Mexican national contractor under the direct supervision of CSP personnel will perform the blasting operation.

Mine Operating Costs

Mine operating costs are based on the anticipated requirement to operate and maintain the planned equipment fleet. Labor rates used in the cost estimates are a result of recent wage and salary surveys conducted in the San Luis Potosi area for similar work including equipment operation, maintenance and support staff positions. Equipment operating costs were established by applying hourly costs estimated by reviewing equipment manuals, researching costs at similar operations, and from experience. The technical support required to generate mine plans, maximize ore recovery, optimize grade control, and give support to the production functions are planned for in the Engineering Department.

Total operating costs for the mining operation by year are summarized by area in Table 1.12.

Table 1.12

Summary of Mine Operating Costs ($ Total)										
Period	Total Production (Ktonne)	Total Cost per Period ($000)								
		Drill	Blast	Load	Haul	Roads	Mine Gen.	Mtce. Gen.	Engr.	Total
PP	9,406	535	816	674	1,501	1,401	321	881	576	6,705
YR1	20,357	1,076	1,725	1,456	3,480	1,591	321	929	846	11,423
YR2	17,930	956	1,523	1,276	3,442	1,591	321	929	786	10,823
YR3	19,407	1,029	1,646	1,386	3,467	1,591	265	929	801	11,113
YR4	16,775	899	1,427	1,190	3,416	1,591	265	804	736	10,327
YR5	16,170	869	1,377	1,160	3,150	1,591	265	718	721	9,851
YR6	9,282	522	805	708	2,747	1,450	265	670	552	7,719
YR7	10,074	547	857	739	2,914	1,450	265	670	571	8,013
YR8	1,141	98	116	142	553	858	185	479	351	2,784
Total	120,542	6,529	10,292	8,731	24,671	13,113	2,471	7,010	5,941	**78,758**
Percent of Total Cos		8%	13%	11%	31%	17%	3%	9%	8%	100%

Summary of Mine Operating Costs ($/Tonne Total Material)										
Period	Total Production (Ktonne)	Total Cost per Period - Ore and Waste ($ per Tonne)								
		Drill	Blast	Load	Haul	Roads	Mine Gen.	Mtce. Gen.	Engr.	Total
PP	9,406	0.057	0.087	0.072	0.160	0.149	0.034	0.094	0.061	0.713
YR1	20,357	0.053	0.085	0.072	0.171	0.078	0.016	0.046	0.042	0.561
YR2	17,930	0.053	0.085	0.071	0.192	0.089	0.018	0.052	0.044	0.604
YR3	19,407	0.053	0.085	0.071	0.179	0.082	0.014	0.048	0.041	0.573
YR4	16,775	0.054	0.085	0.071	0.204	0.095	0.016	0.048	0.044	0.616
YR5	16,170	0.054	0.085	0.072	0.195	0.098	0.016	0.044	0.045	0.609
YR6	9,282	0.056	0.087	0.076	0.296	0.156	0.029	0.072	0.059	0.832
YR7	10,074	0.054	0.085	0.073	0.289	0.144	0.026	0.067	0.057	0.795
YR8	1,141	0.086	0.101	0.125	0.485	0.752	0.162	0.420	0.308	2.440
Total	120,542	0.054	0.085	0.072	0.205	0.109	0.021	0.058	0.049	**0.653**
Percent of Total Cos		8%	13%	11%	31%	17%	3%	9%	8%	100%

Notes: Drill, Load, Haul, Roads (Roads & Dumps), include operating labor & supplies and maintenance labor & repair parts and supplies..

Mine Gen. Mine General - Mine operations salaries plus mine overhead.

Mtce. Gen. Maintenance General - Maintenance salaries and repair parts and supplies for small vehicle and support equipment.

Engr. Engineering - Salaries and supplies for engineering department.

Mine Capital Costs

Capital costs were developed for the mine major, mine support, light vehicles, and stationary equipment. The capital costs are a combination of new and used equipment quotes. It should be noted that the current condition of the mining industry has resulted in a very favorable used equipment market.

Table 1.13 summarizes the total capital cost for mining equipment. The costs include the cost of the machine, brokerage costs, freight costs, and the cost to dismantle and erect the unit. The costs utilized for used equipment reflect the current 'used' market values obtained from several industry sources and publications. Mine initial capital cost is $22,709,469 with $296,000 as sustaining capital in Year 4 for the replacement of light vehicles and support equipment, plus $2,674,500 in Year 5 for major equipment rebuilds, for a total of $25,679,969 for mine capital equipment over the life of the mine.

Table 1.13

Mine, Maintenance, and G&A Capital Costs Summary

Capital Item	PP & Year 1	Year 4 & 5	Total Project
Mine Major Equipment	17,830,000	2,674,500 (Y-5)	20,504,500
Mine Support Equipment	417,400	120,000 (Y-4)	537,400
Maintenance Equipment	1,124,000	72,000 (Y-4)	1,196,000
G&A Equipment	473,000	104,000 (Y-4)	577,000
Maint. Facilities & Mine Roads	2,865,069		2,865,069
Total Capital	**22,709,469**	**2,970,500**	**25,679,969**

1.5 Metallurgical Investigations

The Cerro San Pedro project has been the subject of extensive metallurgical investigations that have evaluated the performance of a variety of ore types subjected to various processing flowsheets. The metallurgical testing described within this section of the feasibility report has supported the conclusion that the Porphyry Oxide and Begonia Limestone ore types, which represent 97% of the total ore to be processed, can be processed effectively with conventional run-of-mine heap leach technology. These conclusions are further supported by the independent data reviews by McClelland Laboratories, Inc. and Kappes, Cassiday & Associates, which are included in Section 5.1 of Appendix 5.0.

In addition to the Porphyry Oxide and Begonia Limestone, metallurgical information for other possible ore types has been included in Section 5.0 of this feasibility report. The current mine plan calls for processing minor quantities of Hospital and Barreno Limestones, which in total represent less than 3 per cent of the project ore tonnage and recoverable gold and silver ounces. Other ore types may be mined and processed in the future if precious metals prices rise sufficiently, but are not considered in this feasibility study.

Metallurgical information for crushed ore processing has also been included in this Section 5.0. Conventional run-of-mine heap leaching for Porphyry Oxide and Begonia Limestone is the preferred processing option evaluated in this feasibility study. Fine crushing of the ore may become economic at a later date in the event that precious metals prices increase substantially.

Table 1.14 below summarizes the key metallurgical parameters developed as a result of the metallurgical investigations described in this Section 5.0.

Table 1.14

Key Metallurgical Parameters by Ore Type				
Ore Type	% Recovery (run-of-mine)		Reagent Consumption (kg/t)	
	Au	Ag	NaCN	Pebble Lime
Porphyry Oxide	75	40	0.30	3.0
Begonia Limestone	55	25	0.30	3.0
Barreno Limestone	20	5	0.30	3.0
Hospital Limestone	35	10	0.30	3.0
Weighted Average	**70.5**	**35.7**	**0.30**	**3.0**

Background

Metallurgical testing was conducted to provide adequate data to conduct a feasibility evaluation of the project, based on a large tonnage, low grade, heap leach development plan. The purpose and objectives of the metallurgical test work performed for the Cerro San Pedro project were to:

- provide metallurgical characterization and understanding of the project ore reserves,
- identify significant or fatal flaws,
- establish metallurgical and plant design criteria,
- establish an operating strategy,

- define metal recoveries, leach kinetics, reagent consumption and operating costs, and
- establish criteria for a closure plan.

Test work has been performed at a number of laboratories and includes the standard bottle roll test, column testing, cyanide solubility testing, diagnostic leaches, ore characterization testing, high solids bottle stirs (HSBS) for heap simulation, solution chemistry analysis, and mineralogical examination. Tests were conducted at various particle sizes and test parameters. All references to particle size (e.g. 13mm, etc.) throughout Section 5.0 refer to the 80% passing particle size, unless otherwise stated. Figure 1.8 is a flow chart representing the progression of test work from standard Phase I tests, followed by more specific tests in Phase II to better characterize metallurgical behavior.

Strategy for Developing Reliable Estimates of Recoveries and Reagent Consumption

Two characteristics of Cerro San Pedro ores required some additional test work to facilitate development of operating parameters.

First, the reserves include a significant amount of recoverable silver (Ag) with Ag to Au ratios in solution being high enough that, by industry standard, a Merrill-Crowe recovery plant would be indicated.

The second characteristic relates to cyanide soluble zinc contained within the ore, and its potential effect on carbon plant or Merrill-Crowe operations. Zinc (Zn) at Cerro San Pedro is primarily in the form of either oxides or carbonates and only a small fraction as the less soluble Zn sulfides.

At Cerro San Pedro, the resource value is entirely precious metals (Au and Ag), therefore, the metallurgical investigation process focused on determining the ultimate precious metals recoveries that could be achieved. Typically Au recovery would be estimated by running bottle roll tests, generally at high solutions to solids ratios, to provide preliminary recoveries of precious metals. Scoping style bottle roll tests would be followed up by column tests. A significant number of both of these standard tests were conducted separately on three of the main Cerro San Pedro ores, Barreno, Begonia, and Porphyry Oxide. Other investigations have focused on determining the viability of adding Porphyry Mixed and Sulfide material as reserves, i.e. whether recoveries and reagent consumption would be favorable enough to allow inclusion of these materials as ore types.

Seven distinct mineral types have been determined by different geological and metallurgical characteristics and are listed below denoting their respective portion of the deposit as discussed in Section 4.0. Porphyry Oxide and Begonia Limestone are the two primary ore types that will be mined and processed under the

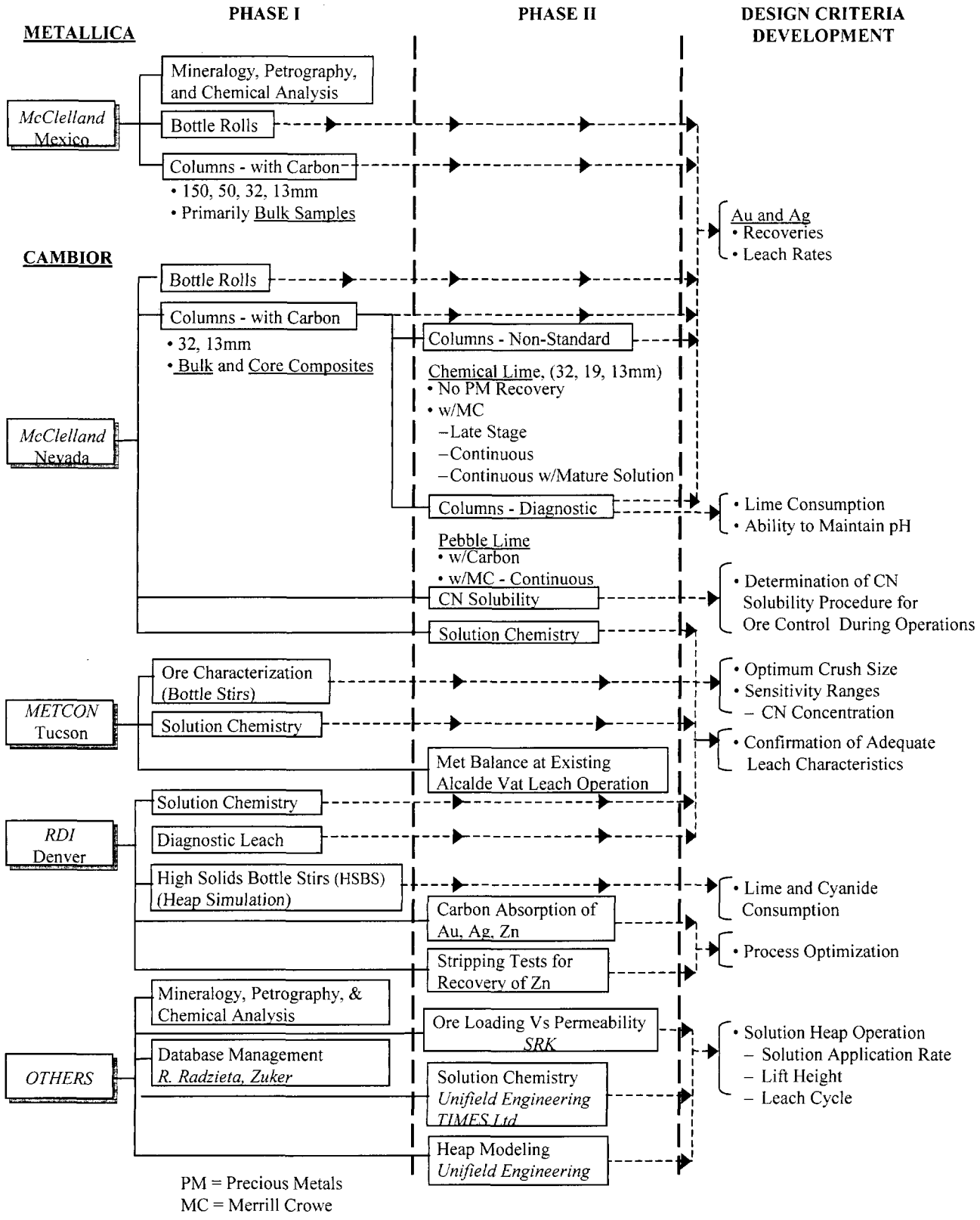


Figure 1.8 Metallurgical and Process Design Test Work

plans developed in this feasibility study, along with small quantities of Barreno Limestone and Hospital Limestone. Higher metals prices and/or improved economics would be needed to support future processing of the other ore types, including mixed and sulfide porphyry ores. Table 1.15 below summarizes the process tonnage by ore type.

Table 1.15

Process Tonnage by Ore Type				
	Tons Ore	Tons ore % of total	Recoverable Au % of total	Recoverable Ag % of total
Porphyry Oxide	41,907,400	85.1%	88.5%	86.2%
Begonia Limestone	5,865,200	11.9%	9.4%	12.4%
Barreno Limestone	284,300	0.6%	0.4%	2.4%
Hospital Limestone	1,192,000	2.4%	1.6%	1.3%

No testing was performed on tailings from prior operations, which comprise approximately 0.5% of the potential available ore tonnes. Tailings were assigned a 40% recovery for both Au and Ag. Average reserve grades for tailings are 0.62 g/t Au and 29.0 g/t Ag. The majority of the tailings are comprised of leach residues from former vat leaching operations.

Beyond the standard bottle roll and column tests, additional tests were conducted as shown in Figure 5.1 that further provide ore characterization information, assess solution chemistry issues, and provide information on kinetics and reagent consumption. These tests also gave insight on the reliability of the standard tests as a predictor of ultimate precious metals recoveries.

A detailed Sulfide Study was conducted on Porphyry Oxide, Mixed and Sulfide materials to relate quantitative/economic-driven metallurgical information with the qualitative geological classification to determine ultimately which materials should be classed as ore or waste. A summary of the results of the Porphyry Sulfide Study is presented under the Related Investigations Section – Sulfide Study – Analysis of Porphyry Oxide, Mixed, and Sulfide Ore Types. Details of this study are included in Section 5.8 of the Appendix.

Description of Metallurgical Samples and Summary of Testing

Metallurgical testing has been performed on a total of 396 different samples (core, core composite, bulk, bulk composite, underground chip samples, and reverse circulation cuttings) collected throughout the known extents of the deposit. A complete listing of samples (for bottle roll testing and for column testing) appears in

Section 5.5 of the Appendix and includes location, domain, and coordinate information. An additional table provides details of the samples that comprise the composite samples (both core and bulk).

Table 1.16 on the next page summarizes the total number of tests by type of test and ore type that comprise the metallurgical data set.

The following summarizes sampling that was conducted for these tests:

Samples were taken by Metallica from surface outcrop locations and from underground drifts and crosscuts, from reverse circulation drill samples, and drill core intervals. Composites were also prepared from these various sample types to provide test samples that represented various deposit ore types for metallurgical testing. These included thoroughly oxidized material from the Porphyry Oxide (PO), Begonia Limestone (BG), Barreno Limestone (BA), Barreno Manganese (BAm), Hospital Limestone (H), and the Porphyry Mixed (PM – oxide and sulfide) and Porphyry Sulfide (PS).

Bulk samples were taken with both lump and fine material being collected in their approximate proportions as contained in the broken rock. No crushing or breaking of lump material was done at the site. Core and other drill interval samples were individually bagged according to their interval. No crushing or breaking of the core was done except to separate the interval being sampled. Additional bulk samples were collected by Cambior at sites previously sampled by Metallica and on new sites established by Cambior.

Cambior drilled and collected additional individual core intervals for bottle roll tests and some underground chip samples for additional work on the Hospital, Barreno, and Barreno Manganese. Cambior's work emphasized developing the second, third, and fourth Composite Series to further build upon Metallica's composite work (Series 1) and previous work for the three major ore types (Porphyry Oxide, Begonia, and Barreno). The Composite Series was used for testing by a full suite of metallurgical methods including bottle rolls, columns, bottle stirs, diagnostic testing, HSBS tests, etc. Column tests were performed only on composite samples, not on individual core or bulk samples.

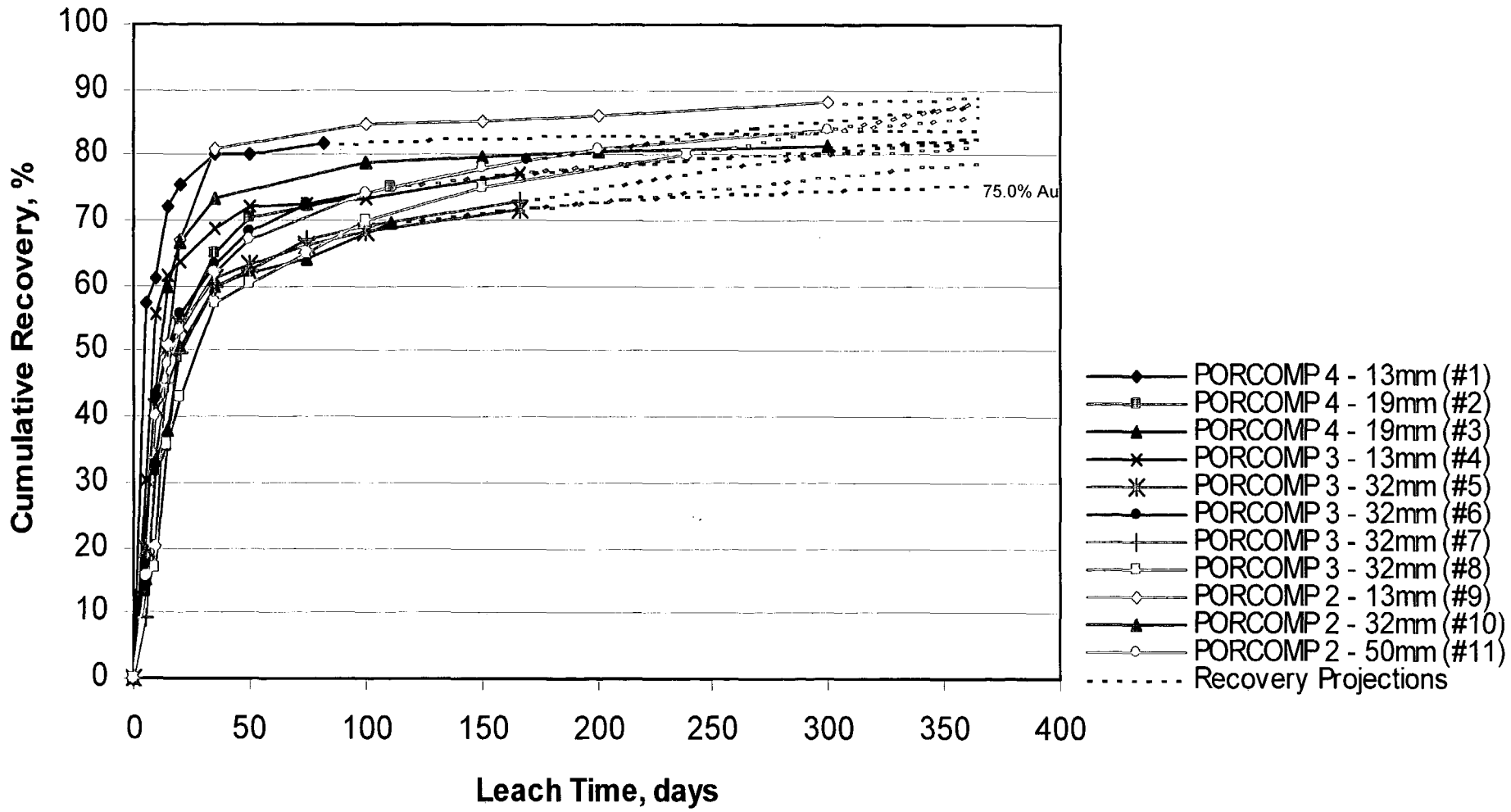
These composite series of samples are identified as follows:

Comp 1 Series – a series of 3 bulk composites by ore type collected by Metallica from previously sampled and tested surface and underground Metallica bulk sample locations. These composites were intended to provide information from short duration column leach tests to be completed during Cambior due diligence.

Table 1.16

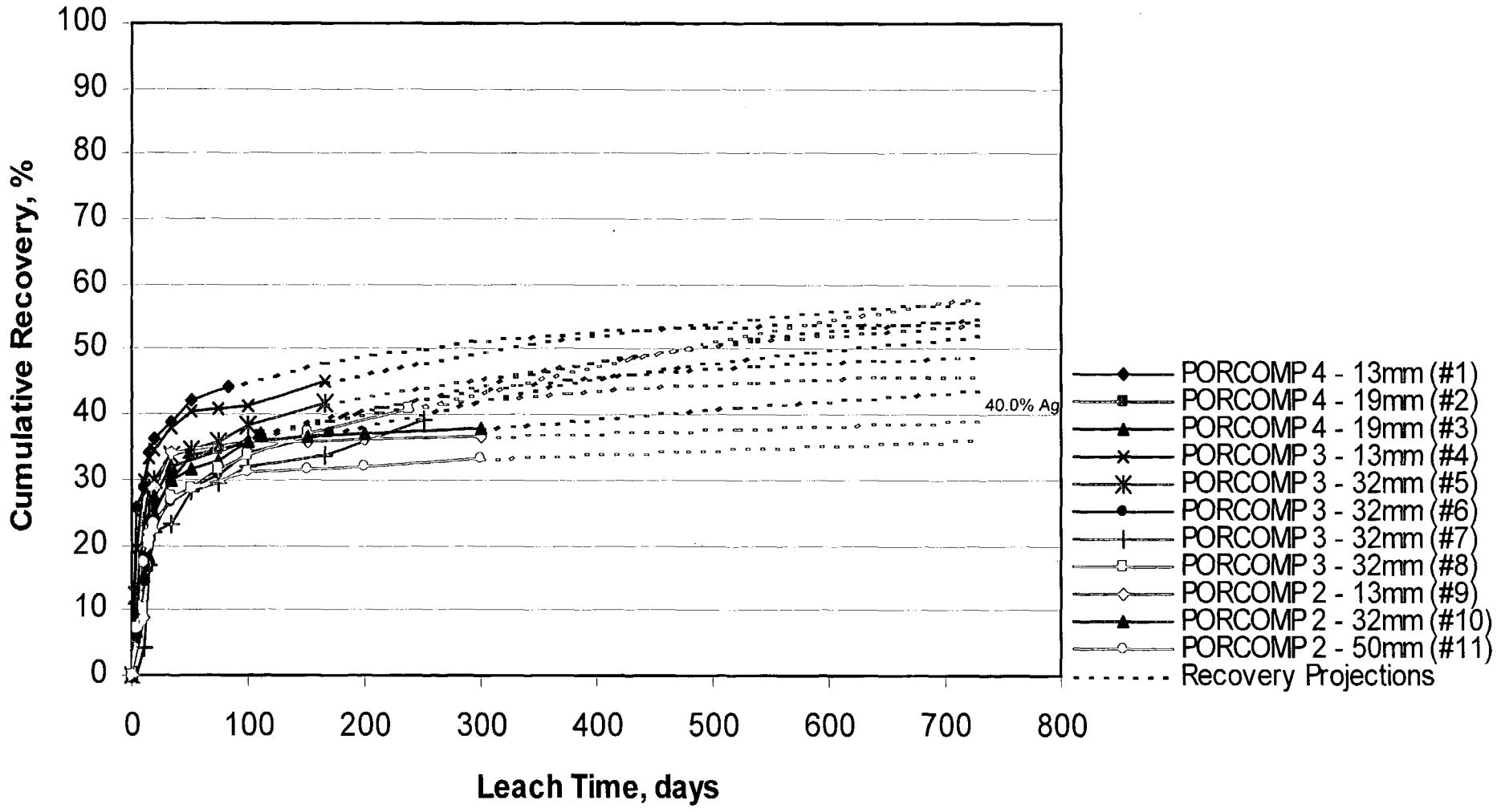
Metallurgical Test Work to Date for Cerro San Pedro										
Type of Test	**Number of Tests**									
	PO	**BG**	**BA**	**Bam**	**All BA**	**H**	**PM**	**PS**	**Other**	**Total**
≥13mm – Primary Data Set for Recovery/Reagent Estimates*:										
Column Tests – Total	**38**	**22**	**11**	**12**	**23**	**0**	**2**	**2**	**0**	**87**
Bulk + bulk composites	(27)	(15)	(11)	(10)	(21)	(0)	(1)	(1)	**(0)**	(65)
Core + core composites	(11)	(7)	(0)	(2)	(2)	(0)	(1)	(1)	**(0)**	(22)
McClelland – Hermosillo (Metallica)	[16]	[7]	[8]	[0]	[8]	[0]	[1]	[1]	[0]	[33]
McClelland – Sparks (Cambior)	[22]	[15]	[3]	[12]	[15]	[0]	[1]	[1]	[0]	[54]
Bottle Roll Tests – Total	**121**	**54**	**51**	**49**	**100**	**23**	**43**	**19**	**8**	**368**
Bulk + bulk composites	(22)	(13)	(11)	(11)	(22)	(0)	(1)	(2)	(1)	(61)
Core + core composites	(99)	(41)	(19)	(23)	(42)	(14)	(42)	(17)	(7)	(262)
Underground chip	(0)	(0)	(21)	(15)	(36)	(9)	(0)	(0)	(0)	(45)
McClelland – Hermosillo (Metallica)	[61]	[25]	[6]	[1]	[7]	[1]	[18]	[12]	[1]	[125]
McClelland – Sparks (Cambior)	[60]	[29]	[45]	[48]	[93]	[22]	[25]	[7]	[7]	[243]
Bottle Stirs – METCON	**65**	**36**								**101**
High Solids Bottle Stirs – RDI	**16**	**20**					**3**	**3**	**0**	**42**
TOTAL	**240**	**132**	**62**	**61**	**123**	**23**	**48**	**24**	**8**	**598**
Research Tests ≥ 13mm	**110**	**80**			**25**					**215**
Bottle Roll Tests <13mm/McClel	**0**	**22**	31	14	**45**	**3**	**0**	**5**	**1**	**76**
TOTAL	**350**	**234**	**93**	**75**	**193**	**26**	**48**	**29**	**9**	**889**

* Several samples with carbonaceous material and/or of lower grade than would be considered ore were also eliminated from this data set.



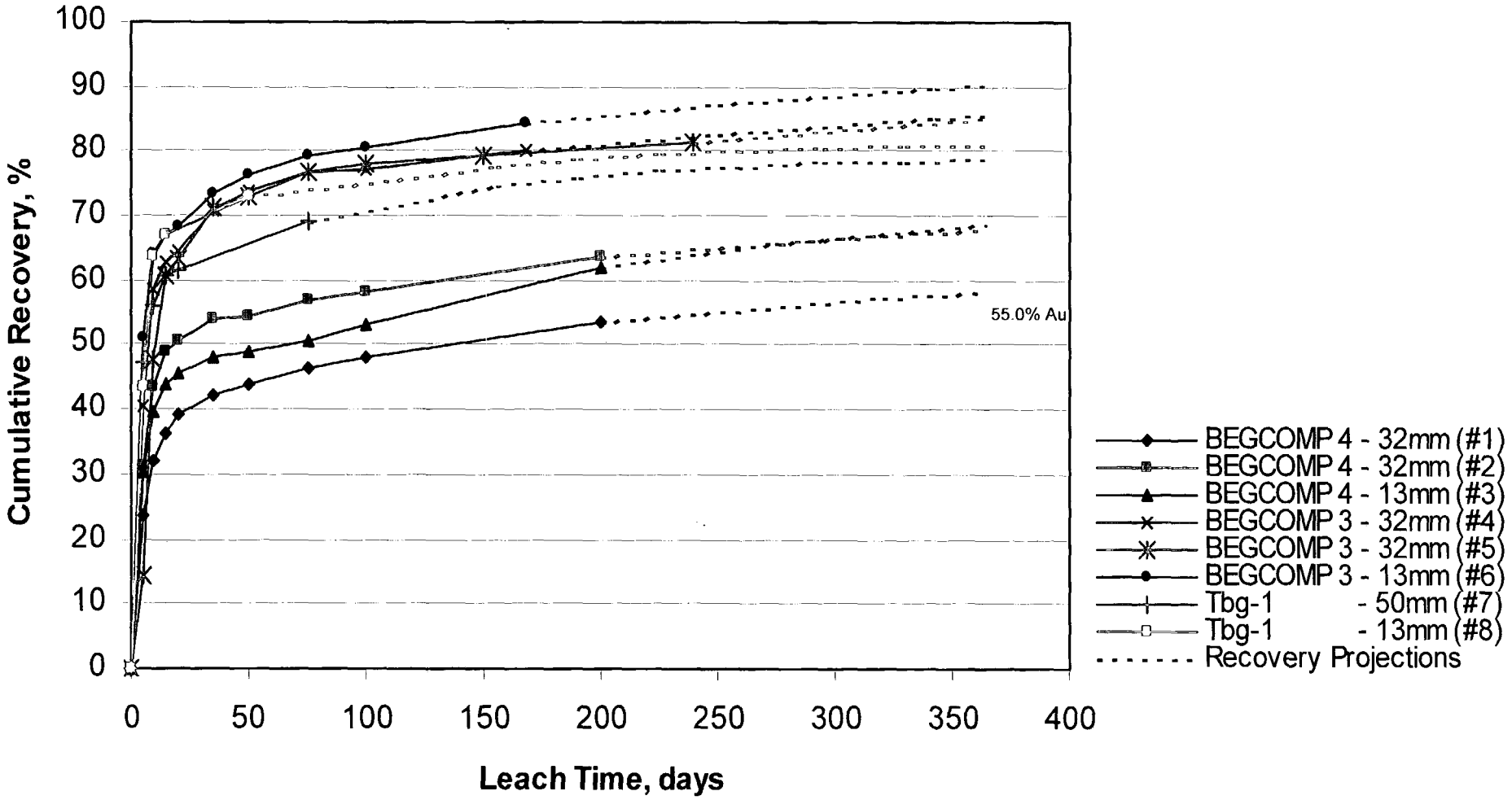
MINERA SAN XAVIER, S.A. de C.V.

Figure 1.9 Column Test Gold Recovery Curves with Ultimate Recovery Projections - Porphyry Oxide



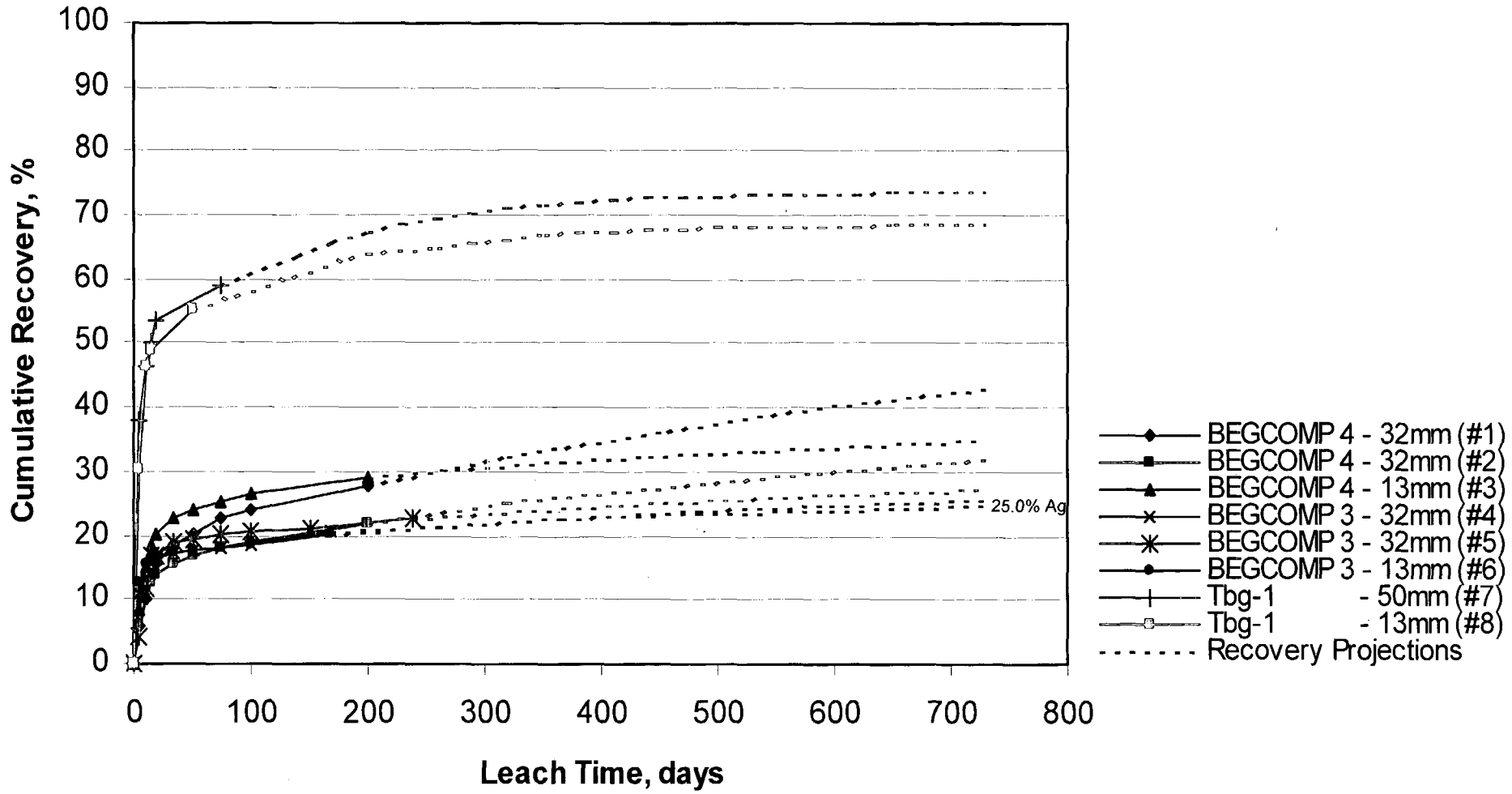
MINERA SAN XAVIER, S.A. de C.V.

Figure 1.10 Column Test Silver Recovery Curves with Ultimate Recovery Projections - Porphyry Oxide



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Figure 1.11 Column Test Gold Recovery Curves with Ultimate Recovery Projections - Begonia Limestone



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Figure 1.12 Column Test Silver Recovery Curves with Ultimate Recovery Projections - Begonia Limestone

1.6 Process and Design Engineering

The process flowsheet incorporates a conventional run-of-mine heap leach operation with a Merrill-Crowe zinc precipitation recovery plant. The ore processing rate will peak at 7 to 8 million tonnes per year (25,000 tonnes per day) based on a six-days-per-week operation. A simplified schematic flowsheet is presented as Figure 1.13.

Site Layout Considerations

Process plant facilities have been located based upon topographic constraints of the site. The leach pad is located in a broad, flat valley area along and to the south of the paved road leading to the Cerro de San Pedro Village (elevation: 1,935 m), approximately 2km from the pit exit ramp. The solution recovery plant is situated in close proximity to the leach pad (elevation: 1,930 m). A general layout of the Cerro San Pedro project site is presented on Figure 1.2 on page 4.

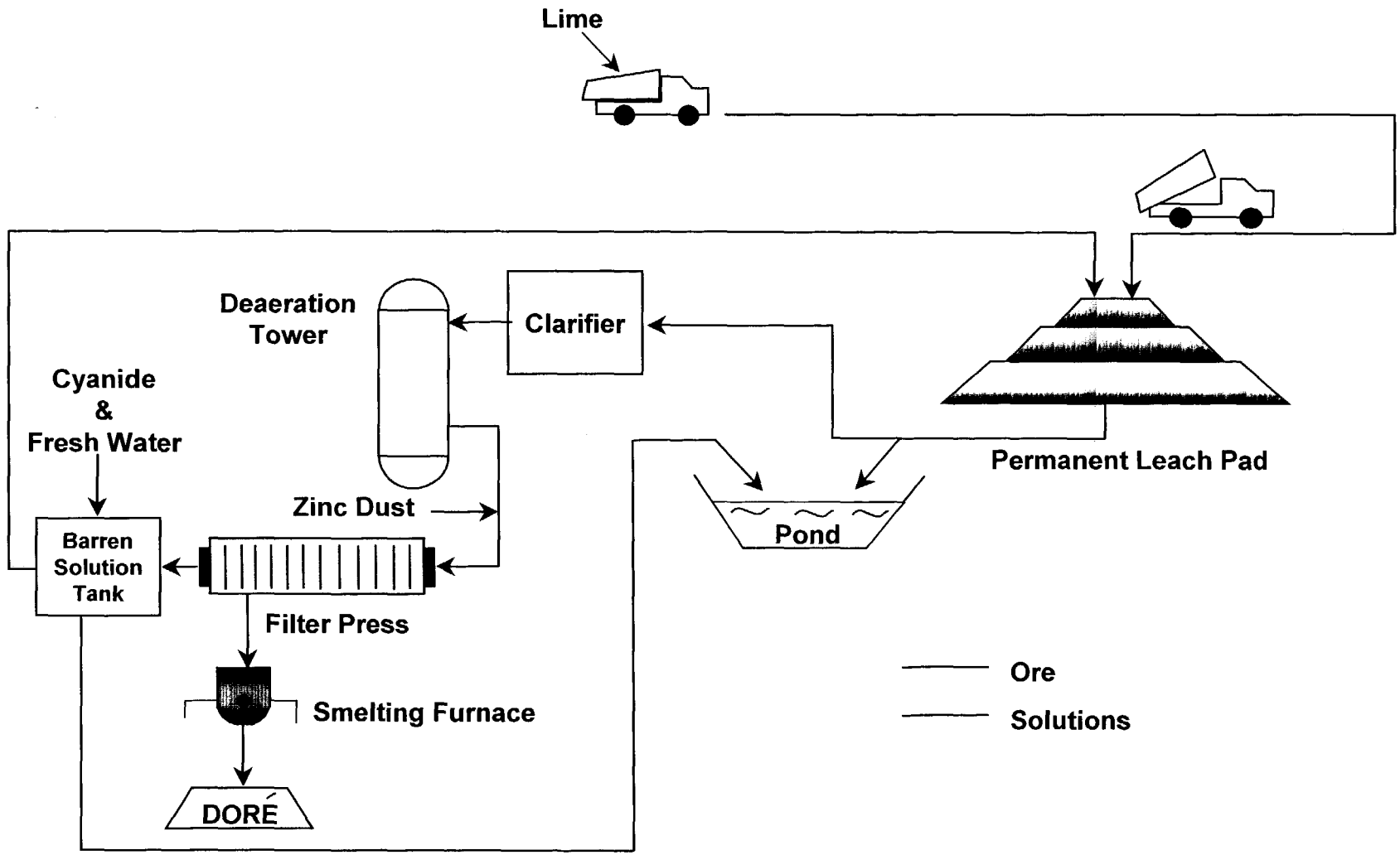
Process Design Criteria

The process plant is designed for a peak rate of 8,000,000 tonnes of ore per year and will treat a total of 49,249,000 tonnes over an eight-year mine life (mining and recovery). Average overall recoveries are expected at 70.5 percent for gold and 35.7 percent for silver, yielding an average annual production of 80,000 ounces of gold and 1.66 million ounces of silver, or approximately 107,000 gold equivalent ounces per year for a total recovery of 856,000 ounces of gold equivalent.

Metallurgical test work indicates that run-of-mine leaching is a viable processing option. The reserves are comprised mostly of Porphyry Oxide, which are particularly amenable to heap leaching without a requirement for crushing.

Run of Mine Haulage and Lime Addition

Run-of-mine ore will be trucked from the mine to the leach pad in 172-tonne haul trucks at a nominal rate of 23,333 tonnes per day. The 2 kilometer long, 29-meter wide haulage road will exit the open pit at elevation 2070 meters and enter the leach pad at elevation 1990 meters. A 300 tonne pebble lime silo with a high-speed discharge batch conveyor will be located at the entrance to the leach pad ramp. Each loaded haul truck will stop at the lime silo, where pebble lime will be added to the load at a rate sufficient to maintain the desired dosage (3kg lime per tonne of ore, or approximately 516 kg per 172-tonne



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Figure 1.13 Simplified Process Flowsheet

truckload). Ore is stacked by truck dump in 10-12 meter lifts. The ore will be spread by a track-mounted D-10 bulldozer, and ripped to a depth of 3-4 meters before leaching commences.

Heap Leach Pad

The design concept for the leach pad is to build the pad in two phases, with a third phase reserved for future expansion. Leach pad grading has been planned to follow existing topographic contours to minimize the earthworks. The leach pad drains internally to a common discharge point at the southwest corner, where solutions can be diverted into external solution storage ponds for processing. The first two phases will be stacked to 60 meters and will store 50 million tones of ore. The third phase, if constructed, will require blasting and removal of a rock knoll to create a maximum slope of 2:1 horizontal:vertical. The third phase will increase the storage capacity to 75 million tonnes by expanding the leach pad footprint and raising the heap height. Construction of the third phase will not be required unless the current mineable reserves are increased.

The preliminary design report by AGRA (Recently acquired by AMEC) is attached as Appendix 6.1 to this feasibility report.

The leach pad liner system will be a conventional composite liner, consisting of a 60 mil high density polyethylene (HDPE) primary liner underlain by a 0.3 meter compacted fine-grained low permeability soil (clay) liner in intimate contact with the HDPE. To protect against impact from truck dumping activities and to enhance solution percolation and drainage, the top surface of the leach pad liner will be overlain by a 0.5 meter bedding layer consisting of minus 19 mm crushed ore or rock. A network of perforated HDPE under-drain pipes will be placed on top of the HDPE liner to facilitate solution percolation and drainage. Solution will be collected and transported to an external solution pond system via a lined open channel.

Leach Solution Recovery and Distribution

Solution from leach pad will flow in an open ditch to the pregnant solution pond or the storm water pond. The bottom 3 meters of the storm water pond will be double lined to allow dual use of the storm water pond as working storage volume for re-circulation and enrichment of low-grade pregnant solutions discharging from the heap by diverting these solutions back into the barren solution tank. Bypassing the Merrill-Crowe plant and re-circulation of low-grade pregnant solutions in this manner is not expected to be a necessary part of the routine operating procedure, but may be desirable during periods of high solution flows or upset pond conditions.

Solution is pumped from the pregnant solution pond to the clarifier filters at the Merrill Crowe plant. Barren solution is pumped from the barren solution tank through solution distribution piping and irrigation type drip emitters for application onto the surface of the ore. Solution application under primary leach will average 90 days and will produce nearly 90 percent of the expected gold and silver recovery, with the balance being produced during subsequent re-leach as a result of the multiple lift operations.

Merrill-Crowe Recovery Plant

The precious metals are recovered from the pregnant heap leach solution in a typical Merrill-Crowe zinc precipitation plant. Pregnant solution is pumped from the pregnant solution to the clarification filters and the clarified solution is transferred to a de-aeration tower for removal of oxygen from the solution. Zinc dust is added to the solution to precipitate the precious metals. The solution containing the precipitated precious metals is filtered to recover the precious metals.

Refining

The precipitate is manually removed from the filter press and placed into a mercury retort furnace for mercury removal. From the retort, the precipitate is loaded into a gas-melting furnace and the molten metal is then poured into 31kg molds. Dore bullion is cleaned, weighed, sampled, and stored in a vault awaiting shipment. Once gold and silver are removed from the solution, the barren solution from the precipitate filters flows to the 2000 m^3 barren solution tank.

The refinery area is a high security, limited-access area. A closed circuit television system with redundant video recording monitors the whole refinery area including the entrances (inside and outside). All refinery access doors are linked to an alarm system, which records every access door movement. Movement detectors are also linked to the alarm system.

Process Plant Services

The process building houses the overall plant facilities such as the Merrill-Crowe recovery plant, the refinery, and the reagent storage area. The refinery is enclosed in a secured building. Other facilities are under an open-sided roof, or are left uncovered. The metallurgical and assay laboratory is located adjacent to the process building.

The assay lab is sized to perform sample preparation and fire assay gold analyses on a nominal 200 samples in a 24 to 36-hour turnaround time.

Process Personnel

Process personnel are under the overall direction of an expatriate process manager. Staffing levels for process are fairly stable from year to year, starting at 17 during pre-production and 39 from Year 1 through Year 8. Activity after Year 8 will no longer involve placement of new ore on the heap, but only recovery of metals from heap solutions and operation of the Merrill-Crowe plant.

Process Operating Cost

Process operating cost estimates are based on information from test work, evaluations from consultants, and data from existing operations. Electrical costs are based on recent quotes from the National Electric Commission (CFE) for the San Luis Potosi area and electrical load studies developed by Summit Valley Equipment and Engineering. Reagent consumption for each ore type is based on extensive metallurgical test work as described in Section 5.0. Costs for the major reagents (sodium cyanide and lime) are based on written quotations for delivered costs from several different suppliers. Other reagent costs are based on data from existing operations and data from SVEE, the Merrill-Crowe plant consultant.

Water costs are based upon a regulated unit cost and a usage rate based upon a total evaporation and soak rate of 12% by weight of ore process tonnage. Operating and maintenance supplies are based upon information from consultants and upon historical data from existing operations.

Process operating costs are summarized in Table 1.17, which shows the average processing cost per tonne by major category. Most of the process operating costs at Cerro San Pedro will vary directly with process tonnage. Tonnage dependent reagents, supplies, and utilities account for about 90% of the total estimated process operating cost at Cerro San Pedro. Labor costs are less variable than the other process cost components and are not expected to rise or fall dramatically during the life of the mine except for start up and closure.

Costs for outside refinery services and security have not been included in the calculation for overall processing costs. These costs are reflected in General and Administration costs for Cerro San Pedro. Heap leach haulage, spreading, and ripping costs are included in the cost estimate for mine operations.

Table 1.17

Process Cost Summary		
Category	**Cost/tonne**	**% of Total**
Process Labor Costs	$ 0.1186	12%
Process Reagents	$ 0.6876	68%
Process Op. & Maint. Supplies	$ 0.0712	7%
Process Utilities-Power	$ 0.0904	9%
Process Utilities-Water	$ 0.0465	4%
Total Process Cost/Ore Tonne	**$ 1.0143**	**100%**

Reagents account for nearly two thirds of the estimated process operating costs at Cerro San Pedro. Table 1.18 shows the estimated cost and consumption rate for these reagents. Table 1.19 shows the expected annual cost for the reagents based upon scheduled processing rates and the average unit cost per tonne of ore processed. Predicted reagent consumption is based upon metallurgical test work and historical operating data from other large Merrill-Crowe heap leach operations.

Table 1.18

Reagent Consumption				
Process Reagent	**Consumption**	**Consumption Units**	**Reagent Unit Cost**	
Cyanide	0.3	kg/tonne ore	$ 1.321	kg
Lime	3	kg/tonne ore	$ 0.075	kg
Zinc	2	Gram Zn/gram precious metals	$ 1.872	kg
Refinery fluxes	2	Gram flux/gram precious metals	$ 0.440	kg
Lead Nitrate	0.03	gram/gram zinc	$ 1.000	kg
Antiscalant	5	gram/tonne ore	$ 3.787	kg
Caustic Soda	3	gram/tonne ore	$ 0.700	kg
Diatomaceous Earth	0.034	kg/tonne ore	$ 0.454	kg

Table 1.19

Annual Reagent Cost									
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	**TOTAL**
Cyanide	$ 2,316,724	$ 2,106,653	$ 2,637,776	$ 3,071,394	$ 2,988,554	$ 2,945,748	$ 3,028,587	$ 423,709	19,519,145
Lime	$ 1,315,125	$ 1,195,875	$ 1,497,375	$ 1,743,525	$ 1,696,500	$ 1,672,200	$ 1,719,225	$ 240,525	11,080,350
Zinc	$ 114,987	$ 228,961	$ 272,078	$ 241,602	$ 206,828	$ 243,889	$ 175,195	$ 75,488	1,559,028
Ref. fluxes	$ 25,383	$ 51,754	$ 61,906	$ 53,906	$ 46,381	$ 54,756	$ 38,497	$ 17,287	349,870
Lead Nitrate	$ 1,843	$ 1,843	$ 1,843	$ 1,843	$ 1,843	$ 1,843	$ 1,843	$ 1,843	14,744
Antiscalant	$ 110,688	$ 100,651	$ 126,027	$ 146,744	$ 142,786	$ 140,741	$ 144,699	$ 20,244	932,580
Caustic Soda	$ 12,275	$ 11,162	$ 13,976	$ 16,273	$ 15,834	$ 15,607	$ 16,046	$ 2,245	103,418
Diat. Earth	$ 35,730	$ 32,491	$ 40,682	$ 47,370	$ 46,092	$ 45,432	$ 46,709	$ 6,535	301,041
TOTAL	$ 3,932,755	$ 3,729,390	$ 4,651,663	$ 5,322,657	$ 5,144,819	$ 5,120,216	$ 5,170,802	$ 787,876	**$33,860,176**
AVERAGE $/TONNE									**$0.6876**

Process Capital Cost

The dominant capital costs for the process facilities at Cerro San Pedro will be associated with the construction of the leach pad, ponds, Merrill-Crowe plant, refinery, lime silo, and solution pumping

facilities. Agra and SVEE have produced engineered "turn-key" construction estimates for the leach pad and plant processing facilities. Capital costs for other ancillary facilities (lime silo, security equipment, etc.) have been estimated based upon known costs at other facilities.

Mobile equipment associated with the process plant will include pickup trucks, a forklift, and a backhoe. A bulldozer will be required to spread, level, and rip ore on the leach pad. Much of the process plant mobile equipment will be pooled with mine operations equipment for dual use. All of the capital for the mobile equipment for the processing area is included in mine capital.

Table 1.20 depicts the initial process plant capital projected for Cerro San Pedro by category.

Table 1.20

Initial Process Capital	
Leach Pad & Solution Ponds	$ 4,462,340
Merrill-Crowe Plant	$ 1,784,906
Refinery	$ 427,188
Solution Pumping/Distribution	$ 900,272
Construction Mgmt, QA/QC	$ 497,895
Engineering	$ 334,037
Laboratory	$ 394,200
Lime Silo	$ 310,000
TOTAL	**$ 9,110,838**

Phase II of the heap leach pad will be constructed in operating Year 3, requiring an additional $3.5 million.

1.7 Infrastructures

Because the project site is in close proximity to the city of SLP, many of SLP's support facilities will be used. Infrastructure required for project development includes all road work; raw water storage and distribution; relocation and development of community infrastructure; and stabilization of the San Pedro Apostol church.

Roads

Improvements will be completed by the end of 2000 to 8.5 kilometers of the existing 10.2 km off-site access road from the SLP Periferico road to the main entrance to the project site, including re-grading, widening to 10m, installing of additional drainage ditches, re-sloping, and improving a bridge crossing.

A 500-meter road from the public road to Cerro San Pedro to the project gatehouse will be constructed to provide access to the plant site. In addition, a 1.6 kilometer mine access road will be constructed 25 meters wide to accommodate the large mine equipment from truck shop area, to the run-of-mine haul road on the north corner of the leach pad.

Water Supply

Based on detailed water balance calculations, the project is estimated to require a peak of 47.4 l/s of raw water for processing and dust control. Average requirements are 31.7 l/s or a total of 986,000 m^3/yr. MSX has developed a water production well near La Zapatilla, some 1.8km southwest of the process building, which is capable of producing 60 l/s of water. Water will be pumped to a tank above the process plant and will be distributed by gravity to the process plant and other facilities.

Other Project Facilities

A main office building will be located at the entrance of the plant site just north of the truck shop and warehouse building and adjacent to the gatehouse. The gatehouse will be equipped with a motorized access control gate and will provide 24 hour per day, seven day per week access control to the mine site. A parking area in front of the main office building will be provided for visitors.

A training building will be located just east of the main office. The building will serve as a general training and meeting facility, and also provide a staging room for the mine shift crews. The locations of the main office and training facilities have been designed to provide close access to the truck shop, warehouse, process plant, and assay lab.

Community Infrastructure

Up to ten houses will be constructed in Cerro de San Pedro to accommodate families who will be displaced from the security (safety buffer) zone. MSX will provide potable water, sewage disposal facilities, electrical power, and construct access roads and sidewalks to these new houses. The San

Pedro Apostol church will also be stabilized as a part of MSX's commitment to protect historic monuments and structures.

The entire La Zapatilla village is located in the area of the proposed leach pad. MSX will relocate 20 families to homes in the newly constructed village of Nueva La Zapatilla, 0.5km south-southwest of the process building. MSX will also construct other community infrastructures, including a school and a church. Municipal works will also include access roads, an electrical transmission line, potable water system, sewage disposal facilities, and a rainwater collection pond.

A contract was awarded to a local SLP contractor in August 2000 for the construction of the 20 new houses, a school, a church, a public plaza, and all municipal works. The project will be completed in January 2001 and is not considered as part of project capital in this study.

Capital Costs

A summary of the estimated initial capital costs for the infrastructures is presented in Table 1.21. The capital cost total of $2.2 million includes $0.6 million for the water supply and distribution utilizing the La Zapatilla well, and $0.4 million for new housing at Cerro de San Pedro. An allocation of $0.2 million has been provided to fund investigations of the structural integrity of the San Pedro Apostol Church and to perform repairs and stabilization prior to regular mine operations.

Table 1.21

Infrastructure Capital Cost Estimate	
Area	**Cost**
Roads	$175,000
Office, Training Building, and Furniture	$370,000
Site Preparation	$475,000
Water Supply	$645,000
Cerro de San Pedro Housing	$350,000
Church Stabilization	$200,000
Total	$2,215,000

1.8 Electrical and Communications

The capital and operating costs for the two areas of infrastructure, electrical power, and communications are minimized because of the proximity of the project to the city of San Luis Potosi. The proximity also facilitates the rapid construction of these two important areas.

Electrical

MSX has negotiated an agreement for the electrical requirements of the Cerro San Pedro project with the governmental agency CFE, the sole electricity provider in Mexico. MSX will pay for one-sixth of the overall cost for the required modifications at the CFE Substation SLP II located near the city of SLP. MSX will construct an 11.3km transmission line (shown in Figure 1.17) from this substation to the mine site. CFE will provide engineering and quality control for construction and subsequently will become owner of the transmission line when completed. The total mine power demand is estimated at 2.5 megawatts (MW) and average price for energy delivered to the site is $0.06 per kilowatt-hour (kWh). At the mine site MSX-constructed Main Substation, the electrical power at 115 kV from the SLP II Substation will be stepped down to an intermediate voltage of 13.8 kV for electrical distribution throughout the mine site via a distribution network.

The 13.8kV network supplies power to the process plant via secondary substations with a step down transformer 13.8 kV/480/277 V, 3 phases, 2,500 KVA. A 250kW diesel-driven standby generator will provide backup during power outages for the pregnant and barren solution pumps. The network also supplies power to the truck shop, administration office, and other facilities.

Communications

Communication requirements between the mine site and the city of San Luis Potosí are fulfilled by a microwave link that can transmit voice, fax, and data as described below:

- Local telephone services (10 circuits, voice and fax) between the main switchboard located in the administrative offices and the city of San Luis Potosí with the possibility of making long distance calls in Mexico;
- Electronic file exchange, Internet access, and email, via a reserved 128 kilobits per second (kbs) bandwidth channel.

TELMEX, the local telephone company, will supply, install, and commission the microwave equipment and MSX will provide the on-site telecommunication room, tower, and electrical power.

A standard twisted pair copper wire network will interconnect the process building and the truck shop to provide network and telephone connectivity. Due to the distance between the main process building and the lab, a short fiber optic connection will be implemented for network connectivity between the two buildings. All closed-circuit cameras will be interconnected via coaxial cable to central monitoring stations. The network outlined above will provide:

- Computer network, for data, E-mail, and Internet access to the administrative offices located in the process building, the truck shop, and the lab, and;
- Local telephone services, voice, and fax (up to 64 extensions grouped into 10 circuits) between the main switchboard located in the process building and truck shop, lab, and guard stations;
- Closed-circuit television coverage for the refining areas, and the guard station.

Capital Costs

A summary, by area of the estimated initial capital costs for the electrical and communication systems, is presented in Table 1.22.

Table 1.22

Electrical & Communications Capital Cost Estimate	
Area	**Cost**
115 kV Transmission Line	$1,354,510
Main Substation 115 kV / 13.8 kV	$566,425
13.8 kV Distribution Lines	$250,000
Communications	$35,745
Total	**$2,206,680**

1.9 General Administration and Services

General Services and Administration (G&A) will provide upper-level management to the overall operation and handle administrative functions not directly related to specific operating areas. These functions include the following:

General Management, Accounting, and Services

General and senior management for the operations are part of the G&A budget. The finance and accounting area includes general accounting, payroll and tax administration, lease and acquisition administration, direction for procurement and logistics, purchasing and materials management, and systems and communications. Other general services include on and off-site bus transportation for employees and trash removal.

Human Resources

Recruitment and training of personnel, employee relations, benefits, and office administration will be an important G&A function. Included in this area is a contracted security force to protect assets and personnel and a transportation company with its own security to regularly pick up gold and silver dore. Medical services for employees and local area residents, provided by two contracted personnel, will be under supervision of G&A. Mechanical ,electrical, and water maintenance and janitorial services for all non-operations areas will also be provided.

Environmental

Environmental management will include monitoring for compliance at all facilities, including water and air sampling and maintenance of an on-site nursery.

Public Relations

Government and local, state, regional and national public relations will be the responsibility of G&A staff. The management of the non-profit Cerro de San Pedro Foundation, established to provide assistance to the community, will also be administered by G&A staff.

Corporate Support

Contract and in-house legal, headquarters accounting support, reserve audits, etc., will be provided through corporate support.

G&A Personnel

G&A personnel remains constant in Years PP through 8 at 18, dropping to 4 in Years 9 through 12. All G&A positions are salaried. Additional personnel required for contracted services occur as a service cost, rather than labor.

G&A Operating Costs

Table 1.23 provides a summary of G&A operating costs. There are no capital costs associated with G&A.

Table 1.23

G&A Operating Costs by Area ($000)							
Year	General Services	Human Resources	Environ-mental	Public Relations	Corporate Support	G&A Manpower	Total
PP	682	73	110	56	100	558	1,579
1	670	73	110	56	100	558	1,567
2	670	73	75	56	100	558	1,532
3	670	71	75	56	100	558	1,530
4	670	70	75	56	100	558	1,529
5	670	69	75	56	100	558	1,528
6	670	68	75	56	80	558	1,507
7	668	67	75	56	55	558	1,479
8	668	62	75	56	55	558	1,474
9	302	49	75	53	25	89	593
Total	6,340	675	820	557	971	5111	14,318

1.10 Environmental and Socioeconomics

Baseline environmental investigations and evaluation of impacts were conducted during the period 1996-1997. The Manifestacion de Impacto Ambiental (MIA - Environmental Impact Statement) was submitted by MSX in October 1997 to the Secretaria de Medio Ambiente Recursos Naturales y Pesca (SEMARNAP – Secretariat of the Environment, Natural Resources, and Fisheries). Subsequently, an MIA resolution was issued in February 1999 by the Instituto Nacional de Ecologia (INE – National Institute of Ecology) which set forth conditions for environmental protection and approval of the MIA. Development of a series of responses and environmental-related plans, as required by MIA resolution, are underway and will continue through the operational and closure phases of the project. In addition, all other necessary permits to begin construction and operations have been granted by the corresponding state and municipal authorities.

MSX has also developed baseline socioeconomic information and established plans to mitigate effects and enhance the socioeconomic status of inhabitants in the communities.

Environmental Baseline

Water Quality

Because there are no perennial streams and groundwater is limited or deep within and adjacent to the project area, there is little risk of impacting any surface or groundwater. With the arid climate and low precipitation in the region, there is low potential for production of large volumes of seepage from within the spent leach pad, mine open pit, or the waste rock facility.

Potable water in the SLP valley is contained in either permeable alluvium, conglomeratic to sandy rhyolite tuff, or fractured latite. Water quality testing in several wells within these aquifers show that metals and most other constituents are well below the maximum allowable limits. Limited deep groundwater is located in fractured limestone, porphyry, and latite beneath the project site, including the La Zapatilla heap leach area. No hydrogeological connection is believed to exist between the limited deep groundwater located near the project site and the down-gradient potable, uncontaminated SLP groundwater aquifers.

Water Supply

MSX will obtain its water supply from a well it recently drilled within the eastern limit of the potable SLP aquifers approximately 1.8km southwest of the process plant/western edge of the leach pad. Drawdown modeling of the effects of average pumping from this location for required Cerro San Pedro project water required shows that the surrounding potable aquifers will not be impacted.

Rock Geochemistry

A number of routine static-type acid-base accounting tests were conducted to determine if rock types present at Cerro San Pedro had the potential for acid generation. As expected, limestone rocks (the major waste rock type) have substantially high neutralization potential, while porphyry rock types (the major rock type) have the potential to produce acid depending on the amount of contained sulfide-bearing minerals. Further kinetic (humidity cell) testing was performed on the three porphyry rock types. This test work indicates that Porphyry Oxide (the majority of porphyry rock type mined as ore and waste) generates weakly acidic to slightly alkaline leachate with limited release of metals. Porphyry Mixed and Sulfide types, however, produce moderate to high acidic leachate with relatively high release rates of contained metals.

Biological

Three main vegetation types exist in the project area, all typical of plant communities established in an arid climate, hilly terrain and soil derived from limestone bedrock. These plant communities are characterized by Yucca species and some large and small cactus in the north half of the project area and with more abundant large and very thorny cactus species in the south and west portions of the project area. Over 100 vegetation species were identified in the project area. Three of these species found throughout the project area (all cactus) are considered endangered, rare, and subject to special protection.

Wildlife is limited by the natural characteristics of the project area, primarily the arid climate and low vegetation production. Several bird species typical of desert areas are present. and the State of SLP also falls within an important migration route for waterfowl (particularly ducks). Five species within the project area are considered endangered and/or protected and include the sparrow hawk, rattlesnake, whipping snake, desert turtle, and viper snake.

Archaeological / Historical

Historical buildings and monuments, including two churches, are common in the village of Cerro de San Pedro, and authorities have established a protection zone to ensure that these are preserved. The church closest to the proposed pit, the San Pedro Apostol church, has already suffered structural damage due to uneven settling of its foundation and poor maintenance over the years. A series of studies and tests have taken place in the past year, led by state authorities and supported/assisted by MSX, to determine means to stabilize and rehabilitate the church.

Environmental Permitting

The MIA was based on development of the Cerro San Pedro project, with an impacted area of 373.4 hectare (ha). The results of this Feasibility Study call for a somewhat smaller pit and waste dump and a modified leach pad and solution pond configuration than that proposed under the MIA. These modifications and others are in the process of being documented and will be forwarded to SEMARNAP. Table 1.24 compares the size of the areas to be impacted.

In addition to identifying baseline conditions, the MIA and MSX have also identified areas of potential environmental impacts and related mitigation strategies. The MIA Resolution documents these areas of impacts and presents a schedule for submission of plans and studies for their mitigation in order to obtain final MIA authorization. The following section summarizes the overall environmental management

plan that addresses prevention and protective measures to be taken during construction and operations included in these submittals.

Table 1.24

Comparison of Impacted Area in MIA versus Feasibility Study				
	Approved in MIA		Feasibility Study	
Site Facility	Has	Description	Has	Description
Open Pit Mine Area	67.58	194 M tonnes	47.34	163 M tonnes
Waste Rock Dumps	178.00	East Only, 117 M tonnes	123.70	East and West 99.6 M tonnes
Roads – Pit to Waste Dumps			2.08	
Areas of Backfill, Crusher Areas, Roads, Conveyors, etc.	15.65	Different layout than Feasibility	30.18	Includes all Crushing Plants
Leach Pad, Ponds, Process Plant, Soil Stockpile	103.01	External Ponds	152.70	New Pad Design, Internal Ponds
Nueva La Zapatilla	9.15	Includes Access Roads	15.66	
Total	373.39		371.66	

Environmental Management

Vegetation and Wildlife

To ensure protection of the biological resources of the area, particularly the three protected cactus species, MSX will rescue and protect these species (and others that will improve subsequent reclamation success) prior to operations. At the end of operations, these species will be re-established at properly prepared sites as summarized in Section 1.11. Wildlife species, particularly birds, will be protected from any hazardous ponds by using floating balls or nets to exclude birds. MSX will also establish sources of fresh water for wildlife.

Materials Management and Safety

All materials will be managed utilizing plans to prevent accidents and spills and to protect the safety of workers and the public. A plan for proper explosive handling and measures to ensure the safety of workers and any inhabitants or visitors in the safety buffer zone will be crucial. Blasting will occur at the end of each shift or at other times as coordinated with local authority assistance, to minimize disruption

and impact to the village of Cerro de San Pedro. Contingency plans will also be developed to address any emergency situations.

Waste Management

A plan to encapsulate potentially acid generating (PAG) waste rock will be incorporated into a waste rock management plan. MSX will conservatively classify Porphyry Oxide waste rock as PAG along with Porphyry Mixed and Sulfide to ensure there is no miss-classification of PAG during operations. Based on the mine schedule, the dump material will be comprised of a limestone (neutralizing/acid consuming) to porphyry (acid generating) waste rock ratio of 14:1. The dump is also constructed on limestone bedrock. Of the significantly lower proportion of PAG material in the dump, nearly 60 percent is Porphyry Oxide which will contribute very little to acidity. Because of the very high proportion of limestone, the selective handling, placement, and isolation of PAG material within the dump will prevent oxidation of sulfides and generation of acid rock drainage. Water balance modeling indicates that little or no effluent is expected to emanate from the waste rock dump.

Because groundwater is significantly below the mine pit, the only contribution to water in the pit will be from precipitation and run-off from surrounding areas. Based on the current design, the maximum accumulation of pit water is estimated at a depth of 5m following a large storm event. A total of 50 percent of pit exposures (primarily in pit walls) is comprised of limestone with high neutralization potential. Of the remaining 50 percent (primarily the pit floor), over half is Porphyry Oxide and the remainder is Porphyry Mixed and Sulfide. The overall arid conditions and deep groundwater at Cerro San Pedro should contribute to a low potential for development of an extensive acid lake in the open pit.

Studies will be conducted during operations to determine if spent ore on the leach pad will have the potential to generate acid leachate upon closure. The control of heap solutions and leachate is discussed under water management.

Hazardous wastes, such as lead-acid batteries, solvents, spent laboratory chemicals, etc. will be collected and properly disposed in an approved off-site facility. Non-hazardous (solid) wastes such as domestic garbage, sewage, construction debris, and plastic will be managed using waste minimization, on- and off-site recycling, or burial in an off-site disposal facility. Other industrial wastes such as scrap steel, used rubber, or empty plastic drums may be made available for resale, or returned to the supplier.

Water Management

The potential impacts to water at the site will be managed during operations and post-closure in several manners. Potable water will be conserved, particularly with regard to the closure strategy of detoxifying/depleting heap solutions by recirculation/evaporation of solutions versus rinsing with fresh

water. Collection of natural run-off into operational facilities (the pit, dump, and leach pad) will be limited by diversion structures, thereby decreasing the potential to generate leachate and/or acid rock drainage. During operations and post-closure, cyanide heap solutions and/or any potential residual leachate will be isolated from the underlying bedrock by a geo-synthetic liner system. Other operational controls include systems to monitor any potential solution leakage from the pad.

Air Quality and Noise Management

An air quality management plan will include measures to minimize air emissions from major sources (fugitive dust from haul trucks and air-borne metals from the Merrill-Crowe recovery plant). The effects of noise generated by blasting will be minimized through appropriate scheduling. Employees will be required to wear hearing protection in areas where noise exceeds safe levels. Monitoring of all blasts will be performed at the San Pedro Apostol church to ensure that vibration and air blast levels stay within the allowable standards.

Monitoring

Monitoring activities will be performed according to internationally accepted standards and the requirements of SEMARNAP. Identifying changes that could take place in the environment due to project development; evaluating effectiveness of preventive and control measures; and ensuring compliance with environmental regulations will be the main objectives of the monitoring program.

Socioeconomic Programs

The development of the Cerro San Pedro Project will require the relocation of the 21 families that live in the village of La Zapatilla to make room for the leach pad. In addition, the open pit mining operations will take place adjacent to the village of Cerro San Pedro where 24 families live as permanent residents. Of these families, 20 in La Zapatilla village will be relocated to a new village built by MSX approximately 2 km southwest of the present La Zapatilla village, and an undetermined number may choose to be relocated to new housing built by MSX within the village of Cerro de San Pedro. Other families have been compensated to relocate to other sites of their choice. Housing, other community infrastructure, and municipal services will be provided at or above the current standard of living conditions. As part of the community infrastructure that MSX will provide, a school will be constructed that can accommodate up to 40 children at the new La Zapatilla village. Currently, school children from La Zapatilla attend school in Portezuelo, 6km away.

The Cerro San Pedro project will create approximately 178 jobs during normal operations, with up to 420 jobs during construction. MSX has established policy to give preferential hiring consideration to people from communities nearby the project, providing direct improvement of economic status to many families. MSX has also committed to assist in the sustainable economic and social development of the area surrounding the project, including the villages of Cerro de San Pedro, Cuesta de Campa, Monte Caldera, and La Zapatilla. An urbanization plan for this area has been developed that considers the baseline socioeoconomics and the future benefits that the project will generate. A non-profit foundation has been established by MSX to administer funding that MSX will provide for the preservation of the village of Cerro de San Pedro and donate assistance for the community. The foundation will be structured to require community participation and be self-sustaining for the long term. Programs the foundation will support include preservation of the two historical churches in Cerro de San Pedro, promotion of tourism by establishing cultural programs, and development of conservation programs such as the botanical gardens and self-sustaining cottage industries that will be compatible with tourism in the area.

1.11 Reclamation and Closure

The closure strategy for the Cerro San Pedro project has been developed with the specific objective of leaving the land in a useful, safe and stable configuration capable of supporting native plant communities, wildlife habitat, watershed functions, and limited livestock grazing. A closure strategy summary is presented in Figure 1.14.

Heap Leach Facility

The heap leach facility closure objective is the chemical and physical stabilization of the spent ore pile. Anticipated closure activities for the heap include detoxification and depletion of the heap effluent through volatilization/evaporation during recirculation of solution, growth medium placement of approximately 20 cm of soil on the top and side slopes of the heap, revegetation by transplanting seedlings and cuttings of native species, and monitoring to evaluate success. A finite quantity of residual effluent may require disposal, but passive disposal techniques (such as a Biopass system) are anticipated. Recontouring of the heap side slopes may be necessary to ensure long-term stability of applied cover soil which would also require installation of additional geosynthetic liner around the leach pad to accommodate regrading. Historic mine waste dumps (tailings) will have been removed during operations and disposed of within the heap.

PIT

- **Storm water run-on diversion.**
  - *Along pit perimeter.*
  - *Potential additional in-pit diversion.*
- **Passive chemical treatment.**
  - *Of pit water using on-site limestone backfill.*
- **Pit slope stabilization.**
  - *Operational/final geotechnical assessment to maximize long-term stability.*
- **Limited revegetation around crest.**

HEAP LEACH PAD

- **Storm water run-on diversion.**
- **Evaporation of solution.**
  - *Using spray emitters.*
- **Natural attenuation.**
  - *Of cyanide during evaporation/volatilization/re-carbonation.*
- **Depletion of entire heap solution inventory within 4 years.**
- **Incorporate kinetic testing results of spent ore after year 2 operations to determine any need for ARD management.**
- **Passive treatment using BioPass system if needed to meet water discharge limits for land application.**
- **Subsurface land application of any potential long-term residual seepage.**
- **Limited surface recontouring to maximize run-off, minimize erosion, and encourage revegetation.**
- **Infiltration barrier placement of 20 cm of cover soil.**
- **Revegetation with rescued/ protected species and other selected species.**

WASTE ROCK DUMP

- **Storm water run-on diversion.**
  - *Upgradient of dump.*
- **Placement of historic mining waste, spent ore and tailings in dump and/or leach pad.**
- **Selective handling of PAG materials (only 7% of waste rock).**
  - *During operations to encapsulate completely in alkaline-generating limestone waste.*
- **Control of erosion on dump surface with construction of moisture collection basins and limited recontouring of surface drainages/slopes.**
- **Refinement of modelling upon closure which currently shows little or no leachate development.**
- **Inherent passive chemical treatment and mixing of any PAG leachate with limestone leachate at 1:14 rock mass ratios (i.e., overall 1:175 acid/neut ratios).**
- **Revegetation with rescued/ protected species and other selected species at micro-sites.**

ANCILLARY MINE FACILITIES

- **Removal/salvage of processing facilities and/or on-site burial of non-hazardous, non-salvageable components.**
- **Return administrative/process/ shop/warehouse buildings to beneficial economic use of community where desirable or remove/salvage.**
- **Revegetation of the footprint of all affected areas with rescued/ protected species and other select species.**

REVEGETATION

- **Incorporate results of soil building and revegetation studies conducted during operations to maximize reclamation success at all facility areas.**

POST-CLOSURE MONITORING AND MAINTENANCE

- **Soil erosion inspection.**
- **Monitoring.**
  - *–Revegetation performance.*
  - *–Presence/absence of seepage from heap pad and waste rock dump.*
- **Monitoring/maintenance of post-closure seepage management systems for heap pad, if necessary.**
- **Reporting information to regulators.**

Figure 1.14 Closure Strategy - For Various Site Facilities

Mine Waste/Waste Rock Dumps

The waste rock disposal site closure objective is primarily the physical stabilization of the facility. Reclamation activities at the waste rock dump are expected to be limited to selective topsoil placement, revegetation and monitoring reclamation success. A limited quantity of growth medium application is anticipated because of the limited quantity of growth medium available from the facility footprint. Revegetation efforts will focus on growth medium placement in microsites, and primarily consist of transplanting mature plants in the manner described for the heap area. Revegetation of the dump side slopes will rely on volunteer invasion by native plants over a long time period. Potentially acid-generating (PAG) waste rock will be isolated within the crest confines of the dump in accordance with the waste rock management plan, within areas where vegetation may be established to inhibit deep infiltration. Existing historic waste rock within and adjacent to San Pedro Creek will have been removed during operations and placed within the waste rock dump.

Mine Pit

The mine pit closure objective is primarily one of securing the site. Key activities involve installing a barbed wire fence around the perimeter of the pit to prevent access by people, livestock, and wildlife. A perimeter diversion ditch is planned to limit surface water flow into the pit. To mitigate the potential for acid drainage in the pit floor where storm water may periodically accumulate and dissipate, partial backfilling with a small quantity of limestone waste rock has been accounted for in contingency costs. Limited revegetation efforts are anticipated around the pit crest in selected areas where visibility is a factor. Monitoring of the revegetation efforts and inspection of the fencing and ditch will be conducted in coordination with monitoring of the reclaimed heap.

Infrastructures

All other site facilities have been categorized under infrastructure and include roads, buildings, process facilities and any other foundation pads, tanks and pipelines. Reclamation objectives include the removal of any environmental liabilities and the return of the site to a condition that resembles pre-mining conditions or restores productivity. All salvageable items will be removed from the site. Potentially hazardous items will be disposed of in a licensed facility. Remaining items that are inert may be either demolished and buried on site in a construction debris landfill or buried in place. Particular structures may be preserved and donated to the local municipality for use by the community. Roads that will not be required after mine closure will be regraded and revegetated to approximate pre-mining conditions.

Capital Costs

All costs associated with closure and reclamation activities are considered capital costs and are summarized in Table 1.25.

Table 1.25

Closure and Reclamation Costs					
Facility/Activity	**Year 9**	**Year 10**	**Year 11**	**Year 12**	**Total**
Leach Pad					
Detoxification/pumping		200,000	200,000		400,000
Passive treatment		75,000	75,000		150,000
Physical stabilization:					
Geosynthetic liner			250,000	250,000	500,000
Slope regrading			630,600	900,000	1,530,600
Coversoil placement			220,000	228,000	448,000
Revegetation:					
Soil building				25,000	25,000
Planting			58,200	120,000	178,200
Subtotal		275,000	1,433,800	1,523,000	3,231,800
Waste Rock Dump					
Physical stabilization:					
Topsoil placement	30,800				30,800
Revegetation:					
Soil building	100,000	78,000			178,000
Planting	100,200	60,000			160,200
Subtotal	231,000	138,000			369,000
Mine Pit					
Pit floor backfilling w/ls	21,000				21,000
Institutional controls:					
Imp. Run-on diversion	1,100				1,100
Perimeter fencing	5,900				5,900
Revegetation/planting	10,000	10,000			20,000
Subtotal	38,000	10,000			48,000
Infrastructures					
Demo/salvage/removal	80,000	20,000			100,000
On-site disposal	40,000	10,000			50,000
Road recontour/reclam	20,000	20,000	7,500		47,500
Rehab disturbed areas	26,000	20,000	10,000		56,000
Subtotal	166,000	70,000	17,500		253,500
TOTAL	435,000	493,000	1,451,300	1,523,000	3,902,300
Contingency (10%)	43,500	49,300	145,100	268,200	390,200
TOTAL	478,000	542,300	1,596,400	1,675,300	4,292,500

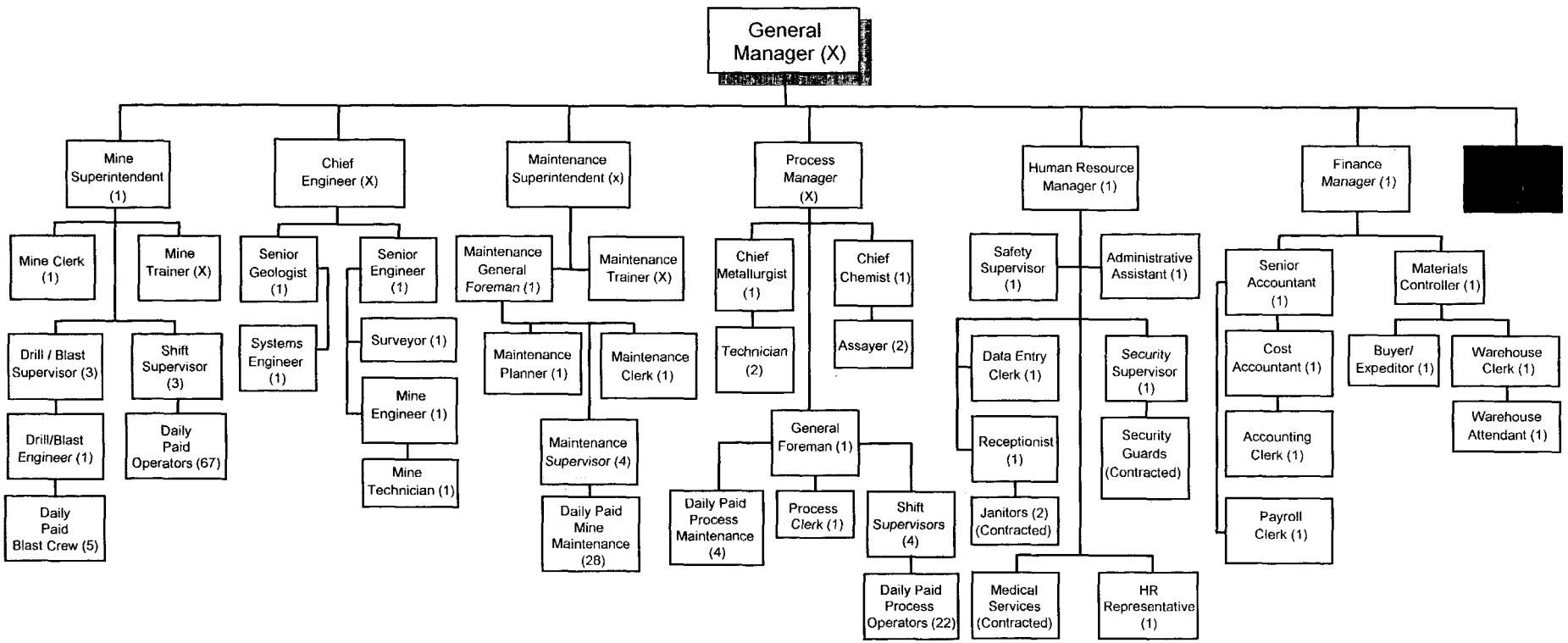
The schedule for completing the closure activities is controlled by the requirements contained in the MIA, specifically that completion of site reclamation shall be within four years of final processing. This timeframe allows for the depletion of heap effluent using evaporative recirculation without a need for

external management facilities. A two-year period of continued, but slowly reduced, solution flow through the heap is anticipated following the last placement of ore on the heap. The majority of the available precious metals should be recovered from the heap at the end of this two-year period, which would coincide with the conclusion of formal processing at the project. Formal reclamation and closure activities of the heap will then be initiated, starting with a two-year period of enhanced solution loss through evaporation and natural attenuation. At the end of this two-year period (Years 9-10), the residual solution should be totally drained from the heap. Following this period, the heap will be regraded, coversoil applied, and the heap revegetated and the process and recovery equipment removed. Reclamation and closure activities of the majority of the site buildings, the open pit, and the mine waste dump will be initiated starting immediately after the conclusion of mining. Annual monitoring would be conducted thereafter to ensure the successful development of vegetative communities and check the general physical stability of the reclamation measures.

1.12 Organization, Structure and Operating Policies

The Cerro San Pedro Project will employ a traditional organizational structure and is divided into three primary areas - Mining, Processing, and General Services and Administration (G&A). The number of expatriate employees will be kept to a minimum, with all but two expatriate employees being replaced by national employees by Year 5 of operations. An overall project organization chart is presented in Figure 1.15 for operations Year 1. A summary of the manpower by area and by year is presented in Figure 1.16. The total number of operations employees ranges from 135 during year Pre-production (PP), increasing to a maximum of 178 in Years 2 through 4, then decreasing to 156 in Year 8, the last year of ore production. The number of employees drops during Years 9 and 10 when only residual metal recovery from the heap and some reclamation are occurring, and drops further during final reclamation and closure. Approximately 63 to 69 percent of the total employees are daily paid, with the balance being salaried.

All national employees, both salaried and daily paid, will be employed by Servicios San Xavier (SSX), a wholly owned subsidiary of Glamis de Mexico, S.A. de C.V. SSX will supply employees to MSX under a Services Agreement. This arrangement will consolidate all employees under one Mexican company. Expatriate employees will work under a similar Services Agreement to MSX, but will be employed by newly created Canadian or U.S. companies to maintain existing benefits and simplify tax consequences.

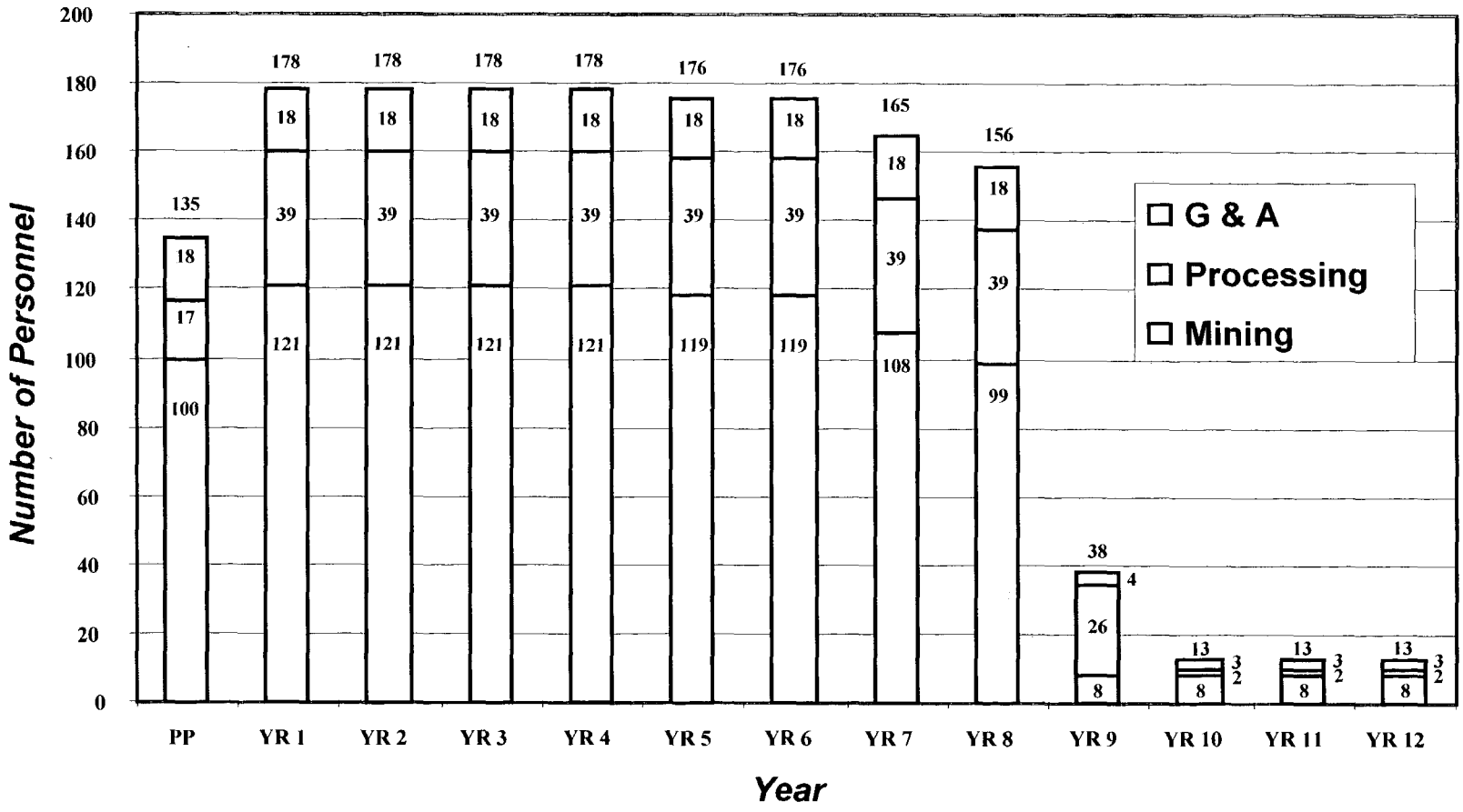


(X) = Expatriate

MINERA SAN XAVIER, S.A. de C.V.

Figure 1.15 Overall Project Organization Chart (Year 1)

Figure 1.16 Operations Manpower Summary Preproduction through Closure



Work Schedule

The work schedule for the Cerro San Pedro Project is based on compliance with Mexican Federal labor law, minimizing the amount of overtime pay and minimizing the amount of work performed on Sundays. Management staff will normally work day shift only, five or six days per week. Some supervisory and/or technical staff will work day shift only, while shift supervisors work a shift rotation schedule, the same as the daily paid employees. After operating experience is gained, it is assumed that the workers on shift rotations will rotate shifts in two to four week intervals.

Labor rates used in the cost estimates are based on recent wage and salary surveys conducted in the SLP area for similar work including equipment operation, maintenance, and support staff positions. Salaries range from $4,200 to $45,000 per year and daily paid labor rates average 109 pesos, or $11.60 per day, equating to $4,234 per year without burden. Benefit burdens, as a percentage of base salary, are approximately 65 percent.

1.13 Construction Management and Schedule

The major construction activities at Cerro San Pedro will be governed by "turn-key" contracts, which will include construction management, engineering, procurement, and safety functions for each construction area. Separate contracts will be awarded for general engineering and quality control/quality assurance; and for construction of the leach pad, process plant, electrical supply and distribution system, on-site buildings, and other small infrastructure packages. With the assistance of third-party engineer(s), the MSX construction management team will supervise and administer these contracts. The major construction contracts will be awarded on a lump-sum basis and will include requirements for contractor performance with regard to schedule, specifications, quality control and quality assurance, safety and environmental compliance, hiring, security, and procurement.

The Construction Project Manager, who will report to the project General Manager during the construction and commissioning period, will lead the MSX construction management team. In addition to the Construction Project Manager, other temporary MSX employees in the construction management team will include a safety officer, secretary, project accountant, clerk, and procurement manager. The Construction Project Manager will be hired only for a fixed term during construction, and will have previous experience with management of large multi-discipline construction projects. Other temporary MSX construction management team employees will have the opportunity to fill permanent operating positions with MSX following successful project construction and commissioning.

All engineering designs and specifications will be subjected to a third-party engineering review before lump-sum construction contracts are awarded. Conformance with the designs and specifications will be assured by the third party engineer(s) hired by MSX to perform this work during the construction period.

The construction management team will be technically supported by vendors' representatives assisting in most major mechanical equipment installation, and by a specialized consultant to manage the Construction Quality Assurance (CQA) program during leach pad and solution pond construction activities. The construction management team will establish procedures and work methods with its managers and in consultation with the MSX environmental coordinator to ensure the protection of the environment, as required under the MIA conditions. A detailed plan and schedule for testing, start-up, and turnover will be prepared by the construction management team. The team will work closely with the MSX operating personnel to ensure proper testing, safety, and operating procedures.

As construction progresses, MSX operating personnel will provide additional support relating to environmental matters, permitting, and communication with different local and federal agencies, human resources, accounting, site first aid service, and security. Minera San Xavier, S.A. de C.V. (MSX) recognizes that an effective safety program during site construction is an absolute requirement. Figure 13.1 presents an organization chart effective during Cerro San Pedro project construction activities.

The combined capital budget for construction management, QA/QC and engineering at Cerro San Pedro is approximately $832,000, or more than 5% of the total estimated construction value. This budget is considered typical for a large heap leach operation administering turn-key construction contracts.

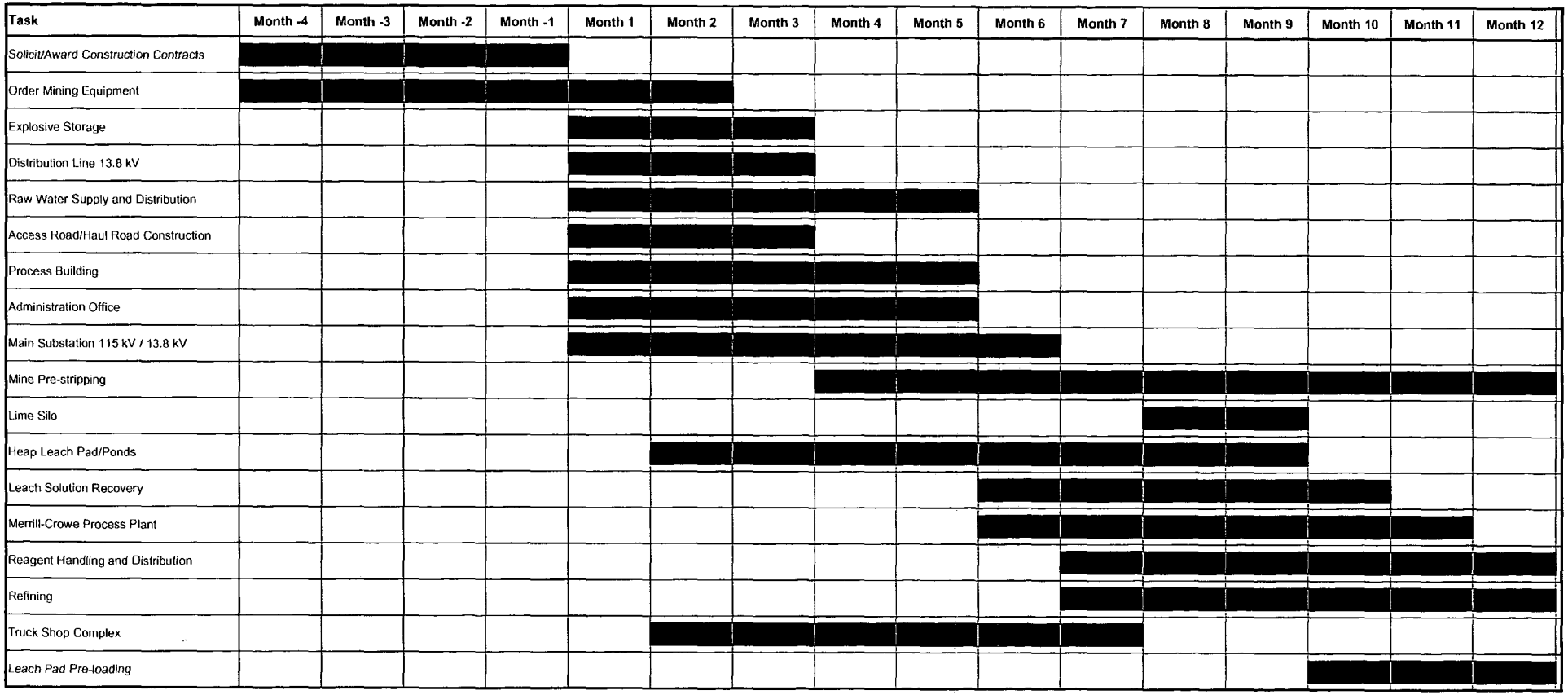
The estimated daily average manpower by month for the construction effort builds from about 100 employees in Month 1 to about 420 employees in Month 5, and then drops off sharply to about 100 construction employees in Month 12. Estimated daily average manpower by month for MSX operations is about 50 in Month 1, gradually building to about 138 employees in Months 5 - 12. A maximum total employees on site occurs in Month 5 at about 555 employees.

The summarized construction schedule by area is illustrated in Figure 1.17.

Cerro San Pedro Project

Construction & Pre-production Time Line

Figure 1.17



1.14 Operating Cost Estimate

Operating costs are developed for all years, Pre-production (PP) through Year 8, and all costs (capital and operating) are treated as capital costs in Year PP. Labor costs and consumable costs are the two primary components of the operating costs.

No contingency has been developed for the operating costs, but the costs for both labor and the major areas of consumables have been confirmed by recent quotations.

Operating Cost Summary

A summary of the operating costs by year by area is presented in Table 1.25. This table consolidates costs in the various areas into total costs per year as well as cost per tonne of ore. Total operating costs during the operating Years 1 through 8 range from $18.9 million in Year 1 to a high of $19.4 million in Year 3. Total operating cost per tonne of ore ranges from a low of $2.25 in Years 6 and 7 to a high of $4.99 in Year 8. Figure 1.18 shows the operating cost per year by area in total dollars, while Figure 1.19 shows the operating cost per year in terms of dollars per tonne of ore.

Mining and processing costs amount to 55 percent and 35 percent respectively of the total operating cost, leaving 10 percent for G&A costs.

Table 1.25

Annual Operating Cost Summary											
	Year									Totals	
	PP	1	2	3	4	5	6	7	8	Production	% of Total
Ore Tonnes	0	5845	5315	6655	7749	7540	7432	7641	1069	49246	
Waste Tonnes	9406	14512	12615	12752	9027	8630	1850	2433	72	71297	
Total Tonnes	9406	20357	17930	19407	16776	16170	9282	10074	1141	120543	
Mining											
Total Cost ($000)	6706	11420	10830	11120	10334	9848	7723	8009	2784	78774	
Unit Cost ($/ore tonne)		1.95	2.04	1.67	1.33	1.31	1.04	1.05	2.60	1.60	55%
Processing											
Total Cost ($000)	0	5903	5368	6722	7826	7615	7506	7717	1080	49737	
Unit Cost ($/ore tonne)		1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	35%
G&A											
Total Cost ($000)	1579	1567	1532	1530	1529	1528	1507	1479	1474	13725	
Unit Cost ($/ore tonne)		0.27	0.29	0.23	0.20	0.20	0.20	0.19	1.38	0.28	10%
Total Cost ($000)	8285	18890	17730	19372	19689	18991	16736	17205	5338	142236	
Unit Cost ($/ore tonne)		3.23	3.34	2.91	2.54	2.52	2.25	2.25	4.99	2.89	

Figure 1.18 Annual Operating Costs per Area

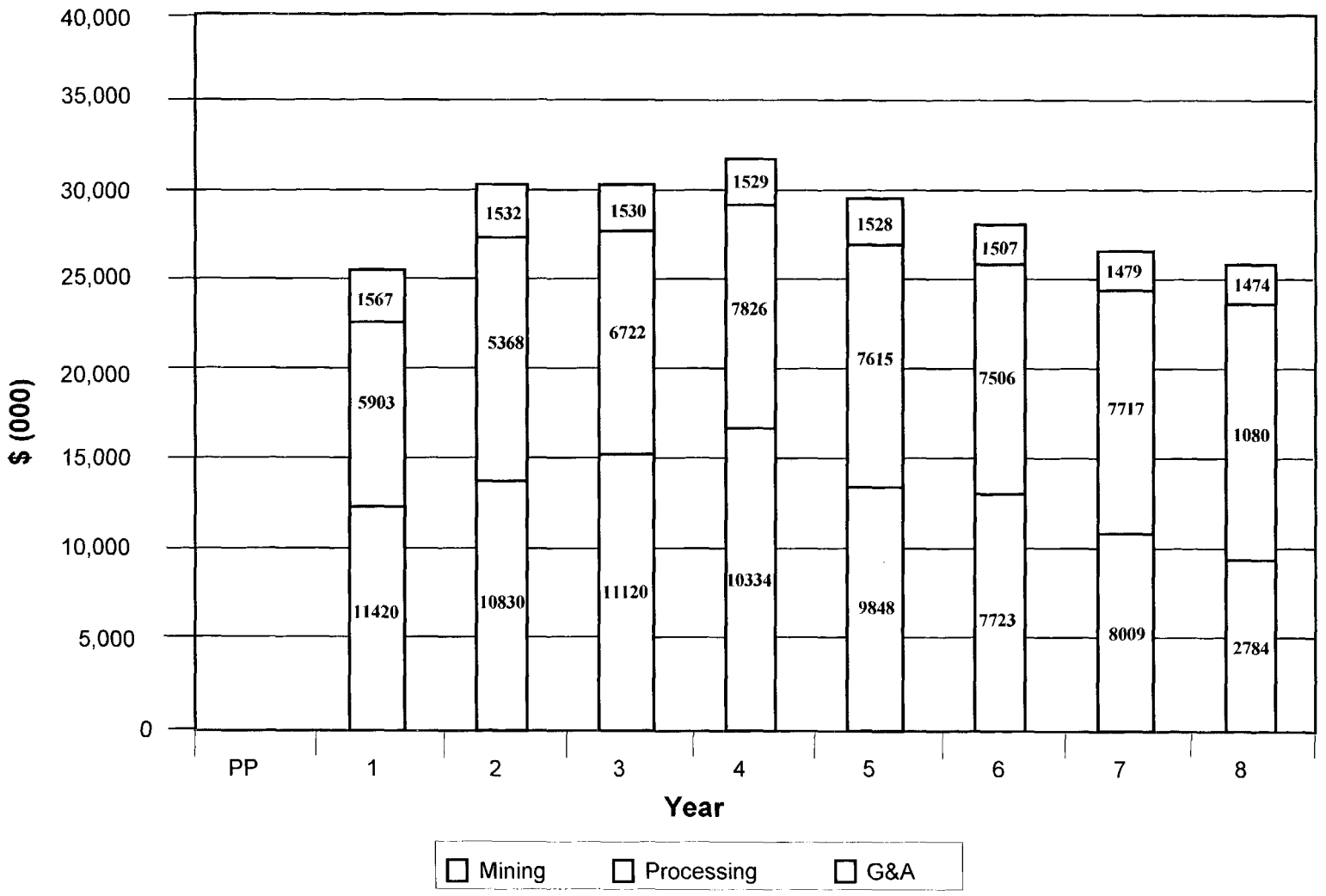
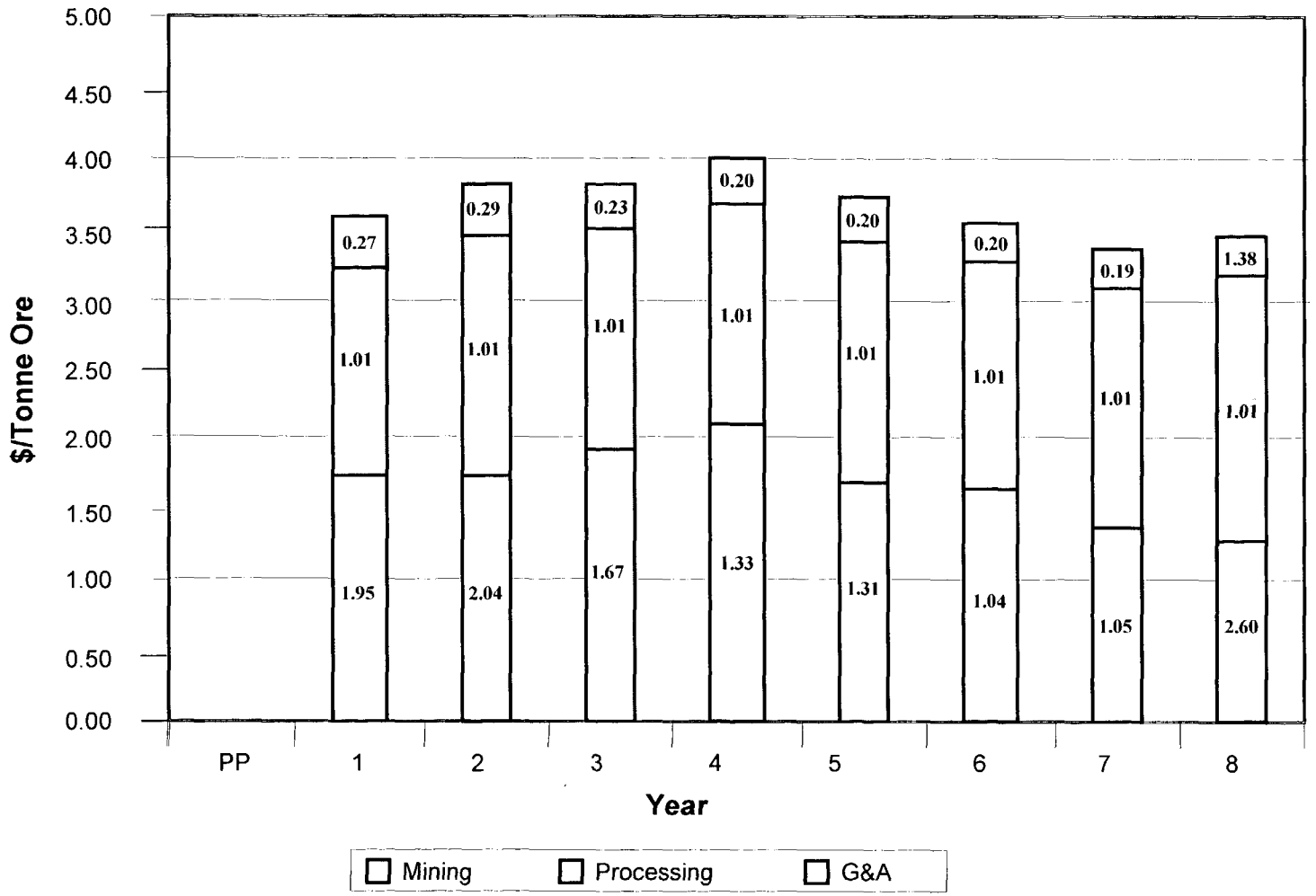


Figure 1.19 Annual Operating Costs per Tonne of Ore



1.15 Capital Cost Estimate

The capital cost estimate prepared by Minera San Xavier, S.A. de C.V. (MSX) and its consultants is represented in U.S. dollars as of the fourth quarter 2000. No adjustment has been provided for future price escalation or inflation.

Most of the construction material and skilled labor are available in Mexico. San Luis Potosí is a relatively large city and most of the services required for project construction are available within the local vicinity.

New and/or used material and equipment purchased outside of Mexico, will be imported under the North America Free Trade Agreement (NAFTA) and/or the Mexican PITEX program, which allows corporations exporting their finished product and operating under specific criteria, the ability to temporarily import equipment and material free of duties and sales tax.

The value-added tax (VAT) is excluded from the capital cost estimate.

Project Total Capital Cost Estimate - Summary by Area

A summary of the project construction, pre-production, and sustaining capital cost estimates is presented in Table 1.26.

The capital cost estimate is divided into major areas of Mining, Processing, and Administration Infrastructure and outlines the following:

- Initial capital expenditures in the pre-production and construction year and Year 1 totals $45.3 million.
- Sustaining capital expenditures includes the construction of the second phase of the leach pad in Year 3 ($3.5 million), replacement of some support equipment in Year 4 ($0.3 million), and rebuilding of some mine equipment in Year 5 ($2.7 million).
- Overall capital cost estimate, incorporating pre-production, construction costs, and sustaining capital totals $51.7 million.

Table 1.26

Capital Cost Summary by Area ($)

Area	PP	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9-12	Total
Mining											
Capitalized Pre-strip (Owner Mining)	$ 6,706,000										$ 6,706,000
Major Mine Equipment	$ 9,054,000	$ 8,776,000				$ 2,674,500					$ 20,504,500
Mine Support Equipment	$ 417,400				$ 120,000						$ 537,400
Maintenance Equipment	$ 1,124,000				$ 72,000						$ 1,196,000
G &A Equipment	$ 473,000				$ 104,000						$ 577,000
Maintenance Facilities & Mine Roads											
Shop/Warehouse/Fuel/Wash	$ 826,000										
Run-of-Mine Haulroad (Contractor)	$ 1,007,169										$ 1,007,169
Explosives Storage	$ 131,900										$ 131,900
Pit Working Access (Contractor)	$ 900,000										$ 900,000
Mining - Subtotal	$ 20,639,469	$ 8,776,000	$ -	$ -	$ 296,000	$ 2,674,500	$ -	$ -	$ -	$ -	**$ 32,385,969**
Processing											
Leach Pad and Solution Ponds	$ 4,462,340			$ 3,479,840							$ 7,942,180
Merrill-Crowe Plant	$ 1,784,906										$ 1,784,906
Refinery	$ 427,188										$ 427,188
Solution Pumping & Distribution	$ 900,272										$ 900,272
Construction Management & QA/QC	$ 497,895										$ 497,895
Engineering	$ 334,037										$ 334,037
Laboratory	$ 394,200										$ 394,200
Lime Silo	$ 310,000										$ 310,000
Processing - Subtotal	$ 9,110,838	$ -	$ -	$ 3,479,840	$ -	$ -	$ -	$ -	$ -	$ -	**$ 12,590,678**
Admin. & Infrastructure											
Roads	$ 175,000										$ 175,000
Office, Training Building, and Furniture	$ 370,000										$ 370,000
Site Preparation	$ 475,000										$ 475,000
Water Supply	$ 645,000										$ 645,000
Cerro de San Pedro Housing	$ 350,000										$ 350,000
Cerro de San Pedro Church Stabilization	$ 200,000										$ 200,000
Property Fencing	$ -										$ -
Electric Power and Communication	$ 2,206,680										$ 2,206,680
Owner's Cost (G&A)	$ 1,579,000										$ 1,579,000
Admin. & Infrastructure - Subtotal	$ 6,000,680	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	**$ 6,000,680**
Project Expenditure Total	$ 35,750,987	$ 8,776,000	$ -	$ 3,479,840	$ 296,000	$ 2,674,500	$ -	$ -	$ -	$ -	**$ 50,977,327**

1.16 Economic Evaluation and Financial Analyses

This section presents a summary of the project's financial analyses, as well as information on anticipated project preproduction and development costs, working capital, and taxes. This information has been formulated into an economic model that evaluates the project's financial criteria on an after-tax basis using constant dollars (fourth quarter 2000). Metal prices of $275 per ounce of gold and $5.00 per ounce of silver were used in the base case evaluation. Sensitivity analyses evaluating the impact of varying project capital and operating costs as well as gold and silver recoveries have been developed. Traditional financial evaluation criteria, such as internal rate of return (IRR) and net present value (NPV), have also been calculated.

Review of Significant Project Information

A total of 120.5 million tonnes of material will be mined and 49.2 million tonnes of ore will be processed at Cerro San Pedro over a mine life of 7.25 years, at an average processing rate of 22,000 tonnes per day or approximately 6.8 million tonnes per year. The grade of gold and silver is fairly stable over the life of the mine, as shown in Table 1.27. The mined grade and process recoveries have a major influence on the overall operating cash cost per ounce of gold, silver, and gold equivalent produced. In addition, the waste/ore ratio varies somewhat over the life of the mine, which also impacts the overall cash operating costs.

Table1.27

Mine Production Schedule						
Project Period	**Ore ktonnes**	**Gold Grade g Au/t**	**Silver Grade g Ag/ t**	**Waste ktonnes**	**Total ktonnes**	**Strip Ratio**
Pre-production	--	--	--	9,406	9,406	--
Year 1	5845	0.650	24.65	14,512	20,357	2.5
Year 2	5,315	0.642	31.01	12,615	17,930	2.4
Year 3	6,655	0.511	29.62	12,752	19,407	1.9
Year 4	7,749	0.611	22.15	9,027	16,776	1.2
Year 5	7,540	0.488	19.59	8,630	16,170	1.1
Year 6	7,432	0.570	23.46	1,850	9,282	0.2
Year 7	7,641	0.574	16.04	2,433	10,074	0.3
Year 8	1,069	0.303	10.69	72	1,141	0.1
Total	49,246	0.57	23.02	71,297	120,543	1.4

Gold and silver recoveries are estimated to average 70.5 percent and 35.7 percent, respectively, through the end of Year 8. However, re-circulation of heap solutions will be required for depletion and

detoxification and some residual metal recoveries will result in additional precious metal production through Year 9 but are not considered in the economics at this time.

The unit operating costs covering areas such as mining, processing, and G&A are relatively stable over the mine life. The average operating cost by area is shown in Table 1.28 and total $2.72 per tonne of ore over the life of the project. Capital costs by area are summarized in Table 1.29. Initial capital costs are estimated at $45.3 million and total capital costs are estimated at $51.7 million over the project life.

Table 1.28

Summary of Operating Costs by Area			
	Operating Costs		
	Total ($000)	Total $/ore tonne	Percent of Total
Mining ($0.65/t)	72,067	1.46	54
Processing	49,738	1.01	37
G&A	12,146	0.25	9
Total	133,952	2.72	100.0

Table 1.29

Summary of Capital Costs by Area ($000)			
	Pre-production	*Sustaining*	*Total*
Mining	29,416	2,970	32,386
Processing	9,110	3,480	12,590
Admin. & Infrastructure	6,751	0	6,751
Total	45,277	6,450	51,727

Economic Model

The economic model used for financial evaluation of the Cerro San Pedro Project is based on an in-house derived spreadsheet generated using Excel software. The model is quite flexible and accounts for yearly variations in material mined and processed, recoveries, operating costs, and capital expenditures. From these input areas, the model generates cash flow estimates on an annual basis.

The entire economic model spreadsheet and results are included at the end of this section.

Treatment of Amortization and Taxation

For the purpose of this economic evaluation, Mexican income tax consists of four main provisions: deductions for depreciation and amortization, tax rates, alternative minimum asset tax, and loss carry forwards.

The economic model accounts for the various depreciation schedules allowed for the value of an asset or service, from the year that the asset is placed in service. Depreciation is not allowed for land or real property purchase payments, real property option payments, and some intangible property, such as water rights. These items are directly expensed in the year of acquisition or service.

The regular income tax rate applicable to corporations in Mexico is 35 percent on taxable income. An effective tax rate of 30% is used in the economic model to allow for additional tax credits that are anticipated during operations (such as the tax credit for diesel). The rate is applied to income after deductions for usual business expenses, asset depreciation, and prior year losses. Profit sharing with employees is not deductible. In addition to the direct income tax, a withholding, estimated at five percent, would apply on any payment of dividend. This will not apply if excess cash flow is reinvested in Mexico.

In addition to the regular tax, an alternative minimum tax on assets must also be considered because a Mexican taxpayer pays, in any given year, the higher of those two taxes. The asset tax commences in the second year of a commercial enterprise and is based on the net tangible asset base of the business for that year as determined after depreciation. The net asset base is then multiplied by 1.8 percent to obtain the asset tax. This tax is recoupable within ten years to the extent that in any of those following years, the regular income tax exceeds the asset tax for that particular year. Any losses (negative taxable income) incurred in a given year can be carried forward and applied to subsequent years to reduce positive taxable income.

The Value Added Tax (VAT) is assessed on all services and capital assets when purchased or imported into Mexico. The rate is 15 percent of the purchase price or imported value plus duties. An accelerated reimbursement provision is available for all VAT credits. The reimbursement period is generally three months, resulting in the repayment of the tax often in the same year in which it is paid.

Precious Metal Production

A summary of gold, silver, and gold equivalent production by year is provided in Table 1.30, with life-of-mine total recovered ounces of 634,060 ounces of gold and 13 million ounces of silver. As used in the economic evaluation, gold equivalent, for the base commodity price case, is defined as gold plus silver divided by 55 (Au Eq oz = Au oz + Ag oz/55). Gold equivalent production ranges from a low of 47,981 to a high of 143,143 and averages 108,799 ounces. Gold production as a proportion of total gold equivalent production varies from 65 percent to 80 percent over the years and averages 73 percent over the project life.

Table 1.30

Summary of Annual Precious Metal Production

	Au Ozs	Ag Ozs	Au Eq Ozs	% Au Ozs of AuEq Ozs
Total Contained Ounces	899,345	36,448,197	1,506,983	60
Estimated Annual Production				
Year 1	61,056	926,509	77,901	78
Year 2	77,337	1,889,095	111,684	69
Year 3	77,085	2,259,657	118,170	65
Year 4	107,368	1,967,636	143,143	75
Year 5	83,382	1,692,959	114,163	73
Year 6	95,980	1,998,662	132,319	73
Year 7	99,480	1,405.187	125,029	80
Year 8	32,373	858,464	47,981	67
Total Project Life	634,060	12,998,169	870,391	73

Revenue and Cash Flow

A summary of mine net realization or revenue based on gold and silver sales, direct operating costs, operating cash flow, and operating cash cost per ounce on an annual basis is provided in Table 1.31.

Table 1.31

Summary of Annual Net Revenue, Operating Costs, Operating Profit, and Cash Cost/Au Eq Ounce				
Year	Net Revenue (Au + Ag) ($000)	Cash Operating Costs ($000)	Operating Profit ($000)	Cash Cost $/Au Eq
1	21,423	19,464	1,959	250
2	30,713	18,552	12,161	166
3	32,497	20,242	12,255	171
4	39,364	20,743	18,621	145
5	31,395	19,831	11,564	174
6	36,388	17,710	18,678	134
7	34,383	18,126	16,257	145
8	13,194	5,691	7,503	119
Total	239,357	144,652	94,705	166

Economic Results

The results of the economic model are presented in Table 1.32 which show the traditional valuation criteria of internal rate of return (IRR) and net present value (NPV) at various gold and silver prices for the designed pit.

At a gold price of $275 per ounce and $5.00 per ounce for silver, and assuming that the initial investment is 100% financed at 9.5%, the project yields a Net Present Value of $7.5 million at a 5% discount rate with an 8.4% Rate of Return.

Table 1.32

Project Rate of Return and Net Present Value			
	$275 Gold $5.00 Silver	$300 Gold $5.25 Silver	$325 Gold $5.25 Silver
Life of Mine	7.25 years	7.25 years	7.25 years
NPV @ 5%	$7.5 million	$19.8 million	$29.5 million
DCFROR	8.4%	13.9%	18.2%
Operating Cost	$166 per AuEq Oz	$167 per AuEq Oz	$167 per AuEq Oz
Total Cost	$199 per AuEq Oz	$195 per AuEq Oz	$195 per AuEq Oz
Pay Back Period	5.6 years	4.7 years	4.0 years

Sensitivity Analyses

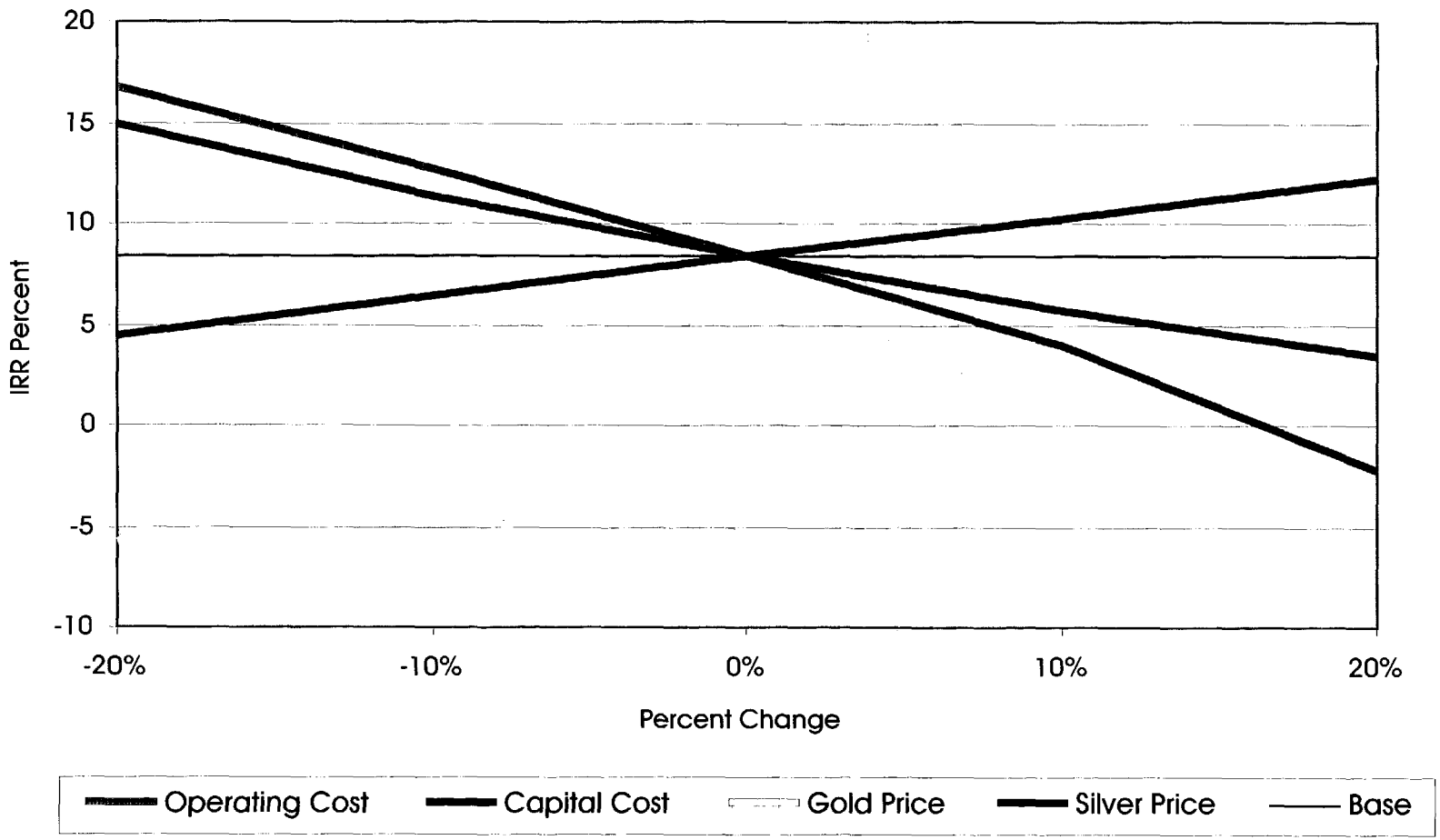
Sensitivities to changes in capital costs, operating costs, and gold and silver recoveries were evaluated on the base case, with changes of ±10 and ± 20 percent being examined for costs and recoveries. As seen in Table 1.33 below, at a given percentage variation in costs, the project is much more sensitive to changes in operating costs than capital cost.

Table 1.33

Rate of Return Sensitivities				
Base Case $275 Au and $5.00 Ag				
Change	**Capital Costs**	**Operating Costs**	**Gold Price**	**Silver Price**
+20%	3.4	-2.2	18.2	12.2
+10%	5.7	3.9	13.4	10.3
0%	8.4	8.4	8.4	8.4
-10%	11.4	12.8	2.7	6.4
-20%	15.0	16.8	-5.8	4.4

Figure 1.20 graphically shows the sensitivity analysis results for the base case commodity prices.

Figure 1.20 IRR Sensitivity



Glamis Gold Ltd.
Cerro San Pedro Project

CERRO SAN PEDRO PROJECT - ECONOMIC MODEL

Final Base Case as of 24oct00

Pit Access included, $0.653 mining cost , 9.5% financing

		Preproduction	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9-12
Production	**TOTALS**	constr/strip	operations	operations	operations	operations	operations	operations	operations	operations	closure
Leach Tonnes	**49,246,000**		**5,845,000**	**5,315,000**	**6,655,000**	**7,749,000**	**7,540,000**	**7,432,000**	**7,641,000**	**1,069,000**	
Grade Au g/t	0.57	-	0.650	0.642	0.511	0.611	0.488	0.570	0.574	0.303	
Ounces Contained Au	899,345		122,111	109,693	109,336	152,288	118,267	136,136	141,101	10,413	
Recovery Rate %Au AVG	70.5%		50.0%	70.5%	70.5%	70.5%	70.5%	70.5%	70.5%	70.5%	
Ounces Au Produced	634,060	-	61,056	77,337	77,085	107,368	83,382	95,980	99,480	32,373	
Grade Ag g/t	23.02	0.00	24.65	31.01	29.62	22.15	19.59	23.46	16.04	10.69	
Ounces Contained Ag	36,448,197	-	4,632,547	5,298,112	6,337,381	5,518,387	4,748,034	5,605,403	3,940,955	367,378	
Recovery Rate %Ag AVG	35.7%		20.0%	35.7%	35.7%	35.7%	35.7%	35.7%	35.7%	35.7%	
Ounces Ag Produced	12,998,169	-	926,509	1,889,095	2,259,657	1,967,636	1,692,959	1,998,662	1,405,187	858,464	
Waste Tonnes	71,297,000	9,406,000	14,512,000	12,615,000	12,752,000	9,027,000	8,630,000	1,850,000	2,433,000	72,000	
Total Surface Tonnes Mined	**120,543,000**	**9,406,000**	**20,357,000**	**17,930,000**	**19,407,000**	**16,776,000**	**16,170,000**	**9,282,000**	**10,074,000**	**1,141,000**	
Waste:Ore Strip Ratio	1.4		2.5	2.4	1.9	1.2	1.1	0.2	0.3	0.1	
Total Tonnes: Equiv Au Ounce S.R.	190		333	232	252	156	194	97	101	35	
Total Ore Tonnes	49,246,000		5,845,000	5,315,000	6,655,000	7,749,000	7,540,000	7,432,000	7,641,000	1,069,000	
Grade g/t Au Equivalent	0.952	-	1.061	1.159	1.005	0.980	0.814	0.961	0.842	0.481	
Ounces Contained Au Equivalent	1,506,983		199,320	198,020	214,987	244,293	197,426	229,589	206,810	16,538	
Average Recovery Rate Au Equivalent	57.8%	0.0%	39.1%	56.4%	55.0%	58.6%	57.8%	57.6%	60.5%	290.1%	
Ounces Produced Au Equivalent	**870,391**	-	**77,901**	**111,684**	**118,170**	**143,143**	**114,163**	**132,319**	**125,029**	**47,981**	
Revenue											
Gold Price	$ 275	$ 275	$ 275	$ 275	$ 275	$ 275	$ 275	$ 275	$ 275	$ 275	
Gold Revenue	174,366,585	$ -	$ 16,790,263	$ 21,267,635	$ 21,198,419	$ 29,526,092	$ 22,929,990	$ 26,394,490	$ 27,357,120	$ 8,902,575	
Silver Price	$ 5.00	$ 5.00	$ 5.00	$ 5.00	$ 5.00	$ 5.00	$ 5.00	$ 5.00	$ 5.00	$ 5.00	
Silver Revenue	64,990,846	$ -	$ 4,632,547	$ 9,445,474	$ 11,298,283	$ 9,838,180	$ 8,464,795	$ 9,993,312	$ 7,025,935	$ 4,292,320	
Total Revenue	**239,357,431**	**$ -**	**$ 21,422,810**	**$ 30,713,109**	**$ 32,496,702**	**$ 39,364,273**	**$ 31,394,785**	**$ 36,387,803**	**$ 34,383,055**	**$ 13,194,895**	
Direct Operating Costs											
Surface Mining Cost	$ 78,773,248	$ 6,706,000	$ 11,420,277	$ 10,829,720	$ 11,120,211	$ 10,334,016	$ 9,847,530	$ 7,722,624	$ 8,008,830	$ 2,784,040	
Cost per Mined Tonne	$ 0.653	$ 0.71	$ 0.56	$ 0.60	$ 0.57	$ 0.62	$ 0.61	$ 0.83	$ 0.80	$ 2.44	
Leach Ore Processing Cost	$ 49,738,460	$ -	$5,903,450	$5,368,150	$6,721,550	$7,826,490	$7,615,400	$7,506,320	$7,717,410	$1,079,690	
Cost per Leach Tonne	$ 1.01	$ 1.01	$ 1.01	$ 1.01	$ 1.01	$ 1.01	$ 1.01	$ 1.01	$ 1.01	$ 1.01	
G&A Cost	12,146,000	$ -	$ 1,567,000	$ 1,532,000	$ 1,530,000	$ 1,529,000	$ 1,528,000	$ 1,507,000	$ 1,479,000	$ 1,474,000	
Cost per Ore Tonne	$ 0.25	$ -	$ 0.27	$ 0.29	$ 0.23	$ 0.20	$ 0.20	$ 0.20	$ 0.19	$ 1.38	
	prestrip credit	$ (6,706,000)									
Total Direct Operating Costs	**133,951,708**	**$ -**	**$ 18,890,727**	**$ 17,729,870**	**$ 19,371,761**	**$ 19,689,506**	**$ 18,990,930**	**$ 16,735,944**	**$ 17,205,240**	**$ 5,337,730**	
Cost per Ore Tonne	$ 2.72	$ -	$ 3.23	$ 3.34	$ 2.91	$ 2.54	$ 2.52	$ 2.25	$ 2.25	$ 4.99	
Other Cash Costs											
Royalties 1.95%	4,667,470	$ -	417,744.79	598,905.63	633,685.69	767,603.32	612,198.31	709,562.15	670,469.57	257,300.45	
Transportation, Refining $2.00/ AuEq oz.	1,740,781		$ 155,802	$ 223,368	$ 236,340	$ 286,286	$ 228,326	$ 264,639	$ 250,059	$ 95,963	
Reclamation	4,292,500										$ 4,292,500
Exploration Expense	-										
Fees	-										
Total Other Cash Costs	**10,700,751**	**$ -**	**$ 573,547**	**$ 822,274**	**$ 870,025**	**$ 1,053,889**	**$ 840,524**	**$ 974,201**	**$ 920,528**	**$ 353,263**	**$ 4,292,500**
Total Cash Operating Costs	**144,652,459.23**	**$ -**	**$ 19,464,274**	**$ 18,552,144**	**$ 20,241,786**	**$ 20,743,395**	**$ 19,831,454**	**$ 17,710,145**	**$ 18,125,768**	**$ 5,690,993**	**$ 4,292,500**

CERRO SAN PEDRO PROJECT - ECONOMIC MODEL (cont.)

Final Base Case as of 24oct00

Pit Access included, $0.653 mining cost , 9.5% financing

		Preproduction	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9-12
Non-Cash Costs											
Depreciation	$ 46,550,284		$ 9,194,907	$ 6,726,567	$ 6,726,567	$ 10,206,407	$ 3,959,467	$ 2,434,092	$ 2,434,092	$ 2,434,092	$ 2,434,092
Depletion	$ -										
Reclamation Accrual	$ -										
Total Non-Cash Costs	**$ 46,550,284**	**$ -**	**$ 9,194,907**	**$ 6,726,567**	**$ 6,726,567**	**$ 10,206,407**	**$ 3,959,467**	**$ 2,434,092**	**$ 2,434,092**	**$ 2,434,092**	**$ 2,434,092**
Total Costs	**$ 191,202,743**	**$ -**	**$ 28,659,181**	**$ 25,278,711**	**$ 26,968,353**	**$ 30,949,802**	**$ 23,790,921**	**$ 20,144,237**	**$ 20,559,860**	**$ 8,125,085**	**$ 6,726,592**
Financing Costs	**$ 15,652,574**	**$ 2,419,241**	**$ 4,069,108**	**$ 4,002,900**	**$ 3,008,438**	**$ 1,721,190**	**$ 428,539**	**$ 3,160**	**$ -**	**$ -**	**$ -**
Gross Earnings	**$ 32,502,115**	**$ (2,419,241)**	**$ (11,305,479)**	**$ 1,431,499**	**$ 2,519,911**	**$ 6,693,281**	**$ 7,175,326**	**$ 16,240,406**	**$ 13,823,195**	**$ 5,069,810**	**$ (6,726,592)**
Taxes (see detail below)											
Asset Tax or "Effective"											
Federal Income Tax @ 30%	$ 6,068,612	$ -	$ -	$ -	$ 456,458	$ 278,071	$ 254,941	$ -	$ 3,558,199	$ 1,520,943	$ -
Total Taxes	**$ 6,068,612**	**$ -**	**$ -**	**$ -**	**$ 456,458**	**$ 278,071**	**$ 254,941**	**$ -**	**$ 3,558,199**	**$ 1,520,943**	
Net Earnings	**$ 26,433,503**	**$ (2,419,241)**	**$ (11,305,479)**	**$ 1,431,499**	**$ 2,063,453**	**$ 6,415,210**	**$ 6,920,384**	**$ 16,240,406**	**$ 10,264,996**	**$ 3,548,867**	**$ (6,726,592)**
Capital Expenditures											
Exploration	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	0
Development	$ 1,907,169	$ 1,907,169	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	0
Capitalized Pre-Strip	$ 6,706,000	$ 6,706,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	0
Mine & Mobile Equipment	$ 23,772,800	$ 12,026,300	$ 8,776,000	$ -	$ -	$ 296,000	$ 2,674,500	$ -	$ -	$ -	0
Process Facilities	$ 12,590,678	$ 9,110,838	$ -	$ -	$ 3,479,840	$ -	$ -	$ -	$ -	$ -	0
Administration/Infrastructure	$ 6,000,680	$ 6,000,680	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	0
Total Capital	**$ 50,977,327**	**$ 35,750,987**	**$ 8,776,000**	**$ -**	**$ 3,479,840**	**$ 296,000**	**$ 2,674,500**	**$ -**	**$ -**	**$ -**	**$ -**
After-Tax Cash Flow	**$ 22,006,459**	**$ (38,170,228)**	**$ (10,886,572)**	**$ 8,158,066**	**$ 5,310,180**	**$ 16,325,617**	**$ 8,205,351**	**$ 18,674,498**	**$ 12,699,088**	**$ 5,982,959**	**$ (4,292,500)**
Cumulative Cash Flow	$ 22,006,459	$ (38,170,228)	$ (49,056,800)	$ (40,898,734)	$ (35,588,554)	$ (19,262,937)	$ (11,057,586)	$ 7,616,912	$ 20,316,000	$ 26,298,959	$ 22,006,459
NPV @ 5%* as of begin yr 0	7,551,301.70										
IRR*	**8.4%**										
Cash Cost per AuEq Ounce	**$ 166**	**$ -**	**$ 250**	**$ 166**	**$ 171**	**$ 145**	**$ 174**	**$ 134**	**$ 145**	**$ 119**	**$ -**
Cash Cost per Ounce (Ag Credit)	**$ 126**		**$ 243**	**$ 118**	**$ 116**	**$ 102**	**$ 136**	**$ 80**	**$ 112**	**$ 43**	
Acquisition Cost per AuEq Ounce	**$ 8**	$ 7,000,000									
Total Cost/ Ounce incl acq.	**$ 207**	**$ -**	**$ 368**	**$ 226**	**$ 228**	**$ 216**	**$ 208**	**$ 152**	**$ 164**	**$ 169**	**$ -**

CAPITAL BUDGET CERRO SAN PEDRO

	Totals	Preproduction	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9-12
Exploration	$ -										
	$ -										
Development (ROM haul road & Pit Access)	$ 1,907,169	$ 1,907,169									
	$ -										
Capitalized Pre-Strip	$ 6,706,000	$ 6,706,000									
Mine & Mobile Equipment											
Major Mine Equipment	$ 17,830,000	$ 9,054,000	$ 8,776,000								
Mine Support Equipment	$ 537,400	$ 417,400				$ 120,000					
Maintenance Equipment	$ 1,196,000	$ 1,124,000				$ 72,000					
G&A Equipment	$ 577,000	$ 473,000				$ 104,000					
Truck Shop/Fuel/Wash	$ 826,000	$ 826,000									
Explosives Storage	$ 131,900	$ 131,900									
Equipment Rebuilds	$ 2,674,500	$ -					$ 2,674,500				
Total	$ 23,772,800	$ 12,026,300	$ 8,776,000	$ -	$ -	$ 296,000	$ 2,674,500	$ -	$ -	$ -	
Process Facilities											
Leach Pad and Solution Ponds	$ 7,942,180	$ 4,462,340			$ 3,479,840						
Merrill-Crowe plant	$ 1,784,906	$ 1,784,906									
Refinery	$ 427,188	$ 427,188									
Solution Pumping/Distribution	$ 900,272	$ 900,272									
Construction Mgmt, QA/QC	$ 497,895	$ 497,895									
Engineering	$ 334,037	$ 334,037									
Laboratory	$ 394,200	$ 394,200									
Lime Silo	$ 310,000	$ 310,000									
	$ -										
Total	$ 12,590,678	$ 9,110,838	$ -	$ -	$ 3,479,840	$ -	$ -	$ -	$ -	$ -	
Administration/Infrastructure											
Roads	$ 175,000	$ 175,000									
Office, Training Building, & Furniture	$ 370,000	$ 370,000									
Site Preparation	$ 475,000	$ 475,000									
Water Supply	$ 645,000	$ 645,000									
Cerro de San Pedro Housing	$ 350,000	$ 350,000									
Church Stabilization	$ 200,000	$ 200,000									
Property Fencing	$ -										
Electric Power & Communication	$ 2,206,680	$ 2,206,680									
Owner's Costs (Year 1 - G&A)	$ 1,579,000	$ 1,579,000									
Total	$ 6,000,680	$ 6,000,680	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Total Capital	$ 50,977,327	$ 35,750,987	$ 8,776,000	$ -	$ 3,479,840	$ 296,000	$ 2,674,500	$ -	$ -	$ -	

TAX AND DEPRECIATION SCHEDULE CERRO SAN PEDRO

MEXICAN TAX LAW

Asset Depreciation Schedule	annual rate	NOTES
Technical Assistance	10%	(used for engineering, construction mgmt, owners costs)
Pre Operating Expenses	10%	Pre strip and road development
Mining Concession Acquisition Cost	10%	*does not include acquisition cost*
Buildings and Structures	5%	too small-ignore
Process Plant and Equipment	6%	deduct engineering, construction mgmt,
Furniture and Office Equipment	10%	too small-ignore
Heavy Duty Trucks, Autos	25%	incl in mining equip
Mobile Mine Equipment	25%	incl in mining equip
Computers	30%	too small-ignore
Pollution Control Equipment	100%	leach pad qualifies (Dave says it's better spread over the heaped ounces)
Electrical Production and Distribution	10%	power line to site+transformers and distribution
Equipment and Activities unspecified	10%	use for all unspecified infrastructure

ANNUAL DEPRECIATION	Pre-strip	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9-12
Exploration		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
TOTAL	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Development		$ 190,717	$ 190,717	$ 190,717	$ 190,717	$ 190,717	$ 190,717	$ 190,717	$ 190,717	$ 190,717
TOTAL	**$ -**	**$ 190,717**	**$ 190,717**	**$ 190,717**	**$ 190,717**	**$ 190,717**	**$ 190,717**	**$ 190,717**	**$ 190,717**	**$ 190,717**
Prestrip		$ 670,600	$ 670,600	$ 670,600	$ 670,600	$ 670,600	$ 670,600	$ 670,600	$ 670,600	$ 670,600
TOTAL	**$ -**	**$ 670,600**	**$ 670,600**	**$ 670,600**	**$ 670,600**	**$ 670,600**	**$ 670,600**	**$ 670,600**	**$ 670,600**	**$ 670,600**
Mobile Equipment		$ 2,767,100	$ 2,767,100	$ 2,767,100	$ 2,767,100					
			$ 2,194,000	$ 2,194,000	$ 2,194,000	$ 2,194,000				
				$ -		$ -	$ -			
					$ -	$ -	$ -	$ -		
						$ -	$ -	$ -	$ -	
							$ 668,625	$ 668,625	$ 668,625	$ 668,625
shop and powder silo		$ 47,895	$ 47,895	$ 47,895	$ 47,895	$ 47,895	$ 47,895	$ 47,895	$ 47,895	$ 47,895
									$ -	$ -
										$ -
TOTAL	**$ -**	**$ 2,814,995**	**$ 5,008,995**	**$ 5,008,995**	**$ 5,008,995**	**$ 2,241,895**	**$ 716,520**	**$ 716,520**	**$ 716,520**	**$ 716,520**
Process Plant		$ 4,774,527	$ 312,187	$ 312,187	$ 3,792,027	$ 312,187	$ 312,187	$ 312,187	$ 312,187	$ 312,187
TOTAL	**$ -**	**$ 4,774,527**	**$ 312,187**	**$ 312,187**	**$ 3,792,027**	**$ 312,187**	**$ 312,187**	**$ 312,187**	**$ 312,187**	**$ 312,187**
Administration/Infrastructure		$ 744,068	$ 544,068	$ 544,068	$ 544,068	$ 544,068	$ 544,068	$ 544,068	$ 544,068	$ 544,068
TOTAL	**$ -**	**$ 744,068**	**$ 544,068**	**$ 544,068**	**$ 544,068**	**$ 544,068**	**$ 544,068**	**$ 544,068**	**$ 544,068**	**$ 544,068**
Total Depreciation BY YEAR	**$ -**	**$ 9,194,907**	**$ 6,726,567**	**$ 6,726,567**	**$ 10,206,407**	**$ 3,959,467**	**$ 2,434,092**	**$ 2,434,092**	**$ 2,434,092**	**$ 2,434,092**
Undepreciated Asset Base "UDAB"	$ 35,750,987	$ 35,332,080	$ 28,605,513	$ 25,358,786	$ 15,448,379	$ 14,163,412	$ 11,729,320	$ 9,295,228	$ 6,861,136	$ 4,427,043
Asset Tax 1.8% of UDAB (start yr 3 as per regs.)	$ -	$ -	$ -	$ 456,458	$ 278,071	$ 254,941	$ 211,128	$ 167,314	$ 123,500	0
Beginning Tax Loss Carry Forward	$ 19,000,000	$ 21,419,241	$ 32,724,720	$ 31,293,221	$ 28,773,310	$ 22,080,029	$ 14,904,704	$ -	$ -	$ -
Gross Income (Loss)	$ (2,419,241)	$ (11,305,479)	$ 1,431,499	$ 2,519,911	$ 6,693,281	$ 7,175,326	$ 16,240,406	$ 13,823,195	$ 5,069,810	$ (6,726,592)
Ending Carry Forward Balance	$ 21,419,241	$ 32,724,720	$ 31,293,221	$ 28,773,310	$ 22,080,029	$ 14,904,704	$ (1,335,702)	$ (13,823,195)	$ (5,069,810)	$ 6,726,592
Taxable Income							$ -			
Federal Tax @ 30% of Gross Earnings	$ -	$ -	$ -	$ -	$ -	$ -	$ 400,711	$ 4,146,958	$ 1,520,943	$ -
FEDERAL INCOME TAX PAID										
Greater of asset tax or 30%, less Tax Credit	**$ -**	**$ -**	**$ -**	**$ 456,458**	**$ 278,071**	**$ 254,941**	**$ -**	**$ 3,558,199**	**$ 1,520,943**	**$ -**
Beginning Asset Tax Credit Carryforward	$ -	$ -	$ -	$ -	$ 456,458	$ 734,529	$ 989,470	$ 588,760	$ -	$ -
Asset Tax Credit Added	$ -	$ -	$ -	$ 456,458	$ 278,071	$ 254,941	$ -	$ -	$ -	$ -
Asset Tax Credit Carryforward Used	$ -	$ -	$ -	$ -	$ -	$ -	$ 400,711	$ 588,760	$ -	$ -
Ending Asset Tax Carryforward Balance	$ -	$ -	$ -	$ 456,458	$ 734,529	$ 989,470	$ 588,760	$ -	$ -	$ -

FINANCING CERRO SAN PEDRO

Assumptions:

Financing begins mid year 0.
Payback begins when project has positive C.F.'s.

Loan Repayment rate as % of C.F. =		100%
Interest Rate (LIBOR + Premium) =		9.500%
Loan Facility Expenses =	$	250,000
Loan Commitment Fee =	$	300,000
Facility Fee @ 0.1875% =	$	90,406
Total Loan Cost	$	640,406

		Pre-strip	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Project Free Cash Flow Before Taxes		$ (35,750,987)	$ (6,817,465)	$ 12,160,966	$ 8,775,076	$ 18,324,878	$ 8,888,831	$ 18,677,658	$ 16,257,287	$ 7,503,902
Working Capital Need (1 mos Direct Op Cost)			$ 1,574,227							
Cummulative Cash Flow before interest costs		$ (35,750,987)	$ (44,142,679)	$ (31,981,713)	$ (23,206,638)	$ (4,881,760)	$ 4,007,072	$ 22,684,729	$ 38,942,016	$ 46,445,918
Estimated Interest Costs		$ (1,698,172)	$ (4,073,590)	$ (3,959,420)	$ (2,870,484)	$ (1,460,948)	$ -	$ -	$ -	$ -
Total Finance Requirement		**$ (37,449,159)**	**$ (48,216,269)**	**$ (35,941,133)**	**$ (26,077,122)**	**$ (6,342,708)**	**$ 4,007,072**	**$ 22,684,729**	**$ 38,942,016**	**$ 46,445,918**
Beginning Loan Balance		$ -	$ (37,449,159)	$ (48,216,269)	$ (36,055,303)	$ (27,280,227)	$ (8,955,350)	$ (66,518)	$ -	$ -
Draw		$ (37,449,159)	$ (10,767,110)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Repayment		$ -	$ -	$ 12,160,966	$ 8,775,076	$ 18,324,878	$ 8,888,831	$ 66,518	$ -	$ -
Ending Balance		$ (37,449,159)	$ (48,216,269)	$ (36,055,303)	$ (27,280,227)	$ (8,955,350)	$ (66,518)	$ -	$ -	$ -
Interest Costs		$ (1,778,835)	$ (4,069,108)	$ (4,002,900)	$ (3,008,438)	$ (1,721,190)	$ (428,539)	$ (3,160)	$ -	$ -
Fees & Loan Expenses		$ (640,406)								
Total Loan Costs	**$ (15,652,574)**	**$ (2,419,241)**	**$ (4,069,108)**	**$ (4,002,900)**	**$ (3,008,438)**	**$ (1,721,190)**	**$ (428,539)**	**$ (3,160)**	**$ -**	**$ -**

1.17 Conclusions and Recommendations

This Feasibility Study was performed with the purpose of improving project economics by decreasing costs and simplifying operations. The results of this Feasibility Study are based on developing the Cerro San Pedro Project as a run of mine operation and utilizing large major mining equipment. Due to the relative short mine life, much of the major equipment will be purchased used and refurbished wherever possible.

The same general format and much of the relevant information contained in the feasibility study for the Cerro San Pedro Project completed by Cambior in 1999 has been utilized in this study. Both the Cambior study and the original 1997 feasibility study completed by Kilborn, included crushing the ore and conveying it to the leach pad which results in higher metal recoveries at higher capital and operating costs. Conversely, in a run of mine operation, the costs for crushing and conveying are eliminated by hauling the ore directly from the pit to the leach pad which reduces overall costs at the expense of decreasing metal recoveries.

The main parameters used in the Feasibility Study are as follows:

- Commodity Prices: $275 per ounce for gold and $5.00 per ounce for silver
- Process Rate: up to 8.0 million tonnes/year (22,000 tpd)
- Average Annual Production: 120,000 ounces gold equivalent
- Mine Life: 7.25 years
- Initial Capital Cost: $45 million
- Total Capital Cost: $51 million
- Operating Cost: $2.78 per ore tonne
- Project financing interest rate: 9.5%
- Start of Construction: To be evaluated as metal prices improve.

Conclusions

Main conclusions regarding the economics of the project, as presented in Section 16.0, are summarized below:

- Initial capital cost is $45 million that amounts to $52 per ounce of gold equivalent produced.

- Average cash operating cost, including royalties, is estimated at $166 per ounce of gold equivalent over the project life.

- At a base commodity price of $275 per ounce of gold and $5.00 per ounce of silver, the project after-tax rate of return is 8.4 percent.

- An increase in commodity prices to $300 for gold and $5.25 for silver yields an after-tax rate of return of 13.9 percent.

- Sensitivity analyses suggest that project economics are most sensitive to operating costs and less sensitive to capital costs.

Recommendations

Based on the results of this Feasibility Study, it is recommended that the necessary funding be provided for maintaining the Cerro San Pedro Project on a ready status until metal prices improve.

In order to be in a position to react quickly to a favorable change in metal prices, it is important that the project maintains an active presence at the local, state, and national levels. This will require a small staff in San Luis Potosi dedicated to follow up on permit requirements, land and mining concession issues, and community relations.

A budget has been developed for 2001 with this purpose in mind. Funding is provided for completing the construction of La Zapatilla village, fencing the property boundary, stabilizing the church, relocating the MSX office to the project site, and to cover G&A costs. In addition, there are two mineral rights payments due and the municipal construction permit must be renewed in June. The details are summarized below:

Cerro San Pedro Project – 2001 Budget	
La Zapatilla Village Construction	$ 300,000
Property Fencing	$ 200,000
Church Stabilization	$ 300,000
Office Relocation	$ 250,000
Administrative Holding Costs	$ 825,600
Mineral Rights Payments	$ 453,000
Municipal Permit	$ 25,000
Total	$ 2,333,600

2.0 INTRODUCTION AND PROJECT DESCRIPTION

2.1 Purpose of Study and Scope of Work

This Feasibility Study for the Cerro San Pedro gold-silver project is based on extensive investigations and modeling of the mineral resources and metallurgy, and development of the most definitive and economically feasible mining, processing, and ancillary operations. The scope includes the evaluation of equipment, processes, environmental and regulatory considerations, and economic factors sufficient to determine the technical viability of the project. All designs were based on customary international construction methods. Capital and operating costs are estimated in US dollars at an accuracy level of plus or minus 10 percent. All cost estimates derived in Mexican pesos have been converted to US dollars based on an exchange rate of 9.4 pesos = 1.00 US dollar.

Areas of study and primary sources of information for the feasibility study are summarized in Table 2.1.

Table 2.1

Sources of Information Used in the Feasibility Study		
Area	**Services Provided**	**Name of Company/Consultant**
Geology	Management	Minera San Xavier
	Assaying	Bondar Clegg
	Modeling, Resource Estimation	Minera San Xavier
	Deposit Geology	Mark Peterson, Consultant/Formerly Metallica
	Mineralogy/Petrography	Petrographic Consultants, Intl.
Mining	Mine Design/Engineering	Glamis / Mine Reserves Associates
	Model Verification	Independent Mining Consultants, Inc.
		GeoSight, Inc.
		Glamis / Mine Reserves Associates
	Previous Reserve Evaluations	Cambior
	Slope Stability	Brawner & Associates
Metallurgy	Management	Glamis
	Bottle Rolls, Columns, CN Sol.	McClelland Laboratories
	Diagnostic Testing/Reagent Work	Resource Development Inc. (RDI)
	Ore Characterization	METCON Research, Inc.
	Database/Statistical Analysis	Ron Radzieta / Zuker Geochemistry Group
	Solution Chemistry	Unifield Engineering

Table 2.1 (continued)

Sources of Information Used in the Feasibility Study		
Area	**Services Provided**	**Name of Company/Consultant**
		TIMES, Ltd., (T. Mudder)
		McClelland Laboratories
Processing	Management	Glamis
	Heap Modeling	Unifield Engineering
	Costing/Data Review	R. Hyyppa
	Leach Pad	Westec / Amec
	Merrill-Crowe Plant Design	Summit Valley Equipment & Engineering
Electrical and Communication	Management	Glamis / Minera San Xavier
	Electrical Power Line	Procoin / CFE
	13.8 kV Distribution Line	Cypesa / Procoin
	Main Substation	Cypesa
	Communication	Telmex / Glamis
Infrastructures	Management	Glamis / Minera San Xavier
	Housing	Constructora Rosval / Constructora y Edificadora B&F
	Access Road	Minera San Xavier
	Water Management	Sodinco Group
Environmental	Management	Minera San Xavier
	Baseline/impact Analysis	Behre Dolbear de Mexico
	ARD Evaluations	Chemac Environmental Services
		Geochemica, Inc.
	Water Balance Modeling	Womack and Associates
		Water Management Consultants
	Closure Planning	Shepherd Miller
		Closure Strategy Group (CSG)
	Permitting	Minera San Xavier
Other	Socioeconomics	Minera San Xavier
	Taxation	Minera San Xavier / Glamis

2.2 Location, Access and Infrastructure

The Cerro San Pedro area is located in central Mexico in the state of San Luis Potosí (SLP) approximately 400 kilometers (km) north of Mexico City along the interstate highway connecting Mexico City with Monterrey. The project is located 20 km east-northeast of the city of SLP, the state capital, and can be easily reached via a 10 km secondary road extending from the Periferico Oriente to the village of Cerro de San Pedro. Alternative access to the property is through the village of Los Gomez located several kilometers east of SLP along Federal Highway No. 70. Figure 2.1 locates the project within

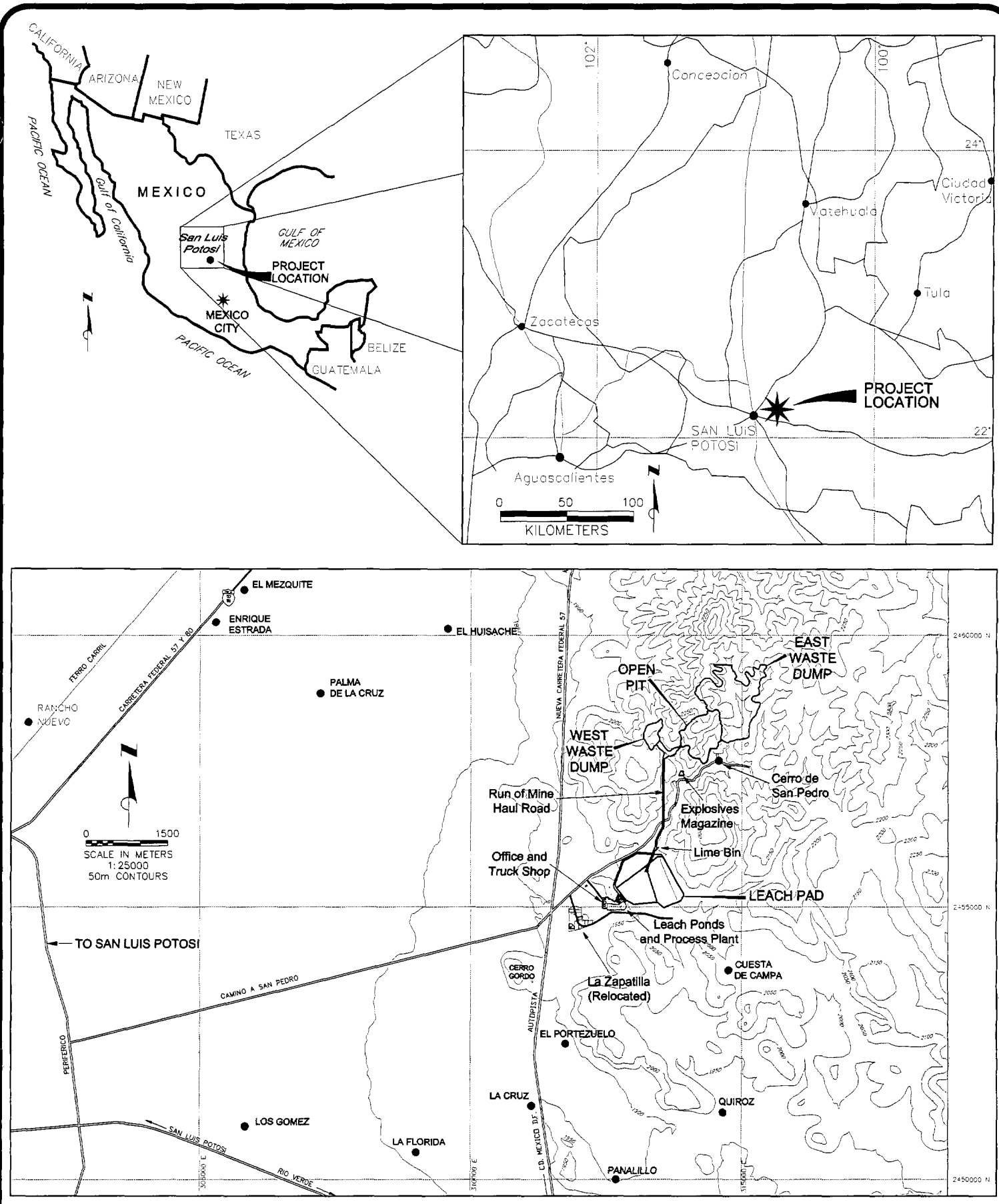
Mexico. Figure 2.2 is a map of the project area showing the general layout of the proposed Cerro San Pedro project. The property itself is traversed by many dirt roads providing adequate access for drilling.

The city of SLP has an adequate airport with many daily flights to Mexico City, Monterrey, Houston, and San Antonio, Texas. SLP is the capital of the state of SLP and a city of approximately 1,000,000 people. There are a number of governmental agencies and private businesses with offices in SLP that provide services to the mining and exploration sector. These include: Instituto Nacional de Estadistica, Geografia e Informatica ("INEGI") for topographic and geologic maps, Consejo de Recursos Minerales ("CRM") for geologic publications, Bondar-Clegg for geochemical analytical services (sample preparation laboratory) and abundant mechanical and supplies support for drilling services. The main power lines carrying electricity to SLP pass within 5 km of the property. Water rights are granted by concessions from the federal government and water is generally supplied by drilling wells.

2.3 Physiography and Climate

The project is located at the margins of two physiographic provinces, the Sierra Madre Oriental to the east and the Mesa Central to the west. It lies within the Sierra de Cerro San Pedro which is characterized by moderate to rugged relief with elevations ranging between 1800 meters above sea level (masl) and 2300 masl. The climate is semi-arid and vegetative cover consists of various shrubs, mesquite, and cactus. Based on information collected by Westec 1997, the warmest months are from April through September, averaging 20.1°C for this period with the maximum averaging 29.2°C for May. The coldest months are December through February with an average of 7.4°C for this period, and a minimum averaging –4.4°C in December. Wind direction is predominantly from the west. No velocity information is available; however, winds of these directions prevail 160 to 240 days of the year.

Data recorded from 1974 through 1994 (21-year period) at the University of San Luis Potosí (UASLP) meteorological station located approximately 23 km southwest of the project at 1900 masl provides the basis for precipitation information. The average annual precipitation data indicates that half the year (November through April) is drier than the other half (May – October). During the wet half of the year, average monthly precipitation is 60.4 mm, while during the dry half of the year, monthly precipitation averages 12.5 mm. The average annual precipitation over this 21-year period is 381 mm. (Over the most recent 10-year period the average is 337 mm per Behre Dolbear de Mexico, MIA). Evaporation data has been taken from a weather station located 110 km west of the site at 1,835 masl. Data recorded from 1980 through 1994 (15-year period) indicates the highest evaporation rates occur from March through August with a monthly average of 213 mm. The lowest evaporation rates occur from



MINERA SAN XAVIER, S.A. de C.V.

Figure 2.1 Location of the Cerro San Pedro Project

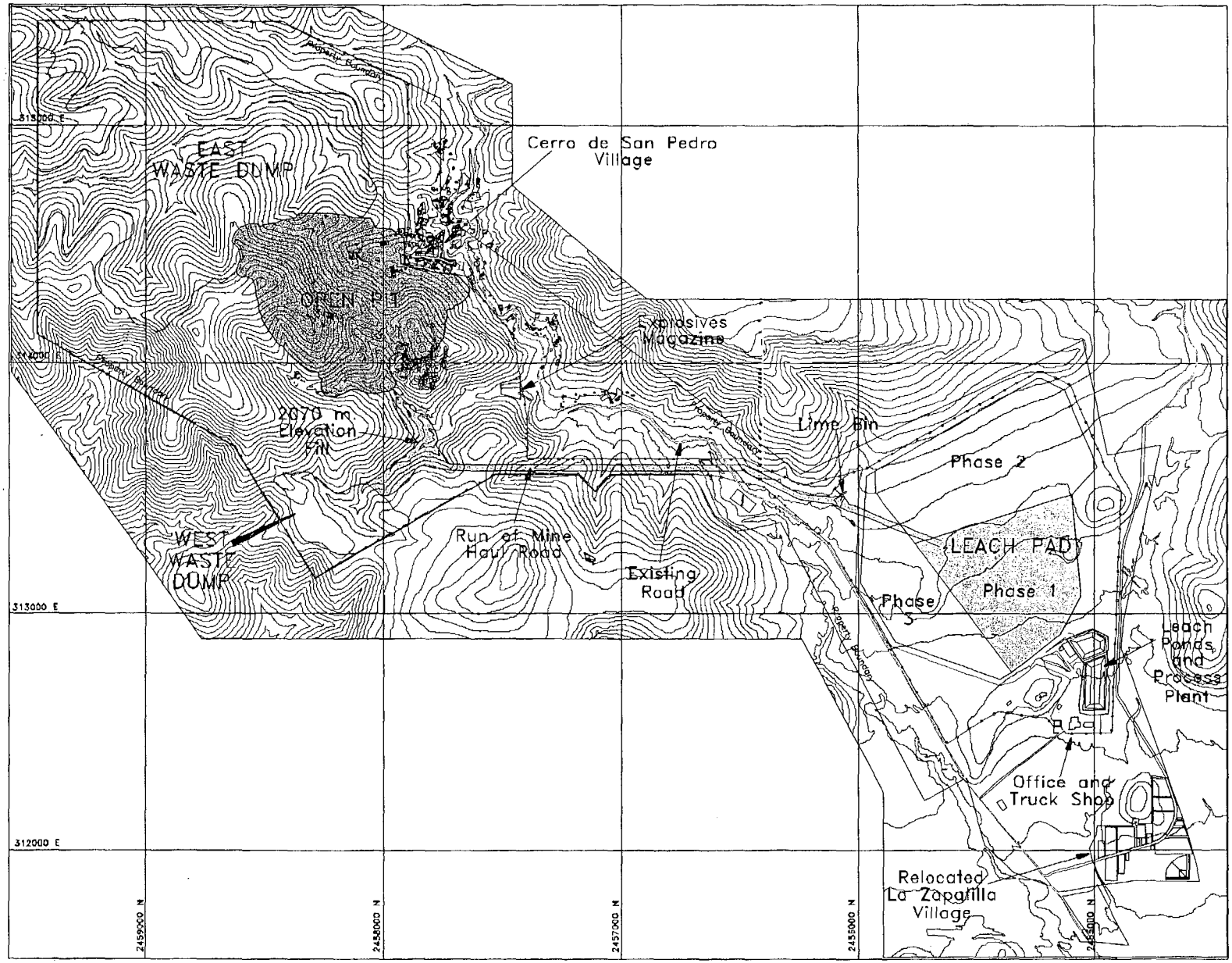


Figure 1.2 General Site Layout

November through January, averaging 122.8 mm/month. The average annual evaporation over this 15 year period is 2,123 mm. Table 2.2 shows the variable nature of and comparison between annual precipitation and evaporation for average, typical, and extreme wet and dry years:

Table 2.2

Comparison of Average Annual Precipitation and Evaporation (mm/year)					
	Extreme Dry Year	**Typical Dry Year**	**Average Year**	**Typical Wet Year**	**Extreme Wet Year**
Precipitation (21 year period, 23 km southwest of project,1900 masl)	**20**	**205**	**381**	**754**	**1,299**
Evaporation (15 year period, 110 km west of project,1835 masl)	**2,832**	**2,328**	**2,123**	**1,842**	**1,413**

Note that different locations and sampling periods were used for the precipitation and evaporation data. Other additional data is also available from the July 1998 Study by UASLP. MSX installed an automated meteorological station at the Cerro San Pedro site in January 2000, which will record precipitation, evaporation, wind speed and direction, etc.

2.4 Seismicity

Seismic information was evaluated from three different sources. Seismicity records compiled by the National Oceanic and Atmospheric Administration (NOAA) indicate that there have been no measurable earthquakes within a 100-km square area around the project site. Within an approximately 200-km square area, two earthquakes were recorded at a magnitude 3.5 – no scale specified - (one in 1984 at 210 km distance from the site and the other in 1985 at 197 km). Records of the National Earthquake Information Center (NEIC) of the U.S. Geological Survey, indicate that two earthquakes were found in the record within a 100 km^2 area: one at a magnitude of 4.2 (no scale noted) at 54 km distance and the other at 3.8 on the Richter scale at a distance of 84 km.

A seismic evaluation using methods by Idcriss (1993) indicates that earthquakes of these distances and magnitude should not have any significant impact at the site; however, since such a small data set may also potentially indicate a lack of data, two other sources (Vick, 1983 and Lomnitz and Rosenblueth, 1976) were consulted. The estimated average peak seismic acceleration for the two sets of data is 30

cm/sec^2 (based on two events in each case). This acceleration is equivalent to 0.03g (gravitational acceleration of 9.81 m/sec^2). Typically, the horizontal bedrock acceleration would be reduced by a factor of 0.3 to 0.7 for pseudostatic stability analyses (Janson, 1985), resulting in an acceleration of 0.01g to 0.02g. Conservatively, however, because of lack of data, an acceleration of 0.03 g is used. From this evaluation, an acceleration of 0.03g is conservatively suggested for use in design considerations at the site.

Information from the Seismic Chart of Mexico also confirms that the project area is located in a non-seismic area and approximately 200 km from the limits of the seismic belt with little seismic activity. Seismic activity recorded between 1988 and 1995 by the National Seismologic Service at the National Geophysical Institute of the National University of Mexico (UNAM) indicates that three seismic events occurred within a 100 km distance from the project site. These events were at 100 km distance on October 1990 at a magnitude of 4.1, at 85 km distance on February 1993 at a magnitude of 4.3, and at 80 km distance on August 1993 at a magnitude of 3.9.

2.5 Mining History and Exploration Activity

2.5.1 Historic Activity

The Cerro San Pedro district has undergone several periods of significant mineral production dating back more than 400 years. Initial mining activity by the Spanish is reported to have begun in 1575 when the Spanish discovered bonanza-type gold and silver oxide mineralization exposed along the southeastern flank of Cerro San Pedro. This discovery also marked the foundation of the city of San Luis Potosí. Production from San Pedro continued sporadically over the next 400 years as ore bodies were mined from progressively deeper levels. A second major period of mining activity began in 1870 when Minera La Victoria y Anexas consolidated approximately 80 percent of the district. By 1904 there were more than 100 active mine adits in the district. Ores mined throughout all historic activity up to 1925 were primarily of the bonanza-type occurring in a series of limestone-hosted breccia veins, chimneys, and mantos.

Beginning in 1925, ASARCO initiated another period of surface mining of oxide ores and also began full scale underground production of semi-massive to massive sulfide ores localized along the upper limestone-porphyry contact. ASARCO ceased operations in the district in 1953. It is estimated that by the end of Asarco's mining activities in the early 1950's, approximately 2.5 million ounces of gold, 40 million ounces of silver, and significant base metals had been produced from the Cerro San Pedro

district. Through 1953, the porphyry-hosted lower grade oxide mineralization and disseminated sulfides remained relatively unexplored.

2.5.2 Recent Exploration Activity

Renewed interest in the Cerro San Pedro district, coinciding with the development of modern heap leach technology, began in 1970 when Geocon S.A. evaluated the district's potential for a large tonnage, low-grade, bulk mineable deposit.

In 1980, Bear Creek Mining Company optioned the property and initiated an exploration campaign consisting of detailed surface and underground mapping in conjunction with extensive sampling of underground workings. Most of Bear Creek's work was focused on limestone-hosted mineralization related to a large breccia pipe exposed in the Barreno pit.

In 1989, Compañía Fresnillo S.A. optioned the property from previous owners and began an extensive three-year exploration program. Like their predecessors, Geocon and Bear Creek, Fresnillo's primary objective was to evaluate the district's potential for a large low grade bulk mineable gold-silver deposit. Fresnillo's program involved detailed surface and underground mapping, systematic geochemical and metallurgical sampling, and the completion of reverse-circulation holes.

Minera San Xavier, S.A. de C.V. (MSX), a wholly owned subsidiary of Metallica Resources Inc. (Metallica) began its exploration campaign at Cerro San Pedro in April 1995 with the objective of expanding previously defined oxide reserves in both the limestone hanging wall and in the underlying porphyry. This program involved comprehensive data compilation, detailed geologic mapping, geochemical sampling, geophysical prospecting, reverse circulation and diamond drilling, and bulk sample collection for metallurgical test work. During 1995, MSX completed approximately 12,000 meters (m) of reverse circulation drilling which in combination with the Fresnillo drill hole data formed the basis for the calculation of the geologic resource and mineable reserves reported in a February 1996 prefeasibility study (Pincock, Allen and Holt, 1996). MSX's 1996 exploration program confirmed and expanded the 1995 reserve estimate, completing more that 51,000 m of exploration drilling since the beginning of MSX's activities. In early 1997, Mine Reserves Associates estimated mineable reserves based on all earlier data.

Although MSX's exploration program had successfully delineated the majority of mineable oxide reserves within its existing land holdings, there still remained potential for discovery of new reserves on adjoining ground. Strong potential also existed for development of additional sulfide reserves both below the

currently defined open pit oxide resource and at depth in the area of high grade sulfide mineralization mined previously by Asarco. Metallica elected to seek a major mining company as a joint venture partner to further evaluate the property and executed an agreement with Cambior in early 1998. In May 2000, Glamis Gold Ltd. (Glamis) acquired Cambior's Mexican holding company and assumed the terms of the joint venture agreement executed by Cambior with Metallica. As part of that agreement, Glamis has evaluated the resources and mining reserves developed by Cambior for the feasibility study completed in November 1999, prior to performing the detailed work that provides the basis for this feasibility study.

Table 2.3 shows the progression of mineral resources and reserves delineated by exploration and development activities prior to this feasibility study.

Table 2.3

Estimates of Resource and Reserve Prior to Feasibility Study											
Source	Date	Mineral Resource			Contained Mineable Reserves				Price ($/oz) Basis	
		million tonnes (Mt)	g/t Au	G/t Ag	million tonnes (Mt)	g/t Au	g/t Ag	Strip Ratio	Au	Ag
Fresnillo	1989	26.4	-	-	17.0	1.02	28.0	2.81:1	400	5.00
Pincock Allen and Holt	1995	109.5	0.63	16.8	61.5	0.65	23.6	1.83:1	400	5.45
MRA	1996	250.0	0.49	15.5	77.3	0.60	24.6	1.51:1	400	5.00
Cambior	1999	198.0	0.50	16.2	63.5	0.62	24.5	1.57:1	300	5.50

2.5.3 Current Mining

Until late 1998, there was mining activity at Cerro San Pedro that consisted of small-scale production by local miners who were mining surface dump material as well as silver-rich limestone ore. The dump material was processed on-site via vat leaching methods. The newly mined material was shipped to local smelters for use as flux. Total combined average production for the various groups then active at Cerro San Pedro was estimated at a maximum rate of 3,000 tonnes per month. MSX option agreements with the principal concessionaires at Cerro San Pedro, the Alcaldes and Mata Celias, stipulated that all small scale mining activity would terminate upon exercise of the purchase options and presently all mining activities have ceased.

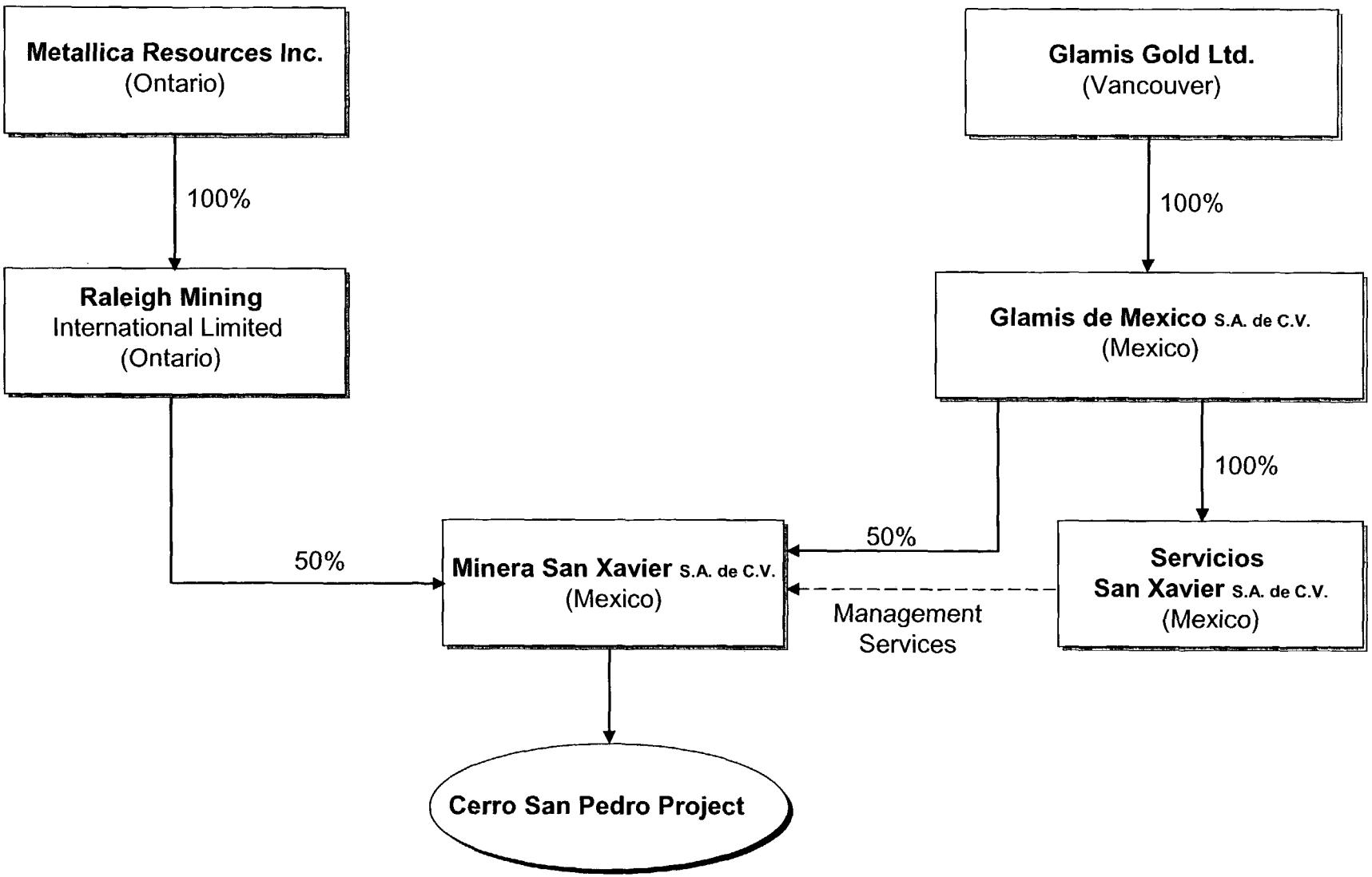
2.6 Shareholders' Agreement with Metallica Resources, Inc.

An agreement between Cambior Inc. (Cambior), Metallica Resources, Inc. and their respective subsidiaries was executed effective January 21, 1998, allowing Cambior to acquire a 50 percent interest in Minera San Xavier (MSX), which holds the mineral concessions and other land holdings that comprise the Cerro San Pedro project. It also appointed Cambior or its affiliates as the manager for conducting all operations.

Prior to this agreement, Raleigh Mining International Limited (Raleigh - a 100 percent owned subsidiary of Metallica) owned 100 percent of the common shares (less 1 share) of MSX. Upon execution of the agreement, MSX issued share certificates to Cambior de Mexico (a 100 percent owned subsidiary of Cambior) representing 84,004,190 common shares of MSX (equaling the number of common shares of MSX held by Raleigh at that time).

By agreement between Glamis Gold Ltd. (Glamis) and Cambior dated May 9, 2000, Glamis acquired all of the issued and outstanding shares of Cambior de Mexico, which in turn owns the 50% interest in MSX. Cambior de Mexico has now been renamed Glamis de Mexico. Pursuant to the Shareholders' Agreement, Glamis de Mexico can retain ownership of the 50% interest in MSX by contributing $19,977,000 in equity to MSX by December 31, 2000. Glamis de Mexico may withdraw as a shareholder of MSX and terminate this agreement at any point during the equity contribution period without any further rights, title or interest to any assets or any further obligation beyond those accrued at the time of termination. Through May 9, 2000, Glamis de Mexico had expended approximately $16 million towards its required contribution. The Shareholders' Agreement provides that it can complete the contribution by advancing any remaining portion of the $19,977,000 not spent by December 31, 2000 to MSX.

Included in the Shareholders' Agreement are provisions for joint management of operations. Glamis is required to make available project loan facilities for development and construction of the project, precious metals marketing facilities, and a buyer hedging facility. Glamis de Mexico also acquired 100 percent of the common shares of Servicios San Xavier (SSX - a services company that was previously 100 percent owned by MSX). Through this transaction, Glamis de Mexico acquired the employees of SSX that are connected with the Cerro San Pedro project. Based on an agreement between SSX and MSX, SSX is retained as manager for the Cerro San Pedro project and agrees to provide management services to MSX at a cost plus mark-up basis. Figure 2.3 illustrates the resulting share ownership and management structure between these entities.



MINERA SAN XAVIER S.A. de C.V.

Figure 2.3 Share Ownership and Management Structure

2.7 Property Rights

Mineral rights in Mexico belong to the Mexican nation and are administered by the federal government pursuant to Article 27 of the Mexican Constitution. Exploration and exploitation concessions may be granted or transferred to Mexican citizens and corporations and to foreigners who will agree, before the Ministry of Foreign Relations, not to invoke the protection of foreign governments. Exploration concessions are granted for a term of 6 years, with the right to convert to an exploitation concession with a term of 50 years. Concessions grant the holder the right to explore or exploit all minerals found in the ground with certain specific exceptions. Base and precious metals are not excepted from the application of the law. Maintenance of concessions requires the semi-annual payment of mining duties (due in January and July) and the performance of assessment work, on a calendar year basis, with assessment work reports required to be filed in the month of May for the preceding calendar year. The amount of mining duties and annual assessment work is set by regulation and increases over the life of either an exploration or exploitation concession and includes periodic adjustments for inflation. Mining concessions are registered at the Public Registry of Mining in Mexico City and in regional offices throughout Mexico.

Surface lands in the Cerro San Pedro project area are either Ejido lands (agrarian cooperative lands granted by the federal government to groups of Campesinos pursuant to Article 27 of the Mexican Constitution of 1917), or lands held in private ownership that were transferred into private ownership prior to the 1917 Constitution. There are also "abandoned" lands in Cerro San Pedro which are lands that at one time were in private ownership but now have no current registered owner. Prior to January 1, 1994, Ejidos could not transfer Ejido lands into private ownership. Amendments to Article 27 of the Mexican Constitution in 1994 now allow individual property ownership within Ejidos and allow Ejidos to enter into commercial ventures with individuals or entities, including foreign corporations.

Both the mining concessions and surface property rights at the Cerro San Pedro project now held by MSX were primarily obtained through negotiations and acquisition agreements with third-party concession and surface right holders.

2.7.1 Mineral Concessions

The Cerro San Pedro mineral rights consist of 41 mineral concessions, covering an area of 9,295 hectares (ha) or 22,967 acres. All concessions are located within the municipality of Cerro de San Pedro. The mineral concessions comprising the Cerro San Pedro Property are divided into ten groups, as set

forth below. Of these, MSX is a party to two separate purchase option agreements. Details of the concessions and groups comprising the Cerro San Pedro Property are provided in Table 2.4:

Table 2.4

Cerro San Pedro Mineral Concessions				
Group	**Concession Name**	**Concession Type**	**Title Number**	**Hectares**
Group 1. 100% Minera San Javier				
1.	La Princesa	Exploitation	180298	5.5916
2.	La Princesa Poniente	Exploitation	180366	0.0076
3.	Begoñia	Exploitation	181179	10.0000
4.	Santa Ana	Exploitation	180598	8.0000
5.	Santa Ana Sur	Exploitation	180597	1.5076
6.	Los Blancos	Exploitation	181180	9.0394
7.	Gorgorron	Exploitation	180300	9.6250
8.	San Nicolas	Exploitation	180608	6.9788
9.	San Nicolas Sur	Exploitation	180610	1.4986
10.	San Nicolas Suroeste	Exploitation	180609	0.1923
11.	Los Riscos	Exploitation	182282	4.3474
12.	La Concepcion	Exploitation	182281	4.2013
			Subtotal	60.9896
Group 2. Optionor: Roberto Alcalde Garcia – Cristina 2 Group				
13.	Cristina 2	Exploitation	180938	0.5537
14.	Gama	Exploitation	179256	41.6391
15.	La Canoa 3	Exploitation	184906	0.0051
16.	Omega 2	Exploitation	180958	0.1687
17.	La Canoa 2	Exploitation	180948	0.6649
18.	Cristina	Exploitation	186321	93.6228
19.	La Canoa	Exploitation	186370	3.4799
20.	Omega	Exploitation	193390	2.0576
			Subtotal	142.1918
Group 3. 100% Minera San Javier				
21.	San Salvador	Exploitation	186268	12.9399
22.	Tribilin	Exploitation	187088	18.2808
23.	La Victoria	Exploitation	185387	10.3797
24.	Gabriel	Exploitation	197046	18.0000

Table 2.4 (continued)

Cerro San Pedro Mineral Concessions				
Group	**Concession Name**	**Concession Type**	**Title Number**	**Hectares**
Group 3 *(continued)*			Subtotal	59.6004
Group 4. 100% Minera San Xavier				
25.	Barreno	Exploitation	179603	11.2359
			Subtotal	11.2359
Group 5. 100% Minera San Xavier				
26.	Porvenir IV Fracc. A	Exploration	201484	51.7965
27.	Porvenir IV Fracc. B	Exploration	201485	1.6242
28.	Porvenir V	Exploration	200783	12.5240
			Subtotal	65.9447
Group 6. Optionor: Antonio Alvarez Ruiz-Porvenir Group				
29.	Porvenir	Exploitation	199546	4.4241
30.	Porvenir I	Exploitation	183925	12.0000
31.	Porvenir II	Exploitation	186269	2.9981
32.	El Porvenir III	Exploitation	192254	11.9923
			Subtotal	31.4145
Group 7. `100% Minera San Javier				
33.	Toro de Oro	Exploration	190031	100.0000
34.	Gumercinda	Exploration	191758	20.0000
			Subtotal	120.0000
Group 8. 100% Minera San Javier				
35.	Louie	Exploration	203707	498.1364
Group 9. 100% Minera San Javier				
36.	Pedro	Exploration	204487	5144.1280
37.	Pedro 2	Exploration	204412	3155.8839
			Subtotal	8300.0119
Group 10. 100% Minera San Xavier				
38.	La Loteria	Exploitation	184377	3.8809
39.	San Fausto	Exploitation	179722	1.0000
40.	Maria del Pilar	Exploitation	179259	0.0049
41.	El Campeon	Exploitation	179257	0.2072
			Subtotal	5.0930
			Total	9,294.6182

Cerro San Pedro mining concession maps are provided in Figures 2.4 and 2.5. All concessions are located within the municipality of Cerro de San Pedro. All of the concessions are exploitation concessions except for the Porvenir IV Fracc. A (26), Porvenir IV Fracc. B (27), Provenir V (28), Toro de Oro (33), Gumercinda (34), Louie (35), Pedro (36), and the Pedro 2 (37) concessions, which are exploration concessions. The exploration concessions are valid until various dates ranging from August 26, 1999 to October 9, 2001, and several are currently in the process of being converted into exploitation concessions. A detailed report containing a survey of the area within the exploration concession must be submitted with the application to convert an exploration concession into an exploitation concession. The exploitation concessions are valid until various dates ranging from December 2036 through December 2041, subject to the periodic payment of taxes and the filing of required reports. These concessions may be extended if production is underway at any time prior to their expiration. Certain environmental permitting requirements must be satisfied before commencing mining operations under an exploitation concession (See Section 10.0 Environmental.) Although MSX has investigated title to these concessions, there is no guarantee that title to such concessions will not be challenged.

Mineral Concession Agreements

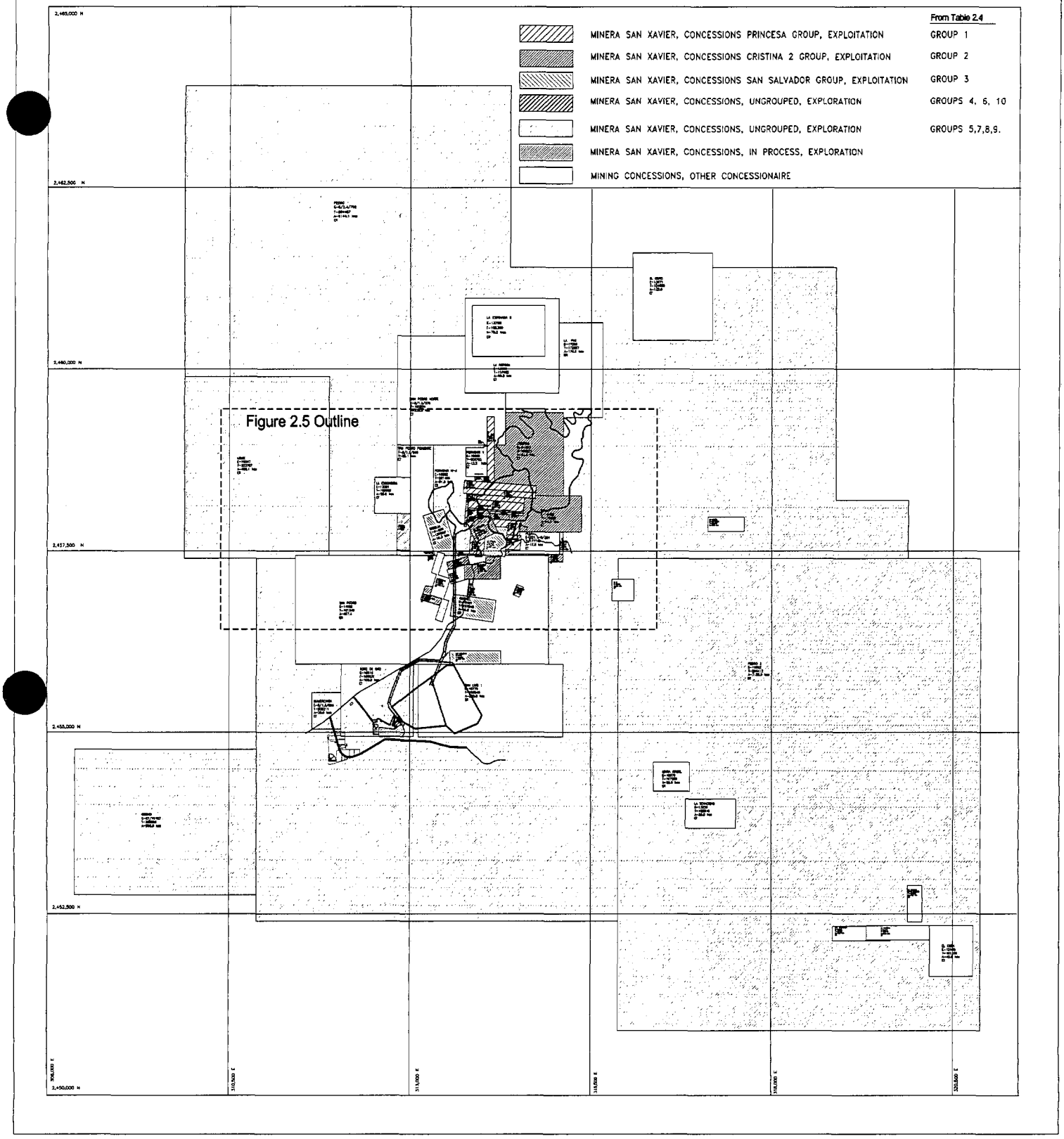
Pursuant to the Purchase Option Agreements, Minera San Xavier, S.A. de C.V. has the option to purchase certain claim groups comprising the Cerro San Pedro Property, and has the right during the term of each Purchase Option Agreement to explore and exploit the concessions subject to such Purchase Option Agreement. The terms of the current Purchase Option Agreements and other mineral concession ownership agreements are summarised below:

Group 1

The concessions comprising Group 1 were subject to an agreement dated March 1, 1994 between MSX and Negociación Minera de la Victoria y Anexas en San Pedro, S.A. The total purchase price of $250,000 was paid in March, 1999.

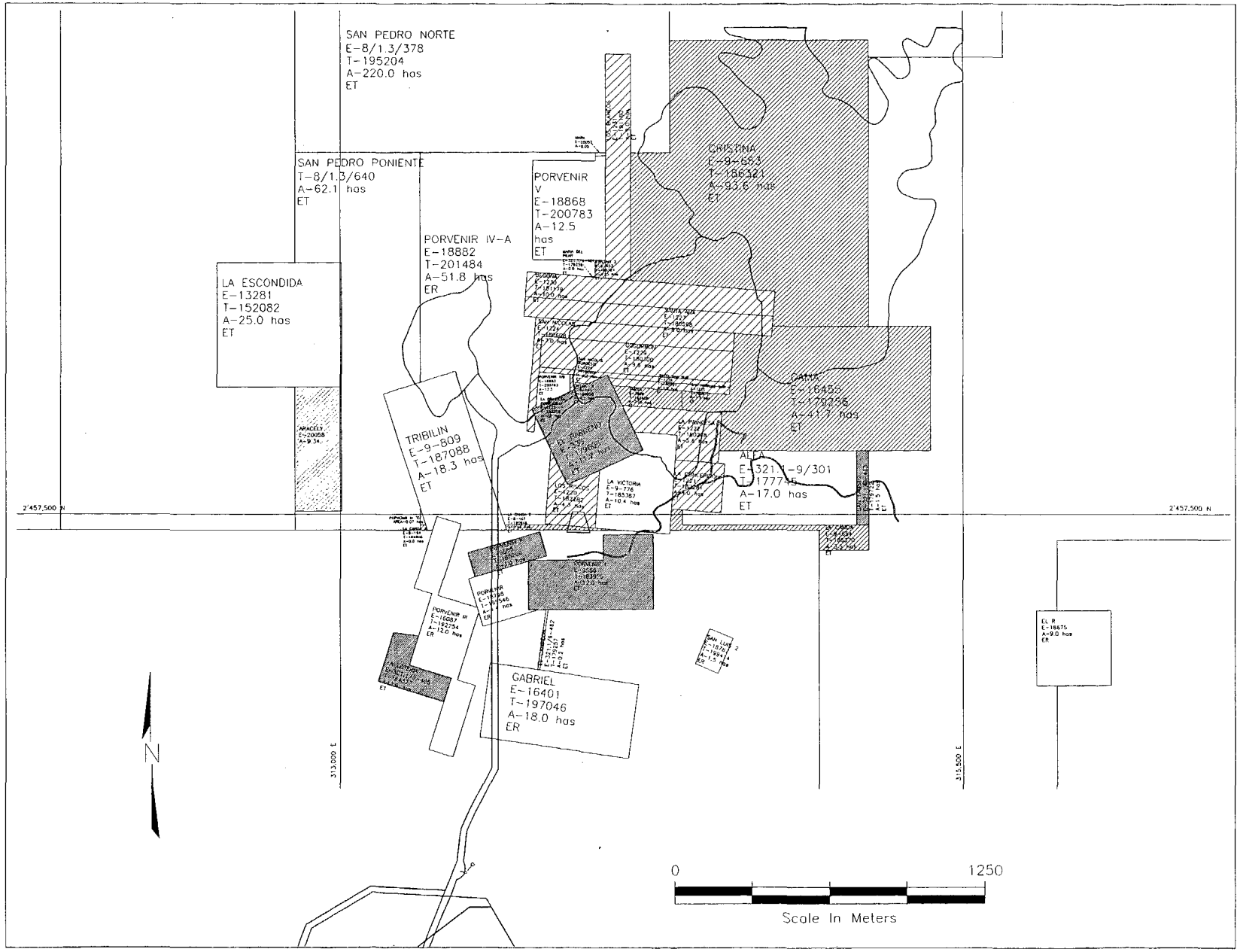
Group 2

The concessions comprising Group 2 are subject to an agreement dated March 1, 1994 between MSX and Tomás Alcalde García and Roberto Alcalde García. Pursuant to the terms of the agreement, as amended, MSX has paid a total of $2,125,033 in option payments through July 2000. The balance of the purchase price, $220,033, is payable on March 1, 2001.



MINERA SAN XAVIER, S.A. de C.V.

Figure 2.4 Concession Map of
Cerro San Pedro Mining District



MINERA SAN XAVIER, S.A. de C.V.

Figure 2.5 Concession Map of
Cerro San Pedro Mineral Resource Area

Group 3

The concessions comprising Group 3 were subject to an agreement dated March 1, 1994 between MSX and Tomás Alcalde García and Gabriel Valle Echenique. This agreement, as amended, provided for a purchase price of $50,000, which was paid on March 8, 1999.

Group 4

The concessions comprising Group 4 are subject to an agreement dated March 1, 1994 between MSX and María Patrocinio Mata Celia, Eligio Mata Celia, María de Jesús Mata Celia, María Magdalena Mata Celia, Roberto Mata Celia, Jose Refugio Mata Celia, Tomás Mata Celia, Martin Mata Celia, Socorro Mata Celia de Marin, Serapio Mata Celia, Jovita Malo Avila de Mata, Jose Marín Cruz and María Martha Zamores Campos de Mata. This agreement provides for a total purchase price of $1,250,000, which was paid in April, 1998.

Group 5

The concessions comprising Group 5 are subject to an agreement dated November 27, 1995 between MSX and Antonio Alvarez Ruiz and Elva Duarte Horta. This agreement provides for a total purchase price of $700,000. A final payment of $300,000 was made on January 15, 1999.

Group 6

The concessions comprising Group 6 are subject to a purchase option agreement dated May 23, 1997 between MSX and Antonio Alvarez Ruiz et al. This agreement provides for a total purchase price of $400,000 plus a 2 ½ percent NSR royalty for a total of $1,000,000. To date payments totaling $300,000 have been paid and additional payments of $50,000 each are due on April 1, 2001, and 2002. Thereafter, an annual $50,000 advance royalty payment is due until advance and production royalties total $1,000,000.

Group 7

The Toro de Oro exploration concession purchase option agreement was entered into with Juan Munoz Sanchez on February 28, 1996. The total purchase price of $20,000 was paid in two installments in 1996 and 1998. The Gumercinda exploration concession was purchased on September 23, 1996 for a total price of $5,000.

Group 8

The Louie exploration concession title was granted to MSX on September 27, 1996 and is valid until September 26, 2002.

Group 9

The Pedro and Pedro 2 exploration concessions were purchased on July 14, 1997, by MSX from Minera Santa Fe de Mexico, S.A. de C.V. and are valid until February 20, 2001 and February 12, 2003, respectively.

Group 10

The La Loteria concession was purchased for $25,000 by MSX from Mr. Enrique Villarreal Quezada on December 7, 1997. The San Fausto, Maria del Pilar and El Campeon concessions were purchased for a total of $15,000 by MSX from Mr. Tomas Alcalde Garcia on December 7, 1997.

On May 22, 2000, MSX received a cancellation notice for three mining concessions from the Direccion General de Mineria (DGM) citing that the tax payments from 1993 to 1997 had not been received. The San Fausto, Maria del Pillar, and El Campeon concessions were bought by MSX in 1997 from Fausto Miranda who is no longer alive and the receipts for the payments during those years were not obtained by MSX from Mr. Miranda. The San Fausto and El Campeon concessions are clearly located outside the pit area, however, the Maria del Pillar concession is outside the current run-of-mine pit limit but it is inside a future ultimate pit limit. The Maria del Pillar concession is a 64 square meter wedge between three other concessions; the Begonia, the Porvenir IV-A, and the Cristina 2.

The DGM notified MSX in December 4, 1998, that it had 60 days to verify or make the missing payments, and when DGM did not get a response from MSX, it proceeded to cancel the concessions. Last June, MSX offered to pay all the missing payments with the applicable penalties stating that it did not have a record of receiving the first notice, but DGM refused to accept the back payments stating that they have a signed receipt of delivery of the first notification. Even though DGM rules are rigid, MSX is attempting to obtain payment verification from the Miranda Family to again appeal to DGM to withdraw the cancellation of the three concessions with special emphasis on Maria del Pillar.

MSX continues to closely monitor the Official Government Newspaper and is prepared to submit a large number of applications when DGM announces the official public lottery for the cancelled concessions.

As of this writing DGM has cleared 12 of the 14 concessions that are located within ultimate pit and as soon as the remaining 2 are cleared, MSX will continue the procedure to ensure that all concessions are in good status with DGM.

2.7.2 Land Use

Land use in the local area consists primarily of small subsistence plots and grazing of goats and sheep. Until late 1998, there was also small scale mining in the concession areas. Inhabitants currently work at small commercial businesses, the Cerro de San Pedro Municipal offices, and commute to a variety of jobs in the city of SLP. There are 24 families living on a full-time basis in the village of Cerro de San Pedro and another 22 families living in the village of La Zapatilla.

Future operations of the Cerro San Pedro project will affect the land use of the local area and will require MSX to obtain the appropriate change in land use through a permitting process. The corresponding document was submitted to the Secretaria de Medio Ambiente Recursos Naturales y Pesca (SEMARNAP – Secretariat of the Environment, Natural Resources, and Fisheries) requesting to change the use of the land within the boundaries of the project area to mining use. In addition, a separate application for a land use license was applied for from the State of SLP. Approvals for both permits were received in 2000.

2.7.3 Surface Rights Acquisition

In order to begin construction of the Cerro San Pedro project, surface rights agreements must be in place for all land to be disturbed by, or adjacent to, the proposed operation. MSX began acquiring surface rights in 1996 from three local Ejidos (Cuesta de Campa, Palma de la Cruz, and Cerro San Pedro), as well as titled landowners and possessionary rights holders.

Ejido Lands

In the case of the Ejidos, MSX has obtained surface occupation lease agreements with all three Ejidos that own property in the Cerro San Pedro project area. A total of 470 hectares are under lease with an annual total lease payment of approximately $30,000. The leases granted MSX temporary occupancy for a period of 15 years (through February of 2012). The leases may be terminated by MSX at any time, but with a penalty payment equivalent to one year's lease payment. Figure 2.6 is a map showing the boundaries of the Ejido surface occupation lease agreements in the Cerro de San Pedro and La Zapatilla areas. Table 2.5 summarizes these agreements.

Table 2.5

Ejido Surface Occupation Lease Agreements			
Ejido	Hectares	Lease Cost/Year	
		Pesos	Dollars ($)
Cuesta de Campa	42.9844	27,000	2,872
Palma de la Cruz	136.1549	68,000	7,234
Cerro de San Pedro	291.3465	170,000	18,085
Total	470.4858	265,000	28,191

Cerro de San Pedro Private Surface Lands and Public Property

There are 24 families that live as permanent residents in the village of Cerro de San Pedro. The village has two churches, a municipal office, and several other public buildings. The school is currently closed, and the few children that live in Cerro de San Pedro go to the school in Portezuelo. In addition, there are several properties that are owned by individuals that do not live in the village permanently, making occasional use of their houses usually on weekends. The remainder of the village is comprised of ruins, many of which do not have registered ownership. INAH has defined most of the village as a protected zone to preserve the two churches and other historical monuments. See Section 10.1.6 for details.

The original strategy to deal with the concerns of operating a mine in close proximity to the village of Cerro de San Pedro was for MSX to obtain control of all the property within a safety buffer zone adjacent to the pit. The safety buffer zone, which included the two churches, the municipal office, and the school, would be fenced and closed to public access Monday through Saturday. On Sundays, when mining activities are suspended, the village would be open to the public to allow access to church services and local tourism. In addition, the municipal office would be relocated outside the safety buffer zone to enable it to continue its normal activities during the week.

Obtaining control of all the property within the safety buffer zone, either through private negotiations or requesting a temporary occupation from the Federal Mining Bureau, is now not considered practical, and the state government will not support restricting access to the village. Instead, the village will remain open to the public and MSX has signed an agreement with the state and municipal authorities to ensure public safety for the village. As a result, MSX will involve the state and municipal authorities in a joint

effort to ensure that the proper safety precautions are taken to protect the public, especially during blasting operations.

MSX will continue to acquire property within the safety buffer zone from owners that choose to engage in private negotiations. This will provide the property owners that feel affected by the mining activities with one of the following alternatives:

- Sale with buyback option at end of project.
- Sale without buyback option.
- Relocation to an MSX house in Cerro de San Pedro outside the safety buffer zone.

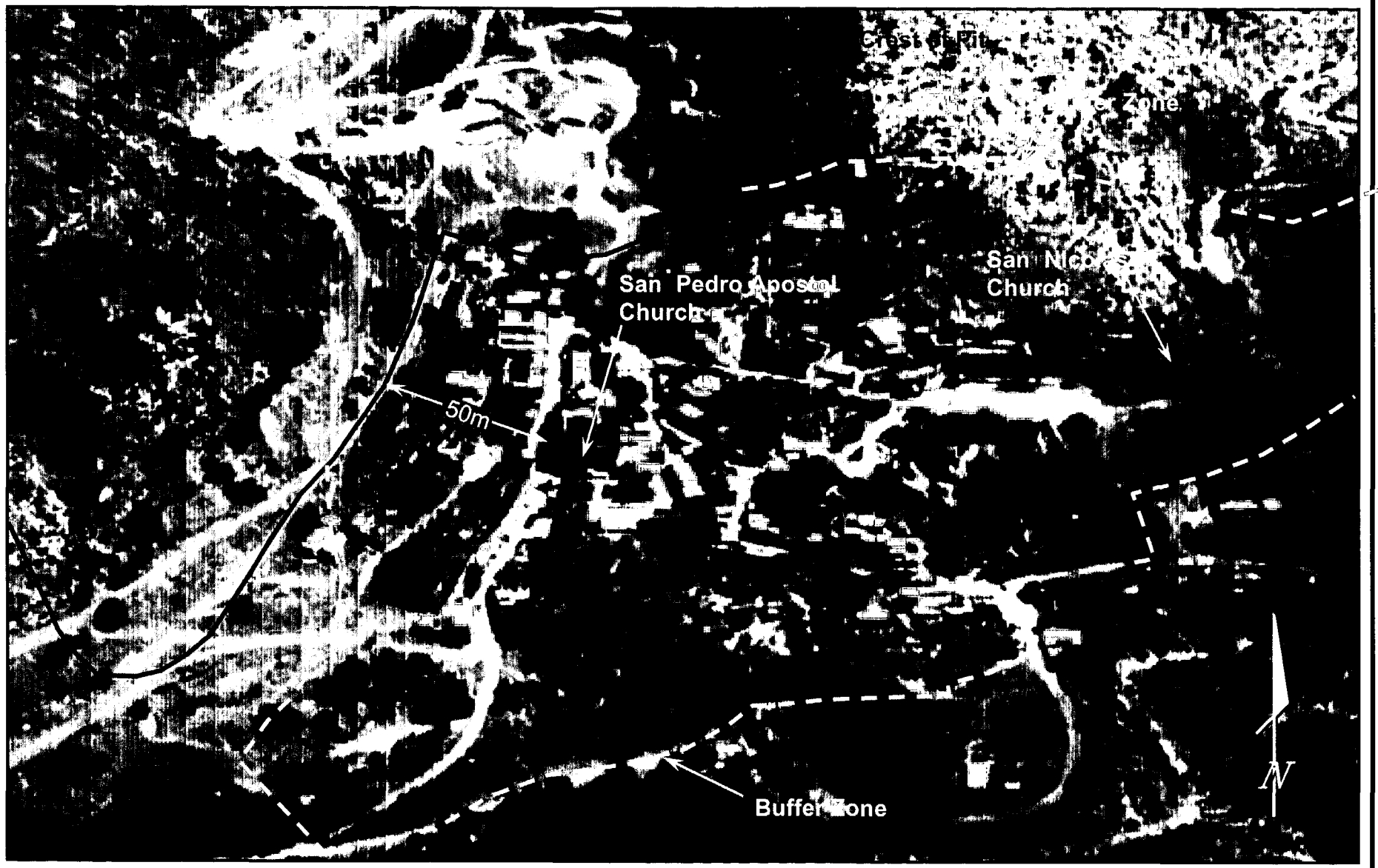
Figure 2.7 is a photograph showing the village of Cerro de San Pedro and the perimeter of the proposed open pit.

Table 2.6 provides a summary of information regarding Cerro San Pedro property acquisition in the safety buffer zone. A complete listing of properties by owner type with the status of property acquisition within the Cerro San Pedro safety buffer zone is shown in Table 2.7. Figure 2.8 shows the relationships of these properties on a map with respect to the buffer zone and proposed operations. Properties outside the safety buffer zone that have a particular strategic value to the project have also been obtained by MSX.

Table 2.6

Summary of Property Acquisitions in Buffer Zone				
Properties in Safety Buffer Zone	**# of Properties**	**# of ha**	**% of Total Properties**	**% of Total ha**
Private Properties Acquired	21	1.8	28	50
Public Properties Agreements	0	0	0	0
Subtotal Acquired	21	1.8	28	50
Private Properties – Not Acquired	45	1.3	61	36
Public Properties – No Agreements*	8	0.5	11	14
Subtotal Not Acquired/No Agreements	53	1.8	72	50
Total Properties	74	3.6	100	100

* An additional 4.5 ha of vacant land is also located within the buffer zone. The Municipality (public) and local Ejido are in discussions to determine their mutual jurisdiction over these lands.



MINERA SAN XAVIER S.A. de C.V.

Figure 2.7 Photograph Showing Village of Cerro de San Pedro and Buffer Zone Boundary

Table 2.7

Surface Land Acquisition - Cerro de San Pedro

Map Code	Buffer Zone	Owner Name	Property/Lot Description	Surface Area (m^2 App)	Agreement Date	Contract Value (Pesos)	Pending Balance (Pesos)	Comments
PROPERTY CONTROLLED BY MSX IN BUFFER ZONE								
PRIVATE PROPERTY - ACQUIRED INSIDE BUFFER ZONE / PIT AREA								
53	In	Ricardo Medellín	1 lot with a house north of town	478.058	18-Sep-96	180,000	0	N
19	In	José Jesús Alba Flores	Hotel west of town	1061.362	10-Dec-96	850,000	0	N
44	In	Juan Carlos Escalante Martínez	1 lot south of town	340.085	17-Dec-96	60,000	0	N
	In	Prisciliano Alvarado Chávez	1 lot north of town		17-Dec-96	160,000	0	P, inside pit, off map
9	In	José Inés y Antonia Alvarez Tello	1 lot west of town	475.74	16-Jul-97	112,500	0	S / R
59	In	Cesario Ojeda Orozco	2 lots east of town	104.745	11-Sep-97	35,000	0	S
45	In	José Trinidad Franco Rdz.	1 lot east of town	345.523	23-Sep-97	85,000	0	S / R
55	In	Jesús Mendoza Ponce	1 lot downtown	42.645	13-Oct-97	35,000	0	S
73	In	Agustín Gutiérrez Márquez	1 lot northwest of town	322.835	7-Nov-97	40,000	0	N
16	In	Aristeo Gutiérrez Chávez	lot with sink north of town	641.584	20-Nov-97	160,000	0	Controversy with Ejido
10	In	Juan Tristán y Marcelina Alvarado	1 lot west of town	419.717	1-Dec-97	75,000	0	S
49	In	Severiano Mata Alvarez	1 lot east of town	669.261	2-Dec-97	85,000	0	S / R
50	In	Fructuoso Leos Mascorro	1 lot east of town	288.349	8-Dec-97	20,000	0	N
20	In	Aristeo Gutiérrez Chávez	1 lot west of town	851.429	25-Feb-98	150,000	0	N
71	In	Aristeo Gutiérrez Chávez	1 lot northwest of town	888.356	13-Feb-98	0	0	R, Inside the pit
50a	In	Ricardo Medellín	1 lot south of town		9-Jun-98	20,000	0	S
41	In	María Julia Flores Torres	1 lot south of town	1114.946	24-Aug-98	90,000	0	S / R
13	In	Fidel Alonso Barbosa	1 lot downtown	198.122	28-Jun-99	75,000	0	N
2	In	Minera San Xavier	1 lot southwest of town	203.489			0	
74	In	Genaro Ruiz Estrada	1 lot east of town	8414.78	18-Mar-97	42,117	0	Controversy with Ejido
33	In	Fidel Alonso Barbosa	1 lot downtown	501.671	28-Jun-99	225,000	0	N
		Subtotal MSX Acquired Private Property in Buffer Zone		17,362.70	or 1.74 ha	2,499,617		
PROPERTY REQUIRING MSX SAFETY/PROTECTION PROGRAM IN BUFFER ZONE								
PRIVATE PROPERTY - NOT ACQUIRED INSIDE BUFFER ZONE								
5	In	Fausto Méndez	1 lot west of town	1151.402				
6	In	Jesús Monroy	1 lot west of town	121.696				
	In	Angel Narvaez	1 lot west of town	38.734				
8	In	Pantaleón Barbosa	1 lot west of town	130.267				
11	In	Raquel Marcos Narvaez	1 lot west of town	618.003				
12	In	Ma. Antonia Rodríguez	1 lot west of town	363.434				
14	In	María del Carmen Ramos	1 lot northwest of town	507.25				

Table 2.7

Surface Land Acquisition - Cerro de San Pedro

Map Code	Buffer Zone	Owner Name	Property/Lot Description	Surface Area (m^2 App)	Agreement Date	Contract Value (Pesos)	Pending Balance (Pesos)	Comments
15	In	María del Carmen Ramos	1 lot northwest of town	213.912				
18	In	Roberto Mata	1 lot northwest of town	279.588				
23	In	Marcos Rangel	1 lot downtown	134.996				
24	In	Municipio o Teodulo Sánchez (museo)	1 lot downtown	62.289				
25	In	Pedro Ramos	1 lot downtown	76.544				
26	In	Unknown owner	1 lot southwest of town	78.696				
27	In	Armando Méndoza	1 lot southwest of town	553.115				NO
29	In	Unión Ganadera	1 lot west of town	95.861				
30	In	Gabriel Muñíz	1 lot west of town	112.248				
31	In	Pedro Ramos	1 lot west of town	32.23				
32	In	Gabriel Muñíz	1 lot west of town	152.649				
34	In	Ariel Alderete	1 lot east of town	364.438				NO
35	In	Pantaleón Barbosa	1 lot east of town	121.549				NO
36	In	Isabel Muñíz	1 lot east of town	14.313				
37	In	Fidel Mata	1 lot east of town	621.338				
38	In	Carlos Ramos	1 lot east of town	143.689				NO
39	In	Lamberto Reyna	1 lot east of town	123.282				
40	In	Severiano Alvarado	1 lot south of town	423.479				
42	In	Guadalupe Solís	1 lot southeast of town	354.693				NO
43	In	Isabel Muñíz	1 lot southeast of town	463.1				
46	In	Eduardo Alvarez	1 lot southeast of town	266.7				
47	In	Faustino García	1 lot southeast of town	236.364				
48	In	Concepción Arriaga	1 lot south of town	128.212				
51	In	Eligio Mata	1 lot east of town	1270.371				
54	In	Fructuoso Leos	1 lot north of town	60.04				
56	In	Isabel Barbosa o Roberto Mata	1 lot north of town	182.883				
57	In	Gabriel Muñíz	1 lot north of town	228.993				
58	In	Mario Martínez	1 lot north of town	217.324				NO
60	In	Isabel Barbosa	1 lot northeast of town	304.538				
61	In	Crescencio Rodíguez	1 lot northeast of town	322.724				
62	In	Raúl Castillo	1 lot northeast of town	435.888				NO
64	In	Magdaleno y Leonardo Rangel	1 lot northeast of town	317.616				
65	In	Juan y Cleto Flores	1 lot northeast of town	262.665				

Table 2.7

Surface Land Acquisition - Cerro de San Pedro

Map Code	Buffer Zone	Owner Name	Property/Lot Description	Surface Area (m^2 App)	Agreement Date	Contract Value (Pesos)	Pending Balance (Pesos)	Comments
67	In	Lic. Florencio Ramos Rangel	1 lot north of town	651.079				NO
68	In	Domingo Corpús	1 lot north of town	820.082				
69	In	Guillermina Ramos Moreno	1 lot north of town	284.205				
70	In	Pedro Gutiérrez	1 lot north of town	140.451				
72	In	Raúl Castillo	1 lot north of town	233.092				NO
		Subtotal Identified Private Property Not Acquired by MSX		13,716.02	or 1.37 ha			
Total Private Property in Buffer Zone				31,078.72	or 3.11 ha			
PUBLIC BUILDINGS WITH ASSOCIATED PARCEL - INSIDE BUFFER ZONE								
3	In	Propiedad Municipal	1 lot southeast of town	1910.328				
4	In	Salón Ejidal	1 lot southeast of town	158.431				
17	In	Presidencia Municipal	1 lot northwest of town	352.847				
21	In	Templo San Pedro y Curato	1 lot downtown	633.187				
22	In	Propiedad Municipal	1 lot downtown	165.743				
28	In	Baños Públicos (municipio)	1 lot west of town	28.274				
63	In	Templo San Nicolás	1 lot northeast of town	698.246				
66	In	Escuela Primaria Benito Juárez	1 lot northeast of town	1117.09				
		Subtotal Public Buildings - No Agreement with MSX		5064.144	or 0.51 ha			
Total Identified Private and Public Properties in Buffer Zone				36,142.86	or 3.61 ha			
OTHER VACANT PROPERTY w/ EJIDO / MUNICIPAL JURSIDICTION IN BUFFER ZONE								
		Subtotal Remaining Vacant Land - No MSX Agreements		45,132.36	or 4.51 ha			UD
Total Area of Buffer Zone				81,275.22	or 8.13 ha			
OTHER PROPERTY INFORMATION - OUTSIDE BUFFER ZONE								
PRIVATE PROPERTY - ACQUIRED OUTSIDE BUFFER ZONE								
74	Out	Genaro Ruiz Estrada	1 lot east of town		18-Mar-97	77,883	0	Controversy with Ejido
	Out	José Jesús Alba Flores	1 lot east of town		20-Mar-97	73,138	0	N
	Out	José Jesús Alba Flores	1 lot east of town		20-Mar-97	100,996	0	N
	Out	JC Esc. Hdez. y Cirina Mtz. Gtz.	5 lots south of town		24-Mar-97	100,000	0	2N / 3S
	Out	Cirilo Blanco Tobias	2 lots La Victoria town		7-May-97	32,000	0	N
	Out	Santos Nava Arista	2 lots south of town		7-May-97	58,000	0	N
	Out	Antonio Pérez Almaguer	5 lots in front of MSX offices		3-Jul-97	75,000	0	N
	Out	José Inés y Antonia Alvarez Tello	1 lot south of town		16-Jul-97	112,500	0	S
	Out	Genaro Ruiz Estrada	1 lot northeast of town		29-Aug-97	75,000	0	Controversy with Ejido
	Out	Herminia Morquecho Castro	1 lot east of town		4-Nov-97	80,000	0	Controversy with Ejido

Table 2.7

Surface Land Acquisition - Cerro de San Pedro

Map Code	Buffer Zone	Owner Name	Property/Lot Description	Surface Area (m^2 App)	Agreement Date	Contract Value (Pesos)	Pending Balance (Pesos)	Comments
	Out	Fructuoso Leos Mascorro	1 lot east of town		8-Dec-97	20,000	0	N
	Out	José Luis Escalante Torres	1 lot La Victoria town		26-Jan-98	220,000	0	S
	Out	Cesario Ojeda Orozco	1 lot San Pedro shaft		13-Feb-98	10,000	0	S
	Out	Fidela Dimas Chavarría	1 lot La Victoria town		13-Feb-98	25,000	0	N
	Out	JC Esc. Hdez. Y Cirina Mtz. Gtz.	2 lots south of town		2-Apr-98	300,000	0	N
	Out	José Antonio Meave Flores	2 lots east of town		6-May-98	40,000	0	S
	Out	José Cruz García Rocha	1 lot east of town		10-Mar-99	13,500	0	S
	Out	Juan Carlos Escalante Hernández	1 lot south of town		13-May-99	35,000	0	S
	Out	Fidel Alonso Barbosa	1 lot in front of MSX offices		28-Jun-99	75,000	0	N
		Acquired Private Property Outside Buffer Zone				1,523,017		

Comment Codes:

N = MSX has received official notarization of legal transfer from a titled landowner.

S = MSX has received title through a successory judgement or intermediate successory judgement.

R = MSX received property through exchange for relocation to home built by MSX outside of buffer zone.

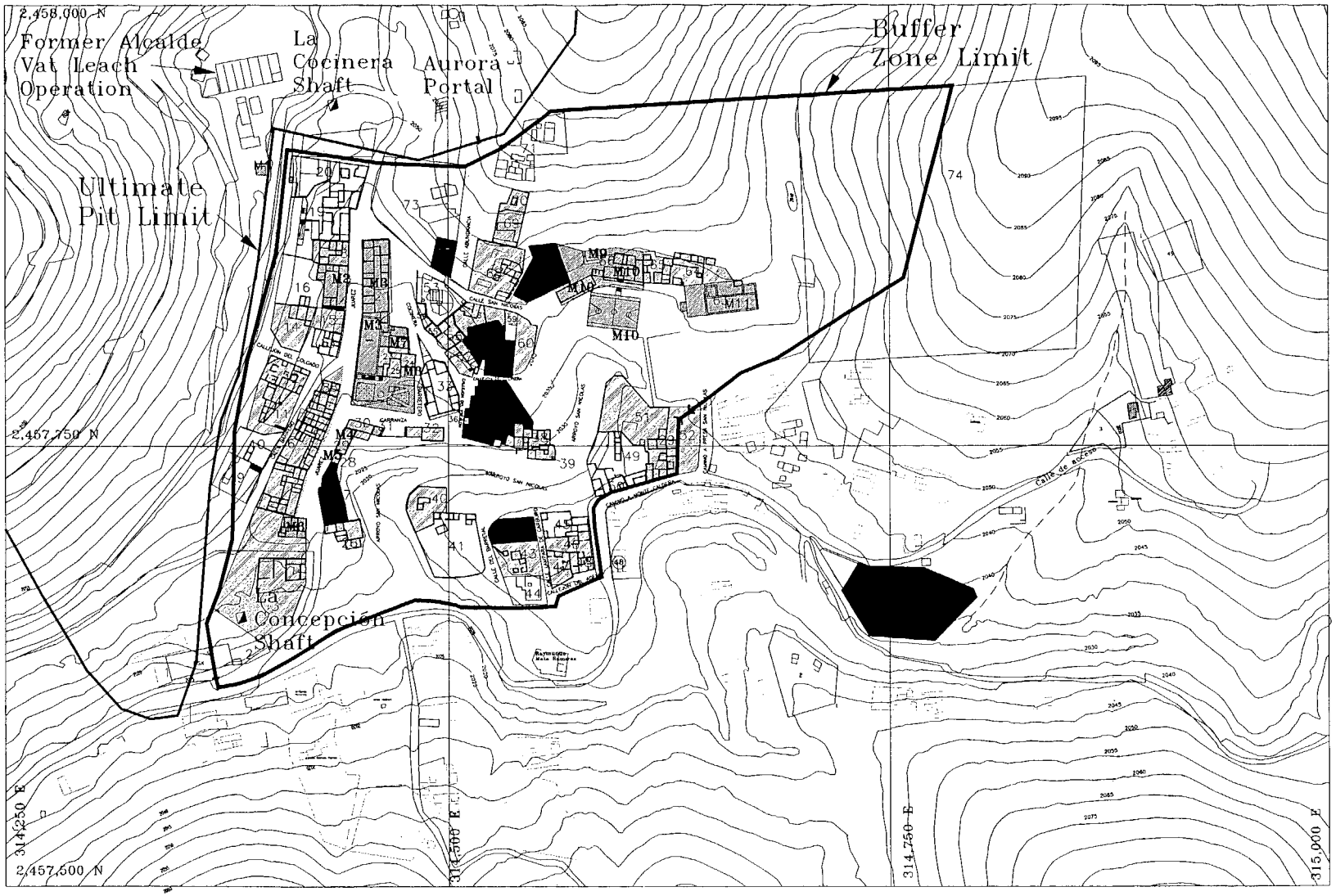
P = possessionary rights holder.

Controversy with Ejido = even though transaction to MSX has occurred on lot which has no registered title, the Ejido in the area is claiming legal title. May requre additional agreement with Ejido if the property is to be used by MSX as a site to build houses.

NO = owners have expressed that they will not sell to MSX.

UD = under discussion - the Ejido and the Municipality in the area are currently working to determine which of the non-private/public properties each has jurisdiction over in the buffer zone so that appropriate agreements may be initiated with MSX.

Total pesos for private surface land acquisitions is 4,022,634 or approximately $427,940.



EXPLANATION

74 MSX PROPERTIES

OWNERS NOT SELLING

M2 PUBLIC BUILDINGS

OTHER PRIVATE PROPERTIES

NOTE:
1. Remaining areas within buffer zone are vacant. Municipality and Ejido are defining jurisdiction of these areas to determine agreement with MSX.

2. The Pit boundary was defined by INAH as no closer than 50m from the Iglesia San Pedro Apostol.

AREA (m2) OF EACH PRIVATE AND PUBLIC PARCEL IN BUFFER ZONE

1.– ANTONIA MATA	121 619 m2.	16.– MSX (AGUSTIN GUTIERREZ)	641 584 m2	31.– PEDRO RAMOS	31 23 m2.	46.– EDUARDO ALVAREZ	566 70 m2	61.– CRESCENCIO RODRIGUEZ	592 724 m2		
2.– MINERA SAN XAVIER	2662 695 m2.	17.– PRESIDENCIA MUNICIPAL	352 647 m2	32.– GABRIEL MUIZ	182 549 m2	47.– FAUSTINO GARCIA	336 354 m2	62.– RAUL CASTILLO	435 588 m2		
3.– PROPIEDAD MUNICIPAL	1349 326 m2.	18.– ROBERTO MATA	218 528 m2.	33.– MSX (FIDEL ALONSO BARBOSA)	92 071 m2.	48.– CONCEPCION ARRIAGA	438 137 m2	63.– TEMPLO SAN NICOLAS	698 146 m2		
4.– SALON EJIDAL	158 431 m2	19.– MSX (HOTEL) (JOSE DE JESUS DE ALBA)	1661 382 m2	34.– ARIEL ALDERETE	306 435 m2	49.– JUAN CHAVEZ (MSX)	869 281 m2	64.– MAGDALENO Y LEONARDO RANGEL	319 816 m2		
5.– FAUSTO MENDEZ	1151 402 m2	20.– MSX (ARISTEO GUTIERREZ CH.)	851 429 m2	35.– PANTALEON BARBOSA	121 543 m2	50.– MSX (FRUTUOSO LEOS)	258 345 m2	65.– JUAN Y CLETO FLORES	259 670 m2		
6.– JESUS MONROY	121 695 m2	21.– TEMPLO SAN PEDRO Y CURATO	633 137 m2	36.– ISABEL MUIZ	14 713 m2	51.– ELIGIO MATA	1270 341 m2	66.– ESCUELA PRIMARIA BENITO JUAREZ	1417 76 m2		
7.– ANGEL NARVAEZ	35 736 m2	22.– PROPIEDAD MUNICIPAL	165 740 m2	37.– FIDEL MATA	821 336 m2	52.– CRISTINO VEGA	681 769 m2	67.– LIC. FLORENCIO RAMOS RANGEL	451 673 m2		
8.– PANTALEON BARBOSA	130 267 m2.	23.– MARCOS RANGEL	134 988 m2	38.– CARLOS RAMOS	145 685 m2	53.– MSX (RICARDO MEDELLIN)	476 058 m2	68.– DOMINGO CORPUS	626 268 m2		
9.– MSX (J. INES ALVAREZ)	475 74 m2	24.– MUNICIPIO O TEODULO SANCHEZ (MUSEO)	62 280 m2	39.– LAMBERTO REYNA	193 252 m2	54.– FRUCTUOSO LEOS	59 04 m2	69.– GUILLERMINA RAMOS	254 205 m2		
10.– MSX (JUAN TRISTAN B.)	419 717 m2	25.– PEDRO RAMOS	78 544 m2	40.– SEVERIANO ALVARADO	423 427 m2	55.– MSX (JESUS MENDOZA PONCE)	32 645 m2	70.– PEDRO GUTIERREZ	140 651 m2		
11.– RAQUEL MARCOS NARVAEZ	615 003 m2	26.– ?	76 656 m2	41.– ROBERTO Y PEDRO FLORES	1114 696 m2	56.– ISABEL BARBOSA O ROBERTO MATA	162 883 m2	71.– MSX (ARISTEO GUTIERREZ CH.)	868 356 m2		
12.– MA. ANTONIA RODRIGUEZ	383 424 m2	27.– ARMANDO MENDOZA	561 115 m2	42.– GUADALUPE SOLIS	354 983 m2	57.– GABRIEL MUIZ	229 993 m2	72.– RAUL CASTILLO	233 092 m2		
13.– JOSE Mo. BARBOSA	198 122 m2	28.– BAÑOS PUBLICOS (MUNICIPIO)	28 274 m2	43.– ISABEL MUIZ	463 10 m2	58.– MARIO MARTINEZ	217 324 m2	73.– MSX (ARISTEO GUTIERREZ CH.)	282 535 m2		
14.– MARIA DEL CARMEN RAMOS	507 25 m2.	29.– UNION GANADERA	95 901 m2	44.– MSX (CARLOS ESCALANTE MTZ.)	340 083 m2	59.– MSX (CESARIO OJEDA)	101 249 m2	74.– GENARO RUIZ ESTRADA	5014 72 m2		
15.– MARIA DEL CARMEN RAMOS	213 612 m2	30.– GABRIEL MUIZ.	112 248 m2	45.– MSX (JOSE TRINIDAD FRANCO)	346 520 m2	60.– ISABEL BARBOSA	304 538 m2				

Public Buildings

M1	Pila Agua Potable
M2	Palacio Municipal
M3	Iglesia San Pedro Apostol
M4	Edf. Ganadera
M5	Baños Publicos
M6	Comite Ejidal
M7	DIF Municipal
M8	Museo Municipal
M9	Aljibe Municipal
M10	Escuela Primaria "Benito Juarez"
M11	Iglesia San Nicolas

MINERA SAN XAVIER, S.A. de C.V.

Figure 2.8 Map of Cerro de San Pedro Land Acquisition Status

A total of 1.806 ha of the 3.108 ha (or 58%) of the private surface within the buffer zone have been acquired (or a total of 50% of the 3.6143 ha of identified private and public properties). The total cost of surface acquisition in Cerro de San Pedro has been $428,374 through July 2000.

La Zapatilla Private Surface Lands

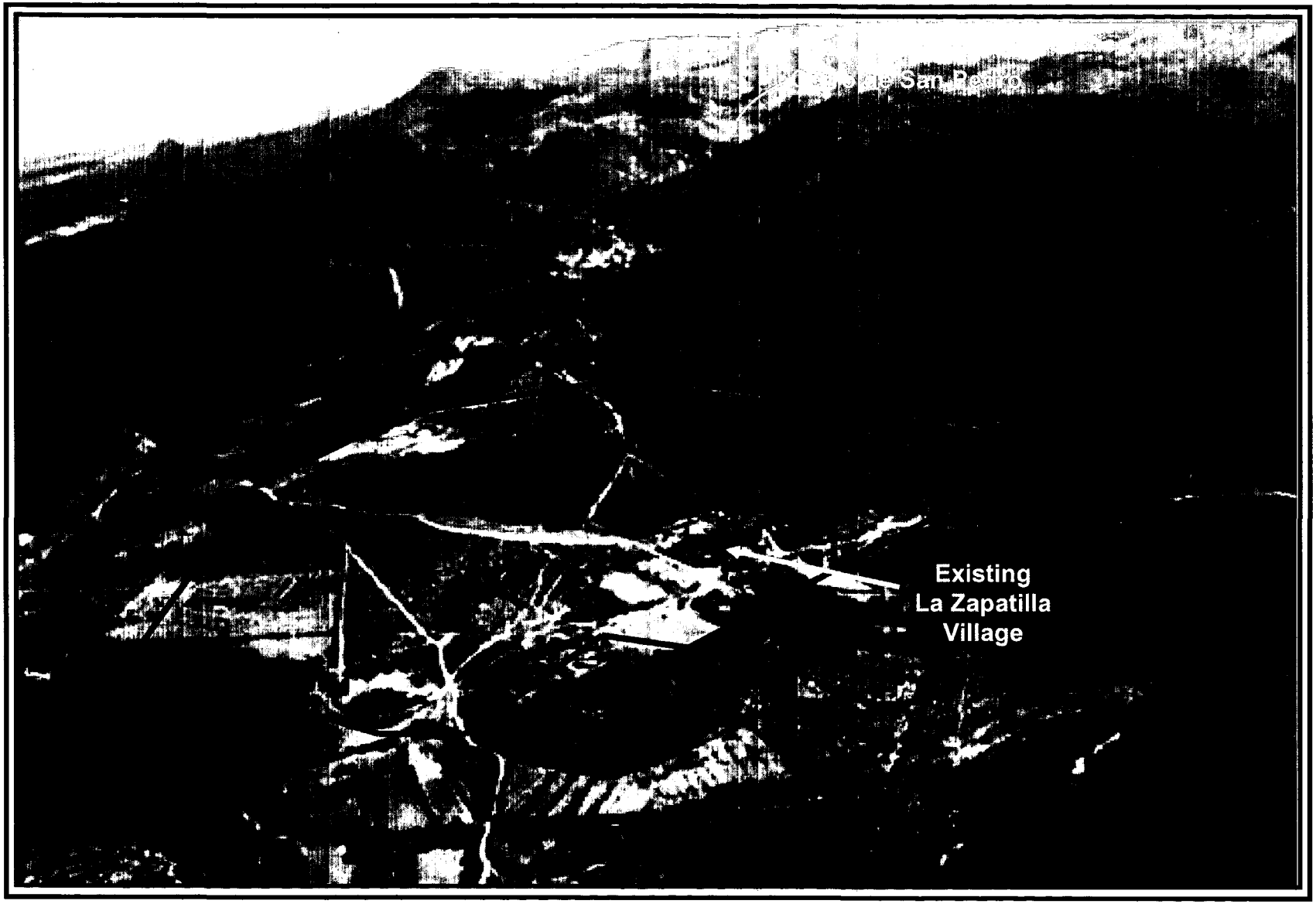
The small village of La Zapatilla is located in the middle of the proposed leach pad site. MSX has completed negotiations with all of the permanent residents to be relocated. A total of 20 houses will be built for the 20 families that have agreed to be relocated to a new village almost 2 km southwest of the present La Zapatilla village. Construction of the new La Zapatilla village started in August 2000 and will be completed in January 2001. It will provide better quality housing, a school, and recreation facilities for those being relocated. In addition, a new chapel will be constructed in place of the small chapel presently located in La Zapatilla. One of the resident families chose to leave the village and settle elsewhere. Figure 2.9 is an aerial photo showing the proposed leach pad area and current La Zapatilla village.

Table 2.8 summarizes the status of the property acquisition within the La Zapatilla area. Table 2.9 presents a detailed list of land acquisitions in La Zapatilla.

Table 2.8

Summary of Property Acquisitions in the La Zapatilla Area				
La Zapatilla Surface Properties	Surface Area		Agreements	
	Hectares	%	Number	%
Surface Acquired	194.6	100	35	100
Surface Not Acquired	0	0	0	0
Total Required	194.6	100	35	100

All the required private surface area has been acquired by MSX. The total cost of surface acquisition in La Zapatilla has been $745,675 through July 2000. Figure 2.10 shows the relationship of the La Zapatilla land ownership to the footprint of the heap leach pad.



MINERA SAN XAVIER S.A. de C.V.

Figure 2.9 Photograph Showing Area of Village of La Zapatilla and Perimeter of 75 Million Tonne Leach Pad

Table 2.9

Surface Land Acquisition - La Zapatilla							
Map Code	Owner Name	Property/Lot Description	Surface Area (Ha. App)	Agreement Date	Contract Value (Pesos)	Pending Balance (Pesos)	Comments
PRIVATE PROPERTY - ACQUIRED BY MSX							
41	Amando Loredo Loredo	1 lot	6.5827	14-Mar-96	40,000	0	N
3	Luciano Picazo Solís	1 lot	18.1835	23-May-96	120,000	0	N
1	Angel Aguilar Gutiérrez	3 lots	5.8319	17-Dec-96	180,000	0	N
7	Pedro Alvarado Alvarez (II)	1 lot	6.0286	24-Jan-97	72,000	0	N
33	Pedro Alvarado Alvarez (II)	1 lot	0.1394	24-Jan-97	0	0	R
21	Joaquín Alvarado Alvarez	1 lot	0.498	27-Jan-97	0	0	R
8	Pedro Alvarado Alvarez (I)	1 lot	9.3649	27-Jan-97	111,989	0	R
11	Luciano Picazo Solís	1 lot	3.0638	28-Jan-97	37,200	0	N
10/29	Ignacio Leos López	2 lots	21.3918	29-Jan-97	275,000	0	R
S/N	Albino Castillo Rodríguez	1 lot	0.04	12-Feb-97	0	0	R
51	Juan Carlos Flores Ibarra	1 lot	0.6355	12-Feb-97	30,000	0	N
43	Félix Sandoval Alvarez	1 lot	16.6514	14-Feb-97	332,000	0	N
6, 58	Germán Alvarez Picazo	2 lots	0.886	19-Feb-97	12,750	0	N
19	Candelario Rodríguez Luna	1 lot	0.1835	20-Feb-97	30,000	0	R
69, 9, 22, 59, 35, 12, 17, 15, 47	Familia Alvarado Castillo	9 lots	20.2728	20-Feb-97	350,000	0	N / R
2	Felipe Alvarado Alvarez	1 lot	8.7478	20-Feb-97	161,291	0	N
34a	Felipe Alvarado Alvarez	1 lot	0.0701	20-Feb-97	0	0	R
34	Felipe Alvarado Alvarez	1 lot	2.6418	20-Feb-97	48,709	0	N
66	Manuel Loredo Loredo	1 lot	1.1592	20-Feb-97	14,000	0	N / R
25, 26	Angel Aguilar Gutiérrez	2 lots	0.3376	21-Feb-97	183,000	0	N
14	Angel Aguilar Gutiérrez y José Juan Aguilar Torres	2 lots	9.2278	21-Feb-97	135,000	0	N
61/57	Hipólito Flores Mares	2 lots	1.1676	21-Feb-97	53,000	0	N / R
56	Andres Puente Morales	1 lot	0.04	22-Feb-97	15,000	0	R
20/55	Marcelino Galván Soto	2 lots	2.4746	18-Mar-97	180,000	0	N
36	Yolanda Rodríguez Angeles	1 lot	0.1027	18-Mar-97	30,000	0	N
46	Beatriz Eugenia de Alba Ortiz	1 lot	1.9826	20-Mar-97	188,117	0	N
60	Beatriz Eugenia de Alba Ortiz	1 lot	0.7664	20-Mar-97	188,117	0	N
46a	José de Jesús de Alba Ortiz	1 lot	0.6056	20-Mar-97	101,269	0	N
13/54	Joaquín Alvarado Alvarez	2 lots	1.7248	24-Mar-97	30,000	0	N

Table 2.9

Surface Land Acquisition - La Zapatilla

Map Code	Owner Name	Property/Lot Description	Surface Area (Ha. App)	Agreement Date	Contract Value (Pesos)	Pending Balance (Pesos)	Comments
56	Félix Acevedo Mendoza	1 lot	0.02	19-Jun-97	0	0	R
39	Pablo Torres Soto	1 lot	1	29-Oct-98	55,000	0	N
S/N	Carmen Escobedo Ojeda	1 lot	0.1749	10-Nov-98	12,000	0	N
11	Luciano Picazo Solís	1 lot	0.03	10-Nov-98	0	0	R
39	Manuel Solís Picazo	1 lot	1.0944	8-Dec-98	70,000	0	N
5	J.L. Mata Jurado y R. Mata Celia	2 lots	9.5443	9-Dec-98	2,632,000	0	N
10/29	Manuel Leos López	1 lot		5-Jan-99	70,000	0	N
5	J.R. Mata Jurado y P. Gpe. Torres	1 lot	0.9859	14-Jan-99	50,000	0	N
69	Marcos Esparza Saucedo	1 lot	0.2605	12-May-99	0	0	R
5	J.R. Mata Jurado y P. Gpe. Torres	1 lot	1.1	14-May-99	10,000	0	N
62A	Camilo Martinez	1 lot	15.5114	11-Oct-99	110,000	0	N
42	Benjamin Solis Lozano	1 lot	3	3-Sep-99	124,696	0	N
42	Jose Rivera	1 lot	5.4296	8-Oct-99	216,200	0	N
16	Felix Flores Mares	2 lots	6.3	7-Jun-00	429,700	0	R
	Subtotal Private Property Acquired		194.6		7,009,038	0	
Total Private Properties Required			194.6				

Comment Codes:

N = MSX has received official notarization of legal transfer from a titled landowner.

R = MSX received property through exchange for relcation to home to be built by MSX in Nueva La Zapatilla (approximately 2km away). The 19 owners that agreed on this exchange will become co-owners in Nueva La Zapatilla. They will run a process in late 1999 to demonstrate to authorities that this is a legitimate transaction that they negotiated freely and to their satisfaction with MSX. This is similar to MSX receiving successory judgement in the place of receiving official notarization of legal transfer from a titled landowner.

Total pesos for private surface acquisitions is 7,009,038 or approximately $745,642. The difference between this and total reported in text is additional payment allocated to "inventory" for value of tailings acquired on one property, and the varying conversion rate of $ to pesos over the past years.

2.7.4 Power Line Right of Way

A 115 kV power line will need to be constructed to supply the project with electricity. The power line will be 11.3 km in length and run from an existing substation to near the process building. The right of way for the new power line will follow next to an existing power line, but a separate right of way had to be negotiated with the affected landowners. The average width needed for the right of way is 23 m. Approximately 98 percent of the total 25.35 hectares of required right of way has been acquired. Table 2.10 details information regarding the status obtaining these rights.

Table 2.10

115 kV Power Line Right of Way Acquisition			
Source for Right of Way	**Number of Parcels**	**Area (ha)**	**% of Total**
Private Ejido land – acquired	68	21.09	83
Common Ejido land - acquired	24	3.77	15
Total acquired	92	24.86	98
Private Ejido land – not acquired	1	0.30	1
Private property – not acquired	1	0.19	1
Total not acquired	2	0.49	2
Total Required	94	25.35	100

The cost of the right of way acquisition for the 115 kV power line has been $203,320 through July 2000. An additional $9,772 is budgeted to complete the acquisition of the remainder of the right of way which is expected in the near future.

2.7.5 Water Rights

Water rights are owned by the Mexican nation and administered by an agency of the federal government; the Comisión Nacional de Agua (CNA). CNA has granted water concessions to private parties throughout the defined SLP Hydrologic Basin. As no new water rights are being issued in the Basin, new users of water must purchase rights from private parties. The Cerro San Pedro Project is forecast to use an average of 1 million cubic meters (m^3) of water per year. MSX has acquired pumping rights to 992,000 cubic meters per year approved by CNA. The aggregate total of the acquired water rights will be transferred from eight existing wells scattered through the Basin to the La Zapatilla well site where a well was completed July 1999 with a total pumping capacity of almost 2 million cubic meters of water per year. The La Zapatilla well is located about 2.5 km southwest of the process building, as shown on the general site layout in Figure 2.2 earlier in this section. Table 2.11 details information *regarding the acquisition of water rights.*

Table 2.11

Water Rights Acquisition		
Water Rights Ownership	**Cubic Meters (m^3)**	**Type of Negotiation**
Jose Isabel Loredo Lopes	24,000	Transfer of rights
Industrial Quimica de Mexico	250,000	Transfer of rights (11 yrs:1998-2009)
Agricultores del Ranchito	53,000	Transfer of rights
Club Campestre de San Luis	185,000	Transfer of rights
Penasco Pozo Numero 7	120,000	Transfer of rights
La Melada (Eduardo Salas Ovalle)	360,000	Transfer of rights
Total Acquired	992,000	

The total cost of water rights acquisition has been $723,344 through July 2000.

3.0 GEOLOGY AND MINERAL RESOURCES

3.1 Regional Geology

The Cerro San Pedro Mineral District lies along the margin between the Sierra Madre Oriental fold belt to the east and the more westerly Mesa Central volcanic plateau physiographic province. These areas correspond to the recently characterized tectonostratigraphic terranes of Mexico as the margin between the Guachichil and Tephuano terranes, respectively.

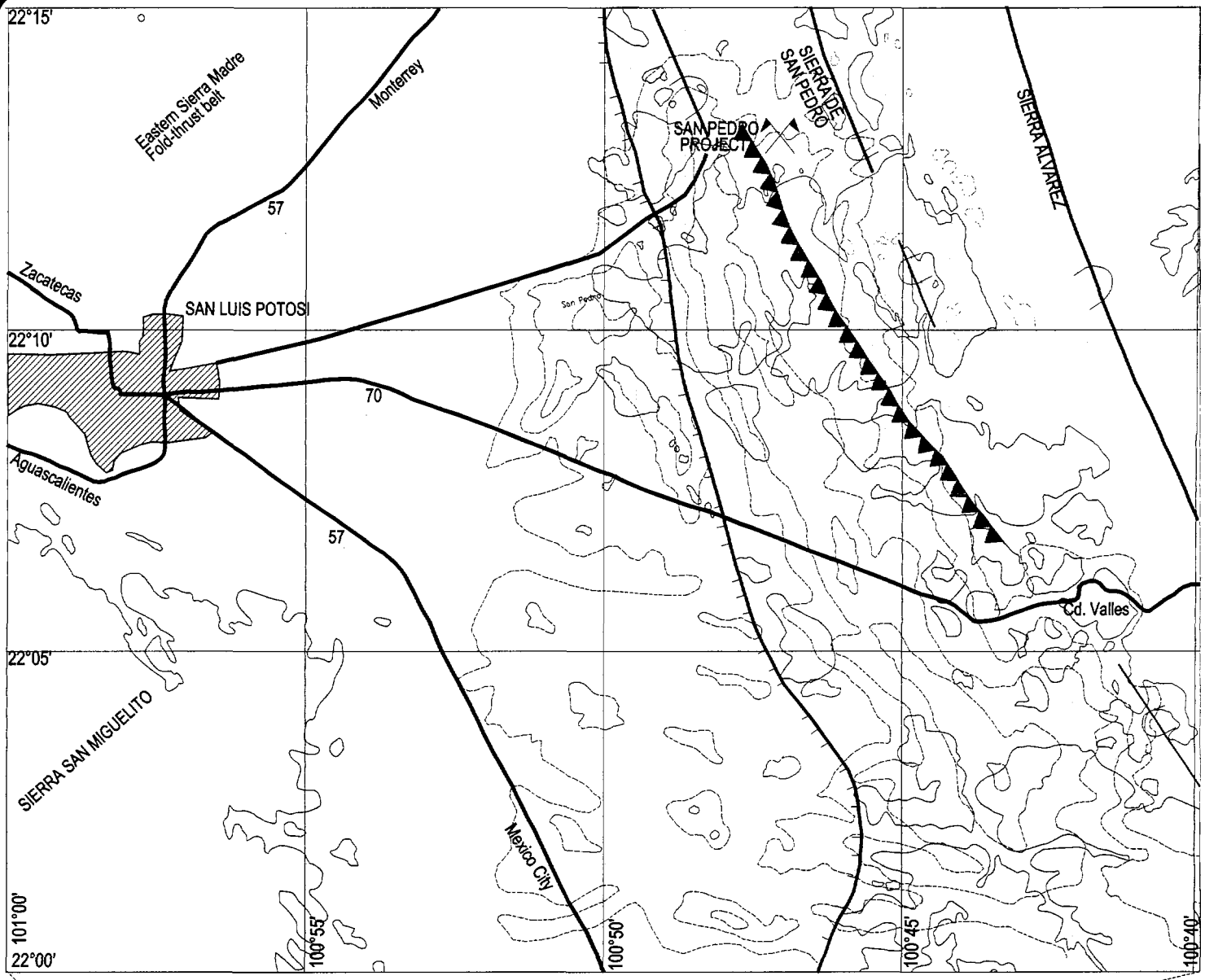
Regional stratigraphy consists of a thick succession of Cretaceous carbonate units, which outcrop in the area as the Aptian and Albian formations called La Peña and Cuesta del Cura Formations, respectively. The deformational history of the area is characterized by a series of east verging folds and thrusts developed during the Laramide orogeny, which in the project area are cross-cut by a complex system of normal and reverse faults and major conjugate northwest and northeast trending right-lateral shears as shown in Figure 3.1. During late Cretaceous to early Paleocene time, the limestone succession in the local project area was intruded by a diorite to quartz-diorite porphyry.

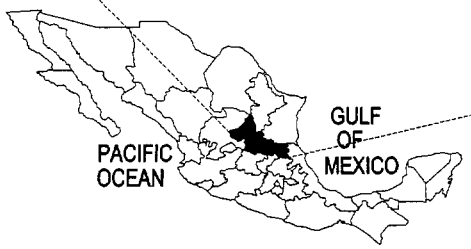
Post Laramide deformation developed a characteristic Basin and Ridge block faulting, resulting in the formation of the San Luis-Villa de Reyes graben to the west of the project area and underlying the city of San Luis Potosi.

3.2 District Geology

The Cerro San Pedro deposit occurs in the Sierra de San Pedro and the western part of the Sierra de Alvarez, both belonging to the Sierra Madre Occidental fold belt. The limestone sequence outcropping in the area, originally deposited on the western slope of the Valles-San Luis carbonate platform, is ascribed to the Aptian La Peña and Albian Cuesta del Cura Formations, which are a transgressive succession and covered a large portion of northeastern Mexico during the Cretaceous.

Multiple deformation phases occurred during the Laramide orogeny, which affected the district and resulted in a series of north-northwest trending folds. The main features belong to the first phase of deformation and include the Barreno and Abundancia synclines to the south and the north of the main deposit, respectively. The folds are intersected by two major conjugate northwest and northeast trending right-lateral shears, which are referred to as the Olvidada and Abundancia Faults, respectively, which serve to define the location of the Cerro San Pedro project area.





N

Explanation

- Range Front Fault
- Thrust
- Regional Fold Axes
- Cretaceous Limestones
- Tertiary Volcanics
- Alluvial Coverage

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Figure 3.1 Regional Geology Map

Another important fault system is called the Mendez, developed in the center of the main deposit between the two shear systems and created the environment to permit the intrusion of the diorite/quartz-diorite porphyry along an east-west dilation zone following the transition from a compressional to an extensional stress regime.

The shape of the porphyry body, as defined by drill hole intercepts, is that of a thick (200-400 m) moderately west-dipping dike. Information from the deepest levels mined by Asarco demonstrates that the intrusive body continues at depth. In general, the complex deformational history of pre-mineral ground preparation and the emplacement of the intrusion in the District are considered to be the primary factors behind the localization of the mineralization in the area.

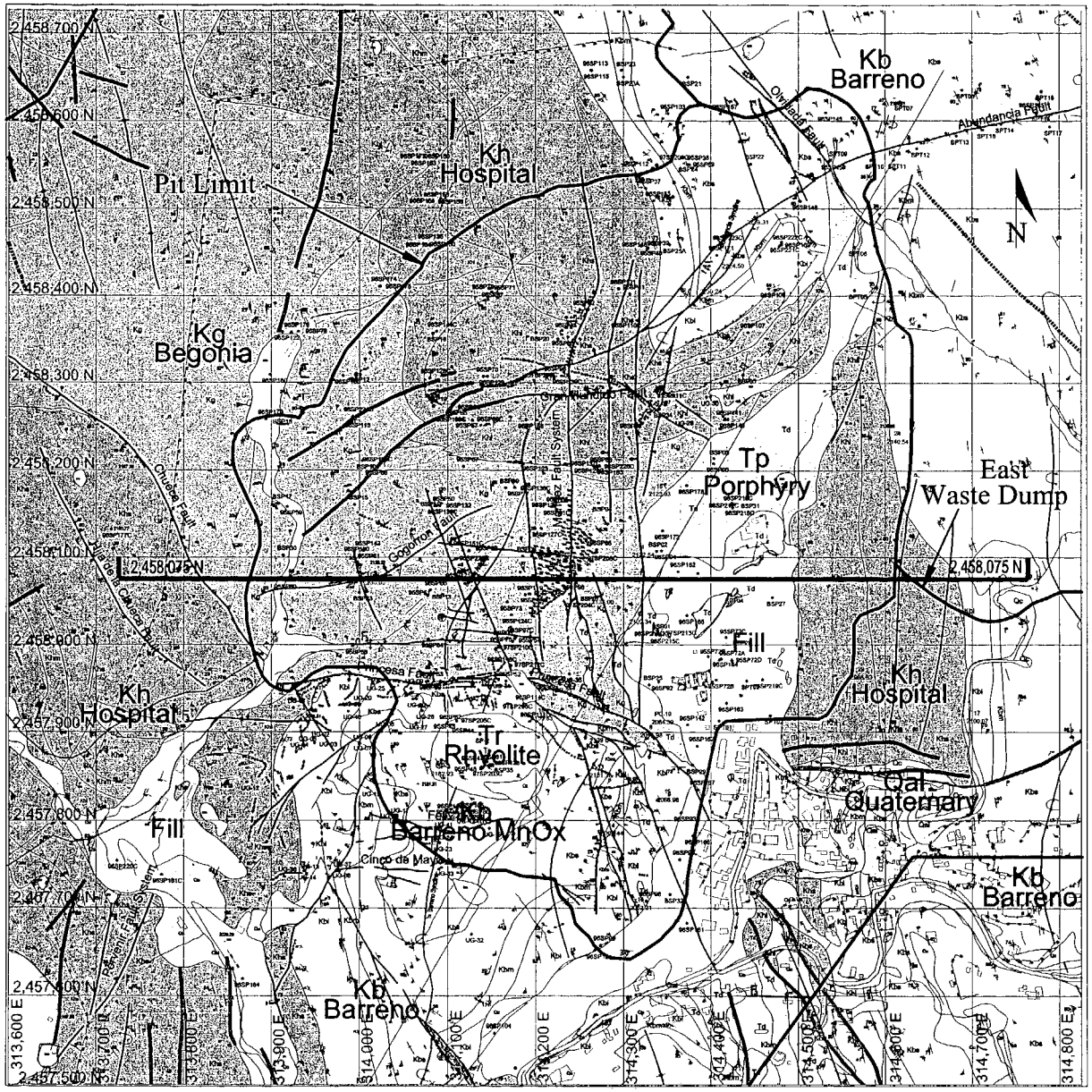
3.2.1 Lithology

The local stratigraphic sequence at Cerro de San Pedro has been informally subdivided into three principal units based on readily distinguishable characteristics (Maynard, 1995). These units include the Begonia, Hospital, and Barreno Limestones, which are described from oldest to youngest below and correspond to the upper part of the La Peña Formation and lower part of the Cuesta del Cora Formation as presented in Figure 3.2.

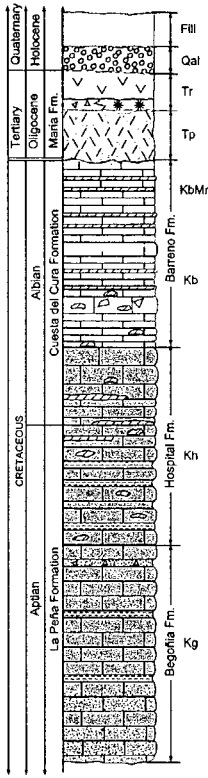
The Begonia Limestone is a 250-m thick sequence of light to medium gray, medium bedded limestones containing thin interbeds of red hematitic shale. Thick-bedded carbonaceous horizons are common in the lower part, which underlies much of the western flank of the Cerro San Pedro deposit in direct contact with the intrusive. Thirty meters below the contact with the overlying Hospital Limestone, there is a distinctive 1.5 to 2 m thick mustard to greenish gray arenaceous limestone.

The Hospital Limestone is a 280 to 300 m sequence of irregularly thin- to thick-bedded limestone representing the transitional sedimentary facies in between the Begonia and Barreno Limestones. The lower contact is distinguished by an increasing amount of interbedded chert and corresponding decrease in shaley interbeds. The upper contact with the Barreno Limestone is characterized by an abrupt decrease in bedding thickness and an increase in interbedded chert.

The Barreno Limestone is a 110 to 150 m sequence of thin-bedded limestones and carbonate breccia subdivided into three stratigraphic units; the lower and upper units being characterized by thin-bedded, finely crystalline limestone with semi-continuous chert interbeds and local silty partings, with the middle sub-unit consisting of a distinctive 5 to 15 meter thick massive sedimentary breccia. The color of all three



Explanation



Fill - Man made cover materials including mine dump and tailings. (0-10 mtrs.)

Quaternary alluvium - recent unconsolidated and caliche cemented alluvium and colluvium. (0-10 mtrs.)

~Unconformity~

Rhyolite tuff - welded, ignimbrage ash flows. (>15 mtrs.)

Rhyolitic breccia/vitrophyre. (1-10 mtrs.)

~Unconformity~

Diorite porphyry - Intrusive into all older rocks variably altered, especially in map area to propylitic, argillic, and sericitic assemblages. (>200 mtrs.)

Upper Barreno Limestone - KbMnOx (>70 mtrs.)
Thin-bedded oolitic limestone with regular chert interbeds; locally argillaceous. Locally abundant maganese oxide.

Middle Barreno Limestone (5-15 mtrs.)
Massive intraformational carbonate breccia.

Lower Barreno Limestone (30-40 mtrs.)
Thin-bedded oolitic limestone with regular chert interbeds and nodules.

Upper Hospital Limestone (~40 mtrs.)
Medium to thin-bedded fine crystalline limestone with intercalated chert lenses and nodules.

Middle Hospital Limestone (0-15 mtrs.)
Medium-bedded fine crystalline limestone with rare chert nodules.

Lower Hospital Limestone (50-60 mtrs.)
Thin to medium-bedded fine crystalline limestone with local chert nodules and lenses; interbeds of hematitic calcareous shale toward basal contact.

Begoñia Limestone (>250 mtrs.)
Medium-bedded micritic limestone with locally abundant hematitic calcareous shale interbeds.

Mustard yellow intraformational breccia within upper 25 meters of unit.

Interbedded carbonaceous horizons toward lower part of sequence.

Basal contact of Begoñia limestone is not observed at Cerro San Pedro.

- Contact
- Fault
- Mineralized fault
- Strike and dip of beds and of overturned beds
- Strike of vertical and horizontal beds
- Strike and dip of fault and vertical fault
- Strike and dip of cleavage
- Strike and dip of foliation in volcanic rocks
- Breccia zone
- Thrust
- Shrinkage or subsidence
- Overturned syncline axis
- Overturned anticline axis
- Shaft
- Roads

0 100 250

Scale in Meters

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Figure 3.2 Geologic Map of a Portion of the Cerro San Pedro Mining District

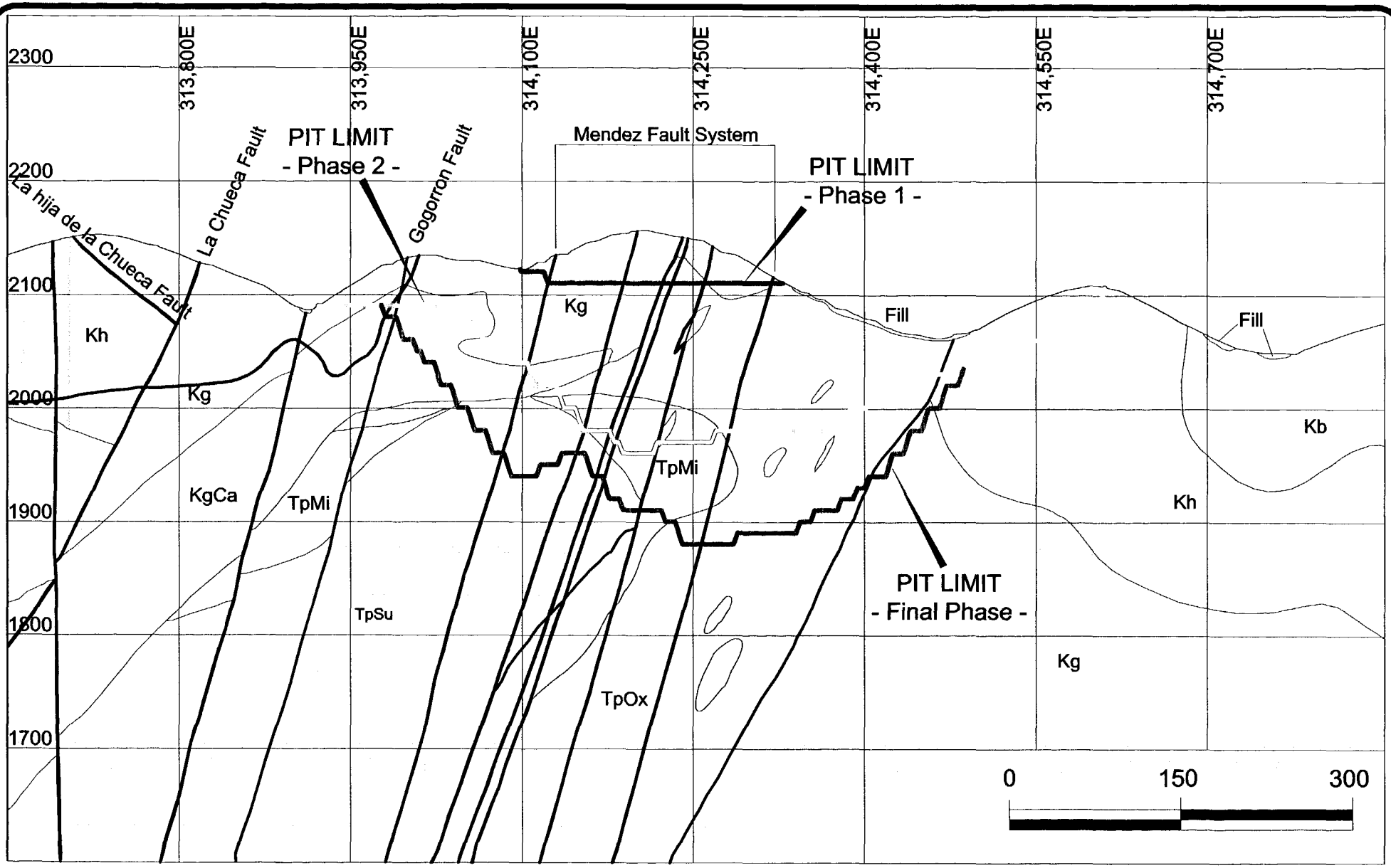
members ranges from medium to dark gray becoming black with increased replacement by manganese oxide.

The San Pedro porphyry is a wedge-shaped, north-striking and west-dipping intrusive dike that has been intensely altered throughout the District. Unaltered San Pedro porphyry located north of Cerro San Pedro is a holocrystalline-porphyritic rock of diorite to quartz diorite composition consisting of 35-55% fine-to-medium-grained subhedral to euhedral phenocrysts of plagioclase, hornblende, biotite, potassium feldspar, and minor quartz in a medium to dark green aphanitic matrix of quartz, K-feldspar, and minor plagioclase.

Hills in the region surrounding Cerro San Pedro are capped by a sequence of post-mineral pyroclastic rocks that unconformably overlie the San Pedro porphyry and limestone country rock. These volcanics consist of a discontinuous dark brownish green basal andesite, overlain by a light reddish-tan, welded rhyolitic tuff of Oligocene age. The base of the rhyolite is commonly marked by a black vitrophyre or a breccia composed of clasts of rhyolite and mineralized limestone from the underlying section. The Tertiary volcanics show no evidence of alteration or deformation.

3.2.2 Structural Geology

The overall tectonic setting of the 1- by 2-kilometer area of the Cerro San Pedro District at the western edge of the Sierra Madre Oriental fold belt is characterized by a series of slightly overturned east-verging anticlines and synclines, which follow NNW-trending axes, developed in the first phase of deformation. This is characterized from a regional system of intersecting conjugate NNW-striking wrench faults and associated east-striking fault splays that have been superposed upon a system of earlier overturned folds, reverse faults, and thrusts. Examples of these folds are the Abundancia and Barreno synclines located in the northern and southern portions of the deposit, respectively. These folds are cut and offset by a system of west-dipping reverse faults trending NNW and are called the Mendez Fault System (see Figure 3.3, a geologic cross section along 2,458,075N). This system, which acted as one of the primary controls for the emplacement of the porphyry intrusive body and the distribution of the mineralization, is marked by multi-stage tectonic breccias, and are generally best developed in the central part of the district. A second phase of deformation developed the conjugate wrench fault system, which cut and offset the Mendez Fault and the earlier folds, and the Princesa and Gran Hundido structures as fault splays that extend from the Abundancia to the Victoria Faults.



Explanation

- Fill Fill
- Tr Rhyolite Tuff
- TpOx Porphyry Oxide
- TpMi Porphyry with Oxide/Sulfide
- TpSu Porphyry Sulfide
- KbMn Barreno Manganese Limestone
- Kb Barreno Limestone
- Kh Hospital Limestone
- KgCa Begonia Carbonaceous Limestone
- Kg Begonia Limestone
- Fault

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Figure 3.3 Geologic Cross Section Along 2,458,075 N. Showing Drill Holes – Looking North –

The north-dipping Gran Hundido Fault and the south dipping Princesa Fault created a large block of uplifted Begonia Limestone and underlying porphyry called the Begonia Horst. The outcropping intrusive body follows an elongated north-striking, west-dipping area of east-west dilation extending approximately 1.5 kilometers through the District, attaining its greatest width in the area of the Begonia Horst.

3.2.3 Alteration and Mineralization

Hydrothermal alteration and mineralization of the San Pedro porphyry and adjacent limestone post date essentially all structures and stratigraphy in the District.

Alteration in the limestone country rocks is largely dependent on factors affecting the rock permeability, such as bedding thickness and the extent of local tectonic deformation features such faults, veining or breccia zones. Even close to well mineralized areas (<2 meters), limestone is typically not visibly altered. Widespread recrystallization or silicification of limestone is not present.

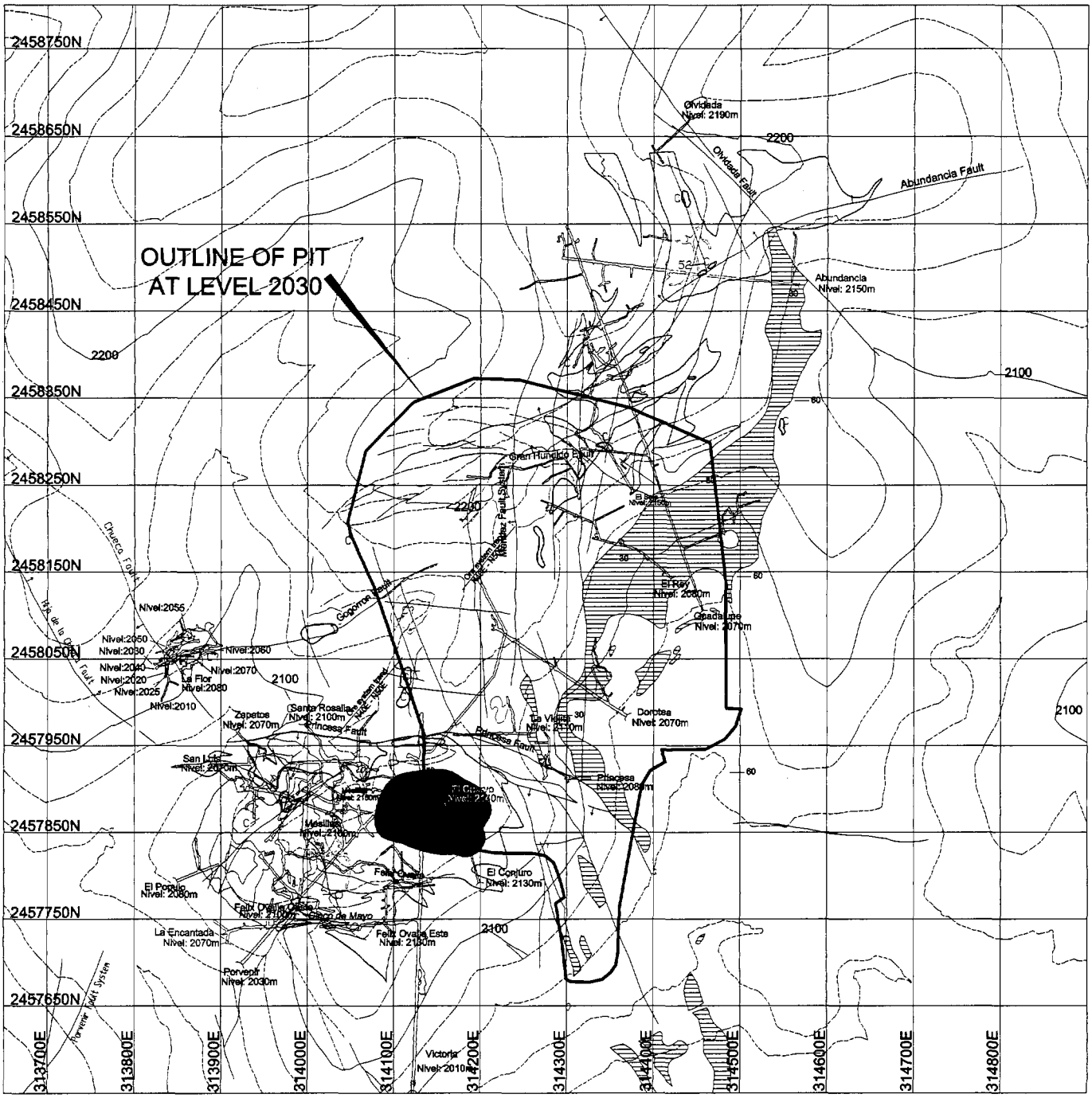
Limestone-Hosted Alteration and Mineralization

Four types of limestone-hosted alteration and mineralization are present at the Cerro San Pedro deposit and include (see Figure 3.4):

stratiform carbonate replacement: characterized by pervasive calcite ± manganese oxide replacement in the thin-bedded units of the Barreno and Hospital Limestones;

discordant stockwork veining and carbonate recrystallization along vein selvages: occurs in the thicker bedded units of the Begonia and Hospital Limestones and typically in zones of breccia along faults, bedding planes, low angle thrust faults, and fault intersections as vuggy crystalline silicification replacing limestone clasts and as ferruginous jasperoid developed along structures;

open space filling and replacement of tectonic breccia: characterized principally by the alteration pattern along the Princesa Fault and the breccias inside the Begonia Horst. The Princesa breccias consist of angular limestone clasts extensively replaced by secondary carbonate in association with finely disseminated manganese and lesser iron oxides. The breccias inside the Begonia Horst show an early episode of silicification, hydrothermal brecciation, and cementation by a mixture of iron oxides and hydroxides, followed by a later episode of cataclastic brecciation and cementation by quartz, barite, hematite, and calcite; and



Explanation

- Diorite porphyry intrusive with general contact dip - contains Au - bearing stockworks
- Zone of black, recrystallized carbonates with Mn+FeOx
- Rhyolite Ignimbrite - Postmineral tertiary
- Shaft
- Open Stope
- Mineralized fault Bxa (surface)
- Mineralized fault Bxa (subsurface)
- Outline of underground + open stopes
- Caved ground above stopes
- C — Chimney deposit location, with plunge where known

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Figure 3.4 Map Showing Areas of Different Mineralization Types, 2030 Level

carbonaceous replacement from locally remobilized carbon: is confined to the Begonia Limestone on the western portion of the hanging wall inside the Begonia Horst. This alteration pattern is well exposed in the Victoria tunnel along the limestone-porphyry contact and extends at depth along structures such as the Princesa and Mendez Faults.

Porphyry-Hosted Alteration and Mineralization

Alteration of the San Pedro porphyry consists of three principal mineral assemblages that partially overlap one another and follow the overall trends of the major ore-controlling structures. In order of increasing alteration intensity, these are:

- chlorite-illite (propylitic) alteration
- illite-kaolinite (argillic) alteration, and
- illite-muscovite-silica (sericitic) alteration.

A study by Winterbourne, 1998-99, is currently underway which is expected to further define the relationships between porphyry alteration and mineralization. Propylitic alteration is characterized by partial to complete replacement of hornblend and biotite phenocrysts to chlorite with minor anatase, epidote, and calcite. Illitic and kaolinitic clays have partially replaced the aphanitic matrix. Accessory magnetite is weak to moderately altered to hematite. As alteration intensity increases from propylitization toward more advanced argillization, matrix replacement by illite-kaolonite becomes more pervasive and is accompanied by complete replacement of mafic phenocrysts and accessory magnetite by hematite and lesser goethite. Plagioclase phenocrysts are replaced by illite. Overprinting sericitic alteration is most strongly developed along major ore-controlling structures, such as the limestone-porphyry contact and the Mendez and Princesa Fault zones. It is characterized by complete replacement of earlier argillic and propylitic alteration minerals by finely crystalline muscovite accompanied by formation of aggregates and veinlets of xenomorphic quartz.

The sericite type of alteration is the most intense and hosts the higher grades of gold-silver mineralization within the porphyry oxide ore type. These higher-grade zones have a mineral assemblage of finely crystalline quartz-alunite-hematite/goethite/jarosite veining hosted within strongly sericitized diorite. Winterbourne's current work suggests that a fourth and fifth alteration type may exist and are expressed by acid-sulfate alteration in the upper portion of the porphyry and as advanced argillic alteration (a mixture of clay gouge plus silica) within deeper zones.

Porphyry oxide mineralization is characterized as material that has undergone replacement by secondary iron oxides after primary sulfides. Oxide assemblages consist of finely crystalline jarosite replacing

goethite and hemimorphite after pyrite and sphalerite, and hematite after pyrite and in relict mafic phenocrysts sites. Other accessories include anglesite in association with plumbojarosite, hydrous zinc and copper sulfates, and traces of iron arsenate. Gold and silver in the porphyry oxides occur as discrete crystals within 0.2 to 8 micron wide bands lining colloform goethite after primary sulfides, and as lesser 4 to 15 micron xenomorphic crystals of native gold and acanthite (<1-2 microns) included within secondary quartz grains.

The mixed porphyry oxide-sulfide and porphyry sulfide zones underlie the main body of porphyry oxide mineralization and form a westerly dipping tongue of disseminated and stockwork sulfides and goethitic oxides that continue at depth beneath the carbonaceous zone in the limestone hanging wall. Gold and silver grades are somewhat lower in both of these ore types than in the porphyry oxide and typically show a progressive decrease at depth.

Mixed porphyry oxide-sulfide mineralization is characterized by partial replacement of primary pyrite and sphalerite by a mixture of goethite and hematite. Coarse gypsum and pale blue hydrous zinc-copper sulfate lining vugs and open fractures are common. Gold occurs as rounded to subrounded crystals, 10-40 microns in size, included within partially oxidized pyrite grains and as wormy intergrowths, <5 microns in size, in goethitic oxides after pyrite. Silver occurs as native xenomorphic grains <8 microns in size, within goethitic oxides.

Porphyry sulfide mineralization occurs primarily as assemblages of ±1-7% disseminated and stockwork veinlets of pyrite-sphalerite±galena that are variably intergrown with quartz, calcite, and occasional K-feldspar, barite, and alunite. Trace amounts of chalcopyrite, tetrahedrite, arsenopyrite, and pyrhotite also occur. Gold occurs as rounded 9-38 micron size blebs contained exclusively within disseminated pyrite grains. Silver occurs as acanthite and argentite in association with trace covellite as tetrahedrite associated with exsolved chalcopyrite inclusions in sphalerite, and as an 8-16% admixture in native gold grains.

3.2.4 Deposit Setting

Geologic studies conducted to date at the Cerro San Pedro District clearly indicate that gold-silver mineralization occurs within a well-developed system of pre-mineral faulting and stockwork fracturing that cuts both the San Pedro porphyry and the enveloping limestone country rock. The high degree of post-intrusive/pre-mineral faulting indicates that the fluids responsible for hydrothermal alteration and mineralization were most active following the emplacement of the San Pedro porphyry and may have been derived from another intrusive source at depth. The absence of a well-developed skarn

assemblage may validate this interpretation since this absence indicates that intrusion and subsequent alteration and mineralization of the porphyry occurred under generally low temperatures.

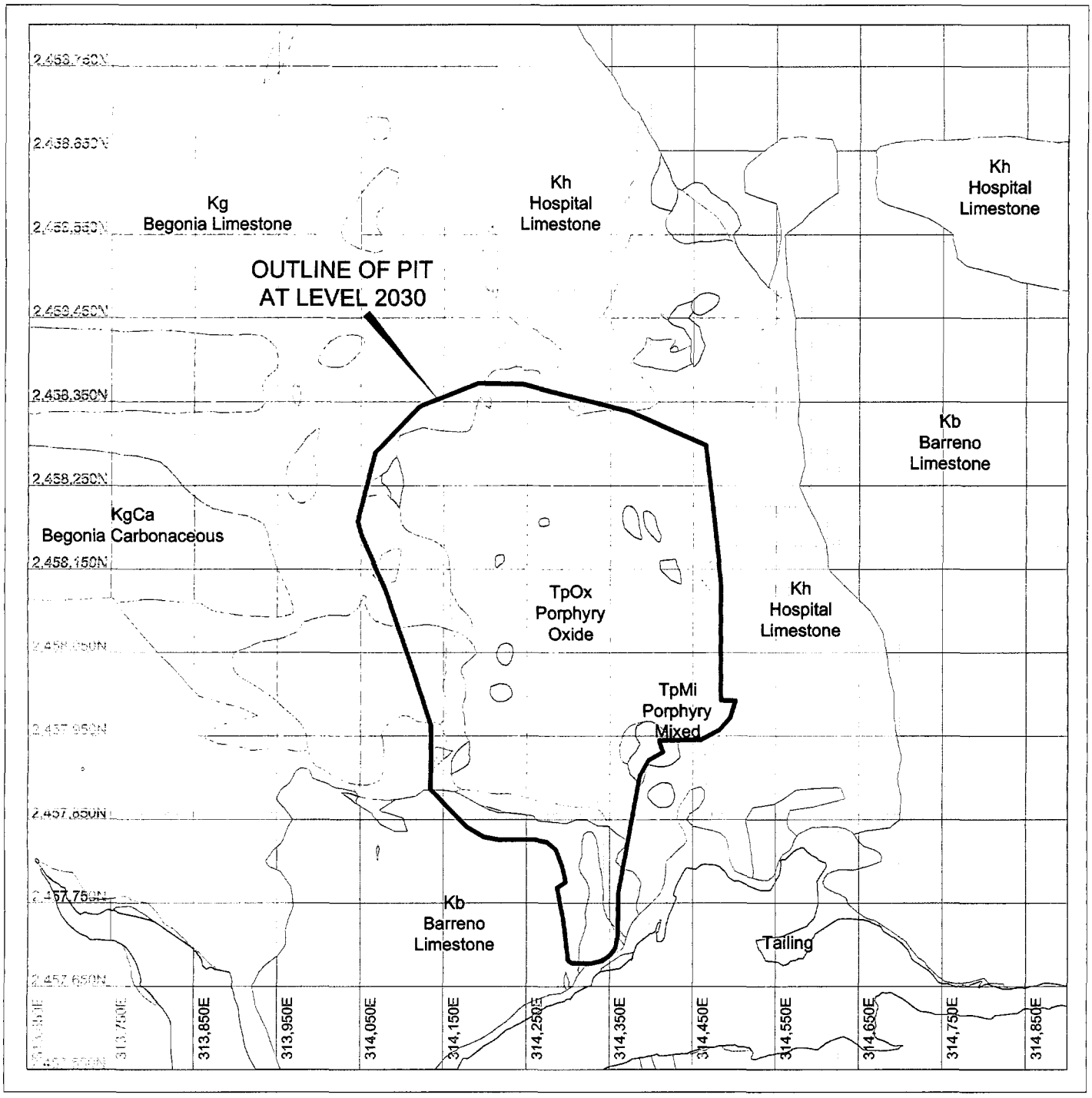
The observed increase in gold and silver grades with increased oxidation intensity indicates that oxidation of primary hypogene sulfide mineralization was integral to development of economic Au-Ag mineralization. Fluid inclusion data indicate that two distinct fluids, a highly saline fluid related to porphyry-hosted sulfide mineralization, and a more dilute fluid related to porphyry and limestone-hosted oxide mineralization, were involved with the mineralizing process. The local presence within the porphyry of high sulfidation style of alteration-mineralization represented by quartz-alunite±barite±anhydrite veining that cross-cuts primary sulfide mineralization, further suggests that at least some of the oxidation at San Pedro may have resulted from hypogene rather than supergene processes. However, the influence of normal "top-down" supergene processes and their resulting oxidation products is dominant as evidenced by the overall configuration of the oxidation zones in the porphyry and particularly the association of oxidation with structural faults and other conduits. In addition, the historic limestone-hosted bonanza grade gold and silver veins mined from the hanging wall of the porphyry represent late stage supergene assemblages that overprint earlier hypogene sulfide mineralization.

Typical geometries for limestone-hosted mineralized bodies are discrete zones of brittle fracture and brecciation including tabular fault controlled veins and breccias and circular to ovate shallow and steeply raking breccia pipes and zones of stockworks.

The shape of mineralized zones in the underlying porphyry is broader and comprises zones of brittle-ductile shearing. Higher-grade mineralization is preferentially developed along the upper and lower porphyry-limestone contacts and along the down dip extension of major fault systems, such as the Mendez Fault system. Away from these structures, a well-developed system of radial and concentric stockwork fractures centered over the Begonia Horst controls the development of lower grade disseminated mineralization.

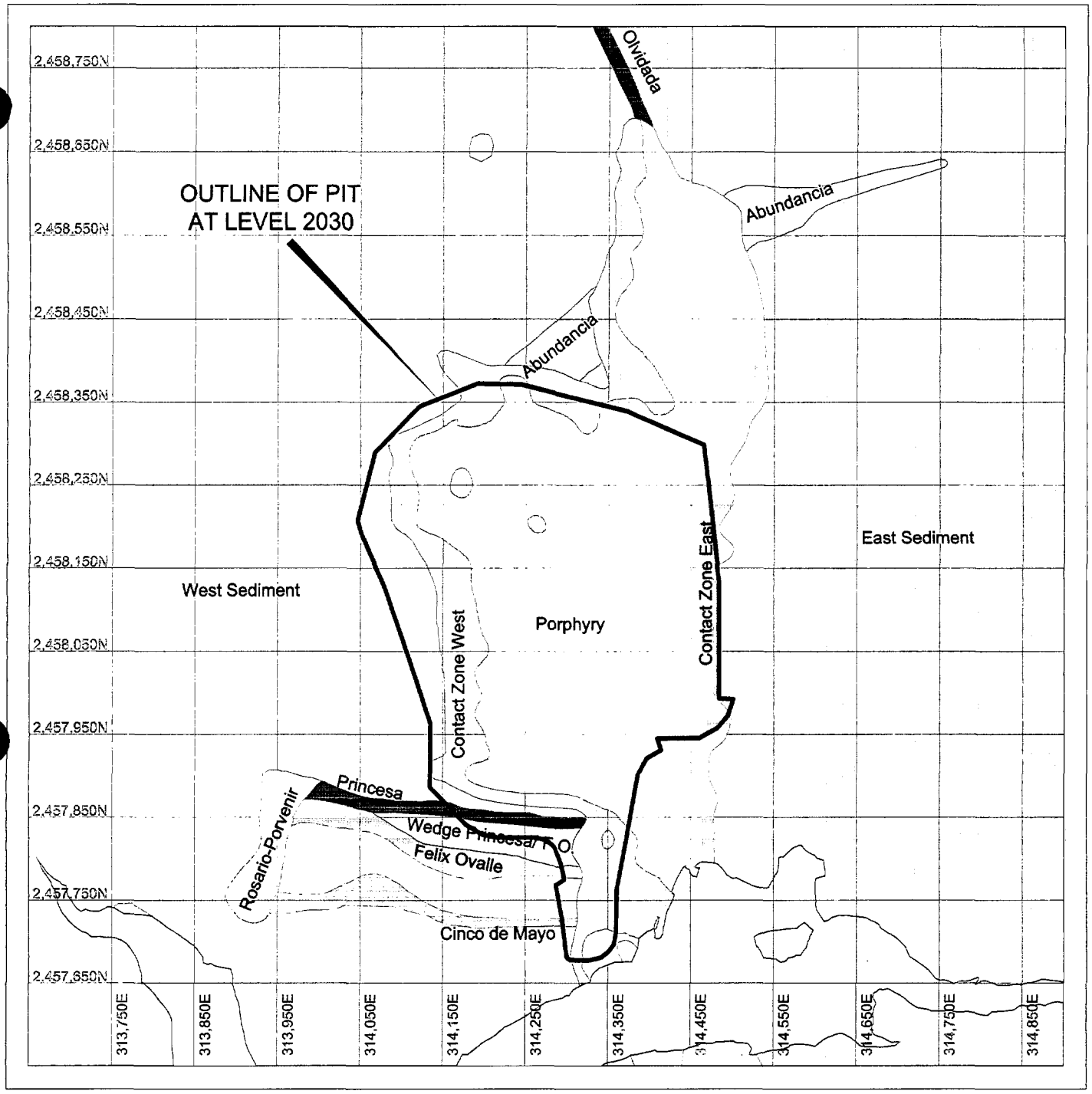
3.3 Geological Interpretation

The geological interpretation of the deposit for use in generating a computer geologic block model was carried out by creating 51 east-west oriented geological cross-sections spaced every 25 meters north-south and 6 north-south oriented cross-sections spaced every 50 meters through the deposit. On each section were plotted drill hole traces and underground workings with their related sampling and geological data. Rock codes and gold and silver grades were plotted as an average 10-meter composite value for drill holes and other samples.



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Figure 3.5 Map Showing Rock Type Classification
2030 Level



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Figure 3.6 Map Showing Structure Type Classification
2030 Level

The sections were interpreted and validated then digitized to facilitate construction of a series of level plans at 10-meter spacing from 2280.0 to 1600.0 meters of elevation. The same procedure was then applied on the plan views (interpretation, validation, and digitizing) to create the base for the three-dimensional rock and structural models.

Once the deposit geometry was obtained, the rock and structural models were combined with the block model. Each block was assigned codes for rock type and structure. The block model consists of 126 blocks east-west by 126 blocks north-south by 84 levels, each block being 10- by 10- by 10- meters wide, long, and high, respectively.

Table 3.1 presents the rock type and structural codes used at Cerro San Pedro. Figures 3.5 and 3.6 show the rock type and the structural type distributions, respectively, for the 2,030m elevation.

Table 3.1

Rock Type and Structural Type Codes

Rock Type			Structure Type	
Description	**Code**	**Density (t/m3)**	**Description**	**Code**
Barreno Limestone	100	2.55	Abundancia	1
Barreno MnOx	101	2.57	Olvidada	2
Hospital Limestone	102	2.59	Princesa	3
Begonia Limestone	103	2.50	Rosario-Porvenir	4
Begonia Carbonaceous	104	2.48	Felix Ovalle	5
Porphyry Oxide	105	2.29	5 de Mayo	6
Porphyry Mixed	106	2.49	West Contact Zone	21
Porphyry Sulfide	107	2.51	East Contact Zone	22
Tertiary Rhyolite	108	2.51	West Sediments	25
Tailings	109	1.80	Porphyry	26
Backfill	110	1.80	Wedge Princesa F-O	27
			East Sediments	28

3.4 Database Drilling Program and Data Collection

3.4.1 Database Information Available

The Cerro San Pedro database was established using the results from four different drilling campaigns: Bear Creek (1982), Cia Fresnillo (1989-1992), MSX-Metallica (1995-1996) and MSX under the Cambior-Metallica Joint Venture (1997-1998) as shown in Table 3.2, totaling some 271 drill holes. These companies as presented in Table 3.3 also collected numerous channel samples in the accessible drifts and stopes.

Table 3.2

Available Drill Hole Database

Company	Year	DDH holes		RC holes		Total	
		No.	Meters	No.	Meters	No.	Meters
Bear Creek	1982			3	276.2	3	276.2
Fresnillo	1992			49	9,518.3	49	9,518.3
MSX-Metallica	1995			47	11,970.0	47	11,970.0
MSX-Metallica	1996	28	8,568.4	78	20,894.9	106	29,463.3
MSX-CAMBIOR	1997	11	2,650.0			11	2,650.0
MSX-CAMBIOR Surface	1998	13	1,439.0			13	1,439.0
MSX-CAMBIOR Underground	1998	42	3,522.9			42	3,522.9
Total		94	16,180.3	177	42,659.4	271	58,839.7

Table 3.3

Available Underground Database

	Year	No. Of Channel Samples	Meters
Bear Creek	1982	854	1397.80
Fresnillo	1990	742	742.00
MSX-Metallica	1995	100	262.38
MSX-Metallica	1996	1,304	2,289.86
MSX	1995-1998	749	2,007.30
Total		3,749	6,699.34

More than 50% of the reverse circulation samples (2,232 from a total of 4,253) collected by Fresnillo were re-assayed for gold and silver during 1996 by MSX. During the 1995 and 1996 drilling by MSX-Metallica the samples were assayed in a systematic way for gold and silver, and sporadically for copper, lead, zinc, molybdenum, arsenic, antimony, mercury and manganese. From 1997 on, each sample was assayed for gold, silver, copper, lead, zinc, molybdenum, arsenic, antimony, mercury and manganese. Cyanide shake leach gold assaying has been done on all samples assaying more than 0.10 g Au/t by fire assay since 1995. Tables 3.4 and 3.5 summarize the assay information available.

Table 3.4

Drill Hole Database Analytical Information					
Element	**No. Samples**	**Element**	**No. Samples**	**Element**	**No. Samples**
Au g/t	27,931	Zn ppm	12,976	Hg ppm	8,910
Ag g/t	27,919	Mo ppm	8,910	Mn ppm	8,680
Cu ppm	12,537	As ppm	8,910	Au CYN g/t	12,710
Pb ppm	12,975	Sb ppm	8,910	Ag CYN g/t	622

Table 3.5

Underground Database Analytical Information					
Element	**No. Samples**	**Element**	**No. Samples**	**Element**	**No Samples**
Au g/t	2,153	Zn ppm	2,060	Hg ppm	2,060
Ag g/t	2,153	Mo ppm	2,025	Mn ppm	1,638
Cu ppm	2,060	As ppm	2,060	Bi ppm	2,060
Pb ppm	2,060	Sb ppm	2,060		

3.4.2 Database Information Used

For the construction of the present resource estimate the results from 255 drill holes of the available 271 drill holes have been used, completed in three different exploration campaigns by Cia Fresnillo (1989-1992), MSX under Metallica (1995-1996) and MSX under Cambior-Metallica Joint Venture (1997-1998). The details of which are shown in Table 3.6. All the Bear Creek and 13 of the Fresnillo holes were not utilized because the logging data are not available.

Table 3.6

Drill Hole Database Information Utilized							
	Year	DDH holes		RC holes		Total	
		No.	Meters	No.	Meters	No.	Meters
Fresnillo	992			36	9,129.3	36	9,129.3
MSX-Metallica	995			47	11,970.0	47	11,970.0
MSX-Metallica	996	28	8,568.4	78	20,894.9	106	29,463.3
MSX-Cambior	997	11	2,650.0			11	2,650.0
MSX-Cambior Surface	1998	13	1,439.0			13	1,439.0
MSX-Cambior Underground	1998	42	3,522.9			42	3,522.9
	Total:	94	16,180.3	161	41,994.2	255	58,174.5

All drill hole samples with no indication of recovery and/or no geologic description were flagged. All samples described and/or inferred to have less than 15% recovery were also flagged. The flagged samples were discarded for use in the present resource estimation, because these samples appear to be biased high for metal value as compared to samples with higher recovery.

Due to the existence of numerous tunnels in the project, channel sampling from underground workings was collected during both the MSX (Metallica) and MSX (Cambior-Metallica) exploration programs, the results of which were also used for the resource estimate, as shown in Table 3.7. Samples collected during prior Bear Creek and Fresnillo sampling campaigns were systematically re-sampled by MSX in 1997 and 1998. Based on the resampling, the Bear Creek and Fresnillo samples were generally biased high for gold and silver and they were, hence, discarded and not used for the present resource estimation. To simplify compositing of underground samples and their manipulation, the channel sampling lines were treated as continuous horizontal drill holes (pseudo-holes).

The area of defined mineral resource has generally been drilled at a 50 m drill hole spacing, with some areas drilled at a closer spacing, locally to a 25 m by 25 m grid.

Table 3.7

Underground Database Information Utilized			
	Year	No. of Channel Samples	Meters
MSX-Metallica	1995	100	262.38
MSX-Metallica	1996	1,304	2,289.86
MSX-Cambior	1997-1998	749	2,007.30
Total		2,153	4,559.54

Samples were collected from:

- Representative splits of reverse circulation drill hole cuttings on a 2-meter length.
- One half of the core samples at a 2-meter average length, with a minimum of 0.1 meter interval to a maximum of 22.5-meter interval
- Underground channel samples on a 2-meter average length, with a minimum of 1.5-meter interval to a maximum of 10.0-meter interval.

Geological information stored in the drill hole and underground sampling database corresponds to rock-type, geologic description, faults, voids, and sample recovery and is referenced to the geological mapping and assaying done on the drill core, drill cuttings and underground channel samples. Void information in drill holes corresponds to where tunnels and stopes were intercepted by a drill hole and no sample was recovered. Each drill hole sample and channel sample has been identified by name, coordinates, azimuth, inclination, and depth, and stored in the MEDSYSTEM database.

Surface topography data was obtained from an air photo survey commissioned to The Orthoshop of Tucson, Arizona, in 1998, and later refined on site by MSX surveyors to correct a few discrepancies around the caved areas such as Barreno, Cinco de Mayo, and Felix Ovalle. All the data prior to the survey have been corrected based on the new topography and added to the database.

The underground topography was built through wire-frames obtained from the survey completed by MSX during 1996-1997 and for a portion of the caved workings from old maps completed by Asarco (1920-1949) and digitized in Geo-Model and then constructed as solids with GS-32. A check program was performed during 1998 to validate the data and in a few cases to correct the existing underground topography within the accessible tunnels and stopes. The location maps of each channel sample collected and each underground drill hole was also completed within this survey. All the topography data have been stored in MEDSYSTEM.

Underground workings, which have been surveyed and incorporated into the topographic model for the deposit, are shown in Table 3.8.

Table 3.8

Surveyed Underground Workings (Tunnels and Stopes)		
Tunnels		**Stopes**
Abundancia	Porvenir	5 de Mayo
El Conjuro	Princesa	Felix Ovalle
Dorotea	El Rey	El Populo
Encantada	Rosalía	El Seis-Abundancia
Felix Ovalle East and West	El Seis	Victoria
Guadalupe	San Luis	
Mesilla Upper and Lower Levels	Victoria	
Olvidada	La Viejita	
El Cuervo	Tunel X	
El Populo.	Zapatos	

3.4.3 Validation of the Database

Validation of the database was done by using software tools, plots on sections and plan view maps to ensure that the information stored in the database occurs in the correct position and conforms with the geological interpretation. The geological data from the drill hole logging sheets were verified and any discrepancies found were corrected by a re-logging of the cores and cuttings stored at the project site. The data entered in the database was then used for the final refinement of the rock and structural models used for the present resource estimate. All the assay results were also checked and the few errors found were corrected.

3.4.4 Validation of Anticipated Results

Since 1995, assaying and assay verification have been performed by Bondar Clegg Laboratories of Vancouver, Canada. The 25th sample in each batch submitted is systematically re-assayed by Bondar Clegg. If discrepancies are observed in the assay results, between the original and reassay value for either gold and silver, the entire batch is re-assayed. Bondar Clegg was also instructed in 1995 and 1996 to send a duplicate pulp sample (each 25th) to Cone Geochemical (Denver) for assay verification. MSX did not submit their own analytical standards or blanks to Bondar Clegg. The Bondar Clegg assays comprise the primary assay database for the project.

MSX performed two tests on assay versus re-assay results. These tests are the F-test and the Student t-Test. The F-test returns the one-tailed probability that the variances in assay and re-assay results for

gold and silver performed at Bondar Clegg are not significantly different. The Student t-Test determines whether two samples are likely to have come from the same two underlying populations that have the same mean.

As shown in Table 3.9, the gold and silver data mean and variance for the Bondar Clegg check assays are statistically similar in both of the F-test and the Student t-Test. Figures 3.7 and 3.8 show good correlation, higher than 90 percent for both distributions, although the gold value dispersion is higher than the dispersion for the silver values. A conditional bias does not appear.

Table 3.9

Results of Analytical Validation (Bondar Clegg Only)

"F" Test Two-Sample for Variances F

	Au		Ag	
	Re-Assay	Assay	Re-Assay	Assay
Mean (g/t)	0.326	0.323	12.979	13.294
Variance	0.384	0.355	788.102	773.571
Observations	1223	1223	1224	1224
df	1222	1222	1223	1223
F	1.080		1.019	
P(F<=f) one-tail	0.090		0.372	
F Critical two-tail	1.119		1.119	

"t"-Test: Two-Sample Assuming Equal Variances

	Au		Ag	
	Re-Assay	Assay	Re-Assay	Assay
Mean (g/t)	0.326	0.323	12.979	13.294
Variance	0.384	0.355	788.102	773.571
Observations	1223	1223	1224	1224
Pooled Variance	0.370		780.837	
Hypothesized Mean Difference	0		0	
df	2444		2446	
t Stat	0.133		-0.279	
P(T<=t) one tail	0.447		0.390	
t Critical one-tail	1.645		1.645	
P(T<=t) two tail	0.894		0.781	
t Critical two-tail	1.961		1.961	

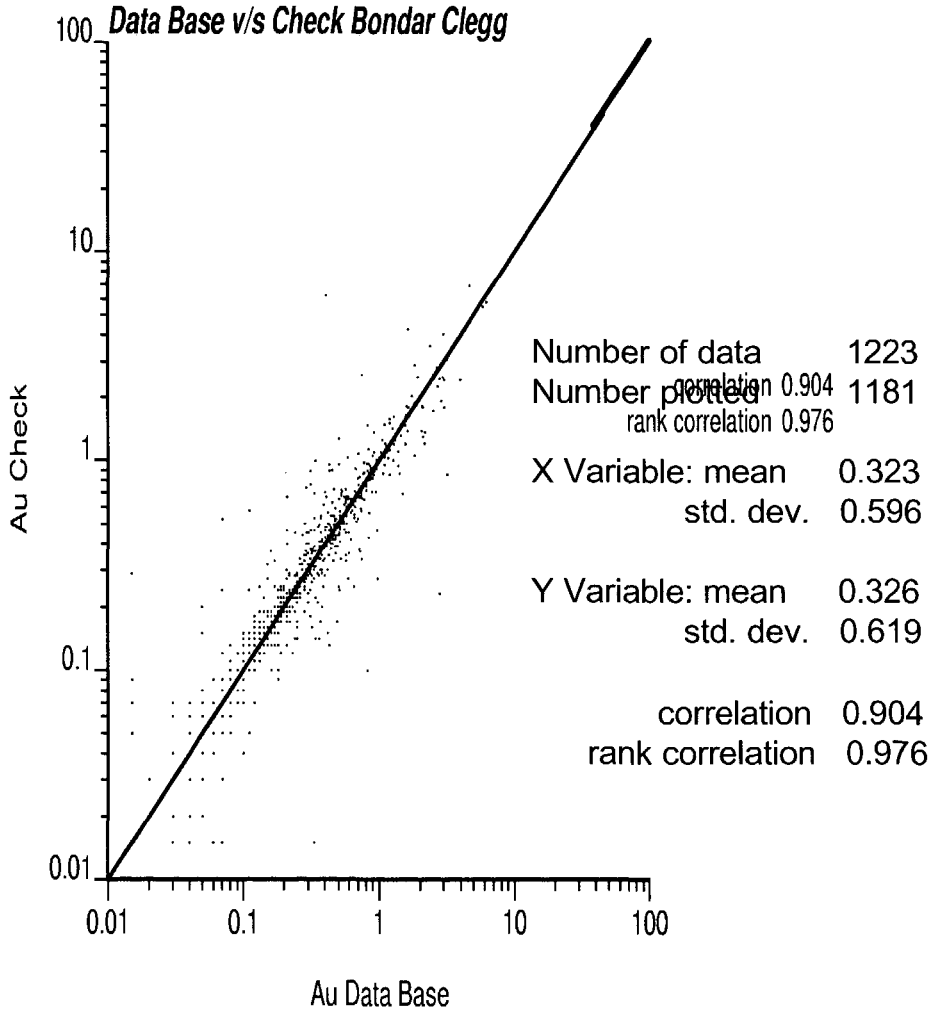


Figure 3.7 Results of Analytical Validation - Gold (Data Base vs Check Bondar Clegg)

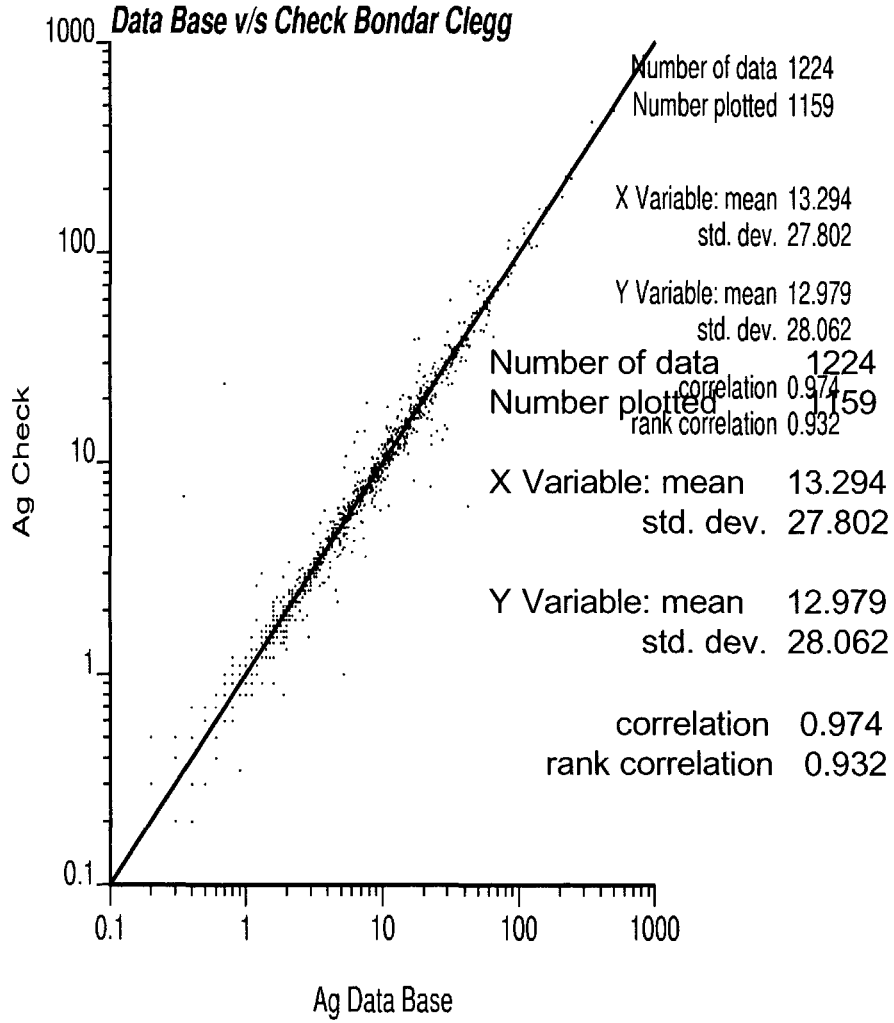


Figure3.8 Results of Analytical Validation - Silver (Data Base vs Check Bondar Clegg)

The comparison between Bondar Clegg and Cone assay results are presented in Table 3.10 and Figures 3.9 and 3.10. The gold assay results are statistically similar between Bondar Clegg and Cone and no bias appears as shown in Figure 3.9. and the scattergram shows a very good correlation between Cone and Bondar Clegg gold assay results. The silver assay results show that the hypothesis of mean and variance similarity is not accepted (Table 3.10). The scattergram presented in Figure 3.10 shows an obvious silver bias between Cone and Bondar Clegg assay results, with the Cone silver assay results being systematically higher than the Bondar Clegg silver assay results. At the time, the silver bias was explained by the difference between the pulp pulverization (-150 mesh for Bondar Clegg versus –190 mesh for Cone). Comparisons between analytical methods from the two laboratories have not been studied.

Table 3.10

Results of Analytical Validation (Bondar Clegg and Cone)

"F" Test Two-Sample for Variances F

	Au		Ag	
	Cone	Bclegg or Database	Cone	BClegg or Database
Mean (g/t)	0.358	0.341	15.47	10.94
Variance	0.705	0.618	1324.40	898.29
Observations	842	842	559	559
Df	841	841	558	558
F	1.139		1.474	
P(**F**<=f) one-tail	0.029		0	
F Critical two-tail	1.145		1.181	

"t"-Test: Two-Sample Assuming Equal Variances

	Au		Ag	
	Cone	BCclegg or Database	Cone	BClegg or Database
Mean (g/t)	0.358	.341	15.47	10.94
Variance	0.705	.618	1324.40	898.29
Observations	842	842	559	559
Pooled Variance	0.661		1111.3	
Hypothesized Mean Difference	0		0	
Df	1682		1116	
t Stat	0.414		2.273	
P(T<=**t**) one tail	0.340		0.012	
t Critical one-tail	1.646		1.646	
P(T<=**t**) two tail	0.679		0.023	
t Critical two-tail	1.961		1.962	

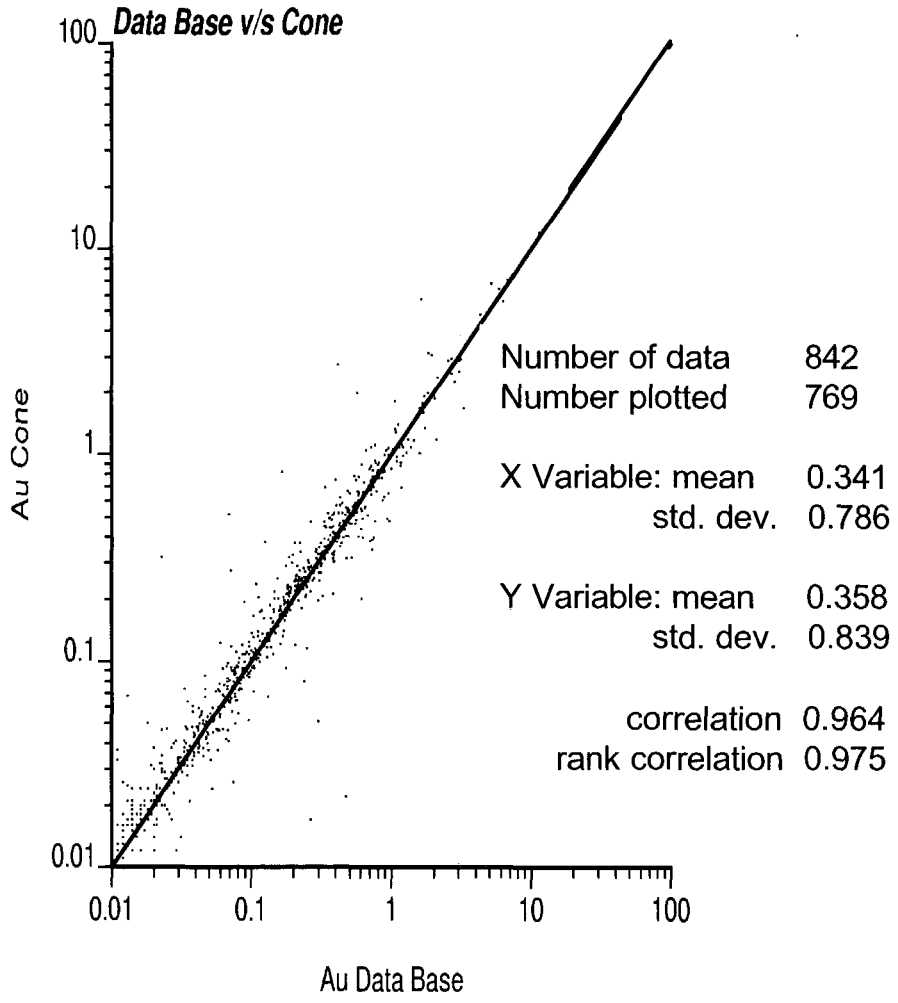


Figure 3.9 Results of Analytical Validation - Gold (Data Base vs. Check Cone)

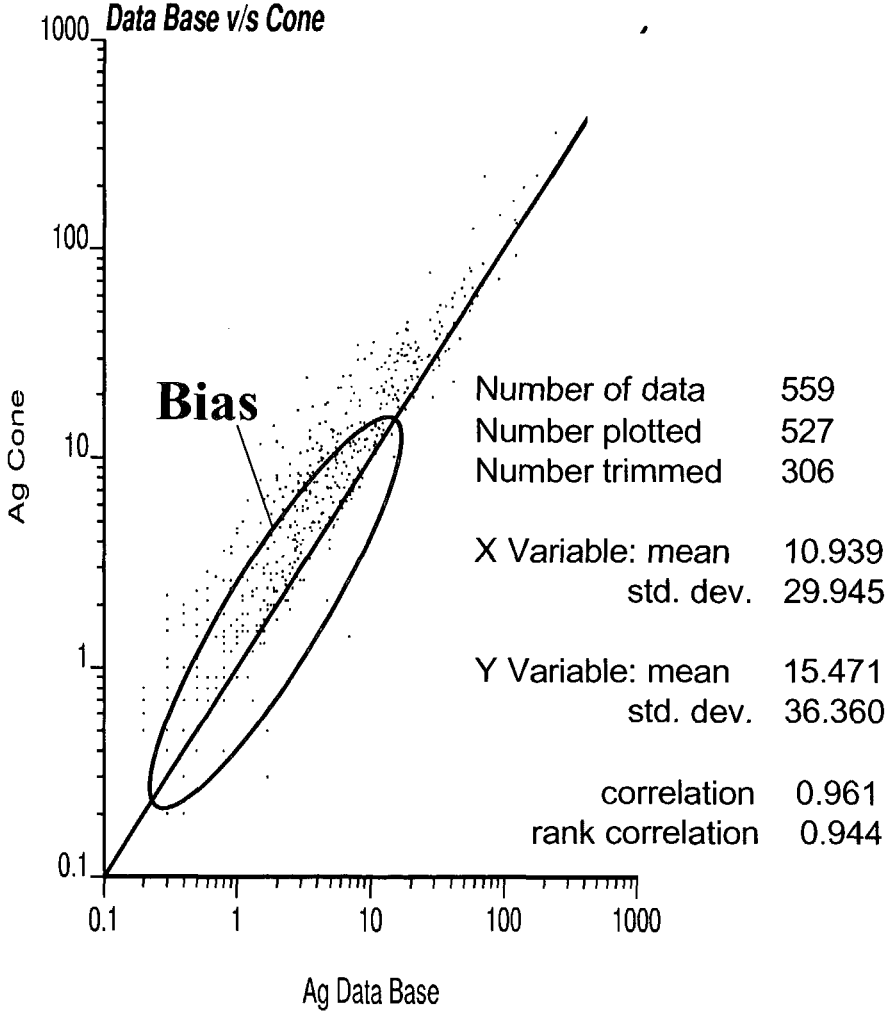


Figure 3.10 Results of Analytical Validation - Silver (Data Base vs. Check Cone)

3.4.5 Silver Bias Investigation

The core versus reverse-circulation twin hole drill program performed during the 1998 within the porphyry suggested a silver bias trend with the core holes reporting a much better silver grade than the older (1995-1996) RC drill holes. There appeared to be no bias in the gold assays, however. To further investigate the cause(s) for the bias, some of the old RC samples were obtained from storage and a new split obtained and sent to Bondar Clegg. Bondar Clegg was asked to prepare these samples using the 1998 sampling protocol and to assay them for gold and silver. The results of the re-assaying gave higher silver grades than the original assays and the silver bias disappears as compared to the core twin assays (see Figure 3.11). The 1998 sampling protocol is different from the previous one because an additional step of comminution is applied before the final pulverization of the sample with the resulting pulp sample being more representative of the entire sample, while the assaying technique has also changed during the year. Gold assaying remains mainly unchanged and was performed by a 30-gram or by a 50-gram Fire assay, with an atomic absorption (AA) measurement. Silver was assayed by agua regia digestion and AA measurement before September 1997. After this date, a new procedure was requested for gold and silver by Fire Assay (Palladium collection) and AA measurement.

In order to further investigate this silver assay bias, 186 coarse reject samples were collected and sent to Bondar Clegg for re-assaying in April 1999. These samples were selected randomly inside the January 1998 pit limit. Assay results of the comparison are presented in Figure 3.12 and show the average silver grade is around 32-percent higher for the newly assayed (1999) sample versus the original assay for the drilling and assaying performed before September 1997. No silver bias was observed for samples assayed after September 1997. Gold shows no bias as observed in Figure 3.13. Even if at that time the silver bias for samples taken before September 1997 was known, the number of samples was insufficient to adequately correct the database.

Therefore an extensive re-assay program was outlined. The goal was to collect approximately 14-percent of the overall sample database that will be used for the resource estimate inside a conceptual pit limit based on the preliminary silver bias correction. The samples were randomly selected inside an outline where most of the mineable reserves are present. A total of 2,120 channel and drill hole coarse reject samples were collected and sent to Bondar Clegg during May 1999. Bondar Clegg prepared them using the 1998 sampling protocol. The results returned were comparable to those from the limited previous sampling program, confirming no bias for gold and a positive silver bias (averaging 28%) for the samples assayed prior to September 1997, as shown in Figures 3.14, 3.15 and 3.16.

Figure 3.11 Drill Hole Twin Comparison
Silver Assays

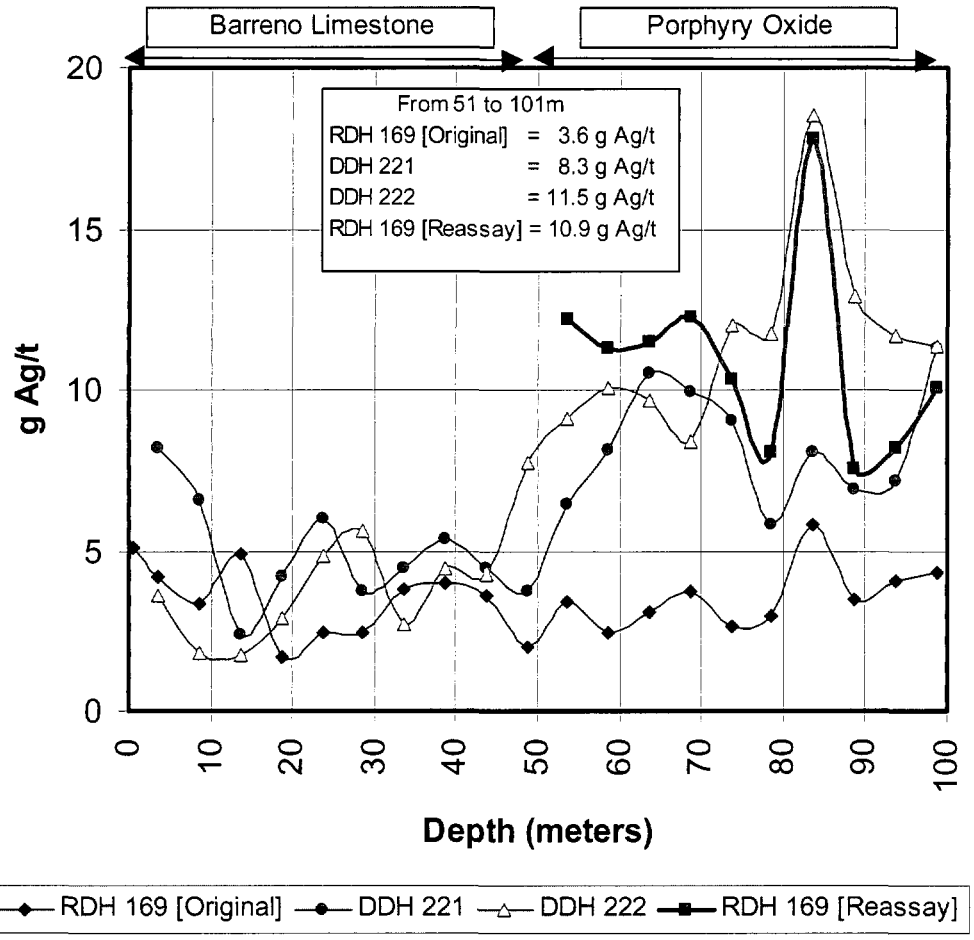


Figure 3.12 Inital Bondar Clegg Reassay Program - Silver (Data = 186)

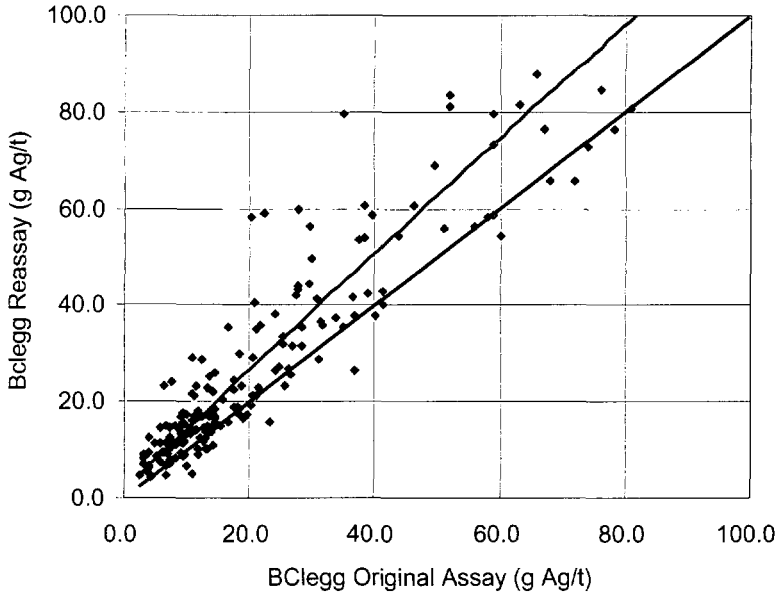


Figure 3.13 Initial Bondar Clegg Reassay Program - Gold (Data = 186)

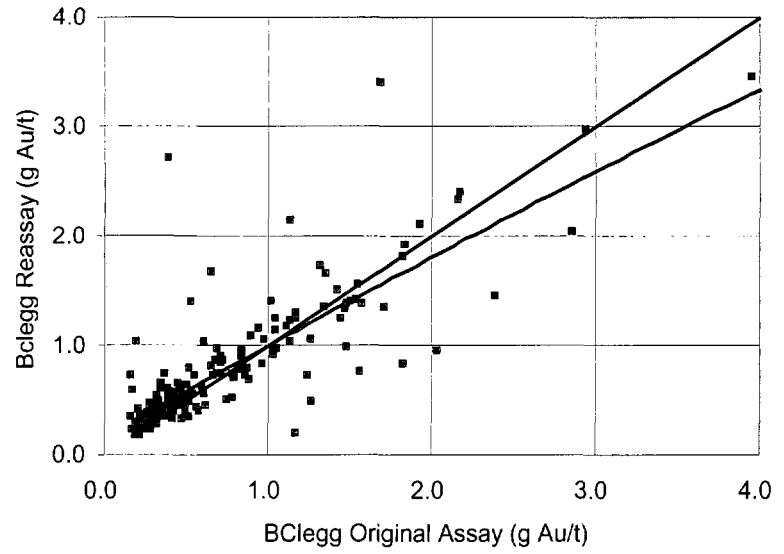


Figure 3.14 Extensive Bondar Clegg Reassay Program - Silver 95&96 (Data = 1,743)

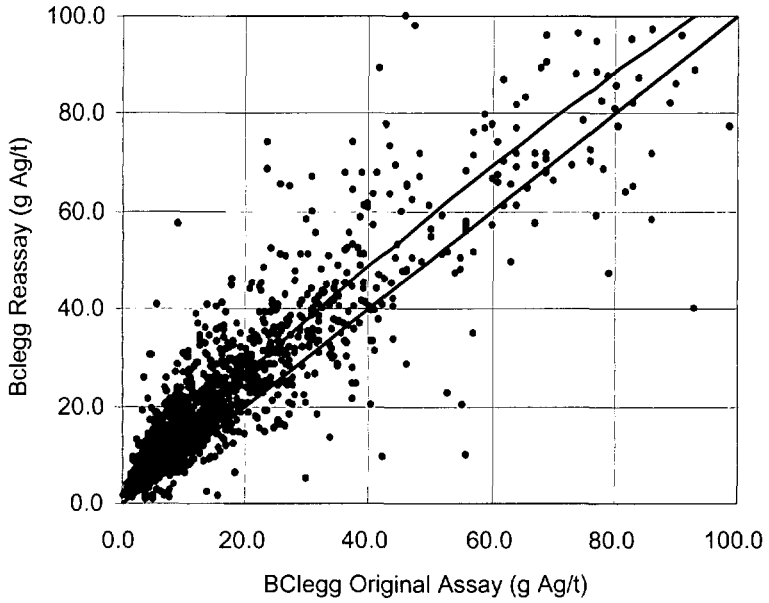


Figure 3.15 Extensive Bondar Clegg Reassay Program - Silver 97&98 (Data = 361)

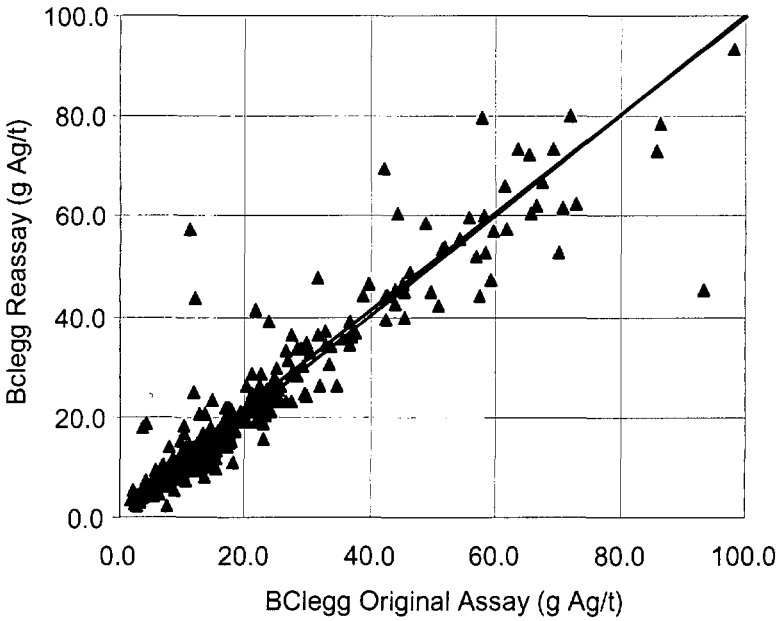
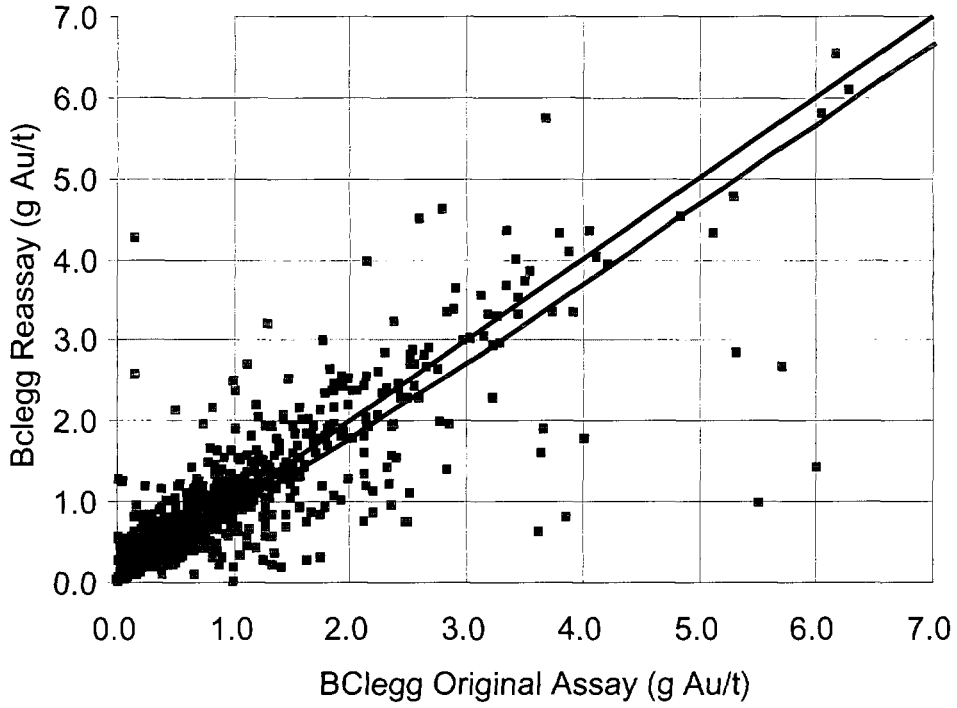


Figure 3.16 Extensive Bondar Clegg Reassay Program - Gold (Data = 2,104)



In order to obtain more confidence on the silver bias and to insure that the Bondar Clegg assay results are valid, 250 samples randomly selected from the previous 2,120 samples were sent to two independent laboratories during the month of July 1999 and 16 blanks were added to crosscheck the assay results. Cone Geochemical from Denver and Chemex Laboratory from Vancouver each received representative splits of the 250 pulps (-150mesh) and coarse rejects (-10mesh) samples. The samples were re-bagged and re-tagged so it was impossible for the laboratory to associate assay results from pulps and rejects. These labs were asked to perform gold, silver assays by FA/AA, silver assays by using partial (agua regia) and total digestion (4 acid) with AA finish and, gold cyanide and silver cyanide assay. Chemex and Cone assays confirmed the silver bias for the samples assayed by Bondar Clegg prior to September 1997. The agua regia digestion technique produced similar silver results between Bondar Clegg, Chemex and Cone as presented in Figures 3.17 and 3.18. Silver assaying with the total digestion technique by Chemex and Cone reproduced the Bondar Clegg results from the recent re-assaying program as presented in Figures 3.19 and 3.20. No gold bias is observed, as shown in Figure 3.21. The Cone and Chemex assay results are similar using pulps or coarse rejects.

The silver bias is the result of the assaying method used by Bondar Clegg prior to September 1997. The agua regia digestion technique is insufficient to put all the silver particles in the sample into solution for subsequent analysis by the AA instrument.

Therefore, the Cerro San Pedro silver database was adjusted for sample assays performed prior to September 1997 by using polynomial regression for the channel and the drill hole samples. The factors were calculated from the 2,120-sample database and are presented in the Table 3.11. Overall, this results in an adjustment of 85 percent or 25,541 samples out of a total of 30,072 samples in the entire silver assay database. This adjustment result in raising the average from 13.84 g/t to 17.10 g/t (+23 percent) based on all silver database assays and from 12.48 g/t to 16.32 g/t (+30 percent) for those samples assayed prior to September 1997.

Table 3.11

Silver Assay Bias Correction Factors

$$Y = A_0 + A_1X + A_2X^2 + A_3X^3 + A_4X^4$$

where Y = Ag Corrected and X = Ag Original

Factors	Drill Holes	Channels
A_0	1.103880854	2.758375734
A_1	1.398538946	1.430514547
A_2	-0.005310806	-0.003584165
A_3	0.000012522	0.000018733
A_4	0	-0.000000048

Figure 3.17 BC Database vs Chemex (2 Acids) - Silver (Data = 250)

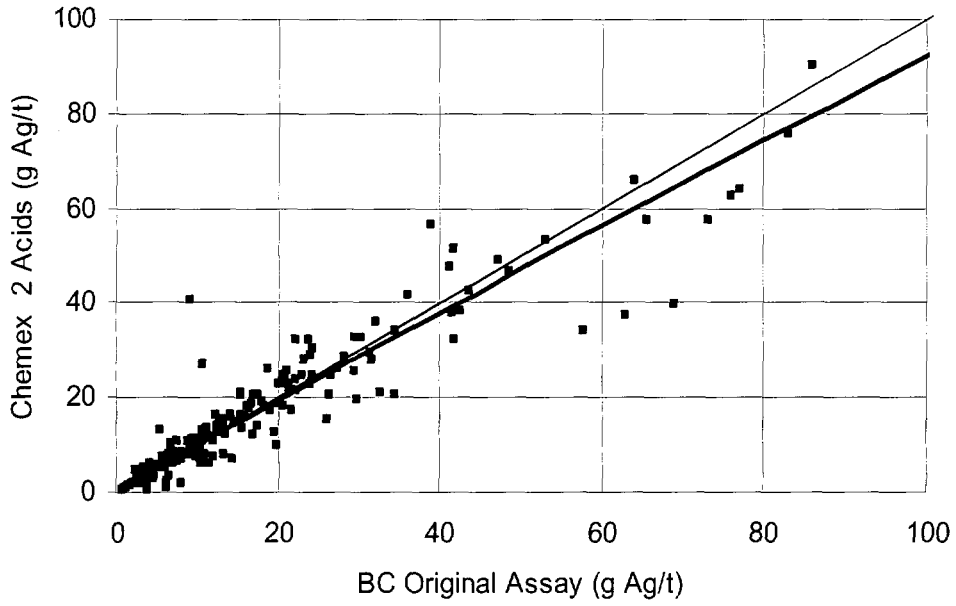


Figure 3.18 BC Database vs Cone (2 Acids) - Silver (Data = 250)

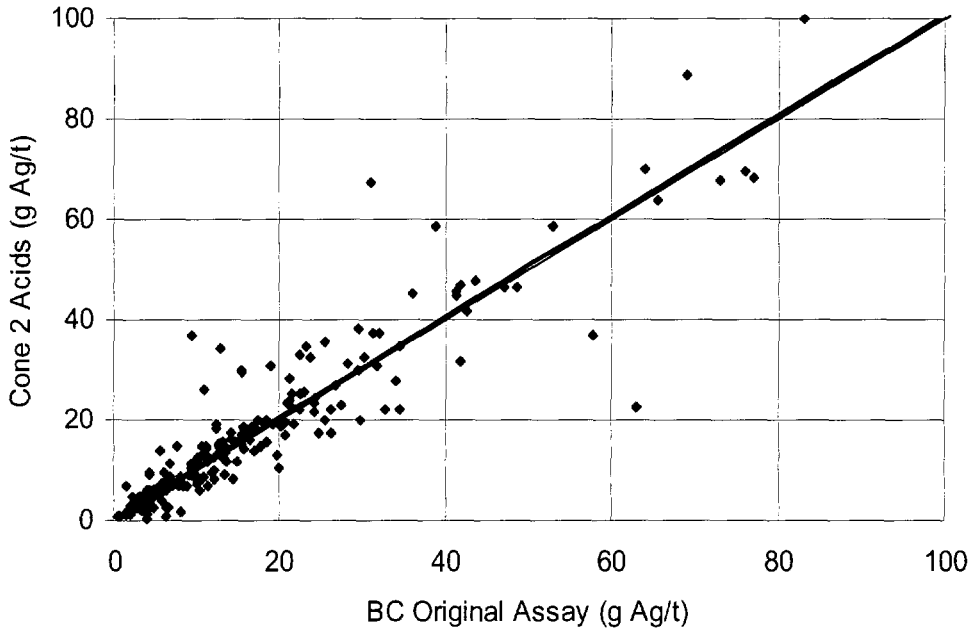


Figure 3.19 BC Extensive Reassay vs Chemex (3 Acids) - Silver (Data = 250)

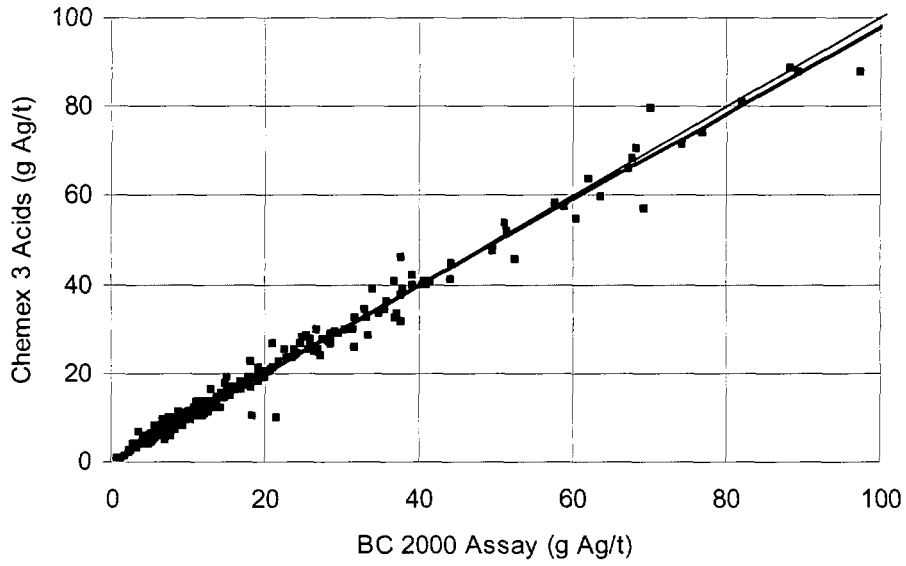


Figure 3.20 BC Extensive Reassay vs Cone (4 Acids) - Silver (Data = 250)

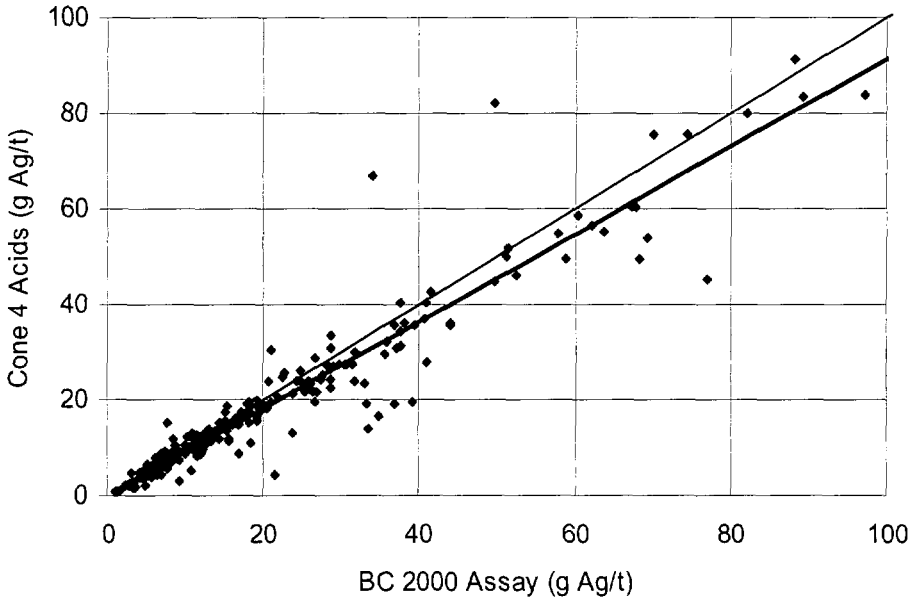
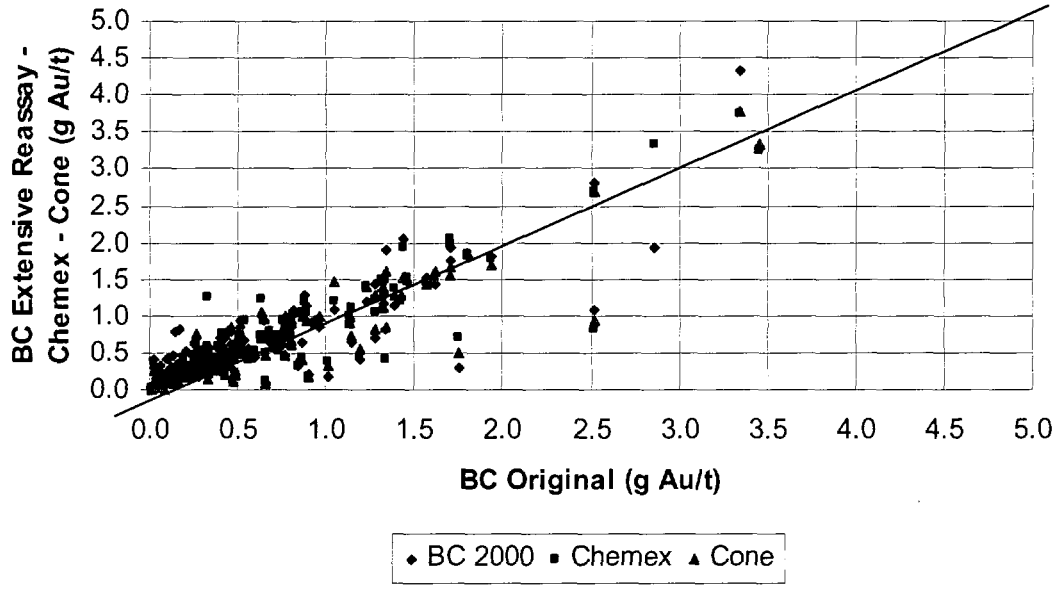


Figure 3.21 BC Database vs BC Extensive Reassay vs Chemex vs Cone-
Gold (Data = 250)



3.5 Construction of the Computer Block Model

The coordinate and block dimensions of the model are shown in Table 3.12. The model covers a north-south dimension of 1,260 meters, an east-west dimension of 1,260 meters, and a vertical dimension of 840 meters.

Table 3.12

Block Model Limits and Dimensions				
Axis	**Min. (m)**	**Max. (m)**	**Block Size (m)**	**# Blocks**
X (Easting)	313,650	314,910	10	126
Y (Northing)	2,457,550	2,458,810	10	126
Z (Elevation)	1560	2,400	10	84

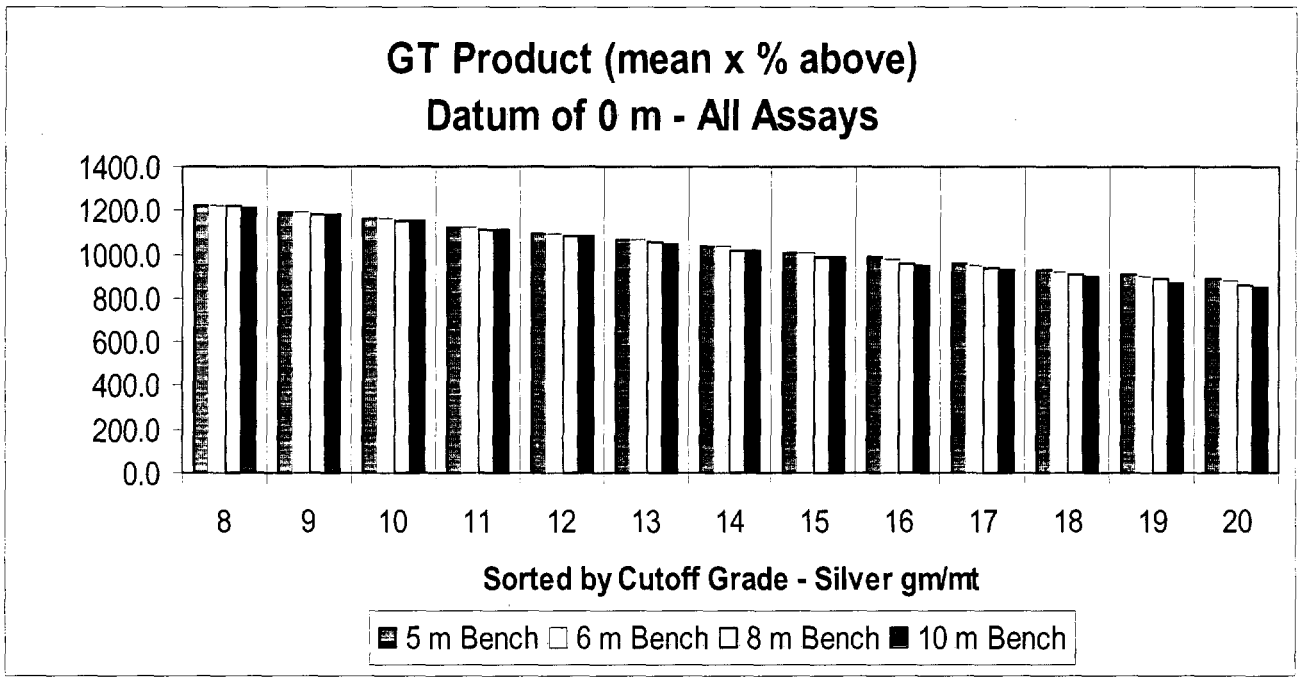
3.5.1 Bench Height Study

Independent Mining Consultants (IMC) was contracted to perform a study to evaluate the impact of various mining bench heights, from 2 to 10m, on the contained mineralization. The study, which is contained in Appendix 3.1, demonstrated that there was little to no penalty in adopting a 10m-bench height which is preferred from a mining perspective. Figure 3.22 presents the results of this study showing contained mineralization (GT product) at varying cutoff grades for gold and silver for bench heights of 5, 6, 8, and 10m benches. Operational gains can be made with higher benches, while the selectivity gains by using shorter bench heights is minimal.

3.5.2 Surface Topography and Underground Voids

The topographic surface was passed to MRA as a gridded topography as well as a percent-remaining in each model block. The modeled underground voids were also transferred as a percent-remaining variable.

The topography was generated from aerial data, while underground void data was generated through physical survey of all accessbile underground openings.



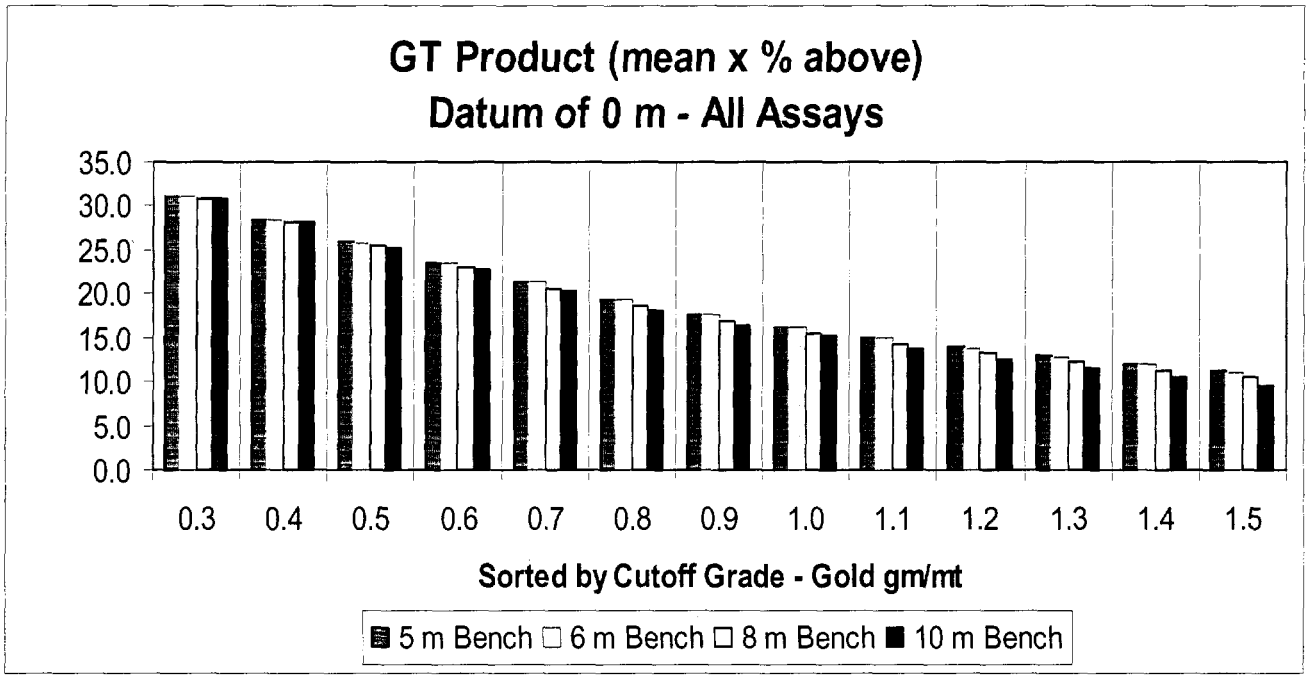


Figure 3.22 Contained Mineralization at Various Bench Heights for Gold and Silver

3.5.3 Composites & Statistics

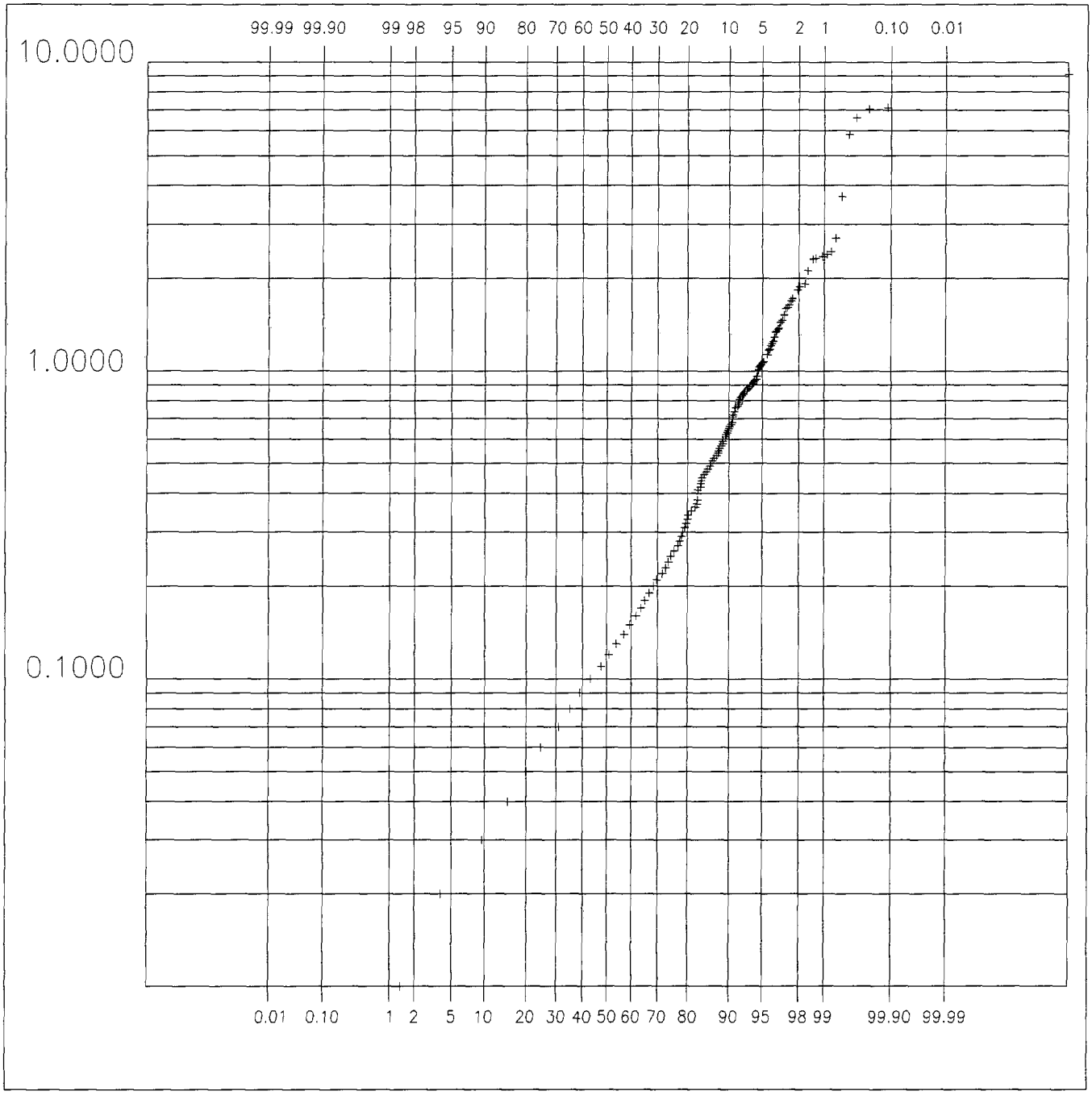
Five meter down-the-hole composites were calculated from the drillhole/channel sample data base. A total of 11,904 composites were computed. Rock type and structural zone codes were transferred from the database to the composite file on a majority basis.

Log-probability plots were generated on groupings of structural zones as defined by the Cambior geologic interpretation. MRA investigated these groupings during 1999 for Metallica and concurred with their validity (Draft Report – "Update of the Cerro San Pedro Model", May 1999).

The log-probability plots show distributions of moderate variability for both gold and silver with coefficients of variation between 1.00 and 2.00. Outlier thresholds were selected by interpretation of the following Log-probability plots, Figures 3.23 – 3.34. Statistics for gold and silver composites are shown in Table 3-13.

Table 3.13

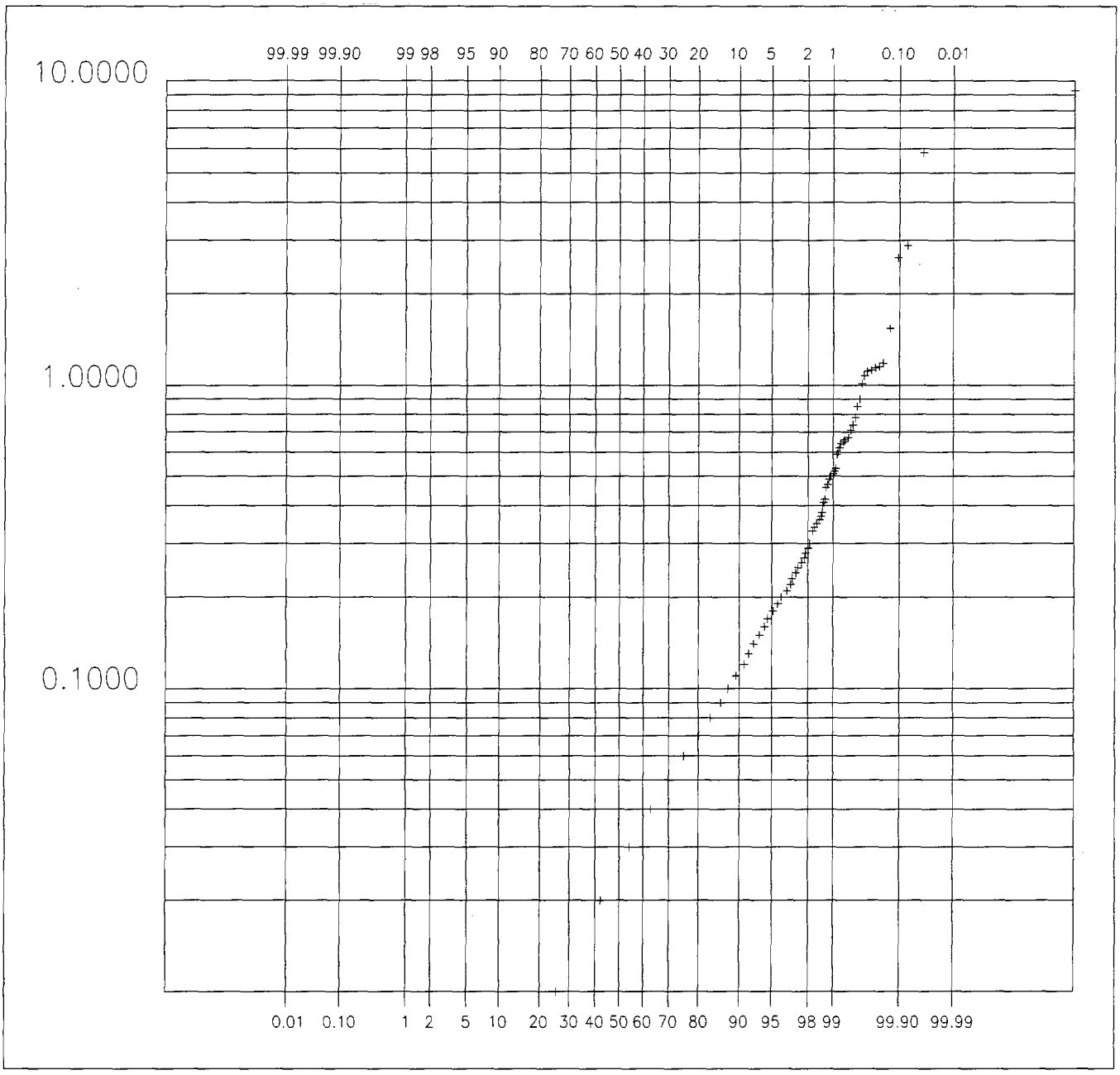
Gold Composite Statistics					
Structure	**Mean**	**Std.**	**Coeff.**	**Number**	**Outlier**
1+2+27	0.30	0.66	2.20	865	2.25
25+28	0.06	0.24	4.00	2796	1.00
4	0.68	0.96	1.41	400	4.50
3+5+6	0.59	0.91	1.54	713	5.00
21+22	0.49	0.81	1.65	1896	5.00
26	0.47	0.58	1.23	4097	5.00
Silver Composite Statistics					
Structure	**Mean**	**Std. Dev.**	**Coeff.**	**Number**	**Outlier**
1+2+27	18.85	19.70	1.04	880	150.00
25+28	6.91	11.53	1.67	3136	80.00
4	34.23	38.34	1.12	411	150.00
3+5+6	27.01	33.17	1.23	727	100.00
21+22	27.50	43.75	1.59	1923	200.00
26	15.76	18.64	1.18	4140	150.00



ITEM	AU	NATURAL LOGS	
NUMBER	865	NUMBER	865
MEAN	0.2990	MEAN	−1.9820
MINIMUM	0.0100	MINIMUM	−4.6050
MAXIMUM	9.1300	MAXIMUM	2.2120
VARIANCE	0.4340	VARIANCE	1.2770
ST. DEV.	0.6590	ST. DEV.	1.1300

MINERA SAN XAVIER, S.A. de C.V.

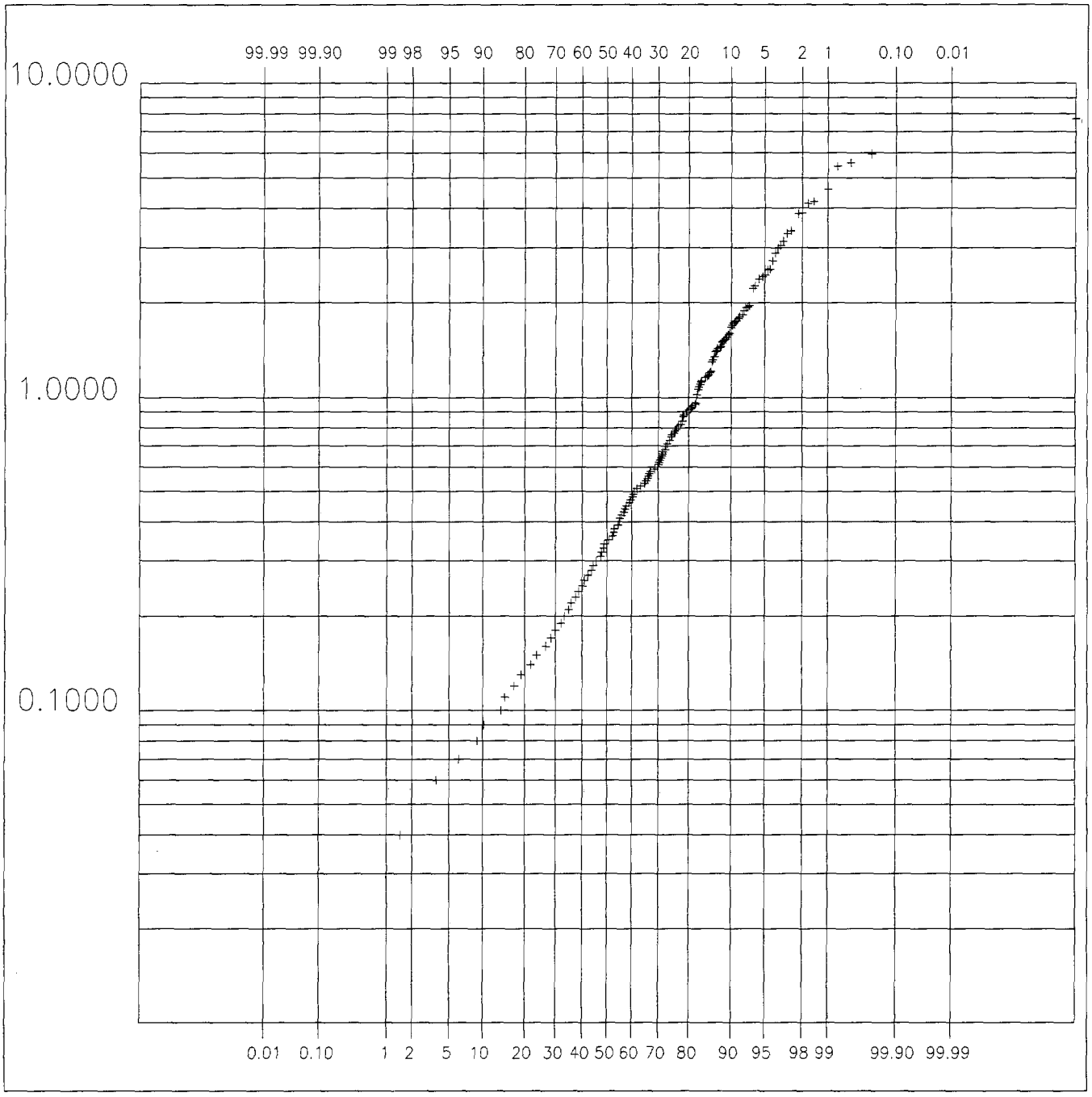
Figure 3.23 Probability Plot for Gold –
Structures 1 & 2 & 27 – Drill Hole and Channels



ITEM	AU	NATURAL LOGS	
NUMBER	2796	NUMBER	2796
MEAN	0.0650	MEAN	−3.4060
MINIMUM	0.0100	MINIMUM	−4.6050
MAXIMUM	9.3100	MAXIMUM	2.2310
VARIANCE	0.0570	VARIANCE	0.9780
ST. DEV.	0.2390	ST. DEV.	0.9890

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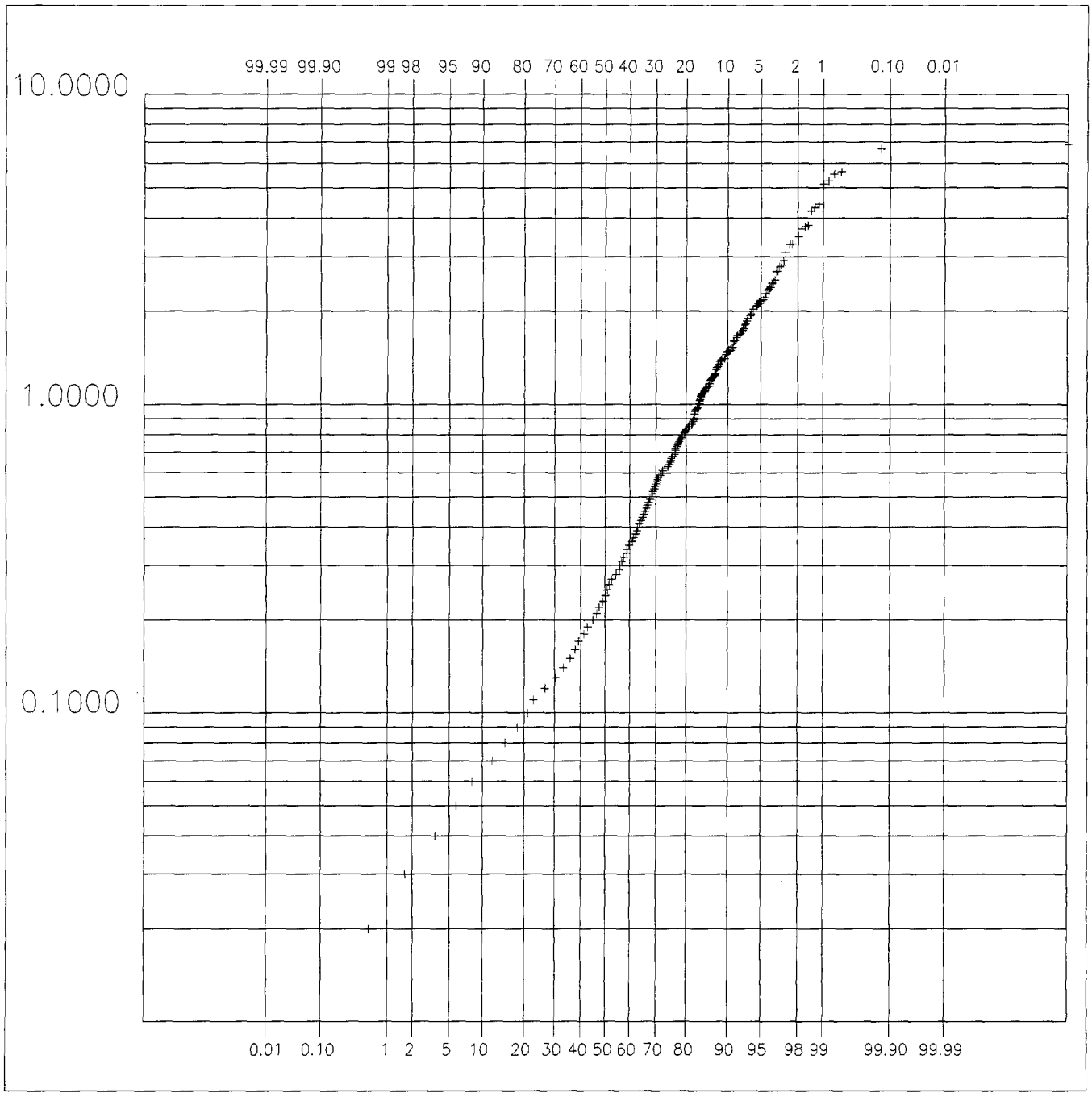
Figure 3.24 Probability Plot for Gold –
Structures 25 & 28 – Drill Hole and Channels



ITEM	AU	NATURAL LOGS	
NUMBER	400	NUMBER	400
MEAN	0.6850	MEAN	−1.0020
MINIMUM	0.0400	MINIMUM	−3.2190
MAXIMUM	7.7200	MAXIMUM	2.0440
VARIANCE	0.9200	VARIANCE	1.1950
ST. DEV.	0.9590	ST. DEV.	1.0930

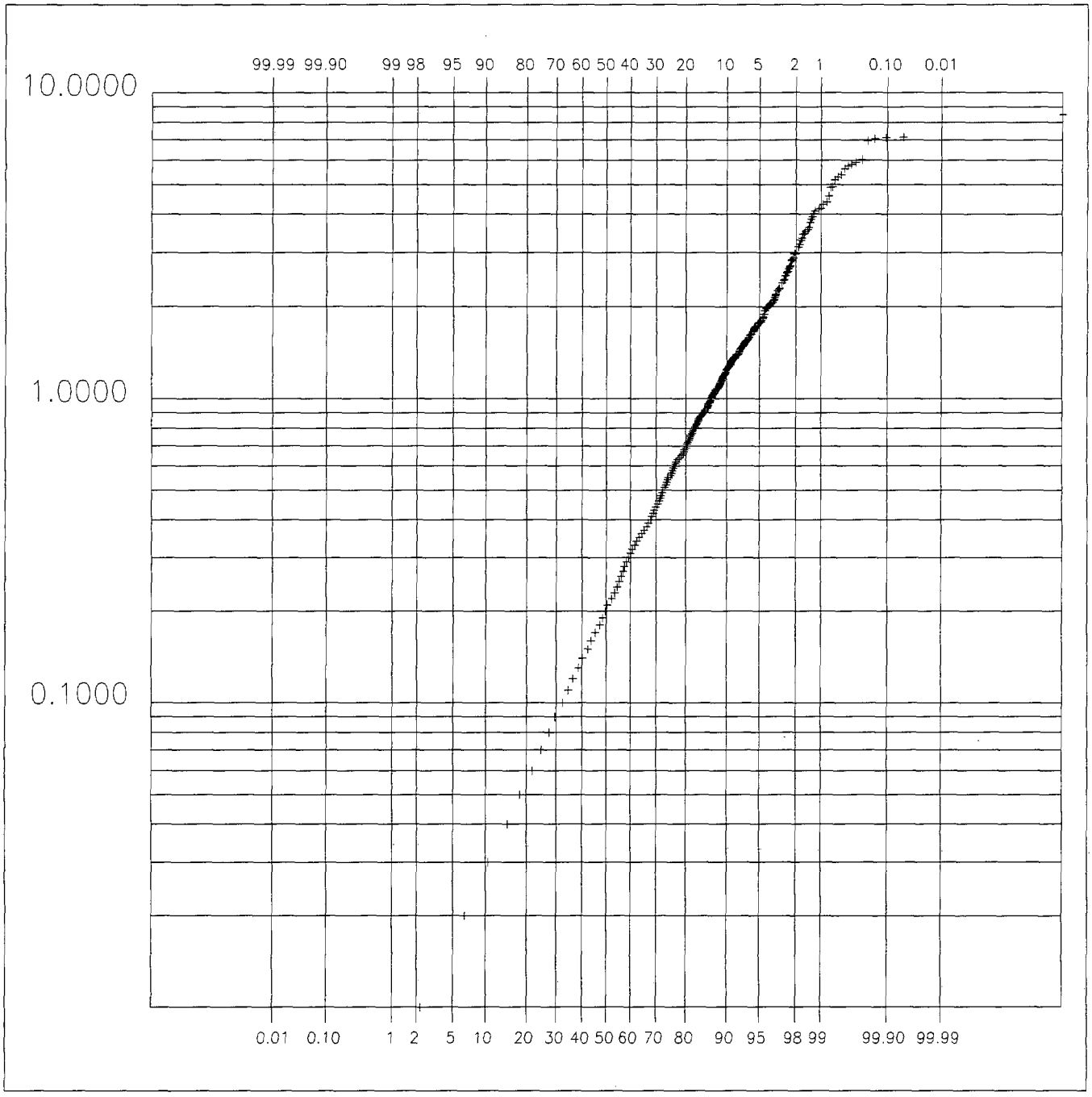
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Figure 3.25 Probability Plot for Gold – Structure 4 – Drill Hole and Channels



ITEM	AU	NATURAL LOGS	
NUMBER	713	NUMBER	713
MEAN	0.5910	MEAN	−1.2520
MINIMUM	0.0200	MINIMUM	−3.9120
MAXIMUM	6.8900	MAXIMUM	1.9300
VARIANCE	0.8220	VARIANCE	1.3810
ST. DEV.	0.9060	ST. DEV.	1.1750

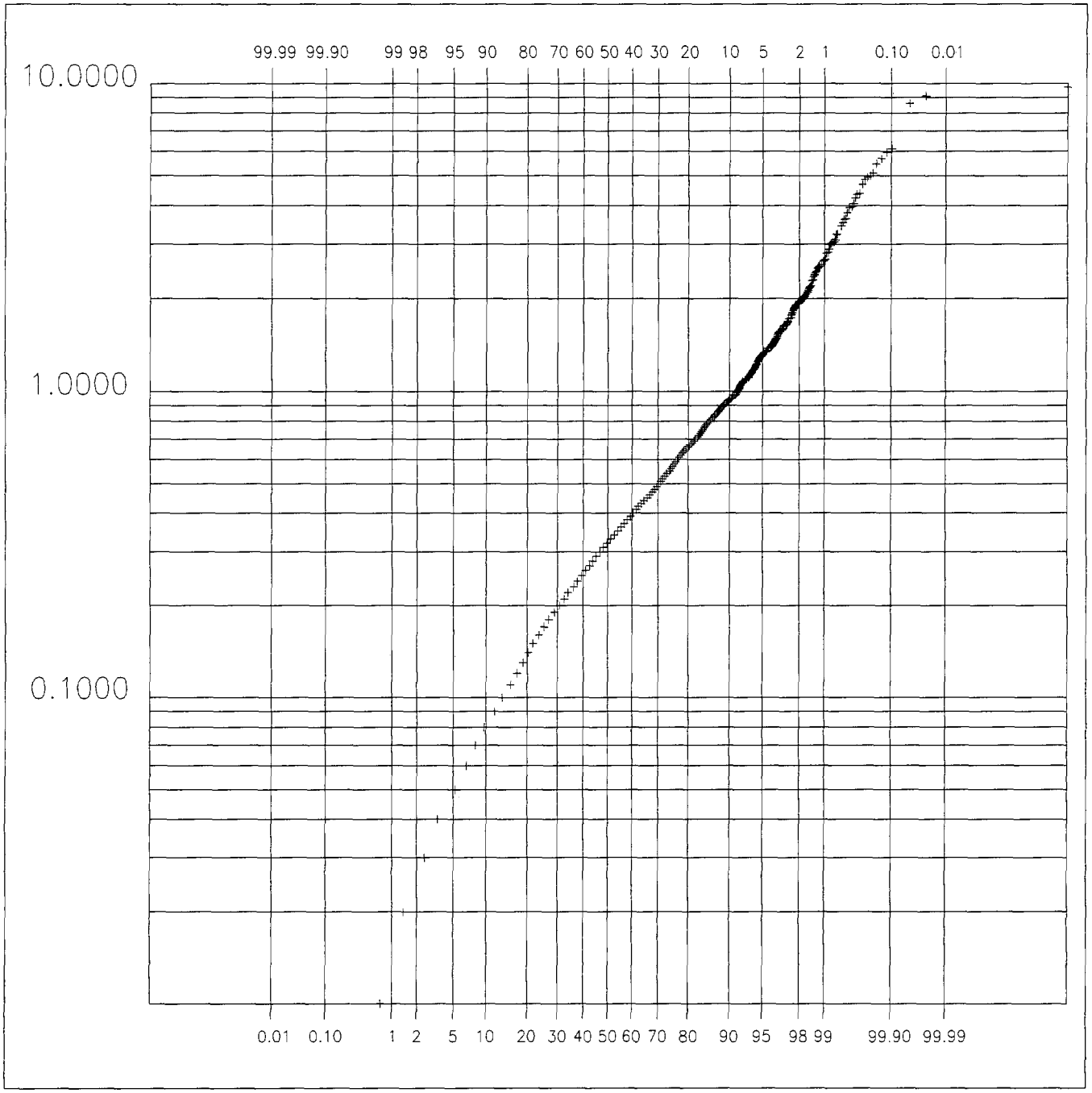
Figure 3.26 Probability Plot for Gold –
Structures 3 & 5 & 6 – Drill Hole and Channels



ITEM	AU	NATURAL LOGS	
NUMBER	1896	NUMBER	1896
MEAN	0.4930	MEAN	−1.5770
MINIMUM	0.0100	MINIMUM	−4.6050
MAXIMUM	8.4600	MAXIMUM	2.1350
VARIANCE	0.6530	VARIANCE	1.8680
ST. DEV.	0.8080	ST. DEV.	1.3670

MINERA SAN XAVIER, S.A. de C.V.

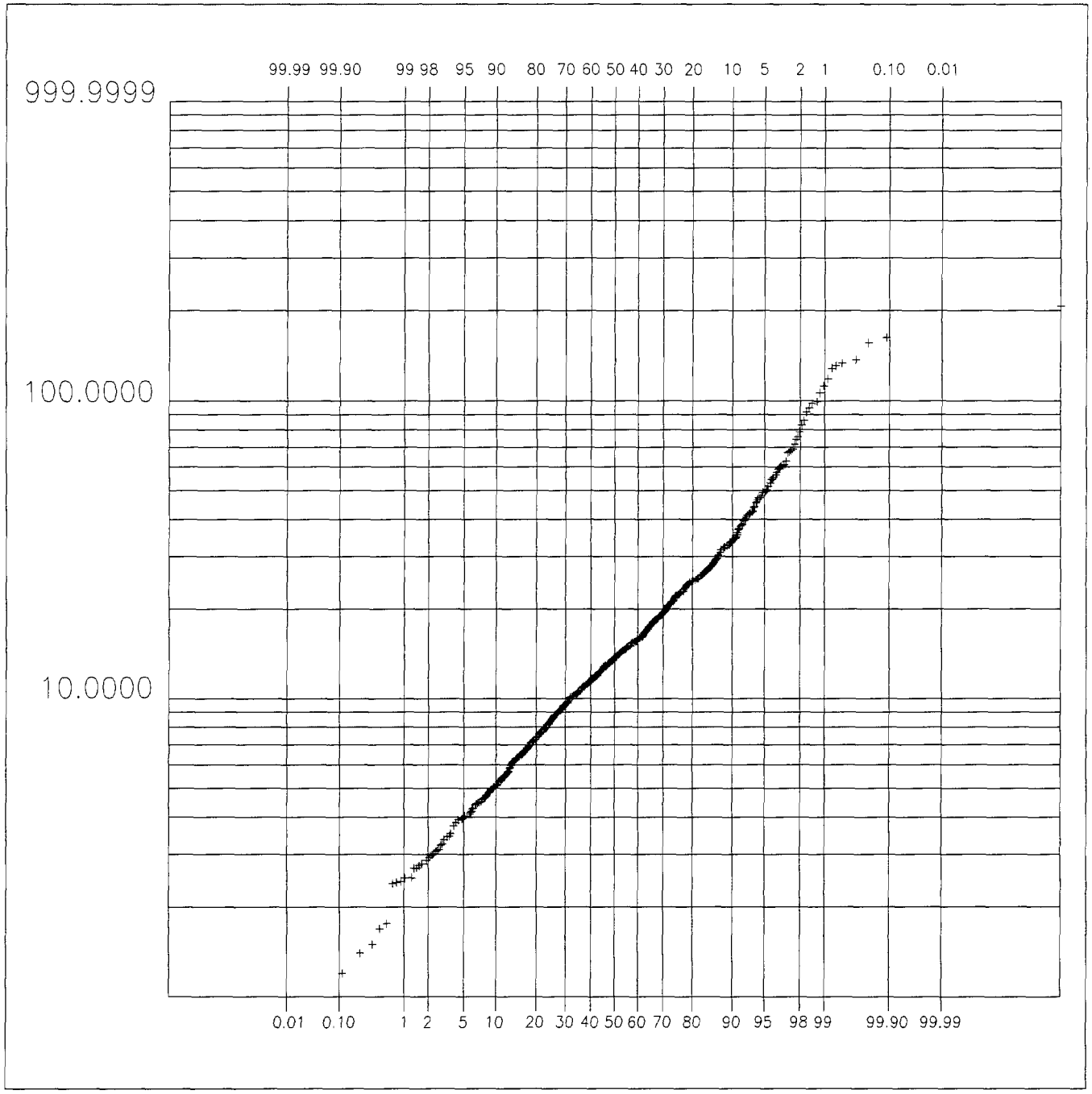
Figure 3.27 Probability Plot for Gold –
Structures 21 & 22 – Drill Hole and Channels



ITEM	AU	NATURAL LOGS	
NUMBER	4097	NUMBER	4097
MEAN	0.4720	MEAN	−1.1950
MINIMUM	0.0100	MINIMUM	−4.6050
MAXIMUM	9.7400	MAXIMUM	2.2760
VARIANCE	0.3360	VARIANCE	0.9580
ST. DEV.	0.5800	ST. DEV.	0.9790

MINERA SAN XAVIER, S.A. de C.V.

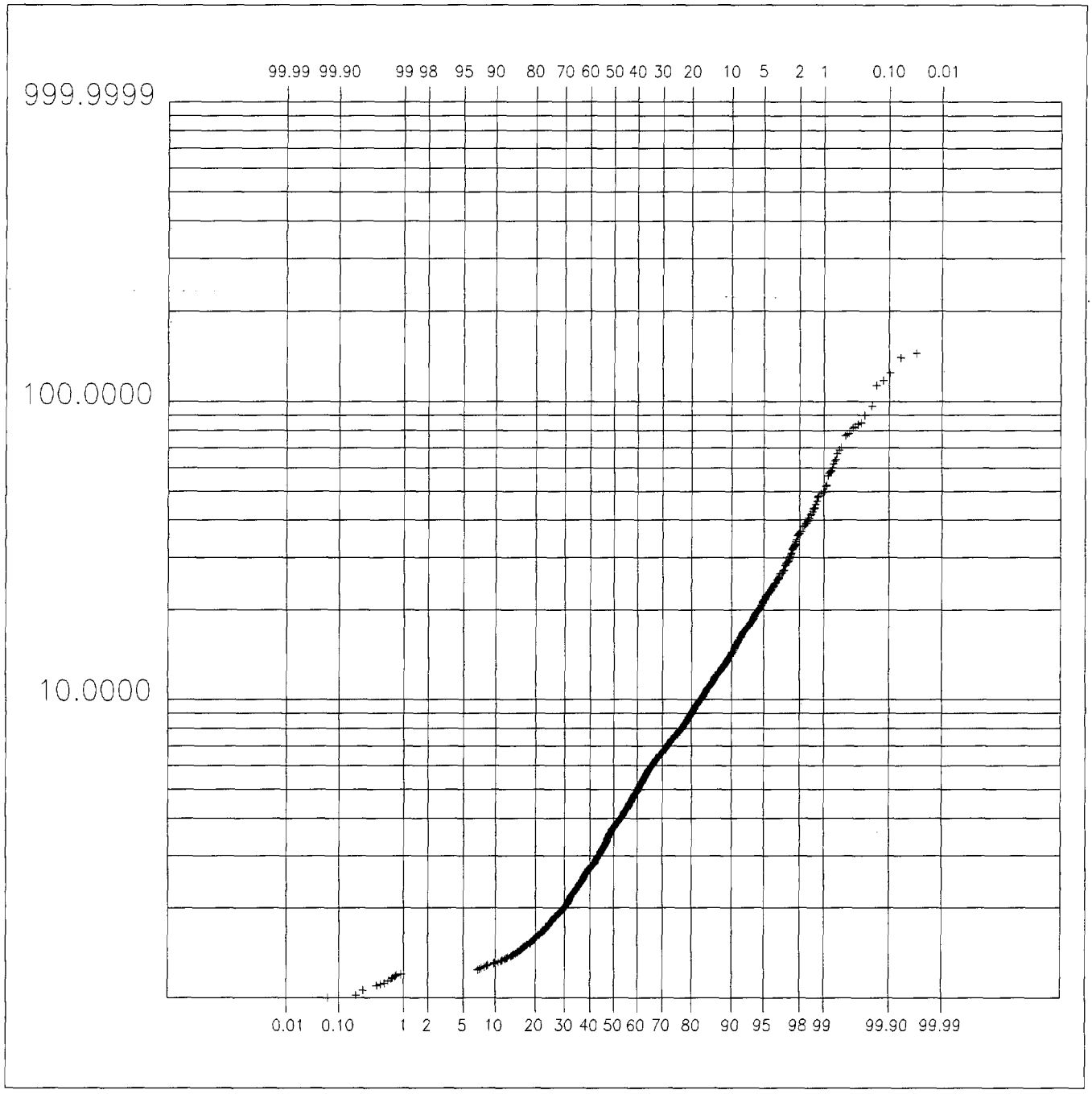
Figure 3.28 Probability Plot for Gold – Structure 26 – Drill Hole and Channels



ITEM	AU	NATURAL LOGS	
NUMBER	880	NUMBER	880
MEAN	18.8480	MEAN	2.6220
MINIMUM	1.2000	MINIMUM	0.1820
MAXIMUM	206.3600	MAXIMUM	5.3300
VARIANCE	388.0040	VARIANCE	0.5840
ST. DEV.	19.6980	ST. DEV.	0.7650

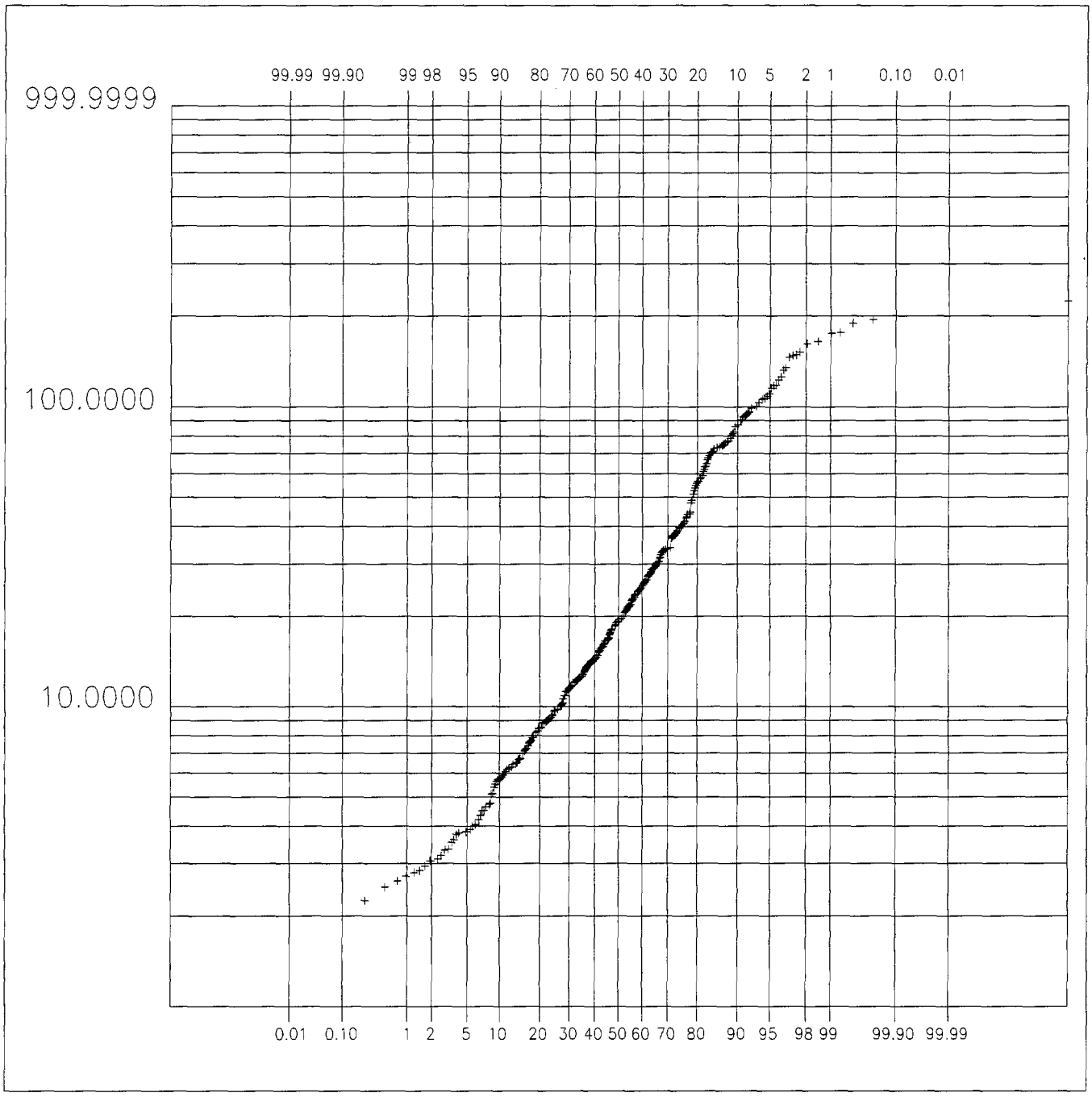
MINERA SAN XAVIER, S.A. de C.V.

Figure 3.29 Probability Plot for Silver –
Structures 1 & 2 & 27 – Drill Hole and Channels



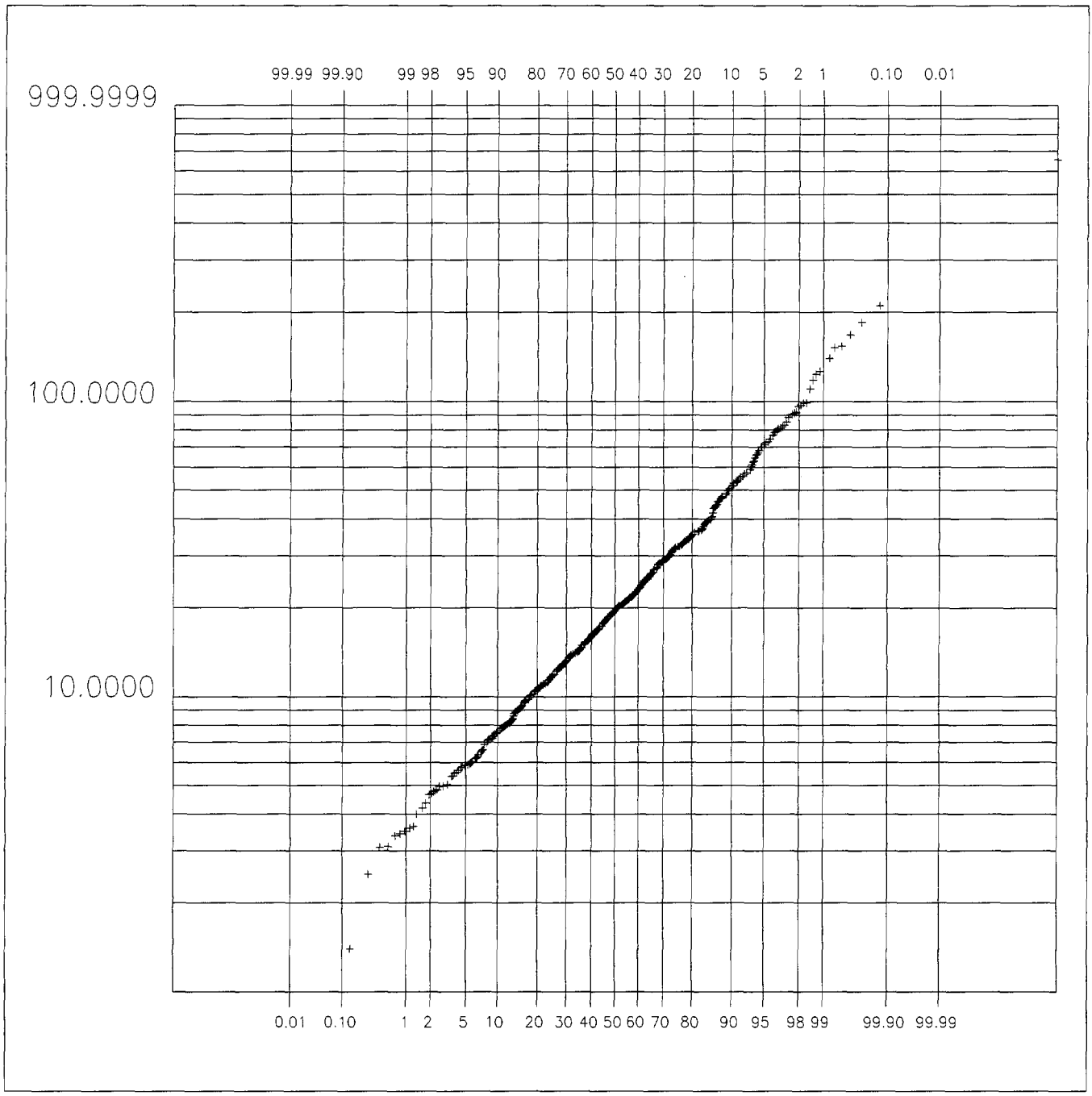
ITEM	AU	NATURAL LOGS	
NUMBER	3136	NUMBER	3136
MEAN	6.9130	MEAN	1.4090
MINIMUM	1.0000	MINIMUM	0.0000
MAXIMUM	299.4600	MAXIMUM	5.7020
VARIANCE	132.8510	VARIANCE	0.8740
ST. DEV.	11.5260	ST. DEV.	0.9350

Figure 3.30 Probability Plot for Silver –
Structures 25 & 28 – Drill Hole and Channels



ITEM	AU	NATURAL LOGS	
NUMBER	411	NUMBER	411
MEAN	34.4290	MEAN	3.0280
MINIMUM	2.2600	MINIMUM	0.8150
MAXIMUM	225.0000	MAXIMUM	5.4160
VARIANCE	1469.6510	VARIANCE	1.0370
ST. DEV.	38.3360	ST. DEV.	1.0180

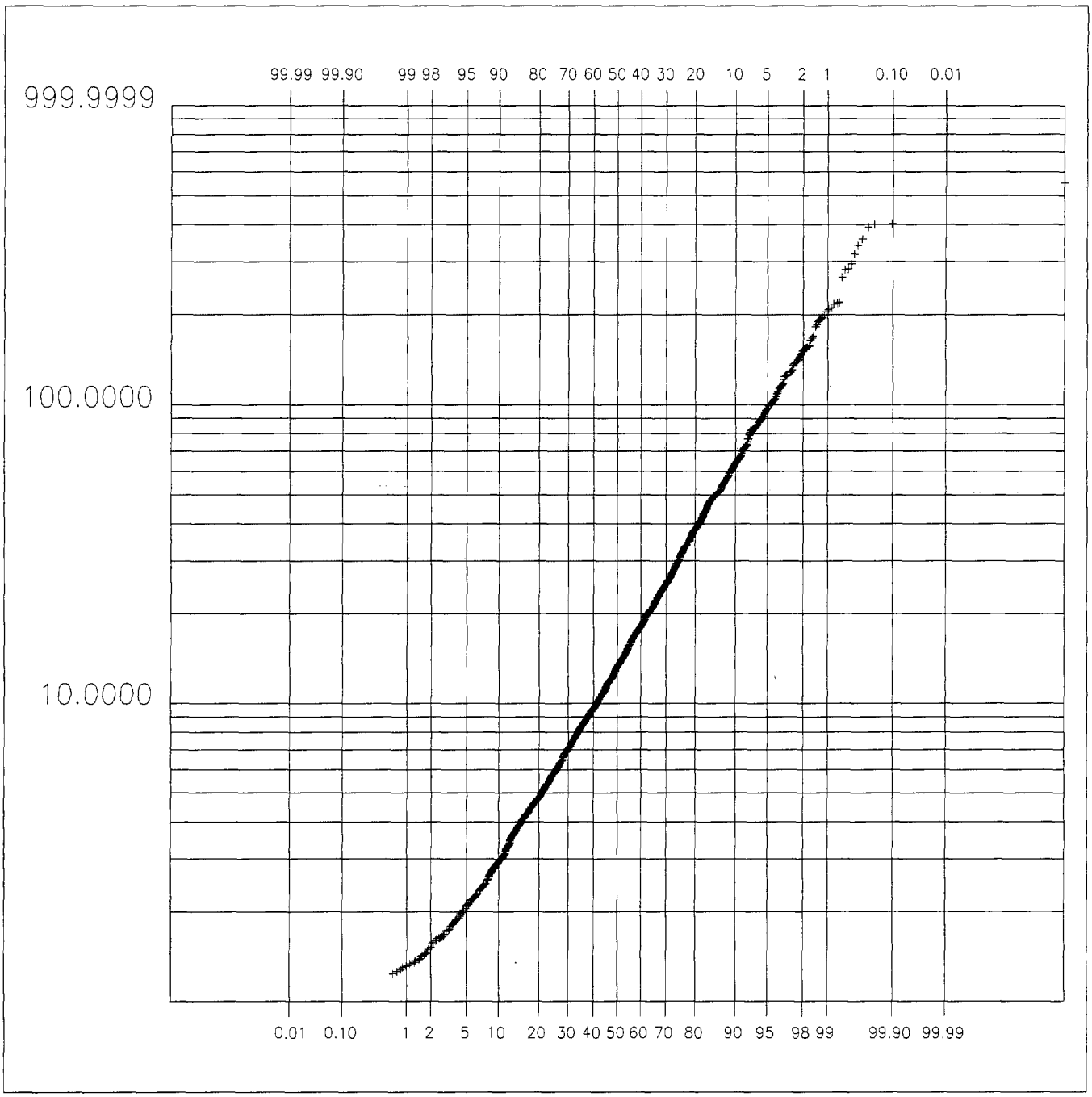
Figure 3.31 Probability Plot for Silver – Structure 4 – Drill Hole and Channels



ITEM	AU	NATURAL LOGS	
NUMBER	727	NUMBER	727
MEAN	27.0120	MEAN	2.9830
MINIMUM	1.4000	MINIMUM	0.3360
MAXIMUM	655.3300	MAXIMUM	6.4850
VARIANCE	1100.5040	VARIANCE	0.5710
ST. DEV.	33.1740	ST. DEV.	0.7560

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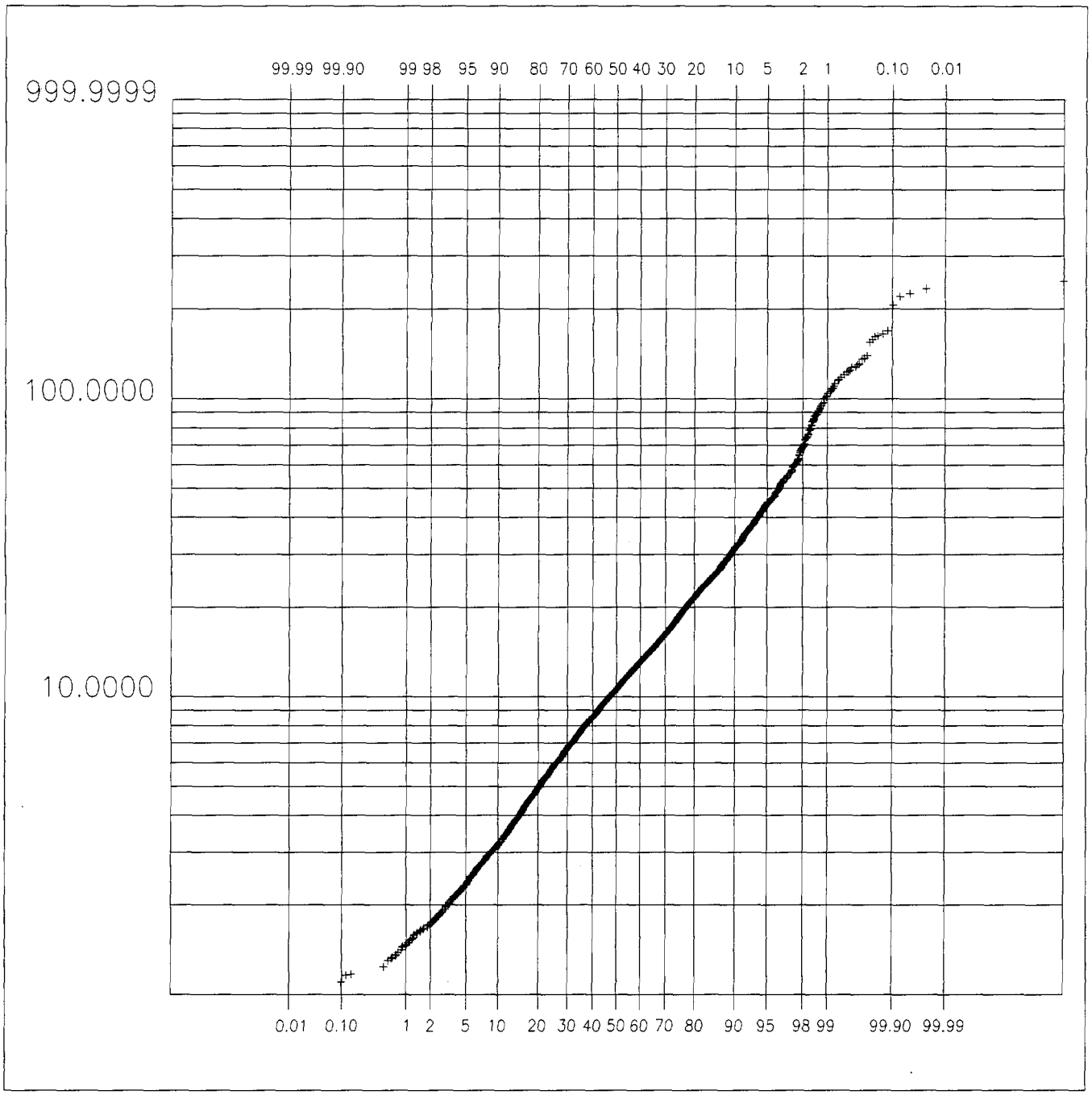
Figure 3.32 Probability Plot for Silver – Structures 3 & 5 & 6 – Drill Hole and Channels



ITEM	AU	NATURAL LOGS	
NUMBER	1923	NUMBER	1923
MEAN	27.5030	MEAN	2.6220
MINIMUM	1.2400	MINIMUM	0.2150
MAXIMUM	552.8100	MAXIMUM	6.3150
VARIANCE	1913.7679	VARIANCE	1.3510
ST. DEV.	43.7470	ST. DEV.	1.1630

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Figure 3.33 Probability Plot for Silver – Structures 21 & 22 – Drill Hole and Channels



ITEM	AU	NATURAL LOGS	
NUMBER	4140	NUMBER	4140
MEAN	15.7590	MEAN	2.3520
MINIMUM	1.1000	MINIMUM	0.0950
MAXIMUM	246.2500	MAXIMUM	5.5060
VARIANCE	347.5190	VARIANCE	0.7830
ST. DEV.	18.6420	ST. DEV.	0.8850

Figure 3.34 Probability Plot for Silver – Structure 26 – Drill Hole and Channels

3.5.4 Variography

Correlograms for silver and gold grades were computed for the combined structural domains described in Table 3.18. Cambior and MRA performed detailed geostatistical analysis which recognizes individual data populations within confined structural zones. Indicator thresholds for each domain were interpreted from the log-probability plots and indicator variograms were calculated. Grade and indicator variograms for gold and silver are listed in Tables 3.14, 3.15 below. Variogram plots are shown in Appendix of the August, 2000 MRA report.

Table 3.14

Silver Correlogram Models

Structure	C_0	C_1	R_1	C_2	R_2	Azm	Plng	Dip
1+2+27	0.22	0.70	38			0	0	0
25+28	0.08	0.45	38	0.31	189	0	0	0
4	0.01	1.17	51			0	0	0
3+5+6	0.17	0.71	49			0	0	0
21+22	0.08	0.46	40	0.37	129	0	0	0
26	0.18	0.40	43	0.40	187	0	0	0

Table 3.15

Gold Correlogram Models

Structure	C_0	C_1	R_1	C_2	R_2	Azm	Plng	Dip
1+2+27	0.19	0.91	42 12			0	0	-90
25+28	0.64	0.35	97	0.09	112	0	0	0
4	0.24	0.76	56 20			30	0	0
3+5+6	0.25	0.70	30 28	0.14	62 43	90	0	0
21+22	0.46	0.34	33	0.18	98	0	0	0
26	0.28	0.50	26	0.24	154	0	0	0

Where:

C_0 = Nugget effect,
C_1 = C value of first structure,
R_1 = Range of first structure (meters),
C_2 = C value of second structure,
R_2 = Range of second structure (meters),
Azm = Azimuth of major axis (degrees),
Plng = Plunge of major axis (degrees),
Dip = Orientation of minor axis (degrees, - sign indicates downward to east from new rotated north)

Indicator cutoffs were interpreted from inflection points in the log-probability plots. These cutoffs roughly correspond to known mineralization characteristics. The limestones have relatively low indicator cutoffs corresponding to the transition between non-mineralization or low-grade mineralization to the localized higher-grade mineralization. The high indicator cutoff for the porphyry corresponds to the transition between disseminated and structurally controlled mineralization. Indicator variogram ranges correspond to the continuity of the mineralization above the indicator cutoff as listed in Tables 3.16, 3.17 below.

Table 3.16

Gold Indicator Variogram Models

Structure	Cutoff g/tonne	C_0	C_1	R_1	C_2	R_2	Azm	Plng	Dip
1+2+27	0.25	0.07	0.11	48	0.03	89	0	0	0
25+28	0.30	0.01	0.01	28			0	0	0
4	0.20	0.08	0.15	40			0	0	0
3+5+6	0.60	0.09	0.12	26			0	0	0
21+22	0.40	0.10	0.10	35			0	0	0
26	1.50	0.02	0.03	32			0	0	0

Table 3.17

Silver Indicator Variogram Models

Structure	Cutoff g/tonne	C_0	C_1	R_1	C_2	R_2	Azm	Plng	Dip
1+2+27	40.	0.04	0.05	38			0	0	0
25+28	35.	0.01	0.01	40			0	0	0
4	45.	0.01	0.16	27			0	0	0
3+5+6	40.	0.07	0.05	41			0	0	0
21+22	8.	0.07	0.07	37			0	0	0
26	60.	0.01	0.02	33			0	0	0

Most variograms were modeled with a global spherical model. Anisotropy was difficult to ascertain and was only modeled if the directionality was pronounced in the experimental variograms, and not as a function of data orientation or spacing.

3.5.5 Geologic Modeling

3.5.5.1 Geologic Domains

The Cerro San Pedro geological model has been constructed placing an emphasis on structural control relative to lithological (rock type) control. A three-dimensional block model was constructed using the

geologic framework designated by Cambior. Model lithology and structural domains follow the detailed work performed by Cambior and presented in the Cambior, October 1999 feasibility.

The Lithology and structural domains created by Cambior were used by MRA. Model codes are the same as the drillhole codes and are summarized in Table 3.18.

Table 3.18

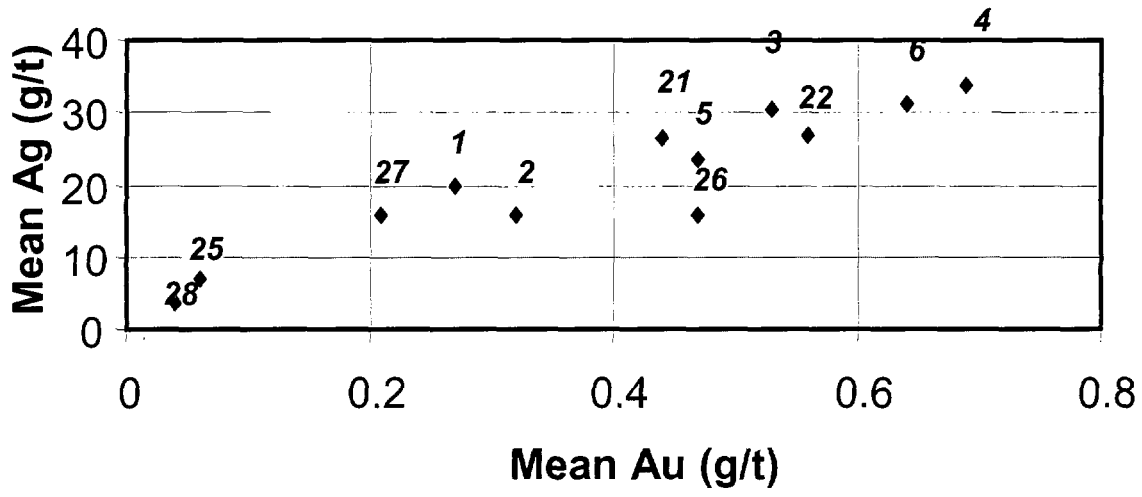
Rock Type and Structural Codes			
Description	Code	Description	Code
Barreno Limestone	100	Abundancia	1
Barreno MnOx	101	Olvidada	2
Hospital Limestone	102	Princessa	3
Begonia Limestone	103	Rosario-Porvenir	4
Begonia Carbonaceous	104	Felix Ovalle	5
Porphyry Oxide	105	Cinco de Mayo	6
Porphyry Mixed	106	West Contact Zone	21
Porphyry Sulfide	107	East Contact Zone	22
Tertiary Rhyolite	108	West Sediments	25
Tailings	109	Porphyry	26
Backfill	110	Wedge Princessa F-O	27
		East Sediments	28

The structural model contains twelve different domains defined on the basis of geological interpretation and spatial anisotropic properties. Overly complicated geological models may adversely affect accurate grade interpolation. Statistical results show that some structural domains give similar statistical results, implying they are eligible for regrouping (as shown in Figure 3.23). Table 3.19 presents the simplified and grouped structural model domains. The simplification is based on the regrouped domains having similar spatial properties and statistical characteristics.

Table 3.19

Simplified/Grouped Structural Domains	
Code	**Description**
1+2+27	Abundancia + Olvidada + Wedge Princesa/Felix Ovalle
25+28	East and West Sediments
3+5+6	Princesa + Cinco de Mayo + Felix Ovalle
4	Rosario-Porvenir
21+22	West and East Contact Zones
26	Porphyry

Figure 3.35 Structural Domains - Means of Gold and Silver



3.5.5.2 Block Densities

Block specific gravities were measured by Cambior and are based on a total of 281 specific gravity determinations. The work performed by Cambior was accepted by MRA and was loaded into the block model as an average value for each lithology, the testing is summarized in Table 3.20, below.

Table 3.20

Measured Densities for Various Rock Types							
Description	**Rock Code**	**No. Tests**	**Min. t/cm^3**	**Max. t/cm^3**	**Average t/cm^3**	**S.D.**	**C.V.**
Barreno Limestone	100	13	2.29	2.68	**2.55**	0.12	0.05
Barreno MnOx	101	19	2.27	2.74	**2.57**	0.11	0.04
Hospital Limestone	102	11	2.42	2.72	**2.59**	0.09	0.03
Begonia Limestone	103	42	1.66	3.07	**2.50**	0.25	0.10
Begonia Carb.	104	3	2.38	2.53	**2.48**	0.07	0.03
Porphyry Oxide	105	132	1.45	2.83	**2.29**	0.25	0.11
Porphyry Mixed	106	41	1.94	2.80	**2.49**	0.20	0.08
Porphyry Sulfide	107	20	2.14	2.91	**2.51**	0.23	0.09
Tertiary Rhyolite	108	0			**2.51**		
Tailings	109	0			**1.80**		

3.5.5.3 Mineralization Envelopes

Mineralized envelopes were developed through inspection of exploration data and interpretation of data on vertical cross sections. Structural controls are the dominant geologic feature defining metal distribution at Cerro San Pedro. Exploration/development data was used to define rock type zones throughout the Cerro San Pedro deposit, more importantly distinct structural domains were defined within each rock type zone to add a controlling factor to grade distribution. Exploration data specific to each of these domains was analyzed to define Geostatistical orientation and range specific to that domain. The structure, grade data and geostatistical parameters associated with each domain were strictly adhered to when defining the mineralized envelopes.

3.5.6 Block Grade Estimation

3.5.6.1 Resource Estimate Techniques

The resource has been evaluated using five different estimation techniques: ordinary kriging (OK), the inverse distance power cube (ID3), PACK with OK and PACK with ID3 and Restrictive Kriging (RK). Cross sections and bench level block model maps were compared for each method to determine the most representative method for estimating the CSP deposit. Cambior implemented the PACK method for estimating the Cerro San Pedro deposit The RK method is a MEDSYTEM equivalent of the PACK technique. Eihter of these restrictive kriging methods would best characterized the grade distribution for the CSP ore deposit.

3.5.6.2 RK Estimation Method

The RK method is recognized as a valid approach to estimating the mineral resource in this deposit. The RK method was used by MRA for developing the grade model for Glamis. The RK method uses a single indicator approach to model grade population changes within structural domains. These population changes often correspond to dissemination and/or structural transitions which may be localized and thus impossible to model in a deterministic manner. The geologic environment at Cerro San Pedro is a primary example of this mix between dissemination and tight structural control within the deposit. Mineral grade tends to fluctuate along the structural boundaries and become more evenly distibuted in the disseminated as you move away from these boundaries.

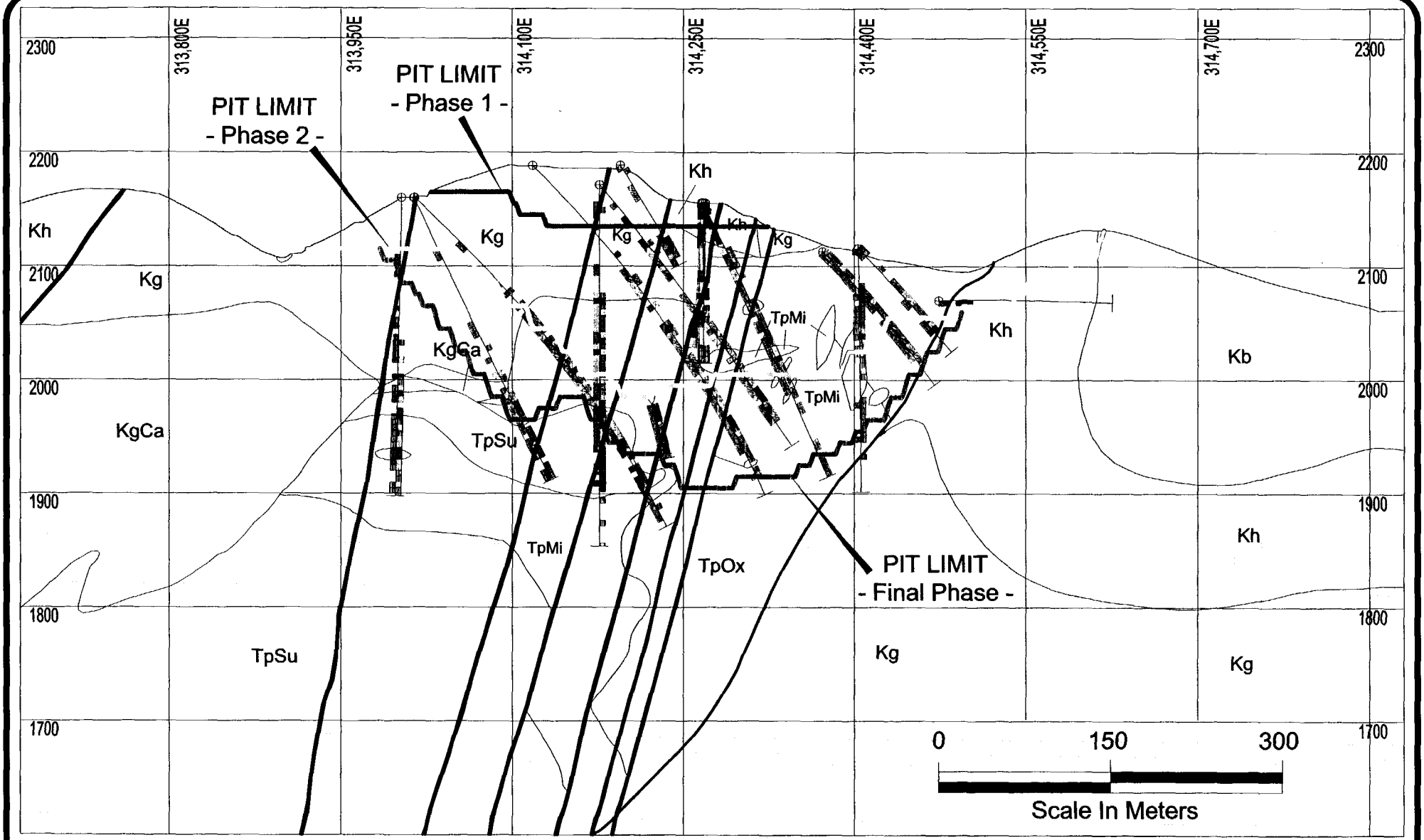
The RK approach begins with selection of an indicator cutoff corresponding to the transition between mineralized populations. These cutoffs are interpreted from the log-probability plot. Cutoffs used for Cerro San Pedro are discussed in Section 3.5.4. Indicator variograms are then computed to determine the continuity of mineralization above the cutoff, i.e. the variogram range.

Using the indicator variogram range as a search distance, block probabilities are estimated. For Cerro San Pedro, these block probabilities were estimated using an inverse-distance-cubed technique which tends to respect localized points. These block probabilities are estimated from 0 - 1 indicators assigned to each composite, 0 if the composite grade is below the cutoff, 1 if equal to or above the cutoff. Block probabilities then represent the likelihood of the block belonging to the mineralized population above the indicator cutoff. During grade estimation, the block probabilities are introduced into the kriging set of equations to adjust the kriging weights. A high block probability, suggesting that a majority of the close composites are above the indicator cutoff, will result a block with a higher estimated grade than what would have been estimated using ordinary kriging. Conversely, a block with a low block probability,

suggesting isolated high grade values would receive a lower grade estimate than ordinary kriging. In this manner, smoothing is reduced and blocks tend to receive grades more reflective of the structure and local data.

A minimum of two and a maximum of nine composites were used for estimation, with a maximum of three composites from a single drillhole. Search distances generally corresponded to variogram ranges. Horizontal search distances were 100 meters in the sediments and contact zones, 150 meters in the porphyry, and 50 meters for all other structural domains. A 20 meter vertical search distance was used for all structural domains. Outlier grade values (as listed in Section 3) were limited to a maximum search distance of 15 meters.

Figures 3.36 through 3.41 show examples of the block model grade estimates in cross-sections and on plan view. Each pair of figures shows geology structure, a pit design limit for each of the three phases, drill hole information and modeled ore blocks above cutoff grade. The paired figures represent one plan view bench level, a west looking and north looking cross-section. The block values above the internal cutoff grade for all ore types are represented by red block outlines.



Explanation

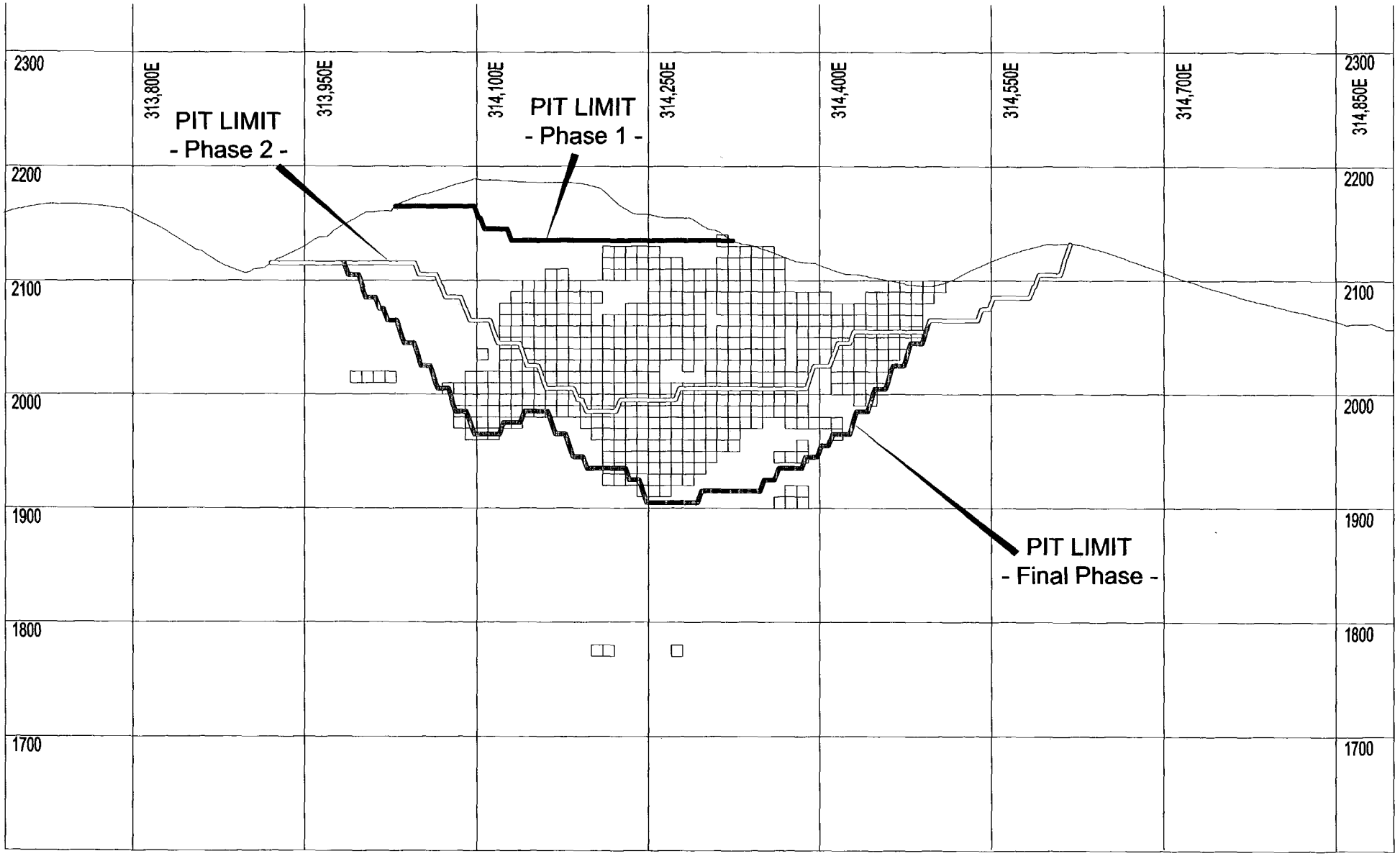
- Fill Fill
- Tr Rhyolite Tuff
- TpOx Porphyry Oxide
- TpMi Porphyry with Oxide/Sulfide
- TpSu Porphyry Sulfide
- KbMn Barreno Manganese Limestone
- Kb Barreno Limestone
- Kh Hospital Limestone
- KgCa Begonia Carbonaceous Limestone
- Kg Begonia Limestone
- Fault

Drill Hole

g Ag/t	g Au/t
10 - 50	0.2 - 0.6
50 - 100	0.6 - 1.0
>100	>1.0

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Figure 3.36 Geologic Cross Section Along 2,458,200 N. Showing Drill Holes – Looking North –



Explanation

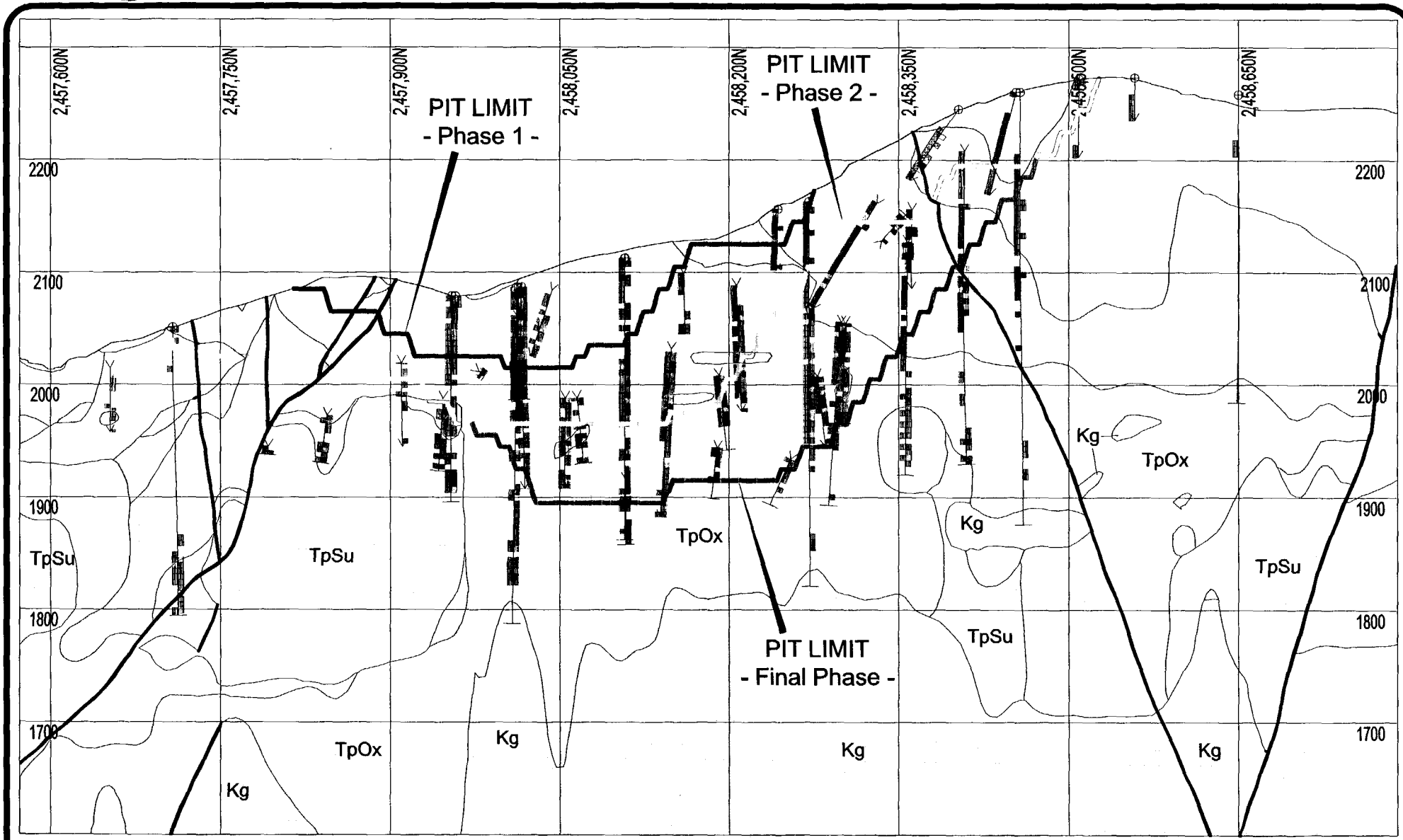
>0.4 Au equivalent

0 150 300

Scale In Meters

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Figure 3.37 Cross Section
Along 2,458,200 N. Showing Ore Blocks
– Looking North –



Explanation

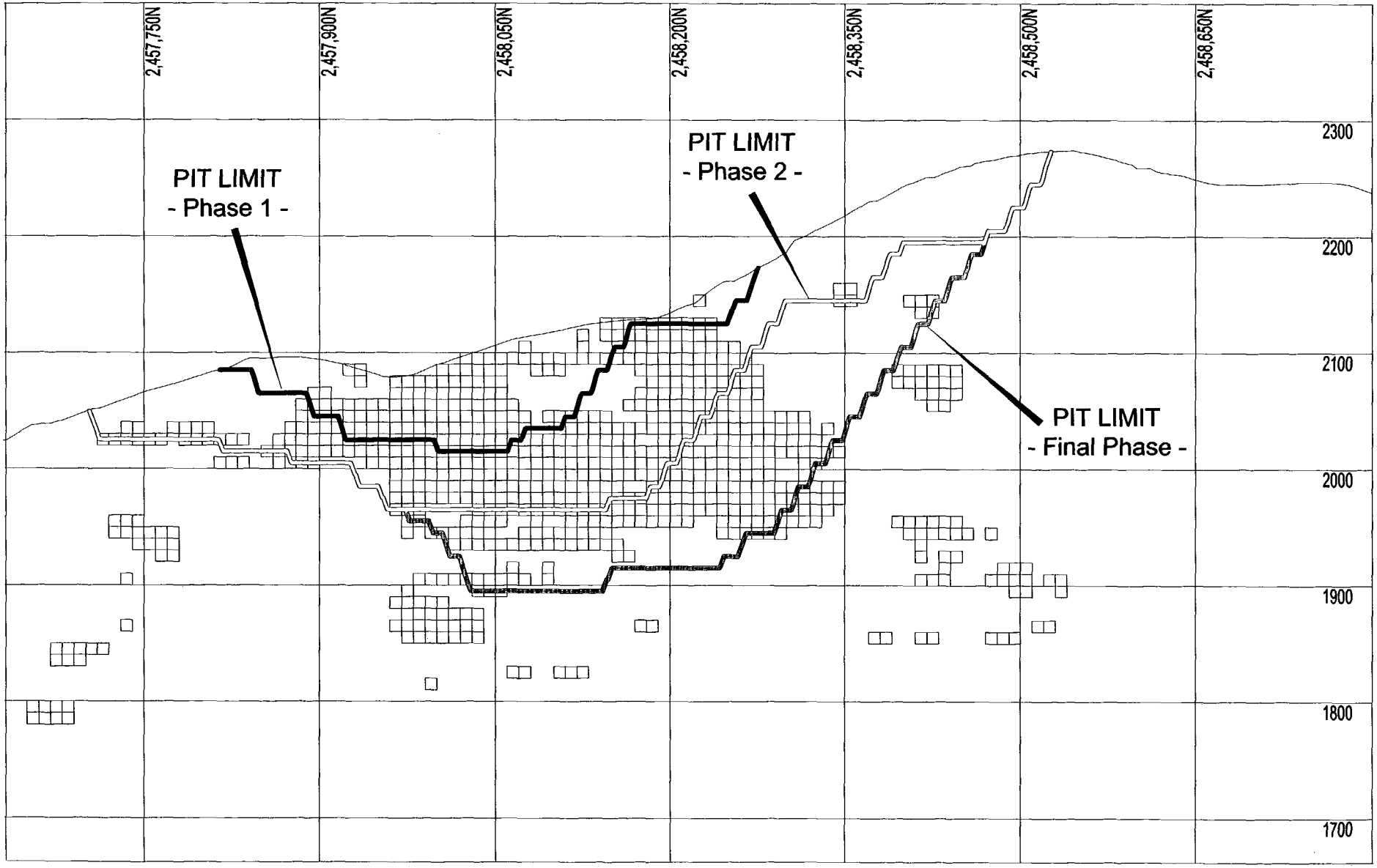
- Fill Fill
- Tr Rhyolite Tuff
- TpOx Porphyry Oxide
- TpMi Porphyry with Oxide/Sulfide
- TpSu Porphyry Sulfide
- KbMn Barreno Manganese Limestone
- Kb Barreno Limestone
- Kh Hospital Limestone
- KgCa Begonia Carbonaceous Limestone
- Kg Begonia Limestone
- Fault

Drill Hole

g Ag/t	g Au/t
10 - 50	0.2 - 0.6
50 - 100	0.6 - 1.0
>100	>1.0

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Figure 3.38 Geologic Cross Section Along 314,325 E. Showing Drill Holes – Looking West –



Explanation

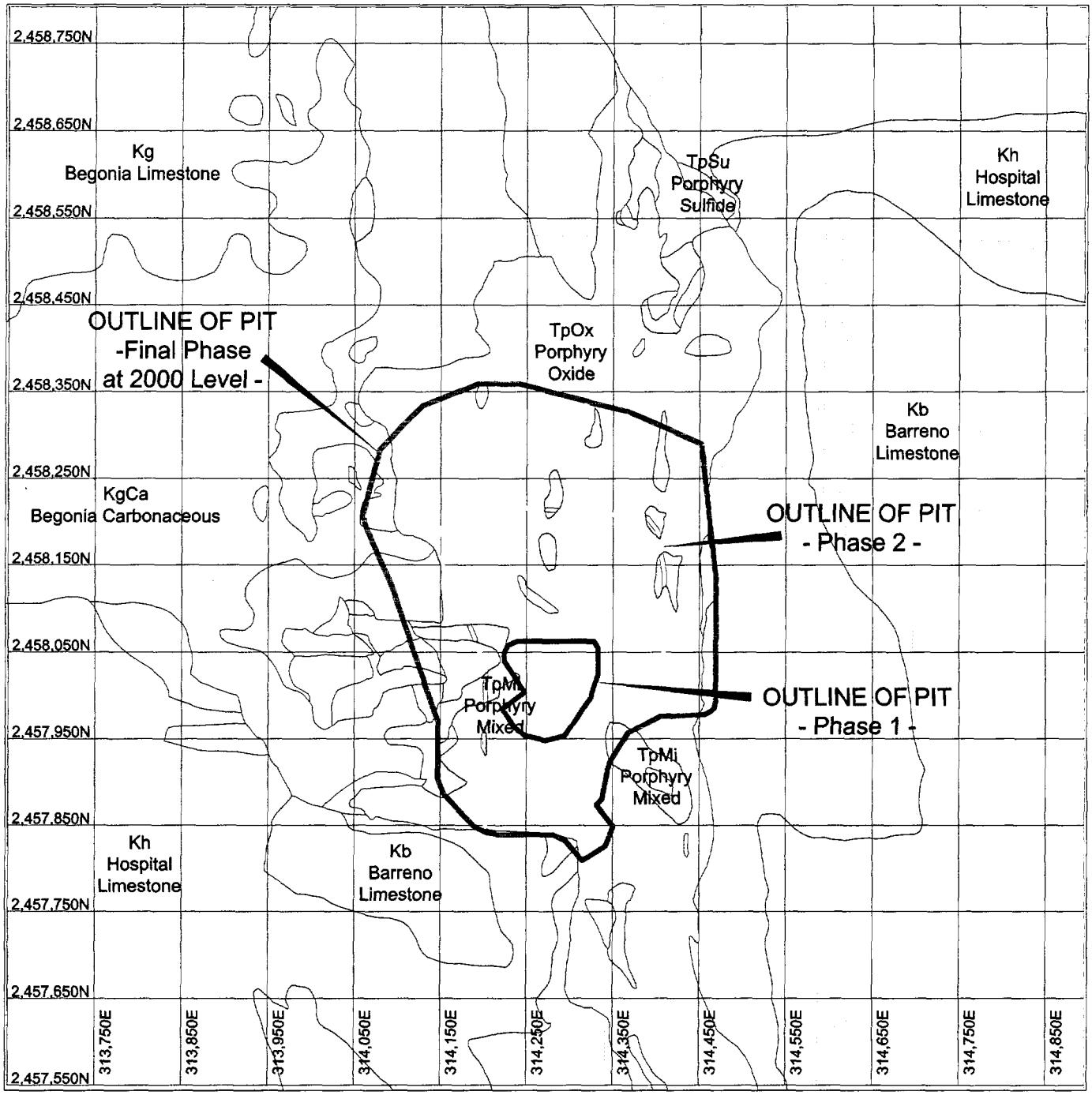
>0.4 Au equivalent

0 150 300

Scale In Meters

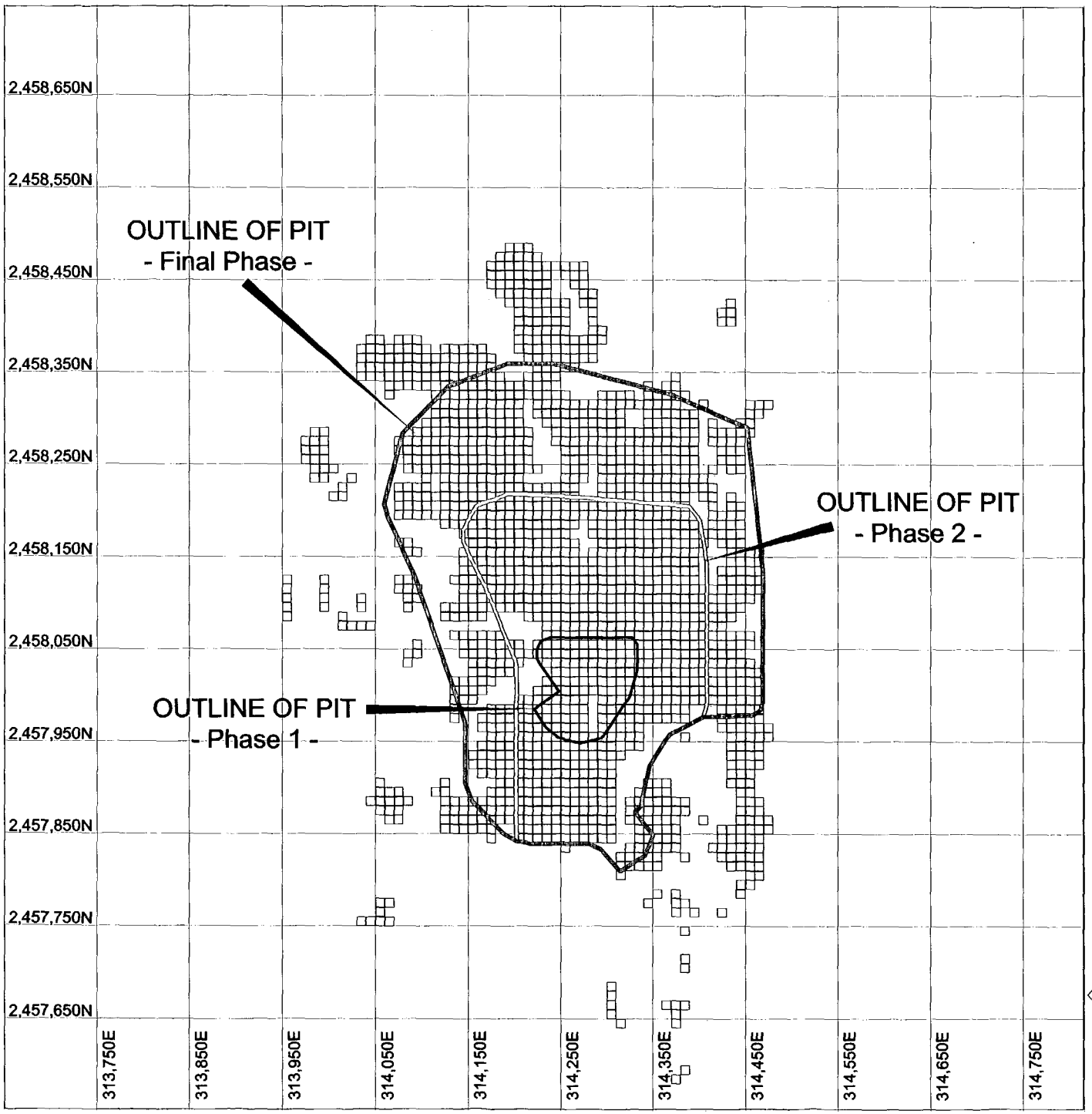
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Figure 3.39 Cross Section
Along 314,325 E. Showing Ore Blocks
– Looking West –



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Figure 3.40 Map Showing Rock Type Classification
– 2000 Level –



Explanation

☐ Positive Internal Cutoff

Block values greater then internal cutoff grade shown in red.

N

0 100 250

Scale In Meters

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Figure 3.41 Map of 2000 Level Showing Ore Blocks

3.6 Geological Resource Estimate

3.6.1 Mineral Inventory

A mineral inventory for the RK estimating method was calculated for the model by rock type and is summarized in Table 3.21. Modeled voids for underground workings were accounted for in this inventory but no attempt was made to remove unmodeled voids, which is estimated to 600,000 tonnes.

Table 3.21

Glamis 2000 Model Mineral Inventory

	0.20 g/t Au			0.30 g/t Au			0.40 g/t Au		
Rock Type	**Ktonnes**	**Au**	**Ag**	**Ktonnes**	**Au**	**Ag**	**Ktonnes**	**Au**	**Ag**
Barreno Ox	10,408	0.51	20.85	6,281	0.69	23.51	4,390	0.84	25.94
BarrenoMnOx	3,042	0.73	30.44	2,390	0.87	32.83	1,889	1.01	35.99
Hospital Ox	5,789	0.57	27.29	3,652	0.76	31.22	2,645	0.92	35.23
Begonia Ox	10,675	0.56	25.01	7,452	0.71	28.79	5,699	0.82	31.65
Begonia Carb	3,835	0.52	24.66	2,463	0.68	29.51	1,934	0.77	31.53
Porphyry Ox	89,353	0.48	15.87	58,709	0.60	19.30	40,494	0.71	22.08
Porphyry Mix	37,931	0.45	14.28	28,314	0.52	16.46	18,847	0.60	19.22
Porphyry Sulf	77,162	0.38	10.01	50,247	0.46	12.03	28,832	0.54	14.14
Rhyolite	191	0.64	17.34	181	0.66	17.69	166	0.69	18.24
Total	**238,386**	**0.45**	**14.95**	**159,689**	**0.56**	**17.75**	**104,895**	**0.67**	**20.81**

The RK resources is presented by Resource Classification in the Table 3.22. These resources do not reflect economic pit designs, but rather are limited to reporting a geologic resource.

3.6.2 Resource Classification

The resource estimate is classified on the basis of these parameters:

- **Measured:** All estimated blocks that had a minimum of two drillholes within one-half of the variogram range from the block center.
- **Indicated:** All estimated blocks that had a minimum of two drillholes within the variogram range from the block center.
- **Inferred:** All other estimated blocks.

All estimation parameters, such as mineralization controls, were respected.

Within the confines of an engineered pit, these measured, indicated, and inferred classifications would translate into proven, probable, and possible categories respectively. This classification scheme adheres to standards set forth by Canadian and American securities authorities. The Mineral Resource is summarized at various cutoff grades by classification in Table 3.22, below.

Table 3.22

Mineral Inventory By Classification

	0.20 g/t Au			0.30 g/t Au			0.40 g/t Au		
Rock Type	**Ktonnes**	**Au**	**Ag**	**Ktonnes**	**Au**	**Ag**	**Ktonnes**	**Au**	**Ag**
Measured	154,953	0.50	17.82	114,173	0.59	20.18	79,433	0.69	23.13
Indicated	61,849	0.38	10.12	33,866	0.49	12.55	18,546	0.61	14.84
Inferred	21,584	0.37	8.20	11,649	0.48	9.07	6,917	0.57	10.18
Total	**238,386**	**0.45**	**14.95**	**159,689**	**0.56**	**17.75**	**104,895**	**0.67**	**20.81**

The grade-tonnage relations are represented by Figures 3.42 and 3.43 at various cutoff grades for both gold and silver. The tonnage-grade curves shows the variation of grade with respect to the cutoff grade is relatively uniform for both metals. The tonnage, however, drops quickly as the cutoff grade increases from 10 to 30 g/t for silver. The tonnage drop for gold is not as pronounced as the cutoff grade increases.

Figure 3.42

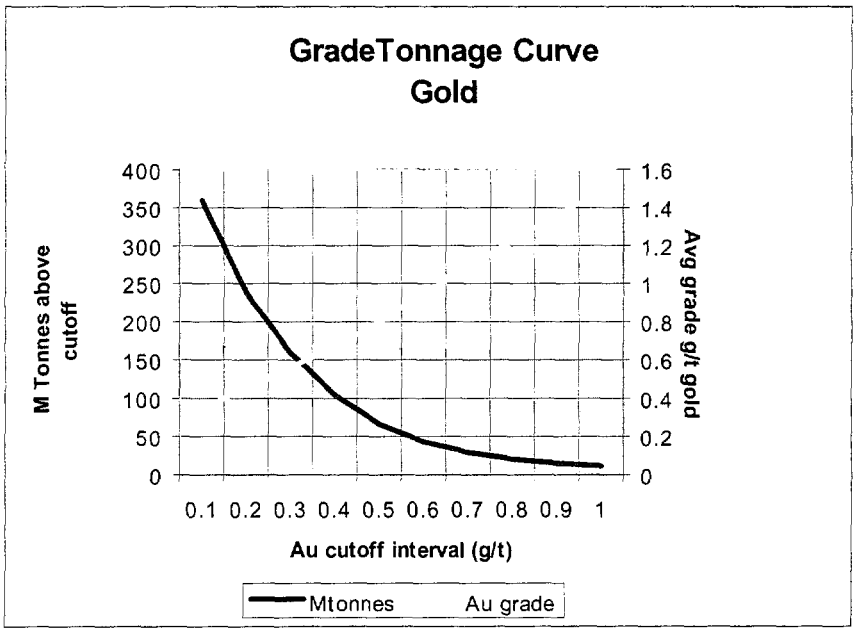
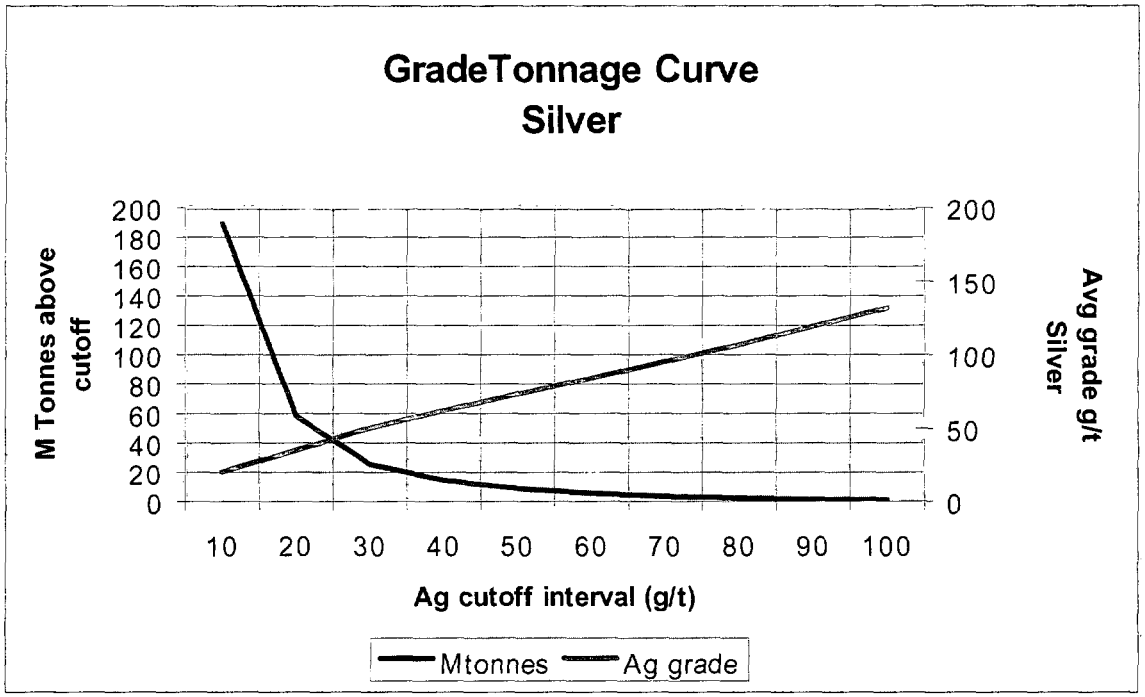


Figure 3.43



3.6.3 Validation of Resource Estimate

Validating the resource model was performed by inspecting various plan and sectional areas of the model. Comparisons of exploration data composites with the block model grade estimates were made to insure structural domains where adhered to and that model grades represented the local composite grade data. The behavior of the RK estimating method shows a close relationship between the block grades and the assay composite grades, which demonstrates the model is valid and represents the Cerro San Pedro mineral deposit.

Five different estimation techniques have been used to estimate the CSP geological resources. Problems associated with the traditional modeling methods, such as Ordinary Kriging or Inverse Distance to a power, are that these methods tend to overly smooth grade and do not restrict unwanted interpolation of blocks without manually establishing physical limits, such as structural and/or rock boundaries. As such, tonnages may be overestimated and grades do not represent local information. The advantage of using the RK indicator kriging method is to limit the extent of grade interpolation within mineralized envelopes and to properly represent the grade within these mineralized zones. A comparison of the results between these resource estimation methods is presented in Table 3.23.

Table 3.23

Comparison of Mineral Resource Using Different Estimation Methods							
	Cutoff = 0.20 g/t Au						
Method	% Difference Tonnes	% Difference Ounces	Tonnes (000)	Au (g/t)	Ag (g/t)	Au Equiv. (g/t)	Ounces Au Eq (000)
Restrictive Kriging (MRA)	**0%**	**0%**	**238,386**	**0.45**	**14.9**	**0.71**	**5,454**
Pack with ID3 (Cambior)	***-17%***	***7%***	***197,800***	***0.50***	***16.2***	***0.80***	***5,080***
Pack with OK (Cambior)	-16%	10%	200,200	0.48	15.4	0.76	4,900
Inv Dist^3 (ID3) (Cambior)	-6%	<1%	224,200	0.47	15.8	0.76	5,480
Ordinary Kriging (Cambior)	-1%	<-1%	235,800	0.44	14.9	0.71	5,420

Independent Mining Consultants (IMC) was requested to determine if any grade dilution should be incorporated into the resource estimate. The IMC study is included as an appendix to this section. IMC does not foresee a requirement to apply a grade dilution factor or procedure to the Cerro San Pedro resource model. They further concluded that the model is probably somewhat conservative in grade, so that any further grade reduction due to dilution is not warranted.

3.6.4 Comparison with Previous Estimates

It is difficult to compare different resource estimates because the database information, estimation techniques, and grade interpolation parameters vary from one estimate to another. Comparing the Cambior and Glamis/MRA models is not a true "apples to apples" comparison due to these variations. Differences between these models are: the method used to adjust high grade data for the silver bias correction, the use of exploration data with sample recovery between 15% and 35%, and the RK method of grade interpolation. The Glamis/MRA model did not negatively adjust higher grade silver data for the bias correction, as strict use of the polynomial correction equation would have performed. The bias proved to be real due to sample preparation not allowing all the available metal to be reported in the exploration assay.

Table 3.24 represents the variation between the December 1998 resource estimate and the present estimate at a 0.2 g Au/t cutoff. The overall tonnage decreases by 30-percent between the current estimate and the earlier estimate is mainly a result the estimation technique used. The gold and silver grades are, however, much higher in the current estimate. The silver bias correction applied to the pre-1997 assays in the database is the main factor for the increase of the silver grade.

Table 3.24

Glamis/Cambior Mineral Resource Comparison									
		September 1999 Cambior Cutoff = 0.20 g/t Au $ 300/oz Au; $5.50/oz Ag				August 2000 Glamis Cutoff = 0.20 g/t Au $ 300/oz Au; $5.25/oz Ag			
Rock Type	Code	Tonnes (000)	Au (g/t)	Ag (g/t)	Au Eq (g/t)	Tonnes (000)	Au (g/t)	Ag (g/t)	Au Eq (000)
Barreno Oxide	100	7,400	0.57	17.8	0.89	10,408	0.51	20.85	0.87
Barreno MnOx	101	2,400	0.79	28.5	1.31	3,042	0.73	30.44	1.26
Hospital Oxide	102	3,400	0.56	22.6	0.97	5,789	0.57	27.29	1.05
Begonia Oxide	103	9,800	0.64	23.6	1.07	10,675	0.56	25.01	1.00
Begonia Carbonaceous	104	3,600	0.62	25.9	1.09	3,835	0.52	24.66	0.95
Porphyry Oxide	105	83,600	0.52	17.7	0.85	89,353	0.48	15.87	0.76
Porphyry Mixed	106	33,700	0.47	15.1	0.75	37,931	0.45	14.28	0.70
Porphyry Sulfide	107	53,600	0.43	11.3	0.64	77,162	0.38	10.01	0.55
Tertiary Rhyolite	108	0	0.00	0.0	0.0	191	0.64	17.34	0.94
Tailings	109	400	0.63	26.8	1.13	N/A	N/A	N/A	N/A
Total		**197,800**	**0.50**	**16.20**	**0.80**	**238,386**	**0.45**	**14.95**	**0.71**
Contained Ozs (million)			**3.19**	**103.03**	**5.08**		**3.45**	**114.6**	**5.45**

3.6.5 Resource Potential

Although the present ore resource estimate was primarily based on the delineation of the potentially open-pit minable oxide-type mineralization, the potential exists for the exploration and development of other types of precious and base metal deposits in the district. The distribution of the mixed and sulfide type porphyry mineralization below the oxide-type porphyry material would tend to limit the extent of a possible open pit at depth. This would be due to higher stripping ratio at depth, generally lower Au and Ag grades associated with the mixed and sulfide porphyry, and the lower recoveries and higher process costs associated with these types of mineralization. For example, deep polymetallic sulfide ore bodies were mined by Asarco between 1925 and 1950, with a total production during this period reported as 2.1 million tonnes of massive sulfide-type ore grading 4.5 g Au/t, 325 g Ag/t, 5% Pb, 8.5% Zn, and 4% Cu. This mineralization remains unexplored at depth.

4.0 ORE RESERVES AND MINE PLANNING

4.1 Economic Cone Input Parameters

Floating cone input parameters for this study used metallurgical recoveries, processing and mining costs derived from the results of Cambior metallurgical testing and historic Glamis operating parameters. Specialized mining software was used to evaluate the three dimensional (3D) block model and to estimate economic mineable pit limits. Recovery, commodity prices, and operating costs criteria were varied to test the sensitivity of the resource to the key operating parameters. The base case commodity prices used were US $275 per ounce gold and $5.25 per ounce silver.

4.1.1 Economic Cone Evaluations

Mintec's MEDSYSTEM software, using a Lerchs-Grossmann (LG) algorithm, was used to evaluate the Cerro San Pedro resource. The economic operating criteria defined by Glamis was input into the MEDSYSTEM LG program to produce ultimate pit limits. The LG program optimized pit limits with respect to location and ore grade of each block, metallurgical recovery of the ore, incremental capital for each tonne of ore, and mine operating parameters to strip waste, stack and process ore. The process costs include general administrative (G&A) costs for the various types of mining/processing operations evaluated.

Commodity grade values were transformed into an equivalency grade/recovery value with Porphyry Oxide Gold as the basis. This transformation simplified and sped the evaluation process. As with the grade equivalency an average haulage cost was used to make the evaluation process more efficient, but considered cost differences during the various stages of mining. Slope angle criteria for the LG runs were based on C.O. Brawner Engineering report with flatter slope angles used to account for access roads into the resource.

A series of LG evaluations were set which reflected two primary types of operations. All the operations evaluated utilized a bulk material open pit mining method, while the ore processing operation varied. A Run Of Mine (ROM), and two Crusher scenarios were evaluated. In the ROM scenario, once the ore is loaded in the pit it is hauled directly to the leach pad with a stop in the haul for lime addition. In the crusher scenarios, the ore is hauled to a crusher facility near the pit to be single-stage crushed to –6 inches or three-stage crushed to –3/4 inches. The crushed ore is then transported to a load-out facility at the edge of the leach pad by conveyor and trucks are used to stack the crushed ore on the leach pad.

Appropriate costs and metallurgical recovery differences were applied for each operating scenario. The ROM scenarios were limited to two rock types for ore bearing material, Porphyry Oxide and Begonia Limestone, while the crusher scenarios considered all material above a breakeven equivalency cutoff. These two ore types are considered to have sufficient metallurgical test data to support corresponding ROM recovery estimates.

4.1.2 Evaluation Input Parameters

The input parameters used for the MEDSYSTEM LG Pit include mining, processing, incremental capital, G&A, commodity price, pit slope angle, and metallurgical recovery. A mining cost of $0.65 per tonne of material was applied to all rock types. Various costs were developed to represent three different process operating scenarios. An additional cost of $0.25 per tonne of ore material was also applied to account for incremental capital. These costs were based on Glamis operating parameters from the Glamis Rand Mining Company operation, experience, manufacturer data, and from previous analysis performed by Cambior, MRA and IMC for Cerro San Pedro resource study. Pit slope criteria follow guidelines established by C.O. Brawner Engineering. Process input criteria was established by Glamis through internal and third party verification of the Cambior metallurgical test data for the various processing scenarios.

Each block in the model was evaluated to have a positive or negative value using the following criteria:

- The revenue per tonne of gold equivalency was calculated assuming the block was potentially ore material and applying the appropriate metallurgical recoveries and commodity price.

- The cost per tonne was calculated as the sum of the mining, processing, G&A, and incremental capital costs.

- The net value per tonne was calculated by subtracting the costs from the revenue.

The 3D LG algorithm uses this net-value information to determine which blocks to mine as ore or waste. The ultimate pit, at a particular set of equivalency gold price, was determined by requiring the ore blocks within the pit shell to not only pay for their processing and G&A costs, but also their mining cost. Once the LG optimized shell of the pit is defined using the appropriate costs criteria, the reserves within that shell were compiled using internal cutoffs, based on only the processing and G&A costs, applied to each rock type. Table 4.1 provide detail for the LG input parameters used.

Table 4.1

Lerchs - Grossmann Input Parameters				
Commodity Price (US $ / oz)		**ROM**	**1 Stage Crush**	**3 Stage Crush**
Gold		$ 275	$ 275	$ 275
Silver		$ 5.25	$ 5.25	$ 5.25
Metallurgical Recovery (%)				
Gold				
	Porphyry Oxide	75%	75%	78%
	Begonia Limestone	55%	55%	60%
Silver				
	Porphyry Oxide	40%	41%	43%
	Begonia Limestone	25%	25%	25%
Unit Costs (US $)				
Mining		**$ 0.65**	**$ 0.65**	**$ 0.65**
Process				
	Leach	$ 0.728	$ 0.728	$ 0.728
	Merrill Crowe	$ 0.250	$ 0.250	$ 0.250
	Pad Haul	$ 0.029	$ 0.083	$ 0.083
	Incremental Capital	$ 0.250	$ 0.250	$ 0.250
	Stack/Spread	$ 0.064	$ 0.174	$ 0.556
	G&A	$ 0.260	$ 0.290	$ 0.290
Total Process Costs		**$ 1.581**	**$ 1.775**	**$ 2.157**
Geotechnical Slope Angle (degrees)				
NW, N, NE (wo haul road)		55	55	55
E, SE, SW, W (w haul road)		45	45	45
Cutoff Grades (g/tonne Eqv Au)				
Breakeven		0.34	0.37	0.41
Internal		0.24	0.27	0.31

Lerchs-Grossmann economic pit limits were generated for the various processing methods, different commodity prices, for a range of expected metallurgical recoveries and various operating costs. These evaluations provided useful results to test the resource sensitivity to these key operating parameters. The various operating scenarios depart from the previous Cambior analysis. Glamis has extensive experience with ROM heap leach operations and their ability to apply highly productive and cost effective open pit mining operations was used as the basis for further evaluation of the Cerro San Pedro deposit, reflecting the current precious metals market. Table 4.2 summarizes the sensitivity evaluations performed and the respective input parameter for each of the cases.

Table 4.2

CASE ID	ORE DELIVERY TYPE	MINING COSTS	PROCESS COSTS	ROCK TYPES USED AS ORE	% RECOVERY Au	% RECOVERY Ag
1a	ROM	$ 0.65	$ 1.58	Porphyry	75%	40%
1b	ROM	$ 0.65	$ 1.58	Porphyry	70%	35%
2a	ROM	$ 0.65	$ 1.58	Porphry	75%	40%
				Begonia Lmstone	55%	25%
2b	ROM	$ 0.65	$ 1.58	Porphyry	70%	35%
				Begonia Lmstone	55%	25%
3a	-6in crush	$ 0.65	$ 1.78	Porphyry	72%	40%
				Begonia Lmstone	55%	25%
3b	-6in crush	$ 0.65	$ 1.78	Porphry	75%	41%
				Begonia Lmstone	55%	25%
4a	-3/4in crush	$ 0.65	$ 2.16	Porphyry	74%	42%
				Begonia Lmstone	55%	20%
				Barreno/Hospital Lmstone	30%	5%
4b	-3/4in crush	$ 0.65	$ 2.16	Porphyry	78%	43%
				Begonia Lmstone	60%	25%
				Barreno/Hospital Lmstone	30%	5%
5a	ROM (+10%mining cost)	$ 0.72	$ 1.58	Porphyry	75%	40%
				Begonia Lmstone	55%	25%
5b	ROM (+5%mining cost)	$ 0.68	$ 1.58	Porphyry	75%	35%
				Begonia Lmstone	55%	25%
5c	ROM (-5%mining cost)	$ 0.62	$ 1.58	Porphyry	75%	40%
				Begonia Lmstone	55%	25%
5d	ROM (-10%mining cost)	$ 0.59	$ 1.58	Porphyry	75%	35%
				Begonia Lmstone	55%	25%
6a	ROM ($300 gold)	$ 0.65	$ 1.58	Porphyry	75%	40%
				Begonia Lmstone	55%	25%
6b	ROM ($325 gold)	$ 0.65	$ 1.58	Porphyry	75%	40%
				Begonia Lmstone	55%	25%

Note : the process costs include G&A costs.

4.1.3 Economic Cone Results

The various scenarios were evaluated by comparing Net Values of the various Lerchs-Grossmann pit shells. The respective costs/recovery operating parameters were applied to each economic shell. The information generated from this analysis identified the pit shell basis with that generated the highest pit value and provides a basis for future operational flexibility as the precious metal market evolves.

The base case developed was a ROM operation, had commodity prices of $275 per ounce gold and $5.25 per ounce silver, that targeted only Porphyry Oxide material. The base case choice considered criteria such as: the simplest operational method, the most straightforward method to implement & operate, the lowest operational risks, and having the lowest potential capital expenditure. The base case

was adjusted to consider operational enhancements such as crushing scenarios to improve recovery or adding additional ore types based on realistic expectations of metallurgical response. Table 4.3 summarizes the results of the Net Value comparison for the various evaluations.

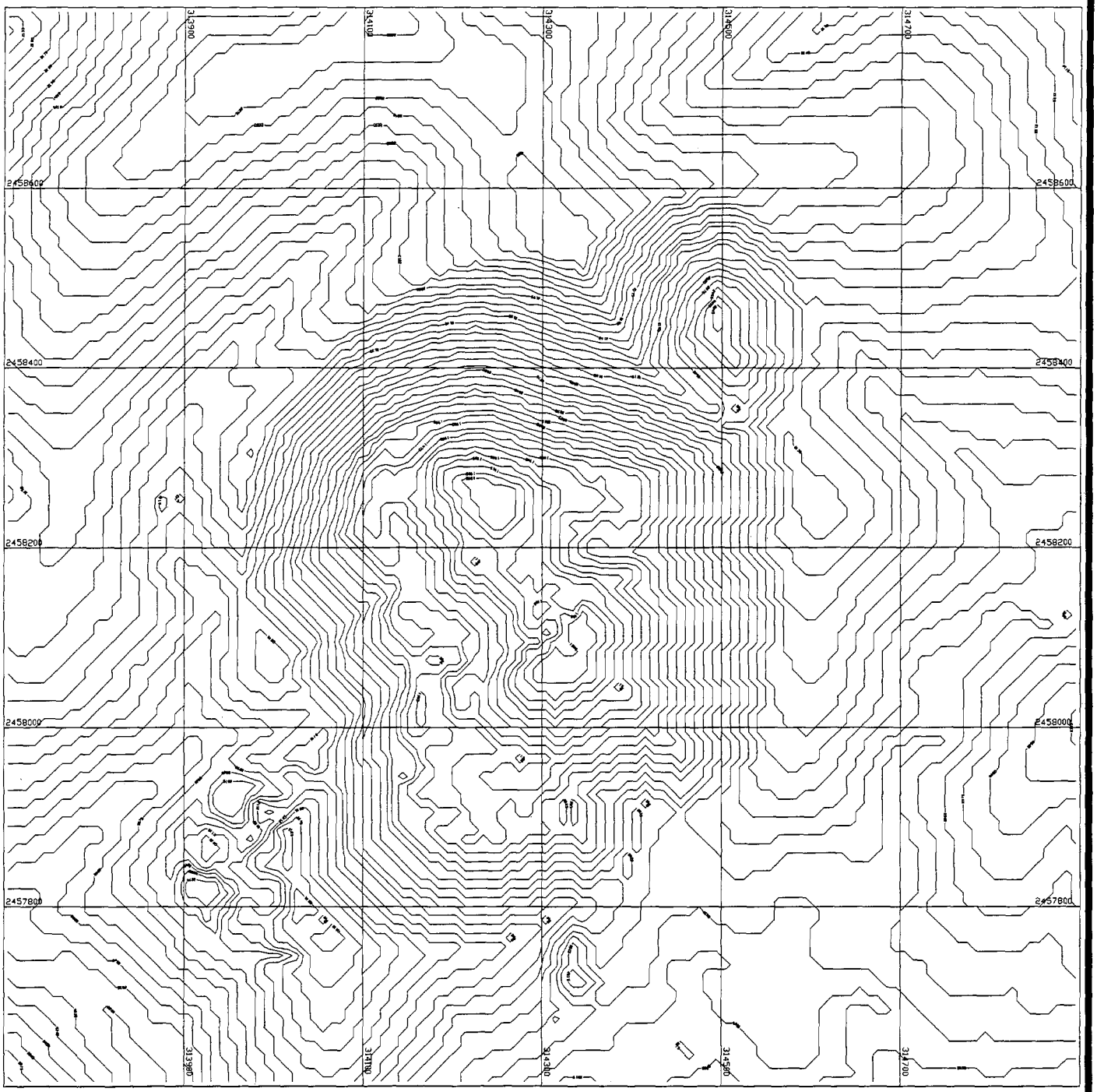
Table 4.3

Lerchs-Grossmann Net Value Pit Comparisons

Pit Shell CASE ID	Pit Shell Gold Price	Total Tonnes	Ore Tonnes	Ore Grade gm/tonne	Contained Ounces EQUIV gold basis	Recoverable Ounces	Pit Value Base $
CASE 1a	275	109,299,000	41,992,000	0.78200	1,055,757	791,818	80,358,212
CASE 1b	275	96,477,000	37,719,000	0.79600	965,304	675,713	63,514,895
CASE 2a	275	115,942,000	48,981,000	0.76600	1,206,277	904,708	96,042,413
CASE 2b	275	102,103,000	44,298,000	0.78400	1,116,583	781,608	78,584,392
CASE 3a	275	101,954,000	43,444,000	0.81200	1,134,166	816,599	80,964,421
CASE 3b	275	110,702,000	45,517,000	0.79900	1,169,260	876,945	88,183,345
CASE 4a	275	98,351,000	40,410,000	0.84800	1,101,731	815,281	72,988,442
CASE 4b	275	107,527,000	43,608,000	0.82600	1,158,076	903,299	84,321,411
CASE 5a	275	104,747,000	46,038,000	0.77600	1,148,600	861,450	89,264,657
CASE 5b	275	111,503,000	47,770,000	0.77000	1,182,597	886,948	92,333,195
CASE 5c	275	128,933,000	51,024,000	0.76700	1,258,232	943,674	99,276,229
CASE 5d	275	132,326,000	52,579,000	0.75700	1,279,673	959,755	103,446,985
CASE 6a	300	136,331,000	54,365,000	0.72800	1,272,452	954,339	111,789,917
CASE 6b	325	175,806,000	62,514,000	0.69900	1,404,899	1,053,674	129,398,189

Glamis concluded that the CASE 2a best represents a mineable base for the Cerro San Pedro mineral resource, based on the Net Value comparisons. This base case, used for designing and ultimate mineable pit is a non-discounted cone calculated at a sales price of US$275 per troy ounce gold and US$5.25 per troy ounce silver. The mining method represented in this case utilizes a bulk mining method, taking advantage of unit costs economies of scale. The ore types identified and used for this case exhibited reliable metallurgical characteristics, require a low capital investment process facility, and have a low unit operating cost for processing the material. The rock types considered ore were limited to Porphyry Oxide and Begonia Limestone. The LG pit shell generated by CASE 2a was used to establish the final pit geometry for design purposes.

Additional non-discounted cones were run at select metal prices for the equivalent gold value to define starter pit and phase pit geometries. The phased LG runs identified pre-stripping requirements for the project, targeted higher grade material as early in the mine life as possible, helped define the number of phases to consider for the project, and provided a test to insure adequate mining widths for the desired mining method. Figure 4.1 shows the geometry of the $275 gold LG pit shell.



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Figure 4.1 Lerchs–Grossmann (LG)
Pit Shell

0 100 200
Scale In Meters

4.1.4 Evaluation Verification

Independent checks of the pit-optimization process have been made for the Cerro San Pedro deposit. All checks used the geologic block models provided by Cambior, however, grade models used were assembled by Cambior or MRA as explained in the previous Section 3 of this report. The independent checks used different pit-optimization software, considered different commodity price as a base, and considered different rock types as ore material. The first verification was made by Independent Mining Consultants (IMC) using the Cambior geology/grade model and a Floating Cone method of determining economic shells. The IMC report noted the sensitivity to this deposit with regard to commodity price, given the majority of the resource material is near the economic cutoff grades calculated for the current precious metals market. Verification by Cambior was through extensive evaluation of the Cerro San Pedro deposit utilizing the Whittle LG software as reported in their 1999 Feasibility Study. The final verification was performed by Mine Reserves Associates for Glamis. MRA utilized the Cambior geologic model, the MRA generated grade model and utilizing the MEDSYSTEM LG evaluation software to generate economic shells. No significant difference was recognized between the various modeling techniques or by the evaluation software used. The results between verifications varied, but the variations were a result of testing the resource for different commodity price and by the material designation for ore types. The various methods revealed total material quantities of near 120 million total tones and near 50 million tones of ore, when considering the Porphyry Oxide and Ilmestones with favorable metallurgical characteristics. Glamis proceeded confidently with its evaluation of the resource given the level of verification this deposit has received

4.1.5 Final Pit Design Parameters

Given the results of the LG evaluation that identified the CASE 2a economic shell as the most suitable scenario, a final mineable pit was developed by MRA with Glamis involvement. Slope angles used for design held to criteria established in C.O. Brawner Engineering report dated August 18, 1999, attached in Section 4.0 of the Appendix. Final highwall slope angle criteria also accounted for wall height and proximity to haul roads for overall highwall slope angles, and the time the wall would be exposed during active mining operations. The MRA design eliminated placing hall roads in the north or west sectors of the pit as means of minimizing stripping for the project. Although slightly flatter slopes of these walls were used as compared to previous Cambior designs, improved stripping requirements resulted. Road geometry considered adequacy for the expected equipment fleet to be used for width and performance characteristics up to the maximum gradeabilty. Maintaining haulage ramps to a maximum of 10% has been proven to maintain fleet performance and equipment longevity. Minimum pushback widths

accounted for fleet access and mobility within the active mining areas. The key design parameters are shown in Table 4.4.

Table 4.4

Pit Design Parameters	
Parameter	**Value**
Slope Angles:	
Interramp – North & West	55 degrees
Interramp – East	52 degrees
Interramp – South	54 degrees
Bench Face Angle	75 degrees
Bench Height	10m
Vertical Interval between Catch Benches	20m
Catch Bench Width (toe to crest):	
North & West Wall	8.6m
East Wall	10.3m
South Wall	9.2m
Designed Road Width	32m
Designed Ramp Gradient	10 %
Minimum Designed Pushback	55m
Minimum Mining Width	30m

Pit design not only considered the purely operational concerns such as highwall slopes, ramp placement and phase pit geometry, but also encompassed protection of important historical buildings in the village Cerro de San Pedro. The pit exits at the 2070 slot on the west allows for ore delivery to the leach pad and to haul waste for initial haul road construction and to a secondary west waste stockpile area. The pit has another primary exit to the east at the 2120 elevation to allow delivery of waste to the primary east waste stockpile area. The final pit is designed respecting the protection boundary set by the Instituto Nacional de Antropologia e Historia (INAH) to protect historic structures. The pit design incorporates haul placement in the pit immediately adjacent to the INAH protection boundary to further buffer the village from long-term highwall exposure. In addition, design of the phased mine plan includes mining slots along the INAH boundary. Mining during the early phase buffers the structures during later mining phases in the higher slopes above the INAH area. Incorporating protection for the INAH structures eliminates some economic ore on the eastern side of the mineralized area. Figure 4.2 shows the final pit design used in this study.



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Figure 4.2 Ultimate Pit
Final Mineable Pit Design

0 100 200
Scale In Meters

4.1.6 Final Pit Mineable Reserves

The final pit design was used to calculate the mineable reserves, which are summarized in Table 4.5. Though economic pit shells considered only Porphyry Oxide and Begonia Limestone, the final mineable ore reported considers additional ore rock types. The additional ore rock types included Barreno and Hospital Limestone.

Ore material was subtracted from the mineable reserves to account for unsurveyed voids not included in the 3D block model. The estimate of the void material not included in the block model are based on the discrepancy between previous historic underground production and known voids. Subtracting known void quantities from the total historic production within the pit area yields the adjustment quantity. This difference is 600,000 tonnes, with an estimated average grade of the adjusted rock type, then subtracted from the final pit reserves.

A block value cutoff was applied to the reserves by the equivalency grade for ore rock types. Equivalency grade considered gold and silver commodity price as well as the metallurgical recovery of the various ore types. Finally the equivalency was related to Porphyry Oxide as the base ore type. All blocks below the equivalency cut-off were calculated as waste material.

4.2 Mine Planning and Production Schedule

The Cerro San Pedro Pit was developed utilizing a 3D LG methodology based on a $275 per ounce gold price and $5.25 per ounce silver price. The large tonnage, low-grade nature of the deposit dictated the use of large-scale open pit mining methods for efficient and cost effective mine development. The Cerro San Pedro Pit was divided into three phases to provide early ore production and spread stripping throughout the mine life, build to a sustainable annual ore quantity and provide relatively even ore production over the life of the project. The phased designs ensure that access is logical and available to all intermediate mining areas, and that adequate operating space was provided to achieve the proposed production rates. Haulage profiles were determined and calculated for each bench from each phase to an advancing leach pad or waste dump location for each production year. The mining schedule was based on an average annual ore production of 7 million tonnes of ROM material, with a maximum total production not to exceed 20 million tonnes. The life of the mine spans nine years including Preproduction (PP) and partial production in year nine. Average mining cost per tonne of material over the life of mine is $0.65 per tonne.

Table 4.5

MINABLE RESERVES -- SUM OF ALL PHASES

(Proven/probable ore above a 0.238 g AuEqv/t internal cutoff. Includes adjustment for underground voids.)

	Oxide Ores (porphyry & limestones)							Waste	Total	Strip
Bench	Ktonnes	g AuEqv/t	g Au/t	g Ag/t	AuEqv kg	Au kg	Ag kg	Ktonnes	Ktonnes	Ratio
2270	0	0.00	0.00	0.00	0	0	0	0	0	n/a
2260	0	0.00	0.00	0.00	0	0	0	109	109	n/a
2250	0	0.00	0.00	0.00	0	0	0	255	255	n/a
2240	0	0.00	0.00	0.00	0	0	0	506	506	n/a
2230	3	0.24	0.44	14.30	1	1	43	730	733	243.33
2220	33	0.28	0.75	30.27	9	25	999	1,050	1,083	31.82
2210	12	0.29	0.99	23.03	4	12	276	1,443	1,455	120.25
2200	16	0.48	1.74	14.37	8	28	230	1,862	1,878	116.38
2190	0	0.00	0.00	0.00	0	0	0	2,275	2,275	n/a
2180	0	0.00	0.00	0.00	0	0	0	2,618	2,618	n/a
2170	23	0.42	0.50	16.84	10	12	387	3,002	3,025	130.52
2160	151	0.35	0.42	17.34	54	63	2,618	3,473	3,624	23.00
2150	273	0.58	0.71	30.50	158	195	8,327	3,745	4,018	13.72
2140	657	0.55	0.62	35.05	362	404	23,029	4,129	4,786	6.28
2130	757	0.48	0.46	27.90	367	350	21,118	4,698	5,455	6.21
2120	916	0.53	0.44	25.52	482	405	23,372	5,396	6,312	5.89
2110	1,153	0.62	0.51	23.59	711	586	27,202	5,503	6,656	4.77
2100	1,733	0.64	0.52	25.63	1,113	895	44,418	5,161	6,894	2.98
2090	2,185	0.62	0.47	26.53	1,364	1,036	57,960	4,511	6,696	2.06
2080	2,817	0.66	0.52	23.74	1,854	1,456	66,866	4,040	6,857	1.43
2070	3,078	0.68	0.51	24.87	2,103	1,582	76,552	3,373	6,451	1.10
2060	3,045	0.74	0.54	24.53	2,242	1,642	74,707	3,165	6,210	1.04
2050	3,220	0.80	0.58	25.95	2,570	1,865	83,573	2,519	5,739	0.78
2040	3,421	0.81	0.58	26.09	2,756	1,990	89,252	2,088	5,509	0.61
2030	3,527	0.76	0.57	22.88	2,698	2,013	80,708	1,281	4,808	0.36
2020	3,401	0.82	0.63	22.92	2,786	2,148	77,945	960	4,361	0.28
2010	3,061	0.84	0.62	23.36	2,578	1,886	71,506	610	3,671	0.20
2000	3,052	0.86	0.63	24.59	2,636	1,928	75,036	431	3,483	0.14
1990	2,575	0.93	0.68	24.81	2,390	1,763	63,887	384	2,959	0.15
1980	2,239	1.00	0.76	24.01	2,229	1,704	53,762	553	2,792	0.25
1970	1,602	0.94	0.76	18.48	1,511	1,211	29,609	638	2,240	0.40
1960	1,445	0.74	0.59	14.56	1,070	859	21,035	615	2,060	0.43
1950	1,134	0.61	0.47	13.02	686	536	14,764	413	1,547	0.36
1940	1,071	0.57	0.44	13.38	614	469	14,325	252	1,323	0.24
1930	866	0.54	0.40	13.53	463	345	11,717	109	975	0.13
1920	725	0.45	0.35	10.35	327	251	7,504	54	779	0.07
1910	490	0.43	0.32	10.03	208	158	4,913	45	535	0.09
1900	360	0.42	0.30	11.62	149	107	4,182	27	387	0.08
1890	219	0.38	0.27	10.64	83	59	2,331	0	219	0.00
Total	49,260	0.74	0.57	23.02	36,594	27,983	1,134,154	72,023	121,283	1.46

4.2.1 Phase Designs

Phase designs attempted divide the deposit into equal ore-bearing volumes, based on LG Pit runs at various gold prices. Mineable phase pit design parameters are the same as used for the ultimate pit design.

Sub-dividing the ultimate pit into smaller mining units improves the stripping ratio and ore grade in the early years. The three mining phases include internal and external access from the mining areas for ore and waste haulage. Table 4.6 summarizes the tonnage from each of the phases. Maps showing the limits of Phase 1, Phase 2, and Phase 3 (the ultimate pit) are presented in Figures 4.3, 4.4, and 4.5, respectively. The LG phase pits adhere to the INAH boundary.

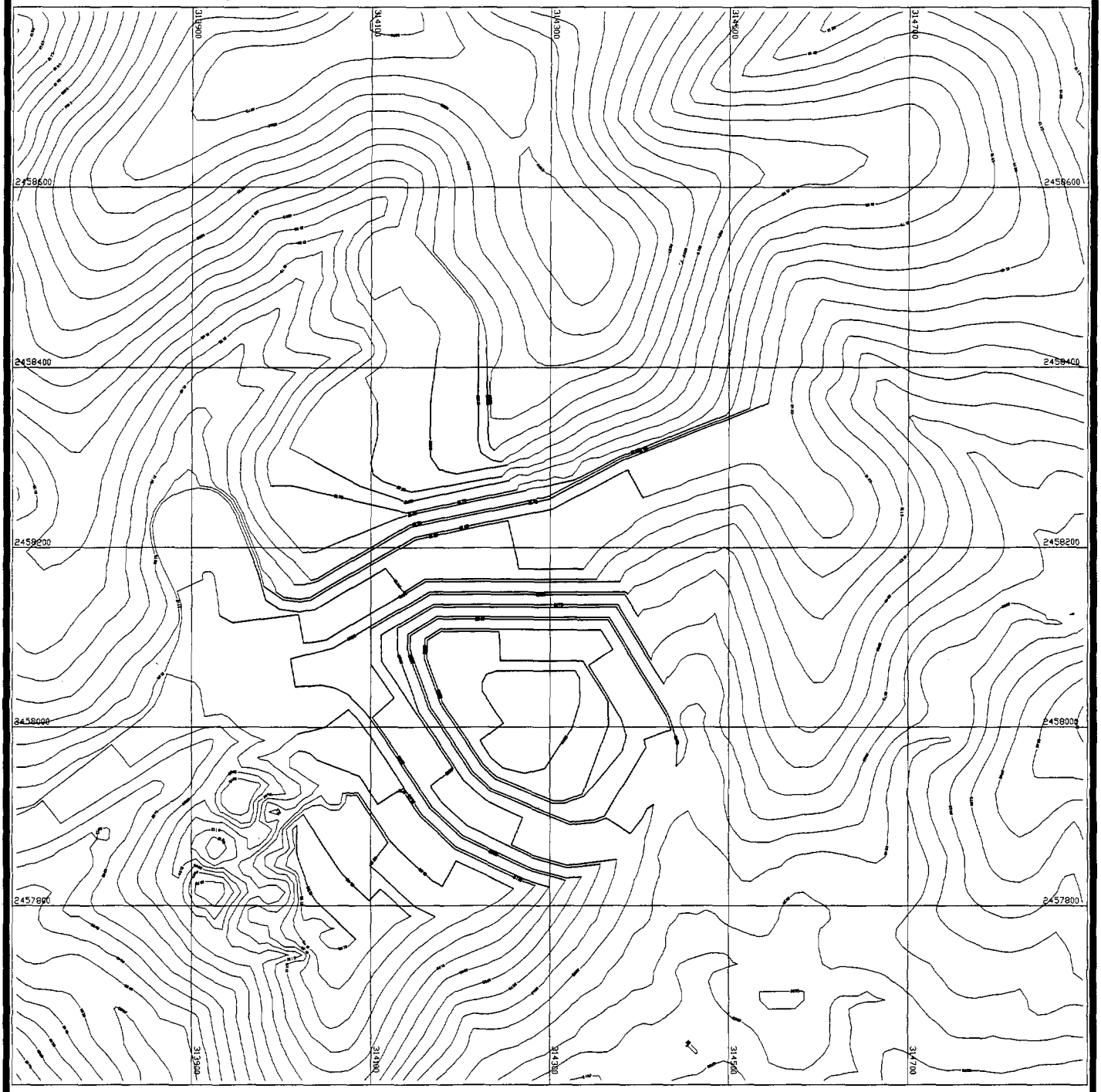
Table 4.6

Summary of Final Mining Phase Tonnages

Mining Phase	Ore Tonnes (000)	Gold Grade g Au/t	Silver Grade g Ag/t	Waste Tonnes (000)	Total Tonnes (000)	Strip Ratio
Access	14	.75	34.79	727	741	51.93
1	9,229	.69	24.57	13,649	44,878	1.48
2	16,402	.58	23.38	31,691	48,093	1.93
3	23,615	.52	18.69	25,956	49,571	1.1
Total	49,260	0.57	23.02	72,023	121,283	1.46

Phase 3 represents the ultimate mineable pit design based on the CASE 2a LG economic pit shell and the other phases are contained within this final pit wall configuration. The access phase requires construction with a smaller mining fleet than will be utilized for production mining operations. This phase will be contracted out and will establish access to the mine area and adequate starter working areas for the mining fleet. Both phases 1 & 2 finalize a portion of the ultimate highwall during operation.

Phase 1 targeted early removal of high-grade ore and operates for three years. It includes approximately 10 million tonnes of pre-production stripping and provides the first two years of ore. This phase operates between the 2230 and 2010 elevations. Phase 2 begins in year three, operates for five years and provides four years of ore. It operates between the 2260 and 1960 elevations. Phase three begins in year four, operates for five years and provides four years of ore. This phase operates between the 2190 and 1890 elevations.



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Figure 4.3 Phase 1 Pit

0 100 200

Scale In Meters



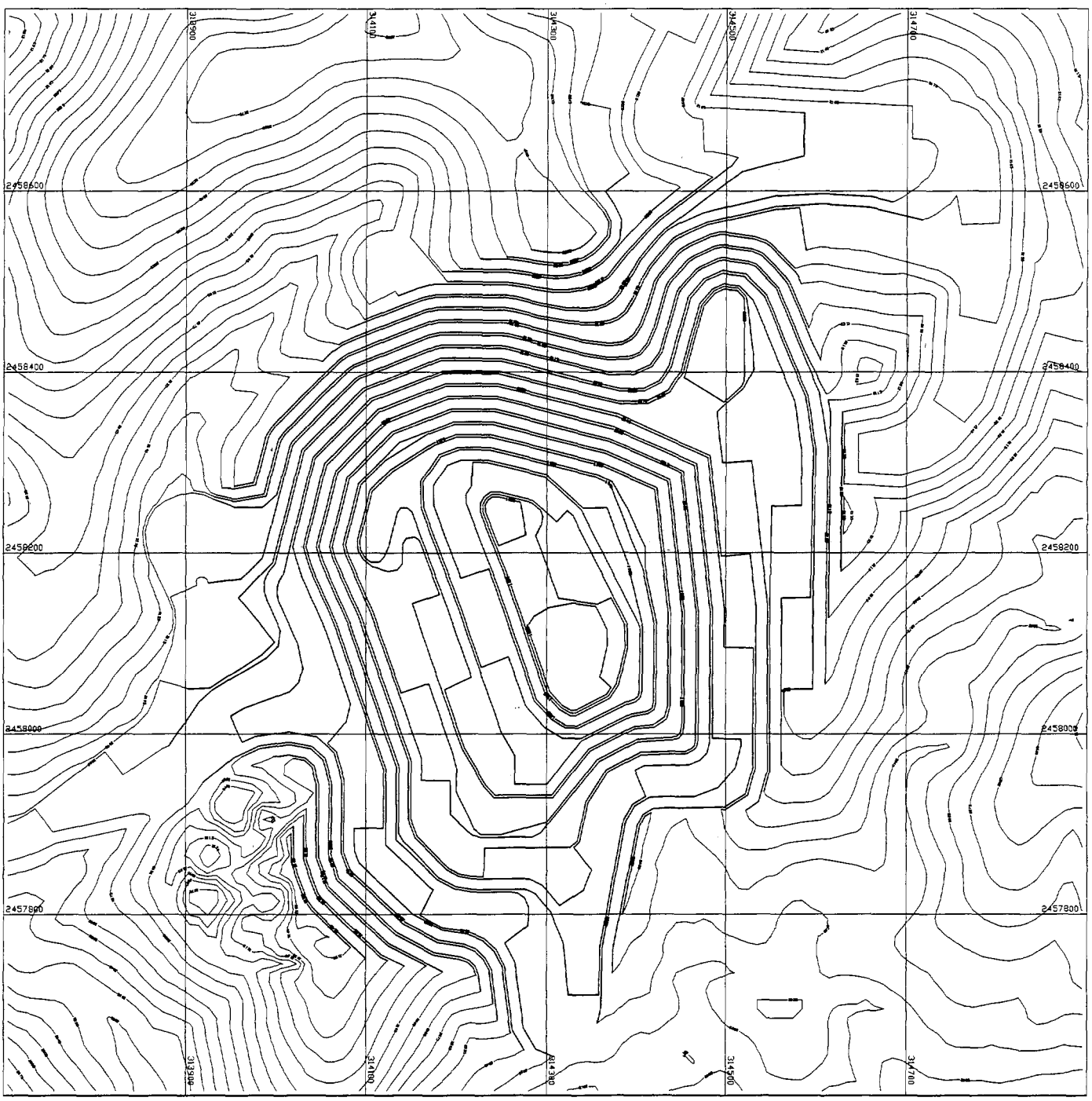
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Figure 4.4 Phase 2 Pit

0 100 200

Scale In Meters



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Figure 4.5 Phase 3 Pit
Ultimate Pit

0 100 200
Scale In Meters

4.2.2 Production Schedule

The schedule was generated based on reserves within the designed pit phases using the following parameters and guidelines:

- Total annual production of ore tonnes of 7 million tonnes.
- Production of total tonnes moved at a target rate not to exceed 20 million tonnes per year.
- An equipment fleet to take advantage of bulk unit cost economies, work within a minimum mining width of 55 meters, minimize loading machines, and keeping equipment needs constant through out the mine life.
- Minimize initial pre-stripping and construct a mine access road to the pit in the Pre-production period.
- Target of 750,000 tonnes of ore in Pre-production for bedding of the leach pad.
- Gradual ramp up of tonnage rates in Pre-production and Year 1.
- Target high grade and low stripping in early period and maintain consistent grades thereafter.
- Mine access road slot on 2070 bench as during pre-production activities.
- Minimize mining shift change over inefficiencies, by utilizing extended hour work shifts.
- No mining on Sundays as prescribed by project permitting.
- Additional production parameters are shown in Table 4.7.

Table 4.7

Production and Equipment Parameters	
Production Parameters	
Annual Ore Production Rate, tonnes	7,000,000
Scheduled Operating Days per Week	6
Scheduled Operating Days per Year	303
Density (loose)	1,852 kg/LCM
Density (Bank)	2,500 kg/BCM
Operating Parameters	
Effective Hours	
Months 1-12	85%
Effective Hours/Shift	8.9 hrs
For 25 cm Hydraulic Shovel:	
Bucket Capacity	25.0 LCM
Fill Factor	95 %
Shovel Loading Cycle (per swing)	0.5 min
Availability (with Sunday maintenance)	85 %
For Cat 793 Haul Trucks	
Capacity	172 tonnes
Availability (with Sunday maintenance)	85 %
Truck Speed Limits *	
Flat, Loaded, Empty	45 KPH
Uphill, Loaded Empty	45 KPH
Downhill Loaded	31 KPH
Downhill Empty	40 KPH
*Truck speeds determined using Caterpillar handbook	

Hydraulic shovels were chosen as primary loading units instead of an all-wheel-loader fleet to reduce loading costs and increase productivity. The use of hydraulic shovels was chosen versus electric shovels to minimize the capital cost and powerline network required for the mine site, provide the flexibility required in mining three phases, and provide a productive match with 172-tonne trucks. The 172-tonne haul trucks were selected as the largest practical truck that would operate in the Cerro San Pedro resource and provide favorable unit costs due to the economies of scale.

In general, no backfilling of the pit is planned for economic purposes, although areas along the edges of the pit will be filled to provide short haul dump access. As mining progresses, minor filling of the pit will be required on a bench by bench basis as underground voids are encountered and to provide temporary access. The mine schedule was completed using an Excel spreadsheet. The detailed mine schedule is summarized by year in Table 4.8.

4.2.3 Annual Plans

A set of annual mining plans was developed using the mining phases discussed in Section 4.2.1 and the production schedule presented in Section 4.2.2. These plans were developed to ensure that there is access to all mining areas, and that there is adequate operating space for the equipment to meet the proposed annual production rates. The pre-mining topography and annual pit maps, are presented as Figures 4.6 to 4.17, illustrate the progression of mining in the Cerro San Pedro Pit as of the end of the selected period. The following paragraphs briefly describe the important aspects of the mining during each period.

Pre-Mining Topography (Figure 4.6)

The current pre-mining area contains existing exploration drill and access roads that will facilitate the construction of new longer roads to accommodate haul trucks, blasthole drills, etc.

Access Construction (Figure 4.7)

A contract miner will be used to establish initial mine access. The contractor will mine 741,000 tons of material that will be placed on the run-of-mine ore haul road. Mining occurs down to the 2070 elevation. All material is placed as fill from the exit, pit at the 2070 elevation, down to the leach pad entrance near the 1980 elevation.

Table 4.8

Annual Production Summary

	Year									
	PP	1	2	3	4	5	6	7	8	TOTAL
Total Material (Ktonnes)	9,406	20,357	17,930	19,407	16,776	16,170	9,282	10,074	1,141	120,543
Waste Material (Ktonnes)	8,746	15,172	12,615	12,752	9,027	8,630	1,850	2,433	72	71,297
Ore Material (Ktonnes)	660	5,185	5,315	6,655	7,749	7,540	7,432	7,641	1,069	49,246
Grade gpt Ag	42.57	22.37	31.00	29.62	22.15	19.59	23.46	16.04	10.69	23.02
Oz Ag Stacked	903,365	3,729,182	5,298,112	6,337,381	5,518,387	4,748,034	5,605,403	3,940,955	367,378	36,448,197
Grade gpt Au	0.44	0.68	0.64	0.51	0.61	0.49	0.57	0.57	0.30	0.57
Oz Au Stacked	9,232	112,879	109,693	109,336	152,288	118,267	136,136	141,101	10,413	899,343
Strip Ratio	13.25	2.93	2.37	1.92	1.16	1.14	0.25	0.32	0.07	1.45

Note: Contractor to mine additional 741,000 tonnes in the Preproduction year to establish access to pit working faces.

Run-of-Mine Ore Haul Road

The ore haul road will require nearly 1.3 million tonnes of waste to complete. Initial pre-strip waste from the mining operation will provide fill material for the haul road. Approximately 200,000 bank cubic meters of road cut outside the pit will be required to construct the run-of-mine haul road. From the bottom of the road cut (2070 m elevation), the road will have a 10% downhill grade to cross the San Pedro Creek bed at the 1960 m elevation. From the creek crossing, the road transitions to a 10% uphill grade in order to clear a large multi-plate culvert crossing that will allow public traffic to Cerro de San Pedro to go under the mine haul road. A contractor will complete the road cut, the creek crossing, and the road crossing during the Pre-production year.

Pre Production (Figure 4.8)

Stripping is the predominant activity occurring during this period. Approximately 660,000 tonnes of ore material will be generated during the second part of the pre production phase. This material will be used to provide crushed bedding material on the pad if its characteristics meet engineered specifications. The strip ratio for this period is 13.25 : 1. Waste material will be used to construct the remainder of the ore haul road, establish the west waste dump, and establish the east waste dump. Mining occurs down to the 2110 elevation. Four haul trucks and one loading machine are required for the pre production period.

Year 1 (Figure 4.9)

Stripping is accelerated during this initial production year of mining in the phase 1 pit, providing approximately 5.2 million tonnes of ore. Phase 2 stripping is started during the period, with total waste being 15,200 million tonnes. High-grade silver is encountered during this initial period averaging 42.57 g/t and 0.44 g/t gold. The waste material is moved to the west and east waste dumps. The stripping ratio for Year 1 is 2.93 : 1. Year 1 production skirts the INAH boundary, but is predominantly north of the important church structure down to the 2060 elevation, while phase 2 is stripped down to the 2160 elevation. The mining fleet is increased to its maximum of eight trucks and two loading machines achieve the production during this period.

Year 2 (Figure 4.10)

Ore mining is shared evenly between Phases 1 and 2 during this period, totaling 5.3 million tonnes. Stripping continues to be a priority as the 2.37 : 1 ratio is only slightly less than the previous year. Phase 2 stripping is over half the total material mined during this period, as phase 1 pit is completed with its low stripping requirements. Pit development is along the INAH boundary from this point on in the life of the

project. Phase 1 is mined to completion to the 2010 elevation, while Phase 2 reaches the 2080 bench. Phase 2 is set to ensure future ore availability. Waste is still split between the east and west waste dumps. All the trucks and both loading machines are utilized to maintain production. Haul profiles are well balanced with long ore hauls and some short waste hauls.

Year 3 (Figure 4.11)

Phase 2 supplies 99% of the ore and is mined through the 2030 bench. Phase 2 continues to be the primary source for both ore and waste, and stripping is started in Phase 3. The stripping ratio falls to less than 2 : 1 and ore production to 6.7 million tonnes nears the targeted 7.0 million tonne annual ore production level. The waste material is placed on the west stockpile taking advantage of the higher productivity to the west while stripping Phases 2 and 3. Mining in Phase 2 completes the 2040 bench while the upper benches on Phase 3 reach the 2150 elevation. The combined stripping ratio for this period is 1.92 : 1. Mining near the INAH boundary is most prominent during this period. All trucks and both loading machines are utilized to maintain production. Haul profiles are still well balanced with the tail end of the stripping program approaching.

Year 4 (Figure 4.12)

Mining continues in both Phases 2 and 3. Pit access is now confined to the permanent exit ramps for waste and ore. Ore production is sustained above the 7.0 million tonnes targeted. Phase 2 provides nearly 70% of the ore produced during the period. Phase 3 stripping is well under way and prepared to yield sustaining ore production the remaining mine life. The 2000 bench is completed in Phase 2, while Phase 3 is stripped down to the 2100 elevation. The strip ratio falls below the overall stripping ratio for the first time during this period. The stripping ratio is 1.16 : 1 for Year 4. Again the operation is truck limited and continues to utilize two loading machines.

Year 5 (Figure 4.13)

Phase 2 mining is complete, yielding around 30% of the ore with almost no stripping requirements. The phased pit is completed at the 1960 elevation. Mining in Phase 3 (ultimate pit) is nearly self-sustaining for ore production and the stripping ratio remains low at 1.14 : 1 for the period. Long ore hauls continue to make the operation truck limited, but mining in both Phases 2 and 3 require the flexibility of two loading machines. The loader utilization begins to decrease during this period.

Year 6 (Figure 4.14)

Phase 3 is a self-sustaining mining area. Mining reaches down to the 1990 elevation, nearly catching up Phases 2 and 3. The long ore hauls drastically reduce utilization of the loading machines, but they are both required to reach production during this period. The low stripping ratio of 0.25 : 1 nearly abandons the waste dump areas and reduces the number of trucks required. This production scenario makes concurrent reclamation available at this time.

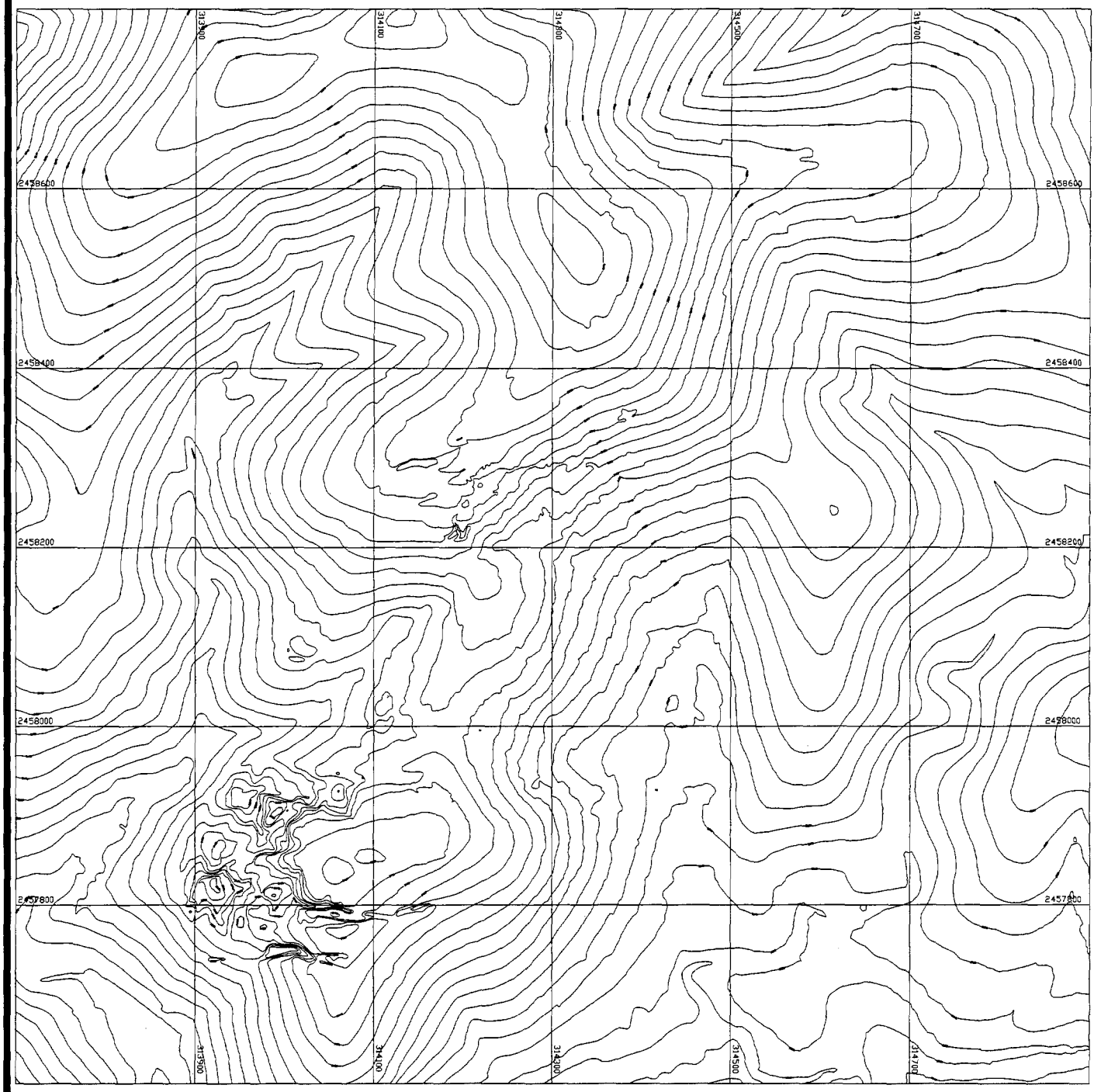
Year 7 (Figure 4.15)

Mining is confined to Phase 3. The stripping ratio average is 0.32 to 1 during this period. The long truck hauls continue to define the production from the operation. Mining takes the pit down to the 1930 bench. From this point, the operation requires only one loading machine throughout the remainder of the mine life and truck requirements are also reduced.

Year 8 (Figure 4.16)

Mining is completed early in the first quarter of Year 8 with the bottom bench at 1890.

A vertical, down-looking aerial photograph of the open-pit mine area is presented as Figure 4.17. This photograph shows the Barreno Hill area to the south, with its significant post-mining activity, and the village of Cerro de San Pedro in the southeast portion of the photograph. The outline of the ultimate, end of Year 8, design pit and the main haul roads within the pit are also shown in this figure.



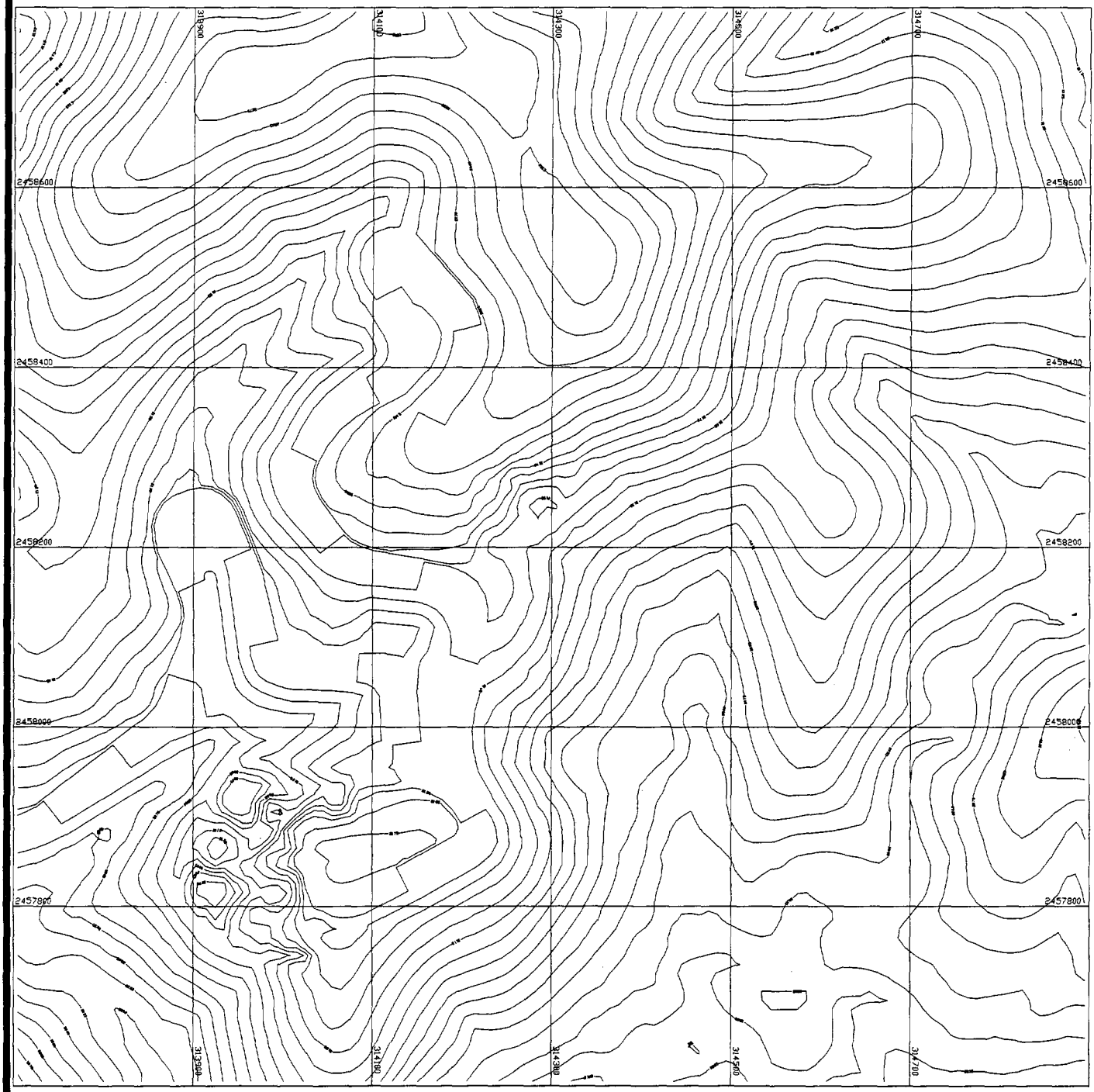
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Figure 4.6 Pre–Mining Topography

0 100 200

Scale In Meters



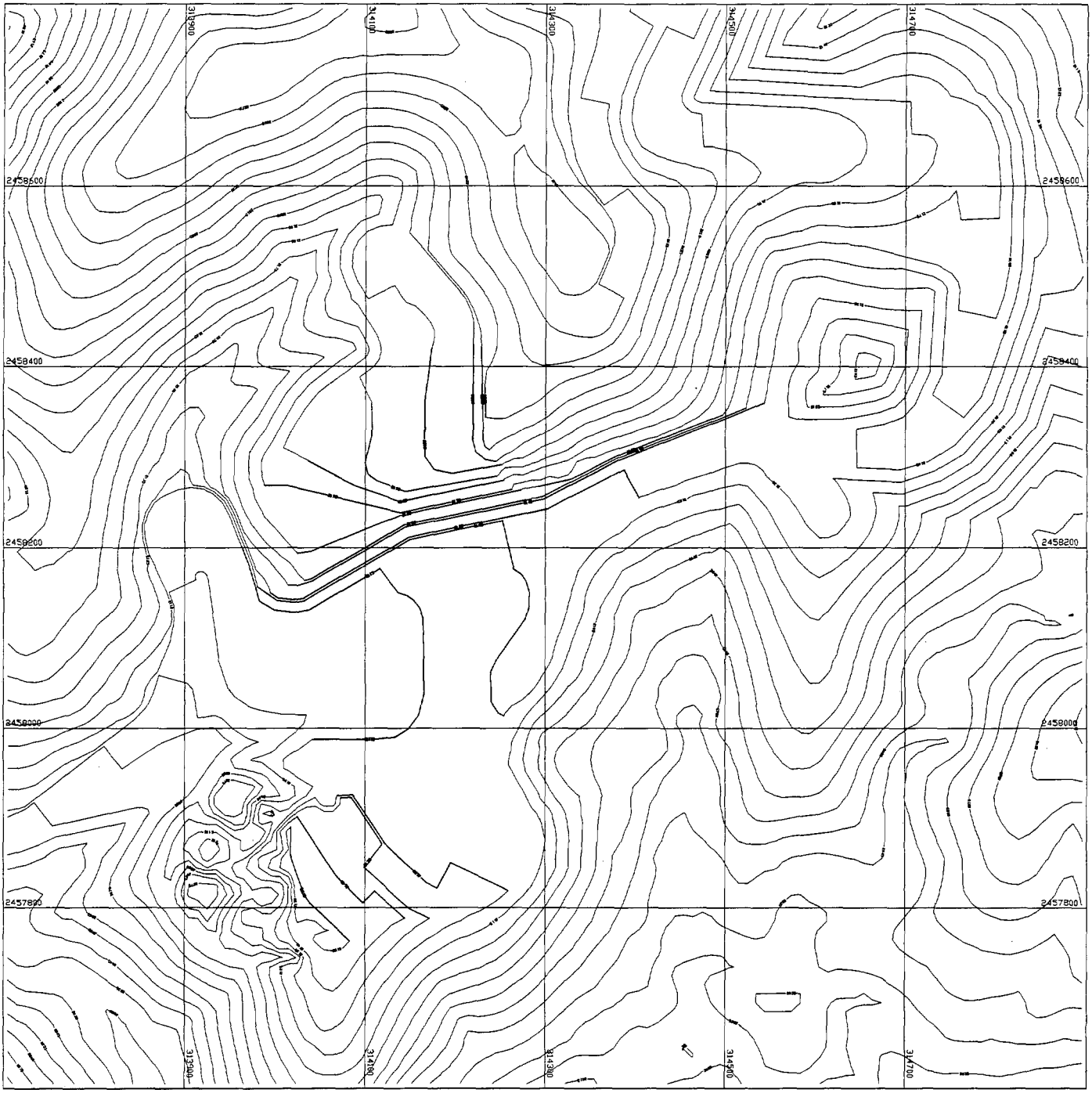
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Figure 4.7 Initial Pit Access Road

0 100 200

Scale In Meters



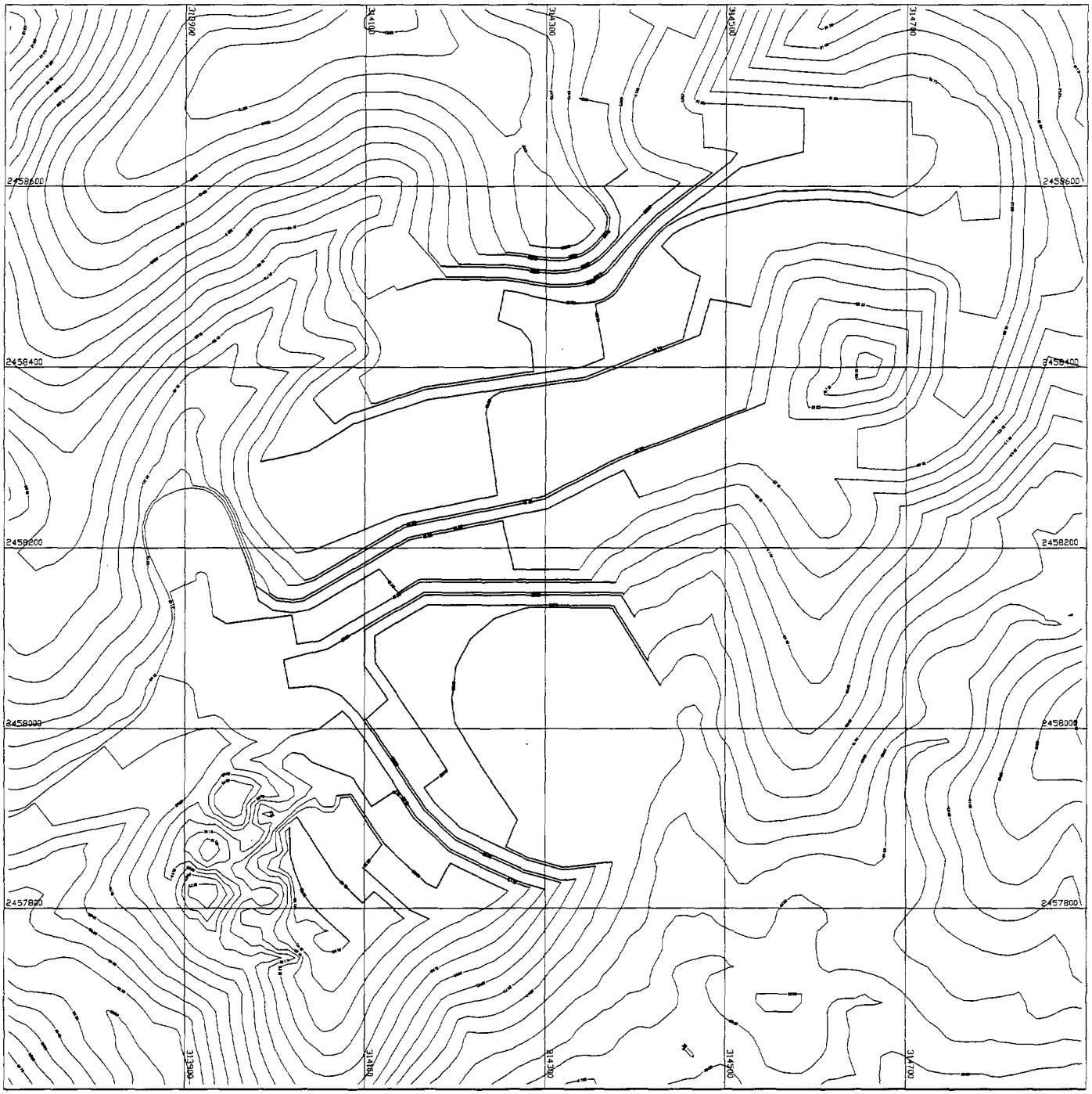
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Figure 4.8 End of Pre-Production

0 100 200

Scale In Meters



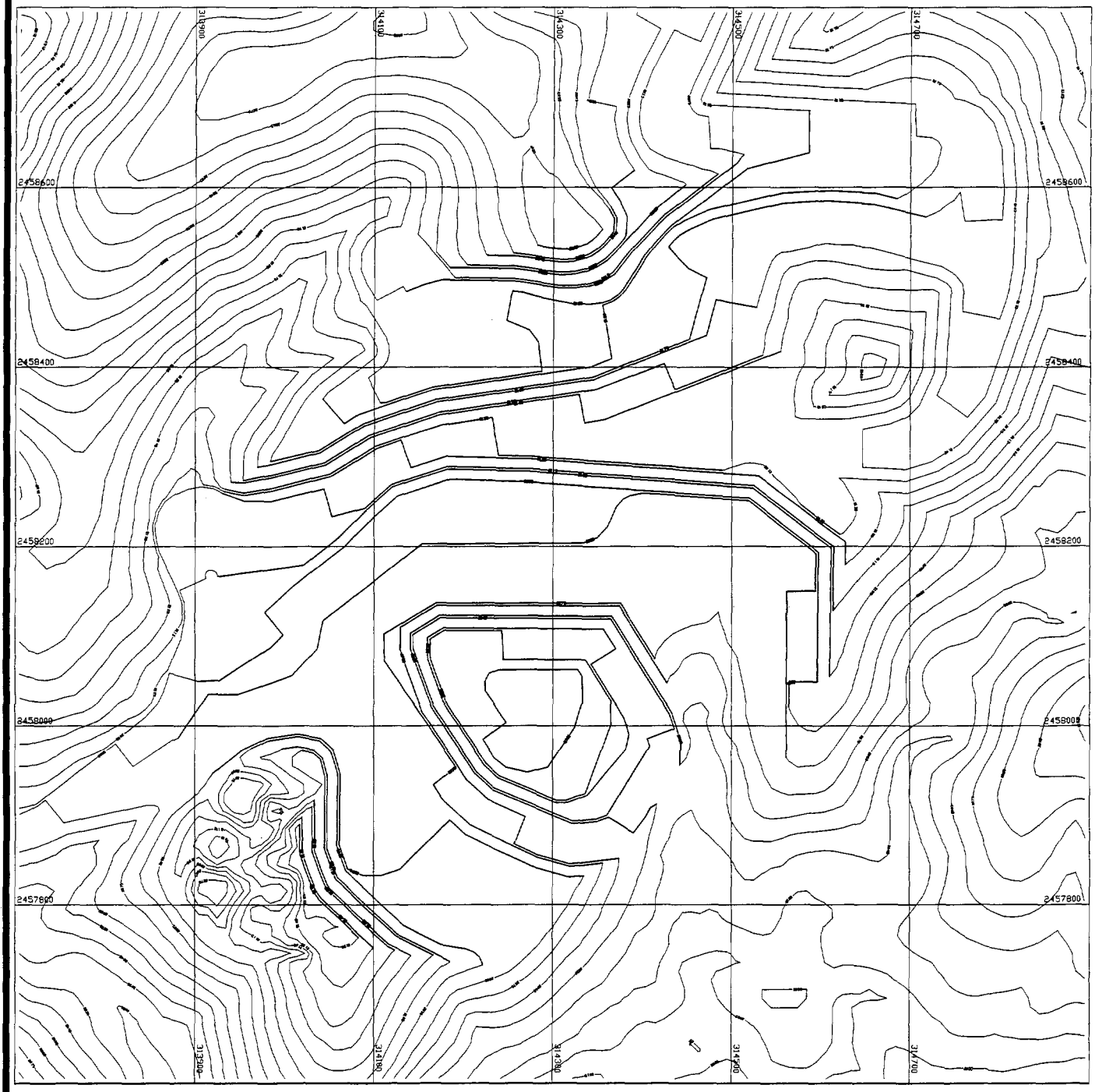
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Figure 4.9 End of Year 1

0 100 200

Scale In Meters



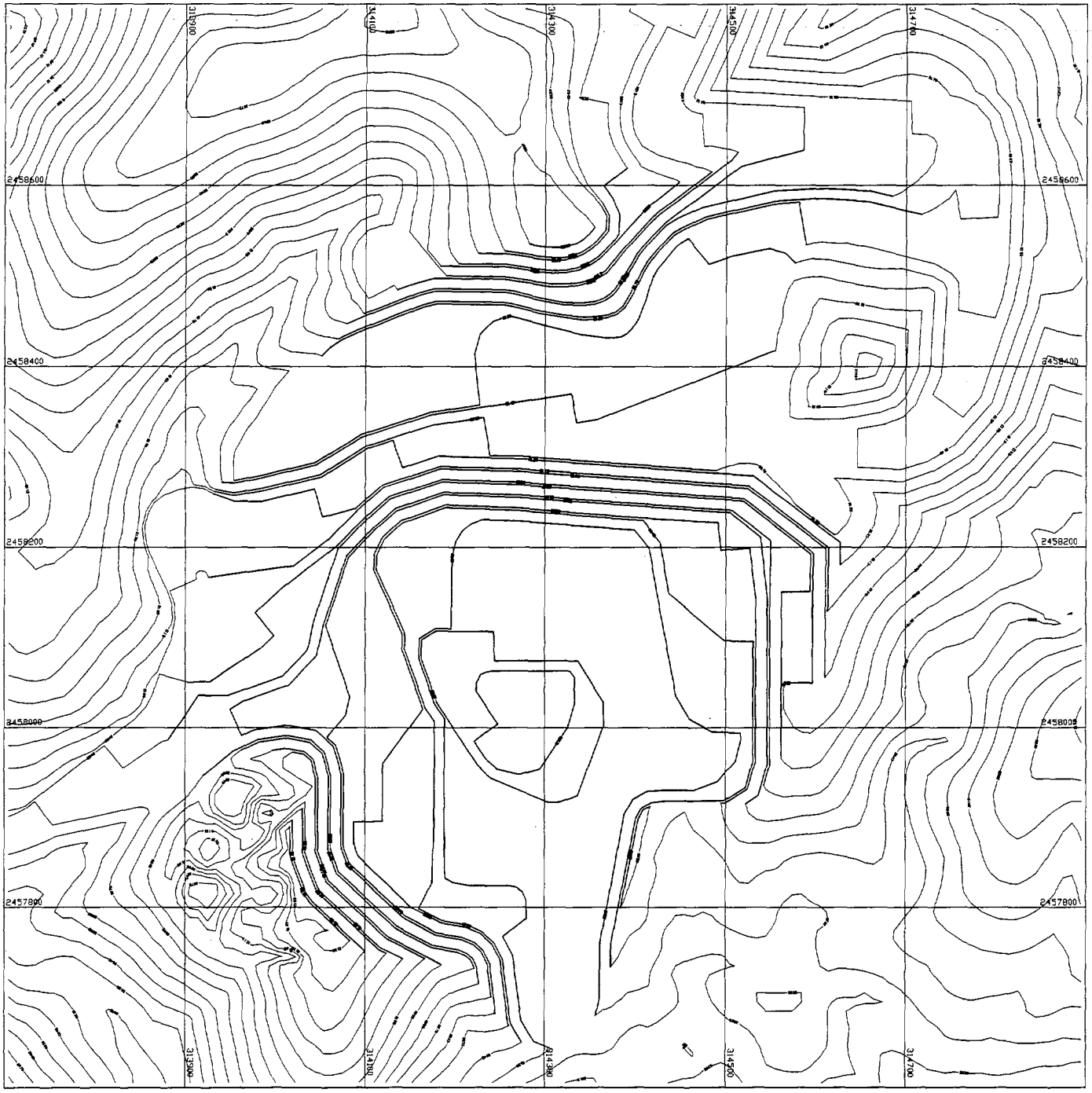
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Figure 4.10 End of Year 2

0 100 200

Scale In Meters



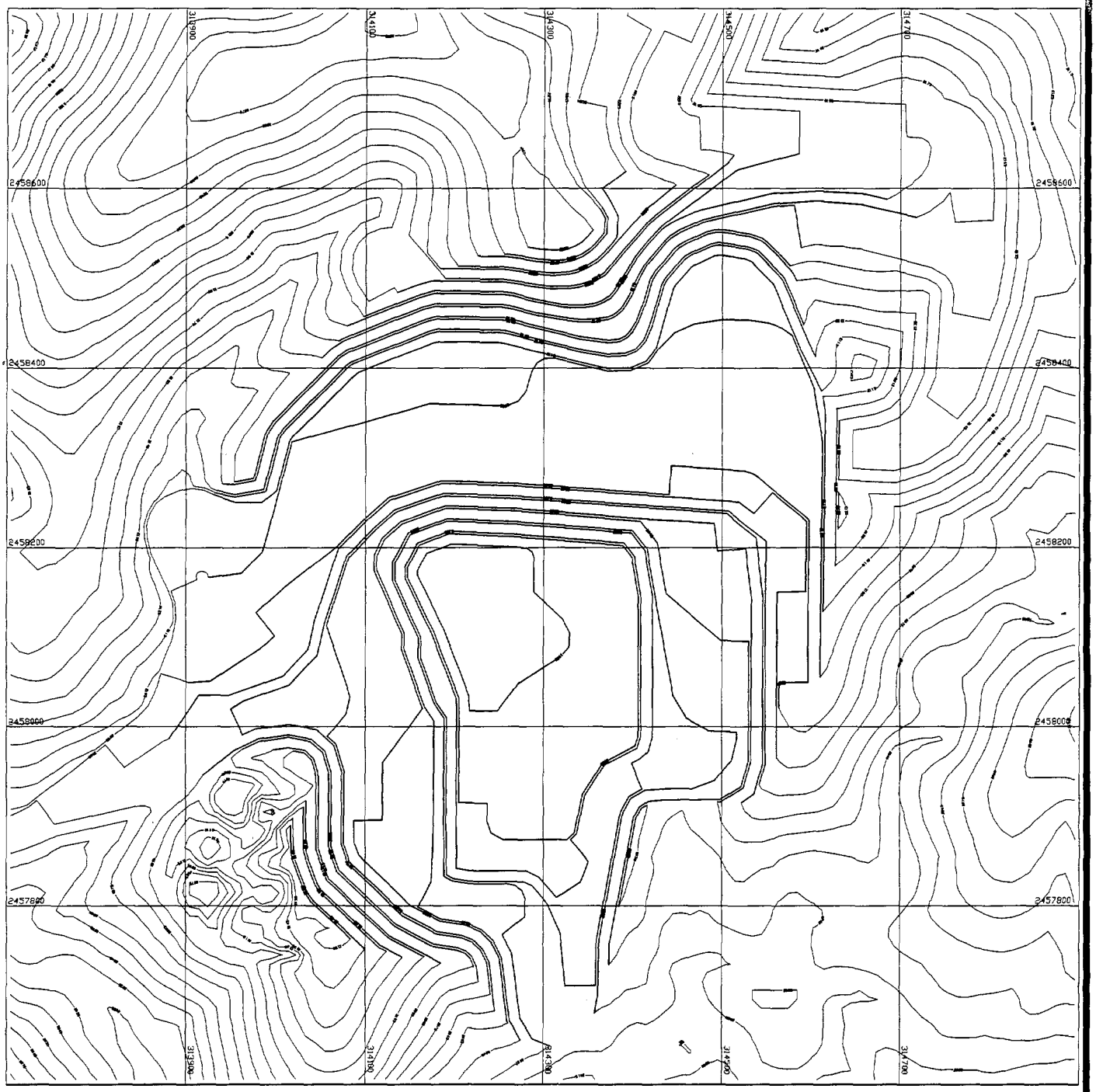
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Figure 4.11 End of Year 3

0 100 200

Scale In Meters



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Figure 4.12 End of Year 4

0 100 200

Scale In Meters



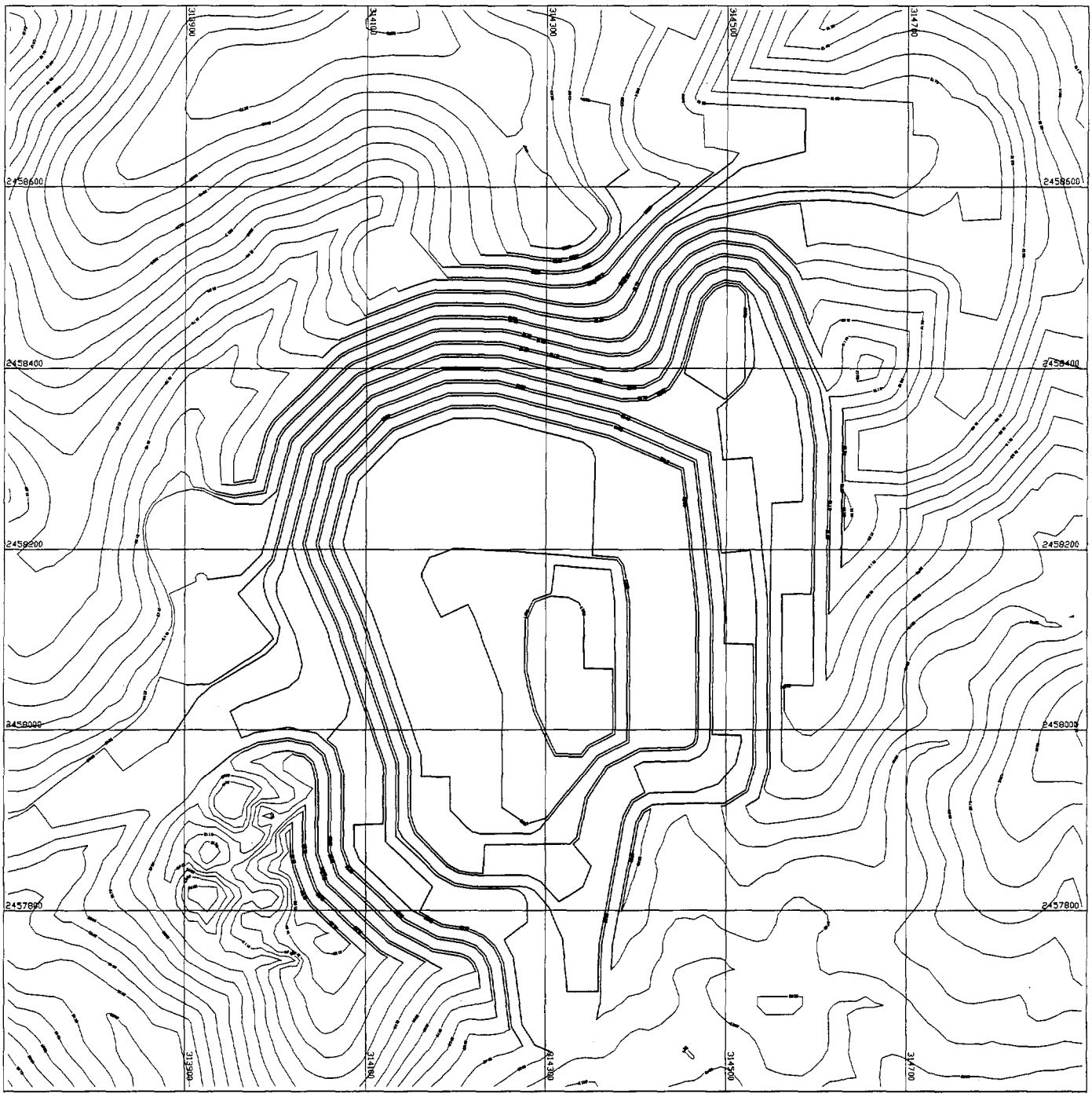
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Figure 4.13 End of Year 5

0 100 200

Scale In Meters



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Figure 4.14 End of Year 6

0 100 200

Scale In Meters



Figure 4.15 End of Year 7



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Figure 4.16 End of Year 8
– Ultimate Pit –

0 100 200
Scale In Meters

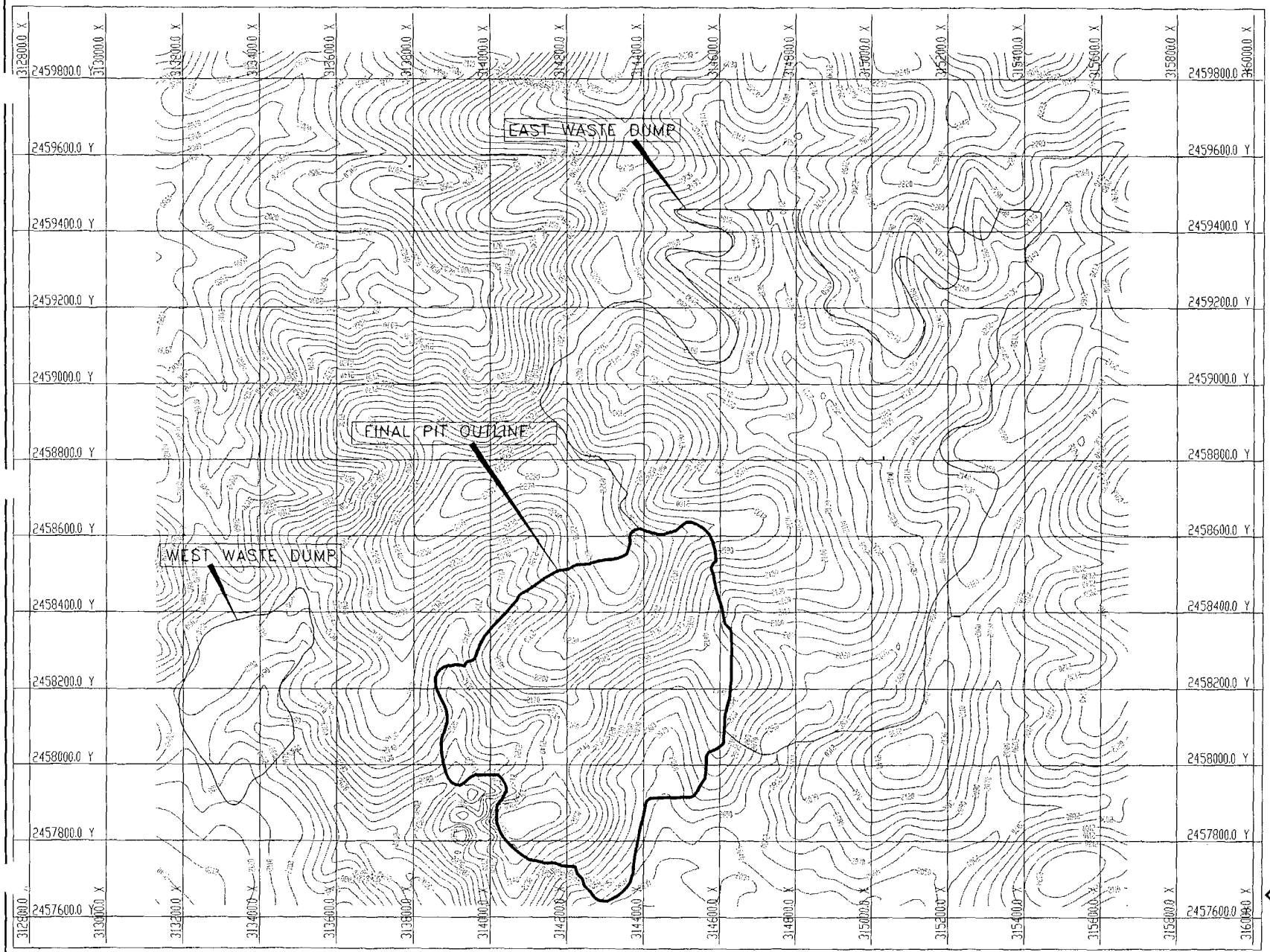


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Figure 4.17 Final (Year 8) Design Pit on Vertical Air Photo Base

0 100 200

Scale In Meters



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Figure 4.18 Mine Area
Original Topography

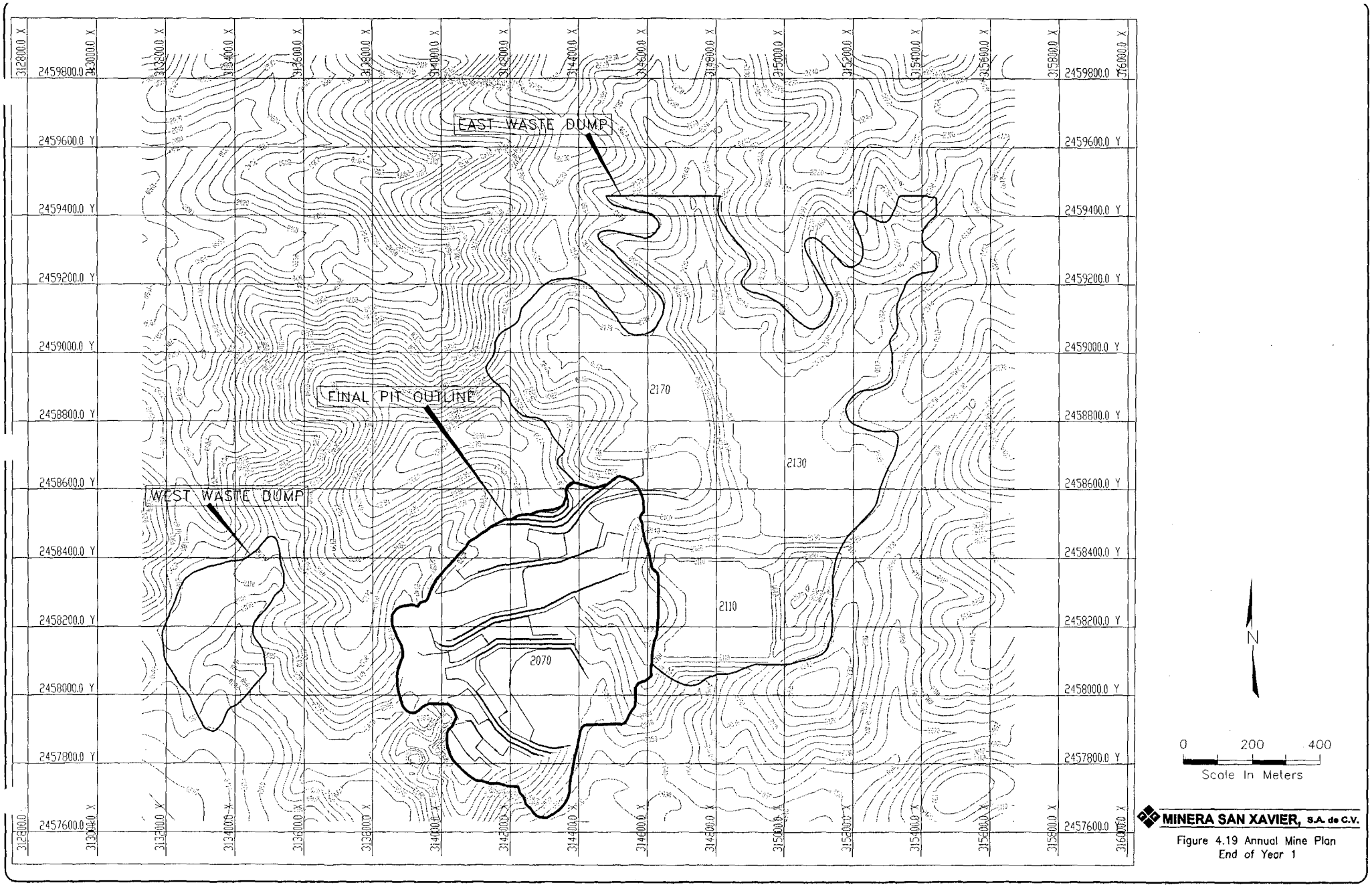
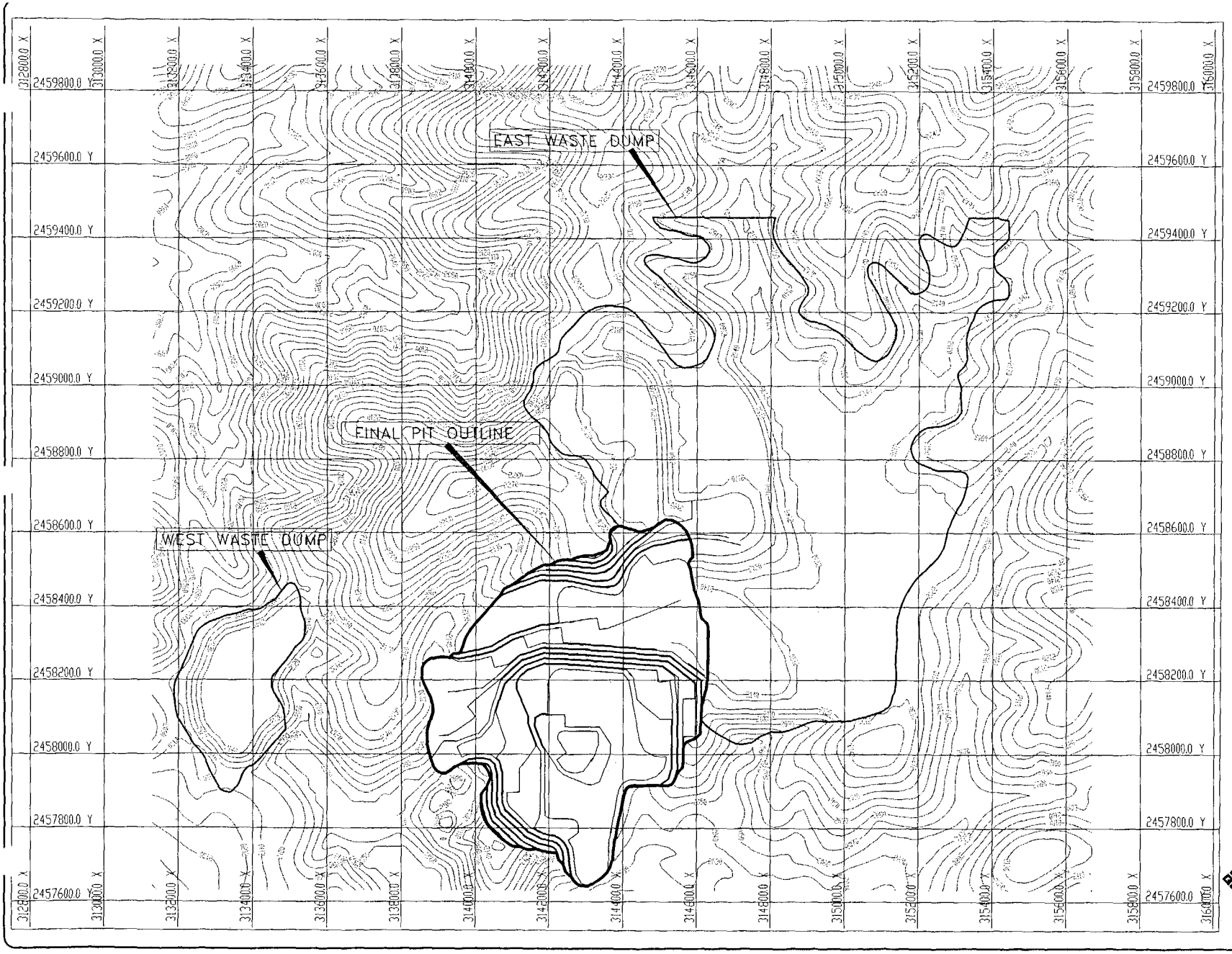
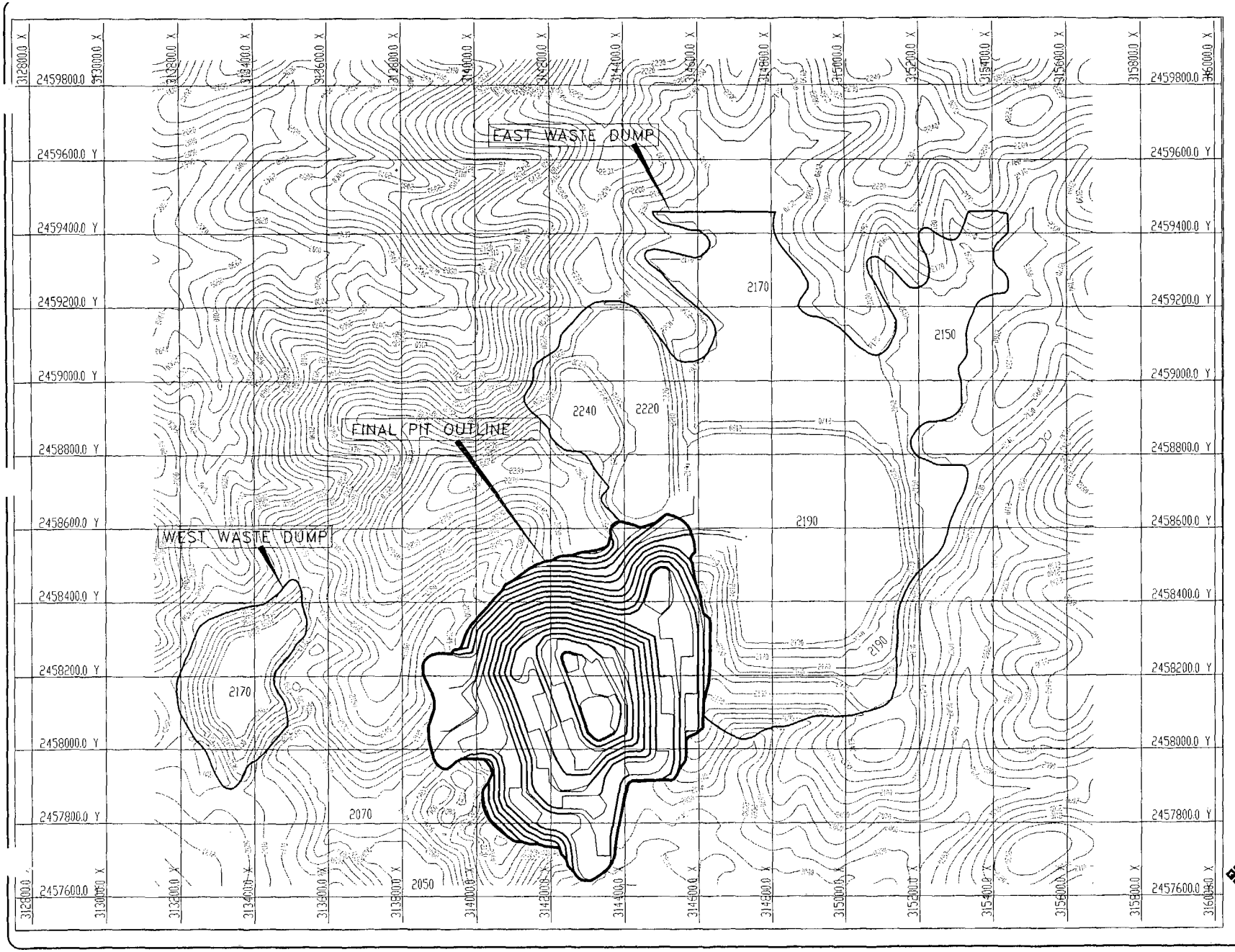


Figure 4.19 Annual Mine Plan
End of Year 1



MINERA SAN XAVIER, S.A. de C.V.

Figure 4.20 Annual Mine Plan
End of Year 3



MINERA SAN XAVIER, S.A. de C.V.

Figure 4.21 Annual Mine Plan
End of Year 8 – Final Pit

4.2.4 Stockpiles and Waste Dumps

A Pre-production stockpile of 660,000 tonnes of ore will be located near the mine exit in the Barreno Hill area. A minimal working stockpile will be maintained until the ore haul road is completed.

Two waste dumps are planned, the east dump, north and east of the pit and a smaller west dump west of the pit, to provide the shortest possible haul distances for waste material. All of the dumps were designed using a density factor of 1.85 tonne per cubic meter and a dump face angle of 37 degrees.

Approximately 60 million tonnes of waste will be placed in the east dump, most of which will be on a flat haul from the pit above the 2120 elevation. The east dump will be constructed from elevations that provide the most efficient hauls. Completion of the 2100 bench will require all waste to be moved from the permanent pit exit. The remainder of the dump will be constructed to its final elevation of 2190.

Approximately 12 million tonnes of waste will be hauled to the west dump when it is advantageous to do so. The use of the west dump will minimize haulage of waste to the east dump, reduce the number of ramps required to keep access available to the east and reduce activity adjacent to Cerro de San Pedro. The west dump will be constructed to the 2170 elevation. Table 4.9 summarizes the waste dump distribution.

Table 4.9

Waste Dump Tonnages by Year

	Crusher Area		Roads, Ramps, & Fill		West Dump		East Dump	
Period	Tonne (000)	Elev. m	Tonne (000)	Elev. M	Tonne (000)	Elev. m	Tonne (000)	Elev. M
Pre-production	--		1,200	1975	--		8,287	2060
Year 1	--	--	--	--	--		15,172	2120
Year 2	--		--		2,000	2140	10,615	2180
Year 3	--		--		7,000	2140	5,752	2130
Year 4	--		--		3,000	2160	6,026	2150
Year 5	--		--		--		8,630	2160
Year 6	--		--		--		1,850	2170
Year 7	--		--		--		2,433	2180
Year 8	--		--		--		72	2190
Total	1,458		1,200		12,000		72,037	

NOTE: Elevation is the average dumping elevation for a particular year.

The original topography of the mine pit and waste dump area is presented in Figure 4.18. The end of Year 1, Year 3, and Year 8 (final pit) topography for the design pit integrated with the east and west waste dumps is presented in Figures 4.19, 4.20, and 4.21, respectively.

A waste rock management plan has been developed to minimize the very slight potential for acid generation within the waste dumps. The plan will involve encapsulating any potentially acid generating material with acid neutralizing waste rock. This plan is described in some detail in Section 11.0.

4.2.5 Blasting Design

The blasting program has been designed to maximize production while minimizing damage to final pit walls and minimizing peak particle velocity, fly rock, and air blast to sensitive structures in the Village of Cerro de San Pedro. The design was developed to maintain an average production rate of 66,000 tonnes of material per day. Prior to operations a comprehensive blasting program will be developed with the assistance of consultants to ensure that all objectives are met.

The blasting program will employ the latest modeling and monitoring technology available. The program will be the responsibility of a Blasting Engineer who will report directly to the Mine Superintendent.

A Contractor/Supplier will perform all blasting activities, other than pattern design and quality control. This contractor will supply all the labor and equipment necessary to deliver and store explosive supplies, load and tie-in blast holes, and assist in the initiation of the blasts. In addition to the aforementioned activities, the contractor will assist in the acquisition of all the necessary permits and in the construction of the magazine site. All supervision and interface issues between the contractor and MSX will be the responsibility of the Blasting Engineer. For feasibility purposes the blasting function was budgeted as though MSX would perform the work.

The basic drill pattern for the primary drill is based on a burden and spacing of 5.6m x 5.6m, a sub-drill of 1m, a hole-diameter of 171 mm, and a bench height of 10 meters. Ammonium nitrate in bulk form will be the primary blasting agent at an average powder factor of 0.15 kg/tonne. Current state of the art initiation and delay technology will be employed to ensure the success of the program objectives.

4.2.6 Grade Control Procedures

The grade control program has three principal objectives:

- To forecast the grade and ore type that will be mined over the forecast period to optimize gold and silver production.
- To insure that the material mined as ore meets the criteria required to be profitable and leachable.
- To provide information to the planning and operations personnel to be able to delineate the ore/waste contacts and maximize economic metal recovery.

To achieve these objectives, bench projection maps will be generated and updated with current assay results. These maps will be employed in mine planning for ore scheduling as well as in the planning of drill patterns and blast design. Quality control procedures will be established for drill-hole sampling, the handling of samples, recording of assay results, mapping of the ore/waste contacts, and the communication and layout of these results in the field. As mining progresses, geological mapping will be updated to insure mine development is based on the best available information.

Blast drill hole sampling procedures that have proven successful at Glamis' operations in California and Nevada will form the basis for the program at Cerro San Pedro Mine, and will be adjusted to reflect the operational differences. The samples will be collected below the deck, bagged and tagged for identification. Samples will initially be taken every five meters and may be increased to ten-meter increments if the nature of the material warrants it. It is anticipated that areas of mining that are clearly in waste or in porphyry ore may lend themselves to ten-meter sample increments. However, the nature of the sedimentary ores may require five-meter increments throughout the mine life.

The ore samples will be assayed for total and cyanide-extractable gold and silver at the on-site laboratory with results made available within 24 hours. These results will be mapped and laid out in the field prior to the advancement of mining the blasted material.

The Engineering Department will have primary responsibility for the Grade Control Program and will use MEDSYSTEM software for data collection, interpretation, ore estimation, ore block generation, grade control reports, etc.

Routine reconciliation analysis of the ore reserves will be performed by comparing the block model grades with the actual drill-hole sample assays. Reserve tonnage will be reconciled by comparing the block model data to the ore truck count.

Ore dilution may occur in three main areas:

- Internal dilution is sub-economic material that is included in the ore block that cannot be economically separated.
- Contact dilution occurs when the ore / waste contact cannot be clearly projected because it is irregular in nature.
- Operational dilution results from operating practices that mix the ore and waste as a result of blasting, overdigging the contacts, poor floor grade control, etc.

Quality standards will be developed in each of these areas to minimize dilution of the ore without negatively impacting the economics of the project.

4.3 Mine Equipment

Mine mobile equipment requirements are based on the annual mine production schedule, mine shift schedules, and the equipment productivity estimates. Table 4.10 lists the major mine equipment fleet requirements.

Table 4.10

Major Mine Equipment Fleet Requirements

Equipment Type	PP	Yr-1	Yr-2	Yr-3	Yr-4	Yr-5	Yr-6	Yr-7	Yr-8
Blast Hole Drill (171mm)	2	2	2	2	2	2	2	2	2
Secondary Drill (102mm)	1	1	1	1	1	1	1	1	1
Hydraulic Shovel (17.2m^3)	0	1	1	1	1	1	1	0	0
Hydraulic Shovel (25.2m^3)	1	1	1	1	1	1	1	1	1
Haul Trucks (172 tonne)	4	8	8	8	8	8	8	7	7
Water Trucks (68,000 lit)	2	2	2	2	2	2	2	2	2
Track Dozer (520 hp)	2	2	2	2	2	2	2	2	2
Tire Dozer (450 hp)	1	1	1	1	1	1	1	1	1
Motor Grader (4.88 m)	2	2	2	2	2	2	2	2	2

4.3.1 Base Production and Operating Parameters

Productivities per operating hour were estimated for the major mine equipment. Factors such as local conditions, labor skill levels and operational needs were considered.

Mine Shift Schedule

The mine work schedule will be two 10.5 hr shifts per day, 6 days per week. The mining operation will be idle on Sundays because of the close proximity of the village. If necessary, it will be possible to work on a restricted basis on Sundays, for example drilling or performing maintenance. The work schedule departs from the most widely used work schedule in Mexico, which is to work forty-eight hours per week over a six-day period. Some operations work twelve-hour shifts when a seven-day per week schedule is utilized.

Productive Time per Day

Productive time per day is the actual time during a 24-hour period that the equipment is effectively producing. Productive time is equal to the total scheduled hours (21 hours per day, 6 days per week) minus nonproductive time.

Scheduled operating time per day is calculated as follows:

Total time per day	21.0 hours
Nonproductive time per day (1)	- 3.2 hours
	17.8 hours

(1) Nonproductive time per day:

Scheduled time per shift	10.50 hours	630 minutes
Start and end of shift delays (15 min. each)		30 minutes
Lunch		30 minutes
Start and end of lunch delays (10 min. each)		20 minutes
Personal delays		15 minutes
Total operating delays per shift	1.6 hours	95 minutes
Total operating delays per day	3.2 hours	

The mine is scheduled to operate 6 days per week and observe 9 holidays during the year for a total of 303 operating days scheduled. The scheduled operating time per year totals 5393 hours (303 days x 17.8 hours per day).

The scheduled operating time is adjusted during the first year of operation to reflect operating conditions during start-up such as operator training and opening working faces in the mine. Table 4.10 summarizes the productive time per day after the application of the scheduled operating delays.

Table 4.11

Effective Operating Time per Day			
Time	**Efficiency Factor During Start-up**	**Productive Time**	**Productive Time**
Month 1 – 6	80%	7.1	14.2
Month 7 – 12	90%	8.0	16.0
Month 13 – L.O.M.	100%	8.9	17.8

Note: (1) Calculation does not reflect the effects of equipment availability.
(2) The calculation assumes "Hot Changes"

Material Characteristics

The material characteristics used for calculating mine equipment productivities were based on a composite average of the rock types within the pit limits. The parameters are summarized below:

Dry Bank Density (tonnes/m^3)	2.5
Material Swell Factor (%)	35
Moisture Content (%)	2
Dry Loose Density (tonnes/m^3)	1.81
Wet Loose Density (tonnes/m^3)	1.85

The moisture content is an estimation of the average moisture contained in the blasted rock. The density of wet loose material was used to calculate haul truck payload limits and travel speeds. All equipment productivity is reported in tonnes per hour.

Operating Requirements

Productivities were calculated using vendor modeling software, vendor estimates, and operating experience with this equipment. The resulting productivities were used to determine the following parameters for each year of the project:

Operating Hours	=	Required Production (tonnes) / Productivity per Unit (tonnes/hr)
Total Fleet	=	Operating Hours / (Productive Hours/Unit) (MA) (UA)
Fleet Utilization	=	Operating Hours / (Total Fleet) (Scheduled Hours/Unit)
Operators	=	(Total Fleet) (# of Crews) (Fleet Utilization)

"Scheduled Hours/Unit" refers to the scheduled operating hours per unit per period of time that the equipment is mechanically able to work.

"MA" refers to the mechanical availability of the equipment. The plan to cease operations on Sunday while performing maintenance allows for this availability throughout the mine life.

"UA" refers to the use of available equipment. It is impossible to use equipment all of the time that it is mechanically available. A use of availability factor of 0.90 was applied to the loading and drilling equipment.

The fleet utilization is equal to the product of MA and UA. The number of units in each fleet was rounded up to a whole unit so that the actual fleet utilization is not greater than the maximum allowable fleet utilization.

"Crew" refers to the number of work crews. The number of operators was based on the number of operating units, not the total number of units in the fleet. The number of operators was rounded from 0.2, i.e., 5.2 = 6 operators.

The total fleet calculation represents the optimum number of units required to meet the production needs during a given period of time. These fleet calculations were used to determine the initial, sustaining and replacement capital costs.

4.3.2 Equipment Operating Requirements

This section contains the equipment productivity estimates and equipment requirements for drilling, loading, and hauling. Table 4.12 summarizes the scheduled operating time per year per major piece of equipment. The scheduled hours do not consider mechanical availability, utilization of equipment or inefficiencies experienced during the operations startup period.

Table 4.12

Annual Operating Time (hours)			
Time Period	**Drills**	**Shovels**	**Haul Trucks**
Preproduction	4584	4584	4584
Year 1	5,393	5,393	5,393
Year 2	5,393	5,393	5,393
Year 3	5,393	5,393	5,393
Year 4	5,393	5,393	5,393
Year 5	5,393	5,393	5,393
Year 6	5,393	5,393	5,393
Year 7	5,393	5,393	5,393
Year 8	5,393	5,393	5,393

Note: Hours do not account for Mechanical Availability and Use of Availability
Hours do reflect the various productive hours
The duration of the Preproduction period is12 months

It should be noted that the hours during the Pre-production period reflects less productive hours; months 1 - 6 assume 80% efficiency and months 7 – 12 assume 90% efficiency. Year 1 through the life of the mine assume 17.8 operating hours per day

Drilling

The drilling fleet was determined based on a production rate of 20 Mt per year, the highest scheduled annual production rate, 10 meter bench heights, a drill pattern of 5.6-m x 5.6-m, and a subdrill of 2-m. In addition to the aforementioned, the mechanical availability and the use of that available time has been considered. Drilling operations can be tailored to meet a variety of production levels by adding a 7^{th} day to the operating schedule. Table 4.13 summarizes the drilling input parameters used to calculate drill fleet requirements within the standard 17.8-hour per day operating schedule.

Table 4.13

Blasthole Drill Productivity and Operating Parameters		
Parameters	**Primary Drill**	**Secondary Drill**
Hole Diameter (mm)	171	102
Bench Height (m)	10	10
Subdrill (m)	2	2
Burden (m)	5.6	3.75
Spacing (m)	5.6	3.75
Bank Density (tonnes/m^3)	2.5	2.5
Rock Mass per hole (tonnes)	784	352
Drilling Rate (m/hr)	35	25
Rock Mass Drilled per hour (tonnes/hr)	2287	733
Scheduled Drill Hours per Year	5393	5393
Mechanical Availability (MA)	85 %	85 %
Use of Availability (UA)	90 %	90 %
Annual Drill Production per Machine (tonnes)	9,433,975	3,025,473

Scheduled hours are based on an effective operating hour. An effective two feet of sub-drill is assumed due to the amount of broken ground that will be encountered in the pit area.

On average 90 percent of the annual production will be achieved by the larger diameter drills and 10 percent of the annual production will be achieved by the smaller diameter secondary drill. In the case of an annual production rate of 20 million tonnes of material, approximately 18 million tonnes will be drilled out by utilizing the two large diameter drills with the remaining 2 million tonnes being drilled by the smaller diameter drill. The smaller diameter drill will be required to drill for initial development, for production purposes and in specialty mining areas. The specialty mining areas include: initial bench development, wall control drilling, secondary breakage of the mine rock, working around underground voids and in areas where specialized drilling and blasting around the INAH boundary is required. It will be necessary to be drilling in two phases at any given time for the majority of the mine life and the production criteria by which the fleet will service requires 2 large diameter and 1 small diameter machines.

Loading (Hydraulic Shovels)

Shovel requirements were based on loading 172-tonne haul trucks, (Caterpillar 789 trucks were used for the modeling), shift productivity of 17.8 hours per day, a mechanical availability of 85 percent and a use of availability that varies during the initial mine life. Table 4.14 summarizes the input parameters used.

Table 4.14

Theoretical Shovel Productivity		
Bank Density (tonnes/m^3)	2.5	
Swell Factor (%)	35	
Loose Density (tonnes/m^3)	1.85	
Bucket Capacity (m^3)	25.2	17.2
Bucket Fill Factor	0.92	0.92
Tonnes per Pass	42.9	29.3
Passes per Truck	4	6
Tonnes Per Truck	172	172
Time per Pass (min.)	0.50	0.50
Load Time per Truck (min.)	2.0	3.0
Truck Spot Time (min.)	0.5	0.5
Total Load Time (min.)	2.5	3.5
Loads per Hour	20.3	14.5
Tonnes per Hour	3491	2494
Scheduled Hours per Year	5,393	5,393
Mechanical Availability (MA)	85	85
Use of Availability (UA)	90	90
Annual Loading Capacity	14,400,375	10,287,750
Combined Shovel Production (tonnes/yr)	24,688,125	

The loading fleet consists of a 17.2 m^3 and a 25.2m^3 hydraulic shovel that operationally match the 172-tonne truck fleet. This loading fleet has 20% more capacity than the maximum annual planned production, affording some decision making for utilizing used equipment and being confident of meeting the planned production. The shovel fleet will be responsible for loading all the planned tonnage throughout the mine life. The initial pre-production year and the last two years of production require only one loading machine.

Hauling

The mine haulage fleet will consist of 172-tonne haul trucks. Truck productivity was calculated based on operating characteristics of the 172-tonne trucks and a close estimate of the actual haul profile the trucks will operate on an annual basis. The haulage productivities were estimated using a haulage software simulation program. Additional verification of truck fleet requirements was provided by Unit Rig, where an electric truck fleet was simulated on the expected hauls for up to 20 million tonnes of annual production. An 8 to 9 truck fleet was estimated. Favorable short waste hauls opportunities were not included in this study and will be incorporated as part of optimizing the mine plan in the future. An availability of 85 percent was used in the simulation to reflect the possibility of a used truck fleet being utilized at the Cerro San Pedro operation. Haulage fleet maintenance will occur during the planned Sunday down time.

Haulage profiles were developed for each bench of each phase from the annual plans. Loading, hauling, lime addition and dumping components were an integral part of the estimated haulage times. Production utilizing annual available hours was then estimated by logically sequencing the phased pits over the life of the project.

The decision to utilize 172-tonne haul trucks was based on Glamis operating experience with this class of truck and the economies of scale by using the largest practicable equipment to reduce unit costs. Caterpillar who manufactures this size of mechanical drive haul trucks has an established presence in Mexico.

The mine productivity required and the haul profiles associated with the annual production dictated the truck fleet requirements. Table 4.15 summarizes the haulage fleet requirements based on total modeled truck hours. The one-way haulage profiles averaged 1,500 meters for ore and 1,900 meters for waste. The vertical lift was from 0 to a maximum of 290 meters.

Table 4.15

Haulage Fleet Requirements				
Period	Total Tonnes	Required Truck Hours	Scheduled Hours per Truck	Fleet Required
Preproduction	9,406	13,710	3507	3.91
Year 1	20,357,000	32,794	4125	7.95
Year 2	17,930,000	32,410	4125	7.86
Year 3	19,407,000	32,663	4125	7.91
Year 4	16,775,000	32,145	4125	7.79
Year 5	16,170,000	29,467	4125	7.14
Year 6	9,282,000	25,623	4125	6.21
Year 7	10,074,00	27,520	4125	6.67
Year 8	1,141,000	3,738	620	6.02

Note: Required Truck Hours are based on Haulage Simulation Model.
Scheduled hours reflect annual operating time and the effect of mechanical availability and use of availability. Number of units required in the fleet were rounded up to the next higher number on 0.2 units, i.e., 1.2 unit equals 2 units.

Mine Support Equipment

Mine support equipment refers to the portion of major mine equipment which is not directly responsible for production, but which is scheduled on a regular basis. Table 4.10 includes the support equipment fleet requirements and includes water trucks, track and tire dozers, and motor graders. Fleet sizes were estimated based on the operational need for a particular piece of equipment. For example, one tire dozer is assumed to support shovel operations in two active mining phases with its mobility. Two large track dozers are required to tend waste dumps and heap area preparation. Because of the fairly extensive haul road network and site access roads, two water trucks and a total of two motor graders are also required.

4.3.3 Maintenance

The maintenance program is based on the premise that planned maintenance, trades training, and a structured and disciplined preventative maintenance program will result in positive impacts on production and spending. The maintenance management system currently in place at Glamis' California and Nevada operations will be the model used to provide this service at Cerro San Pedro. The system is integrated with materials management and cost accounting to optimize work scheduling and cost management. Maintenance planning personnel will administer the system.

Maintenance training will be a key element to the success of the project. Expatriate trainers with proven experience on the equipment that will be used will establish skills training programs for national employees. These programs will include factory-sponsored training, modular training based on equipment manufacturers programs, and scheduled training for all tradesman. The hydraulic shovels are of particular concern as there are few in Mexico and the experienced vendor support will more than likely have to be provided from outside the country.

Scheduled maintenance activities will include preventive maintenance programs based on engine hour intervals and major component pre-failure replacement. Preventive maintenance will include fluid changes, inspection, and wear part build-up. Mobile equipment will be repaired in the truck shop and track equipment will be repaired in the field. Due to the proximity to the city of San Luis Potosi the option of using local shops to perform maintenance of light vehicles will be pursued.

Two lube/fuel trucks will transport the supplies to the equipment in the field to minimize production delays. A fuel station will be constructed near the truck shop for fueling equipment coming out of the shop, refilling the fuel truck, and for fueling gasoline fired vehicles.

Maintenance will be scheduled seven days per week, twenty-four hours per day. The scheduled shutdown of mining operations on Sundays will provide an opportunity to repair key production equipment without negatively impacting production.

4.3.4 Maintenance Facilities

The maintenance facilities are located just south of the administration office close to the main entrance to the site include the following:

- Truck Shop (735 m^2)
- Maintenance office and tool room space (80 m^2)
- Warehouse (228 m^2)
- Wash and fueling area

The location and general arrangement of the maintenance facilities is shown in Figure 2.2 in Section 2.0 of this study.

Truck Shop

The high-bay building section consists of three 10 m x 18 m bays. The building is a fabricated metal-clad steel structure resting on a concrete foundation. The dimensions of the bays in this shop are dictated by the requirement for 172 tonne haul trucks. A concrete pad (18 m x 30 m) in front of the building will be used for haul truck tire changing. The shop is divided as follows:

- Haul truck maintenance and repair bays (2 bays), and;
- Dozer bay for tracked equipment (1 bay).

The shop floor is sloped to a drainage trench, which traverses the length of the shop with discharge to the water-oil reclaim system providing a safeguard against any accidental spillage from equipment. Automatic lube systems consisting of retractable hose reels, located between the high-bays, are piped to a centralized storage area outside the building. In addition to lubricant dispensing, an air compressor and small tools are provided. No machine tool type equipment is supplied, as these works will be performed in the San Luis Potosí area.

Wash & Fuel Pad

A 12 m x 21.5 m wash pad, located near the truck shop, is provided to wash major mobile equipment prior to maintenance works. The concrete slab is designed to accommodate the 172-tonne mine haul trucks. The wash bay is equipped with high-pressure cold water units. Drainage of wastewater is through a trench connected to the adjacent settling basin and water-oil reclaiming system.

A 12 m x 21.5 m fuel pad next to the wash pad is provided to fuel mobile equipment. The floor is sloped to catch any spillage and channel it through a trench connected to the adjacent settling basin and water-oil reclaiming system for the wash pad.

An above-ground fuel storage system next to the fuel pad contains (2) 80,000 liter horizontal tanks and a 20,000 liter gasoline tank stores gasoline for small vehicles. The design criteria takes into account that fuel is readily accessible from the San Luis Potosi area and can be conveniently transported to the site. Tanks are to be provided by the fuel supplier, PEMEX. For safety reasons and environmental considerations, the fuel and gasoline tanks are supplied with 110 percent containment spillage protection. The area is lined with a membrane that is sandwiched between 150 mm layers of sand with 300 mm gravel topping for piping spillage and haul truck overfill protection.

Warehouse

The warehouse building is adjacent to the truck shop and includes shelving space for hardware-type material. The warehouse design criteria takes into consideration that agreements will be made with local suppliers to minimize inventories on site.

4.3.6 Explosive Storage

All the materials required for the blasting program will be stored on site in a federally approved magazine. This magazine site will be a secure facility composed of two magazine buildings and ammonium nitrate storage bins. One of the magazine buildings will be used to store all the class 'A' explosives. The other magazine building will be used to store a limited amount of 'bagged' ammonium nitrate and small-diameter cartridge explosives. The inventory levels will vary based on the production levels at any given time. The magazine site will be sized to handle the inventory required during the highest production period. The location of the explosive storage facility is shown in Figure 2.2 in Section 2.0 of this study.

All of the permits required for the blasting program will be held in the name of the company. All quality control and quality assurance issues related to the storage of blasting materials will be the responsibility of the company. The blasting materials inventory and supply will be the responsibility of a blasting contractor.

4.4 Self-Mining versus Contract Mining

Request for proposals for contract mining were received in September 2000 from MK Gold Company, N.A. Degerstrom, Inc., Sococo de Costa Rica, Thiess South America, - and two Mexican companies - Ingenieros Civiles Asociados, S.A. and Exploraciones y Triturados del Pacifico, S.A. The bids were requested for two cases, hauling ore directly from the pit and staking on the heap leach pad and hauling ore from the pit to a primary crushing facility just outside the pit.

In early 1997, bids for contract mining were also received from six U.S.-based companies and four Mexican companies. Table 4.16 summarizes the bid proposals received from the companies in 2000 and compares them with their bids received in 1997. In both cases the bid proposals were based on preliminary mine plans and without a site visit, and therefore should be considered budgetary in nature. The contract mining option will be evaluated as a trade-off to capital in the economic model.

Table 4.16

Contract Mining Bid Comparison						
2000 BIDS						
ITEM	MK GOLD	DEGERSTROM	SOCOCO	THIESS	ICA	EXTRIPASA
Tonnes per Cubic Meter	2.5	2.0	2.3	2.5	2.5	2.0
Run-of-Mine						
$ per Cubic Meter	$3.56	$2.76	$4.27	$3.13	$3.24	$9.60
$ per Tonne	$1.42	$1.38	$1.86	$1.25	$1.30	$4.80
Crusher						
$ per Cubic Meter	$3.26	$2.16	$3.97	$2.83	$2.64	$6.00
$ per Tonne	$1.30	$1.08	$1.72	$1.13	$1.06	$3.00
Mobilization (Lump Sum)	$2,186,150	$1,200,000	$2,350,000	$2,002,510	$2,741,602	$525,329
Demobilization (Lump Sum)	$1,110,325	$500,000	$700,000	$400,000	$2,247,919	$466,545
Clearing & Grubbing ($/hect.)	$136	$2,500	$1,000	$281	$288	$3,892
Topsoil ($/BCM)	$0.72	$1.65	$2.20	$4.01	$0.89	$2.20
1997 BIDS						
ITEM	MK GOLD	DEGERSTROM	SOCOCO	THIESS	ICA	EXTRIPASA
Tonnes per Cubic Meter	2.5	2.4			2.4	
Run-of-Mine						
$ per Cubic Meter						
$ per Tonne						
Crusher						
$ per Cubic Meter	$1.70	$1.78			$2.14	
$ per Tonne	$0.68	$0.74			$0.89	
Mobilization (Lump Sum)	$6,616,000	$1,500,000			$1,666,000	
Demobilization (Lump Sum)	$903,000	$250,000			$2,000,000	
Clearing & Grubbing ($/hect.)	$108	$2,500			$154	
Topsoil ($/BCM)	$0.39	$1.65			$0.64	

4.5 Mine Personnel

The mine personnel required to operate the Cerro San Pedro Mine are composed of the salaried staff in the mine operations, maintenance, engineering, and geology departments as well as the daily rate personnel required to operate and maintain the equipment, and provide technical support such as grade control and surveying. A Mexican national contractor under the direct supervision of CSP personnel will perform the blasting operation. This contractor will be selected when the project receives final construction approvals.

Safe and productive operating techniques, as well as standards of quality need to be established at the onset of the operation and maintained at a high level throughout the project life. In order to ensure that this takes place, a number of key supervisory and management positions will be filled by expatriate personnel. *These positions will be nationalized as soon as practical.*

The daily paid personnel will be composed of Mexican Nationals. It is the intention to fill as many of the positions as possible from the communities surrounding the project before recruiting from the rest of the country. The start-up phase of the operation will require a core of experienced personnel to ensure a safe and productive operation and assist in the training of the less experienced personnel.

4.5.1 Salaried Staff

The mine-related salaried staff requirements by operating year for the Cerro San Pedro Project can be seen in Table 4.17. Expatriate staff will be utilized in key positions to establish necessary programs and training standards. It is the intent to minimize the number of expatriate staff both in numbers and in duration of assignment. Specific training and development programs will be put in place to prepare national staff for the replacement of expatriates at the earliest appropriate time. Selection criteria of national staff will include the potential to advance into key positions initially occupied by expatriates.

Table 4.17

Mine, Maintenance, and Engineering Departments - Salaried Staff										
Job Title	Pre-strip	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Years 9-12
MINE OPERATIONS										
Mine Superintendent	1	1	1	1	1	1	1	1	1	0
Mine Trainer	X	X	1	1	1	1	1	1	1	0
Shift Supervisor	3	3	3	3	3	3	3	3	3	1
Drill / Blast Supervisor	1	1	1	1	1	1	1	1	1	0
Drill / Blast Engineer	1	1	1	1	1	1	1	1	1	0
Mine Clerk	1	1	1	1	1	1	1	1	1	0
Total	8	8	8	8	8	8	8	8	8	1
MAINTENANCE										
Maint. Superintendent	X	X	X	X	X	1	1	1	1	0
Maint. General Foreman	1	1	1	1	1	1	1	1	1	1
Maint. Supervisor	4	4	4	4	4	4	4	4	4	0
Maint. Planner	1	1	1	1	1	1	1	1	1	0
Maint. Trainer	X	X	X	X	1	1	1	1	1	0
Maintenance Clerk	1	1	1	1	1	1	1	1	1	0
Total	9	9	9	9	9	9	9	9	9	1
ENGINEERING										
Chief Engineer	X	X	X	X	X	1	1	1	1	0
Senior Engineer	1	1	1	1	1	1	1	1	1	1
Mine Engineer	1	1	1	1	1	1	1	1	1	0
Mine Technician	1	1	1	1	1	1	1	1	1	0
Senior Geologist	1	1	1	1	1	1	1	1	1	0
Surveyor	1	1	1	1	1	1	1	1	1	0
Systems Engineer	1	1	1	1	1	1	1	1	1	0
Total	7	7	7	7	7	7	7	7	7	1
Grand Total - Expatriate	4	4	3	3	3	0	0	0	0	0
Grand Total - National	20	20	21	21	21	24	24	24	24	3
Grand Total - Salary	24	24	24	24	24	24	24	24	24	3
X = Expatriate										

4.5.2 Daily Paid Personnel

All daily paid personnel will be Mexican Nationals. As much as possible, these employees will be hired from Cerro de San Pedro and the surrounding areas. It is recognized that there is a requirement to have a core of experienced personnel in the operating and trades occupations in order to effectively commence mining and train less qualified personnel. Selection criteria for each job will be established, including experience, skill, education, etc., and a firm hiring protocol established. Training manuals and modular training programs will be established for each position.

The training and development of personnel during the early stages of the mining operation will impact the productivity per man-hour and therefore the manpower requirement. To account for this, a factor is applied to equipment operation that assumes 85% efficiency at the commencement of the project ramping up to a full 17.8-hour day after the twelfth month. The planned daily paid manpower for the Mine and Maintenance Departments is summarized in Tables 4.18 and 4.19.

Table 4.18

Mine Department Daily Paid Personnel										
	Year									
Job Title	**PP**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9-12**
Drill Operators	6	7	7	7	7	6	5	3	2	0
Shovel Operators	3	6	6	6	6	6	6	3	2	0
Haul Truck Operators	12	24	24	24	24	24	24	21	18	0
Water Truck Operators	3	6	6	6	6	6	6	6	3	1
Track Dozer Operators	6	6	6	6	6	6	6	6	6	1
Wheel Dozer Operators	3	3	3	3	3	3	3	3	3	0
Motor Grader Operators	3	5	5	5	5	4	4	4	3	1
Blaster*	1	1	1	1	1	1	1	1	1	0
Blasting Labor*	4	4	4	4	4	4	4	2	2	0
General Labor	3	3	3	3	3	3	3	3	3	0
Total Mine Operations	44	65	65	65	65	63	63	52	43	3

*Blasting crew positions will be company employees, but assist blasting contractor personnel.

Table 4.19

Maintenance Department Daily Paid Personnel										
	Year									
Position	PP	1	2	3	4	5	6	7	8	9-12
Senior Tradesmen	8	8	8	8	8	8	8	8	8	1
Tradesmen	12	12	12	12	12	12	12	12	12	0
Servicemen	8	8	8	8	8	8	8	8	8	1
Laborers	4	4	4	4	4	4	4	4	4	0
Total Maintenance	32	32	32	32	32	32	32	32	32	2

4.6 Mine Operating Cost

Mine operating costs are based on the anticipated requirement to operate and maintain the planned equipment fleet. Labor rates used in the cost estimates are a result of recent wage and salary surveys

conducted in the San Luis Potosi area for similar work including equipment operation, maintenance and support staff positions. Equipment operating costs were established by applying hourly costs estimated by reviewing equipment manuals, researching costs at similar operations, and from experience. The technical support required to generate mine plans, maximize ore recovery, optimize grade control, and give support to the production functions are planned for in the Engineering Department.

4.6.1 Basis of Estimate

Total operating costs for the mining operation by year are summarized by area in Table 4.20. The cost breakdown by mining area (drill, blast, load, haul, etc.) includes the total cost for that element of the mining operation including labor, parts and consumables, and associated maintenance costs. Mining costs over the life of the project, including Preproduction, are estimated to total $78,762,000.

Table 4.21 summarizes the overall mining cost per tonne of material mined on an annual basis. The costs are inclusive of labor, parts and consumables, and associated maintenance costs. The largest cost area is hauling, which comprises some 31% of the total mine cost of $0.653 per tonne. Other significant areas of mine cost include roads and dumps (17%), blasting (13%), loading (11%), and drilling (8%).

4.6.2 Labor Costs

Table 4.22 presents the average annual staffing levels, salaries, and total labor costs for Pre-production through Year 8. Years 9-12 are related to mine closure and reclamation activities. The cost of labor for the mine area is divided in three main categories: daily paid personnel, national salary staff, and expatriate salary staff. Relocation costs for expatriate employees are also included. Table 4.23 summarizes the cost for the mining in these four categories. Due to the high cost of expatriates, every attempt will be made to nationalize as many of the expatriates at the earliest appropriate time. This objective must be in balance with the need for productivity and quality of work. Overall, labor costs account for 20 percent of the total mining costs over the life of the operation.

Table 4.20

Summary of Mine Operating Costs ($ Total)										
Period	Total Production (Ktonne)	Total Cost per Period ($000)								
		Drill	Blast	Load	Haul	Roads	Mine Gen.	Mtce. Gen.	Engr.	Total
PP	9,406	535	816	674	1,501	1,401	321	881	576	6,705
YR1	20,357	1,076	1,725	1,456	3,480	1,591	321	929	846	11,423
YR2	17,930	956	1,523	1,276	3,442	1,591	321	929	786	10,823
YR3	19,407	1,029	1,646	1,386	3,467	1,591	265	929	801	11,113
YR4	16,775	899	1,427	1,190	3,416	1,591	265	804	736	10,327
YR5	16,170	869	1,377	1,160	3,150	1,591	265	718	721	9,851
YR6	9,282	522	805	708	2,747	1,450	265	670	552	7,719
YR7	10,074	547	857	739	2,914	1,450	265	670	571	8,013
YR8	1,141	98	116	142	553	858	185	479	351	2,784
Total	120,542	6,529	10,292	8,731	24,671	13,113	2,471	7,010	5,941	**78,758**
Percent of Total Cost		8%	13%	11%	31%	17%	3%	9%	8%	100%

Notes: Drill, Load, Haul, Roads (Roads & Dumps), include operating labor & supplies and maintenance labor & repair parts and supplies..

Mine Gen. Mine General - Mine operations salaries plus mine overhead.

Mtce. Gen. Maintenance General - Maintenance salaries and repair parts and supplies for small vehicle and support equipment.

Engr. Engineering - Salaries and supplies for engineering department.

Table 4.21

Summary of Mine Operating Costs ($/Tonne Total Material)										
Period	Total Production (Ktonne)	Total Cost per Period - Ore and Waste ($ per Tonne)								
		Drill	Blast	Load	Haul	Roads	Mine Gen.	Mtce. Gen.	Engr.	Total
PP	9,406	0.057	0.087	0.072	0.160	0.149	0.034	0.094	0.061	0.713
YR1	20,357	0.053	0.085	0.072	0.171	0.078	0.016	0.046	0.042	0.561
YR2	17,930	0.053	0.085	0.071	0.192	0.089	0.018	0.052	0.044	0.604
YR3	19,407	0.053	0.085	0.071	0.179	0.082	0.014	0.048	0.041	0.573
YR4	16,775	0.054	0.085	0.071	0.204	0.095	0.016	0.048	0.044	0.616
YR5	16,170	0.054	0.085	0.072	0.195	0.098	0.016	0.044	0.045	0.609
YR6	9,282	0.056	0.087	0.076	0.296	0.156	0.029	0.072	0.059	0.832
YR7	10,074	0.054	0.085	0.073	0.289	0.144	0.026	0.067	0.057	0.795
YR8	1,141	0.086	0.101	0.125	0.485	0.752	0.162	0.420	0.308	2.440
Total	120,542	0.054	0.085	0.072	0.205	0.109	0.021	0.058	0.049	**0.653**
Percent of Total Cost		8%	13%	11%	31%	17%	3%	9%	8%	100%

Notes: Drill, Load, Haul, Roads (Roads & Dumps), include operating labor & supplies and maintenance labor & repair parts and supplies..

Mine Gen. Mine General - Mine operations salaries plus mine overhead.

Mtce. Gen. Maintenance General - Maintenance salaries and repair parts and supplies for small vehicle and support equipment.

Engr. Engineering - Salaries and supplies for engineering department.

Table 4.22

Mine, Maintenance, and Engineering Annual Manpower Costs - Salaries						
Position	**No.**	**Base**	**Base X No.**	**% Burden**	**Burden**	**Total**
MINE						
Mine Superintendent	1	$34,794	$34,794	0.55	$19,137	$53,931
Mine Trainer (X)	1	$56,000	$56,000	0.55	$30,800	$86,800
Shift Supervisor	3	$17,482	$52,446	0.55	$28,845	$81,291
Drill/Blast Supervisor	1	$24,995	$24,995	0.55	$13,747	$38,742
Blast Engineer	1	$17,482	$17,482	0.55	$9,615	$27,097
Mine Clerk	1	$7,000	$7,000	0.65	$4,550	$11,550
Mine Total	8	$157,753	$192,717		$106,694	$299,411
MAINTENANCE						
Maint. Superintendent (X)	1	$85,000	$85,000	0.55	$46,750	$131,750
Maint. General Foreman	1	$28,996	$28,996	0.55	$15,948	$44,944
Maint. Supervisor	4	$17,482	$69,928	0.65	$45,453	$115,381
Maint. Planner	1	$10,807	$10,807	0.60	$6,484	$17,291
Maint. Trainer (X)	1	$62,000	$62,000	0.55	$34,100	$96,100
Maint. Clerk	1	$7,000	$7,000	0.65	$4,550	$11,550
Maintenance Total	9	$211,285	$263,731		$153,285	$417,016
ENGINEERING						
Chief Engineer (X)	1	$70,000	$70,000	0.55	$38,500	$108,500
Senior Engineer	1	$21,000	$21,000	0.55	$11,550	$32,550
Mine Engineer	1	$18,000	$18,000	0.55	$9,900	$27,900
Mine Technician	1	$13,200	$13,200	0.55	$7,260	$20,460
Senior Geologist	1	$21,000	$21,000	0.55	$11,550	$32,550
Surveyor	1	$13,200	$13,200	0.55	$7,260	$20,460
Systems Engineer	1	$14,400	$14,400	0.55	$7,920	$22,320
Engineering Total	7	$170,800	$170,800		$93,940	$264,740
Grand Total	**24**	**$539,838**	**$627,248**		**$353,920**	**$981,168**

(X) Expatriate Employee

Table 4.23

Mine, Maintenance, & Engineering Annual Manpower Costs					
Period	Expatriate Staff	National Staff	Daily Rate	Relocation Cost	Total
PP	423,150	769,593	567,000	80,000	1,839,743
YR1	423,150	769,593	700,000	0	1892,743
YR2	336,350	812,993	763,000	20,000	1,932,343
YR3	336,350	812,993	819,000	0	1,968,343
YR4	309,350	826,493	910,000	20,000	2,065,843
YR5	0	826,493	735,000	0	1,561,493
YR6	0	826,493	707,000	0	1,533,493
YR7	0	826,493	637,000	0	1,463.493
YR8	0	826,493	623,000	0	1,449,493
YR9-12	0	104,591	21,000	0	125,591
Total	1,828,350	7,402,228	6,482,000	120,000	15,832,578
% of Total	11	47	41	1	100

4.6.3 Consumables and Supplies

The major supplies in the mine will include lubes, fuel, explosives, tires and ground engaging tools (G.E.T.) for the mining equipment. The suppliers of these items will be involved in the permitting, installation, implementation and management of the infrastructure and systems to support their deliveries at the mine site. For example the selected explosive supplier will participate in the permitting and construction of the storage facility, provision of the storage bins if appropriate, managing inventories, and providing the equipment and supplies for down-the-hole service.

The suppliers of the majority of the parts and all the major supplies will have offices located in the San Luis Potosi area, which is within 25 kilometers of the mine. Their proximity to the mine will result in reduced inventory in the mine warehouses and improved deliveries. The parts suppliers are willing to adjust their inventories to meet our needs and participate in on-site consignment inventories.

4.6.4 Equipment Operating Costs

Table 4.24 summarizes the estimated operating costs per hour for the mine major equipment. These costs represent the average direct operating cost per hour over the equipment life. They include operating labor and supplies plus maintenance labor and repair parts.

Table 4.24

Summary of Operating Costs per Hour	
Equipment Type	**Cost per Hour ($)**
Blast Hole Drill (171mm)	100.25
Hydraulic Drill (102mm)	40.83
Hydraulic Shovel (25.23m^3)	221.70
Hydraulic Shovel (17.23m^3)	185.88
Haul Truck (172 Mt)	99.29
Water Truck (Cat 777)	43.28
Track Dozer (Cat D10)	63.90
Wheel Dozer (Cat 834)	55.65
Motor Grader (Cat 16G)	35.75

Actual operating costs are based on the annual operating hour for the major equipment area: Drilling, Loading, Hauling, Roads and Dumps, with the remainder of the support equipment with less than full utilization are grouped under Maintenance General. Maintenance General includes operating labor and supplies (includes fuel) plus maintenance labor and repair parts for small vehicle and support equipment. This equipment include lube/fuel trucks, small construction equipment, cranes, forklifts, pickups, etc. The yearly average cost in this category is estimated at $477,500.

4.7 Mine Capital Cost

Capital costs were developed for the mine major, mine support, light vehicles, and stationary equipment. The capital costs are a combination of new and used equipment quotes. It should be noted that the current condition of the mining industry has resulted in a very favorable used equipment market.

Table 4.25 summarizes the total capital cost for mining equipment. The costs include the cost of the machine, brokerage costs, freight costs, and the cost to dismantle and erect the unit. The costs utilized for used equipment reflect the current 'used' market values obtained from several industry sources and

publications. Mine initial capital cost is $22,709,469, with $296,000 as sustaining capital in Year 4 for the replacement of light vehicles and support equipment, plus $2,674,500 in Year 5 for major equipment rebuilds, for a total of $25,679,969 for mine capital equipment over the life of the mine.

Table 4.25

Mine, Maintenance, and G&A Capital Costs Summary			
Capital Item	**PP & Year 1**	**Year 4 & 5**	**Total Project**
Mine Major Equipment	17,830,000	2,674,500 (Y-5)	20,504,500
Mine Support Equipment	417,400	120,000 (Y-4)	537,400
Maintenance Equipment	1,124,000	72,000 (Y-4)	1,196,000
G&A Equipment	473,000	104,000 (Y-4)	577,000
Maint. Facilities & Mine Roads	2,865,069		2,865,069
Total Capital	**22,709,469**	**2,970,500**	**25,679,969**

Table 4.26 is a detailed list of the initial mine capital. Much of the initial capital cost is associated with mobile equipment, most of which is purchased used. Mine initial capital costs for the Pre-production and Year 1 is $22,709,469, which includes $473,000 for general G&A department costs, but which are included here for simplicity.

It is anticipated most of the mobile equipment remaining in Year 8 will be sold at an estimated value of 15 percent of its original acquisition price in Year 9.

Table 4.26

Mine, Maintenance, and G&A Initial Capital Costs ($)				
Equipment	**Model**	**Unit Cost**	**# of Units**	**Total**
Major Mine Equipment				
Blast Hole Drill – New	DML	576,000	2	1,152,000
Secondary Drill – New	ECM-590	321,000	1	321,000
Shovel (27.2m^3) – Used	RH200	4,900,000	1	4,900,000
Shovel (17.2m^3) - Used	RH170	1,600,000	1	1,600,000
Haul Truck – Used	Cat 789	650,000	8	5,200,000
Water Truck – Used	Cat 777B	439,000	2	878,000
Track Dozer (570hp) – New	Cat D10N	800,000	2	1,600,000
Tire Dozer (450hp) – Used	Cat 834B	339,000	1	339,000
Motor Grader – Used	Cat 16H	270,000	2	540,000
General Mobilization/erection	All	Varies	1	1,300,000
Subtotal Mine Major Equip.				**17,830,000**
Mine Support Equipment				
Flatbed Truck	Ford F-550	34,000	2	68,000
Pickup Truck 4x2	Ford F-150	24,000	5	120,000
Flatbed Pickup 4x2	Ford F-150	23,000	2	46,000
Backhoe 4x4	Case	129,000	1	129,000
Light Towers – Used	Max/Light	6,800	8	54,400
Subtotal Mine Support Equip.				**417,400**
Maintenance Equipment				
45 Ton Crane – Used	P&H	162,000	1	162,000
23 Ton Boom Truck – Used	Int. 4900	106,000	1	106,000
5 Ton Lift Truck – Used	Avail.	23,000	1	23,000
3 Ton Lift Truck – Used	Avail.	14,000	1	14,000
Tire Handler – Used	Avail.	88,000	1	88,000
Lube/Fuel Truck – Used	Int. 4900	110,000	2	220,000
Service Truck – New	Ford F-550	60,000	2	120,000
Pickup Truck 4x2	Ford F-150	24,000	3	72,000
Diesel Welder – Used	Miller	9,000	3	27,000
Electric Welder (300 amp) - New	Miller	3,000	5	15,000
Air Compressor (185 cfm) - Used	Avail.	12,500	1	12,500
Pressure Washer(5 - 10gpm) - New	Avail.	7,250	2	14,500
Shop Tools – New	Avail.	250,000	1	250,000
Subtotal Maintenance Equip.				**1,124,000**
G & A Equipment				
Man Bus (20 Passenger) - New	Avail.	52,000	2	104,000
Pickups (Transport 4x2) - New	Ford F-150	24,000	11	264,000
Ambulance – Used	Avail.	15,000	1	15,000
Radios/Two Way – New	Motorola	1,000	90	90,000
Subtotal G & A Equip.				**473,000**
Maint. Facilities & Mine Roads				
Truck Shop/ Warehouse/Fuel/Wash		826,000	1	826,000
Run of Mine Haul Road		1,007,169	1	1,007,169
Explosive Storage		131,900	1	131,900
Pit Working Access (741k tonnes)		900,000	1	900,000
Subtotal Facilities & Roads				**2,865,069**
Total Initial Capital				**22,709,469**

5.0 METALLURGICAL INVESTIGATIONS

5.1 Introduction

The Cerro San Pedro project has been the subject of extensive metallurgical investigations that have evaluated the performance of a variety of ore types subjected to various processing flowsheets. The metallurgical testing described within this section of the feasibility report has supported the conclusion that the Porphyry Oxide and Begonia Limestone ore types, which represent 97% of the total ore to be processed, can be processed effectively with conventional run-of-mine heap leach technology. These conclusions are further supported by the independent data reviews by McClelland Laboratories, Inc. and Kappes, Cassiday & Associates, which are included in Section 5.1 and 5.2 of the Appendix.

In addition to the Porphyry Oxide and Begonia Limestone, metallurgical information for other possible ore types has been included in this section of the feasibility report. The current mine plan calls for processing minor quantities of Hospital and Barreno Limestones, which in total represent less than 3 per cent of the project ore tonnage and recoverable gold and silver ounces. Other ore types may be mined and processed in the future if precious metals prices rise sufficiently, but are not considered in this feasibility study.

Metallurgical information for crushed ore processing has also been included herein. Conventional run-of-mine heap leaching for Porphyry Oxide and Begonia Limestone is the preferred processing option evaluated in this feasibility study. Fine crushing of the ore may become economic at a later date in the event that precious metals prices increase substantially.

Table 5.1 below summarizes the key metallurgical parameters developed as a result of the metallurgical investigations described herein.

Table 5.1

KEY METALLURGICAL PARAMETERS BY ORE TYPE

Ore Type	% Recovery (run-of-mine)		Reagent Consumption (kg/t)	
	Au	Ag	NaCN	Pebble Lime
Porphyry Oxide	75	40	0.30	3.0
Begonia Limestone	55	25	0.30	3.0
Barreno Limestone	20	5	0.30	3.0
Hospital Limestone	35	10	0.30	3.0
Weighted Average	**70.5**	**35.7**	**0.30**	**3.0**

5.1.1 Background

Metallurgical testing was conducted to provide adequate data to conduct a feasibility evaluation of the project, based on a large tonnage, low grade, heap leach development plan. The purpose and objectives of the metallurgical test work performed for the Cerro San Pedro project were to:

- provide metallurgical characterization and understanding of the project ore reserves,
- identify significant or fatal flaws,
- establish metallurgical and plant design criteria,
- establish an operating strategy,
- define metal recoveries, leach kinetics, reagent consumption and operating costs, and
- establish criteria for a closure plan.

Test work has been performed at a number of laboratories and includes the standard bottle roll test, column testing, cyanide solubility testing, diagnostic leaches, ore characterization testing, high solids bottle stirs (HSBS) for heap simulation, solution chemistry analysis, and mineralogical examination. Tests were conducted at various particle sizes and test parameters. All references to particle size (e.g. 13mm, etc.) throughout Section 5.0 refer to the 80% passing particle size, unless otherwise stated. Figure 5.1 is a flow chart representing the progression of test work from standard Phase I tests, followed by more specific tests in Phase II to better characterize metallurgical behavior.

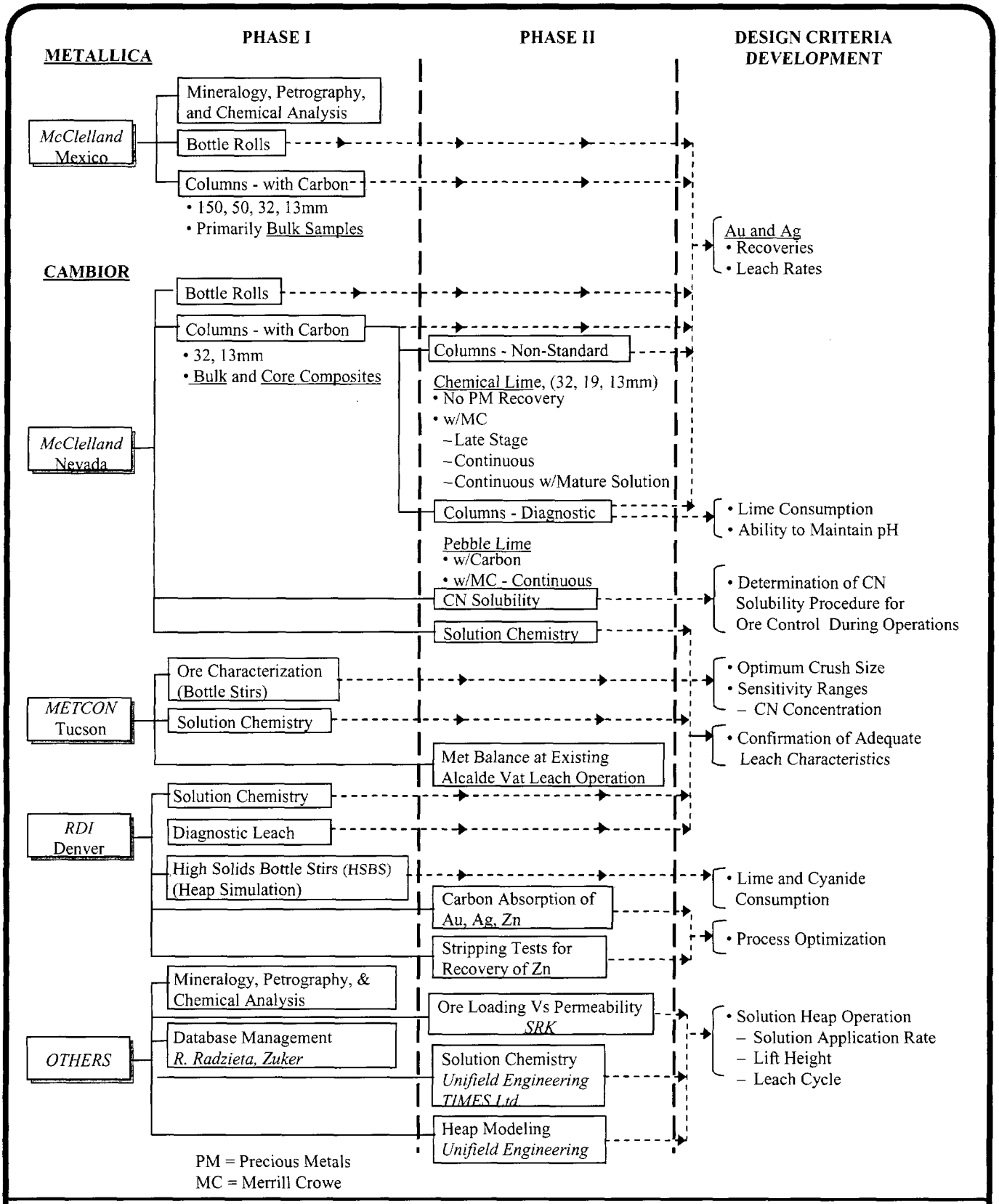
5.1.2 Strategy for Developing Reliable Estimates of Recoveries and Reagent Consumption

Two characteristics of Cerro San Pedro ores required some additional test work to facilitate development of operating parameters.

First, the reserves include a significant amount of recoverable silver (Ag) with Ag to Au ratios in solution being high enough that, by industry standard, a Merrill-Crowe recovery plant would be indicated.

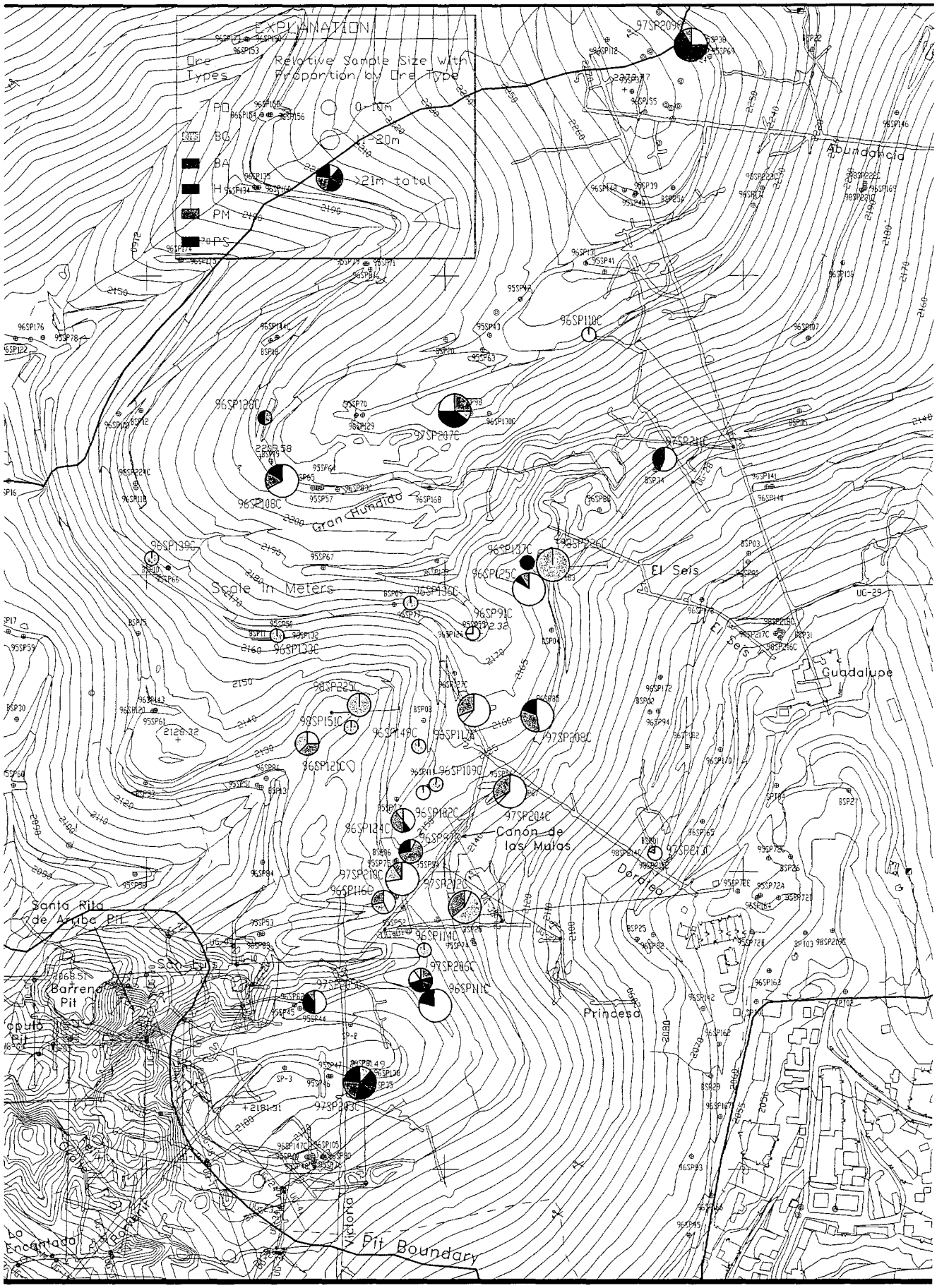
The second characteristic relates to cyanide soluble zinc contained within the ore, and its potential effect on carbon plant or Merril Crowe operations. Zinc (Zn) at Cerro San Pedro is primarily in the form of either oxides or carbonates and only a small fraction as the less soluble Zn sulfides.

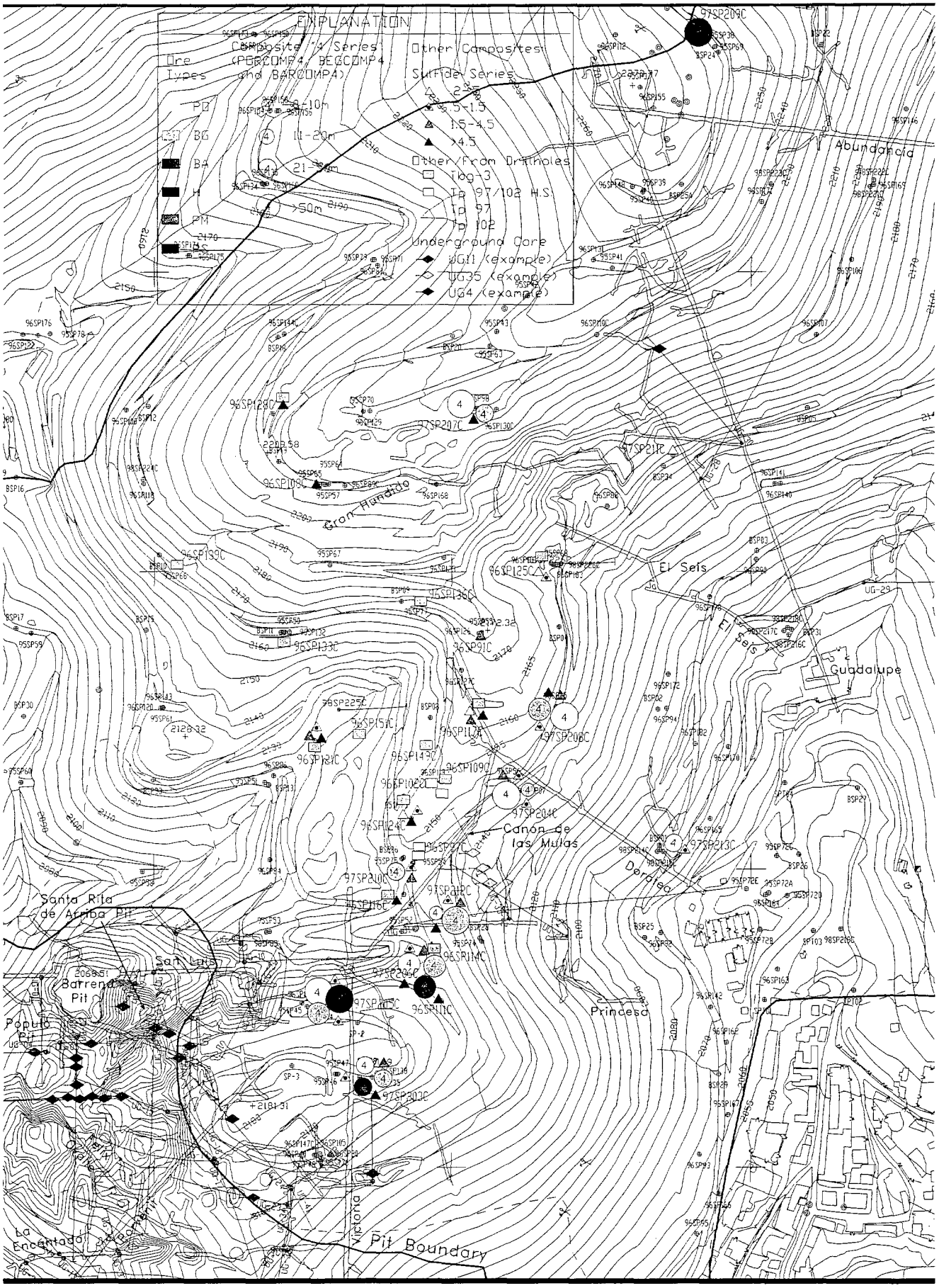
At Cerro San Pedro, the resource value is entirely precious metals (Au and Ag), therefore, the metallurgical investigation process focused on determining the ultimate precious metals recoveries that could be achieved. Typically Au recovery would be estimated by running bottle roll tests, generally at high solutions to solids ratios, to provide preliminary recoveries of precious metals. Scoping style bottle roll tests would be



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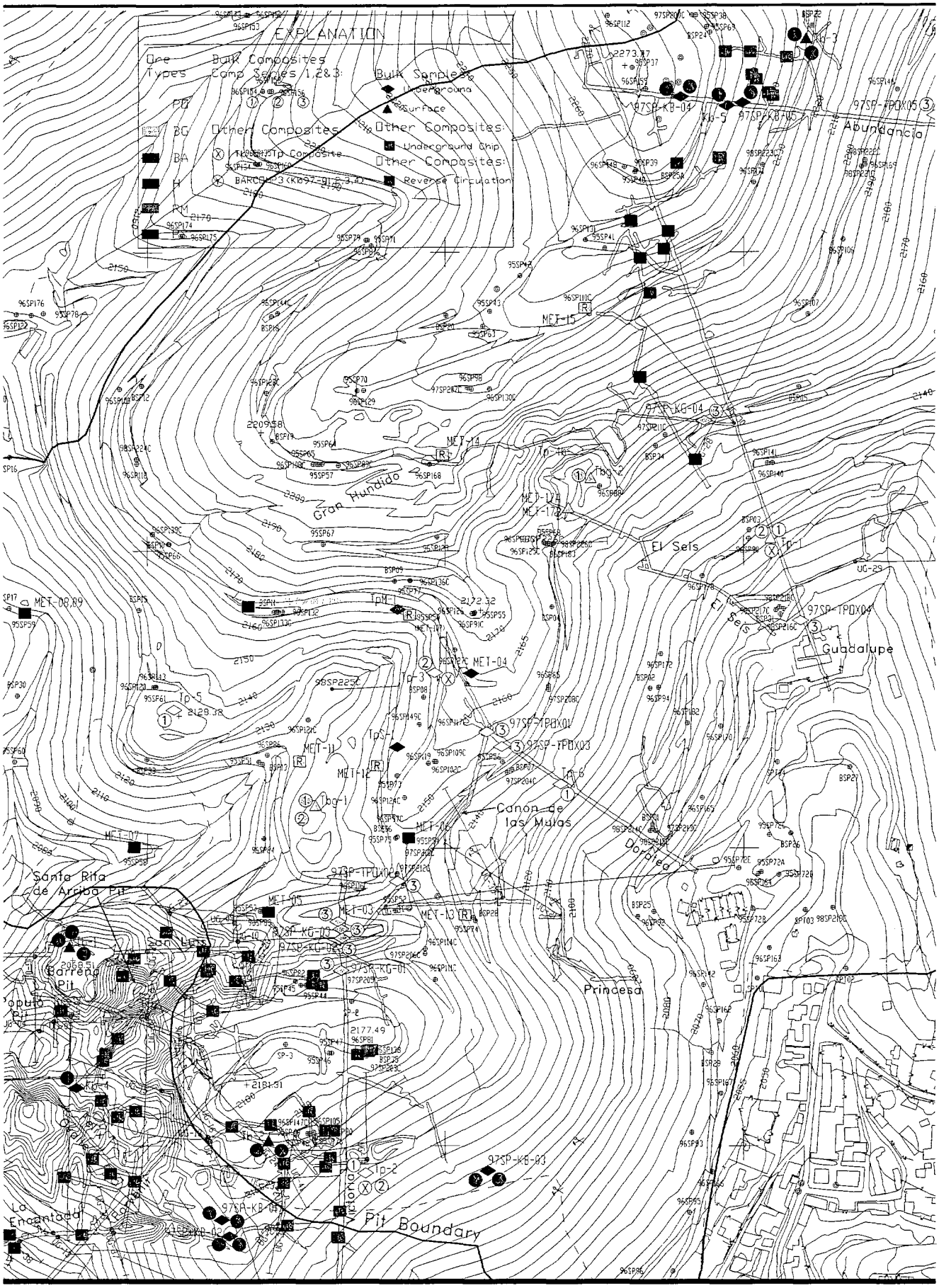
Figure 5.1 Metallurgical and Process Design Test Work


EXPLANATION
Ore Types
Relative Sample Size with Proportion by Ore Type
PD
BG
BA
H
PM
PS
0-10m
10-20m
>21m total
Scale in Meters
Gran Hundida
El Seis
Abundancia
Guadalupe
Canon de las Mulas
Dorada
Princesa
Victoria
Santa Rita de Arriba Pit
Barrera Pit
Pit Boundary
97SP209C
96SP110C
96SP129C
97SP207C
96SP108C
96SP139C
96SP137C
96SP125C
96SP136C
96SP91C
96SP133C
98SP225C
98SP151C
96SP121CC
96SP148C
96SP149C
97SP208C
96SP109C
96SP182C
96SP124C
97SP204C
97SP211C
97SP212C
96SP116C
97SP210C
96SP114C
97SP206C
96SP111C
97SP205C
97SP203C
N
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Figure 5.2 Metallurgical Sample Locations
Individual Core Samples
0
50
100
Scale in Meters



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Figure 5.3 Metallurgical Sample Locations
Core Composites

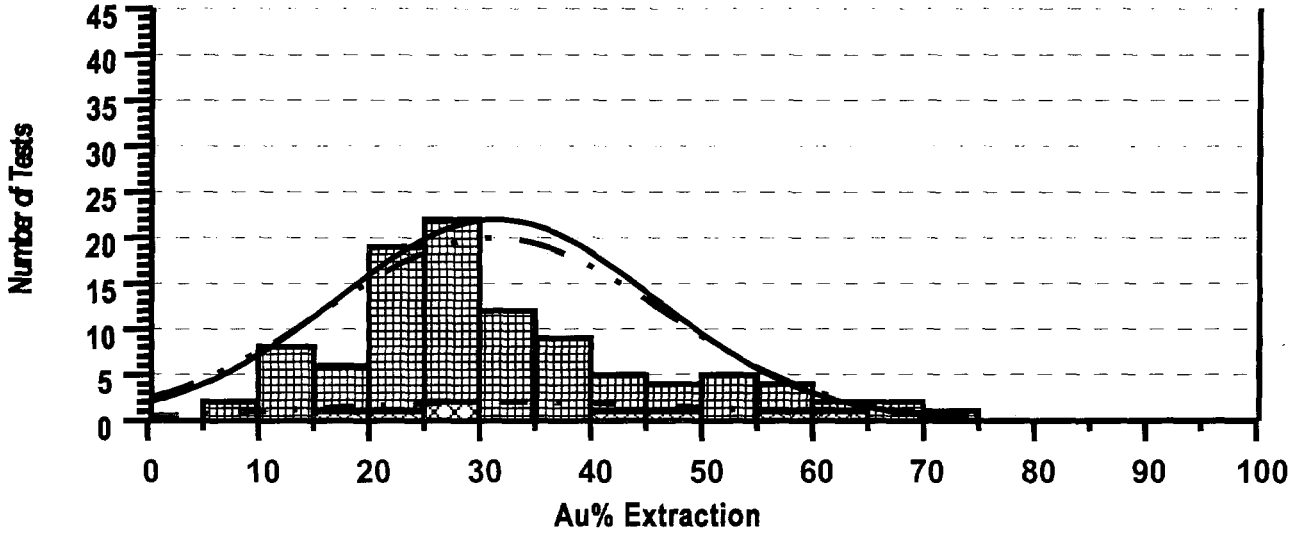


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Figure 5.4 Metallurgical Sample Locations
Non–Core Samples

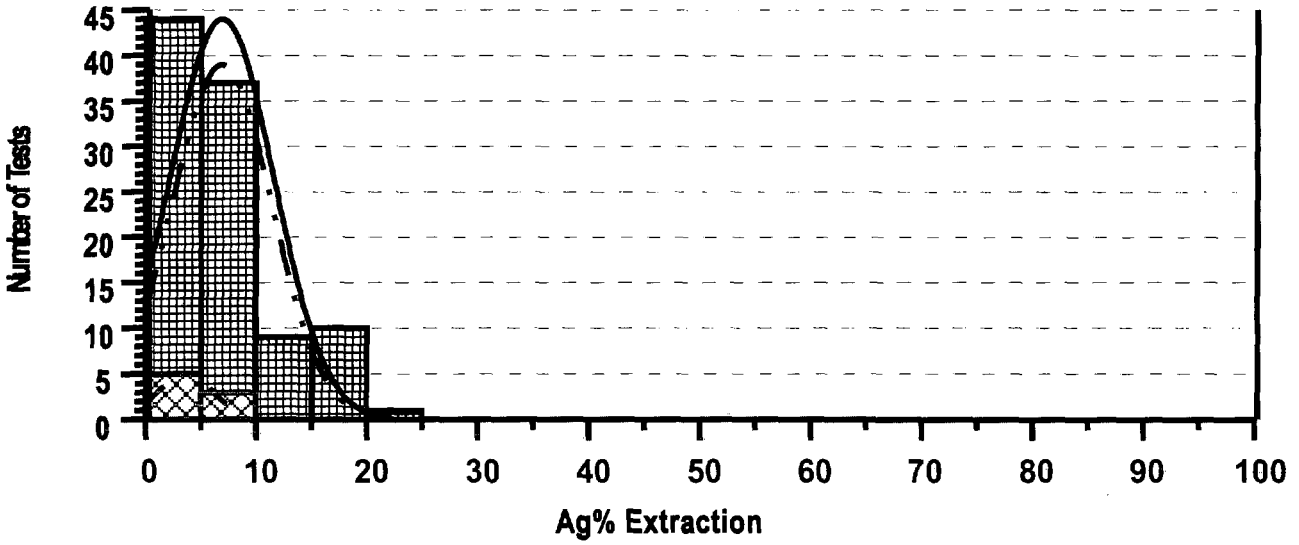
0 50 100
Scale in Meters

Figure 5.5



	Samples	Mean	Median	Std Dev
Columns	8	37.45	35.45	17.27
Bottle Rolls	93	31.10	27.90	13.88
All Tests	101	31.60	27.90	14.18
Economic Model		27.80		

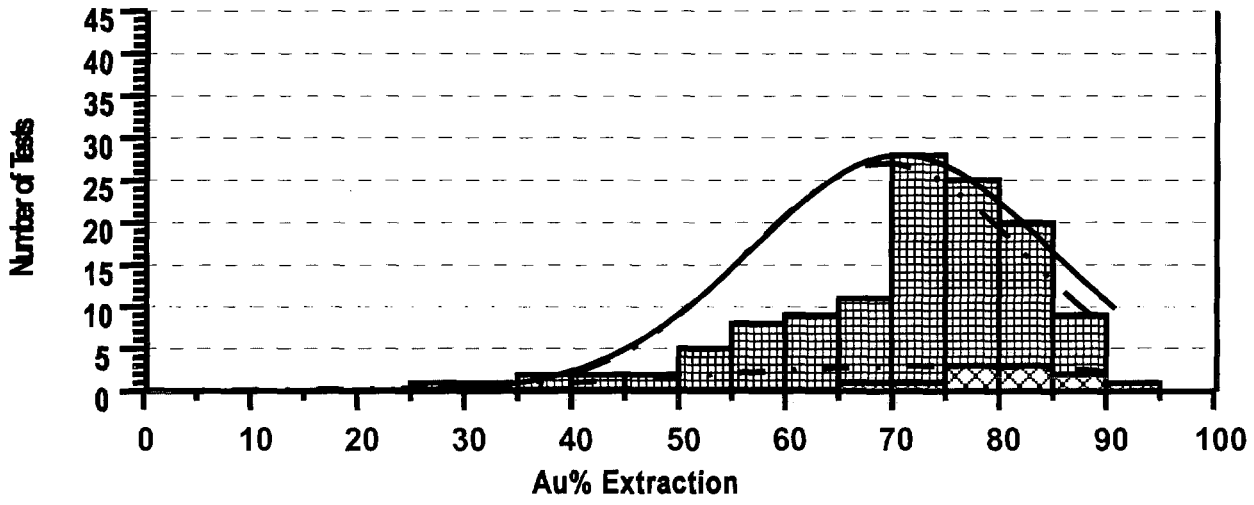
Figure 5.6



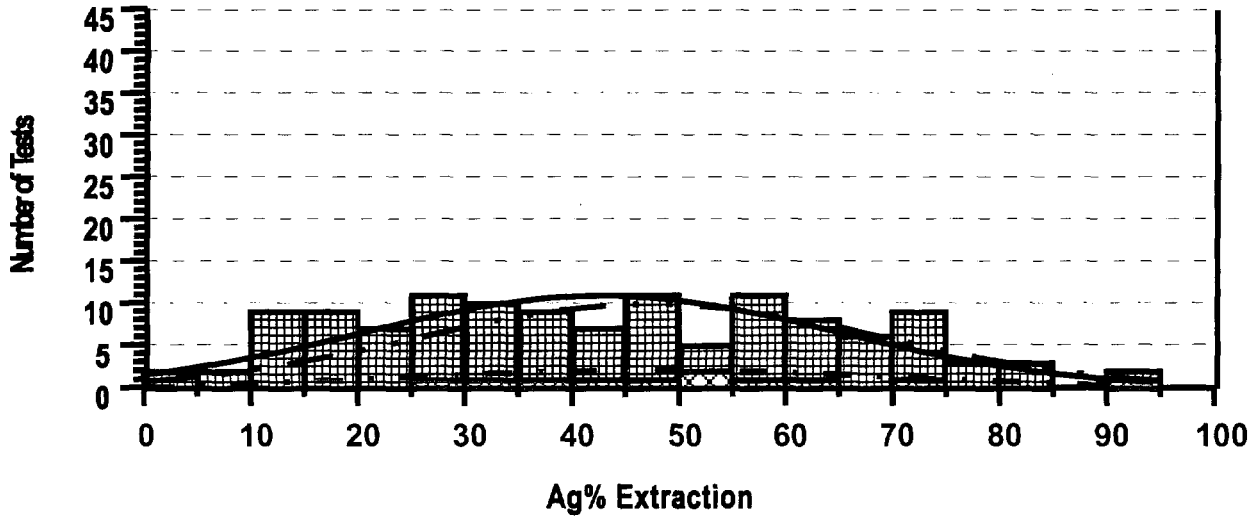
	Samples	Mean	Median	Std Dev
Columns	8	4.16	3.55	2.27
Bottle Rolls	93	7.17	5.80	4.71
All Tests	101	6.93	5.60	4.63
Economic Model		3.20		

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Figures 5.5 and 5.6 Histograms Showing Gold and Silver Recoveries for Column and Bottle Roll Tests at 13mm Particle Size - Barreno Limestone



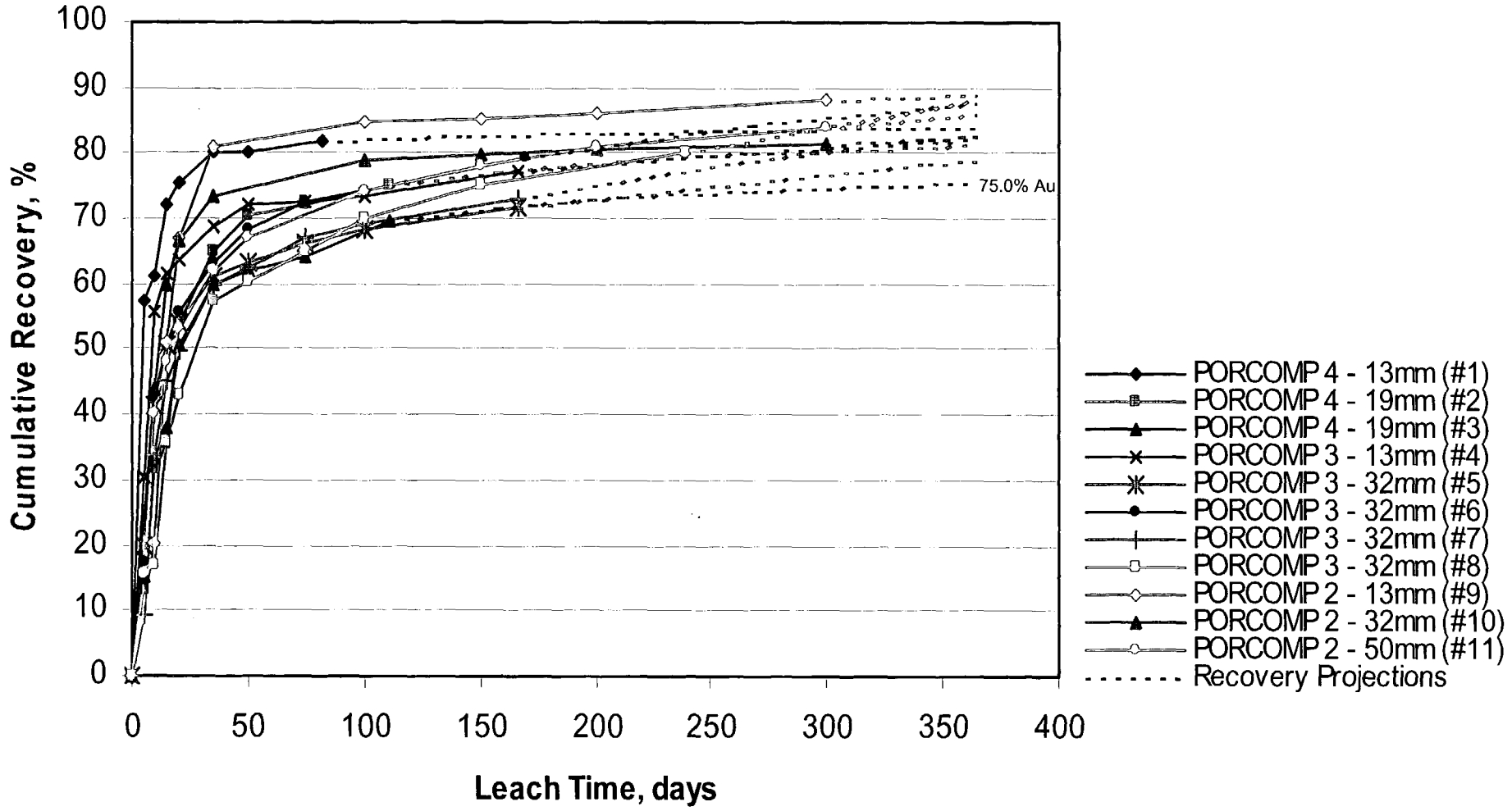
	Samples	Mean	Median	Std Dev
Columns	11	80.90	80.00	6.43
Bottle Rolls	113	70.34	73.10	12.44
All Tests	124	71.28	74.10	12.38
Economic Model		82.00		



	Samples	Mean	Median	Std Dev
Columns	11	52.00	50.30	18.39
Bottle Rolls	113	42.20	40.80	21.91
All Tests	124	43.07	42.20	21.73
Economic Model		50.70		

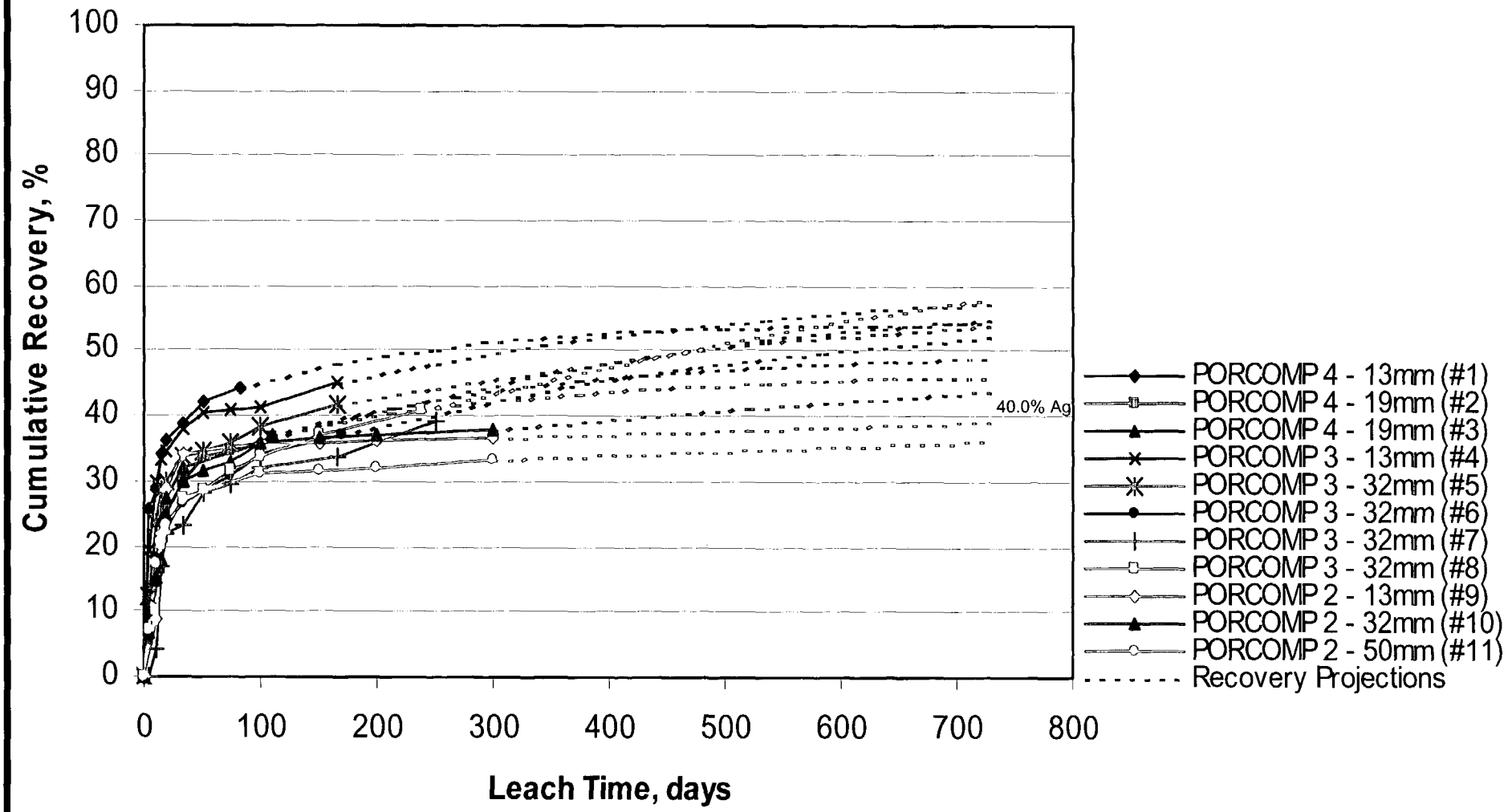
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Figure 5.7 Histograms Showing Gold and Silver Recoveries for Column and Bottle Roll Tests at 13mm Particle Size - Porphyry Oxide



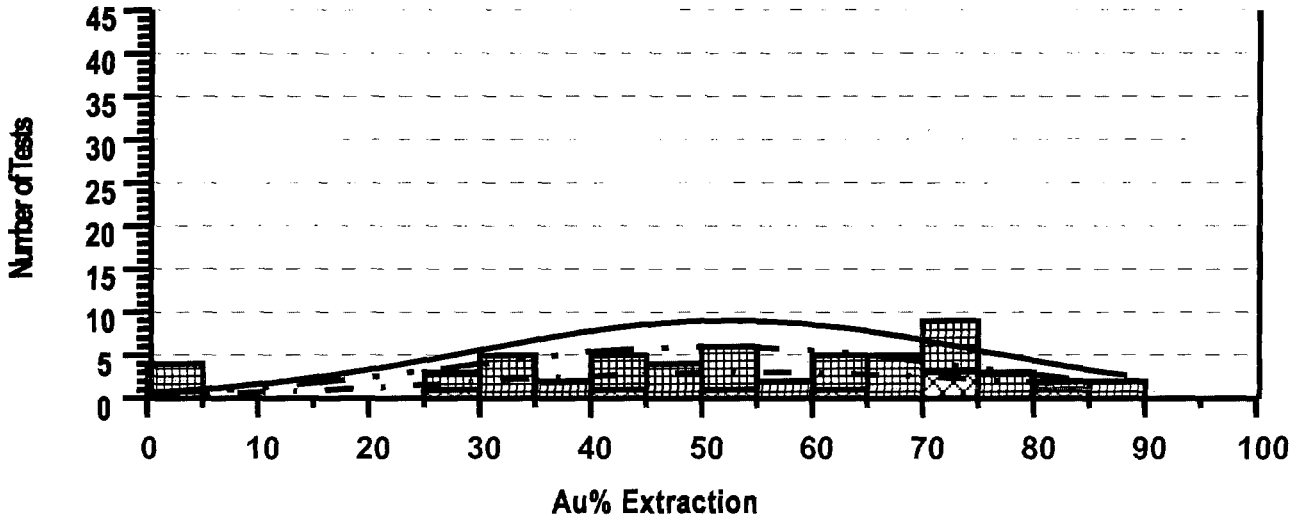
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Figure 5.8 Column Test Gold Recovery Curves with Ultimate Recovery Projections - Porphyry Oxide



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Figure 5.9 Column Test Silver Recovery Curves with Ultimate Recovery Projections - Porphyry Oxide



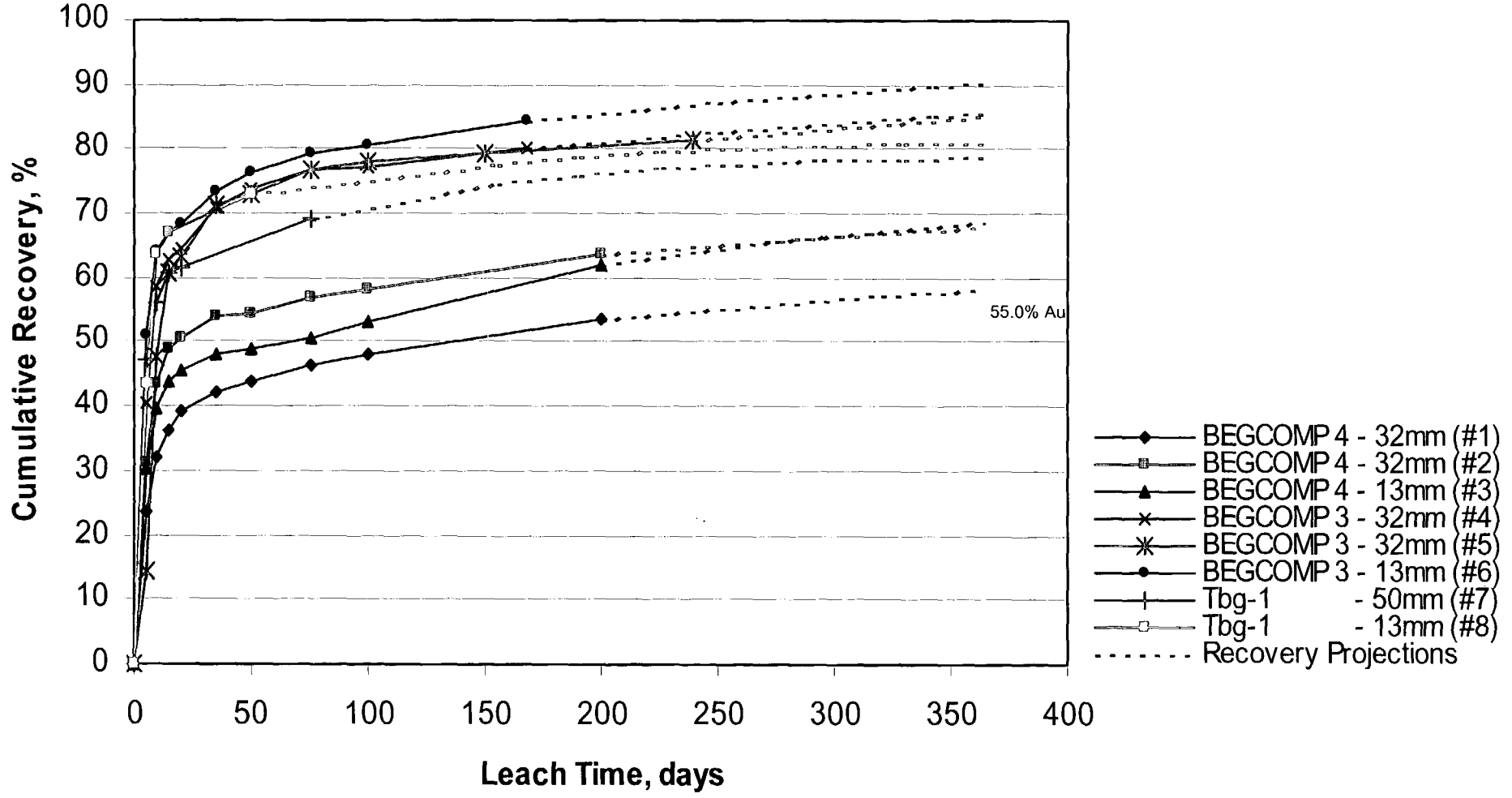
	Samples	Mean	Median	Std Dev
Columns	8	61.30	67.30	18.91
Bottle Rolls	49	52.04	52.90	22.42
All Tests	57	53.34	54.80	22.05
Economic Model		72.90		



	Samples	Mean	Median	Std Dev
Columns	8	41.22	39.00	15.84
Bottle Rolls	49	41.51	40.60	20.12
All Tests	57	41.47	40.60	19.45
Economic Model		39.30		

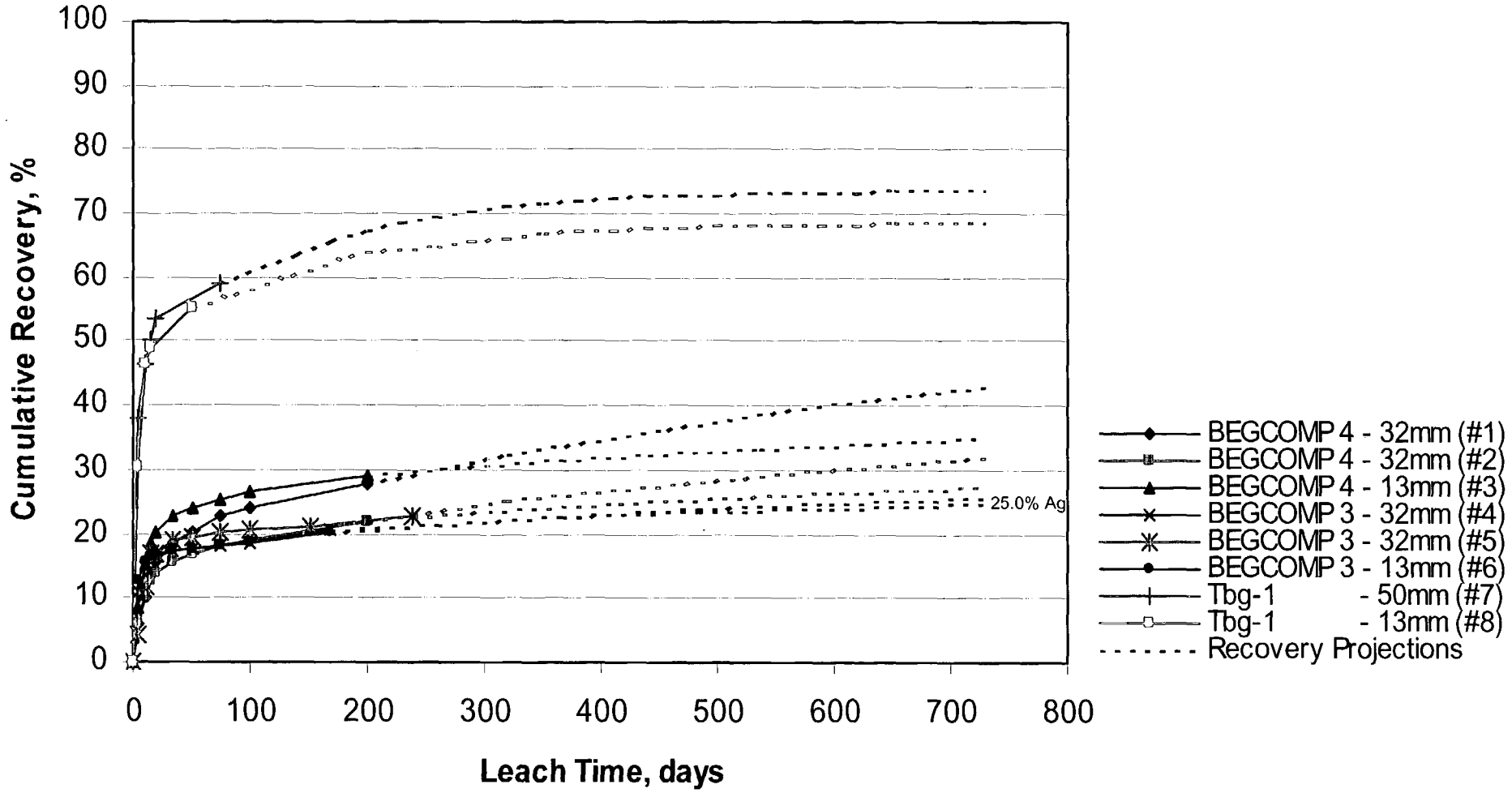
MINERA SAN XAVIER, S.A. de C.V.

Figure 5.10 Histograms Showing Gold and Silver Recoveries for Column and Bottle Roll Tests at 13mm Particle Size - Begonia Limestone



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Figure 5.11 Column Test Gold Recovery Curves with Ultimate Recovery Projections - Begonia Limestone



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Figure 5.12 Column Test Silver Recovery Curves with Ultimate Recovery Projections - Begonia Limestone

followed up by column tests. A significant number of both of these standard tests were conducted separately on three of the main Cerro San Pedro ores, Barreno, Begonia, and Porphyry Oxide. Other investigations have focused on determining the viability of adding Porphyry Mixed and Sulfide material as reserves, i.e. whether recoveries and reagent consumption would be favorable enough to allow inclusion of these materials as ore types.

Four distinct mineral types have been determined by different geological and metallurgical characteristics and are listed below denoting their respective portion of the deposit as discussed in Section 4.0. Porphyry Oxide and Begonia Limestone are the two primary ore types that will be mined and processed under the plans developed in this feasibility study, along with small quantities of Barreno Limestone and Hospital Limestone. Higher metals prices and/or improved economics would be needed to support future processing of the other ore types, including mixed and sulfide porphyry ores. Table 5.2 below summarizes the process tonnage by ore type.

Table 5.2

PROCESS TONNAGE BY ORE TYPE

	Tons Ore	Tons ore % of total	Recoverable Au % of total	Recoverable Ag % of total
Porphyry Oxide	41,907,400	85.1%	88.5%	86.2%
Begonia Limestone	5,865,200	11.9%	9.4%	12.4%
Barreno Limestone	284,300	0.6%	0.4%	2.4%
Hospital Limestone	1,192,000	2.4%	1.6%	1.3%

No testing was performed on tailings from prior operations, which comprise approximately 0.5% of the potential available ore tonnes. Tailings were assigned a 40% recovery for both Au and Ag. Average reserve grades for tailings are 0.62 g/t Au and 29.0 g/t Ag. The majority of the tailings are comprised of leach residues from former vat leaching operations.

Beyond the standard bottle roll and column tests, additional tests were conducted as shown in Figure 5.1 that further provide ore characterization information, assess solution chemistry issues, and provide information on kinetics and reagent consumptions. These tests also gave insight on the reliability of the standard tests as a predictor of ultimate precious metals recoveries.

A detailed Sulfide Study was conducted on Porphyry Oxide, Mixed and Sulfide materials to relate quantitative/economic-driven metallurgical information with the qualitative geological classification to determine ultimately which materials should be classified as ore or waste. A summary of the results of the

Porphyry Sulfide Study is presented under the Related Investigations Section – Sulfide Study – Analysis of Porphyry Oxide, Mixed, and Sulfide Ore Types. Details of this study are included in Section 5.9 of the Appendix.

5.2 Review of Metallurgical Investigations prior to Metalica Resources, Inc.

Metallurgical work performed by Penoles for Fresnillo in 1989 through 1991 included bottle roll and column testing on Porphyry Oxide, Porphyry Mixed and Sulfide, and limestone samples. Much of the mixed, sulfide, and limestone investigations, however, were conducted at very fine particle size and are not considered to be representative for potential heap leach recovery. Previous metallurgical test results for a Porphyry Oxide sample at particle sizes nearest the design size are shown in Table 5.3.

Table 5.3

Metallurgical Results - Porphyry Oxide – Peñoles Laboratory, 1990								
Test Type	# Tests	Particle Size (mm)	Calc. Head Grade (g/t)		Recovery (%)		Consumption (kg/t)	
			Au	Ag	Au	Ag	NaCN	Lime
Bottle roll	1	9.5	0.85	21	84.7	72.1	.132	2.0
Column	1	25.4	0.91	23	75.8	56.9	.601	6.3
Column	1	9.5	0.77	22	81.8	58.3	.536	5.7

Columns were run at 0.10% NaCN concentration for 45 days.

Bottle roll was run at pH of 10.57.

Peñoles proposed a design criteria of 0.137 kg/t NaCN, 5.0 kg/t lime, and 7.5 kg/t cement for agglomeration.

5.3 Description of Metallurgical Samples and Summary of Testing

Metallurgical testing has been performed on a total of 396 different samples (core, core composite, bulk, bulk composite, underground chip samples, and reverse circulation cuttings) collected throughout the known extents of the deposit. A complete listing of samples (for bottle roll testing and for column testing) appears in the Appendix and includes location, domain, and coordinate information. An additional table provides details of the samples that comprise the composite samples (both core and bulk).

Table 5.4 below summarizes the total number of tests by type of test and ore type that comprise the metallurgical data set. Figures 5.2, 5.3, and 5.4 provide locations of individual core samples, core composites, and non-core samples used for metallurgical testing, respectively.

Table 5.4

Metallurgical Test Work to Date for Cerro San Pedro										
Type of Test	**Number of Tests**									
	PO	**BG**	**BA**	**Bam**	**All BA**	**H**	**PM**	**PS**	**Other**	**Total**
≥13mm – Primary Data Set for Recovery/Reagent Estimates*:										
Column Tests – Total	**38**	**22**	**11**	**12**	**23**	**0**	**2**	**2**	**0**	**87**
Bulk + bulk composites	(27)	(15)	(11)	(10)	(21)	(0)	(1)	(1)	**(0)**	(65)
Core + core composites	(11)	(7)	(0)	(2)	(2)	(0)	(1)	(1)	**(0)**	(22)
McClelland – Hermosillo (Metallica)	[16]	[7]	[8]	[0]	[8]	[0]	[1]	[1]	[0]	[33]
McClelland – Sparks (Cambior)	[22]	[15]	[3]	[12]	[15]	[0]	[1]	[1]	[0]	[54]
Bottle Roll Tests – Total	**121**	**54**	**51**	**49**	**100**	**23**	**43**	**19**	**8**	**368**
Bulk + bulk composites	(22)	(13)	(11)	(11)	(22)	(0)	(1)	(2)	(1)	(61)
Core + core composites	(99)	(41)	(19)	(23)	(42)	(14)	(42)	(17)	(7)	(262)
Underground chip	(0)	(0)	(21)	(15)	(36)	(9)	(0)	(0)	(0)	(45)
McClelland – Hermosillo (Metallica)	[61]	[25]	[6]	[1]	[7]	[1]	[18]	[12]	[1]	[125]
McClelland – Sparks (Cambior)	[60]	[29]	[45]	[48]	[93]	[22]	[25]	[7]	[7]	[243]
Bottle Stirs - METCON	**65**	**36**								**101**
High Solids Bottle Stirs - RDI	**16**	**20**					**3**	**3**	**0**	**42**
TOTAL	**240**	**132**	**62**	**61**	**123**	**23**	**48**	**24**	**8**	**598**
Research Tests ≥ 13mm	**110**	**80**			**25**					**215**
Bottle Roll Tests <13mm/McClel	**0**	**22**	31	14	**45**	**3**	**0**	**5**	**1**	**76**
TOTAL	**350**	**234**	**93**	**75**	**193**	**26**	**48**	**29**	**9**	**889**

* Several samples with carbonaceous material and/or of lower grade than would be considered ore were also eliminated from this data set.

The following summarizes sampling that was conducted for these tests:

Samples were taken by Metallica from surface outcrop locations and from underground drifts and crosscuts, from reverse circulation drill samples, and drill core intervals. Composites were also prepared from these various sample types to provide test samples that represented various deposit ore types for metallurgical testing. These included thoroughly oxidized material from the Porphyry Oxide (PO), Begonia Limestone (BG), Barreno Limestone (BA), Barreno Manganese (BAm), Hospital Limestone (H), and the Porphyry Mixed (PM – oxide and sulfide) and Porphyry Sulfide (PS).

Bulk samples were taken with both lump and fine material being collected in their approximate proportions as contained in the broken rock. No crushing or breaking of lump material was done at the site. Core and other drill interval samples were individually bagged according to their interval. No crushing or breaking of the core was done except to separate the interval being sampled. Additional bulk samples were collected by Cambior at sites previously sampled by Metallica and on new sites established by Cambior.

Cambior drilled and collected additional individual core intervals for bottle roll tests and some underground chip samples for additional work on the Hospital, Barreno, and Barreno Manganese. Cambior's work emphasized developing the second, third, and fourth Composite Series to further build upon Metallica's composite work (Series 1) and previous work for the three major ore types (Porphyry Oxide, Begonia, and Barreno). The Composite Series was used for testing by a full suite of metallurgical methods including bottle rolls, columns, bottle stirs, diagnostic testing, HSBS tests, etc. Column tests were performed only on composite samples, not on individual core or bulk samples.

These composite series of samples are identified as follows:

Comp 1 Series – a series of 3 bulk composites by ore type collected by Metallica from previously sampled and tested surface and underground Metallica bulk sample locations. These composites were intended to provide information from short duration column leach tests to be completed during Cambior due diligence.

Comp 2 Series – a series of 3 bulk composites by ore type collected by Cambior from locations previously sampled and tested by Metallica to provide check metallurgical results of previously sampled sites. The sample locations were chosen to allow both rapid collection and a representative sample and to help establish if surface samples behave similarly to underground samples as represented in the Comp 3 Series.

Comp 3 Series – a series of 3 bulk composites by ore type collected by Cambior from new underground locations previously channel sampled and selected by Cambior to provide representative sampling of the ores throughout the deposit. Samples were selected to represent the average grade of the mineable ore,

and provide a geographic spread through the deposit. The results from these Comp 3 Series samples can be compared to the surface samples of the Comp 2 Series.

Comp 4 Series – a series of 3 composites by ore type collected by Cambior from 1997 Cambior drill core generated during the 1997 due diligence period (holes 97SP-203C through 97SP-213C). These Comp 4 Series are thought to be the most representative of any of the composite samples and were selected to both approximate the average grade, geographic range, and geologic/mineralogical variability in the deposit. The core composites are comprised of a split or sawn one-half sample of the generally HQ-sized (38mm) core. The core samples were selected following receipt of assays performed on the other half of the core.

Another series of samples were taken of the Porphyry ore type for use in further defining metallurgical response with respect to sulfide content, relating quantitative metallurgical results with qualitative geological classification, and to determine the potential of considering Porphyry Mixed and Porphyry Sulfide as ore.

Details of all metallurgical samples are presented in Appendix A5.3 as follows:

- Table A5.1 Identification of Samples for Bottle Roll Tests (location, domains, etc.)
- Table A5.2 Identification of Samples for Column Tests (location, domains, etc.)
- Table A5.3 Description of Samples Comprising Composites
- Table A5.4 Index to Abbreviations for Sample Identification Tables

The following summarizes sampling information by ore type.

5.3.1 Porphyry Oxide

Composites were collected from the Porphyry Oxide as follows:

PORCOMP1 – A composite of 4 bulk samples taken by Metallica of Porphyry Oxide tfrom surface exposures near the Alcalde plant (Tp-1, Tp-2) and from underground at Victoria Tunnel (Tp-5) and Dorotea Tunnel (Tp-6).

PORCOMP2 – A sample composite of equal amounts of 3 bulk samples previously taken by Metallica that represent both surface exposures (Tp-1, Tp-2) and underground exposures in the Canon de las Mulas area (Tp-3).

PORCOMP3 – A composite of equal amounts from 5 underground bulk sampling locations established by Cambior in the Canon de las Mulas Tunnel (Tpox97-01, 02), Dorotea (Tpox97-03), Guadalupe (Tpox97-04), and Abundancia Tunnels (Tpox97-05) that is believed to be representative of the Porphyry Oxide ore reserves. These samples cover a broad geographic range from south to north.

PORCOMP4 – A core composite of selected mineralized intervals of the Porphyry Oxide at ≥0.12 g/t recovered Au equivalent in Cambior drill holes drilled in 1997 to represent both average Au and Ag grades throughout the deposit from fresh drill core.

Two additional composites were prepared for more detailed testing on representative samples of Porphyry material that varied in sulfide content. These are comprised of core from various drill holes throughout the Oxide zone and are:

- **PORCOMP 0.2-0.5** (sulfide sulfur content ranging from 0.2-0.5%)
- **PORCOMP 0.5-1.5** (sulfide sulfur content ranging from 0.5-1.5%)

5.3.2 Begonia Limestone

Composites were collected from the Begonia Limestone as follows:

BEGCOMP1 – A composite of 2 bulk surface (Tbg-1, Tbg-2) samples and 1 core composite (Tbg-3) taken at Metallica sampling sites and in Metallica core holes and composited by variable weight percent to yield a calculated head grade for Au and Ag approaching the average for the deposit.

BEGCOMP2 – A bulk sample of Begonia ore taken exclusively from the same locale of a previous Metallica sample at Hundido Chico (Tbg-1) to determine if results could be replicated. This surface sample locality is the closest available to the average grade of the Begonia ore. Additional material from the Tbg-1 location was added to the original BEGCOMP2 sample to comprise the sample that was eventually column tested.

BEGCOMP3 – A composite from 2 underground bulk sampling sites established by Cambior in the Victoria tunnel (Kg97-01) and Guadalupe tunnel (Kg97-04). It is difficult to obtain representative samples of mineralized Begonia from underground sample sites in the accessible tunnels, and these two areas were the best available.

BEGCOMP4 – A core composite of selected mineralized intervals of the Begonia at ≥0.12 g/t recovered Au equivalent in Cambior drill holes drilled in 1997 to represent the average grades for Au and Ag as well as provide a good geographic spread.

5.3.3 Barreno Limestone

Cambior collected samples for both the typical Barreno (BA) and Barreno Manganese (BAm) for additional metallurgical testing on the Barreno in general and to determine if there were any differences in metallurgical characteristics between the two Barreno ore types. Metallica's Barreno samples and test results were reclassified by these two mappable units.

Composites were collected from the Barreno Limestone as follows:

BARCOMP1 – A composite of 3 bulk samples taken by Metallica from the surface in the Barreno pit (Tb-1) and underground at the Abundancia (Kb-5) and Felix Ovalle Oeste (Kb-4) Tunnels composited to achieve near average grade. However, based on current reserve estimates, all of these samples are marginal to the mined pit. This sample would represent the Barreno (non-manganese) ore type.

BARCOMP2 – A sample composite from 3 surface bulk samples originally taken by Metallica [one at Barreno pit (Tb-1), one high manganese sample at Barreno Hill (Tb-2), and one at Abundancia (Tb-3)] in equal proportions to represent the near surface metallurgical behavior of the combined Barreno ore type.

BARCOMP3 – A composite from 5 underground bulk sampling locations established by Cambior in the Victoria Tunnel (Cinco de Mayo – Kb97-01, 02 and Felix Ovalle – Kb97-03) and Abundancia Tunnel (Kb97-04, 05) areas in proportion to approach average grade. As with BARCOMP1, only a few of these sample localities comprising BARCOMP3 fall within the currently defined open pit. This sample would also represent the combined Barreno ore type.

BARCOMP4 – A core composite of selected mineralized intervals of the Barreno at >0.12 g/t recovered Au equivalent in Cambior 1997 drill holes. Samples were obtained from a total of 4 holes to approximate the average grades and as best as possible be representative of the overall Barreno ore type. The sample is a combination of both Barreno and Barreno Manganese rock types and all samples are from within the currently defined pit.

5.3.4 Hospital Limestone

No composite samples for the Hospital Limestone were prepared. When the composite samples were being collected for ultimate column testing, there did not appear to be any significant mineralogical, lithological, or metallurgical difference to the more voluminous Begonia Limestone. However, subsequent bottle roll tests have since demonstrated that Hospital Limestone appears to have significantly lower Au and Ag recoveries than average Begonia Limestone.

5.3.5 Porphyry – Mixed and Sulfide

These samples, primarily core, are from mineralized sections occurring at depth beneath the main body of Porphyry Oxide. Mineralization is characterized by disseminated and stockwork pyrite with subordinate amounts of sphalerite, galena, and local traces of chalcopyrite and arsenopyrite. Alteration is characterized by propylitic, argillic, and silica-sericite assemblages.

With the further work required for the Sulfide Study, two composites were prepared, one each for the Mixed and Sulfide for more detailed testing on a representative sample. These are comprised of core from various drill holes throughout the Porphyry Mixed and Porphyry Sulfide geologic/rock type areas and are:

- **PORCOMP 1.5-4.5** (classified as Porphyry Mixed with sulfide sulfur content ranging from 1.5 to 4.5%)
- **PORCOMP 4.5** (classified as Porphyry Sulfide with sulfide sulfur content >4.5%)

5.4 Bottle Roll Tests by Laboratory and Comparison

A complete Data Set by all ore types for Bottle Roll Tests is included in the Appendix as Table A5.5 with notations of filters that are used in presenting results. Low grade and carbonaceous samples and testing at particle sizes less than 13mm are filtered out in developing recovery and reagent consumption information. Duplicate samples are filtered out only when histograms are presented showing the distribution of test results. Bottle rolls were conducted by McClelland's Hermosillo, Mexico laboratory for Metallica and by McClelland's Sparks, Nevada laboratory for Cambior.

5.4.1 Description of Test Procedures

Bottle roll testing for Metallica and Cambior was performed at industry standards (40% solids by weight for 96 hours). Most samples were leached at 13mm, however, some were tested at finer sizes for ore characterization work and coarser sizes to match column testing at coarser sizes. More detailed procedures are presented in Section 5.3 of the Appendix.

5.4.2 Comparison of Bottle Roll Results by Ore Type

Tables A5.6 and A5.7 in Section 5.0 of the Appendix present bottle roll test averages by ore and sample type for Metallica and Cambior, respectively. Table 5.5 below compares bottle roll results of the two laboratories. Noted on this and other tables is the "Ore Ratio" which was a measurement developed to show a sample of a given ore type its relative economic value. The ore ratio = revenue [Au grade x %Au Recovery x Au value of $300/oz. + Ag grade x %Ag recovery x Ag value of $5.50/oz.] divided by the processing cost. The breakeven economic value is 1.00.

5.5 Standard Column Leach Tests by Laboratory and Comparison

The complete Data Set for all Column Tests is presented in Table A5.8 in Section 5.5 of the Appendix and provides detailed information on the column test parameters and results for each of the samples tested by the McClelland Hermosillo Laboratory for Metallica and by the McClelland Sparks Laboratory for Cambior. Only Standard Column test results are presented in this section of the feasibility study so that a comparison may be made between Cambior and Metallica, since Metallica conducted only standard column tests. Consolidated column results including the standard and non-standard columns are presented in Section 5.6.

5.5.1 Description of Standard Column Test Procedures

The following is a description of the standard locked cycle column leach tests conducted on Cerro San Pedro ores:

Standard Columns with Carbon Precious Metals Recovery – Column pregnant solution is recirculated, closed cycle through activated carbon recovery columns. All of the columns in the Metallica program and a majority of Cambior's columns were of this type, which is typically the standard technique for heap leach investigations. Standard columns were run at particle sizes of 13mm, 32mm, 50mm, and some at run-of-mine (ROM) on bulk composites and core composites, primarily. Most of the column tests prior to the Comp Series were leached from 45 to 90 days. The standard columns for the Comp1 Series were leached for approximately 30 days, the Comp 2 Series for approximately 300 days, and the Comp 3 and 4 Series generally for 170 to 200 days. All standard columns at the $\leq$19mm feed size were agglomerated with lime. A total of 71 of the 87 columns in the metallurgical program were of this standard type.

Details of these standard column procedures and test conditions, as well as the design criteria columns described later in Section 5.6.1 are included in Section 5.5 of the Appendix. Table A5.8 also provides details of test conditions including column dimensions, solution application rate, and leach time, etc.

Table 5.5

Comparison of Metallica versus Cambior >=13mm Bottle Roll Tests
Comparison of Bulk and Core Samples
Carbonaceous and low grade tests were removed

Sample and Test Description				Head Assay (g/t)						Recovery %			Reagent kg/t		Sulfur %		Ore
Sample		Size	Leach	Calc'd Head		Direct Analysis				Au	Ag	Zn	NaCN	Lime	Sfide	Sfate	Ratio
Name	#	mm	hrs	Au	Ag	Au	Ag	Zn (#)	Mn								
Porphyry Oxide																	
Bulk Metallica(7 samp,1 comp)	8	13	96	0.98	34.0	0.92	29.0	2,105 (5)	1,285	76.4	53.8		0.32	2.85	0.88	0.06	5.34
Bulk Cambior(5 samp,9 comp)	14	21	219	0.59	23.4	0.57	22.2	1,898 (13)	1,316	74.9	42.3	12.5	0.30	3.24	0.24	0.08	2.90
Core Metallica(50 samp,3 comp)	53	13	96	1.03	22.4	0.87	21.3	1,243 (50)	443	70.6	51.8		0.20	4.25	0.53	0.07	4.64
Core Cambior(43 samp,3 comp)	46	13	95	0.82	29.6	0.74	31.6	3,206 (44)	1,645	67.9	29.9	3.5	0.47	1.55	0.67	0.11	3.48
Begonia																	
Bulk Metallica(4 samp)	4	13	96	2.01	187.8	1.20	215.4	3,522 (3)	600	59.5	47.6		1.75	4.25	0.06	1.68	15.37
Bulk Cambior(2 samp,7 comp)	9	19	208	0.95	58.3	0.82	59.9	12,234 (8)	1,102	61.9	43.7	7.7	3.34	4.66	0.47	5.08	4.64
Core Metallica(20 samp,1 comp)	21	13	96	1.67	49.3	1.66	48.6	2,965 (15)	730	53.1	54.3		0.75	2.54	0.69	2.13	7.18
Core Cambior(16 samp,4 comp)	20	13	96	1.07	65.4	1.09	67.6	16,867 (12)	1,193	46.2	28.4	2.5	0.53	1.54	0.08	1.48	4.23
Barreno (BA)																	
Bulk Metallica(5 samp,1 comp)	6	13	96	0.92	22.6	0.99	22.8	1,718 (2)	643	36.4	13.9		0.24	1.15	0.02	0.03	1.99
Bulk Cambior(2 samp,3 comp)	5	20	221	0.90	32.3	1.01	26.7	825 (5)	6,424	38.0	12.2	6.5	0.20	1.42	0.01	0.05	2.01
Core Cambior(9 samp,10 comp)	19	13	96	1.84	31.0	1.80	31.0	569 (9)	12,836	25.5	5.3	3.2	0.11	1.23	0.03	0.02	3.35
UG Chip Cambior(MLI)(21 samp	21	13	96	2.06	36.7	2.78	36.7	0		34.2	7.9		0.13	1.30			4.22
Barreno Manganese (BAm)																	
Bulk Metallica(1 samp)	1	13	96	0.41	19.0	0.41	19.0	0		31.7	9.5		0.22	1.30			0.78
Bulk Cambior(3 samp,7 comp)	10	17	192	1.79	31.2	1.43	27.3	8,134 (9)	10,617	48.7	11.9	16.5	1.04	2.40	0.02	0.07	4.94
Core Cambior(11 samp,12 comp)	23	13	96	1.03	43.8	0.96	43.2	694 (12)	17,138	24.7	4.4	2.7	0.27	1.06	0.03	0.02	1.36
UG Chip Cambior(MLI)(15 samp	15	13	96	0.79	42.4	0.67	50.4	0		32.9	5.8		0.13	1.15			1.40
Hospital																	
Core Metallica (1 samp)	1	13	96	0.18	100.0	0.10	98.6	0		0.0	40.0		0.01	1.20			3.29
Core Cambior(10 samp,2 comp)	12	13	96	1.37	46.4	1.26	45.9	5,958 (10)	5,708	51.0	13.3	1.8	0.43	1.18	0.03	0.05	3.34
UG Chip Cambior(MLI)(9 samp	9	13	96	0.34	22.6	0.35	22.7	0		38.5	9.1		0.12	0.97			0.82
Porphyry Mixed																	
Bulk Metallica(1 samp)	1	13	96	0.51	20.4	0.61	28.0	71 (1)	9	35.3	52.9		12.30	50.60	2.01	1.17	1.76
Core Metallica(17 samp)	17	13	96	0.71	17.5	0.74	18.8	2,502 (17)	1,070	34.1	49.6		1.56	7.25	3.60	0.35	2.13
Core Cambior(24 samp,1 comp)	25	13	96	0.80	29.8	0.80	26.9	2,198 (24)	446	48.0	41.9	5.8	0.82	3.51	2.82	0.59	2.95
Porphyry Sulfide																	
Bulk Metallica(2 samp)	2	13	96	1.02	49.7	1.04	50.8	2,220 (1)	20,000	45.3	70.7		12.82	73.30	7.88	1.30	5.21
Core Metallica(10 samp)	10	13	96	0.59	16.5	0.56	15.9	2,707 (10)	690	18.8	47.6		1.47	6.46	4.96	0.72	1.67
Core Cambior(6 samp,1 comp)	7	13	96	0.41	13.4	0.41	13.9	12,099 (6)	701	14.9	32.4	1.0	1.05	2.81	5.21	1.71	0.68

5.5.2 Comparison of Standard Column Results by Ore Type

Tables A5.9 and A5.10 in Section 5.5 of the Appendix present column test result averages by ore and sample type for Metallica (McClelland Hermosillo, Mexico laboratory) and Cambior (McClelland Sparks, Nevada laboratory), respectively. Table A5.11 compares column leach results of the two laboratories for all combined column particle sizes. Table 5.6 below that is used in the comparison discussion provides a more meaningful comparison of column leach results for the 13mm size only. Comparison of precious metals recoveries between Metallica and Cambior have not accounted for adjustments in recoveries that should be made to normalize results to a common column leach time. A comparison of reagent consumption results between the two laboratories was not made since, generally, Metallica columns were conducted for a shorter period than Cambior columns and there were variations in NaCN concentration and application rate. Further work could be conducted to evaluate the major differences existing between the laboratories, as noted below.

Porphyry Oxide

Column recovery averages were comparable for Au for both laboratories and ranged from 78.2% to 83.4% for all sample types. Silver recovery was significantly lower for Cambior testing than on Metallica testing for both bulk and core samples. Core samples had Ag recoveries of 61.5% for Metallica. Cambior did not conduct any standard columns on core, but instead, have completed 6 design criteria columns to date. The details of Ag recoveries for these are shown in Section 5.6 (Table 5.7). The average Ag recovery for these Cambior core columns at 13 to 32mm sizes is 48.0% - 13.5% less than Metallica's standard 13mm core columns. Bulk sample Ag recovery was 53.8% for Metallica and 35.9% for Cambior (18% less).

Begonia Limestone

Column test averages by laboratory and sample type ranged from 47.4 to 74.6% Au recovery. It appears that lower Au recoveries are reflected in samples with lower Au head grade, regardless of the laboratory. Ag recovery averages ranged from 28.7 to 58.1%. Metallica had very high Ag recoveries for bulk samples (58.1%), possibly due to extremely high Ag head grades of their samples and lower than average Zn content for other sampling. The average Ag recovery for Cambior's bulk columns and Metallica and Cambior's core columns compared closely at 31.0, 33.3, and 29.1%, respectively. The average Zn content was fairly close for all these three groups of samples.

Table 5.6

Comparison of Metallica versus Cambior 13mm Standard Column Tests
Comparison of Bulk and Core Samples
Carbonaceous and low grade tests were removed

Sample and Test Description				Head Assay (g/t)							Recovery %			Reagent kg/t		Sulfur %		Ore
Sample		Size	Leach	Calc'd Head		Direct Analysis					Au	Ag	Zn	NaCN	Lime	Sfide	Sfate	Ratio
Name	#	mm	Days	Au	Ag	Au	Ag	Zn	(#)	Mn								
Porphyry Oxide																		
PO Bulk Metallica(5 samp,1 comp)	6	13	60	1.04	44.5	0.85	41.9	2,419	(5)	1,423	83.4	53.8		1.41	3.05	0.69	0.07	5.48
PO Bulk Cambior(3 comp)	3	13	167	0.55	29.4	0.48	27.4	2,247	(3)	1,342	79.8	35.9	1.9	1.56	3.15	0.12	0.16	2.64
PO Core Metallica(3 comp)	3	13	68	0.70	19.8	0.64	19.3	1,232	(3)	657	78.2	61.5		1.11	3.37	0.53	0.02	3.55
Begonia																		
BG Bulk Metallica(3 samp)	3	13	88	0.39	238.5	0.37	273.5	3,522	(3)	600	47.4	58.1		1.29	4.23	0.06	1.68	11.79
BG Bulk Cambior(3 comp)	3	13	167	0.43	36.0	0.34	32.7	9,781	(3)	1,356	70.6	31.0	4.8	2.08	3.40	0.10	3.88	1.99
BG Core Metallica(1 comp)	1	13	70	1.93	59.7	1.64	22.7	6,078	(1)	1,110	74.6	33.3		2.51	1.30	0.16	1.55	6.34
BG Core Cambior(1 comp)	1	13	197	0.42	28.9	0.34	30.3	8,737	(1)	1,008	61.9	29.1		4.19	5.02	0.24	0.94	1.12
Barreno (BA)																		
BA Bulk Metallica(6 samp,1 comp)	7	13	41	1.26	25.5	1.28	26.0	1,718	(6)	643	41.1	4.1		0.41	0.92	0.02	0.03	3.09
BA Bulk Cambior(1 comp)	1	13	28	0.98	37.6	1.07	38.9	880	(1)	7,060	43.9	7.2	2.0	0.50	1.50	0.00	0.00	2.31
Barreno Manganese (BAm)																		
BAm Bulk Cambior(5 comp)	5	13	196	1.69	29.3	1.19	27.5	7,765	(5)	7,655	43.3	3.1	2.9	1.39	1.75	0.03	0.06	3.82
BAm Core Cambior(1 comp)	1	13	201	1.01	43.6	1.05	40.8	783	(1)	13,090	16.8	1.8	2.2	1.53	2.32	0.03	0.01	0.78
Porphyry Mixed																		
PM Bulk Metallica(1 comp)	1	13	101	0.52	25.7	0.61	28.0	71	(1)	9	38.5	51.8		4.83	48.40	2.01	1.17	1.10
Porphyry Sulfide																		
PS Bulk Metallica(1 comp)	1	13	101	0.91	47.7	0.86	41.1	2,220	(1)	20,000	38.5	78.0		5.31	77.90	7.88	1.30	2.39

Barreno Limestone

Barreno column results for bulk samples do not appear to show a significant difference by laboratory or by Barreno geological unit (i.e., Barreno Oxide [BA] or Barreno Manganese [Bam] as visually identified in the field). Average bulk sample column Au recovery for Barreno varies between 41.1 and 43.9%. Ag recovery for bulk samples is consistently very low (between 3.1 and 7.2%). The one core composite column tested by Cambior (BARCOMP4), however, showed significantly lower Au recovery (an average of 25% lower at 16.8%)

Using a combined 23 column tests and 100 bottle roll tests (101 total tests removing all duplicates) a comparison of the distribution of Au and Ag recovery by geological unit, BA and Bam, was made. Figures 5.5 and 5.6 are histograms showing the distribution for Au and Ag, respectively, for each unit. There is essentially no significant difference in metallurgical recoveries for either Au or Ag between the BA and BAm units. Therefore, from this point forward Barreno metallurgical test results will be reported in a combined format - Barreno (BA+BAm).

Hospital Limestone

No columns have been performed on Hospital Limestone ore.

Porphyry Mixed

Only one column has been completed to date, by Metallica, for Porphyry Mixed. This sample contained high amounts of clay and was not representative of the ore type. One Cambior design criteria column on Porphyry Mixed (PORCOMP1.5-4.5) has been completed.

Porphyry Sulfide

Only one column has been completed to date, by Metallica, for Porphyry Sulfide. This sample also contained high amounts of clay and was not representative of the ore type. One Cambior design criteria column on Porphyry Sulfide (PORCOMP4.5) has been completed.

5.6 Consolidated Test Results – Standard and Design Criteria Columns and Bottle Rolls

Details of individual column tests by individual samples have been consolidated for the two laboratories and are presented for each ore type. Bottle roll results on each column sample are also presented separately for each ore type. In addition to the standard columns with carbon precious metals (PM) recovery described previously, other design criteria column tests were conducted to more fully evaluate the effects that Ag and Zn content, and precious metals recovery methods would have on metallurgical behavior. The results of these columns are also presented for each individual sample. Averages have been calculated for standard and design criteria columns and also by particle size for standard columns. It should be noted that the leach time varies considerably between tests. The leach recovery curves presented in Section 5.10 show the results of extending precious metals recoveries to a common, more realistic leach time on a heap to assist in developing ultimate recovery estimates. More details of METSIM modeling with respect to operation of the heap are presented in Section 6.0 (Processing and Design). An evaluation of leach kinetics from all column testing is discussed in the Section on Related Investigations – Solution Chemistry and Leach Kinetics.

5.6.1 Design Criteria Column Procedures

The following are the additional types of design criteria locked cycle column leach tests that have been conducted or are underway on Cerro San Pedro samples (details of procedures are presented in A5.5.1 of Section 5.5 of the Appendix). All design criteria columns ≤19mm feed size were agglomerated with lime. Coding for these column types used in the detailed column results tables are shown in parentheses. The code for standard columns with carbon PM recovery is "cpmr".

Column Tests with no PM Recovery (nopmr) – Two columns of this type were conducted on Begonia ore for specific solution chemistry reasons, i.e., understanding the chemistry of mature solution.

Columns with Continuous Merrill-Crowe (MC) PM Recovery (cmcr) – One column has been completed on 13mm size PORCOMP4 to provide information on recoveries and reagent consumption using continuous MC PM recovery (a typical method for recovering PM values when ores contain high Ag to Au ratios).

Columns for Sulfide Study with Late Stage MC PM Recovery (sslmcr) – Four columns of this type were completed as part of the Sulfide Study on 13mm samples PORCOMP 0.2-0.5, 0.5-1.5, 1.5-4.5, and >4.5. Late MC PM recovery was used.

1st Stage Columns to Generate Mature Solution using Late Stage MC PM Recovery (gmslmcr) - Two column tests were also conducted on 32mm samples of BEGCOMP2 (high Zn/more complicated solution chemistry) and PORCOMP4 (majority of ore reserve). Merrill-Crowe PM recovery was performed later in the leach cycle (after the first 80 days through completion). The mature leach solution generated in these 1st stage tests was used in subsequent column testing to study changes in solution chemistry and to simulate heap actual longer-term heap conditions.

2nd Stage Columns with Continuous MC PM Recovery Using Mature Solution (cmcrms) – Two 2nd stage columns were conducted on PORCOMP4 at the design 19mm size using partially mature solution harvested in 1st stage columns noted above. These columns used MC PM recovery from the beginning and are intended to have one of the highest reliability for design purposes.

Columns with Pebble Lime and Continuous MC PM Recovery (plcmcr) – Three column percolation tests were conducted on PORCOMP3 (19mm feed Porphyry Oxide) to determine the difference in lime requirements and effectiveness in controlling pH when using coarse pebble lime and fine pebble lime for agglomeration/alkalinity control. Continuous MC PM recovery was used. Evaluation of these results is discussed in Section 5.9.10 as it relates to optimization of heap leach process conditions.

Columns with Pebble Lime and Carbon PM Recovery (plcpmr) – Two columns on 19mm PORCOMP4 (Porphyry Oxide) have been completed. One is diagnostic to test the viability and effectiveness of using caustic to raise pH if it should drop below 10.5 on a column initiated with low pebble lime agglomeration at 2.0 kg/t ore and 10mm crush size. The other is a column series test to simulate multi-lift heap leaching using pebble lime agglomeration for alkalinity control optimized at 4.0 kg/t and 10mm crush size. The series columns were designed to identify multi-lift operation of the most reliable level of data to date for modeling heap operating conditions and metallurgical recoveries and reagent consumption. Carbon PM recovery was used in both cases, as the solution chemistry investigations indicated that columns with carbon appropriately simulate field conditions if modified pH control procedures are utilized. Column testing with carbon PM recovery is easier and less costly than with Merrill-Crowe.

5.6.2 Consolidated Results by Ore Type

Porphyry Oxide

Table 5.7 presents column leach test results with averages by particle size for Porphyry Oxide samples. The results of bottle roll testing of splits of the column samples and other bottle rolls by sample type and size are provided in Table 5.8.

Standard columns were conducted at sizes of 13, 32, 50mm, and run-of-mine (ROM – 150mm). Heads and tails were also subjected to assay screen analyses to determine the leaching characteristics of individual size fractions. Overall, Au recoveries were fairly close at all three sizes, but the tails did show somewhat lower recoveries with increasing size. Average Au recoveries for standard columns at 13mm, 32mm, and 50mm were 81.2, 75.5, and 80.5% respectively. Ag recovery was more size dependent that Au. The average column Ag recovery at 13mm, 32mm, and 50mm was 51.3, 36.9, and 43.6%, respectively. The particle size degradation in all columns was minimal. Solution percolation is not expected to cause any on-heap problems and agglomeration was not required on any samples tested. The Porphyry Oxide ore is relatively fast leaching, as evidenced by the fairly high recoveries on PORCOMP1 columns that were leached for only 30 days. Recovery profiles indicated increases in both Au and Ag with additional leach time.

The average recoveries for all 27 standard columns (all carbon recovery, average 112 leach days and 41mm) are 79.5% Au and 44.4% Ag compared to the average recoveries for all 6 completed design criteria columns (all Merrill-Crowe recovery, average 131 leach days and 19mm) of 73.3% Au and 40.4% Ag.

The average bottle roll recoveries in Table 5.8 for splits from all the 13mm column samples is 74.6% Au and 52.9% Ag compared to the 13mm standard column average of 81.2% and 51.3%. As is typically expected in comparing metallurgical data, the columns show a little over 5% higher recovery for Au, however, column recovery for Ag is actually slightly lower than bottle roll results.

Table 5.7

Column Test Results - PORPHYRY OXIDE

Sample and Test Description				Head Assay g/t				Tail g/t		CN Sol %*		Recovery %		Ore	Reagent kg/t	
Sample	Size	Test		Au		Ag		Au	Ag	Au	Ag	Au	Ag	Ratio	NaCN	Lime
Name	mm	Type	Days	Calc	Dir	Calc	Dir									
Tp Composite Bulk Comp	150	cpmr	67	0.64	0.56	12.7	16.9	0.15	7.4			76.6	41.7	2.82	0.79	2.50
	50	cpmr	54	0.62	0.56	13.5	13.1	0.12	6.2			80.6	54.1	3.03	0.65	2.50
	13	cpmr	50	0.50	0.49	13.9	12.8	0.10	6.4			80.0	54.0	2.56	0.91	2.50
Tp-3 Bulk	50	cpmr	80	1.60	1.34	39.8	50.0	0.18	4.2	73.1	58.0	88.8	89.4	9.83	0.69	3.70
	13	cpmr	79	1.87	1.34	44.3	50.0	0.17	4.3	56.7	52.1	90.9	90.3	10.45	1.37	3.70
Tp-4b Bulk	13	cpmr	45	0.84	0.53	36.4	25.1	0.13	20.6	29.8	28.6	84.5	43.4	3.23	2.99	1.70
	13	cpmr	45	0.82	0.53	37.4	25.1	0.17	21.4	30.5	27.8	79.3	42.8	4.48	0.86	1.70
Tp-5 Bulk	150	cpmr	102	1.33	1.08	170.9	120.0	0.33	121.6	89.5	68.1	75.2	28.8	8.91	0.79	3.70
	50	cpmr	73	1.22	1.08	144.7	120.0	0.25	99.3	88.5	49.0	79.5	31.3	8.44	0.81	3.70
	13	cpmr	74	1.18	1.08	122.0	120.0	0.24	79.7	89.0	63.1	79.7	34.7	7.66	1.13	3.70
Tp-6 Bulk	150	cpmr	91	1.14	1.15	18.8	18.4	0.19	13.1	81.6	53.2	83.2	30.3	5.08	0.84	5.00
	50	cpmr	73	1.05	1.15	17.0	18.4	0.19	10.8	127.6	66.5	81.9	36.5	4.69	1.00	5.00
	13	cpmr	64	1.01	1.15	12.8	18.4	0.14	5.4	63.4	77.3	86.1	57.8	4.54	1.19	5.00
Tp-97/102HS Core Comp	13	cpmr	73	0.63	0.64	16.3	12.6	0.20	8.1	69.8	44.2	68.3	50.3	2.66	1.08	4.00
Tp-97Clay Core Comp	13	cpmr	65	0.60	0.54	14.0	21.4	0.10	5.4	83.3	68.6	83.3	61.4	3.02	1.07	2.80
Tp-102Clay Core Comp	13	cpmr	65	0.88	0.74	29.2	24.0	0.15	7.9	118.2	72.3	83.0	72.9	4.98	1.19	3.30
97SP_PORCOMP1 Bulk Comp	50	cpmr	30	0.47	0.46	29.0	37.1	0.15	24.0	87.2	100.7	68.1	17.2	1.97	0.54	2.00
	32	cpmr	30	0.49	0.46	28.0	37.1	0.16	21.2	81.6	52.9	67.3	24.3	2.16	0.67	2.50
	13	cpmr	28	0.54	0.46	48.0	37.1	0.14	35.6	68.5	41.5	74.1	25.8	2.96	0.84	3.50
97SP_PORCOMP2 Bulk Comp	50	cpmr	308	0.50	0.31	20.1	17.0	0.08	13.4	54.0	26.8	84.0	33.3	2.21	1.66	0.50
	32	cpmr	308	0.38	0.31	18.0	17.0	0.07	11.1	71.1	29.9	81.6	38.3	1.61	2.17	1.00
	13	cpmr	306	0.42	0.31	19.9	17.0	0.05	12.6	64.3	27.0	88.1	36.7	1.56	3.28	2.00
97SP_PORCOMP3 Bulk Comp	32	cpmr	168	0.67	0.67	19.9	28.2	0.18	12.1	92.5	67.3	73.1	39.2	2.99	0.94	3.41
	32	cpmr	168	0.74	0.67	18.0	28.2	0.21	10.5	83.8	74.4	71.6	41.7	3.00	1.18	3.09
	32	cpmr	170	0.58	0.67	18.6	28.2	0.12	11.7	106.9	72.0	79.3	37.1	2.80	0.87	4.75
	32	cpmr	239	0.65	0.67	17.4	28.2	0.13	10.3	95.4	77.0	80.0	40.8	2.95	1.14	4.04
	19	plcmcr														
	19	plcmcr														
	19	plcmcr														
	13	cpmr	168	0.70	0.67	20.3	28.2	0.16	11.1	94.3	68.5	77.1	45.3	3.38	0.55	3.96
98SP_PORCOMP4 Core Comp	32	gmslmcr	182	0.80		27.9		0.21	17.2			73.8	38.4	3.75	0.43	8.30
	19	plcpmr														
	19	plcpmr														
	19	cmcrms	113	0.69		26.7		0.21	16.8			69.6	37.1	3.15	0.72	8.90

Table 5.7

Column Test Results - PORPHYRY OXIDE

Sample and Test Description				Head Assay g/t				Tail g/t		CN Sol %*		Recovery %		Ore	Reagent kg/t	
Sample	Size	Test		Au		Ag		Au	Ag	Au	Ag	Au	Ag	Ratio	NaCN	Lime
Name	mm	Type	Days	Calc	Dir	Calc	Dir									
	19	cmcrms	111	0.64		26.0		0.16	16.4			75.0	36.9	3.12	0.51	9.00
	13	cmcr	89	0.60	0.68	23.9	26.4	0.11	13.3	76.7	68.6	81.7	44.4	2.82	1.59	11.82
PORCOMP 0.2-0.5 Core Comp	13	sslmcr	133	0.53	0.61	22.1		0.18	13.5			66.0	38.9	2.35	1.01	12.80
PORCOMP 0.5-1.5 Core Comp	13	sslmcr	156	0.94	0.97	22.4		0.25	11.9			73.4	46.9	3.77	1.43	12.70
AVERAGES (# samps)[# tests]																
Standard Tests																
150mm (3)[3]	150		87	1.04	0.93	67.5	51.8	0.22	47.4	85.5	60.7	78.3	33.6	5.60	0.81	3.73
50mm (6)[6]	50		103	0.91	0.82	44.0	42.6	0.16	26.3	86.1	60.2	80.5	43.6	5.03	0.89	2.90
32mm (3)[6]	32		181	0.59	0.58	20.0	27.8	0.15	12.8	88.5	62.3	75.5	36.9	2.59	1.16	3.13
13mm (11)[12]	13		89	0.83	0.71	34.5	32.6	0.15	18.2	69.8	51.9	81.2	51.3	4.29	1.37	3.16
All Standard Columns (11)[27]	41		112	0.82	0.73	37.1	35.9	0.16	22.1	79.2	57.0	79.5	44.4	4.22	1.16	3.16
All Other Columns (4)[11]	19		131	0.70	0.75	24.8	26.4	0.19	14.9	76.7	68.6	73.3	40.4	3.16	0.95	11.04
All 13mm Columns (14)[15]	13		96	0.80	0.72	32.2	32.2	0.15	17.1	70.4	53.3	79.7	49.7	4.03	1.37	5.01
All Core Composite Columns (6)[11]	17		110	0.70	0.70	23.2	21.1	0.17	12.3	87.0	63.4	74.9	47.5	3.29	1.00	8.17

*CN solubility analysis results of pulverized splits (typically 150 mesh) of the corresponding column samples.

( ) = # of different samples, [ ] = # of tests

Table 5.8

Bottle Roll Test Results - PORPHYRY OXIDE

Sample and Test Description				Head Assay g/t				Tail g/t		CN Sol %*		Recovery %		Ore	Reagent kg/t	
Sample	Size	Test		Au		Ag		Au	Ag	Au	Ag	Au	Ag	Ratio	NaCN	Lime
Name	mm	Type	Hrs	Calc	Dir	Calc	Dir									
Tp-1 Bulk	13	BCy	96	0.46	0.46	9.7	9.7	0.15	6.4	82.6	36.1	67.4	34.0	1.78	0.23	1.70
Tp-2 Bulk	13	BCy	96	0.47	0.47	9.7	9.7	0.13	6.2	44.7	51.5	72.3	36.1	1.94	0.37	1.60
Tp-3 Bulk	13	BCy	96	1.58	1.58	24.3	24.3	0.21	6.0	77.8	90.9	86.7	75.3	8.16	0.38	3.20
	13	BCy	96	1.45	1.34	50.1	50.0	0.26	9.9	73.1	46.1	82.1	80.2	9.09	0.15	3.60
Tp Composite Bulk Comp	13	BCy	96	0.78	0.78	18.5	18.5	0.16	7.2	46.2	54.6	79.5	61.1	3.94	0.31	2.00
Tp-4b Bulk	13	BCy	96	0.78	0.53	33.1	25.1	0.20	21.4	32.1	31.4	74.4	35.3	3.78	0.31	2.10
Tp-5 Bulk	13	BCy	96	1.36	1.08	114.5	76.0	0.37	51.1	77.2	67.2	72.8	55.4	10.03	0.60	3.80
Tp-6 Bulk	13	BCy	96	0.93	1.15	11.9	18.4	0.22	5.6	68.8	83.2	76.3	52.9	3.97	0.22	4.80
Tp-97/102HS Core Comp	13	BCy	96	0.80	0.64	12.3	14.2	0.39	6.2	55.0	58.5	51.3	49.6	2.50	0.15	3.90
Tp-97Clay Core Comp	13	BCy	96	0.67	0.54	16.3	21.4	0.18	6.3	74.6	58.9	73.1	61.3	3.20	0.00	2.80
Tp-102Clay Core Comp	13	BCy	96	0.90	0.74	32.5	24.0	0.22	7.3	115.6	64.9	75.6	77.5	5.38	0.08	3.20
97SP_PORCOMP1 Bulk Comp	50	BCy	240	0.59	0.46	20.4	37.1	0.21	12.6	69.5	143.1	64.4	38.2	2.49	0.01	2.50
	32	BCy	240	0.57	0.46	27.9	37.1	0.21	21.7	70.2	53.0	63.2	22.2	2.26	0.59	3.70
	13	BCy	192	0.55	0.46	40.3	37.1	0.14	22.9	67.3	49.4	74.5	43.2	3.42	0.30	4.10
	13	BCy	192	0.42	0.46	48.1	37.1	0.07	23.8	88.1	41.4	83.3	50.6	3.70	0.23	3.80
97SP_PORCOMP2 Bulk Comp	50	BCy	240	0.45	0.31	19.8	17.0	0.10	13.9	60.0	27.2	77.8	29.8	2.19	0.14	1.90
	32	BCy	240	0.42	0.31	11.1	17.0	0.11	5.4	64.3	48.5	73.8	51.4	1.98	0.01	2.20
	13	BCy	240	0.39	0.31	18.5	17.0	0.07	10.7	69.2	29.1	82.1	42.2	2.20	0.15	2.90
97SP_PORCOMP3 Bulk Comp	13	BCy	192	0.92	0.90	22.5	19.0	0.34	15.1	71.7	61.8	63.0	32.9	3.43	0.45	1.40
	13	BCy	96	0.66	0.67	19.0	28.2	0.17	10.6	100.0	73.2	74.2	44.2	3.07	0.26	3.40
98SP_PORCOMP4 Core Comp	13	BCy	96	0.79	0.45	26.3	24.2	0.20	17.4	58.2	62.4	74.7	33.8	3.60	0.38	4.30
PORCOMP 0.2-0.5 Core Comp	13	BCy	96	0.56	0.61	22.7	23.0	0.17	12.3			69.6	45.8	2.75	0.47	4.00
PORCOMP 0.5-1.5 Core Comp	13	BCy	96	0.98	0.97	26.5	23.7	0.24	11.0			75.5	58.5	4.87	0.69	3.20
AVERAGES (# samps)[# tests]																
>=13mm of 'Column Samples' (14)[21]	18		144	0.79	0.70	29.4	28.1	0.20	14.2	70.5	60.3	73.7	49.6	4.10	0.28	3.18
13mm of 'Column Samples' (14)[17]	13		121	0.85	0.78	31.6	28.3	0.21	14.4	71.7	58.2	74.6	52.9	4.53	0.30	3.32
All >=13mm (113)[121]	14		110	0.90	0.79	26.0	25.8	0.26	14.2	76.8	62.9	70.5	42.5	4.04	0.32	3.01
All 13mm (113)[117]	13		106	0.91	0.81	26.2	25.8	0.27	14.2	77.2	62.7	70.5	42.8	4.10	0.33	3.03
>=13mm Core & Core Comp (98)[99]	13		96	0.93	0.81	25.7	26.1	0.28	14.3	78.3	63.7	69.4	41.6	4.10	0.32	2.99

*CN solubility analysis results of pulverized splits (typically 150 mesh) of the corresponding bottle roll samples.

( ) = # of different samples, [ ] = # of tests

Begonia Limestone

Table 5.9 presents detailed column leach test results with averages by particle size for Begonia samples. The results of bottle roll testing of splits of these column samples and other bottle rolls by sample type and size are provided in Table 5.10.

Recovery profiles for Begonia also indicate a fast leaching ore with increases in both Au and Ag recovery with additional leach time, although recoveries are not as high as the Porphyry Oxide. Metallica conducted a series of bottle rolls at fine grind sizes to examine the possibility of pulp agglomeration. Additional recoveries were not sufficiently attractive to continue investigations. As with Porphyry Oxide, particle size degradation in the columns was minimal and solution percolation is not expected to cause any problems and agglomeration was not required.

Averages are presented by particle size without two non-representative samples that contained extremely high Ag values. Begonia columns at 13, 32, and 50mm sizes show consistent Au recoveries of 61.3, 66.4, and 57.9%. Silver, however, shows much greater sensitivity to particle size with Ag recoveries of 41.2, 25.9, and 39.5% at the 13, 32, and 50mm sizes, respectively. The average bottle roll recoveries for the 13mm size columns are 64.6% Au and 47.2% Ag. Comparing column test results with those of comparable bottle roll samples shows exactly the same Au recovery but significantly lower (by 10%) column Ag recovery than from the bottle rolls (higher column values would typically be expected).

Results of column testing of BEGCOMP2, which was sampled at the same site as Metallica's Tbg-1 to determine if results could be replicated, show some variations. BEGCOMP2 showed lower Au grade and higher Ag grade than Tbg-1. Au recovery was similar between the two samples, however, BEGCOMP2 had lower Ag recovery on a higher grade head. The difference in results for the two samples could be a combination of variability in ore and in variability inherent in laboratory results.

Table 5.9

Column Test Results - BEGONIA

Sample and Test Description				Head Assay g/t				Tail g/t		CN Sol %*		Recovery %		Ore	Reagent kg/t	
Sample	Size	Test		Au		Ag		Au	Ag	Au	Ag	Au	Ag	Ratio	NaCN	Lime
Name	mm	Type	Days	Calc	Dir	Calc	Dir									
Tbg-1 Bulk	50	cpmr	86	0.29	0.27	13.4	17.9	0.09	5.5	72.4	75.4	69.0	59.0	1.62	0.36	8.00
	13	cpmr	85	0.26	0.27	15.0	17.9	0.07	6.7	65.4	76.0	73.1	55.3	1.41	1.51	8.00
Tbg-2 Bulk	50	cpmr	80	0.06	0.04	144.6	207.0	0.04	72.5	66.7	55.5	33.3	49.5	5.98	0.51	1.80
	13	cpmr	80	0.05	0.04	178.0	207.0	0.03	81.0	80.0	54.0	40.0	54.5	7.97	0.96	1.80
Tbg-3 Core Comp	50	cpmr	72	1.63	1.64	51.8	22.7	0.45	38.2	90.8	58.7	72.2	26.3	6.46	1.16	1.30
	13	cpmr	70	1.93	1.64	59.7	22.7	0.49	39.8	74.6	43.2	74.6	33.3	6.34	2.51	1.30
MET-17B Bulk	13	cpmr	98	0.86	0.81	522.6	595.5	0.61	185.0	82.6	42.6	29.1	64.6	26.00	1.41	2.90
97SP_BEGCOMP1 Bulk Comp	50	cpmr	30	0.54	0.33	31.5	25.7	0.28	22.0	83.3	63.8	48.1	30.2	2.04	0.83	3.00
	32	cpmr	30	0.52	0.33	32.1	25.7	0.21	21.7	86.5	41.1	59.6	32.4	2.26	1.11	4.00
	13	cpmr	28	0.62	0.33	35.6	25.7	0.28	25.6	50.0	52.8	54.8	28.1	2.27	1.31	5.00
97SP_BEGCOMP2 Bulk Comp	50	cpmr	308	0.09	0.09	20.4	21.3	0.03	13.8	77.8	6.6	66.7	32.4	0.75	1.41	0.50
	32	gmslmcr	182												0.14	8.30
	32	cpmr	308	0.10	0.09	18.9	21.3	0.04	13.3	70.0	7.1	60.0	29.6	0.59	2.16	0.50
	13	cpmr	304	0.11	0.09	21.7	21.3	0.03	12.0	63.6	6.2	72.7	44.7	0.72	3.74	1.00
97SP_BEGCOMP3 Bulk Comp	32	cpmr	239	0.65	0.61	51.8	51.6	0.12	40.1	95.4	47.5	81.5	22.6	3.34	1.16	4.24
	32	cpmr	168	0.65	0.61	50.4	51.9	0.13	40.0	95.4	48.8	80.0	20.6	3.38	0.79	3.17
	13	cpmr	168	0.57	0.60	50.6	51.2	0.09	40.4	100.0	49.6	84.2	20.2	2.98	1.19	4.20
98SP_BEGCOMP4 Core Comp	32	cpmr	197	0.36	0.33	30.0	31.4	0.13	23.4	94.4	73.7	63.9	22.0	1.47	1.49	2.74
	32	cpmr	197	0.45	0.33	31.9	31.4	0.22	23.0	75.6	69.3	53.5	27.9	1.90	0.75	3.76
	13	nopmr	201	0.25	0.34	27.0	30.3	0.12	20.3	128.0	84.8	52.0	24.8	0.88	2.44	4.69
	13	cpmr	197	0.42	0.34	28.9	30.3	0.16	20.5	76.2	79.2	61.9	29.1	1.12	4.19	5.02
	13	nopmr	201	0.34	0.34	31.0	30.3	0.16	21.0	94.1	73.9	52.9	32.3	1.25	2.48	4.73
AVERAGES (# samps)[# tests]																
Standard Tests																
150mm (0)[0]																
50mm (5)[5]	50		115	0.52	0.47	52.3	58.9	0.18	30.4	78.2	52.0	57.9	39.5	3.37	0.85	2.92
32mm (4)[6]	32		190	0.46	0.38	35.9	35.6	0.14	26.9	86.2	47.9	66.4	25.9	2.16	1.24	3.07
13mm (8)[8]	13		129	0.60	0.52	114.0	121.5	0.22	51.4	74.0	50.5	61.3	41.2	6.10	2.10	3.65
All Standard Columns (8)[19]	29		144	0.53	0.46	73.1	77.9	0.18	38.1	79.0	50.1	62.0	35.9	4.14	1.50	3.28
All Other Columns (2)[3]	19		195	0.30	0.34	29.0	30.3	0.14	20.7	111.1	79.3	52.5	28.6	1.07	1.69	5.91
All 13mm Columns (8)[10]	13		143	0.54	0.48	97.0	103.2	0.20	45.2	81.4	56.2	59.5	38.7	5.09	2.17	3.86
All Core Composite Columns (2)[7]	24		162	0.77	0.71	37.2	28.4	0.25	26.6	90.5	69.0	61.6	28.0	2.77	2.15	3.36

*CN solubility analysis results of pulverized splits (typically 150 mesh) of the corresponding column samples.

( ) = # of different samples, [ ] = # of tests

Table 5.10

Bottle Roll Test Results - BEGONIA

Sample and Test Description				Head Assay g/t				Tail g/t		CN Sol %*		Recovery %		Ore	Reagent kg/t	
Sample and Test Description Name	Size mm	Test Type	Test Hrs	Au Calc	Au Dir	Ag Calc	Ag Dir	Au	Ag	Au	Ag	Au	Ag	Ratio	NaCN	Lime
Tbg-1 Bulk	13	BCy	96	0.30	0.27	19.2	17.9	0.10	10.0	56.7	59.4	66.7	47.9	1.73	6.19	10.30
Tbg-2 Bulk	13	BCy	96	2.36	0.04	201.6	207.0	0.29	103.0	1.7	45.4	87.7	48.9	18.17	0.07	1.50
Tbg-3 Core Comp	13	BCy	96	1.43	1.64	37.7	22.7	0.36	15.7	100.7	68.4	74.8	58.4	7.01	1.53	1.50
MET-17B Bulk	13	BCy	96	0.95	0.81	493.9	595.5	0.61	140.9	74.7	45.0	35.8	71.5	30.70	0.75	2.80
97SP_BEGCOMP1 Bulk Comp	50	BCy	240	0.43	0.33	21.3	25.7	0.17	13.0	104.7	94.4	60.5	39.0	1.95	5.63	7.50
	32	BCy	240	0.70	0.33	9.8	25.7	0.35	0.3	64.3	134.7	50.0	96.9	2.48	4.65	2.50
	13	BCy	192	0.49	0.33	31.2	25.7	0.14	17.1	63.3	60.3	71.4	45.2	2.86	5.62	4.90
	13	BCy	240	0.69	0.33	37.5	25.7	0.34	26.3	44.9	50.1	50.7	29.9	2.62	5.25	3.60
	13	BCy	192	0.52	0.33	30.6	25.7	0.16	14.7	59.6	61.4	69.2	52.0	3.06	6.29	6.30
97SP_BEGCOMP3 Bulk Comp	13	BCy	192	1.17	1.52	92.7	91.0	0.54	56.2	48.7	27.1	53.8	39.4	6.06	0.72	3.70
	13	BCy	96	0.69	0.61	55.6	51.6	0.08	31.5	82.6	45.1	88.4	43.3	4.94	0.27	3.60
98SP_BEGCOMP4 Core Comp	13	BCy	96	0.40	0.33	30.7	31.4	0.21	19.7	80.0	74.6	47.5	35.8	1.83	1.28	1.00
AVERAGES (# samps)[# tests]																
>=13mm of 'Column Samples' (7)[12]	18		156	0.84	0.57	88.5	95.5	0.28	37.4	65.2	63.8	63.0	50.7	6.95	3.19	4.10
13mm of 'Column Samples' (7)[10]	13		139	0.90	0.62	103.1	109.4	0.28	43.5	61.3	53.7	64.6	47.2	7.90	2.80	3.92
All >=13mm (49)[54]	14		115	1.35	1.27	67.0	69.9	0.59	35.9	101.6	69.5	52.5	42.4	6.27	1.18	2.65
All 13mm (49)[52]	13		110	1.39	1.31	69.0	71.6	0.60	37.0	102.3	67.4	52.4	41.5	6.43	1.02	2.56
>=13mm Core & Core Comp (41)[41]	13		96	1.38	1.38	57.1	57.9	0.61	32.7	112.8	71.4	49.7	41.6	5.74	0.64	2.05

*CN solubility analysis results of pulverized splits (typically 150 mesh) of the corresponding bottle roll samples.

( ) = # of different samples, [ ] = # of tests

Barreno Limestone

From the initial test work, recoveries of Au and Ag for Barreno ores were more problematic than either Porphyry or Begonia ore types. Table 5.11 presents detailed column leach test results with averages by particle size for Barreno samples. The results of bottle roll testing of splits from these column samples and other bottle rolls by sample type and size are provided in Table 5.12.

Only standard columns with precious metals recovery via carbon were conducted on the Barreno samples. Barreno columns at 13, 32, and 50mm sizes show steadily and significantly decreasing Au recoveries with increasing feed size. Average Au recovery is 40.4, 30.7, and 21.2% for the 13, 32, and 50mm particle sizes, respectively. Silver recovery, however, is consistently poor with Ag recoveries of 3.8, 2.8, and 5.3% at the 13, 32, and 50mm sizes, respectively. The average bottle roll recoveries for all column split samples are 43.7% Au and 11.4% Ag. Column results have approximately 5% lower Au recovery and significantly lower (by 8%) Ag recovery than bottle roll results on column split samples (higher column values would typically be expected).

The columns showing the best recoveries were from bulk sample Kb-4 and bulk composite BARCOMP3. Both of these had higher Au recoveries, however, both also had a higher Au content than the average to be mined and the other column samples. Kb-4 was particularly high in Au and showed significantly higher Au recovery. Results of column testing on the most representative Barreno sample (BARCOMP4), however, showed the poorest results. Au recovery for the 13mm size column is only 16.8% - nearly 24% below the average Au recovery for all 13mm columns. The average bottle roll recovery for Barreno core samples is only 25.1%, over 20% below the average bottle roll recovery for splits from the 13mm Barreno columns (all but one of which is core).

Table 5.11

Column Test Results - BARRENO (BA + BAm)

Sample and Test Description				Head Assay g/t				Tail g/t		CN Sol %*		Recovery %		Ore	Reagent kg/t	
Sample	Size	Test		Au		Ag		Au	Ag	Au	Ag	Au	Ag	Ratio	NaCN	Lime
Name	mm	Type	Days	Calc	Dir	Calc	Dir									
Tb Composite Bulk Comp	50	cpmr	47	0.76	0.74	22.2	21.9	0.61	20.6			19.7	7.2	0.86	0.25	1.35
	13	cpmr	45	0.69	0.68	22.5	21.9	0.55	20.8			20.3	7.6	0.82	0.33	1.35
Kb-4 Bulk	13	cpmr	42	1.65	1.86	27.3	28.8	0.60	25.9	94.5	22.7	63.6	5.1	5.21	0.40	0.70
	13	cpmr	44	1.82	1.86	29.9	28.8	0.64	28.3	85.7	20.7	64.8	5.4	5.86	0.57	0.70
	13	cpmr	34	2.14	1.86	26.8	28.8	0.83	25.3	72.9	23.1	61.2	5.6	6.49	0.35	0.70
Kb-5 Bulk	13	cpmr	42	0.83	0.91	23.7	24.5	0.61	23.3	86.7	30.0	26.5	1.7	1.10	0.31	1.00
	13	cpmr	34	0.84	0.91	23.4	24.5	0.60	23.0	85.7	30.3	28.6	1.7	1.20	0.27	1.00
	13	cpmr	44	0.83	0.91	25.2	24.5	0.64	24.8	86.7	28.2	22.9	1.6	0.96	0.62	1.00
97SP_BARCOMP1 Bulk Comp	50	cpmr	30	0.77	1.07	42.9	38.9	0.58	40.6	97.4	16.6	24.7	5.4	1.11	0.37	0.80
	32	cpmr	30	0.75	1.07	36.3	38.9	0.61	34.3	85.3	19.3	18.7	5.5	0.85	0.32	1.00
	13	cpmr	28	0.98	1.07	37.6	38.9	0.55	34.9	90.8	16.8	43.9	7.2	2.31	0.50	1.50
97SP_BARCOMP2 Bulk Comp	50	cpmr	308	0.73	0.63	32.2	32.2	0.59	31.1	61.6	7.5	19.2	3.4	0.69	1.39	0.50
	32	cpmr	308	0.66	0.63	34.0	32.2	0.50	33.0	68.2	7.1	24.2	2.9	0.70	1.90	0.50
	13	cpmr	306	0.63	0.63	34.3	32.2	0.46	33.1	71.4	7.0	27.0	3.5	0.62	3.07	0.80
97SP_BARCOMP3 Bulk Comp	32	cpmr	168	1.34	1.31	27.4	25.8	0.85	26.9	109.0	32.1	36.6	1.8	2.42	0.72	0.65
	32	cpmr	239	1.38	1.21	25.7	25.7	0.85	25.2	105.8	34.2	38.4	1.9	2.56	0.99	2.19
	13	cpmr	170	1.18	1.33	24.7	28.2	0.68	24.0	113.6	31.2	42.4	2.8	2.49	0.82	2.49
	13	cpmr	168	1.31	1.33	26.9	25.7	0.71	26.2	102.3	28.6	45.8	2.6	2.79	1.20	0.88
	13	cpmr	168	1.37	1.33	24.7	25.7	0.75	24.0	97.8	31.2	45.3	2.8	3.07	0.59	1.40
98SP_BARCOMP4 Core Comp	32	cpmr	201	1.14	1.28	42.8	41.3	1.02	42.2	107.9	15.9	10.7	1.4	0.64	0.84	1.39
	13	cpmr	201	1.01	1.05	43.6	40.8	0.84	42.8	87.1	14.7	16.8	1.8	0.78	1.53	2.32
AVERAGES (# samps)[# tests]																
Standard Tests																
150mm (0)[0]																
50mm (3)[3]	50		128	0.75	0.81	32.4	31.0	0.59	30.8	79.5	12.0	21.2	5.3	0.89	0.67	0.88
32mm (5)[6]	32		186	1.51	1.14	33.0	31.6	0.92	32.1	90.5	22.6	30.7	2.8	2.87	0.97	1.27
13mm (8)[14]	13		107	1.38	1.22	29.0	28.5	0.73	27.9	88.2	23.5	40.4	3.8	3.13	0.84	1.36
All Standard Columns (8)[23]	23		130	1.33	1.14	30.5	29.6	0.76	29.4	88.0	22.1	35.3	3.7	2.77	0.85	1.27
All Other Columns (0)[0]																
All 13mm Columns (8)[14]	13		107	1.38	1.22	29.0	28.5	0.73	27.9	88.2	23.5	40.4	3.8	3.13	0.84	1.36
All Core Composite Columns (1)[2]	23		201	1.08	1.17	43.2	41.1	0.93	42.5	97.5	15.3	13.8	1.6	0.71	1.19	1.86

*CN solubility analysis results of pulverized splits (typically 150 mesh) of the corresponding column samples.

( ) = # of different samples, [ ] = # of tests

Table 5.12

Bottle Roll Test Results - BARRENO (BA + BAm)

Sample and Test Description				Head Assay g/t				Tail g/t		CN Sol %*		Recovery %		Ore	Reagent kg/t	
Sample	Size	Test		Au		Ag		Au	Ag	Au	Ag	Au	Ag	Ratio	NaCN	Lime
Name	mm	Type	Hrs	Calc	Dir	Calc	Dir									
Tb-1 Bulk	13	BCy	96	0.71	0.71	36.0	36.0	0.44	30.1	63.4	28.9	38.0	16.4	1.80	0.16	1.30
Tb-2 Bulk	13	BCy	96	0.41	0.41	19.0	19.0	0.28	17.2	158.5	25.8	31.7	9.5	0.78	0.22	1.30
Tb-3 Bulk	13	BCy	96	0.83	0.83	7.6	7.6	0.62	6.5	37.3	67.1	25.3	14.5	1.11	0.16	1.50
Tb Composite Bulk Comp	13	BCy	96	0.72	0.72	23.0	23.0	0.45	18.8	65.3	22.6	37.5	18.3	1.66	0.23	0.80
Kb-4 Bulk	13	BCy	96	1.53	1.86	27.4	28.8	0.65	25.6	102.0	22.6	57.5	6.6	4.42	0.15	0.90
Kb-5 Bulk	13	BCy	96	0.82	0.91	24.5	24.5	0.64	23.2	87.8	29.0	22.0	5.3	0.98	0.08	1.20
97SP_BARCOMP1 Bulk Comp	50	BCy	240	0.77	1.07	44.7	38.9	0.53	40.8	97.4	15.9	31.2	8.8	1.49	0.05	1.10
	13	BCy	192	0.96	1.07	37.1	38.9	0.43	31.0	92.7	17.0	55.2	16.4	3.08	0.13	1.70
	13	BCy	192	0.95	1.07	37.3	38.9	0.41	32.0	93.7	16.9	56.8	14.2	3.06	0.15	1.20
97SP_BARCOMP2 Bulk Comp	50	BCy	240	0.63	0.63	30.7	32.2	0.41	29.2	71.4	7.8	34.9	4.9	1.19	0.15	1.00
	13	BCy	240	0.68	0.63	34.5	32.2	0.39	31.9	66.2	7.0	42.6	7.5	1.62	0.25	1.60
	13	BCy	96	0.61	0.63	38.3	32.2	0.39	31.1	73.8	6.3	36.1	18.8	1.66	0.89	13.30
	13	BCy	240	0.93	0.63	27.1	32.2	0.41	24.7	48.4	8.9	55.9	8.9	2.72	0.90	0.10
97SP_BARCOMP3 Bulk Comp	13	BCy	192	1.36	1.32	26.6	26.6	0.75	23.6	98.5	28.9	44.9	11.3	3.21	0.75	1.50
	13	BCy	96	1.36	1.32	27.1	26.6	0.63	22.7	98.5	28.4	53.7	16.2	3.91	0.97	0.80
97SP_BARCOMP3_Kb-97-01/02 Bulk Comp	13	BCy	96	4.28	1.32	33.2	26.6	1.84	28.0	31.3	23.2	57.0	15.7	12.29	1.96	1.50
98SP_BARCOMP4 Core Comp	13	BCy	96	1.03	1.05	41.9	40.8	0.76	39.3	85.4	15.3	26.2	6.2	1.53	0.08	1.00
AVERAGES (# samps)[# tests]																
>=13mm of 'Column Samples' (8)[14]	18		158	1.19	1.02	32.4	31.6	0.62	28.7	79.5	17.8	43.7	11.4	3.06	0.48	1.98
13mm of 'Column Samples' (8)[12]	13		144	1.27	1.04	31.5	30.9	0.65	27.7	78.6	18.8	45.5	12.1	3.35	0.55	2.13
All >=13mm (93)[100]	14		112	1.42	1.50	36.3	36.7	0.89	33.9	74.6	21.7	31.9	7.3	2.77	0.26	1.31
All 13mm (93)[98]	13		109	1.44	1.52	36.3	36.7	0.90	33.9	74.4	22.0	31.9	7.3	2.80	0.26	1.32
>=13mm Core & Core Comp (41)[42]	13		96	1.40	1.34	38.0	37.7	0.96	36.3	83.5	20.8	25.1	4.8	2.26	0.20	1.13

*CN solubility analysis results of pulverized splits (typically 150 mesh) of the corresponding bottle roll samples.

( ) = # of different samples, [ ] = # of tests

Hospital Limestone

Metallica and Cambior's early work assumed that samples of the Hospital Limestone would behave metallurgically similar to the Begonia Limestone, as there is little to geologically distinguish the two rock types. Hence, most all work was performed on the more widespread Begonia rock type. Late in Cambior's studies, specific Hospital core samples and underground chip samples were taken for bottle roll testing. Bottle roll results indicate that precious metals recoveries for the Hospital are lower than the Begonia, and perhaps more similar to Barreno. Metallica did not evaluate the Hospital Limestone as a separate rock unit.

Because no columns have been performed on Hospital Limestone ore, only the results of bottle roll tests are presented in Table 5.13 (all bottle rolls are presented for evaluation). As discussed previously, the average bottle roll recoveries for all core and core composite samples is 47.0% Au and 15.3% Ag.

Porphyry Mixed

Table 5.14 presents column leach test results with averages by particle size for Porphyry Mixed samples. The results of bottle roll testing of splits from these column samples and other bottle rolls by sample type and size are provided in Table 5.15.

Porphyry Sulfide

Table 5.16 presents detailed column leach test results with averages by particle size for Porphyry Sulfide samples. The results of bottle roll testing of splits from these column samples and other bottle rolls by sample type and size are provided in Table 5.17.

Table 5.13

Bottle Roll Test Results - HOSPITAL

Sample and Test Description				Head Assay g/t				Tail g/t		CN Sol %*		Recovery %		Ore	Reagent kg/t	
Sample	Size	Test		Au		Ag		Au	Ag	Au	Ag	Au	Ag	Ratio	NaCN	Lime
Name	mm	Type	Hrs	Calc	Dir	Calc	Dir									
73753 UG Chip	13	BCy	96	0.18	0.41	13.9	11.0	0.10	13.0	172.2	12.2	44.4	6.5	0.46	0.07	0.90
73756 UG Chip	13	BCy	96	0.22	0.21	17.6	15.8	0.17	16.1	77.3	19.9	22.7	8.5	0.37	0.15	0.90
73811 UG Chip	13	BCy	96	0.22	0.17	31.0	31.2	0.14	27.4	63.6	24.8	36.4	11.6	0.68	0.06	1.10
73818 UG Chip	13	BCy	96	0.49	0.31	16.6	11.0	0.41	15.8	55.1	31.9	16.3	4.8	0.45	0.08	0.70
73834 UG Chip	13	BCy	96	0.09	0.07	37.2	39.8	0.07	34.6	0.0	55.4	22.2	7.0	0.31	0.06	0.80
73848 UG Chip	13	BCy	96	0.27	0.21	46.5	47.3	0.03	44.2	51.9	14.6	88.9	4.9	1.35	0.22	1.10
73868 UG Chip	13	BCy	96	0.27	0.24	17.1	19.9	0.21	16.1	77.8	20.5	22.2	5.8	0.37	0.07	0.90
73883 UG Chip	13	BCy	96	0.93	1.10	13.6	16.8	0.45	12.0	103.2	43.4	51.6	11.8	2.46	0.15	0.80
74790 UG Chip	13	BCy	96	0.36	0.41	9.5	11.3	0.21	7.5	66.7	20.0	41.7	21.1	0.89	0.22	1.50
96SP_137C016018 Core	13	BCy	96	0.18	0.10	100.0	98.6	0.18	60.0	388.9	73.7	0.0	40.0	3.29	0.01	1.20
97SP_203C086088 Core	13	BCy	96	0.19	0.17	82.4	75.8	0.17	81.3	110.5	8.3	10.5	1.3	0.19	0.07	1.50
97SP_203C114117 Core	13	BCy	96	0.46	0.45	32.9	25.4	0.17	26.4	119.6	45.3	63.0	19.8	1.94	0.37	1.50
97SP_207C074077 Core	13	BCy	96	0.55	0.65	95.2	100.1	0.31	83.0	125.5	61.2	43.6	12.8	2.17	1.41	1.00
97SP_207C095097 Core	13	BCy	96	0.02	0.03	83.4	80.9	0.02	68.6	150.0	72.3	0.0	17.7	1.21	0.22	0.70
97SP_207C114116 Core	13	BCy	96	0.67	0.69	23.1	23.7	0.14	21.3	92.5	20.8	79.1	7.8	2.72	1.37	1.00
97SP_211C010012 Core	13	BCy	96	0.99	1.34	23.6	25.4	0.24	21.6	121.2	43.6	75.8	8.5	3.81	0.07	1.00
97SP_211C024026 Core	13	BCy	96	0.24	0.31	33.0	41.1	0.10	30.5	100.0	48.8	58.3	7.6	0.89	0.15	1.00
97SP_211C043045 Core	13	BCy	96	0.21	0.31	18.1	21.9	0.03	16.1			85.7	11.0	1.04	0.45	1.00
97SP_211C105107 Core	13	BCy	96	0.13	0.14	29.3	34.3	0.07	25.0	53.8	36.5	46.2	14.7	0.65	0.15	1.50
97SP_213C172174 Core	13	BCy	96	0.19	0.21	10.2	10.6	0.07	6.9	73.7	726.5	63.2	32.4	0.86	0.30	1.50
UG-04_10-18 Core Comp	13	BCy	96	3.33	3.60	12.4	9.9	1.44	11.7			56.8	5.6	9.25	0.00	1.00
UG-30_116-123 Core Comp	13	BCy	96	9.47	7.18	112.6	101.5	6.69	89.8			29.4	20.2	15.40	0.54	1.50
AVERAGES (# samps)[# tests]																
>=13mm of 'Column Samples' (0)[0]																
13mm of 'Column Samples' (0)[0]																
All >=13mm (22)[22]	13		96	0.89	0.83	39.1	38.8	0.52	33.1	105.4	72.6	43.5	12.8	2.31	0.28	1.10
All 13mm (22)[22]	13		96	0.89	0.83	39.1	38.8	0.52	33.1	105.4	72.6	43.5	12.8	2.31	0.28	1.10
>=13mm Core & Core Comp (13)[13]	13		96	1.28	1.17	50.5	49.9	0.74	41.7	133.6	113.7	47.0	15.3	3.34	0.39	1.18

*CN solubility analysis results of pulverized splits (typically 150 mesh) of the corresponding bottle roll samples.

( ) = # of different samples, [ ] = # of tests

Table 5.14

Column Test Results - PORPHYRY MIXED

Sample and Test Description				Head Assay g/t				Tail g/t		CN Sol %*		Recovery %		Ore	Reagent kg/t	
Sample	Size	Test		Au		Ag		Au	Ag	Au	Ag	Au	Ag	Ratio	NaCN	Lime
Name	mm	Type	Days	Calc	Dir	Calc	Dir									
TpM-1 Bulk	13	cpmr	101	0.52	0.61	25.7	28.0	0.32	12.4	26.9	67.3	38.5	51.8	1.10	4.83	48.40
PORCOMP 1.5-4.5 Core Comp	13	sslmcr	TBC													
AVERAGES (# samps)[# tests]																
Standard Tests																
150mm (0)[0]																
50mm (0)[0]																
32mm (0)[0]																
13mm (1)[1]	13		101	0.52	0.61	25.7	28.0	0.32	12.4	26.9	67.3	38.5	51.8	1.10	4.83	48.40
All Standard Columns (1)[1]	13		101	0.52	0.61	25.7	28.0	0.32	12.4	26.9	67.3	38.5	51.8	1.10	4.83	48.40
All Other Columns (1)[1]	13															
All 13mm Columns (2)[2]	13		101	0.52	0.61	25.7	28.0	0.32	12.4	26.9	67.3	38.5	51.8	1.10	4.83	48.40
All Core Composite Columns (1)[1]	13															

*CN solubility analysis results of pulverized splits (typically 150 mesh) of the corresponding column samples.

( ) = # of different samples, [ ] = # of tests

Table 5.15

Bottle Roll Test Results - PORPHYRY MIXED

Sample and Test Description				Head Assay g/t				Tail g/t		CN Sol %*		Recovery %		Ore	Reagent kg/t	
Sample	Size	Test		Au		Ag		Au	Ag	Au	Ag	Au	Ag	Ratio	NaCN	Lime
Name	mm	Type	Days	Calc	Dir	Calc	Dir									
TpM-1 Bulk	13	BCy	96	0.51	0.61	20.4	28.0	0.33	9.6	27.5	84.8	35.3	52.9	1.76	12.30	50.60
PORCOMP 1.5-4.5 Core Comp	13	BCy	96	0.96	0.83	19.0	21.1	0.45	10.3			53.1	45.8	3.19	1.31	13.60
AVERAGES (# samps)[# tests]																
>=13mm of 'Column Samples' (2)[2]	13		96	0.74	0.72	19.7	24.6	0.39	10.0	27.5	84.8	44.2	49.4	2.48	6.81	32.10
13mm of 'Column Samples' (2)[2]	13		96	0.74	0.72	19.7	24.6	0.39	10.0	27.5	84.8	44.2	49.4	2.48	6.81	32.10
All >=13mm (43)[43]	13		96	0.76	0.77	24.7	23.7	0.42	12.7	67.6	76.7	42.2	45.2	2.60	1.38	6.08
All 13mm (43)[43]	13		96	0.76	0.77	24.7	23.7	0.42	12.7	67.6	76.7	42.2	45.2	2.60	1.38	6.08
>=13mm Core & Core Comp (42)[42]	13		96	0.76	0.78	24.8	23.6	0.43	12.8	68.6	76.4	42.4	45.0	2.62	1.12	5.02

*CN solubility analysis results of pulverized splits (typically 150 mesh) of the corresponding bottle roll samples.

( ) = # of different samples, [ ] = # of tests

Table 5.16

Column Test Results - PORPHYRY SULFIDE

Sample and Test Description				Head Assay g/mt				Tail g/mt		Extrac g/mt		CN Sol %*		Recovery %		Ore	Reagent kg/t	
Sample	Size	Test		Au		Ag		Au	Ag	Au	Ag	Au	Ag	Au	Ag	Ratio	NaCN	Lime
Name	mm	Type	Days	Calc	Dir	Calc	Dir											
TpS-1 Bulk	13	cpmr	101	0.91	0.86	47.7	41.1	0.56	10.5	0.35	37.2	34.1	44.2	38.5	78.0	2.39	5.31	77.90
PORCOMP 4.5 Core Comp	13	sslmcr	TBC															
AVERAGES (# samps)[# tests]																		
Standard Tests																		
150mm (0)[0]																		
50mm (0)[0]																		
32mm (0)[0]																		
13mm (1)[1]	13		101	0.91	0.86	47.7	41.1	0.56	10.5	0.35	37.2	34.1	44.2	38.5	78.0	2.39	5.31	77.90
All Standard Columns (1)[1]	13		101	0.91	0.86	47.7	41.1	0.56	10.5	0.35	37.2	34.1	44.2	38.5	78.0	2.39	5.31	77.90
All Other Columns (1)[1]	13																	
All 13mm Columns (2)[2]	13		101	0.91	0.86	47.7	41.1	0.56	10.5	0.35	37.2	34.1	44.2	38.5	78.0	2.39	5.31	77.90
All Core Composite Columns (1)[1]	13																	

*CN solubility analysis results of pulverized splits (typically 150 mesh) of the corresponding column samples.

( ) = # of different samples, [ ] = # of tests

Table 5.17

Bottle Roll Test Results - PORPHYRY SULFIDE

Sample and Test Description				Head Assay g/mt				Tail g/mt		Extrac g/mt		CN Sol %*		Recovery %		Ore	Reagent kg/t	
Sample	Size	Test		Au		Ag		Au	Ag	Au	Ag	Au	Ag	Au	Ag	Ratio	NaCN	Lime
Name	mm	Type	Days	Calc	Dir	Calc	Dir											
TpS-1 Bulk	13	BCy	96	0.82	0.86	38.9	41.1	0.50	12.1	0.32	26.8	37.8	54.2	39.0	68.9	3.76	20.69	76.90
PORCOMP 4.5 Core Comp	13	BCy	96	0.84	0.74	17.6	21.0	0.55	9.6	0.29	8.0			34.5	45.5	2.07	2.36	9.60
AVERAGES (# samps)[# tests]																		
>=13mm of 'Column Samples' (2)[2]	13		96	0.83	0.80	28.3	31.1	0.53	10.9	0.31	17.4	37.8	54.2	36.8	57.2	2.91	11.53	43.25
13mm of 'Column Samples' (2)[2]	13		96	0.83	0.80	28.3	31.1	0.53	10.9	0.31	17.4	37.8	54.2	36.8	57.2	2.91	11.53	43.25
All >=13mm (19)[19]	13		96	0.57	0.56	18.8	18.8	0.39	9.0	0.18	9.8	29.5	66.0	20.2	44.5	1.68	2.51	12.15
All 13mm (19)[19]	13		96	0.57	0.56	18.8	18.8	0.39	9.0	0.18	9.8	29.5	66.0	20.2	44.5	1.68	2.51	12.15
>=13mm Core & Core Comp (17)[17]	13		96	0.52	0.50	15.2	15.1	0.37	8.4	0.15	6.8	30.6	70.9	17.2	41.4	1.27	1.30	4.96

*CN solubility analysis results of pulverized splits (typically 150 mesh) of the corresponding bottle roll samples.

( ) = # of different samples, [ ] = # of tests

5.7 Bottle Stir Tests (Ore Leaching Characterization) by METCON – Tucson, Arizona

One of the most difficult metallurgical parameters to define for design of a heap leach facility is projected metal recovery versus crush size, optimum reagent concentration, and reagent consumption over time. The characterization leach test program (bottle stir test program) was designed to provide an improved understanding of leach parameters and to provide data than can reasonably track expected leach performance in a production operation. A complete summary of this work is included in Section 5.5 of the Appendix 5.0.

5.7.1 Description of Metallurgical Samples

Bottle stir tests were completed on composites of bulk samples from Porphyry Oxide (PORCOMP3) and core samples from Begonia Limestone oxide (BEGCOMP4). A total of 101 bottle stir tests were completed for ore characterization purposes by METCON. Additional data was developed for PORCOMP4 to ensure that results from PORCOMP3 were representative

5.7.2 Description of Bottle Stir Test Procedures

Details of procedures for METCON's bottle stir tests are also presented in Section 5.5 of the Appendix. In general, static cyanidation testing was performed for retention times ranging from 2 to 384 hours at six different size distributions of 32mm (1-¼"), 19mm (¾",) 13mm (½"), 6mm (¼"), 1.65mm (10 mesh), and 0.15mm (100 mesh) for the Porphyry and five sizes (all but 1.65mm) for the Begonia. Leach testing was conducted in a vessel at 20% solids, which was periodically stirred. Chemical grade calcium oxide was added to the slurry until the pH stabilized between 11.2 and 11.6. Sufficient NaCN was added to yield a leach solution concentration of 0.25, 1.0, and 2.0 kg/t for Porphyry and 0.25. 0.50, and 1.0 kg/t for Begonia.

5.7.3 Results of Bottle Stir Tests

Generally, the characterization test data shows that leach kinetics are most sensitive to crush size for both Au and Ag. However, kinetics are also reasonably sensitive to NaCN concentration, particularly below 0.5 g/l at coarser crush sizes. Cyanide consumption on the other hand is fairly insensitive to crush size, but very sensitive to NaCN concentration. Zn dissolution is both sensitive to crush size and NaCN concentration. Future operations, particularly at start-up, must find an optimum balance between these recovery/reagent consumption parameters. The bottle stir data suggest that this optimum production operating balance may involve keeping the NaCN concentration in leach solutions as low as possible to minimize NaCN consumption and Zn dissolution.

5.8 High Solids Bottle Stir (HSBS) Tests – RDI - Denver

A program to more closely simulate heap leaching using a mature solution was developed and applied to Cerro San Pedro ores. An initial test protocol for high-solids bottle stir tests (HSBS) for heap leach simulation was developed and tested on BEGCOMP4. Based on these results, the HSBS test protocol presented below was used with the main objectives being to evaluate the effect of process variables (i.e., pH and NaCN concentration) on precious metal extractions and reagent consumption as the solutions mature with time. Intermediate solutions were also analyzed by ICP to obtain a better understanding of the solution chemistry.

5.8.1 Description of Metallurgical Samples/Ore Types Tested

A total of 32 HSBS tests were completed on PORCOMP4, four porphyry sulfide study composites (PORCOMP 0.2-0.5, 0.5-1.5, 1.5-4.5 and 4.5), BEGCOMP4, and several Begonia core composites. No HSBS testing has been performed on the Barreno, since reagent consumption appears to be very low from other standard testing methods. Hospital ore has not been tested either.

Twenty-two of the 32 tests were conducted at conditions believed to most closely simulate the heap (closed jar, 13 to 32mm particle size, 10.75 to 11.5 pH, 35 to 37 days leach time, and 0.5 g/l concentration NaCN).

5.8.2 Test Procedures

Samples were prepared at the 13mm size primarily, but also on the 32mm particle size for PORCOMP4 and BEGCOMP4. Samples were placed in a bottle and the % solids adjusted to 75% (simulating conditions in a heap). The pH and the NaCN concentration were adjusted to the desired level (pH varied from 10 to 11.5 and NaCN concentration varied from 0.125 g/l to 0.5 g/l). The bottle was rolled for one minute. The lid was closed during and following the rolling of the bottle.

The bottle was rolled once per day for one minute. The sample was aerated for 5 minutes prior to each bottle roll event. After 48 hours, a thief sample was taken and analyzed for free NACN, Au, Ag, and Zn and a portion submitted for ICP analysis. The pH of the slurry was also measured. Another 1 kg sample of ore was then added to the bottle. Water at appropriate pH was added to adjust the solids to 75%. The required NaCN to maintain the slurry at the predetermined level was also added. This procedure for aeration, sampling, and ore/solution addition was repeated for a total of 5 cycles. After 5 cycles, no new ore was added. Only make-up solution was added, adjusting to pre-determined pH and NaCN levels. The sampling time was variable at 96 hrs or greater. Analytical testing was performed for a total of 10 cycles. The final

solids/solution were filtered to collect mature solution. The solids and mature solutions were appropriately analyzed.

5.8.3 Results of HSBS Tests

Test parameters varied pH, NaCN concentration, open versus closed bottles, nitric acid pre-treatment, and particle size, including tests designed to help model actual operating conditions. Diagnostic/research results showed that NaCN consumption decreased with increasing pH. At high pHs, Zn forms $Zn(OH)_2$ and forms a precipitate. Since NaCN does not complex with Zn precipitate, the NaCN consumption is lower and there is a corresponding decrease in Zn extraction. The NaCN consumption as a function of leach time shows significant fluctuations which could be attributable to removal of pregnant solution for analyses during the test and other factors that would result in large variations in NaCN consumption calculations. Calculated assays on leach test residues from assay by size data is significantly different from assayed leach residues for several tests despite following elaborate procedures for preparing material for assay.

Additional tests were performed in an open bottle configuration and showed significantly higher NaCN consumption. It is believed that open bottle tests greatly overestimate the proportion of heaped ore that is exposed to the surface and has free exchange with the atmosphere versus the actual volume of ore that has little surface exposure over time.

An evaluation of the mature solution was also performed. Anionic-cationic analyses, alkalinity, and forms of cyanide and sulfur analyses for leach residue indicates that the majority of the cyanide in the mature solution is present as WAD cyanide and the sulfur is present as sulfate ions. Approximately 25 to 80% of the Ag left in residue was cyanide soluble. Information on cyanide soluble Au was inconclusive because of the presence of precipitates in the cyanide leaches. Significant potassium is present in the mature solutions. Leach residues also contain 0.8 to 8.8 ppm Hg.

Table A5.12 in Section 5.7 of the Appendix details results of the 22 tests used in developing final design criteria for reagent consumption. These results included tests run at 0.5 g/l NaCN, closed bottle, and either 10.75 or 11.5 pH. The results of 4 other open bottle tests are shown for information purposes only. Precious metals recoveries calculated for the HSBS tests are not considered representative of operational recoveries because of the combined factors of low solution to solids ratio and the fact that there was no recovery employed on the HSBS tests (i.e., no carbon or Merrill-Crowe).

Porphyry Oxide

Three different composite Porphyry Oxide samples were HSBS tested for a total of 6 tests. NaCN consumption in closed bottle tests ranged from 0.030 to 0.090 kg/t for 6 tests and was 0.254 kg/t for a sample with the highest sulfide content (0.5 to 1.5% sulfide). NaCN consumption overall averaged 0.091 kg/t. Lime consumption averaged 1.65 kg/t. The average recovery for all 7 tests was 61.7% for Au and 40.1% for Ag.

Begonia Limestone

A total of 9 different Begonia samples for 12 HSBS tests were performed. NaCN consumption ranged from 0.025 to 0.297 and averaged 0.150 kg/t. Lime consumption averaged 0.83 kg/t. The average recovery for all 12 tests was 65.7% Au and 27.1% Ag.

Porphyry Mixed and Sulfide

Two tests were performed on one sample of Porphyry Mixed (sulfide content in the range of 1.5-4.5%). NaCN consumption ranged between 0.365 and 0.398 kg/t. Lime consumption ranged between 5.85 and 4.36 kg/t. Recoveries averaged 38.0% Au and 62.5% Ag.

One test was performed on a sample of Porphyry Sulfide (sulfide content >4.5%). NaCN consumption was 0.474 kg/t and lime consumption was 4.61 kg/t. Recovery was 20% Au and 35% Ag.

5.9 Related Investigations

5.9.1 Solution Chemistry and Leach Kinetics

Overall Heap Leach Chemistry Evaluation of all Standard/Design Criteria Test Work

An evaluation of cyanide, nitrogen, metals, etc. balances from weekly samples from locked-cycle columns was conducted. Ultimate Zn extraction tests were completed at RDI and METCON. Reagent consumption data from all bottle roll, HSBS, and column tests was re-evaluated. Preliminary curves were then established for NaCN and lime consumption versus tonnes of solution/tonnes of ore.

Significant conclusions regarding solution chemistry are:

- Cerro San Pedro ores contain significant concentrations of cyanide soluble Zn, carbonates, and sulfates.
- pH and NaCN concentrations are the most critical parameters which determine precipitation circumstances of Zn and related species.
- Previous test work indicates optimum leach performance at 0.5g/l as NaCN.
- Operating at 0.5g/l NaCN, the optimum pH range is 11.0-11.5. For pH values less than 11.0, some Zn will precipitate as cyanide species. For pH values greater than 11.5, excess lime consumption and/or excess precipitation may occur.
- Operating at pH 11.0 and 0.5g/l NaCN, the final leach solution should contain 10-20% of the extracted Zn, the remainder would have precipitated as Zn carbonate, hydroxide, or oxide along with much greater amounts of "scale" (mostly calcium carbonate).
- Long term ability to hold leach solution pHs above 11.0 can be accomplished through the use of pebble lime, augmented by caustic additions as needed. Pebble lime consumption can be expected to average 50-60% of the hydrated lime consumption shown in the column test data, because laboratory hydrated lime contains water as nearly two thirds of its chemical weight, while pebble lime generally contains more than 95% available lime by weight.

Mature Solution Effect on Leach Kinetics

RDI conducted testing on a 200 mesh (0.074mm) PORCOMP4 sample to evaluate the effect of mature solution on leach kinetics. Leach tests were performed at 50% solids, pH 11 and 0.5 g/l NaCN for 72 hours. Following leaching, the solution was filtered until no additional filtrate could be obtained. The filtrate volume was measured and was used in the next leach test with tap water used for make-up water for a total of 5 cycles. In the fifth cycle, however, the ore weight was reduced and recycle mature solution constituted 100% of the solution to leach. The residues were thoroughly washed and assayed for Au, Ag, and Zn. Some of the mature solutions were also analyzed using ICP methods. The residue wash solution analyses indicates that the solution contained significant Zn and Ag. Based on the residue analyses, it is reasonable to conclude that recycling of mature solution has no effect on precious metals extraction. Even after 5 cycles, Zn analysis of the mature solution was still increasing, however, Zn extraction had only increased to a total of 1.5%.

Soluble Zinc

Various test results indicate that during heap leaching some Zn will be dissolved from the ore and will likely precipitate in the heap. At pH >11.0-11.5, the primary precipitate is Zn hydroxide. As pH drops below 11.0, a higher fraction of the zinc precipitates as Zn cyanide ($ZnCN_2$). This can result in increased NaCN consumption. Commercial operations should be designed to operate with barren solutions in the pH 11.0 range.

While the amount of zinc to be solubilized in commercial operation is significant, the potential formation of precipitates are expected to average less than 0.006% of the total mass in the heap, and the precipitates are not expected to interfere with heap percolation. Solution concentrations for zinc are expected to average below 100 ppm, which is well within an acceptable operating range for Merrill Crowe plant operations.

Commercial operations will utilize pebble lime added directly to the ore, with provisions for caustic additions to trim solution pH as needed. Pebble lime is effective in maintaining high pH levels over a long period of time due to its slow dissolution rate. Because of the higher available CaO content of pebble lime, consumption of this reagent is usually about half the consumption of hydrated lime typically used in laboratory column tests.

Zinc precipitation will most likely behave similarly to other typical precipitates known as "scale" which is typically calcium carbonate. Zinc precipitation should be relatively small in the overall precipitation balance. Commercial heap leach operations will employ the use of antiscalant chemicals, which will combat the formation of scale precipitates in the circuit.

Additional information on zinc leach kinetics, extraction, and recovery of Zn is included in Section 5.5 of the Appendix.

5.9.2 Study of Existing Vat Leaching Operation

METCON performed a metallurgical audit and mass balance around the Alcalde vat leach operation adjacent to the proposed pit at the Cerro San Pedro site. The operation, now shut down, used to process 1,000 tonnes of ore per month from local open cuts. Operations involved the following units and metallurgical procedures:

Crushing Circuit

Blasted material from the Cerro San Pedro mine was broken to 100% passing 200mm and fed from a coarse ore hopper to a jaw crusher, producing 100% passing 76mm material. Material greater than 6mm was discharged by gravity to a hammer mill where material was milled. The final crushed product of 9.5mm was fed by stacker conveyor to the vat feed material stockpile. No feed assays were performed.

Vat Leaching

The vat leach circuit contained 6 vats each with 50 t capacity. Crushed material was loaded into vats using a front-end loader. Irrigation of loaded vats was done at a flow rate of 1,667 l/h for 7 days under flooded conditions with a 1-day drain cycle. The leach solution was at a pH of 12.5, NaCN concentration of 1.0 kg/t, and at 200 g/t of lime. Upon draining, the leached residue was unloaded to a tailings dump area. No tails assays were performed. Each time a vat was loaded, 13,000 l of make-up water was added to the circuit to make-up for moisture retained in the leach residue.

Sedimentation and Precipitation

The pregnant leach solution exited the leaching circuit to a clarifier in a sedimentation tank. The clarified pregnant solution flowed by gravity into the Zn precipitation circuit. The Zn precipitation cell consisted of 2 rectangular vessels divided into 5 separate boxes using steel plates. Solution flow was upward through Zn shavings into consecutive boxes. Au and Ag were precipitated as sludge on the Zn shavings. Barren solution drained from the precipitation boxes was stored in a barren solution tank. Precipitated Au and Ag was removed and washed out from the Zn shavings. Zinc shavings were treated with hydrochloric acid and then neutralized in high pH lime and water and returned to the boxes for the next cycle. Precipitate was sent to a furnace where dore consisting of Au and Ag was poured.

Analytical Procedures

There were no written metallurgical procedures. Free cyanide and free lime determinations were conducted on leach solutions and Au and Ag assays were performed on the precipitate and dore only. As such, a true metallurgical balance could not be performed.

Issues

Results from METCON's sampling found that the Alcalde operation was operated very inconsistently without adequate controls. Feed material was mined from the Gran Hundido area of the Cerro San Pedro deposit, but was not identified by rock type. Feed from vats 1, 2 and 5 ranged from 0.65 to 2.0 g/t Au and 115 to 130 g/t Ag head grade with highest Au values in vat 5. The following was concluded:

- The system was not in control with respect to NaCN concentrations or pH. The system was operated at low pH (9.9 to 11.3) and low NaCN concentration, adversely affecting the precious metal dissolution and increasing NaCN consumption. On days when no new vats were loaded, barren solution was transferred to the feed solution reservoir without adjusting NaCN and lime content, making leach concentrations inadequate to maintain proper leaching conditions. NaCN consumption was as high as 0.368 kg/t and as low as 0.012 (averaging 0.12 kg/t), due to limited control of NaCN and lime concentrations. Lime consumption averaged 0.07 kg/t.
- Precious metal recoveries were estimated at 23.5 to 62.5% Au and 11.5 to 21.7% Ag on feeds from 3 different vats. One reason for the low Ag recoveries is that leached residue was not washed with make up water to remove Ag. Washing would also decrease NaCN and lime retained as moisture and decrease consumption. Assays were performed on the same sample pulp at both labs used by McClelland and at the Bondar-Clegg laboratory in Vancouver. In addition, assays at both labs were compared which analyzed different sample splits of the same interval. The two datasets (pulp and splits) show that the low recoveries were also due to the short leach cycle, low pH, and low NaCN concentration discussed previously. Zinc extraction was estimated at 1.5 to 2%.

5.9.3 Statistical Review of Metallurgical Data/Assays

Gold and Silver Assays

A review of Au and Ag assays from McClelland and Bondar-Clegg laboratories was performed. McClelland assays generally support the Bondar-Clegg assays and appear to confirm the findings of the re-assaying program. Based on a total of some 167 sample split pairs, the average of the direct Au head assay of McClelland labs (0.99 g/t Au) is the same as the Au assay supplied by Bondar-Clegg (1.00 g/tAu). However, the average Ag head assay from McClelland (33.55 g/t Ag) is significantly higher (by 7%) than that of Bondar-Clegg (31.39 g/t Ag). If the data sets are divided into those assays performed pre-1997 and those 1997 and later, the average percent difference for the Ag assays increases to 13% in the pre-1997 data set, which supports the conclusion of the extensive sample re-assay program discussed in Section 3.0.

5.9.4 Cyanide Solubility / Metallurgical Recovery

Cyanide solubility tests were conducted by McClelland on bulk and core drill hole composites of each ore type and including composites PORCOMP1-3, BEGCOMP1-3 and BARCOMP1-3. The purpose of the cyanide solubility testing was to determine which leach conditions affected Au, Ag, or Zn extractions, or NaCN consumption. The overall objective was to begin to develop a cyanide solubility procedure for use in ore control during commercial production. Tests were conducted on samples pulverized to 95% passing 106μm (150 mesh or 0.105mm). The three variables evaluated were NaCN concentration of 1.0, 5.0, or 9.0 gNaCN/l solution, temperatures of 20, 45, or 70°C, and reaction time of 1.5, 3.0, or 4.5 hours.

Cyanide solubility Au and Ag extractions from all of these ore types were not dependent upon the NaCN concentration, leach time, or temperature, within the ranges evaluated. However, Zn dissolution from all of these ore types increased significantly with increases in NaCN concentration, temperature, and leach time.

The standard or routine Bondar-Clegg method of cyanide solubility tests used on drill samples should work as well as any other procedure evaluated in the ranges tested with respect to estimating Au and Ag extractions. Cyanide solubility tests conducted on 0.105mm feeds of Porphyry samples should provide fairly accurate estimates of Au extractions during commercial production. More comparisons are required for Begonia ore types. Cyanide solubility data will over-estimate Au extraction for crushed Barreno ores. Cyanide solubility tests at 106μm feeds will over-estimate Ag extraction for all ore types. A factor will have to be used in order to more accurately predict heap Ag extraction and enable use of cyanide solubility for ore control. Work on cyanide solubility testing for in-pit ore grade control is continuing at different particle sizes to find the optimum parameters to best simulate predicted heap recoveries. Fine grinding tends to "homogenize" differences between and enhance Au and Ag recoveries for most ore types.

Zinc dissolution was also overstated in the cyanide solubility tests. This was caused by the higher NaCN concentrations employed, rather than the ore particle size. Zinc dissolution is a function of NaCN concentration employed in the leach. The NaCN concentration used in the cyanide solubility tests is significantly higher than would be employed in the commercial operation. This would result in much higher estimates of Zn dissolution than would actually be encountered in the commercial operation.

5.9.5 Porphyry Sulfide Study – Analysis of Porphyry Oxide, Mixed and Sulfide Ore Types

Metallurgical testing established the general relationship between percent sulfide, metallurgical extraction, cyanide soluble calculated extraction, and geologic porphyry classification. However, only cyanide soluble Au analyses are consistently available for the geologic/assay database. An evaluation of cyanide solubility for the geologic database shows that there are a number of samples currently classed as Oxide that should be classed as Mixed or Sulfide. Additionally, a number of samples classed as Mixed should probably be classed as Sulfide, with a smaller number that should be classed as Oxide. Despite this relatively poor comparison of geologically versus metallurgically defined classifications (through cyanide soluble analysis for Au), the average calculated Au extractions from cyanide soluble testing for Oxide, Mixed and Sulfide compares very well with the metallurgical extraction percentages for Au. An alternative method for classifying ore may be to use the calculated and/or metallurgical Au extraction % ranges (>60% for Oxide, 25-60% for Mixed, and <25% for Sulfide) to define the classifications.

Mixed and Sulfide material may be economically processed as ore where grades are sufficient. The complete Sulfide Study is included in Section 5.5 of the Appendix.

5.9.6 Crush Size

MSX purchased a used circuit that included a tertiary crushing unit from the closed Hayden Hill mining operation in California. This equipment gives processing at Cerro San Pedro the flexibility to operate down to a crush size of 17mm with the capacity for 8 million t/y ore throughput using a closed tertiary circuit. At a 19mm crush size, throughput can be expanded to 10 million t/y using the same closed tertiary circuit. This information was derived from cost studies by Hyyppa and modeling using METSIM simulations. Under the current gold price scenario, the added gold and silver recovery benefit from crushing does not support the capital and operating costs for crushing Porphyry Oxide or Begonia Limestone ores. This feasibility study has based it economics on a run-of-mine start up. Future metals price increases may allow for crushing plant installation.

Table 5.18 compares average recoveries for Au and Ag by particle size (13, 32, and 50mm) for three major ore types. Average recoveries are presented for standard column tests by size and for bottle rolls of all 13mm samples. Column tests on particle sizes other than 13mm were not conducted on the other ore types.

Table 5.18

Comparison of Precious Metals Recoveries by Major Ore Types and Particle Size								
	B.R. Rec. Au %*	Standard Column Recovery Au (%) – unadj. time			B.R. Rec. Ag (%)*	Standard Column Recovery Ag (%) – unadj. time		
	13mm	13mm	32mm	50mm	13mm	13mm	32mm	50mm
Porphyry Oxide	70.3	81.2	75.5	80.5	42.2	51.3	36.9	43.6
Begonia Limestone	52.0	65.8	66.4	64.0	41.5	33.5	25.9	37.0
Barreno Limestone	31.1	40.4	30.7	21.2	7.2	3.8	2.8	5.3

* Averages taken from the mean of the distribution of all 13mm bottle rolls (duplicates removed)

An evaluation of Au-only recoveries for Porphyry Oxide and Begonia show little sensitivity to particle size. Recoveries from coarser sizes (32 and 50mm) do not seem to be significantly different from the 13mm size and from the few non-standard 19mm size columns. Silver recoveries for these particle sizes are, however, somewhat more sensitive. These results have been corroborated by the run-of-mine column tests by McClelland Laboratories in Hermosillo, Mexico.

This feasibility study proposes run-of-mine leaching of Porphyry Oxide and Begonia Limestone ores. Section 5.1 of Appendix 5.0 includes studies conducted by McClelland Laboratories, Inc. and Kappes, Cassiday & Associates, which corroborate the metals recovery and reagent consumption estimates selected for the purposes of this feasibility study. These estimates are as follows:

Porphyry Oxide

75% Au Recovery 40% Ag Recovery 0.3 kg/tonne NaCN 3.0 kg/tonne pebble lime

Begonia Limestone

55% Au Recovery 25% Ag Recovery 0.3 kg/tonne NaCN 3.0 kg/tonne pebble lime

5.9.7 Pebble Lime Testing

Three column tests to determine the difference in lime requirements and effectiveness in controlling pH when using coarse pebble lime and fine pebble lime for agglomeration/alkalinity control were conducted on 19mm size PORCOMP3 with Merrill-Crowe recovery. Results are as follows:

Pebble Lime Parameters of Column	High pH developed	Days above pH 12.0	pH at Day 56
5 kg/t pebble lime, pulverized	12.4	18	10.9
5 kg/t pebble lime, 10mm crush size	12.6	24	11.0
7.5 kg/t pebble lime, 10mm crush size	12.7	48	11.6

Full-scale pebble lime consumption is projected at 3kg/tonne, which is approximately 60% of the average laboratory column test consumption of hydrated lime. Hydrated lime consumption is always higher than pebble lime consumption, due to the added weight of water in the hydrated lime.

5.9.8 Comminution Test Work

Svedala Industries, Inc. performed High Energy Work Index Tests and Abrasion Index Tests on the three bulk samples of the major Cerro San Pedro ore types. Table 5.19 presents these results. This information can be used to predict energy costs and liner wear in the future if precious metals prices recover to a point which makes installation of a crushing circuit economic for the Cerro San Pedro project.

Table 5.19

Work Index / Abrasion Test Results				
Ore Type	**Sample ID**	**High Energy Work Index (kWh/t)**	**95% Confidence Interval (kWh/t)**	**Abrasion Index (lb/kWh)**
Porphyry Oxide	PORCOMP2	10.09	±.75	.0821
Begonia Limestone	BEGCOMP2	7.05	±.34	.0034
Barreno Limestone	BARCOMP2	8.61	±.64	.1865

Porphyry Oxide

The breakage behavior of PORCOMP2 was consistent. Its average Work Index of 10.09 kWh/t would compare to that of average limestone at 8.29. The product distribution for this material is compared to

average and hard limestone. The PORCOMP2 material would be considered easy to crush. The Abrasion Index is .0821, on the low end of range for average limestone (.00 to .65). Less than normal wear of liners would occur with PORCOMP2 material.

Begonia Limestone

The breakage behavior of BEGCOMP2 was consistent. Its average Work Index of 7.05 kWh/t would compare to average limestone at 8.29. The product distribution for this material is compared to average to hard limestone. This material would be considered easy to crush. The Abrasion Index is .0034, on the very low end of range for average limestone. Less than normal wear of liners would occur with BEGCOMP2 material.

Barreno Limestone

The breakage behavior of BARCOMP2 was consistent. Its average Work Index of 8.61 kWh/st would compare to average limestone at 8.29. The product distribution for this material is compared to average to hard limestone. This material would be considered easy to crush. The Abrasion Index is .1865. Less than normal wear of liners would occur with BARCOMP2 material.

5.10 Summary of Metallurgical Results

Table 5.20 summarizes the relative value of tests in predicting the metallurgical behavior of ores under eventual operating conditions:

Table 5.20

Predictive Value of Different Metallurgical Tests and Analyses

Test Type	Au Ext	Ag Ext	PM Kinetics	NaCN Cons.	Lime Cons.	Heap Permeability
Large Diameter Column (Series) w/ pebble lime/MC - Future	Best	Best	Best	Best	Best	Best
Column (Series) w/ pebble lime/Carbon or MC Rec.	Very Good	Very Good	Very Good	Good	Good	Good
Multiple Stage Column w/ MC PM Recovery	Very Good	Very Good	Very Good	Good	Good	Good
Single Stage Column w/ MC PM Recovery	Very Good	Very Good	Very Good	Good	Good	Good
Standard Column w/ Carbon PM Recovery	Good	Good	Good	Good	Good	Good
Heap Simulation Bottle Stir (Series)	Poor	Poor	Poor	Good	Good	N/A
Heap Simulation Bottle Stir (Single w/ *mature solution*)	Poor	Poor	Poor	Good	Good	N/A
Ore Characterization (Bottle Stir)	Good	Good	N/A	Poor	Poor	N/A
Bottle Roll - 13mm samples	Average	Average	N/A	Average	Average	N/A

Note: Series tests means multiple columns operated in series
Series tests could be replaced by single tests with mature solution
Large diameter columns >2 ft (0.61m) diameter
MC = Merrill-Crowe
PM = Precious Metal

An evaluation by each ore type was made of precious metal recoveries, reagent consumption, and leach kinetics from all columns and bottle roll tests with the following generalized findings.

5.10.1 Overview of Findings

Zinc Leach Kinetics Effect on Heap Leaching / Reagent Consumption

Evaluation of additional testing performed to simulate mature solutions, to address the effects of cyanide soluble Zn, and to better simulate recoveries using Merrill-Crowe processing, showed ultimately that standard tests remained fairly good predictors of recoveries and leach kinetics regardless of the recovery process. Ultimate Zn extractions, the most probable final resting places for the extracted Zn, and most of the other leach solution chemistry issues have been adequately resolved through comprehensive chemical evaluations of critical mass balances for several HSBS and column tests. The new HSBS tests appear to be helpful in the prediction of NaCN consumption.

Reagent Consumption

Lime Consumption/pH Control

Lime consumption can generally be predicted directly from laboratory column test results with little adjustment necessary, based on industry standards developed by comparing laboratory test work with operational results, both of which use laboratory lime. The majority of column tests for Cerro San Pedro utilize hydrated lime at approximately 40.5% CaO. Some of the more recent design criteria column tests have or are utilizing pebble (burnt) lime at an estimated 92% CaO content from a potential Mexican supplier. This pebble lime is estimated to have stochiometrically 2.3 times the CaO (available lime) of hydrated lime. Ongoing column tests indicate pebble lime requirements to be somewhere between 2 and 4 times less than hydrated lime. This can be attributed primarily to this stochiometric ratio and the time release aspect of pebble lime caused by the required additional hydration step. Leach solutions contain relatively large quantities of carbonates, bicarbonates, and sulfates that could be promoting excess lime consumption in the early part of the leach cycle when hydrated lime is used. The following are estimates of lime consumption for extended (projected) time on the heap for each ore type:

- Lime consumption for Porphyry Oxide is estimated at 3 kg/t. (See Section 5.1 of the Appendix - Kappes, Cassiday & Associates Metallurgy Review).
- Lime consumption estimate for Begonia is the same as Porphyry Oxide, as most test work indicates similar lime consumption for these ore types.
- Lime consumption estimate for Barreno is based on column, bottle roll, and HSBS test work, which is consistently lower than Porphyry Oxide and Begonia. The model uses an estimate of 1.80 kg/t lime.

- Lime consumption estimates for Porphyry Mixed and Porphyry Sulfide (processed in later years) are based on interim results extended to a full leach cycle with an allowance for left-over alkalinity in pre-existing leach solutions. The model uses an estimate of 13.2 kg/t lime for each of these ores.

Sodium Cyanide (NaCN) Consumption

Operating NaCN consumptions are typically lower than bottle roll NaCN consumptions. The high solution to solids ratio characteristics of bottle roll tests result in more NaCN and other elements taken into solution and consumed than would occur in an actual heap leach operation. Consumption of NaCN during operations is generally 0.75 times to 1.00 times that calculated from the bottle rolls, if other special kinetics or reactions are not occurring. As an example, the average NaCN consumption for all bottle rolls $\geq$13mm for Porphyry Oxide is 0.321 kg/t, very close to the design NaCN consumption used of 0.30 kg/t.

Column tests usually over estimate NaCN consumption because of cyanide loss by aeration and ultraviolet (UV) light. Based on historical comparisons of pre-operation column tests with subsequent operating results at heap leach sites, NaCN consumption can be predicted from the column test results by taking the rates of NaCN consumed in the columns and applying a factor – usually dividing by 3 to 6. This would similarly yield an estimate of 0.30 kg/t NaCN consumption from the column test results on the Porphyry Oxide. Cyanide consumption can best be predicted on most other Cerro San Pedro ore types by applying this factor to the column NaCN consumptions, rather than using bottle roll data, since bottle roll consumptions for ores with more complicated solution chemistry do not effectively model heap operating conditions.

As previously mentioned, a new procedure (HSBS tests) was developed to aid in reagent consumption estimation, particularly for NaCN. The HSBS tests yielded reagent consumption considerably lower than standard tests with fresh solution suggesting that full scale operation with mature solution will probably lead to even lower reagent consumption. However, as no results are available that compare consumptions from this new procedure to operating consumptions, the standard estimating procedures were utilized.

Crush Size

It can be concluded from an analysis of ore characterization bottle stir tests, column testing at various particle sizes, and bottle rolls that adequate testing was completed to estimate operating parameters at any of the three particle sizes under consideration (i.e., 19, 32, and 50mm). The model estimates the optimum recoveries at a size of 19mm. However, gold and silver recoveries are not highly sensitive to particle size with Porphyry Oxide and Begonia Limestone ore types. A run-of-mine scenario produces the best economic results for Cerro San Pedro at current gold prices, and this feasibility study has been based upon uncrushed

run-of-mine ore delivery and processing. Increased metal prices in the future may lead to a decision to install and operate the former Hayden Hill Mine crushing circuit, which has been purchased by Glamis and is available for this project.

5.10.2 Estimated Precious Metal Recovery and Reagent Consumption by Ore Type

The following summarizes the data that was ultimately used to determine estimated Au and Ag recoveries for all six ore types. For the purposes of this feasibility study, it has been determined that only Porphyry Oxiide and Begonia Limestone can be economically processed with current precious metals prices, and that these ore types will be treated by run-of-mine heap leaching. However, higher precious metals prices may, in the future, make crushing and processing of the other ore types a viable option. The average grade of the deposit for each ore type is presented below:

	g/t Au	g/t Ag
Porphyry Oxide	0.595	22.86
Begonia	0.570	30.93
Barreno	0.902	25.62
Hospital	0.646	35.93
Porphyry Mixed	0.653	24.07
Porphyry Sulfide	1.021	43.28

The supporting gold and silver recovery data is provided in summary tables by each ore type and includes averages for all standard carbon column tests, all 32mm standard carbon columns, all design criteria columns, weighted most representative columns, and the projected recoveries for the weighted most representative columns where applicable. Bottle roll averages for all samples $\geq$13mm, all column samples, and all core samples are also presented. Finally, the average of HSBS testing is provided.

Particular weighting and emphasis was given to run-of-mine and plus 50 mm size column tests for Porphyry Oxide and Begonia Limestone ore types. The run-of-mine recovery and reagent consumption estimates developed in this feasibility study were primarily based upon these test results. Run-of-mine recovery estimates are supported by McClelland Laboratories, Inc. and Kappes, Cassiday, & Associates reviews in Section 5.1 of the Appendix.

For the representative column samples, a projection or extension of ultimate Au and Ag recoveries was made to normalize recoveries to a common leach time on the heap (365 days in the case of Au and 730

days for Ag). The calculations used to develop average projected recoveries are also documented in the tables in Section 5.5 of the Appendix. The projected recovery curve estimates were not considered in the McClelland Laboratories, Inc. and Kappes, Cassiday, & Associates reviews included in Section 5.1 of the Appendix.

All of these results on the summary table can be compared to the final metallurgical criteria selected for each ore type that are provided at the end of each table. Recoveries used in the base case economic model for Porphyry Oxide and Begonia were based upon the run-of-mine estimates for these ore types. Histograms showing the distribution of Au and Ag recoveries for standard columns, bottle rolls and total tests are also presented for each ore type (all duplicate tests on individual samples have been removed with the distribution shown at the 13mm particle size only). Finally, the plot of the projection of precious metal recoveries for ultimate time on the heap are presented for the Porphyry Oxide, Begonia, and Barreno ore types. Both the histograms and the leach curves for recovery show evidence of two or more populations within most ore types (i.e., generally all but Au for Porphyry Oxide show either a wide distribution, or two or more populations with distinct recovery characteristics). Interim leach curves that plot g/t precious metals extraction with time are presented for the Porphyry Mixed and Porphyry Sulfide. No leach rate curves could be presented from actual data for Hospital, since no columns were completed.

Porphyry Oxide

Table 5.21 summarizes results from all column leach (standard and other), bottle roll, and HSBS tests for the Porphyry Oxide ore type. Histograms showing the distribution of Au and Ag extraction values by standard columns, bottle rolls, and total tests are presented in Figure 5.7.

Table 5.21

Supporting Data for Metallurgical Recoveries/Reagent Consumption							
Source of Data				**Recovery**		**Reagent Cons.**	
# of Tests	**Size (mm)**	**Time days (hrs)**	**Test / Sample / Conditions**	**Au (%)**	**Ag (%)**	**NaCN* (kg/t)**	**Lime (kg/t)**
Porphyry Oxide			**Feasibility Estimate[1]**	**75.0**	**40.0**	**0.30**	**3.0**
27	13, 19, 32, 50, 150 (avg 41)	112	All standard Carbon Recovery column avg.	79.5	44.4	1.16	3.16
6	32	181	32mm standard columns	75.5	36.9	1.16	3.13
6	13, 19, 32 (avg 18)	131	All design criteria columns – 5 w/MC Rec., 1 w/Carbon Rec.	73.3	40.4	0.95	11.04
5	19mm		Pebble lime columns				**<5.0 pbl**
12	13, 19, 32, 50 (avg. 24)	160	[1]PORCOMP4, 3, 2 weighted all column avg.	76.3	39.4	0.98	6.74
11	13, 19, 32, 50 (avg. 24)	Ult.	Projected recoveries for above weighted PORCOMP 4, 2, and 2 columns to ultimate leach time.	**82.0**	**50.7**		
1	19	111 to Ult.	PORCOMP4 column – 0.005 gpm/ft^2, 0.5 g/l NaCN, mature solution, MC Rec.	81.3	46.2		10-15 **5.0 pbl**
121	14	(110)	All bottle rolls ≥13mm	70.5	42.5	0.32	3.01
21	18	(144)	Bottle rolls of columns	73.7	49.6	0.28	3.18
99	13	(96)	Bottle rolls of core	69.4	41.6	0.32	2.99
7	13, 32	37	HSBS tests at 10.75-11.5 pH, 0.5 g/l NaCN	61.7	40.1	**0.09**	**1.65**

[1] Feasibility Estimates are based upon recommendation by McClelland Labs, Inc and Kappes, Cassiday& Associates. (See Section 5.1 of the Appendix)

Ult. = time on the heap for ultimate recoveries = 365 days for Au and 730 days for Ag

* The best predictor for NACN consumption is Bottle Roll NaCN x .75 or Column NaCN ÷ 3-6, HSBS NaCN consumption appears to confirm these rates or is even lower.

** Lime consumption is expressed in data as laboratory (or hydrated) lime unless specified as pbl (pebble lime). The best prediction for pebble lime consumption during operations is to apply a factor of 1/2 to 1/3 of that in Columns to account for the stochiometric difference.

Precious Metals Recovery

Estimates of precious metal recoveries are based primarily on column test results from most representative test conditions. Test conditions of importance include type of PM recovery, cyanide concentration, particle size, solution application rate, etc. The specific subset of column test data utilized for Porphyry Oxide in this feasibility study consisted of the run-of-mine and +50 mm column tests with appropriate weighting for sample representation. The head PM assay of these samples were similar to the anticipated grades of the orebody.

The average extraction percent for Au and Ag for all standard columns and for all non-standard columns is close at 79.5 and 73.3%, respectively, for Au and 44.4 and 40.4%, respectively for Ag. Extraction % Au and Ag do not appear to be very sensitive to particle sizes as shown previously in Table 5.16 which compares the averages for columns at 13, 32 and 50mm, however, it does appear that leaching occurs much faster at the 13mm than other sizes based on the average leach time.

Column tests, as expected, indicate generally 5 to 10% higher precious metals recoveries than the bottle tests that are also shown on Table 5.21. The average of all bottle roll recoveries $\geq$13mm is 70.5% for Au and 42.5% for Ag. Recoveries for core based on column and bottle roll data are essentially similar as that for all samples. Figure 5.7 shows that Porphyry Oxide column and bottle recoveries for Ag are much more variable than for Au.

Composite samples PORCOMP2, 3 and 4 were considered to be the most representative of the ore type. Using the weighting presented in Table 5.19, an average recovery of 76.3% for Au and 39.4 % for Ag was estimated based on 12 columns. The projected ultimate recoveries for time on the heap using the same weighting for these samples produced recoveries of 82% for Au and 50.7% for Ag at a 19mm crush size. Lower recovery projected in this feasibility study is a result of the run-of-mine processing selection.

Based on the above evaluations, it can be concluded that the typical industry standard column and bottle roll tests provide a reasonable estimation of precious metals recoveries for Porphyry Oxide. The economic model recoveries for Au and Ag for Porphyry Oxide are estimated at 75% and 40%, respectively for a run-of-mine process, and 82% and 50.7%, respectively, for a 13mm three stage crush.

Reagent Consumption

The average NaCN consumption for all Porphyry Oxide bottle rolls ≥13mm is 0.321 kg/t, very close to the design NaCN consumption shown of 0.30 kg/t. Applying the standard factor to the column test data for Porphyry Oxide (dividing by 3 to 6) shows that 0.30 kg/t NaCN consumption in the economic model is a conservative estimate. The HSBS tests yielded reagent consumption (0.09 kg/t NaCN) considerably lower than standard tests with fresh solution suggesting that full scale operation with mature solution will probably lead to even lower reagent consumption.

From previous discussions regarding converting laboratory hydrated lime consumption to pebble lime consumption, lime consumption is conservatively estimated at 3 kg/t for Porphyry Oxide.

Recovery Curves Extended for Ultimate Time on the Heap

Extended recovery curves were not considered by McClelland Laboratories, Inc. or by Kappes, Cassiday & Associates in the determination of the projected recovery estimate for run-of-mine Porphyry Oxide for this feasibility study. However, the extended curves are useful in demonstrating the potential long-term effect of multi-lift leaching and releaching in a full-scale commercial operation. The projection of Porphyry Oxide recoveries for ultimate time on the heap is presented in Figures 5.8 and 5.9, respectively for Au and Ag. The precious metals leach rate curves for the various column tests are all similar in shape. The difference in Au recovery at any point in time is fairly small between each column leach rate curve. Ultimate Au recovery at 365 days ranges between 75.6 and 89.1% (a 14% spread). The total difference in Ag recovery at any point between leach rate recovery curves is also small, but slightly greater than for Au. Ultimate Ag recovery at 730 days ranges between 36.1 to 57.5% (a 21% spread).

Begonia Limestone

Table 5.22 summarizes results from all column leach, bottle roll, and HSBS tests for the Begonia Limestone. Histograms showing the distribution of Au and Ag extraction values by columns, bottle rolls, and total tests are presented in Figure 5.10. Both Au and Ag recoveries show a wide distribution of values.

Precious Metals Recovery

As in the case of Porphyry Oxide, Begonia precious metal recoveries were based primarily on the run of mine and +50 mm column tests as reviewed by McClelland Laboratories, Inc. and Kappes, Cassiday & Associates in Section 5.1 of the Appendix. The head grades of these samples were, again, similar to estimated ore grades. The average Au recovery for all crushed ore standard columns is 62.0% with an average leach time of 144 days. At the 32mm size, columns averaged 66.4% Au recovery at an average leach time of 190 days – indicating that with increased leach time, Au recovery still increased and was comparable at even coarser particle size. The weighted average of the 10 most representative crushed ore column samples was 62.9% Au recovery. Projected ultimate Au recovery for a time of 365 days on the heap using these same 10 weighted columns is 72.9%. Bottle rolls at $\geq$13mm show average extraction Au % for the more representative column samples of 63.0% and 52.5% for all bottle roll tests. Run-of-mine gold recovery is estimated at 55% Au, crushed ore recovery for Begonia Limestone is estimated at 72.9% Au.

The column test average at the 13mm and 32mm particle size for Ag is 41.2% and 25.9%, respectively. The column test average for core - 27.7% - is similar to the 32mm average. The average Ag recovery for the most representative Begonia columns is also close to these numbers at 26.8%. Bottle roll tests on all Begonia column samples averaged 50.7% Ag extraction. The average Ag recovery for 54 bottle roll tests at $\geq$ 13mm is 42.4% - of these, 41 were bottle rolls run on core/core composites which averaged 41.6% Ag recovery. Run of mine silver recovery is estimated at 25% Ag, crushed ore recovery for Begonia Limestone is estimated at 39.3% Ag.

The distribution of Begonia recoveries for both Au and Ag, noted to be quite wide, also shows evidence of two or more distinct populations within this ore type.

Table 5.22

Supporting Data for Metallurgical Recoveries/Reagent Consumption							
Source of Data				Recovery		Reagent Cons.	
# of Tests	Size (mm)	Time days (hrs)	Test / Sample / Conditions	Au (%)	Ag (%)	NaCN* (kg/t)	Lime** (kg/t)
Begonia			**Feasibility Estimate[2]**	**55.0**	**25**	**0.30**	**3**
19	13, 32, 50	144	All standard Carbon Recovery column avg.	62.0	35.9	1.50	3.28
6	32	190	32mm standard columns	66.4	25.9	2.10	3.65
10	13, 32, 50 (avg. 23)	180	[2]BEGCOMP4, 3, and Tbg-1 weighted all column avg.	64.0	30.5	1.78	4.56
8	23	Ult.	Projected recoveries for above weighted BEGCOMP 4, 3, Tbg-1 columns to ultimate leach time.	**72.9**	**39.3**		
54	14	(115)	All bottle rolls ≥13mm	52.5	42.4	1.18	2.65
12	18	(156)	All bottle rolls of columns ≥13mm	63.0	50.7	3.19	4.10
6	13	(96)	Bottle rolls of columns/13mm/96h	66.8	51.0	1.67	3.45
41	13	(96)	Bottle rolls of core	49.7	41.6	0.64	2.05
12	13, 32	37	HSBS tests at 10.75-11.5 pH, 0.5 g/l NaCN	65.7	27.1	**0.15**	**0.83**

[2] Feasibility Estimates are based upon recommendation by McClelland Labs, Inc and Kappes, Cassiday& Associates. (See Section 5.1 of the Appendix)

Ult. = time on the heap for ultimate recoveries = 365 days for Au and 730 days for Ag

* The best predictor for NACN consumption in ore types with more complicated solution chemistry is Column NaCN ÷ 3-6. HSBS NaCN consumption appears to confirm these rates or is even lower.

** Lime consumption is expressed in data as laboratory (or hydrated) lime unless specified as pbl (pebble lime). The best prediction for pebble lime consumption during operations is to apply a factor of 1/2 to 1/3 of that in Columns to account for the stochiometric difference.

Reagent Consumption

Reagent consumption for the Begonia ore was estimated primarily by the most representative tests with known solution chemistry conditions. The representative tests closely match consumption of Porphyry Oxide samples under similar conditions.

The HSBS data is useful for estimating NaCN consumption. The range of Begonia NaCN consumption in HSBS closed bottle tests run at different pHs and NaCN concentration was between 0.025 and 0.297 kg/t. The average of 32mm and 13mm tests at conditions most closely modeling actual operations (pH of 10.75 to 11.5 and NaCN concentration of 0.5 g/l) showed 0.150 kg/t NaCN consumption. Therefore, the economic model criteria of 0.30 kg/t should be considered a conservative estimate for NaCN consumption.

Lime consumption in all standard column tests for Begonia ranged from 2.92 to 3.65 kg/t between the averages at particle sizes of 13mm and 50mm. Lime consumption in two non-standard columns where no precious metals recovery was employed was higher at 4.71 kg/t laboratory lime. Once again, actual pebble lime consumption is expected to be lower. A lime consumption of 3 kg/t is estimated for Begonia.

Recovery Curves Extended for Ultimate Time on the Heap

Extended recovery curves were not considered by McClelland Laboratories, Inc. or by Kappes, Cassiday & Associates in the determination of the projected recovery estimate for run-of-mine Begonia Limestone in this feasibility study. However, the extended curves are useful in demonstrating the potential long-term effect of multi-lift leaching and releaching in a full-scale commercial operation. Figures 5.11 and 5.12 present Begonia recovery curves for Au and Ag, respectively, extended (or projected) for ultimate time on the heap. The precious metals leach curves are similar in shape for each of these representative columns, all exhibiting a very fast initial leach rate. The difference in Au recovery at any point in time, however, is relatively large between each column leach rate curve. Ultimate Au recovery at 365 days ranges between 61.1 and 90.5% (a nearly 30% spread). The total difference in Ag recovery at any point in time between leach rate recovery curves is even larger. Ultimate Ag recovery at 730 days ranges between 24.8 and 71.5% (a 47% spread). Weighting of these columns based on their relative representation of the ore yielded an overall average projected ultimate recovery of 55% and 25% for run-of-mine Au and Ag, respectively and crushed ore recovery of 72.9% and 39.3% for Au and Ag, respectively.

The wide distribution in recovery curves for these columns is consistent with the wide distribution of bottle roll and column recoveries for all Begonia samples presented in the histograms in Figure 5.10, further evidence of perhaps several populations within the Begonia exhibiting differing metallurgical characteristics.

Barreno Limestone

Barreno Limestone will not be mined or processed under the base case scenario presented in this feasibility study. However, some Barreno Limestone may be mined and processed in the future if higher precious metals prices can support economic processing of these materials. It is also possible that some Barreno Limestone, which would otherwise be mined as waste, will be crushed and placed on the bottom lift of the leach pad as a protective overliner bed. Metallurgical information for Barreno ore has been included in this feasibility report to establish its base case economic parameters.

Table 5.23 summarizes results from all column leach, bottle roll, and HSBS tests for the Barreno Limestone.

Precious Metals Recovery and Reagent Consumption

These results combine all Barreno and Barreno Manganese rock classifications into one metallurgical classification, the Barreno Limestone. Gold recoveries are quite low, particularly at larger crush sizes. Silver recoveries at all particle sizes tested are consistently low. All column tests averaged 35.3% Au extraction and 3.7% Ag extraction. All bottle roll tests (100 tests) at $\geq$13mm averaged 31.9% Au extraction and 7.3% Ag extraction. The weighted column test recoveries (based on 10 columns for the three most representative composite samples) is 24.1% Au and 2.2% Ag. Extension of leach rates for time in a heap on the weighted most representative columns yielded ultimate recoveries of 27.8% Au and 3.2% Ag under a 13mm crushed ore processing scenario. Run of mine gold and silver recovery has been estimated at 20% Au and 3% Ag.

Average NaCN consumption for all bottle rolls $\geq$ 13mm is 0.261 kg/t. Lime consumption from column data ranges from 0.88, 1.27, and 1.36 kg/t for the 50mm, 32mm, and 13mm particle size averages, respectively. The economic model estimate for reagent consumption is 0.20 for NaCN and 1.90 kg/t for lime.

Table 5.23

Supporting Data for Metallurgical Recoveries/Reagent Consumption							
Source of Data				Recovery		Reagent Cons.	
# of Tests	Size (mm)	Time days (hrs)	Test / Sample / Conditions	Au (%)	Ag (%)	NaCN* (kg/t)	Lime** (kg/t)
Barreno			**Estimated Run of Mine**	**20**	**3.0**	**0.20**	**1.90**
23	13, 32, 50	130	All standard Carbon Recovery column avg.	35.3	3.7	0.85	1.27
6	32	186	32mm standard columns	30.7	2.8	0.97	1.27
10	13, 32, 50 (avg. 24)	217	[3]BARCOMP4, 3, 2 weighted all column avg.	24.1	2.2	1.28	1.51
10	13, 32, 50 (avg 24)	Ult.	Projected recoveries for above weighted BARCOMP 4, 3, 2 columns to ultimate leach time.	**27.8**	**3.2**		
100	14	(112)	All bottle rolls ≥13mm	31.9	7.3	0.26	1.31
14	18	(158)	All bottle rolls of columns ≥13mm	43.7	11.4	0.48	1.98
7	13	(96)	Bottle rolls of columns/13mm/96h	41.4	12.4	0.62	2.78
42	13	(96)	Bottle rolls of core	25.1	4.8	0.20	1.13

[3] Weighting = 50% BARCOMP4, 30%BARCOMP3, and 20% BARCOMP2

Ult. = time on the heap for ultimate recoveries = 365 days for Au and 730 days for Ag

* The best predictor for NACN consumption is Bottle Roll NaCN x .75 or Column NaCN ÷ 3-6

** Lime consumption is expressed in data as laboratory (or hydrated) lime unless specified as pbl (pebble lime). The best prediction for pebble lime consumption during operations is to apply a factor of 1/2 to 1/3 of that in Columns to account for the stochiometric difference.

Hospital Limestone

Hospital Limestone will not be mined or processed under the base case scenario presented in this feasibility study. However, some Hospital Limestone may be mined and processed in the future if higher precious metals prices can support economic processing of these materials. It is also possible that some Hospital Limestone, which would otherwise be mined as waste, will be crushed and placed on the bottom lift of the leach pad as a protective overliner bed. Metallurgical information for Hospital ore has been included in this feasibility report to establish its base case economic parameters.

Table 5.24 summarizes results from all testing of the Hospital Limestone (only bottle rolls were performed).

Table 5.24

Supporting Data for Metallurgical Recoveries/Reagent Consumption							
Source of Data				Recovery		Reagent Cons.	
# of Tests	Size (mm)	Time days (hrs)	Test / Sample / Conditions	Au (%)	Ag (%)	NaCN* (kg/t)	Lime** (kg/t)
Hospital			**Estimated Run of Mine**	**35.0**	**10.0**	**0.30**	**3.00**
22	13	(96)	Bottle rolls of core and U.G. chips	43.5	12.8	0.28	1.10
13	13	(96)	Bottle rolls of core only	47.0	15.3	0.39	1.18

* The best predictor for NACN consumption is Bottle Roll NaCN x .75 or Column NaCN ÷ 3-6

** Lime consumption is expressed in data as laboratory (or hydrated) lime unless specified as pbl (pebble lime). The best prediction for pebble lime consumption during operations is to apply a factor of 1/2 to 1/3 of that in Columns to account for the stochiometric difference.

Precious Metals Recovery and Reagent Consumption

Hospital bottle roll test recoveries indicate that this ore type may perform more like Barreno ores, rather than the originally assumed similarity to Begonia. Recovery for Hospital Limestone crushed to 13 mm has been estimated at 50% Au and 15% Ag. The run of mine case has been estimated at 35% Au and 15% Ag recoveries.

Reagent consumption for Hospital Limestone has been estimated at 0.3kg/tonne NaCN and 3 kg/tonne pebble lime.

Porphyry Mixed

Porphyry Mixed ore will not be mined or processed under the base case scenario presented in this feasibility study. However, some Porphyry Mixed may be mined and processed in the future if higher precious metals prices can support economic processing of these materials. Metallurgical information for Porphyry Mixed ore has been included in this feasibility report to establish its base case economic parameters.

Table 5.25 summarizes the results from all significant column leach, bottle roll and HSBS test results for Porphyry Mixed ores. The Porphyry Mixed ore type is comprised of the geological classification of the same name in the geologic rock model. It is estimated to have a sulfide sulfur weight percent from 1.5 to 4.5%.

Table 5.25

Supporting Data for Metallurgical Recoveries/Reagent Consumption							
Source of Data				Recovery		Reagent Cons.	
# of Tests	Size (mm)	Time days (hrs)	Test / Sample / Conditions	Au (%)	Ag (%)	NaCN* (kg/t)	Lime** (kg/t)
Porphyry Mixed			**Base Case Economic Model**	**50.0**	**45.0**	**0.600**	**13.20**
1	13	101	Bulk column – Carbon Rec.	38.5	51.8	4.83	48.40
1	13	TBC	Core column – MC Rec				
2	13	(96)	Bottle rolls of columns	44.2	49.4	6.81	32.10
42	13	(96)	Bottle rolls of core	42.4	45.0	1.12	5.02
2	13	37	HSBS tests at 10.75-11.5 pH, 0.5 g/l NaCN	38.0	62.5	**0.38**	**5.11**

Precious Metals Recovery and Reagent Consumption

Bottle roll tests of 43 core samples at ≥13mm average 42.4% Au recovery and 45.0% Ag recovery. The crushed ore estimated recoveries are 50% for Au and 45% for Ag. Run-of-mine recovery is expected to be lower at 40% Au and 30% Ag.

Reagent Consumption for Porphyry Mixed ore is higher because of the tendency for sulfides to drive pH down. NaCN is estimated at 0.6 kg/tonne, and pebble lime is estimated at 6 kg/tonne.

Porphyry Sulfide

Porphyry Sulfide ore will not be mined or processed under the base case scenario presented in this feasibility study. However, some Porphyry Sulfide may be mined and processed in the future if higher precious metals prices can support economic processing of these materials. Metallurgical information for Porphyry Sulfide ore has been included in this feasibility report to establish its base case economic parameters.

Table 5.26 summarizes the results from all significant column leach, bottle roll and HSBS test results for Porphyry Sulfide ores. The Porphyry Sulfide ore type is comprised of the geological classification of the same name in the geologic rock model. It is estimated to have a sulfide sulfur weight greater than 4.5%.

Table 5.26

Supporting Data for Metallurgical Recoveries/Reagent Consumption							
Source of Data				Recovery		Reagent Cons.	
# of Tests	Size (mm)	Time days (hrs)	Test / Sample / Conditions	Au (%)	Ag (%)	NaCN* (kg/t)	Lime** (kg/t)
Porphyry Sulfide			**Base Case Economic Model**	**25.0**	**35.0**	**0.600**	**13.20**
1	13	101	Bulk column – Carbon Rec.	38.5	78.0	5.31	77.90
1	13	TBC	Core column – MC Rec				
19	13	96	Bottle rolls of all samples ≥13mm	20.2	44.5	2.509	12.15
2	13	(96)	Bottle rolls of columns	36.8	57.2	11.53	43.25
17	13	(96)	Bottle rolls of core	17.2	41.4	1.30	4.96
1	13	37	HSBS tests at 10.75-11.5 pH, 0.5 g/l NaCN	20.0	35.0	**0.47**	**4.61**

Precious Metals Recovery

The average bottle roll recoveries for all Sulfide samples at 13mm or greater are 20.2% Au and 44.5% Ag. Crushed ore estimated recoveries for Porphyry Sulfide ores are 25% for Au and 35% for Ag. Run-of-mine estimated recoveries are 20% for Au and 25% for Ag.

Reagent Consumption for Porphyry Sulfide ore is higher because of the tendency for sulfides to drive pH down. NaCN is estimated at 0.6 kg/tonne, and pebble lime is estimated at 6 kg/tonne.

6.0 PROCESS DESIGN AND ENGINEERING

6.1 Process Flowsheet Development

The process flowsheet incorporates a conventional run-of-mine heap leach operation with a Merrill-Crowe zinc precipitation recovery plant. The ore processing rate will peak at 7 to 8 million tonnes per year (25,000 tonnes per day) based on a six-days-per-week operation. A simplified schematic flowsheet is presented as Figure 6.1.

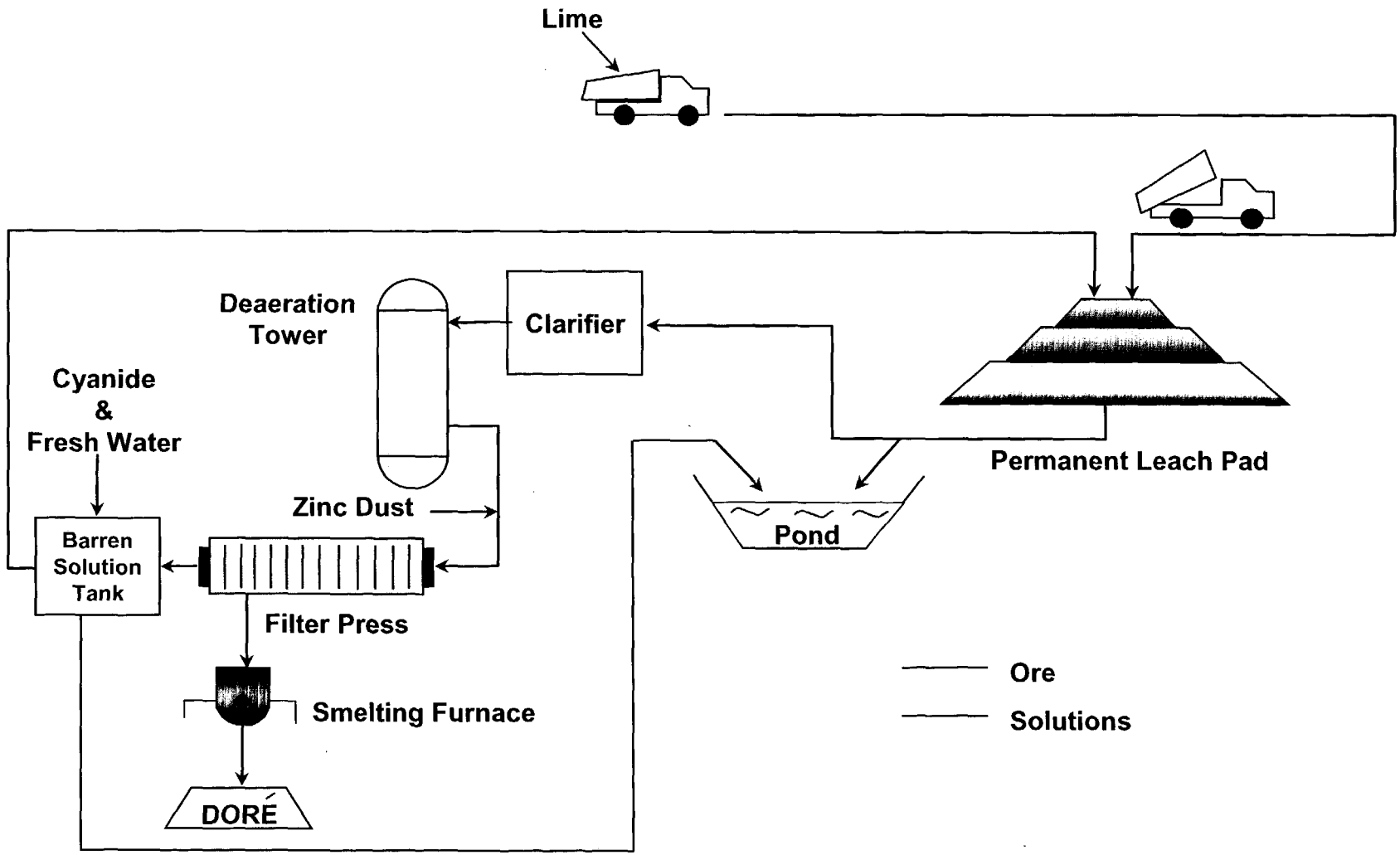
6.2 Site Layout Considerations

Process plant facilities have been located based upon topographic constraints of the site. The leach pad is located in a broad, flat valley area along and to the south of the paved road leading to the Cerro de San Pedro Village (elevation: 1,935 m), approximately 2km from the pit exit ramp. The solution recovery plant is situated in close proximity to the leach pad (elevation: 1,930 m). A general layout of the Cerro San Pedro project site is presented on Figure 6.2.

6.3 Process Design Criteria

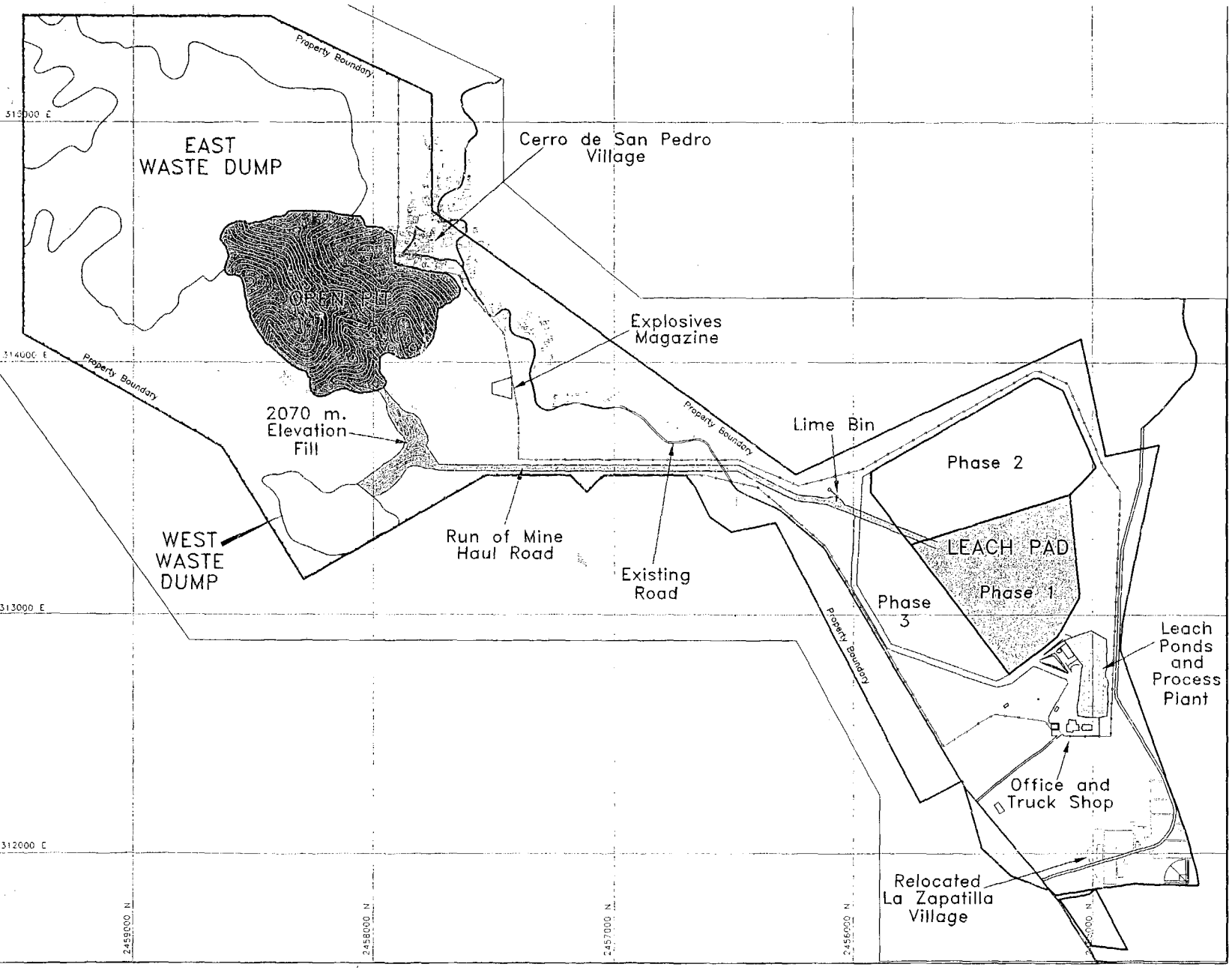
The process plant is designed for a peak rate of 8,000,000 tonnes of ore per year and will treat a total of 49,249,000 tonnes over an eight-year mine life (mining and recovery). Average overall recoveries are expected at 70.5 percent for gold and 35.7 percent for silver, yielding an average annual production of 80,000 ounces of gold and 1.66 million ounces of silver, or approximately 107,000 gold equivalent ounces per year for a total recovery of 870,391 ounces of gold equivalent.

Metallurgical test work indicates that run-of-mine leaching is a viable processing option. The reserves are comprised mostly of Porphyry Oxide, which are particularly amenable to heap leaching without a requirement for crushing. The process design criteria are shown in Table 6.1. The process mechanical equipment list per area is presented at the end of this section.



MINERA SAN XAVIER S.A. de C.V.

Figure 6.1 Simplified Process Flowsheet



MINERA SAN XAVIER, S.A. de C.V.

Figure 6.2 General Site Layout

Table 6.1

Process Design Criteria			
	Unit	**Value**	**Source**
General			
Location		Central Mexico	MSX
Elevation	masl	1,800 to 2,250	MSX
Ambient air temperature			
Maximum summer	°C	32	MSX
Minimum winter	°C	-5	MSX
Annual precipitation	mm/year	381	Westec
Evaporation, net	mm/year	2,123	Westec
Building design snow loading	kg/m^2	20	MSX
Seismicity			
Earthquake frequency	per year	1 to 5	MSX
Typical S wave	-	6.5	MSX
Typical P wave	-	6.5	MSX
Seismic zone	UBC	Zone 1	MSX
Wind velocity			
Mean	km/hr	25	MSX
Maximum gust	km/hr	150	MSX
Fuel available	-	Propane, diesel, gasoline	MSX
Project life	Years	8	MSX
Estimated mineable ore reserves	Mt	49,249,000	MSX
Ore Processed			
Nominal	Mtpd	25,600	MSX
Nominal	Mtph	1,450	MSX
Design	Mtpd	28,400	MSX
Design	Mtph	1,600	MSX
Overall ore grade			
Gold	g/t	0.57	MSX
Silver	g/t	23.01	MSX
Overall metal recovery			
Gold nominal	%	70.5	MSX
Silver nominal	%	35.7	MSX
Ore Characteristics			
Specific gravity (Average)	mt/m^3	2.4	MSX
Run of Mine ore bulk density	mt/m^3	1.60	MSX
Run-of-mine moisture	%	2.0	MSX
Angle of repose	Degrees	37	MSX
Drawdown angle	Degrees	60	MSX
Bond work index, crushing	kWh/t	11.1	SVEE
Abrasion index	-	0.05	SVEE

Table 6.1 (continued)			
Leaching	**Unit**	**Value**	**Source**
Ore leached	mtpy	8,000,000	MSX
Nominal pad feed rate	mtpd	25,600	MSX
Nominal annual gold production			
Peak	troy ounces	130,000	MSX
Low	troy ounces	75,000	MSX
Average	troy ounces	110,000	MSX
Nominal annual silver production			
Peak	troy ounces	3,500,000	MSX
Low	troy ounces	2,000,000	MSX
Average	troy ounces	2,600,000	MSX
Ore placed on pad			
Size, 80% minus	mm	**19**	MSX
Average moisture	%	2	MSX
Dry density	mt/m^3	1.46	MSX
Heap density	mt/m^3	1.70	AGRA[2]
Lime information			
Average lime addition	kg/mt	3.0	MSX
Type	-	Pebble Lime	MSX
Size, 100% minus	mm	10	MSX
Bulk density	mt/m3	1.12	MSX
Storage capacity	mt	300	MSX
Heap configuration			
Nominal lift height	m	10	AGRA
Typical heap height	m	40 to 60	AGRA
Design heap height	m	60	AGRA
Heap slope	h:v	2:1	AGRA
Heap phasing (based on 50 Mtonnes)			
Phase I - Pad area	m^2	302,600	AGRA
Phase II - Pad area	m^2	374,500	AGRA
Total leach pad	m^2	677,100	AGRA
Heap stacking plan (based on 60 Mtonnes)[3]			
Stage 1 heap	mt	13,580,000	AGRA
Stage 2 heap	mt	20,790,000	AGRA
Stage 3 heap	mt	16,090,000	AGRA
Total heap capacity	mt	50,460,000	AGRA
Solution application			
Type	-	Drip emitters	SVEE***
Flowrate, design	$l/min/m^2$	0.122	SVEE
Barren sol. flow, design	m3/hr	1017	SVEE
Recirculation flow, design	m3/hr	250	SVEE
Total sol. application, design	m3/hr	1267	SVEE

Table 6.1 (continued)			
Leaching	**Unit**	**Value**	**Source**
Solution to ore ratio			
Initial, nominal	mt/mt	1.0	MSX
Releach, nominal	mt/mt	2.50	MSX
Ultimate	mt/mt	5.00	MSX
Initial solution application time			
Barren	days	90	SVEE
Recirculation	days	20	SVEE
Solution reagent levels			SVEE
NaCN	g/l	0.5	SVEE
pH range	-	10.0 to 11.0	SVEE
Antiscalant	ppm	8	SVEE
NaCN consumption, oxide ore	kg/mt	0.30	SVEE
Solution recovery pumps			
Number of units	-	2	SVEE
Type	-	Turbine & Centrifugal	SVEE
Motor	kW	240	SVEE
Speed	RPM	1,800	SVEE
Volume capacity	l/s	251	SVEE
Barren solution pumps			
Number of units	-	2	SVEE
Type	-	Centrifugal	SVEE
Motor	kW	280	SVEE
Speed (1 fixed, 1 variable)	RPM	1,800	SVEE
Volume capacity	l/s	283	SVEE
Gold Recovery			
System type	-	Merrill-Crowe	MSX
Solution feed head grade			
Gold nominal	g/t	0.28	MSX
Silver nominal	g/t	5.89[5]	MSX
Precoat and body feed skid			
Precoat tank volume	m^3	14.15	SVEE
Precoat flow rate	l/s	94.3	SVEE
Body feed tank volume	m^3	14.15	SVEE
Body feed flow rate	l/s	0.067	SVEE
Clarification filters			
Number of units	-	3 (2 operating, 1 standby)	SVEE
Type	-	Pressure leaf	SVEE
Filter size surface area	m2	164	SVEE
Flow rate per unit	l/s	125	SVEE

Table 6.1 (continued)			
Deaeration			
Tower size	m	3.4 ∅ x 4.78H	SVEE
Vacuum	kpa	84	SVEE
Vacuum pump, 2 stage	m^3/min	30	SVEE
O_2 level	ppm	0.5	SVEE
Gold Recovery	**Unit**	**Value**	**Source**
Zinc precipitation filters			
Number	-	3 (2 operating, 1 standby)	SVEE
Type	-	Recessed plate	SVEE
Filtration surface per unit	m^2	184.7	SVEE
Total plates	-	57	SVEE
Mercury retort			
Number	-	1	SVEE
Type	-	Retort furnace	SVEE
Size	m^3	0.8	SVEE
Furnace			
Number	-	1	SVEE
Type	-	Gas fired	SVEE
Size	m^3	0.3	SVEE
Input	btuh	5,000,000	SVEE

[2]AGRA = AGRA Earth and Environmental, Inc. (Recently changed name to AMEC)
[3]If additional pad capacity is required, a Phase III pad expansion and Stage 4 stacking plan have been designed with a capacity of 75 million tonnes.
[4 & 5]Gold and silver head grades are based on the noted design criteria for solution application rate and lift height.

6.4 Process Description and Construction

6.4.1 Run of Mine Haulage and Lime Addition

Run-of-mine ore will be trucked from the mine to the leach pad in 172-tonne haul trucks at a nominal rate of 23,333 tonnes per day. The 2 kilometer long, 29-meter wide haulage road will exit the open pit at elevation 2070 meters and enter the leach pad at elevation 1990 meters. A 300 tonne pebble lime silo with a high-speed discharge batch conveyor will be located at the entrance to the leach pad ramp. Each loaded haul truck will stop at the lime silo, where pebble lime will be added to the load at a rate sufficient to maintain the desired dosage (3kg lime per tonne of ore, or approximately 516 kg per 172-tonne truckload). Lime addition will be automatically triggered when the haul truck trips the ultrasonic position switches, signaling that a truck is ready to receive lime. The location of the haul road and lime addition silo can be seen in Figure 6.2.

Ore is stacked by truck dump in 10-12 meter lifts. The ore will be spread by a track-mounted D-10 bulldozer, and ripped to a depth of 3-4 meters before leaching commences.

6.4.2 Heap Leach Pad

The design concept for the leach pad is to build the pad in two phases, with a third phase reserved for future expansion. Leach pad grading has been planned to follow existing topographic contours to minimize the earthworks. The leach pad drains internally to a common discharge point at the southwest corner, where solutions can be diverted into external solution storage ponds for processing. The first two phases will be stacked to 60 meters and will store 50 million tones of ore. The third phase, if constructed, will require blasting and removal of a rock knoll to create a maximum slope of 2:1 horizontal:vertical. The third phase will increase the storage capacity to 75 million tonnes by expanding the leach pad footprint and raising the heap height. Construction of the third phase will not be required unless the current mineable reserves are increased.

Drawings 6.1 through 6.9 shown at the end of this section illustrate the configuration of the 50 million tonne capacity heap leach pad and various construction details. Drawing 6.5 illustrates the configuration of the expanded 75 million tonne heap leach pad, noting the Phase 3 additional lined pad area to the northwest of the 50 million tonne heap. The preliminary design report by AMEC Earth & Environmental, Inc. (Previously AGRA Earth & Environmental) is attached as Section 6.1 of the Appendix.

The total lined leach pad area for Phase 1 and 2 will be approximately 677,000 square meters, with each phase being approximately one half of this total area. The leach pad liner system will be a conventional composite liner, consisting of a 60 mil high density polyethylene (HDPE) primary liner underlain by a 0.3 meter compacted fine-grained low permeability soil (clay) liner in intimate contact with the HDPE. To protect against impact from truck dumping activities and to enhance solution percolation and drainage, the top surface of the leach pad liner will be overlain by a 0.5 meter bedding layer consisting of minus 19 mm crushed ore or rock. A network of perforated HDPE under-drain pipes will be placed on top of the HDPE liner to facilitate solution percolation and drainage.

The leach pad is designed to drain to a single exit point at the southwest end of the pad. The internal perimeter of the leach pad will contain small double-lined v-notch ditches which serve the dual purpose of providing leak detection and maintaining an open solution flow path for storm water runoff and for pregnant solutions exiting the heap. Solution will be collected and transported to an external solution pond system via a lined open channel.

The approximately 50 million tonnes of run-of-mine ore will be stacked on the geomembrane-lined leach pad over an eight-year period. The leach pad will be developed in three stages on two phases, as shown in Table 6.2.

Table 6.2

ORE HEAP STACKING PLAN - 50 MILLION TONNES						
PAD PHASE	**ORE LIFT**	**TOP AREA (sq. m.)**	**ORE VOLUME (M. Tonnes)**	**STACKING TIME (days)**	**CUMULATIVE VOLUME (M. Tonnes)**	**CUMULATIVE TIME (years)**
1	1	255,657	4.36	272	4.36	0.74
1	2	214,524	3.67	253	8.03	1.44
1	3	176,980	3.06	200	11.09	1.99
1	4	143,026	2.49	110	13.58	2.26
STAGE 1 HEAP VOLUME = 13.58 MILLION TONNES						
2	1	351,619	5.77	270	19.35	3.00
2	2	328,139	5.39	260	24.74	3.71
2	3	304,096	5.01	210	29.75	4.29
2	4	279,504	4.62	193	34.37	4.82
STAGE 2 HEAP VOLUME = 20.79 MILLION TONS						
All Pad	5	542,166	8.55	415	42.92	5.95
All Pad	6	483,343	7.48	370	50.40	6.96
STAGE 3 HEAP VOLUME = 15.05 MILLION TONS						
TOTAL HEAP VOLUME = 50.40 Million Tonnes						

NOTES:
1) Ore Production =based on mine plan
2) Ore Density = 1.6 tonnes per cu. Meters
3) Ore Lift Height = 10 –12 meters
4) Active Area under leach = 103,000 sq. Meters

At the onset of leach pad construction, all existing structures will be removed and surface vegetation cleared. Surface rock rubble and organic soil cover will also be stripped prior to construction of the leach pad with any salvageable topsoil being stockpiled for later use during reclamation and closure. The stripped subgrade surface will be scarified and recompacted in preparation for placement of site grading fill and/or low-permeability clayey bedding fill beneath the geomembrane liner. Total cut and fill requirements for Phase 1, including the bedding fill, are estimated at 50,000 and 195,000 cubic meters, respectively. For Phase 2 construction, cut and fill are estimated at 10,000 and 147,000 cubic meters.

The leach pad liner system consists of a 1.5mm (60 mil) high-density polyethylene (HDPE) geo-membrane overlying a minimum of 0.3 m of low-permeability fine-grained bedding fill. The bedding fill material will either be purchased from stockpiled material about 3 km west of the pad (Chavez site) or be sourced from a borrow pit to be located just northwest of the pad itself. The 0.5 m protective free-draining layer on the pad will consist of nominal minus 19 mm size crushed rock or limestone ore if available. The leach pad is divided into a total of ten northeast-southwest oriented cells, each cell measuring about 75 – 125 m wide and 600 – 900 m long. Each cell is separated by a one m high berm. There are five cells in Phase I, and five cells in the Phase II pad expansion.

The solution ponds store the operational, draindown, and design storm flows. The 71,990 cubic meter (m^3) storm water pond is designed to contain water produced from a 100 year, 24-hour storm event (79 mm), with 75 percent runoff from covered areas and 100 percent runoff from the final maximum lined areas, plus direct precipitation on the pond. The pregnant solution pond will store 48,530 cubic meters (m^3), which represents 24 hours of operating volume plus 24 hours of drain down. The Merrill-Crowe plant will discharge into a 2,000 cubic meter (m^3) tank, from which barren solution will be pumped directly back to the heap. Overflow from the barren tank will be directed to the pregnant solution pond. Drawing 6.1 shows the general arrangement of the leach pad and ponds for the project.

The pregnant solution pond will be double lined with 1.5 mm (60 mil) HDPE liners. The primary and secondary solution pond liners will be separated by a geo-synthetic net to promote flow of any potential leakage from the primary liner to a collection/ pump back sump. The bottom 3 meters of the storm water pond will also be double lined, and the upper portion of the storm water pond will be single lined with a 1.5 mm (60 mil) HDPE liner. The design of the ponds is the same for both the 50 million tonne and the expanded 75 million tonne heap leach pads.

An open ditch diversion system diverts the natural runoff from uphill catchment areas around the phased heap leach pad into the downhill natural drainages. Diversion ditches will be sized and constructed to divert the 24-hour design storm runoff.

Three or more monitoring wells will be installed down-gradient of the leach pad and solution ponds. Location of these wells will follow a geotechnical investigation to assure the best locations and the optimum number of wells required for adequate monitoring. The internal perimeter of the leach pad will contain small double-lined v-notch ditches which serve the dual purpose of providing leak detection and maintaining an open solution flow path for storm water runoff and for pregnant solutions exiting the heap. Solution passing through the primary liner in these ditches, if any, will be collected in a geogrid and drained by gravity to the pregnant solution pond.

6.4.3 Leach Pad Loading

The heap leach pad will be constructed by direct dumping from 172-tonne haul trucks in 10-12 m lifts at a nominal rate of 1,450 tonnes per hour. Depending on the length of the ore haul, two or three trucks will generally be used for leach pad loading. A D-10 bulldozer equipped with a ripper will level and rip the heap surface as necessary to minimize compaction.

Heap leach cells will typically be loaded from the southwest to the northeast, or from the downhill side to the uphill side. Panels of ore approximately 100 m by 100 m will be ripped and placed under leach on a weekly basis. As the ore haul retreats along the haul road, segments of the haul road will also be ripped and placed under leach. Prior to placing a new lift of ore over an existing lift, the heap is cross-ripped using a D-10 dozer equipped with a deep penetration (3-4 m) Kelly ripper.

The ore is truck-dumped on the leach pad in nominal 10 meter lifts at the natural angle-of-repose with 5 meter setback benches for an overall two horizontal to one vertical (2H:1V) slope. The design maximum heap height is 70 meters. Computer slope stability analyses performed on the heap at the most critical downgradient pad section resulted in static and pseudostatic factors of safety which meet or exceed the minimum recommended standards for such a structure.

6.4.4 Leach Solution Recovery and Distribution

Each phase of the leach pad is divided into cells for solution recovery, with a total of ten cells -- five cells in Phase I, five cells in Phase II. Each cell is divided by an impervious berm 1.0 m high to collect and direct leach solution percolating through the leach pad. The solution is directed within each cell through a network of collection pipes to a single central collection pipe. Each of the central perforated collection pipes is routed to the leach pad solution discharge box at a common exit point at the low end of the heap. Solutions from each individual cell are sampled periodically at the discharge box and can then be directed to the pregnant solution pond or the storm water pond.

The bottom 3 meters of the storm water pond will be double lined with 60 mil HDPE synthetic liner separated by a geosynthetic grid for leachate collection and recovery. The double lining will allow dual use of the storm water pond as working storage volume for re-circulation and enrichment of low-grade pregnant solutions discharging from the heap by diverting these solutions back into the barren solution tank. Bypassing the Merrill-Crowe plant and re-circulation of low-grade pregnant solutions in this manner is not expected to be a necessary part of the routine operating procedure, but may be desirable during periods of high solution flows or upset pond conditions.

Solution is recovered from the pregnant solution pond via a submersible turbine pump rated at 56 kW which feeds directly into a 187 kW variable frequency drive (VFD) horizontal booster pump, which in turn feeds the clarifier filters at the Merrill-Crowe plant. Solution recovered from the storm water pond will be pumped directly to the barren solution tank via a 30 kW submersible turbine pump.

Barren solution is pumped at a nominal rate of 990 cubic meters per hour (4,355 GPM) from the barren solution tank through solution distribution piping and irrigation type drip emitters for application onto the surface of the ore. In order to minimize the potential for generation of scale and resultant potential plugging of emitters, a descalant chemical will be added to the barren tank and clarifier. Fresh make-up water will be added to the storm water pond to allow precipitation of scale, and then on to the barren solution tank as needed. The two horizontal barren solution pumps are set in series, one with a 280 kW drive and the second equipped with a 280 kW variable frequency drive (VFD).

Solution application under primary leach will average 90 days at an application rate of 8 liters per square meter per hour (0.0030 gpm per sq ft). The primary leach will produce nearly 90 percent of the expected gold and silver recovery, with the balance being produced during subsequent re-leach as a result of the multiple lift operations.

6.4.5 Merrill-Crowe Recovery Plant

The precious metals are recovered from the pregnant heap leach solution in a typical Merrill-Crowe zinc precipitation plant. Pregnant solution is pumped from the pregnant solution pond at a nominal rate of 251 liters per second (4,000 gallons per minute (GPM)), through a solution sampler to three pressure leaf clarification filters, each with a 164 m^2 surface area. Clarified solution is transferred to a 3.4 m diameter by 4.78 m high de-aeration tower equipped with one vacuum pump for removal of oxygen from the solution. Zinc dust is slurried in a zinc mix tank and injected into the pregnant leach solution and the precious metals are precipitated from the pregnant leach solution by the zinc metal. The precipitate filter feed pumps then pump the solution containing the precipitated precious metals to plate and frame filters for precious metals recovery from solution. Diatomaceous earth may be mixed in an agitated pre-coat mix tank and an agitated body feed mix tank, and pumped to the precipitate filters to facilitate precipitate recovery. Each filter has a total filtration area of 184.7 m^2. Sumps and pumps are installed in the Merrill-Crowe area for clean-up purposes.

Drawings 6.10 through 6.19 at the end of this section illustrate the Merrill-Crowe recovery plant. The preliminary design report by Summit Valley Equipment & Engineering, Inc. (SVEE) is attached as Section 6.2 of the Appendix.

6.4.6 Refining

The filter presses are dried by blowing air through the precipitate filter cake until the cake reaches approximately 10% moisture. Approximately 425 kg per day of precipitate is manually removed from the filter press filter plates and placed into a mercury retort furnace for mercury removal. From the retort, the precipitate is loaded into a 0.3 m^3 gas-melting furnace. Flux consisting of silica, fluorspar, borax, and sodium nitrate is mixed in a mixing system with the precipitate. Screw feeders feed the melting furnace on a continuous basis. Molten metal is poured into 31 kg molds. Dore bullion is cleaned, weighed, sampled, and stored in a vault awaiting shipment. Once gold and silver are removed from the solution, the barren solution from the precipitate filters flows to the 2000 m^3 barren solution tank.

Slag is processed through a circuit consisting of a jaw crusher, roll crusher, vibrating slag screen, and vibrating table to remove prills for re-melting in the furnace. Table tails are sent to the heap leach pad.

Sumps and pumps are installed in a refinery area for clean-up purposes. A horizontal packed bed cross-flow scrubber is utilized for off-gas scrubbing from the furnace.

The refinery area is a high security, limited-access area. A closed circuit television system with redundant video recording monitors the whole refinery area including the entrances (inside and outside). All refinery access doors are linked to an alarm system, which records every access door movement. Movement detectors are also linked to the alarm system. Drawing 6.10 illustrates the refinery process area.

6.4.7 Reagent Handling and Distribution

Sodium cyanide storage facilities may be owner built, or provided by the sodium cyanide supplier. Bulk sodium cyanide is transported as solid briquettes. The product is dissolved on site in a sodium hydroxide mixing and storage tank, delivered as a solution, and stored in two 110 m^3 storage tanks. Cyanide will be injected into the barren solution pump discharge to maintain sodium cyanide concentration of approximately 0.5 grams per liter.

Pebble lime will be added directly to the 172 tonne ore trucks via a 300 tonne silo equipped with a rotary vibrating bottom, rotary valve, and high speed discharge conveyor capable of delivering 516 kg of lime to each truck in a few seconds. Lime deliveries will be via bulk trucks from a nearby source. Pebble lime is pneumatically delivered to the silo. Pebble lime addition to ore will be optimized at approximately 3kg per ore tonne to maintain heap feed solution pH in the range 10.5 to 11.0.

Antiscalant is added to the clarifiers, the barren solution tank, and storm water pond via chemical metering pumps, which can maintain an appropriate dosage rate (estimated at 8 mg/liter of solution). Plastic tanks and pumps for the addition of antiscalant will be supplied by the vendor.

High purity zinc powder will be received in 36-kg cans, which are manually added to the zinc feeder system at the Merrill Crowe plant.

Diatomaceous earth (DE) is received in 23-kg bags, which are manually added to the mixer and feed tanks in the Merrill-Crowe plant.

6.5 Heap Operation and Solution Management

New ore will be placed on the heap in 10 m lifts. On a weekly basis, panels of fresh ore (approximately 100 m by 100 m) will be leveled and ripped prior to irrigation. Piping for each new panel will be installed to allow drip irrigation at a rate of approximately 0.0023 liters per second per m^2 (0.003 gpm/ft^2). Approximately 100,000 m^2 (1,076,000 ft^2) of total surface area will be under irrigation at any given time.

The primary leach cycle for each panel of ore will continue for 90 days, by which time approximately 90% of the recoverable gold and silver will be leached. Secondary leaching (re-leaching) will produce the remainder of the recoverable gold and silver as a result of residual leaching through multiple lift stacking and planned rest/re-leach cycles.

Construction of the leach pad in distinct cells allows selective collection and distribution of solution from any of the ten leach cells. This process allows a pregnant solution grade building scenario where, if needed, approximately 250 m^3/hr of lower grade solution can be selectively routed to bypass the Merrill-Crowe plant and recycled back to the heap. The Merrill-Crowe plant has been sized to handle all solutions generated by primary leaching and re-leaching without re-circulation. The option to bypass the Merrill Crowe plant can provide additional flexibility for operators in the event of solution pond imbalances or extended periods of very low grade pregnant solution production.

6.5.1 Precious Metal Production Schedule

For the majority of the project life at Cerro San Pedro, ore flows and solution flows will be in a steady state balance and production schedule estimations can be largely based upon the expected overall gold and silver recovery for the ore placed on the pad in any given time period. The first year of operation at Cerro San Pedro will result in an accumulated inventory of recoverable gold and silver on the heap due

to leaching time and volume constraints typical of any startup. Conversely, the last year of operation will result in higher production due to depletion of accumulated inventory. Cash flow modeling in this feasibility study conservatively defers 30% of the Year 1 recoverable gold and 45% of the Year 1 recoverable silver production to the end of the mine life. Years 2 through 8 are projected to achieve their anticipated steady-state production.

A large heap leach operation such as Cerro San Pedro will observe solution lags and solution surplus periods as stacking moves from lower to higher lifts or from higher to lower lifts. While significant, these lags and surplus periods tend to balance out during the life of the property, and no attempt has been made to predict these short-term production effects in the cash flow and production modeling.

6.5.2 Water Balance and Solution Management

Water balance and solution management are major considerations in leach pad design. To assure the leach pad and reservoirs can contain all leach solution and the pumping and piping system are properly designed, a water balance for the system must be calculated. AGRA Engineering & Environmental (AGRA) performed a detailed water balance study for the project, which is contained within the Final Geotechnical Design Report, September 1999.

The water balance model is based on local meteorological data, plus evaporation and wind direction in the area. The computer model was set up based upon the heap leach pad operating at 365 days per year and is based on the maximum lined leach pad area for each phase. It quantifies the probable volume of water gained by precipitation, lost to evaporation, and retained in the ore matrix; all tied to the leach solution flow applied to the heap.

Water balance computations were performed for several cases, including consideration for above and below average precipitation and evaporation data from recent years of record to predict the accumulation of process solution and the makeup water needed.

The following Table 6.3 from the Final Geotechnical Design Report shows the maximum water balance predictions for the leach pad for eight different cases or conditions of operation. Case 8 is used for the feasibility study with regard to the leach pad water requirements.

Table 6.3

Maximum Water Balance Predictions					
Case	Maximum Excess Water Balance		Maximum Makeup Water Required		
	Date		Date		
	(m^3)	(gal)	(l/s)	(m^3/min)	(GPM)
Case 1 - 100 % Emitters (average year precipitation and evaporation)	0	0	25.2	1.51	399
	N/A		March of Years 4 thru 8		
Case 1 - Phase 1 Pad only (first 2.8 years of operation)	0	0	23.6	1.42	375
	N/A		March of Years 2 & 3		
Case 2 - 100 % Emitters (typical dry year precipitation and evaporation)	0	0	28.3	1.70	449
	N/A		July of Years 4 thru 8		
Case 3 - 100 % Emitters (extreme dry year precipitation and evaporation)	0	0	33.6	2.02	534
	N/A		April of Years 4 thru 8		
Case 4 - 100 % Emitters (typical wet year precipitation and evaporation)	195,266	51,583,419	25.2	1.51	399
	August of Years 4 thru 8		March of Years 4 thru 8		
Case 5 - 100 % Sprinklers (typical wet year precipitation and evaporation)	0	0	66.5	3.99	1,054
	N/A		March of Years 4 thru 8		
Case 5 - Phase 1 Pad only (first 2.8 years of operation)	0	0	64.9	3.89	1,028
	N/A		March of Years 2 & 3		
Case 6 – Same as Case 3 but without factoring pan evaporation over leach pad surface	0	0	52.2	3.13	827
	N/A		April of Years 4 thru 8		
Case 7 - Same as Case 1 but with buried emitters at 30 % evaporation rate	0	0	22.0	1.32	349
	N/A		March of Years 4 thru 8		
Case 8 - Same as Case 1 but with buried emitters at 15 % evaporation rate	1,169	308,815	19.6	1.18	312
	July of Year 1		March of Years 4 thru 8		

6.6 Process Plant Services

6.6.1 Process Mobile Equipment

The process mobile equipment list is included with the mine mobile equipment, described in Section 4.0 of this feasibility report. Major process mobile equipment includes haul trucks to load the heap leach pad, a dozer for spreading and ripping, a backhoe, refinery forklift, and pickup trucks.

6.6.2 Process Building

The process building houses the overall plant facilities such as the Merrill-Crowe recovery plant (680 m^2), the refinery (645 m^2), and the reagent storage area (565 m^2). The refinery is enclosed in a secured building. Other facilities are under an open-sided roof, or are left uncovered as shown in Drawing 6.10.

6.6.3 Assay/Metallurgical Laboratory

The metallurgical and assay laboratory is located adjacent to the process building. The laboratory facility is equipped to perform the following works:

- Preparation and analysis of mine grade control samples;
- Gold fire assay;
- Atomic absorption analysis for gold and silver;
- Fire assay and atomic absorption analysis of final dore and concentrates;
- Leaching (CN soluble) analyses;
- Metallurgical test work required for process optimization;
- Water analysis
- Screen analysis

The assay lab is sized to perform sample preparation and fire assay gold analyses on a nominal 200 samples in a 24 to 36-hour turnaround time.

6.7 Process Personnel

Process personnel are under the overall direction of an expatriate process manager. Staffing levels for process are fairly stable from year to year, starting at 17 during pre-production and 39 from Year 1 through Year 8. Activity after Year 8 will no longer involve placement of new ore on the heap, but only recovery of metals from heap solutions and operation of the Merrill-Crowe plant. The staff that remains

is eliminating the remaining solution in the heap, with associated staff costs becoming part of the capitalized reclamation costs discussed in Section 11.0, Reclamation and Closure.

6.7.1 Salaried Staff

Process salaried staff consists of an expatriate process manager with overall responsibility for all process areas with all other positions being filled by national employees. Table 6.4 is a summary by year of salaried staff positions.

Table 6.4

Process Department Salaried Staff											
	Year										
Job Title	**PP**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10-12**
PROCESS OPS											
Process Manager	X	X	X	X	X	X	X	X	X	0	0
Clerk	1	1	1	1	1	1	1	1	1	1	0
General Foreman	1	1	1	1	1	1	1	1	1	1	0
Production Super	2	4	4	4	4	4	4	4	4	2	1
Subtotal	5	7	7	7	7	7	7	7	7	4	0
METALLURGY											
Chief Metallurgist	1	1	1	1	1	1	1	1	1	1	0
Chief Chemist	1	1	1	1	1	1	1	1	1	1	
Assayers	0	2	2	2	2	2	2	2	2	1	0
Technicians	0	2	2	2	2	2	2	2	2	1	0
Subtotal	2	6	6	6	6	6	6	6	6	4	0
Process Total (X)	1	1	1	1	1	1	1	1	1	0	0
Process Total (Nat)	6	12	12	12	12	12	12	12	12	8	0
Process Total	**7**	**13**	**13**	**13**	**13**	**13**	**13**	**13**	**13**	**8**	**1**

Note: X = Expatriate

6.7.2 Daily Paid Personnel

The operations personnel report to the four production supervisors. Table 6.5 provides a summary by year of the daily paid personnel involved with process operations.

Table 6.5

Process Department Daily Paid Staff											
	Year										
Job Title	PP	1	2	3	4	5	6	7	8	9	10-12
PROCESS OPS											
Merrill-Crowe Oper.	0	4	4	4	4	4	4	4	4	4	0
Laborers	4	4	4	4	4	4	4	4	4	4	0
Refinery Operator	0	2	2	2	2	2	2	2	2	2	0
Laborers	0	2	2	2	2	2	2	2	2	2	0
Tradesmen	2	4	4	4	4	4	4	4	4	2	0
Leach Pad Oper.	2	8	8	8	8	8	8	8	8	6	2
Laborers	2	2	2	2	2	2	2	2	2	2	0
Total	**10**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**26**	**18**	**2**

6.8 Process Operating Cost

6.8.1 Basis of Estimate

Process operating cost estimates are based on information from test work, evaluations from consultants, and data from existing operations. Electrical costs are based on recent quotes from the CFE for the San Luis Potosi area and electrical load studies developed by SVEE. Reagent consumption for each ore type is based on extensive metallurgical test work as described in Section 5.0. Costs for the major reagents (sodium cyanide and lime) are based on written quotations for delivered costs from several different suppliers. Other reagent costs are based on data from existing operations and data from the Merrill-Crowe plant consultant, Summit Valley Equipment and Engineering.

Water costs are based upon a regulated unit cost and a usage rate based upon a total evaporation and soak rate of 12% by weight of ore process tonnage. Operating and maintenance supplies are based upon information from consultants and upon historical data from existing operations. Labor costs are based on extensive cost surveys and are further discussed in Section 12.0.

6.8.2 Process Operating Cost Summary

Process operating costs are summarized in Table 6.6, which shows the average processing cost per tonne by major category. Most of the process operating costs at Cerro San Pedro will vary directly with process tonnage. Tonnage dependent reagents, supplies, and utilities account for about 90% of the total

estimated process operating cost at Cerro San Pedro. Labor costs are less variable than the other process cost components and are not expected to rise or fall dramatically during the life of the mine except for start up and closure.

Costs for outside refinery services and security have not been included in the calculation for overall processing costs. These costs are reflected in General and Administrative costs for Cerro San Pedro. Heap leach haulage, spreading, and ripping costs are included in the cost estimate for mine operations in Chapter 4 of this feasibility report.

Table 6.6

PROCESS COST SUMMARY		
Category	**Cost/tonne**	**% of Total**
Process Labor Costs	**$ 0.1186**	**12%**
Process Reagents	**$ 0.6876**	**68%**
Process Op. & Maint. Supplies	**$ 0.0712**	**7%**
Process Utilities-Power	**$ 0.0904**	**9%**
Process Utilities-Water	**$ 0.0465**	**4%**
Total Process Cost/Ore Tonne	**$ 1.0143**	**100%**

6.8.3 Labor Costs

Process labor costs are presented in Table 6.7, which provides an annual summary of costs for each salaried position, including salary and burden. An average wage for daily paid employees was assumed. The total national labor cost varies little from year to year, as the total number of employees is essentially consistent. Total annual labor costs during the operating years range from $0.46 million in Year 0 to $0.61 million in Years 1 to 8. Labor costs represent a small part (about 12 percent) of the total process costs.

Table 6.7

PROCESS DEPARTMENT – ANNUAL MANPOWER COSTS						
Position	**No.**	**Base**	**Base X No.**	**% Burden**	**$ Burden**	**Total**
Process Manager (Expatriate)	1	$ 70,000	$ 70,000	0.55	$ 38,500	$ 108,500
General Foreman	1	$ 28,995	$ 28,995	0.55	$ 15,947	$ 44,942
Chief Metallurgist	1	$ 25,200	$ 25,200	0.55	$ 13,860	$ 39,060
Chief Chemist	1	$ 21,000	$ 21,000	0.55	$ 11,550	$ 32,550
Shift Supervisor	4	$ 17,462	$ 69,848	0.55	$ 38,416	$ 108,264
Technician	2	$ 13,200	$ 26,400	0.55	$ 14,520	$ 40,920
Assayer	2	$ 17,462	$ 34,924	0.55	$ 19,208	$ 54,132
Data Entry Clerk	1	$ 7,000	$ 7,000	0.65	$ 4,550	$ 11,550
Daily Paid Staff	26	$ 4,242	$ 110,303	0.65	$ 71,697	$ 182,000
Total	**39**		**$ 393,670**		**$ 225,949**	**$ 619,619**

6.8.4 Process Reagents

Reagents account for nearly two thirds of the estimated process operating costs at Cerro San Pedro. Table 6.8 shows the estimated cost and consumption rate for these reagents. Table 6.9 shows the expected annual cost for the reagents based upon scheduled processing rates and shows the average unit cost per tonne of ore processed. Predicted reagent consumption is based upon metallurgical testwork and historical operating data from other large Merrill-Crowe heap leach operations.

Table 6.8

REAGENT CONSUMPTION				
Process Reagent	**Consumption**	**Consumption Units**	**Reagent Unit Cost**	
Cyanide	0.3	kg/tonne ore	$ 1.321	kg
Lime	3	kg/tonne ore	$ 0.075	kg
Zinc	2	gram Zn/gram precious metals	$ 1.872	kg
Refinery fluxes	2	gram flux/gram precious metals	$ 0.440	kg
Lead Nitrate	0.03	gram/gram zinc	$ 1.000	kg
Antiscalant	5	gram/tonne ore	$ 3.787	kg
Caustic Soda	3	gram/tonne ore	$ 0.700	kg
Diatomaceous Earth	0.034	kg/tonne ore	$ 0.454	kg

Table 6.9

ANNUAL REAGENT COST – CERRO SAN PEDRO (000)									
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	**TOTAL**
Cyanide	$ 2,316,724	$ 2,106,653	$ 2,637,776	$ 3,071,394	$ 2,988,554	$ 2,945,748	$ 3,028,587	$ 423,709	$ 19,519,145
Lime	$ 1,315,125	$ 1,195,875	$ 1,497,375	$ 1,743,525	$ 1,696,500	$ 1,672,200	$ 1,719,225	$ 240,525	$ 11,080,350
Zinc	$ 114,987	$ 228,961	$ 272,078	$ 241,602	$ 206,828	$ 243,889	$ 175,195	$ 75,488	$ 1,559,028
Ref. fluxes	$ 25,383	$ 51,754	$ 61,906	$ 53,906	$ 46,381	$ 54,756	$ 38,497	$ 17,287	$ 349,870
Lead Nitrate	$ 1,843	$ 1,843	$ 1,843	$ 1,843	$ 1,843	$ 1,843	$ 1,843	$ 1,843	$ 14,744
Antiscalant	$ 110,688	$ 100,651	$ 126,027	$ 146,744	$ 142,786	$ 140,741	$ 144,699	$ 20,244	$ 932,580
Caustic Soda	$ 12,275	$ 11,162	$ 13,976	$ 16,273	$ 15,834	$ 15,607	$ 16,046	$ 2,245	$ 103,418
Diat. Earth	$ 35,730	$ 32,491	$ 40,682	$ 47,370	$ 46,092	$ 45,432	$ 46,709	$ 6,535	$ 301,041
TOTAL	$ 3,932,755	$ 3,729,390	$ 4,651,663	$ 5,322,657	$ 5,144,818	$ 5,120,216	$ 5,170,801	$ 787,876	**$ 33,860,176**
AVERAGE $/TONNE									**$0.6876**

6.8.5 Process Operating and Maintenance Supplies

Process Operating and maintenance supplies account for approximately 7 percent of the total process-operating budget. These biggest contributors to this cost category include piping and irrigation supplies

for the heap leach operation, propane, pump parts, and other maintenance supplies. Actual operating data from a large heap leach operation was used as a basis for estimating the process operating and maintenance supply costs at Cerro San Pedro.

Costing for refinery and plant security has been included in the General and Administrative costs for the project. Outside refinery services are shown as a separate line item on cash flow estimates.

Table 6.10 illustrates the estimated process operating and maintenance supply costs by category.

Table 6.10

Process Operating and Maintenance Supplies	
Category	**Annual Cost ($)**
Pipes and fittings	48,000
Emitters and Sprinklers	220,000
Sample Prep Supplies	5,000
Wet Lab Supplies	15,000
Fire Assay Supplies	10,000
Propane	20,000
Met Lab Supplies	10,000
Pumps and Pump Parts	20,000
Other Repair and Maintenance Supplies	43,000
Umpire Assaying	5,000
Refinery Supplies	20,000
Contract Services	12,000
Equipment Leases	5,000
Maintenance Agreements	5,000
Total	**$438,000**
Cost ($/t)	**$0.0712/tonne**

6.8.6 Electricity and Water Usage

The process electrical power calculations are based on demand and usage estimates provided by Summit Valley Equipment and Engineering. Details of these estimates are provided in Appendix 6.2.

The SVEE estimate is based upon the first year of operation. Power consumption will increase in latter years as the pumping head (elevation on the heap) increases. Relatively small quantities of electrical power are consumed in the shop and offices at Cerro San Pedro. To account for increased power demand through the latter portion of the mine life and the small ancillary power demands at the shop and administrative offices, a 20% increase to the demand and usage projected by SVEE was conservatively applied to the forecasts for the Cerro San Pedro project. Power costs looking forward are conservatively estimated at $0.06 per kWhr including demand charges.

Well water pumps will also consume considerable amounts of power. The demand and usage for well water projected for Cerro San Pedro is consistent with the demand and usage forecast by in the 1999 Cerro San Pedro Feasibility Report. Likewise, water costs (exclusive of pumping and power) are projected at $0.3 per cubic meter, which is also consistent with the 1999 Feasibility Report.

The majority of water consumption at Cerro San Pedro will occur as a result of heap leach operations. The heap leach operation provides for reuse and re-circulation of solution to the maximum extent feasible. However, new water will be added to the solution inventory as the heap leach pad grows due to the residual soak moisture in the ore, evaporation losses, and other water uses in the plant and mine facility. Soak moisture is estimated at 5% by weight of the ore tonnage applied to the leach pad. Evaporative losses in a drip irrigation environment with open solution ponds are estimated at an additional 5% by weight of ore tonnage. To account for other water uses (road watering, construction water, domestic water uses, etc.) the water consumption estimates for Cerro San Pedro are conservatively based upon a 12% by weight of ore tonnage factor. This projected water usage is consistent with water usage at other large arid environment heap leach operations.

Table 6-11 lists the expected power and water usage rates and costs for Cerro San Pedro.

Table 6.11

UTILITY COST ESTIMATES		
Electric Power		
Annual Power Demand (kWhr)		8,027,950
Cost of power $/kWhr incl demand	$	0.060
Annual cost of power	$	481,677
Annual power cost- well pumps	$	75,000
Subtotal - Annual Power Costs	**$**	**556,677**
Average Cost per Tonne – Electricity	**$**	**0.0904**
Water		
Water usage cubic meters per year (12% of process tonnage)		954,665
Cost of Water per cubic meter	$	0.30
Annual Water Cost	**$**	**286,400**
Average Cost per Tonne – Water	**$**	**0.0465**
Total Utility Cost per Tonne – Electricity & Water	**$**	**0.1370**

6.9 Process Capital Cost

6.9.1 Basis of Estimate

The dominant capital costs for the process facilities at Cerro San Pedro will be associated with the construction of the leach pad, ponds, Merrill-Crowe plant, refinery, lime silo, and solution pumping facilities. AMEC and SVEE have produced engineered "turn-key" construction estimates for the leach pad and plant processing facilities as shown in Appendix 6.1 and 6.2 to this feasibility report. Capital costs for other ancillary facilities (lime silo, security equipment, etc.) have been estimated based upon known costs at other facilities.

Mobile equipment associated with the process plant will include pickup trucks, a forklift, and a backhoe. A bulldozer will be required to spread, level, and rip ore on the leach pad. Much of the process plant mobile equipment will be pooled with mine operations equipment for dual use. All of the process plant mobile equipment capital is included in Chapter 4 of this feasibility report.

Table 6-12 depicts the initial process plant capital projected for Cerro San Pedro by category.

Table 6.12

INITIAL PROCESS CAPITAL	
Leach Pad & Solution Ponds	$ 4,462,340
Merrill-Crowe Plant	$ 1,784,906
Refinery	$ 427,188
Solution Pumping/Distribution	$ 900,272
Construction Mgmt, QA/QC	$ 497,895
Engineering	$ 334,037
Laboratory	$ 394,200
Lime Silo	$ 310,000
TOTAL	**$ 9,110,838**

6.9.2 Leach Pad / Solution Ponds Capital

The leach pad will be constructed in phases. Phase I will be constructed initially, including solution ponds, monitoring wells, and ditches. The entire capital outlay for Phase I is expected to occur in the pre-production/construction year. Phase II will be constructed in operating Year 3, and Phase III (only if current reserves are expanded) will be constructed in operating Year 7. Table 6-13 summarizes quantities and construction costs for each leach pad phase at Cerro San Pedro. The detailed breakout of these costs is included in the AMEC report found in Appendix 6.1.

Table 6.13

ENGINEER'S ESTIMATE OF LEACH PAD AND SOLUTION POND CONSTRUCTION COSTS

Item	Pad Area (m2)	Earthwork Cost	Liner Cost	Total Cost	Unit Cost	
					$/m2	$/ft2
Phase I & Solution Ponds	302,600	$2,874,792	$1,587,548	$4,462,340	14.75	1.37
Phase II	374,500	$1,888,953	$1,590,887	$3,479,840	9.29	0.86
Phase III	207,300	$2,286,238	$902,300	$3,188,538	15.39	1.43

6.9.3 Merrill-Crowe Plant Capital

Summit Valley Equipment and Engineering was requested to provide a "turn-key" estimate for procurement and construction of the Merrill-Crowe plant, building, refinery, solution pumps, reagent mixing and storage, and solution delivery piping sufficient to cover the first lift on Phase I of the leach pad. The SVEE scope included construction and construction management, final detailed engineering, freight, and procurement costs.

The SVEE plant design is capable of handling maximum flows at an 8 Million tonne per year processing rate. Lower flows and/or lower lift heights are planned for the early years of operation at Cerro San Pedro. The oversized filter capacity during the first three years of operation will be beneficial because any clarification problems caused by suspended solids in the solution will occur during this period. Once the lower lifts on the heap are established, the heap itself will begin to act as a clarifier and reduce the load on the clarification circuit.

The entire capital outlay for the Merrill-Crowe plant is expected to occur within pre-production/construction year of the project. No significant sustaining capital should be required over the project life. SVEE did not consider used equipment capital in this estimate. If properly sized precipitate filters and clarifiers can be located prior to commencement of construction at Cerro San Pedro, it may be possible to reduce the Merrill-Crowe plant capital by approximately $300,000.

A summary of the Merrill-Crowe plant capital estimate including solution pumping and distribution is presented in Table 6.14.

Table 6.14

MERRILL-CROWE PLANT CAPITAL		
Merrill-Crowe Plant		
Clarifiers and Precipitate Filters	$	942,283
Electrical and Instrumentation	$	199,393
Reagent Mixing/Storage		
Zinc	$	22,067
Cyanide	$	95,333
Caustic	$	19,333
Precoat Skid	$	30,195
Body Feed Skid	$	13,741
Erection/Concrete	$	338,866
Freight, Packaging, Customs	$	123,695
Solution Pumping and Distribution	$	900,272
Total	**$**	**2,685,178**

6.9.4 Refinery Capital

Table 6.15 presents the capital cost estimate for the Cerro San Pedro refinery. Summit Valley Equipment and Engineering did not include a security package as a part of their estimate scope. A lump sum for security monitoring and alarms has been added to the SVEE estimate shown below.

Table 6.15

CERRO SAN PEDRO REFINERY CAPITAL	
Optional Melt Furnace Gas Flame Safeguard System to Meet F.M. or I.R.I. Specs.	$14,055
Gas Fired Melt Furnace	$78,635
Baghouse with Blower, 10,000 acfm	$41,250
Furnace Exhaust Hood and Ducting	$17,333
Electric Mercury Retort 30 cuft complete with condenser, vent system, etc	$92,430
Flux and Precipitate Mixer w/Furnace Feed Screw Conveyor	$26,667
Cascade Molds, 5 - 1000 oz Side-Pour on Cart	$5,625
Lot Pans and Miscellaneous Hardware, Dore Bar Cleaner	$4,667
9 Slag Pots and Handling Cart	$6,000
Miscellaneous Slag Crusher, Gravity Table, etc.	$20,000
Block Buildings - Retort & MCC	$20,526
Lot Security Cameras, Alarms, Vault Door, Motion Detectors	$100,000
Refinery Total	**$427,188**

6.9.5 Other Process Plant Capital

Construction Management, quality assurance, and quality control for the process facilities and the project infrastructure has been estimated at approximately $500,000. This estimate is based upon the SVEE projection of $153,000 for the Merrill-Crowe plant, an estimate by AMEC of $80,000 for the leach pad, and an additional $265,000 for the remaining infrastructure items. The $265,000 infrastructure estimate is derived from a 5% factor applied to new capital in this category. The $500,000 estimate for Construction management and QA/QC is consistent with actual experience at other large run-of-mine heap leach operations.

Costs for detailed engineering for process and infrastructure facilities at Cerro San Pedro are estimated at approximately $335,000. The basis for this estimate includes a lump sum estimate of $69,000 for detailed Merrill-Crowe plant design engineering by SVEE and an additional $265,000 for engineering on remaining infrastructure items. The $265,000 infrastructure estimate is derived from a 5% factor applied to new capital in this category.

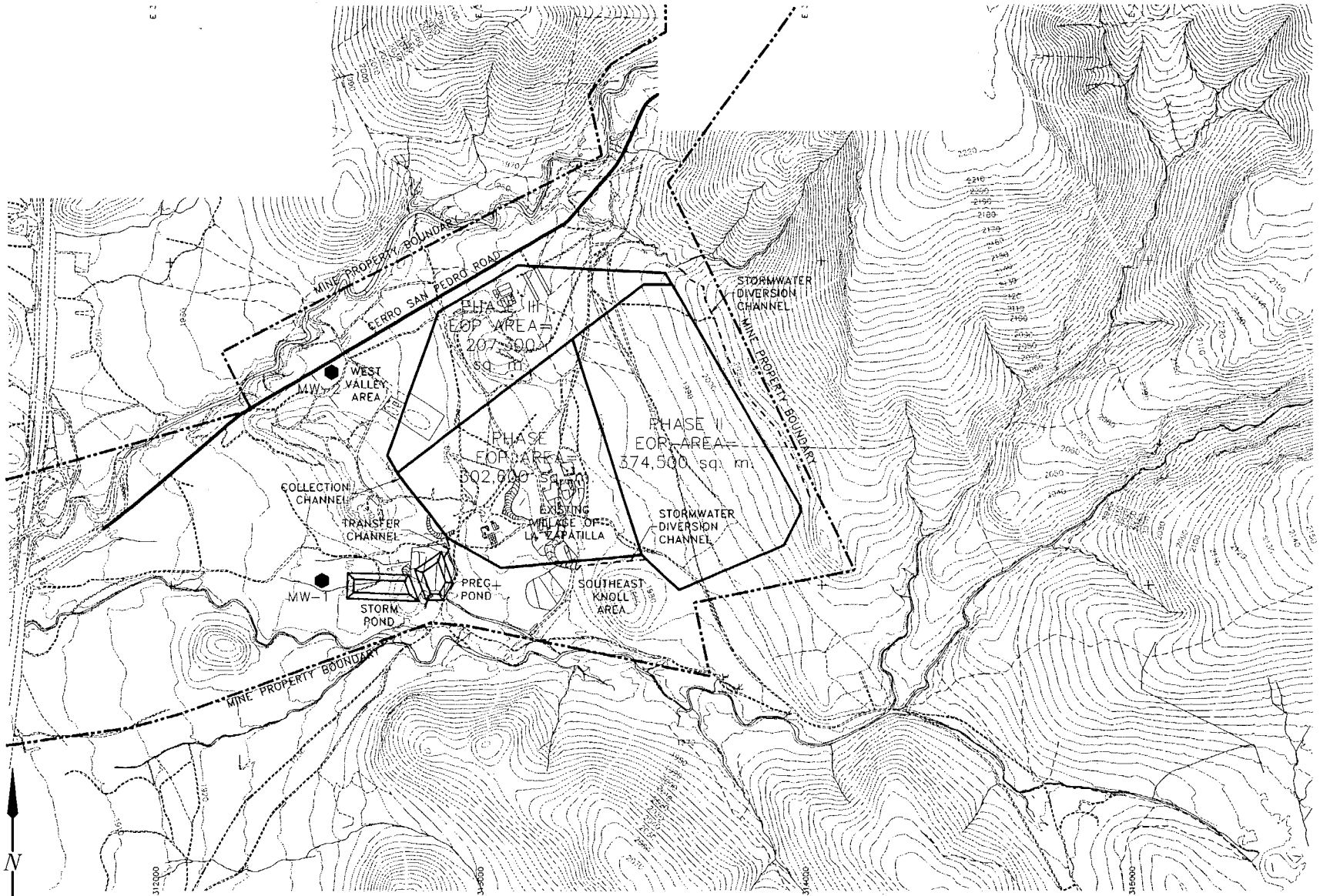
The laboratory facility at Cerro San Pedro is estimated at $394,000 total capital. Construction costs for the laboratory building are estimated at $168,000 including a $26,000 Motor Control Center which will also provide power distribution for the shop and administrative offices. The new cost for furnishings and laboratory equipment is estimated at $200,000. Used laboratory equipment may be available at the time of construction at Cerro San Pedro, resulting in the potential for capital cost savings in this category.

A previous engineering estimate for a 300-tonne pebble lime silo fully equipped with high-speed conveyor, vibrating bottom, level probes, water sprays, baghouse and infrared detectors indicated a capital cost of $310,000.

Table 6.16 summarizes other process plant capital as described in the above discussion.

Table 6.16

Other Process Capital	
Construction Mgmt, Procurement, QA/QC	$ 497,895
Engineering	$ 334,037
Laboratory	$ 394,200
Lime Silo	$ 310,000
Total Other Process Capital	**$1,536,132**



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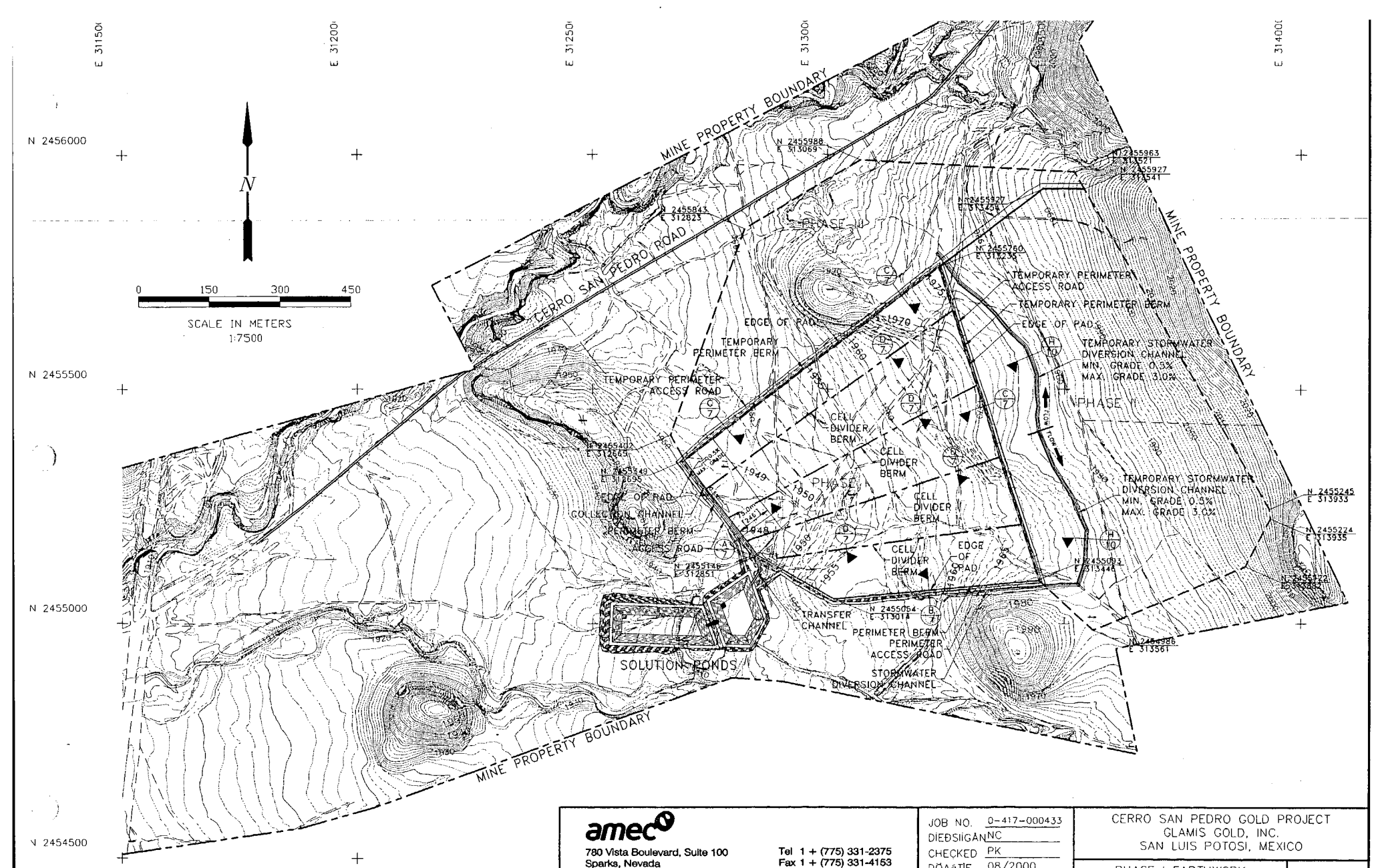
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GENERAL PROJECT LAYOUT & MONITORING WELL LOCATIONS

Drawing 6.1

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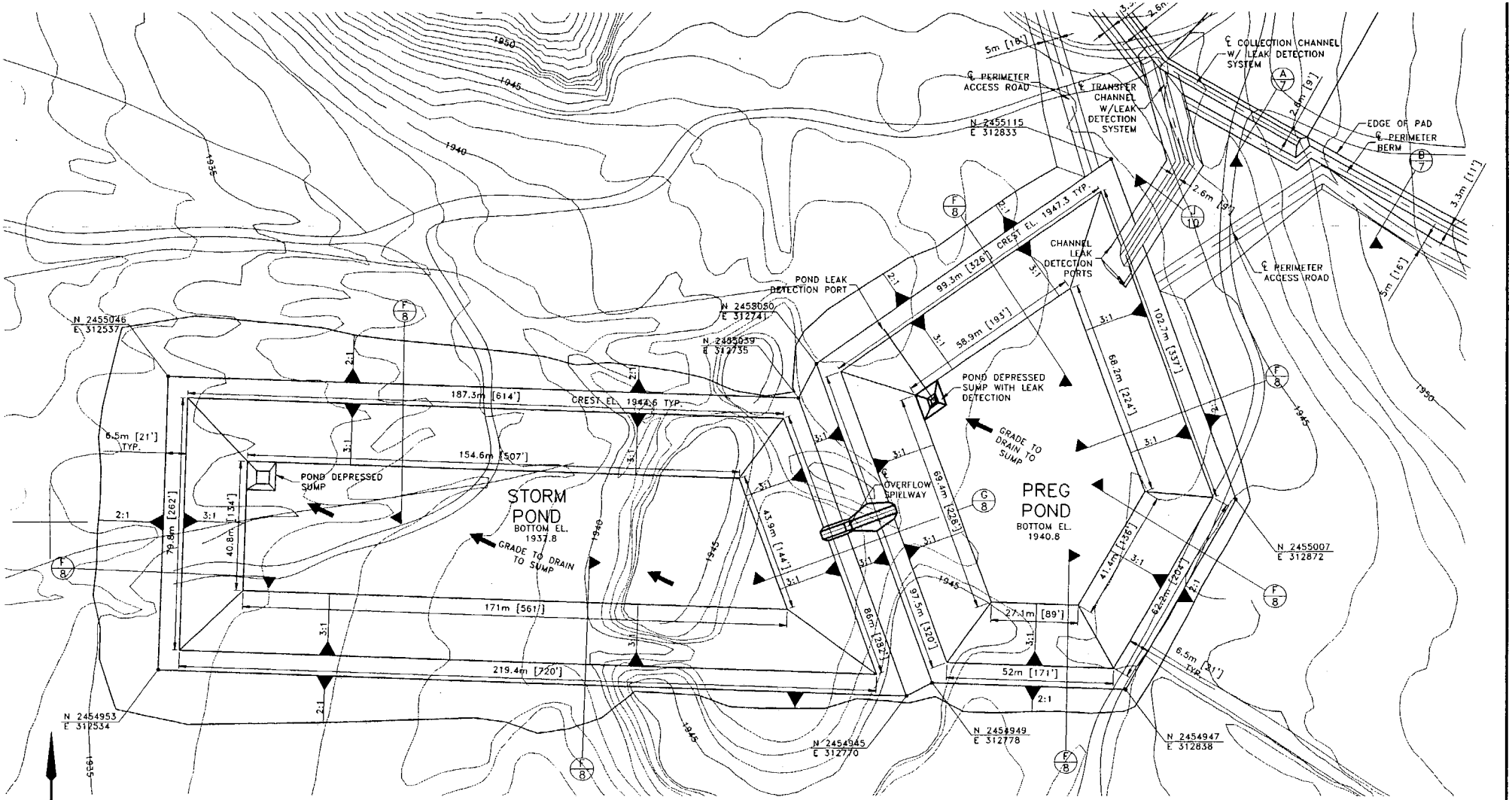
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PHASE I EARTHWORK GRADING PLAN

Drawing 6.2

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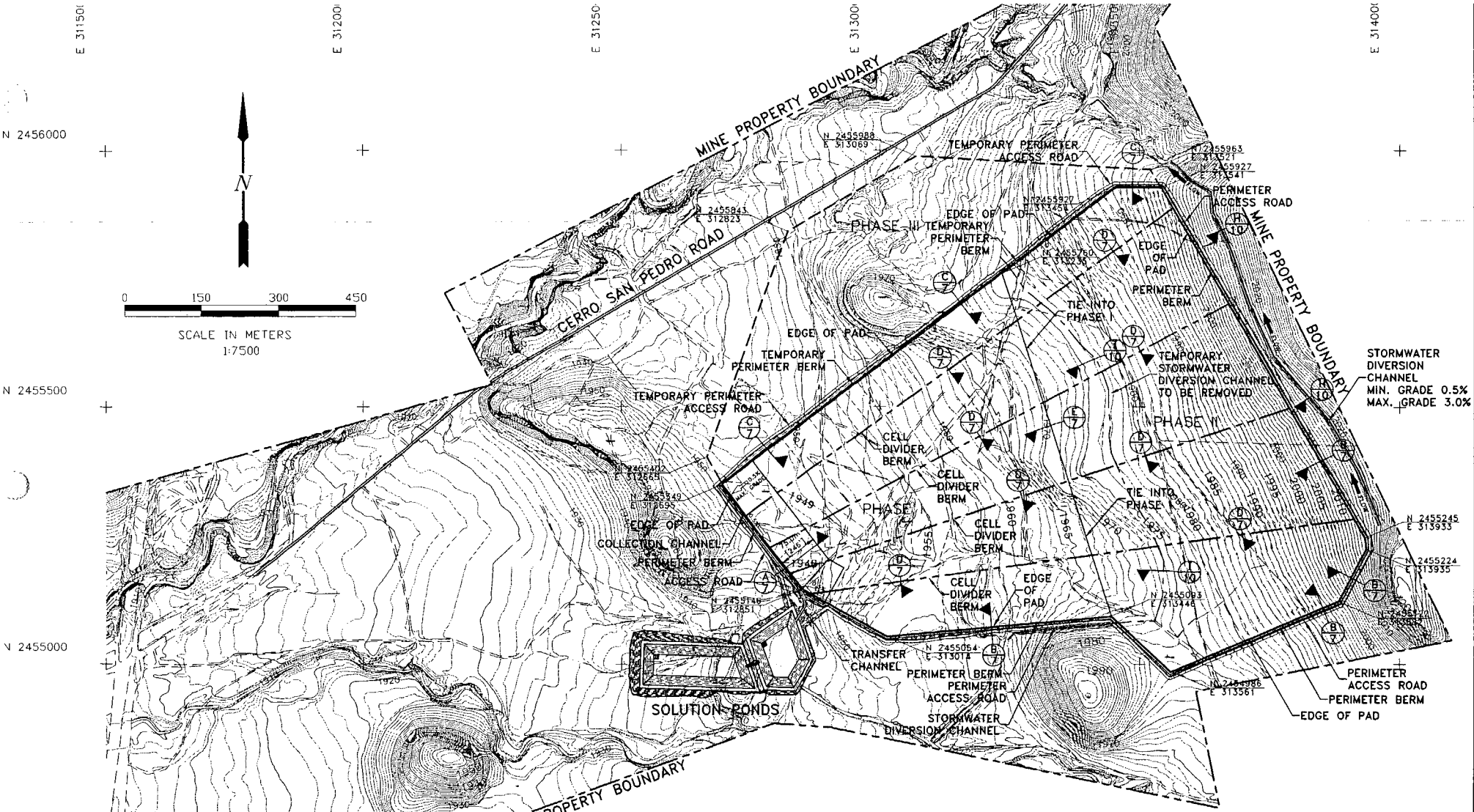
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SOLUTION PONDS | Drawing 6.3

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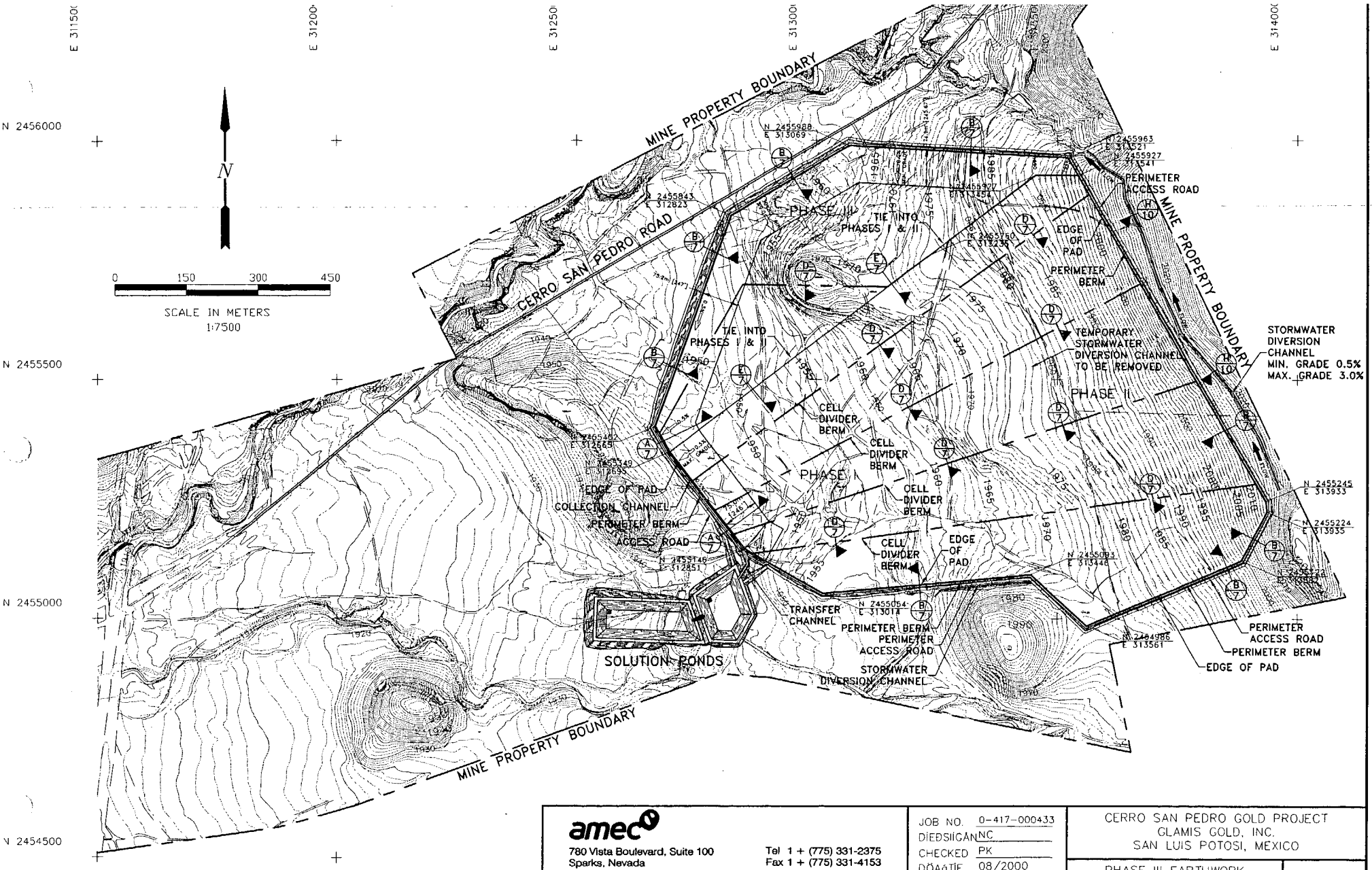
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PHASE II EARTHWORK GRADING PLAN

Drawing 6.4

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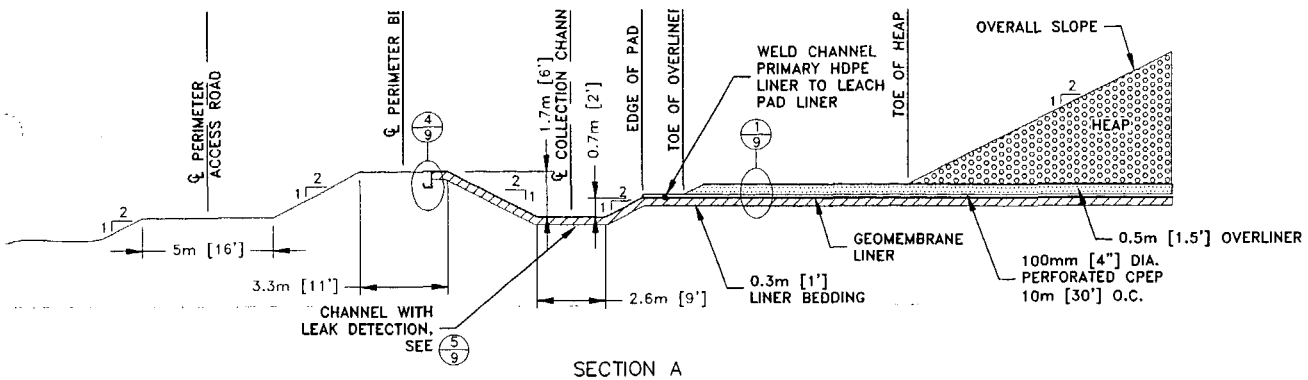
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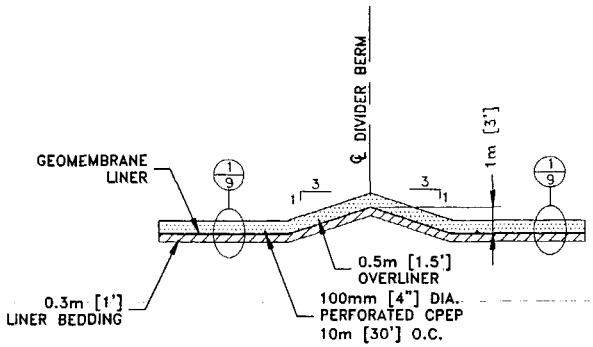
PHASE III EARTHWORK GRADING PLAN

Drawing 6.5

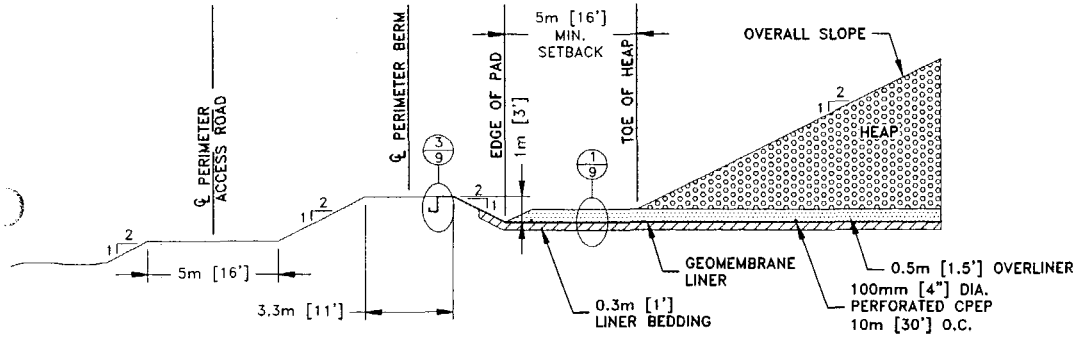
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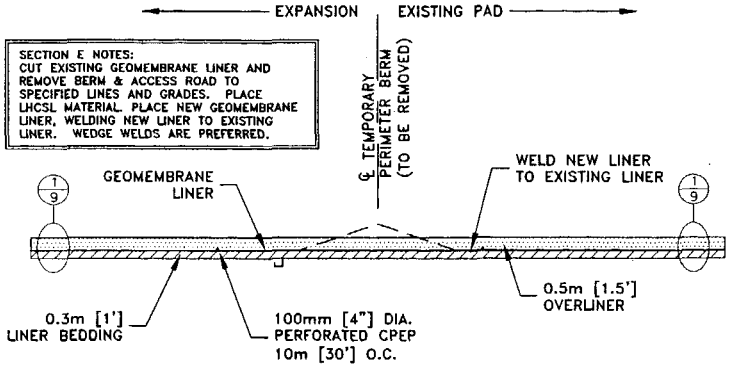
SECTION A
DOWN GRADIENT BERM SECTION SHOWING
COLLECTION CHANNEL WITH LEAK DETECTION
N.T.S.



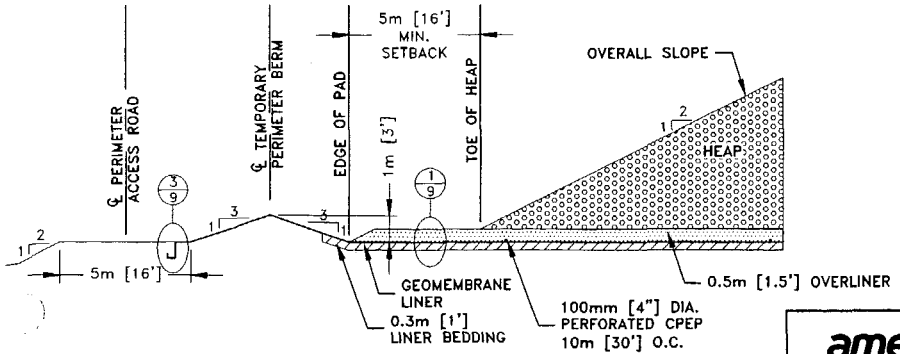
SECTION D
TYPICAL DIVIDER BERM
N.T.S.



SECTION B
TYPICAL PERMANENT PERIMETER BERM
N.T.S.



SECTION E
REMOVAL OF TEMPORARY PERIMETER BERM
N.T.S.



SECTION C
TYPICAL TEMPORARY PERIMETER BERM
N.T.S.

SHEET 7 NOTES:
1. CPEP=CORRUGATED POLYETHYLENE PIPE
2. SECTIONS ARE SHOWN IN FILL CONDITIONS. WHEN CUT CONDITIONS ARE ENCOUNTERED THE MAX. CUT SLOPE SHALL BE 2:1.

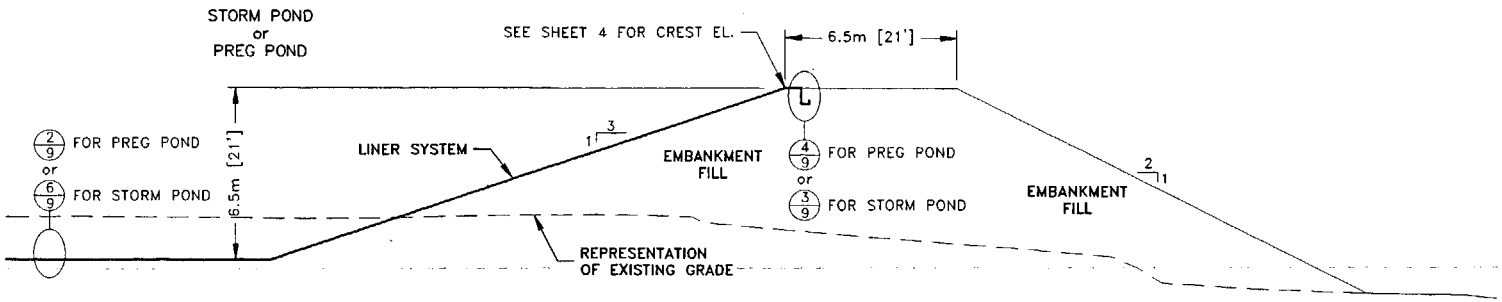
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780 Vista Boulevard, Suite 100
Sparks, Nevada
USA 89434-6656
Tel 1 + (775) 331-2375
Fax 1 + (775) 331-4153
www.amec.com

JOB NO. 0-417-000433
DIEDSIIGANNC
CHECKED PK
DOAGTIE 08/2000
SECOADLIEgraphical

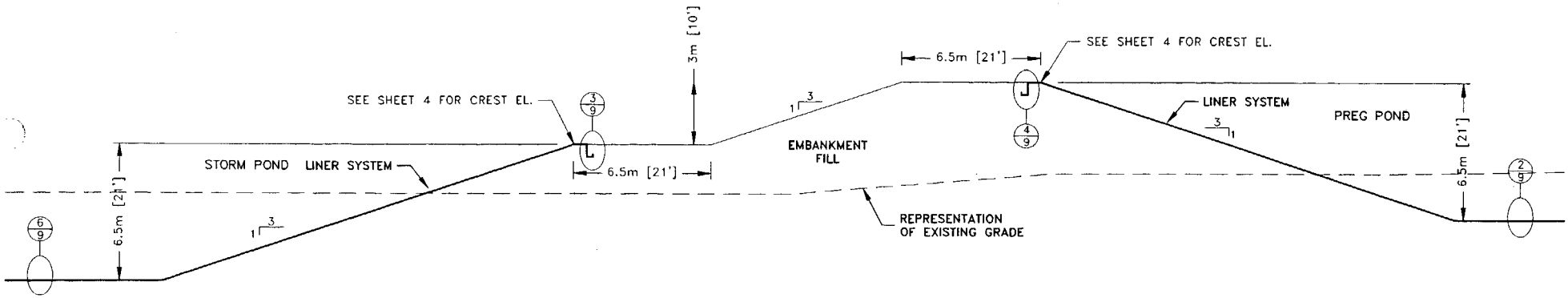
CERRO SAN PEDRO GOLD PROJECT
GLAMIS GOLD, INC.
SAN LUIS POTOSI, MEXICO

TYPICAL LEACH PAD SECTIONS | Drawing 6.6

AMEC DRAWING NO: 433-07RP.DWG



SECTION F
TYPICAL POND SECTION
N.T.S.



SECTION G
INTERMEDIATE BERM BETWEEN PREG POND
& STORM POND
N.T.S.

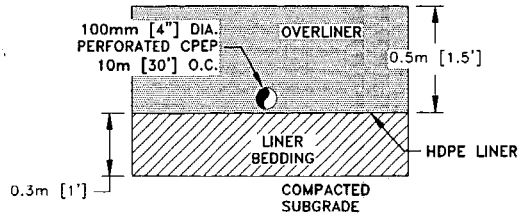
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Fax 1 + (775) 331-4153
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JOB NO. 0-417-000433
DESIGNED NC
CHECKED PK
DATE 08/2000
SCHEDULE Graphical

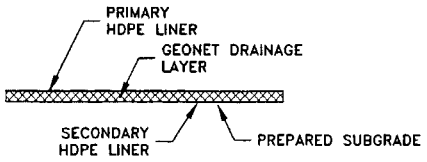
CERRO SAN PEDRO GOLD PROJECT
GLAMIS GOLD, INC.
SAN LUIS POTOSI, MEXICO

TYPICAL POND SECTIONS | Drawing 6.7

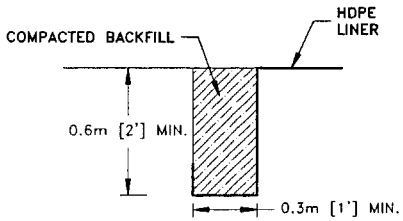
AMEC DRAWING NO: 433-08RP.DWG



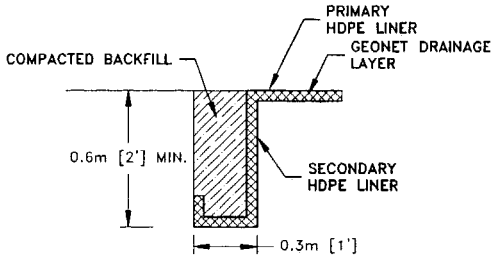
DETAIL 1
LEACH PAD LINING
SYSTEM
N.T.S.



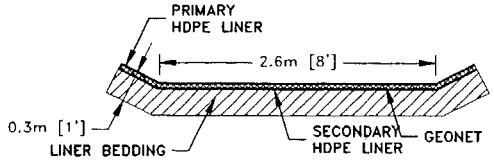
DETAIL 2
PREG POND
LINING SYSTEM
N.T.S.



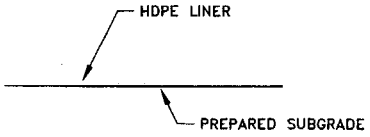
DETAIL 3
TYPICAL SINGLE LINER
ANCHOR TRENCH
N.T.S.



DETAIL 4
TYPICAL DOUBLE LINER
ANCHOR TRENCH
N.T.S.



DETAIL 5
LEAK DETECTION & LINING SYSTEM
FOR SOLUTION CHANNELS
N.T.S.



DETAIL 6
STORM POND LINING
SYSTEM
N.T.S.

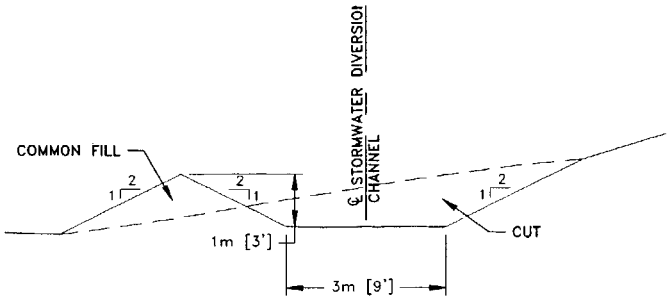
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USA 89434-6656
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JOB NO. 0-417-000433
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CHECKED PK
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SÈCÒÀÐLÌEgraphical

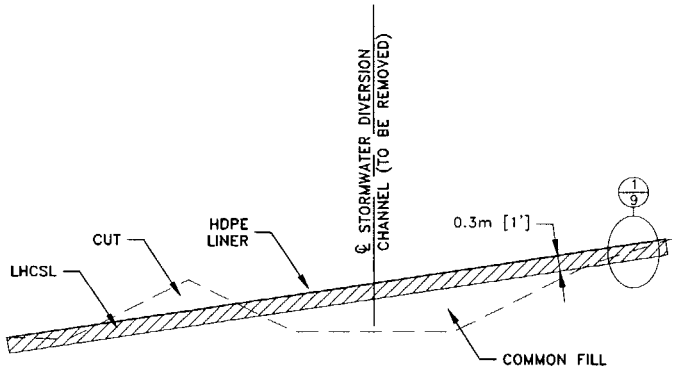
CERRO SAN PEDRO GOLD PROJECT
GLAMIS GOLD, INC.
SAN LUIS POTOSI, MEXICO

TYPICAL LINER DETAILS | Drawing 6.8

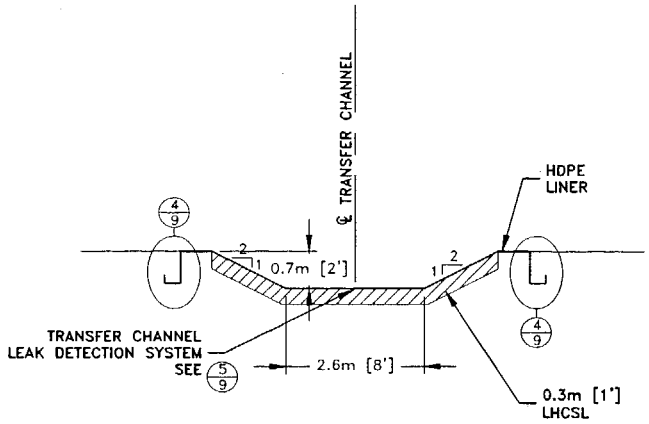
AMEC DRAWING NO: 433-09RP.DWG



SECTION H
TYPICAL STORMWATER
DIVERSION CHANNEL
N.T.S.



SECTION I
REMOVAL OF STORMWATER
DIVERSION CHANNEL
N.T.S.



SECTION J
TYPICAL TRANSFER CHANNEL CHANNEL
N.T.S.

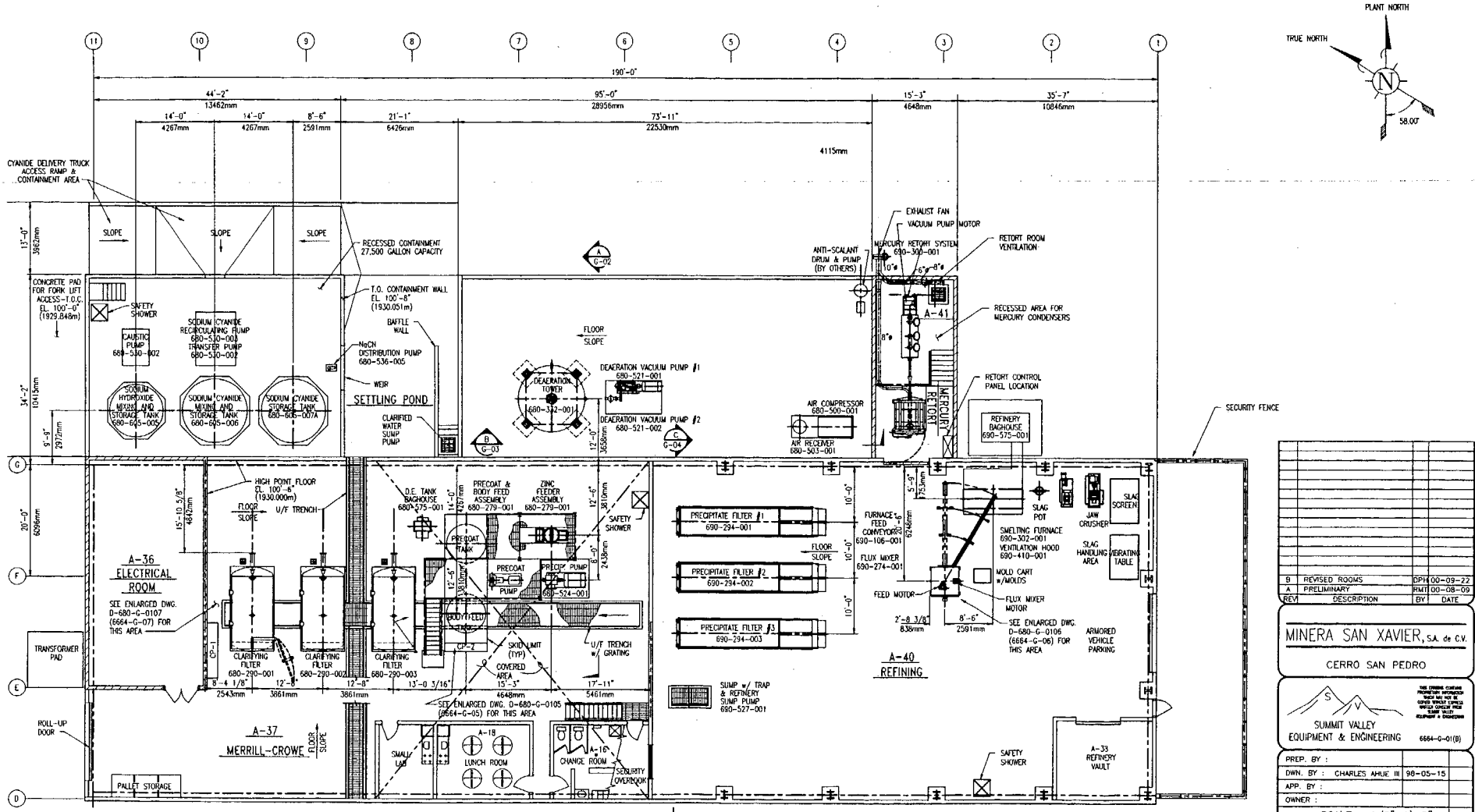
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DÖAGTÍE 08/2000
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CERRO SAN PEDRO GOLD PROJECT
GLAMIS GOLD, INC.
SAN LUIS POTOSI, MEXICO

TYPICAL SECTIONS | Drawing 6.9

AMEC DRAWING NO: 433-10RP.DWG



REV	DESCRIPTION	BY	DATE
B	REVISED ROOMS	DPH	00-09-22
A	PRELIMINARY	RMT	00-08-09

MINERA SAN XAVIER, S.A. de C.V.

CERRO SAN PEDRO

SUMMIT VALLEY EQUIPMENT & ENGINEERING 6664-G-01(B)

PREP. BY :		
DWN. BY : CHARLES AHUE III	98-05-15	
APP. BY :		
OWNER :		
SCALE 1/8"=1'-0"		INIT.

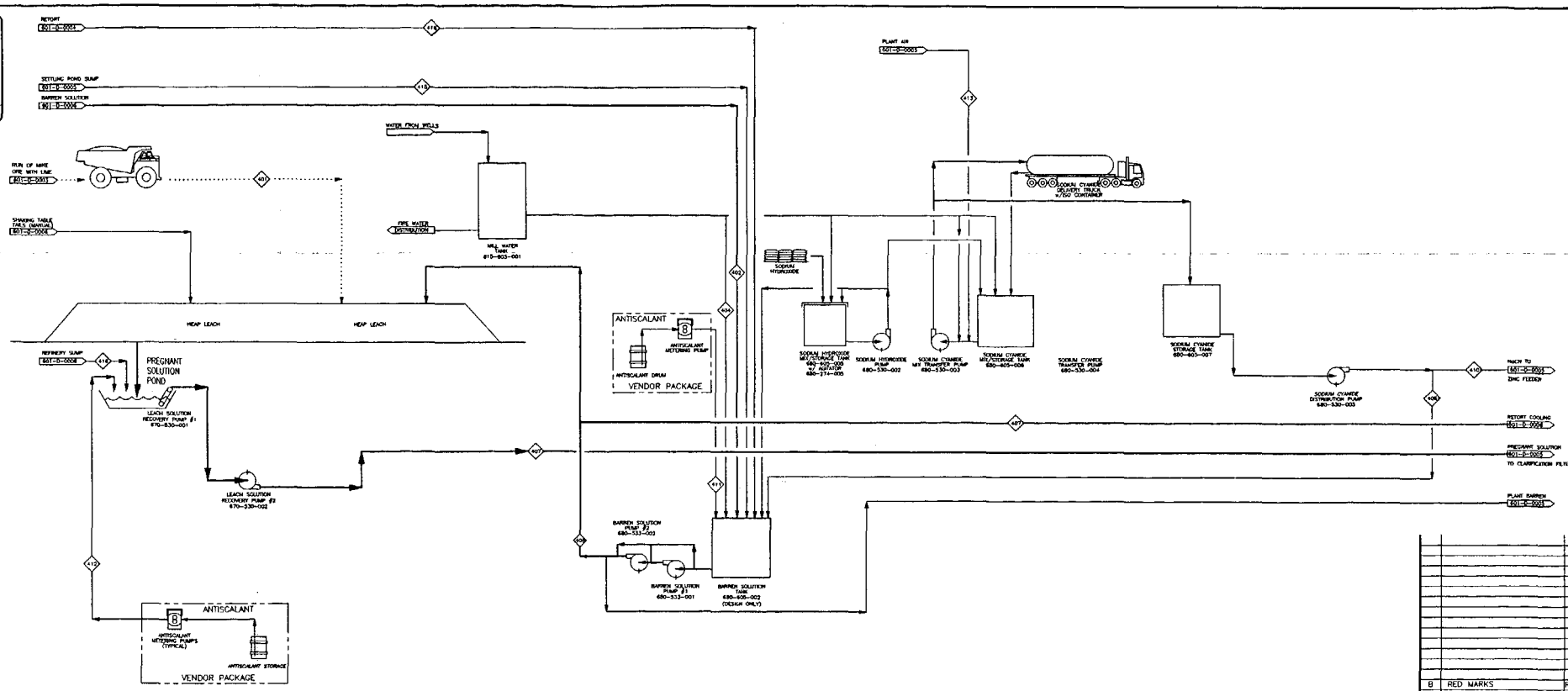
TITLE :

PLANT LAYOUT GENERAL ARRANGEMENT PLAN

SIZE	AREA	DISC.	SEQ. NO.	REV.
D	680	G	0101	B

DRAWING NO. 680-G-0101-B

APPROBATION



STREAM NUMBER		401	402	404a	404b	405	406	407	408	410	411	412	413	415	416	417	418
DESCRIPTION		HEAP LEACH FEED	BARREN SOLUTION	INTER-MEDIATE SOLUTION	MAKE-UP SOLUTION	TYPICAL PREG. PUMP	BARREN TO HEAP LEACH	PREGNANT SOLUTION	NaCN TO BARREN	NaCN TO ZINC FEEDER	BARREN ANTISCALANT	LEACH SOLUTION ANTISCALANT	PLANT AIR SUPPLY	SETTLING POND SUMP	REFINERY SUMP	RETORT SYSTEM	RETORT SYSTEM
OPERATING																	
SOLIDS	MTPH	1425	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
SOLUTION	MTPH	57	909	104	72	0–454	1017	908	0.79	0.057	0.005	0.003	–	18	18	10	10
SOLUTION	GPM	251	909	456	315	0–2000	4476	4000	3.0	0.220	0.018	0.011	–	80	80	44	44
% SOLIDS		98	–	–	–	–	–	–	30% NaCN	30% NaCN	–	–	–	–	–	–	–
TOTAL	MTPH	1481	909	104	72	0–454	1017	908	0.79	0.057	0.005	0.003	–	18	18	10	10
SPECIFIC GRAVITY		1.6	1.0	1.0	1.0	1.0	1.0	1.0	1.15	1.15	1.10	1.10	–	1.0	1.0	1.0	1.0
Au	oz/T	0.490	0.170	0	0	VARIABLE	0.152	0.500	–	–	–	–	–	–	–	0.170	0.170
Ag	oz/T	10.209	0.340	0	0	VARIABLE	0.304	11.150	–	–	–	–	–	–	–	0.340	0.340
Au PRODUCED	oz/DAY	539	119	0	0	VARIABLE	119	350	–	–	–	–	–	–	–	–	–
Ag PRODUCED	oz/DAY	11223	238	0	0	VARIABLE	238	7816	–	–	–	–	–	–	–	–	–

DESIGN																	
SOLIDS	MTPH	1425	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
SOLUTION	MTPH	57	1022	106	74	0–454	1133	1022	0.79	0.065	0.005	0.003	–	18	18	10	10
SOLUTION	GPM	96	4502	466	325	0–2000	4986	4500	3.0	0.247	0.020	0.012	–	80	80	44	44
OPERATING TIME HRS/DAY : DAYS/WEEK		18: 6	24: 7	24: 7	24: 7	VARIABLE	24: 7	24: 7	24: 7	24: 7	24: 7	24: 7	–	VARIABLE	VARIABLE	–	–
Au PRODUCED	oz/DAY	804	134	0	0	VARIABLE	134	394	–	–	–	–	–	–	–	–	–
Ag PRODUCED	oz/DAY	16750	268	0	0	VARIABLE	268	8793	–	–	–	–	–	–	–	–	–

FLOW LEGEND

- ORE STREAM
- SOLUTION FLOW
- INTERMITTENT SOLUTION FLOW
- ANCILLARY OR REAGENT FLOW
- VENDOR PACKAGE

REV	DESCRIPTION	BY	DATE
B	RED MARKS	RMT	00-08-24
A	PRELIMINARY	RMT	00-07-18

MINERA SAN XAVIER, S.A. de C.V.

SUMMIT VALLEY EQUIPMENT & ENGINEERING 6664-F-01(B)

PREP. BY :		
DWN. BY : JAY RENNEMEYER	98-05-27	
APP. BY : TODD WELDON	98-05-27	
OWNER :		
SCALE N/A		INIT.

TITLE :

LEACH SOLUTION RECOVERY PROCESS FLOW DIAGRAM

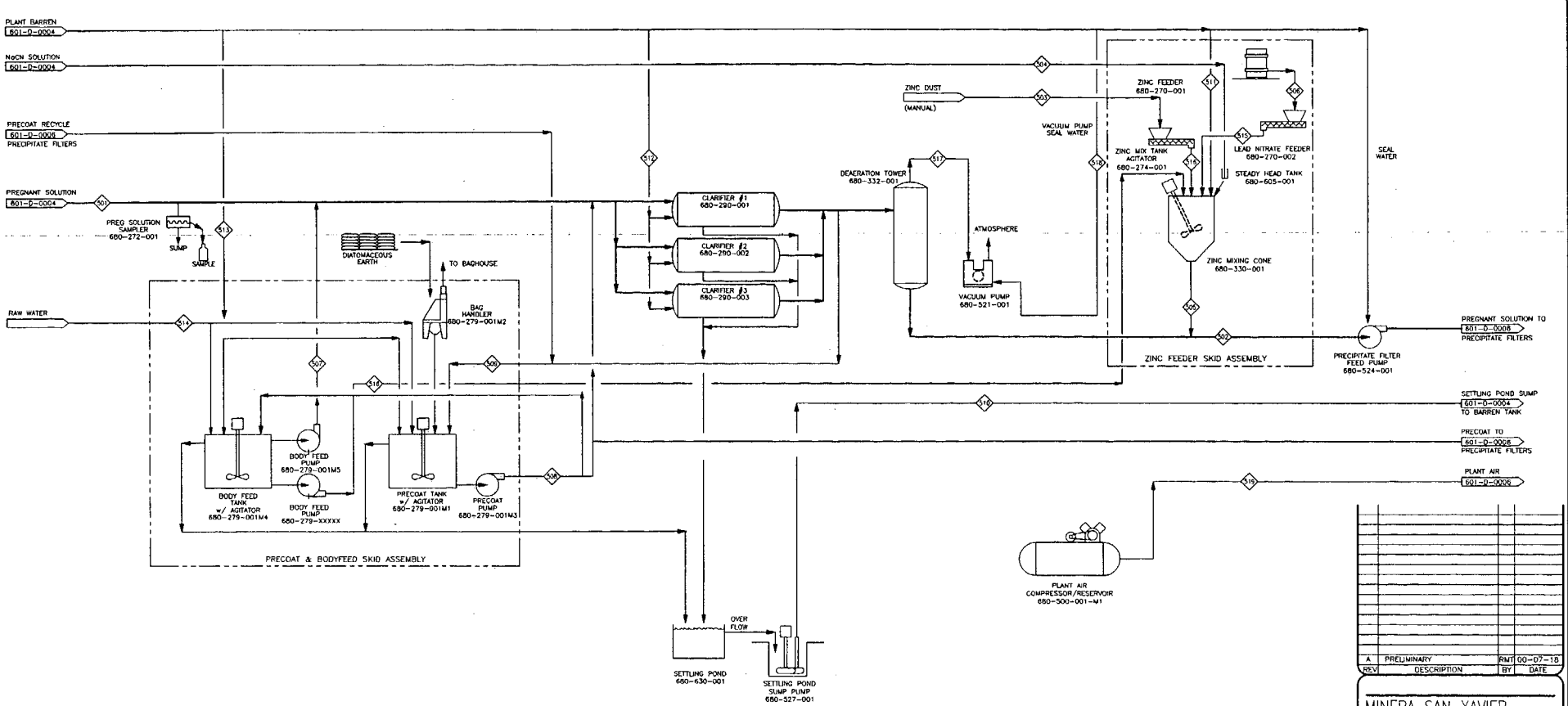
SIZE	AREA	DISC.	SEQ. NO.	REV.
D	601	D	0004	B

DRAWING NO.

APPROBATION

D C B A

– Drawing 6.11 –



STREAM NUMBER		501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519
DESCRIPTION		PREGNANT SOLUTION	PREG TO PRECIP	ZINC DUST	NaCN TO ZINC FEEDER	ZINC SLURRY	LEAD NITRATE	BODY FEED	PRECOAT	PRECOAT RETURN	SETTLING POND SUMP	BARREN TO ZINC FEEDER	CLARIFIER BACK WASH	PRECOAT/ BODY FEED BARREN	PRECOAT/ BODY FEED RAW WATER	LEAD NITRATE SOLUTION	BODY FEED	VACUUM AIR	SEAL WATER	BLOWN DOWN AIR
OPERATING																				
SOLIDS	MTPH	–	–	0.009	–	0.009	–	0.01	40	–	–	–	–	–	–	–	0.009	900scfm	–	170 sm3/h
SOLUTION	MTPH	908	909	–	0.057	0.435	–	0.59	341	341	352	0.378	91	27	27	–	0.44	961.5 TORR	2.73 Apx.	345 KPA
SOLUTION	GPM	4000	4002	–	0.220	1.710	–	2.60	1500	1500	80	1.661	400	120	120	–	1.94	MAXIMUM	12.0 Apx.	100 scfm
% SOLIDS		–	–	100	30% NaCN	2.0	–	2.0	10	–	–	–	–	–	–	–	2.0	–	–	50 psi
TOTAL	MTPH	908	909	0.009	0.057	0.444	–	0.60	381	341	–	0.378	91	27	27	–	0.45	–	2.73 Apx.	–
SPECIFIC GRAVITY		1.0	1.0	–	1.15	1.12	–	1.01	1.06	1.0	1.0	1.0	1.0	1.0	1.0	–	–	–	1.0	–
Au GRADE	g/T	0.500	0.499	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.170	–
Ag GRADE	g/T	11.150	11.145	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	0.340	–
Au PRODUCED	oz/DAY	350	350	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ag PRODUCED	oz/DAY	7816	7816	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

DESIGN																				
SOLIDS	MTPH	–	–	0.010	–	0.010	–	0.01	40	–	–	–	–	–	–	–	0.25	–	–	–
SOLUTION	MTPH	1022	1022	–	0.065	0.476	–	.68	381	341	352	0.412	91	27	27	–	1.25	–	–	–
SOLUTION	GPM	4500	4502	–	0.247	1.872	–	.67	1500	1500	80	1.811	480	120	120	–	5.49	–	–	–
OPERATING TIME HRS/DAY : DAYS/WEEK		24 : 7	24 : 7	2467	24 : 7	24 : 7	–	24 : 7	VARIABLE	VARIABLE	VARIABLE	24 : 7	VARIABLE	VARIABLE	VARIABLE	–	24 : 7	24 : 7	24 : 7	3 : 2
Au PRODUCED	oz/DAY	394	394	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Ag PRODUCED	oz/DAY	8793	8793	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

FLOW LEGEND

- ORE STREAM
- SOLUTION FLOW
- INTERMITTENT SOLUTION FLOW
- ANCILLARY OR REAGENT FLOW
- VENDOR PACKAGE

REV	DESCRIPTION	BY	DATE
A	PRELIMINARY	RMT	00-07-18

MINERA SAN XAVIER, S.A. de C.V.

CERRO SAN PEDRO

SUMMIT VALLEY EQUIPMENT & ENGINEERING 6664-F-02(A)

PREP. BY :		
DWN. BY :	JAY RENNEMEYER	98-05-27
APP. BY :	TODD WELDON	98-05-27
OWNER :		
SCALE	N/A	INIT.

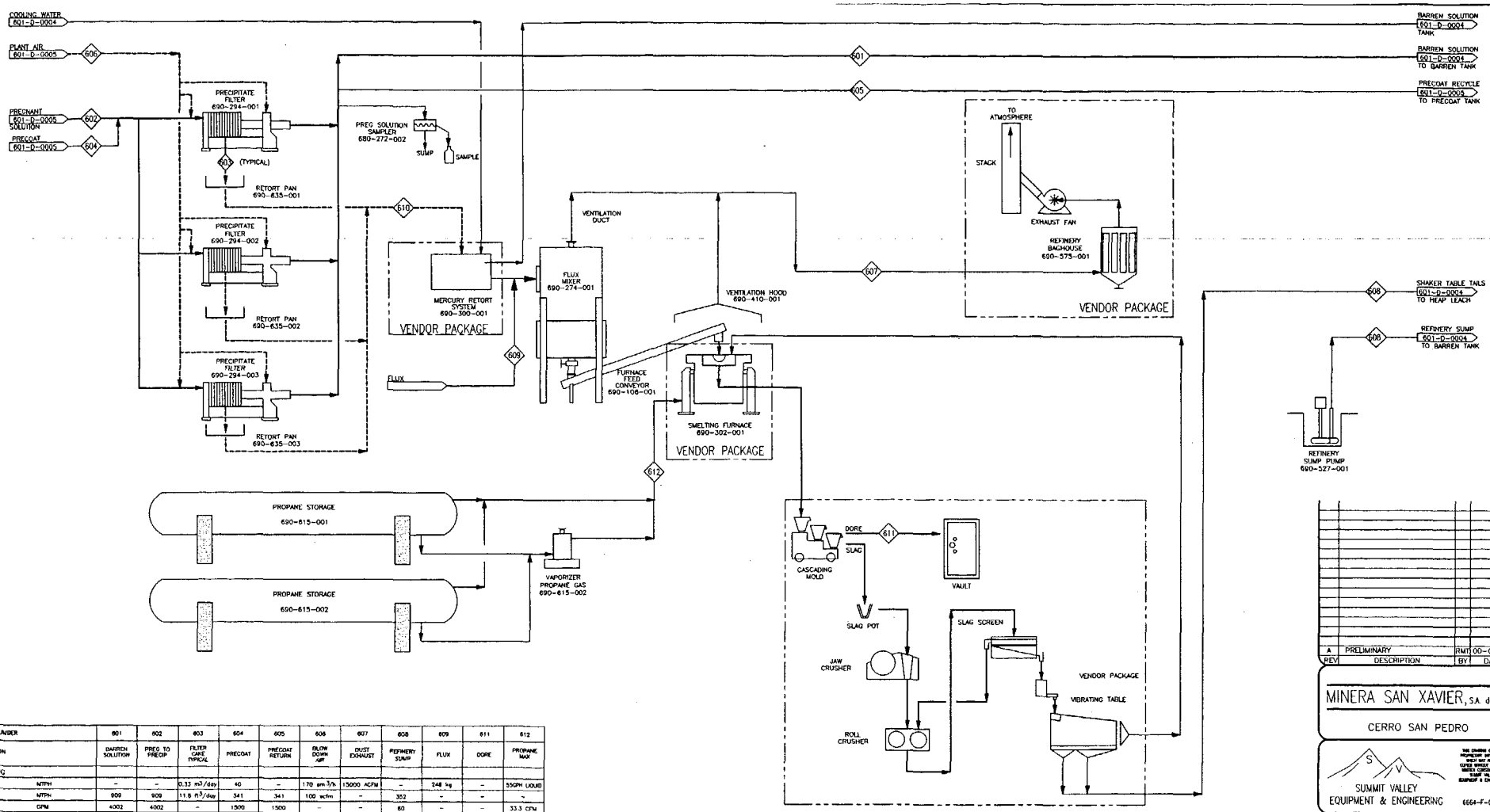
TITLE : PRECIOUS METALS RECOVERY (MERRILL-CROWE) PROCESS FLOW DIAGRAM

SIZE	DRAWING NO. AREA	DISC.	SEQ. NO.	REV.
D	601	D	0005	A

APPROBATION

D C B A

– Drawing 6.12 –



STREAM NUMBER		601	602	603	604	605	606	607	608	609	611	612
DESCRIPTION		BARREN SOLUTION	PREG TO PRECIP	FILTER CAKE TYPICAL	PRECOAT	PRECOAT RETURN	BLOW DOWN AIR	DUST EXHAUST	REFINERY SUMP	FLUX	DORE	PROPANE MAX
OPERATING												
SOLIDS	MTPH	–	–	0.33 m³/day	40	–	170 am³/h	15000 ACFM	–	248 kg	–	550# LIQUID
SOLUTION	MTPH	909	909	11.6 m³/day	341	341	100 scfm	–	352	–	–	–
SOLUTION	GPM	4002	4002	–	1500	1500	–	–	80	–	–	33.3 CFM
% SOLIDS		–	–	–	10	–	–	–	–	–	–	–
TOTAL	MTPH	909	909	–	381	341	–	–	–	–	–	–
SPECIFIC GRAVITY		1.0	1.0	–	1.08	1.0	–	–	1.0	–	–	–
Au GRADE	g/T	0.170	0.771	–	–	–	–	–	–	–	–	–
Ag GRADE	g/T	0.340	14.183	–	–	–	–	–	–	–	–	–
Au PRODUCED	oz/DAY	119	0.498	–	–	–	–	–	–	–	280	–
Ag PRODUCED	oz/DAY	238	11.143	–	–	–	–	–	–	–	8323	–
#/DAY		–	–	–	–	–	–	–	–	545	–	–

DESIGN												
SOLIDS	MTPH	–	–	2.8 m	40	–	–	–	–	248 kg	–	–
SOLUTION	MTPH	1022	1022	98 cu. ft.	341	341	–	–	352	–	–	–
SOLUTION	GPM	4502	4502	–	1500	1500	–	–	80	–	–	–
OPERATING TIME HRS/DAY : DAYS/WEEK		24 : 7	24 : 7	3 : 2	–	VARIABLE	1 : 2	–	VARIABLE	1 : 7	–	VARIABLE
Au PRODUCED	oz/DAY	134	394	–	–	–	–	–	–	–	280	–
Ag PRODUCED	oz/DAY	268	8793	–	–	–	–	–	–	–	8325	–

FLUX COMPOSITION:

BORAX	188
RECYCLED SLAG	188
SODA ASH	113
NITER	113
FLUORSPAR	19
	622

FLOW LEGEND

- ORE STREAM
- SOLUTION FLOW
- INTERMITTENT SOLUTION FLOW
- ANCILLARY OR REAGENT FLOW
- VENDOR PACKAGE

REV	DESCRIPTION	BY	DATE
A	PRELIMINARY	RMT	00-07-18

MINERA SAN XAVIER, S.A. de C.V.

CERRO SAN PEDRO

SUMMIT VALLEY EQUIPMENT & ENGINEERING 6664-F-03(A)

PREP. BY :		
DWN. BY : JAY RENNEMEYER	98-05-27	
APP. BY : TODD WELDON	98-05-27	
OWNER :		
SCALE		INIT.

TITLE :

REFINING

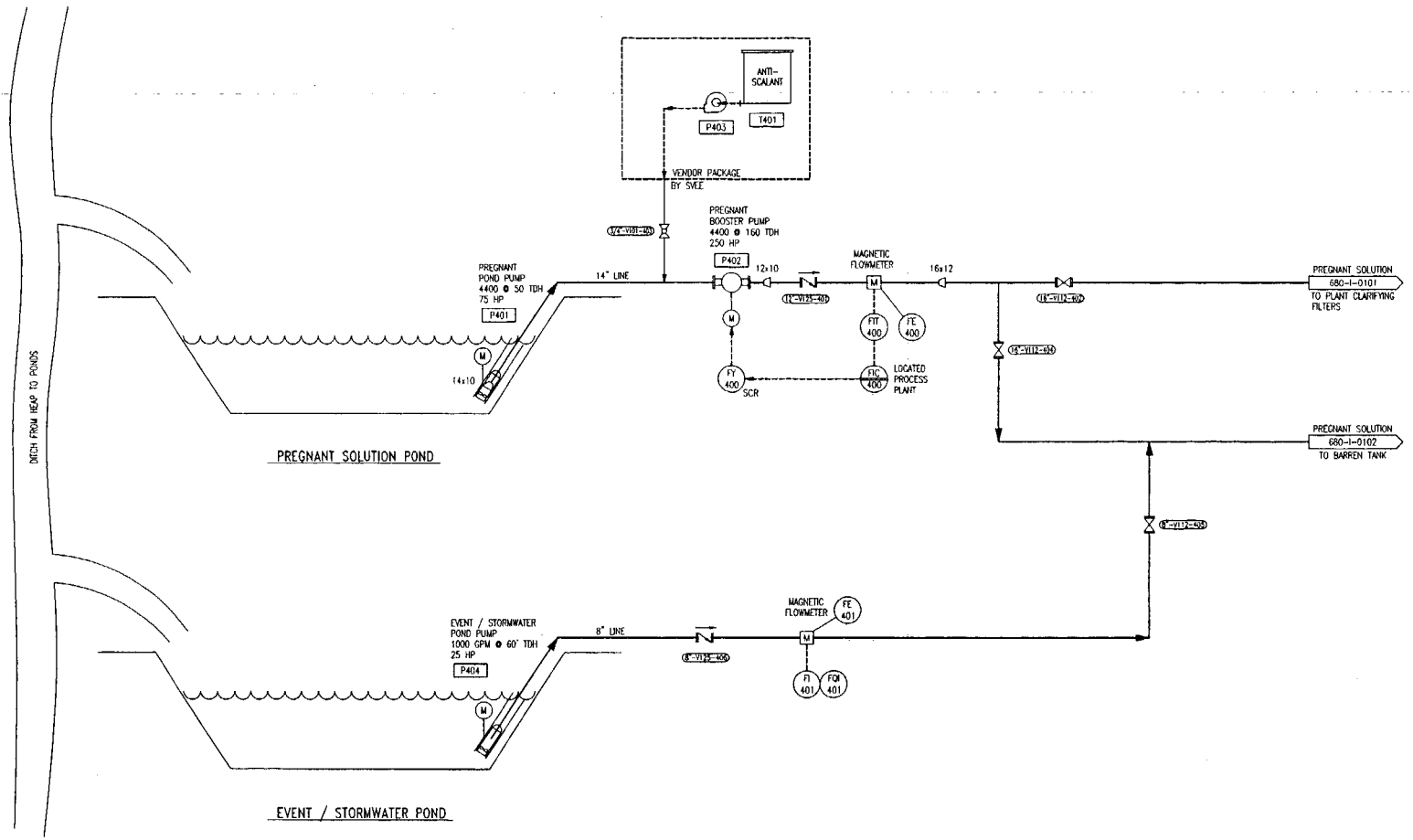
PROCESS FLOW DIAGRAM

SIZE	AREA	DISC.	SEQ. NO.	REV.
D	601	D	0006	A

DRAWING NO. 601-D-0006-A

APPROBATION

D C B A



REV	DESCRIPTION	BY	DATE
C	ADDED EVENT POND	DPM	00-09-22
B	REVISED	RMT	00-08-24
A	PRELIMINARY	TGI	00-08-14

MINERA SAN XAVIER, S.A. de C.V.

CERRO SAN PEDRO

SUMMIT VALLEY EQUIPMENT & ENGINEERING 6864-I-04(C)

PREP. BY :		
DWN. BY : T. IVANOVA	00-08-14	
APP. BY : G. SMITH	00-08-14	
OWNER :		
SCALE		INIT.

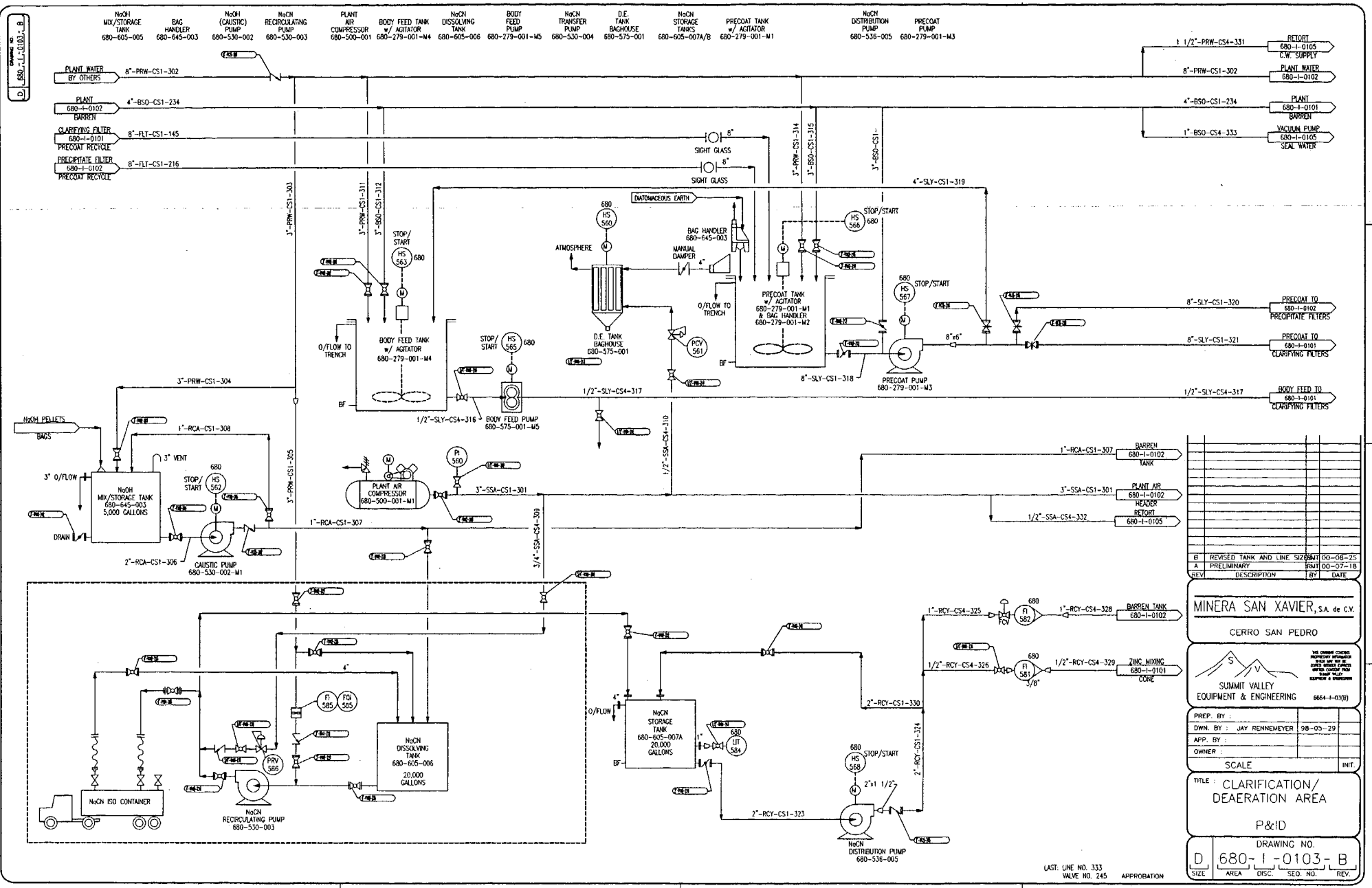
TITLE : PREGNANT/ SOLUTION AREA P&ID

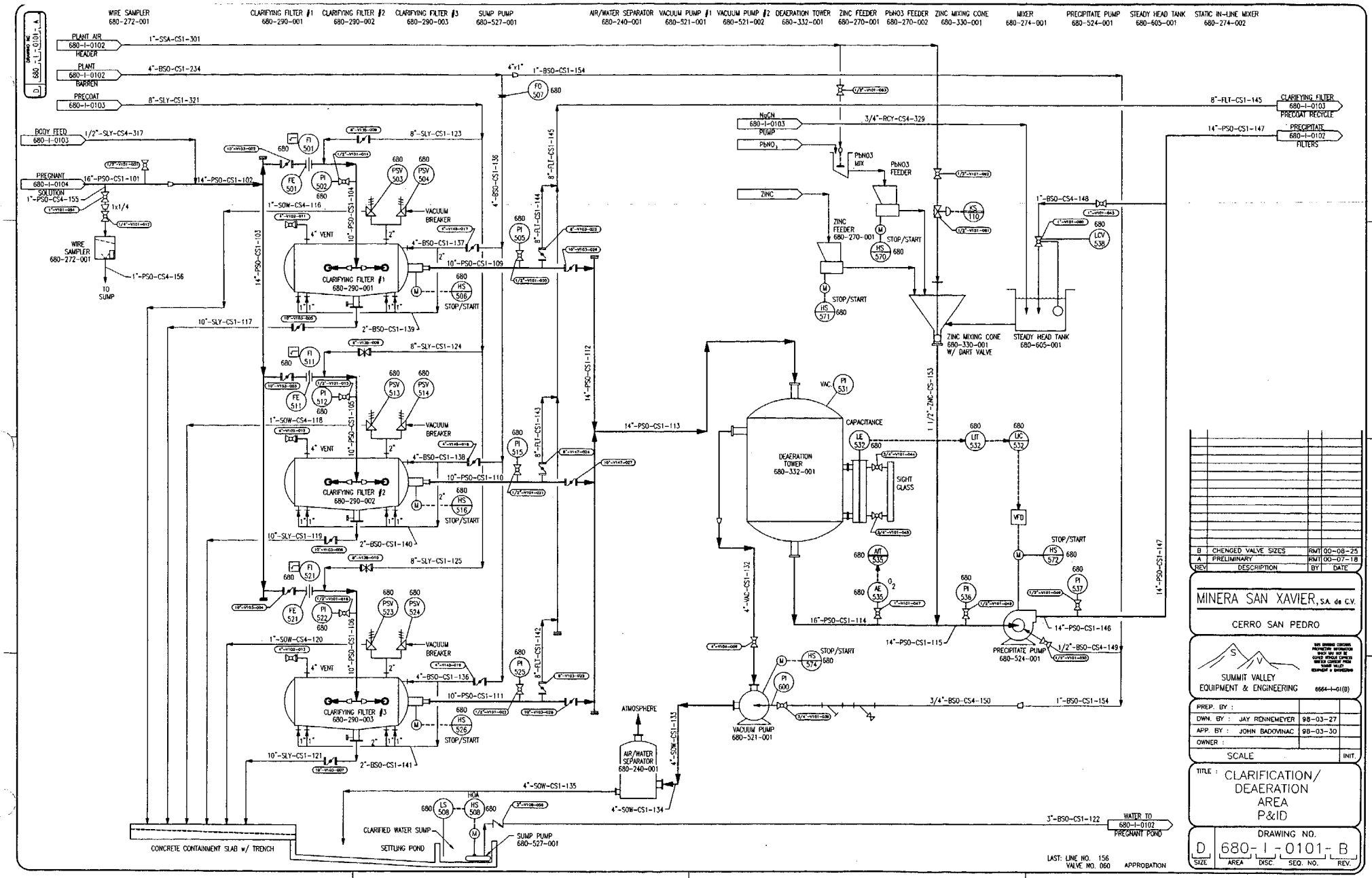
SIZE	DRAWING NO. AREA	DISC.	SEQ. NO.	REV.
D	680- I -0104- C			

APPROBATION

D C B A

– Drawing 6.14 –


NaOH MIX/STORAGE TANK 680-605-005
BAG HANDLER 680-645-003
NaOH (CAUSTIC) PUMP 680-530-002
NaCN RECIRCULATING PUMP 680-530-003
PLANT AIR COMPRESSOR 680-500-001
BODY FEED TANK w/ AGITATOR 680-279-001-M4
NaCN DISSOLVING TANK 680-605-006
BODY FEED PUMP 680-279-001-M5
NaCN TRANSFER PUMP 680-530-004
D.E. TANK BAGHOUSE 680-575-001
NaCN STORAGE TANKS 680-605-007A/B
PRECOAT TANK w/ AGITATOR 680-279-001-M1
NaCN DISTRIBUTION PUMP 680-536-005
PRECOAT PUMP 680-279-001-M3
PLANT WATER BY OTHERS
8"-PRW-CS1-302
PLANT 680-I-0102 BARREN
4"-BSO-CS1-234
CLARIFYING FILTER 680-I-0101 PRECOAT RECYCLE
8"-FLT-CS1-145
PRECIPITATE FILTER 680-I-0102 PRECOAT RECYCLE
8"-FLT-CS1-216
1 1/2"-PRW-CS4-331
RETORT 680-I-0105 C.W. SUPPLY
8"-PRW-CS1-302
PLANT WATER 680-I-0102
4"-BSO-CS1-234
PLANT 680-I-0101 BARREN
1"-BSO-CS4-333
VACUUM PUMP 680-I-0105 SEAL WATER
SIGHT GLASS
3"-PRW-CS1-314
3"-BSO-CS1-315
3"-BSO-CS1-
4"-SLY-CS1-319
DIATOMACEOUS EARTH
3"-PRW-CS1-303
3"-PRW-CS1-311
3"-BSO-CS1-312
STOP/ START HS 563 680
O/FLOW TO TRENCH
BODY FEED TANK w/ AGITATOR 680-279-001-M4
STOP/ START HS 565 680
BODY FEED PUMP 680-575-001-M5
1/2"-SLY-CS4-316
ATMOSPHERE
HS 560 680
MANUAL DAMPER 4"
BAG HANDLER 680-645-003
D.E. TANK BAGHOUSE 680-575-001
PCV 561
O/FLOW TO TRENCH
PRECOAT TANK w/ AGITATOR 680-279-001-M1 & BAG HANDLER 680-279-001-M2
HS 566 680 STOP/START
HS 567 680 STOP/START
8"x6"
8"-SLY-CS1-318
PRECOAT PUMP 680-279-001-M3
8"-SLY-CS1-320
PRECOAT TO 680-I-0102 PRECIPITATE FILTERS
8"-SLY-CS1-321
PRECOAT TO 680-I-0101 CLARIFYING FILTERS
1/2"-SLY-CS4-317
BODY FEED TO 680-I-0101 CLARIFYING FILTERS
3"-PRW-CS1-304
NaOH PELLETS BAGS
1"-RCA-CS1-308
3" VENT
3" O/FLOW
NaOH MIX/STORAGE TANK 680-645-003 5,000 GALLONS
DRAIN
STOP/ START HS 562 680
2"-RCA-CS1-306
CAUSTIC PUMP 680-530-002-M1
3"-PRW-CS1-305
PLANT AIR COMPRESSOR 680-500-001-M1
PI 560
3"-SSA-CS1-301
1/2"-SSA-CS4-310
3/4"-SSA-CS4-309
1"-RCA-CS1-307
1"-RCA-CS1-307 BARREN 680-I-0102 TANK
3"-SSA-CS1-301 PLANT AIR 680-I-0102 HEADER
1/2"-SSA-CS4-332 RETORT 680-I-0105
4"
FI 585
FQI 585
PRV 586
NaCN DISSOLVING TANK 680-605-006 20,000 GALLONS
NaCN ISO CONTAINER
NaCN RECIRCULATING PUMP 680-530-003
O/FLOW
NaCN STORAGE TANK 680-605-007A 20,000 GALLONS
LIT 584
2"-RCY-CS1-330
2"-RCY-CS1-324
2"-RCY-CS1-323
HS 568 680 STOP/START
2"x1 1/2"
NaCN DISTRIBUTION PUMP 680-536-005
1"-RCY-CS4-325
FCV
FI 582
1"-RCY-CS4-328
BARREN TANK 680-I-0102
1/2"-RCY-CS4-326
FI 581
1/2"-RCY-CS4-329
ZINC MIXING 680-I-0101 CONE
3/8"
B REVISED TANK AND LINE SIZES RMT 00-08-25
A PRELIMINARY RMT 00-07-18
REV DESCRIPTION BY DATE
MINERA SAN XAVIER, S.A. de C.V.
CERRO SAN PEDRO
SUMMIT VALLEY EQUIPMENT & ENGINEERING 6664-I-03(B)
PREP. BY :
DWN. BY : JAY RENNEMEYER 98-05-29
APP. BY :
OWNER :
SCALE INIT.
TITLE : CLARIFICATION/ DEAERATION AREA
P&ID
DRAWING NO.
D 680-I-0103-B
SIZE AREA DISC. SEQ. NO. REV.
LAST: LINE NO. 333
VALVE NO. 245
APPROBATION
D C B A
- Drawing 6.15 -



REV	DESCRIPTION	BY	DATE
B	CHENGED VALVE SIZES	RMT	00-08-25
A	PRELIMINARY	RMT	00-07-18

MINERA SAN XAVIER, S.A. de C.V.

CERRO SAN PEDRO

SUMMIT VALLEY EQUIPMENT & ENGINEERING 6664-I-01(D)

PREP. BY :		
DWN. BY :	JAY RENNEMEYER	98-03-27
APP. BY :	JOHN BADOVINAC	98-03-30
OWNER :		
SCALE		INIT.

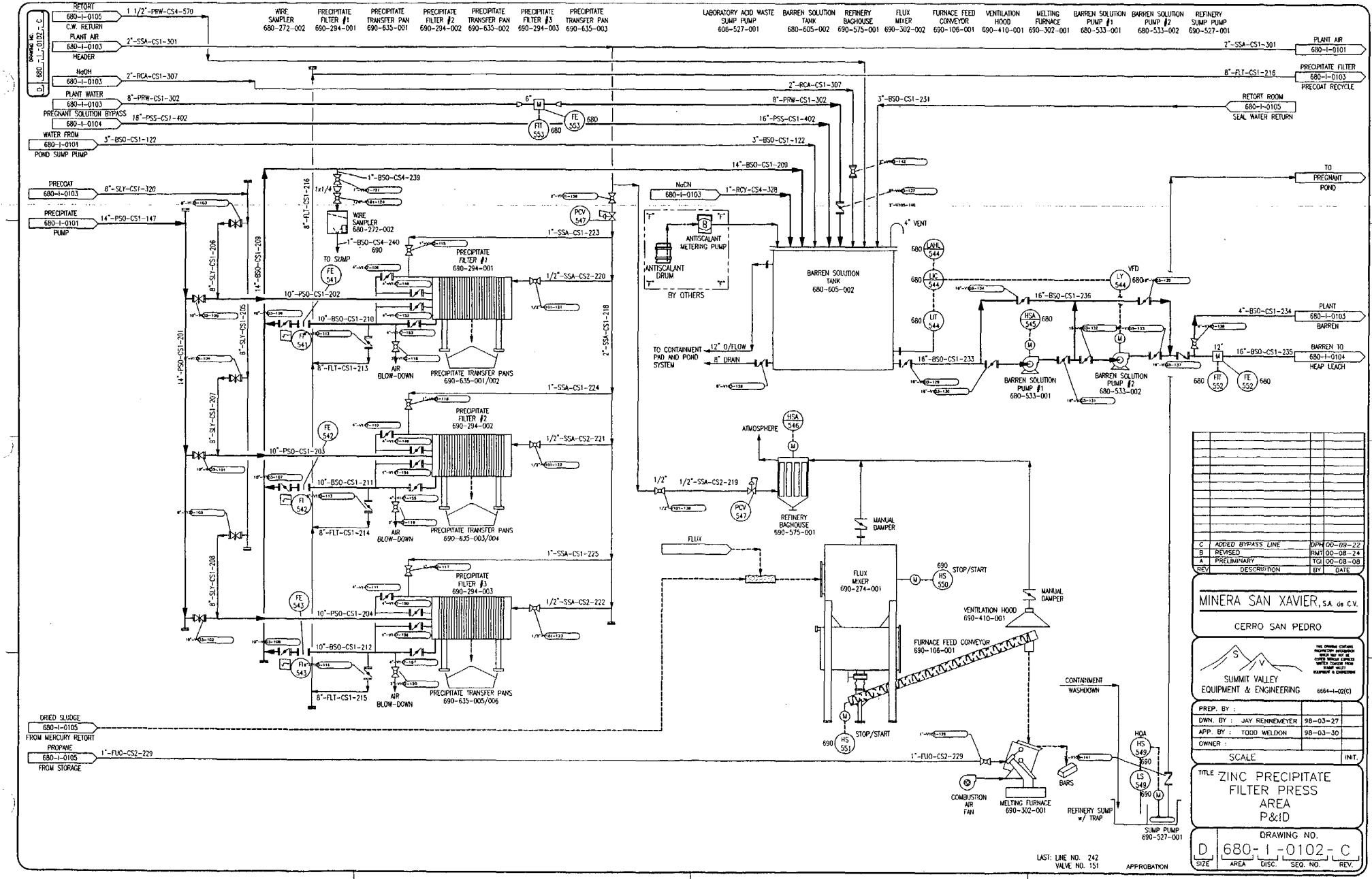
TITLE : CLARIFICATION/ DEAERATION AREA P&ID

DRAWING NO. 680-I-0101-B

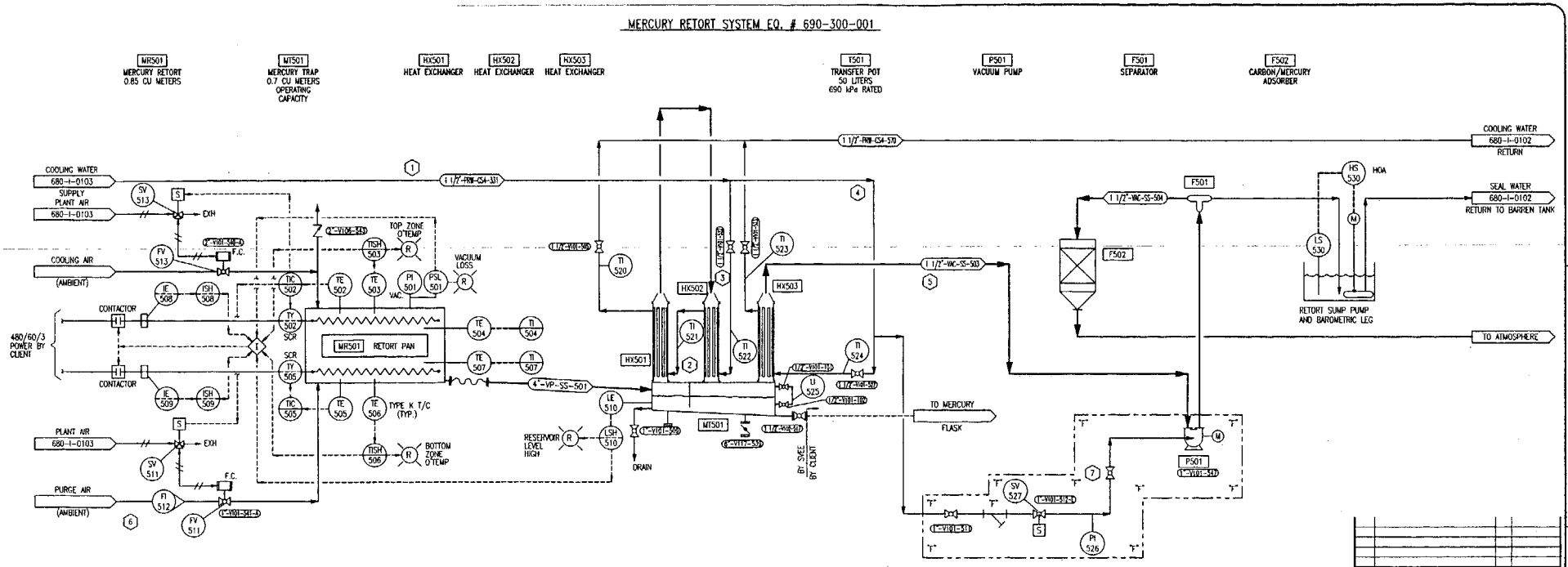
SIZE D | AREA | DISC | SEQ. NO. | REV.

LAST: LINE NO. 156 VALVE NO. 060 APPROBATION

D C B A


RETORT
680-I-0105
C.W. RETURN
PLANT AIR
680-I-0103
HEADER
NaOH
680-I-0103
PLANT WATER
680-I-0103
PREGNANT SOLUTION BYPASS
680-I-0104
WATER FROM
680-I-0101
POND SUMP PUMP
1 1/2"-PRW-CS4-570
2"-SSA-CS1-301
2"-RCA-CS1-307
8"-PRW-CS1-302
16"-PSS-CS1-402
3"-BSO-CS1-122
WIRE SAMPLER 680-272-002
PRECIPITATE FILTER #1 690-294-001
PRECIPITATE TRANSFER PAN 690-635-001
PRECIPITATE FILTER #2 690-294-002
PRECIPITATE TRANSFER PAN 690-635-002
PRECIPITATE FILTER #3 690-294-003
PRECIPITATE TRANSFER PAN 690-635-003
LABORATORY ACID WASTE SUMP PUMP 606-527-001
BARREN SOLUTION TANK 680-605-002
REFINERY BAGHOUSE 690-575-001
FLUX MIXER 690-302-002
FURNACE FEED CONVEYOR 690-106-001
VENTILATION HOOD 690-410-001
MELTING FURNACE 690-302-001
BARREN SOLUTION PUMP #1 680-533-001
BARREN SOLUTION PUMP #2 680-533-002
REFINERY SUMP PUMP 690-527-001
PLANT AIR 680-I-0101
PRECIPITATE FILTER 680-I-0103 PRECOAT RECYCLE
RETORT ROOM 680-I-0105 SEAL WATER RETURN
TO PREGNANT POND
PRECOAT 680-I-0103
PRECIPITATE 680-I-0101 PUMP
8"-SLY-CS1-320
14"-PSO-CS1-147
1"-BSO-CS4-239
1"-BSO-CS4-240
WIRE SAMPLER 680-272-002
TO SUMP
PRECIPITATE FILTER #1 690-294-001
PRECIPITATE FILTER #2 690-294-002
PRECIPITATE FILTER #3 690-294-003
PRECIPITATE TRANSFER PANS 690-635-001/002
PRECIPITATE TRANSFER PANS 690-635-003/004
PRECIPITATE TRANSFER PANS 690-635-005/006
AIR BLOW-DOWN
8"-FLT-CS1-213
8"-FLT-CS1-214
8"-FLT-CS1-215
8"-FLT-CS1-216
14"-BSO-CS1-209
14"-PSO-CS1-201
8"-SLY-CS1-206
8"-SLY-CS1-205
8"-SLY-CS1-207
8"-SLY-CS1-208
10"-PSO-CS1-202
10"-PSO-CS1-203
10"-PSO-CS1-204
10"-BSO-CS1-210
10"-BSO-CS1-211
10"-BSO-CS1-212
1"-SSA-CS1-223
1"-SSA-CS1-224
1"-SSA-CS1-225
2"-SSA-CS1-218
1/2"-SSA-CS2-220
1/2"-SSA-CS2-221
1/2"-SSA-CS2-222
1/2"-SSA-CS2-219
NaCN 680-I-0103
1"-RCY-CS4-328
ANTISCALANT METERING PUMP
ANTISCALANT DRUM
BY OTHERS
BARREN SOLUTION TANK 680-605-002
4" VENT
TO CONTAINMENT PAD AND POND SYSTEM
12" O/FLOW
8" DRAIN
16"-BSO-CS1-233
16"-BSO-CS1-236
16"-BSO-CS1-235
4"-BSO-CS1-234
PLANT 680-I-0103 BARREN
BARREN TO 680-I-0104 HEAP LEACH
BARREN SOLUTION PUMP #1 680-533-001
BARREN SOLUTION PUMP #2 680-533-002
ATMOSPHERE
REFINERY BAGHOUSE 690-575-001
MANUAL DAMPER
FLUX
FLUX MIXER 690-274-001
STOP/START
VENTILATION HOOD 690-410-001
FURNACE FEED CONVEYOR 690-106-001
CONTAINMENT WASHDOWN
DRIED SLUDGE 680-I-0105 FROM MERCURY RETORT
PROPANE 680-I-0105 FROM STORAGE
1"-FUO-CS2-229
COMBUSTION AIR FAN
MELTING FURNACE 690-302-001
BARS
REFINERY SUMP w/ TRAP
SUMP PUMP 690-527-001
HOA
LAST: LINE NO. 242
VALVE NO. 151
APPROBATION
C ADDED BYPASS LINE DPH 00-09-22
B REVISED RMT 00-08-24
A PRELIMINARY TGI 00-08-08
REV DESCRIPTION BY DATE
MINERA SAN XAVIER, S.A. de C.V.
CERRO SAN PEDRO
SUMMIT VALLEY EQUIPMENT & ENGINEERING
6664-I-02(C)
PREP. BY :
DWN. BY : JAY RENNEMEYER 98-03-27
APP. BY : TODD WELDON 98-03-30
OWNER :
SCALE INIT.
TITLE ZINC PRECIPITATE FILTER PRESS AREA P&ID
DRAWING NO.
D 680-I-0102-C
SIZE AREA DISC. SEQ. NO. REV.

– Drawing 6.17 –



1	2	3	4	5	6	7
COOLANT SOLUTION/PER OPERATING RETORT	1st STAGE CONDENSER COOLANT FLOW	2nd STAGE CONDENSER COOLANT FLOW	3rd STAGE CONDENSER COOLANT FLOW	OFFGAS FLOW	PURGE AIR	VACUUM PUMP SEAL WATER
2.5 L/SEC (70 kpa) 40 GPM (10 psig)	1.3 L/SEC (70 kpa) 20 GPM (10 psig)	1.3 L/SEC (70 kpa) 20 GPM (10 psig)	1.3 L/SEC (240 kpa) 20 GPM (10 psig)	2.5 M^3/MIN 90 CFM	68 NM $/HR^3$ AMBIENT 40 SCFM AMBIENT	0.25 L/SEC (70 kpa) 4.0 GPM (10 psig)

REV	DESCRIPTION	BY	DATE
A	PRELIMINARY	RMT	00-07-18

MINERA SAN XAVIER, S.A. de C.V.

CERRO SAN PEDRO

SUMMIT VALLEY EQUIPMENT & ENGINEERING 6684-I-05(A)

THIS DRAWING CONTAINS PROPRIETARY INFORMATION WHICH MAY NOT BE COPIED WITHOUT EXPRESS WRITTEN CONSENT FROM SUMMIT VALLEY EQUIPMENT & ENGINEERING

PREP. BY : C. AHUE III	98-11-10	
DWN. BY : CAIII	98-11-10	
APP. BY :		
OWNER :		
SCALE NONE		INIT.

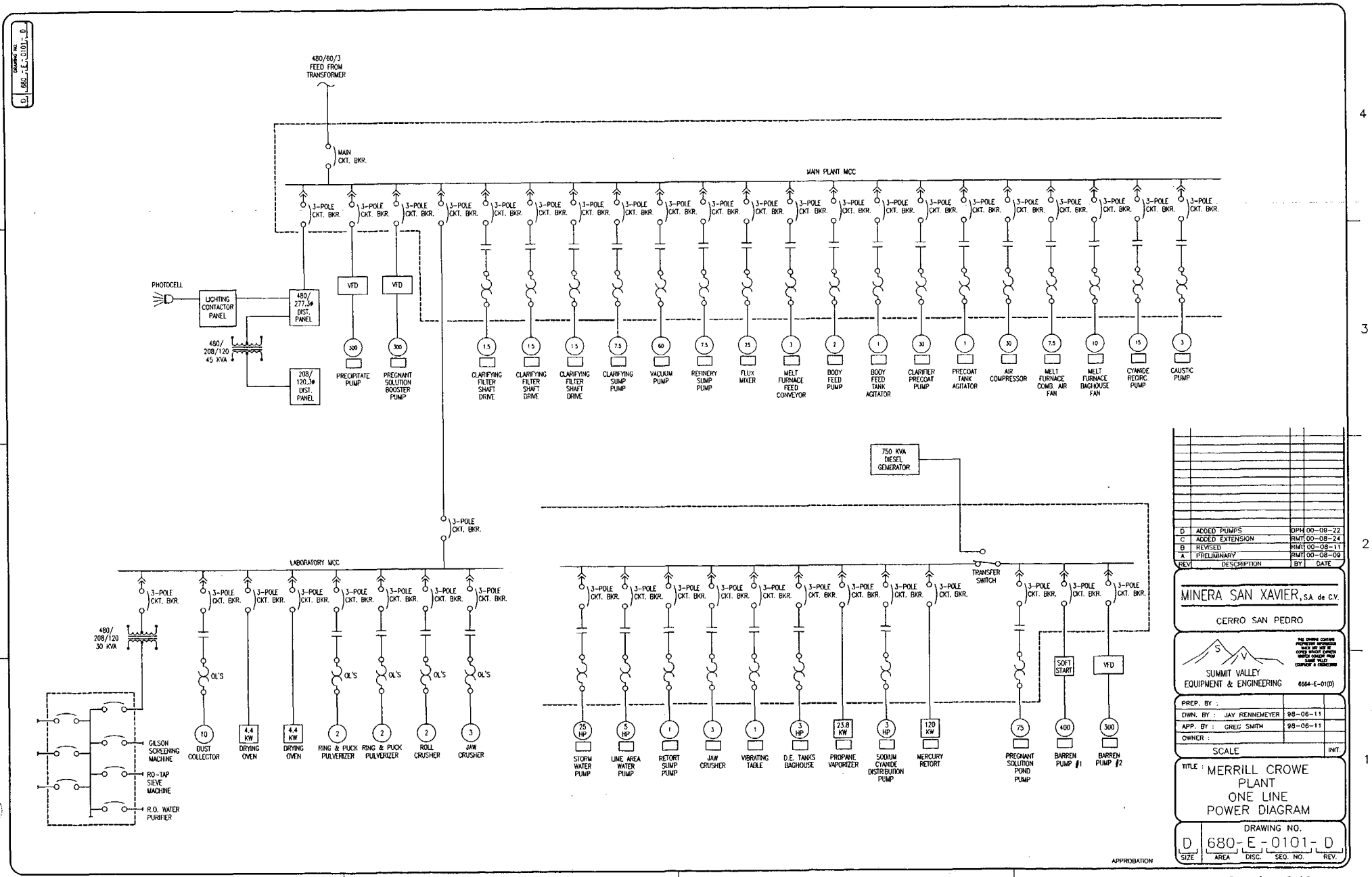
TITLE :

MERCURY RETORT SYS
MODEL 30MR1LP
P & I D

SIZE	AREA	DISC.	SEQ. NO.	REV.
D	680-	I-	0105-	A

DRAWING NO.

APPROBATION



REV	DESCRIPTION	BY	DATE
D	ADDED PUMPS	DPH	00-08-22
C	ADDED EXTENSION	RMT	00-08-24
B	REVISED	RMT	00-08-11
A	PRELIMINARY	RMT	00-08-09

MINERA SAN XAVIER, S.A. de C.V.

CERRO SAN PEDRO

SUMMIT VALLEY EQUIPMENT & ENGINEERING 6664-E-01(D)

PREP. BY :		
DWN. BY : JAY RENNEMEYER	98-06-11	
APP. BY : GREG SMITH	98-06-11	
OWNER :		
SCALE		INT.

TITLE : MERRILL CROWE PLANT ONE LINE POWER DIAGRAM

DRAWING NO. 680-E-0101-D

SIZE D | AREA 680 | DISC. E | SEQ. NO. 0101 | REV. D

– Drawing 6.19 –

7.0 INFRASTRUCTURE

7.1 Introduction

The project is in close proximity to San Luis Potosí, a city with an approximate population of 1,000,000 inhabitants and support facilities. The infrastructure program consists of construction and improvement works for the site access roads, site preparation and construction of the office and training buildings, and the raw water storage and distribution. Other works include relocating a portion of the Cerro San Pedro Village and all of the La Zapatilla Village, stabilizing the San Pedro Apostol church in Cerro de San Pedro and securing the site. Infrastructure-related electrical and communications issues are discussed in Section 8.0.

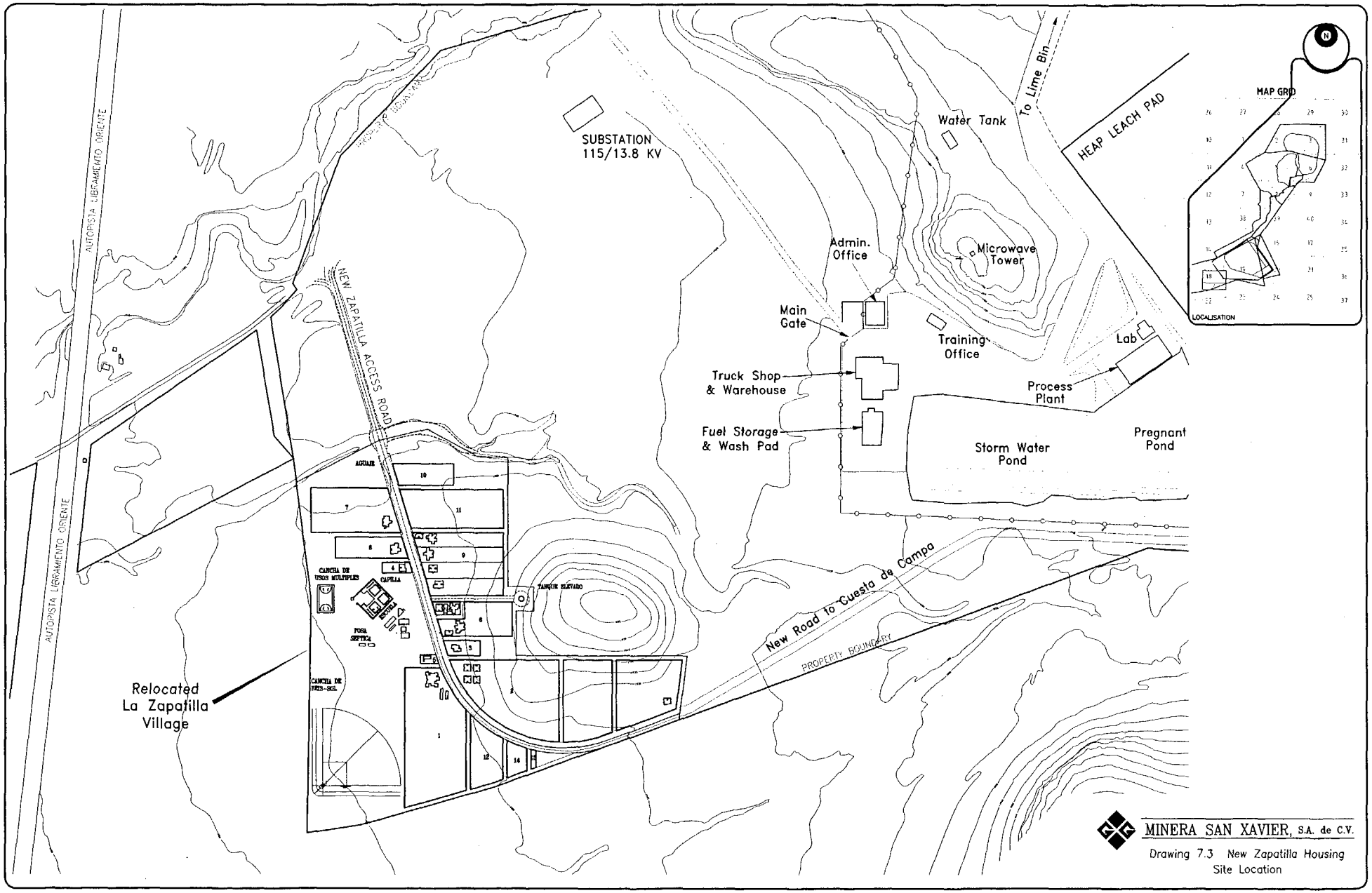
7.2 Site Access

An existing access road with an approximate length of 10.2 kilometers (km) connects the proposed turn-off to the mine site entrance to the Periferico Oriente road as shown on Figure 7.1. In July 2000, MSX awarded a contract for the upgrade of the 8-kilometer unpaved section of the road according to the specifications provided by the Junta Estatal de Caminos (State Highway Department). The road upgrade project includes constructing turn-outs on the intersection of the Periferico Oriente, widening a small bridge over a sewage canal, re-grading and building-up the road base, and surfacing the road base with a chip-seal to prevent dust and decrease maintenance costs. The project will be completed late 2000 and is not considered as part of project capital in this study.

A temporary road linking to the four-lane toll road (autopista Libramiento Oriente) will be built in order to facilitate the delivery of major equipment during the construction phase. The owner of the toll road has also offered to provide a toll access to the public road to Cerro de San Pedro to facilitate deliveries to the project site during operations.

7.3 Roads

A 500-meter road between the public road to Cerro de San Pedro and the gatehouse will be constructed to provide access to the plant site. In addition, a 1.6 kilometer mine access road will be constructed 25 meters wide to accommodate the large mine equipment from truck shop area, to the run-of-mine haul road on the north corner of the leach pad. Berm protection will be provided in the steep sections and drainage will be provided by side ditches and culverts.


AUTOPISTA LIBRAMIENTO ORIENTE
SUBSTATION
115/13.8 KV
Water Tank
To Lime Bin
HEAP LEACH PAD
MAP GRID
LOCALISATION
Admin.
Office
Microwave
Tower
Main
Gate
Training
Office
Lab
Truck Shop
& Warehouse
Process
Plant
Fuel Storage
& Wash Pad
Storm Water
Pond
Pregnant
Pond
NEW ZAPATILLA ACCESS ROAD
New Road to Cuesta de Campa
PROPERTY BOUNDARY
Relocated
La Zapatilla
Village
MINERA SAN XAVIER, S.A. de C.V.
Drawing 7.3 New Zapatilla Housing
Site Location

The existing Cerro de San Pedro road that continues from the entrance to the project site to the Cerro de San Pedro old hospital building will continue to serve as public access to the village and the cemetery. Except for the construction of the mine haul road crossing described in Section 4.0, the existing road will only need minor improvement.

A chain-link fence will be installed alongside the Cerro de San Pedro road to prevent access to mine site access roads and related facilities.

7.4 Main Office and Training Facilities

A 675 square-meter main office building will be located at the entrance of the mine site just north of the truck shop and warehouse building and adjacent to the gatehouse. The gatehouse will be equipped with a motorized access control gate and will provide 24 hour per day, seven day per week access control to the mine site. The 6.0 m x 4.5 m building will be built with natural stone and concrete, similar to local architecture. A parking area in front of the main office building will be provided for visitors.

A 248 square-meter training building will be located just east of the main office. The building will serve as a general training and meeting facility, and also provide a staging room for the mine shift crews. In addition, it will include three offices for mine operations management.

The locations of the main office and training facilities have been designed to provide close access to the truck shop, warehouse, process plant, and assay lab. Site preparation will include a grading plan of the entire facilities area to provide proper drainage and minimize maintenance.

7.5 Water Supply and Distribution

The exploitation well drilling program was selected as the most appropriate among several different water provision alternatives evaluated. These alternatives included acquiring water from existing exploitation wells, located a much greater distance from the site than the La Zapatilla well, and the use of treated sewage effluent from a plant located in San Luis Potosi. Once geophysical surveys and hydrogeological studies were completed, the location of the La Zapatilla exploration well was defined at approximately 2.3 kilometers southwest from the process plant. The La Zapatilla exploration program began on November 16, 1998 and was completed by December 10, 1998. The results as to the water quality and quantity were favorable and supported continuing the investigation works. In March 1999, MSX received the Comision Nacional de Aqua (CNA) authorization to transform the exploration well into an exploitation well.

A contract was awarded to the hydraulic division of the Comisión Federal de Electricidad (CFE) and drilling activities began on March 20, 1999. At the end of July 1999, the drilling program, including the pumping test work, was completed. The well is completed to a total depth of 231.4 m and is some 508 millimeters in overall diameter. The productive, screened interval of the well is from 140.6 m to the bottom at 231.4 m, with the static water level at a depth 150 m or about 1,731 m above sea level. The pumping tests were supervised by the Universidad Autónoma de San Luis Potosí (UASLP). The pumping tests report provided by the UASLP indicates that the La Zapatilla well is capable of supplying a sustained yield of over 60 liters per second (l/s) of water during the mine life, more than twice the planned water consumption. Water analyses have confirmed that the water quality is good and suitable for human consumption. The well exploits an altered and fractured zone within the Portezuelo Latite. The latite was encountered at a depth of 26 m after passing through unconsolidated sand and gravel.

Water distribution is made possible using pumps and a piping distribution system. Water is pumped from the La Zapatilla water well into the barren tank or into the 567,000 liter capacity process plant reservoir at approximately the 1950 elevation. The reservoir's function is to retain an emergency water reserve for the fire protection system, and supply the process plant through gravity. Water will also be pumped from this reservoir to a second 567,000 liter capacity reservoir located near the lime bin to supply the water truck fill station approximately 1.1 kilometers to the northeast.

Table 7.1 lists the estimated quantity of raw water required for the entire project. Both the average and peak estimated consumptions are shown with peak demand in the drier months. Most water is consumed in the leaching of the ore with make-up water demand related to wetting of the ore and evaporation (AGRA, 1999). A significant amount is also used to water mine roads for dust suppression.

Table 7.1

Project Water Requirement				
AREA	Average		Peak	
	GPM	l/s	GPM	l/s
Leach Pad	250	15.8	350	22.1
Process Building	35	2.2	35	2.2
Truck Shop Complex	15	1	15	1
Mine Road Maintenance	150	9.5	250	15.8
Total	**450**	**28.5**	**650**	**41.1**

* GPM: US gallons per minute

To assure continuous water provision, a well (Well No. 1) located some 10 m from the actual La Zapatilla well (Well No. 2) will be turned into a possible production well. This well (Well No. 1) was abandoned by the CFE due to technical problems during well development. Approval from the CNA is pending and restoration works will be performed on this well during the project construction phase.

Potable water will be supplied from the La Zapatilla well. Potable water treatment will be limited to pH adjustment and chlorination. Results from water analyses performed by an accredited laboratory confirm that the water quality conforms to the minimum standards for human consumption.

7.6 Meteorological Station

A meteorological station located just north of the village of Cerro de San Pedro was installed in February 2000, and an air quality monitoring station located in the village of Cerro de San Pedro in September 2000. A second air quality monitoring station will be installed near the leach pad area. These stations will be used for data collection in order to perform temperature, precipitation, and air quality studies. Additional discussion of the meteorological station can be found in Chapter 10.

7.7 Cerro de San Pedro Housing

MSX is prepared to construct up to ten houses for Cerro San Pedro families residing within the safety buffer zone that may choose to be relocated to a zone further removed from the pit. Additional information regarding Cerro de San Pedro land acquisition is available in Section 2.7.3.

During 1998, an existing house was refurbished and a new model house was built. The villagers visited and approved the proposed house. The typical house has an overall area of 90 square meters (m^2) including three bedrooms, a kitchen, a living room, and a complete bathroom on a lot of approximately 225 m^2. Furthermore, construction activities include potable water, sewage disposal, and electrical services.

MSX will supply a new water tank and related water pipeline to these new residences and to replace the 70-year-old electrical distribution line. The private potable water pipeline currently supplies the necessary water for the Cerro de San Pedro Village and will be extended to new houses. MSX will also provide landscaping at each house. General arrangements and typical house details are shown on Drawings 7.1 and 7.2 at the end of this section.

A Conditional Letter of Intent has been issued to CONSTRUCTORA Y EDIFICADORA B & F, S.A. DE C.V., a Mexican contractor, for the construction of the ten houses, water tank and pipeline, sewer services, local electrical distribution, access roads, and sidewalks.

7.8 Cerro de San Pedro Church Stabilization

The situation with the San Pedro Apostol church is discussed in Section 10, but the capital costs associated with the repair and rehabilitation of the church are presented in this section.

7.9 La Nueva Zapatilla Housing

The entire La Zapatilla village is located in the area of the proposed leach pad. MSX has agreed to relocate the existing village approximately 0.5km south-southwest from the process building where 20 houses will be constructed for those that have agreed to be relocated there. In addition to constructing the housing, MSX will construct a school, a church, a public plaza, and a sports field. Municipal works include the access roads, an electrical transmission line, potable water tank and related pipeline from Interapas, sewage disposal facilities, and a rain/runoff collection pond. Six lots without houses will also be provided in the new village as part of negotiations with the owners of property required for the leach pad site. Additional details are described in Section 2.7.3.

A contract was awarded to CONSTRUCTORA ROSVAL, a SLP contractor, in August 2000 for the construction of the 20 new houses, a school, a church, a public plaza, and all municipal works. The project will be completed in January 2001 and is not considered as part of project capital in this study.

Drawings 7.3 and 7.4, at the end of this section, illustrate the layout of the La Nueva Zapatilla Village and provide details of some of the typical houses.

Table 7.2 outlines houses and other facilities included in the contractor's scope of work.

Table 7.2

La Nueva Zapatilla Village Relocation			
Lot	**Lot Area (m^2)**	**House**	**House Area (m^2)**
1	9,960	1-A	200.00
		1-B	64.92
2	8,708	2-A	60.50
		2-B	80.50
		2-C	80.50
		2-D	80.50
3	3,400	3	66.90
4	400	4	57.43
5	200	5	32.93
6	2,788	6-A	110.94
		6-B	44.85
7	5,000	7	99.20
8	2,000	8	109.74
9	6,980	9-A	97.90
		9-B	103.99
		9-C	78.70
		9-D	84.49
10	1,688	Lot only	-
11	5,120	Lot only	-
12	2,500	Lot only	-
13	120	Lot only	-
14	800	Lot only	-
15	382.11	15-A	57.25
		15-B	130.22
16	5,200	Lot only	-
17	5,000	17	56.16
Church	-	-	206
Priest House	-	-	50
School	-	-	150.75
Public Plaza	-	-	820.17

7.10 Property Fencing

Fences will be used to prevent access to the mine site, particularly as the project is in close proximity to the La Nueva Zapatilla and Cerro de San Pedro Villages. Two types of fences will be used depending on the control required for the different areas on the site.

Type 1: Galvanized chain link

Opening: 50 mm x 50 mm

Height: 2.4 m (total)

Top arrangement: 3 barbed wires

Post: Tubular galvanized steel

Option: PVC Bi-oriented geogrid used as a complement at the bottom of the fence around the leach pad perimeter (to prevent reptiles from passing into the leach pad area)

Type 2: Barbed wire (4 rows)

Opening: 300 mm between rows

Height: 1.2 m (total)

Post: Tubular galvanized steel

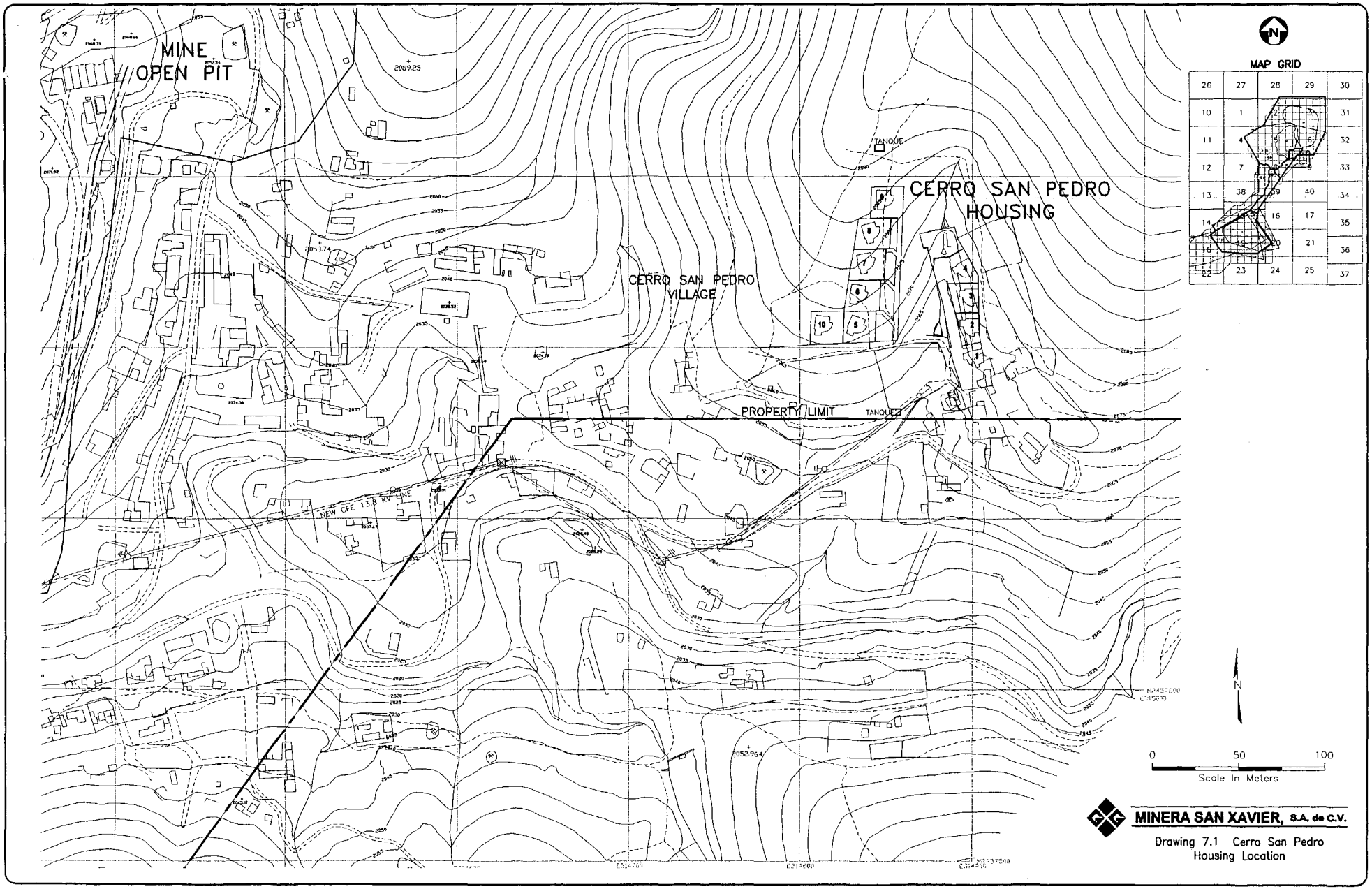
Type 1 fencing is primarily used to restrict access to critical site facilities, which represent a potential health hazard or security risk. The type 2 fence is used to prevent farm animals from accessing the property.

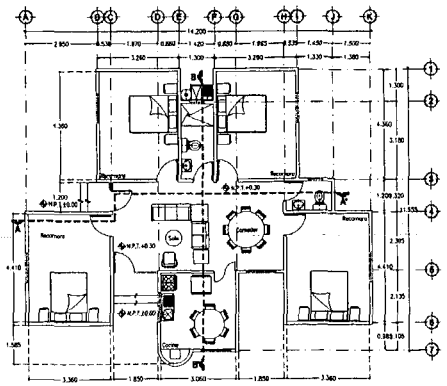
7.11 Infrastructure Capital Costs

A summary of the estimated initial capital costs for the infrastructures is presented in Table 7.3. The capital cost total of $2.2 million includes $0.7 million for the water supply and distribution utilizing the La Zapatilla well, and $0.4 million for new housing at Cerro de San Pedro. An allocation of $0.2 million has been provided to fund investigations of the structural integrity of the San Pedro Apostol Church and to perform repairs and rehabilitation prior to regular mine operations. There is not anticipated to be any ongoing capital costs.

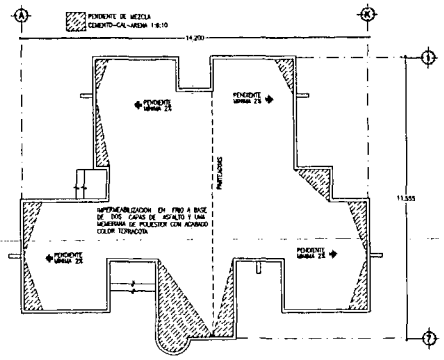
Table 7.3

Infrastructure Capital Cost Estimate	
Area	**Cost**
Roads	$175,000
Office, Training Building, and Furniture	$370,000
Site Preparation	$475,000
Water Supply	$645,000
Cerro de San Pedro Housing	$350,000
Church Stabilization	$200,000
Total	**$2,215,000**

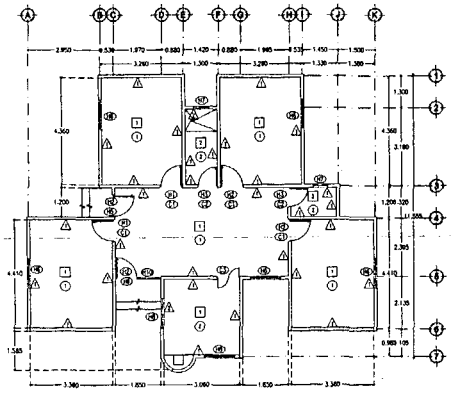

MINE
OPEN PIT
CERRO SAN PEDRO
VILLAGE
CERRO SAN PEDRO
HOUSING
PROPERTY LIMIT
TANQUE
TANQUE
NEW CFE 13.8 KV LINE
2089.25
2053.74
2052.964
MAP GRID
N
0
50
100
Scale in Meters
MINERA SAN XAVIER, S.A. de C.V.
Drawing 7.1 Cerro San Pedro
Housing Location



PLANTA ARQUITECTONICA

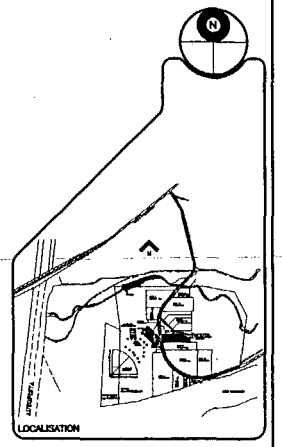


PLANTA CONJUNTO

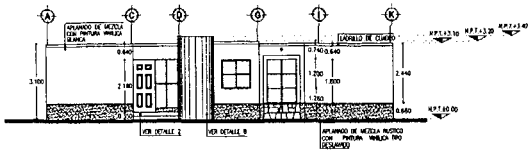


PLANTA ARQUITECTONICA

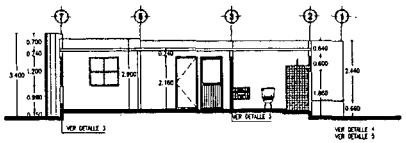
SIMBOLOGIA ACABADOS



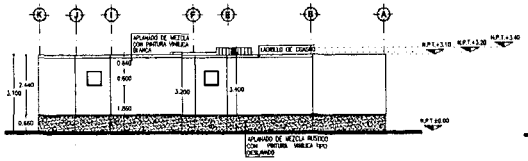
LOCALISATION



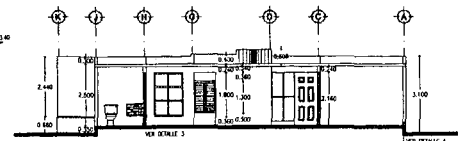
FACHADA PRINCIPAL



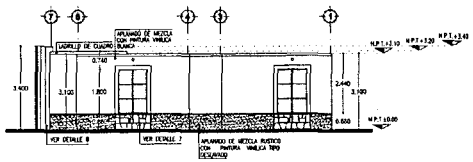
CORTE B-B'



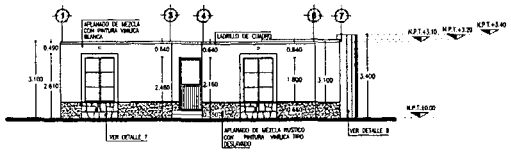
FACHADA POSTERIOR



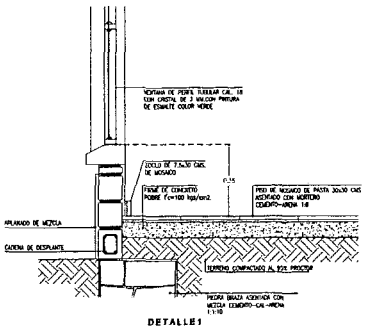
CORTE A-A'



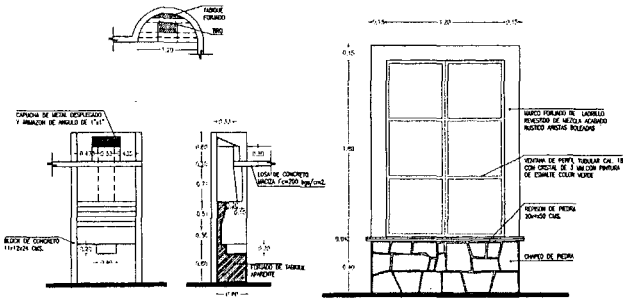
FACHADA DERECHA



FACHADA IZQUIERDA

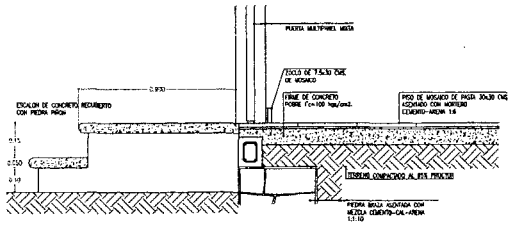


DETALLE1



DETALLE DE CHIMENEA II

DETALLE DE VENTANA 7

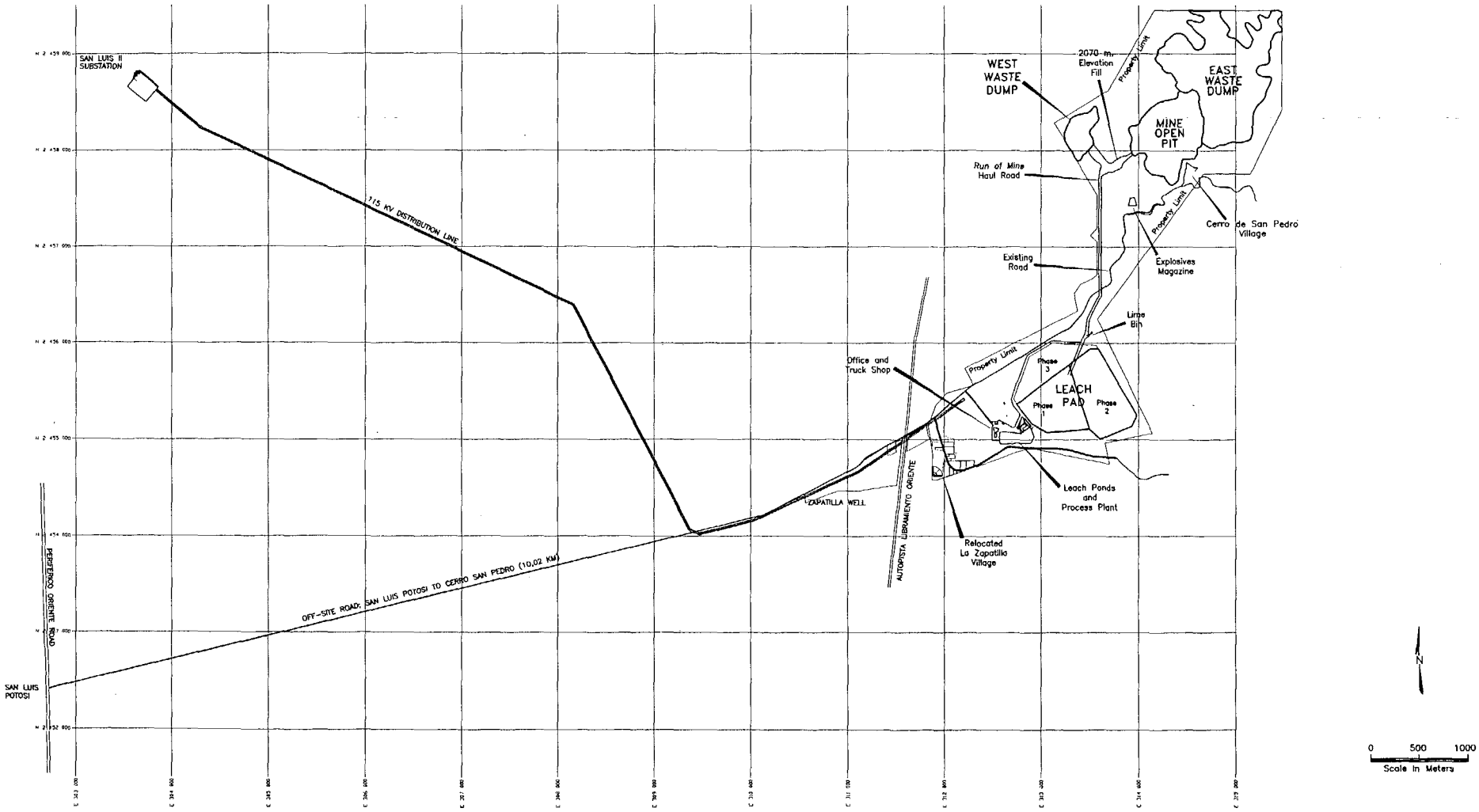


DETALLE2

SCALE: 1 : 100

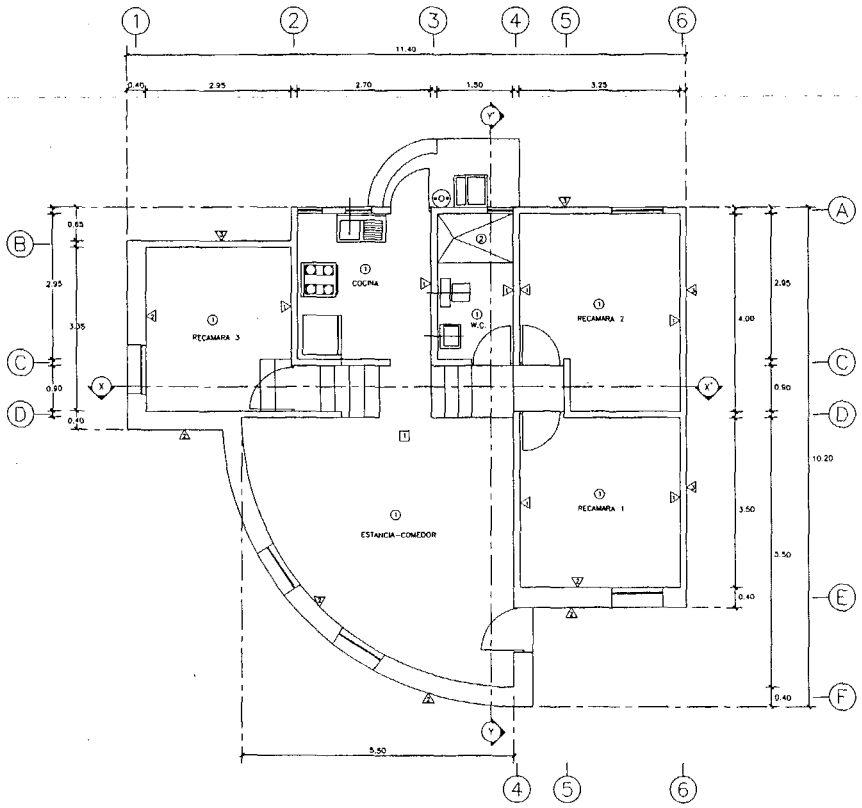
MINERA SAN XAVIER, S.A. de C.V.

Drawing 7.4 New Zapatilla Housing
6A (Pedro II Alvarado Alvarez)

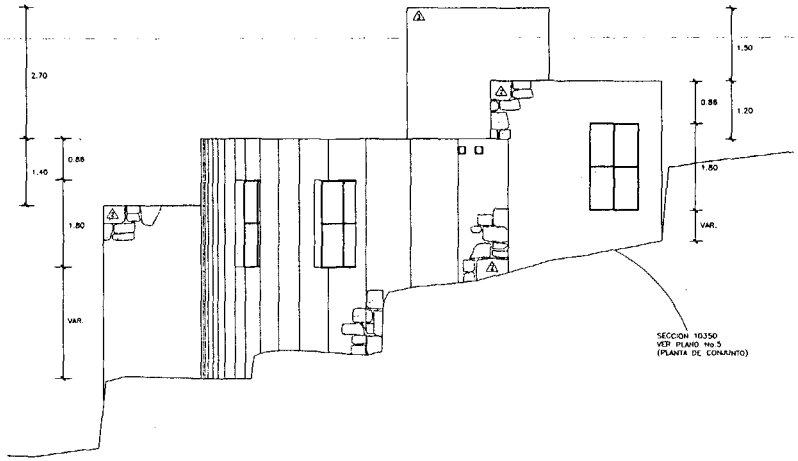


MINERA SAN XAVIER, S.A. de C.V.

Figure 7.1 Off-Site Infrastructure

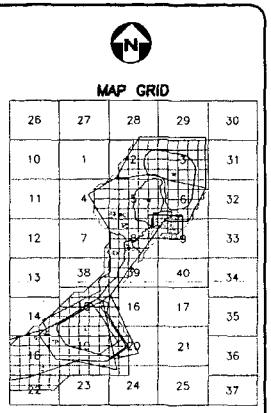


PLANTA ARQ. VIVIENDA TIPO



FACHADA ACCESO

ACABADOS	
○	PISOS
1	LOSETA DE BARRO RUSTICA 30 x 30 BOQUILLAS A 3 CM.
2	VITROPISO ANTIDERRAPANTE.
△	MUROS
1	TIROL PLANCHADO SOBRE YESO.
2	SILLAR DE PIEDRA APARENTE.
3	APLANADO FINO DE MEZCLA.
□	PLAFONES
1	LADRILLO DE BARRO CUADRADO Y VIGUETA DE CONCRETO.



SCALE: 1 : 50

MINERA SAN XAVIER, S.A. de C.V.

Drawing 7.2 Cerro San Pedro Housing
Typical House Details

8.0 ELECTRICAL AND COMMUNICATIONS

8.1 Introduction

In Mexico, electrical energy generation, transport, and distribution are controlled by the Comisión Federal de Electricidad or CFE. This governmental agency is the sole electricity provider in Mexico. The electricity supply contract terms and conditions for the project are established by its regulations. The local electrical grid has a high level of reliability.

Minera San Xavier (MSX) and CFE concluded an agreement whereby MSX will pay for the construction of a transmission line and 1/6 of the overall cost for the required modifications at the CFE substation identified as San Luis Potosí II (SLP II). CFE will provide the engineering works and quality controls for the transmission line during the construction phase.

Once construction is completed, CFE becomes the owner of the transmission line and will operate and maintain it from then on. Electrical energy, as a portion of the project operating costs, is described in Section 6.8.

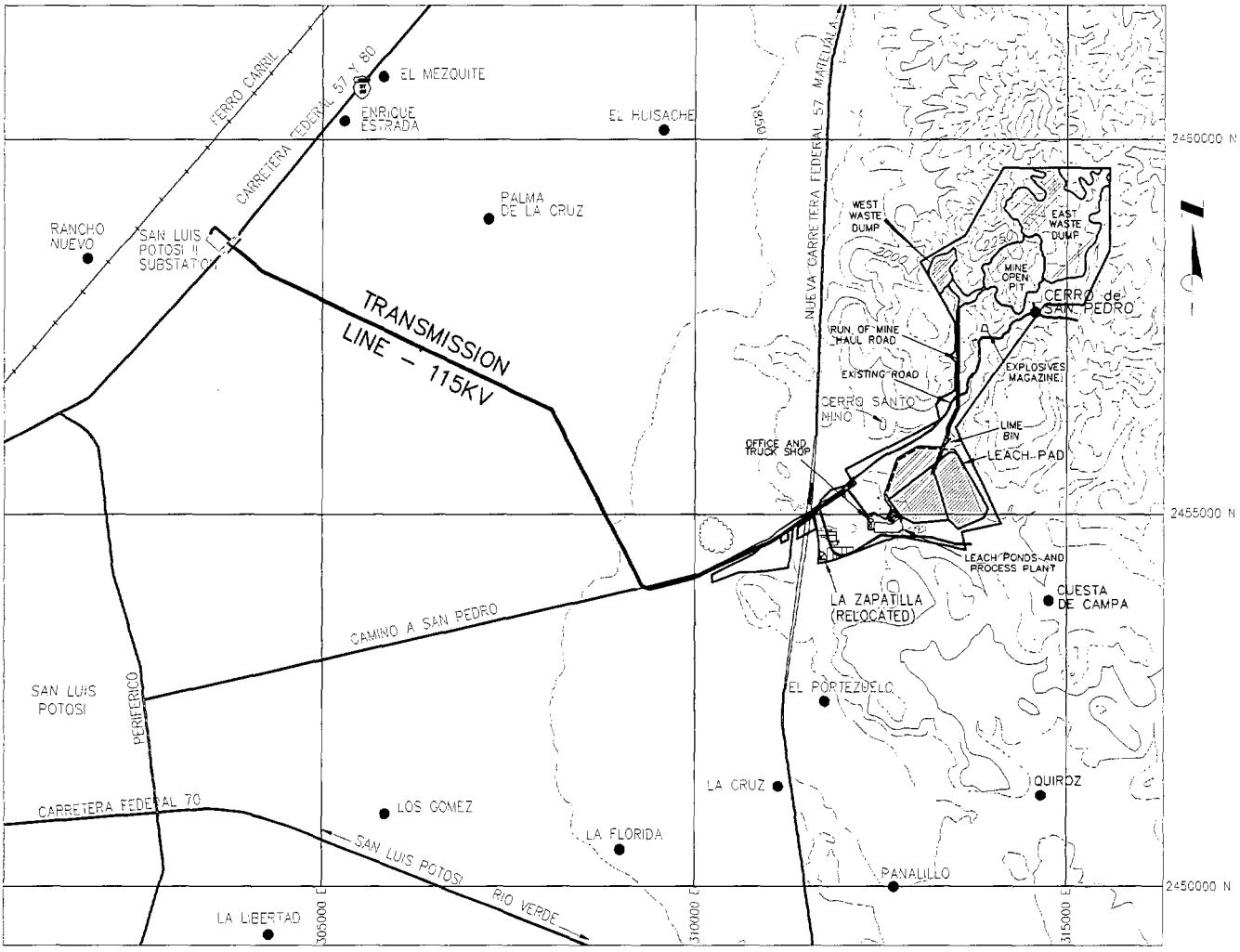
8.2 CFE Substation SLP II

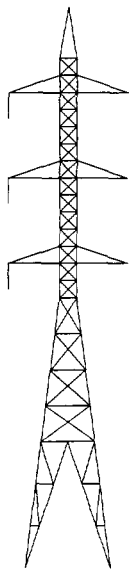
The electrical energy is supplied at a voltage level of 115 kilovolts (kV) from the SLP II substation located near the city of San Luis Potosí. Required modifications at the substation consist of installing new structures, load break switches, and metering and protective equipment.

A purchase order was issued to CFE covering, as agreed, 1/6 of the overall cost for the engineering, supply, installation, and commissioning of the structures and equipment at the SLP II substation. These modifications were performed during the third quarter 1999. Once installation is completed, CFE remains owner of the equipment and operates and maintains it from then on.

8.3 Main Transmission Line

The transmission line covers a distance of 11.3 kilometers (km) as illustrated in Figure 8.1. It originates from the CFE SLP II substation, continues its path towards the southeast for 8.0 km, turns to the northeast for 3.3 km, and ends at the MSX mine site substation. Drawing 8.1 shows the first 12 transmission towers from the SLP II substation, while Drawing 8.2 shows the last four towers





TYPICAL STRUCTURE USED

MINERA SAN XAVIER, S.A. de C.V.

Figure 8.1 Route of 115 KV Transmission Line

and the MSX substation. All drawings are located at the end of this section.

This transmission line path was selected in order to minimize the installation costs. The land profile is relatively flat. The transmission line crosses two highways: Federal highway No 57, at some 30 meters (m) from the CFE SLP II substation, and highway "Libramiento Oriente", at some 10 km from the CFE SLP II substation.

As requested by CFE, the line is supported by forty-four (44) steel structures with arms designed to carry two (2) transmission lines. The aluminum conductor steel reinforced (ACSR) 477 conductors hold enough capacity to fulfill the mine power demand estimated at 7.1 megawatts (MW).

A Conditional Letter of Intent has been issued to PROCOIN, a Mexican contractor, for the supply and construction of the line. A purchase order to PROCOIN covering the detailed engineering, shop drawings, and necessary procedures in order to obtain approvals from the CFE has also been awarded. MSX has already acquired these CFE approvals. Commissioning of the transmission line will be performed by the CFE.

8.4 Main Substation

At the main mine site substation, the 115 kV electrical power is stepped down to an intermediate voltage of 13.8 kV for electrical distribution throughout the mine area. This voltage level is considered more appropriate due to its compatibility with used transformers and the relatively short distance between the main substation and the secondary substations on the complex. Drawing 8.3 presents a one-line electrical diagram showing the electrical distribution from the substation to the various operating areas.

The main substation includes the following major electrical equipment:

- An incoming steel structure with all required insulators and hardware;
- Lightning protection, potential transformers, current transformers, and metering for energy consumption for CFE billing;
- SF-6 gas insulated 121 kV main breaker;
- Power transformer, 115/13.8 kV, 3 phases, 10-12.5 megavolts ampere (MVA), oil type with aerial bushings on primary and secondary crushing plants;
- Metering and protective devices for the power transformer;
- Secondary aerial distribution structures including protective equipment, equipped for one 13.8 kV distribution network and with provision for a second network.

The total running load for the complex is estimated at 3 megawatt (MW).

A Conditional Letter of Intent has been issued to CYPESA, S.A. de C.V., a Mexican contractor, for the supply and construction of the main substation. A purchase order to CYPESA covering the engineering, shop drawings, and necessary procedures to obtain approvals from the CFE has also been awarded. MSX has already acquired these CFE approvals.

8.5 Distribution Lines and Secondary Substations

A 13.8 kV distribution network will supply electrical power to all mine site plants.

The MSX-owned La Zapatilla raw water well is located at 1.8 km southwest from the MSX substation. A CFE 13.2 kV distribution line passes within 60 m from the raw water well. For power demand less than 200 kilowatts (kW), the best solution to power the raw water well pump was using the CFE 13.2 kV distribution line rather than extend the mine grid 13.8 kV line to the well site.

The MSX 13.8 kV overhead distribution network is supported by concrete poles (wooden poles are not available in the State of San Luis Potosí).

The 13.8 kV distribution network supplies electrical power to the process plant and ancillary facilities via a secondary substation with a step down transformer 13.8 kV/480/277 V, 3 phases, 2,500 KVA.

In order to maintain leach solution flow during a power outage, a 250 kilowatts (kW) diesel-driven standby generator is provided to feed power to the leach solution pumps.

8.6 Communications

The existing telephone network only covers rural telephone calls for Cerro San Pedro residents. The network does not have the capacity to cover the large volume of data transmission and long distance calls required for mine operation and administrative activities.

The proposed communication system covers telephony (local and long distance calls), mobile radio, and data acquisition needs as described below.

8.6.1 Fiber Optic/Copper Wire Network

A standard twisted pair copper wire network will interconnect the process building and the truck shop to provide network and telephone connectivity. Due to the distance between the main process building and the lab, a short fiber optic connection will be implemented for network connectivity between the two buildings. All closed-circuit cameras will be interconnected via coaxial cable to central monitoring stations. The network outlined above will provide:

- Computer network, for data, E-mail, and Internet access to the administrative offices located in the process building, the truck shop, and the lab, and;
- Local telephone services, voice, and fax (up to 64 extensions grouped into 10 circuits) between the main switchboard located in the process building and truck shop, lab, and guard stations;
- Closed-circuit television coverage for the refining areas, and the guard station.

8.6.2 Mine site – San Luis Potosi Microwave Network

Communication requirements between the mine site and the city of San Luis Potosí are fulfilled by a microwave link that can transmit voice, fax, and data as described below:

- Local telephone services (10 circuits, voice and fax) between the main switchboard located in the administrative offices and the city of San Luis Potosí with the possibility of making long distance calls in Mexico;
- Electronic file exchange, Internet access, and email, via a reserved 128 kilobits per second (kbs) bandwidth channel;

A Conditional Letter of Intent has been issued to TELMEX, a local telephone company, for the supply, installation, and commissioning of microwave equipment. MSX will provide the on-site telecommunication room, tower, and electrical power whereas TELMEX provides and maintains the microwave equipment. A purchase order to TELMEX covering the engineering, shop drawings, and necessary procedures to obtain approvals from the Comisión Federal de Telecomunicaciones (CFT) has also been awarded.

8.6.3 Internet Provider Network

Communication requirements between the mine administrative offices and the Reno office are fulfilled by the TELMEX microwave link and the local Internet Service Provider (ISP) link that can transmit data via E-mail and/or optional Virtual Private Networking (VPN). Internet security will be provided by a proxy server/firewall.

8.6.4 Mobile Radio Network

The mobile radio network covers the entire mine site via a repeater station installed on the hill near the powder magazine. The main antenna will be mounted on the microwave tower on the hill by the main office and covers the mobile radio communications from the La Zapatilla water well up to the powder magazine. The repeater station provides mobile radio communications coverage for the mine pit area. Telemetry, data acquisition, and control between the La Zapatilla water well and the process building are covered by a microwave link operating in 2.4 gigahertz (Ghz) band (no permit required).

8.7 Electrical and Communications Capital Costs

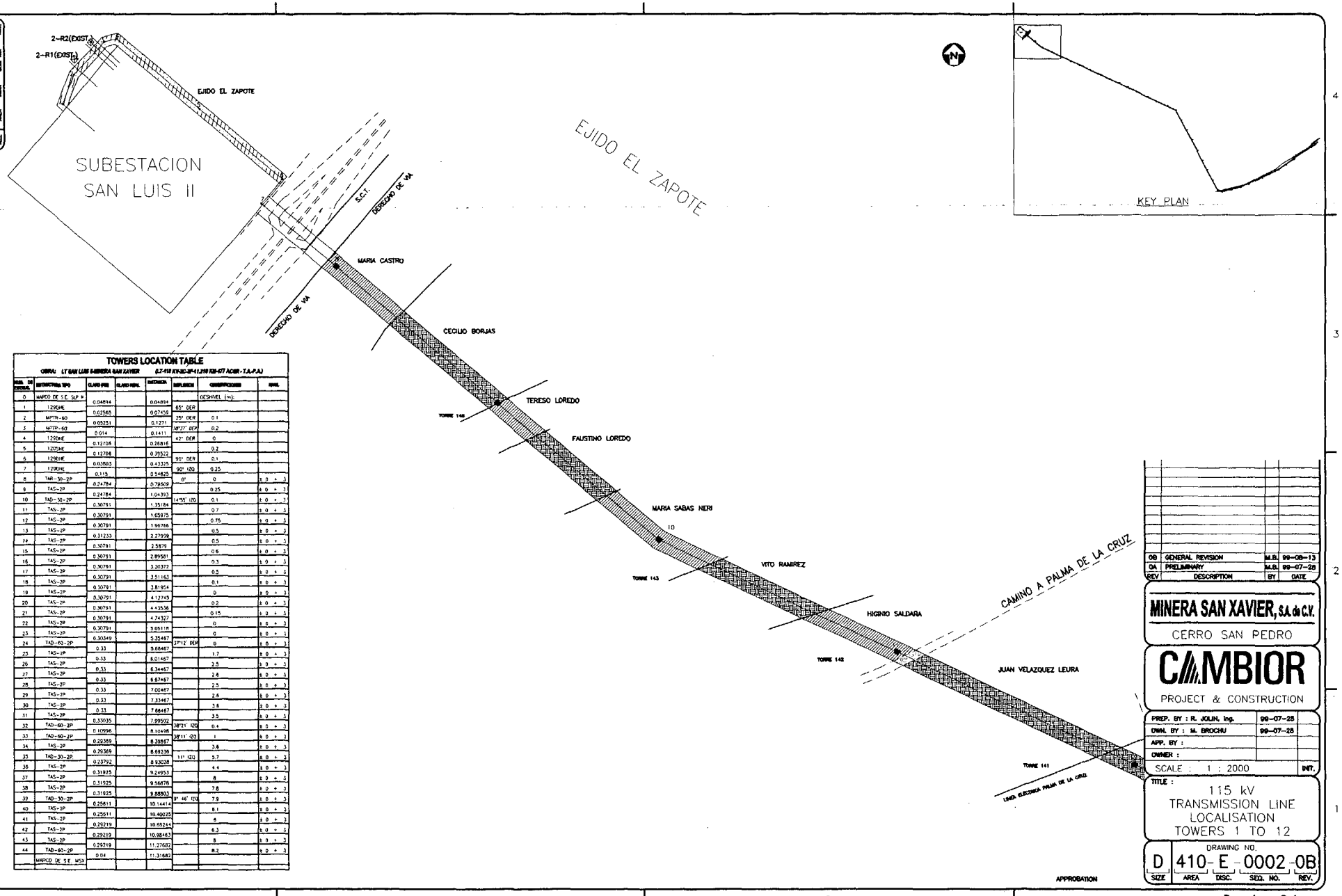
A summary, by area of the estimated initial capital costs for the electrical and communication systems, is presented in Table 8.1.

Table 8.1

Electrical & Communications Capital Cost Estimate	
Area	**Cost**
115 kV Transmission Line	$1,354,510
Main Substation 115 kV / 13.8 kV	$566,425
13.8 kV Distribution Lines	$250,000
Communications	$35,745
Total	**$2,206,680**

The total capital cost is estimated at $2.2 million. Of this amount, approximately 61% ($1.4 million) is for the 11.3 km long 115 kV transmission line ($120,000/km), including installation. The main substation is

the next largest cost at $0.6 million. There are not anticipated to be any operating costs associated with the electrical and communications area, although some amount of communications equipment replacement and upgrading is included in the General Services and Administration operating cost estimate. As such, there are not anticipated to be ongoing capital costs for Electrical and Communications.



DRAWING NO. D 410-E-0002-0B (SIZE | AREA | DISC. | SEQ. NO. | REV.)

TOWERS LOCATION TABLE

OBRA: LT SAN LUIS-MINERA SAN XAVIER (LT-115 KV-SC-SP-41.210 KM-477 ACSR - T.A.P.A.)

NUM. DE CENTRAL	INSTRUCTIVO TIPO	CLAVE PIES	CLAVE HORIZ.	DISTANCIA	DEFLEXION	OBSERVACIONES	NIVEL
0	MARCO DE S.E. SLP II			0.04894		DESNIVEL (m):	
1	129DNE	0.04894		0.07458	65° DER		
2	MPTR-60	0.02565		0.1231	25° DER	0.1	
3	MPTR-60	0.05251		0.1411	14°37' DER	0.2	
4	120DNE	0.014		0.26816	42° DER	0	
5	120DNE	0.12706		0.39522		0.2	
6	129DNE	0.12706		0.43325	90° DER	0.1	
7	129DNE	0.03803		0.54825	90° IZQ	0.25	
8	TAR-30-2P	0.115		0.79509	0°	0	± 0 + 3
9	TAS-2P	0.24784		1.04393		0.25	± 0 + 3
10	TAD-90-2P	0.24784		1.35184	14°55' IZQ	0.1	± 0 + 3
11	TAS-2P	0.30791		1.65975		0.7	± 0 + 3
12	TAS-2P	0.30791		1.96766		0.75	± 0 + 3
13	TAS-2P	0.30791		2.27959		0.5	± 0 + 3
14	TAS-2P	0.31233		2.5879		0.5	± 0 + 3
15	TAS-2P	0.30791		2.89581		0.6	± 0 + 3
16	TAS-2P	0.30791		3.20372		0.3	± 0 + 3
17	TAS-2P	0.30791		3.51163		0.5	± 0 + 3
18	TAS-2P	0.30791		3.81954		0.1	± 0 + 3
19	TAS-2P	0.30791		4.12745		0	± 0 + 3
20	TAS-2P	0.30791		4.43536		0.2	± 0 + 3
21	TAS-2P	0.30791		4.74327		0.15	± 0 + 3
22	TAS-2P	0.30791		5.05118		0	± 0 + 3
23	TAS-2P	0.30791		5.35467		0	± 0 + 3
24	TAD-60-2P	0.30349		5.66467	37°12' DER	0	± 0 + 3
25	TAS-2P	0.33		5.99467		1.7	± 0 + 3
26	TAS-2P	0.33		6.01467		2.5	± 0 + 3
27	TAS-2P	0.33		6.34467		2.8	± 0 + 3
28	TAS-2P	0.33		6.67467		2.5	± 0 + 3
29	TAS-2P	0.33		7.00467		2.6	± 0 + 3
30	TAS-2P	0.33		7.33467		3.6	± 0 + 3
31	TAS-2P	0.33		7.66467		3.5	± 0 + 3
32	TAD-60-2P	0.33035		7.99502	38°21' IZQ	0.4	± 0 + 3
33	TAD-90-2P	0.10996		8.10498	38°11' IZQ	1	± 0 + 3
34	TAS-2P	0.29369		8.39867		3.6	± 0 + 3
35	TAD-30-2P	0.29369		8.69236	11° IZQ	5.7	± 0 + 3
36	TAS-2P	0.23792		8.93028		4.4	± 0 + 3
37	TAS-2P	0.31925		9.24953		8	± 0 + 3
38	TAS-2P	0.31925		9.56878		7.8	± 0 + 3
39	TAD-30-2P	0.31925		9.88803	9° 46' IZQ	7.9	± 0 + 3
40	TAS-2P	0.25611		10.14414		8.1	± 0 + 3
41	TAS-2P	0.25611		10.40025		6	± 0 + 3
42	TAS-2P	0.29219		10.69244		6.3	± 0 + 3
43	TAS-2P	0.29219		10.98463		8	± 0 + 3
44	TAD-60-2P	0.29219		11.27682		8.2	± 0 + 3
	MARCO DE S.E. MSX	0.04		11.31682			

REV	DESCRIPTION	BY	DATE
0B	GENERAL REVISION	M.B.	99-08-13
0A	PRELIMINARY	M.B.	99-07-28

MINERA SAN XAVIER, S.A. de C.V.
CERRO SAN PEDRO

CAMBIOR
PROJECT & CONSTRUCTION

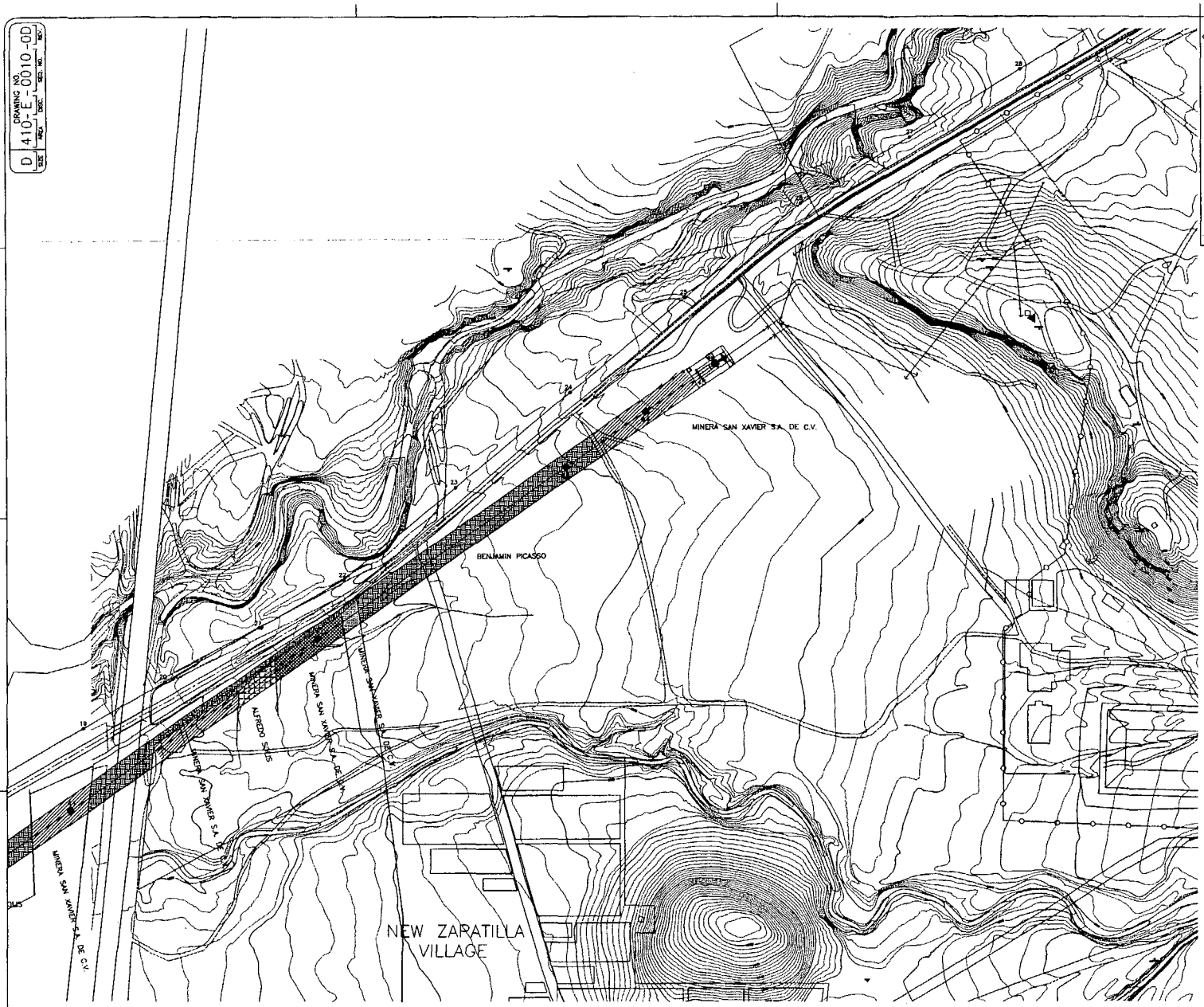
PREP. BY : R. JOLIN, Ing.	99-07-28	
DWN. BY : M. BROCHU	99-07-28	
APP. BY :		
OWNER :		
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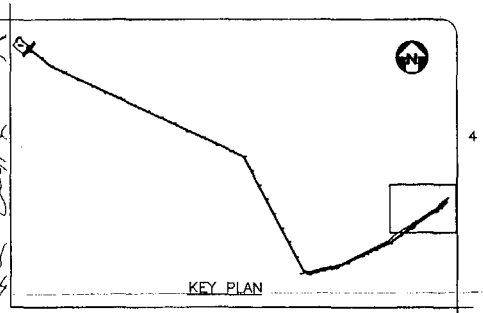
TITLE :
115 kV
TRANSMISSION LINE
LOCALISATION
TOWERS 1 TO 12

DRAWING NO. D 410-E-0002-0B (SIZE | AREA | DISC. | SEQ. NO. | REV.)

APPROBATION

A – Drawing 8.1 –





REV	DESCRIPTION	BY	DATE
0D	115KV LINE LIMITS	M.B.	99-09-10
0C	ZAPATILLA HOUSING	M.B.	99-08-20
0B	GENERAL REVISION	M.B.	99-08-13
0A	PRELIMINARY	M.B.	99-07-28

MINERA SAN XAVIER, S.A. de C.V.

CERRO SAN PEDRO

CAMBIOR

PROJECT & CONSTRUCTION

PREP. BY : R. JOLIN, Ing.	99-07-28	
DWN. BY : M. BROCHU	99-07-28	
APP. BY :		
OWNER :		
SCALE : 1 : 2000		INIT.

TITLE :

115 kV TRANSMISSION LINE LOCALISATION TOWERS 41 TO MSX SUBSTATION

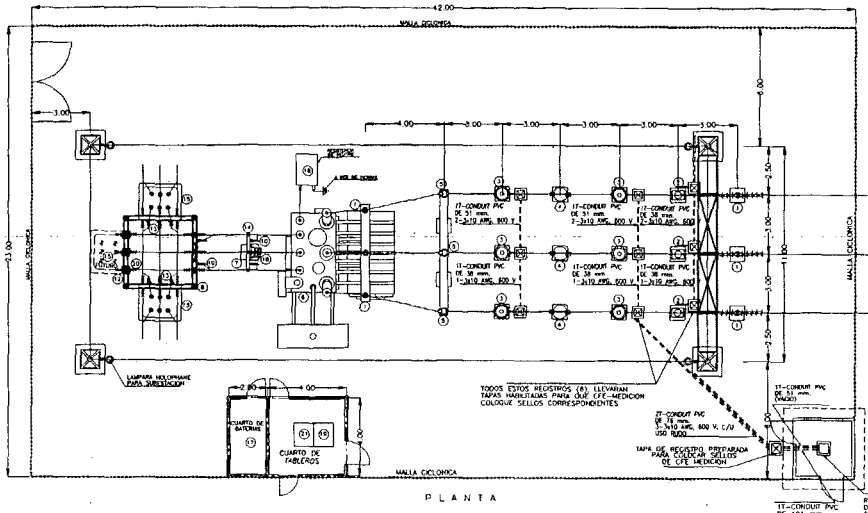
SIZE	AREA	DISC.	SEQ. NO.	REV.
D	410-	E -	0010 -	0D

DRAWING NO.

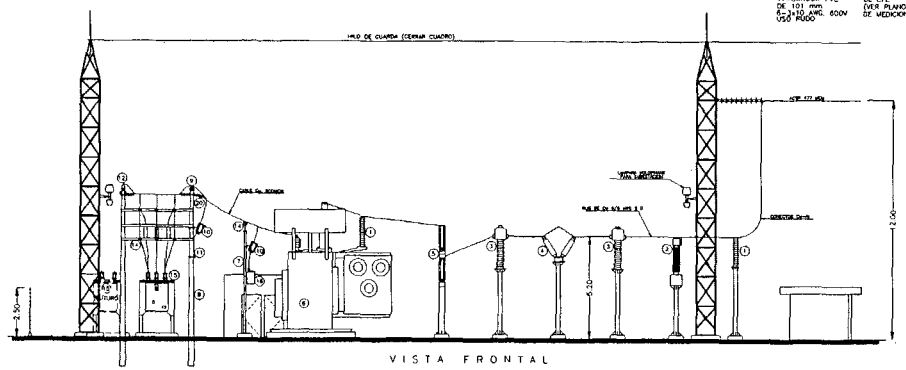
APPROBATION

D C B A

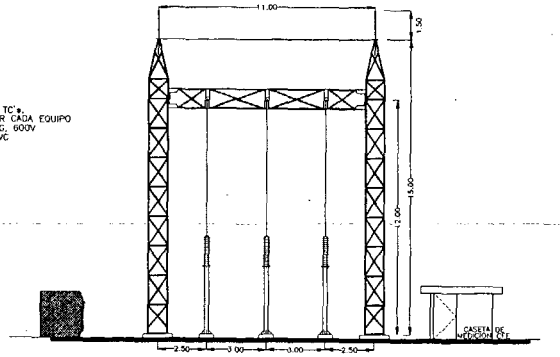
D | 420-E-0101-0F | DRAWING NO. | SIZE | AREA | DISC. | SEQ. NO. | REV.



PLANTA

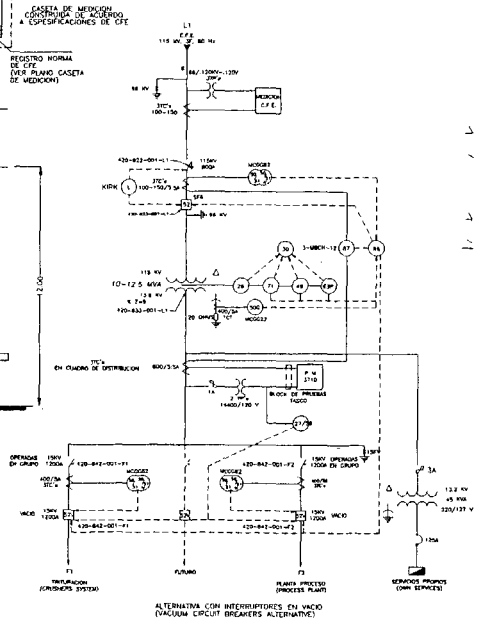


VISTA FRONTAL



VISTA LATERAL

NOTA:
LOS CABLEADOS DE TP'S Y TC'S, COMO ESTAN INDICADOS POR CADA EQUIPO CABLE USO RUDO 3x10 AWG, 600V TIPO VINANEL 2000-PVC+PVC



ALTERNATIVA CON INTERRUPTORES EN VACIO (VACUUM CIRCUIT BREAKERS ALTERNATIVE)

UNIFILAR

EQUIPOS

1.- APARTARRAYOS 96 KV, OHIO BRASS, 5 cm/kv.
2.- TRANSFORMADORES DE POTENCIAL, BALTEAU, UXT-123, 1000-600 : 1-1 MEDICION.
3.- TRANSFORMADORES DE CORRIENTE, BALTEAU, SFC-123, 100-150 : 5-5A MEDICION.
4.- CUCHILLAS DESCONECTADORAS EN V DE 3P, OPERACION SIN CARGA Y EN GRUPO, 800 A, 115 KV, S & C CON PUESTA A TIERRA, CAT. ED-104 V Y 37018-VLG.
5.- CIRCUIT-SWITCHER S & C,121 KV, MOD. 2030, 1200 AMPS., 25 KA, CI.
6.- TRANSFORMADOR DE POTENCIA DE 10-12.5 MVA, 115/13.8 KV, 3 FASES, 60 Hz, VOLTRAN
7.- ESTRUCTURA PARA SOPORTAR TRANSFORMADOR PARA SERVICIOS PROPIOS.
8.- POSTE DE CONCRETO REFORZADO DE 9.00mts.
9.- TRANSFORMADOR DE CORRIENTE 800/5A.
10.- DESCONECTADOR FUSIBLE S & C 89021, 15KV, 100A.
11.- TRANSFORMADOR DE POTENCIAL 14400/120V.

N O T A : DESCRIPCION DETALLADA DEL EQUIPOS, VER LA MEMORIA TECNICA DESCRIPTIVA.

12.- APARTARRAYOS TIPO ESTACION 15KV NEUTRO A TIERRA.
13.- CUCHILLAS DESCONECTADORAS 15KV, 1200A.
14.- AISLADOR PEDESTAL 15KV, CAT. 2115
15.- INTERRUPTOR DE POTENCIA EN VACIO 15KV, 1200A.
16.- TRANSFORMADOR DE SERVICIOS PROPIOS 45kVA, 13,200-220/127V, TIPO DISTRIBUCION, EN ACEITE.
17.- BANCO DE BATERIAS CON CARGADOR ACUMEX, 60 CELDAS 125DC.
18.- BANCO DE RESISTENCIA PARA NEUTRO DE 15KV, 20 OHMS.
19.- TABLERO DE ALARMA, CONTROL, PROTECCION Y MEDICION, PARA INTERRUPTOR DE POTENCIA SF6, S&C EN 115KV.
20.- AISLADOR DE SUSPENCION CT4, CADENA DE 3PZA.
21.- TABLERO DE CONTROL, PROTECCION Y MEDICION PARA INTERRUPTOR DE POTENCIA VACIO 15KV.

CYPESA
ESTA INFORMACION ES PROPIEDAD DE CYPESA Y POR LO TANTO NO PUEDE SER REPRODUCIDA SIN PERMISO ESCRITO DE CYPESA O USADO PARA OTROS PROPOSITOS AJENOS A LOS AUTORIZADOS POR CYPESA

SIMBOLOGIA

- ACOMETIDA CFE
- APARTARRAYOS
- CONEXION A TIERRA
- TRANSFORMACION DE POTENCIAL
- TRANSFORMADOR DE CORRIENTE
- CUCHILLA DESCONECTADORA 800 A, 115 KV. OPERACION EN GRUPO SIN CARGA CON PUESTA A TIERRA
- TRANSFORMADOR DE POTENCIA 115/13.8 KV TRIFASICO
- CUCHILLA SECCIONADORA 15KV, 1200A OPERADAS EN GRUPO, SIN CARGA
- TRANSFORMADOR DE DISTRIBUCION
- RESISTENCIA DE NEUTRO
- DESCONECTADOR FUSIBLE S&C, LISTON 3A
- TABLERO CENTRO DE CARGA
- (52) INTERRUPTOR CIRCUIT SWITCHER 121 KV, S & C
- (52) INTERRUPTOR DE POTENCIA EN VACIO 15KV, 1200A
- INTERRUPTOR TERMOMAGNETICO 125A
- EQUIPO DE MEDICION 3710 POWER MEASUREMENT
- (26) INDICADOR DE TEMPERATURA
- (30) CUADRO DE ALARMAS
- (50G) RELEVADOR INSTANTANEO TIERRA
- (63P) RELEVADOR BUCHHOLTZ
- (71H) INDICADOR DE NIVEL
- (27/59) RELEVADOR DE ALTO Y BAJO VOLTAJE
- (86T) RELEVADOR DE BLOQUEO
- (87T) RELEVADOR DIFERENCIAL
- (50, 51, 67) RELEVADOR DE SOBRECORRIENTE TIEMPO, INSTANTANEO, RESIDUAL TRIFASICO

APPROBATION

MAP GRID

26	27	28	29	30
10	1	2	3	31
11	4	5	6	32
12	7	8	9	33
13	38	39	40	34
14	15	16	17	35
18	19	20	21	36
22	23	24	25	37

REV	DESCRIPTION	BY	DATE
OF	GENERAL REVISION	M.B.	99-08-20
OE	LOCATION MAP	M.B.	99-08-13
OD	CAMBIOS STANDAROS	M.B.	99-07-28
OC	NEW ACCESS PROPOSAL	R.J.	99-03-01
OB	STANDARD TITLE BLOCK	M.B.	99-02-07
OA	FOR APPROBATION	R.G.	98-04

MINERA SAN XAVIER, S.A. de C.V.

CERRO SAN PEDRO

CYPESA S.A. de C.V.
AV. UNIVERSIDAD 1800 TEL. 16 87 35
SAN LUIS POTOSI, S.L.P.

PREP. BY : F. PALAU. Ing.	ABRIL 1998	
DWN. BY : R.V.GUITERREZ	ABRIL 1998	
APP. BY :		
OWNER :		
SCALE : 1 : 125		INIT.

TITLE :
MAIN SUBSTATION
115 KV - 13.8 KV
PLAN AND
ELEVATION

D | 420-E-0101-0F | DRAWING NO. | SIZE | AREA | DISC. | SEQ. NO. | REV.

D C B A

9.0 GENERAL SERVICES AND ADMINISTRATION

9.1 Description

General Services and Administration (G&A) is organized to provide management support to mine operations in those functions that are not specifically covered by the operating departments. The basic components and costs related to G&A are general management and services, human resources, finance and accounting, environmental, public relations, and general corporate support. Most G&A costs are expenses, either labor or consumables, but also include some capitalized costs, including property acquisitions such as surface, mineral, and water rights, as well as office furnishings and computer software.

9.2 G&A Personnel

For use in this section G&A personnel are classified as being in the general management, human resources, or finance and accounting departments. These departments consist of salaried national and expatriate employees. During most of the mine operations, there are a total of 16 salaried employees in G&A. Table 9.1 presents an annual summary of G&A employees by department.

9.3 G&A Services

G&A functions will be centralized at the mine site. A description of G&A services is provided below and is roughly organized by department. While a vast majority of G&A services will be performed by G&A personnel, some functions will be contracted to outside suppliers or organizations, such as personnel transportation, legal services, audit services, payroll processing, and janitorial services. The G&A department will be responsible for all support services, either directly with its own personnel or indirectly with contractor personnel. Key areas of services and expenses designated in the various G&A departments are as follows:

Table 9.1

	Pre-strip	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Years 9-12
General Management										
General Manager	X	X	X	X	X	X	X	X	X	0
Admin Assist	1	1	1	1	1	1	1	1	1	0
Human Resources										
HR Manager	1	1	1	1	1	1	1	1	1	0
Security Supervisor	1	1	1	1	1	1	1	1	1	0
Safety Supervisor	1	1	1	1	1	1	1	1	1	0
HR Representative	1	1	1	1	1	1	1	1	1	0
Receptionist	1	1	1	1	1	1	1	1	1	1
Data Entry Clerk	1	1	1	1	1	1	1	1	1	0
Accounting										
Finance Manager	1	1	1	1	1	1	1	1	1	0
Senior Accountant	1	1	1	1	1	1	1	1	1	1
Cost Accountant	1	1	1	1	1	1	1	1	1	0
Accounting Clerk	1	1	1	1	1	1	1	1	1	1
Payroll Clerk	1	1	1	1	1	1	1	1	1	0
Materials Controller	1	1	1	1	1	1	1	1	1	0
Buyer/Expeditor	1	1	1	1	1	1	1	1	1	0
Warehouse Clerk	1	1	1	1	1	1	1	1	1	0
Warehouse Attendant	1	1	1	1	1	1	1	1	1	0
Environmental										
Environ. Coordinator	1	1	1	1	1	1	1	1	1	1
Subtotal Expatriate	1	1	1	1	1	1	1	1	1	0
Subtotal Salaried	17	17	17	17	17	17	17	17	17	4
Total	18	18	18	18	18	18	18	18	18	4

(X) Expatriate Employee

General Management – The general manager's salary is part of the G&A budget.

Finance and Accounting – Centralized accounting for all mine facilities, financial and cash flow management, accounts payable, and development of financial reporting will be provided by G&A staff. G&A staff will also manage and implement employee relocation; deal with customs brokers and insurance for transportation of goods and materials into and out of Mexico; payroll administration; tax administration; administration fees; overall purchasing and warehousing; and lease and acquisition payments relating to surface agreements, right of ways, and mineral and water concessions.

Accounting – Administration of all accounts payable and receivables for the entire operation, performs centralized accounting, and develops monthly, quarterly, and yearly financial statements. Also assists with payroll administration.

Purchasing and Materials Management - Direction for procurement, customs clearance, transportation, logistics, and warehousing will be a G&A function.

General Services - Bus transportation services between the residential areas of employees living in San Luis Potosi and villages surrounding Cerro de San Pedro will be contracted, with employees paying a token bus fare to minimize legal implications. On-site transportation for employees working in the mine department will be provided by MSX, with the operating expenses included within that operating area where the employees work. Other general services will include trash removal, with refuse that will not be disposed of on-site being hauled, by contractor, to an approved disposal site. The mining department will provide road maintenance and will maintain the equipment and supply qualified operators for this function.

Human Resources – G&A will provide all human resources-related services related to employees, including recruitment and training, employee relations, health, safety, security and building maintenance, as further described below.

Recruitment and Training: Company personnel will establish recruitment procedures, develop company policies, and provide personnel growth and training strategies in conjunction with operations to develop multi-skilled, team-oriented, productive employees. Where appropriate, specific personnel with experience in various mining-related functions will be recruited for various positions, both from the local area within Mexico, and in certain cases, from outside of Mexico.

Employee Relations: Personnel and employee relations, benefits administration, labor relations, fire response, and office administration will be a responsibility of the G&A staff.

Health and Safety – Health and safety are a priority and will be administered in accordance with industry proven "loss control" standards, including, but not limited to, policy preparation and publication, ongoing training to all employees; monitoring programs; inspection and follow-up programs; and maintaining continuous compliance with Mexican federal labor laws. Acceptable standards will be established and enforced.

Security - MSX will maintain a security force to protect assets and personnel. The security force will be contracted and supervised by the Security Supervisor. The contracted security company will provide the usual security personnel items, such as uniforms, batons, and flashlights; while MSX will provide specialty equipment, such as radios, monitors, detection equipment, and vehicles. The security force will operate on a continuous schedule at strategic locations. A contracted transportation company will regularly pick up gold and silver dore bars from the refinery vault, and will provide their own security.

Building Maintenance - Maintenance will be provided to include all mechanical, electrical, and water systems for all facilities not covered by maintenance for that specific department (i.e., mine operations). The cost of supplies, parts, and utilization of equipment is a part of the G&A operating cost. A contracted janitorial staff is included to administer the building maintenance function

Medical Services – Human resources personnel will supervise a contracted staff of one medical practitioner and one nurse who will provide on-site health care services to employees and local area residents. Services will include health screening, preventive care, response to injuries and illness, and coordination with local and regional acute care facilities.

Environmental - Environmental management will be provided by on-site G&A personnel. Policies will be developed to ensure environmental protection and compliance with all permits and regulations. Environmental activities will include regular monitoring of operational facilities for regulatory compliance, including water and air sampling and maintenance of an on-site nursery.

Public Relations – G&A staff will provide all local community, San Luis Potosi state, regional and national relations, including those with governmental and non-governmental organizations. G&A staff will also manage the non-profit Cerro de San Pedro Foundation, established for the preservation of the village of Cerro de San Pedro and assistance to the village and the surrounding communities.

Corporate Support – Corporate support, in general, will include in-house legal services, accounting support, financial audits, and other technical support. An allowance for travel is also included. Some

legal services will be provided by Mexican-based contractors, which will deal with national issues, such as labor law compliance, taxation, etc.

9.4 G&A Operating Costs

General Services and Administration operating costs consist of on-site labor or manpower costs as well as other on-site and off-site costs relating to contract services, such as security, janitorial, various consulting charges, as well as insurance, telephone, and general corporate support.

9.4.1 G&A Labor Costs

Table 9.2 presents annual G&A on-site labor costs, including base salary, and applicable burden. All G&A staff are salaried and there are no daily paid employees in G&A.

Table 9.2

General Services and Administration - Annual Manpower Costs						
Position	**No.**	**Base**	**Base X No.**	**% Burden**	**Burden**	**Total**
General Manager (X)	1	$120,000	$120,000	0.18	$21,600	$141,600
Administrative Asisitant	1	$9,000	$9,000	0.60	$5,400	$14,400
Human Resources Manager	1	$40,800	$40,800	0.50	$20,400	$61,200
Safety Supervisor	1	$17,462	$17,462	0.55	$9,604	$27,066
Human Resources Representative	1	$17,462	$17,462	0.55	$9,604	$27,066
Security Supervisor	1	$12,000	$12,000	0.50	$6,000	$18,000
Receptionist	1	$4,200	$4,200	0.65	$2,730	$6,930
Data Entry Clerk	1	$7,000	$7,000	0.65	$4,550	$11,550
Finance Manager	1	$40,800	$40,800	0.50	$20,400	$61,200
Senior Accountant	1	$19,200	$19,200	0.55	$10,560	$29,760
Cost Accountant	1	$15,600	$15,600	0.55	$8,580	$24,180
Accounting Clerk	1	$7,000	$7,000	0.65	$4,550	$11,550
Payroll Clerk	1	$7,000	$7,000	0.65	$4,550	$11,550
Materials Controller	1	$19,000	$19,000	0.55	$10,450	$29,450
Buyer/Expeditor	1	$15,000	$15,000	0.55	$8,250	$23,250
Warehouse Clerk	1	$7,000	$7,000	0.55	$3,850	$10,850
Warehouse Attendant	1	$4,787	$4,787	0.60	$2,872	$7,659
Enviromental Coordinator	1	$26,400	$26,400	0.55	$14,520	$40,920
	18		$389,711		$168,470	$558,181
Total G & A Manpower Cost						**$558,181**

(X) Denotes Expatriate Employee

9.4.2 G&A Operating Expenses

Table 9.3 presents annual operating costs (overhead) for General Services, Management, Accounting, Human Resources, Public Relations, Environmental, and Corporate Support. Under General Services, the largest part of the operating expenses are related to outside contract services (legal services, audits, payroll, security guards), telephone and communications expenses, insurance (general, business interruption, etc.), computer software and maintenance, and travel (airfare, lodging, meals). Under Human Resources, the largest cost area is for a contracted medical practitioner and nurse, as well as operating supplies for operations employees and the local community. Public Relations operating expenses include funding for the Cerro de San Pedro Foundation, as well as general community assistance. Environmental operating expenses include those related to environmental monitoring and sampling, operating the plant nursery, the reclamation bond cost, and outside consultants to document compliance with the project environmental management program. Corporate Support is estimated to average $100,000 per year, for operating Years 1 through 5, then reducing to $25,000 by Year 9.

9.4.3 G&A Operating Cost Summary

Table 9.4 provides a summary of G&A operating costs, consolidating both labor costs and other expenses (overhead). The annual labor and overhead expenses are roughly the same during the production years. Over the life of the mine, and not reflecting capitalized costs in Pre-strip and Years 9 through 12, the average G&A cost is $0.25 per tonne of ore.

9.5 G&A Capital Costs

Vehicle equipment costs, including man busses and various vehicles for use both on and off the mine site, as well as radios for these vehicles are included under Mining G&A costs presented in Section 4.0.

Table 9.3

General Services & Administration - Annual Operating Costs										
	Pre-strip	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9-12
	($000)	($000)	($000)	($000)	($000)	($000)	($000)	($000)	($000)	($000)
GENERAL SERVICES										
Contract Services	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	45.0
Security Contract	128.0	128.0	128.0	128.0	128.0	128.0	128.0	128.0	128.0	36.0
Bus Contract	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	20.0
Travel	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	12.0
Lease / Rent	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	3.0
Computer / Office supplies	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	4.0
Operating Supplies	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	2.0
Training	24.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	1.0
Vehicle Expense	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	12.0
Employees to/from fuel	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	4.0
Consumables / Tools	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	1.0
Telephone	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	12.0
Overall Insurance	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	20.0
Licenses	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	0.5
Federal Taxes	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	1.0
Freight & Postage	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	3.6	1.2
Maint. & Installation	6.0	6.0	6.0	6.0	6.0	6.0	6.0	4.0	2.0	2.0
Concession Payments	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0	50.0
Ejido/CSP Leases	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
Trash Removal	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	2.0
All vehicles permits and use tax	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	2.0
Professional memberships	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	1.0
Professional subscriptions	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	-
Inmigration fees	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	-
Property taxes	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Total	$ 682.0	$ 670.0	$ 670.0	$ 670.0	$ 670.0	$ 670.0	$ 670.0	$ 668.0	668.0	$ 301.7
HUMAN RESOURCES										
Medical Services	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0	45.0
Safety Equipment	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	4.0	1.0
Recruitment	10.0	10.0	10.0	8.0	7.0	6.0	5.0	4.0	-	-
Employee relations	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	1.0
Radio Comunications	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	1.5
Work Apparel	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	0.5
Total	$ 73.0	$ 73.0	$ 73.0	$ 71.0	$ 70.0	$ 69.0	$ 68.0	$ 67.0	$ 62.0	$ 49.0
PUBLIC RELATIONS										
INAH Bond	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
San Pedro Foundation	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Network Media	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	3.0
Community Assistance	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Total	$ 56.0	$ 56.0	$ 56.0	$ 56.0	$ 56.0	$ 56.0	$ 56.0	$ 56.0	$ 56.0	$ 53.0
ENVIRONMENTAL										
Nursery, Replant. Reforest.	50.0	50.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Reclamation Bond	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Monitoring Expenses	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Environmental Audit	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
Total	$ 110.0	$ 110.0	$ 75.0	$ 75.0	$ 75.0	$ 75.0	$ 75.0	$ 75.0	$ 75.0	$ 75.0
CORPORATE SUPPORT										
Legal & Taxation support	50.0	50.0	50.0	50.0	50.0	50.0	35.0	30.0	30.0	15.0
Accounting support	20.0	20.0	20.0	20.0	20.0	20.0	15.0	10.0	10.0	-
Travel	30.0	30.0	30.0	30.0	30.0	30.0	30.0	15.0	15.0	10.0
Total	$ 100.0	$ 100.0	$ 100.0	$ 100.0	$ 100.0	$ 100.0	$ 80.0	$ 55.0	$ 55.0	$ 25.0
Total Operating Expenses	**$ 1,021**	**$ 1,009**	**$ 974**	**$ 972**	**$ 971**	**$ 970**	**$ 949**	**$ 921**	**$ 916**	**$ 504**
Total Manpower Costs	**$558**	**$558**	**$558**	**$558**	**$558**	**$558**	**$558**	**$558**	**$558**	**$89**
Overall G&A Expenses	**$1,579**	**$1,567**	**$1,532**	**$1,530**	**$1,529**	**$1,528**	**$1,507**	**$1,479**	**$1,474**	**$593**

Table 9.4

General Services and Administration - Annual Operating Cost										
	Pre-strip	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9-12
	($000)	($000)	($000)	($000)	($000)	($000)	($000)	($000)	($000)	($000)
Total Manpower Cost	558.2	558.2	558.2	558.2	558.2	558.2	558.2	558.2	558.2	89.2
General Services Overhead	682.0	670.0	670.0	670.0	670.0	670.0	670.0	668.0	668.0	301.7
Human Resources Overhead	73.0	73.0	73.0	71.0	70.0	69.0	68.0	67.0	62.0	49.0
Public Relations Overhead	56.0	56.0	56.0	56.0	56.0	56.0	56.0	56.0	56.0	53.0
Environmental Overhead	110.0	110.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0	75.0
Corporate Support Overhead	100.0	100.0	100.0	100.0	100.0	100.0	80.0	55.0	55.0	25.0
Total	**$ 1,579**	**$ 1,567**	**$ 1,532**	**$ 1,530**	**$ 1,529**	**$ 1,528**	**$ 1,507**	**$ 1,479**	**$ 1,474**	**$ 593**
Cost per Tonne of Ore		**$ 0.27**	**$ 0.29**	**$ 0.23**	**$ 0.20**	**$ 0.20**	**$ 0.20**	**$ 0.19**	**$ 1.38**	

10.0 ENVIRONMENTAL AND SOCIO-ECONOMICS

Baseline environmental and socioeconomic investigations for Cerro San Pedro were performed by Behre Dolbear de Mexico and reported in "Environmental Impact Statement for Minera San Xavier, S.A. de C.V., San Pedro Mining Project, Cerro San Pedro, San Luis Potosi, Volume I and II", May 1997. See Section 10.3 for details of the environmental permitting process. Several other studies also provide supporting information as noted below.

10.1 Environmental Baseline Investigations

10.1.1 Surface Water

In the project area, all stream flow is intermittent and limited to runoff of several hours duration, typically from summer storms. Figure 10.1 shows the relationship between the sub-basins of the San Pedro and La Zapatilla streams and the northeast area of the San Luis Potosi (SLP) valley. The drainage pattern is dendritic. The main surface stream is the San Pedro, fed by three tributaries, the Mendez, San Nicholas, and Santa Maria streams, each becoming more sinuate toward the flatter valley areas. Any stream flow that the San Pedro stream may collect permeates into the surface upon reaching the SLP valley.

10.1.2 Stream Sediments

Since surface water could not be evaluated, stream sediment samples were taken and analyzed to provide information on their baseline geochemistry. During baseline studies for the MIA, 12 sampling locations were selected in various locations upstream and downstream from the historic mine workings and planned project operations, and at more remote locations. Figure 10.1 also shows these relative locations and Table 10.1 provides details on sample sites with respect to historic mine workings and a comparison of contaminant levels for only those metals that exceeded normal limits. The results of the stream sediments analyses confirm that the mine area is within a mineralized district with derivative mineralized stream sediments. The most highly mineralized samples are adjacent to and downstream from the ASARCO waste rock dumps, a result of previous underground mining operations.

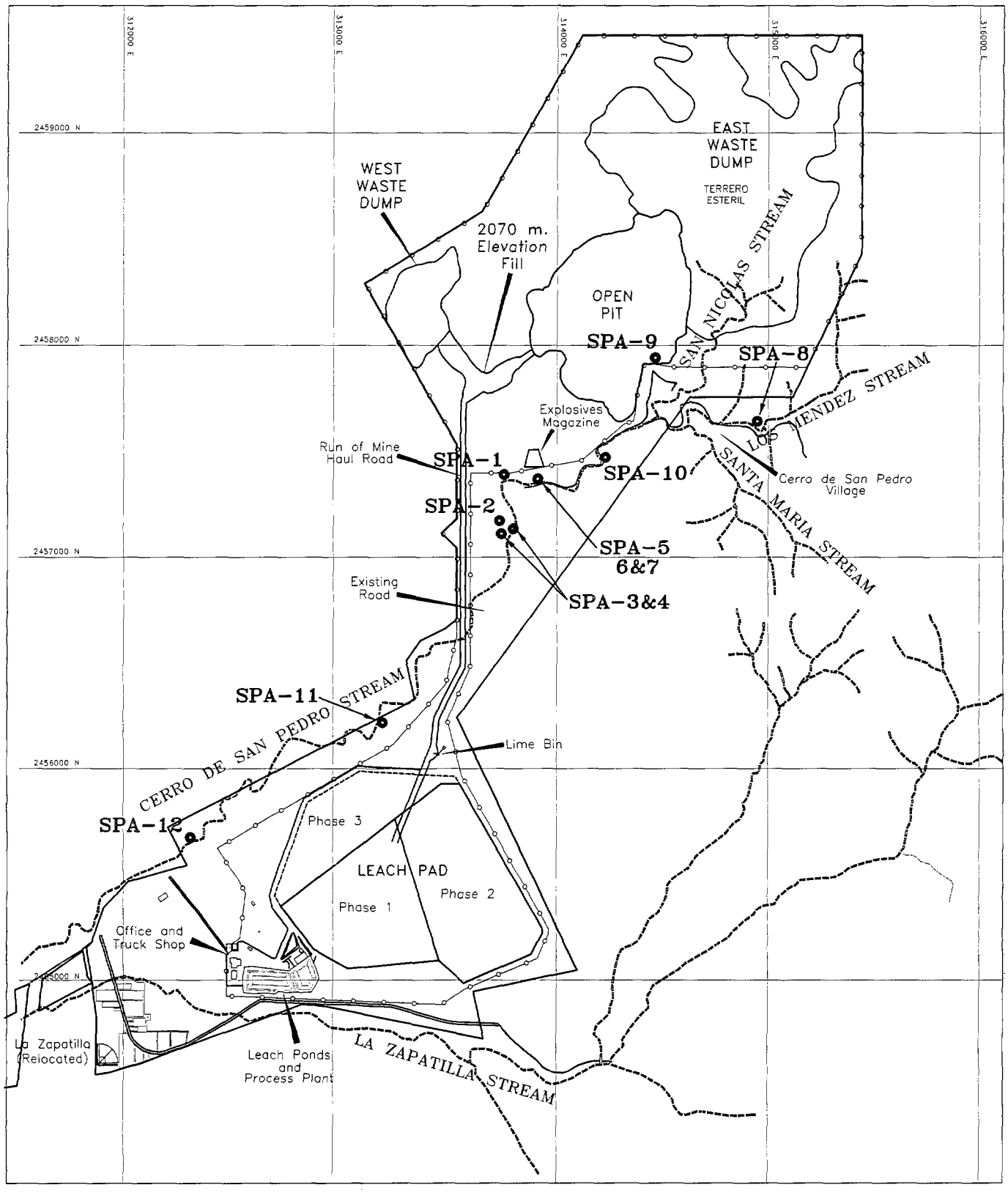


Figure 10.1 Location of Stream Sediment Samples and Drainages

Table 10.1

Stream Sediment Sample Locations, Descriptions, and Significant Analytical Results												
Sample No.	**Stream Valley**	**Description**	**Ag ppm**	**Cd ppm**	**Cu ppm**	**Fe %**	**Mn ppm**	**Mo ppm**	**Pb ppm**	**V ppm**	**W ppm**	**Zn ppm**
Upstream Samples												
SPA-01	North and east	Steep terrain	1.2	2.0	132	1.31	495	1.0	180	51	<10	98
SPA-02	West upstream	Steep terrain	7.0	3.0	28	2.89	670	4.0	770	53	<10	326
Average			**4.1**	**2.5**	**80**	**2.10**	**583**	**2.5**	**475**	**52**	**<10**	**212**
Downstream San Pedro Stream Seds. Affected Area (at 0, 500, 1000, 1500, 1800, 2700, & 3700 meters respectively from existing disturbance)												
SPA-10	In the Village	Downstream of hospital	80.0	120.0	389	7.55	2350	2.0	11400	97	10	9610
SPA-03	Old Workings	Just downstream	93.0	114.5	377	8.28	2320	18	10000	85	20	9570
SPA-05	Ferrocrete layer	Downstream old ores	94.0	151.5	365	9.19	2960	19	10900	97	20	13700
SPA-06	Ferrocrete layer	Downstream old ores	79.0	121.5	344	7.81	2260	10	8500	89	10	9960
SPA-07	Ferrocrete layer	Far end of old ores	100.0	103.0	337	8.91	2490	29	14200	95	20	8790
SPA-11	2.7 km distance	Downstream of village	21.0	85.5	124	3.77	1355	4	2800	69	<10	6220
SPA-12	3.7 km distance	Downstream of village	40.0	68.0	195	5.66	1650	5	6000	79	10	6640
Average			**72.4**	**109.1**	**304.4**	**7.30**	**2198**	**15**	**9114**	**87**	**15**	**9213**
Other Samples												
SPA-08	Los Mendez	Upstream CSP village	>100	10.0	36	1.52	545	3	640	54	<10	640
SPA-09	Alcalde Vats	Leach samples	>100	133.0	561	6.50	4280	26	9600	65	10	7880
SPA-04	Old Workings	Excavated ores	72.0	64.5	148	14.10	415	5	10600	56	20	7560
Comparison Affected Area Levels w/ Normal Limits												
Affected Area Average			72.4	109.1	304.4	7.30	2198	15	9114	87	15	9213
Sedimentary Rocks – Normal Limits			0.2 – 0.4	0.3 - 0.5	5.0 – 40.0	1.3 – 3.1	300 – 385	0.1 – 1.0	5.0 – 40.0	2.0 – 60.0		4.0 – 20.0
Granite – Normal Limits											0.9	
Soils – Normal Limits			1.0			5.0		2.5				50.0
Ratio **Affected** Area Analysis/ Max. Normal Limits			72 x	218 x	7.6 x	1.5 x	5.7 x	6 x	228 x	1.5 x	16 x	184 x
Ratio **Upstream** Area Analysis / Max. Normal Limits			4.1 x	5 x	2 x	0.4 x	1.5 x	1 x	12 x	0.9 x	<10 x	4 x

10.1.3 Groundwater

Because there are no permanent surface water sources in the Cerro San Pedro area, the only viable potable and agricultural water source is from groundwater. Results of studies of groundwater aquifers in the Cerro San Pedro area by Behre Dolbear de Mexico for MSX, as part of the baseline investigations for

the MIA, by the Autonomous University of San Luis Potosi (UASLP), and by MSX's work to develop groundwater resources are presented below.

Main Potable and Agricultural Producing Aquifer – San Luis Valley

The main regional aquifer is comprised of three different units: relatively permeable alluvial materials, sandy to conglomeratic rhyolite tuffs, and fractured latite that were deposited or extruded in the SLP valley lying along the western edge of the Sierra de Alvarez and generally to the west of where the Cerro San Pedro project is located . These aquifers are being exploited in the northeast portion of the SLP valley. One of the 11 wells located near the eastern limit of the aquifer provides the water source for the village of Cerro de San Pedro. This well (well M-1 on Figure 10.2), is approximately 6.3 km west of the village of Cerro de San Pedro and 2.7 km west of the western limits of the proposed heap leach pad.

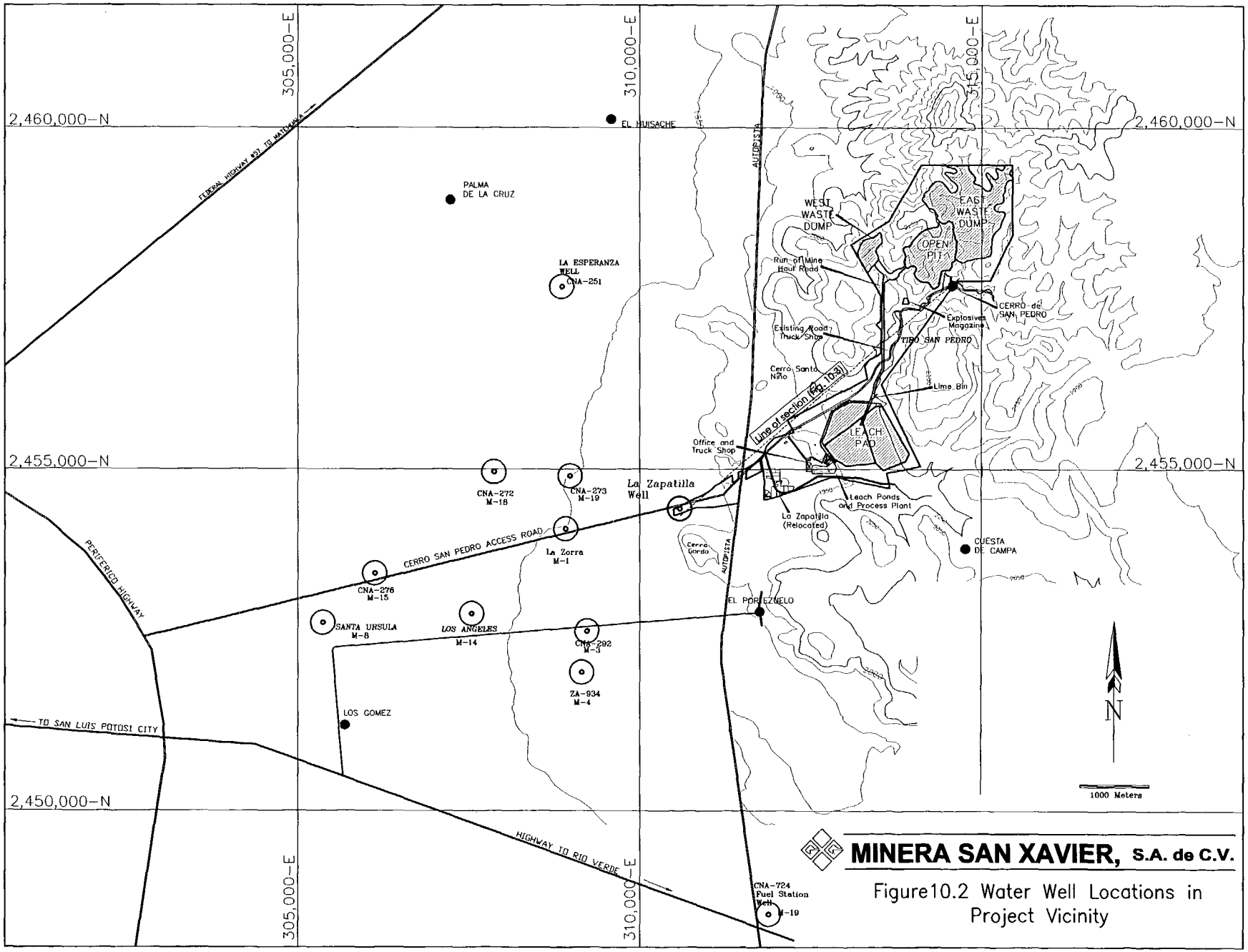
Groundwater Flow

Recorded information from a total of 20 known well sites was evaluated to characterize this aquifer. Eight of the 11 operating wells were sampled to develop baseline information on water quality. The aquifer trends in a general north-south direction, paralleling the eastern edge of the San Luis Potosi valley. The static level of the major producing alluvial aquifer unit that lies further west within the valley is at 105-128 m below the surface. A fairly insignificant, low quality, shallow water producing unit is also located at 34-36 m. An aquitard lies immediately below this shallow aquifer, preventing shallow water from infiltrating to the main aquifer below. Overall groundwater flow direction of the alluvial aquifer within the project area of interest is generally from east to west (from the mountain range to the valley) as shown in Figure 10.2. Transmissibility calculations for the aquifer, based on water well testing, hydraulic gradient, and applying Darcy's Law, indicate that ground water travels at a rate of about 0.047×10^{-3} to 1.1×10^{-3} m/day.

Water Quality

Water quality analyses from eight of the sampled water well locations (well numbers M-1, M-3, M-4, M-8, M-14, M-15, M-18, and M-19) shown on Figure 10.2 that concentration of metals is well below the maximum allowable limits for drinking water, established in the environmental guideline CE-CCA-001/89 for water quality.

The water chemistry for the main aquifer is calcium rich carbonate. One sample from well M-8 was taken in the shallow aquifer and indicated a calcium sulfate water chemistry. Water from this well had a lower pH (6.9 versus 7.6 to 8.0 field pH for the other wells) and had higher concentrations of solids, fecal



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Figure10.2 Water Well Locations in Project Vicinity

material, hardness, alkalinity, sulfates, chlorides, calcium, magnesium, potassium, and barium. The differing chemistry from the shallow aquifer could reflect contamination.

Ground Water in Immediate Project Area

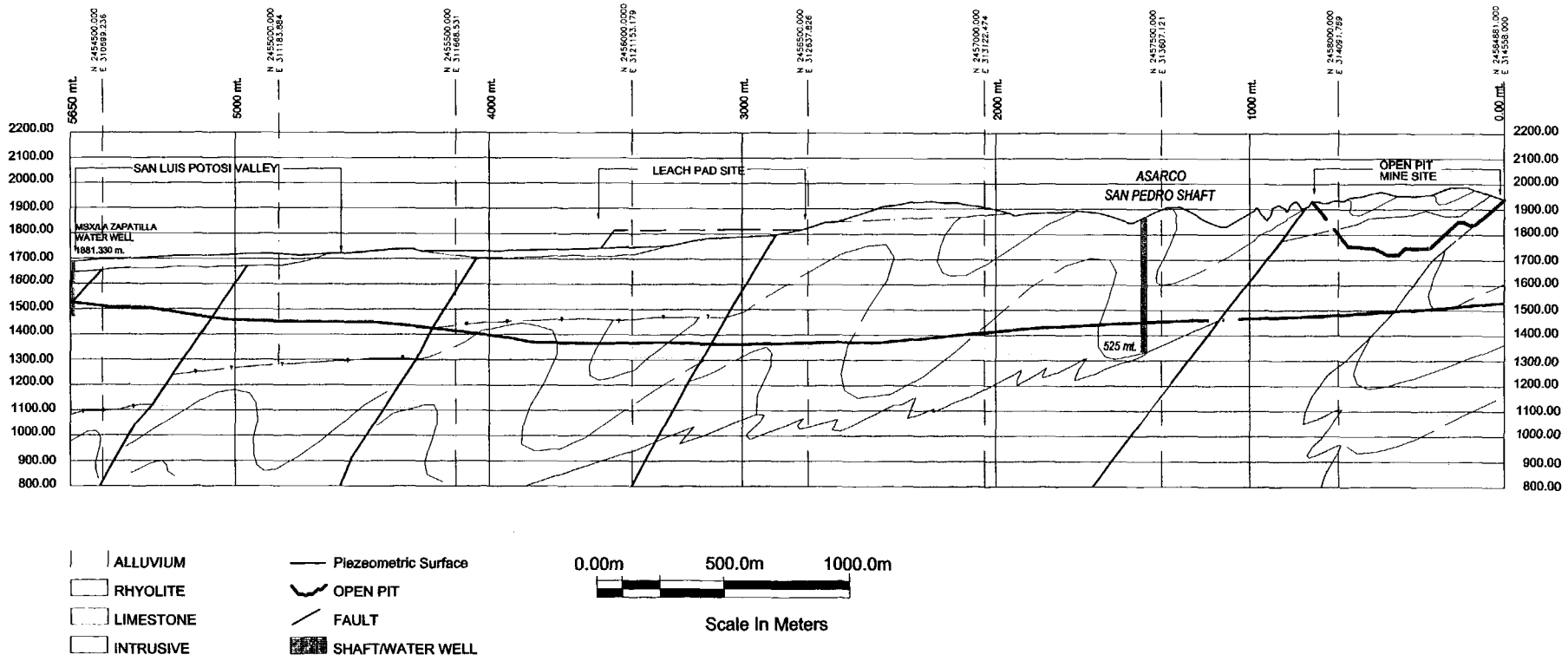
In the area east of the alluvial valley, where the Cerro San Pedro mine pit and waste rock dumps will be developed, drill hole data show the phreatic water level to be at level 150 m (1,730 amsl) below the limit of the proposed pit bottom. The country rock in these areas is limestone or porphyry, both of which have very low permeability. Water in these units is associated with more permeable areas of fracturing and along faults. Because of this the village of Cerro de San Pedro obtains its water much farther away in the valley alluvium aquifer (well M-1). This suggests that fractured limestone and porphyry is not a viable aquifer. However, records indicate that the old ASARCO underground mine is flooded at a certain level (approximately 1,700 amsl). Research of all known records does not suggest that potable or agricultural waters have been produced from the limestone or porphyry rocks. Because of the contrast in permeability between the productive aquifers in and along the SLP valley and the limestone/porphyry in the development area and because there is no evidence of significant contamination in the main alluvial aquifer, these areas are not considered to be hydrogeologically connected.

In the immediate area of La Zapatilla where the leach pad and process facilities will be developed, a thin veneer of alluvium is located at the surface underlain by unfractured latite, neither of which are water-bearing units. Figure 10.3 is a hydrogeological cross-section showing the relationship between the SLP valley aquifers and lithologic units present at La Zapatilla and Cerro de San Pedro.

Study of Impacts from Drawing Project Water Supply from Local San Luis Potosí Valley Aquifer

Additional evaluations completed in July 1998 by the Engineering School of the UASLP, in a report "Hydrogeological Performance of the Aquifer in the Cerro San Pedro Zone, San Luis Potosi", were conducted to determine the effects of annual water consumption required for the project on characteristics of the aquifer. A total of 167 data points (including 99 deep wells that intersected the main aquifer) was evaluated. Sixteen wells exhibiting the best conditions for measuring the static groundwater level and for performing pumping tests were chosen for use in modeling the aquifer. The following are the most significant conclusions from this evaluation:

- The average lowering of the main aquifer from the effects of current pumping is on the order of 0.5 to 2.5m/yr.



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Figure 10.3 Hydrogeologic Section from Proposed Open Pit to La Zapatilla Well Looking Northwest

- Groundwater flow direction is locally affected by a cone of depression created by draw down from heavier pumping of water for agricultural purposes near villages, particularly Palma de la Cruz and Enrique Estrada.
- In the area around the village of La Zapatilla (where the heap leach pad will be located) and farther east toward the mine area, rocks are of such low permeability that there is no significant infiltration of surface water contributing to groundwater recharge in the main aquifer to the west in the SLP valley.
- Modeling in the study area simulated groundwater extraction from the aquifer for 10 years at the current rates. It then compared this simulation with the scenario of an additional 33 l/s extraction over the same 10-year period from a new well located northwest of Portezuelo, near the current La Zapatilla well location. This comparison concluded that there is minimal variation in the static groundwater level, hydraulic gradient, and that no interference with pumping from other wells is produced with the additional 33 l/s extraction.
- Location and pumping of 33 l/s from the alluvial aquifer at a well near the modeled site, will not negatively impact the aquifer. It was recommended that the location of the well that will provide water for the Cerro San Pedro project should be near the site used in the simulation.

Hydrogeological /Geophysical Survey to Develop Project Water

MSX conducted a hydrogeological survey, which compiled detailed information to assist in developing the most favorable site where process and potable water for the project could be produced. Work included a geophysical survey that assisted in the identification of structural irregularities between two existing well sites under consideration (Esperanza and La Zorra), and a target site. Figure 10.2 shows the locations of these wells. Table 10.2 presents water quality information developed from sampling and analysis of these wells. It was concluded from the geophysical survey to develop the La Zapatilla site. In response to the UASLP and MSX studies and additional comments by SEMARNAP and the public, the Comisión Nacional de Agua (CNA) authorized the drilling of an exploratory well. In July 1999, after obtaining favorable results with the exploratory well, MSX completed a production well in the fractured latite aquifer, which is capable of producing over 60 l/s, or almost twice the amount required for the project.

Additional information regarding this production well is reported in Section 7.5.

Table 10.2

Analyses of Water Samples from Selected Wells

	Units	La Esperanza 12/2/1998	CNA (M-19) 11/27/1998	La Zorra (M-1) 11/27/1998	La Zapatilla 8/11/1999
Temperatura	° C	27	27.7	28.2	27.23
Potencial Hidrógeno (pH)		8.02	8.02	8.2	8.36
Conductividad eléctrica en micromhos/cm a 25 oC		390	382	319	422.3
Sólidos totales	mg/L	242.0	228.0	216.0	212.5
Sólidos disueltos totales	mg/L	242.0	228.0	216.0	209.50
Sólidos Sedimentables (Cono Imhoff)		Negativo	Negativo	Negativo	< 0.5
Sólidos Suspendidos totales	mg/L	0.0	0.0	0.0	3.0
Sólidos Suspendidos volátiles	mg/L	0.0	0.0	0.0	84.5
Nitrógeno Amoniacal como N	mg/L	0.19	0.09	0.12	1.204
Nitrógeno Orgánico como N	mg/L	1.47	0.32	0.00	0.240
Nitrógeno total (Kjeldahl)	mg/L	1.66	0.41	0.12	8.241
Nitrógeno de los Nitratos como N	mg/L	3.2	1.9	2.8	6.766
Nitrógeno de los Nitritos como N	mg/L	0.000	0.000	0.000	0.031
Fosfatos totales como P04	mg/L	0.00	0.00	0.00	0.012
Sustancias activas al Azul de Metileno (SAAM)	mg/L	< 0.10	< 0.10	< 0.10	0.036
Coliformes fecales (NMP/100 ml)		0.0	0.0	0.0	23.0
Coliformes totales (NMP/100 ml)		9.0	0.0	0.0	93.0
Color (Escala Pt-Co)	Unidades	0.0	0.0	0.0	2.0
Alcalinidad a la fenolft. como CaC03	mg/L	9.3	4.5	4.5	10.75
Alcalinidad al A. de Metilo como CaCO3	mg/L	95.0	116.0	111.0	90.3
Dureza del Calcio como CaCO3	mg/L	91.0	60.0	70.0	94.734
Dureza del Magnesio como CaCO3	mg/L	33.0	40.7	44.0	10.526
Dureza total como CaCO3	mg/L	124.0	101.0	114.0	105.26
Cloruros (Cl-)	mg/L	27.7	11.0	11.0	21.280
Sulfatos (SO4)	mg/L	16.8	16.8	12.3	4.134
Sulfitos (SO3)	mg/L	0.00	0.00	0.00	< 0.2
Sulfuros					< 0.1
Fenoles	mg/L	< 0.001	< 0.001	< 0.001	0.000
Flururos (F-)	mg/L	0.38	1.0	0.47	1.346
Sílice (Si02)	mg/L	81.0	84.8	74.5	84.84
Aluminio (Al)	mg/L	< 0.04	< 0.04	< 0.04	0.0
Arsénico (As)	mg/L	< 0.01	< 0.01	< 0.01	0.00
Bario (Ba)	mg/L	0.35	0.40	0.66	0.00
Boro (B)	mg/L	< 0.01	< 0.01	< 0.01	0.00
Cadmio (Cd)	mg/L	< 0.001	< 0.001	< 0.001	0.00
Calcio (Ca)	mg/L	36.5	24.0	28.0	50.00
Cianuro (CN)	mg/L	< 0.01	< 0.01	< 0.01	0.001
Cobre (Cu)	mg/L	0.01	0.015	0.00	0.02
Cromo total	mg/L	0.00	0.00	0.00	0.00
Fierro (Fe)	mg/L	0.70	0.11	0.05	0.11
Magnesio (Mg)	mg/L	7.9	9.8	10.7	0.6
Manganeso (Mn)	mg/L	0.008	0.002	0.002	0.00
Mercurio (Hg)	mg/L	< 0.0001	< 0.0001	< 0.0001	0.001
Niquel (Ni)	mg/L	0.00	0.00	0.00	0.01
Plata (Ag)	mg/L	0.00	0.00	0.00	0.00
Plomo (Pb)	mg/L	< 0.001	< 0.001	< 0.001	0.00
Potasio (K)	mg/L	10.0	5.0	5.0	6.7
Sodio (Na)	mg/L	28.0	17.0	8.0	39.0
Zinc (Zn)	mg/L	0.03	0.04	0.16	0.08
Hidrocarburos totales	mg/L	< 5.0	< 5.0	< 5.0	< 5.0

10.1.4 Rock Geochemistry / Acid Rock Drainage

Static Testing

Testing to identify if rock types at Cerro San Pedro had the potential for acid generation was conducted – with results during the 1996 program incorporated into the MIA and with work in 1999 by Cambior adding to this information. A total of 75 samples representative of five rock types that could be mined or exposed at Cerro San Pedro were collected during both testing programs. Most of the samples were from drill core intervals (only 3 limestone/rhyolite samples were bulk samples from the surface). These were analyzed using static testing methods by Hazen Research, Inc. (1996) and Chemac Environmental Services (1999), both of Colorado. A summary of the average acid neutralization potential (ANP), average acid generation potential (AGP), and average of the ANP/AGP ratio by rock type is presented below in Table 10.3. Details are presented in Table A10.1 in the Appendix.

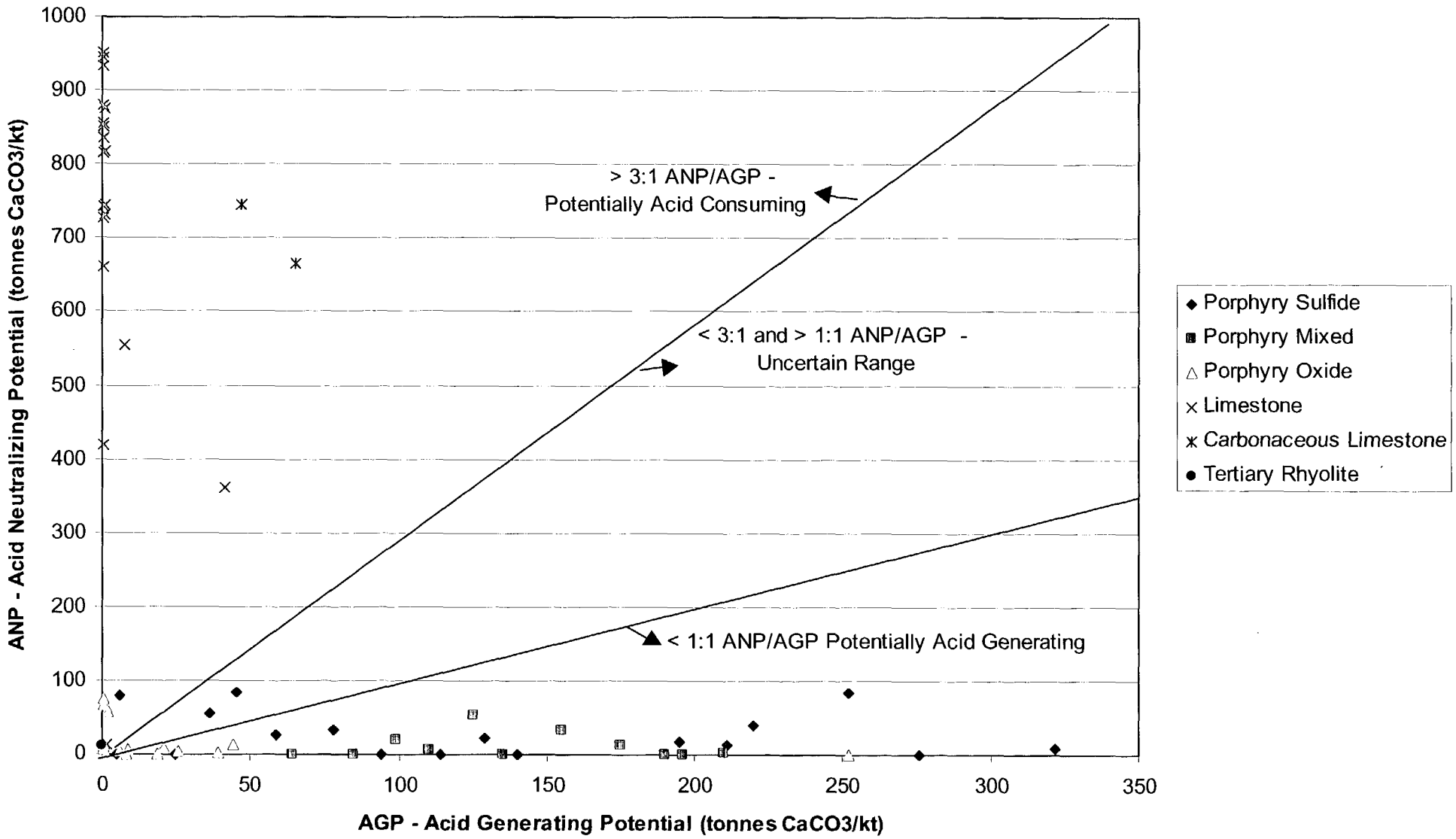
Table 10.3

Summary of Average ANP/AGP Ratios by Rock Type (Static Testing)				
Rock Type	**No. of Samples**	**Average ANP**	**Average AGP**	**Avg. of ANP/AGP Ratios**
Limestone (Begonia, Hospital, Barreno)	26	720.4	8.2*	1,262.5*
Tertiary Volcanics (Rhyolite)	1	11.3	0.2	56.5
Porphyry Oxide	18	19.7	25.2	23.5
Porphyry Mixed (Oxide and Sulfide)	11	14.3	155.0	**0.1**
Porphyry Sulfide	19	28.5	106.8	**1.9**

* no AGP information is available on 5 of the limestone samples.

These results indicate that Porphyry Sulfide and Porphyry Mixed have the potential to generate acid with an ANP/AGP < 3.0. Even though the average ANP/AGP was 23.5 for Porphyry Oxide, half of the individual samples of oxide had ANP/AGP ratios of < 3.0 and are considered (based on static tests only) to be potentially acid generating. Figure 10.4 is a plot of the ANP/AGP and shows that although 50 percent of the Porphyry Oxide samples fall in the < 3.0 ANP/AGP range, all but one sample has relatively low AGP, as opposed to the Porphyry Mixed and Sulfide rocks.

Figure 10.4 Plot of ANP/AGP Ratios for Various Rock Types Based on Static Testing



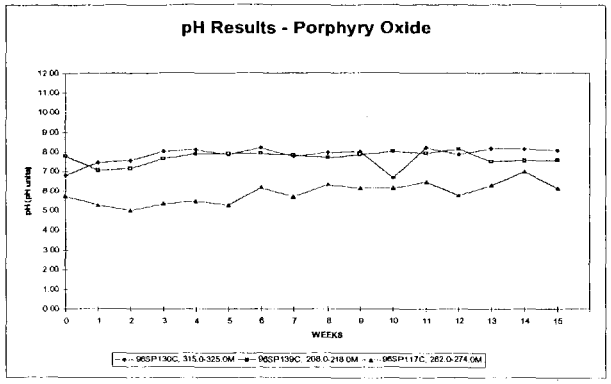
Kinetic Testing

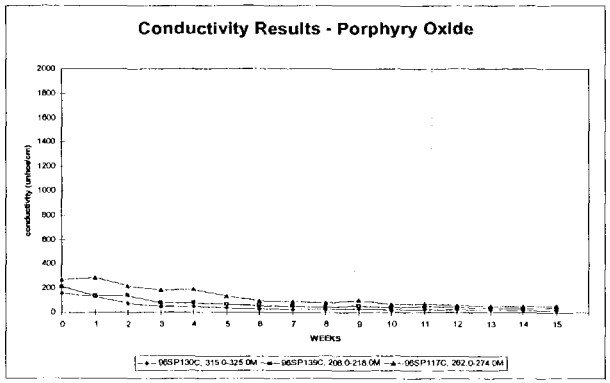
Kinetic testing is usually only conducted on those samples which have the potential to generate acid, based on static testing. As such, kinetic testing was only conducted on porphyry samples. Kinetic testing (humidity cells) to simulate the effects of weathering of exposed porphyry (3 Porphyry Oxide, 2 Porphyry Mixed, 3 Porphyry Sulfide) was conducted by Chemac in 1999. Additional core material from the 1999 static leach test sampling was subjected to humidity cell tests conducted over a 15-week period to better determine the expected acid generating potential of the three porphyry rock types. During part of the leach cycle, variably humid air flows through the rocks (simulating dry periods), following which the samples are leached by simulated rain water (1:4 water to solid ratio), the process cycles on a weekly basis. Samples are rinsed and analyzed for weekly pH, alkalinity, acidity, and conductivity. A more extensive suite of parameters was analyzed at initiation and at 1, 5, 10, and 15 weeks including ICP metals, Hg, chloride, and TDS. A summary of the results of humidity cell testing is presented in the Appendix as Tables A10.2, A10.3, and A10.4 for Sulfide, Mixed, and Oxide porphyry samples, respectively.

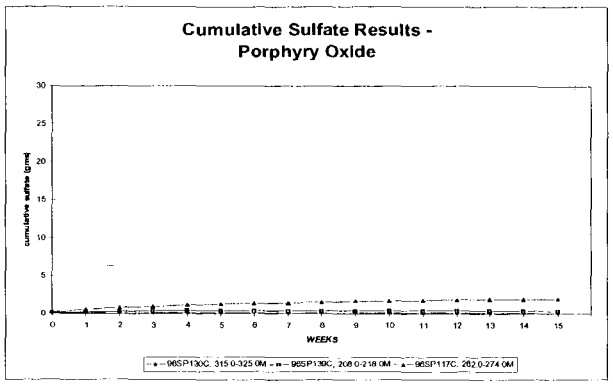
Key results of the kinetic testing are presented in Figures 10.5, 10.6, and 10.7 for Porphyry Oxide, Mixed, and Sulfide, respectively. Cumulative acidity, pH, conductivity, and cumulative sulfate results are for the most part very similar for Porphyry Mixed and Sulfide, indicating that these materials behave similarly when exposed to the weathering process and should be classed as acid generating. The pH for Porphyry Mixed and Sulfide generally ranges from 3.0 to 6.0 over the entire 15-week test period. Overall results for Porphyry Oxide show an average pH of all three samples of 7.33 over the 8- to 15-week period (the period after initial wash-off of secondary salts that better simulates the long term acid generation scenario).

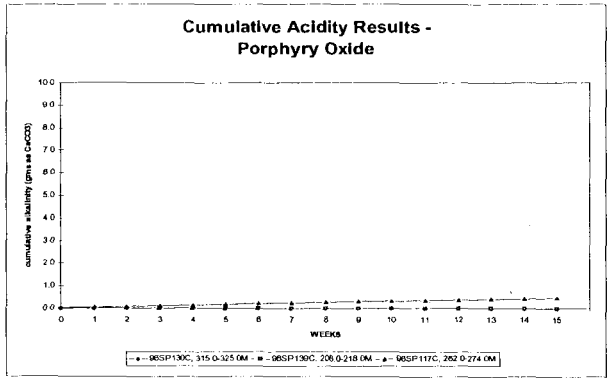
Acidity of Porphyry Mixed and Sulfide samples significantly exceeds alkalinity. Acidity is very low for Oxide samples with acid levels slightly less overall than its corresponding alkalinity. Metals in solution are generally high for Porphyry Mixed and Sulfide samples, as expected with the higher acidity, conductivity and sulfate levels. Release rates for dissolved metals Porphyry Mixed and Sulfide is also very high. Metals in solution and expected release rates for Porphyry Oxide is generally low.

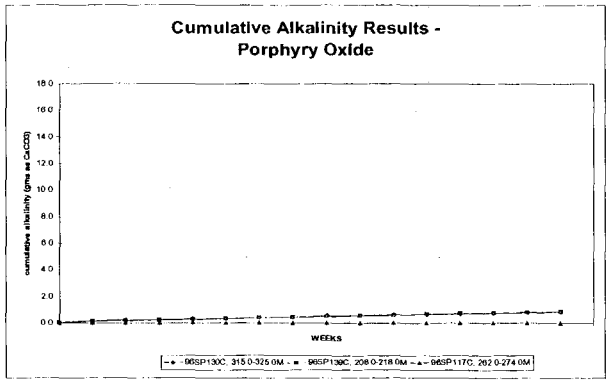
Interpretation of geochemistry and acid generation potential was conducted in mid-1999 by a technical consultant. The net acid generating potential (NAGP), or AGP-ANP, of each porphyry rock type from static test data can be broadly correlated to acidity level from kinetic (humidity cell) testing in Table 10.4:

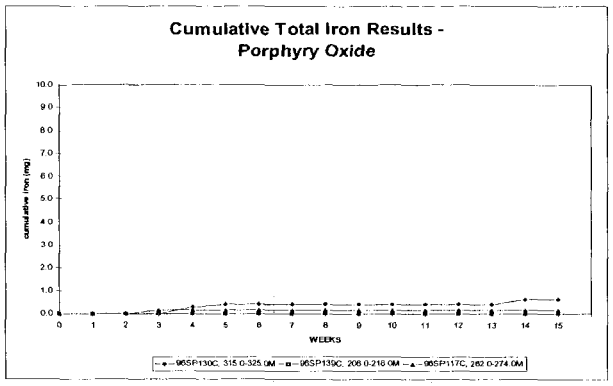


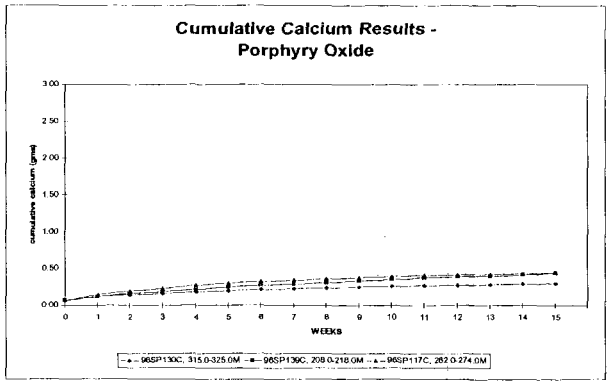






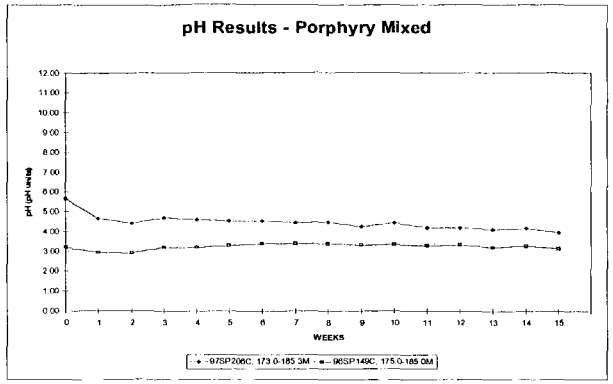


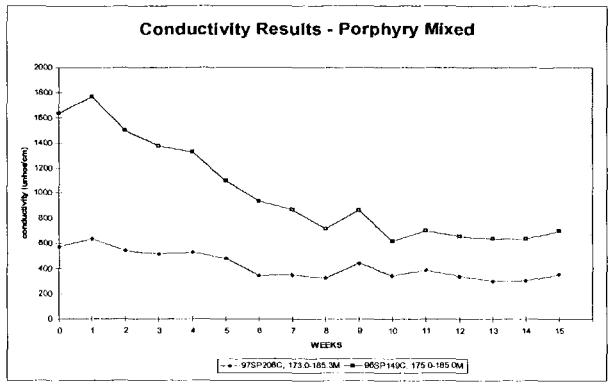


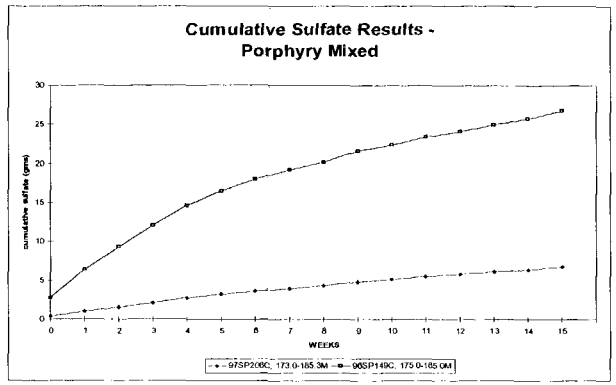


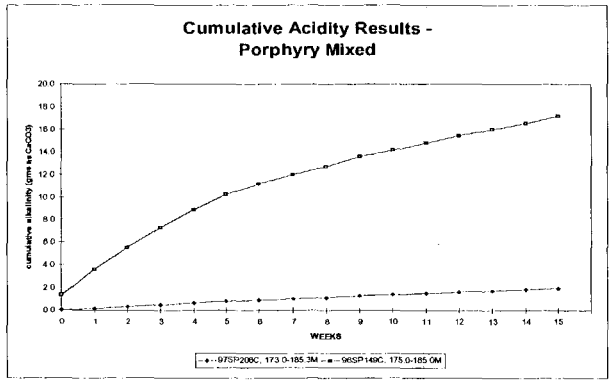
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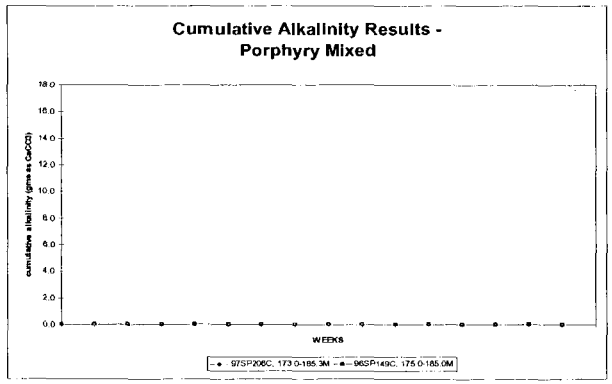
Figure 10.5 Kinetic Test Data (Humidity Cells) for Porphyry Oxide Samples

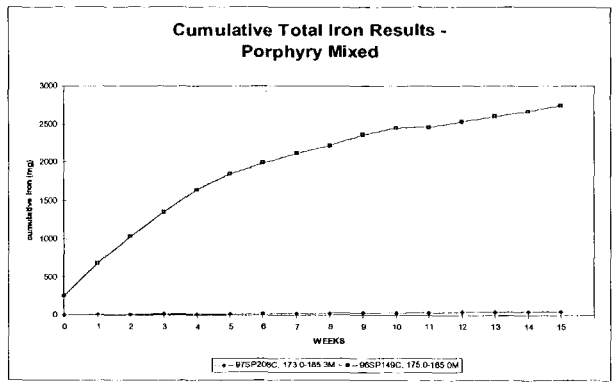


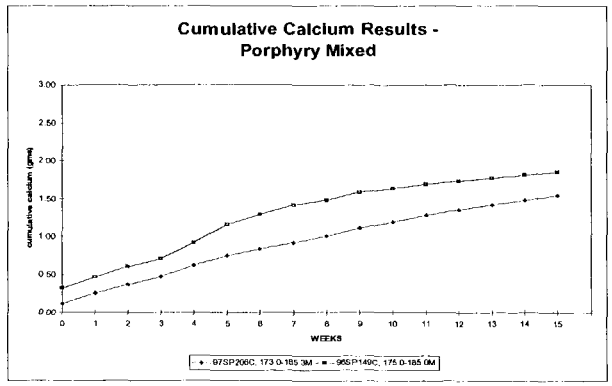






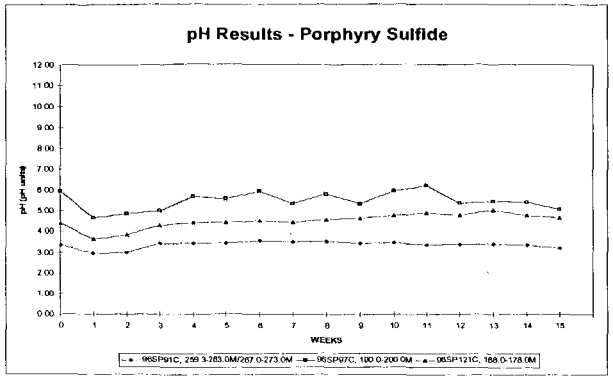


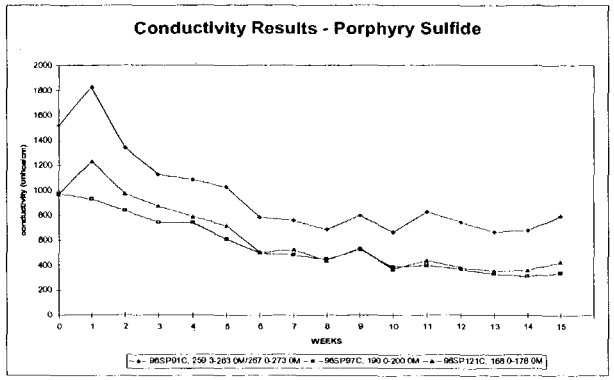


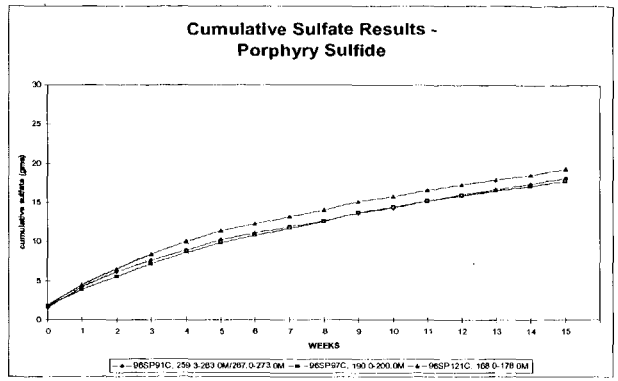


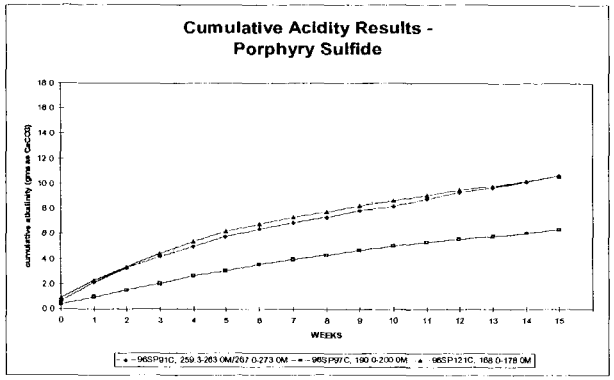
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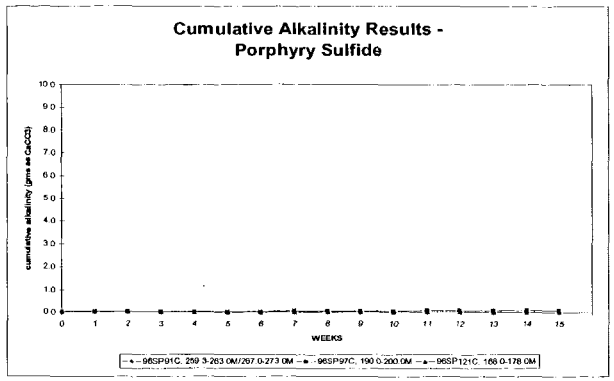
Figure 10.6 Kinetic Test Data (Humidity Cells) for Porphyry Mixed Samples

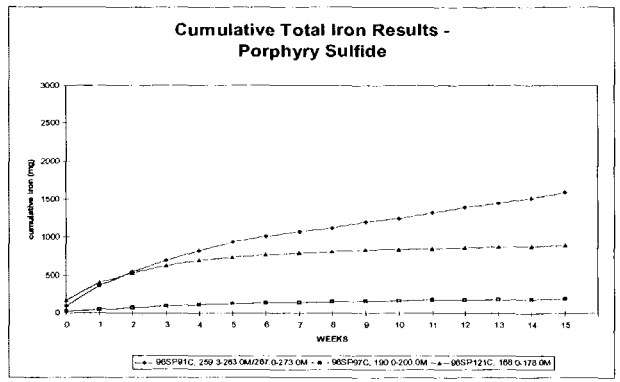


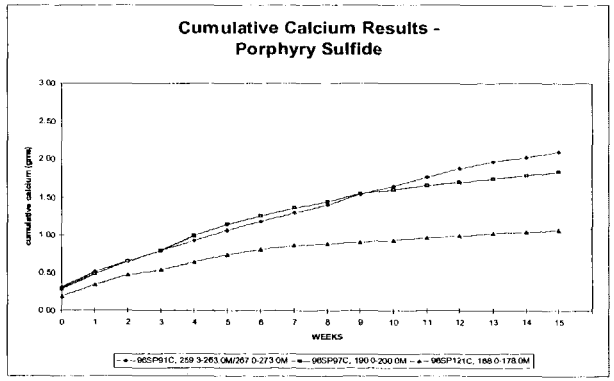












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Figure 10.7 Kinetic Test Data (Humidity Cells) for Porphyry Sulfide Samples

Table 10.4

Classification of Porphyry Rock Types Based on Kinetic Test Data				
Porphyry Type	**Acidity Level**	**Acidity Avg. Wks. 8-14 (mg/l as $CaCO_3$)**	**Samples**	**NAGP (AGP-ANP)**
Sulfide / Mixed	High	232	PS-1, PM-8	>80 t $CaCO_3$/kt
	Moderate	94.5	PS- 2 and 3, PM-7	
Oxide	Low	6.7	PO-4, 5, and 6	< 22 t $CaCO_3$/kt

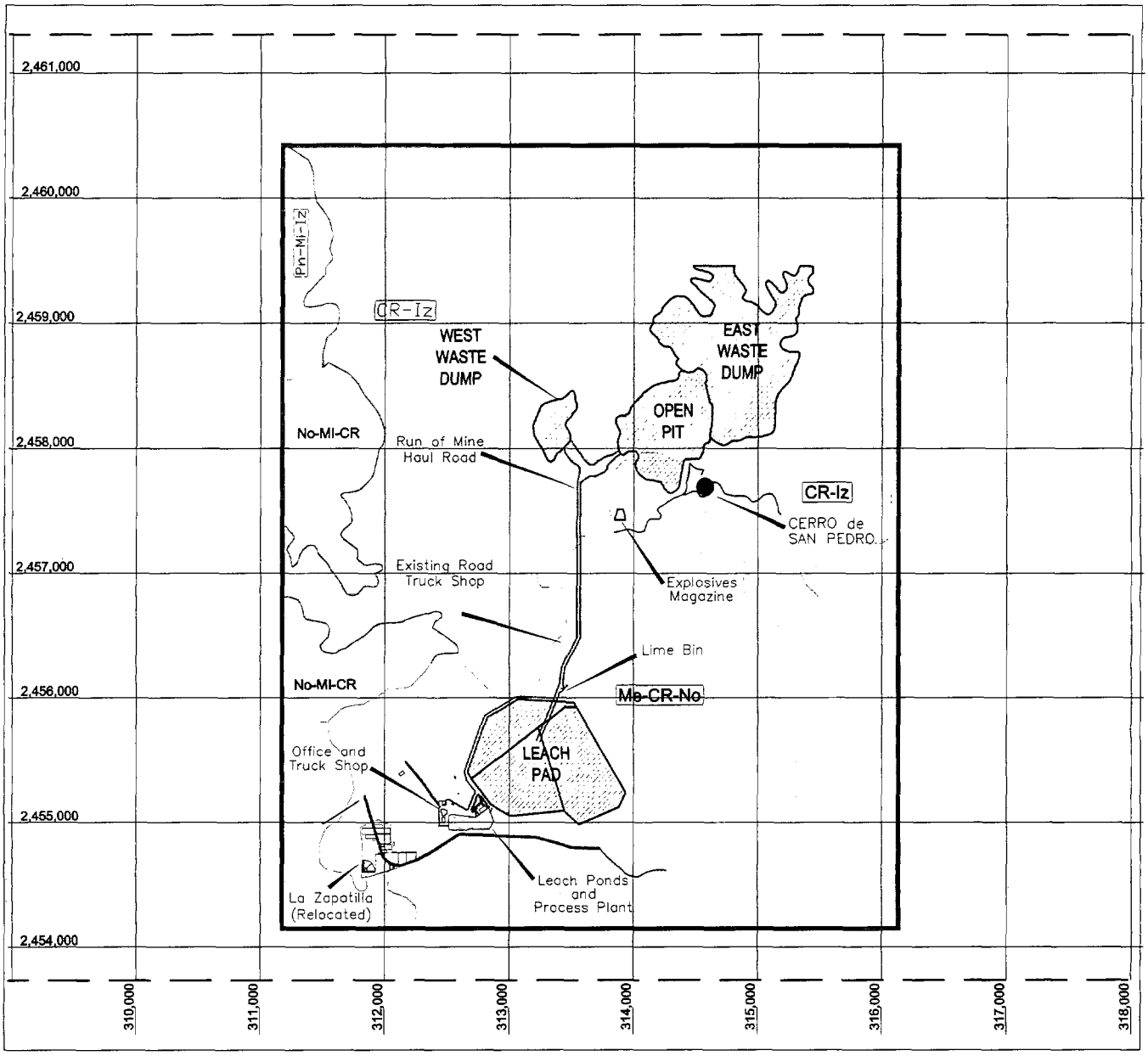
Because Porphyry Oxide typically has little available neutralization potential, any sample with pyritic sulfur over 0.15 percent (AGP >4.7) should probably be considered potentially acid generating (PAG) material. From this analysis, MSX will conservatively categorize Porphyry Oxide material as PAG, as well as Porphyry Mixed and Sulfide, with respect to selective handling in the waste rock dump, particularly from the perspective of thereby eliminating potential for miss-classification between the various porphyry rock types by field personnel. Leach chemistries, however, will be considered in modeling the overall chemistries of any water potentially developed in the pit or in the waste rock dump based on the relative proportions and distinct leaching characteristics of each porphyry rock type and the various limestone rock types.

10.1.5 Biological

Vegetation

There are a total of 8 vegetation types in the Cerro San Pedro area: 3 within the project area and 5 within the area of influence. All these vegetation classifications are related to plant communities that are established in hilly terrain in soil derived from limestone rock and are distributed throughout the project. Figure 10.8 shows the distribution of the different vegetation types or communities of the area in and around the project site.

The three different vegetation types within the project area are shown in Figure 10.8 and are described as follows:



TYPE OF VEGETATION IN THE PROJECT AREA

CR-Iz	Thorny Crassu-rauliphoplio with palm (izotes)
Me-CR-No	Thorny Crassu-rosulipholio thicket with cactus
No-Mi-CR	Cactus Thornless Thicket-Thorny crassu rosulipholio
Pn-Ms-CR	Natural Pastureland-Sub Thornless Thicket_Thorny crassu rasulipholio

Project area
Influence Area

N

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Figure 10.8 Vegetation Types in the Project Area

0 1000
Scale In Meters

1. ***Thorny Crassu-rosulipholio with palm (izotes) / (CR-Iz)*** – covers the north half of the project area and is characterized by the presence of three species of grouped leaves forming roseheads with long and thick leaves ending with thorns. These three species of subarbustive rosulipholies include:

- (Agave striata)
- lechuguilla (Agave lechuguilla)
- guapilla (Hechtia glomerata)

This vegetation type is also associated with candelilla (Euphorbia antisyphilitica) in areas of high vegetation density. Izote or palm (Yucca carnerosana) is also widely dispersed in this vegetative type. Other species found in less abundance are the following large and small cactus:

- peach cactus (Opuntia leucotricha)
- cardon cactus (Opuntia streptacantha)
- blinder cactus (Opuntia microdasys)
- creeping cactus (Opuntia stenopetala)
- Echinocereus
- Coryphantha
- biznagas (Echinocactus platyacanthus, Echinocactus visnaga, and ferocactus)

2. ***Thorny crassu-rosulipholio thicket with cactus / (Me-Cr-No)*** – covers the south and west half of the project area and is characterized by a significant presence of garabatillo (Mimosa leucaenoides) and very thorny cactuses such as clavellina cactus (Opuntia tunicata) and other large cactuses as follows:

- cardon cactus (Opuntia streptacantha)
- peach cactus (Opuntia leucotricha)
- tapona cactus (Opuntia robusta)
- and subarbustive rosulipholies (Agave striata, Agave lechuguilla, and Hechtia glomerata)

3. ***Cactus-Thornless (or Inert?) Thicket – Thorny crassu-rosulipholia / (No-Mi-Cr)*** – has a much smaller distribution in the south and west project area than the preceding two vegetation types and

covers portions of the west side near the area of influence. It is very similar to Thorny crassu-rosulipholio thicket except that cactus species are dominant. These cactus species include:

- cardon cactus (Opuntia streptacantha)
- tapona cactus (Opuntia robusta)
- peach cactus (Opuntia leucotricha)
- garambullo (Myrtillocactus geometrizans)

Cactus clusters are associated with gobernadora plant (larrea tridentata) and sangregrado (Jatropha dioica) forming a thornless thicket such as that present in flat land areas such as La Zapatilla and El Huizache.

In addition to the three vegetation types noted above, the following vegetation types are also present in the area of influence and basically surround the types of vegetation described in the project area:

- ***Natural Pastureland – Thornless Thicket with Izotes***
- ***Natural Pastureland – Sub Thornless Thicket – Thorny crassu rosulipholio***
- ***Natural Pastureland – moderate hydric erosion***
- ***Natural Pastureland – Strong hydric erosion***
- ***Permanent annual temporal agriculture***

The Crassu-rosulipholious species are distributed at a very low density in areas where the soil has been eroded. The pastureland or gramineous species grow after the rainy season during the summer. Aristida, Bouteloua, and Andropogon are the most common species. In areas of low-density vegetation, communities of Agave striata, Agave lechuguilla, and Hechtia are present, sometimes associated with species of Muhlenbergia repens. Most of the year these pastureland areas look cleared and dry. At Monte Caldera to the east of the project, there are some hills with clusters of oaks (Quercus) surrounded by cleared areas of pastureland.

At least 100 species of plants belonging to 30 different families were identified in the project area. Of these 100 species, 27 belong to the cactus family. Of all the 100 vegetative species, only 3 species within the cactus family are endangered, threatened, or have special protection status. Table 10.5 provides details of the distribution of these endangered species.

Table 10.5

Endangered/Rare, Threatened or Protected Plant Species in the Project Area							
	Baseline Population Distribution by Proposed Operations Area						
Cactus Species	Mine Pit	Leach Pad/ Process	Waste Rock Dumps	ROM Haul Road	Bldgs., Shops, Warehouses	La Nueva Zapatilla	Total
Endangered/threatened:							
Mammilaria candida	348	0	1,007	0	177	68	1,600
Rare/threatened:							
Mammillaria crucigera	0	11,518	0	889	0	0	12,407
Special protection status:							
Echinocactus platyacanthus	221	0	816	0	113	31	1,181
Total Number of Plants	**569**	**11,518**	**1,823**	**889**	**290**	**99**	**15,188**

In June 2000, MSX submitted a report to SEMARNAP explaining that after a detailed analysis of the plant species found on the project site, the plants that were believed to be Mammilaria Crucigera are in reality Mammilaria chinocephala. The Mammilaria chinocephala species is not endangered, threatened, or have special protection status and do not have to be transplanted ahead of disturbance.

Wildlife

The dominant vegetation types in the project area and area of influence are not conducive to development of large wildlife species. Only small mammals are present, but even these are scarce. The habitat, with scarce production of food for wildlife, is more conducive to bird species typical of desert areas.

Birds typical of desert areas are widespread in the area and are present as follows by order of abundance:

- passeriformes
- columbiformes
- falconiformes

In addition, the State of SLP is in an important water fowl migration route, particularly for ducks coming from the U.S. and Canada for the winter. A total of 19 bird species were identified in the sampling within

the two primary vegetation types of the project area. These habitats provide excellent bird nesting and refuge areas, particularly within the larger cactus of the cactus clusters. From this on-site sampling, the following five bird species comprise a total relative density in population of 63 percent compared to 37 percent of all remaining bird species:

- thrasher (Toxostoma curvirrostre) – 19%
- canyon wren (Catherpes mexicanus) – 12%
- a swallow species (Hirundo petrochelidon fulva) – 11%
- white wing dove (Zanaida asiatica) – 11%
- cactus wren (Campylorhynchus bruneicapillus) – 10%

Only three types of small mammals and reptiles were observed in the field as follows:

- rabbits (Lepus californicus)
- ground squirrels (Spermophilus mexicanus)
- rattlesnakes (Crotalus scotulatos)

The following were detected through capture in aluminum traps and subsequent release:

- kangaroo rats (Dipodomys ordii)
- wild rats (Neotoma microphus)
- ground squirrel noted above

Although not observed, the habitat created by the main vegetation types also would be conducive for refuge for coyote (Canis latrans) and fox (Urocyon cinereoargenteus). The subarbustive stratus forming the community of Agave striata, Hechtia glomerata, and Euphorbia antisiphilitica would also provide an ideal nesting place for logomorphs and rodents (Lepus californicus, Sylvilagus audubonii, and Spermophilus mexicanus).

Only one animal species was observed in the field that had a status of endangered, rare, threatened or protected species (rattlesnake). However, reports indicate that 4 other species of birds and reptiles may exist in the area. The following are those that are listed in the literature:

- sparrow hawk (Buteo jamaicencis) – special protection
- desert turtle (Gopherus-xerobates-berlianderi) – endangered

- whipping snake (Masticophis flagellum) – endangered
- viper snake (Pituophis deppei) – endangered/threatened
- rattlesnake (Crotalus scotulatos) – special protection

10.1.6 Anthropology / Historical Monuments

There are two historical monuments in the village of Cerro de San Pedro that date back to the 17th century, the San Pedro Apostol church and the San Nicolas Tolentino church. The Instituto Nacional Antropologia e Historia (INAH - National Institute of Anthropology and History) established a protection zone along the limits of the village adjacent to the proposed open pit in order to ensure that these and other historical buildings are preserved. In addition, a detailed document has been prepared by MSX and submitted to INAH, identifying the actual condition of buildings located in the village of Cerro de San Pedro nearest to the pit and the ruins in the Porvenir Valley. INAH will utilize this document to set the amount of the bond to cover damages caused to buildings in the town of Cerro de San Pedro closest to the pit as a result of MSX operations. This document also details the ruins in the Porvenir Valley, some of which will be covered with rock fill as part of the construction of the run-of-mine haul road from the pit to the leach pad.

Of the two churches, the San Pedro Apostol church is closest to the proposed pit and has suffered structural damage due to uneven settling of its foundation and poor maintenance over the years. In 1999, the Secretaria de Desarollo Urbano, Communicaciones y Obras Publicas (SEDUCOP – Department of Public Works for the State of SLP) completed some a series of studies and tests to determine means to stabilize the church from subsidence activity from historic underground workings. The SEDUCOP has assumed a supervisory role in conducting these studies and tests and MSX has committed to provide the technical and economic support to stabilize the church prior to initiating operations. MSX has contracted expertise in structural engineering and geophysical analysis to develop a comprehensive stabilization program and will submit the plan for SEDUCOP's approval before the end of 2000. MSX has also committed to INAH to restore both churches in Cerro de San Pedro during the operating phase of the project. A foundation has been established and will be funded by MSX to protect, preserve, and restore the two churches and other historic buildings in the town of Cerro de San Pedro. A photograph of the San Pedro Apostol Church is presented as Figure 10.9.

The chapel in the village of La Zapatilla will be demolished to make room for the construction of the leach pad. A new church will be constructed in the new La Zapatilla village prior to demolishing the old one.

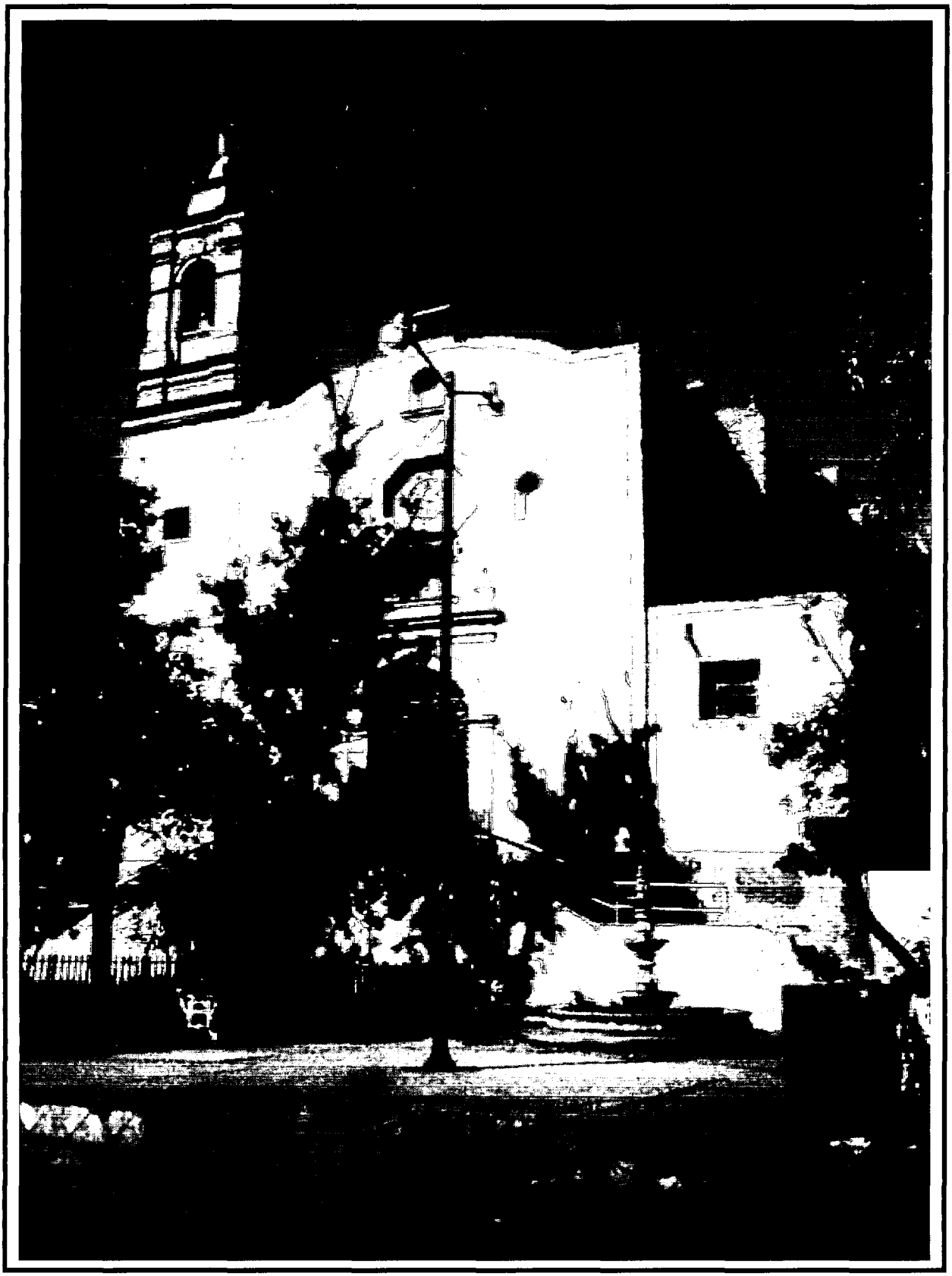


Figure 10.9 Photograph of the San Pedro Apostol Church and Village Plaza

10.2 Environmental Regulations

The primary environmental law that governs the development of mining projects in Mexico is the General Law of Ecological Equilibrium and Environmental Protection (LGEEPA). LGEEPA took effect March 1, 1988 and was recently modified in December 1996. LGEEPA generally established the following:

- The obligatory compliance with regulations, the principles of ecological policies, and the basis for an Environmental Impact Analysis.
- The need to preserve natural and ecological resources and regulations concerning their use.
- The regulations to promote a sensible use of natural resources and their protection. Specific mention to water, atmosphere, and soil is made. In Title No. 3, LGEEPA makes specific mention to exploration and mining activities.
- The process for including the general public as active participants in the protection of the environment.
- The procedures of control and assurance, including sanctions to those who do not comply with the law.

10.2.1 Principal Laws and Regulations

General Law of Ecological Equilibrium and Environmental Protection (LGEEPA)

LGEEPA includes general provisions for environmental impact evaluations that serve as the basis for the permitting process as noted above and with specific provisions for protected natural resources, the rational use of natural resources, and for environmental protection with specific provisions as listed below:

Protected Natural Resources

The law requires the protection of terrestial and aquatic flora and fauna through preservation of natural habitats, and protection and development of species that are endemic, threatened, or in danger of extinction.

Rational Use of Natural Resources

The law requires the rational use of water and aquatic ecosystems, and soil and its resources. Additionally, specific requirements are established to prevent and control harmful effects of the

exploration for and exploitation of non-renewable natural resources on the equilibrium and integrity of ecosystems.

Environmental Protection

The law includes specific provisions for environmental protection on the following subjects:

- Prevention and Control of Air Pollution
- Prevention and Control of Water Pollution and Pollution of Aquatic Ecosystems
- Prevention and Control of Soil Pollution
- Activities Considered Hazardous
- Hazardous Materials and Residues
- Nuclear Energy
- Noise, Vibrations, Thermal Energy and Lighting, Odors, and Visual Pollution

Protection of Historic and Archaeological Sites

The Protection and Conservation of Archaeological and Historical Monuments Characteristic Towns and Natural Beauty Places law provides for protection and preservation of national historic and archaeological sites. INAH has jurisdiction.

National Waters Law

The National Waters Law provides legal authority for protecting the public's interest through the protection, improvement and conservation of basins, aquifers, channels, beds and any other body of water classified as national waters, as well as infiltration of water for aquifer recharge and diversion of waters from one hydrological basin or region to another. The law requires that non-domestic water users obtain permission to use national waters through grants or assignments. Among the obligations for water users is the requirement to comply with the general provisions and standards on water safety and ecological equilibrium and environmental protection (i.e., LGEEPA). Specific water quality standards have been established for receiving water bodies based on the usage classification of the body; however, many water bodies have not yet been classified.

Mining Law

The Mining Law describes the legal requirements for operation of a mining facility. Environmental requirements, and especially closure requirements, specified in the law and implementing regulations are relatively limited. For the most part, the Mining Law refers to other laws and regulations for environmental requirements. Specifically, the fourth chapter of the law (entitled On the Obligations Imposed by Mining Concessions and Allotments and the Beneficiation of Minerals) Article 27 states the following:

> "Holders of exploration and exploitation concessions, regardless of their date of issuance, are obligated to: [Paragraph IV] Subject to the general provisions and to the specific technical rules applicable to the mineral-metallurgical industry in the area of safety of mines and ecological balance and environmental protection..."
>
> No other specific requirements are stated. The above requirement is assumed to refer to the Ecological Equilibrium and Environmental Protection General Law, described above, which provides for ecological balance and environmental protection. Available information indicates that mining industry-specific technical rules have not yet been established.

10.2.2 Environmental Regulatory Agencies

Environmental protection measures in Mexico are primarily organized under a Ministry called the Secretaria de Medio Ambiente Recursos Naturales y Pesca or Secretariat of the Environment, Natural Resources, and Fisheries (SEMARNAP). The responsibilities for environmental management are administered by the following organizations:

- Instituto Nacional de Ecologia (INE, National Institute of Ecology) which establishes general regulations.
- Procuraduria federal de Proteccion al Ambiente (PROFEPA, Environmental Attorney General) who is responsible for the compliance with and enforcement of existing regulations.
- Natural Resources sector of SEMARNAP which is responsible for land rezoning.
- Comision Nacional del Agua (CNA, National Water Commission) which administers the control, permitting, and registration of water resources.

Other Ministries and Agencies with restricted areas of concern include:

- Secretaria de Agricultura y Recursos Hidraulicos (SARH)

- Instituto Nacional Antropologia e Historia (INAH, historic/archaeological sites)
  - Sitios y Monumentos
- Secretaria de la Defensa Nacional (SEDENA, explosives)
- Secretaria del Trabajo y Prevision Social (STPS, safety)
- Secretaria de Salud (SSA, health)
- Secretaria de Comunicaciones y Transportes (SCT, roads, communications)
- Secretaria de Comercio y Fomento Industrial (SECOFI, mining concessions)
- Secretaria de Desarollo Urbano, Communicaciones y Obras Publicas (SEDUCOP) in SLP
- Secretaria de Contraloria y Desarollos Administravos
  - Consejo e de Avaluos de Bienes Nacionales (CABIN)

These agencies play a role in establishing and approving the environmental regulations and conditions for permits and governing operation of the Cerro San Pedro project.

10.3 Permitting

The permitting process is initiated with the submission of a Manifestacion de Impacto Ambiental (MIA) to the SEMARNAP State Office. This office issues a recommendation and sends the original documents to INE in Mexico City. The final permit approval is issued, upon completion of the following steps:

- Technical evaluation of the natural resources by INE.
- Technical evaluation of the risk analysis by INE.
- Technical recommendation of the State SEMARNAP office.

INE and SEMARNAP submit a report requesting any additional information, issuing specific conditions of approved permits, and providing recommendations for approval or reasons for a negative response. A recent amendment also provides for public participation in review of the MIA and allows for public meetings in which any interested party may propose the application of preventive and mitigation measures. The federal agency is required to make a determination within a maximum of 120 days.

From the original INE and SEMARNAP reports and the determinations from the public process, the final resolution are made. Recent regulation stipulates that authorities should issue a resolution not more

than 6 months from the date of submittal. Past processing time from date of submittal has taken from six to eight months. With public participation, this time frame may be extended.

Provisions in the regulations allow the MIA, similar to an environmental impact statement, to be prepared at three increasing levels of detail. All works or activities meeting the MIA criteria must prepare and submit, at a minimum, the general form MIA. According to Article 9 of the implementing regulation, intermediate or specific form MIAs must be prepared at the request of the jurisdictional agency where the characteristics of activity, its impact on the environment, or site conditions, require different and more specific information to be submitted.

Other permits are required to demonstrate that physical, biological, and socioeconomic environments will be protected for the benefit of Mexico's population and future generations. Some of the most important permits required for development and operation of the Cerro San Pedro project include:

- Change in Land Use for mining purposes granted by Semarnap based on technical justification for land rezoning report.
- Land Use License granted by Seducop (State Public Works Department) after the approval of the MIA by Semarnap.
- Construction Permit granted by the Municipality of Cerro de San Pedro after the approval of the State Land Use License.
- Explosives Use and Storage Permit granted by Sedena (Defense Ministry).
- Transfer of Water Rights and Water Well Authorization Granted by CNA (National Water Commission).
- Residual Water Discharge Permit granted by CNA.

10.3.1 Permitting Status for Cerro San Pedro

All the necessary permits to begin construction have been approved by the corresponding federal, state, and municipal authorities. Table 10.6 provides an overview of the time the permitting process has required.

Table 10.6

Status of Permitting and Operations Related Permits, Plans and Licenses			
Permit/License/Plan (by lead agency)	**Date Submitted**	**Date Approved**	**Due Date/Status**
SEMARNAP:			
MIA	11/01/97	02/26/99	
Risk Analysis	11/01/97	02/26/99	
Change in Land Use	11/01/97	09/09/00	
Environmental Assessments			
Power line right-of-way	12/03/98	08/07/00	
SEDUCOP:			
Land Use License	03/15/99	05/05/00	MSX signed an agreement with the State of SLP to submit to an annual environmental audit at MSX expense and take part in a citizens committee to ensure compliance of all environmental commitments.
Cerro SAN PEDRO MUNICIPALITY:			
Construction Permits:			
CPS Houses	09/25/98		
Water upgrade	07/17/98	10/16/98	
Project Facilities: La Nueva Zapatilla By-pass road Crusher/conveyor system Leach pad Process/office building Truck shop	05/15/00	07/04/00	Construction permit is good for one year. It expires June 30, 2001. Permit is based on the original crushing and conveying option and will have to be modified to reflect the run-of-mine alternative.
SEDENA:			
Powder Magazine and Use of Explosives	09/04/00		Initiated process with municipal and state before applying to SEDENA.
CNA (CONAGUA):			
Water Rights Transfers			
608k m^3 transferred	01/15/98	08/15/98	Transferred to La Zapatilla well.
La Melada 360k m^3	08/20/98	03/07/00	Transferred to La Zapatilla well.

Table 10.6

Status of Permitting and Operations Related Permits, Plans and Licenses			
Permit/License/Plan (by lead agency)	**Date Submitted**	**Date Approved**	**Due Date/Status**
Water Drilling			
Exploration water well permit	09/15/98	10/27/98	Exploration well completed 12/98
Production well completion	01/21/99	03/01/.99	Well completed 7/99 (60 l/s)
Septic Tank Construction:			
CSP Housing	07/98	11/16/98	
La Nueva Zapatilla Housing			Contractor to submit.
Project Construction			Will be submitted upon final design
SECODAM (CABIN):			
La Zapatilla Chapel Demolition	01/21/98	09/15/99	New chapel to be constructed as part of new La Zapatilla village before present chapel is demolished.
CSP Church Stabilization	09/22/98	11/18/98	SEDUCOP began work May 1999.
CSP Church Restoration			During operations
INAH / SITIOS Y MONUMENTOS:			
CSP Housing Architecture	08/14/98	09/02/98	Model & relocation housing.
CSP Church Stabilization	Ok	ok	No jurisdiction, but supports plan
CSP Church Restoration			During operations
La Zapatilla Chapel Demolition	Ok	ok	No jurisdiction, but supports plan

10.4 Environmental Impact Evaluation and Conditions for Permit Approval

As part of the permitting process, the MIA was prepared and completed in May 1997 and officially submitted to SEMARNAP in October 1997. Based on further discussions between SEMARNAP and MSX of technical components of the project, incorporation of opinions from technical experts included in a report prepared by the UASLP, and comments by the public, INE issued its MIA approval resolution on February 26, 1999.

10.4.1 Project Parameters in the MIA

The MIA was based on development of the Cerro San Pedro project over a 373.39 hectare (ha) area. The results of this feasibility study call for a somewhat smaller pit and waste dump, and a modified leach pad and solution pond configuration than that proposed under the MIA. These modifications to the MIA are in the process of being documented and will be forwarded to SEMARNAP. Table 10.7 compares impacted areas as noted in the MIA with modifications based on this Feasibility Study.

Table 10.7

Comparison of Impacted Area in MIA versus Feasibility Study				
	Approved in MIA		Feasibility Study	
Site Facility	Has	Description	Has	Description
Open Pit Mine Area	67.58	194 M tonnes	47.34	120 M tonnes
Waste Rock Dumps	178.00	East Only, 117 M tonnes	123.70	East & West, 71 M tonnes
Roads – Pit to Waste Dumps			2.08	
Areas of Backfill, Crusher Areas, Roads, Conveyors, etc.	15.65	Includes crushers and conveyors along east side of San Pedro Creek	30.18	Does not include crushers and conveyors. Includes run of mine haul road from pit to leach pad on west side of San Pedro Creek
Leach Pad, Ponds, Process Plant, Soil Stockpile	103.01	External Ponds	152.70	External ponds
Nueva La Zapatilla	9.15	Includes Access Roads	15.66	
Total	373.39		371.66	

10.4.2 Impact Evaluation and Mitigation Measure / Conditions for Approval

The MIA identifies potential impacts from project activities and the measures to be taken to:

- mitigate environmental and socioeconomic impacts during construction and operation
- to minimize long range impacts and closure liabilities, and
- to maximize the potential for a healthy, sustainable community.

These form the basis for the conditions for approval of the MIA in the MIA Resolution. Table 10.8 summarizes this information as presented in the MIA Resolution and the planned response by MSX. Socioeconomic considerations are also included, with baseline conditions and specific mitigation measures discussed later in Section 10.6.

Table 10.8

Potential Environmental and Socioeconomic Impacts and Mitigation Measures

Environmental – Socioeconomic Component	Potential Impacts	Mitigation Measures
Air	1. Fugitive dust from mining and crushing. 2. Gas emissions from labs, processing. 3. Exposure to workers	1. Air monitoring, characterization of dust/ dispersion patterns, and implementation of most effective controls / dust suppression. 2. Monitoring, evaluation and controls. 3. Personal protective equipment used.
Groundwater Local Area	1. Use of significant water supply from the regional potable aquifer. 2. Potential impacts to water quality in aquifers.	1a. Study to demonstrate technical/economic feasibility of treated water/water from shaft for process water to minimize water use. 1b. Evaluation of use of different methods for application of cyanide on heap. 1c. Evaluation of possible treatment options to eliminate cyanide from pond prior to closure that minimizes water use. 2. Study by UASLP demonstrated no hydrologic connection between aquifer at project and regional potable aquifer/ no potential for impact.
Vegetation	1. Habitat disturbance and loss of plant communities, including 3 known protected species.	1a. Recover soil and plant medium. 1b. Conduct a comprehensive inventory of plants (and animals) 1c. Develop a Protection Plan and Revegetation Program that rescues and relocates all protected species with preservation in a permanent botanical garden and temporary nursery, with revegetation at closure.

Table 10.8 (continued)

Environmental – Socioeconomic Component	Potential Impacts	Mitigation Measures
Wildlife	1. Loss of habitat. 2. Possible harm from toxic waters in solution ponds and from man.	1a. Rescue and relocate any protected species. 1b. Provide alternative sources of fresh water for wildlife – tanks, etc. 2a. Provide protection/prevention of wildlife from exposure (fence, and in-heap solution reservoir). 2b. Worker awareness program/enforcement to protect wildlife from exploitation
Land Use	1. General land use changes; loss of potential use in area.	1. Reclamation (rehabilitation) to allow beneficial future use.
Archaeology – Historical Sites	1. Loss or impact to monuments and other historical/archaeological sites.	1. Provide protection of historical sites (stabilization of Cerro San Pedro church, relocation of La Zapatilla church, etc) overseen by Social Program managed through a foundation established by MSX.
Humans	1. Accidents or hazards could impact workers and/or community health. 2. Health risk from ARD, NaCN, other toxic contamination of air, soils, and water.	1. Develop accident prevention program that is protective of the local community. 2. Same preventive/protective measures noted above.
Demography/ Communities	1. Effect on villages of Cerro de San Pedro and La Zapatilla and its individual residences in vicinity of operation. 2. Loss of sense of community.	1. Relocation of inhabitants, with their permission, to new homes and improved services in a new village or a safe distance from operations and/or compensation to move elsewhere. 2. Social Program to mitigate affects.

Table 10.8 (continued)

Environmental – Socioeconomic Component	Potential Impacts	Mitigation Measures
Economic Activity	1. Local inhabitants may not share in the economic benefits of project. 2. Closure may generate unemployment and decrease commercial opportunities.	1. Commitment to hiring local inhabitants when possible. As many as 350 new jobs will be created. 2a. Generation of taxes and mineral revenues from mineral extraction to government to be used to benefit local and regional community/encourage planning for future. 2b. MSX to assist in developing urbanization program to train local population and promote other economic areas.

10.5 Environmental Management

An overall environmental/health and safety management program will be implemented during construction and operations at Cerro San Pedro to minimize or mitigate any environmental, health and safety, and socioeconomic impacts. This program will be based on the terms and conditions set forth in the MIA Resolution and on standard practices followed in other Glamis operations in the United States.

10.5.1 Vegetation and Wildlife Management

Impacts to vegetation and wildlife habitats will be due to the physical presence of the various structures (pit, waste rock dumps, heap leach pad and ancillary facilities) and increased human activity and access to developed areas. To ensure the protection of flora and fauna in the project area, particularly the three protected species of cactus, MSX will rescue and protect these species prior to operations. Protected cactus species and possibly additional floral species that would be useful for subsequent reclamation will be rescued and protected. At the end of operations, species will be reestablished at properly prepared sites (see reforestation plan in Section 11.0 Reclamation and Closure). During operations the following management policies will be implemented:

- all employees and contractors will be prohibited from harvesting any vegetation and hunting any wildlife;
- the Environmental Department in conjunction with construction will establish and maintain alternate sources of fresh water that can be used by local wildlife, and
- wildlife species (birds) will be protected from any hazardous ponds by installing and maintaining floating balls or nets to scare birds away and erecting fences for a barrier to access by other wildlife.

10.5.2 Materials Management

As is typical of any mine, the Cerro San Pedro project will consume significant quantities of chemicals during the construction and operation phases. These chemicals include fuel for power generation and mobile equipment, various reagents for heap leaching and processing, and explosives for blasting.

Fuel storage design will provide for tanks with a retention dike 1.5 m high capable of containing 110 percent of the volume of the largest tank.

The transportation, handling, storage, and use of chemical reagents must be managed carefully. Workers will be thoroughly trained in safe procedures for handling these reagents. Personal protective equipment (PPE) will be used where appropriate and work areas will be properly ventilated. Incompatible chemicals will not be stored next to one another (e.g., sodium cyanide and acids). Spill contingency planning will be in place for transport and on-site handling of these chemicals.

Proper handling of explosives is crucial to ensure employee and public safety. The explosives magazine will be constructed in strict compliance with the requirements of the Secretary of Defense who oversees the storage and use of explosives in Mexico. Personnel in charge of explosives transport will have specialized training and be knowledgeable of all precautions for the handling of explosive substances.

An Accident Prevention Plan and Spill Prevention Plan will be developed with training for all employees. A Spill Contingency Plan (SCP) will be designed to deal with fuel spills, chemical and reagent spills, and pipeline ruptures. The purpose of the SCP is to provide an immediate response to the spillage of hazardous substances. The objective of this plan is to minimize the impact of the spill on the environment. All operations personnel will be trained in basic spill response and provided with procedures for contacting the On-Scene Coordinator. To reduce the risk of a spill during transport of fuel or chemicals, MSX will ensure that all potentially hazardous materials will be transported by qualified

contractors. MSX will also require a Transport Emergency Plan from the contractor as part of the contract.

10.5.3 Waste Management

The waste management plan deals with the following operational aspects of the project: acid rock drainage management, waste rock management, leached ore and cyanide solution management, hazardous waste management, and non-hazardous waste management.

Mine Waste/Acid Rock Drainage

A detailed plan to encapsulate sulfidic and/or potentially acid generating (PAG) rock within neutralizing limestone waste rock and to isolate sulfidic rock exposures in the pit will be developed during operations. Waste rock will be managed so that any potential for acid rock drainage to develop is prevented. Based on the mine schedule, the dump material will be comprised of a limestone (neutralizing/acid consuming) to porphyry (acid generating) waste rock ratio of 14:1. Of the relatively minor amount of PAG material in the dump, nearly 60 percent is Porphyry Oxide which will contribute very little to acidity. It is expected that proper blending/encapsulating of PAG materials within limestone and placement of strategic limestone rock buffers within the waste rock dump will create a system with an overall potential leachate that is alkaline. Alkalinity of the overall system will mean that no ARD will occur which will inhibit most metals of concern from going into solution. See Section 11.0 Closure for more details. Another positive factor is that the dump is sited on natural limestone bedrock. Measures will be taken to control excess erosion and sedimentation from the dump surface and to divert run-on of surface water. An analysis of the water balance following closure of the dump using the HELP and SoilCover computer models indicates that there will be little or no leachate exiting from the bottom of the waste dump.

Because groundwater is significantly below the bottom of the proposed pit, the only contribution to water in the pit will be from precipitation falling directly into the pit and surface run-off into the pit from upgradient areas during storm events. Diversion of surface run-off from entering the pit will be accomplished through construction of diversion ditches during operations and these will remain post-mining around the upgradient perimeter of the pit. In-pit diversions may also be constructed to intercept water before it accumulates in the pit bottom. With just the perimeter diversion, it is currently estimated that a shallow lake (approximately 5m deep or less) may form locally at the bottom of the pit following a very large storm event. An estimated 50 percent of the entire pit surface exposures are PAG material (primarily in the pit floor), with the remaining 50 percent limestone (primarily in the pit walls). The degree of sulfide oxidation and acid generation within the pit is expected to be minimal due to the arid climate

and the fact that 60 percent of the PAG material is only very slightly acid generating. Backfilling of limestone in the pit floor may be considered to provide neutralizing effects to water that may be acidic.

Studies will be conducted during operations to determine if spent ore on the leach pad will have the potential to generate acid leachate upon closure. The control of heap solutions and leachate is discussed under water management.

Hazardous Waste

Hazardous waste includes solid wastes such as lead-acid batteries and oil filters, and liquid wastes such as waste oil, engine coolant, spent laboratory chemicals, and solvents. Wastes generated from the use of hazardous substances will be collected and properly disposed. Disposal methods include return to the supplier or manufacturer, backhauling by a licensed contractor to an off-site hazardous waste recycling or disposal facility if available, or reuse of the spent material. Where applicable, the hazardous substance supplier will be responsible for the disposal of empty plastic or metal containers.

Non-Hazardous (Solid) Waste)

Non-hazardous waste consists of materials such as domestic garbage, sewage, construction debris, and plastics. Special care will be taken to minimize waste generation and to manage the disposal of any waste materials produced. On and off-site recycling will reduce the volume of non-hazardous solid waste at the project site. Remaining non-hazardous wastes will be buried in designated disposal sites.

Some industrial solid wastes, such as empty plastic drums, scrap steel, surplus construction materials, used rubber products (tires, conveyor belting), and unsalvageable used equipment, will be made available for resale or returned to the supplier where this option is available. Another alternative would be to bury it in the solid waste disposal site with the domestic refuse.

Raw sewage will be discharged into a septic tank and drain field. The oil separated from wastewater will be handled as hazardous waste.

10.5.4 Water Management

The potential impacts to water at the site will be managed during operations and post-closure in several manners. Water will be conserved, particularly with regard to the closure strategy of detoxifying/depleting heap solutions by recirculation/evaporation of solutions versus rinsing with fresh

water. Collection of natural run-off into operational facilities (the pit, dump, and leach pad) will be limited by run-on diversion structures, thereby decreasing the potential to generate leachate and/or acid rock drainage in the long term. During operations and post-closure, cyanide heap solutions and/or any potential residual leachate will be isolated from the underlying bedrock by a geo-synthetic liner system. Any precipitation that is contributed directly onto the heap leach pad during operations will become part of the solution management system and will be contained through a collection and pumping system Water quality monitoring for all these components is covered under Monitoring 10.5.6. Road construction activities will be managed to ensure that the normal cycle of discharge in watercourses is not impeded.

10.5.5 Air Quality and Noise Management

The air quality and noise management plans will ensure the ambient and workplace air and noise levels are adequate to protect the health of the workers and at the same time will not reduce the efficiency of ore extraction and processing for the Cerro San Pedro project.

The air quality management plan will include measures to minimize air emissions from major sources. Fugitive dust is of most concern regarding air quality and will be mitigated by application of water to facilitate dust suppression on haul roads and the application of water, through sprays, at the lime bin to control dust during addition of lime to the ore. Scrubbers will be installed at several locations in the Merrill-Crowe recovery plant to control the release of air-borne metals and ash.

Exposure to noise with continuous sound intensity greater than 85 dBA, or a single exposure to sound exceeding 140 dBA, is detrimental to the hearing function. Sound levels will be monitored in critical areas and employees will be required to wear hearing protection in areas where noise exceeds a safe level. Noise generated by mining equipment and blasting will be minimized through appropriate mine planning and scheduling. Monitoring of all blasts will be performed at selected historic structures in Cerro de San Pedro to ensure that vibration and air blast levels stay within the allowable standards.

10.5.6 Environmental Monitoring Plan

The monitoring plan is an integral component of the environmental management program to be implemented as part of the Cerro San Pedro project. This plan describes monitoring activities that will be carried out to evaluate the status of each environmental component. The main objectives of this plan are: to identify changes which could take place in the environment as a result of project development; to evaluate the effectiveness of preventive and control measures implemented as mitigation strategies; and to ensure

compliance with applicable environmental regulations. Monitoring activities will be performed according to internationally accepted standard procedures and requirements by SEMARNAP.

The plan is designed to monitor all of the environmental components identified and described in the environmental baseline study, including: physical components such as air, groundwater and soils; biological components such as fauna and flora; and cultural resources. Monitoring activities will be established for the following project features: open pit, heap leach facility/process area, precious metals recovery plant, haulage roads, waste rock dumps, and other ancillary facilities including hazardous and solid waste storage areas. Meteorological monitoring will be conducted on a continuous basis.

10.5.7 Reclamation and Closure

Reclamation and closure of the project is discussed in the next section, Section 11.0.

10.6 Socio-Economics

The Municipality of Cerro de San Pedro is adjoined to the north by the Municipalities of Zaragoza and San Luis Potosí, to the west by the Municipality of Soledad de Graciano, and to the east by the Municipality of Armadillo de los Infante. The official seat of the Municipality of Cerro de San Pedro is in the village of the same name and has jurisdiction over the following communities within the township: Cerro de San Pedro, Cuesta de Campa, Portezuelo, La Zapatilla, El Encino, Jesús María, Calderón, and Monte Caldera. Socio-economic information was developed primarily for the Municipality of Cerro de San Pedro.

10.6.1 Baseline Economic Data

As part of the MIA, a survey was conducted in 1997 to determine the level of economic activity within the Municipality of Cerro de San Pedro and the results are listed in the Table 10.9 below:

Table 10.9

Economic Activity in the Municipality of Cerro de San Pedro				
Age	Economically active population	Economically non-active population	Population without specific activity	Population of working age
15-19	92	206	5	303
20-24	111	94	1	206
25-29	78	88	0	166
30-34	69	66	0	124
35-39	56	46	0	102
40-44	31	38	0	69
45-49	22	50	0	72
50-54	40	42	0	82
55-59	23	39	0	62
Total	**522**	**669**	**6**	**1,186**

These statistics suggest that approximately 56 percent of the population of working age is not employed. The main work activities that the population is engaged in are agriculture and unskilled labor with minor participation in mining. This is due to the decrease in mining production and the lack of education required to obtain qualified employment.

The official minimum daily salary in August 1999 in Cerro de San Pedro was $30.20 Mexican pesos. The wages in the Cerro de San Pedro area are from less than one minimum daily salary to three times the minimum daily salary. In agricultural activity, the population that collects less than one minimum daily salary represents almost 50 percent of the people dedicated to this activity.

After considering the segment of the population that collects less than one minimum daily salary, the population that collects from one to two minimum daily salaries make-up the highest percentage of the total. As this illustrates, the economic conditions in the area are poor and there is need of better employment.

10.6.2 Baseline Population Characteristics

The communities that are in the proximity of the Cerro San Pedro Project and will be affected by the project are as follows: El Portezuelo, Monte Caldera, Joyita de la Cruz, Jesús María, Divisadero, Calderón, Cerro de San Pedro, La Zapatilla, Cuesta de Campa, and Las Trojes.

Cerro de San Pedro has experienced growth as a community with very little order and has never had a stable population. The increase or decrease of its growth has depended on the success or failure of the mines in the area.

The total population of the Municipality of Cerro de San Pedro in 1990 was 2,054 inhabitants in the 14 communities identified in Table 10.10. In total, males represent 50.7 percent of the population and females 49.3 percent of the population.

Table 10.10

Population Characteristics of the Municipality of Cerro de San Pedro

Population	Males	Females	Total
El Portezuelo (San Pedro)	478	495	973
Monte Caldera	101	109	210
Joyita de la Cruz	118	89	207
Jesús María	68	73	141
Divisadero	67	70	137
Calderón (Quiroz)	64	47	111
Cerro de San Pedro	48	41	89
La Zapatilla	48	38	86
Cuesta de Campa	33	32	65
Las Trojes	16	19	35
Total	**1,041**	**1,013**	**2,054**

Table 10.11 presents a history of the changes in total population of the Municipality of Cerro de San Pedro over the past 40 years.

Table 10.11

Historic Population of the Municipality of Cerro de San Pedro	
Year	**Total Population**
1950	3,032
1960	2,105
1970	1,975
1980	1,938
1990	2,054

From 1950 to 1980, the population decreased by 36 percent resulting from the lack of work, poorly remunerated jobs, and lack of basic services such as health and education. From 1980 to 1990, there has been a slight increase in the population, resulting not only from higher birth rates, but also from the increase in general services provided in the area, which has made it more attractive for the population to remain in their place of origin. Approximately 53 percent of the increase in the population since 1980 is in the age group between 0 and 19 years which further increases the pressure for better regional development to satisfy the demand that families have for services, employment, and housing.

10.6.3 Socio-Economic Mitigation

The development of the Cerro San Pedro project will require the relocation of the 22 families that live in the village of La Zapatilla to make room for the leach pad. In addition, the open pit mining operations will take place adjacent to the village of Cerro de San Pedro, where 24 families live as permanent residents. Of these families, 20 in La Zapatilla village will be relocated to a new village built by MSX, approximately 2 kilometers southwest of the present La Zapatilla village. In addition, an undetermined number may choose to be relocated to new housing built by MSX within the village of Cerro de San Pedro. Other families have been compensated to relocate to other sites of their choice. Housing, other community infrastructure, and municipal services will be provided at or above the current standard of living conditions. As part of the community infrastructure that MSX will provide, a school will be constructed that can accommodate up to 40 children at the new La Zapatilla village. Currently, school children from La Zapatilla attend school at Portezuelo 6 kilometers away.

10.6.4 Socio-Economic Programs

In addition to giving preferential hiring consideration to people from the nearby communities, MSX has committed to assist in the sustainable economic and social development of the area surrounding the project, including the villages of Cerro de San Pedro, Cuesta de Campa, Monte Caldera, and La Zapatilla. An urbanization plan for the zone taking into account the actual conditions of the area and the benefits that the project will generate was developed to form the basis for long-term regional development. The urbanization plan is part of the documents that were submitted to the State as required for the Land Use License.

MSX has formed a non-profit foundation (Fundación Pro-Preservación del Pueblo de Cerro de San Pedro, A.C.) to supervise and administer the funds that the Company will donate to preserve the village of Cerro de San Pedro and assist the surrounding communities. The foundation will develop programs that require the participation of the members of the community and will be structured to be self-sustaining in the long-term. The ways that the foundation will provide for the benefit of the community include:

- Preservation of the historical monuments in the village of Cerro de San Pedro. The San Pedro Church will be structurally stabilized prior to starting mining operations and both the San Pedro and the San Nicolas churches will be restored during the operational phase of the project.

- Promote tourism in the area through improvements to its infrastructure and by establishing cultural programs that are based on local folklore and traditions.

- Establish programs dedicated to the conservation of the environment such as a botanical garden and a laboratory to study the native species of the region.

- Promote the development of cottage industries such as a silversmith cooperative that can not only provide an economic self-sustaining alternative, but will also create a product compatible with tourism in the area.

11.0 RECLAMATION AND CLOSURE

11.1 Introduction

A successful mine closure strategy involves selection of technical approaches that are compatible with the site and with mine operations and which can be implemented in a timely and cost effective manner. The primary closure objective is to leave the land in a safe and stable configuration suitable for the preferred post-mining use. In achieving this objective, geotechnical stability must be maintained, along with protection of surface and groundwater. The applicable environmental standards for closure of the heap leach operation at Cerro San Pedro are dependent upon the defined post-mining use of the land and water. The main water quality concern relates to the disposal of cyanide and the potential for generation of acid mine drainage containing elevated metals concentrations. From a geotechnical stability viewpoint, the primary concern relates to the slope stability of the leach pad, waste rock disposal facility, and pit walls.

The reclamation and closure plan presented here was summarized from a more comprehensive document prepared by Shepherd Miller and the closure strategy group, which consisted of Dr. Terry Mudder, Kevin Harvey, and Mark Logsdon. This comprehensive study is included in the Appendix for this section.

Approximately 371 hectares will be disturbed during construction and operation of the proposed Cerro San Pedro project. This figure is considered to be a maximum disturbance area based on the project permitting contained in the MIA submittal. Current designs, operational configurations, and area of surface disturbance may vary substantially, especially for the heap leach pad, pit, and waste rock dumps as a function of actual mined tonnage. A breakdown of the maximum disturbed area by facility, based on what was approved in the MIA, was presented earlier as Table 10.7.

As part of its commitment to ensuring protection of the environment, MSX will also address spent ore and tailings dumps related to previous vat leaching operations that are located in the footprint of the mine and leach pad and the historic ASARCO waste dumps located within and adjacent to San Pedro Creek.

11.2 Requirements and Practices

The Cerro San Pedro Project site is semi-arid and the land is not used extensively for agricultural purposes. Land use of the site and surroundings is classified by the National Institute of Geography and Information

(INEGI) as forestry land. Actual land use of the area is mainly for limited livestock grazing (cattle and goats) and seasonal crops. In addition, at least four small metal extraction operations were located until recently in the area. The primary concern is to return the land to its native configuration to provide a habitat for important local species of animals and plants. There are no perennial streams and groundwater is limited and deep. In this particular situation, the risk of impacting useful water supplies is very low and contamination is unlikely. The potential is also low for production of large volumes of seepage from the spent leach pad or the waste rock facility, due to the low precipitation within the region.

The specific objectives of reclamation and closure of the Cerro San Pedro mining project are:

- Mitigation of environmental impact resulting from mine operations;
- Compliance with applicable environmental laws and regulations;
- Geotechnical and geochemical stability of the post-mining landscape;
- A safe post-mining environment for nearby residents and visitors;
- A useful post-mining landscape capable of supporting native plant communities, wildlife habitat, watershed functions and limited livestock grazing.

11.3 Surface Reclamation and Revegetation Plan

The objectives and principles of the reclamation and revegetation program for the Cerro San Pedro mining project are:

- salvaging suitable soil, where available, prior to mine facility construction and re-use during reclamation and revegetation;
- re-contouring the land disturbed by mining, where feasible, so that it is stable, adequately drained and suitable for long-term land use;
- minimizing the long-term visual impacts by creating landforms which are compatible with the surrounding landscape;
- reinstating natural drainage patterns disrupted by mining, wherever feasible;

- preventing erosion by wind and water both during and following mining;
- preventing the oxidation of potentially acid generating materials;
- revegetation of the closed leach pad, waste rock dump microsites, and ancillary mine facilities using protected cactus species rescued prior to mining and native trees and shrubs representing six of the most important species of the region (in accordance with the MIA); and
- the establishment of a sustainable post-mining plant community similar in composition and density to pre-mine conditions, that supports post-mining land uses including wildlife habitat, watershed functions, and limited livestock grazing.

11.3.1 Soils and Soil Availability for Reclamation

Soils in the area of the proposed open pit and waste rock dump consist principally of lithosols, thin layers of clayey sand from 1 to 10 cm in thickness with little organic content, abundant rock fragments, and some caliche. Caliche is sand and clay particles cemented together by calcium carbonate precipitates as a result of evaporation.

Soils in the area of the proposed heap leach pad consist of calcic Xerisols and Castanozems. The Xerisols are very dry sandy silts and clay, from 1 to 20 cm in thickness, with little organic matter, and many small caliche fragments. Xerisols are found on upland sites with less than 5° slopes. Castanozems are a better developed, sandy soil with a distinct profile up to 75 cm deep, containing plant roots and abundant caliche fragments. Castanozems cover the flat areas of the valley immediately west of the proposed mine.

Soils found along the dry washes (arroyos) consist of Fluvisols or Luvisols. These soils consist of well graded clay, silts, sands and gravels transported and deposited by storm runoff.

It should be noted that although soil depths are reported to range from 10 to 75 cm, the distribution of soils in most areas is extremely sparse. Most of the surface in the area of the proposed mine consists of bare rock with only small pockets of soil. Within the proposed leach pad area, it is planned that an average of 20 cm of the surficial soil will be salvaged during construction for use during reclamation (WESTEC, 1998), based on observations in numerous test pits and trenches.

11.3.2 Surface Reclamation and Revegetation Procedures

To achieve the objectives stated above and given the constraints of soils availability, a systematic reclamation and revegetation program has been developed for implementation during closure of the mine site. The sequence of reclamation and revegetation activities is as follows:

Re-contouring

Important considerations in mine reclamation are slope stability, erosion control, integrity of drainage basins, and visual impact. Re-contouring of the spent ore within the leach pad and the surface of the waste rock dump during closure will address these considerations and prepare the site for revegetation. Re-contouring will be used sparingly on the leach pad and the waste rock dump to acquire a more natural topography and, in the case of the waste rock dump, primarily to establish moisture collection basins. The moisture collection basins will be designed to facilitate micro-site development, aid revegetation performance and reduce erosion.

Coversoil Application

The availability of natural soil for salvage and reclamation at the Cerro San Pedro mine site is limited. Where possible, soil will be removed prior to mine construction and stockpiled for later re-spreading during reclamation and revegetation. Very little soil will be available for salvage and reclamation of the waste rock dump. What soil is available will be applied over the moisture collection basins to enhance micro-site development. Research has shown that even a few centimeters of re-applied coversoil can improve plant establishment and long-term revegetation performance. Re-applied coversoil has several properties that make it vastly superior to bare mine spoil as a plant growth medium including better soil structure, infiltration rate, water holding capacity, and nutrient availability.

Soil Construction

Much of the natural landscape in the area of the Cerro San Pedro mine project is a mosaic of exposed bedrock and micro-sites consisting of shallow soil with plant growth. This is especially true in the areas of the proposed open pit and the waste rock dump. There is relatively little natural soil in these areas for pre-mine salvage and post-mining reclamation. What little soil is available should be used to recreate these micro-sites by placing salvaged soil into the moisture collection basins prepared during the re-contouring phase. Additional plant growth medium can be constructed on a micro-site basis by directly amending the disturbed surfaces with organic materials (e.g., sewage sludge, animal manure or

compost) and fertilizers. Soil construction in this manner can be carried out by local work forces using small earth-moving equipment and hand tools. This effort will greatly enhance revegetation success.

Planting

Local work forces will be employed to plant protected species rescued prior to mining and transplanted cactus, agave and mesquite species selected for general revegetation. Additional details regarding revegetation and plant densities, planting methods, transplant handling methods and revegetation scheduling issues, are contained in the Flora and Fauna Compliance Program, which will be submitted to the regulatory authorities in accordance with conditions of the MIA Resolution. This document presents details and standard operating procedures regarding soil preparation, plant material preparation, planting, transplanting, fertilization, irrigation and maintenance of revegetation areas.

11.3.3 Protected Species Revegetation

In accordance with Mexican Official Regulation NOM-059-ECOL-1994, which lists the species of flora considered endangered, rare and subject to special protection, three cactus species with special protection status have been identified within the project area:

- *Mammillaria candida*, classified as endangered and endemic (A*); a total of 1,600 specimens have been identified;
- *Mammillaria crucigera*, classified as rare and endemic (R*); a total of 12,407 specimens have been identified;
- *Echinocactus platyacanthus*, classified as special protection (Pr); a total of 1,181 specimens have been identified

These three cactus species are distributed within the proposed mining project as previously presented in Table 10.5 of Section 10.0.

Prior to construction of a specific mine area or facility, the protected cactus plants identified in Table 10.5 will be removed and replanted in adjacent undisturbed areas.

11.3.4 Non-Protected Species Revegetation

One hundred species of plants were identified during pre-mine ecological inventories of the Cerro San Pedro project site. Based on these studies, the following twelve plant species have been selected for revegetation during mine closure:

- Euphorbia antisyphilitica (candelilla),
- Agave striata (espadin),
- Hechtia glomerata (guapilla),
- Prosopis leavigata (mesquite),
- Agave lechuguilla (lechuguilla),
- Schinus molle (piru),
- Jatropa dioica (sangregado),
- Acacia parviflora (garabatillo rosa),
- Myrtillocactus geometrizans (garambullo),
- Opuntia leucotricha (nopal duraznillo),
- Larrea tridentata (gobernadora),
- Ambrosia confertiflora (estafiate).

These twelve species represent the most important plant species in the area of the mine in terms of relative numbers. As such, they have been selected for use in revegetation of the leach pad, waste rock dump micro-sites, and the footprints of ancillary mine facilities. Planting densities will be based on average densities for natural (pre-mine) plant communities that include these species.

Plant materials used for revegetation will be obtained from various sources. Cactus materials will be obtained from surrounding areas by collecting slips or branches from mother plants. The harvesting of cactus materials in this manner will not impact the mother plants. Agaves can be harvested in a similar manner by collecting plantlets from the mature plants. This method actually improves the health of the mature plant. Agreements with SEMARNAP will be necessary prior to the harvesting of cactus and agave

materials in areas surrounding the mine site. It may be necessary to obtain mesquite plants from outside sources.

The cactus and mesquite species selected for revegetation will be planted by hand using local labor forces from nearby communities. Standard planting procedures will be prepared and distributed to workers in charge of revegetation. Prior to planting, revegetation crews will receive training in planting techniques for cactus and mesquite species.

Additional details regarding revegetation and plant densities, planting methods, transplant handling methods and revegetation scheduling issues, are contained in Flora and Fauna Compliance Program developed by MSX in July 1999 (Programa de Cumplimiento en Materia de Recursos Bióticos).

11.3.5 Revegetation Studies

Natural soil available for pre-mine salvaging and post-mining reclamation is extremely limited at the proposed Cerro San Pedro mine site. This will necessitate the use of alternative substrates for revegetation. Very little soil will be available for revegetation of the waste rock dump. What little soil is available should be salvaged and used to recreate micro-sites of soil and native vegetation. Soil building techniques may be required to augment the limited coversoil. Additional revegetation may also occur on the waste rock surface itself. In the case of the leach pad, there is a greater quantity of soil available for salvage and reclamation. However, some areas of the leach pad may require direct revegetation of the spent ore surface, especially the sloped areas. The same may be true for the other mine facilities including road surfaces, building footprints, etc.

Waste rock, spent ore and other materials potentially used as revegetation substrate will generally require techniques to increase their organic matter content and nutrient status. Soil building techniques may include the application of municipal sludge, animal manure or compost to the waste rock and spent ore surfaces during reclamation. Fertilizer application can be used to ensure that adequate nutrients are available for plant growth. Other techniques to increase revegetation performance on alternative substrates include the use of moisture collection basins and mulch to conserve available moisture.

It is proposed that these techniques and others be evaluated during the operational phase of mining in a series of revegetation studies. The primary objective of these studies will be to test various combinations of soil building, surface manipulation, irrigation and planting techniques to select the best revegetation prescription for post-mining implementation. It may be advantageous to invite the University of San Luis Potosi to assist in the design and management of these revegetation studies. These studies will utilize the same plant species that will be used for final revegetation. The revegetation studies will be carried

out during the operational phases of the mine to ensure that the results will be available within eight years.

11.4 Reclamation and Closure by Facility

Reclamation of any open-pit operation is difficult owing to the steep and rocky pit walls and limited access to most pit benches. These conditions are present at Cerro San Pedro, which, in addition, has a deep, local water table, which will eliminate the potential for a substantial pit lake. Reclamation and closure of the heap leach pad and waste dumps will be made more difficult by the general lack of existing topsoil in the area of the project site, the low rainfall, and the slow growth rate of plant species selected for revegetation.

11.4.1 Open Pit

Post-Mining Stability of Pit Walls

An extensive program of geotechnical tests (Abel, 1996) indicates that the rock within the pit could be mined in a safe manner at slope angles up to 70° with benches every 10 meters. The final slope angle of the pit walls will range from 48° to 54°. During operations, an ongoing program of geological structural mapping of the pit will be carried out to identify possible weak zones that may cause rock fall. Geotechnical stability monitoring will be carried out in accordance with the Pit Slope Stability Program referenced in the MIA. Zones identified as potential risks will be managed by modifying the pit design, benches, blasting program, and final pit wall angle. Other engineering controls will be considered as necessary. At closure, a final geotechnical assessment will be conducted to define long-term stability and provide safe conditions for tourists visiting the pit during post-mining land use.

Acid Rock Drainage

In order to mitigate against the contingency of acid rock drainage impacting a possible pit lake, the option of backfilling a small portion of the pit with acid-neutralizing limestone waste rock will be evaluated during operations.

Revegetation

Revegetation efforts within the open pit are anticipated to be limited to selected areas around the pit crest where visibility is a factor.

11.4.2 Heap Leach Pad / Solution Ponds

Depletion of Heap Solution

Following the end of precious metal recovery from the heap, the volume of heap solution will be reduced by evaporation using spray emitters and the cyanide concentration reduced by natural attenuation. Essentially all solution is anticipated to be depleted over a two-year period. Following solution depletion, surface reclamation and revegetation will commence.

Post-Mining Stability

Slope stability of the heap leach pad was evaluated as part of the facility design process. Site seismicity was considered in these evaluations. The heap will be built to a long-term stable configuration. Re-contouring of the leach pad may be carried out at reclamation, as necessary, to reduce slope angle and erosion potential to reduce visual impact. The risk of long-term gross instability of heap slopes is considered nonexistent.

Acid Rock Drainage

The vast majority of the ore placed on the heap has been shown to be non-acid generating. The small amount of acid generating ore will be surrounded by acid consuming ore, as well as solution buffered with lime to pH 11 to effectively prohibit acid rock drainage conditions from developing.

Surface Reclamation and Revegetation

In addition to standard procedures stated in Section 11.3, the surface reclamation and revegetation sequence for the leach pad and associated process facilities will be as follows:

Re-contouring: Surface re-contouring using earth-moving equipment will be conducted, as necessary, to reduce slope angles, improve slope stability, control erosion, ensure stability of applied coversoil, maintain the integrity of drainage basins, maximize runoff, and reduce visual impact. Benches may be removed to increase runoff and decrease infiltration. The as-built side slopes of 2:1 (horizontal:vertical) may be reduced to 3:1 to allow better retention of coversoil. A geosynthetic plastic liner will first be placed over those areas where heap leach material would be deposited during regrading/slope reduction.

Coversoil Application: A limited amount of soil is available in the area of the proposed leach pad for salvage and reuse during reclamation. Water balance modeling indicates that as little as 20 cm of applied coversoil with successful revegetation will substantially reduce or eliminate infiltration and subsequent leachate generation following closure. The limited soil that is available for salvage and reclamation may be admixed with silty material from an off-site source and distributed evenly up to 20 cm in depth across the top and any remaining flat benches where potential infiltration is greatest. Any remaining coversoil will be applied on the slopes.

Planting: Local work forces will be employed to plant protected species rescued prior to mining and transplanted cactus, agave and mesquite species selected for general revegetation. In addition, native grass species may be selected for seeding on the surface of the leach pad to promote evapotranspiration and coversoil stability.

Closure of Associated Process Facilities

The process facilities include the leach pad, solution ponds, and the Merrill-Crowe plant. At the point which metal recovery ceases and the process plant is not needed for treatment of residual process water, the process plant will be removed for use elsewhere or non-salvageable material from the buildings will be buried onsite. Concrete foundations will be removed and buried onsite or rubblized and buried in place prior to surface reclamation. Recyclable material, such as steel, will be recovered and shipped for sale as scrap.

11.4.3 Waste Rock Dump

Post-Mining Stability

During mine closure operations, a geotechnical review of the waste rock dump will be conducted to assess the as-built configuration versus the permitted design. Any potential stability risks identified during the geotechnical review can be addressed during the surface reclamation phase. Possible actions could include limited re-contouring of the waste rock dump to reduce slope angle, erosion potential and to reduce visual impact.

Acid Rock Drainage

Over 90 percent of the waste rock dump will be comprised of acid consuming/alkaline generating limestone waste rock. The small remaining amount of potentially acid generating waste rock will be encapsulated by the limestone rock. It is projected that leachate flow through the dump will be limited following closure, and any leachate flow exiting the dump will be in direct contact with limestone substrate.

Surface Reclamation and Revegetation

In addition to procedures in stated in Section 11.3, the surface reclamation and revegetation sequence for the waste rock dump will be as follows:

Re-contouring: Nominal surface re-contouring using earth-moving equipment will be conducted to control erosion, maintain the integrity of drainage basins, and reduce visual impact. Moisture-collection basins may be constructed during the re-contouring phase for construction of revegetation micro-sites. It is not anticipated that the dump faces will be recountoured.

Coversoil Application: The dominant soil types in the area of the proposed waste rock dump are lithosols. These poorly developed soils are typically less than 10 cm deep over bedrock or caliche. Much of the surface is devoid of soil, leaving only exposed bedrock. Therefore, it is expected that relatively little natural soil will be salvaged for use during reclamation. What soil is available will be moved from stockpiles and placed on the surface of the dump. Priority will be given to those areas with moisture collection basins constructed during the re-contouring phase.

Soil Construction: If necessary to achieve the objectives of revegetation, soil construction will be carried out on a micro-site basis using organic matter amendments (e.g., sewage sludge, animal manure and/or compost) and fertilizers. It is expected that this effort can be carried out by local work forces using small earth-moving and hauling equipment and hand tools.

Planting: Local work forces will be employed to plant protected species rescued prior to mining and transplanted cactus, agave and mesquite species selected for general revegetation.

11.4.4 Administration, Truck Shop, and Other Buildings

Buildings associated with the mine project include the maintenance shop and warehouse, administrative offices, a laboratory, a training building, a powder magazine and miscellaneous support structures. The

total area disturbed by the construction of mine buildings will be less than 1 hectare. Depending on the potential usefulness and location of the buildings, it may be worthwhile to deed or sell them to the community rather than remove them from the site. A plan regarding the final disposition of the buildings will be prepared prior to closure based on discussions with the local community and applicable regulatory authorities.

All buildings scheduled for decommissioning will be removed for use elsewhere or unsalvageable building materials will be destroyed and used as landfill during reclamation activities. Concrete foundations will be removed for use as fill or buried onsite prior to surface reclamation. Recyclable material, such as steel, will be recovered and shipped for sale as scrap. The footprint of the buildings and associated disturbed areas will be revegetated in accordance with Section 11.3.

11.4.5 Roads / Fuel Storage Areas / Miscellaneous

Access to the different operation areas of the mine will be by dirt roads. The 29-meter wide haul utilized to haul ore directly from the pit to the leach pad will be approximately 2 kilometers in length. In addition, a 25-meter wide road approximately 1.6 kilometer in length road will serve as access from the maintenance facilities to the run of mine haul road. The total area disturbed by these and other access roads/ramps is approximately 11 hectares. All access roads and ramps within the mine area not left for post-mining use will be decommissioned and revegetated in accordance with Section 11.3. Prior to revegetation, the road surfaces will be ripped and scarified to eliminate soil compaction and promote infiltration and plant root growth.

Diesel, gasoline and LP fuel storage tanks will be decommissioned and removed from the site during closure. Soil samples beneath and surrounding all fuel storage areas will be collected and analyzed to determine the presence or absence of hydrocarbon contamination. Contaminated soil encountered during closure will be remediated by either: (1) excavation, transport and disposal to a suitable containment site; (2) excavation and remediation onsite using bioremediation land farming techniques; (3) in-situ bioremedation techniques; or (4) onsite disposal in a lined cell. Disturbed surfaces associated with the former fuel storage areas will be revegetated in accordance with Section 11.3.

11.4.6 Existing Mine Wastes

- The Cerro de San Pedro mining district was discovered over 400 years ago. Since that time, several mining operations have been conducted in the area including more recent small-scale cyanide vat leach facilities. Existing mine waste identified within the proposed project area includes:

- approximately 20,000 tonnes of mine waste rock from the former ASARCO underground mining operation deposited within and adjacent to the San Pedro Creek channel;

- spent ore and tailings dumps associated with two small-scale cyanide vat leach operations within the proposed mine pit; and

- spent ore and tailings dumps associated with a small vat cyanide leach operation within the proposed leach pad.

The waste rock within and adjacent to the San Pedro Creek channel appears to contain residual sulfide mineralization and has oxidized to produce acid as evidenced by the coloration and thick ferrocrete deposits in the arroyo bottom. Analyses of sediment samples collected downstream of the waste rock deposits indicate that metals are being mobilized by storm water running off the waste rock and possibly the other spent ore/tailings dumps. To mitigate potential impacts, the waste rock will be removed and encapsulated in the mine waste rock dump during normal mine operations. The large amount of acid-neutralizing limestone in the waste rock dump should effectively prevent any further acid generation from these materials.

Historic tailings were processed on site using cyanide and are likely to contain residual metals. MSX proposes to clean up the historic tailings sites by excavating and removing the tailings, and disposing them within the proposed heap leach facility. The tailings therefore would be isolated within the heap leach pad where further exposure to the environment would be mitigated.

11.5 Monitoring

In accordance with the conditional authorization of the MIA for the Cerro San Pedro project, all environmental monitoring activities were documented in a single General Monitoring Program and submitted on February 2000. The General Monitoring Program includes post-closure plans for:

- soil erosion inspection and maintenance;

- monitoring of revegetation performance;
- monitoring the presence or absence of seepage from the waste rock dump and leach pad;
- monitoring and maintenance of post-closure seepage management systems for the leach pad (if necessary);
- water quality monitoring;
- monitoring of slope stability;
- the reporting of monitoring and maintenance information to the regulatory authorities.

11.6 Closure Costs and Schedule

A summary of the closure strategy for the Cerro San Pedro project is presented as Figure 11.1. Additional information about closure aspects of the various site facilities is presented below.

The heap leach facility closure objective is the chemical and physical stabilization of the spent ore pile. Anticipated closure activities of the heap include detoxification and depletion of the heap effluent, growth medium placement, revegetation and monitoring. Detoxification of the heap effluent will involve cyanide volatilization through recirculation of solution onto the heap. Depletion of effluent will occur simultaneous to the detoxification as the solution evaporates during recirculation. A finite quantity of residual effluent is likely to require disposal, but passive disposal techniques (Biopass) are anticipated. Growth medium, comprised of the soil pre-stripped from the heap footprint during construction, supported, as needed, by silt from an off-site location, will be placed over the entire heap surface, but primarily on flat surfaces such as the top surface and interlift benches. Estimates for design purposes indicate 20 cm of "topsoil" will be available. Regrading of the heap side slopes may be necessary to ensure long-term stability of applied coversoil. Revegetation will be achieved primarily by transplanting seedlings and cuttings of select native species. Monitoring will be conducted after the first growing season and periodically thereafter to evaluate the success of revegetation efforts and to assess the physical stability of the reclaimed facility.

The waste rock disposal site closure objective is primarily the physical stabilization of the facility. Reclamation activities at the waste rock dump are expected to be limited to selective topsoil placement, revegetation and monitoring. A limited quantity of growth medium application is anticipated with the constraint being the quantity of growth medium available from the facility footprint. Revegetation efforts will essentially be focused in the areas of growth medium placement, and primarily consist of transplanting mature plants in the manner described for the heap area. Revegetation of the dump side slopes will have to rely on volunteer invasion by native plants over a long time period. Because of the anticipated

PIT

- **Storm water run-on diversion.**
  - *Along pit perimeter.*
  - *Potential additional in-pit diversion.*
- **Passive chemical treatment.**
  - *Of pit water using on-site limestone backfill.*
- **Pit slope stabilization.**
  - *Operational/final geotechnical assessment to maximize long-term stability.*
- **Limited revegetation around crest.**

HEAP LEACH PAD

- **Storm water run-on diversion.**
- **Evaporation of solution.**
  - *Using spray emitters.*
- **Natural attenuation.**
  - *Of cyanide during evaporation/volatilization/re-carbonation.*
- **Depletion of entire heap solution inventory within 4 years.**
- **Incorporate kinetic testing results of spent ore after year 2 operations to determine any need for ARD management.**
- **Passive treatment using BioPass system if needed to meet water discharge limits for land application.**
- **Subsurface land application of any potential long-term residual seepage.**
- **Limited surface recontouring to maximize run-off, minimize erosion, and encourage revegetation.**
- **Infiltration barrier placement of 20 cm of cover soil.**
- **Revegetation with rescued/ protected species and other selected species.**

WASTE ROCK DUMP

- **Storm water run-on diversion.**
  - *Upgradient of dump.*
- **Placement of historic mining waste, spent ore and tailings in dump and/or leach pad.**
- **Selective handling of PAG materials (only 7% of waste rock).**
  - *During operations to encapsulate completely in alkaline-generating limestone waste.*
- **Control of erosion on dump surface with construction of moisture collection basins and limited recontouring of surface drainages/slopes.**
- **Refinement of modelling upon closure which currently shows little or no leachate development.**
- **Inherent passive chemical treatment and mixing of any PAG leachate with limestone leachate at 1:14 rock mass ratios (i.e., overall 1:175 acid/neut ratios).**
- **Revegetation with rescued/ protected species and other selected species at micro-sites.**

ANCILLARY MINE FACILITIES

- **Removal/salvage of processing facilities and/or on-site burial of non-hazardous, non-salvageable components.**
- **Return administrative/process/ shop/warehouse buildings to beneficial economic use of community where desirable or remove/salvage.**
- **Revegetation of the footprint of all affected areas with rescued/ protected species and other select species.**

REVEGETATION

- **Incorporate results of soil building and revegetation studies conducted during operations to maximize reclamation success at all facility areas.**

POST-CLOSURE MONITORING AND MAINTENANCE

- **Soil erosion inspection.**
- **Monitoring.**
  - *Revegetation performance.*
  - *Presence/absence of seepage from heap pad and waste rock dump.*
- **Monitoring/maintenance of post-closure seepage management systems for heap pad, if necessary.**
- **Reporting information to regulators.**

Figure 11.1 Closure Strategy - For Various Site Facilities

coarseness of material within the dump side slope and the steep topographic expression, development of vegetation on the slopes is expected to be limited. Potentially acid-generating (PAG) waste rock will be isolated within the crest confines of the dump in accordance with the waste rock management plan, within areas upon which vegetation may be established to inhibit deep infiltration. Monitoring will occur in a manner similar to that for the heap leach facility.

The mine pit closure objective is primarily one of securing the site. As such, the key activities involve developing institutional controls to prevent access by people, livestock and wildlife. This will be achieved by installing a three-strand barbed wire fence around the perimeter of the pit. Although water quality has been determined not to be a significant issue for the pit, installation of a perimeter diversion ditch is planned to limit water flow into the pit. As a contingency to mitigate the potential for acid drainage in the pit floor, partial backfilling of the pit floor will be completed following cessation of mining. This will entail placement of a small quantity of limestone waste rock in the floor of the pit where storm water may periodically accumulate and dissipate. Limited revegetation efforts are anticipated around the pit crest in selected areas where visibility is a factor. Monitoring of the revegetation efforts and inspection of the fencing and ditch will be conducted in coordination with monitoring of the reclaimed heap.

All other site facilities have been categorized under infrastructure for the purpose of reclamation cost estimation. These will include roads, buildings, process facilities and any other foundation pads, tanks and pipelines. Reclamation objectives include the removal of any environmental liabilities and the return of the site to a condition that resembles pre-mining conditions or restores productivity. All items that have a salvage value will be removed from site. Items that require disposal in a licensed facility will also be removed from site. Remaining items that are inert may be either demolished and buried on site in a construction debris landfill or buried in place. Particular structures may be preserved and donated to the local municipality for use by the community. Roads that will not be required after mine closure will be regraded and revegetated to approximate pre-mining conditions. Mine pit access roads will be rendered impassable by cross-ripping and/or mounding earthen piles across the roadway to discourage unwanted visitors.

Costs and schedule associated with the reclamation activities are considered capital costs and described above are summarized in Table 11.1. These costs should be considered budgetary figures only and will be reviewed and updated periodically as the closure plan is updated and as more information is developed during site operation. Most of the closure and reclamation costs will be incurred by outside contractors and consultants, but some costs in Years 8 and 9 could be, in part, consolidated labor and consumable costs related to company/MSX activities. Costs include coversoil placement on the heap top and side slopes, installation of additional geosynthetic liner around the leach pad to accommodate regrading, installation of a biopass system (or similar) for treating the heap effluent, and general revegetation of the heap leach pad

and waste dump. Environmental monitoring costs, both during operation and during the following reclamation, are considered as operating costs and report to under General and Administrative costs.

The schedule for completing the closure activities is controlled by the requirements contained in the MIA, specifically that completion of site reclamation shall be within four years of final processing. This timeframe allows for the depletion of heap effluent using evaporative recirculation without a need for external management facilities. A two-year period (beginning in Year 8 and continuing into year 10) of continued, but gradually reduced, solution flow through the heap is anticipated following the last placement of ore on the heap. The majority of the available precious metals should be recovered from the heap at the end of this two-year period. Formal reclamation and closure activities of the heap will then be initiated, starting with a two-year period of enhanced solution loss through evaporation and natural attenuation. At the end of this two-year period, the residual solution should be contained totally within the in-heap storage reservoir. Following this period, the heap will be regraded, coversoil applied, and the heap revegetated and the process and recovery equipment removed during Year 11. Reclamation and closure activities of the majority of the site buildings, the open pit, and the mine waste dump will be initiated starting immediately after the conclusion of mining in Year 8 and continuing into year 10. Annual inspections would be conducted thereafter to ensure the successful development of vegetative communities and check the general physical stability of the reclamation measures.

Table 11.1

Closure and Reclamation Costs					
Facility/Activity	**Year 9**	**Year 10**	**Year 11**	**Year 12**	**Total**
Leach Pad					
Detoxification/pumping		200,000	200,000		400,000
Passive treatment		75,000	75,000		150,000
Physical stabilization:					
Geosynthetic liner			250,000	250,000	500,000
Slope regrading			630,600	900,000	1,530,600
Coversoil placement			220,000	228,000	448,000
Revegetation:					
Soil building				25,000	25,000
Planting			58,200	120,000	178,200
Subtotal		275,000	1,433,800	1,523,000	3,231,800
Waste Rock Dump					
Physical stabilization:					
Topsoil placement	30,800				30,800
Revegetation:					
Soil building	100,000	78,000			178,000
Planting	100,200	60,000			160,200
Subtotal	231,000	138,000			369,000
Mine Pit					
Pit floor backfilling w/ls	21,000				21,000
Institutional controls:					
Imp. run-on diversion	1,100				1,100
Perimeter fencing	5,900				5,900
Revegetation/planting	10,000	10,000			20,000
Subtotal	38,000	10,000			48,000
Infrastructures					
Demo/salvage/removal	80,000	20,000			100,000
On-site disposal	40,000	10,000			50,000
Road recontour/reclam	20,000	20,000	7,500		47,500
Rehab disturbed areas	26,000	20,000	10,000		56,000
Subtotal	166,000	70,000	17,500		253,500
TOTAL	435,000	493,000	1,451,300	1,523,000	3,902,300
Contingency (10%)	43,500	49,300	145,100	268,200	390,200
TOTAL	478,000	542,300	1,596,400	1,675,300	4,292,500

12.0 ORGANIZATION, WORK SCHEDULE, HIRING AND BENEFITS

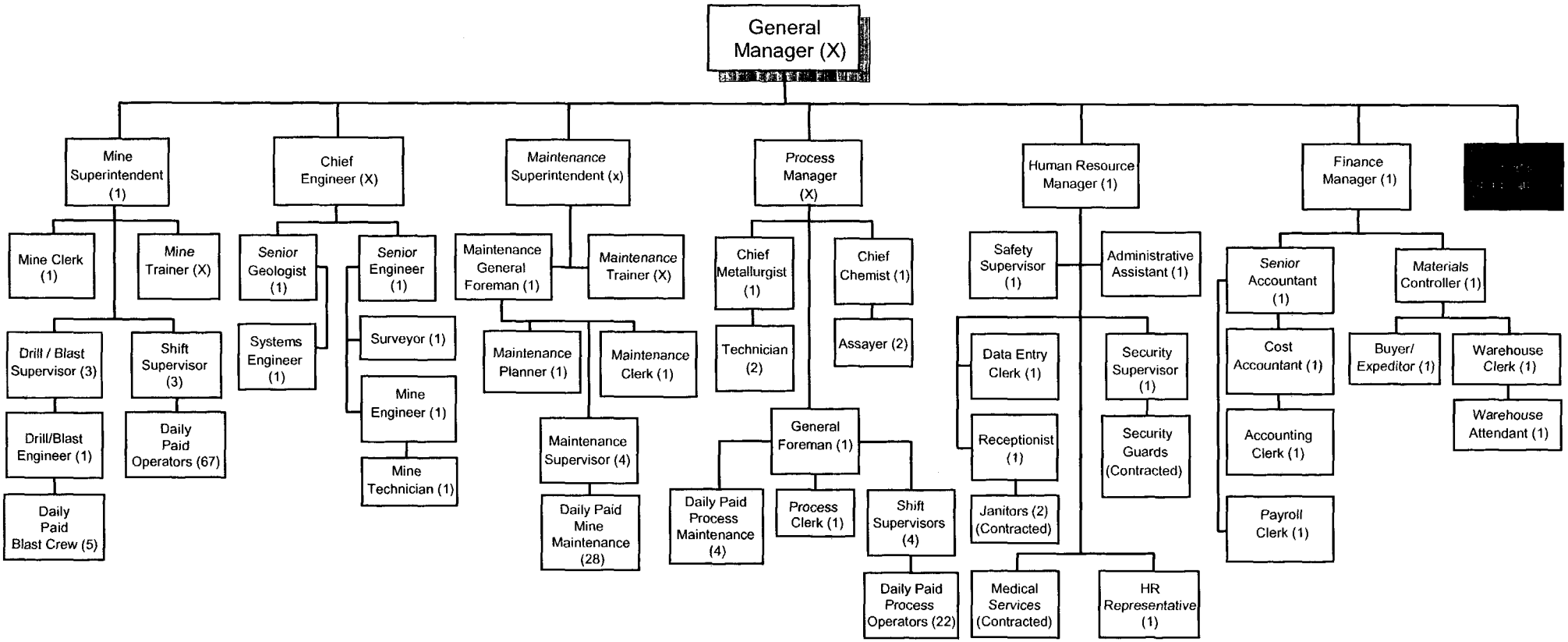
12.1 Organization and Staffing

The Cerro San Pedro Project will employ a traditional organizational structure and is divided into three primary areas - Mining, Processing, and General Services and Administration (G&A). The number of expatriate employees will be kept to a minimum, with all but two expatriate employees being replaced by national employees by Year 5 of operations. An overall project organization chart is presented in Figure 12.1 for operations Year 1. A summary of the manpower by area and by year is presented in Table 12.1 and summarized in Figure 12.2. The total number of operations employees ranges from 135 during year Preproduction (PP), increasing to a maximum of 178 in Years 2 through 4, then decreasing to 156 in Year 8, the last year of ore production. The number of employees drops during Years 9 and 10 when only residual metal recovery from the heap and some reclamation are occurring, and drops further during final reclamation and closure. Approximately 63 to 69 percent of the total employees are daily paid, with the balance being salaried.

All national employees, both salaried and daily paid, will be employed by Servicios San Xavier (SSX), a wholly-owned subsidiary of Glamis de Mexico, S.A. de C.V. SSX will supply employees to MSX under a Services Agreement. This arrangement will consolidate all employees under one Mexican company. Expatriate employees will work under a similar Services Agreement to MSX, but will be employed by newly created Canadian or U.S. companies to maintain existing benefits and simplify tax consequences.

12.2 Work Schedule

The work schedule for the Cerro San Pedro Project is based on compliance with Mexican Federal labor law, minimizing the amount of overtime pay and minimizing the amount of work performed on Sundays. Management staff will normally work day shift only, five or six days per week. Some supervisory and/or technical staff will work day shift only, while shift supervisors work a shift rotation schedule, the same as the daily paid employees. After operating experience is gained, it is assumed that the workers on shift rotations will rotate shifts in two to four week intervals. Table 12.2 presents a more detailed summary of the anticipated work schedule.



(X) = Expatriate

MINERA SAN XAVIER, S.A. de C.V.

Figure 12.1 Overall Project Organization Chart (Year 1)

Table 12.1

Total Manpower Summary by Year

Area	Category	Yr PP	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10	Yr 11	Yr 12
Mining	Expatriate	4	4	3	3	3	0	0	0	0	0	0	0	0
	National Staff	20	20	21	21	21	24	24	24	24	3	1	1	1
	Daily Paid	76	97	97	97	97	95	95	84	75	9	3	3	3
	Subtotal	100	121	121	121	121	119	119	108	99	12	9	9	9
Process	Expatriate	1	1	1	1	1	1	1	1	1	0	0	0	0
	National Staff	6	12	12	12	12	12	12	12	12	8	0	0	0
	Daily Paid	10	26	26	26	26	26	26	26	26	18	2	2	2
	Subtotal	17	39	39	39	39	39	39	39	39	26	2	2	2
G&A	Expatriate	1	1	1	1	1	1	1	1	1	0	0	0	0
	National Staff	17	17	17	17	17	17	17	17	17	4	3	3	3
	Daily Paid	0	0	0	0	0	0	0	0	0	0	0	0	0
	Subtotal	18	18	18	18	18	18	18	18	18	4	3	3	3
Total	Expatriate	6	6	5	5	5	2	2	2	2	0	0	0	0
	National Staff	43	49	50	50	50	53	53	53	53	15	4	4	4
	Daily Paid	86	123	123	123	123	121	121	110	101	27	9	9	9
Grand Total		135	178	178	178	178	176	176	165	156	42	18	18	18

Figure 12.2 Operations Manpower Summary
Preproduction through Closure

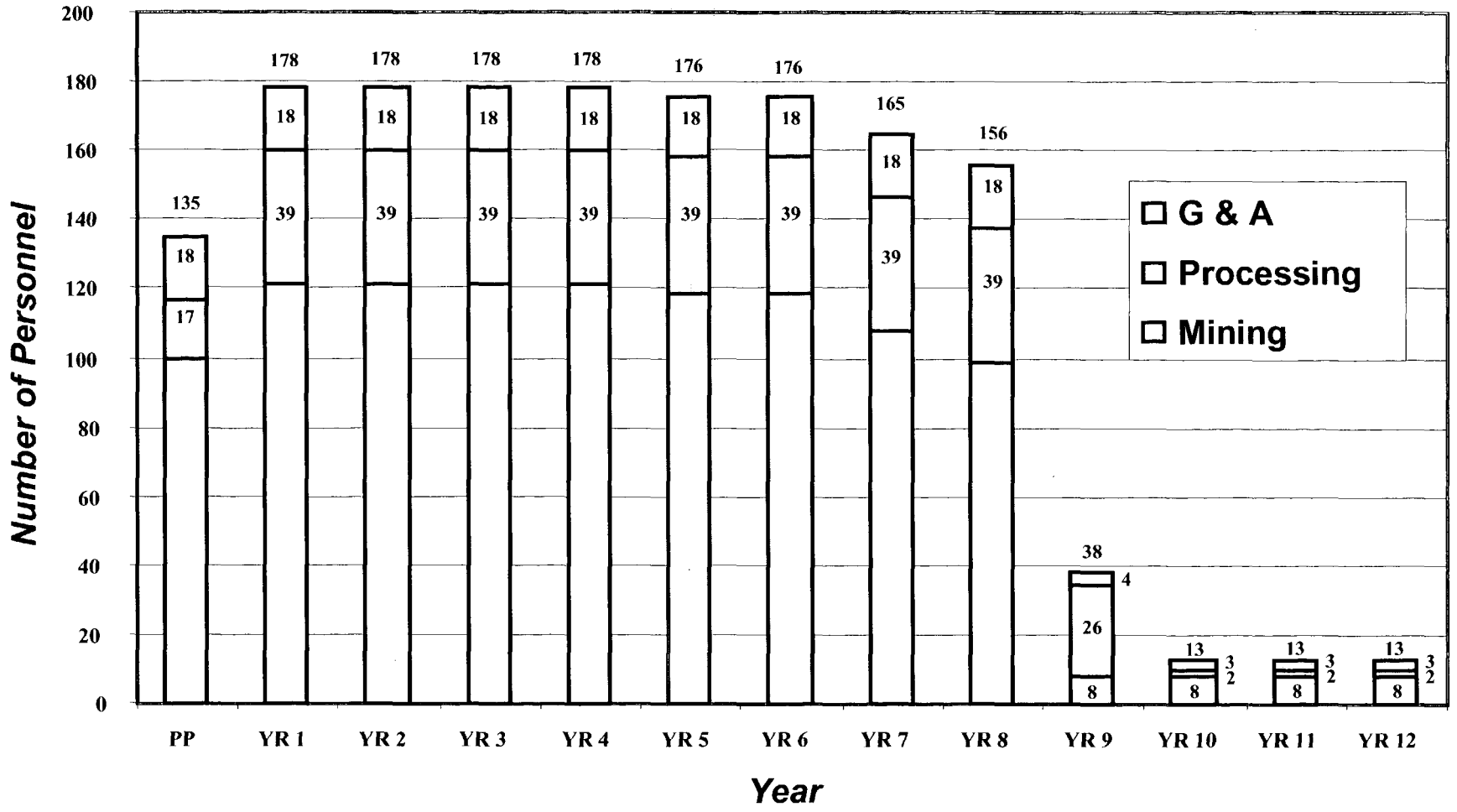


Table 12.2

Salaried and Daily Paid Labor Shift Schedule and Rotations					
Department/Section	**Senior Management**	**Supervisory or Technical**	**Staff**	**Supervisory**	**Daily Paid**
General Management	A	A	A	--	--
Mine Operations	A	A/B	A/B	D	D
Maintenance	A	A/B	A/B	C	C
Engineering	A	A/B	A/B	--	--
Process Operations	A	A/B	A/B	C	C
Process Chemistry	--	A/B	A/B	--	--
Process Metallurgy	--	A/B	A/B	--	--
Environmental	--	A	--	--	--
Admin – Finance	A	A/B	A/B	--	--
Admin – Hum Res	A	A/B	A/B	--	--
Admin – Mat Man	--	A/B	A/B	--	--
Security	To be managed by Contractor, based on Code D				

CODES:

A (Mon-Fri) Day shift only / 9.5 hours per shift / 48 hour work week

B (Mon-Sat) Day shift only / 8.0 hours per shift / 48 hour work week

C 24 hours per day, 7 days per week, 2 shift rotation / 12.0 hours per shift / 48 hour work week

D (Mon-Sat) 2 shift rotation / 10.5 hours per shift / 42 hour work week

12.3 Employee Salaries and Benefits

12.3.1 Salaries

Extensive salary surveys form the basis of the compensation packages for national salary and daily paid staff. The surveys consisted of published databases for mining companies in Mexico, contracted surveys performed in Mexico, as well as independent surveys of selected similar mining operations in Mexico conducted by MSX personnel. The results of these surveys were compiled to determine average wages for staff and daily paid labor classifications. These average base salaries were used and can be found in the respective sections of this study. Salaries for expatriate employees will be in accordance with the Glamis Gold's International Assignment Policy.

Daily paid rates are divided into four classes (A, B, C, and D) based on worker experience, seniority, and function. Table 12.3 presents a summary of the daily paid wages by class based on 365 paid days per year, not including any burden, shown in both pesos and U.S. dollars (9.4 pesos = $1.00 U.S.)

Table 12.3

Daily Paid Rates in Pesos/Dollars by Class			
Class	**Mine**	**Maintenance**	**Process**
A	Laborer 60/6.40	Laborer 60/6.40	Laborer 60/6.40
B	Support Operator 80/8.50	Serviceman 80/8.50	Support Operator 80/8.50
C	Production Operator 100/10.65	Tradesman 100/10.65	Production Operator 100/10.65
D	Senior Operator 125/13.30	Senior Tradesman 125/13.30	Senior Operator 125/13.30

At any one time, it is anticipated that there will be a mix of different wage classes among the daily paid employees, which will change with time as existing employees gain more experience and seniority and new employees are hired. For this reason, a weighted average daily paid wage was used in determining labor costing through the mine life and for the different operating areas. The average daily paid amount of 109 pesos, or $11.60, equates to $4,234 per year without any burden ($7000 per year with a 65% burden). In this feasibility study, there has been no allowance for an increase in salary due to inflation, cost of living increases, or employee seniority or tenure.

12.4.2 Benefits

Benefits are provided to all employees and are summarized on Table 12.4. All employees receive company-funded contributions for I.M.S.S., the Mexican-government administered plans of social security and basic medical care, and INFO/SAR, a government-sponsored housing allowance and savings plan. Overall benefit burdens, as a percentage of base salary, range from 65 percent for daily paid personnel to 18 percent for expatriate employees, based on the average salary for the type of employee.

Table 12.4

Summary of Benefits for Salaried and Daily Paid Employees				
Benefit	**Daily Paid**	**National Staff Junior/Inter**	**National Staff Senior**	**Expatriate**
I.M.S.S. (social/security/medical)	Yes	Yes	Yes	Yes
INFO/SAR (housing & savings)	Yes	Yes	Yes	Yes
Aguinaldo (Christmas bonus)	15 days pay	15 days pay	15 days pay	Incl. in base salary
Vacation Prime	+25% x 8 days pay	+25% x 12 days pay	+25% x 18 days pay	Incl. in base salary
Holidays	+4.5% of days pay	No premium	No premium	No premium
Food Coupons	Yes	Yes	Yes	No
Savings Fund	Yes	Yes	Yes	No
Medical Supplement	Yes	Yes	Yes	Glamis
Life Insurance	Yes	Yes	Yes	Glamis
Retirement Savings	No	No	No	Glamis
Total Benefit	65%	65 % (Junior) 60% (Inter)	55%	18%

12.3.3 Hiring Practices

To maximize the economic contribution of the project to the general San Luis Potosi area, a preferential hiring policy will be in effect for all national salaried and daily paid employees. These practices will be in effect during both construction and operations. The prioritized listing of geographical areas from which to draw employees will be:

- Cerro de San Pedro and surrounding villages
- City of San Luis Potosi
- San Luis Potosi State
- Rest of Mexico

Aside from where the potential employees live, normal employment criteria will be used for screening, including experience, skills, education, aptitude, willingness, physical fitness, honesty, flexibility, adaptability, attitude, and employment history.

Generally, recruitment will be the responsibility of the Human Resources Department and the area where the person will be employed (mining, processing, etc.). The hiring process will include safeguards such as background reference checks, drug testing, medical evaluations, criminal history checks, education verification, etc.

12.3.4 Training

Because of the stated preference to hire local employees and the lack of similar local mining operations, most of the staff and daily paid positions will require some amount of training. Training will generally be done in-house by both expatriate and national staff trainers. Training of employees is emphasized during preproduction through Year 2, after which the expatriate trainers depart and most training is restricted to newly hired employees.

13.0 CONSTRUCTION MANAGEMENT AND SCHEDULE

13.1 Construction Management

The major construction activities at Cerro San Pedro will be governed by "turn-key" contracts, which will include construction management, engineering, procurement, and safety functions for each construction area. Separate contracts will be awarded for general engineering and quality control/quality assurance; and for construction of the leach pad, process plant, electrical supply and distribution system, on-site buildings, and other small infrastructure packages. With the assistance of third-party engineer(s), the MSX construction management team will supervise and administer these contracts. The major construction contracts will be awarded on a lump-sum basis and will include requirements for contractor performance with regard to schedule, specifications, quality control and quality assurance, safety and environmental compliance, hiring, security, and procurement.

The Construction Project Manager, who will report to the project General Manager during the construction and commissioning period, will lead the MSX construction management team. In addition to the Construction Project Manager, other temporary MSX employees in the construction management team will include a safety officer, secretary, project accountant, clerk, and procurement manager. The Construction Project Manager will be hired only for a fixed term during construction, and will have previous experience with management of large multi-discipline construction projects. Other temporary MSX construction management team employees will have the opportunity (if appropriate) to fill permanent operating positions with MSX following successful project construction and commissioning.

All engineering designs and specifications will be subjected to a third-party engineering review before lump-sum construction contracts are awarded. Conformance with the designs and specifications will be assured by the third party engineer(s) hired by MSX to perform this work during the construction period.

The construction management team will be technically supported by vendors' representatives assisting in most major mechanical equipment installation, and by a specialized consultant to manage the Construction Quality Assurance (CQA) program during leach pad and solution pond construction activities. The construction management team will establish procedures and work methods with its managers and in consultation with the MSX environmental coordinator to ensure the protection of the environment, as required under the MIA conditions. A detailed plan and schedule for testing, start-up, and turnover will be prepared by the construction management team. The team will work closely with the MSX operating personnel to ensure proper testing, safety, and operating procedures.

As construction progresses, MSX operating personnel will provide additional support relating to environmental matters, permitting, and communication with different local and federal agencies, human resources, accounting, site first aid service, and security. Minera San Xavier, S.A. de C.V. (MSX) recognizes that an effective safety program during site construction is an absolute requirement. Figure 13.1 presents an organization chart effective during Cerro San Pedro project construction activities.

The combined capital budget for construction management, QA/QC and engineering at Cerro San Pedro is approximately $832,000, or more than 5% of the total estimated construction value. This budget is considered typical for a large heap leach operation administering turn-key construction contracts.

13.2 Execution Plan

The national staff construction employees will work 10 hours per day, 6 days a week. Their payroll will include all fringe and social benefits in effect in Mexico. MSX and its contractors will give hiring preference to residents living in nearby villages, including Cerro de San Pedro and La Zapatilla, in regard to the selection of the national workers composing the project construction workforce.

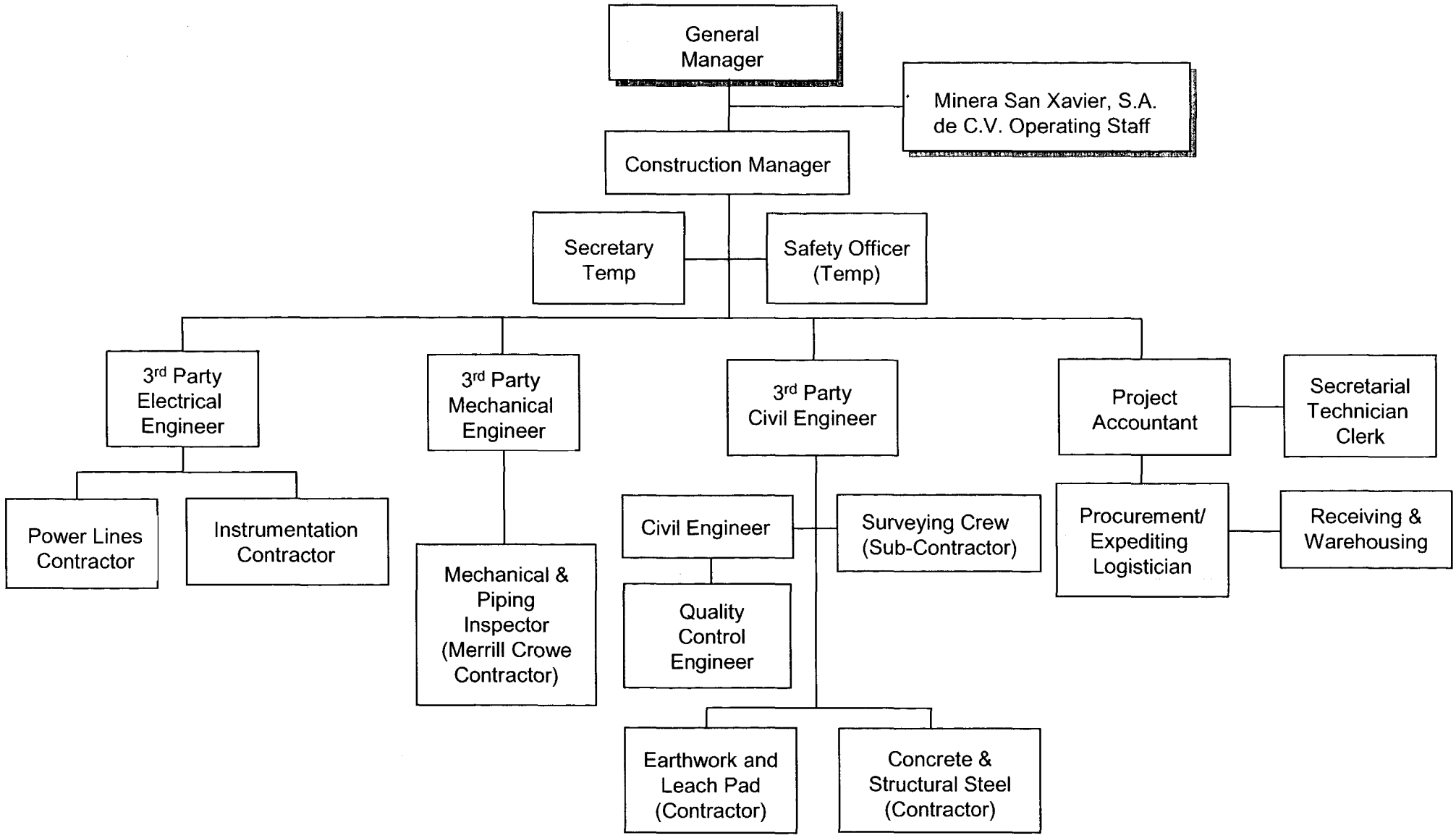
13.3 Procurement Plan

The Construction Project Manager will manage construction procurement with assistance from the Project Accountant and the Procurement Manager. The procurement activities include the execution of all contractual procedures such as Requests for Proposal, bid analysis, and final negotiations up to granting the final contract. A broker will handle all transportation and logistic procedures.

On site, the construction procurement department is responsible for the expediting and receiving of material and equipment purchased directly by MSX and then turned over to each appropriate contractor who is responsible for unloading, warehousing, and installation.

The construction procurement department is also responsible for managing the accounts payable for any local purchases that are not included in the contractor's scope of work, but are required for the proper execution of the project.

Engineering estimates and proposals have been received for all major construction areas required for development of the Cerro San Pedro project. Capital cost estimates and corresponding support for these estimates have been included in the previous chapters of this feasibility report. With the exception of the leach pad work and the process plant facilities, it is expected that construction contracts will be



MINERA SAN XAVIER, S.A. de C.V.

Figure 13.1 Organization Chart - Projects and Construction Team

issued to Mexican companies, with essentially all actual site construction work the responsibility of Mexican-based companies.

13.4 Engineering

The construction engineering activities and/or responsibilities will be divided into the following areas:

- Mechanical and Piping (including Merrill Crowe Plant and Solution Pumping)
- Electrical, Instrumentation, and Communications
- Civil Engineering (including leach pad, general earthworks, and concrete

The following engineering tasks are planned for completion prior to and during the construction phase:

- Detailed design-leach pad, ponds, and solution collection piping;
- Detailed design-power transmission, power distribution, and instrumentation;
- Detailed design-water well pumping and distribution system;
- Detailed design-solution pumping and Merrill Crowe plant; and
- Detailed design-truck shop, warehouse, office, and laboratory.

As discussed previously, the preliminary design for all of the Cerro San Pedro construction components has been developed, including sizing specifications and flowsheets. Most of the project buildings and attendant facilities will utilize "cookie cutter" or vendor package construction designs that are available to MSX from other successful heap leach projects. The preliminary design work is adequate to solicit detailed turn-key proposals from vendors, and will be used as the basis for detailed scope of work and requests for proposals from selected vendors. Because of the advanced nature of the preliminary design work, the detailed design efforts listed above can proceed concurrently with construction. The process engineering designs will mainly be in English whereas infrastructure engineering designs will be in both English and Spanish versions. Technical documents will be issued in English and Spanish. Most of the engineering design work has been, or will be, performed by Mexico-based companies. Major areas not designed by Mexico-based companies include the heap leach pad, and process solution and recovery.

13.5 Project Schedule

The summarized construction schedule by area is presented in Table 13.1 and is further illustrated in Figure 13.3.

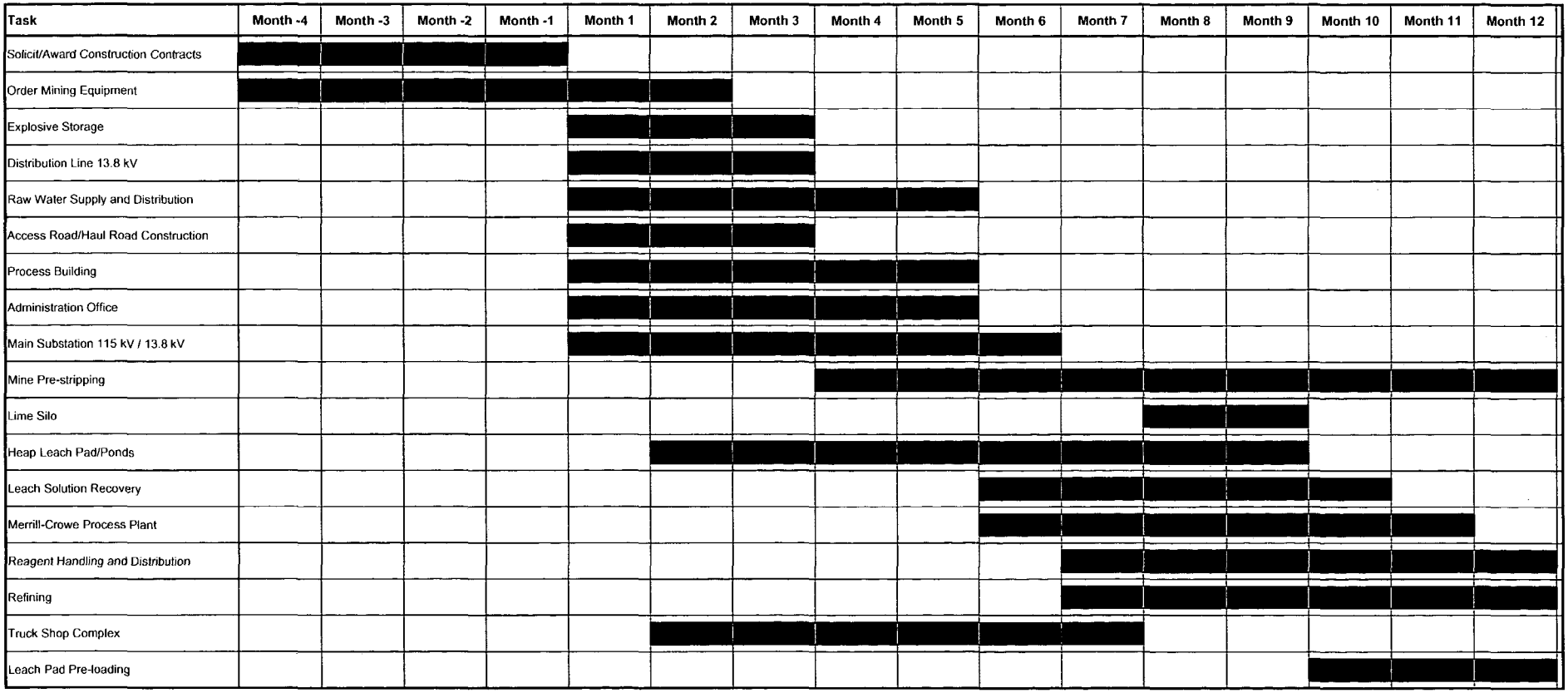
Table 13.1

Summarized Construction Schedule			
Major Area	**Initiation (Beginning Month)**	**Duration (Months)**	**Completion (End of Month)**
Solicit/Award Construction Contracts	-4	4	-1
Order Mining Equipment	-4	6	2
Explosive Storage	1	3	3
Distribution Line 13.8 kV	1	3	3
Raw Water Supply and Distribution	1	5	5
Access Road/Haul Road Construction	1	3	3
Process Building	1	5	5
Administration Office	1	5	5
Main Substation 115 kV / 13.8 kV	1	6	6
Mine Pre-stripping	4	9	12
Lime Silo	8	2	9
Heap Leach Pad/Ponds	2	8	9
Leach Solution Recovery	6	5	10
Merrill-Crowe Process Plant	6	6	11
Reagent Handling and Distribution	7	6	12
Refining	7	6	12
Truck Shop Complex	2	6	7
Leach Pad Pre-loading	10	3	12

Cerro San Pedro Project

Construction & Pre-production Time Line

Figure 13.2



Month 1 shows the start of the project and assumes that all the federal, state, and local permits, authorizations, impact studies, land purchases, rights-of-way, and water rights have been obtained, thereby enabling the construction work to legally begin.

As mentioned previously, engineering for the project is sufficiently advanced to allow solicitation of bids from qualified vendors for construction of major project work areas. Solicitation and evaluation of lump sum bids and awarding major contracts is expected to require 3 months of pre-construction schedule time. Other pre-construction activities will include relocation of protected cactus species and surveying on site. Approximately three months following commencement of construction, MSX will begin pre-stripping operations on site. Lead-time for the mining equipment involved in pre-stripping is estimated at 6 months, and orders for the equipment must be in place approximately 3 months prior to commencement of construction on site.

No other long lead-time equipment orders are anticipated for the Cerro San Pedro Project. As a result, the project construction schedule has been compressed to a period of 12 months. The electrical power line construction and commissioning is considered to be the critical link in the construction schedule. A 12-month construction schedule is typical for a large run-of-mine heap leach operation.

13.6 Construction Labor Force

Mexican contractors have confirmed the accuracy of the labor rates for various crew type compositions as shown in Table 13.2. The labor rates include fringe benefits, indirect costs (working clothes, transportation, small tools, consumables, etc.), and contractor administration and profits. The labor rates have been used to establish the construction costs for the areas of the project which have not yet been awarded to contractors. Table 13.2 also lists the average Mexican crew hourly labor rate based on a 48-hour-per-week working schedule for each specific working crew category. The working crews are scheduled to work a total of 60 hours per week, hence the inclusion of additional overtime wages over the regular (48 hours per week) wages. The concept of the hourly crew rate times the estimated hours or days to complete the various tasks leads to the labor component of the estimated construction cost of a specific area.

(based on a 60 hours per week working schedule)

Table 13.2

Typical Mexican National Working Crew Hourly Rate in ($)

Work Category	Worker Category	Crew Allocation %	Basic Regular Wages (Per week)	Overtime Wages (12 Hours)	Payroll Burden (150%)	Workmen Insurance (30%)	INDIRECT FEES (60%)								Weekly Wages Consildated	Crew Hourly Rate
							Working Clothes	Safety Supplies	Hand Tools	Consumables	Off-Site Transp.	Room & Board	Site Supervision	Adm. & Profits		
Earthworks	Crew Leader	10.00%	141.94	53.23	296.74	58.52	2.66	2.66	10.66	1.42	1.42	3.55	35.53	55.03	66.34	6.11
	Heavy Equipment Operator	10.00%	94.62	35.48	197.83	39.01	1.78	1.78	7.11	0.95	0.95	2.37	23.68	36.69	44.22	
	Truck Drivers	30.00%	70.97	26.61	148.37	29.26	1.33	1.33	5.33	0.71	0.71	1.78	17.76	27.52	99.50	
	Specialized Labourer	20.00%	82.80	31.05	173.10	34.14	1.55	1.55	6.22	0.83	0.83	2.07	20.72	32.10	77.39	
	Skilled Labourer	20.00%	65.05	24.40	136.01	26.82	1.22	1.22	4.88	0.65	0.65	1.63	16.28	25.22	60.81	
	Helper	10.00%	41.40	15.52	86.55	17.07	0.78	0.78	3.11	0.41	0.41	1.04	10.36	16.05	19.35	
Concrete Works	Crew Leader	10.00%	141.94	53.23	296.74	58.52	2.66	2.66	10.66	1.42	1.42	3.55	35.53	55.03	66.34	5.42
	Specialized Labourer	30.00%	82.80	31.05	173.10	34.14	1.55	1.55	6.22	0.83	0.83	2.07	20.72	32.10	116.09	
	Skilled Labourer	20.00%	65.05	24.40	136.01	26.82	1.22	1.22	4.88	0.65	0.65	1.63	16.28	25.22	60.81	
	Labourer	20.00%	47.31	17.74	98.91	19.51	0.89	0.89	3.55	0.47	0.47	1.18	11.84	18.34	44.22	
	Helper	20.00%	41.40	15.52	86.55	17.07	0.78	0.78	3.11	0.41	0.41	1.04	10.36	16.05	38.70	
Structural Steel	Crew Leader	10.00%	141.94	53.23	296.74	58.52	2.66	2.66	10.66	1.42	1.42	3.55	35.53	55.03	66.34	6.57
	Crane Operator	10.00%	94.62	35.48	197.83	39.01	1.78	1.78	7.11	0.95	0.95	2.37	23.68	36.69	44.22	
	Steel Erector	30.00%	82.80	31.05	173.10	34.14	1.55	1.55	6.22	0.83	0.83	2.07	20.72	32.10	116.09	
	Steel Erector Helper	20.00%	53.23	19.96	111.28	21.94	1.00	1.00	4.00	0.53	0.53	1.33	13.32	20.64	49.75	
	Welder	10.00%	76.88	28.83	160.74	31.70	1.44	1.44	5.77	0.77	0.77	1.92	19.24	29.81	35.93	
	Specialized Labourer	10.00%	82.80	31.05	173.10	34.14	1.55	1.55	6.22	0.83	0.83	2.07	20.72	32.10	38.70	
	Skilled Labourer	10.00%	94.62	35.48	197.83	39.01	1.78	1.78	7.11	0.95	0.95	2.37	23.68	36.69	44.22	
Mechanical Installation	Crew Leader	10.00%	177.42	66.53	370.93	73.15	3.33	3.33	13.32	1.78	1.78	4.44	44.41	68.79	82.92	8.73
	Millwright	35.00%	141.94	53.23	296.74	58.52	2.66	2.66	10.66	1.42	1.42	3.55	35.53	55.03	265.34	
	Skilled Labourer	40.00%	94.62	35.48	197.83	39.01	1.78	1.78	7.11	0.95	0.95	2.37	23.68	36.69	176.90	
	Helper	15.00%	41.40	15.52	86.55	17.07	0.78	0.78	3.11	0.41	0.41	1.04	10.36	16.05	38.70	
Piping Installation	Crew Leader	10.00%	141.94	53.23	296.74	58.52	2.66	2.66	10.66	1.42	1.42	3.55	35.53	55.03	66.34	6.98
	Pipefitter	35.00%	94.62	35.48	197.83	39.01	1.78	1.78	7.11	0.95	0.95	2.37	23.68	36.69	176.90	
	Skilled Labourer	35.00%	94.62	35.48	197.83	39.01	1.78	1.78	7.11	0.95	0.95	2.37	23.68	36.69	176.90	
	Helper	20.00%	41.40	15.52	86.55	17.07	0.78	0.78	3.11	0.41	0.41	1.04	10.36	16.05	38.70	
Electrical / Instrumentation Installation	Crew Leader	10.00%	177.42	66.53	370.93	73.15	3.33	3.33	13.32	1.78	1.78	4.44	44.41	68.79	82.92	8.73
	Electrician	35.00%	141.94	53.23	296.74	58.52	2.66	2.66	10.66	1.42	1.42	3.55	35.53	55.03	265.34	
	Skilled Labourer	40.00%	94.62	35.48	197.83	39.01	1.78	1.78	7.11	0.95	0.95	2.37	23.68	36.69	176.90	
	Helper	15.00%	41.40	15.52	86.55	17.07	0.78	0.78	3.11	0.41	0.41	1.04	10.36	16.05	38.70	
Architectural Works	Crew Leader	10.00%	141.94	53.23	296.74	58.52	2.66	2.66	10.66	1.42	1.42	3.55	35.53	55.03	66.34	5.83
	Specialized Labourer	40.00%	82.80	31.05	173.10	34.14	1.55	1.55	6.22	0.83	0.83	2.07	20.72	32.10	154.78	
	Skilled Labourer	30.00%	65.05	24.40	136.01	26.82	1.22	1.22	4.88	0.65	0.65	1.63	16.28	25.22	91.21	
	Helper	20.00%	41.40	15.52	86.55	17.07	0.78	0.78	3.11	0.41	0.41	1.04	10.36	16.05	38.70	

13.7 Group Responsibilities during Construction and Preproduction

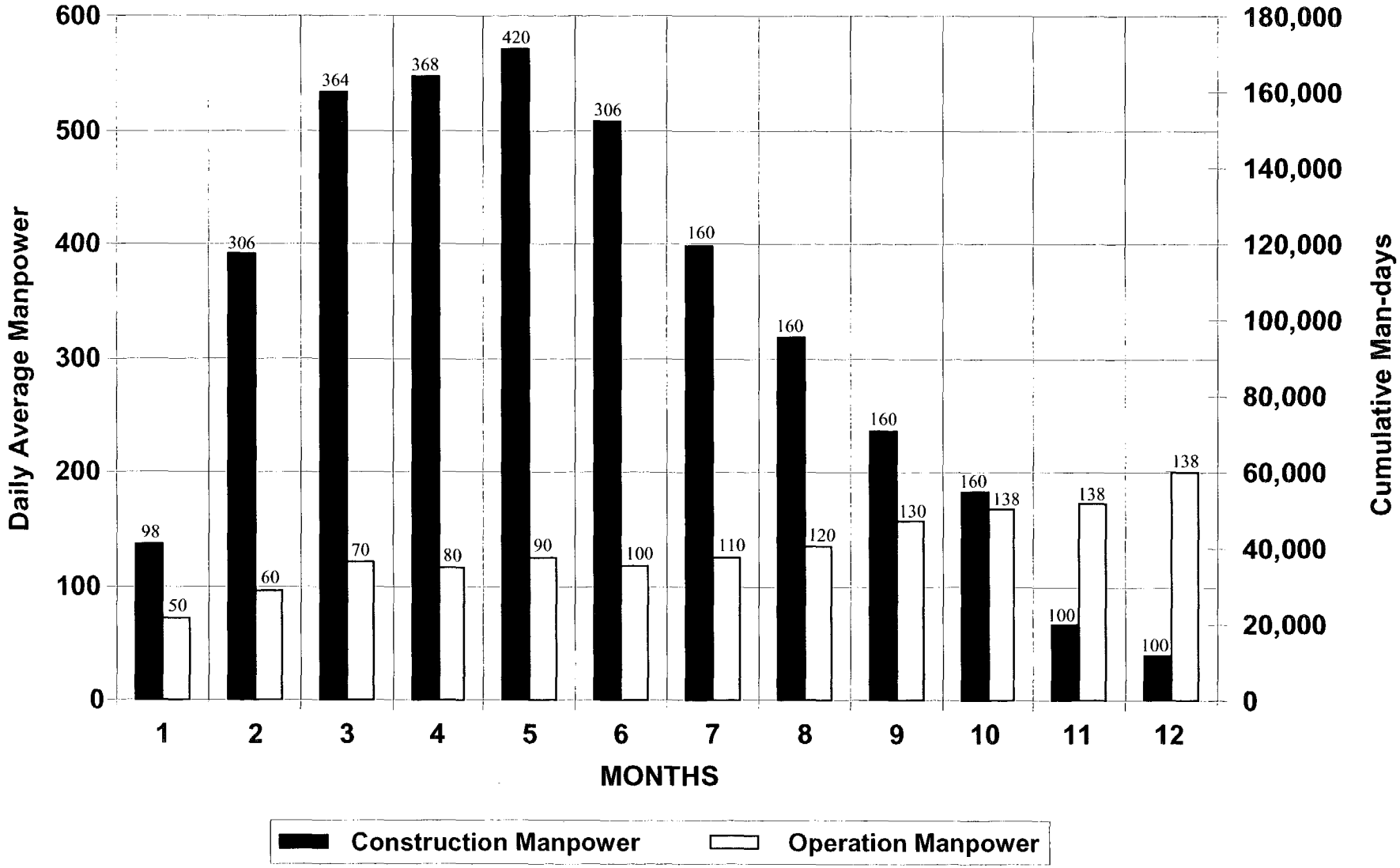
Project construction responsibilities are comprised of two components – the construction group and the operations group. The construction manpower is responsible for the activities summarized in Table 13.1, including all the actual site building or actual construction activities. Mine operations staff, during the construction period will be responsible for delivery and erection of the mining equipment, preproduction waste stripping, and ore production, placement of engineered waste fill for project facilities, construction of certain site access roads, and placement of pad liner materials.

The G&A operations group, during the construction/preproduction period, will assist in general coordination between the construction and operations crews and be very involved with hiring, training, and general administrative and services responsibilities.

13.8 Construction and Operation Manpower

As shown in Figure 13.3, estimated daily average manpower by month for the construction effort builds from about 100 employees in Month 1, builds rapidly to about 420 employees in Months 5, and then drops off sharply to about 100 construction employees in Month 12. Estimated daily average manpower by month for MSX operations is about 50 in Month 1, gradually building to a maximum in Month 12 of about 138 employees. A maximum total employee on site occurs in Month 5 at about 558 employees.

Figure 13.3 Monthly Manpower and Cumulative Man-days During Project Construction



14.0 OPERATING COST ESTIMATE

14.1 Introduction

Detailed operating cost estimates for the various operating areas of mining, processing, and G&A have been presented earlier in this Feasibility Study. Operating costs are developed for all years, Pre-production (PP) through Year 8, and all costs (capital and operating) are treated as capital costs in Year PP. Labor costs and consumable costs are the two primary components of the operating costs.

No contingency has been developed for the operating costs, but the costs for both labor and the major areas of consumables have been confirmed by recent quotations.

14.2 Operating Cost Summary

A summary of the operating costs by year by area is presented in Table 14.1. This table consolidates costs in the various areas into total costs per year as well as cost per tonne of ore. Total operating costs during the operating Years 1 through 8 range from $18.9 million in Year 1 to a high of $19.4 million in Year 3. Total operating cost per tonne of ore ranges from a low of $2.25 in Years 6 and 7 to a high of $4.99 in Year 8. Figure 14.1 shows the operating cost per year by area in total dollars, while Figure 14.2 shows the operating cost per year in terms of dollars per tonne of ore.

Mining and processing costs amount to 55 percent and 35 percent respectively of the total operating cost, leaving 10 percent for G&A costs.

Table 14.1

Annual Operating Cost Summary											
	Year									Totals	
	PP	1	2	3	4	5	6	7	8	Production	% of Total
Ore Tonnes	0	5845	5315	6655	7749	7540	7432	7641	1069	49246	
Waste Tonnes	9406	14512	12615	12752	9027	8630	1850	2433	72	71297	
Total Tonnes	9406	20357	17930	19407	16776	16170	9282	10074	1141	120543	
Mining											
Total Cost ($000)	6706	11420	10830	11120	10334	9848	7723	8009	2784	78774	
Unit Cost ($/ore tonne)		1.95	2.04	1.67	1.33	1.31	1.04	1.05	2.60	1.60	55%
Processing											
Total Cost ($000)	0	5903	5368	6722	7826	7615	7506	7717	1080	49737	
Unit Cost ($/ore tonne)		1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	35%
G&A											
Total Cost ($000)	1579	1567	1532	1530	1529	1528	1507	1479	1474	13725	
Unit Cost ($/ore tonne)		0.27	0.29	0.23	0.20	0.20	0.20	0.19	1.38	0.28	10%
Total Cost ($000)	8285	18890	17730	19372	19689	18991	16736	17205	5338	142236	
Unit Cost ($/ore tonne)		3.23	3.34	2.91	2.54	2.52	2.25	2.25	4.99	2.89	

Figure 14.1 Annual Operating Costs per Area

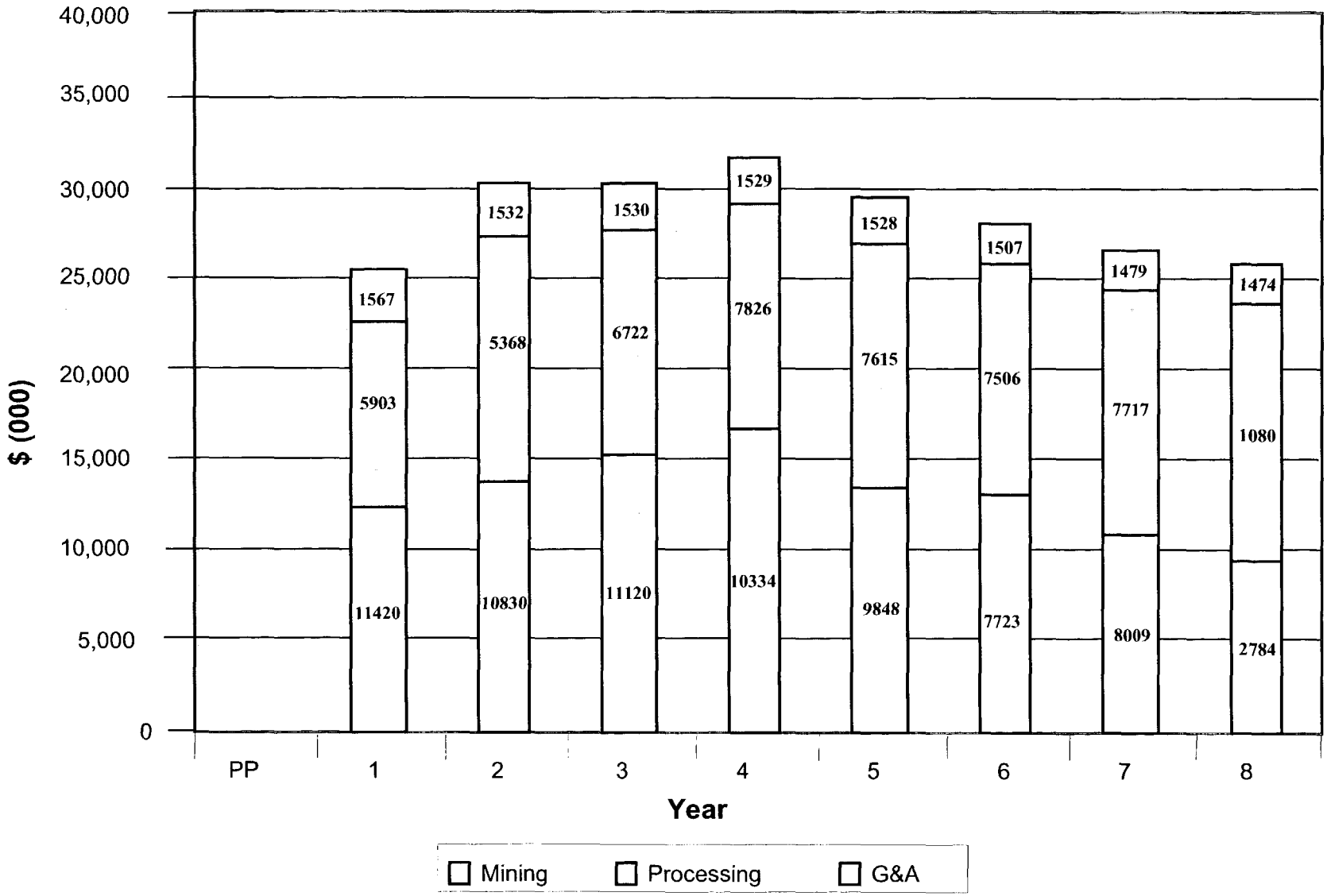
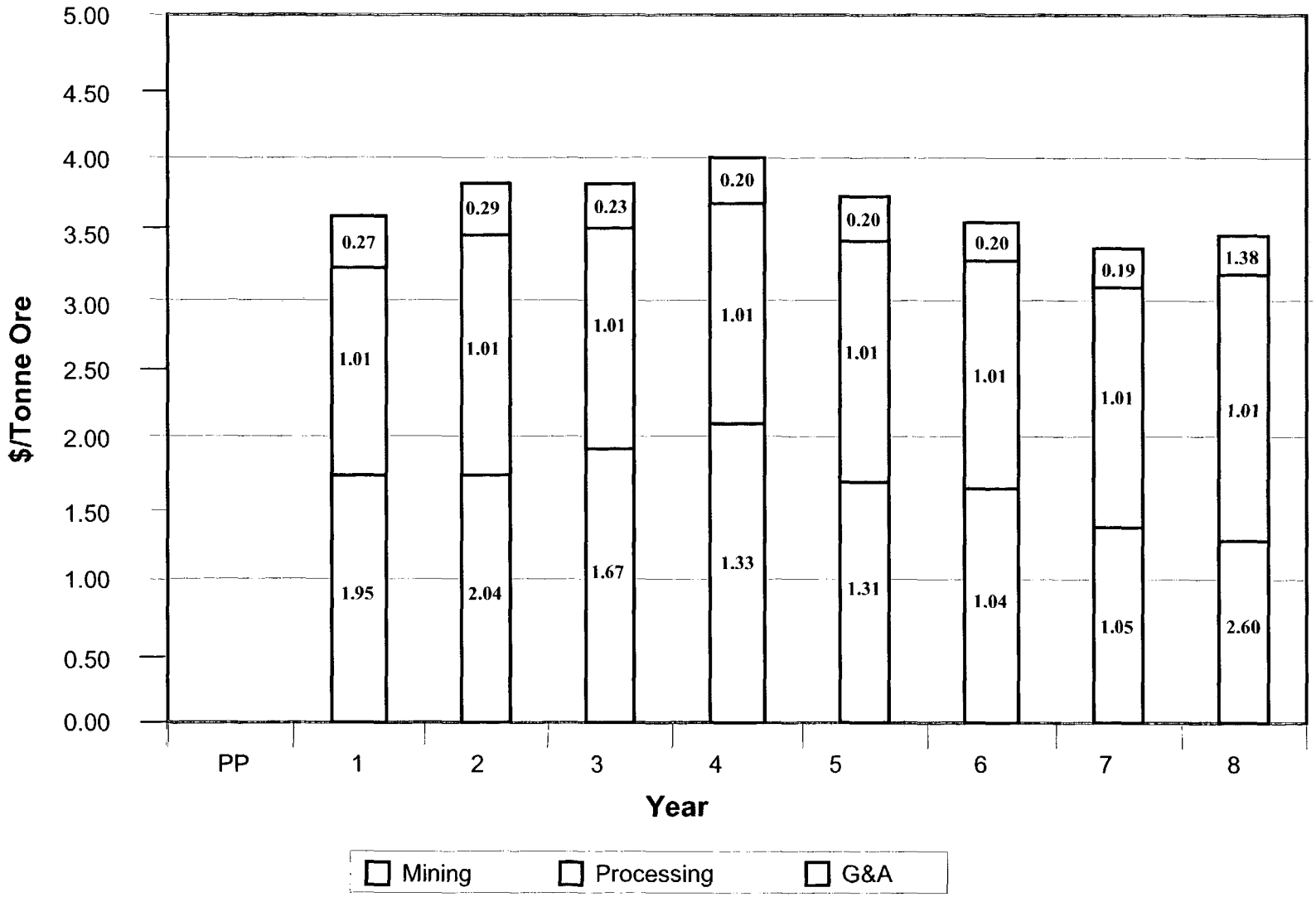


Figure 14.2 Annual Operating Costs per Tonne of Ore



15.0 CAPITAL COST ESTIMATE

15.1 Introduction

The capital cost estimate prepared by Minera San Xavier, S.A. de C.V. (MSX) and its consultants is represented in U.S. dollars as of the fourth quarter 2000. No adjustment has been provided for future price escalation or inflation.

Most of the construction material and skilled labor are available in Mexico. San Luis Potosí is a relatively large city and most of the services required for project construction are available within the local vicinity.

The new and/or used material and equipment purchased outside of Mexico, will be imported under the North America Free Trade Agreement (NAFTA) and/or the Mexican PITEX program, which allows corporations exporting their finished product and operating under specific criteria, the ability to temporarily import equipment and material free of duties and sales tax.

The value-added tax (VAT) is excluded from the capital cost estimate.

15.2 Project Total Capital Cost Estimate - Summary by Area

A summary of the project construction, pre-production, and sustaining capital cost estimates is presented in Table 15.1. Additional information can also be found in the appropriate section of this study.

The capital cost estimate is divided into major areas of Mining, Processing, and Administration Infrastructure and outlines the following:

- Initial capital expenditures in the pre-production and construction year and Year 1 totals $45.5 million.
- Sustaining capital expenditures includes the construction of the second phase of the leach pad in Year 3 ($3.5 million), replacement of some support equipment in Year 4 ($0.3 million), and rebuilding of some mine equipment in Year 5 ($2.7 million).
- Overall capital cost estimate, incorporating pre-production, construction costs, and sustaining capital totals $51.7 million.

Table 15.1

Capital Cost Summary by Area ($)											
Area	PP	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9-12	Total
Mining											
Capitalized Pre-strip (Owner Mining)	$ 6,706,000										$ 6,706,000
Major Mine Equipment	$ 9,054,000	$ 8,776,000				$ 2,674,500					$ 20,504,500
Mine Support Equipment	$ 417,400				$ 120,000						$ 537,400
Maintenance Equipment	$ 1,124,000				$ 72,000						$ 1,196,000
G &A Equipment	$ 473,000				$ 104,000						$ 577,000
Maintenance Facilities & Mine Roads											
Shop/Warehouse/Fuel/Wash	$ 826,000										
Run-of-Mine Haulroad (Contractor)	$ 1,007,169										$ 1,007,169
Explosives Storage	$ 131,900										$ 131,900
Pit Working Access (Contractor)	$ 900,000										$ 900,000
Mining - Subtotal	$ 20,639,469	$ 8,776,000	$ -	$ -	$ 296,000	$ 2,674,500	$ -	$ -	$ -	$ -	**$ 32,385,969**
Processing											
Leach Pad and Solution Ponds	$ 4,462,340			$ 3,479,840							$ 7,942,180
Merrill-Crowe Plant	$ 1,784,906										$ 1,784,906
Refinery	$ 427,188										$ 427,188
Solution Pumping & Distribution	$ 900,272										$ 900,272
Construction Management & QA/QC	$ 497,895										$ 497,895
Engineering	$ 334,037										$ 334,037
Laboratory	$ 394,200										$ 394,200
Lime Silo	$ 310,000										$ 310,000
Processing - Subtotal	$ 9,110,838	$ -	$ -	$ 3,479,840	$ -	$ -	$ -	$ -	$ -	$ -	**$ 12,590,678**
Admin. & Infrastructure											
Roads	$ 175,000										$ 175,000
Office, Training Building, and Furniture	$ 370,000										$ 370,000
Site Preparation	$ 475,000										$ 475,000
Water Supply	$ 645,000										$ 645,000
Cerro de San Pedro Housing	$ 350,000										$ 350,000
Cerro de San Pedro Church Stabilization	$ 200,000										$ 200,000
Property Fencing	$ -										$ -
Electric Power and Communication	$ 2,206,680										$ 2,206,680
Owner's Cost (G&A)	$ 1,579,000										$ 1,579,000
Admin. & Infrastructure - Subtotal	$ 6,000,680	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	**$ 6,000,680**
Project Expenditure Total	$ 35,750,987	$ 8,776,000	$ -	$ 3,479,840	$ 296,000	$ 2,674,500	$ -	$ -	$ -	$ -	**$ 50,977,327**

16.0 ECONOMIC EVALUATION AND FINANCIAL ANALYSES

16.1 Basis of Estimate

This section presents a summary of the project's financial analyses, as well as information on anticipated project preproduction and development costs, working capital, and taxes. This information has been formulated into an economic model that evaluates the project's financial criteria on an after-tax basis using constant dollars (fourth quarter 2000). Metal prices of $275 per ounce of gold and $5.00 per ounce of silver were used in the base case evaluation. Sensitivity analyses evaluating the impact of varying project capital and operating costs as well as gold and silver recoveries have been developed. Traditional financial evaluation criteria, such as internal rate of return (IRR) and net present value (NPV), have also been calculated.

16.2 Review of Significant Project Information

A total of 120.5 million tonnes of material will be mined and 49.2 million tonnes of ore will be processed at Cerro San Pedro over a mine life of 7.25 years, at an average processing rate of 22,000 tonnes per day or approximately 6.8 million tonnes per year. The grade of gold and silver is fairly stable over the life of the mine, as shown in Table 16.1. The mined grade and process recoveries have a major influence on the overall operating cash cost per ounce of gold, silver, and gold equivalent produced. In addition, the waste/ore ratio varies somewhat over the life of the mine, which also impacts the overall cash operating costs.

Table 16.1

Mine Production Schedule						
Project Period	**Ore ktonnes**	**Gold Grade g Au/t**	**Silver Grade g Ag/ t**	**Waste ktonnes**	**Total ktonnes**	**Strip Ratio**
Pre-production	--	--	--	9,406	9,406	--
Year 1	5845	0.650	24.65	14,512	20,357	2.5
Year 2	5,315	0.642	31.01	12,615	17,930	2.4
Year 3	6,655	0.511	29.62	12,752	19,407	1.9
Year 4	7,749	0.611	22.15	9,027	16,776	1.2
Year 5	7,540	0.488	19.59	8,630	16,170	1.1
Year 6	7,432	0.570	23.46	1,850	9,282	0.2
Year 7	7,641	0.574	16.04	2,433	10,074	0.3
Year 8	1,069	0.303	10.69	72	1,141	0.1
Total	49,246	0.57	23.02	71,297	120,543	1.4

Gold and silver recoveries are estimated to average 70.5 percent and 35.7 percent, respectively, through the end of Year 8. However, recirculation of heap solutions will be required for depletion and detoxification and some residual metal recoveries will result in additional precious metal production through Year 9 but are not considered in the economics at this time.

The unit operating costs covering areas such as mining, processing, and G&A are relatively stable over the mine life. The average operating cost by area is shown in Table 16.2 and total $2.72 per tonne of ore over the life of the project. Capital costs by area are summarized in Table 16.3. Initial capital costs are estimated at $45.3 million and total capital costs are estimated at $51.7 million over the project life.

Table 16.2

Summary of Operating Costs by Area			
	Operating Costs		
	Total ($000)	Total $/ore tonne	Percent of Total
Mining ($0.65/t)	72,067	1.46	54
Processing	49,738	1.01	37
G&A	12,146	0.25	9
Total	133,952	2.72	100.0

Table 16.3

Summary of Capital Costs by Area ($000)			
	Preproduction	Sustaining	Total
Mining	29,416	2,970	32,386
Processing	9,110	3,480	12,590
Admin. & Infrastructure	6,751	0	6,751
Total	45,277	6,450	51,727

16.3 Economic Model

The economic model used for financial evaluation of the Cerro San Pedro Project is based on an in-house derived spreadsheet generated using Excel software. The model is quite flexible and accounts for

yearly variations in material mined and processed, recoveries, operating costs, and capital expenditures. From these input areas, the model generates cash flow estimates on an annual basis.

The entire economic model spreadsheet and results are included at the end of this section.

16.3.1 Treatment of Amortization and Taxation

For the purpose of this economic evaluation, Mexican income tax consists of four main provisions: deductions for depreciation and amortization, tax rates, alternative minimum asset tax, and loss carry forwards.

The economic model accounts for the various depreciation schedules allowed for the value of an asset or service, from the year that the asset is placed in service. Depreciation is not allowed for land or real property purchase payments, real property option payments, and some intangible property, such as water rights. These items are directly expensed in the year of acquisition or service.

The regular income tax rate applicable to corporations in Mexico is 35 percent on taxable income. An effective tax rate of 30% is used in the economic model to allow for additional tax credits that are anticipated during operations (such as the tax credit for diesel). The rate is applied to income after deductions for usual business expenses, asset depreciation, and prior year losses. Profit sharing with employees is not deductible. In addition to the direct income tax, a withholding, estimated at five percent, would apply on any payment of dividend. This will not apply if excess cash flow is reinvested in Mexico.

In addition to the regular tax, an alternative minimum tax on assets must also be considered because a Mexican taxpayer pays, in any given year, the higher of those two taxes. The asset tax commences in the second year of a commercial enterprise and is based on the net tangible asset base of the business for that year as determined after depreciation. The net asset base is then multiplied by 1.8 percent to obtain the asset tax. This tax is recoupable within ten years to the extent that in any of those following years, the regular income tax exceeds the asset tax for that particular year. Any losses (negative taxable income) incurred in a given year can be carried forward and applied to subsequent years to reduce positive taxable income.

The Value Added Tax (VAT) is assessed on all services and capital assets when purchased or imported into Mexico. The rate is 15 percent of the purchase price or imported value plus duties. An accelerated

reimbursement provision is available for all VAT credits. The reimbursement period is generally three months, resulting in the repayment of the tax often in the same year in which it is paid.

16.4 Precious Metal Production

A summary of gold, silver, and gold equivalent production by year is provided in Table 16.4, with life-of-mine total recovered ounces of 634,060 ounces of gold and 13 million ounces of silver. As used in the economic evaluation, gold equivalent, for the base commodity price case, is defined as gold plus silver divided by 55 (Au Eq oz = Au oz + Ag oz/55). Gold equivalent production ranges from a low of 47,981 to a high of 143,143 and averages 108,799 ounces. Gold production as a proportion of total gold equivalent production varies from 65 percent to 80 percent over the years and averages 73 percent over the project life.

Table 16.4

Summary of Annual Precious Metal Production

	Au Ozs	Ag Ozs	Au Eq Ozs	% Au Ozs of AuEq Ozs
Total Contained Ounces	899,345	36,448,197	1,506,983	60
Estimated Annual Production				
Year 1	61,056	926,509	77,901	78
Year 2	77,337	1,889,095	111,684	69
Year 3	77,085	2,259,657	118,170	65
Year 4	107,368	1,967,636	143,143	75
Year 5	83,382	1,692,959	114,163	73
Year 6	95,980	1,998,662	132,319	73
Year 7	99,480	1,405.187	125,029	80
Year 8	32,373	858,464	47,981	67
Total Project Life	634,060	12,998,169	870,391	73

16.5 Revenue and Cash Flow

A summary of mine net realization or revenue based on gold and silver sales, direct operating costs, operating cash flow, and operating cash cost per ounce on an annual basis is provided in Table 16.5.

Table 16.5

Summary of Annual Net Revenue, Operating Costs, Operating Profit, and Cash Cost/Au Eq Ounce				
Year	Net Revenue (Au + Ag) ($000)	Cash Operating Costs ($000)	Operating Profit ($000)	Cash Cost $/Au Eq
1	21,423	19,464	1,959	250
2	30,713	18,552	12,161	166
3	32,497	20,242	12,255	171
4	39,364	20,743	18,621	145
5	31,395	19,831	11,564	174
6	36,388	17,710	18,678	134
7	34,383	18,126	16,257	145
8	13,194	5,691	7,503	119
Total	239,357	144,652	94,705	166

16.6 Economic Results

The results of the economic model are presented in Table 16.6 which show the traditional valuation criteria of internal rate of return (IRR) and net present value (NPV) at various gold and silver prices for the designed pit.

At a gold price of $275 per ounce and $5.00 per ounce for silver, and assuming that the initial investment is 100% financed at 9.5%, the project yields a Net Present Value of $7.5 million at a 5% discount rate with an 8.4% Rate of Return.

Table 16.6

Project Rate of Return and Net Present Value			
	$275 Gold $5.00 Silver	$300 Gold $5.25 Silver	$325 Gold $5.25 Silver
Life of Mine	7.25 years	7.25 years	7.25 years
NPV @ 5%	$7.5 million	$19.8 million	$29.5 million
DCFROR	8.4%	13.9%	18.2%
Operating Cost	$166 per AuEq Oz	$167 per AuEq Oz	$167 per AuEq Oz
Total Cost	$199 per AuEq Oz	$195 per AuEq Oz	$195 per AuEq Oz
Pay Back Period	5.6 years	4.7 years	4.0 years

16.7 Sensitivity Analyses

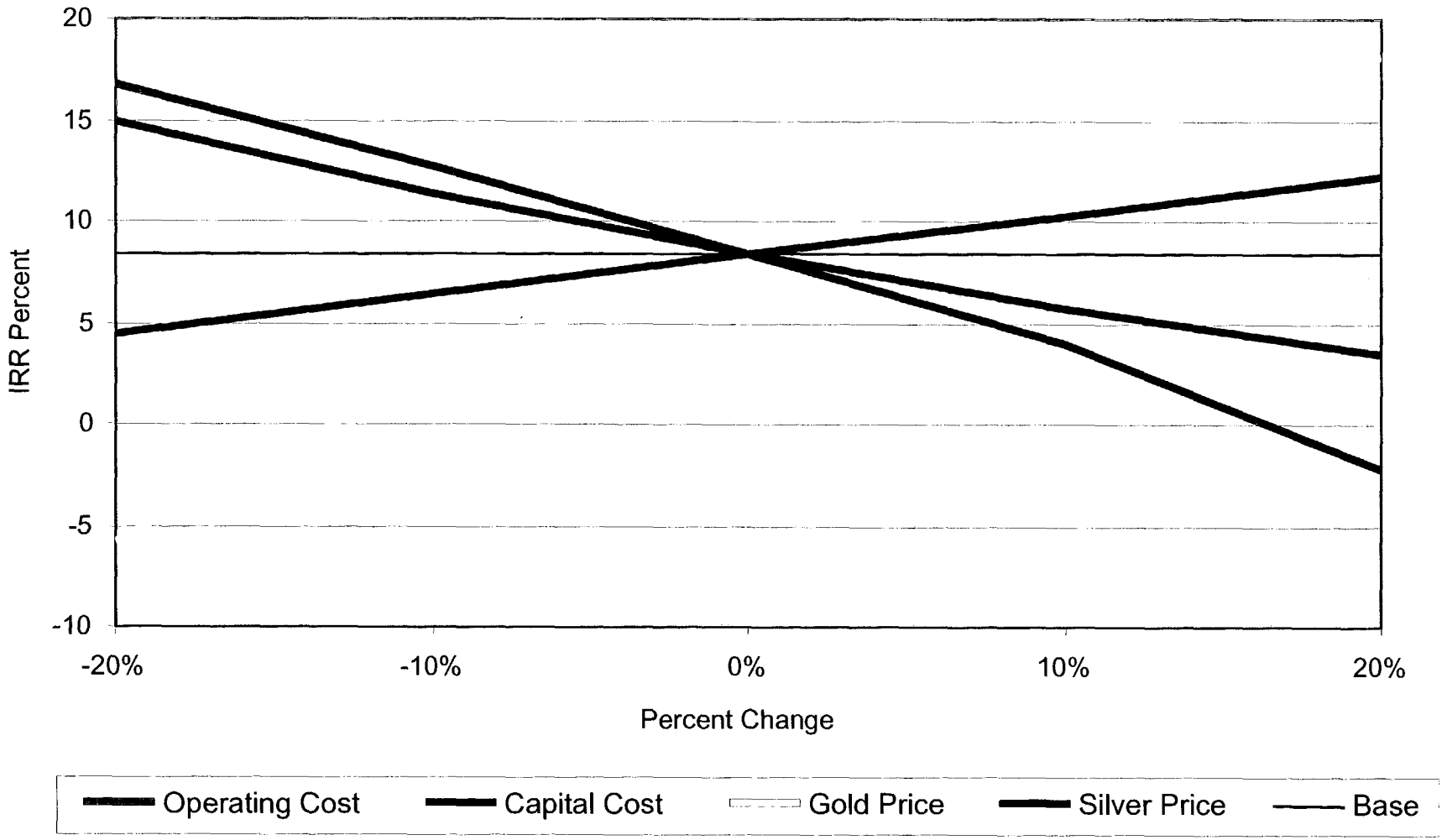
Sensitivities to changes in capital costs, operating costs, and gold and silver recoveries were evaluated on the base case, with changes of ±10 and ± 20 percent being examined for costs and recoveries. As seen in Table 16.7 below, at a given percentage variation in costs, the project is much more sensitive to changes in operating costs than capital cost.

Table 16.7

Rate of Return Sensitivities				
Base Case $275 Au and $5.00 AG				
Change	**Capital Costs**	**Operating Costs**	**Gold Price**	**Silver Price**
+20%	3.4	-2.2	18.2	12.2
+10%	5.7	3.9	13.4	10.3
0%	8.4	8.4	8.4	8.4
-10%	11.4	12.8	2.7	6.4
-20%	15.0	16.8	-5.8	4.4

Figure 16.1 graphically shows the sensitivity analysis results for the base case commodity prices.

Figure 16.1 IRR Sensitivity



CERRO SAN PEDRO PROJECT - ECONOMIC MODEL

Revised Economic Model as of 07dec00

Pit Access included, $0.653 mining cost , no financing, $26 million tax loss carry-forward estimated through end of 2000

		Preproduction	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9-12
Production	**TOTALS**	constr/strip	operations	operations	operations	operations	operations	operations	operations	operations	closure
Leach Tonnes	**49,246,000**		**5,845,000**	**5,315,000**	**6,655,000**	**7,749,000**	**7,540,000**	**7,432,000**	**7,641,000**	**1,069,000**	
Grade Au g/t	0.57	-	0.650	0.642	0.511	0.611	0.488	0.570	0.574	0.303	
Ounces Contained Au	899,345		122,111	109,693	109,336	152,288	118,267	136,136	141,101	10,414	
Recovery Rate %Au AVG	70.5%		54.1%	66.8%	67.2%	67.1%	74.1%	70.0%	72.7%	323.5%	
Ounces Au Produced	634,060	-	66,024	73,317	73,448	102,128	87,643	95,272	102,535	33,693	
Grade Ag g/t	23.02	0.00	24.65	31.01	29.62	22.15	19.59	23.46	16.04	10.69	
Ounces Contained Ag	36,448,197	-	4,632,547	5,298,112	6,337,381	5,518,387	4,748,034	5,605,403	3,940,955	367,379	
Recovery Rate %Ag AVG	35.7%		24.1%	32.4%	33.0%	36.5%	37.9%	35.6%	40.3%	182.6%	
Ounces Ag Produced	12,998,169	-	1,116,398	1,717,306	2,093,549	2,015,859	1,801,615	1,993,723	1,588,842	670,877	
Waste Tonnes	71,297,000	9,406,000	14,512,000	12,615,000	12,752,000	9,027,000	8,630,000	1,850,000	2,433,000	72,000	
Total Surface Tonnes Mined	**120,543,000**	**9,406,000**	**20,357,000**	**17,930,000**	**19,407,000**	**16,776,000**	**16,170,000**	**9,282,000**	**10,074,000**	**1,141,000**	
Waste:Ore Strip Ratio	1.4		2.5	2.4	1.9	1.2	1.1	0.2	0.3	0.1	
Total Tonnes: Equiv Au Ounce S.R.	190		308	245	264	164	184	97	98	34	
Total Ore Tonnes	49,246,000		5,845,000	5,315,000	6,655,000	7,749,000	7,540,000	7,432,000	7,641,000	1,069,000	
Grade g/t Au Equivalent	0.952	-	1.098	1.206	1.050	1.014	0.844	0.996	0.866	0.497	
Ounces Contained Au Equivalent	1,562,040		206,339	206,023	224,561	252,622	204,595	238,052	212,754	17,093	
Average Recovery Rate Au Equivalent	55.7%	0.0%	41.8%	50.7%	49.7%	54.9%	58.8%	55.2%	61.8%	268.5%	
Ounces Produced Au Equivalent	**870,391**	**0**	**86,322**	**104,541**	**111,512**	**138,780**	**120,400**	**131,521**	**131,423**	**45,891**	
Revenue											
Gold Price	$ 275	$ 275	$ 275	$ 275	$ 275	$ 275	$ 275	$ 275	$ 275	$ 275	
Gold Revenue	$ 174,366,559	$ -	$ 18,156,607	$ 20,162,214	$ 20,198,132	$ 28,085,240	$ 24,101,923	$ 26,199,777	$ 28,197,056	$ 9,265,610	
Silver Price	$ 5.00	$ 5.00	$ 5.00	$ 5.00	$ 5.00	$ 5.00	$ 5.00	$ 5.00	$ 5.00	$ 5.00	
Silver Revenue	64,990,843	$ -	$ 5,581,988	$ 8,586,530	$ 10,467,744	$ 10,079,296	$ 9,008,076	$ 9,968,616	$ 7,944,208	$ 3,354,385	
Total Revenue	**239,357,401**	**$ -**	**$ 23,738,595**	**$ 28,748,744**	**$ 30,665,875**	**$ 38,164,536**	**$ 33,109,999**	**$ 36,168,393**	**$ 36,141,263**	**$ 12,619,995**	
Direct Operating Costs											
Surface Mining Cost	$ 78,758,000	$ 6,705,000	$ 11,423,000	$ 10,823,000	$ 11,113,000	$ 10,327,000	$ 9,851,000	$ 7,719,000	$ 8,013,000	$ 2,784,000	
Cost per Mined Tonne	$ 0.653	$ 0.71	$ 0.56	$ 0.60	$ 0.57	$ 0.62	$ 0.61	$ 0.83	$ 0.80	$ 2.44	
Leach Ore Processing Cost	$ 49,738,460	$ -	$5,903,450	$5,368,150	$6,721,550	$7,826,490	$7,615,400	$7,506,320	$7,717,410	$1,079,690	
Cost per Leach Tonne	$ 1.01	$ 1.01	$ 1.01	$ 1.01	$ 1.01	$ 1.01	$ 1.01	$ 1.01	$ 1.01	$ 1.01	
G&A Cost	12,146,000	$ -	$ 1,567,000	$ 1,532,000	$ 1,530,000	$ 1,529,000	$ 1,528,000	$ 1,507,000	$ 1,479,000	$ 1,474,000	
Cost per Ore Tonne	$ 0.25	$ -	$ 0.27	$ 0.29	$ 0.23	$ 0.20	$ 0.20	$ 0.20	$ 0.19	$ 1.38	
	prestrip credit	$ (6,705,000)									
Total Direct Operating Costs	**133,937,460**	**$ -**	**$ 18,893,450**	**$ 17,723,150**	**$ 19,364,550**	**$ 19,682,490**	**$ 18,994,400**	**$ 16,732,320**	**$ 17,209,410**	**$ 5,337,690**	
Cost per Ore Tonne	$ 2.72	$ -	$ 3.23	$ 3.33	$ 2.91	$ 2.54	$ 2.52	$ 2.25	$ 2.25	$ 4.99	
Other Cash Costs											
Royalties 1.95%	4,667,469	$ -	462,902.60	560,600.51	597,984.57	744,208.46	645,644.98	705,283.66	704,754.63	246,089.90	
Transportation, Refining $0.2834/dore oz	3,863,374		$ 335,098	$ 507,463	$ 614,127	$ 600,238	$ 535,416	$ 592,021	$ 479,336	$ 199,675	
Reclamation	4,292,500										$ 4,292,500
Exploration Expense	-										
Fees	-										
Total Other Cash Costs	**12,823,343**	**$ -**	**$ 798,001**	**$ 1,068,063**	**$ 1,212,111**	**$ 1,344,446**	**$ 1,181,061**	**$ 1,297,305**	**$ 1,184,091**	**$ 445,765**	**$ 4,292,500**
Total Cash Operating Costs	**146,760,802.97**	**$ -**	**$ 19,691,451**	**$ 18,791,213**	**$ 20,576,661**	**$ 21,026,936**	**$ 20,175,461**	**$ 18,029,625**	**$ 18,393,501**	**$ 5,783,455**	**$ 4,292,500**

CERRO SAN PEDRO PROJECT - ECONOMIC MODEL (cont.)

Revised Economic Model as of 07dec00

Pit Access included, $0.653 mining cost , no financing, $26 million tax loss carry-forward estimated through end of 2000

		Preproduction	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9-12
Non-Cash Costs											
Depreciation	$ 46,549,384		$ 9,194,807	$ 6,726,467	$ 6,726,467	$ 10,206,307	$ 3,959,367	$ 2,433,992	$ 2,433,992	$ 2,433,992	$ 2,433,992
Depletion	$ -										
Reclamation Accrual	$ -										
Total Non-Cash Costs	**$ 46,549,384**	**$ -**	**$ 9,194,807**	**$ 6,726,467**	**$ 6,726,467**	**$ 10,206,307**	**$ 3,959,367**	**$ 2,433,992**	**$ 2,433,992**	**$ 2,433,992**	**$ 2,433,992**
Total Costs	**$ 193,310,187**	**$ -**	**$ 28,886,258**	**$ 25,517,680**	**$ 27,303,128**	**$ 31,233,243**	**$ 24,134,828**	**$ 20,463,617**	**$ 20,827,493**	**$ 8,217,447**	**$ 6,726,492**
Financing Costs	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**
Gross Earnings	**$ 46,047,215**	**$ -**	**$ (5,147,663)**	**$ 3,231,064**	**$ 3,362,747**	**$ 6,931,293**	**$ 8,975,171**	**$ 15,704,776**	**$ 15,313,770**	**$ 4,402,548**	**$ (6,726,492)**
Taxes (see detail below)											
Asset Tax or "Effective"											
Federal Income Tax @ 30%	$ 8,032,112	$ -	$ -	$ -	$ 456,446	$ 278,060	$ 254,932	$ 1,127,779	$ 4,594,131	$ 1,320,764	$ -
Total Taxes	**$ 8,032,112**	**$ -**	**$ -**	**$ -**	**$ 456,446**	**$ 278,060**	**$ 254,932**	**$ 1,127,779**	**$ 4,594,131**	**$ 1,320,764**	
Net Earnings	**$ 38,015,103**	**$ -**	**$ (5,147,663)**	**$ 3,231,064**	**$ 2,906,301**	**$ 6,653,233**	**$ 8,720,239**	**$ 14,576,997**	**$ 10,719,639**	**$ 3,081,783**	**$ (6,726,492)**
Capital Expenditures											
Exploration	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	0
Development	$ 1,907,169	$ 1,907,169	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	0
Capitalized Pre-Strip	$ 6,705,000	$ 6,705,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	0
Mine & Mobile Equipment	$ 23,772,800	$ 12,026,300	$ 8,776,000	$ -	$ -	$ 296,000	$ 2,674,500	$ -	$ -	$ -	0
Process Facilities	$ 12,590,678	$ 9,110,838	$ -	$ -	$ 3,479,840	$ -	$ -	$ -	$ -	$ -	0
Administration/Infrastructure	$ 6,000,680	$ 6,000,680	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	0
Total Capital	**$ 50,976,327**	**$ 35,749,987**	**$ 8,776,000**	**$ -**	**$ 3,479,840**	**$ 296,000**	**$ 2,674,500**	**$ -**	**$ -**	**$ -**	**$ -**
After-Tax Cash Flow	**$ 33,588,159**	**$ (35,749,987)**	**$ (4,728,856)**	**$ 9,957,531**	**$ 6,152,929**	**$ 16,563,540**	**$ 10,005,106**	**$ 17,010,990**	**$ 13,153,631**	**$ 5,515,775**	**$ (4,292,500)**
Cumulative Cash Flow	$ 33,588,159	$ (35,749,987)	$ (40,478,843)	$ (30,521,312)	$ (24,368,383)	$ (7,804,843)	$ 2,200,263	$ 19,211,253	$ 32,364,884	$ 37,880,659	$ 33,588,159
NPV @ 5%* as of begin yr 0	18,567,586.63										
IRR*	**14.4%**										
Cash Cost per AuEq Ounce	**$ 169**	**$ -**	**$ 228**	**$ 180**	**$ 185**	**$ 152**	**$ 168**	**$ 137**	**$ 140**	**$ 126**	**$ -**
Cash Cost per Ounce (Ag Credit)	**$ 129**		**$ 214**	**$ 139**	**$ 138**	**$ 107**	**$ 127**	**$ 85**	**$ 102**	**$ 72**	
Acquisition Cost per AuEq Ounce	**$ 8**	$ 7,000,000									
Total Cost/ Ounce Incl acq.	**$ 210**	**$ -**	**$ 335**	**$ 244**	**$ 245**	**$ 225**	**$ 200**	**$ 156**	**$ 158**	**$ 179**	**$ -**

CAPITAL BUDGET CERRO SAN PEDRO

	Totals	Preproduction	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9-12
Exploration	$ -										
	$ -										
Development (ROM haul road & Pit Access)	$ 1,907,169	$ 1,907,169									
	$ -										
Capitalized Pre-Strip	$ 6,705,000	$ 6,705,000									
Mine & Mobile Equipment											
Major Mine Equipment	$ 17,830,000	$ 9,054,000	$ 8,776,000								
Mine Support Equipment	$ 537,400	$ 417,400				$ 120,000					
Maintenance Equipment	$ 1,196,000	$ 1,124,000				$ 72,000					
G&A Equipment	$ 577,000	$ 473,000				$ 104,000					
Truck Shop/Fuel/Wash	$ 826,000	$ 826,000									
Explosives Storage	$ 131,900	$ 131,900									
Equipment Rebuilds	$ 2,674,500	$ -					$ 2,674,500				
Total	$ 23,772,800	$ 12,026,300	$ 8,776,000	$ -	$ -	$ 296,000	$ 2,674,500	$ -	$ -	$ -	
Process Facilities											
Leach Pad and Solution Ponds	$ 7,942,180	$ 4,462,340			$ 3,479,840						
Merrill-Crowe plant	$ 1,784,906	$ 1,784,906									
Refinery	$ 427,188	$ 427,188									
Solution Pumping/Distribution	$ 900,272	$ 900,272									
Construction Mgmt, QA/QC	$ 497,895	$ 497,895									
Engineering	$ 334,037	$ 334,037									
Laboratory	$ 394,200	$ 394,200									
Lime Silo	$ 310,000	$ 310,000									
	$ -										
Total	$ 12,590,678	$ 9,110,838	$ -	$ -	$ 3,479,840	$ -	$ -	$ -	$ -	$ -	
Administration/Infrastructure											
Roads	$ 175,000	$ 175,000									
Office, Training Building, & Furniture	$ 370,000	$ 370,000									
Site Preparation	$ 475,000	$ 475,000									
Water Supply	$ 645,000	$ 645,000									
Cerro de San Pedro Housing	$ 350,000	$ 350,000									
Church Stabilization	$ 200,000	$ 200,000									
Property Fencing	$ -										
Electric Power & Communication	$ 2,206,680	$ 2,206,680									
Owner's Costs (Year 1 - G&A)	$ 1,579,000	$ 1,579,000									
Total	$ 6,000,680	$ 6,000,680	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
Total Capital	$ 50,976,327	$ 35,749,987	$ 8,776,000	$ -	$ 3,479,840	$ 296,000	$ 2,674,500	$ -	$ -	$ -	

FINANCING CERRO SAN PEDRO

Assumptions:

Financing begins mid year 0.
Payback begins when project has positive C.F.'s.

Loan Repayment rate as % of C.F. =		100%
Interest Rate (LIBOR + Premium) =		0.000%
Loan Facility Expenses =	$	-
Loan Commitment Fee =	$	-
Facility Fee @ 0.1875% =	$	-
Total Loan Cost	$	-

	Pre-strip	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Project Free Cash Flow Before Taxes	$ (35,749,987)	$ (4,728,856)	$ 9,957,531	$ 6,609,374	$ 16,841,600	$ 10,260,038	$ 18,138,768	$ 17,747,763	$ 6,836,540
Working Capital Need (1 mos Direct Op Cost)		$ 1,574,454							
Cummulative Cash Flow before interest costs	$ (35,749,987)	$ (42,053,297)	$ (32,095,766)	$ (25,486,392)	$ (8,644,792)	$ 1,615,247	$ 19,754,015	$ 37,501,778	$ 44,338,317
Estimated Interest Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Finance Requirement	**$ (35,749,987)**	**$ (42,053,297)**	**$ (32,095,766)**	**$ (25,486,392)**	**$ (8,644,792)**	**$ 1,615,247**	**$ 19,754,015**	**$ 37,501,778**	**$ 44,338,317**
Beginning Loan Balance	$ -	$ (35,749,987)	$ (42,053,297)	$ (32,095,766)	$ (25,486,392)	$ (8,644,792)	$ -	$ -	$ -
Draw	$ (35,749,987)	$ (6,303,310)	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Repayment	$ -	$ -	$ 9,957,531	$ 6,609,374	$ 16,841,600	$ 8,644,792	$ -	$ -	$ -
Ending Balance	$ (35,749,987)	$ (42,053,297)	$ (32,095,766)	$ (25,486,392)	$ (8,644,792)	$ -	$ -	$ -	$ -
Interest Costs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fees & Loan Expenses	$ -								
Total Loan Costs	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**	**$ -**

ADDENDUM

This addendum dated December 7, 2000 contains a revision of the Economic Model found in Section 16.0 of the Cerro San Pedro Project Feasibility Study completed November 10, 2000.

The revised model reflects the following changes:

- The production of both gold and silver were calculated by individual ore type with specific recoveries rather than using a blended average of 70.5% for gold and 35.7% for silver.

- The revised production of gold and silver also reflect leach solution inventory build up and residual leaching at the end of the project.

- Formulas using metal prices were added to calculate the gold equivalent ounces.

- Mining costs totals were adjusted to reflect the costs reported in the feasibility study. Mining unit costs are calculated in the model dividing the total mining cost by the total tons mined.

- The model assumes that the 660,000 tonnes of ore produced during the pre-production year is placed directly on the pad and leached in Year 1. The cost for crushing some of that ore to serve as the protective over-liner on the leach pad is included in process capital.

- The dore transportation and refining cost was adjusted from $2.00 per gold equivalent ounce produced to $0.2834 per ounce of total dore produced.

- Salvage costs were not included in either model since most of the equipment will be purchased used and their salvage value is not expected to be significant at the level of this analysis. Any residual value could provide a buffer to offset costs due future reclamation requirements.

- Cost of financing was removed from the revised model due to the impracticability of applying the Shareholders Agreement financing terms to the model. The revised model is therefore conceptual only, as financing must ultimately be included as required by the Shareholders Agreement.

- The tax loss carry-forward was changed to the $26 million estimated by the end of 2000.

17.0 CONCLUSIONS AND RECOMMENDATIONS

17.1 Introduction

This Feasibility Study was performed with the purpose of improving project economics by decreasing costs and simplifying operations. The results of this Feasibility Study are based on developing the Cerro San Pedro Project as a run of mine operation and utilizing large major mining equipment. Due to the relatively short mine life, much of the major equipment will be purchased used and refurbished wherever possible.

The same general format and much of the relevant information contained in the feasibility study for the Cerro San Pedro Project completed by Cambior in 1999 has been utilized in this study. Both the Cambior study and the original 1997 feasibility study completed by Kilborn, included crushing the ore and conveying it to the leach pad which results in higher metal recoveries at higher capital and operating costs. Conversely, in a run of mine operation, the costs for crushing and conveying are eliminated by hauling the ore directly from the pit to the leach pad which reduces overall costs at the expense of decreased metal recoveries.

The main parameters used in the Feasibility Study are as follows:

- Commodity Prices: $275 per ounce for gold and $5.00 per ounce for silver
- Process Rate: up to 8.0 million tonnes/year (22,000 tpd)
- Average Annual Production: 120,000 ounces gold equivalent
- Mine Life: 7.25 years
- Initial Capital Cost: $45 million
- Total Capital Cost: $51 million
- Operating Cost: $2.78 per ore tonne
- Project financing interest rate: 15%
- Start of Construction: To be evaluated as metal prices improve.

17.2 Conclusions

Main conclusions regarding the economics of the project, as presented in Section 16.0, are summarized below:

- Initial capital cost is $45 million that amounts to $52 per ounce of gold equivalent produced.

- Average cash operating cost, including royalties, is estimated at $166 per ounce of gold equivalent over the project life.

- At a base commodity price of $275 per ounce of gold and $5.00 per ounce of silver, the project after-tax rate of return is 8.4 percent.

- An increase in commodity prices to $300 for gold and $5.25 for silver yields an after-tax rate of return of 13.9 percent.

- Sensitivity analyses suggest that project economics are most sensitive to operating costs and less sensitive to capital costs.

17.3 Recommendations

Based on the results of this Feasibility Study, it is recommended that the necessary funding be provided for maintaining the Cerro San Pedro Project on a ready status until metal prices improve.

In order to be in a position to react quickly to a favorable change in metal prices, it is important that the project maintains an active presence at the local, state, and national levels. This will require a small staff in San Luis Potosi dedicated to follow up on permit requirements, land and mining concession issues, and community relations.

A budget has been developed for 2001 with this purpose in mind. Funding is provided for completing the construction of La Zapatilla village, fencing the property boundary, stabilizing the church, relocating the MSX office to the project site, and to cover G&A costs. In addition, there are two mineral rights payments due and the municipal construction permit must be renewed in June. The details are summarized below:

Cerro San Pedro Project – 2001 Budget	
La Zapatilla Village Construction	$ 300,000
Property Fencing	$ 200,000
Church Stabilization	$ 300,000
Office Relocation	$ 250,000
Administrative Holding Costs	$ 825,600
Mineral Rights Payments	$ 453,000
Municipal Permit	$ 25,000
Total	$ 2,333,600