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Competent person's report for the Reocín Mine and San Juan de Nieva zinc assets held by Asturiana de Zinc, S.L.

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20 March 2002

Denver

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Dear Sirs

COMPETENT PERSON'S REPORT FOR THE REOCÍN MINE AND SAN JUAN DE NIEVA ZINC ASSETS HELD BY ASTURIANA DE ZINC, S.L.

1. Introduction

1.1 Purpose of report

This report has been prepared by Pincock, Allen & Holt ("PAH") for inclusion in listing particulars (the "Listing Particulars") to be published by Xstrata plc (the "Company") in connection with a global offer of ordinary shares in the Company (the "Global Offer") and the proposed admission of the ordinary shares of the Company to the Official List of the UK Listing Authority (the "UKLA") and the admission of such shares to trading on London Stock Exchange plc's market for listed securities.

Lima

PAH was instructed by the directors of the Company to conduct an independent technical review of the Reocín mine and San Juan de Nieva zinc assets held by Asturiana de Zinc S.L. ("Asturiana") zinc mine and process facilities. This report, which summarises the findings of our review, has been prepared in order to satisfy the requirements of a competent person's report ("CPR") as set out in Chapter 19 of the listing rules of the UKLA.

PAH has conducted its review in accordance with the requirements of Chapter 19 of the listing rules of the UKLA and, with respect to resources and reserves, the "Australasian Code for Reporting Mineral Resources and Reserves" (September 1999) published by the Joint Ore Reserves Committee ("JORC") of the Australasian Institute of Mining and Metallurgy, Australian Institute of Geoscientists and the Minerals Council of Australia (the "JORC Code"). The JORC Code establishes the nature of evidence required to ensure compliance with the code. The review was conducted with regard to the JORC Code because it is internationally recognised. In this report, all resource and reserve estimates are reported in accordance with the JORC Code and have been substantiated by evidence obtained from our site visits and observations. They are supported by details of drilling results, analyses and other evidence and take account of all relevant information supplied to us by Asturiana's management and the directors of the Company.

Santiago

In accordance with Chapter 19 of the listing rules of the UKLA, only Proved and Probable Reserves of Reocín have been valued in addition to the San Juan de Nieva smelting plant.

1.2 Capability and independence

This report was prepared on behalf of PAH by the signatories to this report, details of whose qualifications and experience are set out in Annex A to this report.

Seattle

PAH operates as an independent technical consultant providing resource evaluation, mining engineering and mine valuation services to the resources and financial services industry.

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PAH has received, and will receive, professional fees for its preparation of this report. However none of PAH or its directors, staff or sub-consultants who contributed to this report has any interest in:

- the Company or Asturiana; or
- the mining assets reviewed; or
- the outcome of the Global Offer.

Drafts of this report were provided to Asturiana, but only for the purpose of confirming the accuracy of actual material and the reasonableness of assumptions relied upon in the report.

1.3 Scope of work/materiality/limitations and exclusions

PAH reviewed the assets in accordance with the scope of work and exclusions and limitations and on the basis of the materiality criteria set out in Annex B to this report.

PAH has independently assessed the assets of Asturiana by reviewing pertinent data, including resources, reserves, manpower requirements, environmental issues and the life-of-mine ("LOM") plans relating to productivity, production, operating costs, capital expenditures and revenues. All opinions, findings and conclusions expressed in this report are those of PAH and its sub-consultants.

1.4 Inherent mining risks

Mining, refining and sale of base metals such as zinc and lead are carried out in an environment where not all events are predictable.

Whilst an effective management team can, firstly, identify the known risks, and secondly, take measures to manage and mitigate these risks, there is still the possibility of unexpected and unpredictable events occurring. It is not possible therefore to remove totally all risks or state with certainty that an event that may have a material impact on the operation of the mine or smelting/refining operation will not occur.

1.5 Glossary of terms

Words and expressions used in this report are defined in Part X of the Listing Particulars.

2. Overview

2.1 Description of assets

Asturiana has four operational assets, all of which are located in northern Spain. Minority shareholders currently hold less than 7% of Asturiana.

- Reocín is a mining complex comprised of the following operational areas for the production of separate lead and zinc concentrates: an underground mine, an open pit mine, a concentrator (mill) mine waste management, and infrastructure. **Figure 2-1** shows a location map of Reocín. **Figure 2-2** shows an overview of the various facilities at the Reocín mine. Zinc ore has been continuously mined at the Reocín site since 1857. Asturiana purchased the mine in 1981.

- Hinojedo roasting plant is located approximately 6 kilometres north-east of the Reocín mine and processes zinc concentrates from the Reocín mine to produce calcine. The calcine is transported to San Juan de Nieva zinc operation for processing. Additionally, lead concentrates from Reocín are stored here prior to loadout and shipment to external lead smelting facilities. The Hinojedo facility dates to 1929, with a major rehabilitation program completed in 1996 to bring the plant to its current operating configuration. The facility was acquired by Asturiana in 1980.

- The San Juan de Nieva zinc smelter/refinery operation utilises conventional technologies for the production of zinc ingots, zinc alloys, zinc for plating and zinc dust. By-products from San Juan de Nieva are sulphuric acid, mercury and germanium oxide. The unit's operations at San Juan de Nieva include: concentrate receiving and storage, roasting and acid plant, leaching and purification, electrowinning and casting. The San Juan de Nieva smelter was originally commissioned in 1960 and has undergone several expansions, with the most recent being completed in August 2001.

- The Arnao manufacturing facility produces zinc oxide dust, rolled zinc products, lead anodes, and zinc wire. The Arnao factory is reported to have been in operation as early as the 1830s. Asturiana purchased the facility in 1980.

Hinojedo and Arnao are under the management control of San Juan de Nieva.

2.2 Summary of geology

The zinc-lead mineralisation of the Reocín mine is hosted in a series of north-west-dipping limestone beds that have been completely dolomitised. Regional tectonics have caused some minor folding and faulting within the area. Mineralisation occurs in the dolomites over an area approximately 3,500 metres long by 800 metres wide. The thickness of the mineralisation varies between 1.5 metres and 6 metres. Primary mineralisation consists of banded sphalerite and galena. The mineralisation outcrops to the south-east, where surface weathering resulted in the oxidation of the original sulphide minerals to calamine, smithsonite, hydrozincite, and hemimorphite. Initial mining was of the oxide material; however, remaining resources/reserves are predominantly of sulphide mineralogy, with a minor component of oxide material in the open pit.

2.3 Summary of resources and reserves

The remaining reserves as of 31 December 2001 are estimated to be 1.44 million tonnes averaging 7.42% zinc and 0.80% lead. **Table 2-1** shows a summary of the reserves.

Table 2-1 – Summary of Reserves

Mine	Tonnes ('000)	%Zn(S)	%Pb(S)
Proved Reserves	1,441	7.42	0.80

Note: No substantial, additional, undiscovered reserves are likely to exist at Reocín.

Asturiana reports the mineable ore reserves at Reocín based on the JORC Code for reporting reserves and resources. The JORC Code is an acceptable reporting method for ore reserve determination to the mining industry and financial institutions. Based on the JORC Code guidelines the remaining reserves are classified by Asturiana in the proven confidence category.

2.4 Mines, projects and process facilities

The Asturiana operations include the Reocín mine and the San Juan de Nieva zinc smelting/refinery, the Hinojedo roasting facility and Arnao factory.

2.4.1 Mining and smelting operations

The Reocín mine, located in the Spanish region of Cantabria, 5 kilometres west of the town of Torrelavega and 30 kilometres south-west of the port of Santander is Asturiana's only mining operation. The mine includes both open pit and underground operations. The remaining life of both the underground and open pit mines is 1.5 years. The two operations are being mined at rates that will result in near simultaneous exhaustion of both mining areas. Asturiana has no further mining projects.

The open pit is currently extracting mineralisation in the eastern zone of the deposit, which has already been worked underground. Future pit development will extend towards the north-east following the mineralisation in the Barrendera area. The south-west part of the deposit has now been mined out on the surface and the pit is being backfilled with waste from the active parts of the pit and filtered tailings from the concentrator.

For the open pit, Asturiana provides the engineering, drilling and blasting, while a contractor (MOTA) is responsible for the loading and haulage functions. MOTA has been performing this role for 24 years and enjoys a good relationship with Asturiana.

The open pit mining equipment is adequate in both size and numbers to meet the production requirements until the end of mining in mid-2003.

Most underground production comes from the extraction of old pillars in the Capa Sur orebody and by cut and fill mining in the Central Area (Visera). In addition cut and fill mining takes place in the West Area (Punta de Lanza). Haulage drifts are driven into the footwall limestones and most of them have concreted floors. The underground mine workings are accessed by the Santa Amelia shaft, and the Jorge Valdés inclined ramp that begins within the open pit.

All underground mining activities are performed by Asturiana. The underground mine access, infrastructure, equipment and personnel are more than adequate for the projected mine production until the end of the mine life.

Ore processing at the Reocín concentrator is done in conventional crushing, grinding and flotation circuits for the production of separate lead and zinc concentrates. The Reocín concentrator is a modern, clean and well-run facility.

Zinc concentrates from the Reocín mine are processed through the roasting plant at the Hinojedo facility to produce calcine. The San Juan de Nieva zinc smelting/refining operation receives calcine from Hinojedo and zinc concentrates from numerous sources for the production of zinc, sulphuric acid and germanium oxide as by-products. Zinc oxide is produced at Arnao in three distillation columns using zinc ingot and skimmings from San Juan de Nieva as feed.

All of the processing and smelting facilities are capable of producing at the forecast levels. Forecast productivity levels for the smelting and refining facilities are reasonable, acceptable and comparable to other zinc plants around the world.

2.4.2 Production levels

PAH has reviewed the Reocín mine plan and production schedule and found them to be achievable for the remaining ore reserves. Future productivity from both the open pit and underground operations will be at a level to meet the production requirements. Similarly, at San Juan de Nieva, the production plan accurately reflects the forecast production rates, extraction rates and concentrate feed stocks.

Table 2-2 – Reocín historical zinc and lead concentrate total production data

Parameter	Units	1999	2000	2001
Zinc concentrate:				
Quantity	tonnes	143,861	134,893	131,265
Zinc	%	59.47	60.01	60.38
Lead	%	0.76	0.80	0.78
Lead concentrate:				
Quantity	tonnes	10,022	9,320	8,201
Lead	%	71.53	71.07	71.49
Zinc	%	3.26	3.35	2.81

Table 2-3 – San Juan de Nieva plant total production

Zinc	Units	1999	2000	2001
Cathodes received	tpa	338,605	345,320	396,927
Zinc dust produced	tpa	14,104	15,539	18,479
Dross produced	tpa	4,129	3,799	6,135
Zinc cast	tpa	320,372	325,982	372,313
SHG ingot	tpa	227,552	211,675	252,845
Die-cast alloys	tpa	25,931	37,443	34,623
Galvanise	tpa	53,921	70,390	75,973
Zinc oxide	tpa	18,512	11,200	13,677
Other	tpa	–	225	–
Sulphuric acid	tpa	512,100	512,582	584,426

2.4.3 Transport

The final lead concentrate is trucked from the Reocín concentrator to Asturiana's Hinojedo facility, 6 kilometres north-east of the Reocín mine, or the nearby port of Santander for shipment to smelters. The final zinc concentrate is either trucked to the Hinojedo roasting facility for calcining or to Asturiana's San Juan de Nieva zinc plant for processing. All calcine produced at Hinojedo is trucked to San Juan de Nieva.

The San Juan de Nieva smelter receives most zinc concentrates used for feed stock through the port of Avilés. Various zinc products and sulphuric acid from San Juan de Nieva are shipped by truck or loaded onto ships at the Avilés port for shipment to consumers. Germanium oxide is shipped by truck to European refineries. Zinc oxide is bagged and shipped by truck to domestic consumers.

2.4.4 Management

PAH is confident that Asturiana's management and technical personnel at the Reocín mine, San Juan de Nieva smelter, Hinojedo roaster and Arnao factory sites, are a capable project team for the effective management of the operations. Most of the management and technical personnel have extensive experience at these facilities, with many having long tenures. PAH is of the opinion that Reocín's management and technical personnel are capable and understand the key operational and environmental issues, production factors, technical parameters and risks associated for all aspects of the operations. Although projected results are subject to variances, changes and risks typically associated with mining, smelting and refining projects, the production plans are based on sound engineering work and industry accepted practices in regards to reserves, mine plan, production forecasts, environmental issues, capital and operating costs.

2.4.5 Health and safety

There are no identified health and safety issues at the Reocín mine. Considering the age of the Reocín operation, the facilities are in good condition. Air emissions from the operations are limited to vehicle exhaust. Noise is generated principally by the mining and ore crushing/grinding operations. At these operations, employees have been issued with safety equipment for protection. In general these facilities are located well away from potential noise receptors.

Health and safety issues at Hinojedo, San Juan de Nieva and Arnao are primarily related to: (1) air emissions from the roasting/acid plant facilities; (2) fugitive dusts from concentrates and zinc dust production; and (3) jarosite residue from the leaching circuit. No major health or safety issues were identified during the site visit.

2.5 Environmental issues and management

2.5.1 Reocín mine complex

Considering the age and remaining life of the facilities at the Reocín mine, house-keeping is generally very good. The facility discharges are limited to:

- **Air** - vehicle and limited fugitive dust emissions;
- **Water** - mine dewatering, excess water from the concentrator and tailings pond decant;

- **Mine Waste** - tailings, waste rock; and
- **Solid Waste** - office, shop and contractor shop wastes.

Dewatering of the mine produces approximately 1,200 litres per second of water, which is discharged to the Besaya River through a small lake below the tailings pond. During dry periods, the mine discharge makes up a majority of the base flow in the river. Process water, as well as surface water runoff in the concentrator and crusher areas is recycled within the concentrator circuit. Excess water from the concentrator is treated and discharged. Excess plant flows and tailings pond decant are also discharged to the lake with the mine dewatering. The plant and tailings pond discharges are insignificant in comparison to the dewatering discharge volume.

Waste rock and tailings are currently hauled and disposed of in the in-pit waste dump at the west end of the open pit. Tailings filter cake is co-disposed with the waste rock in this waste dump. The filtration plant is routinely out of service for maintenance for a period of approximately 30 days per year. When the plant is down, tailings are pumped as slurry to the existing tailings pond. The pond has adequate capacity for the remaining life of the mine. Access and haul roads are routinely watered to control fugitive dusts from the operation. Vehicle emissions occur at the site, but are considered normal for this type of operation.

The mine has already reclaimed most of the historic waste rock dumps and tailings ponds and continues with its reclamation activities. Currently only the active waste dumps around the open pit, the existing active tailings pond and the plant and support building areas have not been reclaimed. A final closure plan has not been approved by the regional mining authority. Significant issues, which must be resolved, include potential impacts on the Besaya River once mine dewatering ceases as well as the long-term quantity, quality and final disposition of water from the underground mine workings. Mine closure and rehabilitation costs are discussed in Section 2.7.2.

2.5.2 San Juan de Nieva facility

The San Juan de Nieva zinc refinery was brought on line in 1960 and has been expanded and modernised several times, most recently in 2001. House-keeping at the facility is generally very good and recent modifications to the plant should provide for continuing environmental improvement. Discharges from the facility include:

- **Air** - stack emissions from the roasters/acid plant facilities, fugitive dust from concentrates and zinc dust production;
- **Process wastes** - jarosite and jarofix from the leaching process, residues from the purification circuit, sludges from the water treatment plant; and
- **Water** - process, stormwater and cooling water.

The San Juan de Nieva facility produces saleable zinc from zinc concentrates. Concentrates are received either through the port of Aviles or by truck from Hinojedo. Major plant processes include roasting with acid production from the off-gas treatment, leaching, purification, electrowinning, melting and casting.

Stacks at each of the roasters are equipped with air-monitoring equipment to measure particulate and SO_2 emissions. The plant also has four monitoring stations that monitor air quality at the perimeter of the property. The local environmental authority also monitors air quality at four locations around the port of Avilés. While the plant has occasionally exceeded the existing limit at the stack monitoring points, it has generally been in compliance at perimeter monitoring stations operated by Asturiana and the local environmental authority.

Cooling and process water are generally drawn from groundwater and local public water supplies. Process waters are treated in the water treatment plant prior to discharge to surface water in the port of Avilés. Cooling water which is not in contact with the process is discharged directly either to the port or through a marine outfall. The new Plant 4 roaster includes a closed-loop cooling system which continuously recycles water through a cooling tower. In general, the plant meets effluent discharge limits for its water discharges.

Jarosite, iron sulphate, is a major process residue. Until the most recent plant upgrades in 2001, jarosite was disposed of in ponds to the north of the plant. As part of the plant upgrade, a jarofix plant was installed. In the jarofix process, the jarosite is mixed with lime and Portland cement, producing a stable solid product. Metals within the jarofix are rendered non-leachable by this process. Asturiana has developed a jarofix disposal site at the Estrellin Quarry, located approximately 8 kilometres from the plant by road. Treated jarofix is hauled to the site by covered, sealed truck. The disposal site is lined and includes groundwater monitoring wells and leachate collection, treatment and disposal. The facility has a design life of 23 years.

Process residues, including cadmium sponge and other residues from the purification process are handled and disposed of by a licensed hazardous waste contractor at a licenced disposal facility.

2.6 Statutory authorisations

Asturiana controls the mineral rights and the right to mine at the Reocín mine through a Spanish Exploitation Concession as shown in **Table 2-4**. Mineral rights to adjacent lands for exploration are controlled through Spanish Permissions To Investigate. Information provided by Asturiana indicates that they have the right to mine through the remaining life of the mine. However, PAH has not conducted a legal title review.

Table 2-4 – Mineral rights in the Cantabria province

Type	Number/name	Hectares	Date granted	Expires
Exploitation Concession	Reocín Group	13,630.83	Various	2003
Permission To Investigate	16,306 Spat 1a Fraction	498.06	1987	2004
Permission To Investigate	16,306 Spat 4a Fraction	27.67	1987	2005
Permission To Investigate	16,325 St.Vic. 1a Fraction	3,514.09	1989	2002
Permission To Investigate	16,325 St.Vic. 2a Fraction	249.03	1989	2002
Permission To Investigate	16,325 St.Vic. 3a Fraction	83.01	1989	2002
Permission To Investigate	16,503 Paloma	138.35	1998	2002
Permission To Investigate	16,537 Ajo	8,134.98	1998	pending
Permission To Investigate	16,537 Cobreces-2	608.74	1999	2002
Permission To Investigate	16,563 Oeste	1,549.52	2000	pending

2.7 Costs

2.7.1 Operating costs

Reocín mine

PAH has reviewed the forecast operating costs for the remaining LOM and considers them reasonable and acceptable for Reocín based on the extraction rates, types of operation, historical costs, condition of the plant and equipment, type of technology employed and plant capacity.

San Juan de Nieva

PAH has reviewed the forecast operating costs and considers them reasonable and acceptable for San Juan de Nieva based on the condition of the plant and equipment, type of technologies employed and plant capacity.

2.7.2 Capital costs

Reocín mine

PAH considers the forecast capital costs for the remaining LOM as reasonable but in our opinion, the mine closure cost is inadequate and estimates an additional cost of US$1,000,000 for 2005. This has been included in our valuation. Final closure costs will not be known until the regional mining authority approves the mine closure plan.

San Juan de Nieva

PAH has reviewed the forecast capital costs for San Juan de Nieva and consider them reasonable and acceptable based on the condition of the plant and equipment, type of technology employed and plant capacity.

2.8 Risks and synergies

Mining, and in particular underground mining, is done in a working environment where not all events are predictable. An effective management team can identify the known risks and take appropriate measures to manage and mitigate these risks. PAH is not aware of any extraordinary risks at the Reocín mine or San Juan de Nieva that would preclude their continued operation through the LOM for Reocín or for the foreseeable future at San Juan de Nieva zinc smelting/refining operation, based on the assumption that sufficient zinc concentrates can be sourced as feed stock. With the closure of Reocín mine in mid-2003, the continued operation of the Hinojedo roaster will need to be secured from external sources. To date, no definitive plan has been formulated for this transition. Although PAH has not identified any material issues regarding environmental practices and compliance, we have set forth areas of concern in the CPR.

The most critical risks associated with the San Juan de Nieva operations are associated with concentrate supply, acid sales and power costs. Asturiana currently has approximately 80% of its concentrate requirements covered under supply contracts until 2004. However, all supply contracts include cancellation clauses if conditions such as low zinc prices force closure of the supplying mine. The plant configuration allows the plant to operate as three separate units if adequate supply cannot be secured. By shutting down one unit, the plant can operate at reduced capacities without significantly affecting unit production costs.

PAH reviewed the five largest zinc concentrate contracts currently in force. Each contract includes an annual base tonnage the vendor agrees to supply over the contract period. Asturiana typically pays for 85% of the zinc content in the concentrate and 65% of the silver where applicable. Metal payments have a typical minimum deduction of 8% and 3.5 ounces of silver in addition to the 65% of silver content. Treatment charges vary between contracts ranging from US$158.00 to US$191.50, (typically US$180 to US$190) with

adjustments for changing zinc market prices. In addition to treatment charges, the contracts include penalties for iron, silica, mercury and other deleterious substances when received at concentrations exceeding a contract-specified threshold concentration.

Asturiana has been successful in selling the sulphuric acid generated as a by-product from the roasting operation at a profit, even at the expanded plant production rate. Failure of the acid market would reduce the overall income of the operation and could force Asturiana to reduce the zinc production to levels where acid production can be cost effectively managed.

Power represents approximately 50% of the operating costs for the plant. Asturiana currently enjoys among the lowest power cost for zinc refineries world-wide. The current power contract rate is reviewed annually, but has remained relatively constant for several years. The power contract has no clauses limiting rate increases.

There exist excellent synergies between the Asturiana assets. The zinc concentrate from Reocín is treatable at both Hinojedo and San Juan de Nieva. The calcine produced at Hinojedo is treatable at San Juan de Nieva for the production of marketable zinc products.

2.9 Sales and marketing

Zinc products from San Juan de Nieva are certified by the Asociacíon Espanola de Normalizacion (AENOR), the Spanish Association of Standards, and its German counterpart, DQS, under standards UN-EN-IO-9002 for its product qualities. Asturiana's zinc ingots meet LME standards for Special High Grade (SHG) zinc. Other specification standards include:

- UNE-EN 1179 - designation (Z1 99.995);
- ISO 752-81 - designation (Zn 99.995);
- ASTM B6-87 - designation (SHG).

In addition to SHG zinc, San Juan de Nieva produces numerous zinc alloys, which meet various UNE-EN, ISO and ASTM standards. The Asturiana zinc products are sold into both the domestic and foreign markets.

Sulphuric acid at a minimum grade of 98.5% H_2SO_4 is produced at San Juan de Nieva for both domestic (40%) and foreign (60%) markets. This product meets all specifications for sale into the phosphate, chemical and textile, paper and petrochemical industries.

2.10 Valuations

2.10.1 Methodologies and assumptions

PAH has valued the Proved Reserves at Reocín based on the cash flow for the remaining LOM and the San Juan de Nieva smelter based on cash flows for 18 years. The production and cost inputs into the cash flow are based on the various technical and cost data previously presented and opined on by PAH in the body of this report. The only variance to Asturiana's cash flow was the inclusion of an additional US$1,000,000 for closure costs at the Reocín mine. The cash flow was prepared based on the following:

- stand-alone project basis;
- post-tax determination of the NPV;
- plant and equipment has not been valued separately and is considered an integral component in the generation of cash flows;
- nominal cash flow (100% equity);
- cash flows are discounted on a mid-year basis; and
- the price assumptions and treatment charges are based on independent forecasts provided by the Commodity Research Unit.

Table 2.5 – Base case forecast prices

Nominal prices		2002	2003	2004
Zinc[1]	US$/t	841	1,010	1,116
Sulphuric acid[2]	US$/t	19.7	17.5	18.0
US$/A		0.91	0.92	0.92

[1]Forecast LME zinc price.

[2]Based on a weighted average of export and domestic prices.

2.10.2 Valuation results

PAH has determined that the net present value ("NPV") of the Reocín Mine and San Juan de Nieva smelter as of 31 December 2001 at a 9.5% nominal discount rate is US$857 million. The nominal discount rate affects the NPV as shown on **Table 2-6.**

Table 2-6 – Combined Reocín and San Juan de Nieva valuation

Nominal discount rate (%)	Net Present Value[(1)] (US$ millions)
+2%	749
+1%	800
9.5%	857
–1%	921
–2%	991

(1) Valuation is on a 100% basis. Minority shareholders currently hold less than 7% of Asturiana.

Table 2-7 – Base case valuation of zinc operations

Base case valuation	Reocín mine (US$ millions)	San Juan de Nieva (US$ millions)	Total zinc operations (US$ millions)
	6	851	857

2.10.3 Sensitivity analysis

PAH has performed a sensitivity analysis on the following principal assumptions in the cash flow which demonstrate the highest degree of impact on the project's NPV:

- zinc price; and
- operating costs.

PAH's sensitivity analysis was performed at minus 10% for zinc prices and plus 10% for operating costs. **Table 2-8** summarises the results of the sensitivity analysis.

Table 2-8 – Reocín and San Juan de Nieva

	Base case total value (US$ millions)	Zinc price (-10%) (US$ millions)	Operating costs (+10%) (US$ millions)
NPV Valuation	857	504	570

2.11 Conclusions

2.11.1 Reocín mine

PAH concludes the following for the Reocín mine:

- the geological understanding of the remaining reserves is of a sufficient level to support the open pit and underground mine plans to the mine's closure in mid-2003;
- the deposit information is of a sufficient level to categorise the remaining reserves in the Proved category in accordance with the JORC Code;
- the production plans for the mines (underground and open pit) and concentrator accurately reflect the forecast production rates, recoveries and concentrate qualities for the remaining LOM;
- the mining and concentrating equipment are of sufficient capacity and technology for the effective extraction and processing of ores to produce marketable lead and zinc concentrates;
- PAH considers the forecast capital costs for the remaining LOM as reasonable but in our opinion, the mine closure cost is inadequate and estimates an additional cost of US$1,000,000 for 2005. This has been included in our valuation;
- production forecasts, capital and operating costs used in the pro forma cash flow model for reserve valuation appropriately reflect the forecast production levels;
- the management and technical staff at the mine have extensive experience and the required level of expertise in the performance of their respective work areas;
    - at this time, the mine has no known environmental violations or pending legal actions associated with environmental liabilities;
- the facility is operating within all known operating permits; and
- key risks identified by PAH are understood by Asturiana's management.

2.11.2 San Juan de Nieva

PAH concludes the following for San Juan de Nieva:

- the production plans accurately reflect the forecast production rates, extraction rates and concentrate feed stocks;
- the smelting/refining equipment are of sufficient capacity and technology for the effective extraction and processing of zinc concentrates to produce marketable zinc, sulphuric acid and germanium oxide products;
- PAH has reviewed the forecast operating costs and consider them reasonable and acceptable for San Juan de Nieva based on the condition of the plant and equipment, type of technologies employed and plant capacity;
- the management and technical staff have extensive experience and required level of expertise in the performance of their respective work areas;
- environmental issues have been identified or are under study;
- at this time, the San Juan de Nieva plant has no known environmental violations or pending legal actions associated with environmental liabilities;
- the facility is operating within all known operating permits; and

- key risks identified by PAH are understood by Asturiana's management.

3. Summary of mining operations

3.1 Geological characteristics

The Reocín mine is located on the south-east flank of the north-east by south-west trending Santillana syncline, which consists of Triassic and Cretaceous age rocks of deltaic to marine origin, overlying a folded and fractured Paleozoic basement. The zinc-lead mineralisation is hosted in a series of limestone beds that have been completely dolomitised. Regional tectonics has caused some minor folding and faulting within the area. Mineralisation occurs in the dolomites over an area approximately 3,500 metres long by 800 metres wide. The thickness of the mineralisation varies between 1.5 metres and 6 metres. The footwall contact of the mineralisation is very even with a dip of an almost constant 23 degrees, although, the hanging wall contact is very irregular. Primary mineralisation consists of banded sphalerite and galena, with minor marcasite. The lead to zinc ratio is typically around 1:7.5. The mineralisation outcrops to the south-east, where surface weathering has resulted in the oxidation of the original sulphide minerals to calamine, smithsonite, hydrozincite, and hemimorphite. Initial mining was of the oxide materials, however, remaining resources/reserves are predominantly of sulphide mineralogy, with a minor component of oxide material in the open pit.

Two contrasting styles of mineralisation have been recognised in the Reocín mine, each separated by the Visera fault. **Figure 3-2** shows the general geologic relationships of the mineralised horizons. To the west of the fault, the mineralisation is relatively thin (2 to 6 metres), tabular and stratiform and is contained at the base of an 80-metre thick, massively bedded, dolomite unit. Mineralisation principally occurs in the Capa Sur horizon, immediately above the footwall marly limestone. Other, less well-developed horizons in the western section of the mine are the Capa Norte and Tercera Capa horizons, which occur in the hanging wall of the Capa Sur mineralisation. The Visera horizon is developed in the vicinity of the Visera fault between the Barrendera and the Capa Sur ore bodies and represents the merging of the Capa Sur and Capa Norte horizons into a single, mineralised unit. Mining in these areas has been by underground methods.

To the east of the Visera fault the mineralisation is composed of an assemblage of lenticular mineralised units of 45 to 60 metres thick within a thick sequence (200 to 240 metres) of bedded dolomites. Mineralisation in this area is referred to as the Barrendera zone. Mining in this area has been by a combination of open pit and underground methods.

3.2 Maps and plans

Maps and plans for the Reocín mine are presented in **Figures 2-2, 3-1, 3-2, 3-3** and **3-4.**

3.3 Resource and reserve statement

3.3.1 Estimates of volume, tonnage and grades

At a total mine production rate of 1 million tonnes per annum over the remaining mine life, the underground and open pit ore reserves at Reocín will be exhausted by about the middle of the year 2003. More than half of the underground mineable reserves are composed of pillars left from previous underground mining. The tonnage of remaining ore is divided between the open pit and the underground mines at about a 2:1 ratio. However, the contained zinc is almost evenly divided between the open pit and underground mines. Remaining reserves consist of sulphide mineralisation, with minor unrecoverable oxide zinc content. This oxide zinc content is subtracted so that only sulphide zinc content is included for the reserves.

Reserves are estimated by Asturiana through the application of a sulphide zinc Zn(S) resource cut-off grade. This cut-off grade is based on the mining (including the cost of necessary development to access the reserve), and treatment costs. The current cut-off grades are based on grades calculated from recent operating data.

The zinc price and recovery used to check the breakeven Zn(S) equivalent grades for the open pit and underground mines at Reocín in order to calculate the cutoff grade was US$909 per tonne and 95%, respectively:

Equating the revenues and costs in an algorithm to calculate the breakeven cut-off grade, results in cut-off grades 8.0% Zn(S) for the underground mine and 3.3% Zn(S) for the open pit.

Following the recommendations by RTZ Consultants in 1995, Asturiana adopted the reporting of resources and reserves at Reocín in accordance with the JORC Code.

Resource tonnes and grade for the underground mineralisation in the pillars in the central and western areas of the mine are based on chip channel samples. Grades are estimated from the sample data using weighted average grades, with tonnes estimated from the shape of the pillar. Resource tonnes and grade for the underground Viscera and Punta de Lanza zones are based on samples from drill holes and chip channel samples. Grades and tonnes are estimated from the sample data using a computerised block model and an inverse distance estimation method, with Datamine software. Dilutional effects, that occur as a result of the irregular hanging wall contact in conjunction with the minimum mining height of 5 metres required for backfill trucks, are included in the estimation based on the relative mineralised horizon thickness.

Resource tonnes and grade for the surface open pit mineralisation in the Barrendera zone are based on surface and underground drill holes, as well as in-pit grade control holes. Using the drill hole data, the open pit resource/reserves were estimated by Datamine International in December 1996. Open pit reserves were determined using a Whittle 4D optimisation program. The estimation also

involved open pit optimisation, mine design and scheduling. Dilutional effects, which occur as a result of the equipment used on the 10-metre benches, are included in the reserve estimation.

The official reserve position, as of 31 December 2001, is shown in **Table 3-1.** The project mineral resources do not include any additional dilution factors. The resource is fully converted in the reserves, with the inclusion of additional dilution factors as discussed in a subsequent section. There are currently no resources at Reocín additional to the stated reserves. Resource and reserve estimates are only for sulphide mineralisations, with adjustments made during the estimation process to exclude the minor unrecoverable oxide zinc content.

Table 3-1 – Summary of reserves and resources

		Resources				Reserves			
Mine	**Zone**	**Category**	**Tonnes('000)**	**Pb(S)%**	**Zn(S)%**	**Category**	**Tonnes('000)**	**Pb(S)%**	**Zn(S)%**
Underground	Total	Measured	417	1.24	11.73	Proved	488	1.06	10.04
Opencut	Total	Measured	745	0.84	7.78	Proved	953	0.66	6.08
Reocín	**Total**	**Measured**	**1,162**	**0.98**	**9.20**	**Proved**	**1,441**	**0.80**	**7.42**

Note: Resources are effectively stated inclusive of reserves. Resources do not include any additional dilution factors. Reserves are the resources with additional mining dilution factors. No additional resources exist beyond those that are converted to reserves.

Based on the JORC Code guidelines the remaining resources are classified by Asturiana in the Measured Resource category, which upon conversion to reserves are classified by Asturiana in the Proved Reserve category. The mineral resource is inclusive of the reserves and is fully converted to the reserves, with the inclusion of additional dilution factors.

PAH believes that the tonnages and grades have been calculated correctly and reflect the application of prudent and standard engineering practices by the mine personnel.

Figure 3-4 shows the location of the remaining reserves in the open pit and underground mining areas.

Based on PAH's review of past performance of the operation and the reconciliation of the production with the reserve model being used for production planning, PAH believes that the reserves and production forecast being used for the remaining production life (through to June 2003) to be acceptable.

3.3.2 Expected recovery and dilution factors

Remaining reserve estimates were developed in a manner that accounts for mine recovery and dilutional factors for both the open pit and underground operations. Mine recovery for underground mining is considered to be 100% as a result of the planned extraction of all estimated ore mineralisation from the cut and fill method being used. Dilution factors are added to adjust for the additional waste rock taken with the ore, which is 14.4% for Visera ore, 19.3% for Pilares ore and 10.0% for Punta de Lanza ore.

Mine recovery for open pit mining is considered to be 100% as a result of the planned extraction of all estimated ore mineralisation inside of the engineered pit limit. A dilution factor is added to adjust for the additional waste rock taken with the ore, which is 28.0%.

Changes in mine recovery or dilution are not anticipated and should not influence the limited remaining life of mine operations. The mine is more sensitive to other factors such as metal price variability.

3.4 Long-term prospects

Further mineralisation found in the Reocín mine has zinc grades of less than 4% and/or are located in areas that are difficult to access. As a result, it is unlikely that this mineralisation will be mineable and they are not included in any current resource or reserve estimates.

The project areas have been extensively explored over the years. The Asturiana staff are of the opinion that the likelihood for further potentially mineable material is limited and as such the mine is planned for closure in 2003.

3.5 Mining and ore processing

Mining at Reocín includes both open pit and underground operations. Mine engineering is supported by a staff of geologists and mining engineers using industry recognised computerised mine planning software.

The concentrator for processing ores from the open pit and underground mine is located adjacent to the mines on the same site. The concentrator produces separate lead and zinc concentrates, which are shipped to the roasting plant at Hinojedo. Zinc concentrates are roasted to produce calcine which is refined at the San Juan de Nieva electrolytic plant. Lead concentrates are stock-piled and loaded for shipment to other smelters for processing and sale on the open market.

The remaining life of both the underground and open pit mines is less than 1.5 years. The two operations are being mined at rates that will result in near simultaneous exhaustion of both mining areas. Future productivity from both the open pit and underground operations will be at a level to meet the production requirements.

A comparison of the production from the underground operation for 1999, 2000 and 2001 (actual versus the plan average for the year) is shown in **Table 3-2**. There was a shortfall in grade from the underground production because of ground conditions but it was compensated for by increased production in the open pit.

Table 3-2 – Underground production

Category	Units	Actual 1999	Actual 2000	Actual 2001	Reocín plan 2001
Ore	Tonnes/month	42,387	39,016	39,055	38,983
Zinc assay	% Zn(S)[1]	10.83	10.70	10.17	10.94
Zinc assay	% Zn[2]	11.04	10.91	10.42	11.16
Lead assay	% Pb	1.23	1.21	1.19	1.14

(1) Reported as in sulphide.

(2) Reported as total zinc.

Because mine openings in the La Fragua section of the underground mine proved to be less stable than expected, production from this section was halted.

In an effort to make-up for the zinc loss resulting from the La Fragua underground problems, open pit operations were accelerated during 2001. As a result, the reserves were depleted faster than planned. Discussions with the mine staff at Reocín, however, indicated that the reserves in the open pit may have been somewhat understated by the Datamine program and the actual values may be higher. Whether the surplus will be sufficient to replace all of the La Fragua losses will not be known until late in the mine life. The increase in ore mined from the pit resulted in lower than expected grades. The mine staff commented that dilution was somewhat higher than expected, probably due to the accelerated mining rate.

A comparison of the production from the open pit operation for 1999, 2000 and 2001 (actual versus the plan average for the year) is shown in **Table 3-3**.

Table 3-3 – Open pit production

Category	Units	Actual 1999	Actual 2000	Actual 2001	Reocín plan 2001
Ore	Tonnes/month	54,242	50,474	56,945	45,183
Zinc assay	% Zn	6.24	6.55	6.50	6.85
Lead assay	% Pb	1.02	0.97	0.89	0.99

Of the remaining reserves, approximately 63% will be from the open pit mine and the remainder from the underground. PAH has reviewed the Reocín mine plan, production schedule, capacities, recoveries and concentrate grades and found them to be achievable for the remaining ore reserves.

4. Summary of smelting/refining operations

Asturiana owns and operates three zinc production assets located in northern Spain comprising the San Juan de Nieva zinc operation. These assets are:

- the Hinojedo roasting plant which, processes zinc concentrates from the Reocín mine to produce calcine. This is transported to the San Juan de Nieva zinc operation for processing;
- the San Juan de Nieva zinc smelter/refinery, which utilises conventional processing methods for the production of zinc ingots, zinc alloys, zinc for plating and zinc dust, as well as by-products of sulphuric acid, mercury and germanium oxide; and
- the Arnao manufacturing facility, which produces zinc oxide dust, rolled zinc products, lead anodes and zinc wire.

Hinojedo and Arnao are under the management and cost control of San Juan de Nieva.

4.1 Production schedule

The Hinojedo roasting plant has an installed daily capacity to process 200 tonnes of zinc concentrate from Reocín for the production of 165 tonnes of calcine and 105 tonnes of liquid sulphur dioxide. There is no loss of zinc at Hinojedo. Reocín is currently the only source of zinc concentrates to the Hinojedo roasting plant. After closure of Reocín mine in mid-2003, the continued operation of the Hinojedo roaster will be from external sources trucked to Hinojedo and off-loaded at Hinojedo or at the nearby port of Santander. To date, no definitive plan has been formulated for this transition. The Hinojedo roaster plant does not have any mercury removal system due to the low mercury level in the Reocín zinc concentrates. After Reocín's closure, zinc concentrates processed through Hinojedo would need to have low mercury concentrations to ensure the final liquid sulphur dioxide product meets market specifications.

The San Juan de Nieva zinc smelting/refining operation has a production capacity of 460,000 tonnes of zinc per annum, of which 440,000 tonnes are saleable. A major expansion project was completed at San Juan de Nieva in August 2001 increasing its annual capacity from 320,000 tonnes to the 440,000 tonnes per annum of saleable zinc. The difference of 20,000 tonnes between production and saleable represents the zinc that is recycled into the plant's processing circuits. By-product capacity at San Juan de Nieva is 650,000 tonnes per annum of sulphuric acid produced from the roaster off-gases and 5,000 kilogrammes of germanium oxide. The current zinc recovery rate at San Juan de Nieva is approximately 96% to 96.5%. PAH is of the opinion that the forecast zinc recovery of 96.5% is achievable at San Juan de Nieva once the commissioning is complete. The 96.5% zinc recovery was used in the production forecasts for valuation in the pro forma cash flow analysis.

Following the expansion of the San Juan de Nieva plant's design production capacity, approximately 850,000 tonnes of zinc concentrate per year are required as feedstock to the electrolytic zinc plant. In 2001, approximately 702,000 tonnes of zinc concentrate was used as feed stock by the electrolytic zinc plant, of which approximately 130,000 tonnes was acquired from the Reocin mine. Currently, concentrates are either sourced from Reocín or purchased under contracts at an average concentrate grade of 54% zinc. With the closure of Reocín in mid-2003, all concentrates will be purchased under contracts. Typically, San Juan de Nieva receives zinc concentrates from more than 20 sources, of which five to seven sources represent about 70% of its total requirements. The largest single source is the Red Dog mine in Alaska. San Juan de Nieva has contracted for about 80% of its zinc concentrate requirements until 2004. PAH's review of Asturiana's contract terms for zinc concentrates indicate that they conform to standard industry terms for zinc concentrates.

4.2 Plant and equipment

4.2.1 Hinojedo

Facilities at Hinojedo include:

- roasting of zinc concentrates;
- production of liquid sulphur dioxide;
- storage of lead concentrates from the Reocín mine; and
- port facility for loadout of the Reocín lead concentrates.

The daily output at Hinojedo is approximately 165 tonnes of calcine and 105 tonnes of liquid sulphur dioxide (of which 99.95% was SO_2).

Zinc concentrates from the Reocín mine are received and stored in the roaster building. The concentrates are loaded onto a conveyor belt for feeding the roaster. The roasting process produces zinc oxide, termed calcine and sulphur dioxide-bearing gases. The roasting of the zinc concentrate is done in a flash roasting furnace at temperatures of some 1,000ºC. Approximately 200 tonnes of zinc concentrates are treated daily producing gases from 26,000 to 28,000 cubic meters per hour. The flash roaster has four beds (two for drying and two for roasting) and is 26 feet 3 inches in diameter (internal). The roaster off-gases containing sulphur dioxide are passed through the waste heat boiler, wet electrofilter, scrubber and dry electrofilter before being sent to the liquid sulphur dioxide plant. The calcine is sent to the electrolytic zinc plant at San Juan de Nieva for processing.

The sulphur dioxide gases are concentrated through the elimination of oxygen and nitrogen. The process, which is performed in an absorption tower, is based on the selective absorption of sulphur dioxide through the use of dimethylaniline ("DMA") with the remainder of the gases are released into the atmosphere. The sulphur dioxide and DMA are then separated in a second tower through heat treatment. The liquid sulphur dioxide is dried using liquified acid and a bank of compressors and condensers prior to its storage for shipment to market. Storage capacity at Hinojedo is approximately 1,000 tonnes of liquid sulphur dioxide in 11 tanks. The liquid sulphur dioxide is sold as a by-product, primarily to the local wood pulp industry.

4.2.2 San Juan de Nieva

The San Juan de Nieva zinc smelting/refining plant is comprised of the following five major operating areas:

- concentrate receiving and storage;
- roasting and sulphuric acid plant;
- leaching and purification;
- electrowinning; and
- casting.

Concentrates are received by road or via the San Juan de Nieva wharf at the nearby port of Avilés. The concentrates from the wharf are conveyed to the San Juan de Nieva plant site. The calcine produced at Hinojedo is also sent to the San Juan de Nieva plant. The plant has a storage capacity for over 40,000 tonnes of concentrate.

The zinc concentrates are fed to the roasting circuit. There are four roaster lines, all fluid bed design, combining to treat 850,000 tonnes of the zinc concentrate per year. The roaster off-gases are treated in four Lurgi double-contact acid plants. Acid production is dependent on the blend of concentrates, but is currently averaging about 750,000 tonnes of sulphuric acid (98.5%) per year. Mercury is scrubbed from the roaster off-gases before entering the acid plant using Asturiana patented technology. Mercury is recovered from the gas scrubbers in liquid form and sold on the open market.

The calcine from the roasters is treated in a two-stage leaching system comprising of neutral and hot acid sections. Spent electrolyte from the electrowinning plant is used for converting the zinc oxide (ZnO) to zinc sulphate ($ZnSO_4$). The neutral leach discharge is thickened and the thickener overflow is sent to the purification circuit. Germanium oxide is produced from the hot acid leach stream.

Purification of the zinc sulphate solution from neutral leaching is done in three stages for the removal of copper, cadmium, nickel and cobalt. The purified solution is cooled in cooling towers for gypsum removal prior to electrowinning.

Electrowinning is done in four tank houses: two with a capacity of 100,000 tonnes of zinc per year using standard size cathodes and semi-automatic stripping and one with a capacity of 120,000 tonnes of zinc per year using large cathodes and automated stripping. Tank houses "A" and "B" are of the old cascade design and "C" is of the new, patented Asturiana design. A new, modern electrolytic tank house, termed "D", was added in the recent expansion at stated design capacity of 120,000 tonnes per year. Electrolyte impurities are well controlled and the quality of the zinc deposition meets LME specifications for SHG 100% of the time. Cathodes are sent to the casting plant for SHG ingots, die cast alloys and galvanising zinc production.

The casting plant consists of seven induction furnaces each capable of producing any mix of products from SHG ingots to die cast alloys and each can cast various sizes and shapes. The technology is standard and state-of-the-art, although four of the furnaces are smaller than other modern installations.

There are three major infrastructure facilities associated with San Juan de Nieva: (1) port; (2) power; and (3) water. Zinc concentrates from foreign sources are received at the nearby Avilés port from which they are conveyed to the site. Zinc products and sulphuric acid are shipped from the Aviles port to foreign consumers. San Juan de Nieva purchases its power from the regional Utility Hidroeléctrica del Cantábrico at a special industrial rate. The Government reviews the rate on a periodic basis. The contract includes no limits on power cost changes. Asturiana is currently negotiating for multi-year contracts. Power costs over the past 15 years have been relatively stable. The electric grid is reliable with only two power outages in the last 30 years. San Juan de Nieva has a concession to use the full capacity of the Ferrería River for the purpose of industrial water for operations. This water supply is supplemented by water purchased from Consorcio de Aguas de Asturias (CADASA), a local water supplier.

4.2.3 Arnao

The Arnao manufacturing facility is located approximately 4 kilometres west of the San Juan de Nieva plant adjacent to the Cantabria Sea. Arnao was purchased by Asturiana in 1980. Arnao produces the following products:

- zinc oxide dust;
- rolled zinc;
- lead anodes; and
- zinc wire.

Zinc oxide dust is produced in three distillation columns, which are fed with zinc ingot and skimmings from the melting processes at the San Juan de Nieva plant. They are also fed with bottom or surface galvanisation drosses, which are previously melted in a special oven so that a large part of aluminium and iron may be separated off. The zinc vapour from the columns is taken to condensers for the production of zinc oxide dust due by an oxidation chamber and then passed through a sleeve filter, where the zinc oxide is collected. The zinc oxide production capacity of the three columns is 15,000 tonnes per year (capacity 24,000 tonnes per year).

Zinc ingots are initially rolled to a thickness of 10 millimetres in a roughing mill. The roughed zinc is then reduced to a thickness of 0.25 millimetres in a finishing mill and subsequently cut to the customer's requirements. The capacity of the rolling facility is some 9,000 tonnes per year.

Lead anodes are produced at Arnao for the electrolytic process tanks at San Juan de Nieva.

Zinc wire is produced at Arnao in the manufacture of zinc plating. A continuous casting furnace feeds a rough wiredrawing mill followed by two finishing mills. The finishing mills are capable of producing 2 millimetre diameter wire. The production capacity of zinc wire is approximately 500 tonnes per year depending on consumer demand.

4.3 Environmental management/waste disposal

4.3.1 Hinojedo

The Hinojedo plant is a well-established industrial facility with buildings dating back to 1912 and operations reported as early as 1929. Prior to the establishment of the current operations, the plant was rehabilitated during the period 1995 to 1997. Development of the current operation required extensive site demolition and clean-up. Current environmental monitoring at the site is limited. Based on PAH's primary review of the site the following primary emissions and wastes produced at the roasting plant have been identified:

- air emissions from the roasting/SO_2 plant facilities;
- fugitive dust from lead concentrate storage and calcine production;
- storm water run-off from the site with potential metals and other contaminates; and
- lead concentrate spills into river at the ship loadout area.

The Hinojedo plant receives all raw materials from the Reocín mine. With the closure of the mine in 2003, future operation of this plant is uncertain and may require modification or closure and site rehabilitation. No cost estimates have been developed for these scenarios.

4.3.2 San Juan de Nieva

The San Juan de Nieva smelting/refining process includes the intake and storage of concentrate, roasting of concentrates and treatment of gases (acid plant) to produce sulphuric acid, together with leaching, purification, electrowinning, melting and casting of zinc. The process produces the following primary emissions, wastes streams and discharges:

- air emissions from the roasting/acid plant facilities;
- fugitive dust from concentrates and zinc dust production;
- sludge from the water treatment of process and stormwater;
- jarosite wastes from the leaching process;
- impurities from the purification circuit such as copper and cadmium residue; and
- discharge of cooling water to surface water and estuary.

The principal focus of Asturiana's atmospheric emissions management programme is the roasters, acid plant and the zinc dust production plant. Asturiana continuously monitors SO_2 air emissions from Roasters 1, 2, 3, and 4 and, in addition, monitors four air quality stations outside the smelter site. Particulate emissions from the zinc dust furnace and the zinc fusion furnaces 4 and 6 are also monitored. Monthly monitoring results for all of the above emissions are reported to environmental authorities. Asturiana reports that air emissions from these sources meet the requirements of Spanish regulations. The Consejería de Fomento (a local environmental authority) monitors air quality at four sites around the port of Avilés; the closest to the smelter is the Matadero station. Asturiana reports that air quality limits are occasionally exceeded at the smelter. They also report that there have been claims against the company by individuals for exceeding these limits, but the courts have found in favour of Asturiana, and that the Consejería de Medio Ambiente (regional environmental authority) audits/inspects the site two to three times per year and that no issues are currently outstanding.

Residue from the leaching circuit, sludge from the water treatment plant and fluorine waste from washing of roaster gas are managed in the jarosite (iron sulphate) ponds. Jarosite and acid insoluble compounds (lead, calcium and silica) represent the final residue from the leaching circuit. The residue is allowed to settle in thickeners, filtered and then pumped to the jarosite ponds for disposal. Site storm water and excess process water is collected and treated at the water treatment plant; sludge from the plant is disposed of in the jarosite ponds. Asturiana has constructed four ponds, two are closed and reclaimed (1 and 2), one is currently available to accept jarosite waste (Pond 3) and one has been constructed as a temporary jarofix storage (Pond 4). Pond 1 was closed in 1984 and it is unlined and covered. Pond 2 has a geosynthetic liner and is closed and covered with a geotextile and a geosynthetic.

No groundwater monitoring wells are currently installed around Ponds 1 and 2. As a result, impact on groundwater cannot be assessed. Asturiana reports that a monitoring network of some 25 wells existed until 5 years ago. Monitoring for pH, conductivity, zinc and heavy metals showed no groundwater contamination. The wells in this monitoring network were destroyed when the government revegetated the area where the wells were located. Pond 3 is lined with a geosynthetic liner and has some 350,000 cubic metres of storage capacity remaining. Five monitoring wells are associated with Pond 3. As part of the plant upgrade, a jarofix plant was installed. In the jarofix process, the jarosite is mixed with lime and Portland cement, producing a stable solid product. Metals within the jarofix are rendered non-leachable by this process. Asturiana has developed a jarofix disposal site at the Estrellin Quarry, located approximately 8 kilometres from the plant by road. Treated jarofix is hauled to the site by covered, sealed truck. The site is lined, and includes groundwater monitoring wells and leachate collection, treatment and disposal. The facility has a design life of 23 years.

Impurities from the purification circuit such as cadmium residue are accumulated onsite then transported by COGERSA (waste hauler and manager) to a secure hazardous waste facility. COGERSA also handles waste oils and other hazardous waste from the site. Asturiana produces more than 10 tonnes of hazardous waste per year.

4.3.3 Arnao

Based on visits to the Arnao facilities, PAH's findings indicate that there are no environmental issues. PAH's review of the environmental permitting documentation provided indicates that the primary environmental permits and approvals are in place to continue the operation of these facilities. This facility operates under permits issued for San Juan de Nieva.

Based on PAH's primary review of the site, the following primary emissions and wastes produced at the site have been identified:

- air emissions from the zinc oxide furnaces;
- air emissions from the metals furnaces in the wire casting and anode casting areas;
- surface water run-off;
- cooling water discharge; and
- maintenance-related solid and hazardous wastes.

5. Special factors

PAH has not identified any special factors that may affect the viability of operations at the Reocín mine and San Juan de Nieva.

6. Conclusions

6.1 Reocín mine

PAH concludes the following for the Reocín mine:

- the geological understanding of the remaining reserves is of a sufficient level to support the open pit and underground mine plans to its closure in mid-2003;
- the deposit information is of a sufficient level to categorise the remaining reserves in the proven category in accordance with the JORC Code;
- the production plans for the mines (underground and open pit) and concentrator accurately reflect the forecast production rates, recoveries and concentrate qualities for the remaining LOM;
- the mining and concentrating equipment are of sufficient capacity and technology for the effective extraction and processing of ores to produce marketable lead and zinc concentrates;
- PAH considers the forecast capital costs for the remaining LOM as reasonable but in our opinion, the mine closure cost is inadequate and estimates an additional cost of US$1,000,000 for 2005. This has been included in our valuation;
- production forecasts, capital and operating costs used in the pro forma cash flow model for reserve valuation appropriately reflect the forecast production levels;
- the management and technical staff at the mine have extensive experience and the required level of expertise in the performance of their respective work areas;
- at this time, the mine has no known environmental violations or pending legal actions associated with environmental liabilities;
- the facility is operating within all known operating permits; and
- key risks identified by PAH are understood by Asturiana's mine site management.

6.2 San Juan de Nieva

PAH concludes the following for San Juan de Nieva:

- the production plans accurately reflect the forecast production rates, extraction rates and concentrate feed stocks;
- the smelting/refining equipment are of sufficient capacity and technology for the effective extraction and processing of zinc concentrates to produce marketable zinc, sulphuric acid and germanium oxide products;
- PAH has reviewed the forecast capital costs for San Juan de Nieva and considers them reasonable and acceptable based on the condition of the plant and equipment, type of technology employed and plant capacity;
- PAH has reviewed the forecast operating costs and considers them reasonable and acceptable for San Juan de Nieva based on the condition of the plant and equipment, type of technologies employed and plant capacity;
- the management and technical staff have extensive experience and required level of expertise in the performance of their respective work areas;
- environmental issues have been identified or are under study;
- at this time, the San Juan de Nieva plant has no known environmental violations or pending legal actions associated with environmental liabilities;
- the facility is operating within all known operating permits; and
- key risks identified by PAH are understood by Asturiana's site management.

6.3 Valuation

The Reocín mine and San Juan de Nieva operations are valued at US$857 million.

Stephen W. Thomas
Principal Mining Engineer and Director of Mining Services
For and on behalf of
Pincock, Allen & Holt

Part IX Competent persons' and technical reports – Spanish zinc assets

Annex A – Statement of capability and experience

Marshall A. Koval, P.G. - Principal Geologist and President of PAH - Bachelor of Science, Geology; Gemology Degree - Member of NWMA, SME, NMA

Mr. Koval, President of PAH, is a geologist with over 22 years experience in the mining and environmental industries. He served as Project Manager for the closure and reclamation of the Cannon Mine in Washington state, the development of a Sampling and Analysis plan for the Ite Bay tailings disposal area at Southern Peru Copper Corporation, an Environmental Audit of the Ilo, Peru Power Plant, and the development of the site-wide Environmental Compliance and Management Program (PAMA) for the entire Southern Peru Copper Corporation complex including two mines and concentrators, a smelter and copper refinery complex, a port and harbor facility and railway.

Alva L. Kuestermeyer - Principal Mineral Economist and Director of New York Operations - Master of Science, Mineral Economics; Bachelor of Science, Metallurgical Engineering – Member of Society for Mining, Metallurgy and Exploration

Mr. Kuestermeyer has over 27 years of operational and consulting experience in the minerals industry, specifically in mineral processing, extractive metallurgy, market analysis and project economics. Has worked on numerous consulting assignments for base and precious metal, uranium, and industrial mineral projects on a world-wide basis. Projects have included due diligence, mergers, acquisitions, valuations, project economics and market analysis. He has expertise in multi-client studies and cost modelling, market and mineral commodity studies and industry analysis for non-ferrous and precious metal ores, uranium and industrial minerals.

Stephen W. Thomas - Principal Mining Engineer and Director of Mining Services - Bachelor of Science, Mining Engineering - Graduate work in Business Administration - Member of AIME, MMSA, NWMA

Mr. Thomas has over 28 years experience in the minerals industry including senior positions in both engineering and production, at the operations and corporate levels. Responsibilities included preparation of preliminary property evaluations, due diligence evaluations for acquisition support, preparation of project prefeasibility and feasibility studies, project permitting and economic evaluation of projects. He has prepared project development plans for support of bank financing, supervised project engineering, managed construction projects and has managed operations. His experience covers base and precious metals, coal, and industrial minerals and he has participated in projects located worldwide.

Mark Madden, P.E. - Principal Geotechnical Engineer - Master of Science, Civil Engineering (Geotechnical); Bachelor of Science, Civil Engineering - Professional Engineer, States of Alaska and Wisconsin - Member of American Society of Civil Engineers

Mr. Madden has over 21 years of experience completing both geotechnical and environmental permitting projects for a variety of resource development and infrastructure projects. Mr. Madden has performed foundation designs for permafrost conditions, including analyses of heat transfer, frost jacking and secondary creep. He has performed geotechnical investigations and foundation designs for commercial and industrial structures, residential development and utility installation. For several projects, he has provided continuous on-site observation through critical foundation construction operations. He was project engineer for the Kubaka Gold Project in Magadan Oblast, Russia responsible for evaluation of geotechnical and environmental management issues for a bank due diligence review and completion monitoring. He reviewed environmental management issues including transport of all fuels, cyanide and other process chemicals to the site by winter road, onsite storage, handling and disposal of process reagents, camp solid waste disposal, fuel storage and handling, and explosives storage and handling.

Mark G. Stevens, C.P.G. - Principal Geologist - Master of Science, Geology; Bachelor of Science, Geology - Certified Professional Geologist; Registered Geologist in the State of Wyoming - Member of Society for Mining, Metallurgy and Exploration and Society of Economic Geologists

Mr. Stevens has expertise in the fields of geology and resource estimation. He has more than 21 years experience in the evaluation of base and precious metal deposits around the world, including due diligence reviews, reserve audits, technical evaluations, and prefeasibility/feasibility studies. His gold experience includes work on more than 100 mineral deposit studies. Representative gold projects include Rio Narcea, Spain; Florida Canyon, Nevada; Zortman-Landusky, Montana; Midas, Nevada; Bellavista, Costa Rica; Poderosa, Peru; Briggs, California; Mineral Ridge, Nevada; Goldstrike, Nevada; La Cienega, Mexico; Mezcala, Mexico; Relief Canyon, Nevada; and Ivanhoe, Nevada.

Bill Brooks - Metallurgical Engineer - Bachelor of Science, Metallurgical Engineering - Member of SME

Mr. Brooks has over 26 years experience in the minerals industry in operations management, engineering and project management, process engineering, metallurgical engineering, design, construction and operation of gold, copper, silver, nickel, cobalt, and zinc processing facilities and mines. He has implemented innovative solutions to production problems and has a strong financial background including P&L responsibility for numerous operating and engineering assignments.

Annex B – Scope of work/limitations and exclusions/materiality

Scope of work

PAH performed the following scope of work for the CPR:

- site visits and collection of data. Key members of the study team visited the Reocín mine and San Juan de Nieva zinc smelting/refining operations and were given presentations at the respective sites by senior site management. Respective team members inspected the mining and processing operations, zinc smelting/refining operations, infrastructure facilities and environmental management programs.
- technical review and reporting was undertaken by the study team for key elements of the CPR study including geology, resources and reserves, mining and processing operations, infrastructure facilities, capital and operating costs, production forecasts, extraction rates, sources of raw materials, markets, utilisations, plant and equipment and environmental issues.

The CPR covered Asturiana's Reocín mine and San Juan de Nieva zinc smelting/refining operation assets that are materially relevant to the production and cost schedules for Asturiana.

Limitations and exclusions

The CPR was based principally on information provided by Asturiana, either directly from the Reocín mine site, San Juan de Nieva zinc operations, other Asturiana offices, or from reports by other consultants or firms whose work was pertinent in the preparation of this CPR. The report is based on information made available to PAH before 11 January 2002.

The work undertaken for this CPR is a technical review of the information coupled with such site inspections of assets as PAH considered appropriate for the preparation of the CPR.

PAH has not endeavoured to forecast independently the metal prices used in the cash flow. The price assumptions and treatment charges are based on independent forecasts provided by the Commodity Research Unit.

Asturiana provided the technical and cost data for the cash flow in the CPR. PAH reviewed the accuracy and consistency of the assumptions relevant to the production forecasts, capital and operating costs.

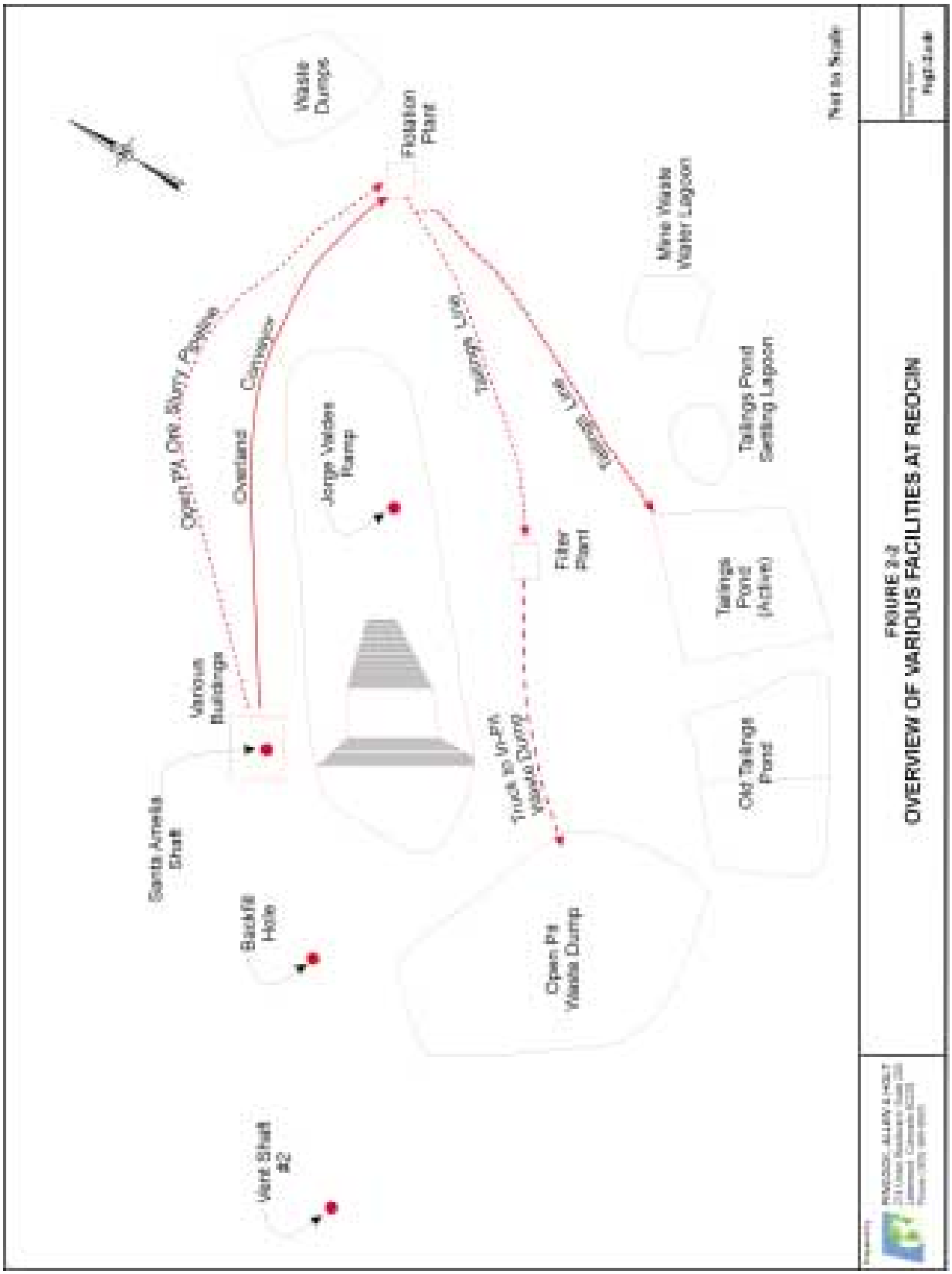
In PAH's opinion, the information provided by Asturiana was reasonable and there were no instances during the preparation of the CPR that suggested any significant errors, misrepresentations or omissions with respect to the information provided.

Materiality

The Reocín mine and San Juan de Nieva zinc smelting/refining assets were examined to identify any significant technical and operating risks. Where risks for the Reocín mine assets are likely to impact on the LOM forecast production, capital and operating costs by less than 10% they are not considered significant. Where risks for the San Juan de Nieva zinc operation assets are likely to impact on the forecast production, capital and operating costs by less than 10%, they are not considered significant. Any identified risks were reviewed to ensure adequate allowance is provided in Asturiana's forecasts. Any significant risks, which are not adequately addressed in the Asturiana forecasts, are considered to be "material".

Figure 2-1 – Location map for Asturiana assets

Figure 2-2 – Reocín layout



Note: Not to scale

Figure 3-1 – Reocín mine concession locations

Figure 3-2 – General plan map of Reocín mine mineralisation

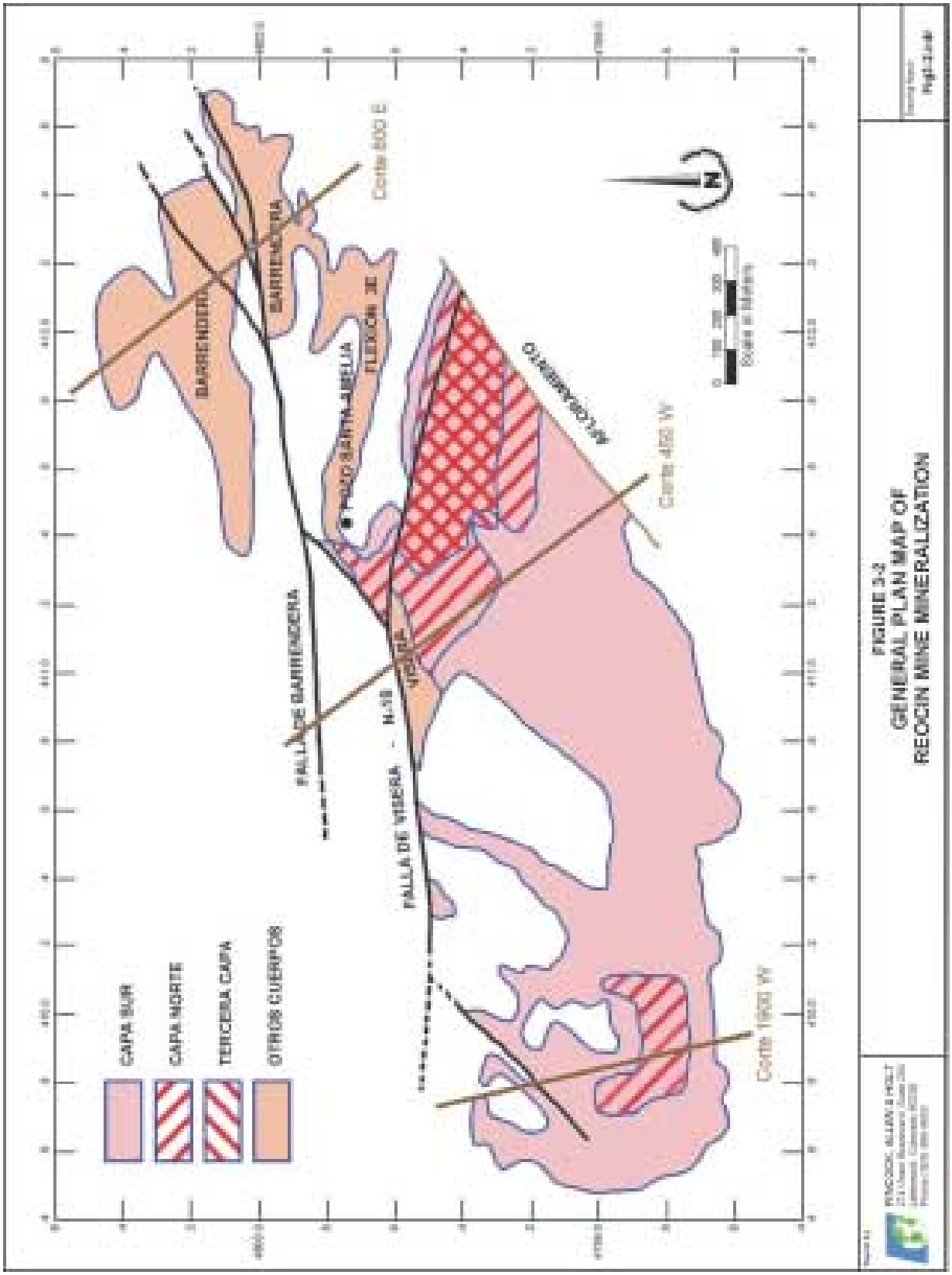


Figure 3-3 – Reocín mine drill hole locations

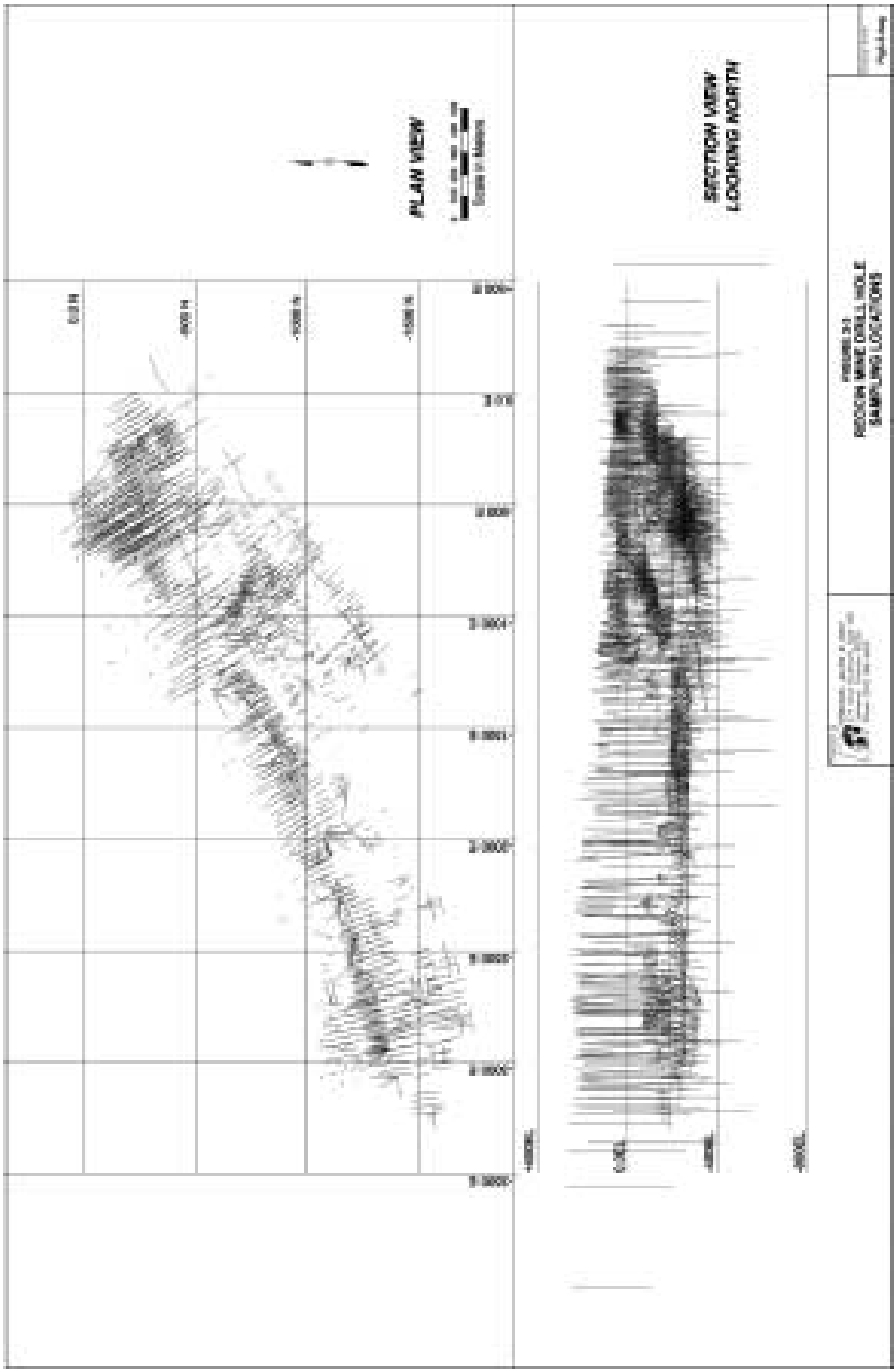
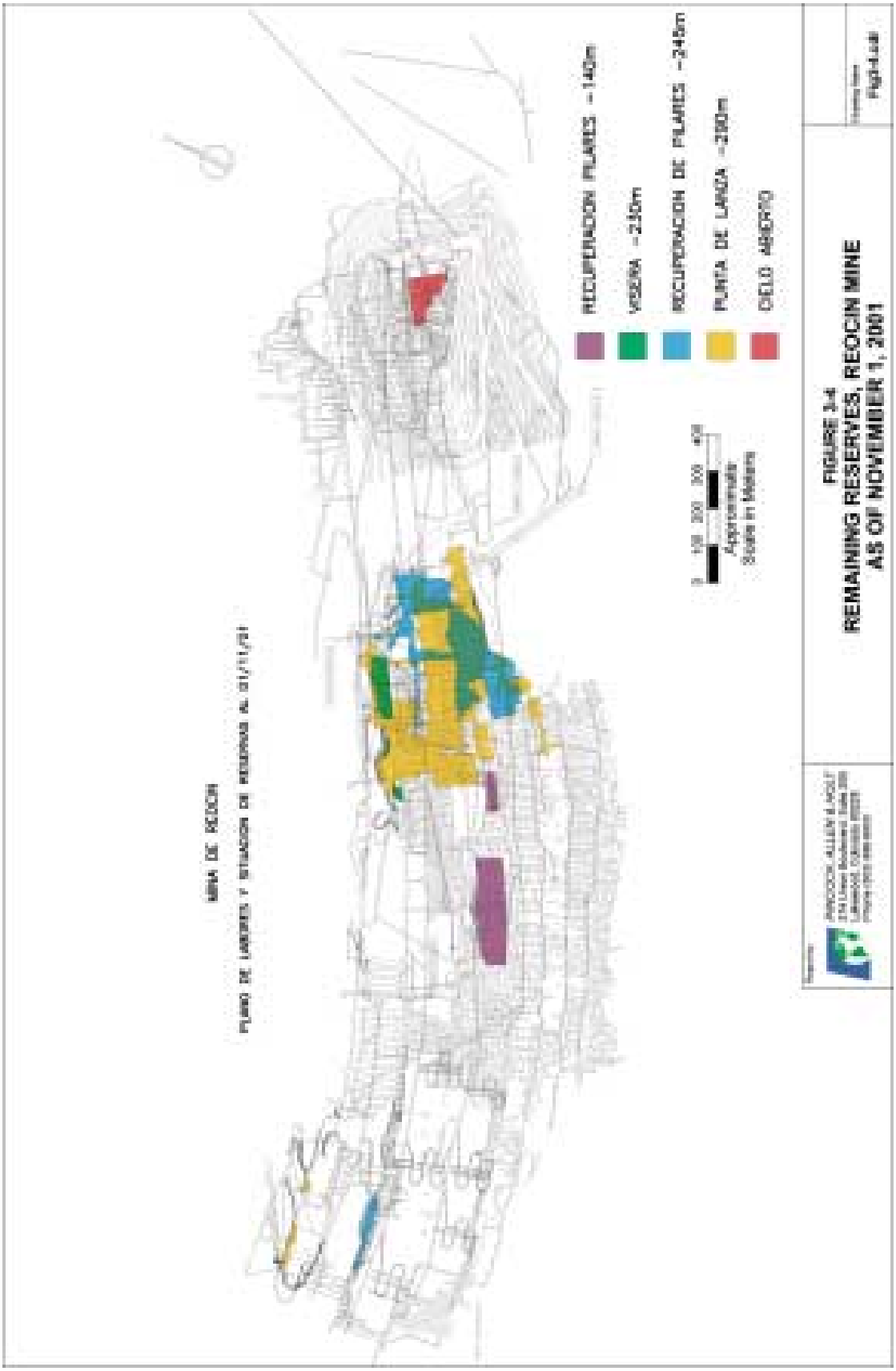


Figure 3-4 – Remaining reserve areas



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