# **REPORT NI 43-101**

# **TECHNICAL REPORT ON THE**

# MINERAL RESOURCES AND RESERVES OF THE

# LOS SANTOS MINE PROJECT,

# SPAIN

**Prepared for** 

Daytal Resources Spain S.L.

by

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# 1 SUMMARY

# 1.1 Introduction and Overview

This report was prepared to provide a Technical Report compliant with the provisions of National Instrument 43-101 - Standards of Disclosure for Mineral Projects, ("NI 43-101"), by way of a review and summary of Resource and Reserve Estimations for the Los Santos Mine, up to the end of June 2015. This current estimate was completed during August-October, 2015. The mine is currently an open pit operation, and is located in the Province of Salamanca in Spain. The principal product of the mine is a tungsten concentrate.

This report was prepared by Adam Wheeler, at the request of Mr. N. Alves, Director of Mine Development, for the Almonty Group ("Almonty"). Assistance and technical detail were supplied by the technical personnel at Los Santos. Adam Wheeler has been involved with resource and reserve estimation at the mine since 2006, and has visited the site many times. In connection with the latest resource and reserve estimate, and with the preparation of this report, Adam Wheeler visited the site from September 21<sup>st</sup> -24<sup>th</sup>, 2015.

The mine started open pit ore production during 2008, and the mill was commissioned during the same year.

# 1.2 Ownership

Daytal Resources Spain S.L. ("Daytal") is a wholly owned Spanish subsidiary of Almonty Industries Inc (Almonty), a corporation governed by the Canada Business Corporations Act (the "CBCA"). Almonty trades on the TSX Venture Exchange (TSX-V) under the symbol "All". The Los Santos mine is 100% owned by Daytal.

### **1.3 Geology and Mineralization**

Los Santos lies within Lower Palaeozoic sediments in the Central Iberian Tectonic Zone, which forms part of a Europe-wide, Variscan age orogenic belt. The stratigraphy comprises a thick sequence of clastic metasediments, ortho- and para-gneisses, with volcanic and carbonate formations.

This stratigraphy was intruded by Hercynian (274 Ma old) granitoids in a series of plutons, with numerous, crosscutting granite and aplite dykes, sills and irregular pods intruding the metasediments up to 0.5km from the regional granite contact.

The Los Santos deposit is a typical skarn-hosted scheelite deposit, where intrusion of granitoids into carbonate-rich sedimentary rocks has resulted in their replacement by calc-silicate or siliceous minerals, together with mineralisation. It forms from impure Fe-rich carbonates and contains pyroxene, scheelite, plagioclase and locally magnetite. The scheelite is generally fine grained, minus 1mm in size, but individual crystals may exceed 1cm.

In particular areas sulphide-rich skarns also occur. They are up to 5m thick and several metres in strike length, and comprise massive or semi-massive sulphide horizons with scheelite mineralisation. Sulphides comprise pyrite, arsenopyrite (lollingite), pyrrhotite and chalcopyrite as principal minerals.

The four main rock types present at Los Santos are skarn, granite, calc-silicates and corneanas, a word applied to mean all other metamorphic rocks (mostly hornfels) at the site.

The tungsten occurs mainly as scheelite within massive pyroxene skarn. The skarn bodies are generally narrow steeply dipping structures. The deposit is made up of a number of discrete zones, six of which have been modelled for the current resource estimate. The strike length varies for each zone, but zone dips are fairly uniform across the deposit, varying between 60° to 90°. Within each zone, the skarn mineralisation is located within a number of individual beds, separated by barren lithologies. The major skarn beds vary between 2m and 20m in width; there are, however, numerous thinner bands measuring tens of centimetres.

### 1.4 Database and Resource Estimation

Subsequent to the original discovery in 1980, Billiton completed an exploration campaign which included 249 trenches and 231 diamond drillholes. In addition in one of the zones, Los Santos Sur, an underground ramp and level access at the 945m elevation was developed, which totalled 825m of development. The level development provided bulk samples as well as underground drilling access.

Since start-up of the mine in 2006, Daytal have also done some additional diamond drilling and reverse-circulation drilling. The current combined sample database used for resource modelling contains data for 495 drillholes and 255 trenches, for a total of 6,779 samples. The total drilled length is 41,924m.

The resource estimation has been completed using a computerised three-dimensional block modelling approach, using the Datamine mining software system. For each of the zones being evaluated, skarn bed interpretations have been built up into wireframe models. Other wireframe models have been defined for the boundaries of the principal lithologies. Volumetric block models were then built up to reflect the lithologies and skarn beds. The principal parent block size used was 10m x 10m x 10m, but with sub-blocks within the skarn beds measuring 5m along-strike and down-dip, and 2.5m across-strike. The model structure was also rotated at an angle of approximately 22°, so that blocks were more logically oriented with the majority of skarn structures.

The skarn bed wireframe models were used to select separate sample sets within each bed. These selected samples were then converted into approximately 2.5m composites. The composite  $WO_3$  grade values were used to interpolate grades into the block model, according to the parent skarn beds to which they belonged. Geostatistical analysis was used to assist in the selection of interpolation parameters, as well with subsequent resource classification. An oxidised layer has also been defined down to 10m underneath the topography.

The final block models were used as the basis of resource estimation, pit optimisation, pit planning and subsequent reserve estimation. The block models contain fields which include the lithology, skarn bed identification, rock density and WO<sub>3</sub> grade.

# 1.5 Mine Planning

The resource block models for each zone have been used for pit optimisation. The pit slope parameters were derived from the geotechnical studies. Overall slope angles, allowing for road intersections and bench configurations, of approximately of  $55^{\circ}$  (North) and  $48^{\circ}$  (South) have been applied. For the top 10m of superficial material, a lower overall slope of  $45^{\circ}$  was applied.

The resultant optimised pit models were used as the basis for final pit designs. Since mine start-up in 2006 open pit mining has started in five zones – Los Santos Sur, Las Cortinas, Sector Central, Capa Este, and Los Santos Sur SW. The pits have 10m benches, although within the skarn ore zones this is reduced to 5m sub-benches. All material is drilled and blasted, using Tamrock CHA1100 drills making 3.5in diameter blastholes. Pre-split lines are used for final pit walls. The haul roads are 10m wide with a 10% gradient, and Komatsu HD465 trucks are used, which carry approximately 55t.

In or near ore, all blasthole cuttings are sampled. This data is used to build up short-term planning block models, from which all ore and waste outlines are blocked out. As well as demarcating the ore boundaries in the pit with ribbons, a geological technician is present at all times during production in the pits, to assist with ore/waste definition during mucking. Komatsu and Cat crawler-excavators are used for both ore and waste excavation.

All mining work is carried out using Spanish mining contractors, Movitex and Perforaciones Noroeste. There are two main separate waste dumping areas, and waste used where possible to backfill mined-out pits. Ore is split into different grade categories, and deposited in separate areas on the run-of-mine (ROM) pad or on a separate low grade stockpile.

For the 12 months preceding September 2015, approximately 525 Kt of ore were mined, along with 3,8 Mt of waste, from 2 open pit areas: Santos Sur and Las Cortinas East.

In the reserve estimation, a small amount of underground ore has also been blocked out from small narrow bed extensions beneath the 'Day 1' pit to the west of Los Santos Sur. These parts can be reached by adit access from the pit or by access from the existing underground ramp. A 3m minimum mining width has been used blocking out these underground reserves, and assumes an overhand cut-and-fill stoping method.

Recent planning work has now also added pit reserves from the Capa 4 and Capa G pit areas, which lie to the west of the current Los Santos Sur- SW pit area.

### 1.6 Mineral Processing

The process plant is primarily based on gravimetric separation, aimed at recovering a high grade scheelite concentrate. During the last 12 months it was able to process 519 Ktpa, with an average feed grade of 0.32% WO<sub>3</sub>. Over the same period the average plant recovery was 60%. The on-going planned recovery is 62%.

The primary crushing circuit employs a jaw crusher, with a nominal 100tph capacity, followed by two cone crushers, generating a minus 12 mm size material in a conical open stockpile ahead of the main process plant. A conveyor feeds this material at 65 tph rate into a rod mill which produces a ground product. This ground ore is then wet-screened at 1000  $\mu$ m, with the oversize being reground in a regrind ball mill and the minus 1000  $\mu$ m undersize product being the raw feed to the gravity circuits.

Two banks of hydrocyclones then split the gravity circuit feed material into 1000/150  $\mu$ m and 150/30  $\mu$ m size fractions. Both size fractions go through low intensity magnetic separation to remove mill steel and pyrrhotite ahead of gravity separation.

The non-magnetics streams from the two size fractions then go to their respective banks of rougher spirals. Middlings are recycled via middlings-cleaners spirals, and the rough spiral tails exit as waste. In both circuits, rougher concentrates are cleaned in a bank of cleaner spirals before going forward to shaking tables. Concentrates from the coarse and fines spirals are fed to a hydrosizer which feeds four separate tabling circuits. Tailings from the cleaner step of all tabling circuits are recycled back to the hydrosizer,

The coarse tailings are dewatered by thickening cyclones and a high frequency screen. Fine tailings are dewatered in a thickener and filter press. In both cases, the final tailings product is dry enough to be trucked and disposed of on the mine waste dump. The thickener overflow is recycled as process water and the plant operates with a zero discharge.

The combined gravity concentrates are batch-processed through two  $3m^3$  flotation cells to float off sulphides. The non-floating material, principally scheelite, is discharged into a dewatering cone, and then goes through a rotary kiln dryer, followed by three-stage high intensity magnetic separation, to remove any remaining mill steel and pyrrhotite and any paramagnetics (mainly pyroxene). A final high grade scheelite concentrate constitutes the final saleable product, and typically has a grade of approximately 65% WO<sub>3</sub>.

The currently predicted overall recovery of  $WO_3$  for the reprocessing of tailings is 46%. Raising this tailings recovery to 50-55% levels is one of the targets of on-going metallurgical testwork.

## 1.7 Mineral Resource and Reserve Estimates

The evaluation work was carried out and prepared in compliance with Canadian National Instrument 43-101, and the mineral resources in this estimate were calculated using the Canadian Institute of Mining, Metallurgy and Petroleum (CIM), CIM Standards on Mineral Resources and Reserves, Definitions and Guidelines prepared by the CIM Standing Committee on Reserve Definitions and adopted by the CIM in May, 2014. The current resource estimation is shown in Table 1-1 and Table 1-2.

Table 1-1 Los Santos – Measured and Indicated Mineral Resources At  $30^{th}$  June, 2015

Resource Category	Tonnes	WO <sub>3</sub>	WO <sub>3</sub>	
	Kt	%	t	
Measured	75	0.41	304	
Indicated	2,133	0.28	6,012	
Total	2,208	0.29	6,316	

Notes

. Cut-Off Grade =  $0.05\%WO_3$ 

- . Minimum width = 2.5m
- . Resources shown are inclusive of reserves
- . Sector Central and Las Cortinas East removed,
- as pits have been completed
- . All other resources shown are total in-situ

Table 1-2. Los Santos – Inferred Mineral ResourcesAt 30th June, 2015

	Tonnes	WO₃	WO <sub>3</sub>
	Kt	%	t
Inferred	1,878	0.25	4,663

Notes

. Cut-Off Grade =  $0.05\%WO_3$ 

The current reserve estimation, stemming from the mine plan developed from this resource base, is shown in Table 1-3. The estimated processing cost for re-processed tailing is 9.52/t leading to a breakeven cut-off grade 0.07% WO<sub>3</sub>. This implies that all of the identified tailings material is economically viable to process, and so is included in the reserve inventory.

<sup>.</sup> Minimum width = 2.5m

	Mine Reserves			
Reserve	Tonnes	WO <sub>3</sub>	WO <sub>3</sub>	
Category	t ('000)	%	Tonnes	
Proven	57	0.44	251	
Probable	1,408	0.33	4,700	
Proven + Probable	1,465 0.34 4,951			

Table 1-3. Los Santos – Proven and Probable Mineral Reserves				
	At 30 <sup>th</sup> June, 2015			

Tailings	Tonnes	WO <sub>3</sub>	WO <sub>3</sub>
	t ('000)	%	Tonnes
Coarse rejects (Arenas)	1,564	0.13	2,107
Fine rejects (Tortas)	498	0.22	1,084
	2,062	0.15	3,191

Stockpiles	Tonnes	WO <sub>3</sub>	WO <sub>3</sub>	
	t	%	Tonnes	
Ore A stockpile	6,717	0.41	28	
Ore B stockpile	8,130	0.19	15	Grand
Oversize stockpile	21,885	0.43	94	
Oxide stockpile	18,455	0.15	28	Total
High Grade Conc. Stock	5	64.9	3.2	WO <sub>3</sub>
Low Grade Conc. Stock	22	38.0	8.4	Tonnes
Intermediate Grade Conc. Stock	76	17.1	6.5	
Total	55,289	0.33	183	8,325

Notes

. Ore cut-offs used :

. Open pits 0.07%WO₃

. Los Santos Sur underground 0.3% WO<sub>3</sub>

. Re-Processed Tailings 0.07% WO3

. Cut-offs derived from a long term planning price of \$37,000/t WO $_3$  APT

The principal operating costs used in connection with this reserve calculation were \$12.63/t ore for processing and administration, \$2.03/t ore for open pit waste mining, and \$30.42/t ore for underground mining. Of the total 1,465 Kt of mining reserves, 1,434 Kt of ore comes from 5 separate open pits and 31 Kt of ore comes from underground workings.

The pits encompassing the reserves shown in Table 1-3 also contain 292 Kt of inferred resources at economic grades. At an annual ore production rate of 500 ktpa, and this reserve base, including approximately 2.06 Mt of tailings that can be re-processed, a mine life of approximately 6 years is suggested.

# 1.8 Conclusions

- 1. The Los Santos mine has now been producing for 7 years. The open pit mining practices have been progressively improved, along with the planning and grade control systems.
- Daytal has all permits and licenses to operate and remain in compliance with appropriate regulations. It has no restrictions with respect to waste dumping capacity, including dry tailings, and it has been possible to backfill some of the excavated pits with waste.
- The diamond drilling campaigns completed by Daytal over the last 7 years have in general confirmed the overall quantities and grades of the scheelite ore which were originally delineated by Billiton in the 1980s.
- 4. The recent drilling campaigns have also identified some potential mineralized extensions beyond the currently modelled zones. These positive results, along with predicted high metal prices, suggest that the mine life derived from the current reserve base is conservative. Exploration drilling planned since 2014 has helped delineate additional open pit and underground reserves to the west of Los Santos Sur.
- 5. Significant improvements have been made to the plant since mine start-up.

# 2 INTRODUCTION

# 2.1 Introduction

The Los Santos scheelite deposit in western Spain was originally investigated by Billiton in the 1970s. Ownership passed into the hands of Siemcal S.A. (SIEMCALSA), a publicly owned company of mining and geological consultants based in Salamanca, Spain. In 2007 the deposit was purchased by Daytal, which at the time was 100% owned by Heemskirk Consolidated Limited (Heemskirk). The mine started production in 2008, managed by Daytal. The mine has continued operation since. Daytal is now a wholly owned Spanish subsidiary of Almonty Industries Inc (Almonty), a corporation governed by the Canada Business Corporations Act (the "CBCA"). Almonty trades on the TSX Venture Exchange (TSX-V) under the symbol "All". The Los Santos mine is 100% owned by Daytal.

In 2015 Adam Wheeler was requested by Daytal to assist in the preparation of an updated NI 43-101 report titled 'Technical Report on the Mineral Resource and Reserves of the Los Santos Mine Project, Spain.'

Adam Wheeler has worked on resource and reserve estimation for Los Santos annually since 2006. The current report was prepared by Adam Wheeler, with assistance from Daytal staff, in order to present updated resource and reserve estimates as of the end of June, 2015. In connection with this work, Adam Wheeler worked on site from September 21<sup>st</sup> -24<sup>th</sup>, 2015, as well as numerous earlier trips between 2007 and 2015.

# 2.2 Terms of Reference

The resource and reserve estimation work was commissioned by Daytal, a wholly owned subsidiary of Almonty, and completed by Adam Wheeler, an independent mining consultant.

Adam Wheeler was retained by Daytal to provide an independent Technical Report on the Mineral Resources and Mineral Reserves at Los Santos, as at June 30<sup>th</sup>, 2015. This Technical Report has been prepared to be compliant with the provisions of National Instrument 43-101 - Standards of Disclosure for Mineral Projects ("NI 43-101").

The report is considered current as of October 31<sup>st</sup>, 2015.

The Qualified Person responsible for the preparation of this report is Adam Wheeler (C.Eng, Eur.Ing), an independent mining consultant. In addition to site visits, Wheeler carried out a study of all relevant parts of the available literature and documented results concerning the project and held discussions with technical personnel from Daytal regarding all pertinent aspects of the project. The reader is referred to these data sources, which are outlined in the "Sources of Information" section of this report, for further details.

The purpose of the current report is to provide an independent Technical Report and update of the resources and reserves for the Los Santos mine, in conformance with the standards required by NI 43-101 and Form 43-101F1. The estimate of mineral resources contained in this report conforms to the CIM Mineral Resource and Mineral Reserve definitions (May, 2014) referred to in NI 43-101.

#### 2.3 Sources of Information

In conducting this study, Wheeler has relied on reports and information prepared by and for Daytal. The information on which this report is based includes the references shown in Section 26.

Adam Wheeler has made all reasonable enquiries to establish the completeness and authenticity of the information provided, and a final draft of this report was provided to Daytal along with a written request to identify any material errors or omissions prior to finalization.

#### 2.4 Units and Currency

All measurement units used in this report are metric, and currency is expressed in US Dollars unless stated otherwise. The exchange rate used in the study described in this report is US\$1.12 to 1.00 Euros (€), unless otherwise stated.

#### 2.5 Disclaimer

Adam Wheeler has reviewed and analysed data provided by Daytal and its consultants and has drawn his own conclusions there from. Adam Wheeler has not performed any independent exploration work, drilled any holes or carried out any sampling and assaying.

While exercising all reasonable diligence in checking and confirmation, Adam Wheeler has relied upon the data presented by Daytal, and previous reports on the property in formulating his opinions.

Title to the mineral lands for the Los Santos property has not been investigated or confirmed by Adam Wheeler and Adam Wheeler offers no opinion as to the validity of the exploration or mineral title claimed.

# 3 RELIANCE ON OTHER EXPERTS

The author has relied, and believes that he has a reasonable basis on which to rely, upon the various topics that are taken directly or paraphrased from the Golder Associates feasibility study report of May 2006. This also encompassed work provided by other consultants and organisations, as summarised below:

- Golder Associates Global Iberica, S.L.
- Eral Equipos and Proyectos , S.A.
- Prehenita (Spanish geological consultancy)
- Control Ingeneria y Servicios S.A., Seinco.

Additional geotechnical studies have been completed by the SADIM consultancy company during 2014-2015.

# 4 PROPERTY DESCRIPTION AND LOCATION

Los Santos is located in the western part of the Iberian Peninsula, in the southern part of the province of Salamanca, within the municipalities of Fuenterroble de Salvatierra and Valdelacasa at longitude 5° 46' west and latitude 40° 32' north. It is 180 km west of Madrid, 50 km south of the city of Salamanca and 1 km east of the town of Los Santos.

The position of Los Santos in Spain is shown in Figure 4-1.

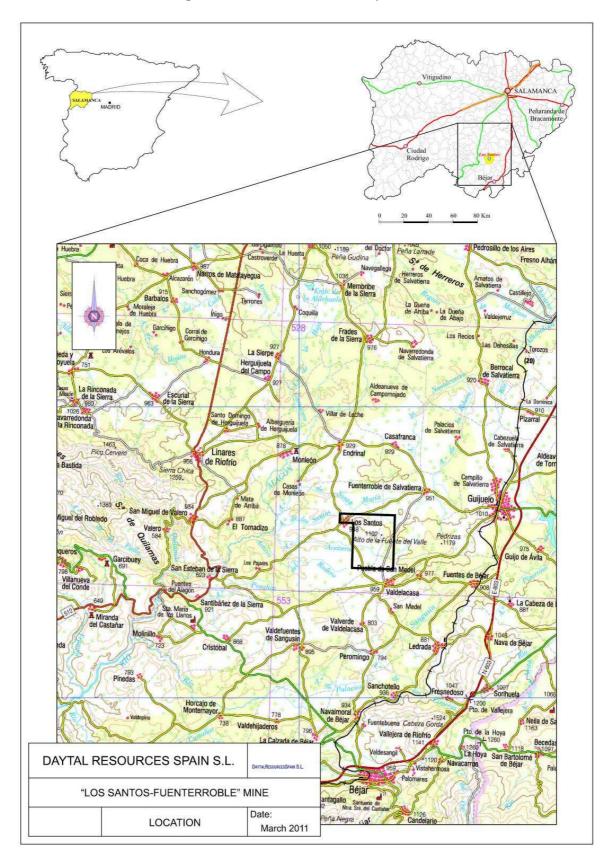


Figure 4-1. Overall Location Map

### 5 ACCESSIBILITY, CLIMATE, LOCAL RESOURCES, INFRASTRUCTURE, PHYSIOGRAPHY

The most direct route to Los Santos is on the A.66 road, part of the national network, from Salamanca to Guijuelo. The position of the mine relative to the Los Santos village is shown in Figure 5-1.

The average altitude of the sector where the deposit is located is 1.000 m above sea level, being located in the South slope of a hill, that extends 3 km from West to East, with a maximum altitude of 1.108 m, descending towards the South to 900 m.

The climate is warm Mediterranean, with cold winters and an annual average rainfall of 900 mm, mainly between November and March, with minimums in June, July and August. The average annual temperature is between 11°C and 14°C, with a maximum registered value of 38°C and a minimum of -14°C. The values for real evapotranspiration is between 40 and 80% of precipitation. The solar evaporation is in the order of 1500 mm/year.

As for rainfall, all meteorological stations show high annual rainfall variability with an average relationship of maximum/minimum rainfall higher than 3.5, average/minimum of 2 and maximum/average less than 1.5. Therefore, mine plans are based on this irregular behaviour, in particular for successive dry periods.

The region located SW of the studied area shows a higher precipitation pattern, decreasing from N to E. Los Santos district shows average records of precipitation around 800 mm, or even 900 mm (depending on sources). This is consistent with nearby meteorological stations and with regional patterns such as the influence of the nearby "Sierra de Francia" hills. The average minimum registered is around 387 mm. The maximums can be inferred, varying between 556.9 mm and 1789 mm, considering a maximum average of 1173 mm/year.

Average annual rainfall is approximately 900 mm. Furthermore, for flood calculations in the Acillero basin, the average of 725 mm registered at Guijuelo is recommended. For Las Navas, the selected station is located at Casafranca, where records show an average of 750 mm per annum. For water availability calculation during dry periods, averages around 350-400 mm per annum are recommended. The stations that support this assessment are Guijuelo, Casafranca and Monleón, with minimum rainfall registers of around 368 mm, 400 mm and 600 mm per annum respectively. It is important to note a minimum of 230 mm per annum registered at Miranda del Castañar as the worst-case scenario, and hence is recommended for future calculations.

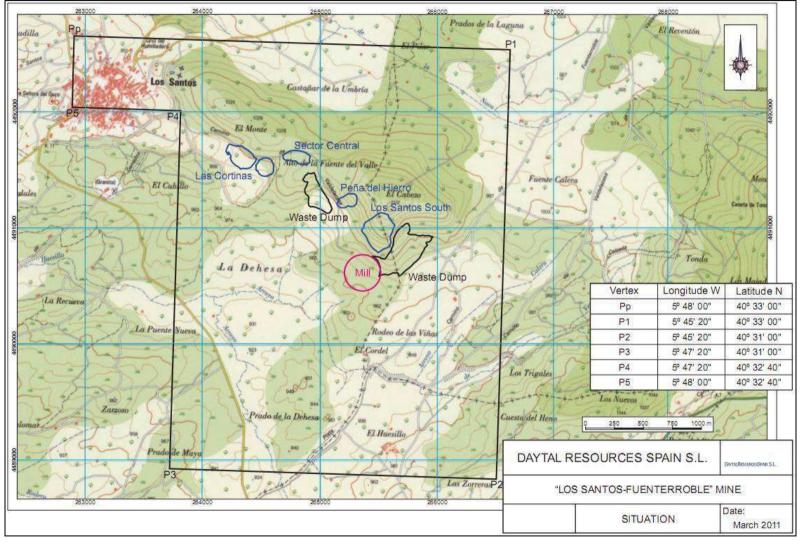


Figure 5-1. Mine Location and Los Santos Village

Daily maximum registers and maximum rainfall within 24 hours registered at nearby stations. From this table it can be observed that the daily maximum rainfall oscillated between 120.4 and 50.3mm. It is important to note that 10 % of maximum rainfall in one year or 20 % of the average annual rainfall may be registered in 1 day. From this observation, a proper water management scheme based on dams is envisaged against the alternative of pumping stations.

The project area is located within the Tajo hydrographical region, close to the limit with the Duero Hydrographical Region which is located between the towns of Los Santos and Fuenterrobles de Salvatierra.

Most of the drainage from the project site reports to the Santa Maria de las Navas stream, with a certain proportion reporting to the south to the Acillero streams. Both streams drain to the main water course in the area, the Alagón river.

The Santa Maria de las Navas stream flows from east to west, with a total catchment area of some 29.6 km2. Two stream gauging stations were established in the Santa Maria de las Navas. The total yearly flows were calculated over the period of operation of the stations:

- 625,000 m3 between may/83 and dec/83
- 1,700,000 m3 between jan/84 y dec/84
- 1,220,000 m3 between jan/85 y dec/85
- 1,300,000 m3 between jan/86 y jun/86

The Acillero stream has an approximate catchment area (above the project location) of 6.5 km2. There only exists 14 months of stream gauging, giving an accumulated flow of 2.5 Mm3. The flows in both streams are mainly seasonal (correlating with the precipitation records), with large flows during winter and spring months, with much reduced or no flow during the summer and autumn months.

#### **6 HISTORY**

Promotora de Recursos Naturales, S.A. and Billiton Española, S.A. formed an exploration joint venture partnership in the second half of 1979 and by March the following year had discovered scheelite in skarn mineralisation near the Village of Los Santos which is situated about 250 km west of Madrid in the Province of Salamanca. Exploration was focussed on skarn mineralisation on the margin between the Bejar granodiorite and the surrounding Cambrian metasediments. The discovery of the Los Santos tungsten bearing skarns was the result of regional geological reconnaissance and the targeted night-time use of ultra-violet lamps to disclose the presence of the tungsten mineral, scheelite (CaWO<sub>4</sub>) which fluoresces under ultra violet light.

A period of intense exploration activity followed, including diamond drilling and some preliminary engineering, until the '80s when it was decided to carry out a pre-feasibility study of the prospect. By 1985, however, with a prevailing tungsten price of US\$81/mtu, the project was not considered viable.

Ownership then passed into the hands of SIEMCALSA, a publicly owned company of mining and geological consultants. In 1995, the UK based company, Navan Resources, entered into an agreement with SIEMCALSA with an option to acquire 65% of the project. Navan undertook additional metallurgical test work, resource modelling and preliminary mineplanning, however, again concluded that at the prevailing commodity prices the project remained uneconomic and it reverted to SIEMCALSA.

In 2005 the Joint Venture of Cambrian Mining Plc, Tungsten SA Pty Ltd and Prehenita S.L. (Daytal hereafter) assessed the Los Santos Tungsten Project (Los Santos Project hereafter) feasibility. This culminated in a feasibility study report compiled by Golder Associates in 2006. Start-up was achieved through its full subsidiary Daytal Resources S.L.

In 2006, Daytal Resources Spain acquired the project and was in turn acquired by an Australian public company, Heemskirk Consolidated Limited. Heemskirk reappraised the earlier technical information and concluded that the prevailing APT commodity price around US\$250/mtu and underlying supply demand position for tungsten concentrates justified development of the Los Santos deposit. Project development was approved and the mine opened in June 2008.

In 2009, the impact of the global financial crisis reduced APT prices to below US\$200/mtu and Heemskirk concluded that it needed to improve tungsten recovery to maintain viability. As a result, the process plant was improved and expanded with the installation of a secondary ball mill and additional table and spiral capacity. Daytal is now a wholly owned Spanish subsidiary of Almonty.

### 7 GEOLOGICAL SETTING AND MINERALIZATION

The Los Santos tungsten deposit is located within metamorphosed, lower Cambrian age, Lower Tamames limestones within the Spanish Variscan orogenic belt. These rocks occur along the northern margin of the late Devonian/early Permian age Alberca-Bejar intrusion which constitutes the western extremity of the Avila batholith. Contact metamorphism at the junction of the intrusive and limestone horizons within the sub vertical northern limb of the Tamamaes syncline formed skarns which, in the Los Santos area of Salamanca Province, Spain, contain economic tungsten mineralisation.

The Variscan orogeny was the result of the late Proterozoic collision between the supercontinents of Gondwana to the south and Laurentia Baltica to the north. The collision caused the closure of the intervening oceanic areas and intense deformation of the continental boundaries. The Variscan chain now represents the pre Mesozoic basement of most of western Europe and crops out in a number of mountain belts from Armorican Massif and Massif Central in France to the Ardennes and the Bohemian Massifs in Germany and the Czech Republic.

The Variscan orogeny formed the Iberian Massif of western Spain and Portugal. From NE to SW, five zones have been recognised:-

- The Cantabrian Zone
- The West Asturian-Leonese zone
- The Central Iberian Zone
- The Ossa Morena Zone
- The South Portuguese Zone

The Los Santos region is located in the autocthanous Central Iberian zone. Emplacement of the Alberca-Bejar granitoids produced a contact metamorphic aureole which extends, in plan view, from 1.5 km up to 8 km from the intrusive contacts. Figure 7-1 shows a plan of the geology of the north-west corner of the north-west corner of the Iberian peninsula.

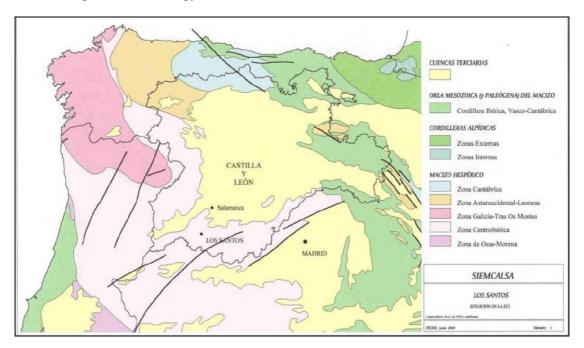


Figure 7-1. Geology of the North-West Corner of the Iberian Peninsula

The local stratigraphy is summarised in Table 7-1.

Geological Age	Principal Rock Types
Tertiary & Quaternary	Clay, arkose, alluvials
Silurian	Alternating slates & quartzites plus some
	volcanic horizons
Lower Ordovician	Basal Conglomerate overlain by Slates &
	Quartzites
Lower Cambrian	Sandstones, limestones and slates of the
	Tamames and Endrinal Formations
Pre- Cambrian	Schists & Graywackes of the Monterrubio &
	Alteatejada Formations

The Silurian lithologies comprise alternating shallow water slates and quartzites with graptolitic slates and some volcanic horizons. The Silurian rocks attain a maximum thickness of 700 metres in the core of the Tamames syncline.

The lowermost Ordovician rocks consist of a transgressive basal conglomerate which rests unconformably on the Tamames Limestone to the north of the Tamamaes syncline and on the pre Cambrian Aldeatejada Formation on the southern edge of the syncline. In the south-west around the Pena de Franca, the basal Ordovician conglomerate overlies the pre Cambrian Monterrubio Formation. The basal conglomerate is overlain by alternating slates and quartzites which grade upwards into the more massive Armoricana quartzites.

The lower Cambrian rocks on the northern flank of the Tamames syncline are composed of the Tamames Sandstone (up to 650 metres thick), the Tamames Limestone, which reaches a

similar thickness and the overlying Endrinal Shale which are believed to represent shallow water, near tidal deposits up to 250 metres thick. Metamorphism of the limestone members of the sequence has resulted in the calc-silicate horizons which host the economic mineralisation at Los Santos.

The oldest rocks are Pre-Cambrian, in the vicinity of Los Santos comprise the slates, conglomerates and volcanic rocks of the Monterrubio Formation. The overlying slates, dolomite breccias and conglomerates of the Aldeatejada Formation are thought to grade upwards into the Cambrian rocks of the Tamames Formations.

A plan of the local geology and mineralization is shown in Figure 7-2. There are several varieties of skarn mineralisation, economically the most important being the fine to medium grained, equigranular pyroxene skarn with scheelite mineralisation. The pyroxene is predominantly a dark green variety of hedenbergite.

Pyroxene skarn occurs in all zones at Los Santos. It forms from impure Fe-rich carbonates and contains pyroxene, scheelite, plagioclase and locally magnetite. The scheelite is generally fine grained, minus 1mm in size, but individual crystals may exceed 1cm.

At the eastern margin of Las Cortinas, sulphide-rich skarns occur. They are up to 5m thick and several metres in strike length, and comprise massive or semi-massive sulphide horizons with scheelite mineralisation. Sulphides comprise pyrite, arsenopyrite (lollingite), pyrrhotite and chalcopyrite as principal minerals and scheelite, sphalerite, native bismuth, bismuthinite and marcasite as accessories. Wolframite also occurs at Las Cortinas: approximately 6% of the tungsten in this area. There are also some higher amounts of wolframite in sulphide zones in Capa Este.

It has been deduced that the scheelite and pyroxene have crystallized simultaneously, within a high temperature phase. Later, remobilisation has led to amphibole, or apatite as in the talc veins at Las Cortinas. In eastern and western ends of Las Cortinas sector, scheelite and wolframite are associated with massive sulphides, with the following minerals:

- Main minerals: Pyrite, arsenopyrite (and/or lollingite), pyrrhotite and chalcopyrite. Pyrite, arsenopyrite (and/or lollingite), pyrrhotite and chalcopyrite.
- Accessory minerals: Scheelite, pseudo galena, bismuth, bismuthinite, and marcasite.

Two metallogenetic stages have been recognized, the first one of As-W in which arsenopyrite, scheelite and pyrite have been deposited. Later, a breccification phase has taken place in which these minerals have been fractured and, through the fissures and hollows, the other minerals of the paragenesis have been introduced: pyrrhotite, chalcopyrite, pseudo galena, bismuth and bismuthinite.

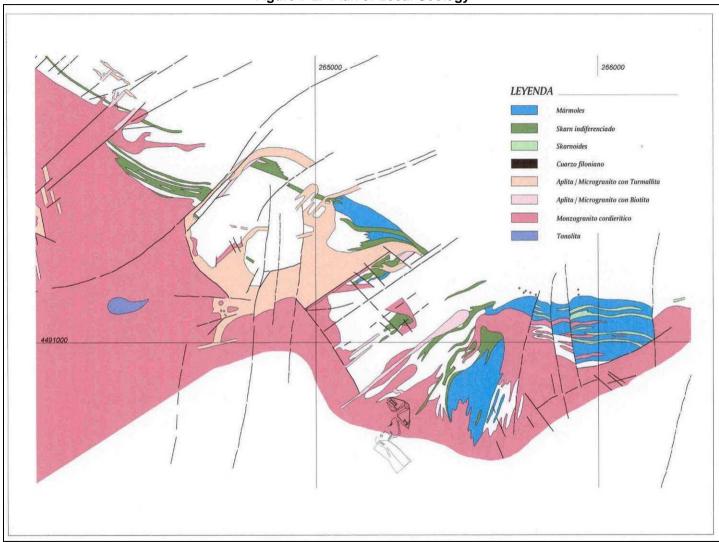


Figure 7-2. Plan of Local Geology

## 8 DEPOSIT TYPES

The Los Santos deposit is a typical skarn-hosted scheelite deposit, where intrusion of granitoids into carbonate-rich sedimentary rocks has resulted in their replacement by calc-silicate or siliceous minerals, together with mineralisation.

Contact metamorphism is accompanied by strong dehydration of the affected country rocks, which increases the proportion of metasomatic fluid phases. These fluids combine with the carbonate ions released, to provide an effective agent for transportation of the wolfram into zones further from the granite. In contact with the host Tamames Limestone, which outcrops over a distance of more than 2 km in the vicinity of the Los Santos mine, these fluids resulted in the emplacement of scheelite (CaWO4) mineralisation in a series of irregular beds and pods immediately adjacent to the granite contact.

The deposit has been divided into a number of zones, six of which form the basis of the current project. From west to east these are known as Las Cortinas, Sector Central, Capa East and Los Santos Sur. The strike length varies for each zone and zone dips are fairly uniform across the deposit varying between  $60^{\circ}$  to  $90^{\circ}$ .

Within each zone, the skarn mineralisation is located within a number of individual beds, separated by barren lithologies. The major skarn beds vary between 2m and 20m in width; there are, however, numerous thinner bands measuring tens of centimetres. Figure 7-2 shows a geological plan of the site, with the principal skarn zones.

# 9 EXPLORATION

### 9.1 Previous Exploration

Applying a scheelite-in-skarn exploration model to a granite-metasediment contact zone in the Guijuelo concession, the Promotora de Recursos Naturales/Billiton Exploration (PRN/BESA) joint venture discovered mineralisation at Los Santos in March 1980.

The exploration programme included aerial photograph interpretation, geological mapping, stream sediment, soil and rock geochemistry and a variety of geophysical techniques.

The initial discovery was followed up by a combination of trenching and drilling. A total of 249 trenches (totalling 10,142m) and 231 drillholes (17,874m) were completed.

3,215 samples were collected over the mineralised intervals and assayed primarily for WO3. Mineralised intervals were defined by Billiton by lamping the core with an ultraviolet lamp and

only those samples fluorescing (indicating the presence of scheelite) were sent for WO3 analysis.

A limited number of sulphide intervals intersected in drillcore at Las Cortinas were analysed for a broader range of elements; including copper, lead, zinc, arsenic and gold. These additional elements do not form part of this study.

At Los Santos Sur the orebodies were accessed underground in order to obtain bulk samples for metallurgical testwork. An 825m ramp was constructed down to the 950m level and a footwall drive with 7 crosscuts and 3 drives in ore completed. A total of 185 bulk samples totalling 5,500t were collected and stored on surface in individual piles.

When Navan reviewed the project in 1996 their final database comprised 483 drillhole or trench records of which 191 were surface holes, 37 underground drillholes at Los Santos South and 255 surface trenches.

This was the same database that was used for the feasibility study completed in 2006.

### 9.2 Daytal Exploration

To verify and test the extension of certain skarn beds in Los Santos Sur and Las Cortinas, Daytal has completed its own exploration drilling campaigns in each year from 2009 to 2015. This has comprised a total of 156 diamond drillholes and 111 reverse circulation (RC) holes. A photograph of these drilling operations is shown in Figure 9-1.



Figure 9-1. Diamond Drilling Operations at Los Santos

## **10 DRILLING**

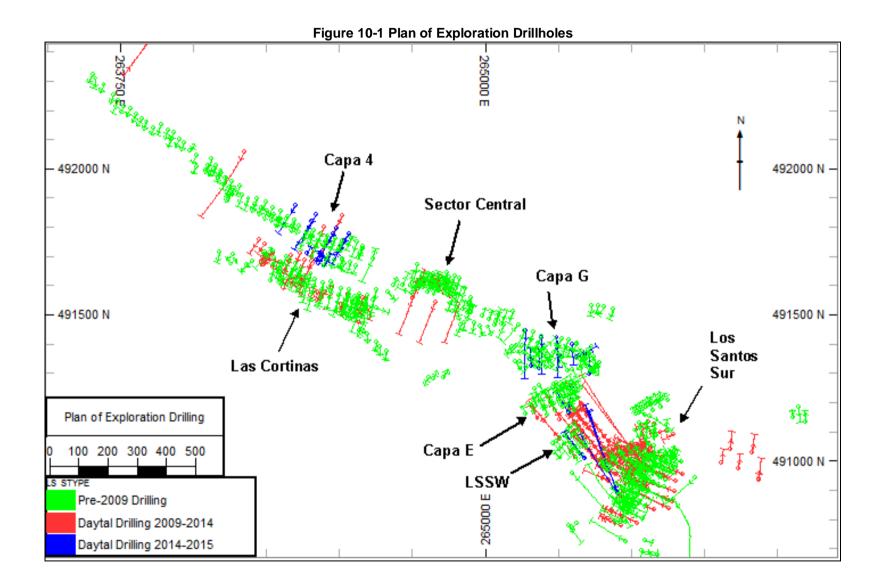
A summary of the current drillhole database is shown in Table 10-1.

	Types	Number of	Length	Average Length/Hole	Number of
	Types	Holes	m	Lengui/Hole m	Samples
Billiton	Surface Holes	191	15,819	83	1,490
Campaign	Underground Holes	37	2,147	58	439
Pre-2006	All Drillholes	228	17,967	79	1,929
	Types	Number of Holes	Length m	Average Length/Hole m	Number of Samples
Daytal RC					
Campaign	Reverse Circulation (RC) Holes	111	2,210	20	942
2009	Total	111	2,210	20	942
				-	
	Years	Number of	Length	Average Length/Hole	Number of
		Holes	m	m	Samples
	2010	25	2,157	86	486
	2011	30	3,249	108	509
Daytal Diamond	2012	39	5,078	130	929
Drilling	2013	31	6,955	224	534
Campaigns	2014	8	1,662	208	260
	2015	23	2,647	115	406
	Total	156	21,748	139	3,124
				Average	
		Number of	Length	Length/Hole	Number of
	Types	Holes	m	m	Samples
All	Diamond Drill Holes	384	39,714	103	5,053
Samples	Reverse Circulation (RC) Holes	111	2,210	20	942
Combined	Total	495	41,924	85	5,995

Table 10-1.	Summary of Drillhole Database
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A plan of all the drillholes currently available is shown in Figure 10-1.

In the Daytal drilling campaign, 110mm core has been taken through the superficial altered material, switching to HQ (core diameter of 63.5mm) in solid rock. The samples taken are generally 0.5-2.5m in length.



# 11 SAMPLE PREPARATION, ANALYSES AND SECURITY

# 11.1 Diamond Core Sampling

In the Billiton and Daytal drilling campaigns, mineralised intervals were generally defined by lamping the core with an ultraviolet lamp and only those samples fluorescing (indicating the presence of scheelite) were sent for  $WO_3$  analysis. Sample intervals were also selected so as to correspond with lithological intervals. If a lithological interval was less than 0.5m, this was then included in the previous or subsequent sample.

Information recorded during core logging included lithological intervals, the appearance under ultra-violet, and a visual estimation of scheelite content, sulphur content and any other altered material. Contact types were also recorded, along with the presence of banding, fractures, vein and dykes.

Core logging during Billiton's campaign was recorded as being generally excellent in skarn intersections. During Daytal's campaign, the drillhole recovery was 97.5% overall, and 96.3% for those portions from which samples were taken. There does not appear to be any relationship between grade and recovery.

During the Daytal campaigns, when the core boxes arrive in the storehouse, a photo of each box is taken, as in the example in Figure 11-1. Samples taken ranged in length from 0.5 m to 2 m.



Figure 11-1. Example of Corebox Photograph

Once the samples were described and sampled, they were piled in a two-store pallet to make the transport easier and placed in order in a specific location in the storehouse. Figure 11-2 shows a photograph of a geologist logging the core, with ultra-violet light assistance.



Figure 11-2. Core Logging Operations

Figure 11-3. Core Logging Area.



### 11.2 Trench Sampling

Trench sample were also taken as part of the Billiton's exploration campaign.

When sampling in trenches, lithological intervals were considered and samples ranged from 2m maximum to 0.5 m minimum. In the trench wall, a channel of 20 cm wide and 2-3 cm deep was made in fresh rock and the channel must be perpendicular to the stratification, the mean structure, the existing banded or foliation.

#### **11.3 Sample Preparation**

After logging, all core for sampling was sawn in two pieces, with one piece being sent onto sample preparation. Similar steps were taken with trench samples. In both the Billiton and Daytal campaigns, the sample preparation steps may be summarised as follows:

- The entire half of the core (3,5 Kg approximately for 1m) was put in a laboratory bag (numbered and with description), then sent to the Drying Oven (aluminium trays).
- Crushing 100% < 50 mm
- Roll Mill 100% <1,5 mm
- Homogenizer
- Splitter
- Ring Mill. In the Daytal campaigns, 1 Kg is pulverised in 3 parts. The reduction was to less than 85 µm in the Billiton campaign, and less than 63 µm in the Daytal campaign, with a ring of chrome-nickel in order to avoid WO<sub>3</sub> contamination. Grind checks were made 2-3 times a week, to ensure 90% was passing 60 µm.

In the Daytal campaigns, a 10g sample was taken for the on-site Los Santos laboratory. Internal check samples were taken every 20-30 samples.

### **11.4 Laboratory Sample Analysis**

During the Billiton campaign, the principal laboratory used was ADARO – Empresa Nacional Adaro de Investigaciones Mineras, S.A. The principal assay method was Fluorescence Spectroscopy (XRF). This was also employed in the BRA laboratories.

In X-ray fluorescence spectroscopy, a beam of electrons strikes a target (such as Mo or Au) causing the target to release a primary source of X-rays. These primary X-rays are then used to irradiate a secondary target (the sample), causing the sample to produce fluorescent (secondary) X-rays. These fluorescent X-rays are emitted with characteristic energies that can be used to identify the nucleus (i.e. element) from which they arise. The number of X-rays measured at each characteristic energy can therefore in principle be used to measure the concentration of the element from which it arises.

The fluorescent X-rays are then dispersed and sorted by wavelength using a selection of different diffraction crystals, hence the term wavelength-dispersive X-ray fluorescence. The dispersed X-rays are then detected with a thallium-doped sodium iodide detector or a flow proportional counter. Each X-ray striking the detector causes a small electrical impulse which can be amplified and measured using a computer-controlled multichannel analyzer. Samples of unknown concentration are compared with well-known international standard reference materials in order to define precise concentration levels of the unknown sample.

The advantages of XRF spectroscopy include:

- The technique is ideal for the measurement of major and minor elements and is thus a preferred technique for whole rock characterization.
- The fusion technique minimizes particle size effects that could otherwise cause problems with the measurement process.
- Numerous trace elements can also be determined from the same fused disk, e.g. Y, Nb, Zr. The disks themselves can be stored indefinitely.

Daytal have their own on-site laboratory, equipped with an AXIOS XRF Spectrometer. The principle of operation of the Daytal spectroscope is the same as outlined above, except that the unit sorts the secondary X-rays according to their energy levels rather than their wavelengths. This is calibrated daily against 3 standard samples for different grade ranges. These sets of standard samples were certified by Alex Stewart Assayers Limited of the UK.

For the Energy Dispersive-type XRF analyzer at Los Santos, it is important that the reference standards have a similar matrix composition as the unknown samples to be determined. This

is because the unit's read-out is sensitive to X-Ray back-scatter, which in turn is a function of the "background" composition of the sample (principally, its Fe, Al, Ca, Na and Mg contents). This is why Daytal uses Los Santos materials as standards. The Alex Stewart results of these samples were used as the reference grades.

The methodology to prepare these standards was to use the Los Santos XRF machine to determine the tungsten trioxide and arsenic grades of each of the references samples, in three (3) grade ranges: <1% WO<sub>3</sub>, 1%< WO<sub>3</sub><50%, and 50%< WO<sub>3</sub><77%. The three grade ranges selected are somewhat arbitrary, but were selected to enhance sensitivity by refining the calibration algorithm within each grade range. These results were compared with the Alex Stewart data, and the regression algorithm fine-tuned to make Los Santos measurements compliant with the Alex Stewart figures. As a check, Daytal re-analyze the standard sample each day to make sure the result is within 0.8% (absolute value) for high grade concentrate samples, and 10% (relative) for low grade samples.

The Daytal assay laboratory provides measurements of  $WO_3$ ,  $As_2O_3$ ,  $SO_3$  and CuO. Blank reference samples are also measured for approximately every 50 samples.

The on-site laboratory facilities at Los Santos are shown in Figure 11-4. This facility started up in 2009.



Figure 11-4. On-Site Laboratory Facilities at Los Santos



#### Figure 11-5. On-Site AXIOS XRF Assaying Equipment

## 11.5 Sample Security

The Daytal core shed is a lockable facility on the outskirts of the town of Los Santos, as shown in the photograph in Figure 11-6. The core shed remains closed and locked when there are not people working there. The on-site laboratory, which is next to the mill, is covered by the mine security system. All check samples were sent by courier to either ALS in Seville or to Alex Stewart in the UK.



#### Figure 11-6. Daytal's Core Shed and Logging Facility

# **12 DATA VERIFICATION**

# 12.1 Billiton Campaign - Quality Control

The steps completed by Billiton, related sample quality control, are summarised below.

## Twin Hole Samples (TS)

Although no specific twin drillholes were drilled, eight underground cross-cuts were developed across the principal skarn beds in the Los Santos Sur zone, at an elevation of 950m, approximately 100m below surface. Prior to the development of these cross-cuts, drillholes were put in along the line of each cross-cut. During subsequent development of the cross-cuts, detailed bulk samples were taken, particularly through the skarn intersections. On average 270t of bulk samples were taken in each crosscut, for a total of 2,220t. These bulk samples (sometimes more than 30t), were prepared right outside the mine in Los Santos (Crushing, Classifying, Cone Crusher), and then sent to ADARO for analysis and treatment of metallurgical tests.

Access is still available to view the current exposure in the ramp and crosscuts.

An additional bulk sampling exercise was also undertaken from a surface exposure at the Sector Central. This was in the form a box-cut, measuring approximately 40m x 20m.

#### Pulp Duplicates (PD)

Pulp duplicates were sent to same laboratory approximately every 20-30 samples.

#### Standard Samples (SS)

Standard samples were also sent periodically to the Adaro and BRA laboratories. Results of 218 such measurements, taken between 1981 and 1986, are summarised in the chart in Figure 12-1. These cover 3 different WO<sub>3</sub> grade levels.

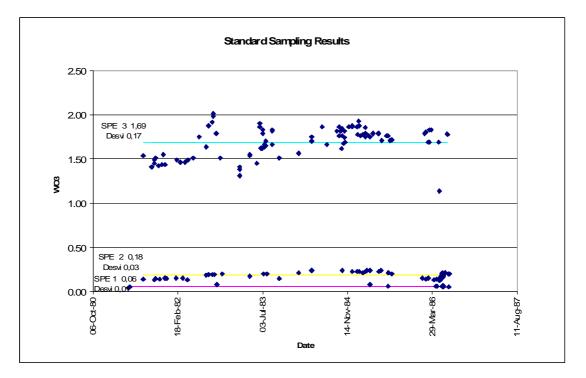


Figure 12-1. Billiton Campaign – Standard Sampling Results

## Check Samples (CS)

Check samples were sent to a BRA laboratory. A further 10% of these were checked again by Alfred H. Knight. These check samples were taken for 40% of all the primary samples. A graph summarising the majority of these check samples is shown below in Figure 12-2, and shows a very good correlation.

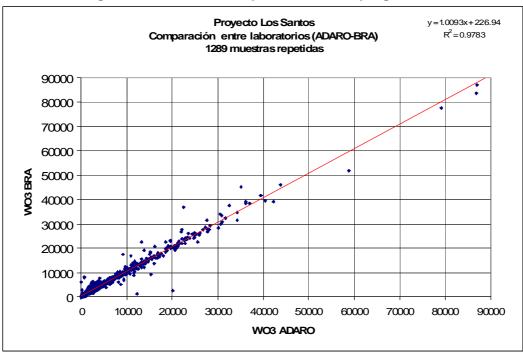


Figure 12-2. Billiton – Graph of Check Sampling Results

## 12.2 Daytal Campaign - Quality Control

During the diamond drilling campaigns from 2009-12, for almost every sample send to the Los Santos laboratory, a sample was also sent to an external laboratory (ALS). The ALS laboratory also made their own internal duplicates' test assays. Additional check samples were also sent to an external SGS check laboratory. In the Los Santos laboratory, internal duplicates were also taken for one for every 20 samples. Duplicates were also sent to the external laboratory for grade control (blasthole) samples, as well for reverse circulation drilling. The results of these summarising the various types of diamond drilling duplicates are shown in Table 12-1.

A relatively poor precision was obtained between the ALS and Los Santos duplicates. The ALS-sourced grades are those used for subsequent resource estimation work. These ALS internal duplicates generally demonstrate an acceptable level of precision, and a low proportion of mis-classifications. Results depicting the HARD (half absolute relative difference) graphs for ALS duplicates are shown in Figure 12-4 and Figure 12-5. Although the ALS-SGS duplicates show a medium to poor level of precision, the overall mean and median values are very similar, with generally good correlation.

A graph of the results from 177 blanks from 2012-13, assayed at the Los Santos laboratory, is shown in Figure 12 3. Of these measurements, 8 were anomalous, at a level of 0.01%, representing 4.5% of all the measurements. These quartz blanks are locally sourced from a quarry. A summary of all the Daytal check sample results from 2009-2015 are shown in Table 12-1.

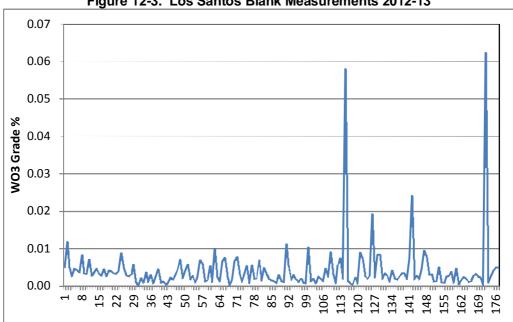


Figure 12-3. Los Santos Blank Measurements 2012-13

		Number	Minin	num	Maxir	num	Mea	an	Med	lian	SI	þ	C۱	,	HARD Precision @90%	Median HARD		Correlation Coefficient	Slope of Regression Line	Prop'n Mis- classified %
			Orig	Dup	Orig	Dup	Orig	Dup	Orig	Dup	Orig	Dup	Orig	Dup	Rank				Line	
	Los Santos Lab duplicates	695	0.0003	0.0004	3.75	3.74	0.16	0.15	0.04	0.04	0.39	0.38	2.5	2.5	12.3%	2.51%	-0.03%	0.95	0.93	2.3%
2009 -	ALS Internal Lab duplicates	150	0.0006	0.0006	33.17	33.17	0.69	0.69	0.12	0.12	2.99	2.99	4.33	4.3	6.7%	0.00%	0.00%	1.00	1.00	0.7%
2012	ALS v SGS Duplicates	42	0.0126	0.005	3.06	3.01	0.32	0.33	0.10	0.12	0.55	0.58	1.75	1.7	32.9%	8.65%	-6.23%	1.00	1.01	0.0%
	ALS v LS duplicates	1632	0.0006	0.0002	33.17	33.36	0.24	0.23	0.03	0.02	1.19	1.07	4.88	4.7	82.5%	17.85%	0.50%	0.97	0.88	3.1%
	Los Santos Lab duplicates	421	0.001	0.001	6.83	6.54	0.24	0.24	0.05	0.05	0.55	0.55	2.34	2.3	16.3%	2.40%	0.80%	1.00	0.99	1.4%
2013	ALS Internal Lab duplicates	30	0.013	0.006	3.20	3.17	0.54	0.54	0.23	0.24	0.74	0.74	1.37	1.4	9.1%	0.55%	0.00%	1.00	1.00	0.0%
	ALS v LS duplicates	264	0.03	0.011	6.94	7.18	0.59	0.58	0.21	0.20	0.99	0.96	1.7	1.6	22.5%	6.05%	1.78%	0.99	0.97	4.5%
2015	Los Santos Coarse duplicates	11	0.016	0.017	0.54	0.56	0.17	0.17	0.04	0.04	0.21	0.21	1.23	1.2	15.4%	1.56%	0.12%	0.99	1.01	0.0%

#### Table 12-1. Check Sample Summary Results 2009-2015

Notes

. HARD = Half Absolute Relative Difference

. HRD = Half Relative Difference

. ALS = ALS laboratory

. LS = Los Santos laboratory

. SGS = SGS laboratory

. 0.07% WO3 used as cut-off in mis-classification test

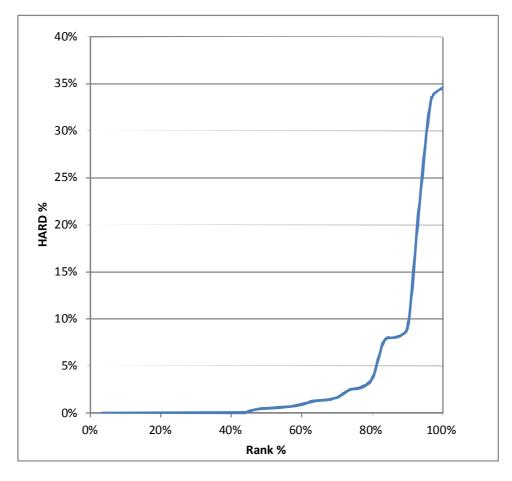
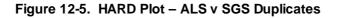
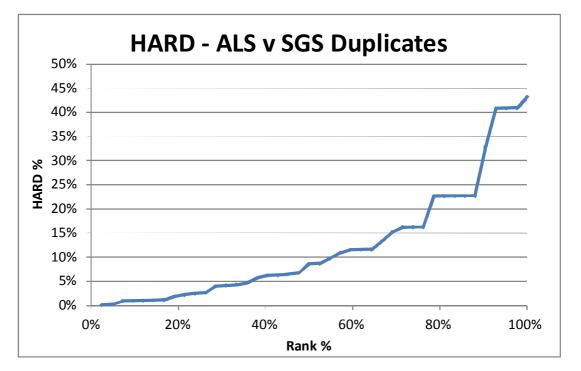


Figure 12-4. HARD Plot – ALS Internal Duplicates, 2012-13





A prepared standard was tested regularly in the Los Santos laboratory, with a certified value of 0.18% WO3. The assay results for this standard are shown in Figure 12-6, for the time periods from July 2012 to June 2013. These results show an acceptable level of precision.

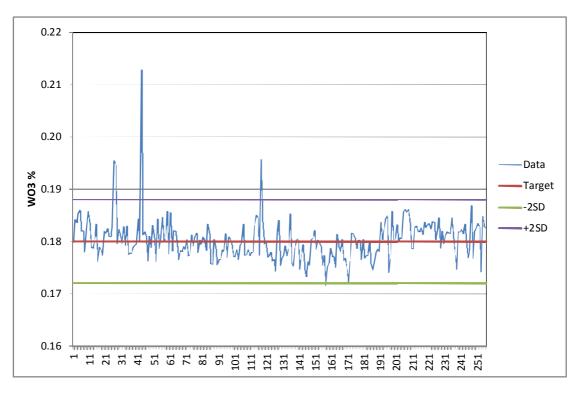


Figure 12-6. Los Santos Internal Standard Testing July 2012 – June 2013

## 12.3 Drillhole Database

Data related to the drill holes are kept in two different formats. Each drill hole has an individual excel spreadsheet where the collar, surveys, lithology, recovery and the names of the sample are included. The assays of the samples supplied by the laboratories are updated by the Geology Manager. These spreadsheets also contain the intercepts of every drill hole.

This Excel data is imported into Datamine, and subjected to From-To sequence tests as well as range checks. The drillhole data files are all combined together into individual desurveyed drillhole files, in which the three-dimensional position and orientation of each sample has been determined. This combination automatically incorporates various cross-checks between the different original files. Subsequent three-dimensional visualisation and generation of sections and plans also offers a means of validation.

# 12.4 Survey Control

All surface surveying measurements are generated in UTM Coordinates, and are referenced to the UTM30 7P coordinate system. Topographical data is measured using a GPS Leica 1200 system.

All drillhole collars are measured where the rod line intersects the surface. In the latest Daytal drilling campaign, downhole surveys were completed using a Reflex Gyro system.

## 13 MINERAL PROCESSING AND METALLURGICAL TESTING

#### **13.1 Introduction**

The process plant was designed by Eral Equipos and Proyectos, S.A. (ERAL). After initial operation with a production rate of up to 300 ktpa during 2010, the plant is now processing 500ktpa. The plant is primarily based on gravimetric separation, aimed at recovering scheelite, so as to provide a concentrate containing greater than 65% WO<sub>3</sub>. Current overall plant recovery of scheelite is approximately 60%. The overall mill flowsheet is shown in Figure 13-3.

The plant is located immediately to the south of the Los Santos Sur pit, near the existing underground portal, in an area close to existing mine workings, the main waste dump and other infrastructure.

## 13.2 Crushing

Run of mine ore (ROM) is dumped in various locations on the ROM pad according to grade range categories and for weathered material. This material is then blended by feeding into a primary jaw crusher, using a front-end loader at a nominal 100 t/h rate. The jaw crusher product is then delivered by conveyor to a primary cone crusher and the product from this crusher is dry-screened on a double-deck vibrating screen. A flowsheet of the crushing circuit is shown in Figure 13-4.

The top deck oversize (plus 27mm) is returned to the primary cone crusher, while the bottom deck oversize (plus12.5mm) is passed to a secondary cone crusher. The secondary cone crusher product joins the primary cone crusher product and recycles back to the screen, while the bottom deck undersize at minus 12.5 mm size is discharged to a stack-out conveyor which forms a conical open stockpile ahead of the main process plant. A view of the crushed intermediate stockpile is shown in Figure 13-1.

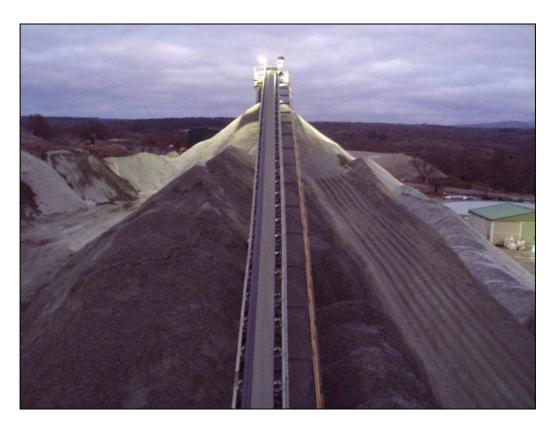


Figure 13-1. Intermediate Crushed Stockpile.

## 13.3 Grinding

Crushed ore from the stockpile is delivered via variable-speed belt feeders and conveyors at 65t/h to a 2.9m diameter x 4.8m long rod mill which wet grinds the ore in open circuit to approximately 50% passing 250  $\mu$ m.

From the rod mill, the ground ore passes to a Derrick Stacksizer where it is wet-screened at  $1000 \mu$ m. The Stacksizer oversize (plus  $1000 \mu$ m) is fed to a regrind mill. This regrind mill is a 2.1m diameter x 3.7m long ball mill. The re-milled product from the ball mill, is then sent to the gravity circuit. Since the beginning of 2011, the hole-size of the panels used in the Derrick screen has been progressively increased from the initial 325 microns to 1 mm. This modification has been motivated by the observation that the majority of the losses were in the -38 microns size range. Even grinding at just 1 mm, it was verified that less than 5% of the losses are in the +500 microns.

### **13.4 Spiral Separation**

The ground ore is first classified into separate coarse (minus 1000  $\mu$ m, nominally plus 150  $\mu$ m), and fine (nominally minus 150, plus 30  $\mu$ m) fractions using banks of hydrocyclones. The final cyclone overflow, nominally minus 30  $\mu$ m in size, is not processed in the gravity circuits and goes direct to the tailings thickener. The first separation step is the removal of strongly magnetic particles, mainly mill steel and pyrrhotite, using one-off, wet low intensity magnetic drum separator in each of the two gravity circuits.

The non-magnetics in the coarse circuit pass to a bank of coarse rougher spirals (36 starts), the concentrate from these spirals going to a bank of cleaner spirals (12 starts) and the middlings going to a bank of middlings-cleaner spirals (12 starts). The tailings from the rougher and middlings-cleaner spirals go to final tailings (as does the middlings from this last bank), while the tails from the cleaner bank go back to the regrind ball mill, and the middlings are recycled back to the feed.

In the fines circuit, the rougher spirals comprise one bank of 48 starts. The concentrate from these fines rougher spirals goes to a bank of fines cleaner spirals (12 starts) and the middlings, from both banks, recirculate back to the rougher bank. The tails from both banks of spirals go to the new fines scavenging circuit.

The new fines scavenging circuit comprises a bank of rougher spirals (36 starts) and a bank of cleaner spirals (12 starts). The middlings from each bank recirculate over the respective feed, and the tailings are discarded as final tailings. The concentrate from the cleaner spirals is sent to the hydrosizer (table circuit). The overflow from the cyclones that control the pulp dilution in the rougher bank is thickened in a second group of cyclones, being the underflow fed to another set of fine spirals (12 starts). The middlings from these spirals recirculate over the feed, and the tailings are discarded as final tailings. The concentrate is sent directly to the ultra-fine group of tables (table circuit).





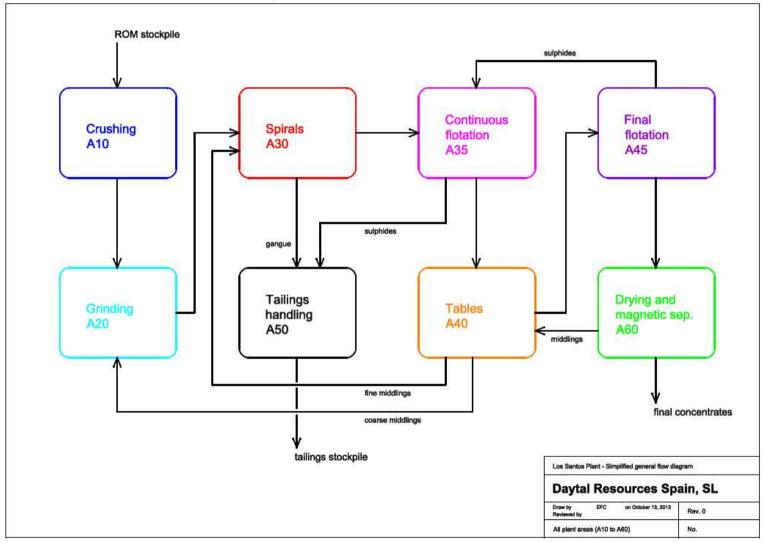


Figure 13-3. Overall General Flowsheet

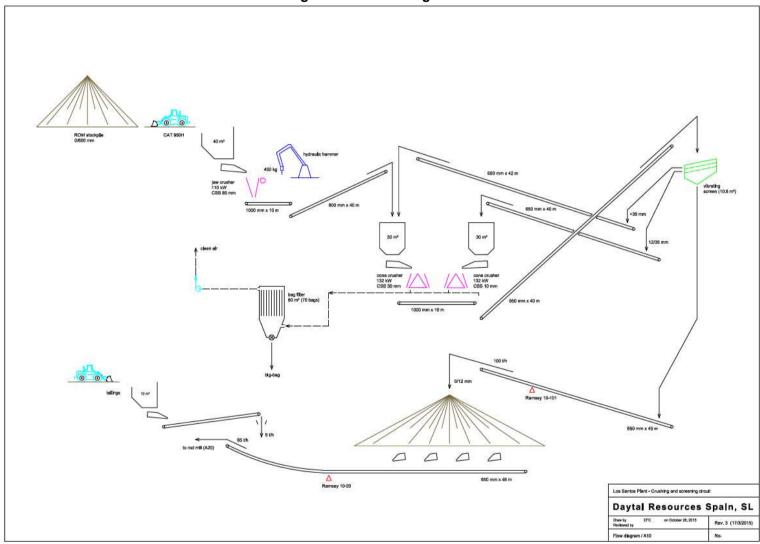


Figure 13-4. Crushing Circuit

# **13.5 Continuous Flotation**

The concentrate from the coarse and fine cleaner spirals, the concentrate from the middlings--cleaner spirals, and the concentrate from the fine scavenging spirals are collected in a sump and pumped to the continuous flotation circuit.

This circuit comprises one bank of four Denver DR cells of 1.4 m<sup>3</sup> each, as shown in Figure 13-5. In the froth, are recovered the sulphides, being mainly composed of arsenopyrite and loellingite. These sulphides are discarded as final tailings. The flotation is performed at neutral pH and PAX is used as collector. Copper sulphate is used to help in the activation of the sulphides and pine oil is used as frother. The product that remains in the pulp is collected in a sump and pumped to the hydrosizer (table circuit).



Figure 13-5. Continuous Flotation Cell

## 13.6 Table Separation

The hydrosizer comprises nine chambers, and feeds four separate tabling circuits. All the circuits are structured in rougher and cleaner steps, with the exception of the fine and ultra-fine circuit, which only has rougher tables. The tailings from the rougher step of the coarse and intermediate tabling circuits are sent to regrinding. The tailings from the rougher fine tables are sent to the fine rougher spirals, while the tailings from the ultra-fine tables are considered final tailings.

The tailings from the cleaner step of all tabling circuits are recycled back to the hydrosizer. Finally, the concentrate from all the cleaner tables and from the ultra-fine rougher tables forms the gravity preconcentrate. A flowsheet depicting grinding, spirals, flotation and tables is shown in Figure 13-9.

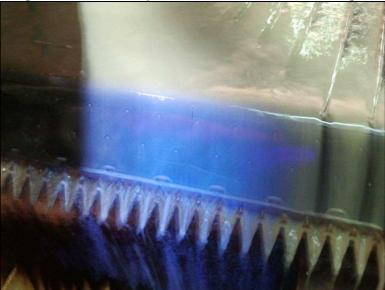


Figure 13-6. Table Separation –Scheelite Under UV Light.

# 13.7 Tailings and Fines

Tailings from the spirals and tables, as well as magnetic fractions from the low intensity drum magnets, are pumped to a bank of dewatering cyclones, with the underflow reporting to a high frequency dewatering screen, from where the undersize is recycled back to the sump of the pump that feeds the de-watering cyclones.

Fine solids, mainly from the overflow of the second group of fines classifying cyclones of the scavenging circuit, go directly to a 12m diameter thickener. Thickener underflow is batched to a 2.25m<sup>2</sup> x 136-plate filter press, which produces a cake suitable for conveyor discharge onto a fines waste stockpile. Overflow from the thickener is recycled as process water. There is no tailings discharge from the process and no tailings dam: all plant waste is dewatered and transported back to the mine waste dumps for disposal.

## **13.8 Final Flotation**

The combined concentrates from the gravity circuits (the so-called "pre-concentrate") is fed into a round screen (via a dewatering cyclone). The oversize (+500 $\mu$ m) is reground in a 900x1200mm rod mill, in close circuit with the screen. The undersize is stored and semi-dewatered in a settling cone, which feeds a 3m<sup>3</sup> batch flotation cell where flotation of the sulphides takes place, as shown in Figure 13-7. Recently, a second cell of 3m<sup>3</sup> has been installed. Typical flotation reagents are dosed to the cell and flotation takes place over about 120 minutes at pH <4.3 to remove sulphides as a froth concentrate. These sulphides recirculate to the continuous flotation circuit. The non-floating material, which is principally scheelite and calc-silicates, is discharged from the batch cell into a dewatering / settling cone and hence transferred to Area 60 for drying and final processing. A filter press has also been recently installed ahead from the dryer, in order to avoid the losses of fines that would occur if the material was stored and dewatered in bulk bags.





The scheelite flotation project has been abandoned, due to technical and economical difficulties, in favour of the installation of the scavenging spirals.

## **13.9 Magnetic Separation**

The semi-dewatered non-float product from the filter press is directly fed into a 20t-capacity surge hopper, from which is extracted at nominally 1t/h rate by a variable-speed belt feeder, and hence by conveyor into a rotary kiln drier. The bone-dry material is then subjected to high intensity, dry, magnetic separation in a three-stage, rare earth roll (RER) magnetic separator. More than 90% of the material collected by the separator comes out in the first roll. The mineralogical composition of this product is mainly magnetic pyroxene (hedenbergite). Due to the presence of scheelite and wolframite, the WO<sub>3</sub> content can be as high as 3%. The product that comes out in the second and third rolls is progressively less rich in magnetic pyroxene and with a higher content in WO<sub>3</sub>.

The intermediate products from the RER magnetic separator are now dressed on a doubledeck table, from which it is possible to obtain a low-grade concentrate, of about 45%  $WO_3$ . It is important to notice that in this way it is possible not only to recover scheelite but also wolframite.



Figure 13-8. Storage of Concentrates

A flowsheet depicting the final flotation, drying and magnetic separation is shown in Figure 13-10.

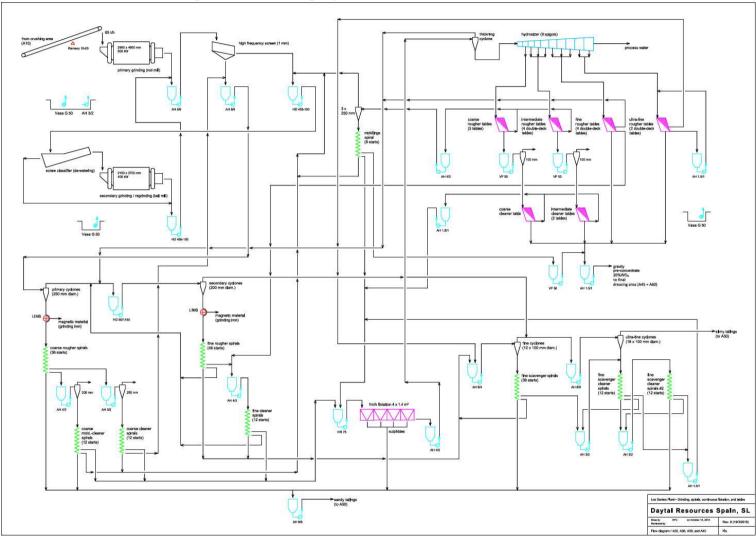


Figure 13-9. Grinding, Spirals, Flotation and Tables Flowsheet

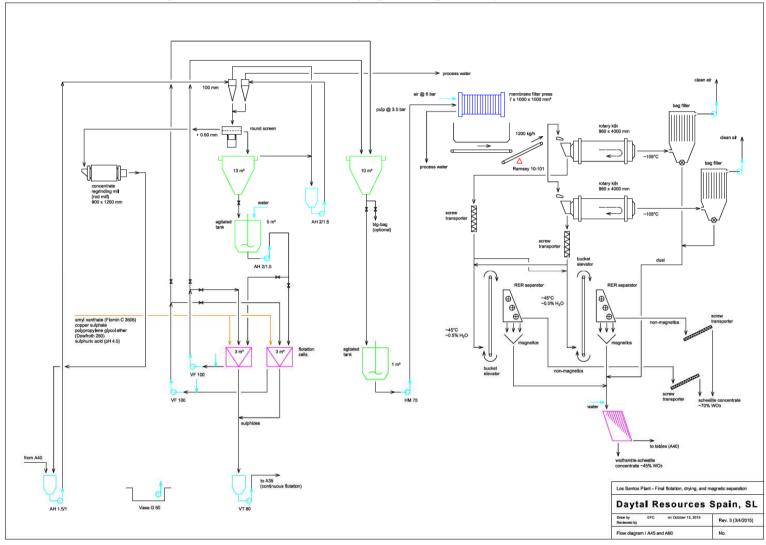
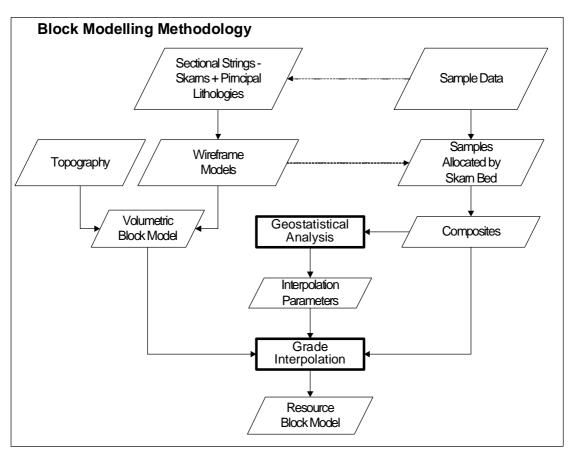


Figure 13-10. Final Flotation, Drying and Magnetic Separation Flowsheet

# 14 MINERAL RESOURCE ESTIMATES

# 14.1 General Methodology

This mineral resource estimation was completed using a three-dimensional block modelling approach, with the application of Datamine software. The general methodology applied is described in the flowsheet in Figure 14-1.





For each of the principal zones, sectional strings and perimeters were defined, based on all available lithological and analysis data. These perimeters were then converted into threedimensional wireframe envelopes. Along with topographical data, this wireframe data was used to create volumetric block models.

Samples associated with mineralised skarn bodies were assigned logical bed identifications, corresponding with the defined skarn wireframe models. These sample data were then converted into approximately 2.5 m composites. The composite WO<sub>3</sub> grade values were then used to interpolate grades into the block model, according to the parent skarn beds to which they belonged. Geostatistical analysis was used to assist in the selection of interpolation parameters, as well with subsequent resource classification.

## 14.2 Interpretation and Sample Data Processing

At the feasibility study stage in 2006, all available sample data was obtained from SIEMCALSA. Data was available from surface drillholes, underground drillholes and surface trench samples. The principal WO<sub>3</sub> assay determined from the Adaro laboratory was that used in resource modelling. For later Daytal exploration campaign from 2009-12, the WO<sub>3</sub> assays from the ALS laboratory were used for the diamond drilling results, the WO<sub>3</sub> assays from the on-site Los Santos laboratory were used for the reverse circulation results. After 2012, the primary WO<sub>3</sub> diamond drillhole sample assays were taken from the Los Santos laboratory.

The original lithological codings from the logged data were imported with the collar, survey and assay information. The skarn bed identification was revised, corresponding with the skarn beds being interpreted.

Sectional interpretations were developed for each zone, defining groups of strings and perimeters which delineate the following principal lithologies:

- Granite
- Corneanas (hornfels)
- Calc-silicates
- Skarn

Seven principal zones within the Los Santos area have now been modelled:

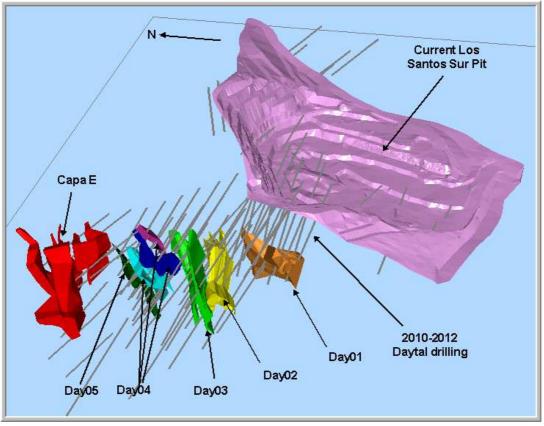
- Las Cortinas
- Sector Central
- Los Santos Sur LSS
- LSS- South-West
- Capa E
- Capa 4
- Capa G

The skarn bed coding system used for the principal zones is summarised in Table 14 1, along with the general description of the general zone dimensions. This includes the most recently drilled mineralized zones of Capa Este and LSS-SW, which are also shown in the 3D view shown in Figure 14-2.

				Depth (m)		Thickne	ess (m)
Zone	SKARN BED	Strike Length	Minimum	Maximum	Average	Maximum	Average
20110	1	300	40	160	110	21	4.4
1.40						9	
LAS	3	385	20	130	60	-	2.3
CORTINAS	20	310	60	150	90	25	5.0
	21	260	20	120	70	12	3.5
SECTOR							
CENTRAL	5	130	40	85	50	36	9.2
(now mined out)							
CAPA E							
(Peña de Hierro)	11	130	-	70	45	60	16.9
	Day01	90	70	190	130	30	12
LSS-SW	Day02	90	35	115	75	22	12
	Day03	115	-	125	60	15	8
	Day04a, b and c	75	-	140	70	35	10
	Day05	25	40	160	100	10	6
	6	165	70	140	110	13	5.0
LOS	7	200	40	230	140	29	11.1
SANTOS	8	170	40	190	90	18	5.6
SUR	9	100	35	80	45	60	13.7
	10	165	50	140	80	33	7.6
CAPA G	12	250	-	140	100	20	9.5
CAPA 4	4	630	20	120	30	12	4.0

Table 14-1. General Zone Dimensions

Figure 14-2. 3D View of Capa E and LSS\_SW Mineralized Zones



The skarn identification used included all of the different skarn types, as the types of skarn can change within the same bed. For each zone, once the lithological wireframes had been developed, the following checks were made:

- Samples were selected according to the three-dimensional position of samples against the wireframe envelopes. Sections were then produced, showing additional samples within the beds that had not been previously identified, as well as previously coded skarn samples which appeared to be outside the wireframes. Apparent errors were then collated and used to refine both the structural wireframes as well as the assigned bed codings.
- Range checks.

After editing of located errors, the final set of structural wireframes and coded sample data were used for subsequent resource modelling purposes. The selected sample sets, for each zone and each bed, were used to create 2.5 m composites across each intersection, for both drillholes and trenches. Prior to compositing,  $WO_3$  top-cut levels were also applied, which are discussed in more detail in the next section. The composites had a slightly variable length, so as to fit a whole number of composites into each intersection. During subsequent compositing, some additional drillhole intersections were also located, where no samples had been taken when passing through interpreted skarn beds. In such cases, additional composites were created with the grade set to  $WO_3$ =0.01%.

The overall summary of samples is shown in Table 14-2, for data up to the end of 2015.

	Types		Number of Holes/Trenches	Length	Number of Samples
Billiton	Surface Holes		191	15,819	1,490
Campaign	Underground Holes		37	2, 147	439
Pre-2006	All Drillholes		228	17,967	1,929
	Surface Trenches		255	10, 167	784
	Total		483	28,134	2,713
	Types		Number of Holes	Length	Number of Samples
Daytal RC					
Campaign	Reverse Circulation (F	RC) Holes	111	2,210	942
2009	Total		111	2,210	942
	Years		Number of		Number of
	Tears		Holes	Length	Samples
	2010		25	2, 157	486
Daytal	2011		30	3,249	509
Diamond	2012		39	5,078	929
Drilling	2013		31	6,955	534
Campaigns	2014		8	1,662	260
campaigne	2015		23	2,647	406
	Total		156	21,748	3,124
	Types		Number of Holes/Trenches	Length	Number of Samples
All	Drillholes		495	41,924	5,995
Samples	Surface Trenches		255	10, 167	784
Combined	Total		750	52,091	6,779

# Table 14-2. Exploration Sample Summary

## 14.3 Geostatistics

Statistical parameters were determined for the selected sample sets in zone and in each skarn bed, as summarised in Table 14-3. As samples were often taken on erratic lengths, statistical parameters were determined with length-weighting. In most cases, the sample length is between 2 and 2.5m.

								LOG	
							STANDARD	ESTIMATE	COEFF. OF
ZONE	BED	NUMBER	MINIMUM	MAXIMUM	MEAN	VARIANCE	DEVIATION	OF MEAN	VARIATION
	1	211	0.001	12.99	0.85	3.03	1.74	1.07	2.0
LAS	3	92	0.002	7.37	0.43	0.90	0.95	0.47	2.2
CORTINAS	20	213	0.001	3.70	0.18	0.17	0.42	0.24	2.3
	21	132	0.001	2.82	0.28	0.18	0.42	0.49	1.5
SECTOR CENTRAL	5	148	0.0010	8.88	0.39	1.04	1.02	0.48	2.6
	6	301	0.0006	5.61	0.29	0.48	0.69	0.69	2.4
	7	705	0.0006	4.37	0.36	0.27	0.52	0.77	1.5
LOS	8	156	0.0006	4.03	0.28	0.35	0.60	0.43	2.1
SANTOS SUR	9	120	0.0010	3.43	0.68	0.68	0.82	1.47	1.2
	10	192	0.0006	5.88	0.28	0.48	0.69	0.42	2.5
	11	60	0.0006	2.09	0.39	0.22	0.47	3.07	1.2
	1	239	0.0000	9.62	0.66	1.33	1.15	1.22	1.8
	2	136	0.0000	3.23	0.25	0.17	0.42	0.28	1.7
LSS - SW	3	141	0.0000	1.79	0.22	0.11	0.33	0.25	1.5
L35 - 5W	4	163	0.0000	33.17	0.62	4.57	2.14	0.48	3.4
	5	47	0.0000	1.63	0.23	0.11	0.33	0.29	1.5
	11	47	0.0020	6.76	0.40	0.78	0.88	0.54	2.2
Capa ESTE	12	77	0.0016	2.55	0.29	0.23	0.48	0.35	1.6
Capa G	12	219	0.0020	2.44	0.19	0.10	0.32	0.20	1.7
Capa 4	4	86	0.0010	11.56	0.42	1.07	1.03	0.54	2.5

Table 14-3. Summary Statistics of Samples – WO<sub>3</sub> By Zone

In many cases, the maximum grade is considerably higher than the average grades. To better analyse these outlier grades, decile analyses were also completed for the sample sets in each zone, as summarised in Table 14-5. Log probability plots were also prepared for the same sample sets, and are shown in Appendix A. In most cases the majority of samples conform approximately to a single log-normal population. However, in many cases, a high grade tail is apparent, indicating outlier grades. Examination of these outlier grades in 3D seldom showed clear zonations, where they might be physically constrained. From these noticeable high grade tails, therefore, as well as from the decile analyses, WO<sub>3</sub> top-cut levels were determined. These top-cut values, by zone, are summarised in Table 14-4, and were applied prior to compositing.

Zone	Value
Las Cortinas	3.7
Los Santos Sur	2.7
LSS-SW	5
Capa E	5
Capa 4	2.5
Capa G	-

Table 14-4. WO<sub>3</sub> Top-Cut Levels

A composite length of 2.5m was selected, as being near to or above most of the original sample lengths. It was also an appropriate length in terms of a selectable mining width during subsequent mine planning. Statistics of the resultant composite data sets are summarised in Table 14-6.

	Las Cortinas							LSS - SW						Capa G									
Q%_FROM C	2%_TO N		IEAN M	IN ſ	MAX	METAL	METAL%	Q%_FROM	Q%_TO	NUMBER	MEAN N			METAL	METAL%	Q%_FROM C	%_то	NUMBER	MEAN	MIN	MAX	METAL	METAL%
0	10	30	0.11 0.	.10	0.12	6.28	1.3	0	10	42	0.11 (	0.10	0.11	5.95	1.5	0	10	11	0.11	0.10	0.11	1.97	2.9
10	20	32	0.13 0.	.12	0.15	7.67	1.6	10	20	44	0.13 (	0.11	0.14	7.26	1.8	10	20	9	0.12	0.11	0.12	2.07	3.0
20	30	31	0.17 0.	15	0.19	10.04	2.1	20	30	47	0.15 (	0.14	0.17	9.19	2.3	20	30	10	0.13	0.12	0.14	2.44	3.6
30	40	30	0.21 0.	.19	0.23	12.18	2.5	30	40	45	0.18 (	0.18	0.20	10.47	2.6	30	40	10	0.15	0.14	0.16	2.75	4.0
40	50	32	0.24 0.	.23	0.26	13.65	2.8	40	50	49	0.23 (	0.20	0.28	13.72	3.4	40	50	9	0.18	0.16	0.19	3.12	4.6
50	60	26	0.33 0.	.27	0.38	19.05	3.9	50	60	48	0.33 (	0.28	0.38	18.70	4.6	50	60	9	0.22	0.20	0.25	3.98	5.8
60	70	42	0.56 0.	.40	0.76	33.67	6.9	60	70	52	0.45 (	0.38	0.53	26.65	6.6	60	70	12	0.29	0.26	0.38	5.51	8.1
70	80	25	0.96 0.	79	1.15	53.01	10.9	70	80	49	0.67 (	0.53	0.82	38.29	9.5	70	80	9	0.44	0.38	0.53	8.41	12.4
80	90	33	1.40 1.	.15	1.87	85.68	17.7	80	90	55	1.11 (	0.84	1.61	64.34	15.9	80	90	10	0.66	0.54	0.76	12.11	17.8
90	100	46	4.13 1.	.87 1	12.99	244.19	50.3	90	100	53	3.59	1.63	33.17	209.77	51.9	90	100	10	1.33	0.80	2.44	25.66	37.7
90	91	3	1.99 1.	.87	2.13	8.17	1.7	90	91		1.66	1.63	1.70	9.53	2.4	91	92	2	0.80	0.80	0.81	2.24	3.3
91	92	4	2.22 2.	.14	2.27	16.51	3.4	91	92	6	1.79	1.74	1.82	10.46	2.6	92	93		0.95	0.95	0.95	1.32	1.9
92	93	2	2.32 2.			8.95	1.8	92	93		1.86			8.36	2.1	94	95			0.97		4.85	7.1
93	94	5				19.64	4.0	93	94		2.03			13.92	3.4	95	96			1.03		2.47	3.6
94	95	5				18.99	3.9	94	95		2.38 2			12.35	3.1	97	98		1.49			5.37	7.9
95	96	6				22.23	4.6	95	96					17.11	4.2	98	99			2.05		3.79	5.6
96	97	6				19.36	4.0	96	97		3.13			19.24	4.8	99	100			2.44	-	5.62	8.3
97	98	5				24.23	5.0	97	98					17.62	4.4	0	100	99	0.37	0.10	2.44	68.01	100.0
98	99	4				31.42	6.5	98	99					39.06	9.7								
99	100		10.52 7.				15.4	99	100		10.53 6				15.4								
0	100	327	0.83 0.	.10 1	12.99	485.40	100.0	0	100	484	0.70 0	0.10	33.17	404.36	100.0								
		los Sa	antos Su								ana Este								Cana 4				
0% FROM C	0% TO N		antos Sui //EAN M	_	MAX	METAL	METAL%	0% FROM	0% то		apa Este MEAN			METAL	METAL%	0% FROM 0	% то	-	Capa 4 MEAN	MIN	MAX	METAL N	VIETAL%
Q% FROM C		Los Sa NUMBER N 96	IEAN M	IN I		METAL 14.41		Q%_FROM 0		NUMBER	MEAN N			0.40		Q%_FROM Q		NUMBER	MEAN	MIN 0.10			
	2%_TO_N 10 20		0.11 0.	IN 1 .10	0.14		METAL% 1.6 2.2		<u>Q%_</u> ТО 10 20	NUMBER 3	MEAN 0.10 (	0.10	0.10		METAL% 1.5 2.3		<u>%_</u> ТО 10 20	NUMBER 6	MEAN 0.11		0.11	METAL N 1.30 1.12	<b>METAL%</b> 1.7 1.5
0	10	NUMBER N 96	<b>MEAN M</b> 0.11 0. 0.15 0.	IN 1 .10 .14	0.14 0.18	14.41	1.6	0	10	NUMBER 3 4	MEAN N	0.10 0.10	0.10 0.11	0.40	1.5	0	10	NUMBER 6 6	0.11 0.12	0.10	0.11 0.13	1.30	1.7
0 10	10 20	NUMBER N 96 89	Image: Mean         M           0.11         0.           0.15         0.           0.21         0.	10 14 18	0.14 0.18 0.24	14.41 19.59	1.6 2.2	0 10	10 20	NUMBER 3 4 4	MEAN         N           0.10         0           0.11         0	0.10 0.10 0.13	0.10 0.11 0.16	0.40 0.63	1.5 2.3	0	10 20	NUMBER 6 5	0.11 0.12 0.14	0.10 0.12 0.13	0.11 0.13	1.30 1.12	1.7 1.5
0 10 20	10 20 30	NUMBER N 96 89 78	Image: Mean         M           0.11         0.           0.15         0.           0.21         0.	.10 .14 .18 .24	0.14 0.18 0.24 0.33	14.41 19.59 26.46 35.74	1.6 2.2 3.0	0 10 20	10 20 30	NUMBER 3 4 4 4	MEAN 0.10 ( 0.11 ( 0.14 (	0.10 0.10 0.13 0.16	0.10 0.11 0.16 0.17	0.40 0.63 0.80	1.5 2.3 3.0	0 10 20	10 20 30	NUMBER 6 5 3	0.11 0.12 0.14 0.18	0.10 0.12 0.13	0.11 0.13 0.17 0.18	1.30 1.12 2.00	1.7 1.5 2.7
0 10 20 30	10 20 30 40	NUMBER N 96 89 78 70	MEAN         M           0.11         0.           0.15         0.           0.21         0.           0.28         0.           0.37         0.	10 14 18 24 33	0.14 0.18 0.24 0.33 0.43	14.41 19.59 26.46 35.74	1.6 2.2 3.0 4.1	0 10 20 30	10 20 30 40	NUMBER 3 4 4 4 4	MEAN         N           0.10         0           0.11         0           0.14         0           0.17         0           0.19         0	0.10 0.10 0.13 0.16 0.18	0.10 0.11 0.16 0.17 0.21	0.40 0.63 0.80 1.12	1.5 2.3 3.0 4.2	0 10 20 30	10 20 30 40	NUMBER 6 5 3 3	0.11 0.12 0.14 0.18 0.19	0.10 0.12 0.13 0.18	0.11 0.13 0.17 0.18 0.19	1.30 1.12 2.00 2.20	1.7 1.5 2.7 3.0
0 10 20 30 40	10 20 30 40 50 60 70	NUMBER N 96 89 78 70 70 71	Image         Image           0.11         0.           0.15         0.           0.21         0.           0.28         0.           0.37         0.           0.49         0.	10 14 18 24 33 43	0.14 0.18 0.24 0.33 0.43 0.55	14.41 19.59 26.46 35.74 46.37	1.6 2.2 3.0 4.1 5.3	0 10 20 30 40	10 20 30 40 50 60 70	NUMBER 3 4 4 4 4 5 5 5	MEAN         N           0.10         0           0.11         0           0.14         0           0.17         0           0.19         0	0.10 0.10 0.13 0.16 0.18 0.22	0.10 0.11 0.16 0.17 0.21 0.24	0.40 0.63 0.80 1.12 1.04	1.5 2.3 3.0 4.2 3.9	0 10 20 30 40	10 20 30 40 50	NUMBER 6 5 3 3 3 5	MEAN 0.11 0.12 0.14 0.18 0.19 0.21	0.10 0.12 0.13 0.18 0.19	0.11 0.13 0.17 0.18 0.19 0.25	1.30 1.12 2.00 2.20 2.74	1.7 1.5 2.7 3.0 3.7
0 10 20 30 40 50 60 70	10 20 30 40 50 60 70 80	NUMBER N 96 89 78 70 71 68 67 67 73	MEAN         M           0.11         0.           0.15         0.           0.21         0.           0.28         0.           0.377         0.           0.49         0.           0.64         0.           0.91         0.	IIN I 10 .14 .18 .24 .33 .43 .56 .79	0.14 0.18 0.24 0.33 0.43 0.55 0.78 1.06	14.41 19.59 26.46 35.74 46.37 62.60 81.35 114.86	1.6 2.2 3.0 4.1 5.3 7.1 9.3 13.1	0 10 20 30 40 50 60 70	10 20 30 40 50 60 70 80	NUMBER 3 4 4 4 4 5 5 5 5 5	MEAN         N           0.10         0           0.11         0           0.14         0           0.17         0           0.19         0           0.23         0           0.31         0	0.10 0.10 0.13 0.16 0.18 0.22 0.24 0.45	0.10 0.11 0.16 0.17 0.21 0.24 0.45 0.74	0.40 0.63 0.80 1.12 1.04 1.23 1.58 3.55	1.5 2.3 3.0 4.2 3.9 4.6 5.9 13.2	0 10 20 30 40 50 60 70	10 20 30 40 50 60 70 80	NUMBER 6 5 3 3 5 6 6	MEAN 0.11 0.12 0.14 0.18 0.19 0.21 0.28 0.55	0.10 0.12 0.13 0.18 0.19 0.19 0.25 0.47	0.11 0.13 0.17 0.18 0.19 0.25 0.35 0.63	1.30 1.12 2.00 2.20 2.74 2.32 3.82 4.74	1.7 1.5 2.7 3.0 3.7 3.1 5.1 6.4
0 10 20 30 40 50 60 70 80	10 20 30 40 50 60 70 80 90	NUMBER         N           96         9           89         78           70         71           68         67           73         63	AEAN         M           0.11         0.           0.15         0.           0.21         0.           0.28         0.           0.37         0.           0.49         0.           0.49         0.           0.49         0.           0.91         0.	10 .14 .18 .24 .33 .43 .56 .79 .07	0.14 0.18 0.24 0.33 0.43 0.55 0.78 1.06 1.51	14.41 19.59 26.46 35.74 46.37 62.60 81.35 114.86 161.71	1.6 2.2 3.0 4.1 5.3 7.1 9.3 13.1 18.4	0 10 20 30 40 50 60 70 80	10 20 30 40 50 60 70 80 90	NUMBER 3 4 4 4 4 5 5 5 5 5 6	MEAN         N           0.10         0           0.11         0           0.14         0           0.17         0           0.19         0           0.23         0           0.31         0           0.54         0           0.96         0	0.10 0.10 0.13 0.16 0.18 0.22 0.24 0.24 0.45	0.10 0.11 0.16 0.21 0.24 0.45 0.74 1.14	0.40 0.63 0.80 1.12 1.04 1.23 1.58 3.55 5.17	1.5 2.3 3.0 4.2 3.9 4.6 5.9 13.2 19.3	0 10 20 30 40 50 60 70 80	10 20 30 40 50 60 70 80 90	NUMBER 6 5 3 3 5 6 6 6 8	MEAN 0.11 0.12 0.14 0.18 0.19 0.21 0.28 0.55 0.76	0.10 0.12 0.13 0.18 0.19 0.25 0.47 0.64	0.11 0.13 0.17 0.18 0.19 0.25 0.35 0.63 1.01	1.30 1.12 2.00 2.20 2.74 2.32 3.82 4.74 12.19	1.7 1.5 2.7 3.0 3.7 3.1 5.1 6.4 16.4
0 10 20 30 40 50 60 70 80 90	10 20 30 40 50 60 70 80 90 100	NUMBER N 96 89 78 70 71 68 67 73 63 63 68	MEAN         M           0.11         0.           0.15         0.           0.21         0.           0.28         0.           0.37         0.           0.49         0.           0.64         0.           0.91         0.           1.27         1.           2.46         1.	IN 10 .14 .18 .24 .33 .43 .56 .79 .07 .51	0.14 0.24 0.33 0.43 0.55 0.78 1.06 1.51 5.88	14.41 19.59 26.46 35.74 46.37 62.60 81.35 114.86 161.71 313.76	1.6 2.2 3.0 4.1 5.3 7.1 9.3 13.1 18.4 35.8	0 10 20 30 40 50 60 70 80 90	10 20 30 40 50 60 70 80 90 100	NUMBER 3 4 4 4 5 5 5 6 5 5 6 5 5 6 5 5 6 5 5 6 5 5 5 6 5 5 5 6 5 5 5 6 5 5 6 6 7 7 7 7 7 7 7 7 7 7 7 7 7	MEAN         N           0.10         0           0.11         0           0.11         0           0.11         0           0.11         0           0.11         0           0.11         0           0.12         0           0.13         0           0.54         0           0.96         0           1.82         2	0.10 0.13 0.13 0.16 0.18 0.22 0.24 0.24 0.45 0.83	0.10 0.11 0.16 0.21 0.24 0.45 0.74 1.14 2.55	0.40 0.63 0.80 1.12 1.04 1.23 1.58 3.55 5.17 11.31	1.5 2.3 3.0 4.2 3.9 4.6 5.9 13.2 19.3 42.2	0 10 20 30 40 50 60 70 80 90	10 20 30 40 50 60 70 80 90 100	NUMBER 6 5 3 3 5 6 6 6 8 10	MEAN 0.11 0.12 0.14 0.18 0.19 0.21 0.28 0.55 0.76 3.12	0.10 0.12 0.13 0.18 0.19 0.25 0.47 0.64 1.03	0.11 0.13 0.17 0.18 0.19 0.25 0.35 0.63 1.01 11.56	1.30 1.12 2.00 2.20 2.74 2.32 3.82 4.74 12.19 42.02	1.7 1.5 2.7 3.0 3.7 3.1 5.1 6.4 16.4 56.4
0 10 20 30 40 50 60 70 80 90 90	10 20 30 40 50 60 70 80 90 100 91	NUMBER         N           96         9           89         78           70         71           68         67           73         63	AEAN         M           0.11         0.           0.15         0.           0.21         0.           0.28         0.           0.37         0.           0.49         0.           0.64         0.           0.911         0.           1.27         1.           2.46         1.           1.54         1.	IN 10 .14 .18 .24 .33 .43 .56 .79 .07 .51 .51	0.14 0.24 0.33 0.43 0.55 0.78 1.06 1.51 5.88 1.55	14.41 19.59 26.46 35.74 46.37 62.60 81.35 114.86 161.71 <u>313.76</u> 18.17	1.6 2.2 3.0 4.1 5.3 7.1 9.3 13.1 18.4 35.8 2.1	0 10 20 30 40 50 60 70 80 90 90	100 200 300 400 500 600 700 800 900 1000 93	NUMBER 3 4 4 4 4 5 5 5 5 6 7 5 1	MEAN         N           0.10         0           0.11         0           0.14         0           0.17         0           0.19         0           0.23         0           0.31         0           0.54         0           0.96         0           1.82         2           1.50         2	0.10 0.13 0.13 0.16 0.22 0.24 0.45 0.45 0.83 1.50	0.10 0.11 0.16 0.21 0.24 0.24 0.45 0.74 1.14 2.55 1.50	0.40 0.63 0.80 1.12 1.04 1.23 1.58 3.55 5.17 11.31 2.78	1.5 2.3 3.0 4.2 3.9 4.6 5.9 13.2 19.3 42.2 10.3	0 10 20 30 40 50 60 70 80 90 90	10 20 30 40 50 60 70 80 90 100 91	NUMBER 6 5 3 3 5 6 6 8 10 1	MEAN 0.11 0.12 0.14 0.18 0.19 0.21 0.28 0.55 0.76 3.12 1.03	0.10 0.12 0.13 0.18 0.19 0.25 0.47 0.64 1.03	0.11 0.13 0.17 0.18 0.19 0.25 0.35 0.63 1.01 11.56 1.03	1.30 1.12 2.00 2.74 2.32 3.82 4.74 12.19 42.02 1.28	1.7 1.5 2.7 3.0 3.7 3.1 5.1 6.4 16.4 56.4
0 10 20 30 40 50 60 70 80 90 90 91	10 20 30 40 50 60 70 80 90 100 91 92	NUMBER N 96 89 78 70 71 68 67 73 63 63 68	AEAN         M           0.11         0.           0.15         0.           0.21         0.           0.28         0.           0.37         0.           0.49         0.           0.64         0.           0.91         0.           1.27         1.           2.46         1.           1.54         1.           1.60         1.	IN 10 .14 .14 .24 .33 .43 .56 .79 .07 .51 .51 .55	0.14 0.18 0.24 0.33 0.43 0.55 0.78 1.06 1.51 5.88 1.55 1.63	14.41 19.59 26.46 35.74 46.37 62.60 81.35 114.86 161.71 313.76 18.17 20.00	1.6 2.2 3.0 4.1 5.3 7.1 9.3 13.1 18.4 35.8 2.1 2.3	0 10 20 30 40 50 60 70 80 90 90 92 94	10 20 30 40 50 60 70 80 90 100 93 95	NUMBER 3 4 4 4 4 5 5 5 5 6 6 5 1 1	MEAN         N           0.10         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11         (           0.11 <t< th=""><th>0.10 0.13 0.13 0.16 0.22 0.24 0.45 0.83 1.50 1.50</th><th>0.10 0.11 0.16 0.21 0.24 0.45 0.74 1.14 2.55 1.50</th><th>0.40 0.63 0.80 1.12 1.04 1.23 1.58 3.55 5.17 11.31 2.78 0.98</th><th>1.5 2.3 3.0 4.2 3.9 4.6 5.9 13.2 19.3 42.2 10.3 3.6</th><th>0 10 20 30 40 50 60 70 80 90 90 90 92</th><th>10 20 30 40 50 60 70 80 90 100 91 93</th><th>NUMBER 6 6 5 3 3 3 5 6 6 6 8 10 1 1</th><th>MEAN 0.11 0.12 0.14 0.18 0.19 0.21 0.28 0.55 0.76 <u>3.12</u> 1.03 1.05</th><th>0.10 0.12 0.13 0.18 0.19 0.25 0.47 0.64 1.03 1.03</th><th>0.11 0.13 0.17 0.18 0.25 0.35 0.63 1.01 11.56 1.03 1.05</th><th>1.30 1.12 2.00 2.74 2.32 3.82 4.74 12.19 42.02 1.28 2.09</th><th>1.7 1.5 2.7 3.0 3.7 3.1 5.1 6.4 16.4 56.4 1.7 2.8</th></t<>	0.10 0.13 0.13 0.16 0.22 0.24 0.45 0.83 1.50 1.50	0.10 0.11 0.16 0.21 0.24 0.45 0.74 1.14 2.55 1.50	0.40 0.63 0.80 1.12 1.04 1.23 1.58 3.55 5.17 11.31 2.78 0.98	1.5 2.3 3.0 4.2 3.9 4.6 5.9 13.2 19.3 42.2 10.3 3.6	0 10 20 30 40 50 60 70 80 90 90 90 92	10 20 30 40 50 60 70 80 90 100 91 93	NUMBER 6 6 5 3 3 3 5 6 6 6 8 10 1 1	MEAN 0.11 0.12 0.14 0.18 0.19 0.21 0.28 0.55 0.76 <u>3.12</u> 1.03 1.05	0.10 0.12 0.13 0.18 0.19 0.25 0.47 0.64 1.03 1.03	0.11 0.13 0.17 0.18 0.25 0.35 0.63 1.01 11.56 1.03 1.05	1.30 1.12 2.00 2.74 2.32 3.82 4.74 12.19 42.02 1.28 2.09	1.7 1.5 2.7 3.0 3.7 3.1 5.1 6.4 16.4 56.4 1.7 2.8
0 10 20 30 40 50 60 70 80 90 90 91 92	10 20 30 40 50 60 70 80 90 100 91 92 93	NUMBER N 96 89 78 70 71 68 67 73 63 63 68 5 4 6 5	AEAN         M           0.11         0.           0.15         0.           0.21         0.           0.28         0.           0.37         0.           0.49         0.           0.64         0.           0.91         0.           1.27         1.           2.46         1.           1.54         1.           1.60         1.	IN         I           110         14           114         24           333         3           433         56           779         007           551         55           666         66	0.14 0.24 0.33 0.43 0.55 0.78 1.06 1.51 5.88 1.55 1.63 1.76	14.41 19.59 26.46 35.74 46.37 62.60 81.35 114.86 161.71 313.76 18.17 20.00 23.12	1.6 2.2 3.0 4.1 5.3 7.1 9.3 13.1 18.4 35.8 2.1 2.3 2.6	0 10 20 30 40 50 60 70 80 90 92 92 94 96	10 20 30 40 50 60 70 80 90 100 93 95 97	NUMBER 3 4 4 4 4 4 5 5 5 5 6 6 5 1 1 1 1	MEAN         N           0.10         (           0.11         (           0.14         (           0.17         (           0.19         (           0.23         (           0.31         (           0.54         (           0.96         (           1.82         2           1.50         2           1.50         2	0.10 0.13 0.13 0.16 0.18 0.22 0.24 0.45 0.45 0.83 1.50 1.50 1.50	0.10 0.11 0.17 0.21 0.24 0.45 0.74 1.14 2.55 1.50 1.50	0.40 0.63 0.80 1.12 1.04 1.23 1.58 3.55 5.17 11.31 2.78 0.98 2.62	1.5 2.3 3.0 4.2 3.9 4.6 5.9 13.2 19.3 42.2 10.3 3.6 9.8	0 10 20 30 40 50 60 70 80 90 90 90 92 93	10 20 30 40 50 60 70 80 90 100 91 93 93 94	NUMBER 6 5 3 3 3 5 6 6 6 8 8 8 10 11 1	MEAN 0.11 0.12 0.14 0.18 0.19 0.21 0.28 0.55 0.76 3.12 1.03 1.05 1.28	0.10 0.12 0.13 0.18 0.19 0.25 0.47 0.64 1.03 1.03 1.05 1.28	0.11 0.13 0.17 0.18 0.25 0.35 0.63 1.01 11.56 1.03 1.05 1.28	1.30 1.12 2.00 2.74 2.32 3.82 4.74 12.19 42.02 1.28 2.09 1.53	1.7 1.5 2.7 3.0 3.7 3.1 5.1 6.4 16.4 56.4 1.7 2.8 2.1
0 10 20 30 40 50 60 70 80 90 90 91 92 93	10 20 30 40 50 60 70 80 90 100 91 92 93 94	VUIMBER N 96 89 78 70 71 68 67 73 63 63 63 63 63 63 64 6 7 3 4 6 7 7	Itean         M           0.11         0.           0.15         0.           0.21         0.           0.28         0.           0.27         0.           0.37         0.           0.49         0.           0.64         0.           0.91         0.           1.27         1.           2.46         1.           1.54         1.           1.60         1.           1.69         1.           1.87         1.	IN         I           110         14           118         24           333         433           566         779           007         551           555         666           884         844	0.14 0.24 0.33 0.43 0.55 0.78 1.06 1.51 5.88 1.55 1.63 1.76 1.92	14.41 19.59 26.46 35.74 46.37 62.60 81.35 114.86 161.71 313.76 18.17 20.00 23.12 21.45	1.6 2.2 3.0 4.1 5.3 7.1 9.3 13.1 18.4 35.8 2.1 2.3 2.6 2.4	0 10 20 30 40 50 60 70 80 90 92 94 94 96 98	10 20 30 40 50 60 70 80 90 100 93 95 97 97	NUMBER 3 4 4 4 4 4 5 5 5 5 5 5 6 6 6 5 5 1 1 1 1 1	MEAN         N           0.10         (           0.11         (           0.14         (           0.17         (           0.19         (           0.23         (           0.31         (           0.54         (           0.96         (           1.82         2           1.50         2           1.50         2           2.35         2	0.10 0.13 0.13 0.16 0.18 0.22 0.24 0.45 0.83 1.50 1.50 1.50 1.59 2.35	0.10 0.11 0.16 0.21 0.24 0.45 0.74 1.14 2.55 1.50 1.50 1.59 2.35	0.40 0.63 1.12 1.04 1.23 1.58 3.55 5.17 11.31 2.78 0.98 2.62 3.28	1.5 2.3 3.0 4.2 3.9 4.6 5.9 13.2 19.3 42.2 10.3 3.6 9.8 12.2	0 10 20 30 40 50 60 70 80 90 90 90 92 93 93	10 20 30 40 50 60 70 80 90 100 91 93 94 95	NUMBER 6 5 3 3 3 5 6 6 6 8 10 1 1 1 1 2 2	MEAN 0.11 0.12 0.14 0.18 0.19 0.21 0.28 0.55 0.76 3.12 1.03 1.05 1.28 2.44	0.10 0.12 0.13 0.18 0.19 0.25 0.47 0.64 1.03 1.03 1.05 1.28 2.44	0.11 0.13 0.17 0.18 0.25 0.35 0.63 1.01 11.56 1.03 1.05 1.28 2.44	1.30 1.12 2.00 2.74 2.32 3.82 4.74 12.19 42.02 1.28 2.09 1.53 4.64	1.7 1.5 2.7 3.0 3.7 3.1 5.1 6.4 16.4 56.4 1.7 2.8 2.1 6.2
0 10 20 30 40 50 60 70 80 90 90 90 91 92 93 93 94	10 20 30 40 50 60 70 80 90 100 91 92 93 94 95	VUIMBER N 96 89 78 70 71 68 67 73 63 63 63 63 63 63 63 63 63 7 11	Itean         M           0.11         0.           0.15         0.           0.21         0.           0.28         0.           0.27         0.           0.37         0.           0.49         0.           0.49         0.           0.49         0.           0.49         0.           0.49         0.           0.49         0.           0.49         0.           0.49         0.           1.27         1.           1.24         1.           1.54         1.           1.60         1.           1.69         1.           1.87         1.           2.02         1.	IN         I           110         114           118         24           333         433           556         79           007         551           555         666           884         922	0.14 0.24 0.33 0.43 0.55 0.78 1.06 1.51 5.88 1.55 1.63 1.76 1.92 2.10	14.41 19.59 26.46 35.74 46.37 62.60 81.35 114.86 161.71 313.76 18.17 20.00 23.12 21.45 24.40	1.6 2.2 3.0 4.1 5.3 7.1 9.3 13.1 18.4 35.8 2.1 2.3 2.6 2.4 2.8	0 10 20 30 40 50 60 70 80 90 92 94 99 99 99	100 200 300 400 500 700 800 900 1000 933 955 977 999 1000	NUMBER 3 4 4 4 4 4 4 5 5 5 5 5 5 5 6 6 7 5 1 1 1 1 1 1 1	MEAN         N           0.10         (           0.11         (           0.14         (           0.17         (           0.19         (           0.19         (           0.19         (           0.23         (           0.31         (           0.54         (           0.54         (           0.54         (           1.82         1           1.50         1           1.50         2           2.35         2           2.55         2	0.10 0.13 0.13 0.16 0.18 0.22 0.24 0.24 0.45 0.83 1.50 1.50 1.50 1.59 2.35	0.10 0.11 0.21 0.24 0.45 0.74 1.14 2.55 1.50 1.50 1.59 2.35	0.40 0.63 0.80 1.12 1.04 1.23 1.58 3.55 5.17 11.31 2.78 0.98 2.62 3.28 1.66	1.5 2.3 3.0 4.2 5.9 13.2 19.3 4.2 10.3 3.6 9.8 12.2 6.2	0 10 20 30 40 50 60 70 80 90 90 90 92 93 93 94 96	10 20 30 40 50 60 70 80 90 100 91 93 93 94 95 97	NUMBER 6 5 3 3 5 6 6 6 8 8 10 1 1 1 2 2 1	MEAN 0.11 0.12 0.14 0.18 0.19 0.21 0.28 0.55 0.76 3.12 1.03 1.05 1.28 2.44 2.44	0.10 0.12 0.13 0.18 0.19 0.25 0.47 0.64 1.03 1.03 1.03 1.28 2.44 2.44	0.11 0.13 0.17 0.18 0.25 0.35 0.63 1.01 11.56 1.03 1.05 1.28 2.44 2.44	1.30 1.12 2.00 2.74 2.32 3.82 4.74 12.19 42.02 1.28 2.09 1.53 4.64 4.64	1.7 1.5 2.7 3.0 3.7 5.1 6.4 16.4 56.4 1.7 2.8 2.1 6.2 6.2
0 10 20 30 40 50 60 70 80 90 90 91 92 93 94 95	10 20 30 40 50 60 70 80 90 100 91 92 93 94 95 96	VUIMBER N 96 89 78 70 71 68 67 73 63 63 63 63 63 63 64 6 7 3 4 6 7 7	AEAN         M           0.11         0.           0.15         0.           0.21         0.           0.28         0.           0.37         0.           0.49         0.           0.49         0.           0.49         0.           0.41         0.           1.27         1.           1.54         1.           1.60         1.           1.60         1.           1.69         1.           2.02         1.           2.23         2.	IN         I           10         114           114         18           224         33           43         56           79         07           551         55           66         84           92         13	0.14 0.18 0.24 0.33 0.43 0.55 0.78 1.06 1.51 1.63 1.76 1.92 2.10 2.33	14.41 19.59 26.46 35.74 46.37 62.60 81.35 114.86 161.71 313.76 18.17 20.00 23.12 21.45 24.40 30.64	1.6 2.2 3.0 4.1 5.3 7.1 18.4 35.8 2.1 2.3 2.6 2.4 2.4 2.8 3.5	0 10 20 30 40 50 60 70 80 90 92 94 94 96 98	10 20 30 40 50 60 70 80 90 100 93 95 97 97	NUMBER 3 4 4 4 4 4 4 5 5 5 5 5 5 5 6 6 7 5 1 1 1 1 1 1 1	MEAN         N           0.10         (           0.11         (           0.11         (           0.14         (           0.17         (           0.19         (           0.19         (           0.23         (           0.31         (           0.54         (           0.54         (           0.54         (           0.54         (           1.50         1           1.50         1           2.35         2           2.55         2	0.10 0.13 0.13 0.16 0.18 0.22 0.24 0.24 0.45 0.83 1.50 1.50 1.50 1.59 2.35	0.10 0.11 0.21 0.24 0.45 0.74 1.14 2.55 1.50 1.50 1.59 2.35	0.40 0.63 1.12 1.04 1.23 1.58 3.55 5.17 11.31 2.78 0.98 2.62 3.28	1.5 2.3 3.0 4.2 3.9 4.6 5.9 13.2 19.3 42.2 10.3 3.6 9.8 12.2	0 10 20 30 40 50 60 70 80 90 90 92 93 93 93 94 96 97	10 20 30 40 50 60 70 80 90 100 91 93 93 94 95 97 98	NUMBER 6 5 3 3 5 6 6 6 6 8 10 1 1 1 1 2 1 1	MEAN 0.11 0.12 0.14 0.18 0.19 0.21 0.28 0.55 0.76 3.12 1.03 1.05 1.28 2.44 2.44 3.34	0.10 0.12 0.13 0.18 0.19 0.25 0.47 0.64 1.03 1.03 1.05 1.28 2.44 2.44 3.34	0.11 0.13 0.17 0.18 0.25 0.35 0.63 1.01 11.56 1.03 1.05 1.28 2.44 2.44 3.34	1.30 1.12 2.00 2.20 2.74 2.32 3.82 4.74 12.19 42.02 1.28 2.09 1.53 4.64 4.64 4.18	1.7 1.5 2.7 3.0 3.7 3.1 5.1 6.4 16.4 56.4 56.4 2.8 2.1 6.2 6.2 5.6
0 10 20 30 40 50 60 70 80 90 90 91 92 93 94 94 95 96	10 20 30 40 50 60 70 80 90 100 91 92 93 94 95 96 97	VUMBER N 96 89 78 70 71 68 67 73 63 68 63 68 5 4 6 6 7 11 11 7 8	AEAN         M           0.11         0.           0.15         0.           0.21         0.           0.23         0.           0.37         0.           0.49         0.           0.64         0.           0.91         0.           0.49         0.           0.49         0.           1.27         1.           1.46         1.           1.69         1.           1.87         1.           2.02         1.           2.23         2.           2.50         2.	IN         I           10         10           114         18           224         33           33         43           556         79           007         551           555         66           844         922           113         446	0.14 0.18 0.24 0.33 0.43 0.55 0.78 1.06 1.51 1.63 1.75 1.63 1.76 2.10 2.33 2.58	14.41 19.59 26.46 35.74 46.37 62.60 81.35 114.86 161.71 313.76 18.17 20.00 23.12 21.45 24.40 30.64 34.57	1.6 2.2 3.0 4.1 5.3 7.1 18.4 35.8 2.1 2.3 2.6 2.4 2.4 2.8 3.5 3.9	0 10 20 30 40 50 60 70 80 90 92 94 99 99 99	100 200 300 400 500 700 800 900 1000 933 955 977 999 1000	NUMBER 3 4 4 4 4 4 4 5 5 5 5 5 5 5 6 6 7 5 1 1 1 1 1 1 1	MEAN         N           0.10         (           0.11         (           0.14         (           0.17         (           0.19         (           0.19         (           0.19         (           0.23         (           0.31         (           0.54         (           0.54         (           0.54         (           1.82         1           1.50         1           1.50         2           2.35         2           2.55         2	0.10 0.13 0.13 0.16 0.18 0.22 0.24 0.24 0.45 0.83 1.50 1.50 1.50 1.59 2.35	0.10 0.11 0.21 0.24 0.45 0.74 1.14 2.55 1.50 1.50 1.59 2.35	0.40 0.63 0.80 1.12 1.04 1.23 1.58 3.55 5.17 11.31 2.78 0.98 2.62 3.28 1.66	1.5 2.3 3.0 4.2 5.9 13.2 19.3 4.2 10.3 3.6 9.8 12.2 6.2	0 10 20 30 40 50 60 70 80 90 90 92 93 94 96 97 98	10 20 30 40 50 60 70 80 90 100 91 93 93 94 95 97 98 99	NUMBER 6 6 5 3 3 5 6 6 6 6 6 6 8 100 11 1 1 1 1 1 1 1 1 1 1	MEAN           0.11           0.12           0.14           0.18           0.19           0.21           0.28           0.55           0.76           3.12           1.03           1.05           1.28           2.44           3.34           3.94	0.10 0.12 0.13 0.19 0.25 0.47 0.64 1.03 1.03 1.05 1.28 2.44 2.44 3.34 3.94	0.11 0.13 0.17 0.18 0.25 0.35 0.63 1.01 11.56 1.03 1.05 1.28 2.44 2.44 3.34 3.94	1.30 1.12 2.00 2.20 2.74 2.32 3.82 4.74 12.19 42.02 1.28 2.09 1.53 4.64 4.64 4.18 7.89	1.7 1.5 2.7 3.0 3.7 3.1 5.1 6.4 16.4 56.4 16.4 56.4 2.8 2.1 6.2 6.2 5.6 10.6
0 10 20 30 40 50 60 70 80 90 90 91 92 93 94 95 95 96 97	10 20 30 40 50 60 70 80 90 100 91 92 93 93 94 95 96 97 98	VUIMBER N 96 89 78 70 71 68 67 73 63 63 63 63 63 63 63 63 63 7 11	AEAN         M           0.11         0.           0.15         0.           0.21         0.           0.23         0.           0.37         0.           0.49         0.           0.64         0.           0.91         0.           0.47         1.           2.46         1.           1.69         1.           1.69         1.           2.02         1.           2.23         2.           2.50         2.           2.82         2.	IN         I           10         14           14         33           43         56           79         07           551         55           66         84           92         13           46         73	0.14 0.28 0.24 0.33 0.43 0.55 0.78 1.06 1.51 1.55 1.63 1.76 1.92 2.10 2.33 2.58 3.05	14.41 19.59 26.46 35.74 46.37 62.60 81.35 114.86 161.71 313.76 18.17 20.00 23.12 21.45 24.40 30.64 34.57 35.75	1.6 2.2 3.0 4.1 5.3 7.1 9.3 13.1 18.4 35.8 2.1 2.3 2.6 2.4 2.8 3.9 4.1	0 10 20 30 40 50 60 70 80 90 92 94 99 99 99	100 200 300 400 500 700 800 900 1000 933 955 977 999 1000	NUMBER 3 4 4 4 4 4 4 5 5 5 5 5 5 5 6 6 7 5 1 1 1 1 1 1 1	MEAN         N           0.10         (           0.11         (           0.14         (           0.17         (           0.19         (           0.19         (           0.19         (           0.23         (           0.31         (           0.54         (           0.54         (           0.54         (           1.82         1           1.50         1           1.50         2           2.35         2           2.55         2	0.10 0.13 0.13 0.16 0.18 0.22 0.24 0.24 0.45 0.83 1.50 1.50 1.50 1.59 2.35	0.10 0.11 0.21 0.24 0.45 0.74 1.14 2.55 1.50 1.50 1.59 2.35	0.40 0.63 0.80 1.12 1.04 1.23 1.58 3.55 5.17 11.31 2.78 0.98 2.62 3.28 1.66	1.5 2.3 3.0 4.2 5.9 13.2 19.3 4.2 10.3 3.6 9.8 12.2 6.2	0 10 20 30 40 50 60 70 80 90 90 90 92 93 94 96 97 98 99	10 20 30 40 50 60 70 80 90 100 91 93 93 94 95 97 98 99 100	NUMBER 6 6 5 3 3 5 5 6 6 6 6 6 6 6 10 1 1 1 1 1 2 2 1 1 2 2	MEAN 0.111 0.122 0.144 0.188 0.199 0.211 0.288 0.555 0.766 3.122 1.033 1.055 1.288 2.444 2.444 3.344 3.944 8.088	0.10 0.12 0.13 0.19 0.19 0.25 0.47 0.64 1.03 1.03 1.05 1.28 2.44 2.44 3.34 3.94 5.91	0.11 0.13 0.17 0.18 0.25 0.35 0.63 1.01 11.56 1.03 1.05 1.28 2.44 2.44 3.34 3.94 11.56	1.30 1.12 2.00 2.20 2.74 2.32 3.82 4.74 12.19 42.02 1.28 2.09 1.53 4.64 4.64 4.18 7.89 15.76	1.7 1.5 2.7 3.0 3.7 3.1 5.1 6.4 16.4 56.4 1.7 2.8 2.1 6.2 6.2 6.2 5.6 6 10.6 21.2
0 10 20 30 40 50 60 70 80 90 90 90 91 92 93 94 95 96 97 98	10 20 30 40 50 60 70 80 90 100 91 92 93 93 94 95 96 97 98 99	VUMBER N 96 89 78 70 71 68 67 73 63 63 63 63 63 63 63 63 63 7 1 1 7 8 7 8 7 8 7 8 7	AEAN         M           0.11         0.           0.15         0.           0.21         0.           0.28         0.           0.37         0.           0.49         0.           0.49         0.           0.49         0.           0.49         0.           0.49         0.           0.49         0.           0.49         0.           0.49         0.           0.49         0.           0.49         0.           1.27         1.           1.60         1.           1.60         1.           1.60         1.           1.62         1.           2.26         1.           2.20         2.           2.82         2.           3.25         3.	IN         I           10         14           14         33           43         56           79         07           51         55           66         84           92         13           46         73           006         84	0.14 0.24 0.33 0.55 0.78 1.06 1.51 1.51 1.63 1.76 1.92 2.10 2.33 2.58 3.05 3.93	14.41 19.59 26.46 35.74 46.37 62.60 81.35 114.86 161.71 313.76 18.17 20.00 23.12 21.45 24.45 24.45 35.75 41.45	1.6 2.2 3.0 4.1 5.3 7.1 9.3 13.1 18.4 35.8 2.1 2.3 2.6 2.4 2.8 3.5 3.5 3.5 3.5 4.1 4.7	0 10 20 30 40 50 60 70 80 90 92 94 99 99 99	100 200 300 400 500 700 800 900 1000 933 955 977 999 1000	NUMBER 3 4 4 4 4 4 4 5 5 5 5 5 5 5 6 6 5 5 1 1 1 1 1 1 1	MEAN         N           0.10         (           0.11         (           0.14         (           0.17         (           0.19         (           0.19         (           0.19         (           0.23         (           0.31         (           0.54         (           0.54         (           0.54         (           1.82         1           1.50         1           1.50         2           2.35         2           2.55         2	0.10 0.13 0.13 0.16 0.18 0.22 0.24 0.24 0.45 0.83 1.50 1.50 1.50 1.59 2.35	0.10 0.11 0.21 0.24 0.45 0.74 1.14 2.55 1.50 1.50 1.59 2.35	0.40 0.63 0.80 1.12 1.04 1.23 1.58 3.55 5.17 11.31 2.78 0.98 2.62 3.28 1.66	1.5 2.3 3.0 4.2 5.9 13.2 19.3 4.2 10.3 3.6 9.8 12.2 6.2	0 10 20 30 40 50 60 70 80 90 90 92 93 94 96 97 98	10 20 30 40 50 60 70 80 90 100 91 93 93 94 95 97 98 99	NUMBER 6 6 5 3 3 5 5 6 6 6 6 6 6 6 10 1 1 1 1 1 2 2 1 1 2 2	MEAN 0.111 0.122 0.144 0.188 0.199 0.211 0.288 0.555 0.766 3.122 1.033 1.055 1.288 2.444 2.444 3.344 3.944 8.088	0.10 0.12 0.13 0.19 0.19 0.25 0.47 0.64 1.03 1.03 1.05 1.28 2.44 2.44 3.34 3.94 5.91	0.11 0.13 0.17 0.18 0.25 0.35 0.63 1.01 11.56 1.03 1.05 1.28 2.44 2.44 3.34 3.94	1.30 1.12 2.00 2.20 2.74 2.32 3.82 4.74 12.19 42.02 1.28 2.09 1.53 4.64 4.64 4.18 7.89	1.7 1.5 2.7 3.0 3.7 3.1 5.1 6.4 16.4 56.4 16.4 56.4 2.8 2.1 6.2 6.2 5.6 10.6
0 10 20 30 40 50 60 70 80 90 90 91 92 93 94 95 95 96 97	10 20 30 40 50 60 70 80 90 100 91 92 93 93 94 95 96 97 98	VUMBER N 96 89 78 70 71 68 67 73 63 68 63 68 5 4 6 6 7 11 11 7 8	AEAN         M           0.11         0.           0.15         0.           0.21         0.           0.28         0.           0.37         0.           0.49         0.           0.49         0.           0.49         0.           0.41         0.           1.27         1.           2.46         1.           1.60         1.           1.60         1.           1.69         1.           2.22         2.           2.50         2.           3.25         3.           4.90         4.	IN         I           10         10           14         18           24         33           43         56           79         07           51         55           55         66           84         92           113         46           73         06           03         10	0.14 0.24 0.33 0.55 0.78 1.06 1.51 1.51 1.63 1.76 1.92 2.10 2.33 2.58 3.05 3.93 5.88	14.41 19.59 26.46 35.74 46.37 62.60 81.35 114.86 161.71 313.76 18.17 20.00 23.12 21.45 24.40 30.64 34.57 35.75	1.6 2.2 3.0 4.1 5.3 7.1 9.3 13.1 18.4 35.8 2.1 2.3 2.6 2.4 2.8 3.9 4.1	0 10 20 30 40 50 60 70 80 90 92 94 99 99 99	100 200 300 400 500 700 800 900 1000 933 955 977 999 1000	NUMBER 3 4 4 4 4 4 4 5 5 5 5 5 5 5 6 6 5 5 1 1 1 1 1 1 1	MEAN         N           0.10         (           0.11         (           0.14         (           0.17         (           0.19         (           0.19         (           0.19         (           0.23         (           0.31         (           0.54         (           0.54         (           0.54         (           1.82         1           1.50         1           1.50         2           2.35         2           2.55         2	0.10 0.13 0.13 0.16 0.18 0.22 0.24 0.24 0.45 0.83 1.50 1.50 1.50 1.59 2.35	0.10 0.11 0.21 0.24 0.45 0.74 1.14 2.55 1.50 1.50 1.59 2.35	0.40 0.63 0.80 1.12 1.04 1.23 1.58 3.55 5.17 11.31 2.78 0.98 2.62 3.28 1.66	1.5 2.3 3.0 4.2 5.9 13.2 19.3 4.2 10.3 3.6 9.8 12.2 6.2	0 10 20 30 40 50 60 70 80 90 90 90 92 93 94 96 97 98 99	10 20 30 40 50 60 70 80 90 100 91 93 93 94 95 97 98 99 100	NUMBER 6 6 5 3 3 5 5 6 6 6 6 6 6 6 10 1 1 1 1 1 2 2 1 1 2 2	MEAN 0.111 0.122 0.144 0.188 0.199 0.211 0.288 0.555 0.766 3.122 1.033 1.055 1.288 2.444 2.444 3.344 3.944 8.088	0.10 0.12 0.13 0.19 0.19 0.25 0.47 0.64 1.03 1.03 1.05 1.28 2.44 2.44 3.34 3.94 5.91	0.11 0.13 0.17 0.18 0.25 0.35 0.63 1.01 11.56 1.03 1.05 1.28 2.44 2.44 3.34 3.94 11.56	1.30 1.12 2.00 2.20 2.74 2.32 3.82 4.74 12.19 42.02 1.28 2.09 1.53 4.64 4.64 4.18 7.89 15.76	1.7 1.5 2.7 3.0 3.7 3.1 5.1 6.4 16.4 56.4 1.7 2.8 2.1 6.2 6.2 6.2 5.6 6 10.6 21.2

Table 14-5. Decile Analysis

								LOG	
ZONE	BED		MINIMUM	MAYIMIM	MEAN	VARIANCE	STANDARD DEVIATION	-	COEFF.OF
ZONE						-		-	
	T	164	0.001	3.70	0.65	0.83	0.91	1.22	1.4
Las Cortinas	3	67	0.001	2.71	0.30	0.33	0.57	0.90	1.9
	20	208	0.001	3.52	0.14	0.10	0.32	0.25	2.2
	21	99	0.001	1.83	0.25	0.12	0.34	0.59	1.4
	6	199	0.001	4.97	0.24	0.36	0.60	0.79	2.6
	7	468	0.001	2.63	0.33	0.21	0.45	1.02	1.4
Los Santos Sur	8	151	0.001	4.03	0.24	0.27	0.52	0.46	2.2
Los Santos Sur	9	168	0.001	3.43	0.53	0.54	0.74	3.91	1.4
	10	164	0.001	5.88	0.24	0.37	0.61	0.48	2.6
	11	54	0.001	1.51	0.23	0.12	0.35	1.35	1.5
	1	118	0.001	3.99	0.64	0.59	0.77	1.52	1.2
	2	74	0.000	2.48	0.25	0.14	0.37	0.34	1.5
LSS SW	3	71	0.013	1.32	0.22	0.06	0.25	0.27	1.2
L33_3W	4	89	0.001	4.46	0.48	0.69	0.83	0.61	1.7
	5	29	0.000	1.63	0.22	0.10	0.31	0.34	1.4
	11	25	0.001	2.04	0.33	0.27	0.52	0.88	1.6
Capa Este	12	41	0.001	1.90	0.27	0.16	0.40	0.53	1.5
Capa G	12	204	0.001	2.40	0.16	0.07	0.27	0.32	1.7
Capa 4	4	74	0.001	5.21	0.42	0.62	0.79	0.58	1.9

Table 14-6. Statistical Summary of Composites

For each set of skarn composites, within each zone, directional experimental variograms were generated. Pairs were constrained by having to belong to the same skarn bed. For each zone, three principal directions were used to generation on the variograms – along strike, down-dip and cross-strike, although in most cases there were insufficient pairs for the cross-strike direction. From these experimental variograms (in most cases the pairwise relative variograms were used), model variograms were fitted, as shown in Figure 14-3 for Los Santos Sur. The experimental and model variograms are shown in Appendix A. The resultant model variogram parameters are summarised in Table 14-7.

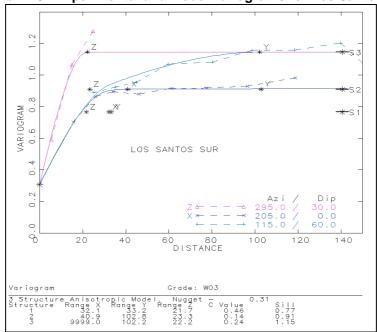


Figure 14-3. Experimental and Model Variograms for Los Santos Sur

Zone	Bed	Orient	ation	NUGGET	Ran	ge 1 (ı	m)	C1	Ran	ge 2 (r	n)	C2	Ran	ige 3 (	(m)	C3
		ANGLE1	ANGLE2		1	2	3		1	2	3		1	2	3	
Las Cortinas		35	70	0.28	7	7	4	0.20	16	25	9	0.15	9999	30	12	0.04
Los Santos Sur	1	115	60	0.31	32	33	22	0.46	41	103	23	0.14	9999	102	22	0.24
Los Santos Sur	6	155	60	0.31	32	33	22	0.46	41	103	23	0.14	9999	102	22	0.24
LSS_SW				0.03	10	10	10	0.23	51	51	51	0.07				
Capa E				0.03	16	16	16	0.02	30	30	30	0.01	-	-	-	-
Capa G		170	70	0.01	30	20	8	0.00	45	40	9	0.03	9999	60	11	0.02
Capa 4		30	85	0.06	16	32	4	0.36	9999	33	4	0.04	9999	33	9999	0.25

#### Table 14-7. Model Variogram Parameters

Notes

. Angle1 is about axis 3 (z) . Angle 2 is about axis 1 (x)

## 14.4 Volumetric Modelling

The various interpreted three-dimensional wireframe models were used to construct separate volumetric block models for each zone. After grade interpolation, these separate block models were then subsequently combined to form an overall block model for the whole Los Santos area, which was used for pit optimisation.

For each zone, the principal wireframes used were for the following lithologies.

- Granite
- Corneanas (hornfels)
- Calc-silicates
- Skarn

An additional topographic wireframe model was also used to cut blocks off against the surface. For the areas which have been mined this topography represented the surface at the end of June, 2015. All zones were modelled within the same common model prototype, which is summarised in Table 14-8. The principal parent block size used was 10m x 10m x 10m, but with sub-blocks within the skarn beds measuring  $5m \times 5m \times 5m$ . Additional sub-blocks with varying sizes were created against zone boundaries, to provide an appropriate volumetric fit. The model structure was also rotated at angle of approximately  $22^{\circ}$ , so that blocks were more logically oriented with the majority of skarn structures.

An oxidised layer was also modelled, with lower densities, for material up to 10m below the original topography.

	Ра			
Axis	Origin	Size	Number	Range
	m	m		m
Х	263,255	10	266	2,660
Y	491,490	10	108	1,080
z	700	10	45	450

#### Table 14-8. Model Prototype Parameters

Note

. X-axis rotated at 21.679 degrees

. For LC, SC and C4 zones,

. temporary prototype made with 5 x 2.5 x 5m cells, for selectivity purposes . For SS, SW, CE and CG zones,

. temporary prototype made with 2.5 x 5 x 5m cells, for selectivity purposes

In the build-up of the overall model of each zone, separate models were built up of each of the different components. These were then combined, in such a way so that any small intersections of the different structures were resolved. In most cases the granite structures were added last, as these structures do logically intersect the other lithologies.

During construction of the volumetric model, the horizontal width of each part of skarn bed was also determined, which also enabled average width calculations. For each zone, the resultant volumetric block model contained the following fields:

Different numbers for each principal lithology
Name of each principal lithology
Logical number of separate beds within the separate skarn bodies
Applied rock density value
Horizontal width of each skarn bed

A summary of the different skarn beds in each zone are shown in Table 14-1.

# 14.5 Densities

Separate density values were assigned to each principal lithology. The principal density measurements made during previous studies, along with the final density values used in the current study, are shown in Table 14-9. The different laboratories used for these densities measurements are summarised below:

- ADARO
- THACSA
- BESA (Billition)
- Escuela Tecnica Superior de Ingenieros de Minas de Madrid

		ADARO	THACSA			
Study	Rock Type	Density	Density	Sample No.	Drillhole	Depth
	Pvroxene skarn	3.48	3.53	7931	29	19.1
	Pyroxene skarn	3.39	3.41	7953	28	71
	Pyroxene skarn	3.42	3.42	7961	24	74.3
	Pyrite skarn	3.33	3.49	7939	29	44.1
	Pyrrhotite skarn	3.54	3.60	7945	30	46.8
D.Carter		3.43	3.49			
Nov-82						
	Pvroxene-feldspar skarn	2.84	2.86	7948	30	37.8
	Feldspar skarn	2.92	2.89	7964	27	46.3
	Marble	2.73	2.76	7936	29	64.78
	Schist	2.74	2.71	7968	27	20.7
	Granite	2.61	2.63	7969	29	91.5
	Rock Type	No of Samples	Density			
	Granite	3	2.72			
Dames & Moore 84	Aplite	3	2.65	Escuela Tecni	ca Superior	
	Schist	5	2.76		de Minas de Madrid	
	Calcsilicate	16	3.07	de lingemeree		
	Marble	4	2.87			
	Skarn	5	3.36			
	Rock Type	No of Samples	Density			
	Granodiorite, granite & aplite	6	2.69	BESA		
Piteau Associates 85	Schist	5	2.76	BLOA		
1 1000 1000 000	Calcsilicate	15	3.08			
	Marble	4	2.87			
	Skarn	5	3.36			
	Orani	5	5.50			
	Overall Summary					
	<u></u>		Source			
		Carter	Dames & Moore	e Piteau	Average - Value Used	
	Rock Type	82	84	85	In Current Study t/m <sup>3</sup>	
	Corneanas (schist)	2.73	2.76	2.76	2.75	
	Calcsilicate		3.07	3.08	3.07	
	Granite	2.62	2.72	2.69	2.68	
	Skarn	3.46	3.36	3.36	3.40	

#### Table 14-9. Density Values

## 14.6 Grade Estimation

For each zone, the skarn composite data sets were used to interpolate WO<sub>3</sub> grades into the corresponding skarn bed blocks of the volumetric block model in each zone. The geostatistical analysis was used to help derive interpolation parameters.

When the interpolation procedure took place for each block, a number of progressively larger searches for available samples were attempted, until sufficient samples had been found. This process also recorded which search was successful in locating samples. The initial search ellipse distances stemmed from the 2/3 level of the model variograms. If insufficient samples were found, then a second larger search ellipse was used, as approximately the dimensions of the model variogram ranges. Again if insufficient samples were found, then a final 3rd search was used with very large distances, to ensure that practically all blocks within the modelled skarn structures did receive some  $WO_3$  grades.

An additional control was placed on the first 2 searches, for the allocation of measured and indicated resources, which was to only allow this allocation if at least two drillholes were encountered. During the interpolation of each skarn block, a maximum of twelve composites could be used. From any particular drillhole, only a maximum of two 2.5 m composites could be used, so that other composites would have to be found from other drillholes. In all cases, grades were only interpolated from composites belong to the same corresponding skarn and bed identification.

The interpolation parameters used are summarised in Table 14-10. For each zone, the search ellipses were oriented so as to be parallel with the skarn beds in that zone. These orientations are summarised in Table 14-11. In Sector Central, the dip varies both along strike and down-dip. For this zone, therefore, a set or orientation strings were defined throughout the skarn bed. These strings were subsequently used to interpolate a dip value into the block model, and then these dip values were utilised during the grade interpolation. In Los Santos Sur, one particular set of beds (bed 6) has a quite different orientation to the other beds. A separate orientation was therefore used for this bed.

The principal method of  $WO_3$  grade interpolation used was ordinary kriging (OK). However, for subsequent testing and validation purposes, alternative  $WO_3$  grade values were also interpolated using nearest-neighbour and inverse-distance weighting methods.

Zone	Searc	h Distances X:	Y:Z (m)	Search	Minimum	Minimum No. of
	1	2	3 #	1	Composites	Drillholes
Las Cortinas	12.5	12.5	2.5	1st	3	2
	25	25	5	2nd	3	2
	62.5	62.5	12.5	3rd	1	-
Los Santos Sur	15	20	2.5	1st	3	2
	30	40	5	2nd	3	2
	75	100	12.5	3rd	1	-
Capa E, Capa G	15	20	2.5	1st	3	2
LSS-SW,	30	40	5	2nd	3	2
Capa 4	75	100	12.5	3rd	1	-

#### Table 14-10. Grade Estimation Parameters

Notes:

X:Y:Z are along-strike: down-dip : cross-strike, as defined in zone table below # Cross-strike direction limited as composites are constrained within each zone Max of 2 x 2.5m composites used per hole Maximum number of composites used = 12

All grades interpolated using ordinary kriging

#### Table 14-11. Zone Orientations

ZONE	Bed	Dip Direction	Dip	
Las Cortinas	All	22	80	
Los Santos Sur	All other beds	115	60	
	6	155	60	
Capa E + LSS-SW	All	150	67	
Capa G		170	70	
Capa 4		30	80	

Note s

# . Dynamic anisotropy used for LSS and LSS-SW, so dominant angles stem from mineralized skarn orientations

## 14.7 Mineral Resource Classification

Resource classification criteria were based on a "Two-Thirds Rule", which placed the boundary between Measured and Indicated Resources at approximately the sampling distance which explains at least two thirds of the data variability, as represented by the sill of the variogram. This is thus dependent on the nugget effect, Co, as well as on other characteristics of the model variogram. Thus, for the WO<sub>3</sub> variograms for Las Cortinas, 'measured' distance was then doubled for a distance to be appropriate for indicated resources, which in most cases gave a distance very close to or less than the variogram range.

The 1st and 2nd search volumes, therefore, broadly corresponded to measured and indicated resources, respectively. However, owing to the complex pattern of drillholes intersections, this could sometimes produce very complicated groups of different resource categories. Each bed and each zone were therefore examined in long-section, and a set of strings defined, stemming from the initial resource demarcation, to break up each bed into more logical portions of different resource classes. This is demonstrated in the example shown in Figure 14-4. In general, the resultant applied resource classification can be summarised as follows:

Measured Covered by a grid of bed intersections at least 15m x 15m

- Indicated Covered by a grid of bed intersections at least 30m x 30m
- Inferred Within the interpreted skarn beds, but with sampling that is not in a regular grid of at least 30m x 30m

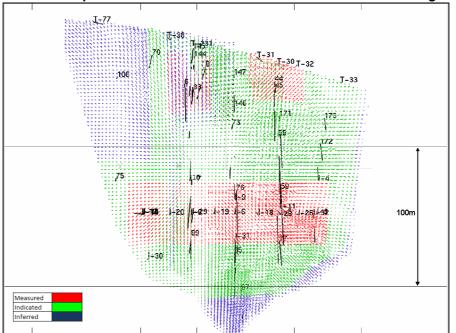


Figure 14-4. Example of Resource Classification - Los Santos Bed 7 Long Section

## 14.8 Model Validation

A comparison was made of the average  $WO_3$  model grades, for all resource levels, with the corresponding average sample and composite grades for the different modelled beds. These results are summarised for the updated zones, as shown in Table 14-12.

				Model Grades		
Zone	Bed	Samples	Composites	ОК	NN	ID
LSS	6	0.36	0.36	0.32	0.30	0.31
	7	0.45	0.46	0.50	0.47	0.50
	8	0.44	0.45	0.49	0.49	0.47
	9	0.77	0.77	0.48	0.44	0.51
	10	0.41	0.41	0.42	0.40	0.42
	11	0.50	0.50	0.48	0.54	0.51
	1	0.51	0.49	0.46	0.48	0.48
LSS-	2	0.23	0.23	0.22	0.21	0.22
sw	3	0.18	0.18	0.18	0.20	0.21
	4	0.73	0.54	0.48	0.46	0.51
	5	0.26	0.25	0.22	0.23	0.24
Capa Este		0.17	0.16	0.16	0.16	0.18
Capa G		0.19	0.16	0.14	0.14	0.13
Capa 4		0.47	0.45	0.48	0.46	0.45

Table 14-12. Comparison of Average Sample and Model

Notes

- . Bed ID for LSS-SW is specific to just that zone
- . OK Ordinary kriging
- . NN nearest neighbour
- . ID inverse distance weighting
- . For LSS, Bed 9 only represents 1% of LSS tonnage

As would be expected, the average grades decline from the sample to the composite stage, due to the effects of top-cutting. The model average grades effectively represent a declustering of these high grade intersections. Overall the average model grades compare well the overall sample and composite grades. Detailed block model sections showing the both the composite and block model  $WO_3$  grades, were also examined, as shown in the example in Figure 14-5. Sections through all of the zones were closely examined during testing of different interpolation methods and parameters.

As part of the model validation process, grade profiles (swath plots) were also produced on 20m slices, and the average grades per slice compared with the composites on the same slices. An example of a grade profile plot is shown in Figure 14-6, for Capa Este. This shows a favourable comparison between composite grades and model grades, derived from kriging, inverse distance weighting and nearest neighbour estimation. All of the grade profiles for recently updated LSS-SW zones are shown in Appendix A.

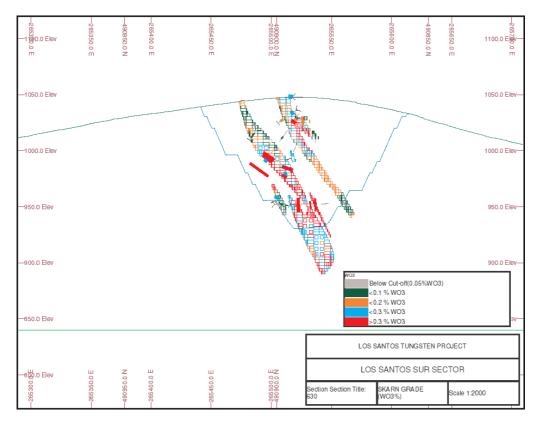


Figure 14-5. Example Block Model Cross-Section – Los Santos Sur

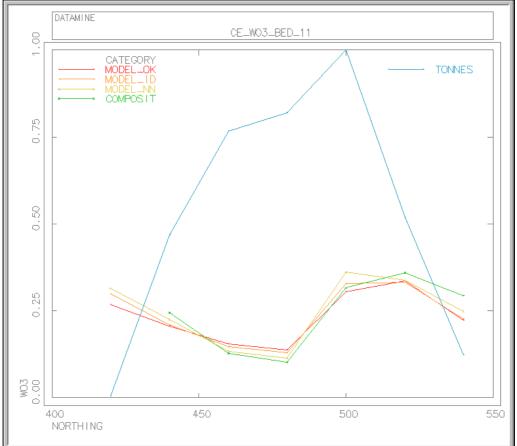


Figure 14-6. Example Grade Profile Plot – Capa Este

## 14.9 Mineral Resource Reporting

The resultant geological block models were evaluated in detail, with respect to zone, resource class, and skarn bed. When the volumetric model was built up, the widths of the different parts of the skarn beds were also determined. These widths were used to impose a minimum width of 2.5m on subsequent resource evaluation, such that any parts less than 2.5m thick were diluted up to this thickness, with a zero dilutant grade.

The overall resource evaluation results' breakdown is shown in Table 14-14, at two different cut-off grades: 0.05% and 0.10%. At a cut-off of 0.05% WO<sub>3</sub>, this gives a total of approximately 2.21 Mt of measured and indicated resources. A grade-tonnage table, and associated curve, is shown in Table 14-13.

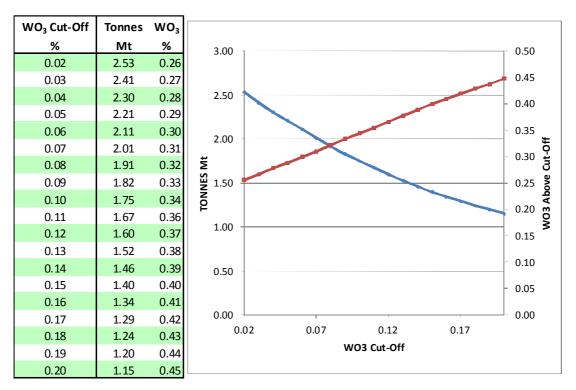


Table 14-13. Grade-Tonnage Table – Measured and Indicated Resources Only

>= 0.05%								
	Measur	ed	Indicate	ed	Measured+In	dicated	Inferred	
ZONE	Tonnes	WO <sub>3</sub>	Tonnes	WO <sub>3</sub>	Tonnes	WO₃	Tonnes	WO₃
	Kt	%	Kt	%	Kt	%	Kt	%
Las Cortinas West	1	0.06	399	0.22	400	0.22	88	0.13
Los Santos Sur	74	0.41	417	0.30	491	0.32	275	0.26
Los Santos Sur - SW	-	-	1,050	0.31	1,050	0.31	585	0.27
Capa Este	-	-	26	0.15	26	0.15	127	0.19
Capa G	-	-	157	0.14	157	0.14	418	0.15
Capa 4	-	-	84	0.44	84	0.44	385	0.36
TOTAL	75	0.41	2,133	0.28	2,208	0.29	1,878	0.25

# Table 14-14 Resource Model Breakdown

(As of June 31<sup>st</sup>, 2015)

#### WO<sub>3</sub> >= 0.10%

	Measure	ed	Indicat	ed	Measured+Ir	dicated	Inferre	d
ZONE	Tonnes	WO₃	Tonnes	WO <sub>3</sub>	Tonnes	WO <sub>3</sub>	Tonnes	WO₃
	Kt	%	Kt	%	Kt	%	Kt	%
Las Cortinas West	-	-	299	0.27	299	0.27	51	0.16
Los Santos Sur	67	0.44	340	0.35	407	0.36	219	0.31
Los Santos Sur - SW	-	-	888	0.36	888	0.36	445	0.33
Capa Este	-	-	18	0.18	18	0.18	99	0.22
Capa G	-	-	71	0.23	71	0.23	270	0.20
Capa 4	-	-	64	0.55	64	0.55	343	0.40
TOTAL	67	0.44	1,680	0.34	1,747	0.35	1,427	0.31

#### Notes

. Minimum width = 2.5m

. All resources shown are inclusive of reserves

. Sector Central and Las Cortinas East removed as pits have been completed

# **15 MINERAL RESERVE ESTIMATES**

# 15.1 Open Pit Mine Planning

The approach taken may be summarised by the following steps:

- 1. Preparation of the block model for each zone, such that grades were regularised to a selective mining unit size of 2.5m x 5m x 5m. For each zone, the 2.5m was oriented cross-strike to the main bed orientations.
- 2. Combination of the block models from each zone, to create a complete block model for all zones.
- 3. Pit optimisation, to produce series of optimised pit shells, for range of different scenarios and parameters.
- 4. Selection of the most appropriate ultimate pit shells for subsequent reference purposes in actual pit design.
- 5. Pit design, followed by evaluation, to produce a reserve estimate appropriate to open pit mining.
- 6. Final schedule development based on the final pit designs.

The economic parameters were prepared by Daytal, based on data from the actual mining operation, as well as on reasonable projections. A summary of the current base case open pit parameters are shown in Table 15-1. No additional mining factors were applied, because of the dilution already embedded in the regularised block model, to represent a minimum selective width of 2.5m.

The pit slope parameters were derived from geotechnical studies - originally Piteau 1985 and Metales Hispania 2000. More recently in 2011 and 2015 geotechnical studies were completed by SADIM. From these studies, face angles of 73° (in all directions) have been recommended. In oxidised material, approximately 10m below the topography, a face angle of 45° has been recommended. The bench configuration is based on a 4m safety berm for every 20m vertically. With a 10m haul road being used, final overall slope angles are typically between 55° and 48°, depending on the predominant location of the haul road relative to the pit. Examples of the final designs are shown in 3D views for Las Cortinas and Los Santos Sur/Capa Este, with the skarn block model contents are shown in Figure 15-1 and Figure 15-2.

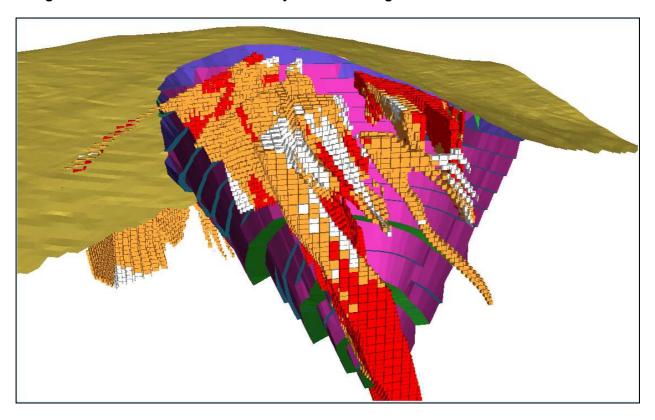
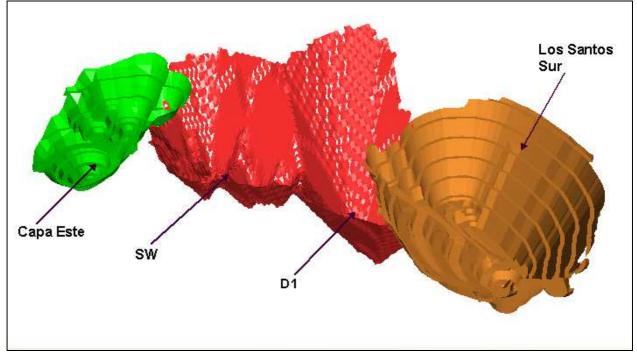


Figure 15-1. Los Santos Sur – Cut-Away View - Pit Design and Skarn Block Model

Figure 15-2. Ultimate Pit Designs – Capa E and Los Santos Sur



Description		Unit	
Processing			
-	APT Price	\$/mtu WO 3	370
	Metal Price - received,	\$/mtu WO <sub>3</sub>	288
	after transport + smelting	\$/t WO <sub>3</sub>	28,800
	Recovery	%	62.0%
	Processing Cost	\$/t ore	9.72
	G & A	\$/t ore	3.25
	Total Applied Ore Cost	\$/t ore	12.64
	(Processing+G&A+OreMining-WasteMining)		
Mining			
	Ore mining	\$/t ore	1.70
	Waste mining	\$/t waste	2.03
	Applied cut-off grade	% WO <sub>3</sub>	0.07%
	Minimum selectivity width	т	2.5
Mining Parameters			0
	Mining Recovery		100
	Dilution		
	Breakeven Economic Out-Off		0.07%
Pit Slope Parameter			
	Bench Configuration		
	Face Angle		<b>73</b> °
	Berm Width, every 20m	т	4
	Bench Height	т	10
	Overall max slope with road intersections		55°
	Face Angle for top oxidised 10m		45°
	Haul Road		
	Gradient		10%
	Width	т	10
	Width for bottom 2 benches	т	8

Table 15	-1. Oper	n Pit Parame	eters
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The economic parameters shown in Table 15-1 are derived from the actual operating costs at Los Santos. Considering the range of breakeven cut-off grades for different potential tungsten prices and exchange rates, along with the continuity of ore zones and what can practically be outlined and selectively mined in the current open pit operations, it was decided to continue the use of 0.07% WO<sub>3</sub> as the cut-off for ore/waste definition purposes for long term planning and reserve estimation.

Pit designs were based on the maximum cashflow optimisation shells for each zone. For each pit, the exit point was positioned on the south down-slope side. A main haul road width of 10m width was applied, with a 6m road width for bottom-most 20m. In some cases, small additional 5m cuts was also taken from the designed pit bases. Near surface, a lower face angle of 45° was applied to allow superficial oxidised material. A plan of the current final pit designs is shown in Figure 15-3, and with the mine infrastructure in Figure 15-4.

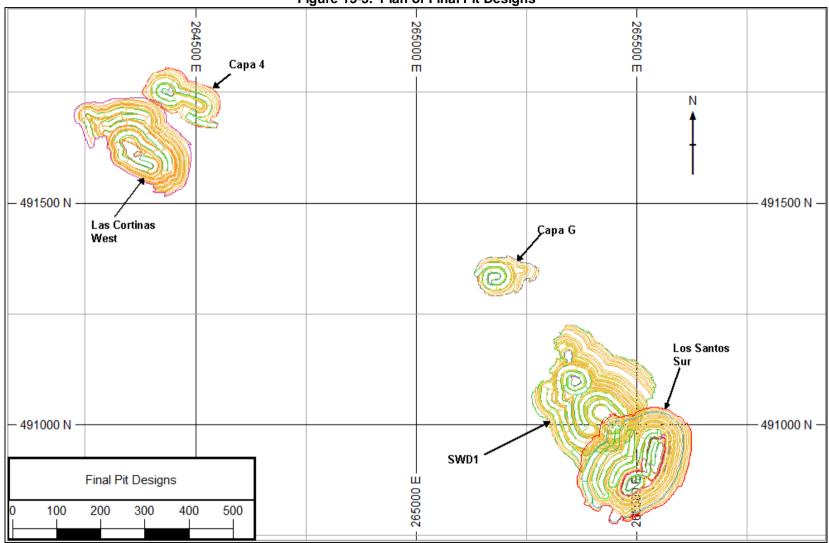


Figure 15-3. Plan of Final Pit Designs

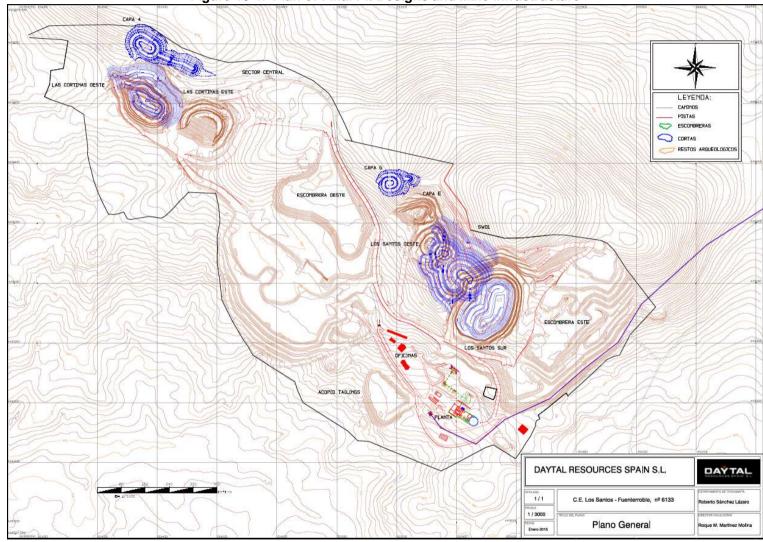


Figure 15-4. Plan of Final Pit Designs and Mine Infrastructure

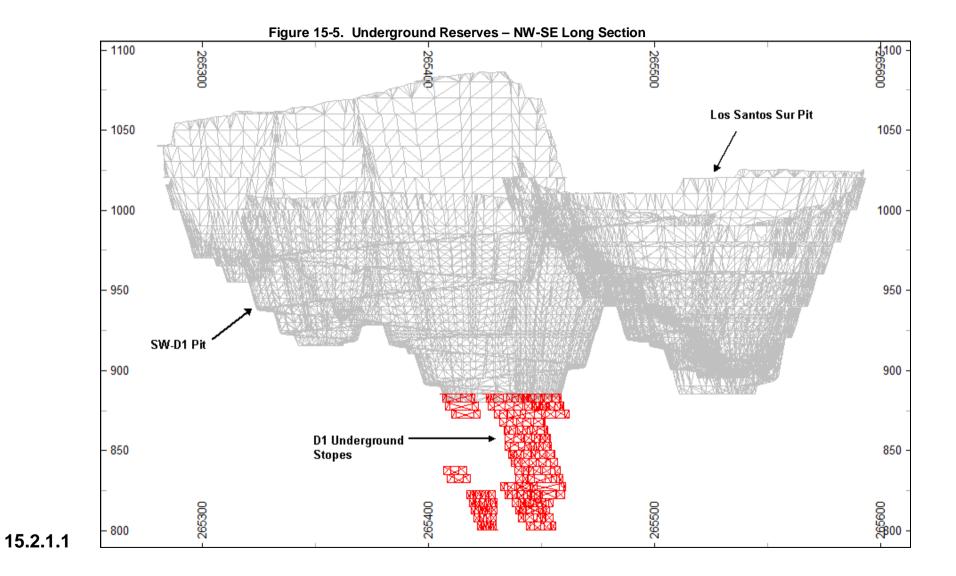
# 15.2 Underground Mine Planning

In an area underneath the planned SW-D1 pit, some small skarn extensions were blocked out for underground mining, resulting in approximately 31 Kt of underground ore. It should be possible to access these underground stopes through adit access from the pit, as well as by extension of the existing underground development. In this blocking out process, a cut-off grade of 0.3% WO<sub>3</sub> has been used, which was derived from the parameters shown in Table 15-2. The underground mining cost was derived from estimates from local Spanish mining contractors. The blocking out was based on a cut-and-fill mining method, with 5m lifts.

	Description	Unit	Values
Processing			
	APT Price	\$/mtu WO 3	370
	Metal Price - received,	\$/mtu WO <sub>3</sub>	288
	after transport + smelting	\$/t WO 3	28,800
	Recovery	%	62%
	Processing Cost	\$/t ore	9.72
	G & A	\$/t ore	3.25
	Total Applied Ore Cost	\$/t ore	43.39
	(Processing + G&A + Mining)		
Mining			
	U/g mining operating cost	\$/t ore	30.42
	Breakeven Economic Cut-Off	WO3 %	0.24%

Table 15-2. Underground Cut-Off Grade Calculation

The blocked out underground zones are depicted in Figure 15-5, and cover a range of elevations from 800m to 895 mRL.



#### 15.3 Tailings Re-Processing

With improvements in mill recovery, this has meant that specific areas where tailings have historically been deposited still contain economic  $WO_3$  grades. These tailing areas comprise two different kinds of tailings:

- a) Coarse rejects from the thickening cyclones and dewatering screens (Arenas).
- b) Fine rejects from the filter press (Tortas).

Up to 2012 separate dumps were made for these different types of tailings. After 2012 a large combined dump area (Acopio 5) has been use for both types of tailings. Since June, 2010, the dumping locations have been recorded and collated, with the known tailings grades by time period. Volumes of the separate dumping areas have been determined by the development of wireframe models of the pre-dump surfaces, along with the dumped surfaces at different time periods. During 2012 in-situ tailings density and humidity measurements were made (by the company Seinco – stability study). Further density measurements wre made recently for the Acopio 5 tailings area. All of these collated volumes, grades and resultant tonnages have been collated as shown in Table 15-3.

		June 2010 - June 2012		)12	Jul y 2012 - June 2013		July 2013 - June 2015			Total As Of June 2015		2015	
		Volume	Tonnes	WO3	Volume	Tonnes	WO3	Volume	Tonnes	WO3	Volume	Tonnes	WO3
		m <sup>3</sup> x 1000	t x1000	%	m <sup>3</sup> x 1000	t x1000	%	m <sup>3</sup> x 1000	t x1000	%	m <sup>3</sup> x 1000	t x1000	%
	1	29	45	0.10							29	45	0.10
	2	12	19	0.17							12	19	0.17
Coarse rejects	3	149	234	0.12							149	234	0.12
(Are nas)	4	260	407	0.15							260	407	0.15
	5		-		138	216	0.10	355	643	0.14	493	858	0.13
	Sub-Total	450	705	0.14	138	216	0.10	355	643	0.14	943	1,564	0.13
Fine rejects	1	163	246	0.24	2	3	0.20	49	76	0.14	214	324	0.22
(Tortas)	2	42	63	0.25	74	111	0.20				116	174	0.22
	Sub-Total	205	309	0.24	76	114	0.20	49	76	0.14	330	498	0.22
	Total	656	1,014	0.17	214	330	0.13	404	718	0.14	1,273	2,062	0.15

Table 15-3. Summary of Tailings Material Identified for Re-Processing

Notes

. Collation started at June 2010 as reference for separate dumping . Density Measurements Acopios 1-4 and Tortas

		Wet Sg Hu	midity	Dry Bulk Sg				
		1.99	15%	1.69				
	Arenas	1.80	20%	1.44				
		A	1.57					
	Tortas	1.77	15%	1.50				
	Overall			1.55				
. Density Measurements Acopios 5								
		Wet Sg Hu	midity	Dry Bulk Sg				
	Acopio 5	2.05	12%	1.81				

The envisaged processing cost for re-processed tailing is 9.52/t leading to a breakeven cut-off grade 0.07% WO<sub>3</sub>. This implies that all of the identified tailings material is economically

viable to process, and so is included in the reserve inventory. The currently predicted overall tailings recovery (coarse and fine) is 46%. Raising this tailings recovery to 50-55% levels is one of the targets of on-going metallurgical testwork.

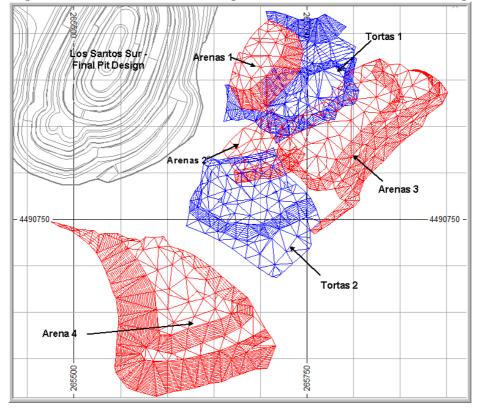


Figure 15-6. Plan of Eastern Tailings Areas Identified for Re-Processing

Figure 15-7. Aerial Photograph of Eastern Tailings Areas



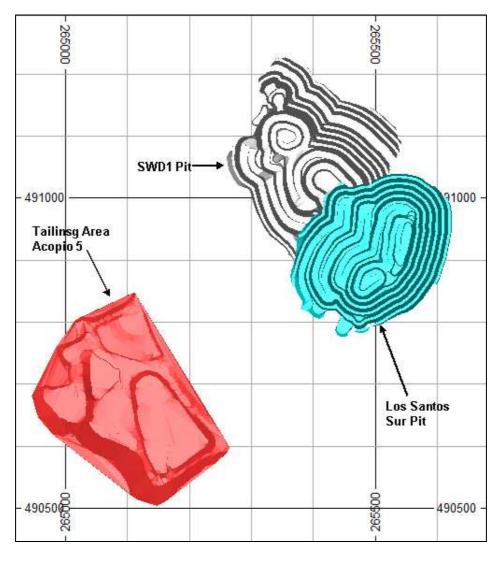


Figure 15-8. Central Tailings Area

#### **15.4 Mineral Reserves**

An overall summary of mineral reserves is shown in Table 15-4, which also includes the contents of the various stockpiles, as well as tailing material. A summary of the inferred resources is shown in Table 15-5, for this material within the final pit outlines. A breakdown of the different pits, and Los Santos Sur underground part, is shown in Table 15-6 . A gradetonnage table of the reserves is shown in Table 15-7.

	Mine Reserves				
Reserve	Tonnes	WO <sub>3</sub>	WO <sub>3</sub>		
Category	t ('000)	%	Tonnes		
Proven	57	0.44	251		
Probable	1,408	0.33	4,700		
Proven + Probable	1,465	0.34	4,951		

Table 15-4.	<b>Reserve Evaluation</b>	Summary
	As of June 30 <sup>th</sup> , 2015	-

Tailings	Tonnes	WO <sub>3</sub>	WO <sub>3</sub>
	t ('000)	%	Tonnes
Coarse rejects (Arenas)	1,564	0.13	2,107
Fine rejects (Tortas)	498	0.22	1,084
	2,062	0.15	3,191

Stockpiles	Tonnes	WO <sub>3</sub>	WO <sub>3</sub>	
	t	%	Tonnes	
Ore A stockpile	6,717	0.41	28	
Ore B stockpile	8,130	0.19	15	Grand
Oversize stockpile	21,885	0.43	94	
Oxide stockpile	18,455	0.15	28	Total
High Grade Conc. Stock	5	64.9	3.2	WO <sub>3</sub>
Low Grade Conc. Stock	22	38.0	8.4	Tonnes
Intermediate Grade Conc. Stock	76	17.1	6.5	
Total	55,289	0.33	183	8,325

Notes

. Ore cut-offs used :

. Open pits 0.07%WO<sub>3</sub>

. Los Santos Sur underground 0.3% WO $_3$ 

. Re-Processed Tailings 0.07% WO3

. Cut-offs derived from a long term planning price of \$37,000/t WO $_3$  APT

	Tonnes	WO <sub>3</sub>	WO <sub>3</sub>
	t ('000)	%	Tonnes
Las Cortinas West	14	0.20	28
Los Santos Sur	90	0.41	369
SW/D1	170	0.32	544
Capa G	3	0.23	7
Capa 4	15	0.40	60
Total	292	0.35	1,008

# Table 15-5. In-Pit/Mine Inferred ResourcesAs of June 30th, 2015

Notes:

Same cut-offs as for reserves

				C	)pen pit								Under	ground		
	Las Cortinas	West	Los San	tos Sur	SW	, D1	Сара	a G	Сара	a 4	Open P	it Total	D	1	Overal	ll Total
	Kt	WO₃ %	Kt	WO₃%	Kt	WO₃ %	Kt	WO₃ %	Kt	WO₃ %	Kt	WO₃ %	Kt	WO₃%	Kt	WO₃ %
Proven Reserves	0.1	0.07	57	0.44	0	0.00	0	0.00	-	-	57	0.44	0	0.00	57.1	0.44
Probable Reserves	224	0.29	237	0.39	764	0.32	90	0.19	62	0.53	1,377	0.33	31	0.59	1,408	0.33
Proven + Probable	224	0.29	294	0.40	764	0.32	90	0.19	62	0.53	1,434	0.33	31	0.59	1,465	0.34
In-Design Inferred	14	0.20	90	0.41	170	0.32	3	0.23	15	0.40	292	0.35	-	-	292	0.35
Waste	1,619		653		8,351		243		531		11,397				11,397	
Waste+Inferred	1,633		743		8,521		246		546		11,689				11,689	
Strip Ratio t/t	7.3		2.5		11.2		2.7		8.8		8.2					
Total Rock	1,857		1,037		9,286		336		609		13,125		31		13,156	

Table 15-6 Reserve Breakdown

Notes

. Ore cut-offs used :

. Open pits 0.07%WO3

. D1 underground 0.3% WO3

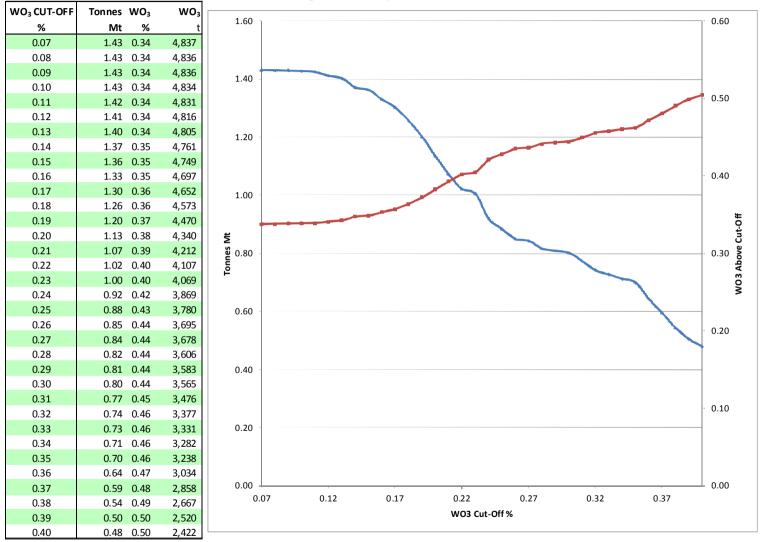


Table 15-7. Grade-Tonnage Table – Open Pit Proven and Probable Reserves

# **16 MINING METHODS**

The open pit operations are conventional drill and blast operations, using mining contractors as summarised below:

- MOVITEX (Movimientos de Tierra y Excavaciones Nieto S.L.U.) for initial drilling, blasting, loading and transport.
- Perforaciones Noroeste S.A. --- All other drilling

A summary of all on site mining equipment is shown in Table 16-1.

Owner	Туре	Number	Model
	Backhoe Loaders	3	CAT 385 C
	55t Trucks	1	САТ 773 В
	55t trucks	4	KOMATSU HD465-7
	Bulldozer	1	CAT 824 C
	Drill rig	1	INGERSOLL-RAND
	Drill rig	2	SANDVICK DX800
	62t truck	3	CAT 775 E
Movitex	Front-End Loader	1	CAT 972 G
INIOVILEX	Backhoe Loader	1	CAT 345 C
	54 t trucks	2	CAT 773 E
	Backhoe Loader	1	KOMATSU PC340
	Backhoe Loader	1	VOLVO EC240
	Backhoe Loader	1	365 CL
	Backhoe Loader	1	KOMATSU PC 350NLC-8
	Telescopic Loader	1	P38.13
	Drill rig	1	RANGER ROCK PILOT 700N/SERIE
J.VILAPLANA	Grader	1	VOLVO G710
J.A. CUMPLIDO	Backhoe Loader	1	KOMATSU PC340
Perforaciones	Drill rig	2	TAMROCK CHA 660C
Noroeste	Drill rig	2	TAMROCK CHA 1100C
Noroeste	Drill rig	2	SANDVIK PANTERA 1100
	Backhoe Loader	1	CASE CX330
	Backhoe Loader	1	CASE 580 SUPER M
	32t Articulated Dump Truck	2	VOLVO A35C
Daytal	Mini-loader	1	THOMAS 153/2005
	Telescopic Lift	1	TEREXLIFT 4017
	Forklift	1	HANGCHA CPCD25N-RW13
	Front-End Loader	2	САТ 950 Н

Table 16-1. Summary of Mining Equipment

Mining operations are based on mining 10m benches in waste, and 5m benches in ore, with 0.5m of sub-drilling. Tamrock CHA1100 rigs are used for blasthole drilling. The blastholes are 3.5 in. in diameter, and drilled on a 3m x 2.5m pattern in Los Santos Sur, and a 3m x 2.5m pattern in the other pits. Typical blasthole drilling operations are shown in Figure 16-1.

Figure 16-1. Blasthole Drilling Operations



Pre-split lines are drilled along the edges of final walls. These pre-split holes are 3 in. in diameter, and are 0.8m apart. Typical pre-split drilling operations are shown in Figure 16-2, along with pre-split lines from the bench above.



#### Figure 16-2. Pre-Split Drilling Operations

Figure 16-3. When water is present, water-resistant emulsion explosives (Riogel) are used. Mucking operations are completed using Hitachi 210W and Komatsu PC1250 excavators, loading Komatsu HD465 55 tonnes loaders, as shown in Figure 16-4. Short-term grade control starts with sampling of blasthole drilling cuttings. These average grades of these each

blasthole are used to delineate ore and waste boundaries, as well as ore grade categories, at the time of mining.



Figure 16-3. Explosives Loading at Los Santos Sur.

The night following every blasting containing ore, a team of geologists checks with ultra-violet (UV) lighting the real position of the ore after blasting displacement, in order to reduce dilution to the minimum. They also pass the UV lamp by the waste dumps and stockpiles, to check for any kind of error on ore/waste selection. These practices were introduced during 2012, and have demonstrated improvements. During all ore mucking operations, a grade control geologist is always present, to check and check for any other variations that can be seen in the pit with the blasted skarn material.



Figure 16-4. Mucking Operations at Los Santos Sur

An aerial view of the mining operations Las Cortinas West pit is shown in Figure 16-5, with a picture from the pit floor in Figure 16-6. An overall view of the Los Santos Sur pit is shown in Figure 16-7, with the haul road system in Figure 16-8.

The production mining operations currently employ 30 people – all contractors. All of the other 68 employees on site work directly for Daytal.



Figure 16-5. Photograph of Las Cortina West Pit.



Figure 16-6. Mining Operations in Las Cortinas West

Figure 16-7. Overall View of Los Santos Sur Pit





Figure 16-8. Haul Road System at Los Santos Sur

# 17 RECOVERY METHODS

Figure 17-1. During the last 12 months it was able to process 518 ktpa, with an average feed grade of 0.32% WO3. Current overall plant recovery of scheelite is approximately 60%. The plant is primarily based on gravimetric separation, aimed at recovering scheelite, so as to provide a concentrate containing greater than 65% WO<sub>3</sub>.

Total raw water consumption for the process plant and ancillaries is 5,500m<sup>3</sup>/month, or approximately 9m<sup>3</sup>/h at full plant production rate. This usage is virtually all process make-up water, to replace the water that exits the process with the dewatered coarse and fine plant tailings, and is sourced under a water supply agreement with the town council of Fuenterroble de Salvatierra as well as Los Santos. A plan diagram of the mill installation area is shown in Figure 17-2.



Figure 17-1. Photograph of Crushing Facilities and Ore Feed to the Mill

For dust control straw is spread over the stockpile areas, and covered with a layer of (mineralized ) mud from the cleaning of the thickener. This straw prevents cracking of the clay surface after drying and this solution works well, as shown in Figure 17-3.

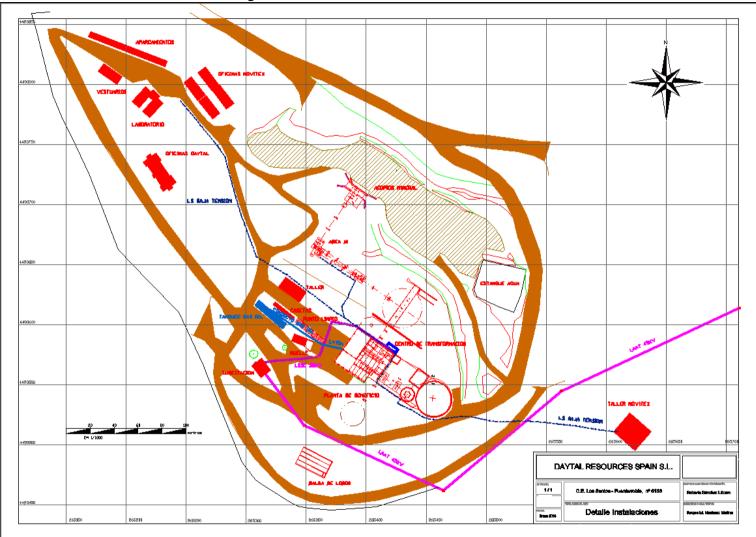




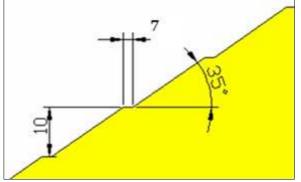


Figure 17-3. Dust Control System

## **18 PROJECT INFRASTRUCTURE**

The most direct route to Los Santos is on the A.66 road, part of the national network, from Salamanca to Guijuelo. A road branches off the town and leads into the north-western corner of the property. This road then continues eastwards and then south-eastwards to main centre of the mine infrastructure, which includes the mill, the mine offices and the main waste dump. A site plan is shown in Figure 5-1. The main access road provides convenient access to all of the current and planned open pits. For the waste mined in the Las Cortinas and Sector Central pits, waste dumps are located to the west of the access road.

It was decided that some of the excavated pit volumes can be subsequently used for waste dumping purposes – these are Capa Este, Sector Central and the east side of Las Cortinas, as shown in Figure 5-1. In addition to this, external waste dumps have also been started top south of Las Cortinas, as well as well as east of Los Santos Sur. The waste dumps are built up with face angles of 35 degrees, and a 7m berm every 10m lift, which gives an overall angle of 24-28 degrees, as shown in the cross-section in Figure 18-1.





Tailings from the spirals and tables are pumped to a bank of dewatering cyclones, with the underflow reporting to a high frequency dewatering screen to render them dry enough for transportation by conveyor to an open tailings stockpile. Fine solids from the overflow of the fines classifying cyclones, go directly to a 12m diameter thickener along with undersize from the coarse tails dewatering screen. Thickener underflow is batched to a filter press that produces a cake suitable for conveyor discharge onto a fines waste stockpile. Overflow from the thickener is recycled as process water. There is no tailings discharge from the process and no tailings dam: all plant waste is dewatered and transported back to the mine waste dumps for disposal.

Power was supplied by the mine's own power generation plant, comprising 3 x 1.25KVA diesel generator sets. A connection to the national grid was completed in early October 2013, and is working normally. Photographs of this connection are shown in Figure 18-2 and Figure 18-3.



Figure 18-2. Pylons Connecting Grid With Los Santos

Figure 18-3. Grid Connection at Los Santos



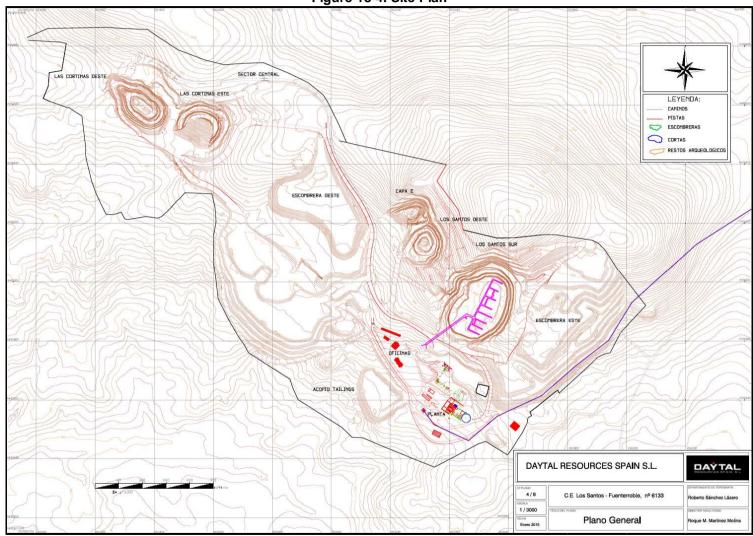


Figure 18-4. Site Plan

# **19 MARKET STUDIES AND CONTRACTS**

The majority of production is committed under a long-term contract, that was extended when Almonty acquired control of Daytal, and now expires in September 2016. This contract calls for delivery, in 1 tonne Bulk Bags, in standard short container lots per consignment, of tungsten concentrate grading plus 65% WO<sub>3</sub>.

As per standard industry practice, the price paid per tonne of concentrate is based on the number of contained metric tonne units ("mtu") of Tungstic Oxide (WO<sub>3</sub>). This unit price varies for individual consignments according to the prevailing Ammonium Paratungstate (APT) price as published during the week of shipment in Metals Bulletin magazine ("the Metals Bulletin price").

The details of the contract, including the APT discount rate applicable, are strictly commercialin-confidence and may not be disclosed, but equate to industry norms. There is a floor price of \$250/mtu for APT in the contract.

# 20 ENVIRONMENTAL STUDIES, PERMITTING AND SOCIAL IMPACT

Daytal has all permits and licenses to operate and in compliance with appropriate regulations. A list of these permits and concessions is summarised below in Table 20-1.

Description	Date
Granting of perimission of investigation "Los Santos" (SIEMCALSA)	10/08/1993
Approval of Declaration of Environmental Impact	25/03/2002
Granting of Mining Concession "Los-Santos-Fuenterroble" No.6.133 (SIEMCALSA)	14/08/2002
Authorisation of transfer to Daytal Resource Spain S.L.	19/07/2006
Acceptance of appointment of Director Facultativo: Sebastián Maroto	08/02/2007
Environmental License	05/03/2007
Plant installation	19/03/2007
Urbanistic License	10/08/2007
Approval of Working Plan 2008	01/07/2008
Acceptance of appointment of Director Facultativo: Tomás Vecillas	04/06/2008
Presentation of Restoration Evaluation	20/08/2008
Approval of Working Plan 2009	03/04/2009
Approval of Working Plan 2010	01/12/2010
Authorisation of work contract (Sánchez y Lago S.L.)	17/10/2010
Approval of Working Plan 2011	04/02/2011
Approval of Working Plan 2012	21/02/2012
Approval of Working Plan 2013	14/06/2013
Acceptance of appointment of Director Facultativo: Roque M. Martínez Molina	14/01/2014
Authorisation of work contract (MOVITEX)	15/01/2014
Approval of Working Plan 2014	01/05/2014
Approval Flotation installation	12/03/2015
Authorization by private use of public mountain (Dehesa Boyal, № 119)	19/03/2015
Approval of Working Plan 2015	01/05/2015

Table 20-1.	Summary	of Permits
-------------	---------	------------

In accordance with Spanish law, the Environmental Plan and the Restoration Plan were presented jointly with Exploitation Plan, had to be approved in order to start up the mine. Daytal Resource Spain S.L. presented en 2002 the Environmental Impact Plan and the Restoration Plan as part of the Mining Plan for Los Santos-Fuenterroble. This included the installation of the gravimetric and flotation parts of the processing plant, as well as a waste dump an initial area of 14 hectares, and then 36 hectares for a second phase of expansion.

On the 25<sup>th</sup> May, 2002, a positive result was received with respect to the Environmental Impact Study, and declared publicly on 3<sup>rd</sup> May, 2002, along with the declaration of 180,000 Euros being guaranteed for the restoration of space affected by mining activity. The mining license was also approved in September, 2002.

In July, 2007, a study was completed with respect to the stability of the planned waste dump, and presented to the local mineral authorities, along with a modified exploitation plan. An example of revegetated area alongside the main mine access road is shown in Figure 20-1.

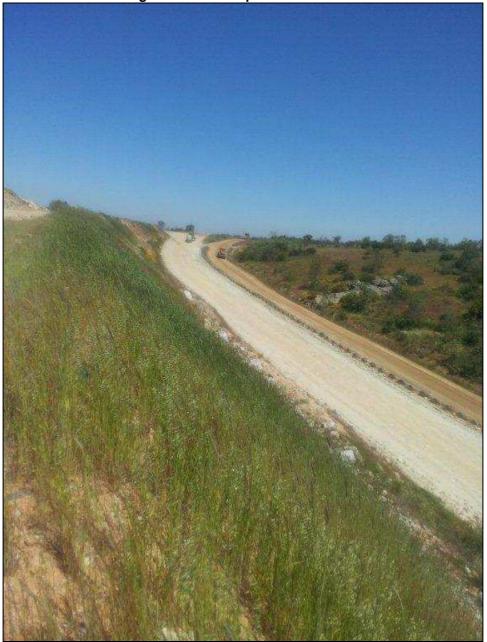


Figure 20-1. Example of Restoration

With respect to water management, underground water is intercepted in some of the open pit workings. This water is currently used for dust suppression on the haul roads. Some of this water is also used to augment the water used in the processing plant, and so reduce processing costs.

Ahead of reusing the water from the pits, the water used in the plant is sourced from the local municipal water supply. The plant design has been modified to recycle as much water as possible. There is no tailings discharge from the process and no tailings dam: all plant waste is dewatered and transported back to the mine waste dumps for disposal.

The project has total support from the local community. This includes agreements with local landowners affected by the mine exploitation. The mine closure plan incorporates the dismantling of the processing plant, filling of the excavated pits, with the exception of Los Santos Sur, revegetation of the waste dumps, budgeted at 428,300 Euros.

#### 21 CAPITAL AND OPERATING COSTS

Average unit costs, based on the last 12 months up to September 2015, as summarised in Table 21 1. Major capital expenditures over the last 12 months (financial year) are shown in Table 21 2.

Description	Unit	Values
Recovery		66.1%
Milling Cost	\$/t ore	9.72
General & Administration	\$/t ore	3.25
Ore mining	\$/t ore	1.70
Waste mining	\$/t waste	2.03

Table 21-1. Average Unit Costs from Last 12 Months

Notes

. Figures from actual costs Oct 14 - Sept15

#### Table 21-2. Capital Expenditures – Last 12 Months

	Total
	\$x 1000
Exploration	329
Property, Plant and Equipment	669
Total	998

Notes

. Figures from actual costs Oct 14 - Sept15

Major capital expenditures planned over the next 24 months are summarised in Table 21-3.

Table 21-3.	Planned	Capital	Expenditure -	- 2016-18
-------------	---------	---------	---------------	-----------

	Total
	\$x 1000
Plant Equipment	358
Site Equipment	123
Exploration drilling (2000m)	250
Total	731

# 22 ECONOMIC ANALYSIS

An economic analysis over the life-of-mine (LOM) plan, based on revenue derived from the mine reserves only, and the additional processing of tailings when the mine has ore has been exhausted. The main economic parameters assumed in this LOM plan are shown in Table 22-1.

The envisaged processing cost for re-processed tailing is 9.52/t leading to a breakeven cut-off grade 0.07% WO<sub>3</sub>. This implies that all of the identified tailings material is economically viable to process, and so is included in the reserve inventory and the LOM plan. The currently predicted overall tailings recovery (coarse and fine) is 46%. Raising this tailings recovery level to 50-55% levels is one of the targets of on-going metallurgical testwork.

Description		Unit	Values
Processing			
WO3	APT Price	\$/mtu WO 3	370
	Metal Price - received,	\$/mtu WO្រ្ទ	288
	after transport + smelting	\$/t WO 2	28,800
	Conventional Ore Recovery	%	62%
	Tailings Recovery	%	46%
	Processing Cost	\$/t ore	9.72
	G&A	\$/t ore	3.25
	Total Applied Ore Cost (Processing+G&A+OreMining-WasteMining)	\$/t ore	12.63
	Tailings Processing Cost	\$/t ore	9.52
Mining			
_	Contractor Cost	\$/bcm rock	4.86
	Indirect Cost	\$/bcm rock	0.67
	Total Mining Cost	\$/bcm rock	5.53
	Ore mining - open pit	\$/t ore	1.70
	Waste mining - open pit	\$/t waste	2.03
	Ore mining - underground	\$/t ore	30.42
Mining Param	neters		
	Mining Recovery	%	95
	Dilution	%	5
	Breakeven Economic Cut-Off		
	Open Pit Mining		0.07%
	Tailings Re-Processing	% WO 3	0.07%

Table 22-1. Main Economic Parameters for LOM

Description	Unit	Totals	2015	2016	2017	2018	2019	2020	2021	2022
LOS SANTOS SUR										
LSS Vol TOTAL	m3	352,413	177,605	174,808						
LSS Ton ORE	t	294,050	-	151,145						
LSS WO3 TOTAL	%	0.40	0.41	0.39						
LAS CORTINAS OESTE										
	2									
LCW Vol TOTAL	m3	653,076	-	108,061						
LCW Ton ORE LCW WO3TOTAL	t %	224,239 0.29	<b>108,216</b> 0.27							
	70	0.29	0.27	0.30						
SANTOS SUR OESTE										
SWD1 Vol TOTAL	m3	3,377,223	159,651	1,977,051	1,173,228	67,293				
SWD1 Ton ORE	t	764,163		128,435	581,284	54,444				
SWD1 WO3 TOTAL	%	0.32		0.21	0.34	0.36				
CAPA G										
CAPA G Vol TOTAL	m3	120,328		120,328						
CAPA G Ton ORE	t	90,261		90,261						
CAPA G WO3 TOTAL	%	0.19		0.19						
	<i>,,,</i>	0.15		0.15						
САРА 4										
CAPA 4 VOI TOTAL	m3	233,723		233,723						
CAPA 4 Ton ORE	t	62,437		62,437						
CATA 4 WO3 TOTAL	%	0.53		0.53						
LIFE OF MINE										
Vol Waste	m3	4,296,826	805,370	2,446,097	995,254	50, 105				
Vol Ore	m3	439,937	76,901	167,874	177,974	17,188				
Vol TOTAL	m3	4,736,763	882,271	2,613,971	1,173,228	67,293				
Ton hg	t	626,209	123,473	214,647	255,618	32,472				
Ton lg	t	808,941	127,648	,	325,666	21,972				
Ton ORE Mined Open Pit	t	1,435,150			581,284	54,444				
WO3 HG WO3 LG	% %	0.55 0.17	0.53 0.17		0.57 0.17	0.48 0.19				
WO3 TOTAL	%	0.17		0.10	0.17	0.19				
	<i>70</i>									
MTU		477,360		171,024	199,294	19,701				
		2.99	10.47	14.57	5.59	2.92				
Total OP Waste Mined	t t	11,687,367 3,527,821	2,190,607 251,121		2,707,090 581,284	136,285	E00.000	E00 000	500,000	02.000
Total Ore (+Tailings) Processed D1 Underground Production	<u> </u>	5,527,821	251,121	548,301	361,264	555,115	500,000	500,000	500,000	92,000
Tonnes Mined	t	30,671				30,671				
WO3 Grade	%	30,071				0.59				
WO3 HG product	t					112				
Tailings Production	-									
Tailings In Stock	t				2,062,000	1,592,000	1,092,000	592,000	92,000	C
WO3 Grade	%				0.15	0.15	0.15	0.15	0.15	0.15
Tailings Processed	t	2,062,000				470,000	500,000	500,000	500,000	92,000
WO3 Grade	%	0.15				0.15	0.15	0.15	0.15	0.15
WO3 LG product	t	1,423				324	345	345	345	63
Total Products										
WO3 HG Product	t	2,240			897	208				
WO3 LG Product	t	2,255			339	350	345	345	345	63
WO3 Total Product		4,495	542	1,060	1,236	559	345	345	345	63
Revenue						<u> </u>				
Contained W03 Sales - HG	US\$ x 1000	64,508		20,993	25,832	6,002	0.000	0.000	0.000	1 000
Contained W0 <sup>3</sup> Sales - LG	US\$ x 1000	64,937		9,545	9,754	10,087	9,936	9,936		1,828
Total Revenue	US\$x 1000	129,445	15,596	30,538	35,586	16,089	9,936	9,936	9,936	1,828
Cash Costs Mining	US\$ x 1000	27,135	4,881	14,460	6,491	1,303				
Mining Mill	US\$ x 1000 US\$ x 1000	33,575			5,648	1,303 5,003	4,760	4,760	4,760	876
Admin	US\$ x 1000 US\$ x 1000	4,670		3,328 1,784	5,048 1,891	5,005 177	4,700	-+,700	4,700	0/0
Operating Cash Costs	US\$ x 1000	65,380			14,031	6,483	4,760	4,760	4,760	876
Operating Margin	US\$ x 1000	64,065	7,458	8,966	21,555	9,606	5,176	5,176	5,176	
Capital Costs		0.,000	,,.50	5,5 50		3,000	3,2.0	-,1,0	2,270	552
Mine Capex	US\$ x 1000	481		241	241					
Tailings Capex	US\$ x 1000	3,175				3,175				
Total Capital	US\$ x 1000	3,657		241	241	3,175				

## Table 22-2. LOM Economic Analysis

Cashflow

US\$ x 1000

60,408

7,458

8,726 21,315 6,430 5,176 5,176 5,176 952

# 23 ADJACENT PROPERTIES

From June-August, 2012, Daytal completed the following work within two nearby investigation permits:

#### • QUIÉN SABE investigation permit:

Daytal conducted a geological mapping study, placing greater interest in the areas of contact between regional granite and hornfels, due to the possible formation of skarns in that area. In Fuente Ladrón area, placed in the municipality of Los Santos, three trenches were made, 66.00 meters total length:

-TFD001: 26.50 meters.

-TFD002: 16.00 meters.

-TFD003: 23.50 meters.

Logging and sampling were completed in each trench. Samples were assayed in Los Santos Mine lab and they had no significant mineralization.

#### • POR SI ACASO investigation permit:

Geological mapping and three channels sampling were made in this permit.

Channels sampling had 37.85 meters total length and were placed in the municipality of Monleón:

-RM001: 10.80 meters.

-RM002: 17.30 meters.

-RM003: 9.75 meters.

Logging and sampling were completed in each channel. Samples were assayed in Los Santos Mine lab. RM001 had some significant mineralization from 3.70 m to  $5.40 \text{ m} @ 0.12 \text{ \%WO}_3$ .

## 24 OTHER RELEVANT INFORMATION

#### 24.1 Geotechnical Studies

The pit slope parameters were derived from geotechnical studies - originally Piteau 1985 and Metales Hispania 2000. More recently in 2011 a geotechnical study was completed by SADIM. From the studies face angles of  $73^{\circ}$  (in all directions) have been recommended. In oxidised material, approximately 10m below the topography, a face angle of  $45^{\circ}$  has been recommended. The bench configuration is based on a 4m safety berm for every 20m vertically. With a 10m haul road being used, final overall slope angles are typically between  $55^{\circ}$  and  $48^{\circ}$ , depending on the predominant location of the haul road relative to the pit.

#### 24.2 Water Management

The water reuse at the plant is at levels of approximately 95-97%. The remaining difference from 100%, sewage water, potable water and garden water represents an extra consumption of 200-250 m<sup>3</sup> day, that are acquired from the municipalities of Fueterroble and Los Santos.

The water for sanitary uses needs to be controlled water and will never be more than 25% of that value and will always be supplied by external sources (municipalities). All the remaining water (industrial water) will be from internal sources.

The area inside the mine boundary has the capacity to supply 10 times the mine's annual needs of industrial water. In 2012, a trench and concrete box were constructed, in order to collect all the water from the higher slopes. This water is decanted in a small decantation pound before coming to the underground gallery were it is stored. The pumping system of the gallery was in 2012 reinforced, with a duplication of the water pipe from the gallery to the plant, to make it completely independent. That pipe is also connected to the garden watering.

A steel tube was installed in the former Sector Central mined excavation, which has now been filled with waste rock. Pipes for pumping of water from this zone were placed in 2010 and revised in July 2012. The water from the operating pits of the west zone (LCW and LCE) will be pumped as process water to the plant.

An additional water source is the zone for storage of tailings below the main office (Acopio 5, Figure 15-8) has a small decantation pond in the lower part. This is in a valley that collects a reasonable area and the tailings contains 11% water. This storage has a capacity of 4,400 m<sup>3</sup> of water. Now a small pump for this zone has been installed.

#### 24.3 Safety Access

The actual access road has some safety limitations as it has 2 crossings between normal vehicles and industrial vehicles. A new road dedicated exclusively for normal vehicles will be prepared, starting from the actual one before the Las Cortinas West zone and going by the border of the old west waste dump, up until the offices' area. This facility will avoid crossings between normal vehicles and industrial machinery.

#### 25 CONCLUSIONS AND RECOMMENDATIONS

The evaluation work was carried out and prepared in compliance with Canadian National Instrument 43-101, and the mineral resources in this estimate were calculated using the Canadian Institute of Mining, Metallurgy and Petroleum (CIM), CIM Standards on Mineral Resources and Reserves, Definitions and Guidelines prepared by the CIM Standing Committee on Reserve Definitions and adopted by CIM Council May, 2014. The updated resource estimation is shown in Table 25-1 and Table 20-2.

Table 25-1 Los Santos – Measured and Indicated Mineral Resources

	AL 30	June, 20	115
Resource Category	Tonnes	WO <sub>3</sub>	WO <sub>3</sub>
	Kt	%	t
Measured	75	0.41	304
Indicated	2,133	0.28	6,012
Total	2,208	0.29	6,316

Notes

. Cut-Off Grade = 0.05%WO<sub>3</sub>

- . Minimum width = 2.5m
- . Resources shown are inclusive of reserves
- . Sector Central and Las Cortinas East removed,
- as pits have been completed
- . All other resources shown are total in-situ

Table 25-2 Los Santos – Inferred Mineral Resources
At 30 <sup>th</sup> June, 2015

	Tonnes	WO <sub>3</sub>	WO <sub>3</sub>
	Kt	%	t
Inferred	1,878	0.25	4,663

Notes

. Cut-Off G rade =  $0.05\%WO_3$ 

```
. Minimum width = 2.5m
```

The updated reserve estimation, stemming from the mine plan developed from this resource base, is shown in Table 25.3.

#### Table 25-3. Los Santos – Proven and Probable Mineral Reserves

	Mine	Reserve	es
Reserve	Tonnes	WO <sub>3</sub>	WO <sub>3</sub>
Category	t ('000)	%	Tonnes
Proven	57	0.44	251
Probable	1,408	0.33	4,700
Proven + Probable	1,465	0.34	4,951

At 30<sup>th</sup> June, 2015

Tailings	Tonnes	WO <sub>3</sub>	WO <sub>3</sub>
	t ('000)	%	Tonnes
Coarse rejects (Arenas)	1,564	0.13	2,107
Fine rejects (Tortas)	498	0.22	1,084
	2,062	0.15	3,191

Stockpiles	Tonnes	WO <sub>3</sub>	WO <sub>3</sub>	
	t	%	Tonnes	
Ore A stockpile	6,717	0.41	28	
Ore B stockpile	8,130	0.19	15	Grand
Oversize stockpile	21,885	0.43	94	
Oxide stockpile	18,455	0.15	28	Total
High Grade Conc. Stock	5	64.9	3.2	WO <sub>3</sub>
Low Grade Conc. Stock	22	38.0	8.4	Tonnes
Intermediate Grade Conc. Stock	76	17.1	6.5	
Total	55,289	0.33	183	8,325

Notes

. Ore cut-offs used :

. Open pits 0.07%WO3

. Los Santos Sur underground 0.3%  $WO_{3}$ 

. Re-Processed Tailings 0.07% WO<sub>3</sub>

. Cut-offs derived from a long term planning price of \$37,000/t WO\_3  $\ensuremath{\text{APT}}$ 

The following conclusions have been reached:

- 1. The Los Santos mine has now been producing for 7 years. The open pit mining practices have been progressively improved, along with the planning and grade control systems.
- Daytal has all permits and licenses to operate and remain in compliance with appropriate regulations. It has no restrictions with respect to waste dumping capacity, including dry tailings, and it will be possible to backfill some of the excavated pits with waste.
- The diamond drilling campaigns completed by Daytal over the last 7 years have in general confirmed the overall quantities and grades of the scheelite ore which was originally delineated by Billiton in the 1980s.
- 4. The recent drilling campaigns have also identified some potential mineralized extensions beyond the currently modelled zones. These positive results, along with predicted high metal prices, suggest that the mine life derived from the current reserve base is conservative. Exploration drilling planned during 2015 has helped delineate additional open pit and underground reserves to the west of Los Santos Sur.
- 5. Significant improvements have been made to the plant since mine start-up.

# 26 REFERENCES

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# 27 QUALIFIED PERSONS CERTIFICATES

#### **Certificate Of Author**

Adam Wheeler, Mining Consultant, Cambrose Farm, Redruth, Cornwall, TR16 4HT, England. Tel/Fax: (44) 1209-899042; E-mail: <u>adamwheeler@btinternet.com</u> As the author of this report on the Los Santos Mine, I, A. Wheeler do hereby certify that:-

- 1. I am an independent mining consultant, based at, Cambrose Farm, Redruth, Cornwall, TR16 4HT, England.
- 2.
   I hold the following academic qualifications: 

   B.Sc. (Mining)
   Camborne School of Mines
   1981

   M.Sc. (Mining Engineering)
   Queen's University (Canada)
   1982
- 3. I am a registered Chartered Engineer (C. Eng and Eur. Ing) with the Engineering Council (UK). Reg. no. 371572.
- 4. I am a member in good standing of the Institute of Mining, Metallurgy and Materials (Member).
- 5. I have worked as a mining engineer in the minerals industry for over 30 years. I have experience with a wide variety of mineral deposits and reserve estimation techniques.
- 6. I have read NI 43-101 and the technical report, which is the subject of this certificate, has been prepared in compliance with NI 43-101. By reason of my education, experience and professional registration, I fulfil the requirements of a "qualified person" as defined by NI 43-101. My work experience includes 5 years at an underground gold mine, 7 years as a mining engineer in the development and application of mining and geological software, and 21 years as an independent mining consultant, involved with evaluation and planning projects for both open pit and underground mines.
- I am responsible for the preparation of the technical report titled "Technical Report on the Mineral Resource and Reserves of the Los Santos Mine" and dated October 31<sup>st</sup>, 2015. I have worked on site during various times since 2006, specifically from September 20<sup>st</sup> -24<sup>th</sup>, 2015, in connection with the preparation of this report.
- 8. As of the date hereof, to the best of the my knowledge, information and belief, the technical report, which is the subject of this certificate, contains all scientific and technical information that is required to be disclosed to make such technical report not misleading.
- 9. I am independent of Daytal Resources Spain S.L., pursuant to section 1.5 of the Instrument.
- 10. I have read the National Instrument and Form 43-101F1 (the "Form") and the Technical Report has been prepared in compliance with the Instrument and the Form.
- 11. I consent to the filing of the report with any Canadian stock exchange or securities regulatory authority, and any publication by them of the report.

Dated this 31<sup>st</sup> of October, 2015

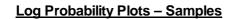
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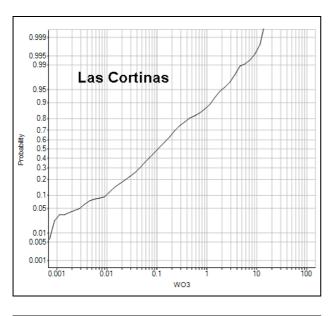
A. Wheeler, C.Eng.

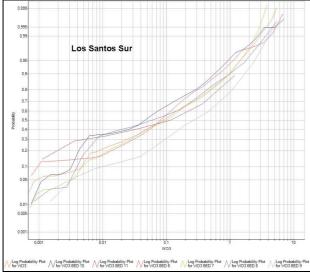
# **APPENDIX A:**

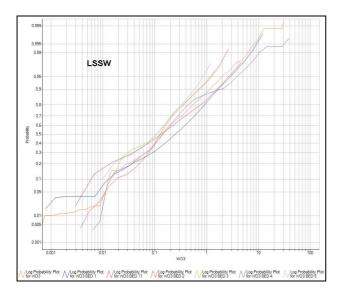
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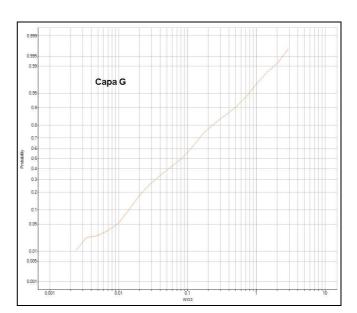
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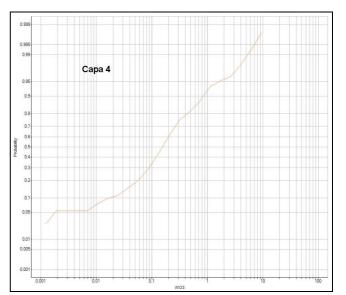


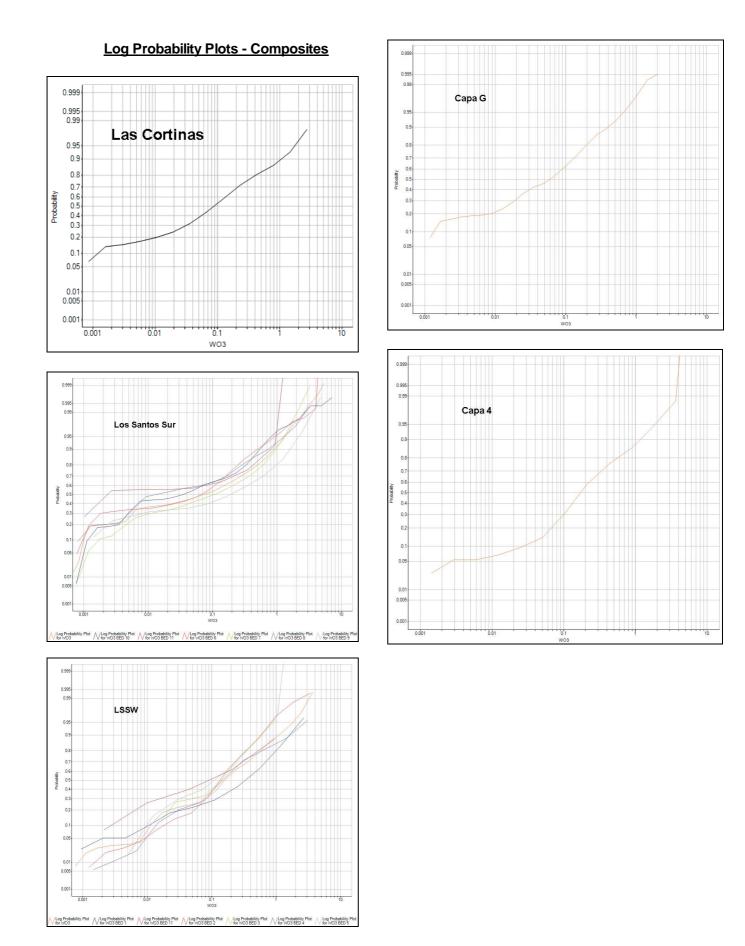




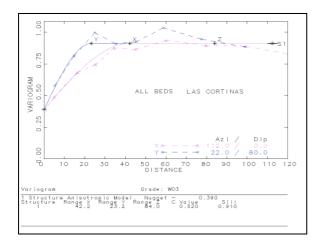


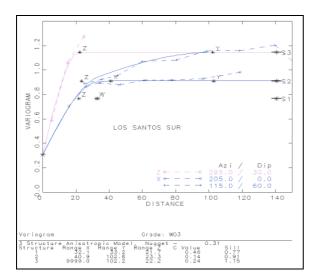


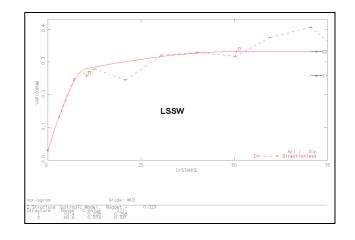


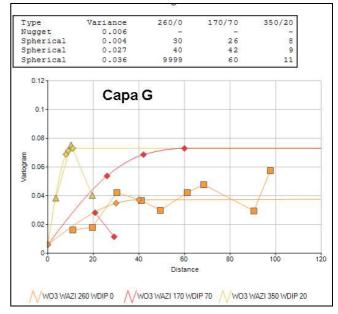


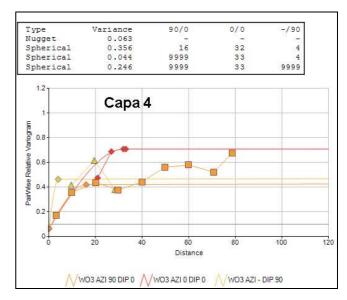
#### Variograms











**APPENDIX B:** 

Glossary of Terms

# UNITS OF MEASURE AND ABBREVIATIONS

DMT	dry metric tonne
Ktpa	Kilo-tonnes per annum
m	meters
m/h	meters per hour
mtu	metric tonne unit
	1 mtu = 10kg = 0.01t
m <sup>3</sup>	cubic meter
m³/h	cubic meters per hour
t	Tonne (1,000 kg)
km	Kilometers
kt	Tonnes x 1,000
Mt	Tonnes x 1,000,000
NI	National Instrument (43-101)
NSR	Net smelter return
ppb	Parts per billion
ppm	Parts per million
tph	Tonnes per hour
tpa	Tonnes per annum/year
3D	Three-dimensional

QA/QC	Quality assurance/ quality control
ha	hectares
US\$	US dollars
UTM	Universal Transverse Mercator
XRF	X-ray fluorescence

#### APT Pricing

Mined tungsten concentrates are priced by reference to the price of Ammonium Paratungstate (APT), an intermediate product in the production of tungsten metal, powder, tungsten carbide or other end use tungsten products. Prices are quoted "per metric tonne unit" (mtu) which is equivalent to 10 kg of product. An equivalent price per tonne is therefore the price on an mtu basis multiplied by 100.

The price received at the mine for its concentrate sales is typically subject to a discount to the APT price to cover the cost of converting mined concentrate to APT as in the case of TC/RC charges for base metals.

European APT prices are widely used as a reference price and are quoted in the "Metal Bulletin" twice weekly. Since peaking at US\$252/257 per mtu in September 2008, prices declined to a low of US\$170/200 per mtu in July 2009 as the Global Financial Crisis deepened. Since then, as the world economies start to recover, prices have improved and spreads have narrowed to reach US\$330/340 per mtu by the end of 2010.