



WAVES  
Technical Report  
Mineral Accounts  
April 2017



# Mineral Accounts of the Philippines



Wealth Accounting and the Valuation  
of Ecosystem Services  
[www.wavespartnership.org](http://www.wavespartnership.org)



## **WAVES – Global Partnership for Wealth Accounting and the Valuation of Ecosystem Services**

Wealth Accounting and the Valuation of Ecosystem Services (WAVES) is a global partnership led by the World Bank that aims to promote sustainable development by mainstreaming natural capital in development planning and national economic accounting systems, based on the System of Environmental-Economic Accounting (SEEA). The WAVES global partnership ([www.wavespartnership.org](http://www.wavespartnership.org)) brings together a broad coalition of governments, United Nations agencies, nongovernment organizations and academics for this purpose. WAVES core implementing countries include developing countries – Botswana, Colombia, Costa Rica, Guatemala, Indonesia, Madagascar, the Philippines and Rwanda – all working to establish natural capital accounts. WAVES also partners with UN agencies – UN Environment Programme, UN Development Programme, and the UN Statistical Commission—that are helping to implement natural capital accounting. WAVES is supported by a multi-donor trust fund and is overseen by a steering committee. WAVES donors include Denmark, the European Commission, France, Germany, Japan, The Netherlands, Norway, Switzerland, and the United Kingdom.

## Foreword

The Mineral Accounts of the Philippines are environmental accounts developed and compiled by the Philippine Statistics Authority (PSA) under the Wealth Accounting and the Valuation of Ecosystem Services (WAVES) project of the World Bank. WAVES is a global initiative launched in 2010 to mainstream natural capital in development planning and national economic accounts in support of sustainable development. It aims to help countries build accounts for natural capital and thus ensure that their significance and benefits are incorporated in development programs and policies.

The Philippines was identified as one of the core implementing countries of the WAVES project. The Philippines WAVES (Phil-WAVES) seeks to promote sustainable development by valuing natural capital. Pilot studies were conducted in Laguna Lake and Southern Palawan. This technical report on Mineral Accounts is considered a milestone in the history of the PSA, being a pioneering effort to develop the first environmental accounts estimates since the organization's inception in September 2013. As with other initiatives of the institution to develop operational frameworks and methodologies, the PSA deemed it wise to establish linkages and partner with United Nations agencies, the private sector, civil society organizations, academe, and stakeholders within the mining communities. The call to support the operationalization and institutionalization of the framework on environmental accounting turned out to be a success, thanks to the participation of various stakeholders in this PSA endeavor.

The PSA would like to express its sincerest gratitude to the Mines and Geosciences Bureau (MGB) of the Department of Environment and Natural Resources (DENR) for providing data on minerals and the mining industry in general. It also wishes to acknowledge the support extended by the members of the WAVES Steering Committee, the Interagency on Environment and Natural Resources Statistics, and the Phil-WAVES Technical Working Group on Mineral Resource Statistics for their support and cooperation.

The PSA is also grateful for the dedicated support of Dr. Stefanie Sieber-Onder, Senior Environmental Economist, and Dr. Maya Gabriela Villaluz, Senior Environmental Engineer, of the World Bank; the technical guidance provided by Corazon R. Buenaventura, an expert on national accounts and environmental accounts; and Dr. Glenn-Marie Lange, an international consultant on environmental accounting. The PSA also values the support of Brendan Freeman and John Power of the Australian Bureau of Statistics, who served as resource speakers during the training workshop on the 2012 System of Environmental-Economic Accounting (SEEA) and the 2012 SEEA and its Linkages to the 2008 System of National Accounts, held in February and September 2014, respectively, at the PSA.

The invaluable support of the foregoing individuals and institutions has been instrumental in the development of the Mineral Accounts, in keeping with the PSA's mandate.

*Lisa Grace S. Bersales*  
LISA GRACE S. BERSALES, Ph.D.  
National Statistician

## List of Acronyms and Abbreviations

ANNI	Adjusted Net National Income
ANNS	Adjusted Net National Savings
CDP	Community Development Plan
CI	Conservation International
CLRF	Contingent Liability and Rehabilitation Fund
CRIRSCO	Committee for Mineral Reserves International Reporting Standards
CW	Comprehensive Wealth
DAO	Department Administrative Order
DBM	Department of Budget and Management
DENR	Department of Environment and Natural Resources
DMPF	Declaration of Mining Project Feasibility
DMT	Dry Metric Ton
DOF	Department of Finance
ECC	Environmental Compliance Certificate
EP	Exploration Permit
EPEP	Environmental Protection and Enhancement Program
FMRDP	Final Mine Rehabilitation and/or Decommissioning Plan
FTAA	Financial or Technical Assistance Agreement
GDP	Gross Domestic Product
GLOBE	Globe Legislators Organization
GVA	Gross Value Added
ICC	Indigenous Cultural Communities
IIED	International Institute for Environment and Development
IP	Indigenous People
IUCN	International Union for Conservation of Nature
JORC	Joint Ore Reserves Committee

JORC Code	The Australasian Code for Reporting of Exploration Results
MGB	Mines and Geosciences Bureau
MPSA	Mineral Processing Sharing Agreement
MT	Metric Ton
NCA	Natural Capital Accounting
NEDA	National Economic and Development Authority
PC	Produced Capital
PMRC	Philippines Mineral Resource/Reserve Classification
RA	Republic Act
RETF	Recipient Executed Trust Fund
SAMREC	South African Code for the Reporting of Mineral Resources and Mineral Reserves
SEEA 2012-CF	System of Environmental-Economic Accounting 2012 - Central Framework
SDMP	Social Development and Management Program
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNSC	United Nations Statistical Commission
UNFC 2009	United Nations Framework Classification for Fossil and Mineral Reserves and Resources 2009
WAVES	Wealth Accounting and the Valuation of Ecosystem Services
WB	World Bank
WRI	World Resource Institute
WWF	World Wildlife Fund



# EXECUTIVE SUMMARY

The Philippines, a mineral resource-rich country, needs to mainstream its natural capital in development planning and national economic accounts to help ensure comprehensive efforts toward sustainability. Against this backdrop, the Philippine Wealth Accounting and the Valuation of Ecosystem Services (Phil-WAVES) project was launched by the World Bank in the Philippines in 2013 to facilitate the development of natural accounts.

One of the objectives of Phil-WAVES is to support the institutionalization of selected modules of the United Nations System of Environmental-Economic Accounting (SEEA) 2012. This multipurpose conceptual framework developed by the UN is intended to facilitate understanding of the interactions between the environment and the economy.

The SEEA provides information on a broad spectrum of environmental and economic issues including, in particular, the assessment of trends in the use and availability of natural resources, the extent of emissions and discharges to the environment resulting from economic activity, and the degree of economic activity undertaken for environmental purposes.

Minerals are naturally occurring, inorganic substances which have a fixed structure and chemical composition, and which can be obtained through mining. Mineral resource is considered to be a non-renewable natural resource owing to its inability to regenerate on a human time scale. The harnessing of this resource contributes significantly to the economic development of the country in terms of employment generation, export earnings, taxes and other fees paid to the government, and infrastructure development.<sup>1</sup>

The Philippines has one of the world's richest deposits of mineral resources, being home to the fifth largest mineral reserves worldwide. It ranks third in gold reserves, fourth in copper, fifth in nickel, and sixth in

---

<sup>1</sup>NAMRIA, DENR as cited in Philippine Asset Accounts: Forest, Land/Soil, Fishery, Mineral and Water Resources; NSCB, 1998.

chromite globally. In 2010, the country's total metallic mineral reserves were assessed at 14.5 billion metric tons while its non-metallic mineral reserves were estimated at 67.7 billion metric tons. Thirty percent of the total land area of the country, or 9 million hectares, is found to be geologically prospective for metallic minerals. The country's mineral reserves are valued at US\$ 1.387 trillion<sup>2</sup>.

In 2015, the total Gross Value Added (GVA) of mining and quarrying industry at constant prices amounted to PhP 80,000 million. Nickel accounted for the largest contribution to the value added for metallic mining at 75.4 percent, while the shares of gold and copper were at 14.1 percent and 9.8 percent, respectively.<sup>3</sup>

Using the SEEA framework, natural capital or environmental capital can be measured through the asset accounts. The asset accounts record the opening and closing stocks of environmental assets and the different types of changes in the stocks over an accounting period. It also assesses whether current patterns of economic activity are depleting and degrading the available environmental assets. Asset accounting can be combined with valuations of produced and financial assets to provide broader estimates of national wealth.

This study attempts to measure the mineral reserves in the Philippines, particularly nickel, gold, copper, and chromium, based on the SEEA framework. These mineral commodities were chosen based on their economic importance, or, more specifically, their contributions to the total metallic mining activity in the country. The availability of data to support the development of mineral accounts presented in this report was a major factor behind the success of completion of this study.

The accounts compiled provide an assessment of the available stocks, in physical and monetary terms, of the four mineral resources at the

---

<sup>2</sup>Tolentino, Maria Paula. 2015. Mining Recovery Predicted by 2019 with Political Support. Philippine Resources: Mining, Petroleum and Energy Journal. Issue No. 4. 2015. Retrieved from [https://issuu.com/paperlesstrail/docs/philippine\\_resources\\_2015\\_issue\\_4\\_on\\_july\\_7](https://issuu.com/paperlesstrail/docs/philippine_resources_2015_issue_4_on_july_7), 2016.

<sup>3</sup> PSA, 2013



beginning and at the end of the year, covering the changes that affect the stocks. The mineral resources/reserves were classified as follows: Class A – Commercially Recoverable Resources; Class B – Potentially Commercially Recoverable Resources; and Class C – Non-commercial and Other Known Deposits. The study presents the physical and monetary accounts for gold and copper based on metal content, while those for nickel and chromite were based on ore deposits, there being no pressing plant for these commodities in the country.

In monetary terms, the Net Present Value (NPV) was the approach applied to the valuation of mineral resources, which focus only on Class A reserves. Based on the resulting accounts, macroeconomic indicators, (i.e., adjusted net national income, adjusted net savings and comprehensive wealth), were developed.

The accounts cover an 11-year period, from 2002–2012. The following sections present these accounts, including the major findings, on four major minerals found in the Philippines, namely, nickel, gold, copper, and chromite.

## **NICKEL**

From 2002 to 2006, the country's total reserves of nickel were mostly categorized under Classes B and C, with reserves amounting to 349.5 and 285.9 million metric tons (MT), respectively. Between 2007 and 2012 most of the reserves became part of Class A, at 1,788.9 million MT. From 2002 to 2006, Class A nickel reserves accounted for 16.4 percent on the average of the total reserves of nickel. The volume of Class A nickel reserves rose to 49.9 percent in 2007 at 611.1 million MT, which spiked 71.6 percent, to 1.8 billion metric tons in 2012.

The reserves under Class A grew between 2005 and 2012, thanks to new mineral discoveries, upward reappraisal, and reclassification. In 2006, 2007, 2009, 2010, and 2012 mineral discoveries were recorded at 11.6 million MT, 4.9 million MT, 14.0 million MT, 5.4 million MT, and 327.0 million MT, respectively. The biggest increase can be attributed to the upward

reappraisal in 2007 and 2012, which contributed 369.0 million MT and 349.0 million MT, representing 60.4 percent and 19.5 percent of the total stock for the year, respectively.

On the monetary side, the value of Class A nickel reserves exhibited an increasing trend. In 2002, 69.4 million MT of nickel reserves were valued at PhP 2,426.2 million at 12 percent discount rate, and PhP 1,943.10 million at 15 percent discount rate. In 2012, the values of 1,788.9 million MT of reserves ballooned to PhP 68,508.0 million at 12 percent discount rate, and PhP 54,819.72 million at 15 percent discount rate.

The unit resource rent for Class A nickel ranged from PhP 627 per metric ton to as low as PhP 207 per metric ton, or an average of PhP 364 between 2002 and 2012. It went up for three consecutive years, from 2002 to 2005, dropped in 2006 before reaching its peak in 2007 at PhP 627.

## **GOLD**

Class A gold reserves had the highest share in the total gold reserves at 45.0 percent in 2002 while Classes B and C contributed 47.8 percent and 7.2 percent, respectively, to the stocks. From 2002 to 2012, the total closing stocks of Class C had the highest percent contribution at 37.5 percent on the average while Class A and B contributed an average of 35.7 percent and 26.9 percent, respectively.

In 2002, the opening stock of gold reserve for Class A was estimated at 0.8 million kilograms. By the end of 2012, the gold reserve stood at 1.5 million kilograms. It was in 2006 when the highest discovery of gold reserve was estimated at 0.2 million kilograms.

At 12 percent and 15 percent discount rates, the value of Class A gold reserves in 2002 was estimated at PhP 56,790.7 million and PhP 48,486.7 million, respectively. The corresponding value in 2012 was pegged at PhP 110, 849.7 million and PhP 88,681.9 million, respectively. The unit resource rent for gold showed an increasing trend from 2002 to 2012, that is, between PhP 163.4 thousand and PhP 844 thousand during the period. The

highest resource rent was posted in 2011 with an estimated value of PhP 882.8 million.

## **COPPER**

From 2002 to 2012, the country's average copper reserves were predominantly Class C, with 75.7 percent of stocks, followed by Class A, with an average of 12.8 percent. Class B had a share of 11.5 percent of the total estimated copper resources.

From 2002 to 2007, the annual stock of Class A copper reserves was recorded at about 132.0 million MT. In 2008, the discovery of 4.6 million dry metric tons (DMT) boosted the reserves. The highest recorded closing stock of copper metal was estimated at 140.3 million DMT in 2011, while the lowest was placed at 132.5 million DMT in 2007.

Copper metal extracted from 2002 to 2008 was estimated at an average of 80,224 DMT. It increased by 219.2 percent, from 92,808.8 DMT in 2008 to 203,414.4 DMT in 2009.

The period 2008-2009 saw a high demand for copper and nickel, which were used for the construction of the Beijing National Stadium, or Bird's Nest, the main venue of the 2008 Beijing Olympic Games. Between 2009 and 2012, extraction of copper rose to an average of 240,562.3 DMT.

The value of Class A copper reserves in 2002 was pegged at PhP 2,621.64 million. Their highest recorded value was reached in 2011 at PhP 36,212.76 million and PhP 28,970.21 million, at 12 percent and 15 percent discount rates, respectively.

The value of the unit resource rent for copper peaked in 2007 at PhP 18,024 per metric ton, and was at its lowest in 2002 at PhP 3,972 per metric ton.

## CHROMITE

Class C of chromite reserves had the highest average share of 45.8 percent from 2002 to 2012. The highest and lowest shares varied by 16.4 percent, with a minimum share of 42.9 percent in 2003 and a maximum share of 59.3 percent in 2012. Class B had an average share of 29.3 percent from 2002-2012. The difference between the highest and lowest shares varied by 18.9 percent, with a minimum share of 16.1 percent in 2012 and maximum share of 35.0 percent in 2006. Class A had the lowest share of 24.9 percent for the 2002-2012 period. The highest and lowest shares showed a difference of 6.5 percent, with a minimum share of 20.0 percent in 2006 and a maximum share of 26.4 percent in 2003.

The Class A chromite reserves rose steadily at an average of 9.9 million MT throughout the period 2002-2012. The highest closing stocks of Class A chromite recorded in 2012 at 17.2 million MT were attributed to the huge discoveries and upward reappraisals recorded during the year. The lowest closing stocks were estimated at 7.5 million MT in 2006.

On the monetary side, the highest resource value of Class A chromite reserves, at 12 percent, was pegged at PhP 730.6 million in 2012 while the lowest estimated value was posted in 2002 at PhP 144.3 million. The highest resource value of Class A chromite reserves, at 15 percent discount rate, was posted in 2012 at PhP 584.5 million while the lowest was recorded in 2002 at PhP 115.4 million.

The unit resource rent of chromite reserves averaged PhP 1,667.28 per metric ton from 2002 to 2012. The highest unit resource rent was valued at PhP 3,598.87 per metric ton in 2009, which reflects the lowest extraction recorded in the same year. The lowest unit resource rent was PhP 786.97 per metric ton in 2002.

# Table of Contents

	Page
<b>Foreword</b>	<b>iii</b>
<b>List of Acronyms and Abbreviations</b>	<b>iv</b>
<b>Executive Summary</b>	<b>2</b>
<b>Introduction</b>	<b>12</b>
Mineral Resources in the Philippines	12
Mining Industry in the Philippines	14
Objectives of the Study	16
<b>Philippine Initiatives in Mineral Asset Accounting</b>	<b>18</b>
ENRAP: Beginnings of environmental accounting in the Philippines	18
IEMSD-ENRA: Piloting SEEA in the Philippines	18
ENRA II Project	19
WAVES Project	20
Phil-WAVES	21
<b>Framework of Mineral Asset Accounting</b>	<b>24</b>
Scope and coverage of mineral accounts	24
System of Environmental and Economic Accounting	25
<b>Operational Framework of Mineral Asset Accounting</b>	<b>32</b>
Data and sources	32
Data and sources: Physical Accounts	34
Data and sources: Monetary Accounts	35
Data limitations	38
Estimation methodology	38
<b>Results and Discussion</b>	<b>46</b>
Nickel	46
Gold	58
Copper	69

Chromite	79
<b>Recommendations and future directions</b>	<b>90</b>
Improvement of the generation of the administrative data	90
Localization of the UNFC-2009	90
Expansion of the coverage of mineral asset accounts	91
Enhancement on the estimation methodology for monetary accounts	91
<b>Appendices</b>	<b>92</b>
Appendix 1. UNFC-2009 Specifications	92
Appendix 2. Philippine Mining Operations Framework	94
Appendix 3. International Mining & Energy Resources Classification Systems	97
Appendix 4. Consensus on the Mineral Resource Classification in the Philippines	103
Appendix 5. Localized criteria on Mineral Accounts	104
Appendix 6. Revised MGB form	108
<b>Appendix Tables</b>	<b>120</b>
Appendix Table 1. Physical account: Class A nickel reserves, in ore, in million metric tons, 2002-2012	120
Appendix Table 2. Physical account: Class B nickel reserves, in ore, in million metric tons, 2002-2012	121
Appendix Table 3. Physical account: Class C nickel reserves, in ore, in million metric tons, 2002-2012	122
Appendix Table 4. Monetary account: Class A nickel reserves, at 12 percent discount rate, in million pesos, 2002-2012	123
Appendix Table 5. Monetary account: Class A nickel reserves, at 15 percent discount rate, in million pesos, 2002-2012	124
Appendix Table 6. Nickel Class A resource life / mine life and net change, 2002-2012	125
Appendix Table 7 Physical account: Class A gold reserves, in metal content, in million kilograms, 2002-2012	126
Appendix Table 8. Physical account: Class B gold reserves, in metal content, in million kilograms, 2002-2012	127
Appendix Table 9. Physical account: Class C gold reserves, in metal content, in million kilograms, 2002-2012	128
Appendix Table 10. Monetary account: Class A gold reserves, at 12 percent discount rate, in million pesos, 2002-2012	129
Appendix Table 11. Monetary account: Class A gold reserves, at 15 percent discount rate, in million pesos, 2002-2012	130

Appendix Table 12. Gold Class A resource life / mine life and net change, 2002-2012	131
Appendix Table 13. Physical account: Class A copper reserves, in metal content, in million dry metric ton, 2002-2012	132
Appendix Table 14. Physical account: Class B copper reserves, in metal content, in million dry metric ton, 2002-2012	133
Appendix Table 15. Physical account: Class C copper reserves, in metal content, in million dry metric ton, 2002-2012	134
Appendix Table 16. Monetary account: Class A copper reserves, at 12 percent discount rate, in million pesos, 2002-2012	135
Appendix Table 17. Monetary account: Class A copper reserves, at 15 percent discount rate, in million pesos, 2002-2012	136
Appendix Table 18. Copper Class A resource life / mine life and net change, 2002-2012	137
Appendix Table 19. Physical account: Class A chromite reserves, in metal content, in million dry metric ton, 2002-2012	138
Appendix Table 20. Physical account: Class B chromite reserves, in metal content, in million dry metric ton, 2002-2012	139
Appendix Table 21. Physical account: Class C chromite reserves, in metal content, in million dry metric ton, 2002-2012	140
Appendix Table 22. Monetary account: Class A chromite reserves, at 12 percent discount rate, in million pesos, 2002-2012	141
Appendix Table 23. Monetary account: Class A chromite reserves, at 15 percent discount rate, in million pesos, 2002-2012	142
Appendix Table 24. Chromite Class A resource life / mine life and net change, 2002-2012	143
<b>References</b>	<b>144</b>
<b>Definition of terms</b>	<b>146</b>

## List of Figures

Figure 1. Schematic diagram of a mining project's stages of operations, legal requirements and indicators	33
Figure 2. Percent distribution and volume of closing stocks of Classes A, B, and C nickel reserves, in ore, in million metric tons, 2002-2012	46
Figure 3. Closing stocks, discoveries and extractions of Class A nickel reserves, in million metric tons, 2002-2012	47
Figure 4. Total reserves, extraction and mine life, nickel, 2002-2012	50
Figure 5. Closing stocks, discoveries and reclassification of Class B nickel reserves, 2002-2012	50
Figure 6. Closing stocks, discoveries and reclassification of Class C nickel reserves, 2002-2012	52

Figure 7. Unit resource rent and resource value of nickel, per metric ton, in pesos, 2002-2012	54
Figure 8. Class A nickel reserves closing stocks, at 12 and 15 percent discount rates, 2002-2012	55
Figure 9. Percent distribution and volume of closing stocks of Class A, B, and C gold reserve, in metal content, in million kilograms, 2002-2012	58
Figure 10. Closing stocks, discoveries and extractions of Class A gold reserves, in metal content, in millions of kilograms, 2002-2012	60
Figure 11. Total reserves, extraction and mine life, Gold, 2002-2012	61
Figure 12. Gold closing stocks and discoveries, Class B, in metal content, in million kilograms, 2002-2012	63
Figure 13. Closing stocks and discoveries of Class C gold reserves, in metal content, in million kilograms, 2002-2012	63
Figure 14. Unit resource rent and resource value of gold reserves, per kilogram, in pesos, 2002-2012	65
Figure 15. Class A gold reserves closing stocks, at 12 and 15 percent discount rate, in million pesos, 2002-2012	67
Figure 16. Percent distribution and volume of closing stocks of Class A, B, and C copper reserves, in metal content, in million metric tons, 2002-2012	69
Figure 17. Closing stocks, discoveries and extraction of Class A copper reserves, in metal content, in dry metric ton, 2002-2012	71
Figure 18. Total reserves, extraction and mine life, Copper, 2002-2012	72
Figure 19. Closing stocks, discoveries and reappraisals of Class B copper reserves, in metal content, in dry metric ton, 2002-2012	72
Figure 20. Closing stocks, discoveries, and reappraisals of Class C copper reserves, in metal content, in dry metric ton, 2002-2012	74
Figure 21. Copper unit resource rent and resource value, per metric ton, in pesos, 2002-2012	76
Figure 22. Percent distribution and volume of closing stocks of Class A, B, and C Chromite reserves, in ore, in million metric tons, 2002-2012	79
Figure 23. Discoveries, extraction, and closing stocks of Class A chromite reserves, 2002-2012	80
Figure 24. Mine life and extractions of Class A Chromite reserves, 2002-2012	83
Figure 25. Closing stocks, reclassification and reappraisals of Class B chromite reserves, in metric tons, 2002-2012	83
Figure 26. Closing stocks, reclassification and reappraisals of Class C chromite reserves, in metric tons, 2002-2012	85
Figure 27. Chromite unit resource rent and resource value per metric ton, in pesos, 2002-2012	87
Figure 28. Class A chromite reserves closing stocks, at 12 and 15 percent discount rates, 2002-2012	87



# 1 | Introduction

## Mineral Resources in the Philippines

Minerals are naturally occurring, inorganic substances marked by a fixed structure and chemical composition, and which are gathered through mining. A mineral resource is considered to be a non-renewable natural resource because of its inability to regenerate on a human time scale (NSCB, 1998).

According to Tolentino (2015), the Philippines is one of the world's richest in mineral resources, ranking fifth globally in total mineral reserves. It ranks third in gold, fourth in copper, fifth in nickel, and sixth in chromite deposits. In 2010, the country's total metallic mineral reserves were assessed at 14.5 billion metric tons (MT) while its non-metallic mineral reserves were estimated at 67.7 billion MT. Thirty percent (or 9 million hectares) of the total land area of the country is found to be geologically prospective for metallic minerals. The country's mineral reserves are currently estimated at US\$ 1.387 trillion.

Tolentino (2015) further explained that in terms of the country's top three metals, Mindanao has 70 percent of gold and 62 percent of copper reserves in the Philippines. Luzon has 53 percent of the country's reserves of nickel, and has the bulk of zinc and chromite reserves. Palawan, an island province in Luzon, accounts for much of these reserves.

**Table 1. Volume of Production, 2000-2015**

Year	Nickel (MT)	Gold (kg)	Copper (DMT)	Chromium (MT)
2000	851,600	47,064	129,759	20,920
2001	1,300,788	44,867	95,983	27,926
2002	883,252	49,845	79,213	22,003
2003	671,523	53,901	80,917	33,778
2004	874,193	50,509	70,578	42,707
2005	1,563,115	53,275	75,283	38,081
2006	3,961,451	50,989	73,981	46,728
2007	4,046,156	42,003	88,788	31,592
2008	5,648,120	28,580	92,809	15,268

Year	Nickel (MT)	Gold (kg)	Copper (DMT)	Chromium (MT)
2009	8,264,293	38,324	203,414	14,322
2010	13,172,543	40,847	236,814	14,807
2011	20,457,358	31,120	253,975	25,483
2012	25,270,822	15,762	268,046	36,629
2013	25,488,945	17,248	18,423	20,643
2014	33,127,757	18,423	349,269	47,056
2015	32,357,244	20,643	337,185	15,502

Source: MGB-DENR, 2015

The Philippines, as shown in the latest 2009 Philippine Standard Industrial Classification (PSIC), has identified other metallic minerals deposited in the country, namely, iron ores, uranium and thorium ores, silver ores, and other non-ferrous metal ores like aluminium (bauxite), lead, tin, manganese, cobalt, molybdenum, tantalum, vanadium, etc.

Based on the national accounts, from 2000 to 2015, the average contribution of other metallic minerals to the Philippines' total metallic mineral reserves was reported at 1.77 percent and 0.98 percent at current prices and constant 2000 prices, respectively. This showed a generally increasing trend during the 15-year period, growing at an average of 47.7 percent at current prices and 24.6 percent at constant prices.

As stated, mineral resources are non-renewable. Once extracted, the ore vanishes and will take a long time to replenish. Mining activity is therefore unsustainable. Adverse environmental impacts may arise if this issue is not properly addressed. While the construction of the asset account for other natural resources is undoubtedly important, it is more crucial for the minerals because of their exhaustibility. The asset accounts can yield indicators on sustainability, such as the level of resources, the extraction rate, and the expected life index of the assets. These indicators can serve as a useful guide in policy formulation and legislation on our mineral assets (NSCB, 1999).

## Mining Industry in the Philippines

The mining industry plays a very important role in the country's economic development. The industry provides employment to a significant portion of the population, directly and indirectly. In 2000, the share of employment in the Mining and Quarrying (MAQ) industry to the total employment stood only at 0.39 percent. In 2015, the share of employment went up to 0.60 percent (see Table 2).

The launch of a mining project spurs local and regional economic development as mining firms invest in road infrastructure, utilities, and other facilities within the mine site. Mining likewise contributes to the country's foreign exchange earnings through exports and yields additional revenue for the government through taxes and fees paid on mining and other related activities (NSCB, 1999).

**Table 2. Employment in Mining and Quarrying and its Share to Total Employment, 2000-2015**

Year	Total Employment (in thousand)	Employment in MAQ (in thousand)	Share of Employment in MAQ to Total Employment (%)
2000	28,285	110	0.39
2001	29,157	104	0.35
2002	30,062	113	0.38
2003	30,628	104	0.34
2004	31,611	118	0.37
2005	32,875	128	0.39
2006	32,636	139	0.43
2007	33,564	143	0.43
2008	34,089	170	0.50
2009	35,060	175	0.50
2010	36,035	216	0.60
2011	37,192	223	0.60
2012	37,600	263	0.70
2013	38,118	267	0.70
2014	38,837	233	0.60
2015	38,741	232	0.60

Source: Labor Force Survey, Philippine Statistics Authority

**Table 3. Gross Value Added of Total Metallic Mining and its Contribution to GDP, 2000-2015**

Year	GVA of Mining and Quarrying		GVA of Total Metallic Mining		Share of Total Metallic Mining to GDP (%)	
	Current Prices	Constant 2000 Prices	Current Prices	Constant 2000 Prices	Current Prices	Constant 2000 Prices
2000	22,518	22,518	12,787	12,787	0.36	0.36
2001	22,088	21,296	13,040	12,137	0.34	0.33
2002	40,047	34,961	15,803	12,653	0.38	0.33
2003	51,065	39,547	20,482	13,264	0.45	0.33
2004	54,215	37,631	21,617	12,376	0.42	0.29
2005	69,608	43,624	24,905	13,333	0.44	0.30
2006	76,548	43,535	31,883	14,991	0.51	0.32
2007	93,905	51,649	45,863	18,198	0.67	0.36
2008	95,410	50,926	38,578	16,128	0.50	0.31
2009	106,396	59,130	47,546	19,859	0.59	0.37
2010	128,727	65,898	65,245	24,859	0.72	0.44
2011	143,027	70,509	67,282	27,073	0.69	0.46
2012	121,435	72,047	50,908	28,075	0.48	0.45
2013	115,425	72,893	48,736	30,595	0.42	0.45
2014	130,192	81,695	57,708	36,961	0.46	0.52
2015	108,109	80,500	48,266	35,788	0.36	0.47

Source: Philippine Statistics Authority

The mining industry produced 31,743,765 DMT of reserves in 2014 valued at PhP 138,610 million. Out of this production, 29,682,132 DMT valued at PhP 167,787 million, was exported. Mining exports' contribution to GDP growth stood at 6.5 percent with government revenue valued at PhP 27.8 million (see Table 4).

In 2014, the total Gross Value Added (GVA) of mining and quarrying industry at 2000 constant prices amounted to PhP 76,474 million. Nickel accounted for the largest contribution on the value added for metallic mining at 73 percent, while the shares of gold and copper were at 14 and 11 percent, respectively (PSA, 2015).

**Table 4. Contribution of the Mining Industry to the Economy, 2014**

Production		Exports		Exports contribution (%)	Government Revenue (billion pesos)
Volume (DMT)	Value (million pesos)	Volume (DMT)	Value (million pesos)		
31,743,765	138,610	29,682,132	167,787	6.5	27.8

Source: MGB-DENR

## Objectives of the Study

The welfare of the country's population has always been central to any economic development policies, programs, and projects of the government. Among the sectors in the economy, those belonging to the mining industry need priority attention by the government. There is therefore a dire need for information about mining, particularly on mineral resources, to ensure more appropriate interventions and a more efficient allocation of the country's resources.

Against this backdrop the Philippine Statistics Authority (PSA) is mandated to develop an operational framework for environmental accounting and therefore come up with new methodologies and generate on a regular basis the information needed for a specific target group.

The PSA, by virtue of Republic Act 10625, otherwise known as the Philippine Statistical Act of 2013, is mandated to plan, develop, prescribe, disseminate and enforce policies, rules and regulations and coordinate government-wide programs governing the production of official statistics, general-purpose statistics, and civil registration services. The PSA is primarily responsible for all national censuses and surveys, sectoral statistics, consolidation of selected administrative recording systems, and compilation of national accounts.

The PSA is also tasked to support the institutionalization of selected modules of the System of Environmental-Economic Accounting (SEEA) 2012 - Central Framework (SEEA 2012-CF), particularly the development of the physical and monetary accounts for mineral asset accounts. The mineral asset accounts seek to record the opening and closing stocks of

environmental assets and the different types of changes in the stocks over an accounting period.

Using records on the opening and closing stocks of minerals, an assessment can be made of whether current patterns of economic activity are depleting and degrading the available environmental assets. Information from asset accounts can be used to facilitate the management of environmental assets, taking into consideration the sustainable use of resources and the capacity of environmental assets to continue to provide inputs to the economy and society. Moreover, valuations of natural resources and land can be combined with valuations of produced and financial assets to facilitate broader estimates of national wealth.

The compilation of the mineral asset accounts will pave the way for the development of macroeconomic indicators, particularly adjusted net national income and adjusted net national savings in support of the sectoral development planning and policymaking at the National Economic and Development Authority (NEDA), Department of Budget and Management, Department of Finance, DENR, and other relevant sectoral agencies.

## 2 | Philippine Initiatives in Mineral Asset Accounting

### ENRAP: Beginnings of environmental accounting in the Philippines

In 1991, the Philippines, through a US Agency for International Development project – the Environmental and Natural Resources Accounting Project (ENRAP), undertook the compilation of the first natural resources accounts, under the DENR with the involvement of the defunct National Statistical Coordination Board (NSCB).

The DENR project, which adopted the Peskin framework<sup>4</sup>, paved the way for the development of a database for environmental accounting and the generation of a number of parameters/assumptions through the conduct of special studies.

### IEMSD-ENRA: Piloting SEEA in the Philippines

In 1995, a project under the auspices of the United Nations Development Programme's (UNDP) Country Programme on Integrated Environmental Management for Sustainable Development (IEMSD) was implemented as a component of SEEA. ENRA adopted the UN SEEA 1993 framework, a satellite account of the System of National Accounts (SNA). The former National Statistical Coordination Board spearheaded the ENRA project and built on some of the earlier works of ENRAP that led to the successful compilation of five asset accounts – fishery, forest, minerals, land and soil, and water resources.

The national accounts developed for minerals covered six commodities, namely gold, copper, chromite, nickel, iron, and manganese. Of these, only gold, copper, and chromite were valued using the Net Present Method (NPM) and the unit User Cost Method (UCM) or El Serafy Method (ESM).

---

<sup>4</sup>The Peskin model "explicitly accounts for the economically valuable services of natural resources and the environment as a medium for the disposal of wastes, a supplier of recreational services, esthetics, and the life support of species" (ENRAP, 1991).

The data used to establish the mineral accounts in monetary terms covered the results of the Annual Survey of Establishments, conducted by the then National Statistics Office<sup>5</sup>, and mineral production data from the Minerals News Service, a publication of the MGB. Such data were validated in IESD-ENRA's Philippine Asset Accounts (1998). The discount rates used were 5 percent and 10 percent.

The specific feature of the accounts structure in the 1993 SEEA framework relative to the flows of asset was classified into three major categories, namely, a) extraction, b) other accumulation – changes due to economic decisions, and c) other volume changes – other changes due to decisions other than economic.

## **ENRA II project**

With the success of the ENRA sub-program, the second phase of the project was launched in 1998. The ENRA II Project focused on the development and enhancement capacities for environmental and natural resource accounting. Its fundamental objective was to institutionalize the generation and utilization of the Philippine Economic-Environmental and Natural Resources Accounting (PEENRA), which aimed to mainstream environmental concerns in policy formulation, planning and decision making at the national level and in selected regions and provinces.

Under the ENRA II project, the different national asset and emission accounts were updated. Moreover, mineral accounts developed at the national level were pilot-tested at the sub-national level. Regional and provincial accounts were then developed in the Cordillera Administrative Region (CAR) under the NSCB Regional Unit, and in Palawan through the Palawan Council for Sustainable Development Staff (PCSDS).

For CAR, data on three commodities, specifically copper and gold for metallic minerals and limestone for non-metallic minerals, were compiled. The physical accounts, however, covered only large-scale mining due to the

---

<sup>5</sup>Now part of the Philippine Statistics Authority by virtue of RA 10625, An Act Reorganizing and Strengthening the Philippine Statistical System.



unavailability of other data. In deriving the monetary accounts, CAR tried the NPM and UCM methods using the Integrated Annual Report (IAR) submitted by mining companies to MGB. The discount rate used was the social discount rate of NEDA at 15 percent.

On the other hand, PCSDS compiled physical and monetary data on nickel and sand and gravel for its mineral accounts. Data for nickel was sourced from the reports of the MGB while that for sand and gravel came from the Provincial Environment and Natural Resources Office. The monetary accounts were estimated using NPM with the 15 percent discount rate from NEDA.

## **WAVES Project**

The Wealth Accounting and the Valuation of Ecosystem Services (WAVES) project is a global partnership launched in 2010 by the World Bank to mainstream natural capital in development planning and national economic accounts and therefore harness sustainable development. Such initiative was undertaken to help countries build natural capital accounts and consequently ensure that their benefits are achieved through appropriate development policies.

WAVES' core implementing countries — collectively known as the 'First 5,' — are Botswana, Colombia, Costa Rica, Madagascar, and the Philippines. Amid growing global acceptance of natural capital accounting (NCA) and WAVES, the First 5 was expanded to include Guatemala, Indonesia and Rwanda.

WAVES is supported by a multi-donor trust fund, which comes from countries in Europe and Asia. Other countries like Australia through the Australian Bureau of Statistics and the Department for Environment, Food and Rural Affairs of the United Kingdom provide technical support and lend their expertise to implementing countries (WAVES Annual Report, 2014).

## ***“Partnering with UN Agencies, private sectors, civil society organization, regional groups and other sectors”***

WAVES is also working closely with United Nations (UN) agencies, namely, the United Nations Environment Programme (UNEP), United Nations Development Programme (UNDP), and the United Nations Statistical Commission (UNSC). These UN agencies are helping in the implementation of NCA using the SEEA 2012-CF as the accounting framework.

WAVES likewise forged strategic alliances with the private sector, such as the Natural Capital Coalition or NCC (formerly TEEB for Business) and the Resource for the Future (RF). Together with WAVES, the NCC worked with the International Finance Corporation (IFC) in defining the work plan that would help the private sector incorporate the value of natural capital in their decisions. On the other hand, RF collaborated with WAVES in the updating and improvement of the forest accounts in WB's global database for comprehensive wealth (WAVES Annual Report, 2016).

Among civil society organizations, the Conservation International (CI), the International Institute for Environment and Development (IIED), the Globe Legislators Organization (GLOBE), the International Union for Conservation of Nature (IUCN), the Nature Conservancy, the World Resource Institute (WRI), and the World Wildlife Fund (WWF) are participating in the NCA initiative in different parts of the world.

## **Phil-WAVES**

The Philippines-WAVES partnership, otherwise known as Phil-WAVES, is composed of both the recipient and bank-executed activities that complement and reinforce each other. The Recipient-Executed Trust Fund (RETF) is being implemented by the Philippine Statistics Authority (PSA) while the Bank-Executed Trust Fund (BETF) is directly implemented by the World Bank. NEDA acts as the Project Monitoring Office (PMO) of the Phil-WAVES project.

The objective of the Phil-WAVES RETF is to support the institutionalization of selected modules of the SEEA 2012. The project has the following components:

- a) Developing macroeconomic indicators based on World Bank's methodology for computing adjusted net national income, adjusted net savings, and comprehensive wealth;
- b) Developing physical and monetary accounts for minerals and mangroves based on the United Nations 2012 SEEA;
- c) Building capacity for the institutionalization of selected SEEA modules, focusing on methodologies and components of SEEA, data collection, survey, and data storage and management skills;
- d) Providing overall guidance and strategic direction in the implementation of the project, review of work plans, and project preparation and monitoring.

The identification of the two major accounts — mineral asset account and mangrove account — were based on two identified policy issues: (1) revenue and benefit sharing and (2) coastal zone protection and disaster risk reduction, respectively.



## 3 | Framework of Mineral Asset Accounting

### Scope and Coverage of Mineral Accounts

Mineral resources include both metallic and non-metallic minerals. In terms of economic contribution to the country, the important metallic minerals found in large reserves in the country are gold, copper, chromite, nickel, iron, cobalt, platinum, silver, mercury, manganese, molybdenum, and zinc.

The PSA, in its measurement of all economic activities for the country's economic performance or the Gross Domestic Product (GDP), considers full accounting of economic activities of the entire industries under mining and quarrying. This basic concept follows the international guidelines stipulated in the 2008 United Nations System of National Accounts (SNA). The scope and coverage of all economic activities is included in the latest 2009 Philippine Standard Industrial Classification (PSIC).

This pilot study on mineral accounts focused only on metallic minerals, particularly chromite, copper, gold, and nickel. These resources contribute 99 percent of the total gross value added of the mining industry. The four metallic minerals collectively hold an 80 percent share of the total export revenues of metallic minerals, accounting for ore and metal contents.

All categories of mineral resources covered in this study are measured based on the available stocks at the start of the year (or the opening stock) including those activities that affect the opening and the closing stocks, namely: discoveries, extraction, reappraisals and reclassification. The revaluation of these resources is also accounted for when valuation of these resources are considered for the monetary accounts.

The stocks of these resources are classified as "inferred" and "probable and proven" reserves following the Philippine Mineral Resource/Reserve Classification (PMRC), the classification system used by the MGB. The existing classification under the PMRC has been made consistent, using the bridge matrix, with the 2009 United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources (UNFC-2009) as recommended by the SEEA 2012.

A detailed discussion on the alignment of the existing local classification under the PMRC with the UNFC-2009 following the 2012 SEEA-Central Framework recommendation is included in Appendix 5.

## **System of Environmental-Economic Accounting**

The SEEA 2012-CF serves as the framework for this pilot study.

The SEEA 2012-CF is a multipurpose conceptual framework for understanding the interactions between the economy and the environment. The Central Framework covers measurement in three main areas: (a) the physical flows of materials and energy within the economy and between the economy and the environment; (b) the stocks of environmental assets and changes in these stocks; and (c) economic activity and transactions related to the environment. SEEA 2012-CF puts statistics on the environment and its relationship to the economy at the core of official statistics. It is a statistical framework consisting of a comprehensive set of tables and accounts, which guides the compilation of consistent and comparable statistics and indicators for policymaking, analysis, and research.

The SEEA provides information related to a broad spectrum of environmental and economic issues including, in particular, the assessment of trends in the use and availability of natural resources, the extent of emissions and discharges to the environment resulting from economic activity, and the amount of economic activity undertaken for environmental purposes.

### **Asset Accounts for Mineral Resources**

Asset accounts for mineral resources organize relevant information covering the quantities and values of stocks of these resources and changes in stocks over accounting periods. The asset accounts can be presented in physical and monetary terms. Accounting for the flows of extraction, depletion, and discoveries as well as other changes such as reappraisals and reclassifications in physical terms is central to the mineral asset accounts. It can provide valuable information on the availability of individual resources.

The monetary account values the stocks and flows of mineral resources in monetary terms and allows important links to be made to the value added and operating surplus of the extracting industries. Such measures provide a view of extraction activity that recognizes a more complete set of production costs. Monetary estimates of these assets may be used in the determination of government taxation and royalty settings, given that in many countries, including the Philippines, the government is the collective owner of these assets on behalf of society.

### **Classification of Mineral Resources**

Mineral resources include deposits of non-metallic and metallic minerals which are generally found underground. Hence, the quantity of resources that one might reasonably expect to be extracted is not known with any large degree of precision. A key factor in the measurement of mineral resources is the concentration and quality of minerals in ore deposits, which influence the likelihood and cost of extraction and the degree of confidence in the quantity that can be sustainably extracted in the future.

Many countries have their own national classification systems to define the scope of known deposits, i.e., the Australasian Joint Ore Reserves Committee Code (JORC Code), the South African Code for the Reporting of Mineral Resources and Mineral Reserves (SAMREC), etc. SEEA 2012, however, is recommending the use of the UNFC- 2009 (Appendix 1).

The UNFC-2009 is a generic, flexible scheme for classifying and evaluating quantities of fossil energy and mineral resources. It classifies mineral and energy resources by determining whether projects for the extraction and exploration of the resources have been confirmed, developed, or planned, and if so to what extent. The underlying resources are classified based on the maturity of the projects. The UNFC-2009 is based on the breakdown of the resources according to three criteria affecting their extraction, to wit:

**Economic and social viability (E)** — Shows the favorability of economic and social conditions in establishing the commercial viability of the project;

**Field project status and feasibility (F)** — Presents maturity of studies and commitments necessary to implement mining plans or development projects, extending from early exploration efforts occurring before it has been confirmed that a deposit or accumulation exists, to projects involving extraction and sale of a product; and,

**Geological knowledge (G)** — Indicates the level of certainty of geologic knowledge and potential recoverability of quantities of the resource concerned.

On the other hand, known deposits are categorized in three classes, each defined according to combinations of criteria derived from the UNFC-2009:

- (a) **Class A:** Commercially recoverable resources;
- (b) **Class B:** Potentially commercially recoverable resources; and
- (c) **Class C:** Non-commercial and other known deposits

An overview of how the classes of resources are defined based on the UNFC criteria is shown in Table 6.

A basic physical asset account for mineral resources is shown in Table 5.

**Table 5. Physical asset accounts for Mineral resources**

	Type of mineral resource (Class A: Commercially recoverable resources)	
	Non-metallic minerals (tons)	Metallic minerals (thousands of tons)
<b>Opening stock of mineral resources</b>		
<b>Additions to stock</b>		
Discoveries		
Upward reappraisals		
Reclassifications		
Total additions to stock		



	Type of mineral resource (Class A: Commercially recoverable resources)	
	Non-metallic minerals (tons)	Metallic minerals (thousands of tons)
<b>Reductions in stock</b>		
Extractions		
Catastrophic losses		
Downward reappraisals		
Reclassifications		
Total reductions in stock		
<b>Closing stock of mineral resources</b>		

In the accounting table, the changes in the stock, from the opening to the closing stock, are due to the following changes:

- a. **Discoveries** — include the quantity of new deposits found during the accounting period.
- b. **Reappraisals** — may be upward or downward. The changes in the classification of mineral reserves are based on the changes in geological information, technology, resource price or a combination of these factors.
- c. **Extractions** — refer to the quantity of the physically removed deposits or the volume of production.
- d. **Catastrophic losses** — pertain to catastrophic or exceptional events like flooding and collapsing of mines, these are difficult to measure.
- e. **Reclassifications** — are changes in assets that result from situations in which asset is used for a different purpose.

**Table 6. Classification of Mineral resources**

SEEA Classes		Corresponding UNFC-2009 Project Categories		
		E	F	G
		Economic and social viability	Filed project status and feasibility	Geological knowledge
Known deposits	Class A: Commercially Recoverable Resources	E1: Extraction and sale have been confirmed to be economically viable	F1: Feasibility of extraction by a defined development project or mining operation has been confirmed.	Quantities associated with a known deposit that can be estimated with a high (G1), moderate (G2) or low (G3) level of confidence
	Class B: Potentially Commercially Recoverable Resources	E2: Extraction and sale is expected to become economically viable in the foreseeable future	F2.1: Project activities are ongoing to justify development in the foreseeable future Or	
			F2.2: Project activities are on hold and/or where justification as a commercial development may be subject to significant delay	
	Class C: Non-Commercial and Other Known Deposits	E3: Extraction and sale is not expected to become economically viable in the foreseeable future, or evaluation is at too early a stage to determine economic viability	F2.2: Project activities are on hold and/or where justification as a commercial development may be subject to significant delay Or	
F2.3: There are no current plans to develop or to acquire additional data due to limited potential Or F4: No development project or mining operation has been identified				

Potential deposits (not included in SEEA)	Exploration Projects Additional quantities in place	E3: Extraction and sale is not expected to become economically viable in foreseeable future or evaluation is at too early a stage to determine economic viability.	F3: Feasibility of extraction by a defined development project or mining operation cannot be evaluated due to limited technical data	Estimated quantities associated with a potential deposit, based primarily on indirect evidence (G4)
			Or F4: No development project or mining operation has been identified	

Notes:

<sup>1</sup> Including on-production projects, projects approved for development, and projects justified for development.

<sup>2</sup> Including economic and marginal development projects pending, and development projects on hold.

<sup>3</sup> Potential commercial projects may also satisfy requirements for E1.

<sup>4</sup> Including unclarified development projects, non-viable development projects, and additional quantities in place.

Source: System of Environmental-Economic Accounting (SEEA) 2012 - Central Framework, p.163.

## Monetary Asset Accounts for Mineral Resources

The monetary accounts for assets are based on estimated physical accounts. Thus, the structure of these accounts is almost the same as that of the physical account (see Table 7).

The additional entry in the monetary asset account relates to the recording of revaluations, which occur due to changes either in resource prices over the accounting period or in assumptions underlying the NPV approaches that are typically used to value mineral resources.

Due to the uncertainty in the expected extraction profile and incomes of types of reserves, it is recommended that only Class A deposits be valued. Moreover, if valuation for Class B and C types of deposit is estimated, values for each type should be clearly distinguished.

**Table 7. Monetary Asset Accounts for Mineral resources**

	Type of mineral resource (Class A: Commercially recoverable resources)	
	Non-metallic minerals (tons)	Metallic minerals (thousands of tons)
<b>Opening stock of mineral resources</b>		
<b>Additions to stock</b>		
Discoveries		
Upward reappraisals		
Reclassifications		
Total additions to stock		
<b>Reductions in stock</b>		
Extractions		
Catastrophic losses		
Downward reappraisals		
Reclassifications		
Total reductions in stock		
<b>Closing stock of mineral resources</b>		

The NPV is the approach applied to the valuation methodologies of mineral resources, which pertains mostly to estimation of resource rent. Resource rent is the economic rent that accrues in relation to environmental assets, including natural resources. Some variables used in estimating the monetary accounts are discount rate and the mine life.

## 4 | Operational Framework of Mineral Asset Accounting

### Data and Sources

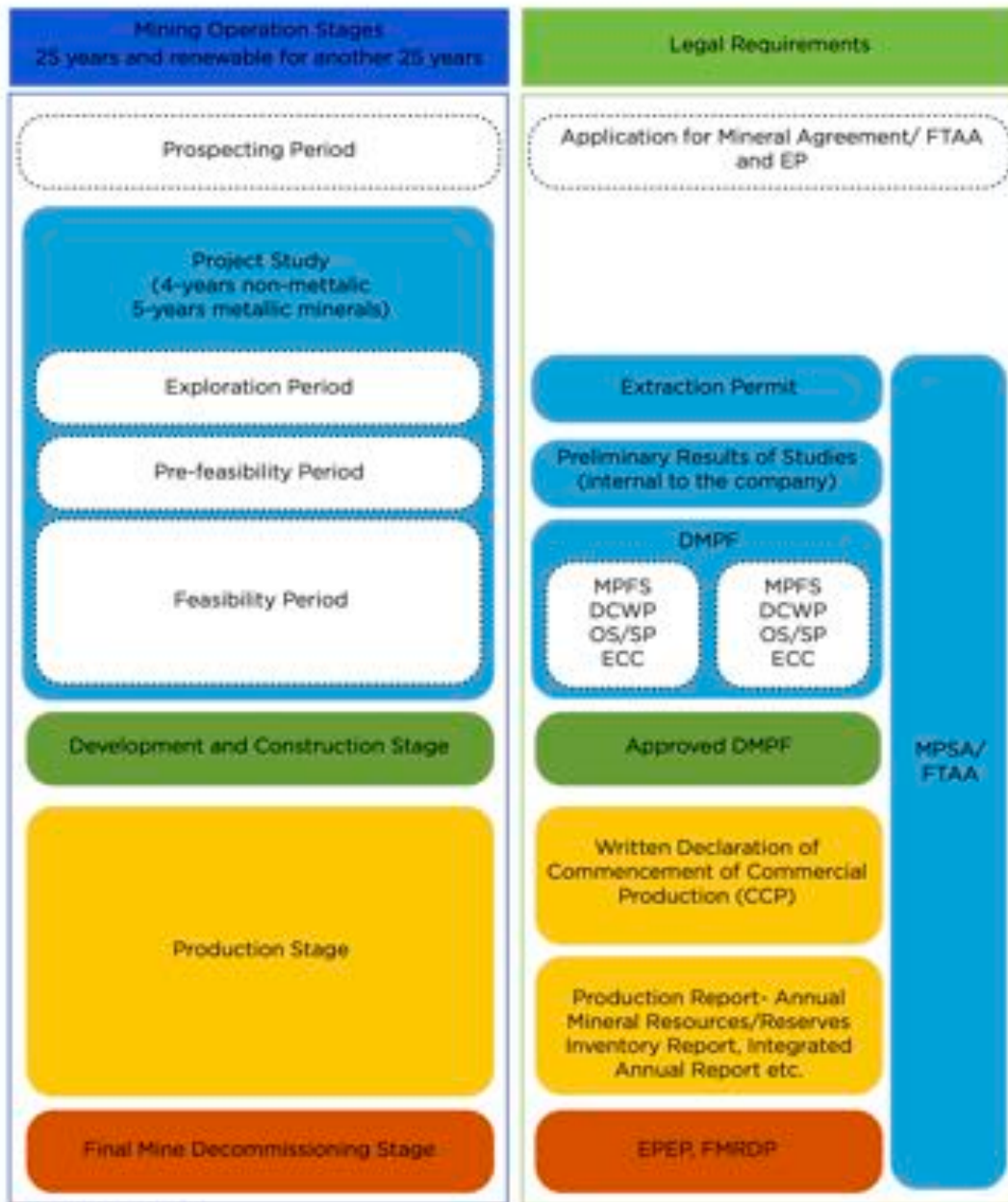
The data used in the estimation of the mineral accounts was based mostly on the accomplished administrative forms of the MGB. The bureau is tasked with the administration and disposition of mineral lands and resources; promulgation of rules and regulations, policies, and programs relating to mineral resources management and geosciences development; and performing such other duties and functions as may be assigned by the DENR Secretary and/or provided by law.<sup>6</sup>

Two major factors were considered in the review of data and its sources: legal requirements and a clear understanding of the different stages of mining operation (see Figure 1). Information relevant to the accounting was then identified for each production stage in order to establish the historical data on the company, which aids primarily in the identification of mineral resources or reserve reclassification entries. This also served as a framework for analyzing the mining sector (see Appendix 2).

---

<sup>6</sup>Mandate and functions. <http://www.mgb.gov.ph/transparency/about-us/mandate-and-functions>. Accessed June 30 2016.

Figure 1. Schematic diagram of a mining project's stages of operations, legal requirements and indicators



**ABBREVIATIONS:**

MPFS	Mining Project Feasibility Study
DCWP	Development and Construction Work Program
OS	Order of Survey
SP	Survey Plan
ECC	Environmental Compliance Certificate
SDMP	Social Development and Management Program
EPEP	Environmental Protection Enhancement Program

EP	Exploration Permit
FMRDP	Final Mine Rehabilitation and Decommissioning Plan
MPSA	Mineral Production Sharing Agreement
FTAA	Financial and Technical Assistance Agreement
DMPF	Declaration of Mining Project Feasibility

## Data and Data Sources: Physical accounts

1. The **Declaration of Mining Project Feasibility (DMPF)** is a regulatory requirement for application by mining companies, which is submitted to the MGB prior to the start of a mining operation. This includes the plans of a mining firm to undertake the operation requiring approval from the government. The DMPF and the attached documents are as follows:
  - **Exploration Report** — includes the profile of the mining company, including the following: name of company, address, primary and secondary commodity produced. Basic information that can be generated in this report consists of: (a) ore resource and reserve data; (b) mineral grade and recovery rate; (c) unit of measurement; (d) projected mine life including technology used; (e) date of the approval of mining contracts and explorations (f) date of submission and approval of DMPF (g), date of company letter informing MGB of the commencement of operations; and, (h) MGB's subsequent date of reply on approval or disapproval of the mining operation.
  - **Mining Project Feasibility Study (MPFS)** — this document submitted by mining companies to MGB serves as accompanying information to the Exploration Report. For the purpose of this study, the MPFS was used to validate the data coming from the said report. The validation was done to compare the data from the Exploration Report and to ensure that these two sets of documents were consistent.
2. The **Annual Mineral Resource/Reserve Inventory (AMRI) Report** (MGB Form) is a monitoring form based on Department Administrative Order (DAO) 1996-40, Section 270 of Chapter XXIX – Reporting Requirements and Fines. The relevant information that is available covers: (a) annual data on the remaining reserves; (b) extraction or production; (c) data related to reappraisals (i.e., changes in mineral grade and recovery rates); (d) classification of reserves; (e) status of mining operations; and (f) date of submission to MGB by the mining companies. (Appendix 6)

3. **Administrative Orders** — containing information including suspension orders and termination orders and the lifting of said orders. Such information should establish the status of the mining operations and facilitate the proper classification of the reserve based on the criteria set under the UNFC-2009 Classification System.
4. Other sources of information include:
  - **Philippine Standard Geographic Code (PSGC)** of the PSA — used to validate correctness of the exact location of the mining operation based on administrative/political subdivision. This also guides the presentation of the accounts by region, province, and lower levels of administrative disaggregation.
  - **Philippine Mineral Reporting Code (PMRC)** — serves as a basis of the mineral resource/reserve classification indicated in MGB administrative data and is aligned with the Combined Reserves International Reporting Standards Committee (CRIRSCO). The PMRC served as basis for aligning the classification of reserves with the UNFC.

## **Data and Data Sources: Monetary accounts**

### **1. National Accounts Statistics**

For each metallic mineral, the data for the compilation of economic activities related to mining are derived from estimates of national accounts by industry. These data are compiled by the PSA on a quarterly and annual basis. They are available in monetary terms for gross output, gross value added by type of economic activities involved in the production of specific metallic minerals, namely: (a) copper mining; (b) gold mining; (c) chromium mining; (d) nickel mining; and, (e) other metallic minerals, e.g., silver, iron, manganese, zinc, tin, molybdenum, etc.

### **2. Input-Output Accounts**

The data from the Input-Output (I-O) Accounts, the latest of which corresponds to Benchmark 2006, are available for detailed industry and commodity classifications with 240 industries/commodities. The



I-O shows the relationships of different industries as producers and as supplier of commodities. The data are available in monetary terms and serve as benchmark information on the total gross output, total gross value added, and total intermediate consumption spent by metallic mining in their production of metallic mineral resources. The I-O also provides more detailed disaggregation of the gross value added, e.g., compensation, consumption of fixed capital, indirect taxes, operating surplus (or profit), as well as details on intermediate consumption as supplier of inputs to the production process for each metallic mineral.

The data are disaggregated by type of metallic mining, namely: (a) copper; (b) gold; (c) chromium; (d) nickel; (e) other metallic and non-metallic minerals such as stone, gravel, clay, sandpits, etc.

For this study, the I-O accounts provide benchmark information on the cost structure of each metallic mineral in terms of how much is contributed by which industries to produce the total production, say, in gold mining. Such data will show, for example, how much electricity and fuel are consumed, how much labor is used, and how much indirect taxes are paid by the mining industry to the government.

### **3. Census of Philippine Business and Industry (CPBI), Annual Survey of Philippine Business and Industry (ASPBI), and Quarterly Survey of Philippine Business and Industry (QSPBI)**

The CPBI and ASPBI provide a consolidated report on specific aspects of a mining company's operations, namely: (a) economic profile on total employment, workers, etc. (b) main revenue (or sales from specific mining activity; (c) cost structure required to generate production of metallic minerals, e.g., intermediate inputs; and (d) capital expenditures such as for equipment, building, etc.

The QSPBI sets the parameters on revenue, employment, and compensation by type of mining establishment or company. These data are used when data from the CPBI and ASPBI are not yet available.

The CPBI is available every six years, the latest of which corresponds to 2012 while the latest available data for ASPBI is for 2015. The QSPBI is available every 90 days after the reference quarter.

The derived data serve as supplemental indicators to extrapolate the benchmark values coming from the Input-Output Accounts.

#### 4. **Integrated Annual Report (IAR)** of Mining Companies

The IAR, which is sourced from the MGB, provides a more disaggregated data on revenue income and other secondary income, detailed cost estimates of mining companies, etc.

The IAR provides parameters to come up with other breakdowns of cost estimates that are not explicitly available from data provided in the national accounts, input-output accounts, and establishment surveys. These data include other cost estimates like interest paid on loans including other payments by mining companies, e.g., environmental fees, fiduciary costs, insurance fees, etc. (See Appendix 6.)

#### 5. **Data on Producer and Purchaser Prices**

The available data on metallic mineral resources, e.g., copper, gold, nickel, chromite from MGB correspond to the form of ore, metal and/or concentrate, which are valued using the producer price. Producer prices, which represent the amount paid to mining companies as producers of metallic minerals, consist of the basic value of the mineral resource, including taxes less subsidies on products other than the value-added tax (2008 SNA).

The intermediate consumption or the inputs used to produce mineral resources are valued at the purchaser prices, which represent the amount paid by purchasers for goods used for inputs to production.

Treasury bills (T-bills) is another indicator used in order to value the resources as financial asset. The use of such an indicator assumes that such trends are more stable, which diminishes the erratic trend or the

variability of the varying factors present in the existing market scenarios. The data on T-bills are available on a monthly basis from the website of the Bangko Sentral ng Pilipinas.

### **Data limitations**

As with other studies on environmental accounts, the present study has data limitations. The MGB Form 29-19, or the Mineral Resource/Reserve Inventory (MRI) Report, is the main source of data on mineral reserves. However, some reports of mining companies have incomplete data such as those on the grade and the unit of volume of specific mineral reserves. In addition, based on data processed by the technical staff of a certain project, some mining companies are not listed in the MRI Report. Moreover, information provided by mining companies/permittees listed in the MRI Report does not match the list of the approved Mineral Production Sharing Agreements (MPSAs).

Data from mining companies' administrative reports are not comprehensive enough to provide better estimates of the metallic mineral resources. There are missing data in the existing IAR, MRI, and other documents provided by the MGB.

It was also found out that there were more data gaps in the existing IAR, MRI, and other source documents provided by the MGB.

### **Estimation methodology**

The physical accounts for gold and copper revolve around ore and metal contents. The monetary accounts for these commodities used the metal content as basis for valuation.

The physical and monetary accounts for nickel and chromite present data on these minerals in ore form. The physical accounts estimates were compiled entirely at the tenement level (i.e., mining area). However, due to certain data confidentiality issues related to some legal obligations, the accounts are only presented at the national level.

In monetary terms, the NPV method, as recommended by the SEEA 2012, was employed. Likewise, the valuation was done using aggregated physical accounts.

Both the physical and monetary accounts covered a 11-year period (2002-2012) to facilitate better understanding of existing trends in metallic mineral resources. Updating the consolidated data to cover more recent years (2013- 2015) was not possible for lack of data. Such an effort will mean MGB must consolidate the available data by company and ensure that data gaps are addressed by mining firms, and validated. This is especially applicable to data indicated in the DMPF, IAR, and MRI.

The following general procedures were followed in developing the physical and monetary accounts for mineral resources.

### **Physical Accounts**

The physical accounts were compiled for metallic mineral reserves, including chromite, copper, gold and nickel. As earlier mentioned, such accounts for gold and copper correspond to the ore and metal content, and for chromium and nickel, to their ore form.

Although the recommended classification system of the SEEA 2012 is the UNFC-2009, the classification system used by the Philippines for mineral resources/reserves is the Philippine Mineral Resource/Reserve Classification (PMRC). Using the PMRS, the reserves are classified as inferred, indicated, and measured for mineral resources; and as probable and proved for mineral reserves (Appendix 4). To align the two classifications, a localized classification was adopted (Appendix 5).

In compiling the opening and closing stocks of mineral ores, the units of measurement indicated in the reports are Wet Metric Tons (WMT), Metric Tons (MT), and Dry Metric Tons (DMT). These were first standardized and presented in MT. Based on discussions with the MGB, MT and DMT are the same but the unit of measurement terminology used in this study to refer to volume is MT. The Rate of Water Content (RWC) was computed to

estimate the volume for reserve/resource data with incomplete information.

The formula used to measure RWC is expressed as follows:

$$RWC = \frac{\text{Ore in WMT} - \text{Ore in MT}}{\text{Ore in WMT}}$$

where:

RWC = Rate of water content

WMT = Wet metric tons

MT = Metric tons

The ore grades that were used to measure the metal content of the ore were standardized to indicate that mining production in a specific tenement was economically viable. The averages were derived for the national, regional, and provincial levels when ore grade was not reported. Depending on available data, the average used to supplement missing data was based on the averages. For mining areas, however, with previous reports from DMPF or previous submissions of MGB Form 29-19, previous grades were applied. Grades applicable to the adjacent mining area were also recommended as an alternative.

In the absence of metal concentration (MC) data, the following formula was applied:

$$MC = \text{Ore} \times \text{Grade}$$

where

MC = Metal Content

Based on consultations with the MGB technical staff and experts from the Technical Working Group on Mineral Resource Statistics (TWG-MRS) of the Phil-WAVES project, it was recommended that metal form be expressed based on recoverable metals using a Recoverable Rate (RR). Recoverable metals (RM) are metals that are economically useful in the production, and are part of the metal content of the ore, which may differ from one operation to the other depending on the technology used.

To derive the RM, the following formula was applied:

$$RM = MC \times RR$$

where:

- RM = Recoverable metal
- MC = Metal Content
- RR = Recoverable rate

For the period of discovery considered in this study, the date of submission of the DMPF with corresponding attachments, i.e., exploration reports to the MGB, was used. Ideally, discovery should be based on the establishment of geological knowledge by the company and not by the government. However, such data is not included in the reports. On the other hand, there are also exploration reports that do not reach the stage of document submission to the MGB, primarily because projects are deemed not feasible. The DMPF is a major requirement for the approval of project feasibility studies.

If the date of the DPMF submission could not be determined, the following parameters were used instead:

- Inventory Year
- Report Year
- Date of Approval (MGB Form 29-19)
- Date of Submission (MGB Form 29-19)

Reports on reappraisals are not readily retrievable from the administrative file of the MGB or are not part of mining companies' reports. However, indicators exist to determine the reappraisal outcomes. To derive data on reappraisal, data on current and previous reserves were compared after deducting production data for the previous year or period. The result can be classified as upward reappraisal (if positive) or downward reappraisal (if negative). Note, however, that addition or reduction for reappraisal could be due to changes in geologic information, technology, resource price, or a combination of these factors.

Similarly, there was no available data on reclassification, but there are derived indicators. Reserve reclassification is obtained based on the criteria set under the UNFC-2009 classification system. It may occur if certain deposits are opened or closed to mining operations owing to government decisions concerning access rights to a deposit.

### **Monetary Accounts**

The estimation of monetary accounts requires information on both the market price and the physical quantities of the resource. It is important to acquire data on the income and operating cost structure per commodity to derive the parameters to be used in the valuation of the reserve and related flows, i.e., discoveries, extraction, reappraisal and reclassification. Basically, the cost and return structure is used to derive the Resource Rent (RR), which is a function of Resource Value (RV). On the other hand, RV is derived using the NPV method or a recommended process to discount the RR.

By definition, the NPV is the value of an asset determined by estimating the stream of income expected to be earned in the future, and discounting the future income back to the present accounting period. To be able to discount the RR using the NPV method, parameters on "resource life" expressed as "mine life" for mineral accounting, using an "extraction rate" and an appropriate discount rate, must be derived and acquired, respectively.

To arrive at a resource value using the NPV, parameters on resource rent, extraction rate, resource or mine life were derived as follows:

**Estimation of resource rent:** The resource rent was estimated using data on commodity price (normally prices used in the national accounts) for each of the four accounts covered, and the computed volume of reserve (to arrive at an estimated income data) and operating cost per commodity, which are limited to extraction activity.

Using the above-mentioned parameters, the following procedure was applied to arrive at estimates of the resource rent using data taken from the Annual Survey of Philippine Business and Industry (ASPBI):

- a. Derive Gross Output (GO) / Total Revenue by multiplying price by the volume of extraction. This is expressed through the following equation:

$$GO = Price \times Volume$$

- b. Use the data on operating cost of mineral extraction to derive the Gross Operating Surplus (GOS). This is expressed through the following equation:

$$GOS = GO - \text{Operating Cost (Intermediate consumption, Compensation Employees and other Taxes on Production plus other subsidies on Production)}$$

where:

$$GOS = \text{Gross operating surplus}$$

$$GO = \text{Gross output}$$

Note, however, that to arrive at GOS, “intended for the derivation of resource rent” the special subsidies on extraction (if there is any) and specific taxes on extraction should be deducted after this step. There was no identified special subsidy on extraction and the taxes on



extraction are not separated from the taxes on production. The next procedure therefore directly estimates the Resource Rent.

- c. Estimate the resource rent by user cost of production assets and the consumption of fixed capital together with return to produced assets. Operationally, this is derived by deducting the depreciation of fixed capital, return to produced asset and interest expense. The formula is as follows:

$$RR = GOS - (\text{Depreciation of Fixed Capital Return to Produced Asset and Interest Expense})$$

where:

RR = Resource rent

GOS = Gross operating surplus

**Estimation of Resource Value using NPV:** To arrive at a resource value, the derived resource rent was discounted using the NPV and the two different discount rates — 15 and 12 percent — and derived resource life. The discount rates used were 15 percent and 12 percent. The 15 percent discount rate is currently the rate used in the Philippines while the proposed 12 percent rate is being considered by the Philippines.

The following procedures were applied:

- a) Estimate mine life using data on extraction or production and total reserve. Mine life is therefore computed by dividing the stock at a time by actual extraction for the period.

$$\text{Mine Life} = \frac{\text{Reserves (Closing Stocks)}/\text{Extraction}}{\text{Rate}}$$

b) Compute for the RV using the NPV through the following formula:

$$RV_1 = \sum_{t=1}^n \frac{RR_t}{(1+r)^t}$$

where:

- RR = Resource rent
- r = Discount rate
- n = Mine life

The computed resource value in a given period is the resulting value of the total reserve within the accounting period. The total resource value is considered as the price of the resource in situ. Indirectly, it is also computed by multiplying a Unit Resource Value (URV) by the total reserve. The URV is computed by dividing the total value of the resource by the total volume.

The value of additions and reductions in the stock was calculated using the URV of the reserve in situ.

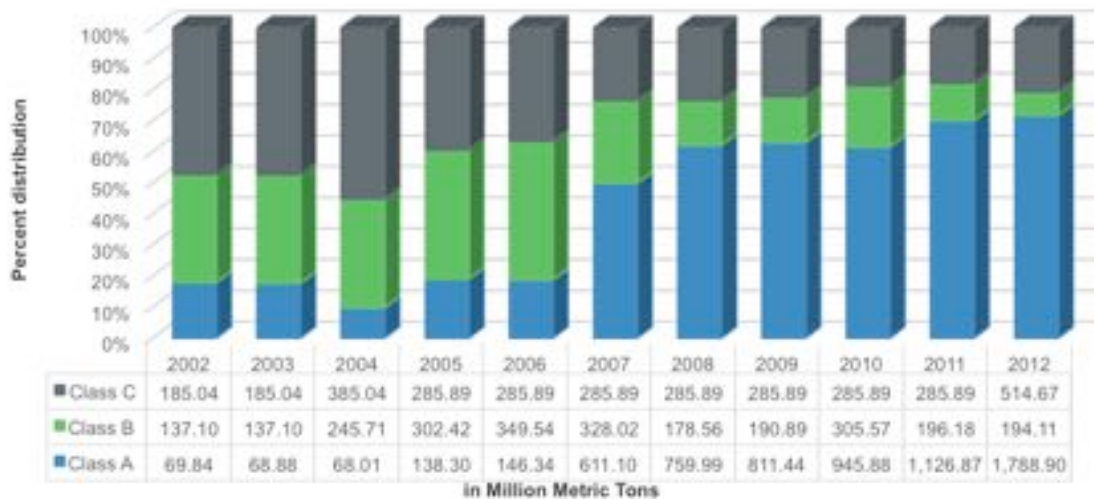
## 5 | Results and Discussion

### Nickel

#### Physical Accounts

From 2002 to 2006, the country's total reserves of nickel were mostly categorized under Classes B and C (Figure 2). It was only between 2007 and 2012 that most of the reserves became part of Class A. During the period 2002-2006, Class A nickel reserves accounted for an average of 16.4 percent. The volume of Class A nickel reserves rose 317.6 percent to 611.1 million MT in 2007 from 146.3 million MT 2006. The average share of these reserves between 2008 and 2012 was 25.1 percent, translating to a volume of 1,788.9 million MT in 2012.

**Figure 2. Percent distribution and volume of closing stocks of Classes A, B, and C nickel reserves, in ore, in million metric tons, 2002-2012**



## Class A Nickel

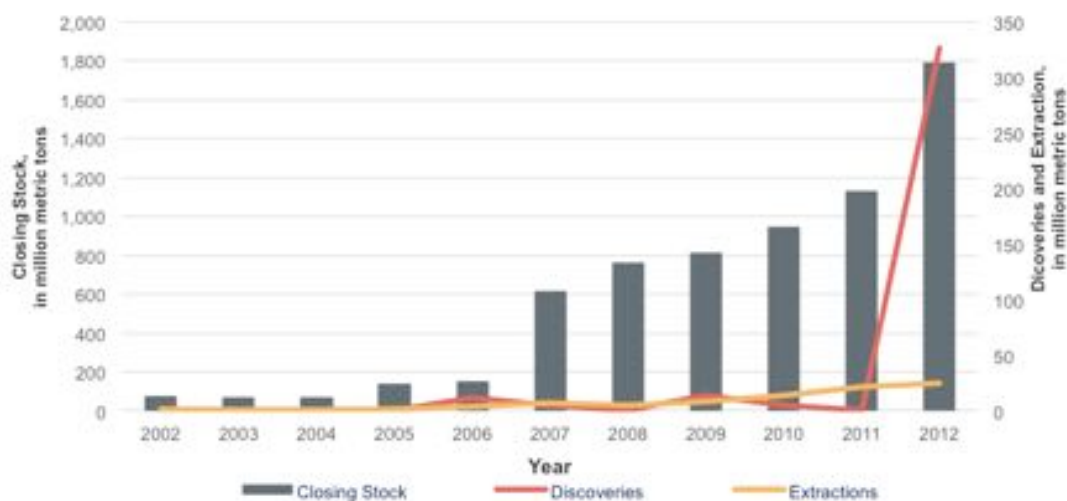
From 2002 to 2004, the total reserve for Class A showed a decline, with an average growth rate of negative 1.3 percent. During this period, no additions to stocks were reported although there were extractions.

The reserves under Class A started to grow in the period 2005-2012, owing to new discoveries, upward reappraisal, and reclassification. In 2006, 2007, 2009, 2010, and 2012 discoveries were recorded at 11.6 million MT, 4.9 million MT, 14.0 million MT, 5.4 million MT, and 327.0 million MT, respectively. The highest increase may be attributed to the upward reappraisal in 2007 and 2012, which contributed 60.4 percent, or 369.0 million MT, in 2007, and 19.5 percent, or 349.0 million MT, in 2012 (see Table 8).

Reclassification from 2007 to 2012 amounting to a total of 473.9 MMT also contributed to the growth in Class A reserves. The biggest volume reclassified to Class A from other categories was recorded in 2008 at 153.5 MMT.

On the other hand, the recorded downward reappraisals in 2011 and 2012 did not reflect a considerable impact on the additions to yield a negative net change.

**Figure 3. Closing stocks, discoveries and extractions of Class A nickel reserves, in million metric tons, 2002-2012**



**Table 8. Physical account: Class A nickel reserves, in ore, in million metric tons, 2002-2012**

Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	<b>71.04</b>	<b>69.84</b>	<b>68.88</b>	<b>68.01</b>	<b>138.30</b>	<b>146.34</b>	<b>611.10</b>	<b>759.99</b>	<b>811.44</b>	<b>945.88</b>	<b>1,126.87</b>
<b>Addition to Stock</b>											
Discoveries	-	-	-	-	11.61	4.90	-	14.01	5.37	-	327.00
Upward reappraisals	-	-	-	71.40	-	368.98	0.86	44.14	44.91	108.14	348.94
Reclassifications	-	-	-	-	-	98.26	153.49	1.57	97.96	11.46	12.18
<b>Total additions to stock</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>71.40</b>	<b>11.61</b>	<b>472.14</b>	<b>154.35</b>	<b>59.73</b>	<b>148.24</b>	<b>218.60</b>	<b>688.12</b>
<b>Reductions to stock</b>											
Extractions	1.20	0.96	0.87	1.11	3.58	7.38	5.46	8.28	13.80	21.15	24.95
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	16.45	1.14
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	<b>1.20</b>	<b>0.96</b>	<b>0.87</b>	<b>1.11</b>	<b>3.58</b>	<b>7.38</b>	<b>5.46</b>	<b>8.28</b>	<b>13.80</b>	<b>37.60</b>	<b>26.09</b>
<b>Closing Stocks</b>	<b>69.84</b>	<b>68.88</b>	<b>68.01</b>	<b>138.30</b>	<b>146.34</b>	<b>611.10</b>	<b>759.99</b>	<b>811.44</b>	<b>945.88</b>	<b>1,126.87</b>	<b>1,788.90</b>

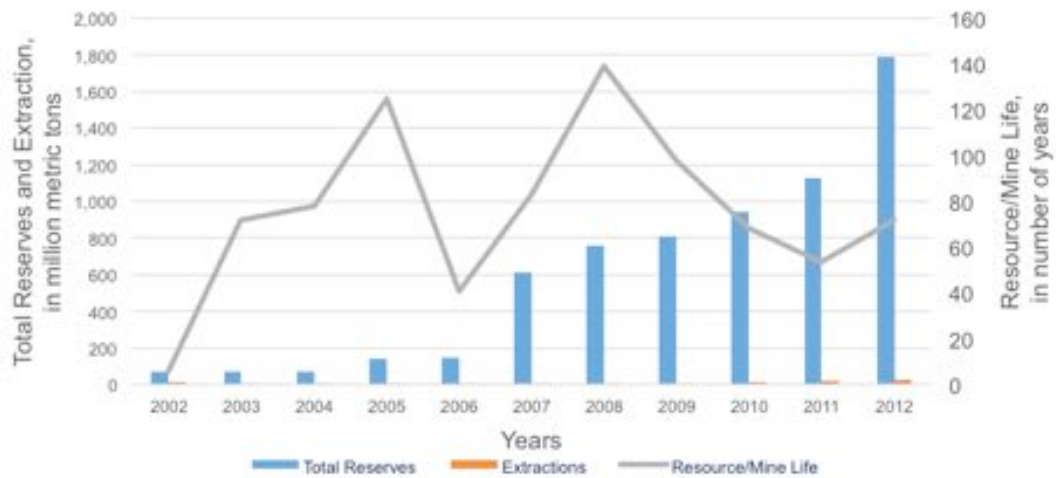
Table 9 shows the behavior of the mine life of nickel reserves from 2002 to 2012. The mine life of nickel reserves in 2002 was projected to last six years. In 2008 the estimated mine life of nickel reserves was 139 years, considered the longest for the period. Increased mine life during the period 2002-2005 was attributed to a decline in extraction, which was estimated at an annual average rate of 49.06 percent. The sharp increase in reserves in 2005, at 103.4 percent, was due to a positive net change from total additions and reductions, mainly as a result of the recorded upward reappraisal amounting to 71.4 million MT.

**Table 9. Nickel Class A resource life / mine life and net change, 2002-2012**

Year	Total Reserved in Million MT	Extraction in Million MT	Net change in Million MT			Resource life/mine life in years
			Extraction/ Discoveries	Upward/ Downward Reappraisals	Addition/ reduction in stocks	
2002	69.84	12.00	1.20	-	-	6
2003	68.88	0.96	-	-	-	72
2004	68.01	0.87	-	-	-	78
2005	138.30	1.11	-	-	1.20	125
2006	146.34	3.58	1.20	-	-	41
2007	611.10	7.38	-	1.20	-	83
2008	759.99	5.46	68.64	-	-	139
2009	811.44	8.28	-	-	1.20	98
2010	945.00	13.80	-	-	-	68
2011	1,126.87	21.00	-	1.20	69.84	54
2012	1,788.90	24.95	-	-	-	72

From 2002 to 2012, the average length of time before all reserves were fully extracted was 79 years. Between 2003 and 2012, mine life was at its trough at 41 years in 2006 due to the significant rise in production/ extraction at 223.1 percent, leading to a net change of negative 88.6 percent. The increase in 2012 of mine life was primarily a result of the sharp increase in net discoveries and reappraisals at 279.3 percent.

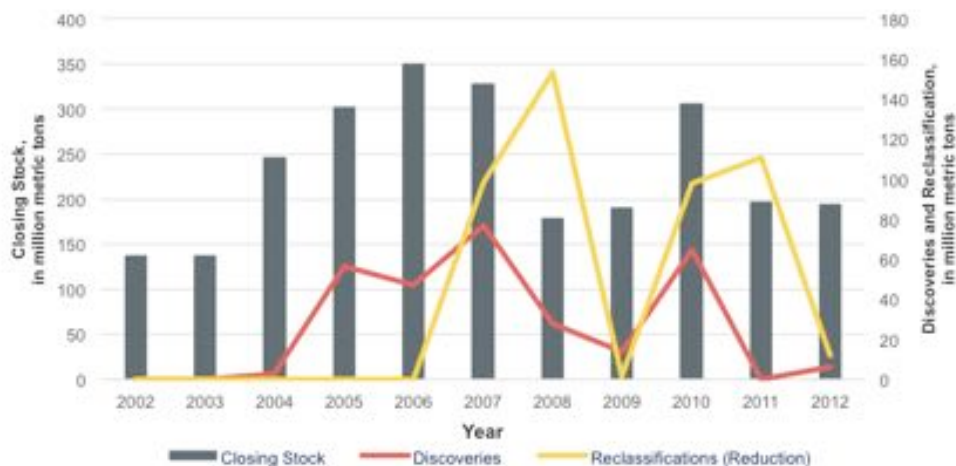
**Figure 4. Total reserves, extraction and mine life, nickel, 2002-2012**



**Class B Nickel**

Figure 5 shows an erratic movement in the stocks of Class B nickel reserves. There were no recorded changes in the level of stocks from 2002 to 2003. Such reserves started to increase in 2004, with the recorded discovery and additional reclassification from other categories estimated at 2.6 million MT and 106.0 million MT, respectively, which also pushed the stocks to spike 79.2 percent from 2003 – the highest recorded increase throughout the accounting period. This was followed by 60.1 percent in 2010 with a net change of 114.7 million MT. Other upward changes were recorded in 2005, 2006, and 2009, with 23.1 percent, 15.6 percent, and 6.9 percent, respectively.

**Figure 5. Closing stocks, discoveries and reclassification of Class B nickel reserves, 2002-2012**



**Table 10. Physical account: Class B nickel reserves, in ore, in million metric tons, 2002-2012**

Class B	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	137.10	137.10	137.10	245.71	302.42	349.54	328.02	178.56	190.89	305.57	196.18
<b>Addition to Stock</b>											
Discoveries	-	-	2.63	56.71	47.12	76.74	28.02	13.91	64.74	-	6.35
Upward reappraisals	-	-	-	-	-	-	-	-	147.91	1.07	3.76
Reclassifications	-	-	105.98	-	-	-	-	-	-	-	-
<b>Total additions to stock</b>	-	-	108.61	56.71	47.12	76.74	28.02	13.91	212.65	1.07	10.11
<b>Reductions to stock</b>											
Extractions	-	-	-	-	-	-	-	-	-	-	-
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	24.00	-	-	-	-
Reclassifications	-	-	-	-	-	98.26	153.49	1.57	97.96	110.46	12.18
<b>Total reduction in stock</b>	-	-	-	-	-	98.26	177.48	1.57	97.96	110.46	12.18
<b>Closing Stocks</b>	137.10	137.10	245.71	302.42	349.54	328.02	178.56	190.89	305.57	196.18	194.11

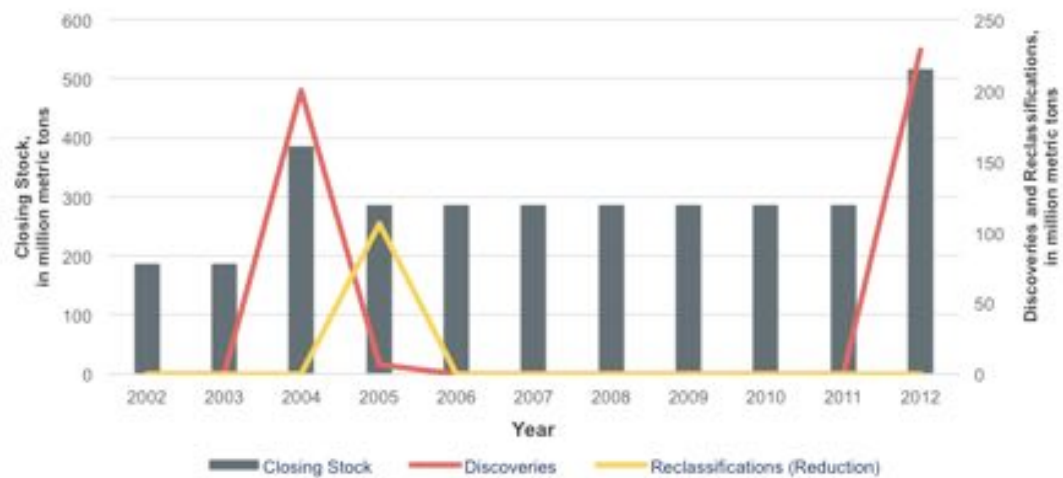


There were recorded reappraisals in 2010, 2011, and 2012, but the significant rise was brought about by the upward reappraisal in 2010 with 147.9 million MT, or 48.4 percent of the total stock in the same year.

### Class C Nickel

Figure 6 shows a steady volume of Class C nickel stocks from 2002 to 2003 at 185.0 million MT. It doubled by 108.1 percent in 2004 to a volume of 385.0 million MT due to the 200.0 million MT recorded discoveries. The stocks rose anew in 2005 following a recorded reclassification of reserves from Class C to Class A, with a volume of 105.9 MMT. The stocks from 2005 to 2011 and recorded a sharp increase of 80.0 percent in 2012, with discoveries amounting to 228.8 million MT.

**Figure 6. Closing stocks, discoveries and reclassification of Class C nickel reserves, 2002-2012**



**Table 11. Physical account: Class C nickel reserves, in ore, in million metric tons, 2002-2012**

Class C	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	185.04	185.04	185.04	385.04	285.89	285.89	285.89	285.89	285.89	285.89	285.89
<b>Addition to Stock</b>											
Discoveries	-	-	200.00	6.82	-	-	-	-	-	-	228.78
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total additions to stock</b>	-	-	200.00	6.82	-	-	-	-	-	-	228.78
<b>Reductions to stock</b>											
Extractions	-	-	-	-	-	-	-	-	-	-	-
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	105.98	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	-	-	-	105.98	-	-	-	-	-	-	-
<b>Closing Stocks</b>	185.04	185.04	385.04	285.89	285.89	285.89	285.89	285.89	285.89	285.89	514.67

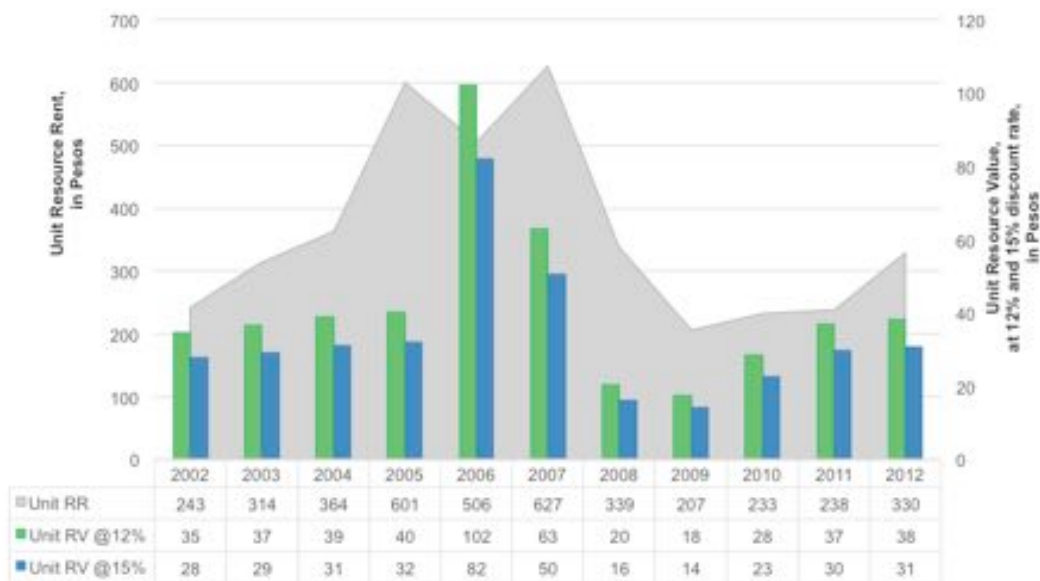
## Monetary Accounts

As shown in Figure 7, the changing resource rent, ranged from as low as PhP 207 per metric ton to as high as PhP 627 per metric ton, yielding an average of PhP 364 in the period 2002-2012. It went up for three consecutive years from 2002 to 2005, dropped in 2006, and peaked in 2007 at PhP 627. The lowest price registered was in 2009 at PhP 207.

On the other hand, the value of Class A stocks was computed using two different discount rates, 12 percent and 15 percent. Based on the results of the study, the Unit RR was higher by an average of 88.4 percent and 90.7 percent than the unit resource value using discount rates at 12 and 15 percent, respectively.

As shown also in Figure 7 the computed value of Class A reserves using a 12 percent discount rate was recorded at PhP 35 pesos per metric ton in 2002. The resource value also increased from 2002 to 2006. The highest increase during the said period was registered at 154.7 percent in 2006. The average resource value from 2002 to 2012 is PhP 42 per metric ton.

**Figure 7. Unit resource rent and resource value of nickel, per metric ton, in pesos, 2002-2012**

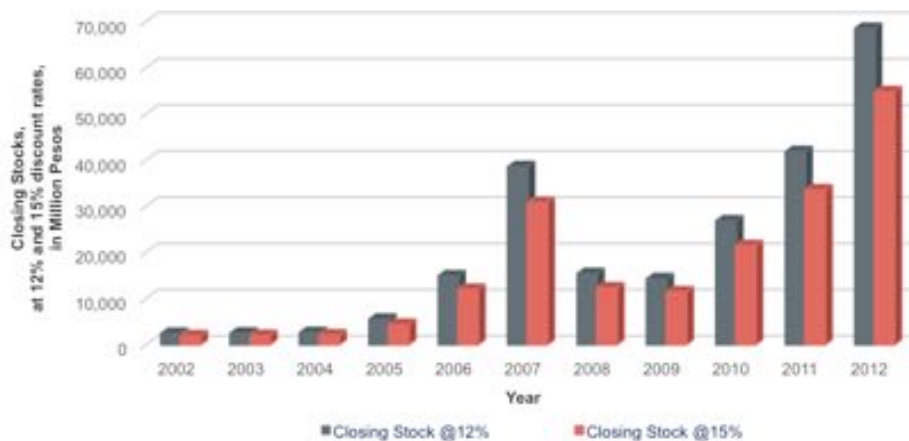


On the other hand, resource value at 15 percent discount rate moved in parallel with the resource rent discounted at 12 percent. The highest recorded value was at PhP 82 in 2006 and the lowest was PhP 14 per metric ton in 2009.

### Resource/Reserve Value at 12 Percent Discount Rate

In terms of reserve value, nickel exhibited a rising trend at an average of 58.6 percent during the period 2002-2012. This can be attributed to additions in stocks, particularly discoveries, upward reappraisals and reclassification, valued at PhP 13.5 billion, PhP 58.2 billion, and PhP 25.1 billion, respectively. Growth decreased sharply in 2008 at negative 60 percent.

**Figure 8. Class A nickel reserves closing stocks, at 12 and 15 percent discount rates, 2002-2012**



### Resource/Reserve Value at 15 Percent Discount Rate

The trend of the monetary value at 15 percent discount rate is the same as the trend of the monetary value at 12 percent discount rate. In terms of actual value, the PhP 2.3 billion opening stock value of nickel reserve in 2002 grew to PhP 54.8 billion in the closing stocks of 2012, brought about by the additions and reductions in stocks, as well as price changes, as shown in Figure 8.

**Table 12. Monetary account: Class A nickel reserves, at 12 percent discount rate, in million pesos, 2002-2012**

Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	2,873.92	2,426.22	2,516.30	2,652.73	5,543.72	14,942.33	38,547.45	15,425.81	14,293.74	26,834.01	41,833.63
<b>Addition to Stock</b>											
Discoveries	-	-	-	-	465.48	500.38	-	284.42	94.63	-	12,139.46
Upward reappraisals	-	-	-	-	-	37,675.28	54.58	895.94	791.04	3,067.77	12,953.94
Reclassifications	-	-	-	2,785.16	-	10,033.31	9,681.69	31.96	1,725.69	3,133.67	452.16
<b>Total additions to stock</b>	-	-	-	2,785.16	465.48	48,208.97	9,736.17	1,212.32	2,611.36	6,201.44	25,545.56
<b>Reductions to stock</b>											
Extractions	48.55	33.43	31.93	43.18	143.37	753.58	344.36	168.13	243.08	600.01	926.07
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	466.79	42.45
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	48.55	33.43	31.93	43.18	143.37	753.58	344.36	168.13	243.08	1,066.81	968.52
<b>Revaluation of the stock</b>	-399.16	123.52	168.36	149.00	9,076.49	-23,850.26	-32,513.46	-2,176.27	10,171.99	9,864.99	2,097.29
<b>Closing Stocks</b>	2,426.22	2,516.30	2,652.73	5,543.72	14,942.33	38,547.45	15,425.81	14,293.74	26,834.01	41,833.63	68,507.97

**Table 12. Nickel monetary account: Class A , at 15 percent discount rate, in million pesos, 2002-2012**

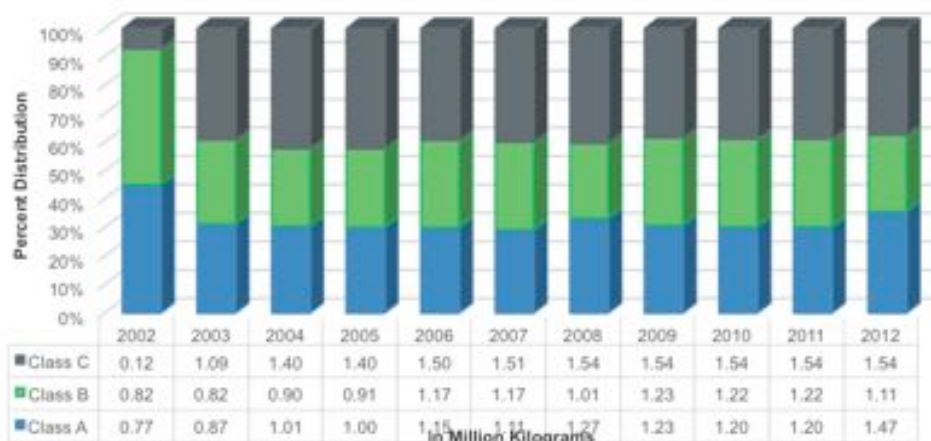
Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	2,302.60	1,943.10	2,013.53	2,122.45	4,434.98	12,030.49	30,840.21	12,340.65	11,435.15	21,474.44	33,529.18
<b>Addition to Stock</b>											
Discoveries	-	-	-	-	372.39	402.87	-	227.54	75.70	-	9,729.64
Upward reappraisals	-	-	-	-	-	30,333.44	43.59	716.75	632.84	2,455.04	10,382.44
Reclassifications	-	-	-	2,228.41	-	8,078.10	7,745.92	25.56	1,380.57	2,507.78	362.40
<b>Total additions to stock</b>	-	-	-	2,228.41	372.39	38,814.41	7,789.51	969.86	2,089.11	4,962.82	20,474.48
<b>Reductions to stock</b>											
Extractions	38.90	26.78	25.55	34.55	114.69	606.73	275.50	134.50	194.47	480.17	742.23
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	373.56	34.03
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	38.90	26.78	25.55	34.55	114.69	606.73	275.50	134.50	194.47	853.73	776.26
<b>Revaluation of the stock</b>	-320.60	97.21	134.48	118.66	7,337.82	-19,397.96	-26,013.56	-1,740.86	8,144.64	7,945.65	1,592.32
<b>Closing Stocks</b>	1,943.10	2,013.53	2,122.45	4,434.98	12,030.49	30,840.21	12,340.65	11,435.15	21,474.44	33,529.18	54,819.72

## GOLD

### Physical Accounts

Figure 9 shows the contribution of Classes A, B, and Class C to the total gold reserves during the period 2002-2012. In 2002 Class B had the highest share in the total gold reserves, at 47.8 percent, or 0.82 million kilograms. Class A contributed 45.0 percent or 0.77 million kilograms, and Class C 7.2 percent or 0.12 million kilograms. From 2002 to 2012, however, the total closing stocks of Class C posted the highest percent contribution at an average of 37.5 percent while Classes A and B contributed 35.7 percent and 26.9 percent, respectively, on the average

**Figure 9. Percent distribution and volume of closing stocks of Class A, B, and C gold reserve, in metal content, in million kilograms, 2002-2012**



### Class A Gold

Table 14 shows the physical account of Class A gold reserves based on metal content. In 2002 the opening stock for gold was estimated at 0.80 million kilograms. By the end of the accounting period in 2012, the gold reserve stood at 1.47 million kg. The biggest discovery of gold reserve was reported in 2006 at 0.20 million kg. The gold extraction from 2002 to 2005 was estimated at an average of 0.05 million kg.

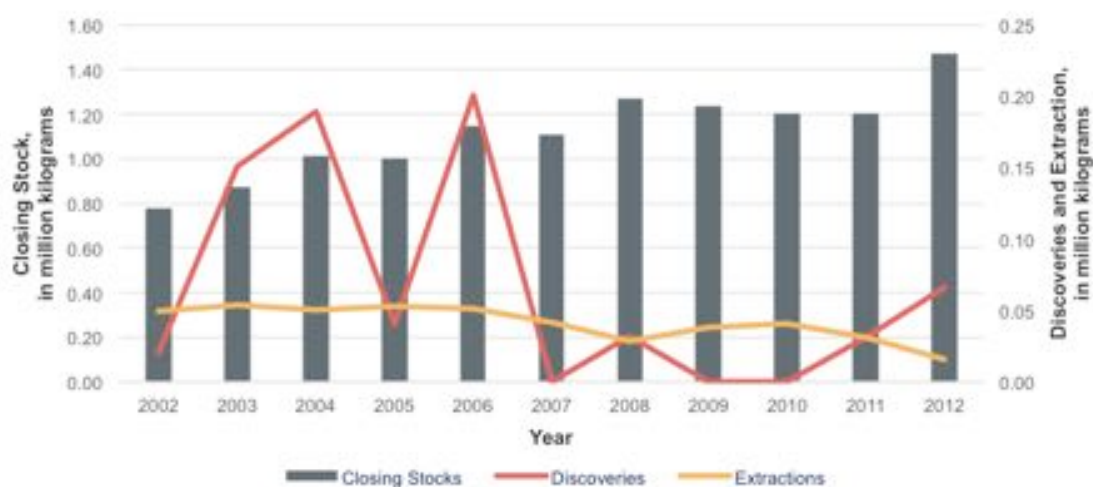
As shown in Figure 10, the trend in discoveries and extractions of Class A gold reserves fluctuated between 2002 and 2012.

**Table 14. Physical account: Class A Gold reserves, in metal content, in million kilograms, 2002-2012**

Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	<b>0.80</b>	<b>0.77</b>	<b>0.87</b>	<b>1.01</b>	<b>1.00</b>	<b>1.15</b>	<b>1.11</b>	<b>1.27</b>	<b>1.23</b>	<b>1.20</b>	<b>1.20</b>
<b>Addition to Stock</b>											
Discoveries	0.02	0.15	0.19	0.04	0.20	-	0.03	-	-	0.03	0.07
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	0.16	-	0.01	-	0.22
<b>Total additions to stock</b>	<b>0.02</b>	<b>0.15</b>	<b>0.19</b>	<b>0.04</b>	<b>0.20</b>	<b>-</b>	<b>0.19</b>	<b>-</b>	<b>0.01</b>	<b>0.03</b>	<b>0.29</b>
<b>Reductions to stock</b>											
Extractions	0.05	0.05	0.05	0.05	0.05	0.04	0.03	0.04	0.04	0.03	0.02
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	<b>0.05</b>	<b>0.05</b>	<b>0.05</b>	<b>0.05</b>	<b>0.05</b>	<b>0.04</b>	<b>0.03</b>	<b>0.04</b>	<b>0.04</b>	<b>0.03</b>	<b>0.02</b>
<b>Closing Stocks</b>	<b>0.77</b>	<b>0.87</b>	<b>1.01</b>	<b>1.00</b>	<b>1.15</b>	<b>1.11</b>	<b>1.27</b>	<b>1.23</b>	<b>1.20</b>	<b>1.20</b>	<b>1.47</b>



**Figure 10. Closing stocks, discoveries and extractions of Class A gold reserves, in metal content, in millions of kilograms, 2002-2012**



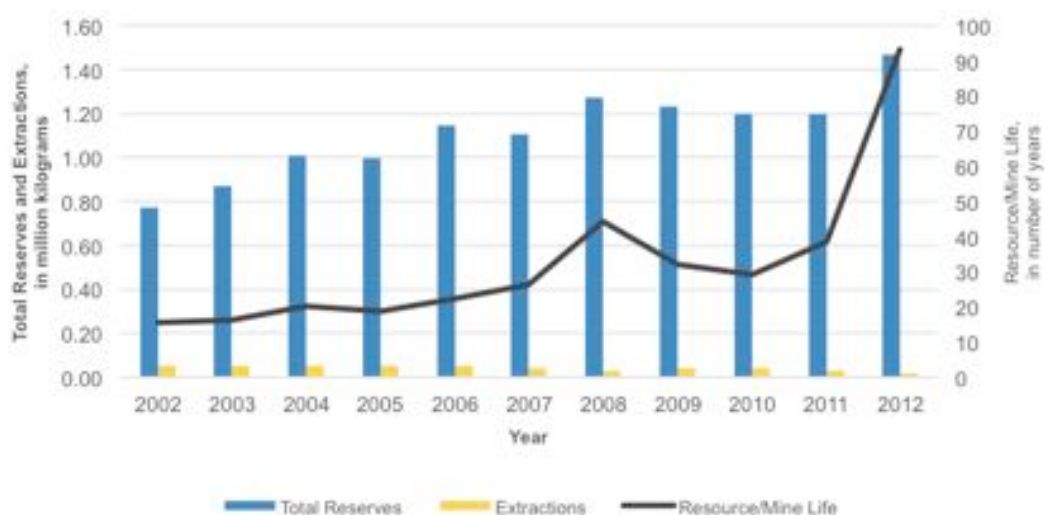
As shown in Table 15, the mine life of gold reserves was estimated to last 16 years between 2002 and 2003. The longest estimated mine life was determined in 2012 with 93 years, or a 138.4 percent increase from 39 years in 2011. The average length of time before all gold reserves would be fully extracted was 32 years. Figure 11 shows the trends in the mine life of gold reserves from 2002 to 2012.

**Table 15. Gold Class A resource life/mine life and net change, 2002-2012**

Year	Total Reserved in Million MT	Extraction in Million MT	Net change in Million MT			Resource life/mine life in years
			Extraction/ Discoveries	Upward/ Downward Reappraisals	Addition/ reduction in stocks	
2002	0.77	0.05	-0.03	-	-0.03	16
2003	-0.87	0.05	0.10	-	0.10	16
2004	1.01	0.05	0.14	-	0.14	20
2005	1.00	0.05	-0.01	-	-0.01	19
2006	1.15	0.05	0.15	-	0.15	22
2007	1.11	0.04	-0.04	-	-0.04	26
2008	1.27	0.03	-	-	-	44
2009	1.23	0.04	-0.04	-	-0.04	32
2010	1.20	0.04	-0.04	-	-0.04	29

Year	Total Reserved in Million MT	Extraction in Million MT	Net change in Million MT			Resource life/mine life in years
			Extraction/ Discoveries	Upward/ Downward Reappraisals	Addition/ reduction in stocks	
2011	1.20	0.03	-	-	0.00	39
2012	1.47	0.02	0.05	-	0.05	93

Figure 11. Total reserves, extraction and mine life, Gold, 2002-2012



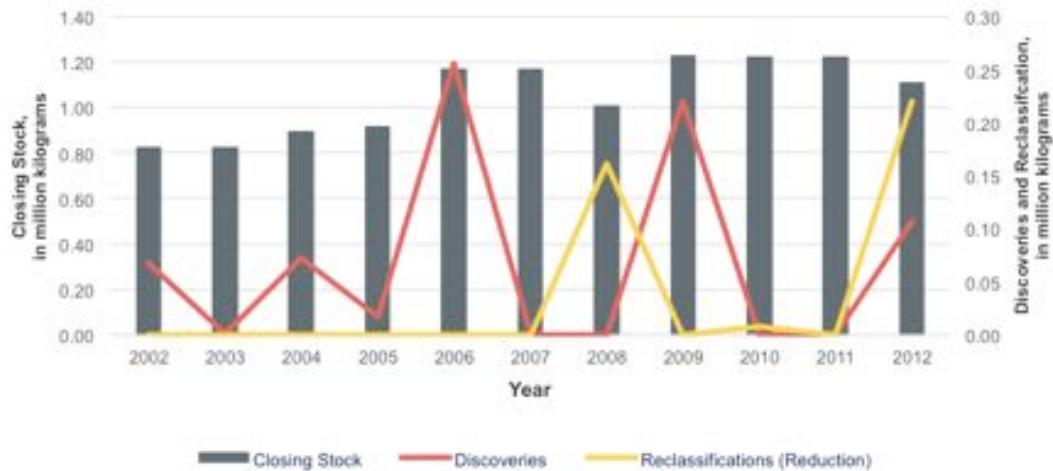
### Class B Gold

For Class B, in 2002 the opening stock of gold reserve in terms of metal content was estimated at 0.75 million kg while the closing stock in 2012 was estimated at 1.1 million kg. The highest volume of discoveries was posted in 2006 at 0.26 million kg but the highest volume of closing stock was in 2009 at 1.2 million kg (Table 16).

**Table 16. Physical account: Class B Gold reserves, in metal content, in million kilograms, 2002-2012**

Class B	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	<b>0.75</b>	<b>0.82</b>	<b>0.82</b>	<b>0.90</b>	<b>0.91</b>	<b>1.17</b>	<b>1.17</b>	<b>1.01</b>	<b>1.23</b>	<b>1.22</b>	<b>1.22</b>
<b>Addition to Stock</b>											
Discoveries	0.07	-	0.07	0.02	0.26	-	-	0.22	-	-	0.11
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total additions to stock</b>	<b>0.07</b>	<b>-</b>	<b>0.07</b>	<b>0.02</b>	<b>0.26</b>	<b>-</b>	<b>-</b>	<b>0.22</b>	<b>-</b>	<b>-</b>	<b>0.11</b>
<b>Reductions to stock</b>											
Extractions	-	-	-	-	-	-	-	-	-	-	-
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	0.16	-	0.01	-	0.22
<b>Total reduction in stock</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>0.16</b>	<b>-</b>	<b>0.01</b>	<b>-</b>	<b>0.22</b>
<b>Closing Stocks</b>	<b>0.82</b>	<b>0.82</b>	<b>0.90</b>	<b>0.91</b>	<b>1.17</b>	<b>1.17</b>	<b>1.01</b>	<b>1.23</b>	<b>1.22</b>	<b>1.22</b>	<b>1.11</b>

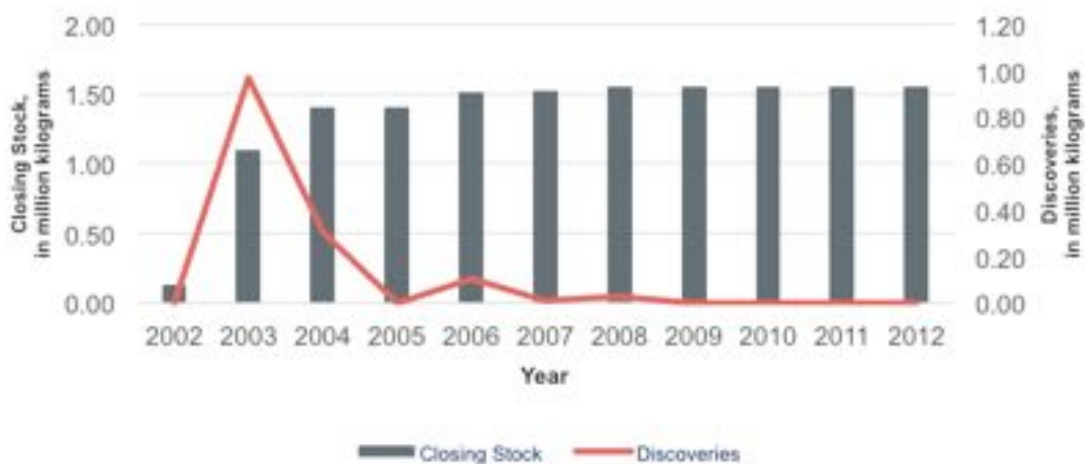
**Figure 12. Gold closing stocks and discoveries, Class B, in metal content, in million kilograms, 2002-2012**



### Class C Gold

Gold mineral reserve in terms of metal content for Class C had an estimated closing stock of 0.12 million kg in 2002 and a closing stock of 1.5 million kg in 2012. The highest discovery was recorded in 2003 and was estimated at 0.97 million kg.

**Figure 13. Closing stocks and discoveries of Class C gold reserves, in metal content, in million kilograms, 2002-2012**



**Table 17. Physical asset accounts: Class C Gold reserves, in metal content, in million kilograms, 2002-2012**

Class C	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	0.12	0.12	1.09	1.40	1.40	1.50	1.51	1.54	1.54	1.54	1.54
<b>Addition to Stock</b>											
Discoveries	-	0.97	0.31	-	0.10	0.01	0.03	-	-	-	-
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total additions to stock</b>	-	0.97	0.31	-	0.10	0.01	0.03	-	-	-	-
<b>Reductions to stock</b>											
Extractions	-	-	-	-	-	-	-	-	-	-	-
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	-	-	-	-	-	-	-	-	-	-	-
<b>Closing Stocks</b>	0.12	1.09	1.40	1.40	1.50	1.51	1.54	1.54	1.54	1.54	1.54

## Monetary Accounts

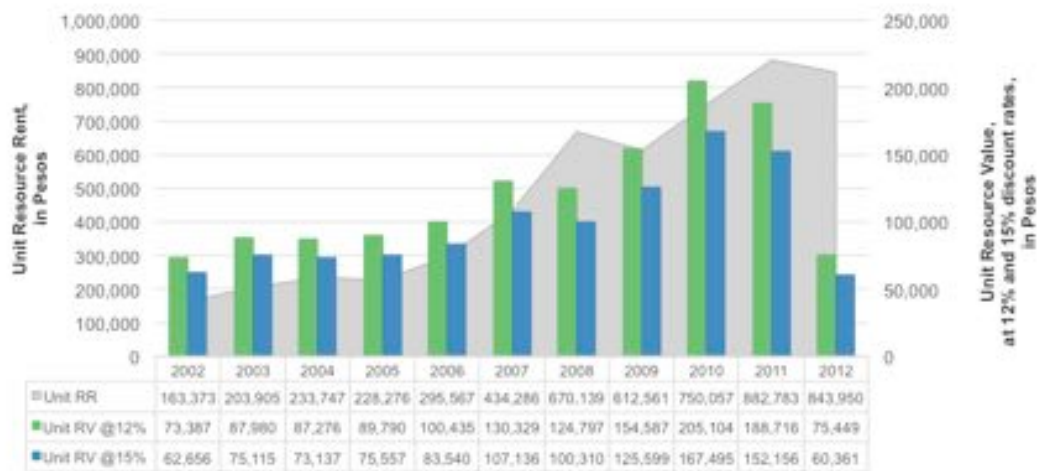
Given two discount rates, 12 percent and 15 percent, and using the NPV method, the unit resource value of gold in 2002 was estimated at PhP 73.4 thousand and PhP 62.7 thousand, respectively. As shown in Figure 13, the unit resource value at 12 percent was higher than the corresponding value at 15 percent. In 2012, while the unit resource value at 15 percent discount rate was estimated at PhP 60.4 thousand, the unit resource value at 12 percent discount rate was estimated at PhP 75.4 thousand.

The trend in unit resource rent for gold mineral reserves shows an increase in the period 2002-2012 (see Figure 13). The unit resource rent for gold mineral reserve was estimated at PhP 163.4 thousand in 2002, rising to almost PhP 844 thousand in 2012. The highest resource rent posted by gold was in 2011 with an estimated value of PhP 882.8 million.

## Resource/reserve value at 12 Percent Discount Rate

The reported increase of the resource value of gold at 12 percent discount rate averaged 20.6 percent between 2002 and 2010. As shown in Figure 14, it slowed to PhP 226.2 billion in 2011 from PhP 245.8 billion in 2010, translating to an 8 percent decline. The resource value grew 95.2 percent, at a 12 percent discount rent, from PhP 56.8 billion in 2002 to PhP 110.8 billion in 2012 (see Table 18).

**Figure 14. Unit resource rent and resource value of gold reserves, per kilogram, in pesos, 2002-2012**



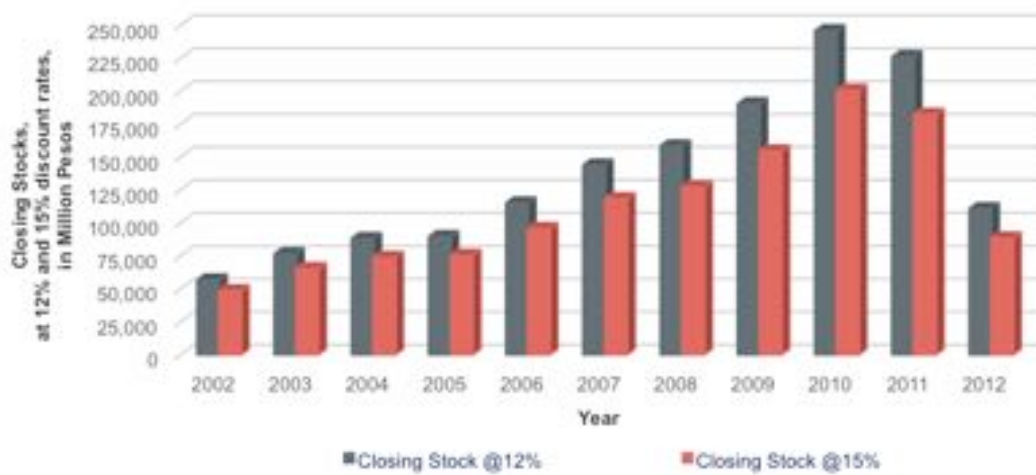
**Table 18. Monetary account: Class A Gold reserves, at 12 percent discount rate, in million pesos, 2002-2012**

Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	29,273.44	56,790.73	76,649.65	88,187.33	89,578.80	115,210.04	144,027.44	158,514.32	190,427.70	245,767.53	226,181.05
<b>Addition to Stock</b>											
Discoveries	761.39	11,079.97	16,692.74	3,533.51	17,998.36	-	4,164.01	-	-	6,436.97	12,426.69
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	21.08	-	-	-	-	21,073.80	-	1,121.58	-	41,628.96
<b>Total additions to stock</b>	761.39	11,101.05	16,692.74	3,533.51	17,998.36	-	25,237.80	-	1,121.58	6,436.97	54,055.65
<b>Reductions to stock</b>											
Extractions	1,817.51	3,955.68	4,443.81	4,649.68	4,578.30	4,218.57	3,724.79	4,782.77	6,314.37	6,382.87	2,974.54
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	1,817.51	3,955.68	4,443.81	4,649.68	4,578.30	4,218.57	3,724.79	4,782.77	6,314.37	6,382.87	2,974.54
<b>Revaluation of the stock</b>	28,573.41	12,713.55	-711.26	2,507.65	12,211.17	33,035.98	-7,026.14	36,696.16	60,532.61	-19,640.57	-166,412.44
<b>Closing Stocks</b>	56,790.73	76,649.65	88,187.33	89,578.80	115,210.04	144,027.44	158,514.32	190,427.70	245,767.53	226,181.05	110,849.71

## Resource/reserve value at 15 Percent Discount Rate

The trend in the monetary account at 15 percent discount rate is the same at 12 percent. In 2002, the resource value of gold reserves was estimated at PhP 48.5 billion. In 2002, the resource value of gold reserves was estimated at PhP 48.5 billion. In 2012, the recorded resource value at 15 percent discount rate was PhP 88.7 billion (see Table 19).

**Figure 15. Class A gold reserves closing stocks, at 12 and 15 percent discount rate, in million pesos, 2002-2012**





**Table 19. Monetary account: Class A Gold reserves, at 15 percent discount rate, in million pesos, 2002-2012**

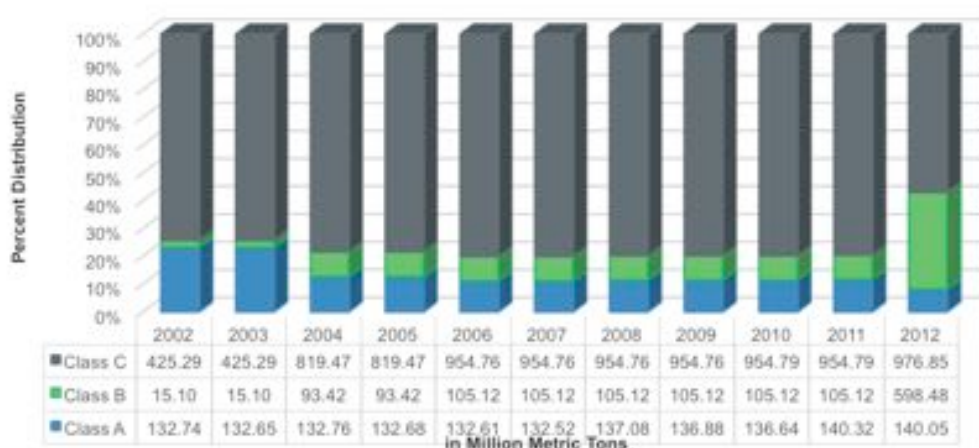
Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	24,744.11	48,486.67	65,441.77	73,900.24	75,379.71	95,829.39	118,396.61	127,410.97	154,719.28	200,702.03	182,363.00
<b>Addition to Stock</b>											
Discoveries	643.58	9,459.83	14,251.89	2,961.05	15,145.45	-	3,422.99	-	-	5,256.65	10,019.27
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	17.99	-	-	-	-	17,323.55	-	911.26	-	33,564.18
<b>Total additions to stock</b>	643.58	9,477.83	14,251.89	2,961.05	15,145.45	-	20,746.54	-	911.26	5,256.65	43,583.45
<b>Reductions to stock</b>											
Extractions	1,536.29	3,377.27	3,794.03	3,896.39	3,852.60	3,508.92	3,061.93	3,844.31	5,130.32	5,212.47	2,398.29
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	1,536.29	3,377.27	3,794.03	3,896.39	3,852.60	3,508.92	3,061.93	3,844.31	5,130.32	5,212.47	2,398.29
<b>Revaluation of the stock</b>	24,635.27	10,854.55	-1,999.40	2,414.81	9,156.83	26,076.14	-8,670.25	31,152.62	50,201.80	-18,383.21	-134,866.25
<b>Closing Stocks</b>	48,486.67	65,441.77	73,900.24	75,379.71	95,829.39	118,396.61	127,410.97	154,719.28	200,702.03	182,363.00	88,681.92

## Copper

### Physical Accounts

Figure 16 shows the percent share of Classes A, B, and C to the total copper reserves during the accounting period 2002-2012. Class C yielded the largest share with an average of 75.7 percent, followed by Class A 12.8 percent, and Class B 11.5 percent

**Figure 16. Percent distribution and volume of closing stocks of Class A, B, and C copper reserves, in metal content, in million metric tons, 2002-2012**



### Class A Copper

For Class A copper reserves, a discovery of 4.6 million dry metric tons in 2008 largely influenced the sharp increase of the total stocks of copper reserves. The highest closing stock of copper metal was posted in 2011, with 140.3 million dry metric tons (DMT), while the lowest was 132.5 million DMT in 2007.

The production of copper metal from 2002 to 2008 on the average was 80,224 DMT. Between 2008 and 2009 it more than doubled from 92,808.8 DMT to 203,414.4 DMT due to an increased demand for copper metals. A huge demand for copper and nickel was recorded during the period 2008-2009 as these materials were needed for the construction of the Beijing National Stadium. From 2009 to 2012, production of copper grew at an average of 240,562.3 DMT.

**Table 20. Physical account: Class A Copper reserve, in metal content, in million dry metric ton, 2002-2012**

Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	132.81	132.74	132.65	132.76	132.68	132.61	132.52	137.08	136.88	136.64	140.32
<b>Addition to Stock</b>											
Discoveries	-	-	0.17	-	-	-	4.66	-	-	3.93	-
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total additions to stock</b>	-	-	0.17	-	-	-	4.66	-	-	3.93	-
<b>Reductions to stock</b>											
Extractions	0.08	0.08	0.07	0.08	0.07	0.09	0.09	0.20	0.24	0.25	0.27
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	0.08	0.08	0.07	0.08	0.07	0.09	0.09	0.20	0.24	0.25	0.27
<b>Closing Stocks</b>	132.74	132.65	132.76	132.68	132.61	132.52	137.08	136.88	136.64	140.32	140.05

Figure 17. Closing stocks, discoveries and extraction of Class A copper reserves, in metal content, in dry metric ton, 2002-2012

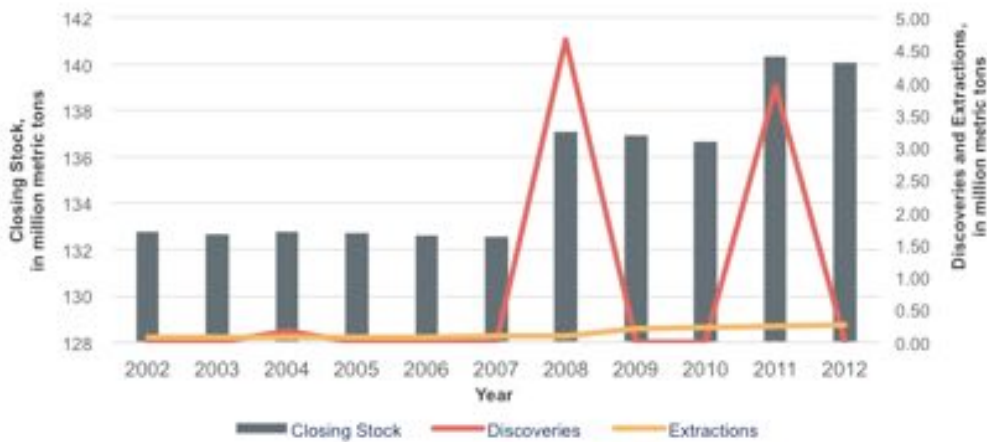
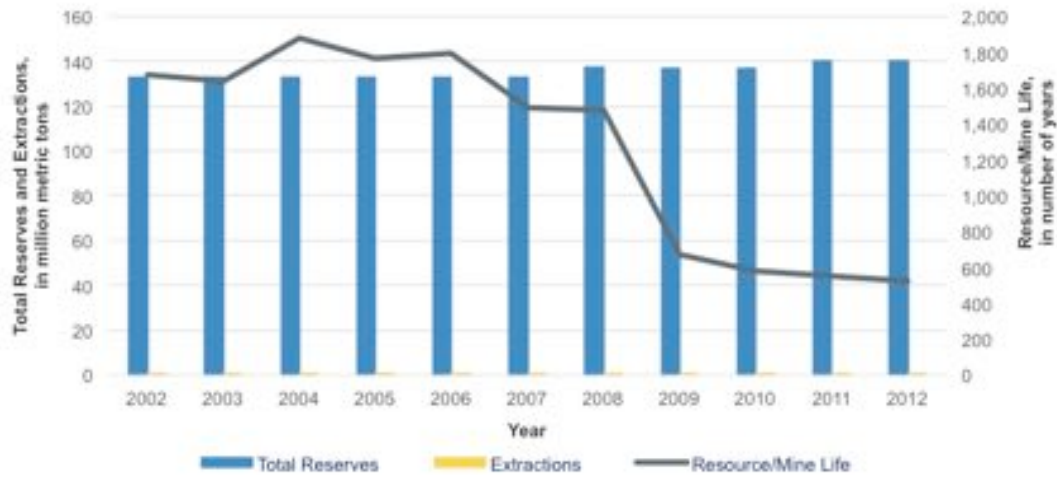


Table 21. Copper Class A resource life/mine life and net change, 2002-2012

Year	Total Reserved in Million MT	Extraction in Million MT	Net change in Million MT			Resource life/mine life in years
			Extraction/ Discoveries	Upward/ Downward Reapprais als	Addition/ reduction in stocks	
2002	132.74	0.08	-0.08	-	-0.08	1,676
2003	132.65	0.08	-0.08	-	-0.08	1,639
2004	132.76	0.07	0.10	-	0.10	1,881
2005	132.68	0.08	-0.08	-	-0.08	1,762
2006	132.61	0.07	-0.07	-	-0.07	1,792
2007	132.52	0.09	-0.09	-	-0.09	1,493
2008	137.08	0.09	4.56	-	4.56	1,477
2009	136.88	0.20	-0.20	-	-0.20	673
2010	136.64	0.24	-0.24	-	-0.24	577
2011	140.32	0.25	3.68	-	3.68	552
2012	140.05	0.27	-0.27	-	-0.27	522

As shown in Figure 18, the mine life of copper reserves steadily dropped. In 2002, the estimated mine life was 1,676 years. The highest estimated mine life was 1,792 years in 2006. In 2012, the estimated mine life was 522 years. The average period before the copper reserves would be fully extracted was 1,277 years.

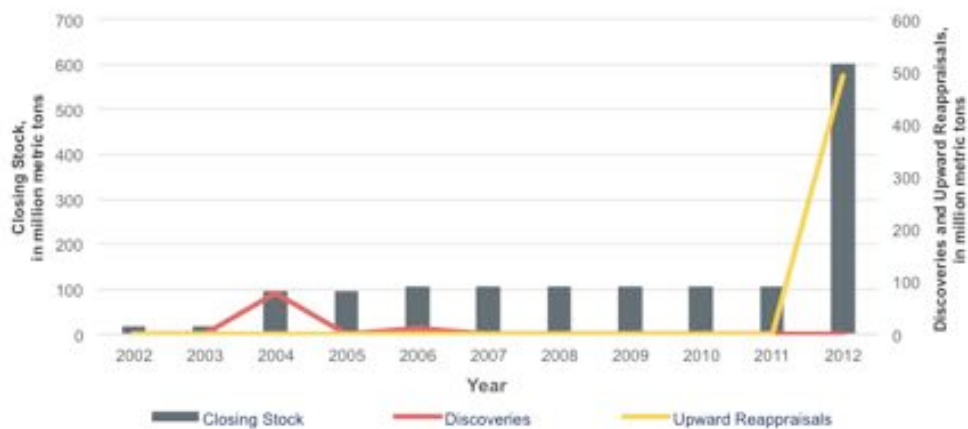
**Figure 18. Total reserves, extraction and mine life, Copper, 2002-2012**



### Class B Copper

For Class B, no recorded additions or reductions were posted in 2002 and 2003, putting the closing stocks at a steady volume of 15.1 million DMT. Intermittent discoveries were reported during the accounting period. The highest amount of discoveries posted was in 2004 at 78.3 million DMT while the lowest was recorded in 2006 at 11.7 million DMT. In 2012 an upward reappraisal was reported, resulting in a surge in the closing stock of Class B copper at 598.5 million DMT.

**Figure 19. Closing stocks, discoveries and reappraisals of Class B copper reserves, in metal content, in dry metric ton, 2002-2012**



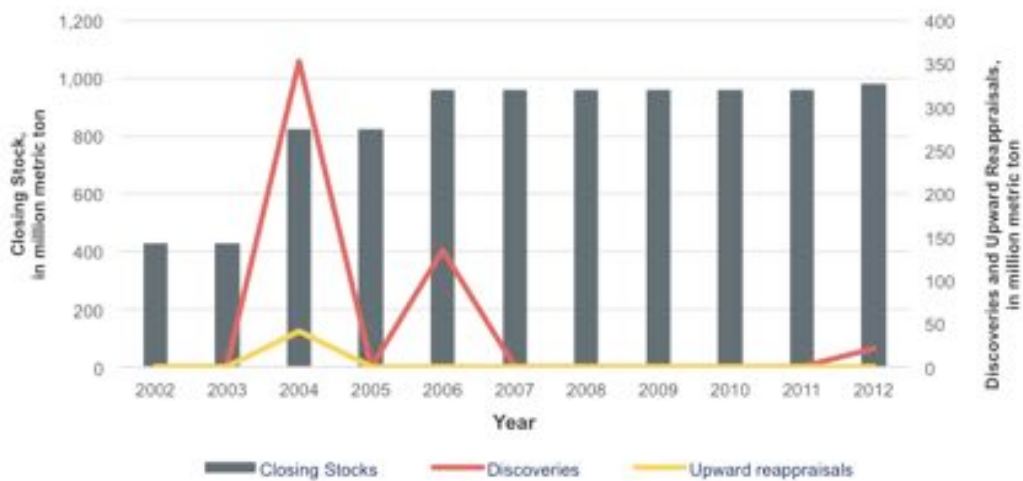
**Table 22. Physical account: Class B Copper reserve, in metal content, in million dry metric ton, 2002-2012**

Class B	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Opening Stocks	15.10	15.10	15.10	93.42	93.42	105.12	105.12	105.12	105.12	105.12	105.12
Addition to Stock											
Discoveries	-	-	78.32	-	11.70	-	-	-	-	-	-
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total additions to stock</b>	-	-	78.32	-	11.70	-	-	-	-	-	-
Reductions to stock											
Extractions	-	-	-	-	-	-	-	-	-	-	-
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	-	-	-	-	-	-	-	-	-	-	-
Closing Stocks	15.10	15.10	93.42	93.42	105.12	105.12	105.12	105.12	105.12	105.12	105.12

## Class C Copper

The highest additions to stock for Class C of copper occurred in 2004, as a result of an upward reappraisal and discoveries, estimated at 394.2 million DMT. The said additions almost doubled the 2003 stocks to 819.5 million DMT. With the discoveries reported in 2006 and 2012, the closing of Class C copper at the end of the accounting period was pegged at 976.8 million DMT.

**Figure 20. Closing stocks, discoveries, and reappraisals of Class C copper reserves, in metal content, in dry metric ton, 2002-2012**



**Table 23. Physical account: Class C Copper reserve, in metal content, in million dry metric ton, 2002-2012**

Class C	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	425.29	425.39	425.29	819.47	819.47	954.76	954.76	954.76	954.76	954.79	954.79
<b>Addition to Stock</b>											
Discoveries	-	-	353.48	-	135.29	-	-	-	0.03	-	22.06
Upward reappraisals	-	-	40.70	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total additions to stock</b>	-	-	394.18	-	135.29	-	-	-	0.03	-	22.06
<b>Reductions to stock</b>											
Extractions	-	-	-	-	-	-	-	-	-	-	-
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	-	-	-	-	-	-	-	-	-	-	-
<b>Closing Stocks</b>	425.29	425.29	819.47	819.47	954.76	954.76	954.76	954.76	954.79	954.79	976.85

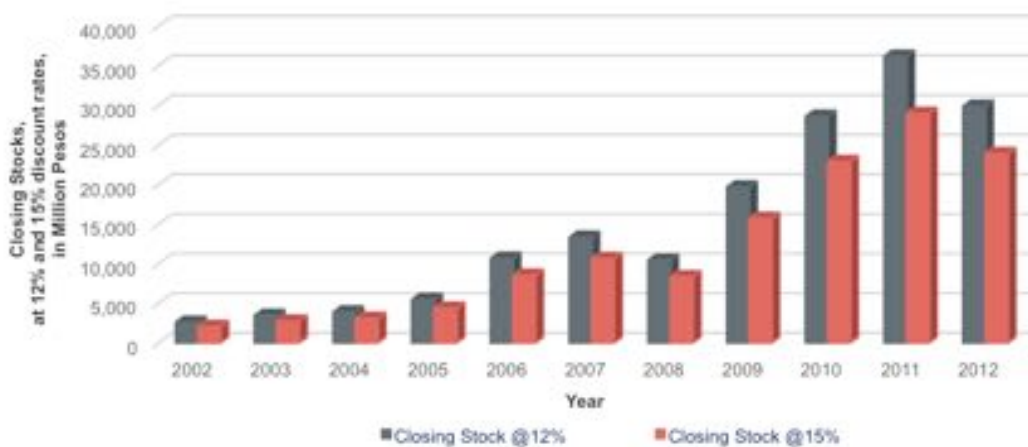


## Monetary Accounts

The resource value of copper at 12 percent and 15 percent discount rates were highest in 2011 with a value of PhP 258 and PhP 206 per metric ton, respectively, while the lowest was evident in 2002 at PhP 19 and PhP 15 per metric ton, respectively.

The unit resource rent for copper peaked in 2007, at PhP 18,024 per metric ton (see Figure 21), and was at its lowest in 2002, with a value of PhP 3,972 per metric ton.

**Figure 21. Copper unit resource rent and resource value, per metric ton, in pesos, 2002-2012**



### Resource/reserve value at 12 Percent Discount Rate

In 2002, the resource value of copper reserves was estimated at PhP 2,621.6 million using 12 percent discount rate. Since then it climbed steadily until 2007, posting an average increase of almost 41 percent. In 2012, the resource value of copper reserves at 12 percent discount rate was recorded at PhP 29,886.6 million (see Table 24).

### Resource/reserve value at 15 Percent Discount Rate

At 15 percent discount rate, the resource value of copper reserves in 2002 was estimated at PhP 2,097.3 million (see Table 25). In 2012, the corresponding resource value was PhP 23,909.3 million.

**Table 24. Monetary account: Class A Copper reserves, at 12 percent discount rate, in million pesos, 2002-2012**

Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	2,817.73	2,621.64	3,464.46	3,902.60	5,503.53	10,684.14	13,336.04	10,465.19	19,688.94	28,615.27	36,212.76
<b>Addition to Stock</b>											
Discoveries	-	-	4.48	-	-	-	468.66	-	-	823.70	0.01
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total additions to stock</b>	-	-	4.48	-	-	-	468.66	-	-	823.70	0.01
<b>Reductions to stock</b>											
Extractions	1.68	1.60	1.84	2.21	3.07	7.15	9.34	15.53	34.06	53.19	69.17
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	1.68	1.60	1.84	2.21	3.07	7.15	9.34	15.53	34.06	53.19	69.17
<b>Revaluation of the stock</b>	-194.40	844.41	435.50	1,603.14	5,183.68	2,659.06	-3,330.17	9,239.28	8,960.39	6,826.98	-6,256.95
<b>Closing Stocks</b>	2,621.64	3,464.46	3,902.60	5,503.53	10,684.14	13,336.04	10,465.19	19,688.94	28,615.27	36,212.76	29,886.64

**Table 25. Monetary account: Class A Copper reserves, at 15 percent discount rate, in million pesos, 2002-2012**

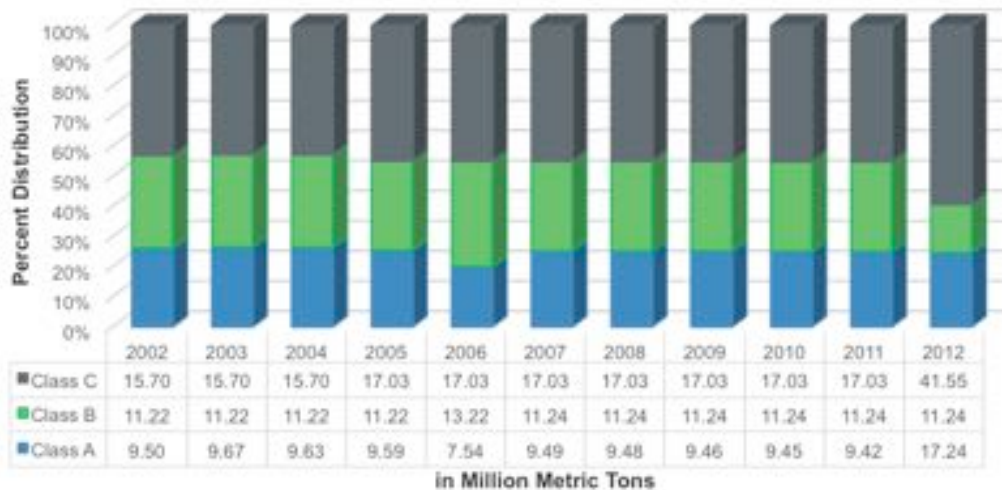
Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	2,254.18	2,097.31	2,771.57	3,122.08	4,402.82	8,547.31	10,668.83	8,372.16	15,751.15	22,892.21	28,970.21
<b>Addition to Stock</b>											
Discoveries	-	-	3.59	-	-	-	374.93	-	-	658.96	0.01
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total additions to stock</b>	-	-	3.59	-	-	-	374.93	-	-	658.96	0.01
<b>Reductions to stock</b>											
Extractions	1.34	1.28	1.47	1.77	2.45	5.72	7.47	12.42	27.25	42.55	55.34
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	1.34	1.28	1.47	1.77	2.45	5.72	7.47	12.42	27.25	42.55	55.34
<b>Revaluation of the stock</b>	-155.52	675.53	348.40	1,282.51	4,146.94	2,127.24	-2,664.13	7,391.42	7,168.31	5,461.58	-5,005.56
<b>Closing Stocks</b>	2,097.31	2,771.57	3,122.08	4,402.82	8,547.31	10,668.83	8,372.16	15,751.15	22,892.21	28,970.21	23,909.32

# Chromite

## Physical Account

As shown in Figure 21, Class C of chromite reserves had the highest average share recorded among the three classes at 45.8 percent from 2002 to 2012. The difference between the highest and lowest shares by 16.4 percent, with a minimum share of 42.9 percent in 2003 and a maximum share of 59.3 percent in 2012. Class B had an average share of 29.3 percent during the 2002-2012 period, while the difference between the highest and lowest shares was 18.9 percent. The minimum share was pegged at 16.1 percent in 2012 while the maximum share, which was noted in 2006, was 35.0 percent. Class A had the lowest average share of 24.9 percent for the period 2002-2012. The highest and lowest shares over the ten-year period varied by 6.5 percent, with a minimum share of 20.0 percent in 2006 and maximum share of 26.4 percent in 2003.

**Figure 22. Percent distribution and volume of closing stocks of Class A, B, and C Chromite reserves, in ore, in million metric tons, 2002-2012**



## Class A Chromite

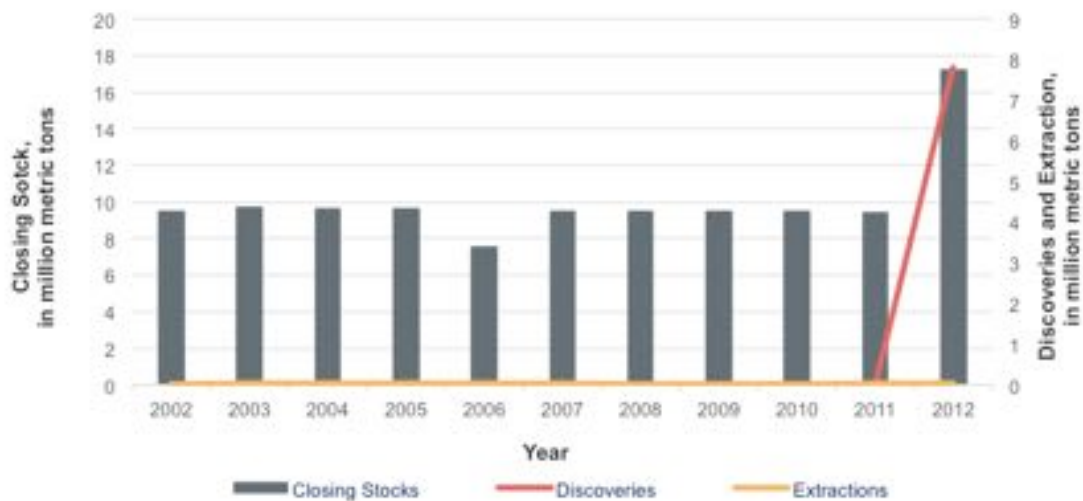
The closing stocks of Class A chromite were continuously rising at an average of 9.9 million MT per year throughout the accounting period. The

highest closing stock of Class A was recorded in 2012 at 17.2 million MT owing to the high recorded discoveries and upward reappraisals during the year. The lowest closing stock recorded was in 2006 at 7.5 million MT.

The average extraction per year from 2002 to 2012 was 29.1 thousand MT. The highest extraction of chromite was registered in 2006 at 46.7 thousand MT while the lowest was 14.3 thousand MT in 2009. The extraction grew from 2002 to 2006 at an average of 14.1 percent per year. By 2007 it declined sharply, at 32.4 percent, from the previous year. Extraction also slowed from 15.3 thousand MT in 2008 to 14.8 thousand MT in 2010. Growth ensued in 2011 at 72.1 percent from the previous year. As of 2012, the extraction was at 36.6 thousand MT.

Discoveries for Class A were recorded in 2009 and 2012 at 1.0 thousand MT and 7.8 million MT, respectively.

**Figure 23. Discoveries, extraction, and closing stocks of Class A chromite reserves, 2002-2012**



**Table 26. Physical account: Class A Chromite reserve, in ore, in million metric tons, 2002-2012**

Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	8.87	9.50	9.67	9.63	9.59	7.54	9.49	9.48	9.46	9.54	9.42
<b>Addition to Stock</b>											
Discoveries	-	-	-	-	-	-	-	-	-	-	7.08
Upward reappraisals	0.65	0.20	-	-	-	-	-	-	-	-	0.05
Reclassifications	-	-	-	-	-	1.98	-	-	-	-	-
<b>Total additions to stock</b>	0.65	0.20	-	-	-	1.98	-	-	-	-	7.85
<b>Reductions to stock</b>											
Extractions	0.02	0.03	0.04	0.04	0.05	0.03	0.02	0.01	0.01	0.03	0.04
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	2.00	-	-	-	-	-	-
<b>Total reduction in stock</b>	0.02	0.03	0.04	0.04	2.05	0.03	0.02	0.01	0.01	0.03	0.04
<b>Closing Stocks</b>	9.50	9.67	9.63	9.59	7.54	9.49	9.48	9.46	9.45	9.42	17.24

**Table 27. Chromite Class A resource life/mine life and net change, 2002-2012**

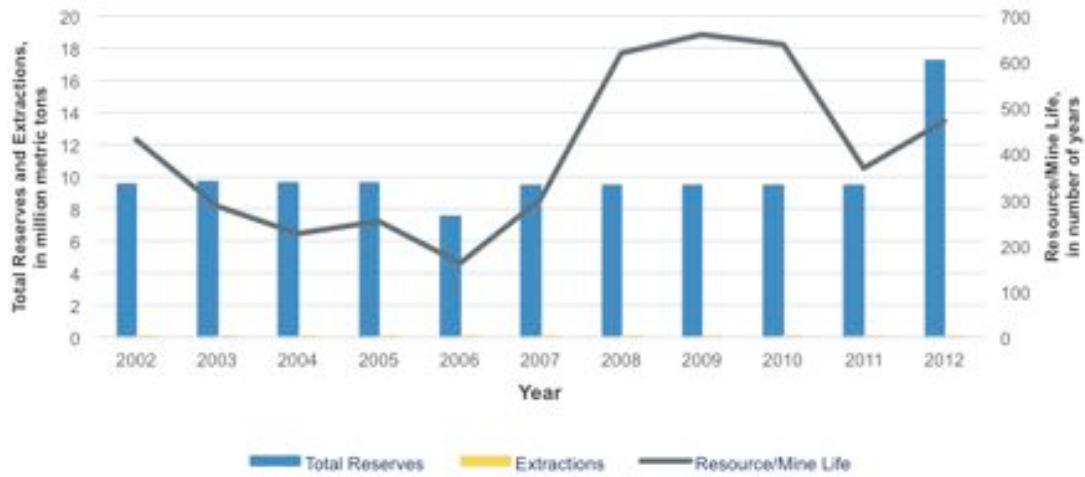
Year	Total Reserves in Million MT	Extraction in Million MT	Net change in Million MT			Resource life/mine life in years
			Extraction/ Discoveries	Upward/ Downward Reappraisals	Addition/ reduction in stocks	
2002	9.50	0.02	-0.02	0.65	0.63	432
2003	9.67	0.03	-0.03	0.20	0.17	286
2004	9.63	0.04	-0.04	-	-0.04	225
2005	9.59	0.04	-0.04	-	-0.04	252
2006	7.54	0.05	-0.05	-	-2.05	161
2007	9,49	0.03	-0.03	-	1.95	300
2008	9.48	0.02	-0.02	-	-0.02	621
2009	9.48	0.01	-0.01	-	-0.01	661
2010	9.45	0.01	-0.01	-	-0.01	638
2011	9.42	0.03	-0.03	-	-0.03	370
2012	17.24	0.04	7.76	0.05	7.81	471

Figure 24 shows increasing extractions and declines in the mine life of the total chromite reserves. Moreover, the highest estimated mine life was in 2009 at 661 years, which also shows the lowest recorded extraction at 14 thousand MT in the same year.

The lowest estimated mine life was determined in 2006 at 161 years. During the year, 46.7 thousand MT of extraction was recorded – the highest recorded throughout the accounting period, when registered no additions to stock.

The average extraction rate from 2002 to 2012 was 0.7 percent of the Class A total chromite reserves. Furthermore, 402 years was the average estimated mine lifespan of the remaining chromite reserves.

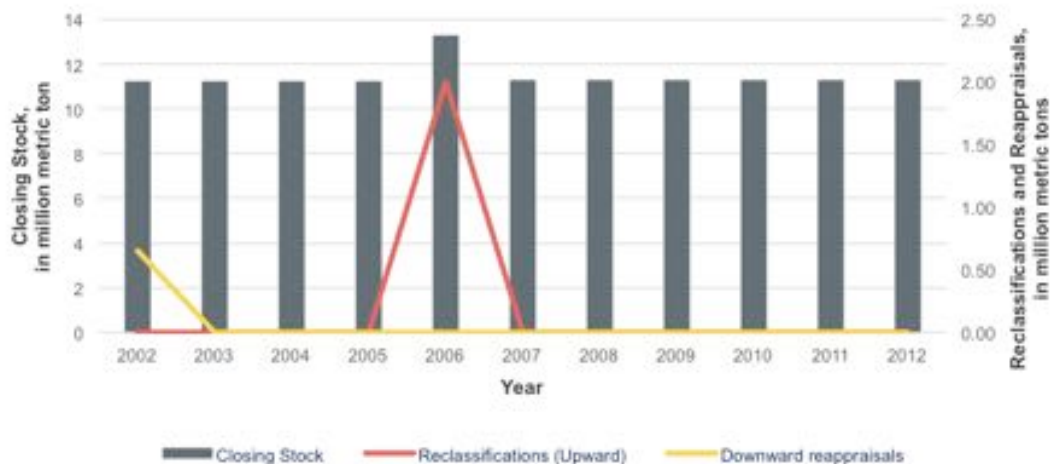
**Figure 24. Mine life and extractions of Class A Chromite reserves, 2002-2012**



### Class B Chromite

The stock of Class B chromite reserves in 2002 was pegged at 11.2 MT. Four years later, in 2006, the stock rose to 13.2 million MT, with the upward reclassification of an estimated 2.0 million MT. This was reduced to 11.2 million MT, following the downward reclassification of 1.9 million MT to Class C chromite. From 2008 to 2012, the closing stock of chromite stayed at 11.2 million MT (see Table 28).

**Figure 25. Closing stocks, reclassification and reappraisals of Class B chromite reserves, in metric tons, 2002-2012**





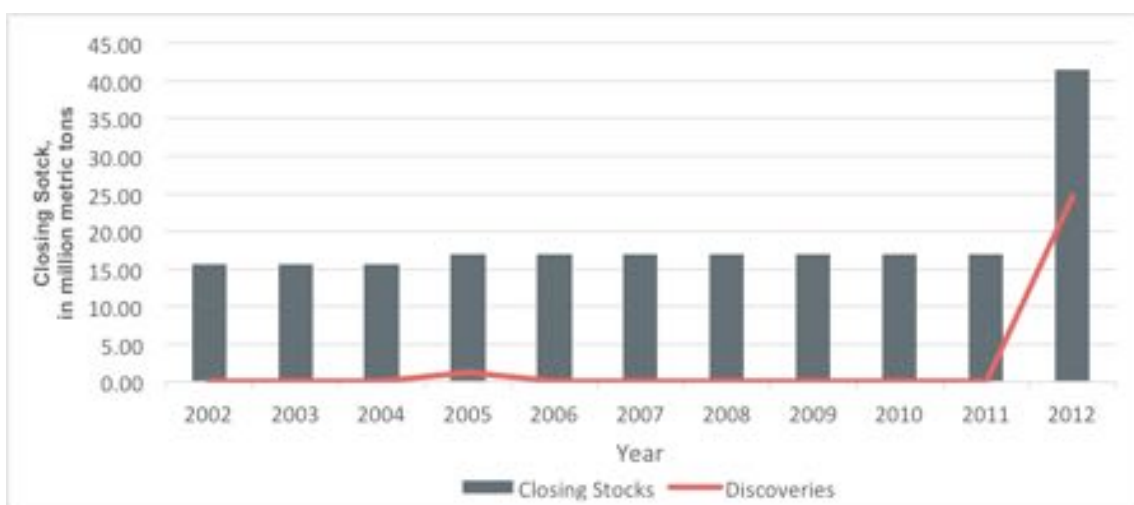
**Table 28. Physical account: Class B Chromite reserve, in ore, in million metric tons, 2002-2012**

Class B	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	11.87	11.22	11.22	11.22	11.22	13.22	11.24	11.24	11.24	11.24	11.24
<b>Addition to Stock</b>											
Discoveries	-	-	-	-	-	-	-	-	-	-	-
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	2.00	-	-	-	-	-	-
<b>Total additions to stock</b>	-	-	-	-	2.00	-	-	-	-	-	-
<b>Reductions to stock</b>											
Extractions	-	-	-	-	-	-	-	-	-	-	--
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	0.65	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	1.98	-	-	-	-	-
<b>Total reduction in stock</b>	0.65	-	-	-	-	1.98	-	-	-	-	-
<b>Closing Stocks</b>	11.22	11.22	11.22	11.22	13.22	11.24	11.24	11.24	11.24	11.24	11.24

## Class C Chromite

With the discoveries of 24.5 million MT in 2012, the closing stock of Class C chromite reserves was pegged at 41.5 million MT, the highest recorded closing stock throughout the accounting period (see Table 29). No reductions in stocks were recorded for Class C chromite reserves between 2002 and 2012.

**Figure 26. Closing stocks, reclassification and reappraisals of Class C chromite reserves, in metric tons, 2002-2012**



## Monetary Accounts

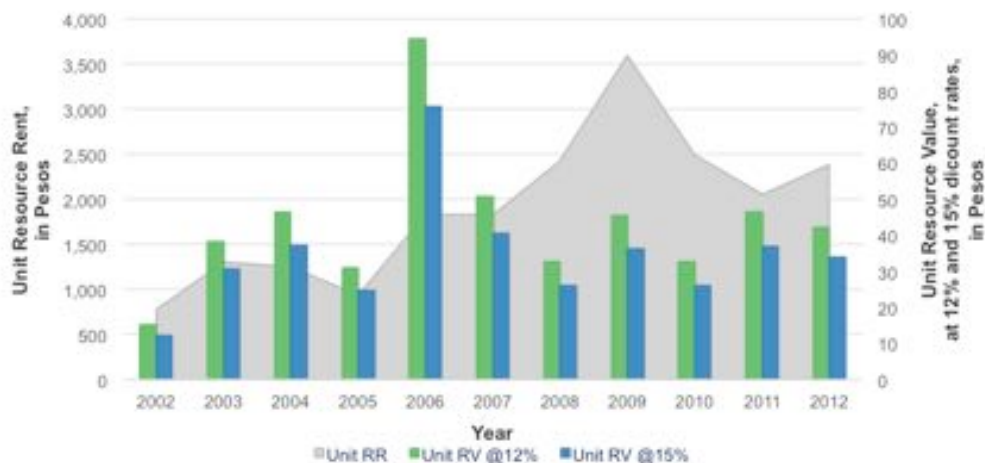
The unit resource rent of chromite reserves averaged PhP 1,667.3 per metric ton from 2002 to 2012. The highest unit resource rent was PhP 3,598.9 per metric ton in 2009, which reflects the lowest extraction in the same year at 0.01 million MT. The lowest unit resource rent was PhP 786.9 per metric ton in 2002. From 2005 to 2008, it increased to PhP 1,481.8 per metric ton. The unit resource rent declined sharply by 76.8 percent between 2009 and 2011.

Meanwhile, the unit resource value of chromite reserves at 12 percent and 15 percent discount rates was highest in 2006 at PhP 95 per metric ton and PhP 15 per metric ton, respectively. The unit resource value at 12 percent and 15 percent discount rates was lowest in 2002 at PhP 15 per metric ton and PhP 12 per metric ton, respectively (see Figure 27).

**Table 29. Physical account: Class C Chromite reserve, in ore, in million metric tons, 2002-2012**

Class C	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	15.70	15.70	15.70	15.70	17.03	17.03	17.03	17.03	17.03	17.03	17.03
<b>Addition to Stock</b>											
Discoveries	-	-	-	1.33	-	-	-	-	-	-	-
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total additions to stock</b>	-	-	-	1.33	-	-	-	-	-	-	-
<b>Reductions to stock</b>											
Extractions	-	-	-	-	-	-	-	-	-	-	--
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	-	-	-	-	-	-	-	-	-	-	-
<b>Closing Stocks</b>	15.70	15.70	15.70	17.03	17.03	17.03	17.03	17.03	17.03	17.03	17.03

**Figure 27. Chromite unit resource rent and resource value per metric ton, in pesos, 2002-2012**



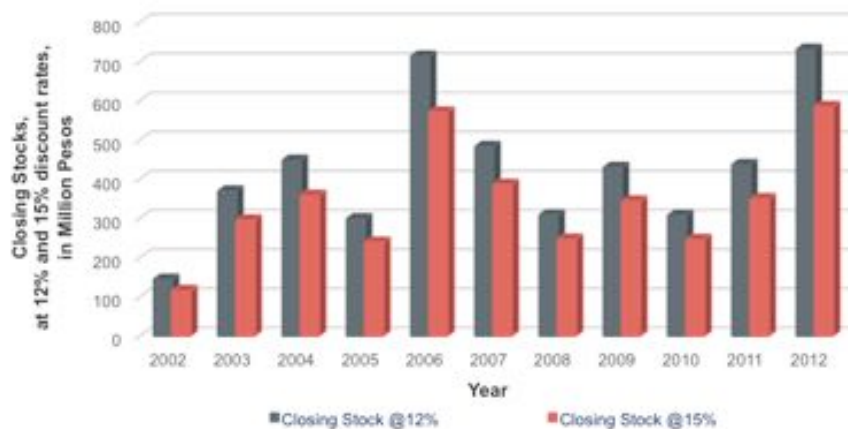
**Resource/reserve value at 12 Percent Discount Rate**

The highest resource value of Class A chromite reserves at 12 percent (see Table 30) was pegged at PhP 730.6 million in 2012 while the lowest was posted in 2002 at PhP 144.3 million.

**Resource/reserve value at 15 Percent Discount Rate**

The highest resource value of Class A chromite reserves at 15 percent discount rate was posted in 2012 at PhP 584.5 million while the lowest was recorded in 2002 at PhP 115.4 million (see Table 31).

**Figure 28. Class A chromite reserves closing stocks, at 12 and 15 percent discount rates, 2002-2012**



**Table 30. Monetary account: Class A Chromite reserve, at 12 percent discount rate, in million pesos, 2002-2012**

Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	264.53	144.28	369.22	447.82	298.62	713.50	482.59	308.27	429.47	307.35	436.81
<b>Addition to Stock</b>											
Discoveries	-	-	-	-	-	-	-	0.05	-	-	330.62
Upward reappraisals	9.87	7.69	-	-	-	-	-	-	-	-	2.09
Reclassifications	-	-	-	-	-	100.85	-	-	-	-	-
<b>Total additions to stock</b>	9.87	7.69	-	-	-	100.85	-	0.05	-	-	332.71
<b>Reductions to stock</b>											
Extractions	0.33	1.29	1.99	1.19	4.42	1.61	0.50	0.65	0.48	1.18	1.55
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	189.29	-	-	-	-	-	-
<b>Total reduction in stock</b>	0.33	1.29	1.99	1.19	193.72	1.61	0.50	0.65	0.48	1.18	1.55
<b>Revaluation of the stock</b>	-129.79	218.54	80.59	-148.01	608.59	-330.13	-173.83	121.80	-121.62	130.64	-37.36
<b>Closing Stocks</b>	144.28	369.22	447.82	298.62	713.50	482.59	308.27	429.47	307.35	436.81	730.61

**Table 31 Monetary account: Class A Chromite reserve, at 15 percent discount rate, in million pesos, 2002-2012**

Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	264.53	144.28	369.22	447.82	298.62	713.50	482.59	308.27	429.47	307.35	436.81
<b>Addition to Stock</b>											
Discoveries	-	-	-	-	-	-	-	0.05	-	-	330.62
Upward reappraisals	9.87	7.69	-	-	-	-	-	-	-	-	2.09
Reclassifications	-	-	-	-	-	100.85	-	-	-	-	-
<b>Total additions to stock</b>	9.87	7.69	-	-	-	100.85	-	0.05	-	-	332.71
<b>Reductions to stock</b>											
Extractions	0.33	1.29	1.99	1.19	4.42	1.61	0.50	0.65	0.48	1.18	1.55
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	189.29	-	-	-	-	-	-
<b>Total reduction in stock</b>	0.33	1.29	1.99	1.19	193.72	1.61	0.50	0.65	0.48	1.18	1.55
<b>Revaluation of the stock</b>	-129.79	218.54	80.59	-148.01	608.59	-330.13	-173.83	121.80	-121.62	130.64	-37.36
<b>Closing Stocks</b>	144.28	369.22	447.82	298.62	713.50	482.59	308.27	429.47	307.35	436.81	730.61

## **6 | Recommendations and future directions**

### **Improvement of the generation of the administrative data**

Administrative data from the MGB are rich sources of relevant information for mineral asset accounts. To maximize their utilization, it's important that the generation and collation of such data are done systematically. The use of an appropriate information technology software/hardware is also imperative.

Since data requirements change over time, administrative forms may be revised or enhanced to incorporate the needed data vis-a-vis improvements in the estimation of the sector.

It is also highly recommended that the Integrated Annual Report (IAR) submitted by mining firms to the MGB be included as designated statistics of the MGB. The IAR contains data relevant to environmental accounting, which needs to be processed regularly.

The PSA's System of Designated Statistics is a mechanism for the identification and generation of crucial data for administrators, planners, policymakers, and decision makers in the government and private sectors. It is also an important tool for addressing problems, such as data gaps, duplication, delayed release and inaccessibility of important datasets, and serves as a framework for setting priorities in data production. The designation of statistics indicate the implementing agency and includes the prescribed frequency of collection, geographic disaggregation, and schedule of data dissemination.

### **Localization of the UNFC-2009**

A standard reporting or classification system of extractive resources, i.e., mineral and energy resources, should be adopted by the Philippines. The MGB is using the CRIRSCO to classify the mineral resources/reserves. On the other hand, SEEA 2012 is recommending the use of UNFC-2009.

To harmonize the classification of mineral resources/reserves with internationally and acceptable classification systems, a localized version of the UNFC-2009 should be crafted. Since the UNFC covers not only minerals but also energy resources, the Technical Working Groups on Mineral and Energy Resources Statistics may be jointly convened for this purpose. The proposed localized version of the UNFC can then be submitted to the IAC on Environment and Natural Resources Statistics and the PSA Board for approval/adoption.

### **Expansion of the coverage of mineral asset accounts**

The compilation of the mineral asset accounts should be expanded to include other metallic and non-metallic minerals. It will give a comprehensive picture of the mineral resources/reserves of the country.

### **Enhancement of the estimation methodology for monetary accounts**

To generate better estimates, the compilation methodology should be enhanced. In particular, the parameters used, e.g., compensation of employees, depreciation, etc., should be improved or updated.



## 7 | Appendices

### Appendix 1

#### UNFC-2009 Specifications

The SEEA 2012-Central Framework recommended the use of the UNFC-2009 for mineral asset accounts. The UNFC-2009 is an internationally applicable and acceptable classification system used to build resource inventory. Moreover, it aims to help the stakeholders and policymakers in the assessment of extractive resource for management purposes. The development of UNFC-2009, especially in the harmonization of terminologies and definitions, is fully aligned with CRIRSCO for solid minerals, and the Petroleum Resources Management System (PRMS) of the Society of Petroleum Engineers for oil and gas and other aligned classification systems by means of bridging documents (Griffiths, 2014).

The UNFC was started in 1997 to develop a classification system for solid fuels and mineral commodities. In 2004, the UNFC was extended to include oil, natural gas, and uranium, and mapped to CRIRSCO template and PRMS. UNFC-2009 was approved in late 2009 and published in 2010. UNFC specifications were also published in 2013 under the United Nations Economic Commission for Europe (ECE) Energy Series No. 42.

The UNFC consists of three classes: Classes A, B, and C, and potential deposits. These classes are defined based on three major criteria: Economic and Social Viability (E), Field Project Status and Feasibility (F), and Geological Knowledge (G).

The Economic and Social Viability (E) covers market conditions and social acceptability. This criterion is categorized into E1 in which extraction and sale is economic; E2 in which extraction and sale have not yet been confirmed to be economic but there are reasonable prospects in the foreseeable future; and E3, which posits that there are no economic extractions and sale in the foreseeable future.

The Field Project Status and Feasibility (F) is used for an assessment of the development of a mining operation. Its categories are F1 to F4. Category F1 shows that extraction and sale are taking place, and feasibility for a defined mining operation has been implemented. Subcategories are F1.1, where extraction is currently taking place; F1.2, where infusion of capital funds and development of mining operation are underway; and F1.3, where details on the studies have been sufficiently completed.

Category F2 shows that the feasibility of a mining operation in the foreseeable future is under further evaluation. Its three subcategories are F2.1, where project activities are ongoing to justify development; F2.2, where project activities are on hold and/or subject to significant delay; and F2.3, which indicates limited potential for acquiring additional data. Category F3 signals that feasibility is under preliminary study and cannot be evaluated due to limited data. Category F4 shows that no mining operation has been identified.

Geological Knowledge (G) is categorized based on the level of confidence in the identified quantities of mineral and ore deposits. G1 category indicates a high level of confidence in the mineral quantities, G2 moderate level of confidence, and G3 low level of confidence. The estimated quantities under potential deposit fall under G4 category.

Broadly, UNFC-2009 is categorized based on technical and commercial evaluation studies, specifically on the project status, maturity of feasibility, and resource recovery efficiency of the mining companies. The UNFC-2009 adaptation, based on the local needs determined through mapping and testing, is the key toward continuous development of its specifications and guidelines.

## APPENDIX 2

### Philippine Mining Operational Framework

The schematic diagram in Figure 1, page 36 show the legal and administrative mandatory requirements for Philippine mining operations. Exploration is the first phase of a mining operation, which spans six to eight years, including the pre-feasibility and feasibility study of metallic minerals. The said mining stage also consists of a geological study of the potential mineral resources in an area covered by an exploration permit.

The Declaration of Mining Project Feasibility (DMPF) shows the commercial viability of a project (based on RA 7942, Section 24). It also reflects the economic and financial capability, as well as the legal, environmental, and social acceptability, of a mining company to conduct an operation.

The DMPF mandatory requirements for the acceptance are: 1) Sworn Declaration of Mining Project Feasibility (DMPF); 2) DENR Secretary's Certificate attesting to a Board Resolution for the accomplishment of the DMPF; 3) Mining Feasibility Study Report prepared by the MGB (used for the validation of the exploration results and mining feasibility study report of the holder); 4) three-year work program; 5) approved survey plan, 6) Environmental Compliance Certificate (ECC); 7) Environmental Protection and Enhancement Program (EPEP); 8) Final Mine Rehabilitation and/or Decommissioning Plan (FMRDP); 9) Social Development and Management Program (SDMP); 10) Final Exploration Report; 11) project approval/endorsement by the Sanggunian (a local legislative body) or the community concerned; 12) proof of technical competence; 13) proof of financial capability to undertake mining activities; and other requirements that will may be imposed by the DENR.

An approved DMPF grants the holder an exclusive right to the Mineral Production Sharing Agreement (MPSA), or Financial or Technical Assistance Agreement (FTAA) (Ibid). The MPSA and FTAA has a term of 25 years from the date of issuance and renewable for another 25 years.

SEAA Classes		Corresponding UNFC-2009 Project Categories		
		E	F	G
		Economic and social viability	Filed project status and feasibility	Geological knowledge
Known deposits	Class A: Commercially Recoverable Resources	E1: Extraction and sale has been confirmed to be economically viable	F1: Feasibility of extraction by a defined development project or mining operation has been confirmed.	Quantities associated with a known deposit that can be estimated with a high (G1), moderate (G2) or low (G3) level of confidence
	Class B: Potentially Commercially Recoverable Resources	E2: Extraction and sale is expected to become economically viable in the foreseeable future	F2.1: Project activities are ongoing to justify development in the foreseeable future Or F2.2: Project activities are on hold and/or where justification as a commercial development may be subject to significant delay	
			F2.2: Project activities are on hold and/or where justification as a commercial development may be subject to significant delay Or F2.3: There are no current plans to develop or to acquire additional data at the time due to limited potential Or F4: No development project or mining operation has been identified	
Class C: Non-Commercial and Other Known Deposits	E3: Extraction and sale is not expected to become economically viable in foreseeable future or evaluation is at too early a stage to determine economic viability.	F2.2: Project activities are on hold and/or where justification as a commercial development may be subject to significant delay Or F2.3: There are no current plans to develop or to acquire additional data at the time due to limited potential Or F4: No development project or mining operation has been identified		
Potential deposits (not included in SEAA)	Exploration Projects Additional quantities in place	E3: Extraction and sale is not expected to become economically viable in foreseeable future or evaluation is at too early a stage to determine economic viability.	F3: Feasibility of extraction by a defined development project or mining operation cannot be evaluated due to limited technical data Or F4: No development project or mining operation has been identified	Estimated quantities associated with a potential deposit, based primarily on indirect evidence (G4)

Notes

<sup>1</sup> Including on-production projects, projects approved for development and projects justified for development.

<sup>2</sup> Including economic and marginal development projects pending and development projects on hold.

<sup>3</sup> Potential commercial projects may also satisfy requirements for E1.

<sup>4</sup> Including unclarified development projects, non-viable development projects, and additional quantities in place.

Source: System of Environmental-Economic Accounting (SEEA) 2012 - Central Framework.

The development and construction phase commences on the date of approval of the DMPF and ends on the day immediately prior to the date of Commencement of Commercial Production<sup>7</sup>, a written declaration approved by the MGB Regional Office, signifying the start of mining operations. The production period comes after the extraction and sales activity. The MPSA or FTAA holder has the right to continue exploration activities (Primer on the Philippine Minerals Industry, 2015).

Mining companies must comply with regular reporting requirements, specifically the Monthly Report on Production, Sales and Inventory of Metallic Minerals and Employment (as prescribed in MGB Forms Nos. 29-1 to 29-9), Integrated Annual Report, Annual Mineral Reserve Inventory Report, Monthly General Accident Report, Monthly Explosive Consumption Report, Semi-Annual Report on Mine Waste and Tailings Generated, Semi-Annual Status Report on the Environmental Work Program, Quarterly Report on Production, Annual and Quarterly Status Report (based on the Work Program of MPSA/FTAA Contractor), and other reports to be required by the MGB director. consistent with Section 270 of DAO No. 2010-21, Providing for a Consolidated Department of Environment and Natural Resources Administrative Order for the Implementing Rules and Regulations of Republic Act No. 7942, otherwise known as the “Philippine Mining Act of 1995”.

Finally, the Final Mine Decommissioning Phase requires the mining companies to undertake an Environmental Protection Enhancement Program (EPEP) and the Final Mine Rehabilitation Development Program (FMRDP).

---

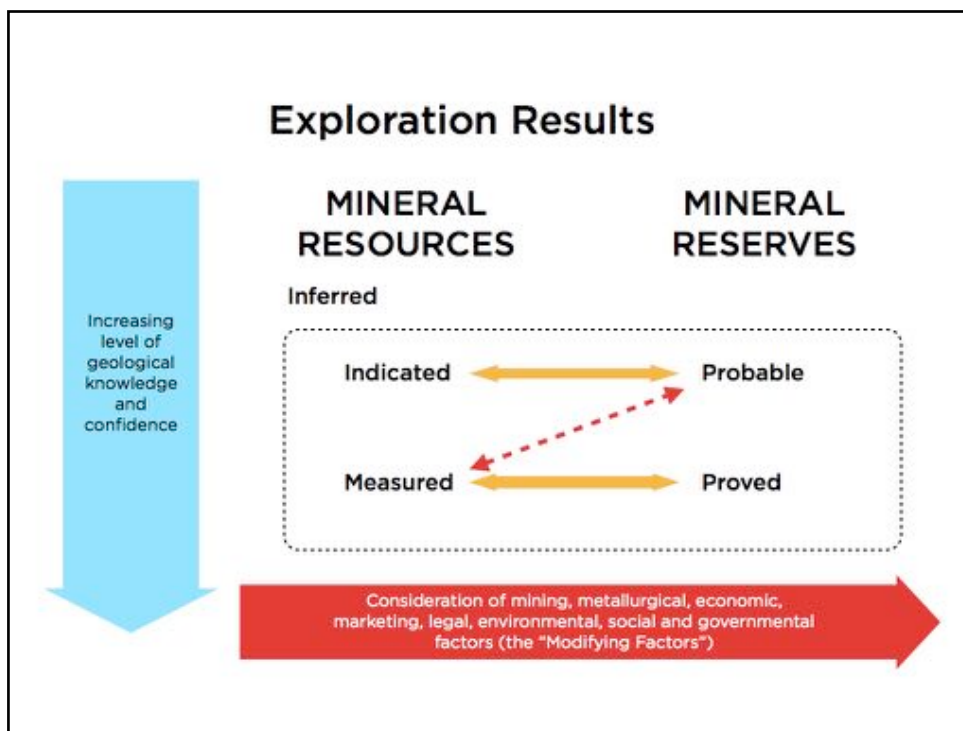
<sup>7</sup> See Primer on the Philippine Minerals Industry, 2015 ([http://www.bakermckenzie.com/-/media/files/insight/publications/2015/02/primer-on-the-philippine-minerals-industry/files/read-publication/fileattachment/bk\\_manila\\_primermineralsindustry\\_2015.pdf](http://www.bakermckenzie.com/-/media/files/insight/publications/2015/02/primer-on-the-philippine-minerals-industry/files/read-publication/fileattachment/bk_manila_primermineralsindustry_2015.pdf))

## APPENDIX 3

### International Mineral and Energy Resources Classification Systems

#### CRIRSCO Classification System

The mineral and energy industries are continuing their efforts toward the standardization of reporting systems for extractive resources. A key component of these initiatives is the CRIRSCO, which provides extensive guidelines on the classification criteria and mandatory system reporting on the tonnage/grade estimates and definitions for mineral resource and ore reserve classes. The members of CRIRSCO are as follows: Canadian Institute of Mining, Metallurgy and Petroleum; Joint Ore Reserves Committee of Australia; Society for Mining, Metallurgy and Exploration of the United States; South Africa Mineral Resource Committee; Institute of Mining Engineers of Chile; Pan-European Reserves Committee of Western Europe; and Institute of Materials, Minerals and Mining of the United Kingdom.



The CRIRSCO Classification System

The CRIRSCO classification is based on mineral resources and reserves while the standardized criteria are guided by the increasing level of geological confidence, particularly in terms of the form, grade or quality, and quantity, which are reasonable prospects for eventual economic extraction.

Classes of mineral resources are inferred, indicated, and measured. Inferred and indicated mineral resources are at the lower level of confidence but vary according to probability such that indicated mineral resources can be converted into a probable mineral reserve. Measured mineral resources have a higher level of confidence and may be converted either to a probable or proved mineral reserve.

Proved mineral reserves are economically mineable, and are assessed based on the pre-feasibility and feasibility studies, as well as the high degree of confidence in the parameters such as mining, metallurgical, economic, governmental, marketing, legal, environmental, and social aspects, which are known as 'modifying factors'.

The probable mineral reserves are an economically mineable part of indicated, and in some circumstances, measured mineral resources (2013). They have a lower level of confidence in the 'modifying factors' compared to the proved mineral reserves.

The development of CRIRSCO is mainly based on the existing reporting standards under the Australasian Code, known as JORC Code, which was previously used by the Philippine mining industry.

### **The McKelvey System**

Another internationally known mineral and energy classification mode is the McKelvey System, which categorizes resources based on the degree of assurance of occurrence and economic considerations. Developed by American geologist Vincent Ellis McKelvey in 1976, after whom it was named, the system is being used by the US Bureau of Mines and US Geological Survey (USBM/USGS 1980). There are two main categories

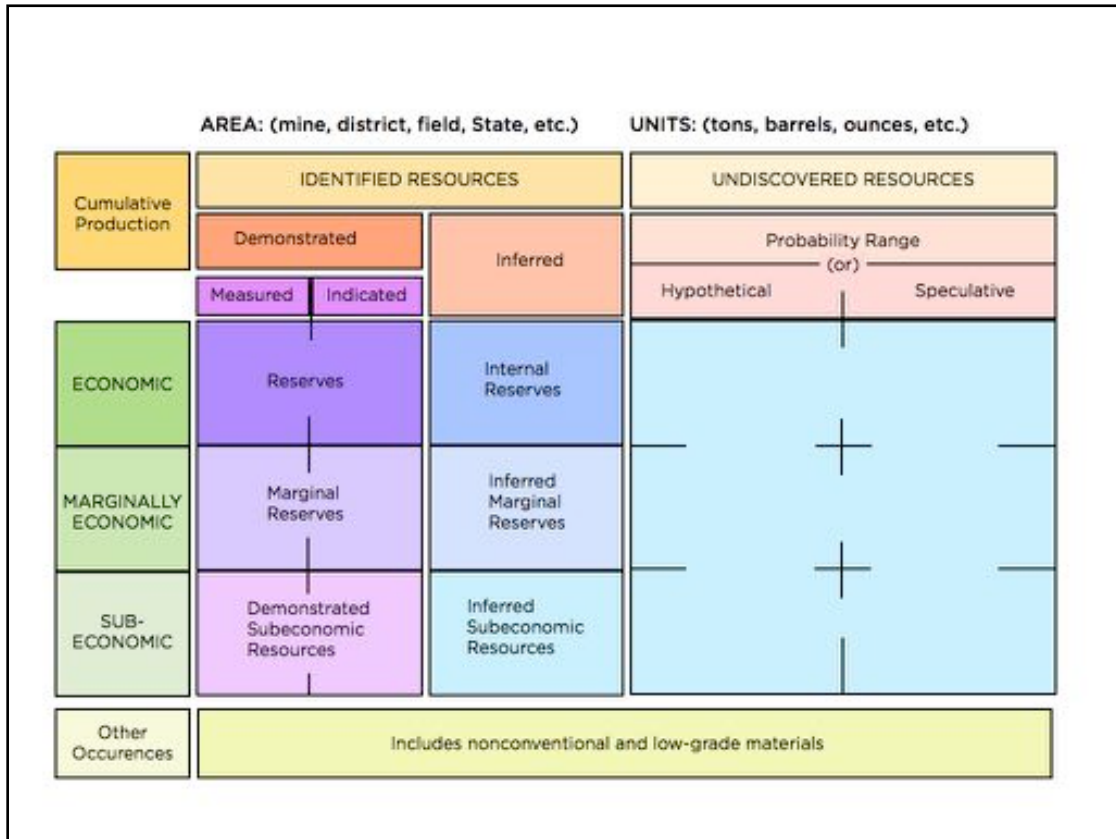
under the McKelvey system, based on the degree of occurrence: discovered and undiscovered.

Discovered resources are classified into two, namely, the identified mineral resources, whose qualities are rarely known in terms of specific measurements and geological confidence that takes into account the economic and sub-economic components. However, the reserves are portions of the usable mineral commodities that can be legally and economically extracted based on the time of determination. Specifically, these are subcategorized as measured and indicated, which are based on the distance sampling methods. Inferred mineral resources are parts of a mineral resource for which estimates are based on assumed continuity. Demonstrated resources are also included in the reporting system to show the sum of measured and indicated resources.

Undiscovered resources, or bodies of mineral-bearing material, are presumed to exist in a mining site based on broad (regional) knowledge and theory. The possible existence of unknown resources in a mining district is assumed while unknown types of deposits are recognized.

Economic resources and reserves are defined based on their profitability at the time of determination, while sub-economic resources and reserves do not satisfy such criterion. Thus, McKelvey system was the proposed classification system for the subsoil assets indicated in SEEA 2003 (p.315).





Source: US Geological Survey

## The McKelvey System

### PRMS Resources Classification System

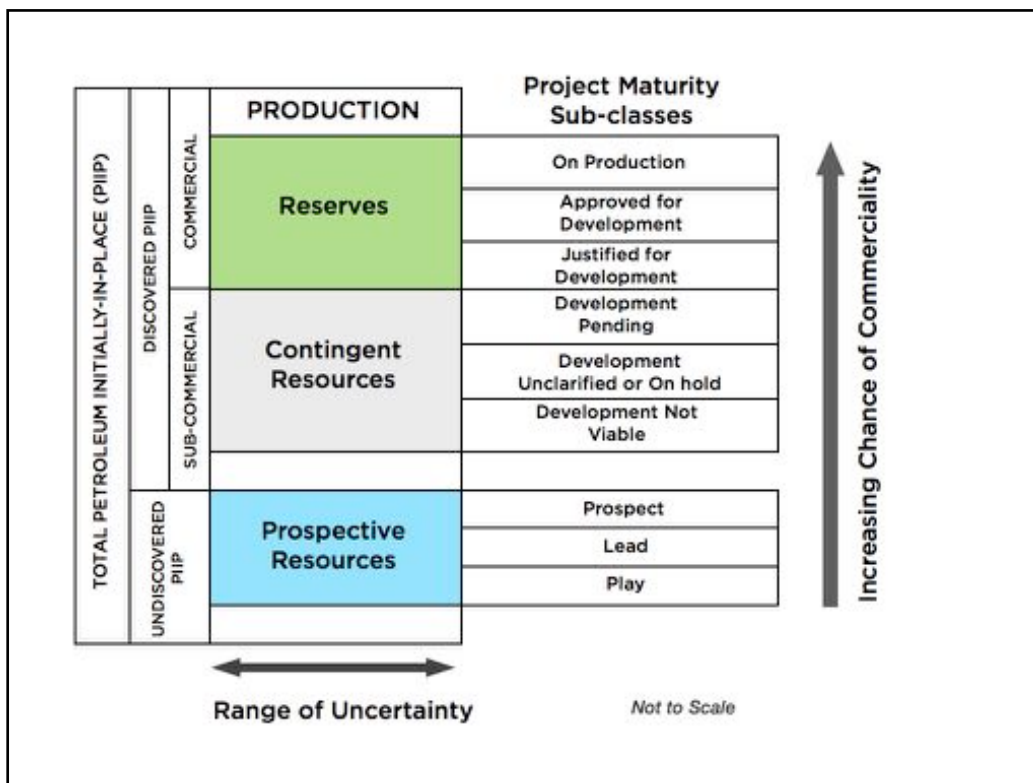
As the McKelvey System improved over time, another set of resource classification reporting standards evolved – the Petroleum Resources Management System (PRMS). Established in 2007, the PRMS is used to estimate petroleum quantities, evaluate development projects, and present results within a comprehensive classification framework.

The total petroleum initially in-place is classified into discovered and undiscovered. Discovered petroleum initially-in-place refers to known petroleum quantity accumulation that is subject to production. Reserves and contingent resources are under this category, and are deemed commercially viable and potentially commercially viable, respectively, based on improvement of the project maturity status.

Undiscovered petroleum initially in-place covers resources that are potentially recoverable, particularly prospective resources, which are possibly subject to discovery and development. In the future unrecoverable resources may be discovered and found among undiscovered resources, based on technological changes.

Resource evaluation could be used in the analysis of PRMS Resource Classification System. The resource classification reporting criteria consist of the reservoir, which reflects the value of resources; the project, which indicates the development of maturity based on the technical, economic, or contractual aspects of reserve extraction; and the property (lease or license area), on which are based the fiscal aspects of rights and obligations related to the mining operation.

The criteria for the PRMS are based on the discovery status, commerciality, project status and commercial risk (under which also falls the project maturity subclasses, reserve and economic status). Meanwhile, the resources categorization is based on the range of uncertainty, specifically the low, best, and high estimates that represent the probability distribution of volumes.



Source: Society of Petroleum Engineers

### PRMS Resource Classification System

#### UN Framework Classification for Fossil Energy and Mineral Reserves and Resources

The SEEA 2012 introduced United Nations Framework Classification for Fossil Energy and Mineral Reserves and Resources (UNFC-2009). It is a universal classification system designed to meet the reporting standards for energy and mineral resources and reserves, financial reporting standards, resources management functions and business processes. Furthermore, the UNFC-2009 aims to facilitate international comparisons between the existing different mineral and energy classification systems.

## Appendix 4

### Consensus on the Mineral Resource Classification in the Philippine

Based on the publication Environmental and Natural Resource Accounting: The Cordillera Experience, under the ENRA II Project in 2001, only the proven reserves were considered in the mineral accounts, comprising probable and possible reserves. On the other hand, in the Special Studies on Small-Scale Gold Mining Activity in 1999, the estimated geologic mineral reserve was categorized as indicated or inferred reserve. At the time, there were no reporting standards in the country. Some of the mining companies, however, were following the Australasian Code, also known as JORC Code, while others were using other international reporting standards already existing then. The consensus on the local mineral resource classification was arrived at in later years.

The Philippine Mineral Reporting Code (PMRC), established on August 8, 2007, is a public reporting system in the Philippines that sets guidelines and criteria, which are aligned with the global standards, for identifying mineral resources and ore reserves based on exploration results. Furthermore, it is harmonized and modelled substantially on the JORC Code and CRIRSCO. The PMRC was developed by a committee consisting of the MGB, Board of Investments, Philippine Stock Exchange, Chamber of Mines, Philippine Minerals Development Institute Foundation, Society of Metallurgical Engineers of the Philippines, Philippine Society of Mining Engineers, Geological Society of the Philippines, and the Philippine-Australia Business Council.

The Philippine mining industry is required to comply with this code in accordance with the DENR Administrative Order No. 2010-09, titled Providing for the Classification and Reporting Standards of Exploration Results, Mineral Resources and Ore Reserves. This aims to promote industry-wide consistency, transparency and competence in terms of mineral resources and ore reserves reporting standards toward achieving global compatibility.

## Appendix 5

### Localized Criteria on Mineral Accounts

The UNFC-2009 specification has been harmonized with the existing legal and administrative requirements for the Philippine mining operations such as permits and reports, observed mining stages, data availability, and the existing classification system, which is the PMRC.

The localization of the UNFC-2009 is intended to be used for the development of national mineral asset accounts and for the assessment of the proposed SEEA 2012 classification system extent and applicability. Localized criteria are delineated based on economic and social viability (E), project feasibility and status, and (F) geological knowledge (G).

When a mining company has records on sales and extraction and its status is confirmed as operating, and has approved DMPF (which also implies the company has complied with all the required legal and administrative requirements) and begun commencement of commercial production, it means it has satisfied the E1 and F1 criteria for Class A.

On the other hand, Class B indicates a need for justification of the reserves' economic viability in the foreseeable future as a result of the following: extraction technology changes; temporary suspension due to the non-feasibility (i.e., market prices, grade, etc.); violation of current laws and regulations; force majeure events; and/or, completion of exploration while approval of DMPF is pending. The local criteria for Class B category cover the E2, F2.1, and/or F2.2 classifications under the UNFC-2009 system.

The established quantity and quality of resources based on exploration results without DMPF, and such criteria as mines that have expired, non-renewal of mining permits, and undertakings of the government and non-permittees that have no mining patents, conform to the E3, F2.2, F2.3, and/or F4 specifications for Class C. Mining companies which have permanently stopped operations due to force majeure or have been closed due to bankruptcy also funder under this class.

## Classification Criteria (evidence based)

### Classification Criteria, by Category and Sub-category

#### Class A: Commercially Recoverable Resources

##### **Based on Economic Viability:**

1. There are recorded sales of processed ore within areas with known deposits during an accounting period, or
2. There are recorded extraction activities of minerals or ore undertaken within areas with known deposits during the accounting period, or
3. When results of feasibility studies conducted revealed economic viability in terms of current market conditions and realistic assumptions of future market conditions and recognized by the government, manifested through the approval of the DMPF.

##### **Based on Social Viability:**

1. There is an economic or institutional unit with legal rights to extract known deposits within the accounting period.
2. When there is approved DMPF accompanied by the Mining Project Feasibility Study (MPFS) with compliance to the following:
  - a. Environmental Compliance Certificate (ECC).
  - b. Environmental Protection and Enhancement Program (EPEP)/ Final Mine Rehabilitation and/or Decommissioning Plan.
  - c. Contingent Liability and Rehabilitation Fund (CLRF).
  - d. Social Development and Management Program (SDMP), Advancement of Mining Technology and Geoscience, and information, education and communication.
  - e. Community Development Plan (CDP).
  - f. Free prior and informed consent of Indigenous Peoples / Indigenous Cultural Communities (IP/ICC) for mining operations within ancestral domain pursuant to Section 16 of the R.A. 7942 - Opening of Ancestral Lands for Mining Operations and Republic Act No. 8371 - The Indigenous Peoples Rights Act of 1997.
  - g. Local Government consent based on DENR Memorandum No. 09-2004.

##### **Based on Field Project Status and Feasibility:**

1. Within approved projects and justified for development or upon approval of DMPF and compliance of other requirements by a permittee or contractor.
2. Projects undertaking development stage or production stage.

##### **Based on Geological Knowledge:**

1. With estimated quantities of reserve and classified according to level of confidence and relevant quality classification.

## CLASS B: Potentially Commercially Recoverable Resources

### **Based on Economic Viability:**

1. When there is justification for development in the foreseeable future within an open mining areas with previous existing information due to an increased confidence resulting from technological change (i.e. cut-off rate).
2. When activities of a mining project or tenement area are suspended due to temporary Non-Feasibility (i.e. due to economic factors and/ or force majeure).
3. Projects with pending approval of submitted DMPF by the MGB (for special request to the Director of MGB).

### **Based on Social Viability:**

1. When activities of a mining project or tenement area are temporarily suspended due to reasons not in violation of current laws and regulations. The suspension should not exceed one year from effectivity date of suspension.
2. When activities of a mining project or tenement area are temporarily suspended due to Force Majeure. The suspension should not exceed one year from the effectivity date of suspension.

### **Based on Field Project Status and Feasibility:**

1. Exploration period has been completed with pending DMPF approval.

### **Based on Geological Knowledge:**

1. With estimated quantities of reserve and classified according to level of confidence and relevant quality classification.

## CLASS C: Non-commercial and Other Known Deposits

### **Based on Economic Viability:**

1. Results of exploration and evaluation probed non-viability of production however, quantity and quality of the resource has been confirmed, or
2. Includes established reserves and mineral resources of inactive mines (for further clarification).
3. Includes established reserves and mineral resources as a result of government exploration undertakings or by a non-permittee/ contractor.

### **Based on Social Viability:**

1. Mining project operations stopped due to force majeure (for further clarification; need to indicate time duration).
2. Mining project operations stopped due to economic related reasons (i.e. bankruptcy).

### **Based on Field Project Status and Feasibility:**

1. Projects with exploration reports without DMPF or under mining patent.
2. Projects with expired and non-renewed permits/contract.

### **Based on Geological Knowledge:**

1. With estimated quantities of reserve and classified according to level of confidence and relevant quality classification.

## Mapping of Localized UNFC Criteria

SEEA Classes	Corresponding UNFC 2009 project categories			
	E Economic and social viability	F Field project status and feasibility	G UNFC 2009	H Ecological Knowledge
Class A: Commercially Recoverable Resources <sup>1</sup>	E1. Extraction and sale has been confirmed to be economically viable	Localised Criteria There are recorded extraction and sales undertaken within area with known deposits during the accounting period, with legal rights to extract.	UNFC 2009 F1. Feasibility of extraction by a defined development project or mining operation has been confirmed	Localised Criteria Within approved projects and justified for development or upon approval of IMPP and compliance of other requirements by a permittee or contractor. Projects undertaking development stage or production stage.
	When activities of a mining project or treatment area are temporarily suspended due to reasons not in violation of current laws and regulations/ES/Is or Force Majeure. The suspension should not exceed one year from effectivity date of suspension.	When there is justification for development in the foreseeable future within an open mining area with permits existing information due to an increased confidence resulting from technological change (i.e. cut-off rates).	F1.1 Project activities are ongoing to justify development in the foreseeable future Or F1.2 Project activities are on hold and/or where justification as a commercial development may be subject to significant delay	Exploration period has been completed with pending IMPP approval.
Class B: Potentially Commercially Recoverable Resources <sup>2</sup>	E2. Extraction and sale is not expected to become economically viable in foreseeable future or evaluation is at too early a stage to determine economic viability	When activities of a mining project or treatment area are suspended due to temporary economic factors and/or force majeure. When activities of a mining project or treatment area are suspended due to temporary economic factors and/or force majeure. When activities of a mining project or treatment area are suspended due to regulatory or Force Majeure. The suspension should not exceed one year from effectivity date of suspension.	F2.1 Project activities are on hold and/or where justification as a commercial development may be subject to significant delay Or F2.2 There are no current plans to develop or to acquire additional data at the time due to limited potential Or F2.3 No development project or mining operation has been identified	When activities of a mining project or treatment area are temporarily suspended due to reasons not in violation of current laws and regulations or Force Majeure. The suspension should not exceed one year from effectivity date of suspension. Projects with expired and non-renewed permits/contract.
	E3. Extraction and sale is not expected to become economically viable in foreseeable future or evaluation is at too early a stage to determine economic viability	Results of exploration and evaluation probed non-viability of production however, quantity and quality of the resources has been confirmed, or includes established reserves and mineral resources of inactive mines (for further clarification) and government exploration undertakings or by a non-permittee/contractor	F3.1 Project activities are on hold and/or where justification as a commercial development may be subject to significant delay Or F3.2 There are no current plans to develop or to acquire additional data at the time due to limited potential Or F3.3 No development project or mining operation has been identified	Projects with exploration reports without DIBIR or under mining permits.
Class C: Non-Commercial and Other Known Deposits <sup>3</sup>	E4. Extraction and sale is not expected to become economically viable in foreseeable future or evaluation is at too early a stage to determine economic viability	When activities of a mining project or treatment area are suspended due to temporary economic factors and/or force majeure. When activities of a mining project or treatment area are suspended due to regulatory or Force Majeure. The suspension should not exceed one year from effectivity date of suspension.	F4. Feasibility of extraction by a defined development project or mining operation cannot be evaluated due to limited technical data Or F4. No development project or mining operation has been identified	Quantities associated with a known deposit that can be estimated with a high (H2), moderate, (M2) or low (L2) level of confidence
Potential deposits (not included in SEEA)				With estimated quantities of reserve and classified according to level of confidence and relevant quality classification.
				Estimated quantities associated with a potential deposit, based primarily on indirect evidence (G4)
				Estimated quantities associated with a potential deposit, based primarily on indirect evidence (G4)



## Appendix 6

### Revised MGB Form No. 29-19

Revised MGB Form No. 29-19

Republic of the Philippines  
Department of Environment and Natural Resources  
**MINES AND GEOSCIENCES BUREAU**  
North Avenue, Diliman, Quezon City

#### ANNUAL MINERAL RESOURCE/ORE RESERVE INVENTORY REPORT (PER MINING CONTRACT/PERMIT)

##### I. General Information

Name of Mining Contractor/Permit Holder/Permittee: \_\_\_\_\_

Office Address: \_\_\_\_\_

Contact Number: \_\_\_\_\_

Type of Mining Contract/Permit: \_\_\_\_\_

Mining Tenement Number/Denomination: \_\_\_\_\_

Name of Operator (if any): \_\_\_\_\_

Office Address: \_\_\_\_\_

Contact Number: \_\_\_\_\_

##### II. Location of Contract/Permit Area

\_\_\_\_\_  
(Site/Barangay) (Municipality) (Province)

##### Geographical Coordinates:

Corner	Latitude	Longitude
1		
2		
3		
4		

(please use additional sheet, if necessary)

Total Area: \_\_\_\_\_ Hectares

##### III. Status of Operation (Please tick appropriate box/es)

Under Exploration  
Date Started: \_\_\_\_\_

Under Development  
Date Started: \_\_\_\_\_

Production Stage  
Authorized Annual Mine Production (as per 3 Year Work Program): \_\_\_\_\_  
Actual Annual Mine Production: \_\_\_\_\_

Stopped Operation  
Date Stopped: \_\_\_\_\_  
Reason/s: \_\_\_\_\_

page 1 of 4 pages

Mined/Explored Commodity:  Metallic  Non-metallic  
 (Please specify) \_\_\_\_\_

## Type of Deposit:

- Metallic  Non metallic
- Vein type  Mottled
- Porphyry  Siliceous
- Placer  Coralline
- Others, please specify: \_\_\_\_\_  Others, please specify: \_\_\_\_\_

Classification of Commodity: \_\_\_\_\_  
 [e.g., (for metallic) Chromite - Refractory; Nickel Ore/Saprolite - Direct Shipping;  
 (for non metallic) Limestone - Cement Manufacture; Basalt - Aggregate]

Mining Method/s: \_\_\_\_\_  
 (e.g., Surface Mining - Open Pit; Underground Mining - Cut and Fill)

Processing: \_\_\_\_\_  
 (e.g., Gravity Concentration - Tabling; Flotation - Bulk/Selective)  
 (please provide detailed flow sheet)

% Recovery: \_\_\_\_\_

## IV. Mineral Resource/Ore Reserve Inventory

## A. Mineral Resource Inventory

## 1. Previous Year's Mineral Resource Inventory

Category	Tonnage/ Volume	Grade/Assay (Primary Mineral)	Grade/Assay (Secondary/Associated Mineral)
Measured			
Indicated			
Inferred			
TOTAL			

## 2. Mineral Resource Blocked for the Reporting Period (if any)

Category	Tonnage/ Volume	Grade/Assay (Primary Mineral)	Grade/Assay (Secondary/ Associated Mineral)	Remarks
Measured*				
Indicated**				
Inferred				
TOTAL				

\*Indicate in Remarks column if resource is New, or Upgraded from Indicated or Inferred Resource  
 \*\*Indicate in Remarks column if resource is New, or Upgraded from Inferred Resource

**3. Total Mineral Resource Inventory (A1 + A2 - B2)**

Category	Tonnage/ Volume	Grade/Assay (Primary Metal)	Grade/Assay (Secondary/Associated Metals)
Measured			
Indicated			
Inferred			
<b>TOTAL</b>			

**B. Ore Reserve Inventory****1. Previous Year's Ore Reserve**

Category	Tonnage/ Volume	Grade/Assay (Primary Ore)	Grade/Assay (Secondary/Associated Ore)
Proved			
Probable			
<b>TOTAL</b>			

**2. Additional Ore Reserve Converted from Mineral Resource**

Category	Tonnage/ Volume	Grade/Assay (Primary Ore)	Grade/Assay (Secondary/Associated Ore)
Proved			
Probable			
<b>TOTAL</b>			

**3. Ore Reserve Mined/Extracted**

Category	Tonnage/ Volume	Grade/Assay (Primary Ore)	Grade/Assay (Secondary/Associated Ore)
Proved			
Probable			
<b>TOTAL</b>			

**4. Total Remaining Ore Reserve (B1 + B2 - B3)**

Category	Tonnage/ Volume	Grade/Assay (Primary Ore)	Grade/Assay (Secondary/Associated Ore)
Proved			
Probable			
<b>TOTAL</b>			

Method of Mineral Resource Estimation/Ore Reserve Computation:

- Geometric
- Triangle
- Area Averaging
- Polygon
- Cross Sectional
- Others, please specify: \_\_\_\_\_
- Statistical
- Inverse Distance Weighting
- Kriging
- Others, please specify: \_\_\_\_\_
- Others, please specify: \_\_\_\_\_

**Computer Software Used (if any):**

\_\_\_\_\_  
 [Specify details i.e. SURPAC MINEX, GEMS, etc.]

**Reference/s Used in Mineral Resource Estimation/Ore Reserve Computation:**  
 (Provide location map/s showing the exploration site/s)

<input type="checkbox"/> <b>Geological Inferences</b>	<input type="checkbox"/> <b>Geophysical</b>
Area Covered:	Type of Geophysical Method:
Spacing:	Area Covered:
No. of Samples Collected:	Spacing:
	Average Depth:
<input type="checkbox"/> <b>Trenching</b>	<input type="checkbox"/> <b>Test Pitting</b>
Area Covered:	Area Covered:
Spacing:	Spacing:
Total No. of Trenches Dug:	Average Depth:
Average Length & Width:	Total No. of Test Pits:
No. of Samples Collected:	No. of Samples Collected:
<input type="checkbox"/> <b>Auger Drilling</b>	<input type="checkbox"/> <b>Diamond Drilling</b>
Area Covered:	Area Covered:
Spacing:	Spacing:
Average Depth:	Average Depth:
Total No. of Drill Holes:	Total No. of Drill Holes:
No. of Samples Collected:	No. of Samples Collected:
<input type="checkbox"/> <b>Previous Workings</b>	<input type="checkbox"/> <b>Others, please specify:</b>
Area Covered:	
Spacing:	
Average Depth:	
No. of Samples Collected:	

**Factors/Parameters Used in:****Mineral Resource Estimation**

Specific Gravity: \_\_\_\_\_

Cut Off Grade: \_\_\_\_\_

Others, please specify: \_\_\_\_\_

I hereby certify that the foregoing information are true and correct to the best of my knowledge.

Printed Name and Signature of Competent Person  
Company: \_\_\_\_\_  
Position: \_\_\_\_\_  
Date: \_\_\_\_\_

Printed Name and Signature of President/Authorized Representative

Contractor/Permittee/Permit Holder/Operator

**ACKNOWLEDGEMENT**

Republic of the Philippines

| 55.

At \_\_\_\_\_ on this day \_\_\_\_\_ of \_\_\_\_\_ personally appeared before me:

Name	ID Number	Date of Issuance
_____	_____	_____
_____	_____	_____
_____	_____	_____

who acknowledged to me that they executed the foregoing Report voluntarily and that the same is of their own free act and deed.

**WITNESS MY HAND AND SEAL**, on the date and place written above.

**NOTARY PUBLIC**

Until \_\_\_\_\_  
PR No. \_\_\_\_\_  
Issued on \_\_\_\_\_

Doc. No. \_\_\_\_\_  
Page No. \_\_\_\_\_  
Book No. \_\_\_\_\_  
Series of \_\_\_\_\_

#### **INSTRUCTIONS**

The Annual Mineral Resource/Ore Reserve Inventory Report shall be accomplished in compliance with Department of Environment and Natural Resources Administrative Order No. 2010-09 in re: Providing for the Classification and Reporting Standards of Exploration Results, Mineral Resources and Ore Reserves.

Every holder of a mining permit, Mineral Agreement, Financial or Technical Assistance Agreement or Small-Scale Mining Contract or its operator shall submit to the Director, copy furnished the Regional Director concerned, an Annual Mineral Resource/Ore Reserve Inventory Report using the prescribed MGB Form No. 29-19, on or before the end of the first quarter of each calendar year.

A holder of Quarry or Sand and Gravel Permit or its operator shall likewise submit the same report (MGB Form No. 29-19) to the Provincial Governor/City Mayor concerned, copy furnished the Director and the Regional Director concerned, on or before the end of the first quarter of each calendar year.

Republic of the Philippines  
Department of Environment and Natural Resources  
**MINES AND GEOSCIENCES BUREAU**  
Mineral Economics Information and Publication Division  
North Avenue, Diliman, Quezon City

**INTEGRATED ANNUAL REPORT OF METALLIC MINERALS, NON-METALLIC MINERALS AND QUARRY RESOURCES**  
For the Report Year \_\_\_\_\_

**NAME OF COMPANY/LICENSE/PERMITTEE:**

**ADDRESS (Mailing address):**

**PART I - MINING COMPANY INFORMATION**

**Permit or Contract Number:**

**Date Established:**

**Tax Account Number:**

**COMPANY NAME** - (Write below the correct name of company if it is not the same as in the address box. If name of person, write surname first.)

**ADDRESS** (Write the correct address if it is not the same as in the address box)

**Telephone Number:** (Write only one telephone number and one local number)

**Direct Line:**

**Local No.:**

**Fax No.:**

**E-mail Address:**

**FORM OF OWNERSHIP:** (Indicate if Single Proprietorship, Partnership, Corporation, Cooperative, Association or Government)

**PERCENTAGE OF OWNERSHIP:** (Indicate in percent if Filipino, Canadian, American, Chinese, Japanese, British, Spanish based on capital invested as of the end of reported year)

**NAME OF MANAGING OFFICIAL:**

**POSITION:**

**PART 2 - OPERATING EXPENSES AND OTHER CHARGES**

(Please write all expenses incurred by the HEAD OFFICE solely on mining operations/activities. Value in Thousand Pesos ('000))

**1. OPERATING EXPENSES**

1.1 Salaries and Wages	P	1.10 Commission Expense	
1.2 Supplies Expense		1.12 Donations and Contributions	
1.3 Repair and Maintenance of Buildings & Equipment (fees received by others)		1.13 Cost of Assets Sold in the Same Conditions as Purchased	
1.4 Utilities Expense		1.14 Royalties outside of those paid Under Taxes	
1.5 Insurance Payments (excluding those related to employment)		1.15 Rentals Expense Outside of Those Paid Under Taxes	
1.6 Marketing Expense		1.16 Provisions for Bad Debts	
1.7 Telephone, Telegraph, Postage & Other Communication Expenses		1.11 Cost of Activities, such as Construction & Exploration, Contracted or Sub-Contracted to other Companies/Entities	
1.8 Transport Expense		1.17 Others not included above (specify)	
1.9 Legal, Accounting, Auditing & Other Professional & Business Services Fees		<b>TOTAL (1.1 to 1.17)</b>	P -
<b>2. DEPRECIATION CHARGES</b>	P		
<b>3. INTEREST EXPENSE</b>	P		

**PART 3 - TAXES PAID (December 31, \_\_\_\_\_), Value in Thousand Pesos ('000)**

**1. NATIONAL IMPOSITIONS**

1.1 Excise Tax on Minerals	P	1.7 Other National Taxes (Specify)	
1.2 Income Tax		A. Fringe Benefit Taxes	
1.3 Customs Duties/Fees		B.	
1.4 Value added Tax		C.	
1.5 Capital Gains Tax		D. Other National Taxes and Fees	
1.6 Documentary Stamp Tax		<b>1.0 Total National Taxes (1.1 to 1.7)</b>	-

**2. LOCAL IMPOSITIONS**

2.1 Real Property Tax	P	2.7 Wharfage Fees	P
2.2 Local Business Tax		2.8 Sand & Gravel Tax	
2.3 Occupation Fees		2.9 Extraction Fees	
2.4 Community Tax		2.10 Other Local Taxes (Specify)	
2.5 Registration Fees		2.10.1	
2.6 Permit Fees		<b>2.0 Total Local Taxes (2.1 to 2.10)</b>	-

**3. WITHHELD TAXES**

3.1 W/T on Payroll	P	3.7 W/T on Royalty for Transfer of Technology	
3.2 W/T on Royalties on Claim/ Surface Owners		3.8 Other Withheld Taxes (Specify)	
3.3 W/T on Dividends		3.8.1	
3.4 W/T on Profit Remittance to Mother Company		3.8.2	
3.5 W/T on Interest Income		3.8.3	
3.6 W/T on Interest Payments		<b>3.0 Total Withheld Taxes (3.1 to 3.8)</b>	-

**GRAND TOTAL (1.0 + 2.0 + 3.0)**

-

**4. ROYALTY PAYMENTS**

4.1 Government / Mineral Reservation			
4.2 Claimowners and/or Surface Owners			
4.3 Indigenous Peoples			

<b>PART 4 - FIXED ASSETS AND CAPITAL EXPENDITURES</b>						
Report the value in thousand pesos ('000) of all fixed assets of the HEAD OFFICE. Include improvements on land such as culverts, sidewalks, wall, roads, waiting sheds and other structures. Include also value of tools which last for more than a year, value of all equipment used for transporting persons, freight and other materials, office equipment, drinking fountain, filing cabinets and others.						
		Book Value at Beg. of Report Year Jan. 1, ____	Reserve for Depreciation Dec. 31, ____	Capital Expenditures		Book Value at End of Report Year Dec. 31, ____
				New/1st Hand	Used/2nd Hand	Receipt from Sales
1. Land						
2. Buildings & Structures						
3. Transport Equipment						
4. Office Equipment						
5. Furniture & Fixture						
6. Other Fixed Assets						
<b>TOTAL (1 to 6)</b>	<b>P</b>	-	-	-	-	-
<b>PART 5 - SUMMARY OF OUTSTANDING LOANS (Value in Thousand ('000))</b>						
This refers to the amount of loans as of end of report year. Indicate in appropriate spaces provided the amount of loan according to source.						
SOURCES OF LOANS	Outstanding Loans at End of Report Year Dec. 31, ____	Amount of New Borrowings During Jan-Dec of Report Year _____				
		Cash Loans	Deferred Credits			
			Machinery & Equipment	Raw Materials	Guarantee/ Security	
1. Foreign (specify country)	\$	\$	\$	\$	\$	
2. Local (specify source of loans)	P	P	P	P	P	
3. Loan Repayments (Principal)	LOCAL : P		FOREIGN: \$			
<b>PART 6 - SUMMARY OF INCENTIVES AVAILED OF (Value in Thousand Pesos ('000))</b>						
NATURE OF INCENTIVES		SOURCE / VALUE OF INCENTIVES AVAILED OF				
		Board of Investments	Mines and Geosciences Bureau	Other Agencies		
<b>1. Allowable Deduction</b>						
1.1 Accelerated Deduction of Organizational & Pre-Operating						
1.2 Accelerated Depreciation						
1.3 Net Operating Loss Carry-Over						
1.4 Deduction for Expansion Reinvestment						
1.5 Double Deduction of Promotional Expenses						
1.6 Double Deduction of Shipping Costs						
1.7 Allowance for Investment In a Pioneer Enterprise						
<b>2. Tax-Exemptions</b>						
2.1 Compensating Tax On Imported Capital Equipment						
2.2 Import Duty On Imported Capital Equipment						
2.3 Sales Tax (Pioneer Enterprise)						
2.4 Advance Sales Tax On Imported Raw Materials, Supplies,						
2.5 Capital Gains Tax-Exemption						
2.6 Tax-Exemption On Sale of Stock Dividends						
<b>3. Tax Credit</b>						
3.1 Tax Credit for Withholding Tax On Interest Payments on						
3.2 Tax Credit On domestic Capital Equipment						
3.3 Special Tax Credit On Raw Materials/Supplies of Exported Finished Products						
<b>TOTAL (1 to 3)</b>		<b>P</b>	-	-	-	
PREPARED BY:		OFFICIAL DESIGNATION	ADDRESS		TELEPHONE NO.	
(Signature Over Printed Name)						
CERTIFIED BY:		OFFICIAL DESIGNATION	ADDRESS		TELEPHONE NO.	
(Signature Over Printed Name)						



MINE SITE PARTICULARS							
ANSWERS SHOULD REFLECT INFORMATION PERTAINING TO MINE SITE ONLY							
PART 7 - MINE INFORMATION							
SITE NAME:		REGION:		PROVINCE		MUNICIPALITY:	
Major Product (Enter only one major product per site)			Date of First Operation			Change	
			Year:	Month:	Day:		
MINING METHODS USED: (Enter only one mining method per block)			MILLING METHODS USED: (Enter only one milling method per block)				
1.			1.				
2.			2.				
3.			3.				
CAPACITY IN METRIC TON: (Mining)			CAPACITY IN METRIC TON: (Milling)				
SMELTER/REFINERY (LOCAL AND FOREIGN):			ESTIMATED RESERVE:				
SHIPPING POINT (PHIL. PORT)	NAME OF SMELTER/REFINERY/BROKER/DESTINATION			ADDRESS OF SMELTER/REFINERY/BROKER DESTINATION			
COMPANY CONTRACTED TO OPERATE THIS SITE (if any):							
NAME OF CONTACT PERSON:			ADDRESS:				
PART 8 - TOTAL PRODUCTION							
		UNIT	GROSS QUANTITY	GROSS VALUE (000)	AVERAGE GRADE		
A. PRIMARY							
B. BY-PRODUCTS							
PART 9 - TOTAL EXPORT/LOCAL SALE							
	COUNTRY OF DESTINATION	GROSS QTY <small>(Specify Unit Used)</small>	GROSS VALUE		AVERAGE GRADE		
			Pesos (P'000)	Dollars (\$'000)			
A. PRIMARY							
B. BY-PRODUCTS							
PART 10 - PRODUCTION COST: COST OF USED MATERIALS AND SUPPLIES							
Report the value of materials and supplies used during the report year. Include industrial and non-industrial costs incurred by this site in its operations. Allocate accounts to heading. Value in thousand pesos ('000).							
ITEMS	UNIT OF MEASURE (liter)	VOLUME	MINING	MILLING	HAULING, HANDLING & STORAGE	ADMINISTRATION	TOTAL
1. Grease and Lubricants							-
2. Chemicals							-
3. Explosives							-
4. Spare Parts							-
5. Containers and Packing Materials							-
6. Lumber							-
7. Steel Balls							-
8. Non-Durable Tools							-
9. Others Not Included Above							-
TOTAL COST OF USED MATERIALS AND SUPPLIES BY SOURCE			P	-	-	-	-
CONVERSION RATE: (US \$1.00 = P)							
PART 11 - PRODUCTION COSTS: COST OF FUELS AND UTILITIES							
Report the value of fuel and utilities consumed during the report year. Allocate accounts according to heading. Value in thousand pesos ('000).							
1. COST OF FUELS (Indicate if gas, gasoline, diesel oil, bunker oil, coal, etc)							
	UNIT OF MEASURE (liter)	QUANTITY	MINING	MILLING	HAULING, HANDLING & STORAGE	ADMINISTRATION	TOTAL
Gas							-
Gasoline							-
Diesel oil							-
Bunker oil							-
Coal							-
TOTAL COST OF USED FUELS BY SOURCE			P	-	-	-	-
CONVERSION RATE: (US \$1.00 = P)							

2. COST OF UTILITIES								
		UNIT OF MEASURE	QUANTITY	MINING	MILLING	HAULING, HANDLING & STORAGE	ADMINISTRATION	TOTAL
<b>2.1 Water</b>		Liter		-	-	-	-	-
a. Purchased								-
b. Generated								-
<b>2.2 Electricity</b>		KWH		-	-	-	-	-
a. Purchased								-
b. Generated				-	-	-	-	-
b.1 By the above fuels								-
b.2 By Other Sources								-
<b>3. Sold</b>								-
<b>TOTAL (2.1 + 2.2 + 3)</b>		P		-	-	-	-	-
PART 12 - PRODUCTION COST: COST OF LABOR								
Report number of persons who worked in or for this company, their basic salaries and wages, overtime pay and benefits for work done by regularly paid employees within the report year, paid in cash and in kind prior to all deductions such as withholding tax, group insurance, union fees, etc. Value in thousand pesos ('000).								
TYPE OF REGULARLY-PAID EMPLOYEES	Number of Regularly Paid Employees	SALARIES & WAGES	OVERTIME PAY	SSS/GSIS	EXTRA BENEFITS PAID IN CASH	EXTRA BENEFITS PAID IN KIND	TOTAL	
<b>1. MINING</b>	-	-	-	-	-	-	-	
a. Skilled							-	
b. Laborer							-	
<b>2. MILLING</b>	-	-	-	-	-	-	-	
a. Skilled							-	
b. Laborer							-	
<b>3. Hauling, Handling &amp; Storage</b>	-	-	-	-	-	-	-	
a. Skilled							-	
b. Laborer							-	
<b>4. Administrative Workers</b>							-	
<b>TOTAL (1 to 4)</b>	-	-	-	-	-	-	-	
PART 13 - OPERATING EXPENSES AND OTHER CHARGES								
Report the value of expenses of the MINESITE for the report year. Include industrial and non-industrial charges incurred in the operations. Value in thousand pesos ('000).								
<b>1. OPERATING EXPENSES</b>								
<b>1.1 Marketing Expense</b>								
1.1.1. Smelter Charges				1.1.4. Assaying & Analysis Charges				
1.1.2. Refinery Charges				1.1.5. Other Marketing Expenses				
1.1.3. Freight Charges (Excluding customs duties)				<b>SUB-TOTAL (1.1.1 to 1.1.5)</b>		P		-
<b>1.2 General &amp; Administrative Expenses</b>								
1.2.1. Repair & Maintenance of Buildings and equipment (Fees received by Others)				1.2.8. Cost of Assets Sold In The Same Condition as Purchased				
1.2.2. Insurance Payments (excluding those related to employment)				1.2.9. Donations and Contributions				
1.2.3. Transportation Expense (outside of production and freight charges)				1.2.10. Rentals Expense Outside of Those Paid Under Taxes				
1.2.4. Telephone, Telegraph, Postage and Other Communication Expenses				1.2.11. Royalties Outside of Those Paid Under Taxes				
1.2.5. Legal, Accounting, Auditing & Other Professional & Business Services Fees				1.2.12. Provision for Bad Debts				
1.2.6. Commission Expense				1.2.13. Others Not Included Above (Specify)				
1.2.7. Cost of Activities such as Construction Contracted and Sub-Contracted by Others				<b>SUB-TOTAL (1.2.1 to 1.2.13)</b>		P		-
<b>TOTAL OPERATING EXPENSES (1.1 &amp; 1.2)</b>							P	-
<b>2. DEPRECIATION</b>			P					
<b>3. INTEREST EXPENSES</b>			P					
<b>4. DEPLETION CHARGES</b>			P					
<b>5. ENVIRONMENTAL COST</b>			P					
<b>6. SOCIAL DEVELOPMENT COST</b>			P					

PART 14 - FIXED ASSETS AND CAPITAL EXPENDITURES							
Report the value of fixed assets of the MINESITE. Include improvements on land such as culverts, sidewalks, walls, roads, waiting sheds, and other structures. Include value of tools which last for more than one year, value of all equipment used for transporting persons, freight and other materials, office equipment, drinking fountains, filing cabinets and others. Value in thousand pesos ('000).							
	Book Value at Beg. of Report Year Jan. 1, ____	Reserve for Depreciation Dec. 31, ____	Capital Expenditures		Receipt from Sales	Book Value at End of Report Year Dec. 31, __	
			New/1st Hand	Used/2nd Hand			
1. Land							
2. Mining Property and Claims							
3. Buildings & Structures							
4. Machineries & Other Production Equipment							
5. Transport Equipment							
6. Pollution Control Devices							
7. Other Fixed Assets							
<b>TOTAL (1 to 7) P</b>	-	-	-	-	-	-	
PART 15 - SUMMARY OF CONTRACTED AND SUB-CONTRACTED ENTITIES							
Report the names of the companies/entities contracted to perform certain							
NAME OF COMPANY/ENTITY				NATURE OF JOB			
1.							
2.							
3.							
PART 16 - REPORT ON PROBLEMS ENCOUNTERED							
Describe the problems encountered in the mine site with respect to the specified areas listed below							
1. RAW MATERIALS, POWER, FUEL							
2. POLLUTION CONTROL							
3. MACHINERIES AND EQUIPMENT							
4. FINANCE AND CREDIT							
5. GOVERNMENT POLICIES/REGULATIONS							
6. OTHERS							
PART 17 - EXPLORATION PROJECTS							
Indicate the type of projects whether for diamond drilling, aditing/tunnelling, geology or assaying & analysis charges. Name the location, type of reserves, meterage advance and cost in thousand pesos for each type of project.							
	Location	Ore Reserves			Meterage Advance	Cost ('000)	
		Positive	Probable	Possible			
A. Minesite Exploration Project(s)							
B. Outside Exploration Project(s)							
PART 18 - EXPANSION PLANS / NEW PROJECTS WITHIN OR OUTSIDE THE MINE SITE							
SITE NAME:		REGION:		PROVINCE:		MUNICIPALITY:	
Major Product (Enter only one major product per site)				Target Date of Operation			
				Year:		Month: Day:	
CAPACITY IN METRIC TONS: 1) MINING		2) MILLING					
PROJECT COSTS: (Name the specific COSTS INCURRED by this Project)							
PERCENTAGE OF OWNERSHIP: (Name the specific NATIONALITIES that will participate in this project; include their PERCENTAGE OF OWNERSHIP)							
GOVERNMENT LOANS / INCENTIVES:							
GOVERNMENT INSTITUTION / AGENCY				NATURE OF LOANS / INCENTIVES			
1.				1.			
2.				2.			
EMPLOYMENT GENERATION							
TYPE OF EMPLOYEES				NUMBER			
1.				1.			
2.				2.			
PROJECT DESCRIPTION							
1. TYPE OF PROJECT:							
2. ESTIMATED RESERVES (MT):							
3. METHODS TO BE USED:							
4. DESCRIPTION OF LOCATION OR ENVIRONMENT:							
PRESENT STATUS OF THE PROJECT							

PREPARED BY:		OFFICIAL DESIGNATION	ADDRESS	TELEPHONE NO.
(Signature Over Printed Name)				
CERTIFIED BY:		OFFICIAL DESIGNATION	ADDRESS	TELEPHONE NO.
(Signature Over Printed Name)				
<b>CERTIFICATION</b>				
I hereby certify that all information in this report are complete, true and correct to the best of my knowledge and belief.				
SIGNATURE OF REPORTING OFFICIAL		OFFICIAL POSITION	DATE	
REPUBLIC OF THE PHILIPPINES)				
) S.S.				
)				
Subscribed and sworn to before me this ____ day of ____, 20____, the affiant exhibiting his/her Residence Certificate				
No. _____, issued at _____, on the ____ day of _____ 20____.				
DOC NO.		NOTARY PUBLIC		
PAGE NO		My Commission Expires on Dec. 31, _____		
BOOK NO.		PTR No. _____		
SERIES OF				

## Appendix Tables

**Appendix Table 1. Physical account: Class A nickel reserves, in ore, in million metric tons, 2002-2012**

Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	71.04	69.84	68.88	68.01	138.30	146.34	611.10	759.99	811.44	945.88	1,126.87
<b>Addition to Stock</b>											
Discoveries	-	-	-	-	11.61	4.90	-	14.01	5.37	-	327.00
Upward reappraisals	-	-	-	71.40	-	368.98	0.86	44.14	44.91	108.14	348.94
Reclassifications	-	-	-	-	-	98.26	153.49	1.57	97.96	11.46	12.18
<b>Total additions to stock</b>	-	-	-	71.40	11.61	472.14	154.35	59.73	148.24	218.60	688.12
<b>Reductions to stock</b>											
Extractions	1.20	0.96	0.87	1.11	3.58	7.38	5.46	8.28	13.80	21.15	24.95
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	16.45	1.14
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	1.20	0.96	0.87	1.11	3.58	7.38	5.46	8.28	13.80	37.60	26.09
<b>Closing Stocks</b>	69.84	68.88	68.01	138.30	146.34	611.10	759.99	811.44	945.88	1,126.87	1,788.90

**Appendix Table 2. Physical account: Class B nickel reserves, in ore, in million metric tons, 2002-2012**

Class B	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	137.10	137.10	137.10	245.71	302.42	349.54	328.02	178.56	190.89	305.57	196.18
<b>Addition to Stock</b>											
Discoveries	-	-	2.63	56.71	47.12	76.74	28.02	13.91	64.74	-	6.35
Upward reappraisals	-	-	-	-	-	-	-	-	147.91	1.07	3.76
Reclassifications	-	-	105.98	-	-	-	-	-	-	-	-
<b>Total additions to stock</b>	-	-	108.61	56.71	47.12	76.74	28.02	13.91	212.65	1.07	10.11
<b>Reductions to stock</b>											
Extractions	-	-	-	-	-	-	-	-	-	-	-
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	24.00	-	-	-	-
Reclassifications	-	-	-	-	-	98.26	153.49	1.57	97.96	110.46	12.18
<b>Total reduction in stock</b>	-	-	-	-	-	98.26	177.48	1.57	97.96	110.46	12.18
<b>Closing Stocks</b>	137.10	137.10	245.71	302.42	349.54	328.02	178.56	190.89	305.57	196.18	194.11

**Appendix Table 3. Physical account: Class C nickel reserves, in ore, in million metric tons, 2002-2012**

Class C	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	185.04	185.04	185.04	385.04	285.89	285.89	285.89	285.89	285.89	285.89	285.89
<b>Addition to Stock</b>											
Discoveries	-	-	200.00	6.82	-	-	-	-	-	-	228.78
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total additions to stock</b>	-	-	200.00	6.82	-	-	-	-	-	-	228.78
<b>Reductions to stock</b>											
Extractions	-	-	-	-	-	-	-	-	-	-	-
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	105.98	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	-	-	-	105.98	-	-	-	-	-	-	-
<b>Closing Stocks</b>	185.04	185.04	385.04	285.89	285.89	285.89	285.89	285.89	285.89	285.89	514.67

Appendix Table 4. Monetary account: Class A nickel reserves, at 12 percent discount rate, in million pesos, 2002-2012

Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	2,873.92	2,426.22	2,516.30	2,652.73	5,543.72	14,942.33	38,547.45	15,425.81	14,293.74	26,834.01	41,833.63
<b>Addition to Stock</b>											
Discoveries	-	-	-	-	465.48	500.38	-	284.42	94.63	-	12,139.46
Upward reappraisals	-	-	-	-	-	37,675.28	54.58	895.94	791.04	3,067.77	12,953.94
Reclassifications	-	-	-	2,785.16	-	10,033.31	9,681.69	31.96	1,725.69	3,133.67	452.16
<b>Total additions to stock</b>	-	-	-	2,785.16	465.48	48,208.97	9,736.17	1,212.32	2,611.36	6,201.44	25,545.56
<b>Reductions to stock</b>											
Extractions	48.55	33.43	31.93	43.18	143.37	753.58	344.36	168.13	243.08	600.01	926.07
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	466.79	42.45
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	48.55	33.43	31.93	43.18	143.37	753.58	344.36	168.13	243.08	1,066.81	968.52
<b>Revaluation of the stock</b>	-399.16	123.52	168.36	149.00	9,076.49	-23,850.26	-32,513.46	-2,176.27	10,171.99	9,864.99	2,097.29
<b>Closing Stocks</b>	2,426.22	2,516.30	2,652.73	5,543.72	14,942.33	38,547.45	15,425.81	14,293.74	26,834.01	41,833.63	68,507.97



**Appendix Table 5. Nickel monetary account: Class A , at 15 percent discount rate, in million pesos, 2002-2012**

Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	2,302.60	1,943.10	2,013.53	2,122.45	4,434.98	12,030.49	30,840.21	12,340.65	11,435.15	21,474.44	33,529.18
<b>Addition to Stock</b>											
Discoveries	-	-	-	-	372.39	402.87	-	227.54	75.70	-	9,729.64
Upward reappraisals	-	-	-	-	-	30,333.44	43.59	716.75	632.84	2,455.04	10,382.44
Reclassifications	-	-	-	2,228.41	-	8,078.10	7,745.92	25.56	1,380.57	2,507.78	362.40
<b>Total additions to stock</b>	-	-	-	2,228.41	372.39	38,814.41	7,789.51	969.86	2,089.11	4,962.82	20,474.48
<b>Reductions to stock</b>											
Extractions	38.90	26.78	25.55	34.55	114.69	606.73	275.50	134.50	194.47	480.17	742.23
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	373.56	34.03
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	38.90	26.78	25.55	34.55	114.69	606.73	275.50	134.50	194.47	853.73	776.26
<b>Revaluation of the stock</b>	-320.60	97.21	134.48	118.66	7,337.82	-19,397.96	-26,013.56	-1,740.86	8,144.64	7,945.65	1,592.32
<b>Closing Stocks</b>	1,943.10	2,013.53	2,122.45	4,434.98	12,030.49	30,840.21	12,340.65	11,435.15	21,474.44	33,529.18	54,819.72

**Appendix Table 6. Nickel Class A resource life / mine life and net change, 2002-2012**

Year	Total Reserved in Million MT	Extraction in Million MT	Net change in Million MT			Resource life/mine life in years
			Extraction/ Discoveries	Upward/ Downward Reapprais als	Addition/ reduction in stocks	
2002	69.84	12.00	1.20	-	-	6
2003	68.88	0.96	-	-	-	72
2004	68.01	0.87	-	-	-	78
2005	138.30	1.11	-	-	1.20	125
2006	146.34	3.58	1.20	-	-	41
2007	611.10	7.38	-	1.20	-	83
2008	759.99	5.46	68.64	-	-	139
2009	811.44	8.28	-	-	1.20	98
2010	945.00	13.80	-	-	-	68
2011	1,126.87	21.00	-	1.20	69.84	54
2012	1,788.90	24.95	-	-	-	72

**Appendix Table 7. Physical account: Class A Gold reserves, in metal content, in million kilograms, 2002-2012**

Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	<b>0.80</b>	<b>0.77</b>	<b>0.87</b>	<b>1.01</b>	<b>1.00</b>	<b>1.15</b>	<b>1.11</b>	<b>1.27</b>	<b>1.23</b>	<b>1.20</b>	<b>1.20</b>
<b>Addition to Stock</b>											
Discoveries	0.02	0.15	0.19	0.04	0.20	-	0.03	-	-	0.03	0.07
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	0.16	-	0.01	-	0.22
<b>Total additions to stock</b>	<b>0.02</b>	<b>0.15</b>	<b>0.19</b>	<b>0.04</b>	<b>0.20</b>	<b>-</b>	<b>0.19</b>	<b>-</b>	<b>0.01</b>	<b>0.03</b>	<b>0.29</b>
<b>Reductions to stock</b>											
Extractions	0.05	0.05	0.05	0.05	0.05	0.04	0.03	0.04	0.04	0.03	0.02
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	<b>0.05</b>	<b>0.05</b>	<b>0.05</b>	<b>0.05</b>	<b>0.05</b>	<b>0.04</b>	<b>0.03</b>	<b>0.04</b>	<b>0.04</b>	<b>0.03</b>	<b>0.02</b>
<b>Closing Stocks</b>	<b>0.77</b>	<b>0.87</b>	<b>1.01</b>	<b>1.00</b>	<b>1.15</b>	<b>1.11</b>	<b>1.27</b>	<b>1.23</b>	<b>1.20</b>	<b>1.20</b>	<b>1.47</b>

**Appendix Table 8. Physical account: Class B Gold reserves, in metal content, in million kilograms, 2002-2012**

Class B	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	0.75	0.82	0.82	0.90	0.91	1.17	1.17	1.01	1.23	1.22	1.22
<b>Addition to Stock</b>											
Discoveries	0.07	-	0.07	0.02	0.26	-	-	0.22	-	-	0.11
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total additions to stock</b>	0.07	-	0.07	0.02	0.26	-	-	0.22	-	-	0.11
<b>Reductions to stock</b>											
Extractions	-	-	-	-	-	-	-	-	-	-	-
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	0.16	-	0.01	-	0.22
<b>Total reduction in stock</b>	-	-	-	-	-	-	0.16	-	0.01	-	0.22
<b>Closing Stocks</b>	0.82	0.82	0.90	0.91	1.17	1.17	1.01	1.23	1.22	1.22	1.11

**Appendix Table 9. Physical asset accounts: Class C Gold reserves, in metal content, in million kilograms, 2002-2012**

Class C	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	0.12	0.12	1.09	1.40	1.40	1.50	1.51	1.54	1.54	1.54	1.54
<b>Addition to Stock</b>											
Discoveries	-	0.97	0.31	-	0.10	0.01	0.03	-	-	-	-
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total additions to stock</b>	-	0.97	0.31	-	0.10	0.01	0.03	-	-	-	-
<b>Reductions to stock</b>											
Extractions	-	-	-	-	-	-	-	-	-	-	-
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	-	-	-	-	-	-	-	-	-	-	-
<b>Closing Stocks</b>	0.12	1.09	1.40	1.40	1.50	1.51	1.54	1.54	1.54	1.54	1.54

**Appendix Table 10. Monetary account: Class A Gold reserves, at 12 percent discount rate, in million pesos, 2002-2012**

Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	29,273.44	56,790.73	76,649.65	88,187.33	89,578.80	115,210.04	144,027.44	158,514.32	190,427.70	245,767.53	226,181.05
<b>Addition to Stock</b>											
Discoveries	761.39	11,079.97	16,692.74	3,533.51	17,998.36	-	4,164.01	-	-	6,436.97	12,426.69
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	21.08	-	-	-	-	21,073.80	-	1,121.58	-	41,628.96
<b>Total additions to stock</b>	761.39	11,101.05	16,692.74	3,533.51	17,998.36	-	25,237.80	-	1,121.58	6,436.97	54,055.65
<b>Reductions to stock</b>											
Extractions	1,817.51	3,955.68	4,443.81	4,649.68	4,578.30	4,218.57	3,724.79	4,782.77	6,314.37	6,382.87	2,974.54
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	1,817.51	3,955.68	4,443.81	4,649.68	4,578.30	4,218.57	3,724.79	4,782.77	6,314.37	6,382.87	2,974.54
<b>Revaluation of the stock</b>	28,573.41	12,713.55	-711.26	2,507.65	12,211.17	33,035.98	-7,026.14	36,696.16	60,532.61	-19,640.57	-166,412.44
<b>Closing Stocks</b>	56,790.73	76,649.65	88,187.33	89,578.80	115,210.04	144,027.44	158,514.32	190,427.70	245,767.53	226,181.05	110,849.71

**Appendix Table 11. Monetary account: Class A Gold reserves, at 15 percent discount rate, in million pesos, 2002-2012**

Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	24,744.11	48,486.67	65,441.77	73,900.24	75,379.71	95,829.39	118,396.61	127,410.97	154,719.28	200,702.03	182,363.00
<b>Addition to Stock</b>											
Discoveries	643.58	9,459.83	14,251.89	2,961.05	15,145.45	-	3,422.99	-	-	5,256.65	10,019.27
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	17.99	-	-	-	-	17,323.55	-	911.26	-	33,564.18
<b>Total additions to stock</b>	643.58	9,477.83	14,251.89	2,961.05	15,145.45	-	20,746.54	-	911.26	5,256.65	43,583.45
<b>Reductions to stock</b>											
Extractions	1,536.29	3,377.27	3,794.03	3,896.39	3,852.60	3,508.92	3,061.93	3,844.31	5,130.32	5,212.47	2,398.29
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	1,536.29	3,377.27	3,794.03	3,896.39	3,852.60	3,508.92	3,061.93	3,844.31	5,130.32	5,212.47	2,398.29
<b>Revaluation of the stock</b>	24,635.27	10,854.55	-1,999.40	2,414.81	9,156.83	26,076.14	-8,670.25	31,152.62	50,201.80	-18,383.21	-134,866.25
<b>Closing Stocks</b>	48,486.67	65,441.77	73,900.24	75,379.71	95,829.39	118,396.61	127,410.97	154,719.28	200,702.03	182,363.00	88,681.92

**Appendix Table 12. Gold Class A resource life/mine life and net change, 2002-2012**

Year	Total Reserved in Million MT	Extraction in Million MT	Net change in Million MT			Resource life/mine life in years
			Extraction/ Discoveries	Upward/ Downward Reapprais als	Addition/ reduction in stocks	
2002	0.77	0.05	-0.03	-	-0.03	16
2003	-0.87	0.05	0.10	-	0.10	16
2004	1.01	0.05	0.14	-	0.14	20
2005	1.00	0.05	-0.01	-	-0.01	19
2006	1.15	0.05	0.15	-	0.15	22
2007	1.11	0.04	-0.04	-	-0.04	26
2008	1.27	0.03	-	-	-	44
2009	1.23	0.04	-0.04	-	-0.04	32
2010	1.20	0.04	-0.04	-	-0.04	29
2011	1.20	0.03	-	-	0.00	39
2012	1.47	0.02	0.05	-	0.05	93



**Appendix Table 13. Physical account: Class A Copper reserve, in metal content, in million dry metric ton, 2002-2012**

Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	132.81	132.74	132.65	132.76	132.68	132.61	132.52	137.08	136.88	136.64	140.32
<b>Addition to Stock</b>											
Discoveries	-	-	0.17	-	-	-	4.66	-	-	3.93	-
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total additions to stock</b>	-	-	0.17	-	-	-	4.66	-	-	3.93	-
<b>Reductions to stock</b>											
Extractions	0.08	0.08	0.07	0.08	0.07	0.09	0.09	0.20	0.24	0.25	0.27
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	0.08	0.08	0.07	0.08	0.07	0.09	0.09	0.20	0.24	0.25	0.27
<b>Closing Stocks</b>	132.74	132.65	132.76	132.68	132.61	132.52	137.08	136.88	136.64	140.32	140.05

Appendix Table 14. Physical account: Class B Copper reserve, in metal content, in million dry metric ton, 2002-2012

Class B	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	15.10	15.10	15.10	93.42	93.42	105.12	105.12	105.12	105.12	105.12	105.12
<b>Addition to Stock</b>											
Discoveries	-	-	78.32	-	11.70	-	-	-	-	-	-
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total additions to stock</b>	-	-	78.32	-	11.70	-	-	-	-	-	-
<b>Reductions to stock</b>											
Extractions	-	-	-	-	-	-	-	-	-	-	-
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	-	-	-	-	-	-	-	-	-	-	-
<b>Closing Stocks</b>	15.10	15.10	93.42	93.42	105.12	105.12	105.12	105.12	105.12	105.12	105.12

**Appendix Table 15. Physical account: Class C Copper reserve, in metal content, in million dry metric ton, 2002-2012**

Class C	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	425.29	425.39	425.29	819.47	819.47	954.76	954.76	954.76	954.76	954.79	954.79
<b>Addition to Stock</b>											
Discoveries	-	-	353.48	-	135.29	-	-	-	0.03	-	22.06
Upward reappraisals	-	-	40.70	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total additions to stock</b>	-	-	394.18	-	135.29	-	-	-	0.03	-	22.06
<b>Reductions to stock</b>											
Extractions	-	-	-	-	-	-	-	-	-	-	-
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	-	-	-	-	-	-	-	-	-	-	-
<b>Closing Stocks</b>	425.29	425.29	819.47	819.47	954.76	954.76	954.76	954.76	954.79	954.79	976.85

**Appendix Table 16. Monetary account: Class A Copper reserves, at 12 percent discount rate, in million pesos, 2002-2012**

Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	2,817.73	2,621.64	3,464.46	3,902.60	5,503.53	10,684.14	13,336.04	10,465.19	19,688.94	28,615.27	36,212.76
<b>Addition to Stock</b>											
Discoveries	-	-	4.48	-	-	-	468.66	-	-	823.70	0.01
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total additions to stock</b>	-	-	4.48	-	-	-	468.66	-	-	823.70	0.01
<b>Reductions to stock</b>											
Extractions	1.68	1.60	1.84	2.21	3.07	7.15	9.34	15.53	34.06	53.19	69.17
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	1.68	1.60	1.84	2.21	3.07	7.15	9.34	15.53	34.06	53.19	69.17
<b>Revaluation of the stock</b>	-194.40	844.41	435.50	1,603.14	5,183.68	2,659.06	-3,330.17	9,239.28	8,960.39	6,826.98	-6,256.95
<b>Closing Stocks</b>	2,621.64	3,464.46	3,902.60	5,503.53	10,684.14	13,336.04	10,465.19	19,688.94	28,615.27	36,212.76	29,886.64

**Appendix Table 17. Monetary account: Class A Copper reserves, at 15 percent discount rate, in million pesos. 2002-2012**

Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Opening Stocks	2,254.18	2,097.31	2,771.57	3,122.08	4,402.82	8,547.31	10,668.83	8,372.16	15,751.15	22,892.21	28,970.21
Addition to Stock											
Discoveries	-	-	3.59	-	-	-	374.93	-	-	658.96	0.01
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total additions to stock</b>	-	-	3.59	-	-	-	374.93	-	-	658.96	0.01
Reductions to stock											
Extractions	1.34	1.28	1.47	1.77	2.45	5.72	7.47	12.42	27.25	42.55	55.34
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	1.34	1.28	1.47	1.77	2.45	5.72	7.47	12.42	27.25	42.55	55.34
Revaluation of the stock	-155.52	675.53	348.40	1,282.51	4,146.94	2,127.24	-2,664.13	7,391.42	7,168.31	5,461.58	-5,005.56
<b>Closing Stocks</b>	<b>2,097.31</b>	<b>2,771.57</b>	<b>3,122.08</b>	<b>4,402.82</b>	<b>8,547.31</b>	<b>10,668.83</b>	<b>8,372.16</b>	<b>15,751.15</b>	<b>22,892.21</b>	<b>28,970.21</b>	<b>23,909.32</b>

**Appendix Table 18. Copper Class A resource life/mine life and net change, 2002-2012**

Year	Total Reserved in Million MT	Extraction in Million MT	Net change in Million MT			Resource life/mine life in years
			Extraction/ Discoveries	Upward/ Downward Reapprais als	Addition/ reduction in stocks	
2002	132.74	0.08	-0.08	-	-0.08	1,676
2003	132.65	0.08	-0.08	-	-0.08	1,639
2004	132.76	0.07	0.10	-	0.10	1,881
2005	132.68	0.08	-0.08	-	-0.08	1,762
2006	132.61	0.07	-0.07	-	-0.07	1,792
2007	132.52	0.09	-0.09	-	-0.09	1,493
2008	137.08	0.09	4.56	-	4.56	1,477
2009	136.88	0.20	-0.20	-	-0.20	673
2010	136.64	0.24	-0.24	-	-0.24	577
2011	140.32	0.25	3.68	-	3.68	552
2012	140.05	0.27	-0.27	-	-0.27	522

Appendix Table 19. Physical account: Class A Chromite reserve, in ore, in million metric tons, 2002-2012

Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Opening Stocks	8.87	9.50	9.67	9.63	9.59	7.54	9.49	9.48	9.46	9.54	9.42
Addition to Stock											
Discoveries	-	-	-	-	-	-	-	-	-	-	7.08
Upward reappraisals	0.65	0.20	-	-	-	-	-	-	-	-	0.05
Reclassifications	-	-	-	-	-	1.98	-	-	-	-	-
<b>Total additions to stock</b>	0.65	0.20	-	-	-	1.98	-	-	-	-	7.85
Reductions to stock											
Extractions	0.02	0.03	0.04	0.04	0.05	0.03	0.02	0.01	0.01	0.03	0.04
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	2.00	-	-	-	-	-	-
<b>Total reduction in stock</b>	0.02	0.03	0.04	0.04	2.05	0.03	0.02	0.01	0.01	0.03	0.04
Closing Stocks	9.50	9.67	9.63	9.59	7.54	9.49	9.48	9.46	9.45	9.42	17.24

Appendix Table 20. Physical account: Class B Chromite reserve, in ore, in million metric tons, 2002-2012

Class B	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Opening Stocks	11.87	11.22	11.22	11.22	11.22	13.22	11.24	11.24	11.24	11.24	11.24
Addition to Stock											
Discoveries	-	-	-	-	-	-	-	-	-	-	-
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	2.00	-	-	-	-	-	-
<b>Total additions to stock</b>	-	-	-	-	2.00	-	-	-	-	-	-
Reductions to stock											
Extractions	-	-	-	-	-	-	-	-	-	-	--
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	0.65	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	1.98	-	-	-	-	-
<b>Total reduction in stock</b>	0.65	-	-	-	-	1.98	-	-	-	-	-
Closing Stocks	11.22	11.22	11.22	11.22	13.22	11.24	11.24	11.24	11.24	11.24	11.24



Appendix Table 21. Physical account: Class C Chromite reserve, in ore, in million metric tons, 2002-2012

Class C	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	15.70	15.70	15.70	15.70	17.03	17.03	17.03	17.03	17.03	17.03	17.03
<b>Addition to Stock</b>											
Discoveries	-	-	-	1.33	-	-	-	-	-	-	-
Upward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total additions to stock</b>	-	-	-	1.33	-	-	-	-	-	-	-
<b>Reductions to stock</b>											
Extractions	-	-	-	-	-	-	-	-	-	-	--
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	-	-	-	-	-	-	-
<b>Total reduction in stock</b>	-	-	-	-	-	-	-	-	-	-	-
<b>Closing Stocks</b>	15.70	15.70	15.70	17.03	17.03	17.03	17.03	17.03	17.03	17.03	17.03

**Appendix Table 22. Monetary account: Class A Chromite reserve, at 12 percent discount rate, in million pesos, 2002-2012**

Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	264.53	144.28	369.22	447.82	298.62	713.50	482.59	308.27	429.47	307.35	436.81
<b>Addition to Stock</b>											
Discoveries	-	-	-	-	-	-	-	0.05	-	-	330.62
Upward reappraisals	9.87	7.69	-	-	-	-	-	-	-	-	2.09
Reclassifications	-	-	-	-	-	100.85	-	-	-	-	-
<b>Total additions to stock</b>	9.87	7.69	-	-	-	100.85	-	0.05	-	-	332.71
<b>Reductions to stock</b>											
Extractions	0.33	1.29	1.99	1.19	4.42	1.61	0.50	0.65	0.48	1.18	1.55
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	189.29	-	-	-	-	-	-
<b>Total reduction in stock</b>	0.33	1.29	1.99	1.19	193.72	1.61	0.50	0.65	0.48	1.18	1.55
<b>Revaluation of the stock</b>	-129.79	218.54	80.59	-148.01	608.59	-330.13	-173.83	121.80	-121.62	130.64	-37.36
<b>Closing Stocks</b>	144.28	369.22	447.82	298.62	713.50	482.59	308.27	429.47	307.35	436.81	730.61

**Appendix Table 23 Monetary account: Class A Chromite reserve, at 15 percent discount rate, in million pesos, 2002-2012**

Class A	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
<b>Opening Stocks</b>	264.53	144.28	369.22	447.82	298.62	713.50	482.59	308.27	429.47	307.35	436.81
<b>Addition to Stock</b>											
Discoveries	-	-	-	-	-	-	-	0.05	-	-	330.62
Upward reappraisals	9.87	7.69	-	-	-	-	-	-	-	-	2.09
Reclassifications	-	-	-	-	-	100.85	-	-	-	-	-
<b>Total additions to stock</b>	9.87	7.69	-	-	-	100.85	-	0.05	-	-	332.71
<b>Reductions to stock</b>											
Extractions	0.33	1.29	1.99	1.19	4.42	1.61	0.50	0.65	0.48	1.18	1.55
Catastrophic losses	-	-	-	-	-	-	-	-	-	-	-
Downward reappraisals	-	-	-	-	-	-	-	-	-	-	-
Reclassifications	-	-	-	-	189.29	-	-	-	-	-	-
<b>Total reduction in stock</b>	0.33	1.29	1.99	1.19	193.72	1.61	0.50	0.65	0.48	1.18	1.55
<b>Revaluation of the stock</b>	-129.79	218.54	80.59	-148.01	608.59	-330.13	-173.83	121.80	-121.62	130.64	-37.36
<b>Closing Stocks</b>	144.28	369.22	447.82	298.62	713.50	482.59	308.27	429.47	307.35	436.81	730.61

**Appendix Table 24. Chromite Class A resource life/mine life and net change, 2002-2012**

Year	Total Reserves in Million MT	Extraction in Million MT	Net change in Million MT			Resource life/mine life in years
			Extraction/ Discoveries	Upward/ Downward Reapprais als	Addition/ reduction in stocks	
2002	9.50	0.02	-0.02	0.65	0.63	432
2003	9.67	0.03	-0.03	0.20	0.17	286
2004	9.63	0.04	-0.04	-	-0.04	225
2005	9.59	0.04	-0.04	-	-0.04	252
2006	7.54	0.05	-0.05	-	-2.05	161
2007	9,49	0.03	-0.03	-	1.95	300
2008	9.48	0.02	-0.02	-	-0.02	621
2009	9.48	0.01	-0.01	-	-0.01	661
2010	9.45	0.01	-0.01	-	-0.01	638
2011	9.42	0.03	-0.03	-	-0.03	370
2012	17.24	0.04	7.76	0.05	7.81	471

## References

- Australian Government Geoscience. National classification system for identified mineral resources. McKelveys Reserves and Resources. Retrieved at: <http://www.australianminesatlas.gov.au/aimr/class.html> McKelvey's reserves and resources October 18, 2011/ Matt Hall on 30 October 2015.
- Mines and Geosciences Bureau. Primer on Application for Exploration Permit (EP). <http://www.mgb.gov.ph> (accessed 23 September 2014).
- Mines and Geosciences Bureau. Primer on the Application of Financial or Technical Assistance Agreement (FTAA). <http://www.mgb.gov.ph> (accessed 23 September 2014).
- Department of Environment and Natural Resources Administrative Order No. 2010-09. Providing for the Classification and Reporting Standards of Exploration Results, Mineral Resources and Ore Reserves.
- National Statistical Coordination Board. May 1998. Philippine Asset Accounts: Forest, Land/Soil, fishery, Mineral, and Water Resources. Makati, Philippines.
- National Statistical Coordination Board. March 1999. ENRA Report. Special Studies on Small-Scale Gold Mining Activity. Environment and Natural Resource Accounting Project (Phase II): Institutionalization of the Philippine Economic-Environmental and Natural Resource Accounting (PEENRA) Project. United Nations Development Programme
- National Statistical Coordination Board. 2001. Environmental and Natural Resource Accounting: The Cordillera Experience
- Quisumbing Torres. 2015. Primer on the Philippine Minerals Industry 2015. Retrieved at: <http://www.aseancanada.com/Phil%20Mineral%20Ind%20Primer%20WP1174051.pdf> on August 20, 2015.
- Tolentino, Maria Paula. 2015. Mining Recovery Predicted by 2019 with Political Support. Philippine Resources: Mining, Petroleum and Energy Journal. Issue No. 4. 2015. Retrieved at: [https://issuu.com/paperlesstrail/docs/philippine\\_resources\\_2015\\_issue\\_4](https://issuu.com/paperlesstrail/docs/philippine_resources_2015_issue_4) on July 7, 2016.
- United Nations, European Commission, International Monetary Fund, Organization for Economic Cooperation and Development, and World Bank. 2003. Handbook of National Accounting - Integrated of Environment and-Economic Accounting. Final Draft.

United Nations. 2014. System of Environmental-Economic Accounting 2012 - Central Framework. New York.

United States Bureau of Mines (USBM)/United States Geological Survey (USGC).1980. Principles of Resources /Reserve classification for minerals. US Geological Survey Circular 831, 5pp. Retrieved at: <http://www.pubs.usgs.gov/1980/0831/report.pdf> on October 24, 2015.

Virola, R. A., de Perio, S. M., Angeles, E. T. 2000. Environmental Accounting in the Philippines. Makati City.

Virola, R. A., Lopez-Dee, E. P. 2005. Green GDP Towards Sustainable Development: The Philippine Experience. Paper presented during the International Conference on “See Beyond and Reach Out for Sustainable Development: The Case Studies from International Experiences” organized by the National Resources, Environment, Science and Technology Bureau of the Office of National Economic and Social Development Board at the Amari Watergate Hotel, Bangkok, Thailand on 18 July 2005.

World Bank. 2014. Waves Annual Report 2014. Washington, DC. USA.

## Definition of terms

Asset	A store of value representing a benefit or series of benefits accruing to an economic owner by holding or using the entity over a period of time. It is a means of carrying forward value from one accounting period to another.
Catastrophic Losses	Reductions in assets due to catastrophic and exceptional events.
Discount rate	The annual percentage by which future income is discounted to give an equivalent value in the present period. The discount rate expresses a time preference for money now rather than in the future.
Discoveries	Additions representing the arrival of new resources to a stock and commonly arise through exploration and evaluation.
Environmental Asset	The naturally occurring living and non-living components of the earth, together constituting the biophysical environment, which may provide benefits to humanity.
Extractions	Reductions in stock due to the physical removal or harvest of an environmental asset through a process of production.
Gross Domestic Product (GDP)	The total output produced within the geographical boundaries of the country regardless of the nationality of the entities producing of the output.
Gross Value Added (GVA)	The total payment to factors of production, namely: wages, interest, profits and rents. It also includes capital consumption allowance and indirect taxes. It is also estimated by deducting from gross value of output the sum of non-factor cost such as raw materials and supplies, containers and packing materials, fuel, advertising and other non-industrial overhead cost.
Industry	Consists of a group of establishments engaged in the same, or similar, kinds of activity.
Market prices	The amounts of money that willing buyers pay to acquire something from willing sellers.
Mineral	All naturally occurring inorganic substance in solid, gas, liquid, or any intermediate state excluding energy materials such as coal, petroleum, natural gas, radioactive materials, and geothermal energy.

Mineral Resources	Any concentration of minerals/rocks with potential economic value.
Net present value	The value of the asset based on the summed value of discounted future earnings from the asset.
Ore	Naturally occurring substance or material from which a mineral or element can be mined and/or processed for profit.
Production	An activity, carried out under the responsibility, control and management of an institutional unit, that uses labor, capital, goods and services
Reappraisals	Changes in the measured stock of assets due to the use of updated information that permits reassessment of the size of the stock.
Reclassifications	Changes in assets that result from situation in which an asset is used for a different purpose. A reclassification of an asset in one category should be offset by an equivalent reclassification in another category.
Resource rent	The revenue generated from the sale of a resource asset less all costs incurred in its extraction, included the costs of produced capital.
Return to environmental assets	The income attributable to the use of environmental assets in a production process after deducting all costs of extraction, including any costs of depletion of natural resources
Revaluations	Changes in the value of assets due to price changes and reflect nominal holding gains and losses on environmental assets. The nominal holding gain for environmental assets is calculated in the same way as for non-financial assets— as the increase in value accruing to the owner of the asset as a result of a change in its price over a period of time
Unit resource rent	The resource rent per unit of resource extracted.





