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ABBREVIATIONS

AAGR	Annual Average Growth Rate
AET	Actual Evapotranspiration
AN	Ammonium Nitrate
ANFO	Ammonium Nitrate – Fuel Oil
APCF	Anti – Pollution Control Facilities
ASDMP	Annual Social and Development Management Plan
AURI	Acute Respiratory Tract Infection
AVP	Audio – Visual Presentation
BACHRISMUPAL	Bataraza Christian Muslim Palawano Association, Inc.
BFAR	Bureau of Fisheries and Aquatic Resources
BHS	Barangay Health Stations
BHW	Barangay Health Workers
BMWP	Biological Monitoring Working Party
BOD	Biological Oxygen Demand
BSWM	Bureau of Soil and Water Management
CADT	Certificate of Ancestral Domain Title
CBD	Convention on Biological Diversity
CBMS	Community Based Monitoring Survey
CBNC	Coral Bay Nickel Corporation
CEC	Cation Exchange Capacity
CEDO	Cooperative and Economic Development Office
CENRO	Community Environment and Natural Resources Officer
CENRO	City Environment and Natural Resources Office
CENRO	Community Environment and Natural Resources Office
CHED	Commission on Higher Education
CITES	Convention on International Trade of Endangered Species
CLUP	Comprehensive Land Use Plan
CLWUP	Comprehensive Land and Water Use Plan
CMR	Compliance Monitoring Report
CMVR	Central Motor Vehicle Rules
ComRel	Community Relations
CPH	Census of Population and Housing
CRA	Community Relations Assistance
CRO	Community Relations Office
CSR	Corporate Social Responsibility
DA	Department of Agriculture
DAO	DENR Administrative Order
DBH	Diameter Breast Height
DCCs	Day Care Centers
DENR MC	Department of Environment and Natural Resources – Memorandum Circular
DepEd	Department of Education
DIA	Direct Impact Area
DMT	Dry Metric Ton
DO	Dissolved Oxygen
DOH	Department of Health
DOLE	Department of Labor and Employment
DP	Decommissioning Plan
DPWH	Department of Public Works and Highways
DSWD	Department of Social Welfare and Development
DTI	Department of Trade and Industry
ECA	Environmentally Critical Area

ECAN	Environmental Critical Area Network
ECC	Environmental Compliance Certificate
ECM	Environmental Compliance Monitoring
ECP	Environmentally Critical Project
EGGAR	Engineering Geological and Geohazard Assessment Report
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMB	Environmental Management Bureau
EMP	Environmental Monitoring Plan
EMU	Environmental Monitoring Unit
EPEP	Environmental Protection and Enhancement Program
EPR	Enrolment Participation Rate
EPRMP	Environmental Performance Report and Management Plan
EQPL	Environmental Quality Performance Level
ERA	Environmental Risk Assessment
ERP	Emergency Response Policy
ERPP	Emergency Response and Preparedness Plan
ERT	Emergency Response Team
ETF	Environmental Trust Fund
FGDs	Focus Group Discussions
FMR	Final Mine Rehabilitation
FMR/DP	Final Mine Rehabilitation and/or Decommissioning Plan
FO	Fuel Oil
FPIC	Free and Prior Informed Consent
FPIC	Free and Prior Informed Consent
GFR	General Fertility Rate
GHG	Greenhouse Gas
GK	Gawad Kalinga
GR	Groundwater Recharge
HDR	Human Development Report
HPAL	High – Pressure Acid Leach?
HPP	Hydrometallurgical Processing Plant
ICC	Indigenous Cultural Communities
ICCs	Indigenous Cultural Communities
IEC	Information, Education, and Communication
ILS	Indigenous Learning School
IMP	Impact Management Plan
IMR	Infant Mortality Rate
IP	Indigenous People
IRA	Internal Revenue Allotment
IRRI	International Rice Research Institute
IUCN	International Union for Conservation of Nature
IV	Importance Value
KIIs	Key Informants' Interviews
LGU	Local Government Unit
LSIFR	Location Specific Individual Fatality Risk
LSVMS	Leonides S. Virata Memorial School
MASL	Meters Above Sea Level
MCM	Million Cubic Meters
MEPEO	Mine Environmental Protection and Enhancement Office
MGB	Mines and Geosciences Bureau
MMT	Multi – Partite Monitoring Team
MOA	Memorandum of Agreement
MPSA	Mineral Production Sharing Agreement

MPSA	Mine Productivity Sharing Agreement
MRF	Mine Rehabilitation Fund
MTF	Monitoring Trust Fund
NAMRIA	National Mapping and Resource Information Authority
NAPOCOR	National Power Corporation
NCIP	National Commission on Indigenous People
NEDA	National Economic and Development Authority
NFPA	National Fire Protection Agency
NGOs	Non – Government Organizations
NIA	National Irrigation Administration
NO_x	Nitrogen Dioxide
NSO	National Statistics Office
NWRC	National Water Resources Council
OHSAS	Occupational Health and Safety Assessment Series
PAGASA	Philippine Atmospheric, Geophysical Astronomical Services Administration
PALECO	Palawan Electric Cooperative
PCO	Pollution Control Officer
PCSD	Palawan Council for Sustainable Development
PENRO	Provincial Environment and Natural Resources Office
PET	Potential Evapotranspiration
PEZA	Philippine Economic Zone Authority
PGR	Population Growth Rate
PhilRice	Philippines Rice research Institute
PHIVOLCS	Philippine Institute of Volcanology and Seismology
PM10	Particulate Matter 10
PMR	Proportioned Mortality Rate
PPE	Personal Protection Equipment
PSU	Palawan State University
PTB	Pulmonary Tuberculosis
R&D	Research and Development
RCF	Rehabilitation Cash Fund
RHU	Rural Health Unit
RIA	Regional Impact Area
RMM	Resident Mine Manager
RTEPZ	Rio Tuba Economic Processing Zone
RTN	Rio Tuba Nickel
RTNFI	Rio Tuba Nickel Foundation, Inc.
RTNMC	Rio Tuba Nickel Mining Corporation
SDMP	Social Development and Management Program
SDP	Social Development Plan
SEP	Strategic Environmental Plan
SEP	Socio – Economic Profile
SHP	Safety and Health Program
SMR	Self – Monitoring Report
SO_x	Sulfur Dioxide
SWMP	Site Waste Management Plan
TDS	Total Dissolved Solids
TESDA	Technical Education and Skills Development Authority
TPH	Ton Per Hour?
TSP	Total Suspended Particle
TSS	Total Suspended Solids
UMPI	Unichamp Mining Philippines, Inc.
US EPA	United States Environmental Protection Agency
UTI	Urinary Tract Infection

VOCs	Volatile Organic Compounds
WMT	Wet Metric Ton
WPU	Western Philippines University
WWTF	Wastewater Treatment Facility

EXECUTIVE SUMMARY

1.0 PROJECT BACKGROUND

1.1 Background of the Project

Project Name:	**Increase in Annual Production of the Gotok Limestone Quarry Project**
Nature of Project:	**Resource Extractive Industry (Quarry)** **Increase in annual production**
Total Area:	**13.0 ha**
Site Location:	**Barangay Iwahig, Rio Tuba and Sandoval, Municipality of Bataraza, Province of Palawan**

1.2 Profile of the Proponent

Name of Proponent:	**Rio Tuba Nickel Mining Corporation (RTNMC)**
Office Address:	29th Floor NAC Tower, 32nd Street, Bonifacio Global City, Taguig, Metro Manila
Contact Person:	Philipp D. Ines Resident Mine Manager
Tel. No./ Fax No.:	(02) 798-7622 loc. 8308

1.3 Profile of the Preparer

EPRMP Preparer:	Gaia South, Inc.
Office Address:	7th Floor Montepino Bldg., Adelantado cor. Gamboa St., Legaspi Village, Makati City
Contact Person:	Liezyl S. Liton-Relleta Project Director
Tel. No./ Fax No.:	(02) 893-5661

Presented in **Table ES1** is the comparative matrix of the current and proposed operation in the quarry and crushing plant.

Table ES1
Comparative components of quarry and crushing plant operations

Component	Existing Operation	Proposed Expansion
MPSA	213-2005-IVB	SAME
ECC	ECC-0707-002-3721 – Gotok Limestone Quarry ECC-CO-1312-0043 – Crushing Plant	New ECC
Area covered in the MPSA	**84.5 hectares**	**84.5 hectares**
Total project area for the quarry operation (within the MPSA)	**14.05 hectares**	**SAME**
ECC Approved quarry area within the MPSA	13.0 hectares	13.0 hectares
Ancillary facilities within the MPSA	0.9 hectares	SAME
Access roads	0.15 hectares	SAME
Total project area for the crushing plant operation (within AMA-IVB-144A and MPSA-114-98-IV)	**3.796 hectares**	**SAME (Note that the crushing plant will remain under ECC-CO-1213-0043)**
Infrastructures	1.895 hectares	SAME
Stockpile area	0.631 hectares	SAME
Access road	0.770 hectares	SAME
Storage area of explosives	0.500	SAME
Total project area outside any MPSA (hauling road)	**6.80**	**SAME**
Common facilities with RTNMC Nickel Operations	26.45	SAME
Annual Production Rate	372,000 WMT per year	725,000 WMT per year
Mine life	Up to 2026	Up to 2022
Method of ore extraction	conventional drilling and blasting technique	SAME
Hauling road	10 km	SAME
Crushing plant	**Note that the crushing plant will remain under ECC-CO-1213-0043**	
Usage	• Limestone crushing	SAME
Components	• Jaw Crusher - One (1) unit, Kurimuto, 3,020 ST, 700 mm x 500 mm x 95 mm CSS/ Discharge • Roll Crusher- One (1) unit Kurimuto 3624 Double Roll Crusher • Vibrating Screen - Two (2) units Triple Deck with 75 mm opening; One (1) unit, NFS 1230, 1200 mm X 3000 mm w/ 100 mm opening, single Deck; One (1) unit, 1200 mm X 3650 mm w/ 25 mm opening, single Deck	• Jaw Crusher - One (1) unit, Terex Jacques, JW 42, 1070 mm x 760 mm • 125mm CSS/ discharge • Roll Crusher- One (1) unit Cone Crusher, Terex- Jaques, TC100 • Vibrating Screen - One (1) unit, Triple Deck, 6' x 16", 80 mm top, 55 mm middle and 30mm bottom; One (1) unit, NFS 1230, 1200 mm X 3000 mm w/ 30mm opening, single Deck; One (1) unit Double Deck Horizontal Screen, 5' x 15', 55 mm top and 3mm bottom deck • Water System
Size Out put	0-30mm	• 0-30 mm • 30-55 mm • 55- 80 mm
Maximum Capacity	110 TPH	250 TPH
Water Source	• Water wells 2 and 3 • Umawi Stream • Mine pit and siltation ponds	• Water wells 2 and 3 • Umawi Stream • Mine pit and siltation ponds Tagpisa Siltation pond (back-up source)
Water requirement	No washing at the pre-modified plant 14 m^3/day (road watering)	1,044 m^3/day (washing plant) 16.5 m^3/day (road watering) 106.5 m^3/day (domestic water

Component	Existing Operation	Proposed Expansion
	106.5 m^3/day (domestic water requirement)	requirement)
Power Source	One (1) 700 kW Diesel Generator Two (2) 350 kW Diesel Generator	SAME
Power requirement	373,912 kW-hr	1,670,438 kW-hr
Fuel requirement	733,100 liters	1,566,100 liters
Manpower requirement	117 (supervisor, operator, driver, utilities and security guards)	213 (supervisor, operator, driver, utilities and security guards)
Project Cost	PhP 221 M	PhP 376,906,207

2.0 PROJECT BACKGROUND

2.1 The Environmental Impact Assessment (EIA) Report

Securing an Environmental Compliance Certificate (ECC) for an expansion project of a resource extractive industry (Environmentally Critical Project) such as this particular project requires an Environmental Performance Report and Management Plan (EPRMP). This study follows the standard EPRMP outline presented in the Revised Procedural Manual for DENR Administrative Order No. 30, Series of 2003 (DAO 03-30).

- Project Description;
- Analysis of Key Environmental Impacts;
- Environmental Risk Assessment;
- Impacts Management Plan;
- Environmental Compliance Monitoring;
- Emergency Response Policy and Generic Guidelines;
- Abandonment/Decommissioning/Rehabilitation Policies and Generic Guidelines; and
- Institutional Plan for EMP Implementation.

To facilitate the start of the study, a Public Scoping Meeting was held last February 27, 2014 at the Gotok Elementary School in Barangay Iwahig, Municipality of Bataraza, Province of Palawan. The meeting was attended by 79 participants from the Department of Environment and Natural Resources (DENR), Palawan Council for Sustainable Development (PCSD), Municipal office, Barangay Council, Indigenous Cultural Community (ICC) members and local stakeholders, church, academe, farmers' sector, local organizations, RTNMC and Gaia South (**Table ES2**). **Annex ES1** includes the Public Scoping Report.

Following the conduct of Public Scoping Meeting, a Technical Scoping Meeting was held in March 31, 2014 at the EIA Conference Room, 2nd Floor EMB Building, DENR Compound, Visayas Avenue, Diliman, Quezon City. The EMB Case handlers facilitated the meeting which was attended by the EMB Review Committee Members, representatives of RTNMC and Gaia South, Inc. **Annex ES2** is the Technical Scoping Checklist.

Table ES2
Participants of the Public Scoping

Sector/ Organization	No. of Participants
Mines and Geosciences Bureau (MGB) Region IVB (MIMAROPA)	1
Environmental Management Bureau (EMB) Region IVB (MIMAROPA)	1
EMB Brooke's Point	1
Palawan Council for Sustainable Development Staff (PCSDS)	1
Municipal Planning and Development Office of the Municipality of Bataraza	1
Barangay Council of Iwahig	3

Sector/ Organization	No. of Participants
Barangay Council of Sandoval	4
Indigenous Cultural Community (ICC) from Brgy. Iwahig	3
ICC from Brgy. Sandoval	2
Farmers' Association of Sandoval	6
Farmers' Association Iwahig	4
Senior Citizens' Group	1
Religious Sector	1
Gawad Kalinga (GK) Highlanders	4
Rural Improvement Club (RIC)	2
Residents from Brgy. Iwahig	3
Residents from Brgy. Sandoval	13
Resident from Brgy. Ocayan	1
Teachers from Sitio Gotok	5
Teacher from Brgy. Sandoval	1
Day Care (DCM)	2
Student from Gotok	1
Rio Tuba Nickel Mining Corp.	14
Gaia South, Inc.	4
Total No. of Participants	**79**

2.2 Limitations of the Study

The Scoping Checklist that was agreed upon during the Technical Scoping Meeting serves as the guide for all the imperative information needed in this EIA. Experts from different field of interest prepared this comprehensive EPRMP based from primary data gathered through actual fieldwork and secondary data sourced from the barangay and municipal offices and other related agencies such as the National Mapping and Resource Information Authority (NAMRIA), Philippine Institute of Volcanology and Seismology (PHIVOLCS), Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), Bureau of Soils and Water Management (BSWM), and Mines and Geosciences Bureau (MGB), among others.

2.3 The Project Team

Table ES3 shows the pool of experts from Gaia South Inc. who was commissioned to prepare this EPRMP document. **Annexes ES3** and **ES4** are the Accountability Statements of RTNMC and Gaia South, Inc., respectively.

Table ES3
List of EIA team members and their respective field of expertise

Consultant/Researchers	Module/Position
Liezyl S. Liton-Relleta	Project Director
Emmanuel G. Ramos, PhD	Team Leader / Geology / Technical Reviewer
Perfecto Evangelista, PhD	Soils and Land use
Thelma D. Dela Cruz, MSc	Environmental Risk Assessment
Judeline Dimalibot, MSc	Terrestrial Fauna
Dhiocel A. Celadiña, MSc	Terrestrial Flora
Davee Drake Medina, MSc	Hydrology/Hydrogeology
Emiterio Hernadez, MSc.	Resource Person for Flood Modelling
Neil James E. Duran	Air and Water Quality
Katherine Escalona, MSc	Freshwater Ecology
Rolando Soncuya, MA	Socio-economics and Public Health
Ozzy Boy Nicopior, MSc	Mapping Specialist
Danica Dela Rosa	Senior Technical Associate
Hanna Bermillo-Arriesgado, MSc	Senior Technical Associate

2.4 The EIA Study Schedule and Area

The MPSA of RTNMC for the Gotok Limestone quarry project covers about 84.5 ha bounded by the coordinates shown in **Table ES4**. From the 84.5 ha, only 13.0 ha was approved by the DENR and PCSD as the active Gotok quarry area. The boundaries of the approved 13.0 ha Gotok Limestone Quarry (**Table ES5**) is within Barangays Iwahig and Sandoval, Municipality of Bataraza, Province of Palawan (**Figure 1.2.1**).

Table ES4. PRS 92' Geographic Coordinates of MPSA

Corner	Latitude	Longitude
1	8˚35'50"	117˚27'45"
2	8˚36'20"	117˚27'45"
3	8˚36'20"	117˚28'15"
4	8˚35'50"	117˚28'15"

Table ES5 Geographical coordinates of Phase 1 and Phase 2 of the Gotok operations

Corner	Latitude	Longitude
Phase 1		
1	8˚36'4.29"N	117˚27'48.26"E
2	8˚36'4.26"N	117˚27'52.05"E
3	8˚36'3.21"N	117˚27'50.74"E
4	8˚35'59.78"N	117˚27'50.41"E
5	8˚35'58.50"N	117˚27'49.56"E
6	8˚35'57.59"N	117˚27'47.81"E
7	8˚35'57.90"N	117˚27'46.45"E
8	8˚35'58.92"N	117˚27'45.32"E
9	8˚36'0.93"N	117˚27'45.54"E
Phase 2		
1	8˚36'17.50"N	117˚27'47.30"E
2	8˚36'20.00"N	117˚27'48.00"E
3	8˚36'20.00"N	117˚27'52.76"E
4	8˚36'18.44"N	117˚27'54.16"E
5	8˚36'16.66"N	117˚27'54.32"E
6	8˚36'15.06"N	117˚27'54.47"E
7	8˚36'13.27"N	117˚27'54.92"E
8	8˚36'12.11"N	117˚27'56.52"E
9	8˚36'10.27"N	117˚27'58.32"E
10	8˚36'08.09"N	117˚27'56.93"E
11	8˚36'08.70"N	117˚27'54.06"E
12	8˚36'06.12"N	117˚27'53.32"E
13	8˚36'06.25"N	117˚27'47.86"E
14	8˚36'13.10"N	117˚27'46.40"E
15	8˚36'15.00"N	117˚27'46.01"E

On the other hand the limestone crushing plant is situated at the existing operation site of RTNMC. **Table ES6** shows the geographical coordinates of the crushing plant area.

Table ES6
Geographical coordinates of the crushing plant area

Corner	Latitude	Longitude
1	8°33'33.61"N	117°25'36.36"E
2	8°33'30.34"N	117°25'36.36"E
3	8°33'30.34"N	117°25'34.93"E
4	8°33'27.44"N	117°25'34.93"E
5	8°33'27.44"N	117°25'32.14"E
6	8°33'29.00"N	117°25'32.14"E
7	8°33'29.00"N	117°25'31.27"E
8	8°33'30.23"N	117°25'31.27"E
9	8°33'30.23"N	117°25'29.65"E

Corner	Latitude	Longitude
10	8°33'31.98"N	117°25'29.65"E
11	8°33'31.98"N	117°25'31.13"E
12	8°33'32.64"N	117°25'32.22"E
13	8°33'32.64"N	117°25'32.95"E
14	8°33'33.61"N	117°25'32.95"E

The series of activities conducted for the development of this EPRMP is detailed on **Table ES7**.

Table ES7
EIA study schedule

Activity	Period
Environmental and Social fieldwork	March to April 2014
Review of environmental monitoring reports and environmental compliance documents	April
Data gap analysis	May 2014 to June 2014
Draft EPRMP Report Writing	June 2014 to January 2015
Submission of EPRMP to EMB for Technical Screening	December 2015
Review Committee Technical Review	(to be included)
Finalization of EPRMP Report	(to be included)

2.5 The EIA Methodology

The discussion of this EIA revolves around the baseline data parameter requirements indicated in the Technical Scoping Checklist. These data were gathered using scientifically acceptable schemes and were assessed using the scientific methodology/approach required by the DENR. **Table ES8** summarizes the EIA methodology. Provided, as **Annex 2.1.1** is the baseline methodology for each environmental component.

Table ES8
EIA study methodology

Component	Description
Land Use	• Use of Comprehensive Land use Plan (CLUP) of Bataraza; • Use of Palawan Council for Sustainable Development (PCSD) Environmentally Critical Areas Network (ECAN) Map; and • Citation of Municipal and Provincial Resolutions for Land Use Classification.
Geology	• Use of maps and reports from the MGB, PHIVOLCS, other related literature and RTNMC EPRMP 2014.
Pedology	• Use of CLUP Bataraza BSWM reports, project map and NAMRIA Topographic Map with a scale of 1:50,000; • Soil samples from four (4) observation sites collected using a drill-type auger from within the project area; • Physico-chemical analyses of samples (texture, pH, N, OM, P, K, CEC). Analysis was done at the soils laboratory of BSWM. • Heavy metal analysis (Hg, Cr^{+6}, Cu, Cd, As and Pb) was analyzed by Ostrea Mineral Laboratories. • Four erosion susceptibility ratings namely: (1) rainfall, (2) soil properties, (3) land use/vegetation and (4) slope were used to form the final erosion susceptibility rating.
Terrestrial Biology	• Use of NAMRIA Topographic Map; • Terrestrial Flora survey - 16 sampling stations for the closed-canopy and open-canopy ecosystem. The dimension of the quadrat was 20m x 10m. Each quadrat was divided into sub-quadrats using the four cardinal directions. • Terrestrial Fauna survey - three (3) terrestrial vertebrates survey sites/transects and four (4) caves. Information were gathered thru observations using all the senses, and use of field equipment and materials which include binoculars, GPS, digital camera, 3m x 12m nylon mist nets, live and snap traps, flashlights, bird bags, and field notebooks. To monitor the terrestrial vertebrate fauna the following standard procedures were used:

Component	Description
	○ **Bird -** Direct observations while doing the transect walk coupled with mist netting were employed for taxon ○ **Mammals** - Methods used included mist netting for volant or flying species. Live trapping, tracks and sign identification (e.g. droppings, wallowing areas, dens) and direct sighting techniques were used for terrestrial and arboreal (but non-volant) species. ○ **Reptiles and Amphibians (Herps) -** The Visual Encounter Survey was used in the inventory of herps while passing through established transect lines. Frogging was done in the only water body (creek) which was located at the western side outside the area with the tree-cutting permit. ○ **Cave Assessment -** Caves in the vicinity and within the quarry site was assessed according to the provisions of RA 9072, the National Caves and Cave Resources Management and Protection Act of 2001
Hydrogeology	• Use of RTNMC records, PAGASA data, National Water Resources Board records and NAMRIA Map; • The monthly PET in the Gotok area was computed from the RTNMC and CBNC weather data using the FAO Penman-Monteith Method (Allen, et al, 1998); • The monthly AET values were then estimated from the PET values were using the Turc-Pike Equation (Xu, C.Y. and Singh, V.P., 2004); • The annual water balance for the Ocayan river watershed was computed using the Long Term Water Balance Method (Sokolov & Chapman, 1974); and • For the 1D hydrodynamic modeling of the river system surrounding the Gotok MPSA, a free and open source software called ANUGA, developed by Roberts and collaborators from the Australian National University (ANU) and Geoscience Australia (GA) was used
Water Quality	• Use of monitoring reports for the trend of the parameters being analyzed; and • Water quality assessment on four (4) ambient freshwater sampling stations conducted in accordance to the EMB's manual on ambient water quality monitoring. • The parameters considered were pH, total suspended solids (TSS), dissolved oxygen (DO), biochemical oxygen demand (BOD), salinity, fecal coliform, total coliform, *E. coli*, lead, arsenic, cadmium, mercury, chromium hexavalent and Oil and Grease.
Freshwater Ecology	• Five (5) sampling sites were established for the assessment; and • Plankton were collected from 30-L surface water while benthos were collected using modified surber sampler.
Meteorology, Air and Noise	• Use of monitoring reports and PAGASA data; • Three (3) sampling stations were established for the 24-hr ambient air monitoring report. The parameters monitored were PM10, TSP, SO_2, and NO_2; • For the monitoring of the noise level, three (3) sampling stations were established; and • The estimated GHG emission was derived through the GHG emission calculation tool (version 2.4) formulated by the Greenhouse Gas Protocol Initiative using the fuel requirements provided by RTNMC.
Socio-economics and Public Health	• Primary data generated from Key Informant Interviews (KII), Focus Group Discussions (FGDs), field observations and surveys. Participants were municipal officials from Bataraza, barangay officials and representatives from Barangays Iwahig, Sandoval and Rio Tuba. • surveys ; Use of secondary information such as municipal, barangay and rural health profiles, CLUP, Information, Education, and Communication (IEC) documentation, Social Development and Management Plan (SDMP) Reports, RTN Foundation, Inc. documents, RTNMC hospital documents and other related reports.

2.6 Public Participation

At the very start of the application for an ECC, the stakeholders were already involved. This was through the conduct of various IEC campaigns and Public Scoping Meeting wherein the stakeholders were made aware of the proposed project, possible economic benefits and the conduct of an environmental study needed in securing an ECC. **Table ES9** shows some of the recent meetings conducted by RTNMC in which impact barangays participated. Full-list of the IEC activities implemented is provided as **Annex 5.1.2**.

Table ES9. Recent meetings conducted by RTNMC in relation to its current project

Year	Activity	Participants
2016	Conduct of IEC Caravan within Impact Barangays	Residents of Barangay Iwahig, Barangay Sandoval and Barangay Rio Tuba
	Conduct of monthly coordination meeting with ICCs, IPDO and PMC	Tribal Chieftains and IPDO staff
2017	Conduct of IEC within Host and Neighboring barangays	Residents of Barangay Iwahig, Barangay Sandoval and Barangay Rio Tuba
	Conduct of Meetings, FGDs	Members/residents of all impact barangays

During the actual EIA activity, local stakeholders were involved using a participatory method such as Key Informant Interviews (KIIs) and Focus Group Discussions (FGDs).

Matrix of issues and concerns raised during the IEC activities and Public Scoping Meetings are provided as **Annex ES5**.

The public participation does not only include attendance to meetings (e.g. IEC, FGDs, KIIs) but it also extends to the partaking in the monitoring activities of the environmental compliance of the operation of RTNMC. This is through the Multi-Partite Monitoring Team (MMT). Current composition of the MMT is discussed in *Chapter 6*. On the other hand, during IECs the results of the monitoring are also presented to the people to which they can raise questions and RTNMC responds. The IECs are documented. Through this, the public are being notified on the current and future plans/activities of the company. Thus, local participation is highly regarded by the Company.

2.7 Delineation of Impact Areas

The degree of the impact of the project on an area can be categorized as primary and secondary. This is determined based on the proximity of an area to a certain project component.

For this proposed project, the primary impact areas are delineated based on the following:

1. Within the Gotok Active Plan;
2. All the buffer zones as required under the ECC;
3. Located within 200 m from both sides of the haulage roads from quarry area to Kulantuod Junction;
4. The host area for the crushing plant, quarry ancillary facilities and haulage road; and
5. River or stream used as final discharge outlet of the crushing plant.

Barangays Iwahig and Sandoval where the Gotok Limestone Quarry is located and Brgy. Rio Tuba, where the limestone crushing plant is situated, are all host communities and therefore considered as primary impact areas.

The potential impact on the flora and fauna are concentrated within the 13.0-ha approved area (Phase 1 and Phase 2). A 50-m bufferzone delineated around the periphery of approved quarry area is being maintained. Status of the maintenance of the vegetation within the bufferzone is discussed in *Chapter 2*.

On the other hand, areas which are not host to any project components but still experiencing the effect of the operations of the quarry and crushing plant are considered as secondary impact areas. These areas were delineated using the assumption that the effect of noise and dust can still be felt within 1,000 m or 1 km from both sides of the haulage roads and within 1,000 m from the boundaries of the 13.0 ha quarry area and crushing plant. The nearby barangay of Ocayan from where a stretch of the haulage road is located is considered as secondary impact area for this project.

Municipality of Bataraza is identified as the Regional Impact Area (RIA) of the project as the impacts, mostly of social aspect can be experienced. The whole province of Palawan will also be indirectly affected by the proposed project due to social benefits that will arise from the quarry operation. Please refer to **Figure 1.2.6** in ***Chapter 1*** for the map of the project impact areas.

Stated as a conditionality under ECC No. 0201-021-313, *buffer zones of forty (40) meters wide measured landward along river/stream bank's high water line and along the entire periphery of the project site shall be established. Fast growing vegetation, indigenous where possible, shall be planted and maintained in these zones.* **Figure 1.2.7** in ***Chapter 1*** illustrates the buffer zones for this project.

3.0 SUMMARY OF BASELINE CHARACTERIZATION

Table ES9 presents the summary profile of the environment and people in the impact areas of the Gotok Limestone Quarry and processing plant.

Table ES9
Summary of profile of the environment and people

Component	Description
Land Use	Baseline • Based from the latest CLUP, the municipality of Bataraza has four (4) general land uses namely: 1) settlement/built-up areas; 2) agricultural areas; 3) forest areas; and 4) special use areas; • According to the ECAN Map from PCSD, the 84.5 ha MPSA of RTNMC lies within two (2) zones namely: controlled use zone and traditional use zone; • Through the Free and Prior Informed Consent (FPIC) and Certificate of Ancestral Domain Title (CADT), there are no conflicting tenurial/land issues within the MPSA; and • Given the irreversible impacts of the quarry project in the area, RTNMC is also implementing its Reforestation and Rehabilitation Program.
Geology	• The main structural feature in the region is the thrust fault contact between the ultramafic rocks and the older sedimentary and volcanic rocks; • The ultramafic rock that underlies the MPSA of the Gotok Limestone quarry consist of harzburgite, dunite and pyroxenite, in order of decreasing abundance; • The continued operation in the quarry site significantly changed the original landform, slope and underground geomorphology in the project area. The original sloping and rugged terrain will be transformed into crater-like formations after the quarrying operations. As part of the rehabilitation program, RTNMC shall backfill the said craters to maintain a relatively consistently level topography; and • Liquefaction occurs in seismically active areas that are underlain by thick, saturated deposits of unconsolidated sand and silt. Since Palawan is not seismically active and there are no thick, unconsolidated sand and silt deposits in the vicinity of the project site, the area is not prone to liquefaction and subsidence. However, landslide due to heavy rains and erosion might happen.
Pedology	• The soil type in the project area is Bolinao clay and the two (2) soil mapping units are the Bolinao clay 0 – 8% slopes and Bolinao clay 18≥50% slopes; • From the soil analysis: Bolinao clay 18≥50% slopes : ○ Copper and Iron are very low. Zinc is high to very high and Manganese is low. The

Component	Description
	natural fertility of the soil is high; Bolinao clay 0 – 8% slopes on the infilled valley: ○ Copper and Iron are very low. Zinc is very high (2.23 mg/kg) while Manganese is medium. The natural fertility of this soil is medium; Bolinao clay 0 – 8% slopes on broad flat to almost flat terrain: ○ Copper, Zinc and Iron are very low. Manganese is medium. The natural fertility of this soil is low; ○ All heavy metals (Arsenic, Cadmium, Nickel, Cobalt, Lead and Mercury) for all soil types are below the contamination levels as prescribed by the Taiwanese and Dutch standards; and ○ The bare area on Bolinao clay with 18≥50% slopes is with "high susceptibility to erosion while the Forest, Coconut plantations and Shrubland on Bolinao clay with slopes of 0 – 8% are with "slight susceptibility to erosion". • Based on the Composite Erosion Susceptibility Decision Rule of Bruce (1982), the final rating of the area is "moderately susceptible to erosion"; • The continued operation in the quarry site will significantly result to loss of top soil in the project area and with the increase in production, soil contamination with oil and grease will likely occur if not mitigated properly; and • In order to mitigate the impacts of its current operation, RTNMC implements its solid waste and hazardous waste management program.
Terrestrial Ecology	Terrestrial Flora • In general, the vegetation of the quarry area is a limestone forest which had both closed-canopy forest and open-canopy ecosystem; • During the study, seven (7) plant species namely: *Aglaia smithii*, Antipolo (*Artocarpus blancoi*), Ipil (*Intsia bijuga*), Hamindang, Mitrephora (*Mitrephora fragrans*), *Sindora inermis*, Xylosma (*Xylosma palawanense*) that are in the redlist of International Union for Conservation of Nature (IUCN) for threatened plant were recorded; • The impacts of the Gotok Limestone Quarry to the flora biodiversity will be the removal and loss of habitat, loss of important species, and threat to the abundance, frequency and distribution of important local species if not properly mitigated. These impacts will be concentrated on the area where tree cutting was applied for within the MPSA; and • As part of its environmental program, about 1.84 hectares of mined-out portions of the quarry area were completely rehabilitated. RTNMC has planted a total of 496 seedlings of endemic and indigenous forest tree species and vetiver seedlings.
	Terrestrial Fauna • There are 38 bird species, 58% of which are residents, 39% are endemic while 3% are migratory. The Palawan Hornbill, *Anthracoceros marchei*, is under the Vulnerable category. *Pericrocotus cinnamomeus* (Small Minivet) and *Stachrys hypogrammica* (Striped Babbler) are given the Near Threatened category; • Among the 10 species (7 : volant; 3: non Volant) of mammals observed and recorded from the three (3) survey sites, majority are considered as Least Concern except for *Macaca fascicularis philippensis* which is under the Near Threatened category (DENR 2004-15). All species are common, abundant and widespread; • During the survey, six (6) species of amphibians and three (3) species of reptiles were recorded. Seven of which are categorized as Least Concern while one (1) is Near Threatened (DENR 2004-15); and • The felling of trees and the clearing of vegetation will hinder the mobility of wildlife species specially tree and ground dwellers and fragmentation of habitats will occur. Monkeys were observed in Transect 1 and Transect 3 but not in Transect 2, which is in the middle of the two (2) sites. The only access from Transect 1 to Transect 3 is through the trees. If these are cut, then foraging of monkeys will be limited to the site in Transect 1. As for ground dwellers, the animals cannot move from one area to another without vegetation cover. They are in danger of dessication e.g. frogs and toads. Eventually, loss of access will result to loss of species. In the long run, alien or invasive species will proliferate and will prevail over native and endemics.
Hydrogeology	• The Gotok Limestone Quarry lies at the southwestern section of the limestone hill and is drained by an intermittent tributary of the Ocayan River; • The annual rainfall, evapotranspiration, stream discharge and groundwater recharge in the Ocayan River watershed amount to 218.94, 109.41, 91.00 and 18.53 MCM, respectively; • Residents of Barangays Sandoval and Iwahig used to obtain their domestic water requirements from Level 1 water sources consisting of shallow wells and springs; • The aquifers in the vicinity of the project site are replenished from direct rainfall infiltration, infiltration from the tributaries of the Iwahig and Ocayan rivers and

Component	Description
	groundwater movement from high to low areas so the increased production of the quarry will have an insignificant effect on the amount of available groundwater in the vicinity; • the project will not compete with users of groundwater since there are no wells in the immediate vicinity of the quarry and the water source of residents in the area is already supplied by the Level 2 water system of RTNMC and CBNC; • The flood modeling predicts that the Gotok quarry area is not prone to riverine floods for both simulations of baseline conditions and proposed expansion. However, localized flooding may occur on the south and southwest portion of the MPSA; and • As part of RTNMC's stormwater management system, diversion canals, ditches and two silt collector sumps were constructed to reduce instances of flooding as well as a mitigating measure to lessen siltation. This sump is periodically desilted to insure its effectivity during flooding events.
Water Quality	• In the 2014, four (4) sampling stations (two in Oning Creek (freshwater) and two in Rio Tuba River (brackish)) were established by Gaia South for the water quality assessment; o All the stations sampled for pH, DO, salinity, BOD, TSS, oil and grease and heavy metals (Cr^{+6}, As, Cd, Pb and Hg) are within the DENR Class C and SC standards; and o The bacteriological parameters of the sampled stations failed to meet the DENR standard • Water quality monitoring of RTNMC for the Gotok Limestone Quarry Project involves monthly sampling/monitoring of two (2) stations: Oning Spring and Gotok Entry Tunnel. The parameters being monitored are pH and TSS. The pH levels from 2010 to 2014 were relatively within the DAO 2016-08 standard of 6.5 to 9.0. As for the TSS, the values for all stations from 2010 to 2014 monitoring period are under the 80 mg/L limit of DAO 2016-08 for Class C except for second of 2010 at the Gotok Entry Tunnel Station. • The quarry operation, which includes ground stripping made a significant alteration to the landscape. During the continued mining operations, it is expected that sediments from exposed and denuded surfaces will contribute to surface run-off and erosion, leading to possible siltation of nearby waterbodies. Stockpiled soil and other waste materials will also be susceptible to erosion during heavy rains. • A silt collector sump has been constructed by RTNMC as a mitigating measure to trap the fine particles that may be carried away by runoff water to adjoining areas during heavy downpour. This sump is periodically desilted to insure that effluent water discharging from the sump shall be free of fine particles and will accommodate the increased volume of run-off during heavy downpour.
Freshwater Ecology	• Three of the five (5) sampling sites for freshwater ecology assessment represent Rio Tuba River while the remaining two (2) represent Oning spring; • Rio Tuba River is mostly dominated by marine diatom species with concentrations ranging from more than 30,000 cells per liter to more than a million cells per liter and while Gotok spring is also dominated by diatoms, it is at a lesser extent; • Larval forms of zooplankters were also observed to be the most dominant group in all sampling points; • Not much benthic organisms are observed in Rio Tuba; • The family-based scores indicate that upstream Oning has fairly poor water quality while downstream Oning has poor waters; and • No important aquatic species in Oning is threatened with the increase in the annual production of Gotok limestone quarry project. However, increased input of wastewater from settling ponds may increase the probability of an algal bloom in Rio Tuba River.
Meteorology	• The nearest synoptic station to the project site is located in Puerto Princesa, Province of Palawan; • The area is categorized as Type III climate under the Modified Corona Classification of the Philippine Climate which is characterized by relatively dry condition from January to April and wet throughout the year; • Based from three (3) identified rainfall stations (Guintalunan, Mangingidong and Piersite) at Rio Tuba, the rainy season occurs from May to December wherein October is the rainiest month; • The Northern Palawan area is mostly hit by typhoon, which approximately occurs once a year which is mostly during the last quarter of the year when the tail end of the cold front moves towards the southern part of the Philippines; • Based from PAGASA Climate Change Projections, the highest temperature change is the 2.1˚C increase in 2050 for the months of June-July-August; and

Component	Description
	• In addition, Palawan rainfall events (>200 mm) will increase by 250% by year 2020 and 2050. This significant increase may result to localized flooding of the project site considering that quarry activities are designed to culminate at 2022. This impact is short term, which may occur during extreme rain events.
Air	• Air quality monitoring program of RTNMC for this quarry project monthly measurement and recording of the concentration of particulates on two (2) sampling stations established near the quarry area and another one (1) in the admin compound facing the crushing plant for monitoring and reported in the submitted SMR for the Nickel Mining Project; • The particulate concentration of the three (3) sites are all below the maximum standard of the DENR which is 300 µg/Ncm; • The four (4) parameters (NO_2, SO_2. TSP and PM10) analyzed for ambient air were maintained below the DENR standard limit while regular operation was on – going; and • The increased in production of the quarry and modified crushing plant of the project will have an impact on the area's air quality primarily through elevated levels of dust and to a minor extent, SO_x and NO_x in the mining areas where heavy equipment are being used, along access routes and haul roads and within the vicinity of the crushing plant.
Noise	• The RTNMC established a two (2) sampling station for monitoring the noise level within the vicinity of the quarry operations; • The recorded noise readings for all time period from 2012 to 2013 are above the respective standard limit; • A 24-hr noise level sampling was conducted for three (3) stations within and near the vicinity of the quarry area and hauling road from February – March 2014 and it shows that all the three (3) stations exceeded the maximum standard; • Increase in production capacity is accompanied by increase in transport activities within and around the quarry area thus the level of noise is expected to increase. Residents along the hauling route of the dumptrucks will be directly affected by the noise generated from the vehicles that transport limestones to the crushing plant. In addition, blasting activities shall be performed once a week while hole drilling is performed in non-active benches in preparation for the next blasting operation; and • Monitoring data of RTNMC shows noise levels exceeded the maximum noise level for light industrial area. Mitigating measures for the increased noise level should be intensified in preparation for the additional heavy equipment and vehicles that will be utilized with the increased production.
Socio-economics	*Municipality of Bataraza* • The total population of the Municipality of Bataraza was 63,644 persons based on the 2010 Census of Population and Housing (CPH) equivalent to about 8.2% of the total provincial population, higher than the 6% in 2000; • Based on the 2000 census, *Palaw'an* was the leading ethnic group in Bataraza accounting for 31.20% of household population. It is followed by Tagalogs accounting for 18.53% while another IP group, the *Jama Mapun* was third with 10.68% of the household population; • As for the educational system in Bataraza, there were 49 educational facilities catering to the elementary, secondary, and tertiary students: • Thru the proposed project, the Municipality and the impact barangays may benefit from the following: a. Enhancement of employment and livelihood opportunities; b. Increase business opportunities and associated economic activities; and c. Increased revenue of the LGUs. • RTNMC and its sister company CBNC has an integrated social development program composed of the legally mandated Social Development Management Plan (SDMP) and non-SDMP programs that both companies voluntarily implement in favor of the 11 barangays and 24 ICC communities in Bataraza; *Perception survey* • One hundred forty-five (52.35%) out of 277 total respondents were aware that RTNMC is planning to expand the operation of the Gotok Quarry while 129 respondents (46.57%) were not; • About 208 respondents (75.09%) are aware of the positive impacts of mining and 119 of them are living near the quarry area. Some of the positive impacts cited are employment, establishment of business, medical missions and grant of scholarship; • Ninety-seven respondents (35.02%) answered that mining have negative impacts such as shaking of land and flooding for the quarry area and production of bad smell from the crushing area; • One hundred twenty two (44.94%) respondents were in the opinion that the expansion

Component	Description
	project will provide additional positive effects to them while 155 respondents (55.96%) said otherwise. The positive impacts cited are employment, development of communities and nearness to report for work while the negative impacts are flooding, destruction of trees, generation of dusts and landslides; and • When asked about their opinions about the project, one hundred twenty four respondents (44.77%) strongly agree while 72 respondents (25.99%) agree with the proposed expansion of the quarry. Forty-nine respondents strongly disagree with the proposed project while 11 respondents disagree. To summarize, 70.76% approved the project while 21.66% did not approve.
Public Health	• Barangay Rio Tuba listed 19 health related facilities, which include three (3) private medical clinics, one (1) hospital, two (2) maternal and child clinics, a Barangay Health Center, a Family Planning Center, six (6) Day Care Centers and five (5) drug stores. Also, there is the South Palawan Provincial Hospital located in Brooke's Point, about 32 km from the Poblacion area of Bataraza. The RTNFI Hospital, located within the RTN Townsite about 35 km from the town proper which complements the role of the Municipal RHU in health service delivery; • Infant Mortality Rate (IMR) in Bataraza were recorded at 24.55, 16.75, and 11.28 in 2006, 2005 and 2004, respectively; • The leading cause of sickness in the municipality according to the annual health reports starting from 2005 was acute upper respiratory tract infection followed by acute watery diarrhea and malaria; • In Barangay Rio Tuba, the leading cause of death for three consecutive years from 2008 to 2010 was hypertension. Cancer and old age were two (2) other primary causes of mortality in 2010. Other leading causes of death in year 2009 were accidents, with three (3) reported cases, drowning, pancreatitis, pulmonary tuberculosis (PTB), natural cause, diarrhea, asthma, and stub wounds; • Prevalence of malnutrition in Bataraza had been in increasing trend from 2005 to 2007. Reported malnutrition rate were 7.35%, 9.85% and 14.12% in 2005, 2006 and 2007, respectively; • Less than half of the households in Bataraza had access to sanitary toilet facilities. Based on the 2007 records of the Municipal Health Office, only 45% of households had sanitary toilet facilities; and • The proposed expansion of the quarry operations would require additional workers but any additional workers that may be hired by RTNMC would not unduly burden the existing health system in place in Bataraza. However, it is anticipated that the volume of trucks coming from the quarry area to the crushing area in Rio Tuba would significantly increase and may have health implications.

4.0 SUMMARY OF KEY ENVIRONMENTAL IMPACTS AND MANAGEMENT

Presented as **Table ES10** are the key environmental impacts for land, water, air and people and the corresponding management measures. Further details on the mitigating measures are presented in *Section 4.1* of *Chapter 4.*

Table ES10
Impacts assessment and mitigation

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
LAND USE AND CLASSIFICATION					
Change/ inconsistency in land use, slope and subsurface geomorphology The continued operation in the quarry site significantly changed the original landform, slope and underground		✓	✓	✓	• RTNMC shall strictly comply with its approved quarry plan, which involves incremental quarry development and progressive rehabilitation to minimize ground disturbance. • Maintain vegetation cover in the designated buffer zones and in the peripheries of roads

List of Key Impacts	Pre-Construction	Construction	Operation	Abandonment	Options for Prevention or Mitigation or Enhancement
geomorphology in the project area. The original sloping and rugged terrain will be transformed into crater-like formations after the quarrying operations. As part of the rehabilitation program, RTNMC shall backfill the said craters or uneven surface to maintain a relatively consistently level topography.					and quarry area.
Encroachment in Environmentally Critical Areas (ECA) The current location of the RTNMC's project site is considered to be under ECA, qualifying based on two (2) categories. First, the area constitutes some endangered flora species. Second, the area is traditionally occupied by Indigenous People (IP). However, through FPIC and Certificate of Ancestral Domain Title (CADT), there are no conflicting tenurial/land issues within the MPSA. It should be emphasized however that Palawan is considered a critical area with its wide biodiversity. **Caves/sinkholes** The widely distributed caves and sinkholes in the MPSA are evident in the distribution of topographic depressions as shown in **Figure 2.1.2**. The extent of these karst features does not appear to be extensive, however, since the 1:50,000 topographic map does not show any depressions or sinkhole features. This may mean that the limestone is limited in both vertical and horizontal extent and that the limestones are yet limitedly affected by dissolution and thus the development of sinkholes is yet limited. To address the potential groundwater and other environmental degradation that may use these caves and sinkholes as pathways, the company deemed it best to avoid these karst features altogether, as can be seen in the proposed quarry development plan. Exclusion of the caves/sinkholes from cutting and quarrying activities as dictated by the terms and condition of the SEP clearance for the Gotok Limestone Project.		✓	✓		• RTNMC shall strictly comply with its approved quarry plan, which involves incremental quarry development and progressive rehabilitation to minimize ground disturbance. • Maintain vegetation cover in the designated buffer zones and in the peripheries of roads and quarry area.
Possible tenurial land issues* There are no conflicting tenurial/land issues within the MPSA through the					

List of Key Impacts	Phase Occurrence: Pre-Construction	Construction	Operation	Abandonment	Options for Prevention or Mitigation or Enhancement
FPIC and CADT.					
GEOLOGY/GEOMORPHOLOGY					
Change/ inconsistency in land use, slope and subsurface geomorphology The continued operation in the quarry site significantly changed the original landform, slope and underground geomorphology in the project area. The original sloping and rugged terrain will be transformed into crater-like formations after the quarrying operations. As part of the rehabilitation program, RTNMC shall backfill the said craters to maintain a relatively consistently level topography.		✓	✓		• RTNMC shall strictly comply with its approved quarry plan, which involves incremental quarry development and progressive rehabilitation to minimize ground disturbance. • Maintain vegetation cover in the designated buffer zones and in the peripheries of roads and quarry area. • Maintain the 50 m buffer zone around the known opening of the Gray Cave and other caves in the quarry area. These buffer zones are demarcated on the ground and excluded from all quarry activities to protect the integrity of the natural cave structure and to protect the cave-dependent organisms.
Inducement of subsidence, liquefaction, landslides* Liquefaction occurs in seismically active areas that are underlain by thick, saturated deposits of unconsolidated sand and silt. Since Palawan is not seismically active and there are no thick, unconsolidated sand and silt deposits in the vicinity of the project site, the area is not prone to liquefaction and subsidence. However, landslide due to heavy rains and erosion might happen.		✓	✓		• For potential occurrence of landslides, ensure strict implementation of and compliance with the safety and health program, especially the ERPP. • Ensure that all personnel, workers and contractors are properly oriented of the ERPP and ensure the regular conduct of emergency drills.
PEDOLOGY					
Soil erosion Based on the Composite Erosion Susceptibility Decision Rule of Bruce (1982), the final rating of the area is "moderately susceptible to erosion". Although the slope of the area is 3-5% which is considered as "slightly susceptible to erosion", other factors contributing to soil erosion qualifies the area to the "moderately susceptible to erosion" category. The rain may carry the silt in the drainage system of the quarry area thereby affecting the fertility and productivity of soil around the site. This impact is considered significant and will happen in a long period of time if no effective mitigation procedure is employed.		✓	✓		• RTNMC shall strictly comply with its approved quarry plan to limit the extent of exposed soil. • Maintenance of existing stormwater collection system (interceptors, drains, berms and siltation ponds) and installation of other erosion control structures.
Loss of top soil The continued operation in the quarry site will significantly result to loss of top soil in the project area. This impact is		✓	✓		• Proper stockpiling of recovered topsoil if immediate re-application is not possible. • Use of local provenance species of native plants for rehabilitation (when feasible, vegetation established on rehabilitated land

List of Key Impacts	Phase Occurrence: Pre-Construction	Construction	Operation	Abandonment	Options for Prevention or Mitigation or Enhancement
unavoidable and irreversible.					should be similar to the vegetation type and community that was present before quarry started. It is also essential that as much of the local seeds and propagules contained within the top few centimeters of soil be nurtured for later revegetation programs).
Soil contamination with oil and grease The expansion will require additional equipment and vehicles, which use oil and grease. Furthermore, an increase in daily production will result to more frequent hauling of mined ore from Gotok Quarry to the crushing plant. Surface soil contamination with oil and grease will likely occur from leaks and spillages.		✓	✓		• Maintenance of vehicles / heavy equipment strictly within the motorpool. • Regular maintenance of existing storage area for hazardous wastes such as used oil and used oil filter. • Regular maintenance of the oil and water separator shall be done to ensure optimum performance. • Good housekeeping practices including proper handling and clean-up of oil at the motorpool. • Use of auto shut off valves for refueling/re-oiling activities.
Siltation of drainage systems An increase in daily production and hauling activities will result to siltation of drainage systems within the quarry area and along the hauling route. Siltation and sedimentation in the downstream area of the quarry site will be more pronounced during rains. The resulting transport of the sediment will lead to deposition of the materials downstream, along the banks and beds of the rivers, and into the sea. This impact is significant and may occur in a long run if no proper mitigating measure is conducted.		✓	✓		• Installation of sufficient number of diversion canals, interceptors, drains, and berms to avert run-off away from erosion-prone areas. • Regular inspection and maintenance of erosion control structures, drainage channels, culverts and siltation ponds.
Generation of solid and hazardous waste Wastes are being generated from the offices, townsite and other areas where operation is concentrated. This impact affects the aesthetic value of the area and shall cause trajectory diseases from the RTN hospital if not properly contained. Hazardous waste including used oil, batteries and busted lamps/bulbs are also produced from the admin operations, hospital and townsite. Improper waste disposal could also contaminate drainage system in the project site.			✓	✓	• Intensification of the implementation of a Solid Waste Management Program within the quarry area, plantsite, and townsite.
Conversion of soil and rock materials to high valued products The main impact of the project is the conversion of limestone in the ground into a useable and valuable commodity. The mining activities will therefore result into			✓		

List of Key Impacts	Phase Occurrence: Pre-Construction	Phase Occurrence: Construction	Phase Occurrence: Operation	Phase Occurrence: Abandonment	Options for Prevention or Mitigation or Enhancement
the conversion of an idle, low valued earth material into a high valued commodity. This positive impact is only applicable during the operation of the activity.					
TERRESTRIAL BIOLOGY					
Threat to abundance and/or loss of important local flora and fauna species The impacts of the Gotok Limestone Quarry to the flora biodiversity will be the removal and loss of habitat, loss of important species, and threat to the abundance, frequency and distribution of important local species. These impacts will be concentrated on the area where tree cutting was applied for within the MPSA. The area where tree cutting was applied is approximately 10.6 hectares. Quarrying is one example of open-pit mining, which removes surface (and subsurface) materials wholly including vegetation. The felling of trees and the scraping off of ground vegetation will result to the destruction of habitats including roosting and feeding sites of terrestrial fauna, both vertebrates and invertebrates. The area with MPSA for the Gotok Limestone Quarry harbors mostly residents and endemic species of birds, mammals and herps. Removing the trees and the entire vegetation will mean the destruction of roosting and feeding sites which will eventually result to the gradual loss and/or disappearance of endemic species. The removal of the surface soil and original vegetation will most likely cause alien and invasive species of plants and animals to proliferate. Hence, during abandonment, these organisms will prevail and it is not certain if and when original flora and fauna will return. The loss of roosting, nesting and feeding sites brought about by the cutting of trees will lead to the decrease of the number of species and population of wild fauna specially those which are forest and tree dependents. Volant mammals will not be affected if the hill where Maginhawa and Inugon Caves are located will not be touched or disturbed. The creek at the western side (this is where the water flows		✓	✓		• Balling and transplanting of important and threatened plant species of appropriate size. When the balled plants recovered in the nursery they shall be used and transplanted in the buffer zones of the quarry area as well as in the reforestation areas of the company • Propagation of threatened and ecologically important tree species that were found in the project area. This can be adopted as flagship species of RTNMC and will be incorporated as part of the strategy of the company in promoting biodiversity conservation.

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
underground), will eventually be covered with earth and soil because of erosion caused by quarrying. This will affect the habitats of amphibians (mostly frogs) in the area. The presence of *Hoplobatrachus rugulosus* in the pond in the farm beside the hill where the Maginhawa Cave poses danger to the endemic and indigenous species present in the area.					
Hindrance to access to wildlife The felling of trees and the clearing of vegetation will hinder the mobility of wildlife species specially tree and ground dwellers, fragmentation of habitats will occur. Monkeys were observed in Transect 1 and Transect 3 but not in Transect 2, which is in the middle of the two (2) sites. The animals were seldom seen in Transect 2 because there were very few fruiting trees in the area. The only access from Transect 1 to Transect 3 is through the trees. If these are cut, then foraging of monkeys is limited to the site in Transect 1. As for ground dwellers, the animals cannot move from one area to another without vegetation cover. They are in danger of dessication e.g. frogs and toads. Eventually, loss of access will result to loss of species. In the long run, alien or invasive species will proliferate and will prevail over native and endemics.					• Conduct of felling or cutting of trees by section to give time for the animals to adapt to a more suitable habitat.
HYDROLOGY AND HYDROGEOLOGY					
Change in drainage morphology The area of the Gotok Limestone Quarry Project will be limited to the approved 13.0 ha area within the MPSA.			✓		• Construction of diversion canals on open areas to divert surface runoff to the two existing silt collector sumps constructed within the vicinity of the quarry area..-
Change in stream depth The river bed of the downstream portion of Ocayan River may be affected during operation due to earth movement.			✓		• Maintenance of the existing collector sumps within the area.
Inducement of flooding Using the final elevation of the mining area in the flood model (100-year flood return) revealed no major changes in the flood characteristics of the areas downstream of the MPSA based on the comparative results of the two scenarios (**Figures 2.2.7** and **2.2.8**). Within the MPSA, however, depression storage at the downstream-most portion of the mining area which is visible under the pre-development scenario would become			✓	✓	• Improvement and continuous maintenance of the existing drainage channels and sediment control structures within the quarry area.

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
moderately larger in scope once the project progress. **<u>Considering climate change scenario</u>** The climate change projections of PAGASA indicate that rainfall will become more during the rainy season and become less during the dry season. Increasing rainfall intensities will increase the frequency of flooding.					
Depletion in water resources/competition in water use The increased production of the quarry will have an insignificant effect on the amount of available groundwater in the vicinity since Gotok Hill is small and groundwater recharge mainly comes from direct rainfall infiltration throughout the area. Moreover, the project will not compete with users of groundwater since there are no wells in the immediate vicinity of the quarry and the water source of residents in the area is already supplied by the Level II water system of RTNMC and CBNC.					
WATER QUALITY					
Deterioration of water quality *Rio Tuba River* Rio Tuba River is the catch basin of both the industrial and domestic waste in the area. The modified crushing plant produces 313,200 m^3 of wastewater annually. This wastewater is directed to a settling pond. Overflow of the pond is discharged into the Rio Tuba River after it passes thru Upper Kinurong and Lower Kinurong settling ponds. The advantage of the river is the regular inundation of saltwater that dilutes organic materials and allows precipitation of organic matter in the water column. The process allows clarification of water periodically. The ecological process, however, deposits much organic matter into the bottom of the river and increases the sedimentation rate. Benthos, although limited in the brackish environment, is also disadvantaged by the frequent and fast deposition rate.			✓		• Installation and maintenance of the siltation pond designed to contain the wastewater coming from the crushing plant. • Regular maintenance of the drainage system within the offices and motorpool area.

List of Key Impacts	Phase Occurrence: Pre-Construction	Phase Occurrence: Construction	Phase Occurrence: Operation	Phase Occurrence: Abandonment	Options for Prevention or Mitigation or Enhancement
As a catch basin, limiting nutrients to plankton growth also enters the river periodically. Extra nutrient increases the probability of harmful algal bloom occurrences. Consequently, it may increase the probability of fish kill events; spat kills and even unsightly algal accumulation. Current ecological condition of the river points that algal bloom is present. *Oning Spring* Oning Spring, on the other hand, may not be affected in terms of ecological index or water quality, but rather on the overall dynamics, aesthetics, and history of the spring. The proposed maximum depth of 25 masl may affect the cavern where the river disappears and would likely be irreversible. The water quality of the creek that drain the vicinity of the quarry will not experience any adverse impact since surface runoff from the quarry does not reach this creek. The surface runoff is collected in two (2) silt collector ponds and readily infiltrates into the ground.					
Increase in surface run-off and sedimentation of surface water bodies As documented, the quarry operation, which includes ground stripping made a significant alteration to the landscape. During the continued mining operations, it is expected that sediments from exposed and denuded surfaces will contribute to surface run-off and erosion, leading to possible siltation of nearby waterbodies. Stockpiled soil and other waste materials will also be susceptible to erosion during heavy rains.			✓		• Re-evaluation of the existing design of the stormwater collection system and installation of additional components shall be done if needed. • Regular monitoring of the drainage facilities and siltation pond(s) particularly during the rainy season to ensure optimum performance. • Regular cleaning of drainage channels from sediments and debris that may inhibit the flow of water. • Strict implementation of the quarry plan within the approved area.
Contamination of water resources from oil and grease The expansion will require additional equipment and vehicles, which use oil and grease. Furthermore, an increase in daily production will result to more frequent hauling of mined ore from Gotok Quarry to the crushing plant. Surface water contamination with oil and grease will likely occur from leaks and spillages.			✓		• Proper material handling and equipment maintenance. • Good housekeeping practices including proper handling and clean-up of oil at the motorpool site and at the contractor's area.
FRESHWATER ECOLOGY					
Threat to existence and/or loss important local species and			✓		• Installation and maintenance of the siltation pond designed to contain the wastewater

List of Key Impacts	Phase Occurrence: Pre-Construction	Construction	Operation	Abandonment	Options for Prevention or Mitigation or Enhancement
Threat to abundance, frequency and distribution of freshwater species No important aquatic species in Oning is threatened with the increase in the annual production of Gotok limestone quarry project. However, increased input of wastewater from settling ponds may increase the probability of an algal bloom in Rio Tuba River.					coming from the crushing plant.
METEOROLOGY					
Change in local climate According to projection of PAGASA, Palawan rainfall events (>200 mm) will increase by 250% by year 2020 and 2050. This significant increase may result to localized flooding of the project site considering that quarry activities are designed to culminate at 2022. This impact is short term, which may occur during extreme rain events.			✓		• Progressive rehabilitation and maintenance of the vegetation along the buffer zones. • Re-evaluation of the existing design of the stormwater collection system and installation of additional components shall be done if needed. • Regular monitoring of the drainage facilities and siltation pond(s) particularly during the rainy season to ensure optimum performance. • Regular cleaning of drainage channels from sediments and debris that may inhibit the flow of water. • Strict implementation of the quarry plan within the approved area.
GREENHOUSE GAS EMISSION					
Contribution in terms of Greenhouse Gas Emission Due to the additional requirement of heavy equipment for the proposed increase in production, the GHG Emission is expected to increase. Progressive rehabilitation and maintenance of the vegetation along the buffer zones shall be implemented to aide in the sequestration of the increased GHG emissions from the increased number of vehicles and heavy equipment. Aside from this, regular maintenance of all heavy equipment shall be practiced.			✓		• Progressive rehabilitation and maintenance of the vegetation along the buffer zones.
AIR QUALITY AND NOISE LEVEL					
Degradation of air quality The increased in production of the quarry and modified crushing plant of the project will have an impact on the area's air quality primarily through elevated levels of dust and to a minor extent, SO_x and NO_x in the mining areas where heavy equipment are being used, along access routes and haul roads and within the vicinity of the crushing plant.			✓		• Maintenance of vegetative cover along peripheries of the quarry area. • Installation of windbreakers in the quarry area and the vicinity of the crushing plant to prevent the proliferation of dust particles during dry and windy days. • Implement a lower drop height during limestone loading and speed limit of service vehicles, hauling trucks and other heavy equipment. • Regular water spraying specially on unpaved stretch of the haulage route. • Covering hauling trucks with tarpaulin or

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
					canvas to prevent the unwanted discharge of materials and dusts. • Installation of tire-washing platform at the Kulantuod junction.
Increase in ambient noise level Increase in production capacity is accompanied by increase in transport activities within and around the quarry area thus the level of noise is expected to increase. Residents along the hauling route of the dumptrucks will be directly affected by the noise generated from the vehicles that transport limestones to the crushing plant. Within the quarry area, sources of noise are the blasting operation, which is performed using dynamites and ANFO (Ammonium nitrate/Fuel oil) and the hole drilling operation. With the increase in production, blasting activities shall be performed once a week while hole drilling is performed in non-active benches in preparation for the next blasting operation. In addition, the number of heavy equipment used in the quarry operation (drilling, blasting, stockpiling, loading and hauling) such as backhoes, wheel loaders, bull dozer, breaker, drilling equipment, and dumptruck shall be augmented to support the increased production of 725,000 MT. This may result to an increase in the ambient noise level not only within the quarry area but also at the nearby communities.			✓		• Maintenance of existing vegetation near the quarry area to serve as noise barrier. • Proper vehicle and heavy equipment maintenance. • Proper scheduling of equipment operation to avoid disturbance to the nearby communities. • Proper monitoring of noise level especially during blasting activity around the quarry area and nearby communities.
SOCIO-ECONOMICS					
Displacement of settlers *Barangay Rio Tuba* -- The influx of migrants seeking employment and livelihood opportunities created by the mining operations triggered the rapid urbanization of Rio Tuba from 1996 up to the present. Rio Tuba had a population of 7,663 persons in 2000 and the number of inhabitants more than doubled by 2010, with a population of 16,577 persons. Correspondingly, the demand for living space increased resulting in the appreciation of land prices in Rio Tuba, especially along the Macadam Road. The increase in land prices is also being felt in the nearby barangays of Sumbiling, Ocayan, Sandoval and Igang-Igang.					

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
Barangays Iwahig and Sandoval - The 84.5-ha MPSA covering the Gotok Quarry area (located in Brgys. Iwahig and Sandoval) is uninhabited and the expansion of the quarry will not displace any type of settler or occupant. The surface owners and/or occupants have been paid by the company for their surface rights before the start of the quarry operations and there are no issues or concerns in relations to the purchase of the surface rights of the whole MPSA area. The surrounding areas/parcels of lands are agricultural and are planted by coconuts and rice. These crops continue to grow and produce and there are no reported adverse effects of the quarry operations to the agricultural sector. RTNMC is very aware that their mining operations (including the quarry operations) would result in an increase in demand for decent housing for their employees and workers. Hence, aside from the GK housing project, which has targeted the IPs in the area, regular employees of RTNMC and CBNC are provided with free housing either within the RTNMC Townsite or elsewhere. Aside from the free housing opportunity, water and electrical supply are also subsidized for the regular employees of the two companies. The operations of the mine have resulted in additional demand for housing, which is partially addressed by the private sector especially in Rio Tuba. Households provide halfway houses or temporary shelter to their relatives and town mates who are desirous to partake in the employment or livelihood opportunities created by the mining operations. Some households have developed their housing areas to rent rooms or bed spaces for casual workers or migrants who are desirous to work in the mine. There is a possibility that the informal settlement located in Sitio Marabajay, Rio Tuba will expand to accommodate additional informal dwellers seeking to partake in the benefits being derived from RTNMC such as employment, livelihood opportunities and improved delivery of					

List of Key Impacts	Phase Occurrence: Pre-Construction	Phase Occurrence: Construction	Phase Occurrence: Operation	Phase Occurrence: Abandonment	Options for Prevention or Mitigation or Enhancement
basic services. It would be more appropriate if RTNMC would seek LGU intervention through the municipal and barangay officials on the further influx of informal dwellers because they have the legal mandate to maintain public order and protect the public good. Overall, RTNMC is addressing the increase in housing demand brought about by its mining operations including the quarry operations through the IP housing program and in-house housing projects. In addition, the increase in housing demand has created and energized the housing sector and the residents have taken advantage of this opportunity to build additional housing units, remodel old houses and restructure their homes to earn additional income from this housing demand.					
Change/conflict in land ownership There will be no change/conflict in land ownership as the quarry area is uninhabited.					
Cultural/ lifestyle change (especially on Indigenous People) The *Palaw'an* Tribe in Bataraza is on a crossroad of development. Their choices are to go up further to the mountains and minimize interactions with the lowlanders to preserve their cultural identity and traditional ways or embrace the modern ways of information technology, latest techniques in upland agriculture, with all the accessories of modernity but lose or dilute their traditional ways and cultural identity. The *Palaw'an* IP group has been perceived by many of the residents in the direct and indirect impact barangays as a special and privileged group because they are the recipients of special benefits from RTNMC and CBNC such as the Gawad Kalinga Project providing for free housing for the Palaw'ans, free medical services and medicines in the RTN Hospital, fishing and farm equipment. In addition, they have their ILS and have priority for scholarships provided by RTNMC. The SDMP is also disaggregated so that there are specific budget allocations for the IP group in each barangay.			✓		• Program awareness on the preservation of tribal practices. • Conduct of ethnographic study to document culture and traditions. • Establishment of a centralized tribal museum to house the cultural artifacts that may be gathered by the tribe.

List of Key Impacts	Phase Occurrence: Pre-Construction	Construction	Operation	Abandonment	Options for Prevention or Mitigation or Enhancement
Based on the FGDs and KIIs, there are active and deliberate efforts by some tribal elders to preserve their cultural identity by buying back their musical instruments and teaching some promising youth to learn to play these musical instruments. There are some GK areas where the circular pattern of the Palaw'an is still evident and reflective of their traditional spatial orientation.					
In-migration The two (2) main reasons for migrating to Bataraza were livelihood and the migrants' family. In the crushing area, livelihood is higher than in the quarry area. There is a general tendency that migrants tend to settle in Rio Tuba because of greater livelihood opportunities that in other adjacent areas.			✓		• Priority employment of qualified locals. • Provision of appropriate skills training for workers including local hires to control unnecessary increase in local population. • Proper record-keeping of in-migration survey.
Threat to the delivery of basic services/ resource competition Rather than a threat, this is perceived to be a positive impact given the efforts and programs implemented by RTNMC in the water supply, power supply, communications, health resources, peace and order, education facilities and recreational/sports facilities.			✓		• Provision of adequate school facilities and educational materials; training for teachers.
Generation of local benefits (Employment) Some of the benefits from the project implementation include: a. Enhancement of employment and livelihood opportunities; b. Increase business opportunities and associated economic activities; and c. Increased revenue of the LGUs.			✓	✓	• Prioritization of qualified local residents in employment. • Introduction of livelihood projects (skills training for local community as part of SDMP). • Proper maintenance of rehabilitated infrastructure /facilities will enhance this positive impact. • Pertinent fees to be paid promptly.
Traffic congestion Increase in production capacity is accompanied by increase in transport activities within and around the mining area thus the traffic congestion is expected to increase as well.			✓		• Creation and maintenance of a flag man in Kulantuod Junction to warn in-coming vehicles of emerging dump trucks from the quarry site . • Maintenance of traffic aids and street sweepers.
PUBLIC HEALTH					
Threat to public health and safety The proposed expansion of the quarry operations would require additional workers but any additional workers that may be hired by RTNMC would not unduly burden the existing health system in place			✓		• Improvement of facilities of RTN Hospital • Continue Health Monitoring Study. • Implement dust suppression measures such as covering of trucks during hauling. • Regular watering of haulage roads specially along or near the residential and office areas. • Strict implementation of the use of Personal

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
in Bataraza. However, it is anticipated that the volume of trucks coming from the quarry area to the crushing area in Rio Tuba would significantly increase and may have health implications.					Protective Equipment (PPE) among workers. • Ensure that vehicles used are well maintained and suitable for the terrain. • Adopt and implement the safest methods/ technology. • Ensure that persons doing specialized tasks are fully trained. • Strictly implement safety protocols. • Conduct of training programs/drills for all workers and employees that will include safe job procedures, basic firefighting procedures, good housekeeping, OHSAS Systems, emergency preparedness and response, defensive driving, and first aid. • Establishment of clear and adequate signages mainly in accident-prone areas. • Avoid operation during inclement weather • Maintain proper security and cordon off hazardous areas. • Provision of well-ventilated work area. • Improvement in the provision of health facilities/services available to workers and employees during emergencies. • Continue monitoring of workers' health. • Conduct of regular information campaigns to update worker's health and safety responses.

Summary of the Performance Assessment

Land

For its environmental management, RTNMC has conducted earth balling activities, progressive rehabilitation program and maintenance of bufferzones within the periphery of the quarry area among others. To further increase the effectivity of management program, additional mitigating measures mentioned in the matrix of Impact Assessment and Mitigation (**Table ES10**) are recommended.

Water

To ensure the compliance with the environmental standards, one of the mitigating measures implemented by RTNMC was to provide drainage canals that lead to two (2) collector sumps. This measure ensures that fine particles from the open area will not be carried away by runoff water to adjoining areas during heavy downpour. The sumps served as catch basin and allow infiltration of the collected water back into the ground. These sumps are periodically desilted to maintain efficiency specially during heavy downpour where increased volume of run-off is expected.

In the assessment of the water quality monitoring data for Oning Spring (WQM1-Station 14) and Gotok Entry Tunnel (WQM2- Station 15), the data showed that the pH and TSS are generally within the DENR standards. However to strengthen the monitoring, this study recommended to include monitoring of one of the collector sumps located at the southwest potion of the MPSA as water quality station for effluent. Samples of the effluent should be collected whenever there is an overflow.

Air

The air quality monitoring shows that the TSP trends for both stations located within the vicinity of the quarry show values that are below the standard limit set by the DENR (300 µg/Ncm). To further monitor/assess the impact of the quarry as well as the effectiveness of the mitigating measures, this study recommended to include GK Gotok, a residential area, in the monitoring program. A station located near the crushing plant shall also be monitored.
In terms of the predicted increased noise level, current mitigating measures should be intensified in preparation for the additional heavy equipment and vehicles that will be utilized with the increased production. To be able to mitigate the exceedance in noise level, equipment will strictly be operated within working hours and blasting operation will be properly scheduled and announced so as not to cause disturbance to nearby communities. Silencer will be maintained in each equipment.

People

RTNMC and its sister company CBNC has an integrated social development program composed of the legally mandated Social Development Management Plan (SDMP) and non-SDMP programs that both companies voluntarily implement in favor of the 11 barangays and 24 ICC communities in Bataraza.

SDMP II covered the years 2009 to 2013 and actual disbursements amounted to PhP 276.654 million. This was shared with CBNC with RTNMC shouldering approximately one third of the total amount. The largest amount (PhP 93 million) was spent on education. This was followed by social services with PhP 76 million, livelihood programs with PhP 42 million and finally health and sanitation with PhP 116 million. The amount of health and sanitation did not include the amount spent for the RTNFI hospital, which had a separate budget.

Aside from the projects under the SDMP, RTNMC implements the non-SDMP program which is a joint project of the company and CBNC for the host and neighbouring communities of Bataraza. This program is funded by corporate funds of both companies and is separate and distinct from the legally mandated SDMP program. This program is implemented by RTNFI, a private foundation.

For the period from 2009 to 2013, the total amount spent under the non-SDMP program totaled PhP 686.507 million. Again, the share of RTNMC is approximately one third of the total amount.

In *Chapter 5* of this EPRMP, the study recommends several projects that the impact barangays and RTNMC may consider.

5.0 PROPOSED MONITORING PLAN

To ensure the effectivity of the mitigating measures and compliance of the proposed expansion to all environmental laws, the proposed environmental monitoring program is presented as **Table 6.1.1** in *Chapter 6.*

6.0 CONTINGENT LIABILITY AND REHABILITATION FUND (CLRF)

A Memorandum of Agreement (MOA) was entered on 28 July 2003 among RTNMC, CBNC, MGB-IVB, Provincial Government of Palawan, Municipal Government of Bataraza, PCSD, residents of Brgy. Rio Tuba, residents of Sitio Gotok, Brgy. Iwahig, *Katutubong Palawan*, HARIBON Foundation, and Bataraza Christian Muslim Palawano Asso., Inc. (BACHRISMUPAL). The MOA states that pursuant to *Section 181* of the *DENR Administrative Order (DAO)*, a Mine Rehabilitation Fund (MRF) shall be established. The current MRF of RTNMC/CBNC is in two (2) forms: Monitoring Trust Fund (MTF) and Rehabilitation Cash Fund (RCF). The MTF committed as per MOA to cover the expenses of the monitoring activities is PhP 50,000.00 and the current amount deposited in the Development Bank of the Philippines (DBP) is PhP 62,266.61.

On the other hand, the RCF committed as per MOA to ensure compliance with the approved rehabilitation activities is PhP 5,000.000.00 and the current amount deposited is 5,496,378.55. In addition, an Environmental Trust Fund (ETF) amounting to PhP 250,000.00 was established by RTNMC. The current amount deposited under the ETF is PhP 249,066.46.

Annex 6.5.1 shows the signed MOA while **Annex 6.5.2** includes the Statement of Account from the government bank indicating the available funds as of September 30, 2015.

As mentioned previously, the CLRF of the Gotok Quarry is part of the CLRF created for the operation of the HPP of CBNC. However, for the monitoring expenses of the MMT, RTNMC does not utilize the MTF. Instead of withdrawing the deposited fund, RTNMC uses its operational fund.

Once the separate ECC for the Gotok Limestone Quarry has been issued, an Environmental Protection and Enhancement Program (EPEP) and Final Mine Rehabilitation/ Decommissioning Program (FMRDP) shall be formulated for the operation of the Gotok Quarry and the Crushing plant. Subsequently, the CLRF fund exclusively for the said project shall be created.

1 Project Description

Rio Tuba Nickel Mining Corporation

This chapter presents the specific details of the proposed project including the purpose of the application, location, components, process, capacity, workforce and capital investment of Rio Tuba Nickel Mining Corporation (RTNMC). Discussions will focus on the increase in annual production of the Gotok Limestone Quarry and the use of the modified crushing plant.

1.1 PROJECT BACKGROUND

On 10 July 2002, RTNMC was granted an Environmental Compliance Certificate (ECC No. 0201-021-313, **Annex 1.1.1**) for the Hydrometallurgical Processing Plant (HPP) Project, which includes the 13.0-ha limestone quarry in Sitio Gotok, Barangay Iwahig, Municipality of Bataraza. In a letter received by the Environmental Management Bureau (EMB) on August 27, 2002, RTNMC requested for the amendment of the aforementioned ECC (**Annex 1.1.2**). The letter included a copy of the Joint Statement of RTNMC and CBNC in which the companies agreed that CBNC will be the lead company in implementing the then proposed HPP Complex Project. The requested amendments included the transfer of ownership and responsibility of the following components:

1. HPP;
2. Hydrogen Sulfide Production Plant;
3. 9.9 MW Coal-Fired Power Plant;
4. Water Piping Facilities;
5. Two (2) Tailings Dam and Its management;
6. Pier site operations which are land-based;
7. Coal and sub-material stock management; and
8. Product shipment, among others.

while RTNMC will retain ownership and responsibility for the following:

1. Gotok Limestone Quarry;
2. Water Intake Dam;
3. Causeway and trestle;
4. Ore supply and pile management;
5. Siltation ponds and canals management;
6. Road maintenance and other existing RTNMC facilities.

As supporting documents to the request for ECC amendment, RTNMC submitted a copy of the Memorandum of Agreement (MOA) on ECC No. 0201-021-313 and SEC Certificate and Articles of Incorporation and By-Laws of CBNC on September 12, 2002 (**Annex 1.1.3**).

The office of the EMB Director gave its response on the request for ECC amendment on December 4, 2002 (**Annex 1.1.4**). In the letter, it was stated that the office does not split or divide the conditions of the ECC but it may acknowledge any agreement that can be entered between RTNMC and CBNC in relation to the ECC. The letter also stated that RTNMC should submit a duly signed Deed of Assignment and Responsibilities between RTNMC and CBNC and other related documents.

On December 5, 2002, the Records Section of the EMB Central Office received the Deed of Assignment signed by the President of both corporations and the signed MOA (**Annex 1.1.5**). The office of the EMB Director acknowledged the receipt of the said documents in a letter dated February 12, 2003 (**Annex 1.1.6**)

In 2006, CBNC applied for the ECC of the HPP Line 2 as an expansion of its project and on February 1, 2007, the ECC with reference code ECC-0701-002-was granted to CBNC (**Annex 1.1.7**). This ECC supersedes the ECC No. 0201-021-313 issued for the HPP Line 1. A summary of the project timeline is provided in **Table 1.1.1**.

Table 1.1.1. Timeline of the approval and transfer of responsibilities

Date		Supporting Document
July 10, 2002	ECC (Ref no. 0201-021-313) for the HHP Project was granted to RTNMC	Copy of the ECC (**Annex 1.1.1**)
August 27, 2002	The letter addressed to DENR Secretary Heherson Alvarez thru EMB Director Julian Amador requesting for the amendment of ECC No. 0201-021-313 was received by the EMB Central Office Records Section.	Letter dated August 26, 2002 (**Annex 1.1.2**)
September 12,2002	A copy of the Memorandum of Agreement between RTNMC and CBNC on the assignment of rights and its obligations in the ECC No. 0201-021-313 was received by the EMB Central Office Records Section.	Letter dated September 6, 2002 (**Annex 1.1.3**)
December 4, 2002	EMB Central Office sent a letter of response to the letter of RTNMC dated August 26, 2002.	Letter dated December 4, 2002 (**Annex 1.1.4**)
December 5, 2002	A copy of the Draft Deed of Assignment on the Delineation of Responsibilities of RTNMC and CBNC was received by the EMB Central Office Records Section.	Letter dated November 8, 2002 (**Annex 1.1.5**)
February 24, 2003	The letter of EMB Central Office acknowledging the receipt of the photocopy of Deed of Assignment on the Delineation of Responsibilities of RTNMC and CBNC in compliance with ECC No. 0201-021-313 was received by RTNMC.	Letter dated February 12, 2003 (**Annex 1.1.6**)
February 1, 2007	The ECC (Ref. Code 0701-002-3721) for the Line 2 HPP Project of CBNC was granted. This ECC supersedes ECC No. 0201-021-313.	Copy of the ECC (**Annex 1.1.7**)

Although the components of the Gotok Limestone Quarry understandably remained under the ownership and responsibility of RTNMC based on the abovementioned deed of assignment, it was still covered under the approved ECC-0701-002-3721 issued to CBNC. On the other hand, its crushing plant is covered under the ECC (ECC-CO-1312-0043) for its Rio Tuba Beneficiated Nickel Silicate Ore Expansion (Production/Extraction Output) Project.

It should be noted that the original crushing plant was intended for saprolite ore screening and crushing before it was converted into crushing of limestone requirement for CBNC's HPAL Line 1. Under the expanded ECC of Beneficiated Nickel Silicate Ore, it does not specifically mentioned crushing plant but rather "Mining facilities and equipment".

In this regard, RTNMC is applying under its name, for a separate ECC covering the components of the Gotok Limestone Quarry. Moreover, this application shall cover the proposed increase in the annual production of the said project from 372,000 MT (equivalent to 186,000 MT each for Lines 1 and 2) as declared in the Environmental Impact Statement (EIS), to approximately 725,000 WMT of limestone.

With the proposed increase in limestone production, the existing crushing plant located near the HPP had to be developed and augmented. The modification included remodeling of the new plant components in order to increase the capacity to 250 tons per hour. It should likewise be emphasized that the crushing plant shall remain under RTNMC's ECC CO-1213-0043. An internal memorandum of RTNMC is provided in this report as **Attachment 11** for the use of the existing crushing plant for the Gotok Quarry Operations.

It is important to emphasize that the proposed Gotok expansion project will utilize the allowed 13.0 ha quarry area located within the 84.5 ha-Mineral Production Sharing Agreement (MPSA 213-2005-IVB) (**Annex 1.1.9**) in Sitio Gotok, Barangay Iwahig as indicated in the ECC and in the Strategic Environmental Plan (SEP) (**Annex 1.1.10**) issued by the Palawan Council for Sustainable Development (PCSD) to RTNMC.

No new areas shall be opened for this proposed expansion and shall only concentrate within the "*multiple-use zone*" as declared in the Environmentally Critical Areas Network (ECAN) Map of Bataraza (**Annex 1.1.11**). Likewise, the same type of quarry operations as well as its process shall be implemented for this proposed project. However, it is expected that equipment usage and manpower involvement in the quarry area and crushing plant shall increase. In addition, this application will also transfer all the obligations and rights of the Gotok Limestone Quarry under the RTNMC management.

Presented hereunder is the simplified diagram of this proposed application (**Figure 1.1.1**).

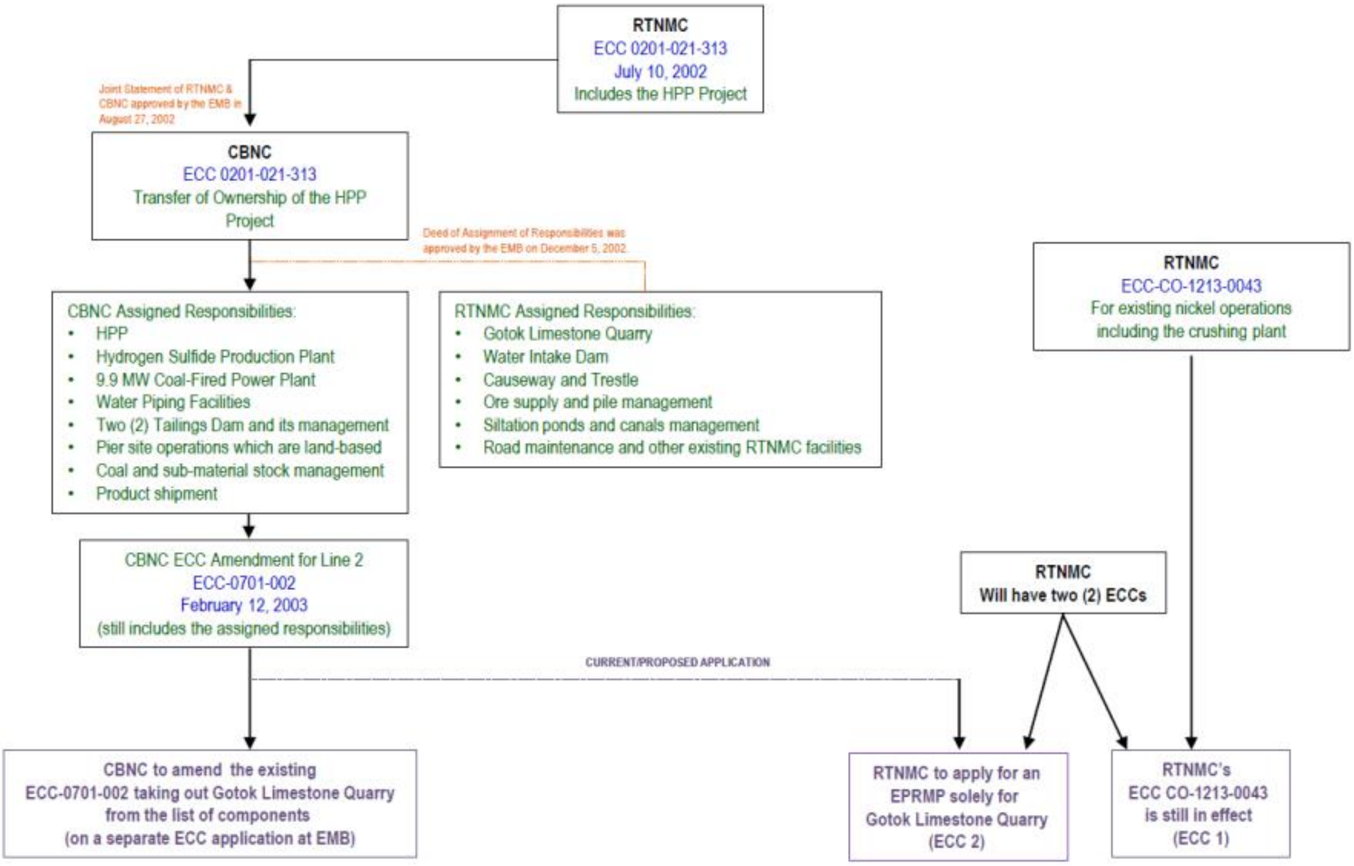


Figure 1.1.1. Diagram of the ECC application

1.2 PROJECT LOCATION AND AREA

1.2.1 Location, Vicinity and Accessibility

The MPSA of RTNMC for the Gotok Limestone Quarry project is an 84.5-ha land bounded by the coordinates shown in **Table 1.2.1**. Only 13.0 ha of the 84.5-ha MPSA was allowed for the quarry activity as indicated in the ECC. The development of the 13.0 ha quarry area located within Sitio Gotok, Barangay Iwahig, Municipality of Bataraza, Province of Palawan is divided into Phase 1 (2.6 ha) and Phase 2 (10.4 ha). **Table 1.2.2** shows the geographical coordinates for the boundaries of Phases 1 and 2, respectively. **Figures 1.2.1** and **1.2.2** depict the location and vicinity maps of the Gotok Limestone Quarry while **Figures 1.2.3** and **1.2.4** present the site development plan of the quarry area and the crushing plant, respectively. Also provided in **Figure 1.2.5** is the site development plan overlaid on the ECAN map of Bataraza.

The limestone crushing plant, on the other hand, is situated at the existing operation site of RTNMC. **Table 1.2.3** shows the coordinates of the crushing plant area.

The project site is accessible from Puerto Princesa City via the south road passing through the Municipalities of Aborlan, Narra, Sofronio Española, and Brooke's Point. Travel time is approximately five (5) hours. A bus company and commercial utility vans service the route. The private airplane of RTNMC flies directly to Rio Tuba from Puerto Princesa Airport. The commercial flight from Manila takes about one (1) hour to reach Puerto Princesa Airport.

Table 1.2.1. PRS 92' Geographic Coordinates of MPSA

Corner	Latitude	Longitude
1	8˚35'50"N	117˚27'45"E
2	8˚36'20"N	117˚27'45"E
3	8˚36'20"N	117˚28'15"E
4	8˚35'50"N	117˚28'15"E

Table 1.2.2. Geographical coordinates of Phase 1 and Phase 2 of the Gotok operations

Corner	Latitude	Longitude
Phase 1		
1	8˚36'4.29"N	117˚27'48.26"E
2	8˚36'4.26"N	117˚27'52.05"E
3	8˚36'3.21"N	117˚27'50.74"E
4	8˚35'59.78"N	117˚27'50.41"E
5	8˚35'58.50"N	117˚27'49.56"E
6	8˚35'57.59"N	117˚27'47.81"E
7	8˚35'57.90"N	117˚27'46.45"E
8	8˚35'58.92"N	117˚27'45.32"E
9	8˚36'0.93"N	117˚27'45.54"E
Phase 2		
1	8˚36'17.50"N	117˚27'47.30"E
2	8˚36'20.00"N	117˚27'48.00"E
3	8˚36'20.00"N	117˚27'52.76"E
4	8˚36'18.44"N	117˚27'54.16"E
5	8˚36'16.66"N	117˚27'54.32"E
6	8˚36'15.06"N	117˚27'54.47"E
7	8˚36'13.27"N	117˚27'54.92"E
8	8˚36'12.11"N	117˚27'56.52"E
9	8˚36'10.27"N	117˚27'58.32"E
10	8˚36'08.09"N	117˚27'56.93"E
11	8˚36'08.70"N	117˚27'54.06"E
12	8˚36'06.12"N	117˚27'53.32"E
13	8˚36'06.25"N	117˚27'47.86"E
14	8˚36'13.10"N	117˚27'46.40"E
15	8˚36'15.00"N	117˚27'46.01"E

Table 1.2.3. Geographical coordinates of the crushing plant area

Corner	Latitude	Longitude
1	8°33'33.61"N	117°25'36.36"E
2	8°33'30.34"N	117°25'36.36"E
3	8°33'30.34"N	117°25'34.93"E
4	8°33'27.44"N	117°25'34.93"E
5	8°33'27.44"N	117°25'32.14"E
6	8°33'29.00"N	117°25'32.14"E
7	8°33'29.00"N	117°25'31.27"E
8	8°33'30.23"N	117°25'31.27"E
9	8°33'30.23"N	117°25'29.65"E
10	8°33'31.98"N	117°25'29.65"E
11	8°33'31.98"N	117°25'31.13"E
12	8°33'32.64"N	117°25'32.22"E
13	8°33'32.64"N	117°25'32.95"E
14	8°33'33.61"N	117°25'32.95"E

1.2.2 Delineation of Impact Areas

The degree of the impact of the project on an area can be categorized as primary and secondary. This is determined based on the proximity of an area to a certain project component.

For this proposed project, the primary impact areas are delineated based on the following:

1. Within the 13.0-ha Gotok Active Plan;
2. All the buffer zones as required under the ECC;
3. Located within 200 m from both sides of the haulage roads from quarry area to Kulantuod Junction;
4. The host area for the crushing plant, quarry ancillary facilities and haulage road; and
5. River or stream used as final discharge outlet of the crushing plant.

Barangays Iwahig and Sandoval where the Gotok Limestone Quarry is located and Brgy. Rio Tuba, where the limestone crushing plant is situated, are all host communities and therefore considered as primary impact areas.

The potential impact on the flora and fauna are concentrated within the 13.0-ha approved area. A 50-m bufferzone delineated around the periphery of approved quarry area is being maintained. Status of the maintenance of the vegetation within the bufferzone is discussed in *Chapter 2*.

On the other hand, areas which are not host to any project components but still experiencing the effect of the operations of the quarry and crushing plant are considered as secondary impact areas. These areas were delineated using the assumption that the effect of noise and dust can still be felt within 1,000 m or 1 km from both sides of the haulage roads and within 1,000 m from the boundaries of the 13.0 ha quarry area and crushing plant. The nearby barangay of Ocayan from where a stretch of the haulage road is located is considered as secondary impact area for this project.

Municipality of Bataraza is identified as the Regional Impact Area (RIA) of the project as the impacts, mostly of social aspect can be experienced. The whole province of Palawan will also be indirectly affected by the proposed project due to social benefits that will arise from the quarry operation. Please refer to **Figure 1.2.6** for the map of the project impact areas.

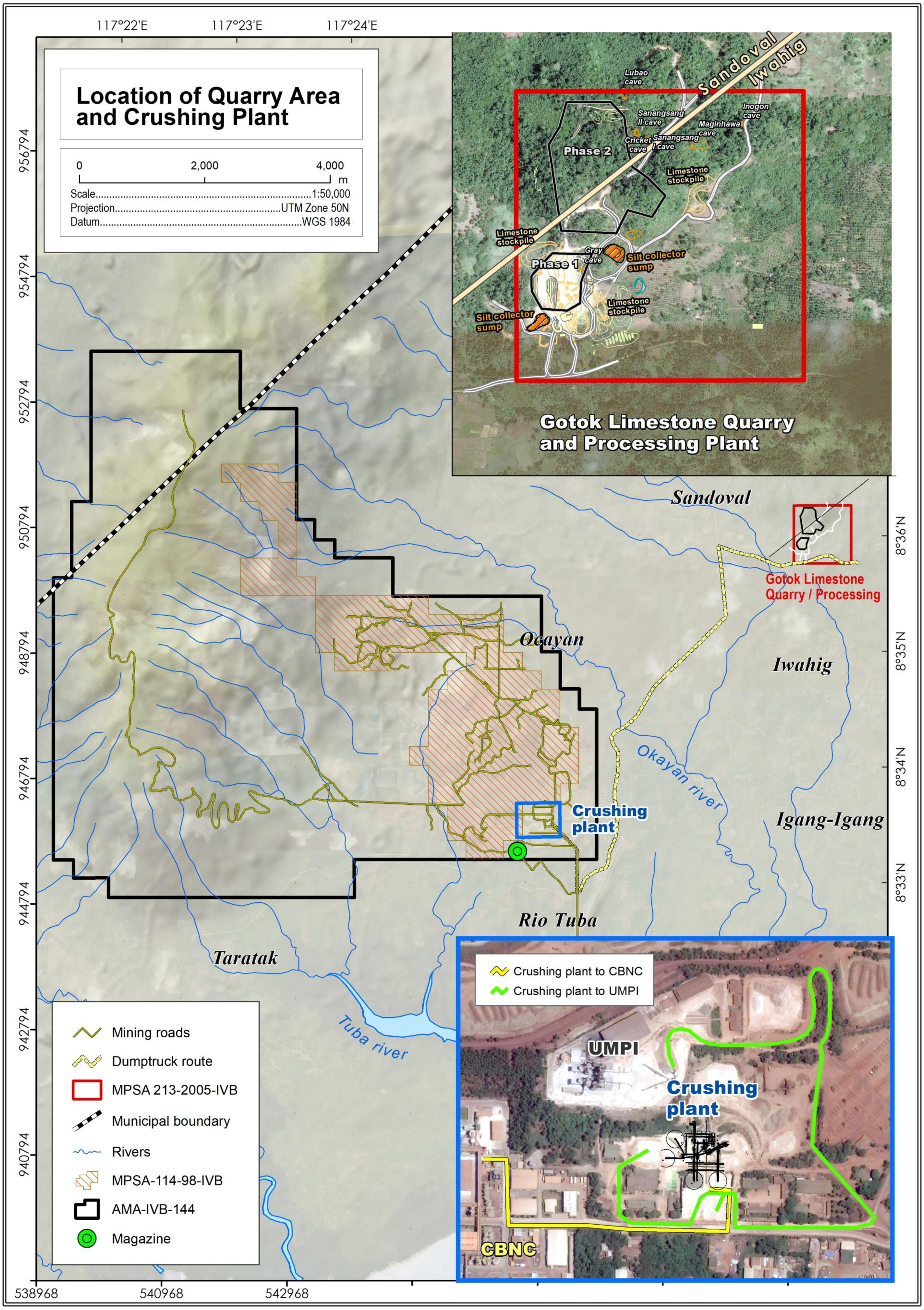


Figure 1.2.1. Location map of the Gotok Quarry Area and the Crushing Plant

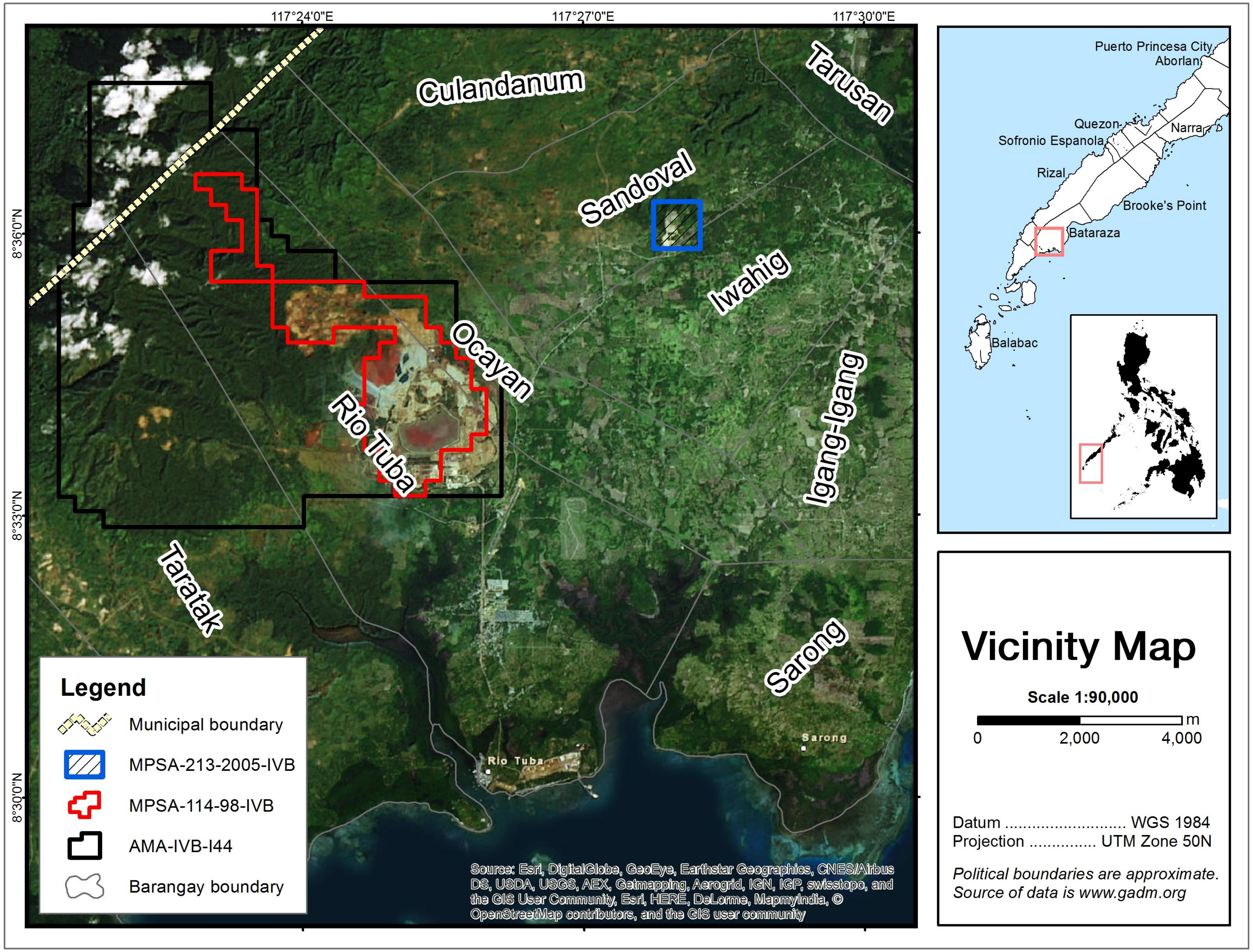


Figure 1.2.2. Vicinity map of the Gotok Quarry Area

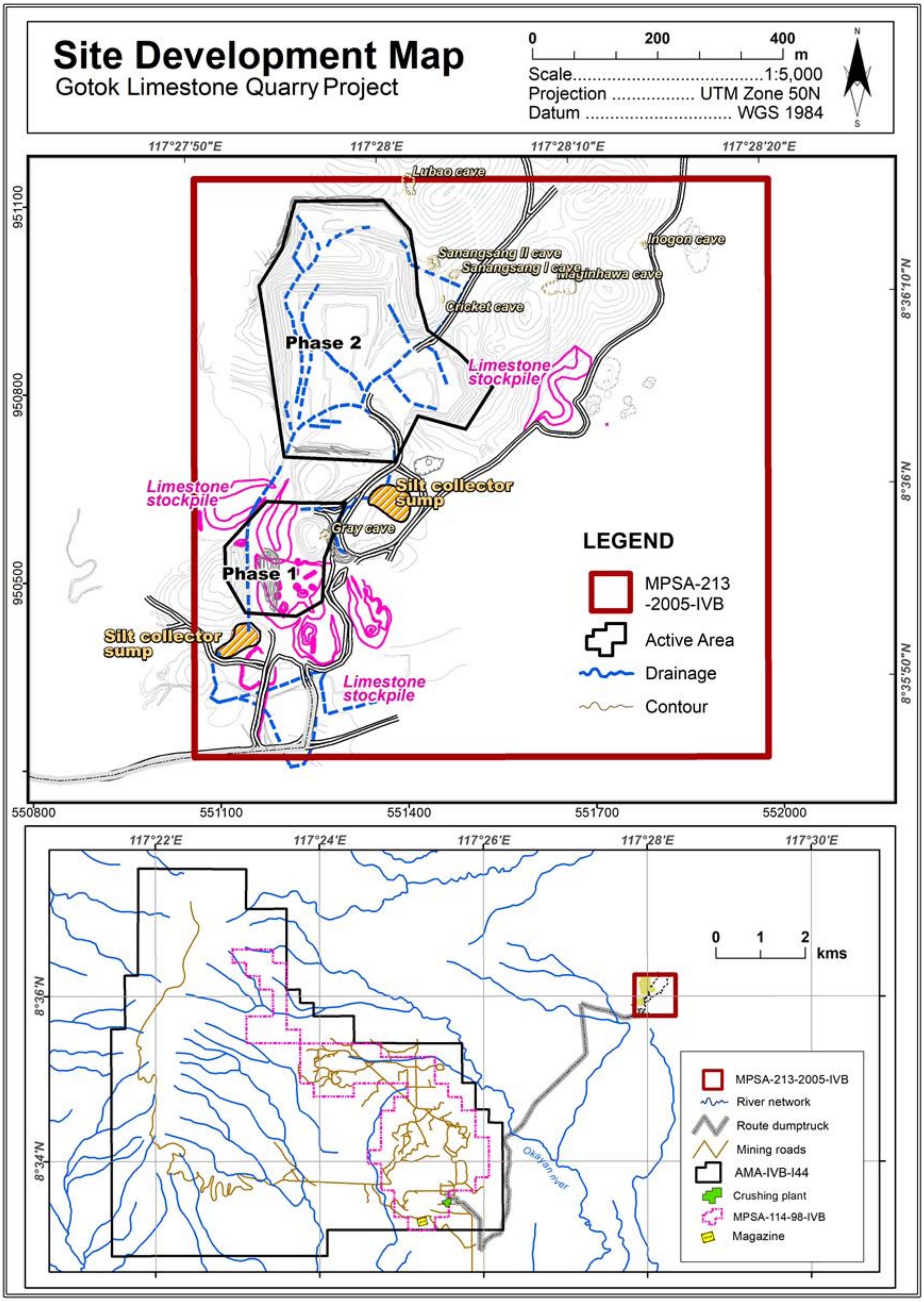


Figure 1.2.3. Site development map of Gotok Limestone Quarry Project

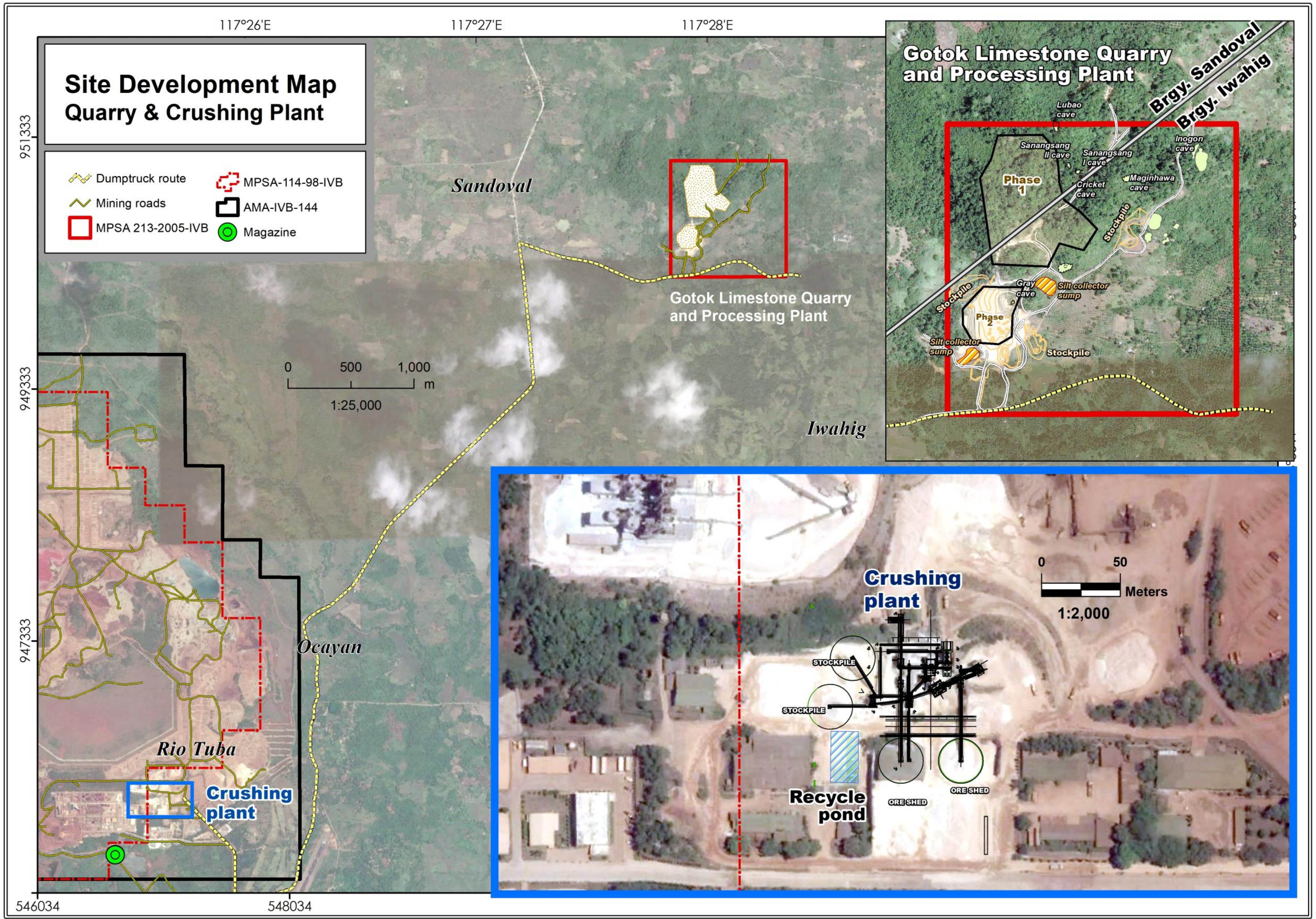


Figure 1.2.4. Site development map of Crushing Plant

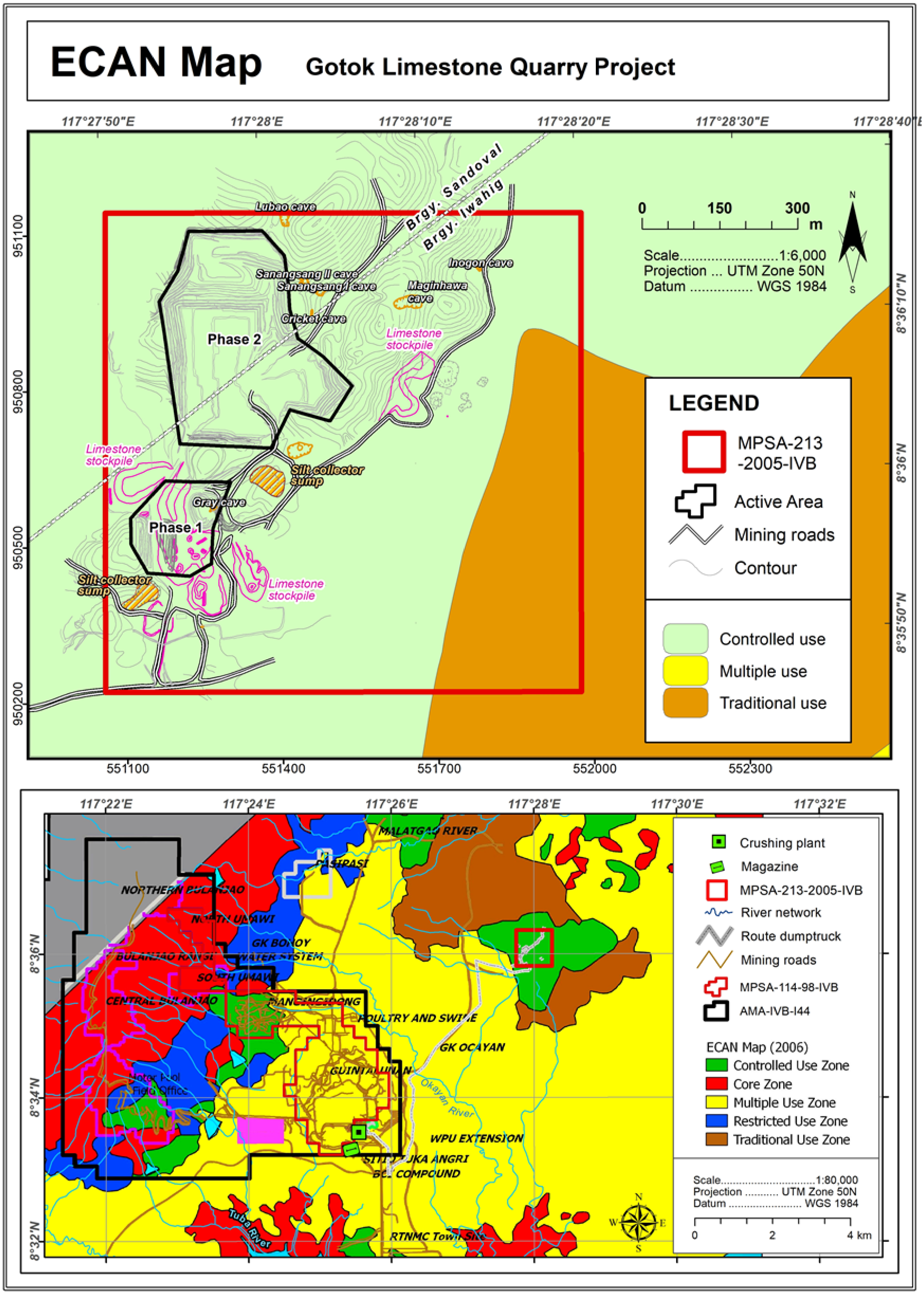


Figure 1.2.5. Site development map of Gotok Limestone Quarry Project overlaid on the Bataraza ECAN Map

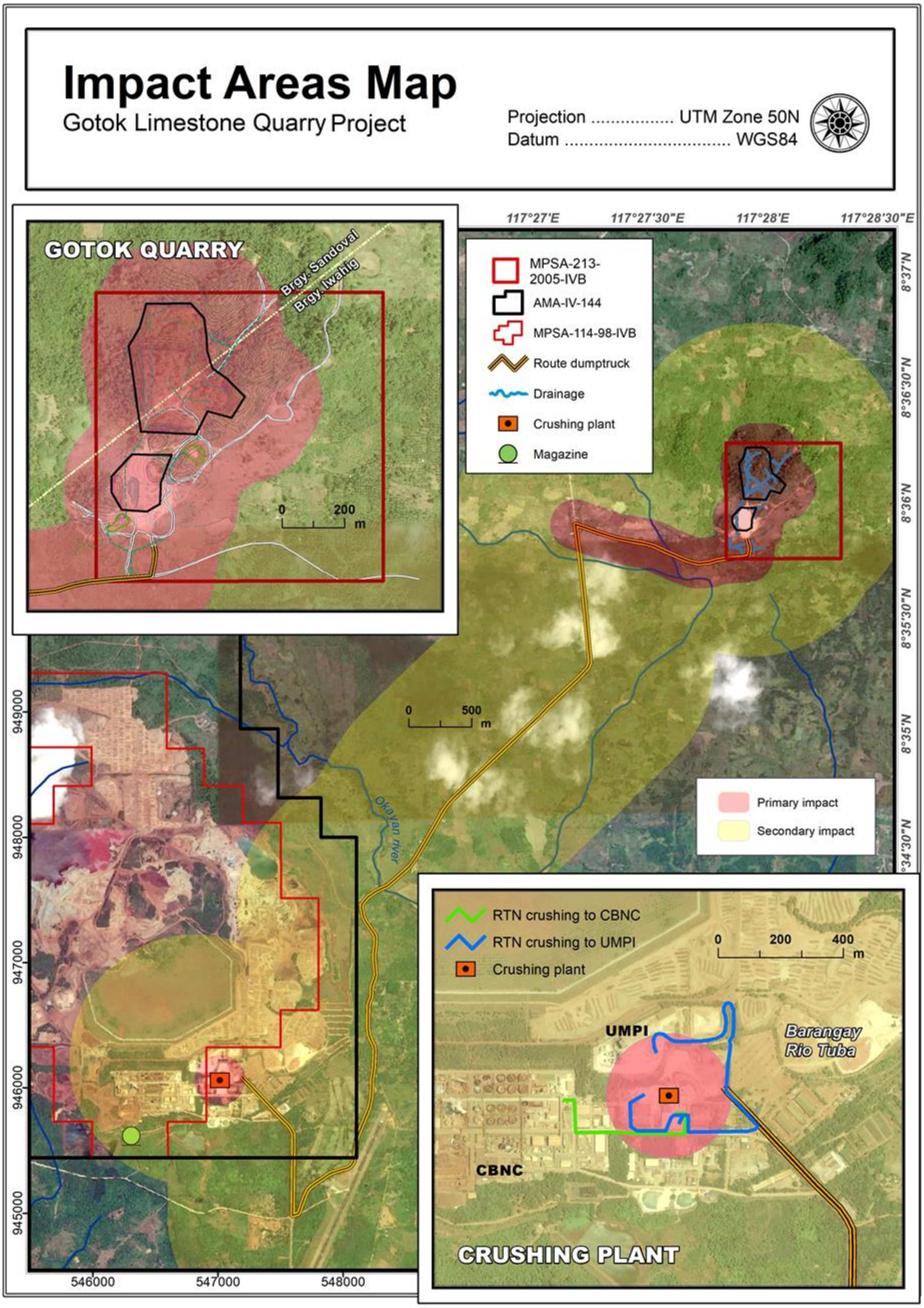


Figure 1.2.6. Impact area of Gotok Limestone Quarry Project

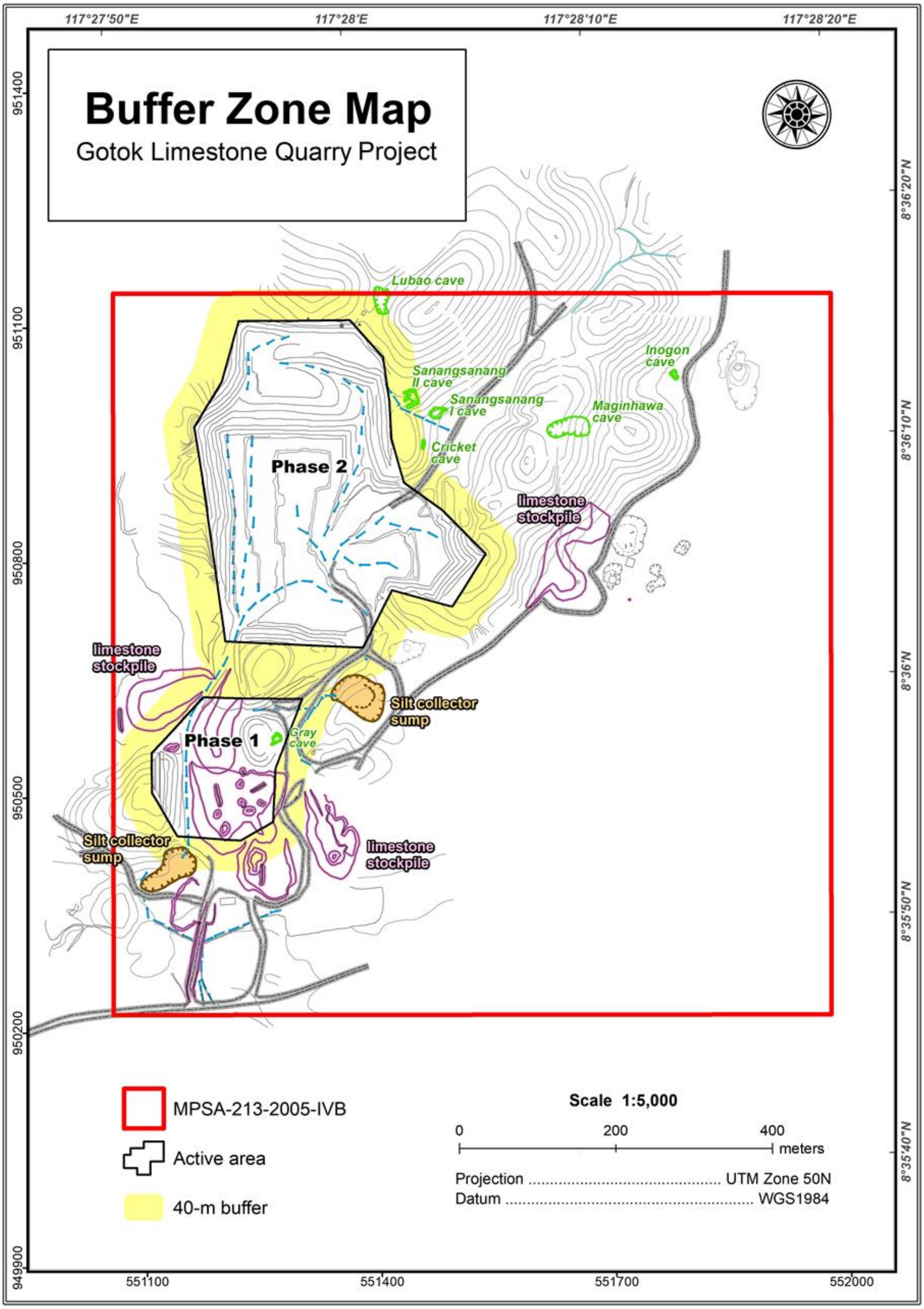


Figure 1.2.7. Buffer zone map of Gotok Limestone Quarry Project

Stated as a conditionality under ECC No. 0201-021-313, buffer zones of forty (40) meters wide measured landward along river/stream bank's high water line and along the entire periphery of the project site shall be established. Fast growing vegetation, indigenous where possible, shall be planted and maintained in these zones. **Figure 1.2.7** illustrates the buffer zones for this project.

1.3 PROJECT RATIONALE

There is a need to increase the production of the limestone quarry and crushing plant in order to supply the demand of the CBNC and Unichamp Mineral Philippines, Inc. (UMPI).

CBNC is a hydrometallurgical processing plant that refines raw limonitic nickel ore into an intermediate downstream product of mixed nickel sulfide, sources its limestone directly from the Gotok quarry. The crushed limestone from RTNMC and lime slurry from UMPI is utilized for the neutralization of the wastewater and tailings. These two (2) materials are added to increase pH of the tailings from a pH 6 to pH 8 to 8.5 as part of the mitigating measures.

For the crushing plant, RTNMC opted to modify its old crushing plant to increase its production from a maximum capacity of 110 TPH to 250 TPH. Furthermore, the modification allows the crushing plant to produce the size requirement UMPI who produces the lime slurry for CBNC as stated above.

On the other hand, the significant economic contributions of the on-going operation of the Gotok Limestone Quarry and Crushing Plant to the Municipality of Bataraza are the following:

Generation of direct employment to the locality

The limestone operation ensures the direct employment of about 111 people annually as regular and contractual employees of the company. With the proposed increase in production, the number of employed individual for this project is expected to increase.

In addition, the technical knowledge transferred to its employees by way of training and practical experience contributes to their competence as workers in the limestone operation.

Economic viability support to nearby larger industries

Furthermore, CBNC which is a hydrometallurgical plant that refines raw limonitic nickel ore into an intermediate downstream product of mixed nickel sulfide, sources its limestone directly from the Gotok quarry. Without the supply of limestone from the Gotok quarry, CBNC will have to source its limestone across the sea from Bohol or Malaysia. This of course translates into much increased costs. Therefore, direct sourcing and supply of materials is much efficient in terms of time and finances.

Social Development and Management Program (SDMP) and Corporate Social Responsibility (CSR)

With the continuous operation of the quarry since the start of its operation in 2005, the operation's host barangays of Iwahig and Sandoval have benefited from the SDMP with regard to infrastructure, education, livelihood opportunities and assistance.

Contributing driver of economic activity in the area

The operation of the quarry needs various services (such as material handling and hauling services), materials and supplies (fuel, oil and lubes, personal protective equipment, tires etc.). These are primarily sourced from local suppliers, whenever available. The consumption of local goods and services contributes to the economic activity which further offers employment and business opportunities in the locality.

Payment of various taxes, permit fees to the government

The operation of the quarry generates tax revenue of various types such as Income taxes, excise taxes, withholding taxes, property taxes, etc. which are directly paid to the local government of Bataraza.

1.4 PROJECT ALTERNATIVES

The alternatives considered for this project is presented in **Table 1.4.1** were essentially limited to the decision on whether to proceed or not with the proposed increase in production capacity inasmuch as the site is an existing quarry.

Table 1.4.1. Project Alternatives

Aspect	Standard Criteria	Options Considered	Assessment
Crushing of the blasted limestone from the quarry site	• Capacity • Sizing	• To continue the use of the old crushing plant and for CBNC to import slake lime • Modification of the crushing plant	• The old crushing plant only has a maximum capacity of 110 TPH (at 24 hrs/day, 300 days per year), which will not be enough to sustain the proposed increase in production as compared to expected 250 TPH capacity after the modification. • In terms of sizing, the old crushing plant can only produce 0-30 mm while the modification allowed the crushing plant to produce both the size requirements of CBNC (0-30 mm) and UMPI (30-80mm). • If modification was not implemented, CBNC would continue to import slake lime which was done in 2004 to 2015. Importation always have the concern of suitable barges or boats to transport the slake lime by sea. In order not to hamper the HPP operations, CBNC maintains high inventory of imported slake lime which poses high risk of environmental pollution in addition to high inventory cost. Sea transportation always has the risk of accident at sea which could result to marine pollution if it happens.

1.5 PROJECT COMPONENTS

1.5.1 Current Operation

Table 1.5.1 shows the summary area utilization for the operation of the Gotok Limestone Quarry. **Figure 1.5.1** shows the existing quarry area and its ancillary facilities overlaid on Google Earth.

Table 1.5.1. Summary of area utilization for the Gotok Operation

Facilities	Area (ha)
A. Within MPSA of Quarry (213-2005-IVB)	
Approved quarry area	13.00
Ancillary facilities	0.90
Access road	0.15
Sub-total (A)	**14.05**
B. Within AMA-IVB-144A	
Crushing Plant Facilities	2.526
Product Handling Facilities, Transport (portion of Macadam road)	0.770
Sub-total (B)	**3.300**
C. Within MPSA-114-98-IV	
Storage area of explosives	0.50
Sub-total (C)	**0.50**
D. Common facilities with RTNMC Nickel Operations	
Townsite infrastructures	5.26
Hospital	0.09
Airport facilities	20.00
Plantsite Facilities	1.10
Sub-total (D)	**26.45**
D. Hauling road (Portion of macadam road, barangay and provincial roads)	**6.80**
Total Project Area	**51.10**

1.5.1.1 Quarry Operation

Figure 1.5.2 shows the long range plan of the current operation within the 13.0 ha allowable area of the 84.5-ha MPSA of RTNMC. Area utilization of the entire 84.5 ha MPSA aside from the quarry area is provided in **Table 1.5.2**. As seen in the table, remaining 70.45 ha include unutilized area, sink holes and their prescribed buffer zones that are excluded from any development. The unutilized area in the MPSA is the intended for future development.

Table 1.5.2. Gotok limestone quarry area and ancillary facilities within the MPSA

Quarry site and facilities	Area (ha)
Approved quarry area	
Phase 1	**2.6
Phase 2 (with tree cutting permit)	10.4
Sub-total	**13.0**
Ancillary facilities	
Quarry stockpile area	0.3
Topsoil stockpile area	0.1
Silt collector sumps	0.5
Access Road	0.15
Sub-total	**1.05**
Total	**14.05**
Remaining area*	**70.45**

*Note: *This includes delineated buffer zones for caves within the MPSA*
***RTNMC is currently utilizing 2.33 ha out of 2.6 ha as temporary stockpile area for limestone*

Table 1.5.3 provides the annual limestone production since 2005. The limestone are being supplied to CBNC and Unichamp Mineral Philippines, Inc. (UMPI).

Table 1.5.3. Historical Limestone Production (2005-2017)

Year	Limestone Supply/ Reserve (WMT)	Limestone Demand (WMT)
2005	22,421	22,421
2006	50,675	50,675
2007	73,480	73,480
2008	39,480	39,480
2009	186,238	186,238
2010	224,865	224,865
2011	145,991	145,991
2012	58,980	58,980
2013	211,560	211,560
2014	428,979	428,979
2015	593,280	593,280
2016	482,088	482,088
2017	528,667	528,667

To be able to operate according to its existing quarry plan (**Figure 1.5.2**), RTNMC uses the equipment listed in **Table 1.5.4**.

Table 1.5.4. Gotok limestone quarry equipment

Equipment	Make/Model	Quantity
PRODUCTION EQUIPMENT		
A. Dump trucks	VOLVO/FM 64R, 6x4	9 units
B. Wheel Loader	VOLVO L-150F	6 units
C. Bulldozers	KOM/ D85EX-15	2 units
D. TX-Loader		1 unit
DRILLS		
Air Track Drill Machine*	Furukawa 200	3 units
OTHER EQUIPMENT		
A. Fuel Lorry	VOLVO FM 64R	1 unit
B. Maintenance Truck	ISUZU NPR 22	1 unit
C. Road Grader	VOLVO G930	1 unit
D. Truck Trailer	VOLVO FM 64R	1 unit
E. Air Compressor*	HINO 100	1 unit

Source: RTNMC, 2015
*Note: *Drilling & Blasting Contractor's Equipment (CONEX)*

Aside from the facilities presented in **Table 1.5.2**, there are other facilities/infrastructures located outside the MPSA, which are vital to the limestone quarry operation. These are the crushing plant, hauling road, and the storage area of explosives.

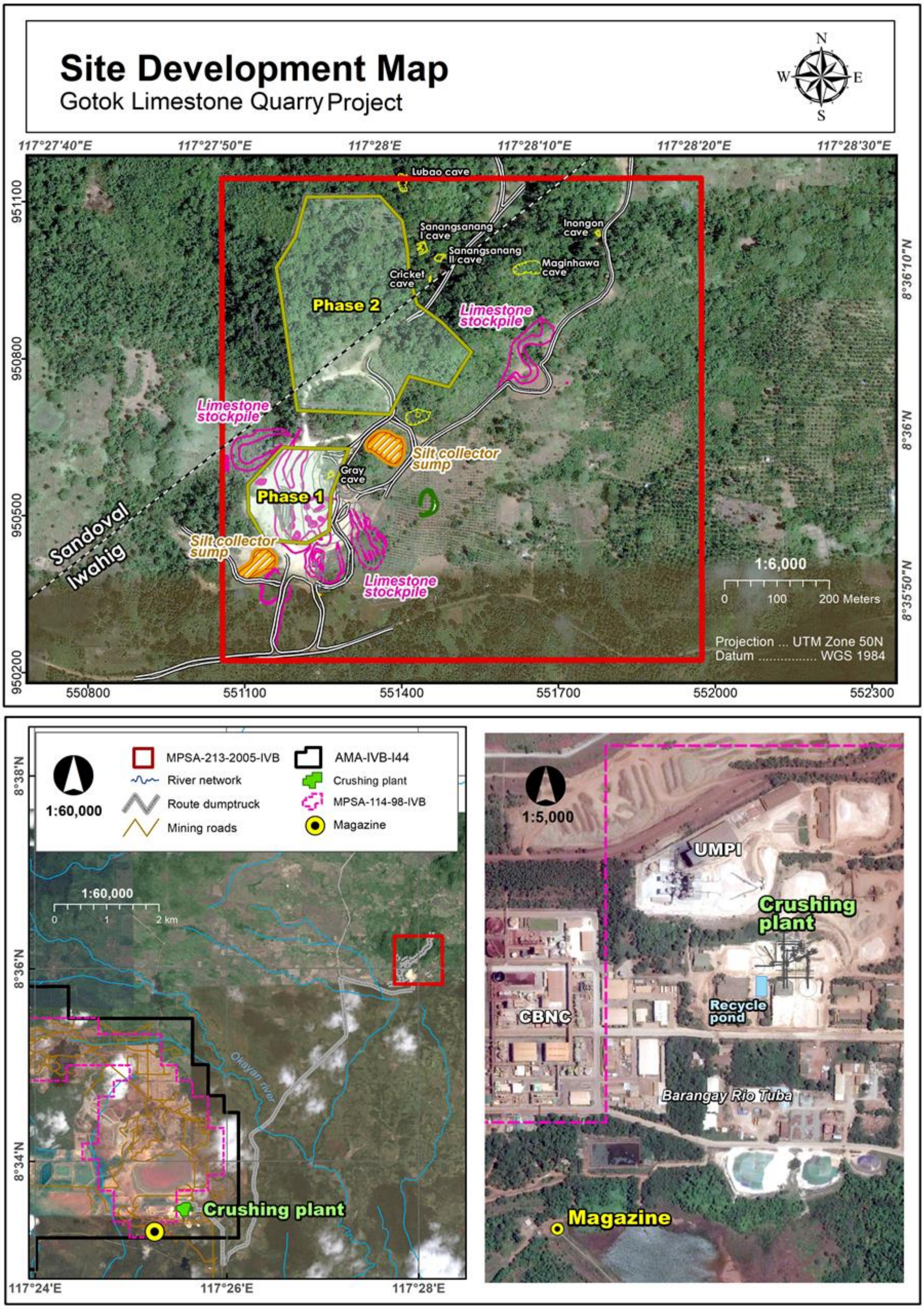


Figure 1.5.1. Gotok quarry and crushing plant facilities overlaid on Google Earth

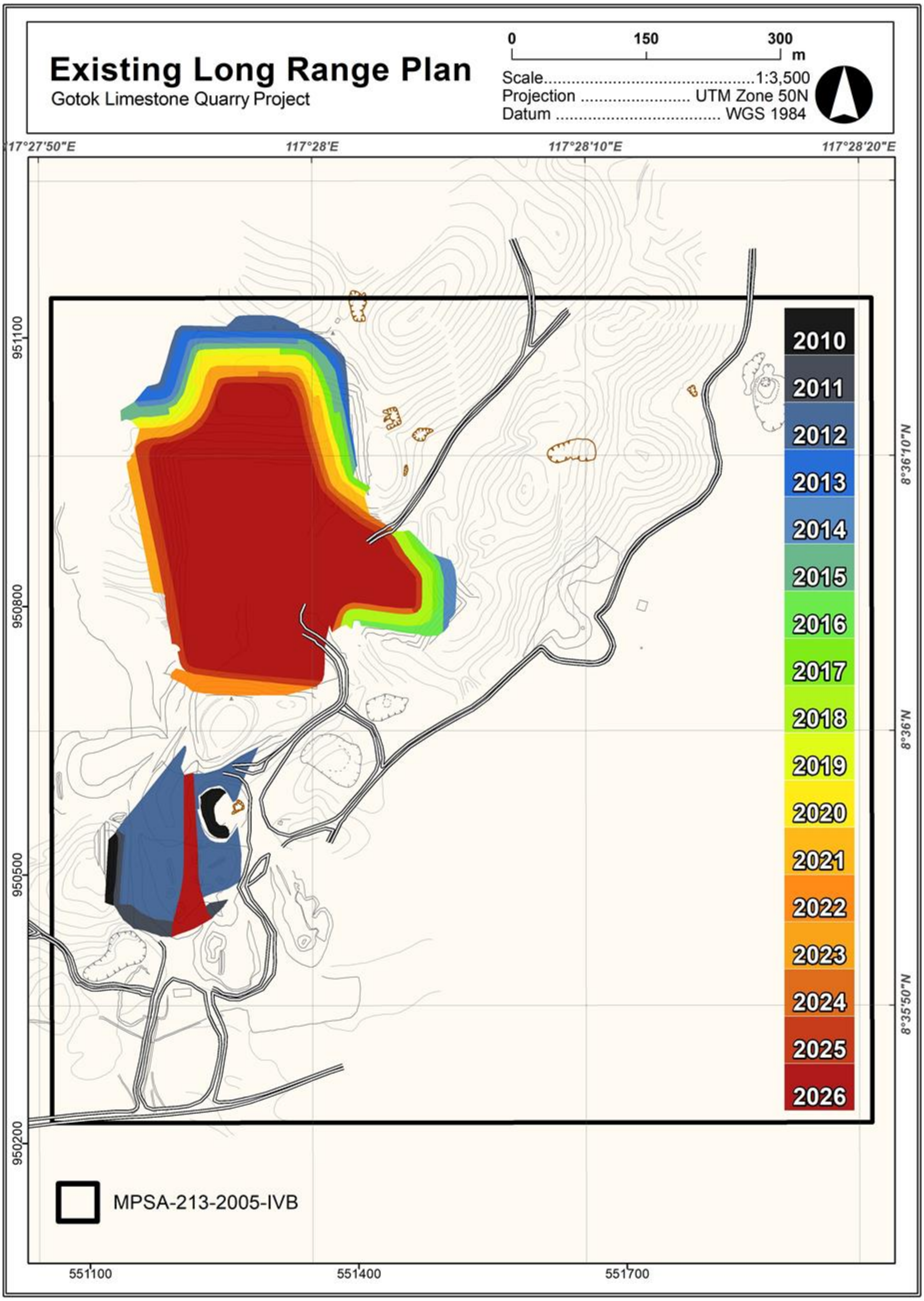


Figure 1.5.2. Existing Gotok Limestone Quarry Plan

1.5.1.2 Crushing Plant Operation

Presented in **Table 1.5.5** are the area allotment of the crushing plant and its support facilities prior to its modification. It used to have a maximum capacity of 100 TPH and operated at 24 hrs/day, 300 days per year.

A total of 2.526 ha were allocated for the operation of the crushing plant and its support facilities. The breakdown of the area is show in **Table 1.5.5**.

Table 1.5.5. Existing crushing plant and its support facilities

Infrastructure	Area (Hectares)
INFRASTRUCTURES	
Screening/Crushing Plant	0.058
Crushed Limestone Shed	0.058
Crusher Feed Area	1.779
Crushed Limestone Stockpile Area	0.631
Total	**2.526**

Source: RTNMC, 2014

Plate 1.5.1. Crushing plant

Plate 1.5.2. Crushed limestone shed

1.5.1.3 Other Facilities of RTNMC

Shown in the succeeding sections are other facilities of RTNMC. The employees were housed in a townsite (**Plate 1.5.3**) where a school (**Plate 1.5.4**) and a hospital (**Plate 1.5.5**) are also situated. The airstrip (**Plate 1.5.6**) is located beside the Macadam Road (**Plate 1.5.7**).

Within the mining complex are heavy equipment depot (**Plate 1.5.8**), administration building (**Plate 1.5.9**), and the back-up power plant (**Plate 1.5.10**).

Plate 1.5.3. RTN Townsite

Plate 1.5.4. Leonides S. Virata Memorial School (LSVMS)

Plate 1.5.5. RTNMC Hospital

Plate 1.5.6. RTNMC Airstrip

Plate 1.5.7. Macadam Highway

Plate 1.5.8. Equipment depot

Plate 1.5.9. Administration Building

Plate 1.5.10. Back-up Power Plant

1.5.1.4 Product Handling Facilities, Transport

RTNMC has designated a pre-piling area near the quarry site for the temporary storage of limestone prior to hauling. From the quarry area in Sitio Gotok, Brgy. Iwahig, dump trucks are being utilized to transport extracted limestone to the crushing plant located at Brgy. Rio Tuba. The hauling trucks travel a total of 10 km from the quarry site to the crushing plant. The total hauling route is comprised of 0.2 km quarry access road; 1.4 km barangay road (quarry site to Kulantuod junction); 6.6 km provincial road; and 1.8 km stretch of the Macadam Road as seen in (**Figure 1.5.3**). The hauling operation is for 10 hours per day on the average. The volume of traffic is at nine (9) dump trucks traversing the hauling route per hour.

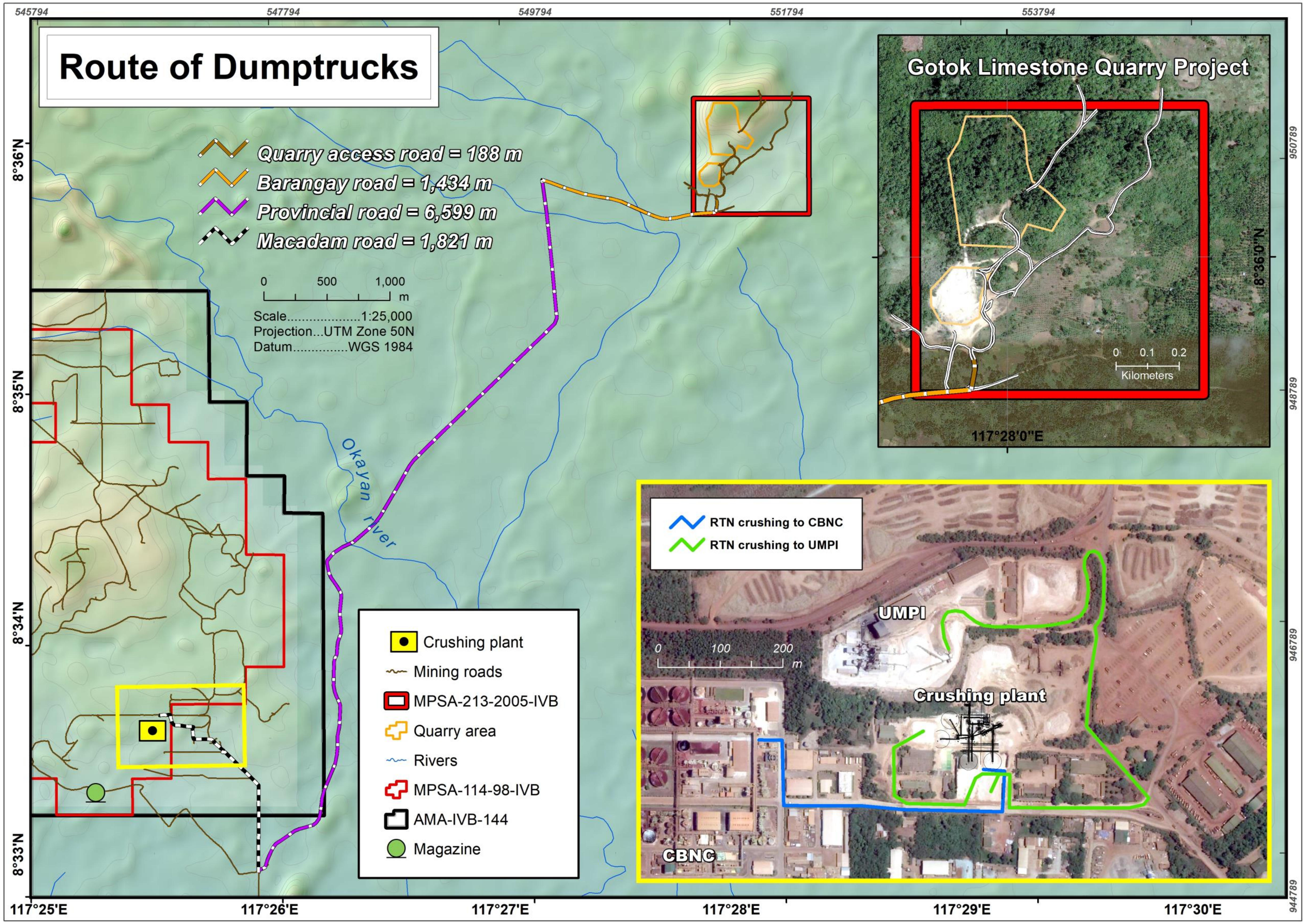


Figure 1.5.3. Route of dump trucks

The crushed limestone is temporarily held at the stockpile area within the crushing plant prior to its transport to CBNC and UMPI by means of a 10-wheeler dump truck. **Figure 1.5.3** also shows the hauling routes from Crushing Plant to CBNC and to UMPI.

1.5.1.5 Pollution Control and Waste Management Facilities

Gotok Quarry Area

Dust Control Measures

Water spraying along hauling road and access roads is regularly conducted. Local laborers are being hired for this activity (**Plate 1.5.11**). In addition, a vehicle speed limit of 30 kph is being enforced specially on unpaved roads to minimize dust generation.

Silt Control Measures

Silt of fine particles from operations may be carried away by runoff water to adjoining areas during heavy downpour. Two silt collector sumps are constructed at the downstream portion of the quarry area to minimize siltation (**Figure 1.5.4**). The sumps are periodically desilted to insure optimal operation.

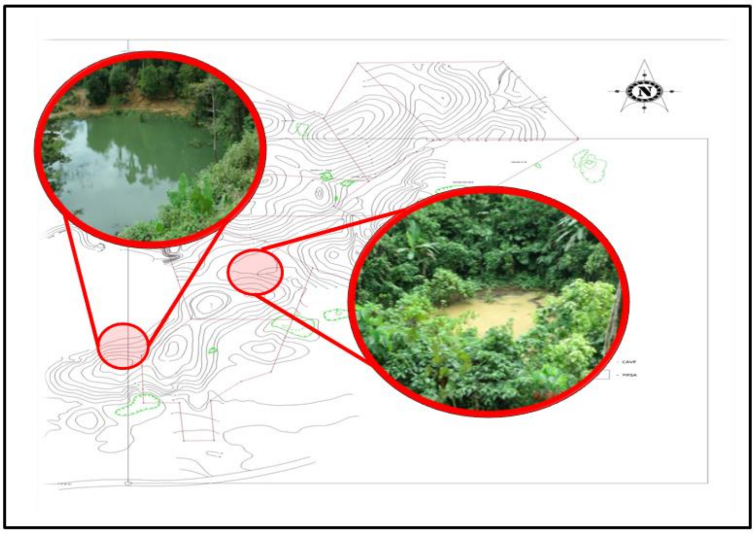


Figure 1.5.4. Strategic location of the silt collector sumps

Plate 1.5.11. Water spraying of the hauling road

Domestic Waste Management

RTNMC has designated garbage bins within the buildings and waste disposal areas around the site, which are being cleaned and collected at a regular basis. Designated holding areas for other wastes such as busted lamps, metal craps and other hazardous materials have been established for proper segregation and handling.

Crushing Plant Area

Dust Control Measures

Conveyors and major equipment are equipped with the appropriate dust control measures to prevent or minimize dust dispersion such as:

- Mist sprayer along the product discharge section of the conveyor belt system;
- Tarpaulin cover for open spaces and stockpiles;
- Cover for conveyor belt system to prevent prevailing wind or momentary gustiness from blowing dust particles from the crushed limestone;
- Wind breaker made of tarpaulin installed along path of prevailing wind direction; and
- Regular watering at the peripheries and immediate vicinity of the crushing plant to sustainably suppress dust.

In addition, service vehicles and dump trucks using the plant access roads are subjected to speed limit of 30 kph.

Silt Control Measures

Wastewater generated from crushing plant operation is discharged to water settling/recycling pond with a capacity of 1,200 cubic meters (**Plate 1.5.12**). The pond will be able to accommodate the wastewater discharged from the crushing plant with estimated water requirement of 1,044 m3/day. To maximize the capacity and efficiency of the pond, a catchbasin was installed at its entry/inlet for initial filtering and regular desilting is being conducted everyday. The collected silt is temporarily stockpiled until it dries and then later transported and sold to CBNC.

Plate 1.5.12. Water settling/recycling pond

Overflow of the pond discharges to the Upper Kinurong Pond and then flows to Lower Kinurong Pond before finally discharging to Rio Tuba River. Layout of the pond is presented as **Annex 1.5.1**

Magazine Area

<u>Health and Safety Measures</u>

The explosives/explosive ingredients are housed in five (5) separate magazines, four (4) of which are made fully of reinforced concrete, protected by steel doors and hardened double locks and one (1) magazine which is made up of two (2) joined container-type magazines located in one perimeter fence. These magazine buildings are located in near Upper Kinurong Siltation pond with a total area of 5,000 m^2 and are secured by double perimeter fences measuring about 8 feet in height. As part of the recommendation included in the Risk Associated with Accidental Explosion of Explosives Magazine and its Mitigation study conducted by Conex, berms were installed in between magazines (**Plate 1.5.13**).

Plate 1.5.13. Constructed berm at the Magazine area

Based on CONEX's permit and licenses, which is valid until December 19, 2018, the company is authorized to import the following explosives/ explosive ingredients with corresponding quantity specified below:

Explosives/Explosive Ingredients	Maximum Storage (Capacity)
Ammonium Nitrate	84,975 kg
Dynamite	338 Cases
Connector	2,900 pieces
Safety Fuse	170 meters
Ordinary Blasting Cap	200 Pieces
Non- Electric Blasting Cap	1,900 Pieces.

Additional health and safety measures being implemented by RTNMC are the following:

1. Regular inspection of the magazine through walk through inspection;
2. Posting of MSDS for all chemicals related to explosives stored in the magazine;
3. Installation and regular checking of fire extinguisher in the magazine; and
4. RTNMC representative- Safety Officer is present during withdrawal of explosives/ blasting accessories and its transport from magazine to the blasting area.

1.5.2 Proposed Expansion

1.5.2.1 Proposed Quarry Operation

The estimated mineable reserve is placed at approximately 9.02 Million MT limestone. With a target production of a maximum 725,000 WMT per year, the life of the quarry would be a little more than eight (8) years (**Table 1.5.6**).

Figure 1.5.5 shows the proposed Gotok limestone annual quarry plan based on the Feasibility Study. Further, the plan is presented yearly from 2018 to 2026. **Annex 1.5.2** contains the Feasibility Study on Gotok Limestone Quarry and Crushing Plant Expansion Project.

In the future, RTNMC may extend its operations beyond the existing 13-hectare quarrying area. In this case, all necessary documentation and clearances shall be secured accordingly.

Table 1.5.6. Projected Limestone supply and demand

Year	Limestone Supply/ Reserve (WMT)	Limestone Demand (WMT)
2018	725,000	725,000
2019	725,000	725,000
2020	725,000	725,000
2021	725,000	725,000
2022	725,000	725,000
2023	725,000	725,000
2024	725,000	725,000
2025	725,000	725,000
2026	260,912	725,000

Source: RTNMC, 2018

With the increase in production, it is expected that the current number of vehicles and heavy equipment used in the operation will also increase. **Table 1.5.7** shows the additional requirements for every type of equipment.

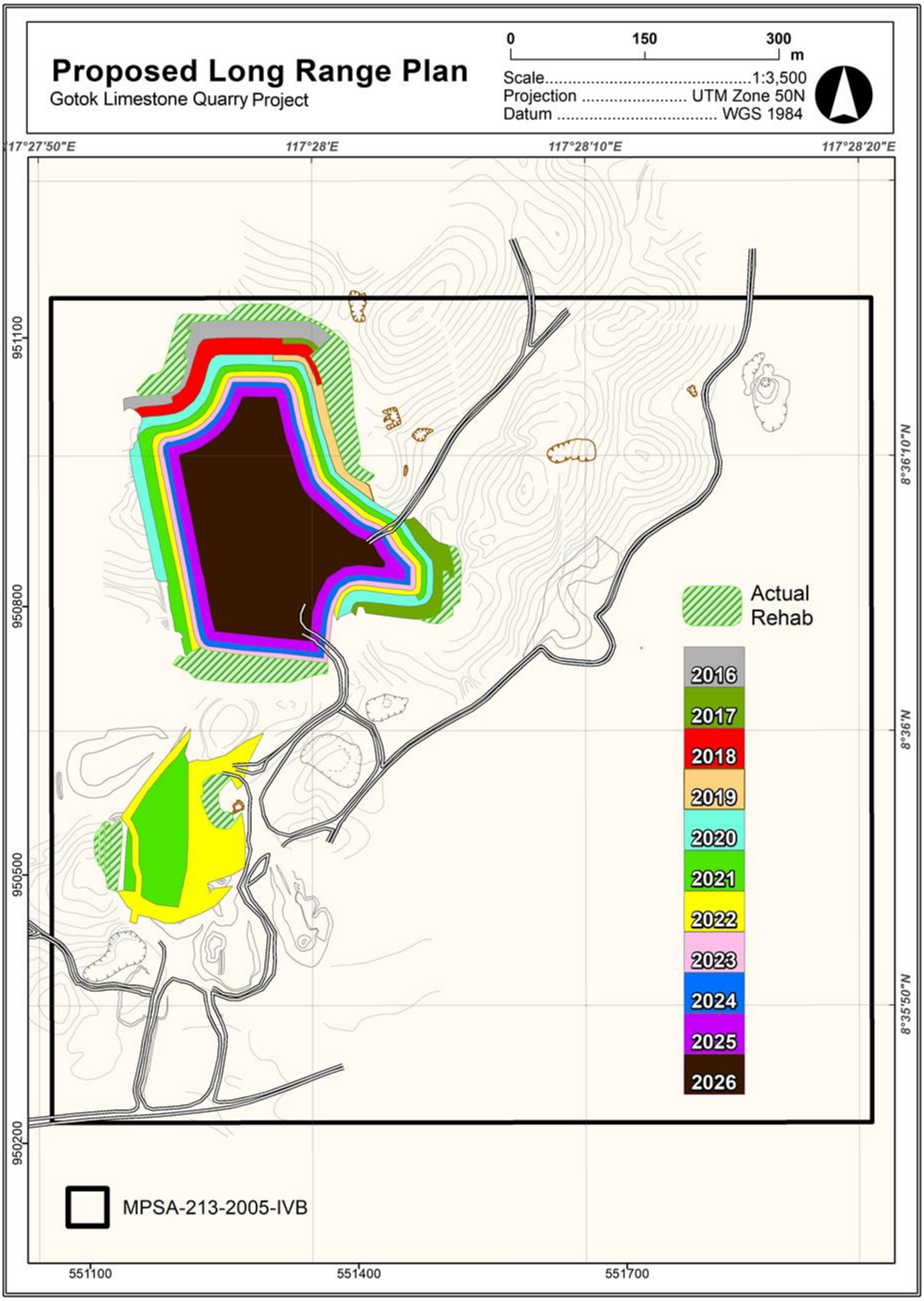


Figure 1.5.5. Proposed long range plan of the Gotok Limestone Quarry

Table 1.5.7. Vehicles and heavy equipment requirement for the proposed quarry operation

Equipment	Existing	Proposed
PRODUCTION EQUIPMENT		
A. Dump trucks	9 units	21 units
B. Wheel Loader	6 units	10 units
C. TX-Loader	1 unit	2 units
D. Bulldozers	2 units	2 units
DRILLS		
Air Track Drill Machine*	3 units	4 units
OTHER EQUIPMENT		
A. Fuel Lorry	1 unit	1 unit
B. Maintenance Truck	1 unit	1 unit
C. Road Grader	1 unit	1 unit
D. Truck Trailer	1 unit	1 unit
E. Air Compressor*	2 units	2 units

1.5.2.2 Proposed Crushing Plant Operation

The modified crushing plant has a different configuration compared to the old plant as seen in the flow diagram presented as **Figure 1.5.6**. One component of the proposed modified crushing plant is the water washing spray system, which will result in an additional water requirement for the project. The old design is only capable of producing crushed limestone with a size of 0-30 mm while the modified plant can produce both 0-30 mm and 30-80 mm. Comparison of the old vs. the modified crushing plant is presented in **Table 1.5.8**.

Table 1.5.8. Old crushing plant vs. New Crushing plant

Details	Old	New
Equipment	**Quantity/Make/Model**	
Jaw Crusher	One (1) unit, Kurimuto, 3020 ST, 700 mm x 500 mm x 95 mm CSS/ Discharge	One (1) unit, Terex Jacques, JW 42, 1070 mm x 760 mm 12 5mm CSS/ discharge
Roll Crusher	One (1) unit Kurimuto 3624 Double Roll Crusher	One (1) unit Cone Crusher, Terex- Jaques, TC100
Vibrating Screen	Two (2) units Tripple Deck with 75mm opening	One (1) unit, Triple Deck, 6' x 16", 80 mm top, 55 mm middle and 30 mm bottom
	One (1) unit, NFS 1230, 1200 mm X 3000mm w/ 100 mm opening, single Deck	One (1) unit, NFS 1230, 1200 mm X 3000 mm w/ 30 mm opening, single Deck
	One (1) unit, 1200 mm X 3650 mm w/ 25 mm opening, single Deck	One (1) unit Double Deck Horizontal Screen, 5' x 15', 55 mm top and 3 mm bottom deck
Feeder	Two (2) units Belt Feeder, 1200 mm width X 7 meters length	One (1) unit Apron Feeder 10-420, 1200 mm width x 6.meters length
Belt Conveyor	Four (4) units, 750 mm Conveyor Belt Width Nine (9) unit, 600 mm Conveyor Belt Width	Eight (8) units, 900 mm Conveyor Belt Width Sixteen (16) units, 600 mm Conveyor Belt Width
Cone crusher	n/a	One (1) unit Cone Crusher, Terex- Jaques, TC1000
Trommel	n/a	One (1) unit, 600mm shell dia. x 3.5 meters length
Desander Unit	n/a	One (1) unit ZX-200/ 250, Capacity:200 cu.m/ hr able to deliver driven medium of 0 to 10 mm solids
Water System	n/a	Twelve (12) units, Vee-Jet Nozzles with minimum residual pressure of 40 Psi and equipped with 5 cu.m water storage tank

Details	Old	New
Equipment	**Quantity/Make/Model**	
		Two (2) units, Sydex Centrifugal Pump Capacity: 75 cu.m/ hr
		Two (2) units, Sydex and Goulds Centrifugal Pump Capacity: 75 cu.m/ hr able to deliver driven medium of 0 to 5mm solids
Sumps	n/a	1,200 cu.m; 5 cu.m
Output size	0-30mm	0-30mm, 30-55 mm & 55- 80mm
Maximum Capacity	110 TPH	250 TPH

The existing ore shed located within the vicinity of the crushing plant shall be used to temporarily hold the crushed limestone prior to hauling to CBNC and UMPI.

Figure 1.5.7 shows the general layout and footprint of the components of the proposed modified limestone crushing plant.

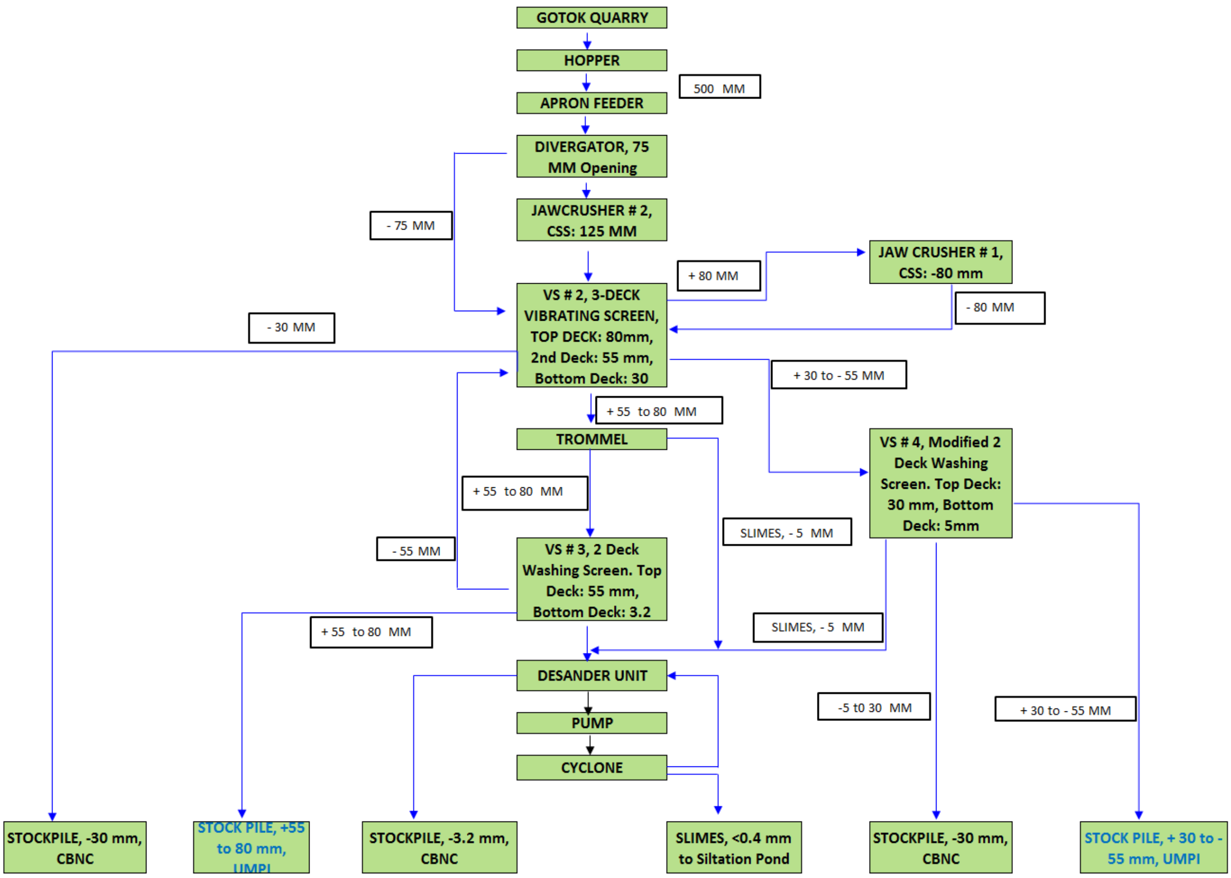


Figure 1.5.6. Crushing plant flow diagram

1.5.2.3 Product Handling Facilities, Transport

The current hauling route shall be used continuously for the proposed expansion. The hauling of the increased production shall be accomplished by increasing the number of dump trucks while retaining the same operation hours. The volume of traffic will increase to 20 dump trucks traversing the hauling route every hour.

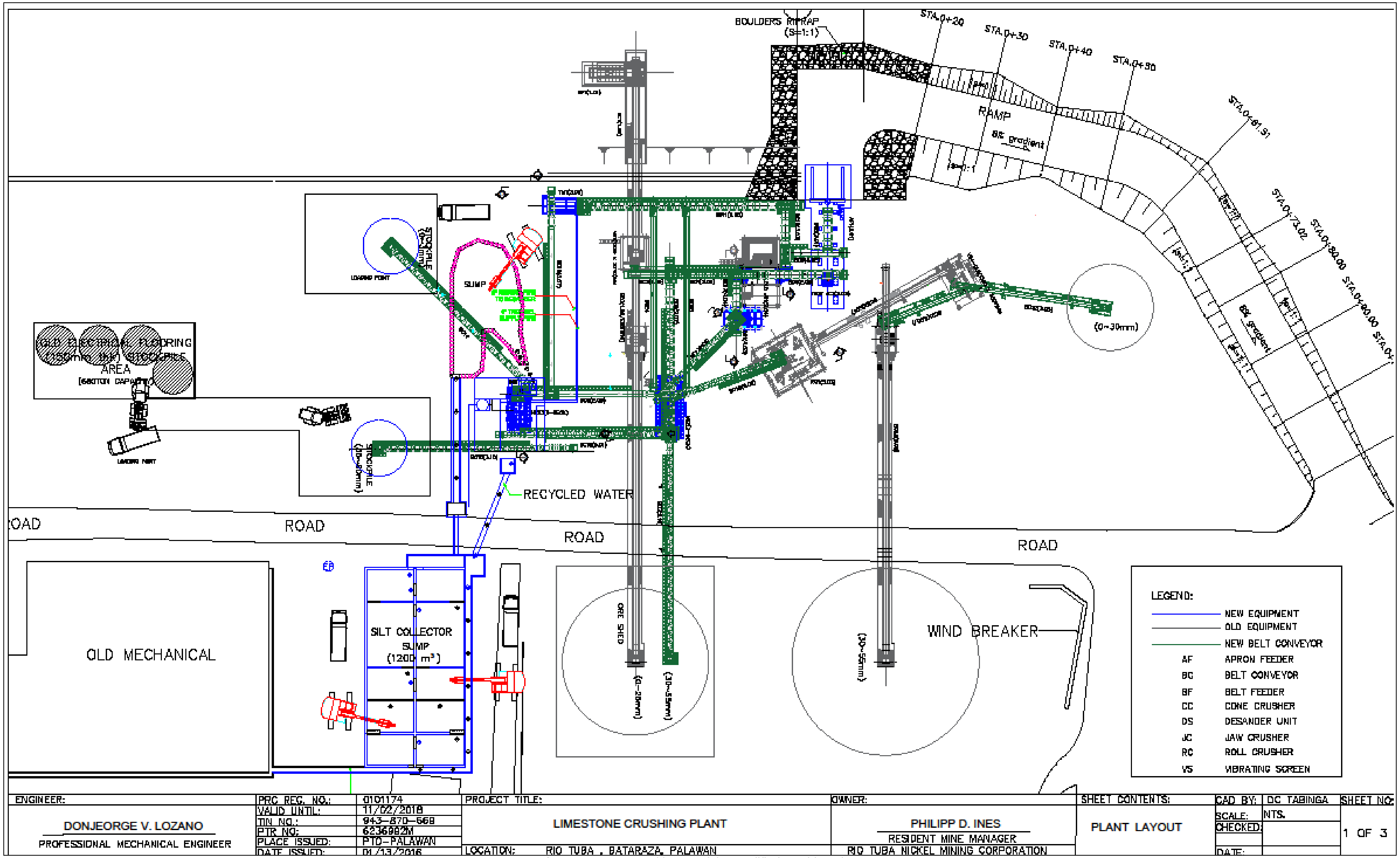


Figure 1.5.7. General layout of the modified crushing plant

1.5.2.4 Pollution Control Devices

The proposed project will continue to utilize the existing pollution control devices discussed in *Section 1.5.1.4*. Moreover, RTNMC constructed an additional 1,200-m^3 capacity settling pond which is 30 m west of the crushing plant that will hold the discharge from the said plant facility. Clear water will be recycled back to the washing plant.

Chapter 4 contains the recommended additional pollution control measures based on the assessment of the baseline conditions and probable impacts of the proposed expansion.

1.6 PROCESS/TECHNOLOGY

The current and the proposed expansion involve operations in the quarry area and the used of the modified crushing plant. The proposed quarry operation shall adopt the current method of open cast mining using conventional drilling and blasting technique within the existing 13.0-ha quarry area. The extracted limestone from the quarry shall be transported to the crushing plant for size reduction. To accommodate the increase in production, the existing crushing plant shall be modified to increase its operating capacity.

Crushed limestones shall be delivered to the HPP of CBNC and Lime Milk Plant of UMPI depending on size requirements.

Figure 1.6.1 illustrates the limestone quarrying process of RTNMC.

1.6.1 Quarrying Operation

1.6.1.1 Quarry Development

Continued operation of the existing mining operation shall be implemented. **Figure 1.5.5**, in the earlier section depicts the proposed mining plan for the Gotok Limestone Quarry. The existing access road shall be maintained and utilized. Areas subject to scheduled quarry development as presented in *Section 1.5.2.1* shall undergo site clearing.

Cross-sections of the current operation and the final quarry configuration are provided as **Figures 1.6.2** and **1.6.3,** respectively.

1.6.1.2 Blasting Operation

The massive characteristics of the limestone deposit requires drilling and blasting to produce the required fragmentation of 16" size products for feed to the Jaw Crusher with an opening of 20 inches.

Drilling. For drilling, a TH-CD-650 Hydraulic Crawler Drill machine equipped with a compressor shall be used. The drill hole diameter is 2.5 inches or 64 mm. Drilling in a row shall be 1.75 m x 2.00 m x 6.00 m. Typical drilling pattern is provided as **Figure 1.6.4**.

Blasting. Charging of a 6-m drill hole consists of a primer using a 50-mm dynamite of 1 kg, a column charge and drill sludge and clay for stemming. To produce 5,000 DMT needed for one week production, around 104 holes at 48 tonnes per hole are required. The powder factor is 0.3 to 0.4 kg/m^3. In a normal operation, blasting can be scheduled once a week with 5 to 6 days allotted for drilling.

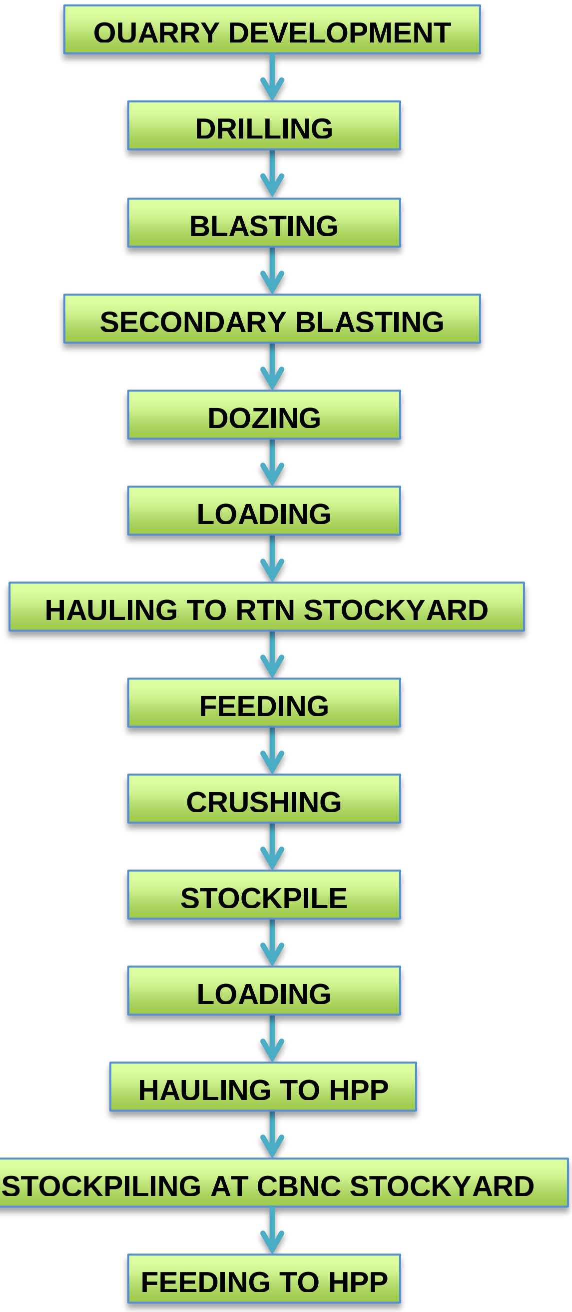


Figure 1.6.1. Limestone quarrying process

1.6.1.3 Stockpiling/Dozing

After blasting, the broken material will be gathered and removed from the bench face and stockpiled in an adjacent location. This is done to clear the area and prepare it for another round of drilling and blasting.

1.6.1.4 Loading and Transportation

The material will be loaded to a 10-MT dump truck using a wheel loader (WL). The material will be hauled and dumped temporarily at a stockyard, which is adjacent to the RTNMC crushing plant.

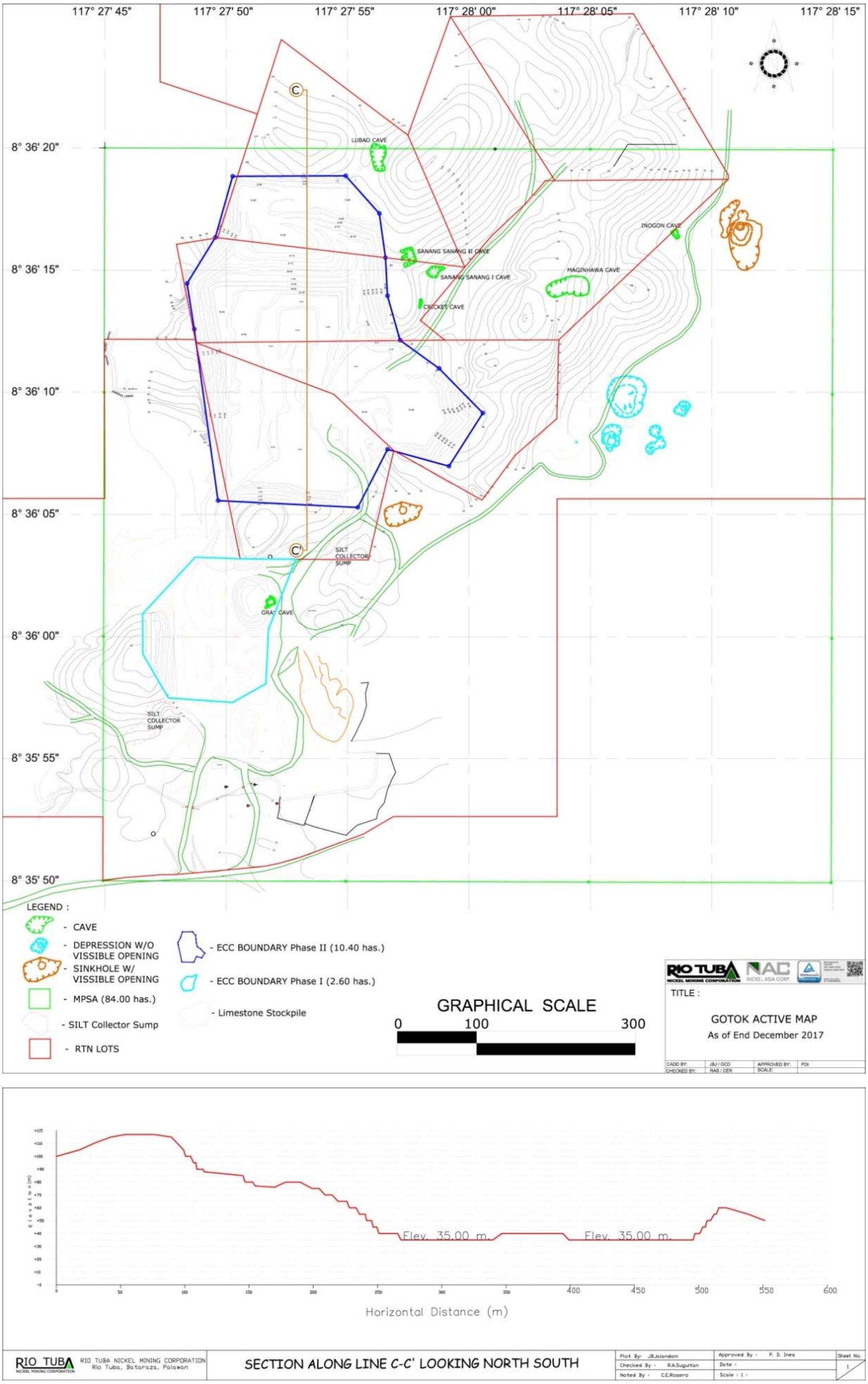


Figure 1.6.2. Cross-section of the current quarry operation

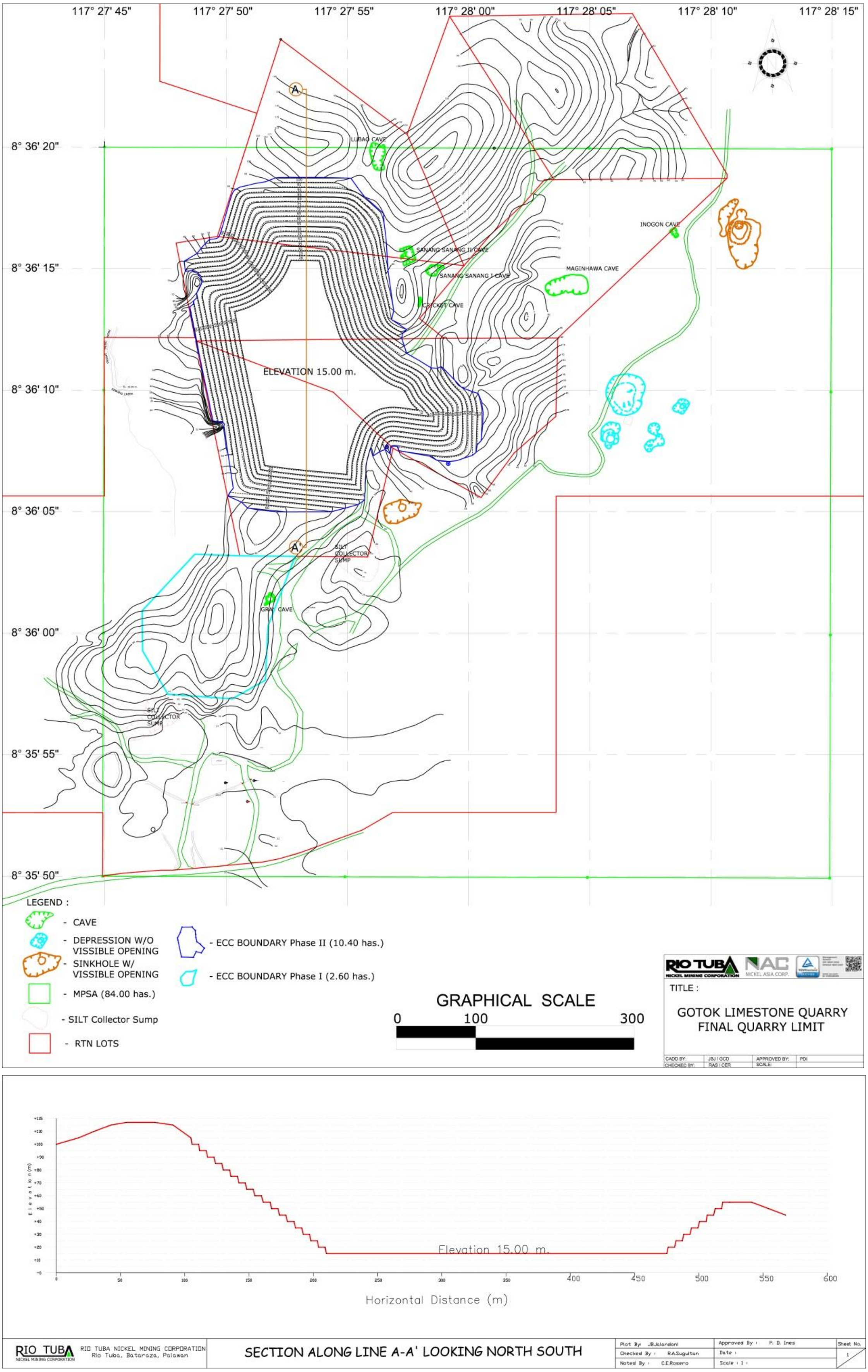


Figure 1.6.3. Cross-section of the final quarry configuration

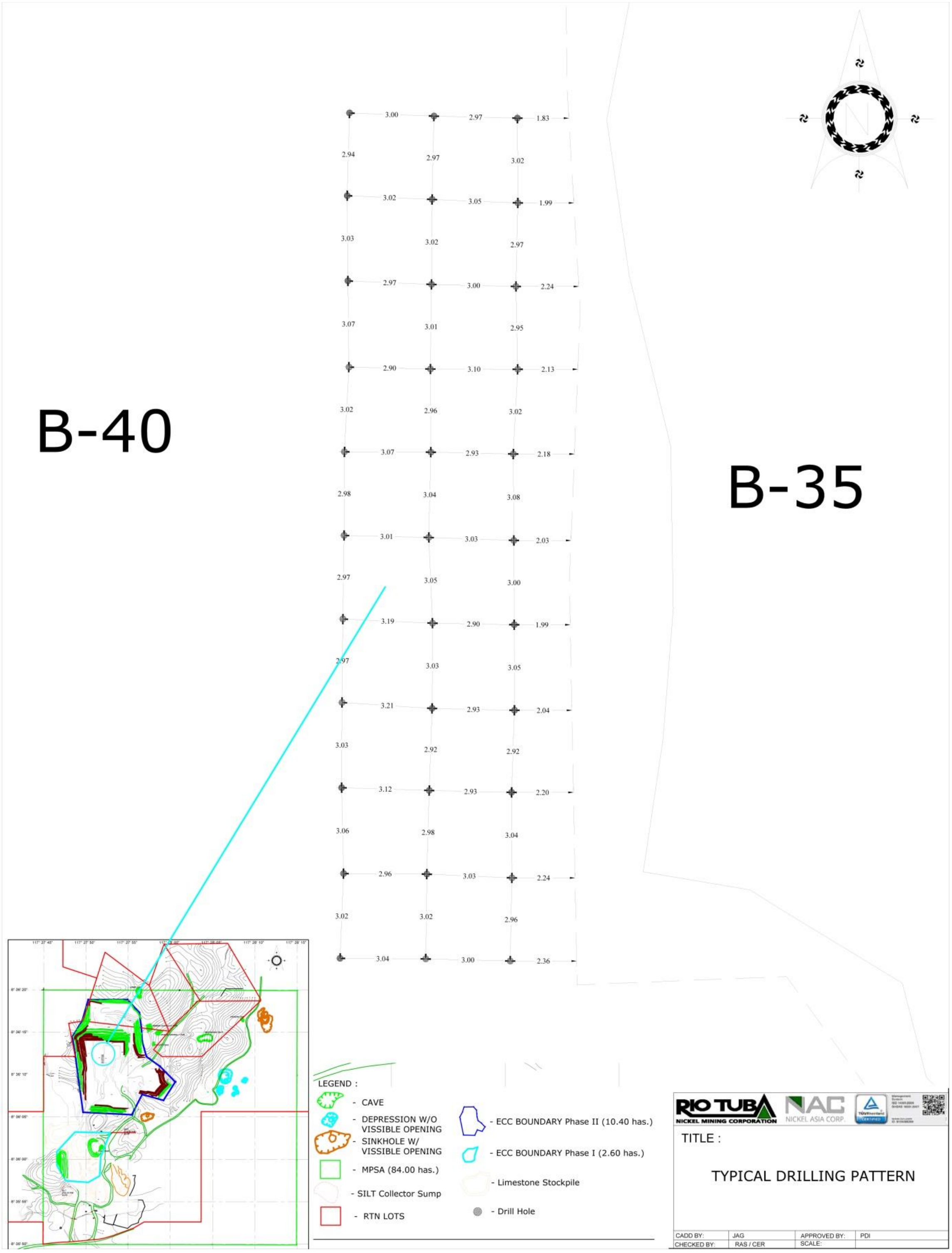


Figure 1.6.4. Typical drilling pattern of RTNMC

1.6.2 Crushing Plant Operation

1.6.2.1 Hopper Feeding/Crushing

The blasted limestone will be fed to a receiving hopper or an apron feeder of the modified crushing plant. Initial size reduction will be done using a jaw crusher with 4-inch (100 mm) discharge setting and processing in the modified crushing plant. The final size of about 1 inch (30 mm) will be achieved using a roll crusher. The crushed material will be temporarily contained in the stockpile area (30-55 and 55-80 mm) or the ore shed (<30 mm) prior to hauling to the plant site.

1.6.2.2 Loading and Transportation

The crushed limestone at the stockpile area (30-80 mm) will be transported to UMPI plantsite while the materials at the ore shed (<30 mm) will be hauled to the HPP plant site which is about 1 km away.

1.6.3 Water Supply and Requirements

The current operation in the quarry area and pre-modified crushing plant do not require the use of water. However, upon modification, the crushing plant requires an amount of 1,044 m^3 for its daily operation translating to 313,200 m^3 yearly requirement. With the proposed increase in production, the crushing plant will be operated at 24 hours a day and 300 days per year. The said volume of water will be sourced from water wells and Tagpisa siltation pond (**Table 1.6.1**). In addition, RTNMC constructed a 1,200-m^3 capacity settling pond to hold the waste water discharging from the washing plant. Clear water will be recycled back to the washing plant.

Road watering/spraying is part of the impact management plan for the suppression of dust generated from the quarrying and hauling operations. A water truck with a volume capacity of 14,000 L makes a trip once a day along the access/haulage roads within the quarry area. For the Gotok barangay road, watering/spraying is handled by three (3) families from the nearby community using three (3) improvised water tractors or *"kuliglig"* with a capacity of 1 m^3 each. On the average, water spraying activities are scheduled for 20 days/month during dry months (Dec.-May) and 10 days/month during rainy days (June-Nov.) within the quarry area, and 25 working days/month (all year round) for Gotok Barangay road. **Table 1.6.1** provides the estimated daily volume of water being used.

Table 1.6.1. Daily water supply and requirement

Use of water	Source of water		Capacity	Current water requirement	Proposed Water requirement	Issued Permits from NWRB
Manpower domestic water requirement (quarry area and crushing plant)	Water well no. 2*		2,059.2 m^3/day	106.5 m^3/day	106.5 m^3/day	Water Permit Application 8617; 7.26 L/s
	Water well no. 3		1,944.0 m^3/day			Water Permit Application 8618; 16.11 L/s
Road Watering	Inside Quarry Area	Ocayan River		14 m^3/day (for 20 days per month	14 m^3/day (for 20 days per month	WP no. 159: 500 L/s
		Mine pit and				WP no. 159:

	(Water truck)	Siltation ponds		during dry months and for 10 days per month during wet months)	during dry months and for 10 days per month during wet months)	500lps
		Water well no. 2 *	2,059.2 m^3/day			Water Permit Application 8617; 7.26 L/s
		Water well no. 3*	1,944.0 m^3/day			Water Permit Application 8618; 16.11 L/s
	Barangay road (3 improvised water tractor)	Oning spring and Barangay water system	3 m^3/day	28 m^3/day for (for 25 days per month)	28 m^3/day for (for 25 days per month)	
Modified Crushing Plant	Water well no. 2 *		2,059.2 m^3/day	-	1,044 m^3/day	Water Permit Application 8617; 7.26 L/s
	Water well no. 3*		1,944.0 m^3/day			Water Permit Application 8618; 16.11 L/s
	Tagpisa siltation pond **		203,588 m^3			WP no. 159: 500 L/s

*Notes: * Existing water well source of domestic water for RTN plant site*
*** Siltation pond will serve as back-up source*

1.6.4 Power Supply and Requirements

The company sources its power requirements from one (1) unit of 700 kW and two (2) units of 350 kW diesel generator sets. The proposed expansion in the Gotok quarry will not require additional electric power in its operation. However, the operation in its crushing plant shall have an annual power requirement of 1,670,438 kW-hr. Prior to its modification, the annual power requirement of the crushing plant is 373,912 kW-hr.

Table 1.6.2. Crushing plant power requirement

Particulars	Crushing Plant Power Requirement (kW-hr)	
	Before modification	After modification
Apron Feeder and Divergator	-	87,000
Jaw Crusher	172,626	341,280
Triple Deck Vibrating Screen	-	35,308
Trommel	-	52,080
Horizontal Screen / Washing Plant	-	223,200
Water System	-	297,600
Cone Crusher	-	171,100
Roll Crusher / Screening	201,286	462,870
Total	**373,912**	**1,670,438**

1.6.5 Fuel Requirements

RTNMC utilizes heavy equipment to perform activities such as drilling, loading and hauling. In its current operation, RTNMC consumes about 733,100 L of fuel, which is expected to increase to 1,566,100 L.

Table 1.6.3. Fuel requirements for the current and proposed operation

Equipment	Current		Proposed	
	Quantity (No. of units)	Annual Fuel Requirement (Liters)	Quantity (No. of units)	Annual Fuel Requirement (Liters)*
Production Equipment				

Equipment	Current		Proposed	
	Quantity (No. of units)	Annual Fuel Requirement (Liters)	Quantity (No. of units)	Annual Fuel Requirement (Liters)*
Dump truck	9	237,100	21	530,000
Wheel Loader	6	210,000	10	569,000
Bulldozer	2	58,600	2	58,600
TX-Loader	1	106,100	2	239,200
Drills				
Air Track Drill Machine	3	72,000	4	96,000
Other Equipment				
Fuel Lorry	1	2,000	1	2,000
Maintenance Truck	1	3,000	1	3,000
Road Grader	1	17,400	1	17,400
Truck Trailer	1	500	1	500
Air Compressor	1	24,000	2	48,000
Service Vehicle				
Service Jeep	1	2,400	1	2,400
Total		**733,100**		**1,566,100**

*Note: *Proposed Annual Fuel requirement based on estimated engine hours of equipment*

1.6.6 Waste and Wastewater Generated

The operations in the Gotok limestone quarry and crushing plant generate approximately 1,068 m^3 of solid wastes consisting mainly of domestic and industrial wastes annually. These include canteen wastes, human wastes, used batteries, used drums, used oil and used oil filters. The solid waste management plan currently being implemented includes collection of domestic wastes, segregation into bio and non-biodegradable and disposal to GP-28. It is a mined-out pit with a holding capacity of 240,000 m^3 which can fill-up within 20 years.

Wastewater generated from the project will come mostly from the operation of the crushing plant. The water requirement of 1,044 m^3/day for its operation will be converted into wastewater, which will be contained in a settling/recycling pond wherein, clear water will be recycled and only the overflow will be discharged into the upper Kinurong.

1.7 PROJECT SIZE

1.7.1 Mineral Resource

Based on the Feasibility Study submitted to MGB Region IVB last March, 14, 2018 (**Annex 1.5.2**), the mineral resource estimate of 11,271,487 WMT includes indicated resources from 80 masl to 15 masl as seen in **Table 1.7.1**. The final elevation of the area after the quarry operation will be 15 masl.

Table 1.7.1. Mineral resource estimate of Gotok limestone quarry as of March 2015

$CaCO_3$ Range	Tonnage (WMT)	% $CaCO_3$	% MgO	% Si_2O_3
≥ 95.00%	1,293,095	95.55%	0.68%	1.94%
≥ 95.00% to ≤94.99%	5,156,839	93.10%	0.85%	2.50%
< 89.99%	4,821,553	73.54%	1.70%	11.69%

Source: A Feasibility Study on Gotok Limestone Quarry and Limestone Crushing Plant Expansion Project, 2018

On the other hand the conservative mineral reserve estimate based on the March 2015 mineral resource estimate and with a recovery rate of 80% is presented in **Table 1.7.2**.

Table 1.7.2. Mineral reserve estimate of Gotok limestone quarry as of March 2015

$CaCO_3$ Range	Tonnage (WMT)	% $CaCO_3$	% MgO	% Si_2O_3
High Grade	2,815,898	94.00%	0.79%	2.29%
Low Grade	6,201,291	80.93%	1.38%	8.22%
Total	**9,017,190**	**85.01%**	**1.19%**	**6.37%**

Source: A Feasibility Study on Gotok Limestone Quarry and Limestone Crushing Plant Expansion Project, 2018

The mineable reserves are computed based on the following parameters:

- Overall pit slope : 39.81°
- Bench Height : 5.00 m
- Berm : 5.00 m
- Width of haul road : 10.00 m
- Road gradient : 10%
- Working bench slope : 78.69°

1.7.2 Material Balance

The existing quarry production produces approximately 372,000 WMT annually. **Figure 1.7.2** shows that for the proposed operation, a 725,000 WMT annual limestone production will produce a topsoil/overburden of 7,492 WMT.

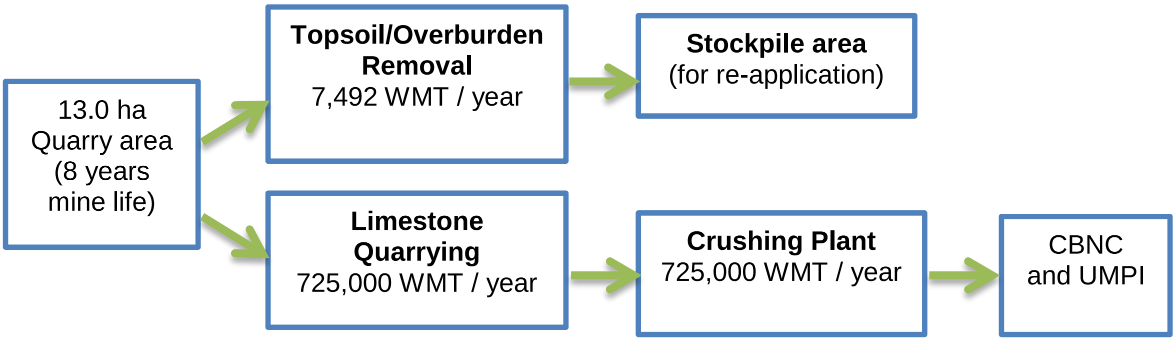


Figure 1.7.1. Material Balance for the Gotok limestone quarry project

The extracted limestone from the quarry site is transported to the crushing plant for size reduction before hauling to CBNC while the removed topsoil/overburden will be stockpiled at the designated site pending availability of mined-out area for rehabilitation.

Table 1.7.3 describes the components of current quarry operations and the proposed expansion.

Table 1.7.3. Comparative components of quarry and crushing plant operations

Component	Existing Operation	Proposed Expansion
MPSA	213-2005-IVB	SAME
ECC	ECC-0707-002-3721 – Gotok Limestone Quarry ECC-CO-1312-0043 – Crushing Plant	New ECC
Area covered in the MPSA	**84.5 hectares**	**84.5 hectares**
Total project area for the quarry operation (within the MPSA)	**14.05 hectares**	**SAME**
ECC Approved quarry area within the MPSA	13.0 hectares	13.0 hectares
Ancillary facilities within the MPSA	0.9 hectares	SAME
Access roads	0.15 hectares	SAME
Total project area for the	**3.796 hectares**	**SAME**

Component	Existing Operation	Proposed Expansion
crushing plant operation (within AMA-IVB-144A and MPSA-114-98-IV)		
Infrastructures	1.895 hectares	SAME
Stockpile area	0.631 hectares	SAME
Access road	0.770 hectares	SAME
Storage area of explosives	0.500	SAME
Total project area outside any MPSA (hauling road)	**6.80**	**SAME**
Common facilities with RTNMC Nickel Operations	26.45	SAME
Annual Production Rate	372,000 WMT per year	725,000 WMT per year
Mine life	Up to 2026	Up to 2022
Method of ore extraction	conventional drilling and blasting technique	SAME
Hauling road	10 km	SAME
Crushing plant		
Components	• Jaw Crusher - One (1) unit, Kurimuto, 3020 ST, 700 mm x 500mm x 95 mm CSS/ Discharge • Roll Crusher- One (1) unit Kurimuto 3624 Double Roll Crusher • Vibrating Screen - Two (2) units Triple Deck with 75mm opening; One (1) unit, NFS 1230, 1200 mm X 3000mm w/ 100mm opening, single Deck; One (1) unit, 1200 mm X 3650mm w/ 25mm opening, single Deck • Feeder - Two (2) units Belt Feeder, 1200mm width X 7 meters length • Belt conveyor - Four (4) units, 750 mm Conveyor Belt Width; Nine (9) unit, 600 mm Conveyor Belt Width	• Jaw Crusher - One (1) unit, Terex Jacques, JW 42, 1070mm x 760mm • 125mm CSS/ discharge • Roll Crusher- One (1) unit Cone Crusher, Terex- Jaques, TC100 • Vibrating Screen - One (1) unit, Triple Deck, 6' x 16", 80mm top, 55mm middle and 30mm bottom; One (1) unit, NFS 1230, 1200 mm X 3000mm w/ 30mm opening, single Deck; One (1) unit Double Deck Horizontal Screen, 5' x 15', 55mm top and 3mm bottom deck • Feeder - One (1) unit Apron Feeder 10-420, 1200mm width x 6.meters length • Belt conveyor - Eight (8) units, 900 mm Conveyor Belt Width; Sixteen (16) units, 600 mm Conveyor Belt Width • Cone crusher • Trommel • Desander Unit • Water System • Sumps
Size Out put	0-30mm	• 0-30mm • 30-55 mm • 55- 80mm
Maximum Capacity	110 TPH	250 TPH
Water Source	• Water wells 2 and 3 • Umawi Stream • Mine pit and siltation ponds	• Water wells 2 and 3 • Umawi Stream • Mine pit and siltation ponds Tagpisa Siltation pond (back-up source)
Water requirement	No washing at the pre-modified plant 14 m^3/day (road watering) 106.5 m^3/day (domestic water requirement)	1,044 m^3/day (washing plant) 16.5 m^3/day (road watering) 106.5 m^3/day (domestic water requirement)
Power Source	One (1) 700 kW Diesel Generator Two (2) 350 kW Diesel Generator	SAME
Power requirement	373,912 kW-hr	1,670,438 kW-hr
Fuel requirement	733,100 liters	1,566,100 liters

Component	Existing Operation	Proposed Expansion
Manpower requirement	117 (supervisor, operator, driver, utilities and security guards)	213 (supervisor, operator, driver, utilities and security guards)
Project Cost	PhP 221 M	PhP 376,906,207

1.8 DEVELOPMENT PLAN, DESCRIPTION OF PROJECT PHASES AND CORRESPONDING TIMEFRAMES

The current operation of RTNMC in Gotok quarry involves an open pit bench mining and utilize conventional drilling and blasting technique. The expansion project will continue the existing operation, utilizing the approved 13.0-ha quarry area in Phase 2. Also, the crushing plant will be modified to meet the increase in limestone production. **Figure 1.8.1** depicts the development plan/schedule of the expansion process. The following sections outline the project phases.

1.8.1 Pre-construction Phase

The initial step in the crushing plant modification is the procurement of materials and additional components which include apron feeder divergator, triple deck vibrating screen, trammel, horizontal screen/washing plant, water system and cone crusher. This process will take about four (4) months to complete. Prior to the completion of the procurement, soil/foundation testing will be conducted. This is usually done to ensure that the site can withstand the engineering design/load of the facility.

Part of the pre-construction phase is the conception of the feasibility study used as basis for this proposed project which was submitted to the MGB Region IVB on March 18, 2018 (**Annex 1.5.2**). The study served as the basis for the proposed annual production of 725,000 WMT and long range quarry plan presented in this chapter as **Figure 1.5.5**.

1.8.2 Construction Phase

The scope of this phase in the crushing plant modification involved concrete/foundation works, mechanical works, electrical works, debugging/modification and testing and commissioning. The modification of the crushing plant took about five (5) months.

Currently, some preparatory activities for Phase II of the Gotok quarry is currently carried out which includes the tree cutting and site clearing operation (note that this is already covered under the existing ECC). In 25 May 2012, RTNMC secured an approved SEP clearance for the tree cutting (**Annex 1.8.2**).

In descending order of frequency values, the following are the common species found in the area: Kamagong (*Diospyros blancoi)*, Akle (*Arbizia acle*) and Molave (*Vitex parviflora*). Others include, Amugis (*Dracontomelon dao*), Sakat (*Terminalia nitens)*, Bogo (*Garuga floribunda*), Antipolo (*Arthocarpus blancoi*), Pahutan (*Mangifera* sp.), Batino (*Alstonia macrophylla*), Malugai (*Pometia pinnata)*, Ipil (*Intsia bijuga*), and Narra (*Pterocarpus indicus*). Among the lesser-Used Species category include Duguan (*Myristica* sp.), Putian (*Cryptocarya densiflora*), Tibig (*Ficus nota*), and Binunga (*Macaranga tanarius*). Also pulpwood and matchwood species were observed such as Dita (*Alstonia scholaris*), Anabiong (*Trema orientalis*), and Kupang (*Parkia roxburghi*). In compliance with the granted tree cutting permit, poles and sapling size trees had been earth-balled and grown in varying sizes of planting containers such as 1-tonner bags (150), cut empty fuel drums (54), empty plastic containers (60) and, 10” x 12” black polyethylene bags (2,000) for total of 2,264. Also, 11,500 undergrowths and regenerants were retrieved from the field as bare root materials and grown in a nursery for re-conditioning to ensure field survival. In addition, 5 kilos of seeds of Baro and Baribedan spp. were collected and sown in the nursery.

1.8.3 Operation Phase

The operation phase of the Gotok quarry will involve open cast mining method of Phase 2. As discussed earlier in *Section 1.6.1*, the quarry process will include area preparation, blasting, stockpiling, loading and transportation.

To support the proposed increase in annual production, RTNMC shall purchase additional equipment as indicated in **Table 1.5.7**. Moreover, additional personnel shall be employed to operate the said equipment.
The proposed increase in production shall also entail increase in the waste and dust generation. Current pollution control measures being implemented is presented in *Section 1.5.1.5* of this chapter while the additional mitigating measures to address these possible impacts shall be discussed in *Chapter 4*.

1.8.4 Abandonment/ Rehabilitation Phase

Rehabilitation of the affected areas will commence after the 13.0-ha quarry area reached the 15 masl elevation. RTNMC has practiced rehabilitation by phases or as the operation progresses. The revised Final Mine Rehabilitation and Decommissioning Plan (FMR/DP) for the Gotok Limestone Quarry Project was submitted to MGB in response to the advice of the Contingent Liability and Rehabilitation Fund Steering Committee (CLRFSC) (**Annex 1.8.3**).

1.8.4.1 Decommissioning Plan

The decommissioning plan of the RTNMC for the Gotok Limestone Quarry Project shall involve disposition of the following structural parts, equipment and materials.

Table 1.8.1. Mode of disposition of structural parts, equipment and material

Materials	Mode of Disposition
Equipment for quarry, crushing and screening, power generation and office	• Useable equipment is sold • Non useable are sold as scrap
Conveyor belt sections, oil filters, tires, spare parts, batteries and consumables, either used or unused	• Consumables and useable parts are sold • Non useable will be sold as scrap or disposed to a landfill
Cable, power lines, electrical wires, posts and pipes	• Useable items will be donated to the community • Non useable are sold as scrap
Other storage tanks	• Useable items will be donated to the community • Non useable are sold as scrap or disposed to a landfill
Explosives	• Unused Explosives will be handled by the company’s Blasting Contractor
Tables, chairs, beds and cabinets	• Useable items will be donated to the community • Non useable are sold as scrap or disposed to a landfill
Roofing, walling, toilet fixtures, doors window, and other fixtures	• Useable items will be donated to the community • Non useable are sold as scrap or disposed to a landfill
Concrete floors and slabs	• Donated to the community as backfill material
Domestic wastes including sewage sludge	• Domestic wastes are brought to the landfill • Sewage sludge is used for soil conditioning

Source: Revised FMRDP for the Gotok Limestone Quarry Project, 2017

1.8.4.2 Final Landform Design

Final landform design for mined-out areas will be designed to conform to the original surface configuration but contoured with an elevation relatively 15 masl. The quarry areas will be rehabilitated into forestlands, industrial tree plantation, aquaculture, and/or pastureland subject to discussions and agreement with the community and the LGU/s.

1.8.4.3 Mine Rehabilitation

Surface Preparation

RTNMC practices progressive quarry rehabilitation which takes place when the final quarry/pit limit of the benches is reached. Surface preparation starts by backfilling small, depressed areas or pits with materials sourced nearby. Waste materials within the same mined-out areas will be pushed into the depressions and then leveled-off to a more favorable land configuration using bulldozers. A 30-cm topsoil will be spread all over the area after backfilling and leveling. Adequate drainage system will be provided within the reclaimed land surface.

Backfill materials used are the mudstone and/or limestone contaminated with mudstone excavated in the quarry area.

Revegetation

As practiced by RTNMC, fast growing and heat tolerant pioneer species will be used for the revegetation activities. *Acacia mangium*, *A. auricoliformis*, *Gmelina arborea*, and *Casuarina nodiflora* are among the plant species currently being grown by RTNMC. **Plate 1.8.1** shows the nursery and species that are being nurtured at the RTNMC nursery. Field planting is normally implemented during the onset of rainy season after surface preparation. Distance between plants shall be maintained at 2 m interval.

Climax species can also be used in the revegetation activities. Planting shall start three (3) years after the pioneer/reforestation species have established. Consequently, the pioneer species have already developed the necessary cover for the growth and survival of shade-loving climax species. Apitong (*Dipterocarpus grandiflorus*), Ipil (*Intsia bijuga*), Narra (*Pterocarpus indicus*), Almaciga (*Agathis philippinensis*), and Kamagong (*Diospyros philippinensis*) are among the climax species with high survival rate. At the periphery of the rehabilitated areas, fruit bearing trees shall be planted to become source of food for some wildlife species thriving in the area including birds.

Plate 1.8.1. RTNMC Nursery

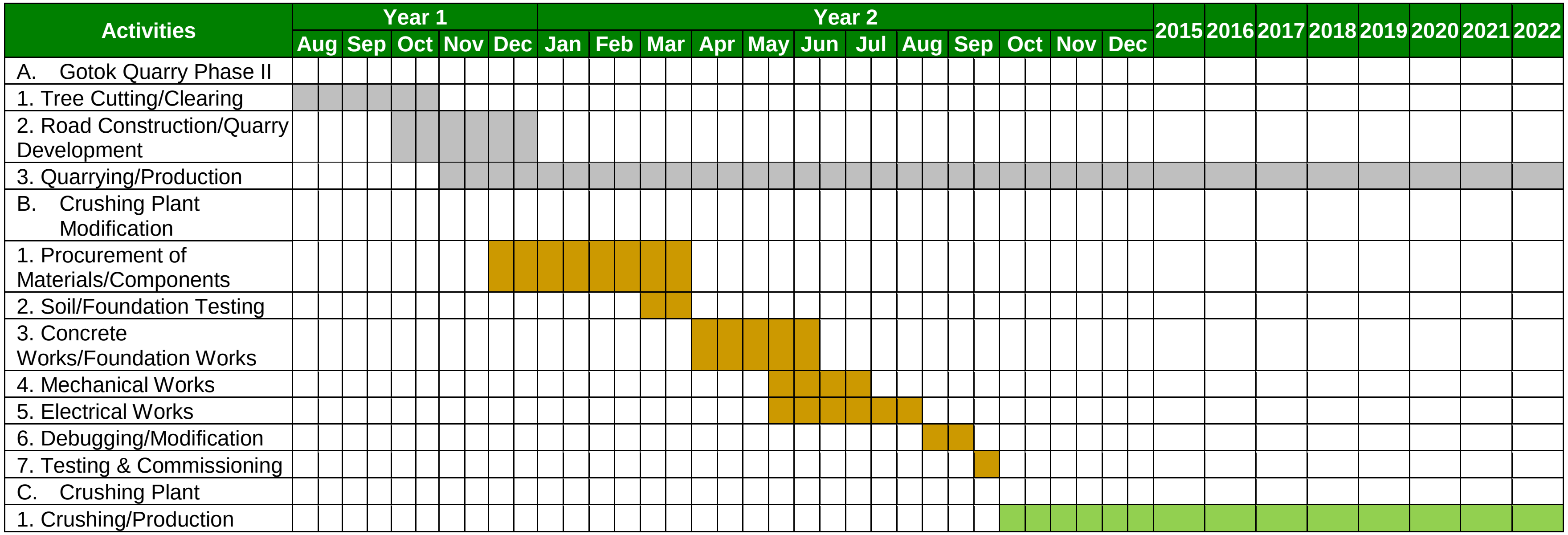


Figure 1.8.1 Development plan/schedule of the proposed Gotok limestone quarry

Maintenance

The newly rehabilitated areas will be monitored closely to ensure high survival rate of plant species. Grass cutting, watering during dry months, reapplication of fertilizer and fencing shall be conducted until the seedlings have grown. Dead seedlings shall be replaced to have a sufficient cover for the climax species.

RTNMC strictly employs the activities indicated in its Annual Environmental Protection and Enhancement Program (AEPEP).

1.9 MANPOWER

The current total manpower pool of RTNMC and its contractor for the Gotok quarry operation is 117 employees. Of which, 53 employees are deployed in quarrying, 55 in the crushing plant, five (5) in the transport of limestone to CBNC and UMPI and four (4) in the feeding station of CBNC. Additional 96 employees will be hired as the expansion commences.

Table 1.9.1

Table 1.9.1 specifically presents the existing pool of manpower employed in the Gotok quarry as well as the manpower requirement of the expanded operation.

Table 1.9.1. Existing and proposed manpower requirements of the Gotok quarry

Manpower	Existing Operation	Expanded Operation
Per Project Component		
Quarrying and Transport	53	65
Crushing plant operation	55	120
Transport to CBNC and Unichamp	5	24
Feeding station of CBNC	4	4
Total	**117**	**213**

Source: RTNMC, as of August 2016

1.10 INDICATIVE PROJECT INVESTMENT COST

The estimated project investment cost for this proposed expansion project is **PhP 377 M**. **Table 1.10.1** presents the breakdown of the project investment cost.

Table 1.10.1. Breakdown of investment cost

Component	Cost (PhP)
Quarry	25,089,817.00
Crushing plant modification	250,197,700.00
Heavy equipment	101,618,690.00
Total	**PhP 376,906,207 .00**

2 Analysis of key environmental impacts

Rio Tuba Nickel Mining Corporation

This chapter contains the baseline assessment of the environment and people based on field sampling and, interviews as well as secondary data from the mine site, barangay halls, municipal office and other agencies. The baseline assessment serves as the basis for impact assessment as well as formulation of the various plans and programs in the succeeding chapters.

2.1 THE LAND

This section contains the baseline and impact assessment for the land use, geology and geomorphology, pedology and the terrestrial biology. Sampling procedures in the conduct of the baseline data are presented in **Annex 2.1.1**.

2.1.1 Land Use and Classification

2.1.1.1 Methodology

Secondary data from the provincial government of Palawan, municipal government of Bataraza and Palawan Council for Sustainable Development (PCSD) were used as references for this particular section. Materials used include the 2009-2019 Comprehensive Land Use Plan (CLUP) of Bataraza and Environmentally Critical Areas Network (ECAN) maps of PCSD.

2.1.1.2 Findings and Discussions

Background of ECAN

ECAN is a graded system of protection and development control over the whole of Palawan which provide the strategic framework of the Strategic Environmental Plan (SEP).

According to Section 7 of R.A. 7611, the ECAN shall ensure the following:

1. Forest conservation and protection through the imposition of a total commercial logging ban in maximum protection and restricted use zones;
2. Protection of watersheds;
3. Preservation of biological diversity;
4. Protection of tribal people and preservation of culture;
5. Maintenance of maximum sustainable yield;
6. Protection of rare and endangered species and their habitat;
7. Provision of areas for environmental and ecological research, education and training; and
8. Provision of areas for tourist and recreation.

The three (3) main components of ECAN (Section 8) are:

1.Terrestrial;

2.Coastal/marine area; and

3.Tribal ancestral land.

Terrestrial Component of the ECAN

Section 15 of PCSD Resolution No. 94-44 establishes the criteria to be followed by PCSD in delineating the core zone. The criteria include elevation, first-growth forest and slopes among others to which the Gotok Limestone Quarry is classified under Controlled-use area whereby regulated use is allowed.

Land Use of Bataraza based on ECAN Map

An ECAN Map for the Municipality of Bataraza has been prepared by PCSD (**Annex 2.1.2**). On 09 January 2006, the Municipal Council of Bataraza adopted an ECAN Map (v. 2005) of Bataraza under Resolution No. 01, Series of 2006. On November 2008, the Municipality of Bataraza revised and modified the ECAN zone map of Bataraza following the permission granted to it under Resolution No. 08-358 of the PCSD. Subsequently, the Provincial Legal Office approves Resolution No. 001, Series of 2010 endorsing, recommending and supporting the application of RTNMC for Mine Productivity Sharing Agreement (MPSA) as discussed in the session of the Municipal ECAN Board on 22 March 2010. The Municipality of Bataraza afterwards proceeded to revise its CLUP covering the period 2009-2018. On January 2010, the *Sangguniang Panlalawigan* approved the revised CLUP (refer to **Annex 2.1.2**). Other Resolutions and other documentations on the process of approving and amending the ECAN Map are included in **Annex 2.1.3**. **Table 2.1.1** summarizes the different land uses.

Table 2.1.1. Land area of different land uses

Category	Area Utilization	
	Area (has.)	% to Total Area
1. Forest & Forest Use Categories	33,064.86	45.53
1.1 Production Forest	13,344.86	-
1.2 Protection Forest	19,720.06	-
2. Agriculture	22,511.44	31.00
3. Built up Areas	2,500.00	3.44
4. Special Uses		-
4.1 Mining and Quarrying	5,262.50	7.25
4.2 Open Grassland/Pasture	1,452.74	2.00
4.3 Infrastructure	300.00	0.41
4.4 Other uses		
4.4.1 Dumpsites	10.00	0.01
4.4.2 Cemetery	15.00	0.02
4.5 Water Uses		
4.5.1 Mangroves and nipa swamps	7,357.57	10.13
4.5.2 Inland water bodies	147.44	0.20

Source: Municipality of Bataraza Comprehensive Land Use Plan, 2009-2018

The area is a controlled-use zone based on the PCSD ECAN Map (**Figure 2.1.1**).

Landcover and Vegetation of the Project Area

Four landcover/vegetation types were identified and mapped within the MPSA. The landuse/vegetation types are as follows: Forest; Shrubland; Coconut and Fruit trees; and Bare area.

Forest is the dominant vegetation of the hilly area in the northern and middle parts of the MPSA (**Figure 2.1.2**). Forest tree species are: Molave (*Vitex parviflora*), *Shorea* sp., Antipolo (*Artocarpus blancoi*), Amugis (*Koordersiodendron pinnatum*), Malamanga, Malacafe, Binunga (*Macaranga tanarius*), Bago (*Gnetum gnemon*) and Kamias (*Averrhoa bilimbi*) (**Plate 2.1.1**).

The Shrubland exists in the Tree Cutting Permit area and on the sideslope of the hill in the mid-eastern part of the MPSA (**Plate 2.1.1**). Two small patches of shrubland exist adjacent to the Bare area and Coconut plantations in the southern part of the MPSA. Shrub/plant species are: Binunga (*M. tanarius*), Hagimit (*Ficus minahassae*), Samburagot and Comote-camotehan (vine).

Plate 2.1.1. Forest located northwest of Tree cutting permit area in the MPSA

Plate 2.1.2. Shrubland inside the tree cutting permit

The Coconut plantations with Fruit trees such as Rambutan (*Nephelium lappaceum)*, Cashew (*Anacardium occidentale)*, Bignay (*Antidesma bunius)*, Jackfruit (*Artocarpus heterophylla)*, Guava (*Psidium guajava)*, Banana (*Musa sapientum)* with Pineapple exist in the southern part of the MPSA.

The Bare areas are the actively being quarried area in the middle part of the Tree Cutting Permit area and the area being used as stockpile area of the limestone stones and boulders in the southern part of the MPSA (**Plate 2.1.3** and **Plate 2.1.4**).

Plate 2.1.3. Limestone quarry within the Tree Cutting Permit area

Plate 2.1.4. On-going rehabilitation of a mined-out area

Classification of the Project Site based on Proclamation No. 2146

As stated in Proclamation No. 2146, the current project is classified under Type 2, Resource Extractive Industries, of the Environmentally Critical Project (ECP), being a major mining project. The current location of the RTNMC's project site is also within Environmentally

Critical Areas (ECAs), qualifying based on two (2) categories: (1) area considered as habitat of some endangered flora species, and (2) area traditionally occupied by Indigenous People (IP). Base on the Free and Prior Informed Consent (FPIC) and Certificate of Ancestral Domain Title (CADT), there are no conflicting tenurial/land issues within the MPSA. The copy of the Compliance Certificate to the FPIC process and CADT can be seen in **Annexes 2.1.4** and **2.1.5**, respectively. It should also be emphasized that Palawan is considered a critical area with its wide biodiversity. An endorsement from PCSD is included in this report (**Annex 1.1.2**).

Caves and sink holes

This section discusses both caves and sink holes near the project area. Sinkholes and caves are marked by topographic depressions, which are indicated by the comb-like (hachured) lines in the map presented in **Figure 2.1.1**.

The caves listed on **Table 2.1.2** are not considered as ECA, specially as areas set aside as aesthetic, potential tourist spot. None of the caves are cited as Class 1 and Class 2 as defined under DENR MC 2012-03.

However, under the terms and conditions of SEP Clearance for the Gotok Limestone Quarry approved last May 25, 2012, the caves as listed on **Table 2.1.2** shall be protected and excluded from tree cutting and quarry operations. In line with this, a peripheral buffer zone of 50 m surrounding the cave/s shall be ground delineated/demarcated and excluded from quarrying activities to ensure cave integrity and protect cave-dependent wildlife/organisms from unnatural activities and human disturbance.

Table 2.1.2. Caves listed in the SEP Clearance with the MPSA of the Gotok Limestone Quarry

Caves		Latitude	Longitude
1	Gray Cave	8˚36’01.2” N	117˚27’52.3” E
2	Cricket Cave	8˚36’14.8” N	117˚27’58.9” E
3	Sanang-sanang I Cave	8˚36’15.1” N	117˚28’01.3” E
4	Sanang-sanang II Cave	8˚36’14.9” N	117˚27’58.2” E
5	Lubao Cave	8˚36’19.6” N	117˚27’56.2” E
6	Maginhawa Cave	8˚36’13.9” N	117˚28’06.2” E
7	Inogon Cave	8˚36’16.5” N	117˚28’16.1” E

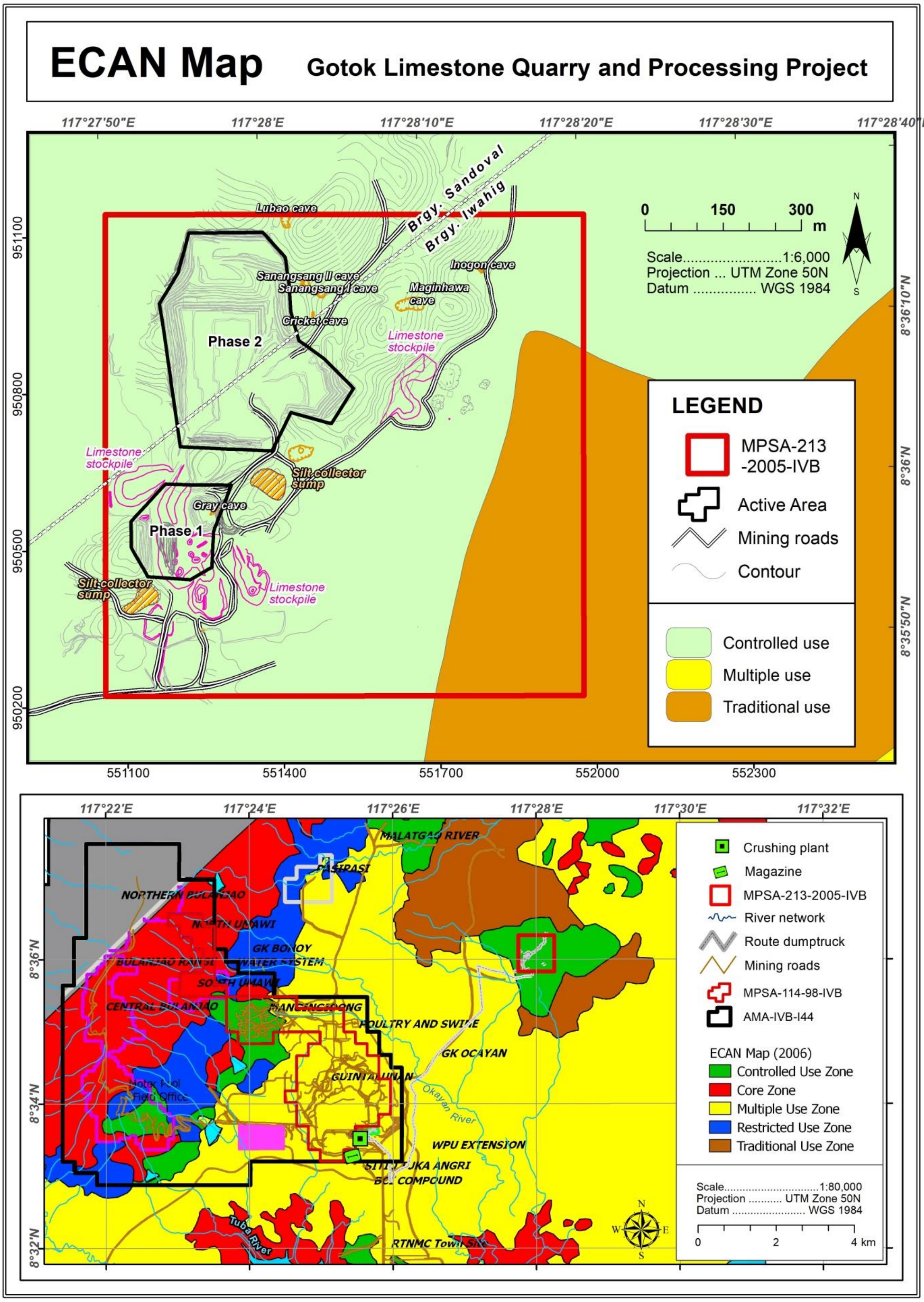


Figure 2.1.1. Environmentally Critical Area Network (ECAN) map generated by RTNMC (*Source: PCSD, 2006*)

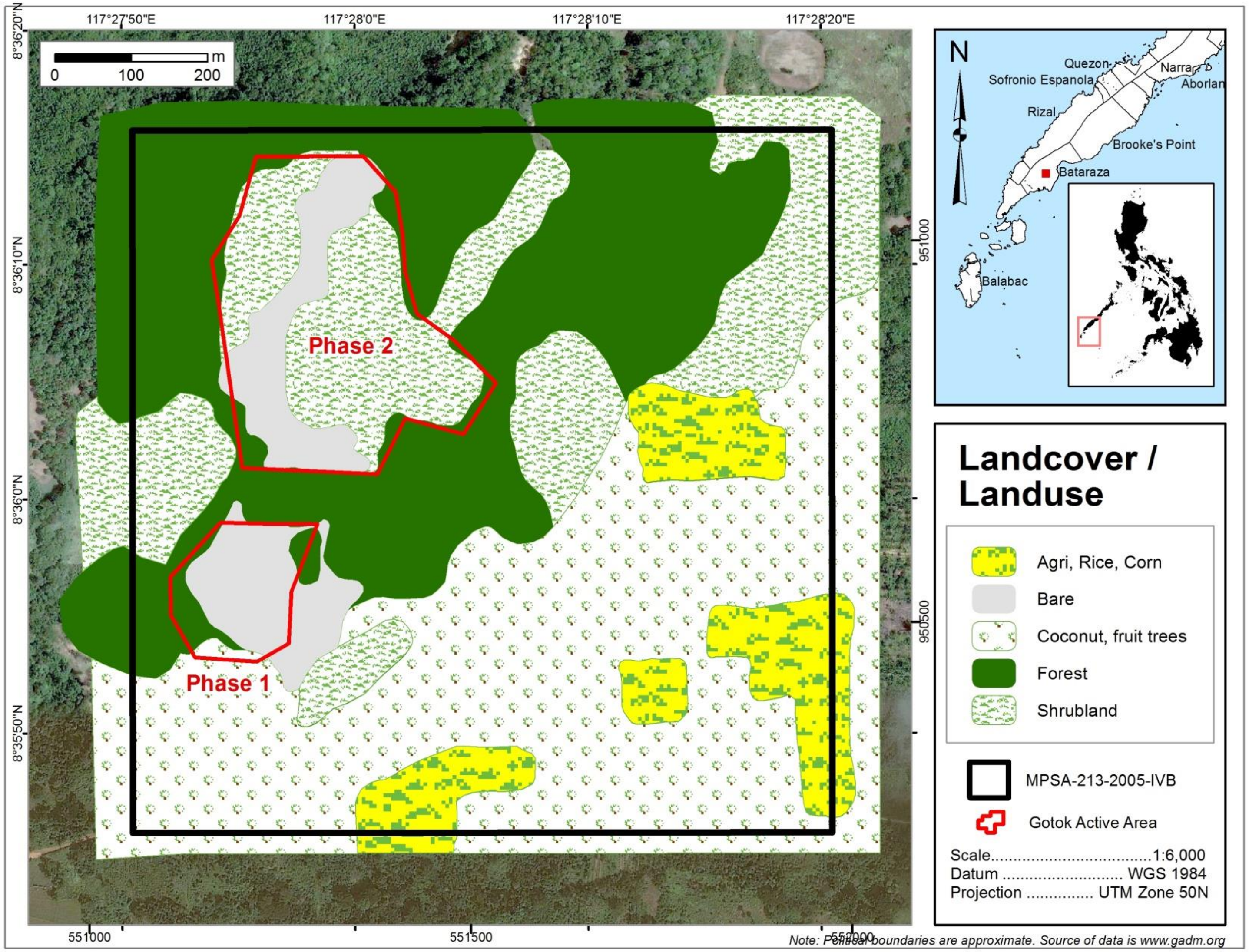


Figure 2.1.2. Landcover/vegetation map

2.1.1.3 Impact Assessment and Environmental Performance

Predicted Impacts

The following matrix summarizes the potential impacts that may be brought by the increased production of the quarry and modified crushing plant. Each impact was categorized in terms of stage/period of possible occurrence, duration, likelihood of occurrence, and magnitude. Entries with asterisks are perceived to be not significant or negligible while italicized entries were perceived to be a positive impact of the project.

Table 2.1.3. Impacts assessment and mitigation for land use and classification

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
Change/ inconsistency in land use, slope and subsurface geomorphology The continued operation in the quarry site significantly changed the original landform, slope and underground geomorphology in the project area. The original sloping and rugged terrain will be transformed into crater-like formations after the quarrying operations. As part of the rehabilitation program, RTNMC shall backfill the said craters or uneven surface to maintain a relatively consistently level topography.		✓	✓	✓	• RTNMC shall strictly comply with its approved quarry plan, which involves incremental quarry development and progressive rehabilitation to minimize ground disturbance • Maintain vegetation cover in the designated buffer zones and in the peripheries of roads and quarry area
Encroachment in Environmentally Critical Areas (ECA) The current location of the RTNMC's project site is considered to be under ECA, qualifying based on two (2) categories. First, the area constitutes some endangered flora species. Second, the area is traditionally occupied by Indigenous People (IP). However, through FPIC and Certificate of Ancestral Domain Title (CADT), there are no conflicting tenurial/land issues within the MPSA. It should be emphasized however that Palawan is considered a critical area with its wide biodiversity. **Caves/sinkholes** The widely distributed caves and sinkholes in the MPSA are evident in the distribution of topographic depressions as shown in **Figure 2.1.1**. The extent of these karst features does not appear to be extensive, however, since the 1:50,000 topographic map does not show any depressions or sinkhole features. This may mean that the limestone is limited in both vertical and		✓	✓		• RTNMC shall strictly comply with its approved quarry plan, which involves incremental quarry development and progressive rehabilitation to minimize ground disturbance • Maintain vegetation cover in the designated buffer zones and in the peripheries of roads and quarry area

horizontal extent and that the limestones are yet limitedly affected by dissolution and thus the development of sinkholes is yet limited. To address the potential groundwater and other environmental degradation that may use these caves and sinkholes as pathways, the company deemed it best to avoid these karst features altogether, as can be seen in the proposed quarry development plan. Exclusion of the caves/sinkholes from cutting and quarrying activities as dictated by the terms and condition of the SEP clearance for the Gotok Limestone Project.					
Possible tenurial land issues (Not Applicable) There are no conflicting tenurial/land issues within the MPSA through the FPIC and CADT.					

Performance Assessment

The soil quality as shown by the results of soil analysis reveal that the soil texture is clay which is moderately to highly susceptible to erosion. Given the susceptibility of this type of soil to erosion with the addition of the impacts of the increased production of the quarry in the area such as soil contamination with oil and grease and the generation of solid and hazardous wastes, RTNMC has been committed in implementing its Solid Waste and Hazardous Waste Management Program as well as the management strategies for oil and grease. These programs are presented in the succeeding sections. Moreover, with the implementation of a progressive rehabilitation which takes place when the final quarry/pit limit of the benches is reached, area of open/bare land is limited reducing the occurrence for soil erosion.

In terms of soil fertility, it ranges from low, medium to high. To preserve the fertility within the area outside of the quarry, a bufferzone around the perimeter of the 13 ha-quarry area is being maintained. In addition, the topsoil stripped from the land during the site clearing is temporarily placed in a stockpile area within the MPSA to be used during rehabilitation. This is also to minimize loss of topsoil. The Reforestation and Rehabilitation Program is further discussed in *Section 2.1.4.2*.

2.1.2 Geology/Geomorphology

2.1.2.1 Methodology

This discussion is based on the available geologic maps and reports gathered from the Mines and Geosciences Bureau (MGB), PHIVOLCS, and the geologic report by D. Medina (2004) for the Gotok limestone area, and other related literature.

2.1.2.2 Findings and Discussions

Stratigraphy

Figure 2.1.3 presents the geologic map of the central sections of Bataraza and Rizal municipalities in southern Palawan compiled from Cabrera, 1985; Sto. Domingo et al., 1989 and the Mines and Geosciences Bureau, 1989. The map shows that seven (7) major rock units that underlie the area from youngest to oldest:

- Quaternary Deposits;
- Pliocene Iwahig Formation;
- Late Miocene Sayab Formation;
- Oligocene Pandian Formation;
- Paleocene to Early Eocene Panas Formation;
- Late Cretaceous to Early Eocene Espina Formation; and
- Late Cretaceous Mt. Beaufort Ultramafics.

The Mt. Beaufort Ultramafics occupies the southern portion of Bulanjao Range at central Bataraza and the core of Mt. Sarab near the eastern coast. It constitutes the lower segment of the Palawan Ophiolite and is made of serpentinized harzburgite, dunite and pyroxenite. This assemblage serves as the parent rocks of the nickel laterite deposit that is being mined by RTNMC at the southeastern flank of Bulanjao Range.

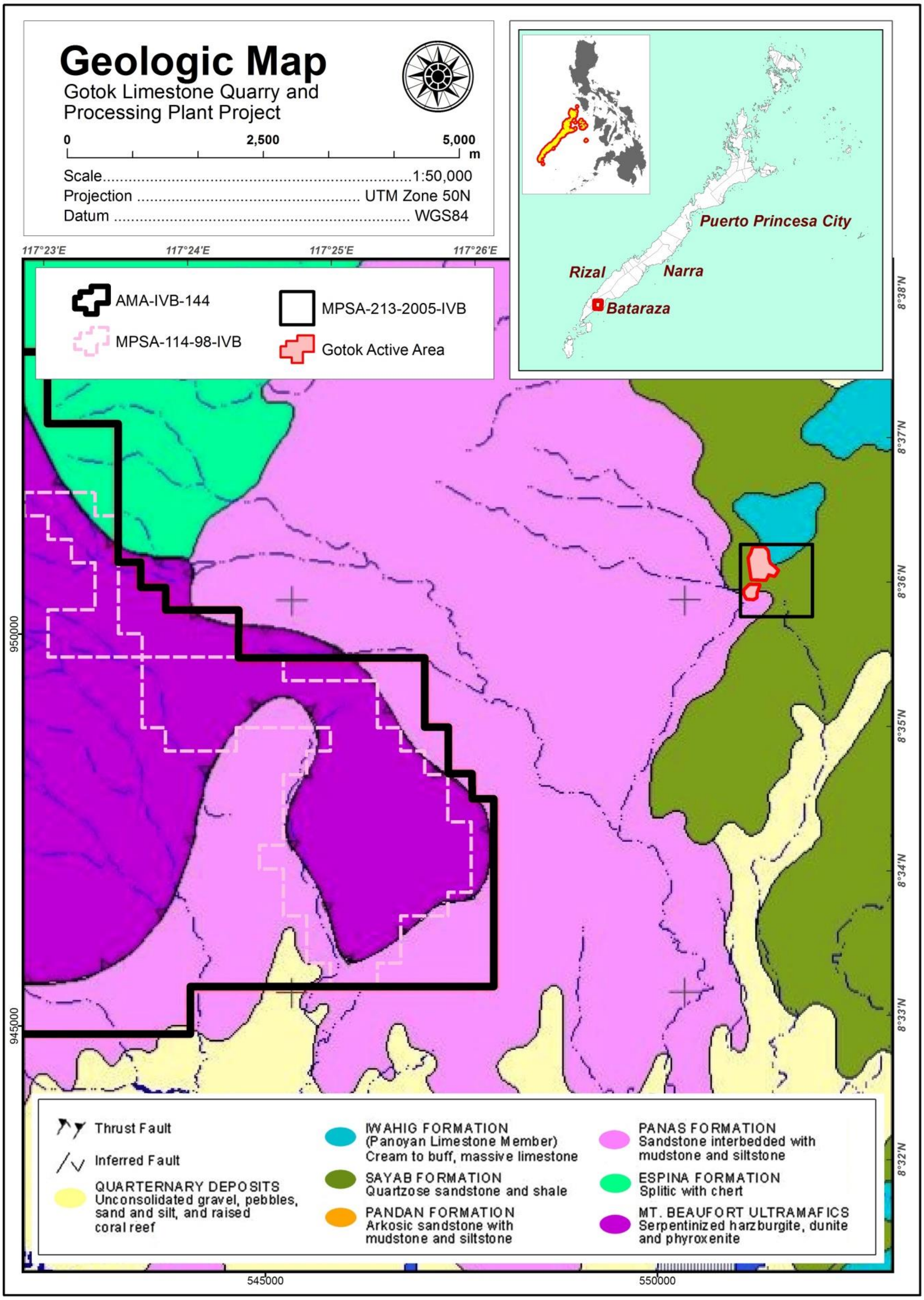


Figure 2.1.3. Regional geologic map (*Source: Cabrera, 1985; Sto. Domingo et al., 1989 and the Mines and Geosciences Bureau, 1989*)

The Espina Formation underlies the northeastern section of Bulanjao Range. It consists of spilitic basalt and chert that represent the upper section of the Palawan Ophiolite. The basalt exhibits abundant pillow structures and is generally highly fractured. The chert is deep red to orange, thinly bedded and laminated. It is commonly found along the borders of the pillow structures (Cabrera, 1985).

Highly folded and indurated, well-bedded quartz-rich sandstone, shale/siltstone and mudstone characterize the Panas Formation. Rocks of this formation surround the ultramafic and basaltic rocks and occur extensively to the southeast and southwest of Bulanjao Range. The sandstone is light brown to gray, thinly bedded and highly indurated, while the shale and siltstone are brown to dark gray, thinly bedded and friable.

The Pandian Formation outcrops extensively at the western side of southern Palawan. It conformably overlies the Panas Formation and consists of massive, porous, arkosic sandstone intercalated with mudstone and shale. The sandstone is light brown to gray and friable. It is primarily made up of fine to coarse grained, sub-angular to sub-rounded quartz and feldspar grains. The mudstone and shale layers are well indurated.

Gently dipping sandstone and shale interbeds of the Sayab Formation unconformably overlie the Panas Formation to the east of Bulanjao Range. The sandstone of light gray to reddish brown consists mainly of fine to medium grained quartz. The shale is reddish brown, silty and occasionally displays laminations.

The Iwahig Formation rests on the Sayab Formation. It consists of two (2) members, namely the Panoyan Limestone and the Pusok Conglomerate. Pebbles composed of chert, limestone and indurated sediments make up the Pusok Conglomerate, while the Panoyan Limestone consists of creamy white to beige, massive, coralline limestone. Outcrops of the Panoyan Limestone only are exposed in Bataraza and the surrounding areas. They occur as steep karstic hills that rise above the undulating terrain to the east of Bulanjao Range.

The oldest rocks underlying the Gotok Quarry are the well bedded sandstone, shale/siltsone and mudstone of the Panas Formation. These rocks underlie the northeast, west, and south sides of the Gotok limestone area. The sandstone is light brown to gray, thinly bedded and highly indurated, while the shale and siltstone are brown to dark gray, thinly bedded and friable.

The Panoyan Limestone member of the Iwahig Formation unconformably overlies Panas Formation. The limestone rocks are creamy white to beige, massive and coralline occurring as steep karstic hills. This unit also occupies the low hills northwest and east of the Gotok Hill.

Quaternary alluvial and limestone deposits comprise the youngest rocks. The alluvium consists of consolidated to unconsolidated gravel, pebbles, sand and silt that are derived from the older rocks. They mantle the coast and plains of southern Palawan. The limestone occupies areas adjacent to the shoreline. They consist of raised coral reefs that gently dip seaward. **Figure 2.1.4** geological profile and stratigraphic features of the Gotok quarry area, along with the regional geologic column where the local rock units are contained while **Figure 2.1.5** shows the geologic map of the project area.

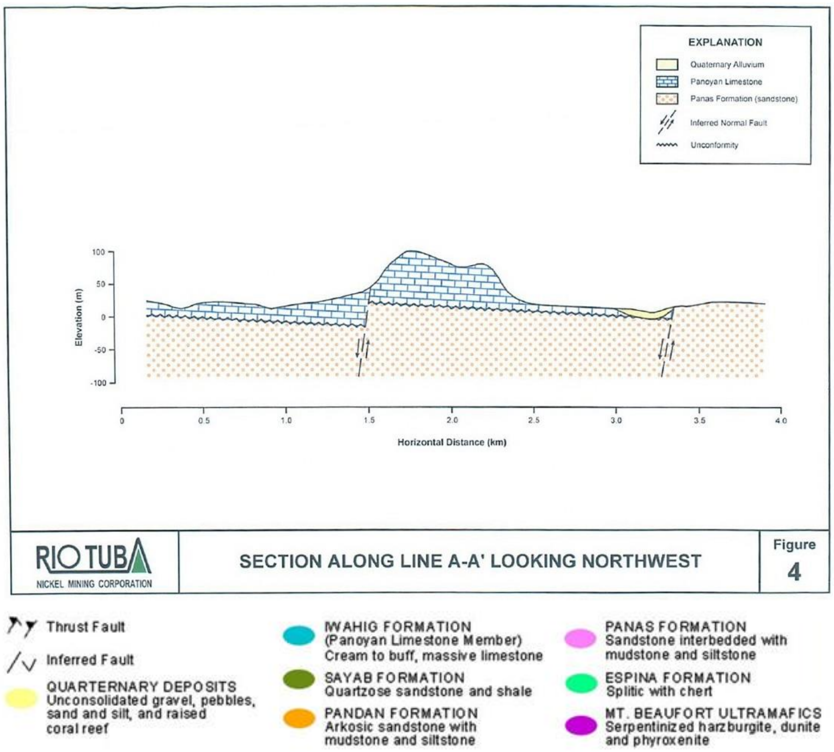


Figure 2.1.4. The geologic section shows the oldest unit in the area as the Panas Formation which is dated as Eocene, and the Panoyan Limestone which is part of the Pliocene-aged Iwahig Formation. The quaternary alluvium is mainly found around the river channels. Cross-section along A-A' (looking north-northwest)

Structural Geology

The main structural feature in the region is the thrust fault contact between the ultramafic rocks and the older sedimentary and volcanic rocks. The thrusting caused intense shearing and faulting along the margins of the ophiolite and folding, faulting and jointing in the adjacent rocks (Cabrera, 1985). The fault and fold structures that developed as a result of the thrusting generally trend north to northeast.

Geomorphology

Rugged to gently undulating terrain distinguishes much of Bataraza. The highest land feature in the area is the north-northeast trending Bulanjao Range, which is located at the central portion of the municipality. From there, the land slopes down to the western and eastern coastlines. Steep slopes and sharp peaks characterize the Bulanjao Range whose ridgeline averages 900 meters above sea level (masl). Its highest point is the Escapardo Peak, which rises to 1,036 masl. Ultramafic and volcanic rocks underlie the Bulanjao Range.

Alluvial fan deposits that are topographically expressed as gently sloping land, rest at the base of Bulanjao Range. These deposits consist primarily of boulders, cobbles and coarse sand derived from the weathering and erosion of the ultramafic and volcanic rocks.

The areas farther out and up to the western and eastern coast assume a gently to moderately rolling nature. The broad hills that are found in these areas do not rise above 250 masl. Folded and moderate to gently dipping sedimentary rocks underlie the undulating land.

A cluster of small, steep and rugged hills that rarely exceed 100 masl punctuate the undulating ground to the east of Bulanjao Range. The Panoyan Limestone underlies this area, which exhibits typical karstic features such as caves, sinkholes and springs.

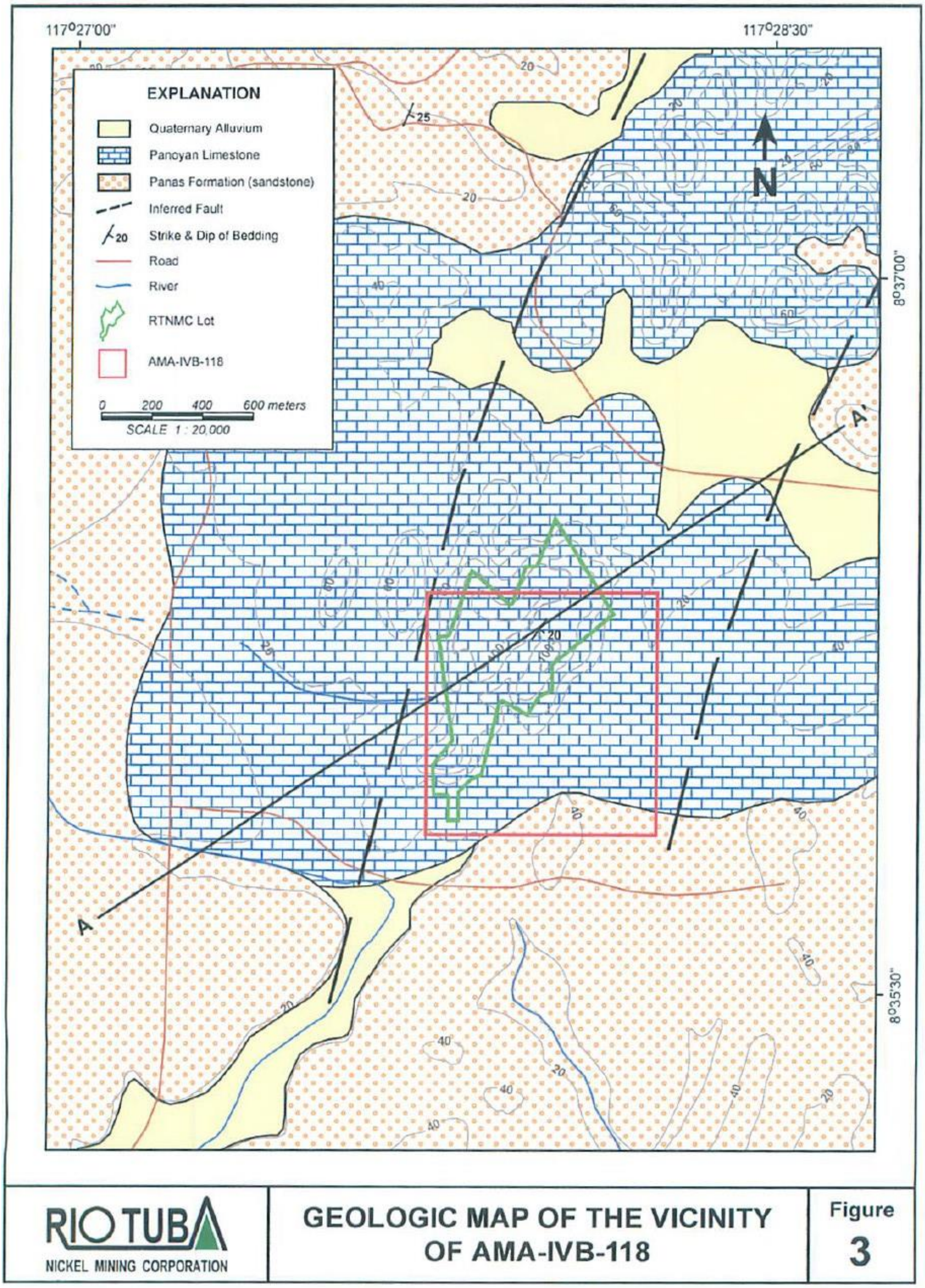


Figure 2.1.5. Geologic map of the project area (Medina, 2004)

The flat, narrow coastal plains and floodplains are underlain by Quaternary alluvial deposits and raised coral reefs. Please refer to **Figure 2.1.6** for the Geomorphological Map of Southern Palawan.

The limestone hosts karstic landforms, marked by sinkholes and caves, and the calcareous rocks are marked by prominent hills.

Drainage Systems

The river systems in central Bataraza exhibit a dendritic drainage pattern. The drainage pattern is locally radial in the vicinity of Bulanjao Range where their headwaters originate. The occurrence of linear channels and sharp bends such as along Sumbiling and Canipan Rivers suggest that in these areas, the rivers are influenced by fault structures.

Seismicity and Other Geologic Hazards

Palawan is located in the tectonically stable region of the Philippines. A virtual absence of seismicity and Tertiary igneous activity characterizes this region that includes the Cuyo Islands, Sulu Sea and possibly southern Mindoro and Zamboanga (MGB, 1982). The area is far from active faults and trenches which are the main earthquake generators in the archipelago (**Figure 2.1.7**).

Figure 2.1.8 shows the generalized section reflecting the lithology, hydrology, geodynamic processes and the landform.

There is no record of destructive earthquakes (magnitude >7) in Palawan. The PHIVOLCS earthquake database revealed that only five (5) earthquakes occurred in the vicinity of the island from 1907 to the present (**Table 2.1.4**). These earthquakes attained magnitudes of less than 6.0. They moreover occurred in the northern end of the island and offshore to the south, which are both far from the project site.

Table 2.1.4. Earthquake occurrences in Palawan

Year	Month	Day	Hour	Minute	Second	Latitude	Longitude	Depth (km)	Local Magnitude
1956	2	13	22	39	50	10.50	119.50	33	-
1978	6	14	12	49	18.50	7.56	116.38	33	5.7
1981	6	18	22	47	14.50	10.59	119.68	50	4.0
1982	9	24	19	54	7.40	10.65	119.21	33	3.4
2001	7	31	16	41	32.36	8.02	117.66	40	4.6

Source: PHIVOLCS Earthquake Database

Ground Motion

The intensity of ground shaking that result from a seismic event is measured by the horizontal acceleration. It depends on the earthquake magnitude, distance of the site to the earthquake generator, and the soil condition. Thenhaus et al. (1994) estimated peak horizontal ground acceleration that has a 10% probability of being exceeded in 50 years for rocks and soils throughout the Philippines. The ground-motion probabilities were estimated using a return period of 474 years and a model of 21 seismic source zones that describe the geographic extent and frequency of earthquake occurrence for major tectonic elements in the Philippines. Earthquakes smaller than Ms 5.0, which do not cause significant damage, were not considered in the estimation.

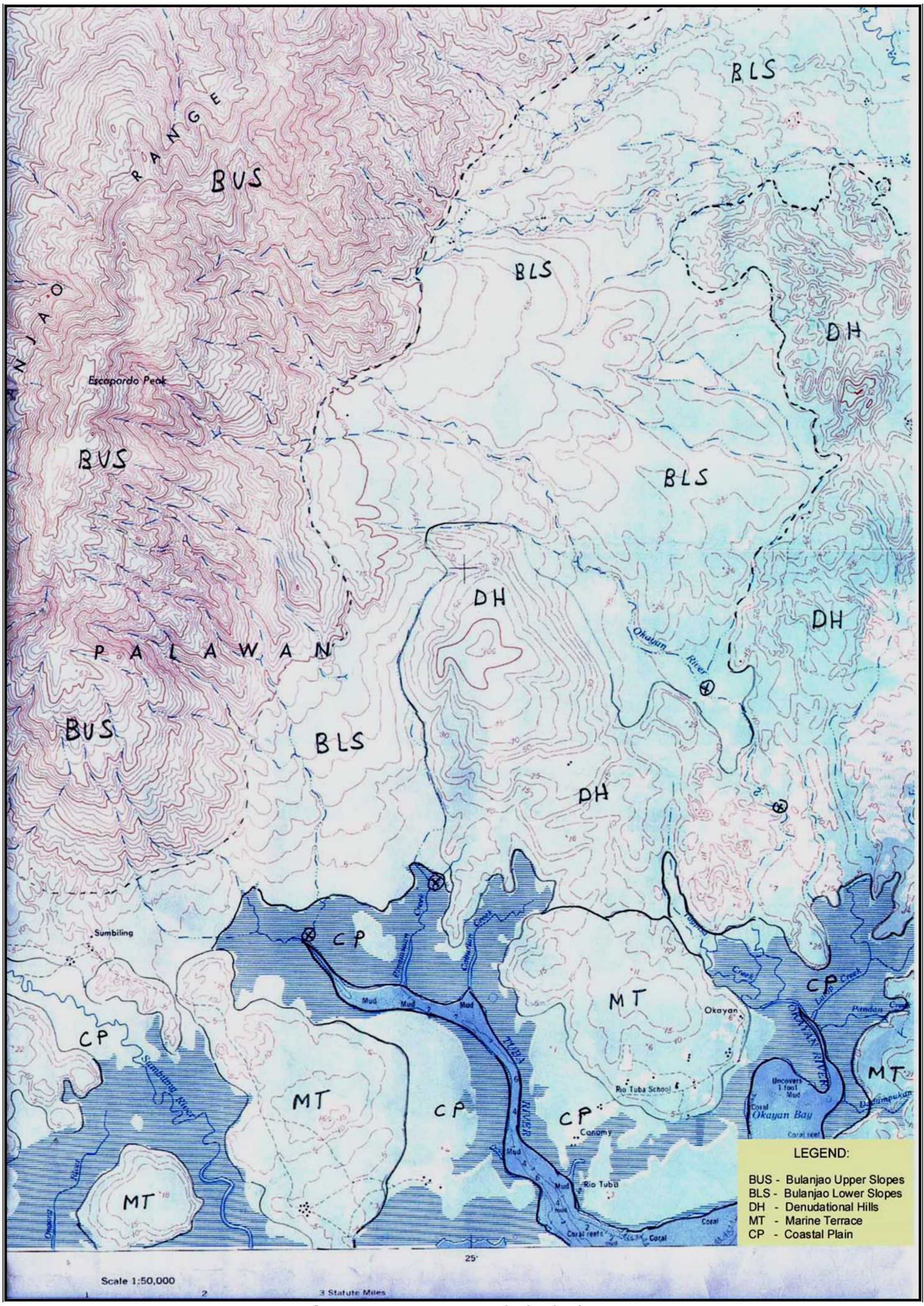


Figure 2.1.6. Geomorphological map

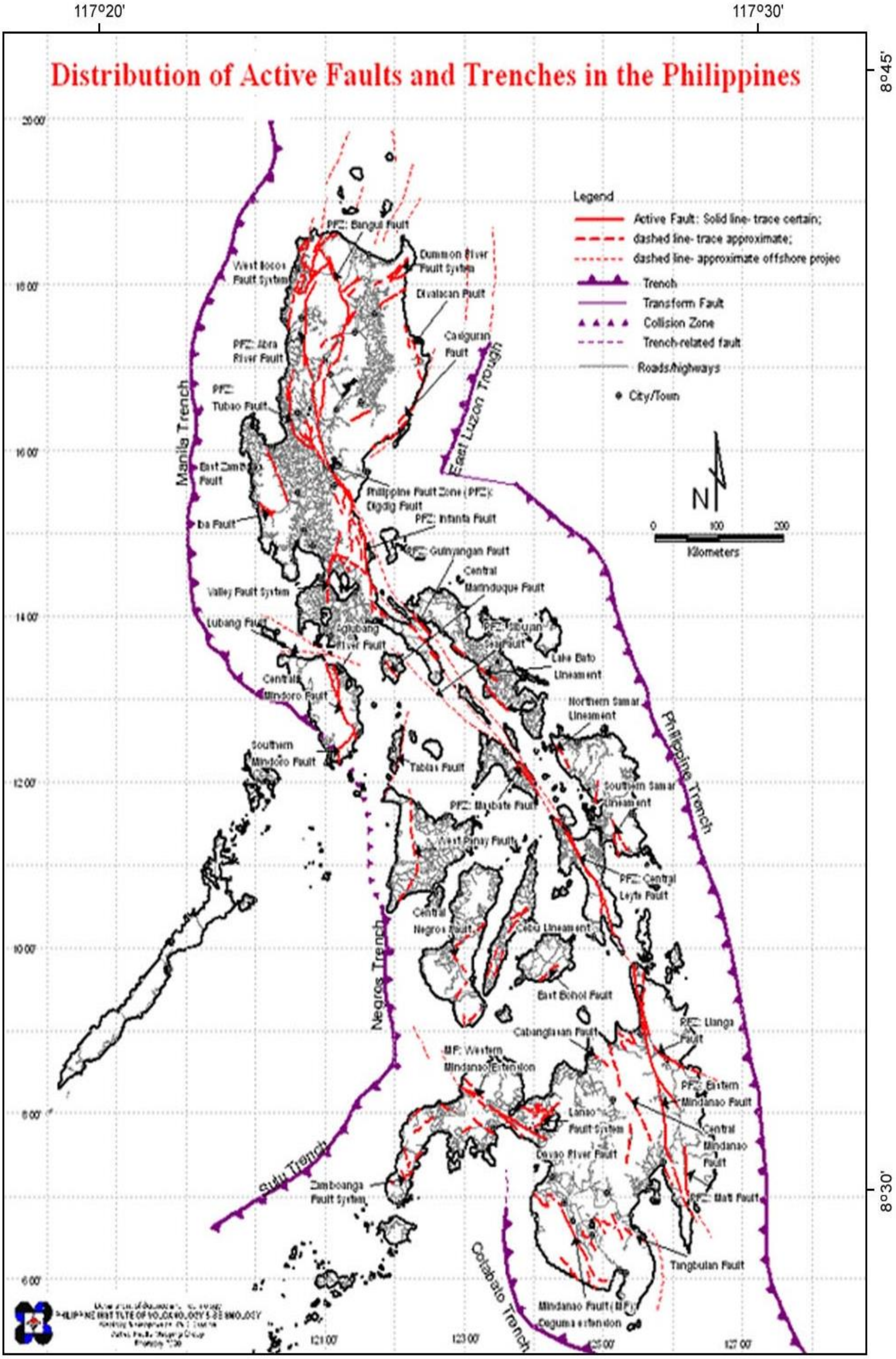
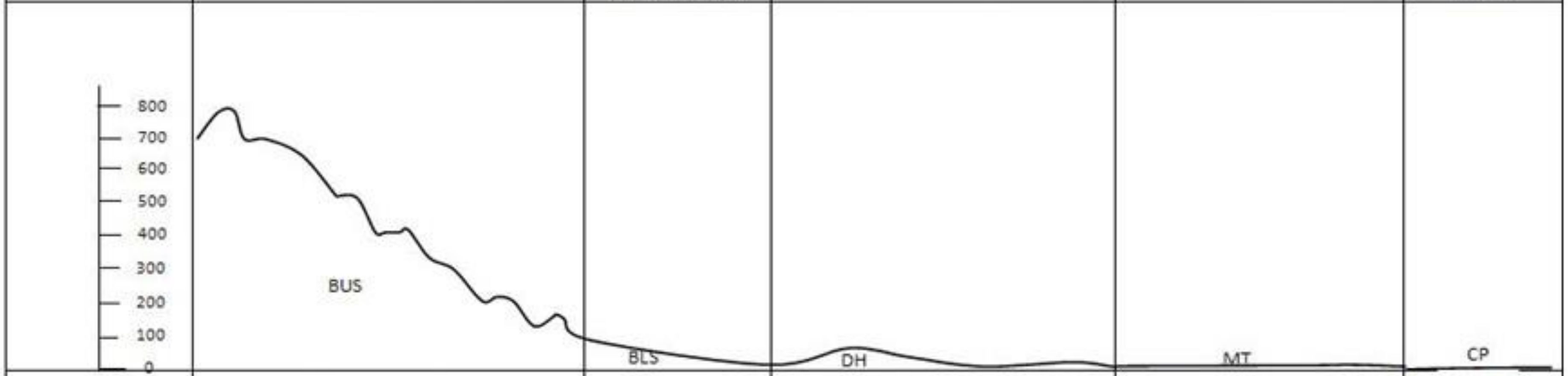


Figure 2.1.7. Main earthquake generators (*Source: Philippine Institute of Volcanology and Seismology)*



Land form	Bulanjao Upper Slope	Bulanjao Lower Slope	Denudational Hill	Marine Terroce	Coastal Plain
Soils	Mainly colluvial, limited residual	Residual, olluvial	Residual clays	Marine clay, silt	Marine clay silt
Lithology	Ultramafic rocks	Ultramafic rocks	Ultramafic/Sedimentary rocks	Limestone underneath sediments	—
Hydrology	Run off predominant	Run off predominant	Run off predominant, limited groundwater	Infiltration predominant, potential aquifer	Susceptible to flooding
Foundation	Good rock foundation potential aggregate source	Adequate for foundation	Adequate for foundations settlement likely	Adequate for structures, settlement	Tidal incursion Settlement 4

Figure 2.1.8. Lithology, hydrology, geodynamic process and landforms

Figure 2.1.9 presents the estimates of seismic acceleration in terms of percent of the acceleration due to gravity (g). The figure shows that none of the peak acceleration contours cross the island of Palawan. This indicates that the peak acceleration amplitudes that Palawan may experience will be considerably less than 0.3 g in soft soil and 0.2 g in medium soil and rock conditions. This is particularly true for the southern end of the island where the project site is located, since this area is quite far from the contoured region.

Liquefaction

Liquefaction occurs in seismically active areas that are underlain by thick, saturated deposits of unconsolidated sand and silt. When the ground shakes, the sediments are rearranged in a more compact manner and the pore water is forced upwards. The ground loses its shear strength and behaves like a liquid. This results in the settlement of structures into the soil.

Since Palawan is not seismically active and there are no thick, unconsolidated sand and silt deposits in the vicinity of the project site, the area is not prone to liquefaction.

Tsunami

Earthquakes, landslides and volcanic eruptions that occur under the sea can produce giant sea waves called tsunamis. Tsunamis attain great speed and energy and may cause heavy damage when it strikes a populated coastline.

Earthquakes along the Sulu and Negros Trenches may generate tsunamis that could travel across the Sulu Sea and reach the eastern coast of Palawan. The project site is however not in direct danger of tsunamis since it is several kilometers inland and is situated on high ground.

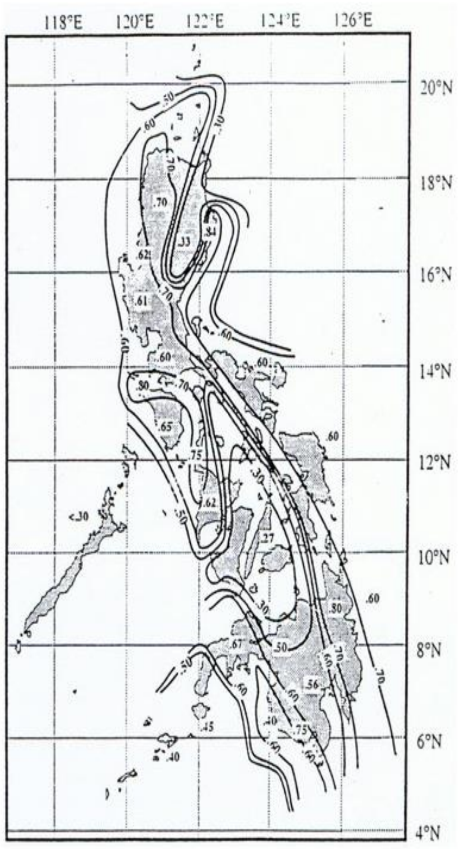
Volcanic Hazards

There are no active volcanoes in the island. Tremendous eruptions from volcanoes in other parts of the Philippines may however subject the area to ash fall depending on the prevailing wind direction.

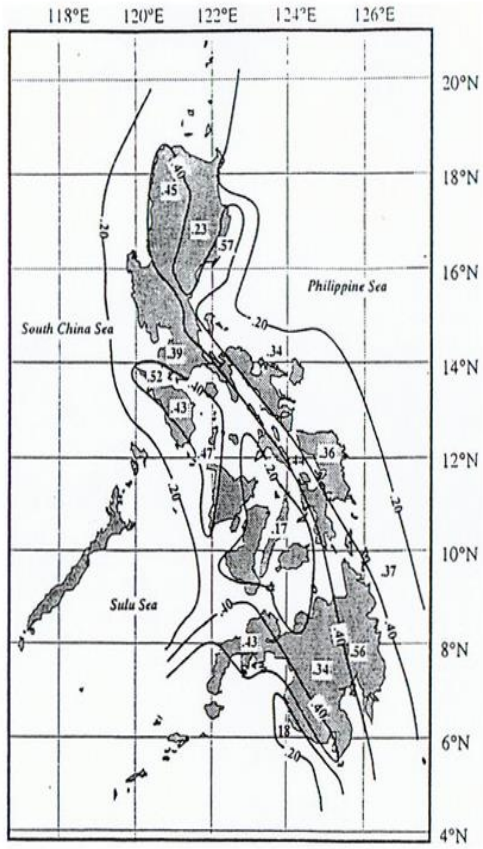
Landslides

Heavy and prolonged rainfall may increase the pore pressure within the lateritic soil and the sheared zone contact of the ultramafics. The increase in pore pressure causes a corresponding decrease in shear strength, which depending on the slope angle and the weight of the overlying material, may trigger landslides. Since the lateritic soil on the slopes of Mt. Bulanjao is relatively thin and the underlying ultramafic rocks generally competent, the landslides are expected to be minor.

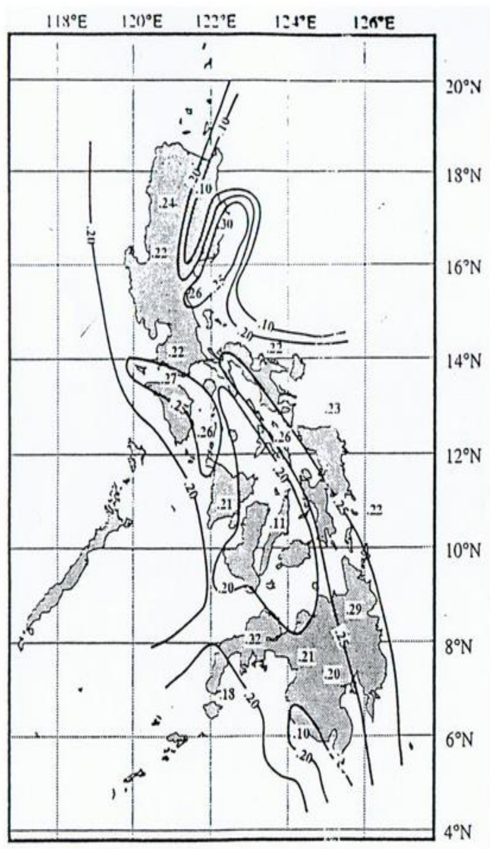
Two, small and shallow landslides scars were observed in the steep upper slopes of the western side of Bulanjao Range. The landslides apparently occurred in the thin residual soil that covered these slopes and did not cause any damage to the lowland.



Map showing peak horizontal acceleration amplitudes in soft soil for the Philippine region. Acceleration values have a 10% probability of exceedance in 50 years. Contours are in terms of the acceleration of gravity (g).



Map showing peak horizontal acceleration amplitudes in medium soil for the Philippine region. Acceleration values have a 10% probability of exceedance in 50 years. Contours are in terms of the acceleration of gravity (g).



Map showing peak horizontal acceleration amplitudes in rock for the Philippine region. Acceleration values have a 10% probability of exceedance in 50 years. Contours are in terms of the acceleration of gravity (g).

Figure 2.1.9. Estimates of seismic acceleration *(Source: Thenhaus, et al. 1994)*

2.1.2.3 Impacts Assessment and Environmental Performance

Predicted impacts

The following matrix summarizes the potential impacts that may be brought by the increased production of the quarry and modified crushing plant. Each impact was identified as to the period of possible occurrence, duration, likelihood of occurrence, and magnitude. Entries with asterisks are perceived to be not significant or negligible while italicized entries were perceived to be a positive impact of the project.

Table 2.1.5. Impacts assessment and mitigation for geology/geomorphology

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
Change/ inconsistency in land use, slope and subsurface geomorphology The continued operation in the quarry site significantly changed the original landform, slope and underground geomorphology in the project area. The original sloping and rugged terrain will be transformed into crater-like formations after the quarrying operations. As part of the rehabilitation program, RTNMC shall backfill the said craters to maintain a relatively consistently level topography.		✓	✓		• RTNMC shall strictly comply with its approved quarry plan, which involves incremental quarry development and progressive rehabilitation to minimize ground disturbance. • Maintain vegetation cover in the designated buffer zones and in the peripheries of roads and quarry area. • Maintain the 50 m buffer zone around the known opening of the Gray Cave and other caves in the quarry area. These buffer zones are demarcated on the ground and excluded from all quarry activities to protect the integrity of the natural cave structure and to protect the cave-dependent organisms.
Inducement of subsidence, liquefaction, landslides* Liquefaction occurs in seismically active areas that are underlain by thick, saturated deposits of unconsolidated sand and silt. Since Palawan is not seismically active and there are no thick, unconsolidated sand and silt deposits in the vicinity of the project site, the area is not prone to liquefaction and subsidence. However, landslide due to heavy rains and erosion might happen.		✓	✓		• For potential occurrence of landslides, ensure strict implementation of and compliance with the safety and health program, especially the ERPP. • Ensure that all personnel, workers and contractors are properly oriented of the ERPP and ensure the regular conduct of emergency drills.

Performance Assessment

Given the irreversible impacts of the increased production of the quarry and modified crushing plant in the area, RTNMC have been committed in its Reforestation and Rehabilitation Program as discussed in *Section 2.1.4.2*.

2.1.3 Pedology

2.1.3.1 Methodology

This study covered the review of existing literature and maps of the project area. This was followed by a fieldwork last April 22-23, 2014.

Soil characterization was made through soil auger borings in the representative sites of the soil mapping units of the soil type within the project area. Site selection was made with the use of the project location map and the NAMRIA topographic map with a 1:50,000 scale. Geographical position of each observation/sampling location was recorded using a GPS. Slope gradient was also determined using an Abney Hand Level.

Soil samples were collected for physico-chemical analyses (texture, pH, nitorgen, organic matter, phosphorus, potassium and Cation Exchange Capacity). The analysis was done at the soils laboratory of the Bureau of Soils and Water Management (BSWM) in Quezon City while heavy metal analysis (mercury, cobalt, nickel, cadmium, arsenic and lead) was done at Ostrea Mineral Laboratories, Inc at Binan, Laguna. **Annex 2.1.6** shows the results of the analysis. Currently, the Philippines has not established its own standards for soil analysis. In the absence of this set of standards, this study opted to use the Taiwanese standards for arsenic, cadmium, nickel and lead and the Dutch standards was used for Cobalt

Soil erosion susceptibility or erosion potential of the project area was mapped using the soil mapping units. For each soil unit, erosion susceptibility was assessed based on a contributing factor taken at a time. The individual susceptibility assessments were then aggregated to form a composite erosion susceptibility score for the soil unit. The contributing factors include rainfall, soil erodibility, vegetation or landuse and slope.

They were characterized as follows:

- For the rainfall, PAGASA's rainfall data as compiled in Puerto Princesa, Palawan station was used.
- Erodibility of the various soil mapping units was determined following the results of the field assessment and physical analysis.
- Vegetation or land use was assessed in the field. This was supplemented by the interpretation of Google earth imageries.
- The slope ranges in the Soil map.

2.1.3.2 Findings and Discussions

<u>Soils of the Project Area</u>

The soil sampling points and its geographic coordinates are shown in **Table 2.1.6** (**Figure 2.1.10**). Based on the sampling, one soil type with two (2) soil mapping units were identified, characterized and mapped in the project area as shown in **Figure 2.1.11**.

Table 2.1.6. Coordinates of the soil sampling points

Sampling points	Location	Latitude	Longitude
1	Gotok Quarry, Brgy.Sandoval	8^0 36.316' N	117^0 27.938' E
2	Gotok Quarry, Brgy. Sandoval	8^0 26.183' N	117^0 27.881' E
3	Gotok Quarry, Brgy. Sandoval	8^0 36.249' N	117^0 27.991' E
4	Paul Castegador Farm, Bgy.Iwahig	8^0 36.004' N	117^0 27.940' E

The soil type in the project area is Bolinao clay and the two (2) soil mapping units are the Bolinao clay 0-8% slopes and Bolinao clay >18% slopes. Bolinao clay developed from the weathering of limestone.

The Bolinao clay >18% slopes occur on the hilly area on the northern and middle part of the MPSA, particularly the area with the tree cutting permit. Bolinao clay 0 – 8% slopes occur on the infilled valley in the northeast and the flat to almost flat terrain in the southeastern part of the MPSA (**Figure 2.1.11**).

Bolinao clay >18% slopes, as represented by observations 1 and 2, is a well-drained shallow (20 – 40 cmdepth) soil (**Table 2.1.7** and **Plate 2.1.5**). Soil reaction is mildly to moderately alkaline (pH 7.55 – 8.14). Nitrogen is medium to high (0.46 – 0.94%). Organic matter and K are very high with 9.17 – 12.8% and 1.35 – 1.67% cmol/kg, respectively. Phosphorous is low to medium (10.31 – 11.16 mg/kg). CEC is high to very high with 36.81 – 44.2 cmol/kg.

Table 2.1.7. Results of soil sampling, April 22-23, 2014

Soil Properties	Standard Value	Bolinao clay, >18% Slopes		Bolinao clay, 0-8% slopes	
		Observation 1	Observation 2	Observation 3	Observation 4
Physical Properties					
Soil Texture	-	Clay	Clay	Clay	Clay
Slope (%)	-	50	68	5	1
Drainage	-	Well Drained	Well Drained	Well Drained	Well Drained
Soil Depth (cm)	-	20	40	25	>100
Chemical Properties		*	**	*	**
pH	-	7.55	8.14	7.91	5.28
Nitrogen (%)	-	0.94	0.46	0.30	0.23
Organic Matter (%)	-	12.86	9.17	4.28	3.40
Phosphorus (mg/kg)	-	11.60	10.31	102.55	4.69
Potassium (cmol/kg)	-	1.35	1.67	0.92	0.23
Cation Exchange Capacity (cmol/kg)	-	44.20	36.81	21.10	10.95
Available Micronutrients (mg/kg)					
Copper	-	1.34	0.89	2.50	0.53
Zinc	-	2.56	1.07	2.23	0.60
Iron	-	24.11	12.30	35.32	31.08
Manganese	-	73.55	36.32	105.90	101.20
Heavy Metals (mg/kg)					
Arsenic	***40	11.80	9.75	12.22	10.98
Cadmium	***5	1.59	1.62	2.92	1.73
Nickel	***200	73.40	81.02	112.27	54.40
Cobalt	****240	19.35	20.84	26.47	24.56
Lead	***500	23.91	21.23	26.21	14.68

*Note: * Topsoil; ** Weighted Average of 40 cm depth (Topsoil and Subsoil); ***Taiwan standard for assessment of soil contaminated with heavy metals (mg/kg); ****Dutch standard value*

Plate 2.1.5. Soil profile of Bolinao clay with 18 - 50% slopes inside the Tree cutting permit area

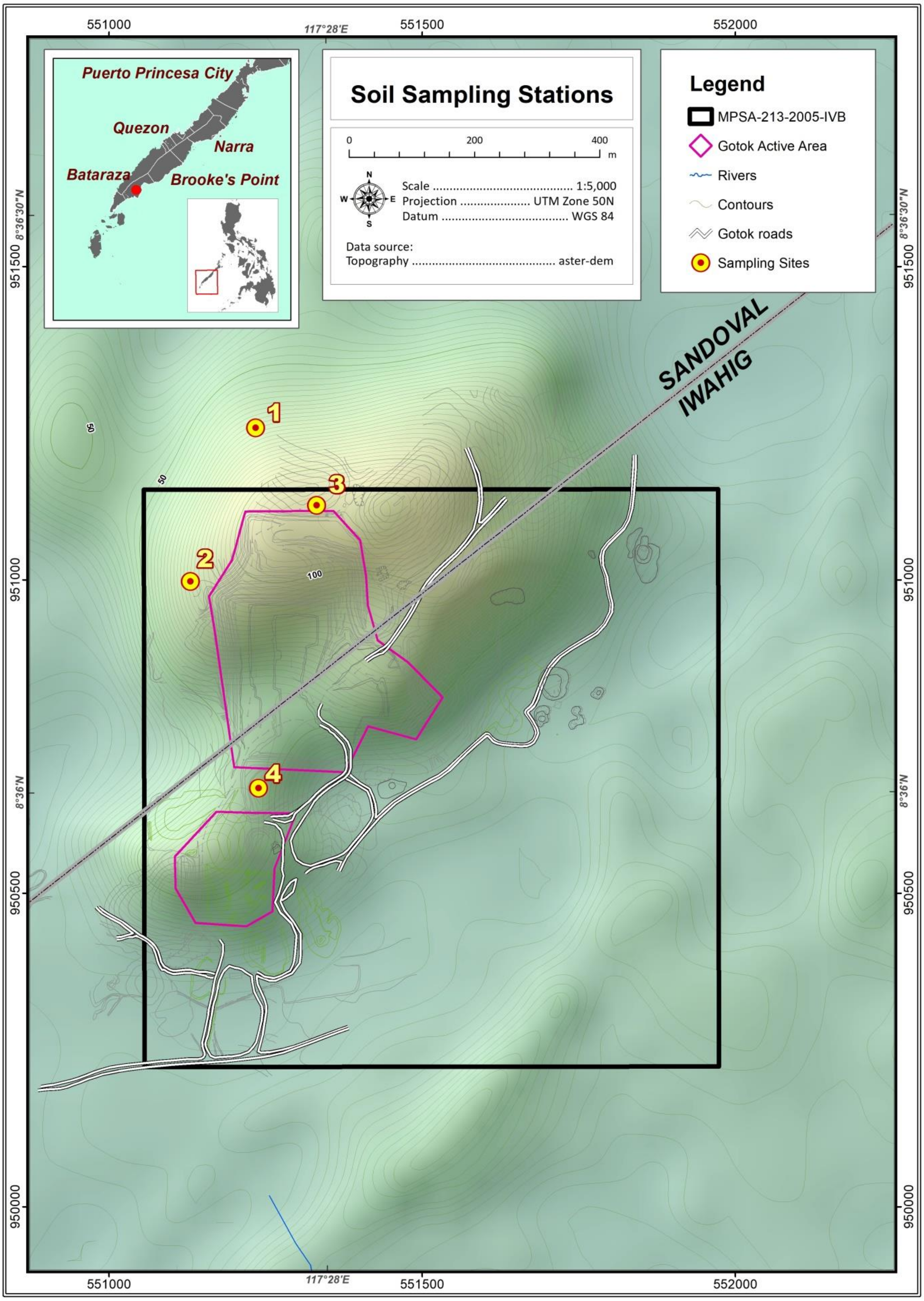


Figure 2.1.10. Soil sampling station map

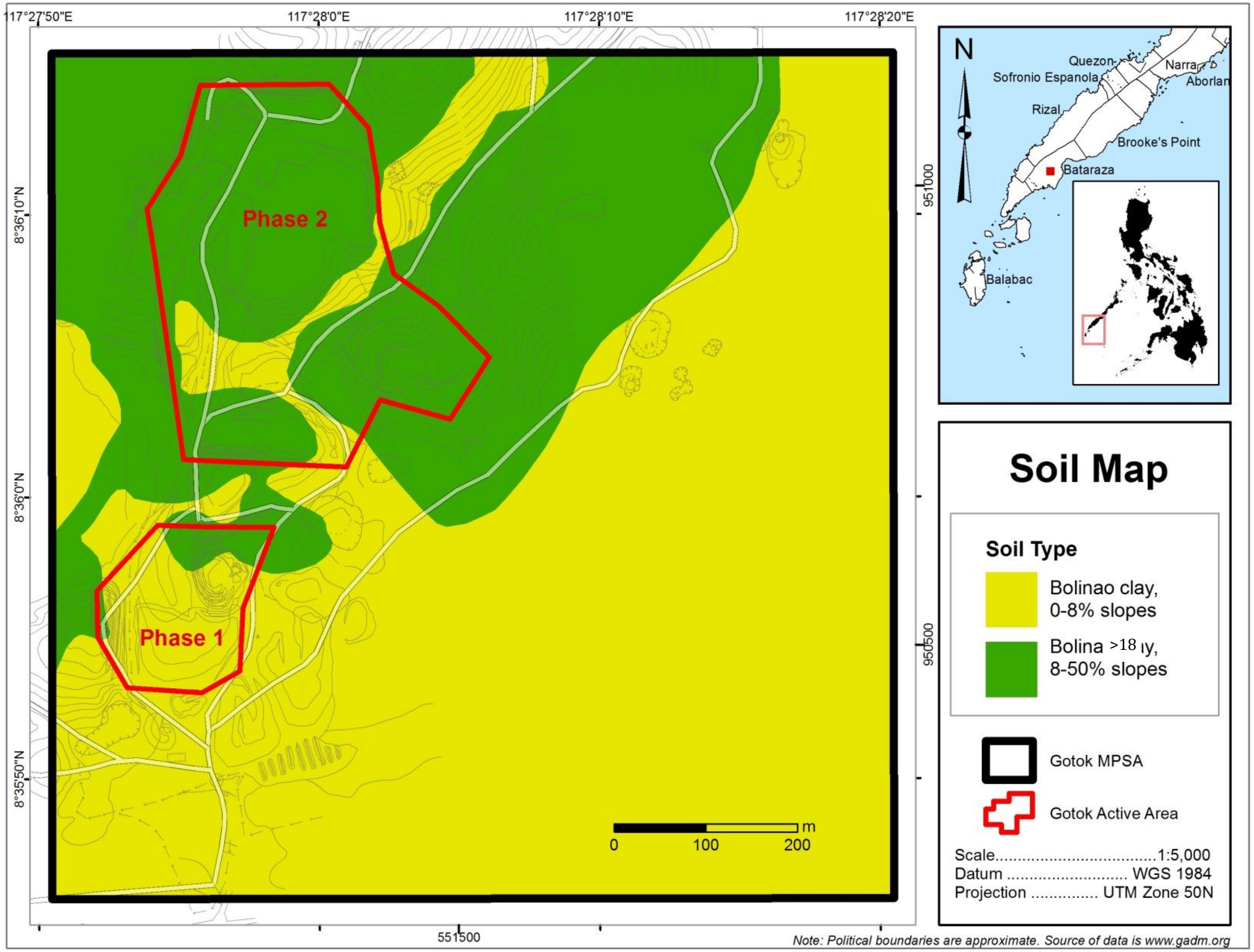


Figure 2.1.11. Soil map

For the available micronutrients, Cu and Fe are very low with 0.89 – 1.34 mg/kg and 12.30 – 24.11 mg/kg, respectively. Zinc is high to very high (1.07 – 2.56 mg/kg), and Mn is low (36.32 – 73.55 mg/kg). The natural fertility of the soil is high. On the other hand, the heavy metals (As, Cd, Ni, Co, Pb and Hg) in Bolinao Clay >18% slopes are all below the contamination levels as prescribed by the Taiwanese and Dutch standards, for As of 40 mg/kg; Cd of 5 mg/kg; Ni of 200 mg/kg; Co of 240mg/kg; Pb of mg/kg; and Hg of 2 mg/kg.

As represented by Observation 3, the Bolinao clay 0 – 8% slopes on the infilled valley is a well-drained shallow soil (25 cm depth). Soil reaction is moderately Alkaline (pH 7.91) while Ni, OM and CEC are medium with 0.30%, 4.28% and 21.1 cmol/kg, respectively. Phosphorus and K are high with 102.55 mg/kg and 0.92 cmol/kg, respectively.

For available micronutrients, Cu and Fe are very low with 2.50 and 35.32 mg/kg, respectively. Zn is very high (2.23 mg/kg) while Mn is medium (105.90 mg/kg). The natural fertility of this soil is medium. On the other hand, the heavy metals (As, Cd, Ni, Co, Pb, and Hg) in Bolinao Clay 0 – 8% slopes on infilled valley are below the contamination level as prescribed by the Taiwanese and Dutch standards.

The Bolinao clay 0 – 8% slopes on broad flat to almost flat terrain as represented by Observation 4 is a well-drained deep soil. Soil reaction is strongly acidic (pH 5.28). N is medium (0.23 mg/kg) while OM (3.40%), Phosphorus (4.69 mg/kg), K (0.23 cmol/kg), and CEC (10.95 cmol/kg) are low.

For available micronutrients, Co, Zn and Iron are very low with 0.53, 0.60 and 31.08 mg/kg, respectively. Mn is medium with 101.20 mg/kg. The natural fertility of this soil is low. The low fertility and strong acidity of the Bolinao clay on flat to almost flat terrain in the MPSA can be attributed to the mixture of reddish brown lateritic materials in the soil profile, which originated from the upper part of the major watershed of the island. On the other hand, the heavy metals (As, Cd, Ni, Co, Pb and Hg) are below the contamination levels as prescribed by the Taiwanese and Dutch standards.

Soil Suitability Classification

A qualitative suitability classification was made by comparing the plant's environmental requirements with the physico-chemical properties of the soil mapping units (**Table 2.1.8**). The selection of the plants included in the table was geared towards the reforestation of the project area.

Results showed that Molave, Narra and Cashew are suitable on Bolinao clay >18% slopes. Mahogany is also suitable but with rooting depth (shallow soil) as the limitation (**Table 2.1.9**). Guyabano, Calamansi, Rambutan, Coconut, Bignay, Jackfruit, Rimas, Banana, Pineapple and Corn are not suitable on Bolinao clay, >18% slopes.

Meanwhile, Molave, Narra, Cashew, Guyabano, Calamansi, Rambutan, Bignay, Jackfruit, Rimas, Banana, Pineapple, and Corn are suitable on Bolinao clay 0 – 8% slopes in Infilled Valley. Mahogany and Coconut are suitable with soil depth (shallow soil) as the limitation whereas the forest tree species (Molave, Narra and Mahogany), fruit trees, and Pineapple and Corn are suitable on Bolinao clay, 0 – 8 % slopes on broad flat terrain with low fertility as the limitation.

Table 2.1.8. Environmental requirements of selected plants

Plant	Slope (%)	Soil Depth (cm)	Drainage	Soil pH	Soil Texture	Soil Fertility
Molave	0≥50	≥ 40	Moderately well to well drained	4.5 – 8.0	Loamy to structured clay	Low to medium
Narra	0≥50	≥ 40	Moderately well to well drained	4.5 – 7.5	Loamy to clay	Low to medium
Mahogany	0>50	> 70	Moderately well to well drained	5.0 – 7.5	Loamy to clay	Low to medium
Cashew	0≥50	≥40	Moderately well to well drained	4.5 – 8.0	Loamy to clay	Low to medium
Guyabano	0 – 30	50	Moderately well to well drained	5.0 – 8.0	Loamy to structured clay	Low to medium
Calamansi	0 – 30	50	Moderately well to well drained	5.0 – 7.5	Loamy to clay	Low to medium
Rambutan	0 – 30	50	Moderately well to well drained	5.0 – 7.5	Loamy to clayey	Low to medium
Coconut	0 – 30	> 75	Moderately well to well drained	6.0 – 8.0	Sandy loam to clay	Medium
Bignay	0 – 30	50	Moderately well to well drained	4.5 – 8.0	Loamy to clay	Low to medium
Jackfruit	0 – 30	50	Moderately well to well drained	5.0 – 7.5	Loamy to clayey	Low to medium
Rimas	0 – 30	> 50	Moderately well to well drained	5.0 – 8.0	Loamy to clayey	Low to medium
Banana	0 – 18	> 50	Moderately well to well drained	5.0 – 7.0	Sandy loam to clay	Medium
Pineapple	0 – 18	30	Moderately well to well drained	5.0 – 7.5	Sandy loam to clay	Low to medium
Corn	0–18	50	Moderately well to well drained	5.0 – 7.5	Sandy loam to clay	Medium to high

Table 2.1.9. Qualitative suitability classification

Plant	Soil Type/ Soil Mapping Units		
	Bolinao clay, >18% slopes (Obsv. 1 and 2)	Bolinao clay, 0-8% slopes (Obsv.3, Infilled valley)	Bolinao clay, 0-8% slopes (Obsv.4, Broad flat terrain)
Molave	S	S	S*
Narra	S	S	S*
Mahogany	S**	S**	S*
Cashew	S	S	S*
Guyabano	NS	S	S*
Calamansi	NS	S	S*
Rambutan	NS	S	S*
Coconut	NS	S**	S*
Bignay	NS	S	S*
Jackfruit	NS	S	S*
Rimas	NS	S	S*
Banana	NS	S	S*
Pineapple	NS	S	S*
Corn	NS	S	S*

Note: S - Suitable; NS – Not Suitable; S - Suitable but with low fertility as limitation; S** - Suitable but with rooting depth (shallow soil) as limitation*

Soil Erosion Susceptibility of the Municipality

The four (4) contributing factors to erosion include rainfall, soil erodibility, vegetation/ landuse, and slope. To determine the extent of erosion susceptibility within the municipality, three (3) degrees of susceptibility are defined for each of the four contributing factors. These are "slightly susceptible" "moderately susceptible" and "highly susceptible".

Rainfall

For rainfall, the degree rating is shown in **Table 2.1.10**. **Annex 2.1.7** shows the rainfall data of Puerto Princesa City from 1971 to 2000. Data shows that there are two (2) months with high rainfall (>200 mm/mo). Four months with moderate rainfall (more than 150 mm/mo but less than 200 mm/mo), and the remaining months with low rainfall. The wettest month is October with 222.3 mm of rainfall. The month with least rainfall is February with rainfall of 23.7 mm. Based on these rainfall data, the erosion susceptibility rating for the whole project area is "slight".

Table 2.1.10. Erosion susceptibility based on rainfall

Degree of Susceptibility	Rainfall Type
Slightly	Areas with 5 to 6 dry months and 3 to 4 wet months
Moderately	Areas with 5 to 6 dry months and 5 to 6 wet months
	Areas with 2 to 4 dry months and 5 to 6 wet months
Highly	Areas with 5 to 6 dry months and 3 to 4 wet months with one or more months of 500mm or more rainfall per month
	Areas with 5 to 6 dry months and 5 to 6 wet months with one or more months of 500mm or more rainfall per month

Source: Bruce, R.C 1982

Soil Properties

For soil types, the susceptibility score is shown in (**Table 2.1.11**). The criteria that were used are the soil depth and clay-silt fraction. Bolinao clay with less than 50 cm soil depth and with 0 – 100% clay-silt fraction is with "high susceptibility to erosion". Bolinao clay with >100 cm soil depth and 60 – 100% clay-silt fraction is with "moderate susceptibility to erosion".

Table 2.1.11. Erosion susceptibility based on soil properties

Degree of Susceptibility	Soil Depth and Texture
Slightly	Areas with 50 to 100cm solum and 60 to 100% clay-silt fraction
	Areas with greater than 100cm solum and 0 to 60 percent clay-silt fraction
	Unclassified soils of the mountain
Moderately	Areas with 50 to 100cm solum and 0 to 60% clay-silt fraction
	Areas with greater than 100cm solum and 60 to 100% clay-silt fraction
Highly	Areas with less than 50cm solum and 0 to 100% clay-silt fraction

Source: Bruce, R.C 1982
Notes: Solum is made up of surface soil and subsoil. Clay-silt fraction is percent total of clay and silt particles determined through mechanical analysis of topsoil.

Land use/Vegetation

For landuse/vegetation, the degree rating is shown in **Table 2.1.12**, as shown by landuse/vegetation map of the municipality (Landuse/Vegetation Map, **Figure 2.1.2** of *Section 2.1.1.5* Landuse and Vegetation of the Project Area), there are four (4) landuse/vegetation types identified in the project area. Based on **Table 2.1.12**, the areas with forest, coconut, and shrubs are with "slight susceptibility to erosion". The Bare area is with "high susceptibility to erosion".

Table 2.1.12. Erosion susceptibility based in vegetation and crops grown

Degree of Susceptibility	Type of Crops/Ground Cover
Slightly	Areas grown to paddy rice
	Areas permanently planted to coconut, mixed orchard, fruit trees, etc.
	Areas covered with dense forest/shrubs, tall grasses and pine trees

Degree of Susceptibility	Type of Crops/Ground Cover
Moderately	Areas grown to sugar cane
	Open grassland
	Areas with thin growth of deciduous forest with scattered kaingin clearings Areas, sloping planted to coconut or fruit trees intercropped with upland row crops (corn, cassava, sweet potato, etc.)
Highly	Areas of diversified upland row crops – corn, cassava, upland rice, mungbean, pineapple, etc.
	Areas planted to tobacco
	Areas with thin growth of short grasses with patches of kaingin clearings; Sparsely vegetated land; Bare area

Source: Bruce, R.C 1982

Slope

As shown by the slopes in the soil map (**Figure 2.1.12**), and based on **Table 2.1.13**, Bolinao clay with 0 – 8% slopes is with "slight susceptibility to erosion". Bolinao clay with >18% slopes is with “high susceptibility to erosion”.

Table 2.1.13. Erosion susceptibility based on slope

Degree of Susceptibility	Slope Range
Slightly	Areas with slope between 0 and 8%
Moderately	Areas with slope between 8 and 18%
Highly	Areas with slope greater than 18%

Silt of fine particles from operations may be carried away by runoff water to adjoining areas during heavy downpour. A silt collector sump has been constructed by RTNMC as a mitigating measure to trap the fine particles (**Plates 1.5.10** and **1.5.11**). This sump is periodically desilted to insure that effluent water discharging from the sump shall be free of fine particles.

Final Erosion Susceptibility Rating

The four (4) erosion susceptibility ratings of each soil unit are aggregated to form the final rating consistent with **Table 2.1.14**, which shows the decision rule on the composite or final erosion susceptibility index. The Soil Erosion Susceptibility Map (**Figure 2.1.13**) displays the result of erosion susceptibility ratings.

As shown in **Figure 2.1.13**, the Forest, Coconut plantations and Shrubland on Bolinao clay with slopes of 0 – 8% are with “slight susceptibility to erosion”. The Bare area on Bolinao clay with 0 – 8% slope is with “moderate susceptibility to erosion”. The Forest and Shrubland on Bolinao clay with >18% slopes are with “moderate susceptibility to erosion”. The bare area on Bolinao clay with >18% slope is with “high susceptibility to erosion”.

Table 2.1.14. Composite erosion susceptibility decision rule

Individual Susceptibilities (Rainfall – landuse – slope – soil)	Final Degree of Erosion Susceptibility
S – S – S – S	Slightly
M – M – M – M	Moderately
H – H – H – H	Highly
H – M – H – H	Highly
H – S – M – M	Moderately
H – M – M – H	Moderately

Source: Bruce, R.C 1982
Note: S – slightly susceptible; M – moderately susceptible; and H – highly susceptible

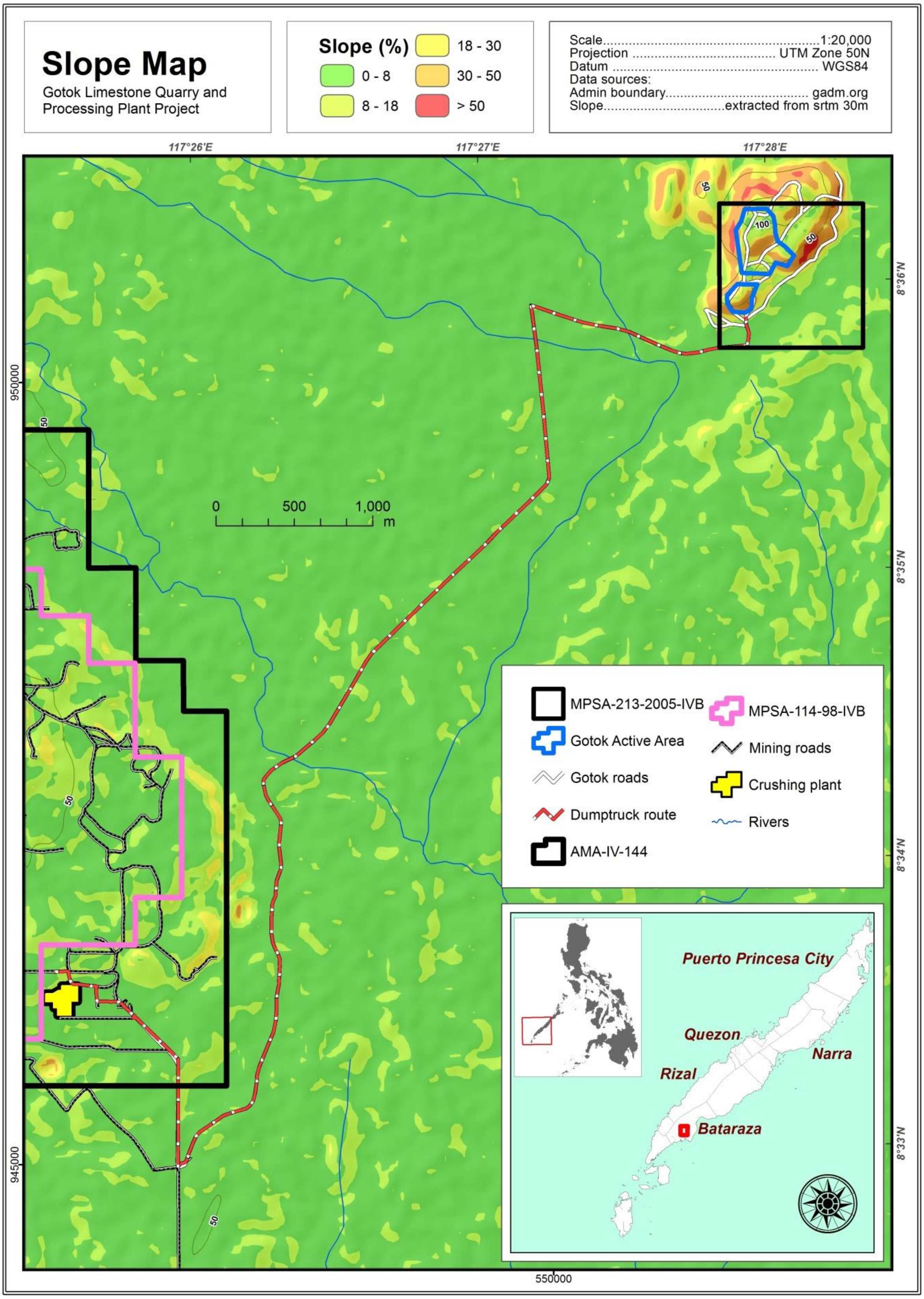


Figure 2.1.12. Slope map of the Gotok quarry area and crushing plant

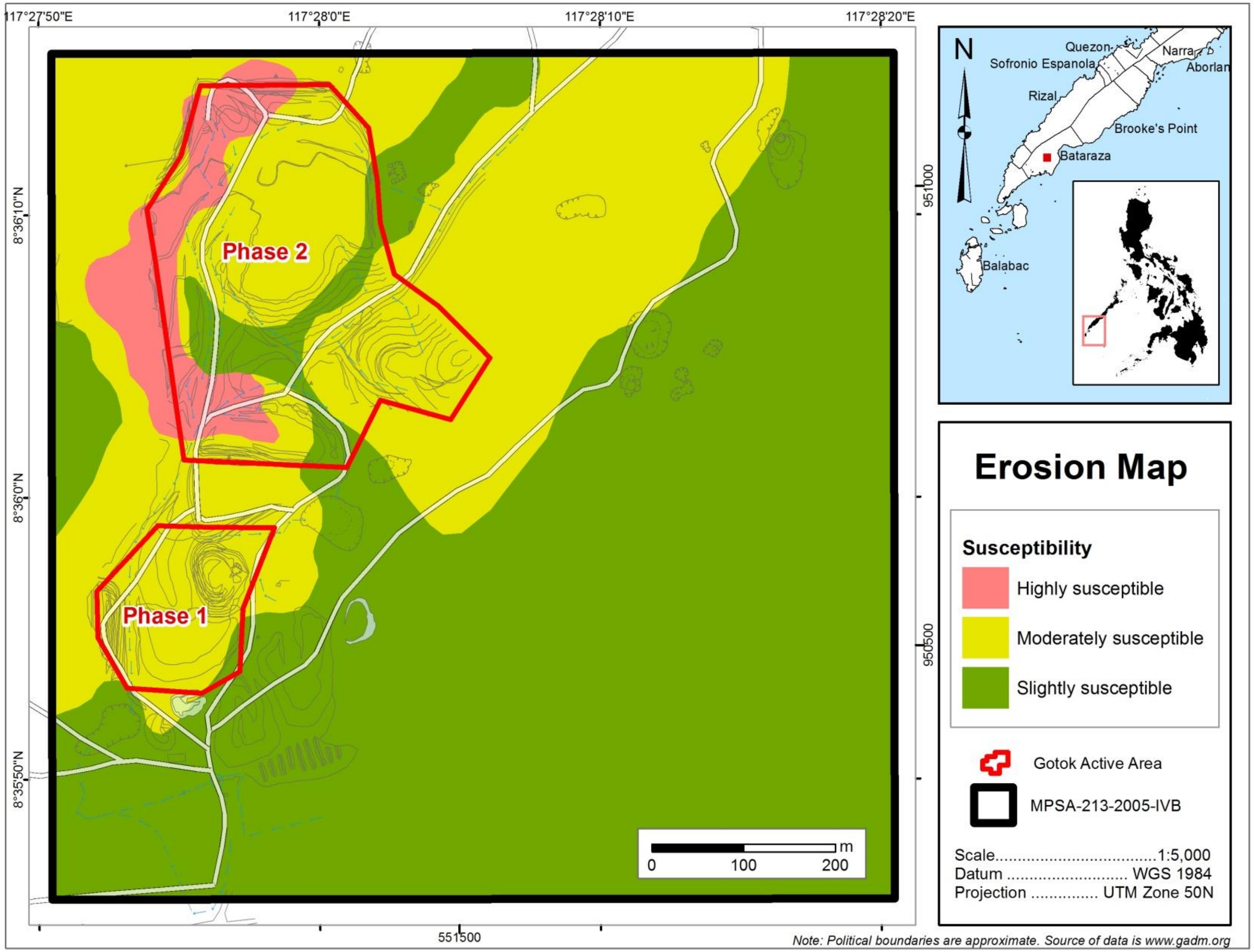


Figure 2.1.13. Soil erosion susceptibility map

2.1.3.3 Impact Assessment and Environmental Performance

Predicted Impacts

The following matrix summarizes the potential impacts that may be brought by the increased production of the quarry and modified crushing plant. Each impact was identified as to the period of possible occurrence, duration, likelihood of occurrence, and magnitude. Entries with asterisks are perceived to be not significant or negligible while italicized entries were perceived to be a positive impact of the project.

Table 2.1.15. Impacts assessment and mitigation for geology/geomorphology

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
Soil erosion Based on the Composite Erosion Susceptibility Decision Rule of Bruce (1982), the final rating of the area is "moderately susceptible to erosion". Although the slope of the area is 3-5% which is considered as "slightly susceptible to erosion", other factors contributing to soil erosion qualifies the area to the "moderately susceptible to erosion" category. The rain may carry the silt in the drainage system of the quarry area thereby affecting the fertility and productivity of soil around the site. This impact is considered significant and will happen in a long period of time if no effective mitigation procedure is employed.		✓	✓		• RTNMC shall strictly comply with its approved quarry plan to limit the extent of exposed soil. • Maintenance of existing stormwater collection system (interceptors, drains, berms and siltation ponds) and installation of other erosion control structures.
Loss of top soil The continued operation in the quarry site will significantly result to loss of top soil in the project area. This impact is unavoidable and irreversible.		✓	✓		• Proper stockpiling of recovered topsoil if immediate re-application is not possible. • Use of local provenance species of native plants for rehabilitation (when feasible, vegetation established on rehabilitated land should be similar to the vegetation type and community that was present before quarry started. It is also essential that as much of the local seeds and propagules contained within the top few centimeters of soil be nurtured for later revegetation programs).
Soil contamination with oil and grease The expansion will require additional equipment and vehicles, which use oil and grease. Furthermore, an increase in daily production will result to more frequent hauling of mined ore from Gotok Quarry to the crushing plant. Surface soil contamination with oil and grease will likely occur from leaks and spillages.		✓	✓		• Maintenance of vehicles / heavy equipment strictly within the motorpool. • Regular maintenance of existing storage area for hazardous wastes such as used oil and used oil filter. • Regular maintenance of the oil and water separator shall be done to ensure optimum performance. • Good housekeeping practices including proper handling and clean-up of oil at the motorpool. • Use of auto shut off valves for

					refueling/re-oiling activities.
Siltation of drainage systems An increase in daily production and hauling activities will result to siltation of drainage systems within the quarry area and along the hauling route. Siltation and sedimentation in the downstream area of the quarry site will be more pronounced during rains. The resulting transport of the sediment will lead to deposition of the materials downstream, along the banks and beds of the rivers, and into the sea. This impact is significant and may occur in a long run if no proper mitigating measure is conducted.		✓	✓		• Installation of sufficient number of diversion canals, interceptors, drains, and berms to avert run-off away from erosion-prone areas. • Regular inspection and maintenance of erosion control structures, drainage channels, culverts and siltation ponds.
Generation of solid and hazardous waste Wastes are being generated from the offices, townsite and other areas where operation is concentrated. This impact affects the aesthetic value of the area and shall cause trajectory diseases from the RTN hospital if not properly contained. Hazardous waste including used oil, batteries and busted lamps/bulbs are also produced from the admin operations, hospital and townsite. Improper waste disposal could also contaminate drainage system in the project site.			✓	✓	• Intensification of the implementation of a Solid Waste Management Program within the quarry area, plantsite, and townsite.
Conversion of soil and rock materials to high valued products The main impact of the project is the conversion of limestone in the ground into a useable and valuable commodity. The mining activities will therefore result into the conversion of an idle, low valued earth material into a high valued commodity. This positive impact is only applicable during the operation of the activity.			✓		

Performance Assessment

The soil quality as shown by the results of soil analysis reveal that the soil texture is clay which is moderately to highly susceptible to erosion. Given the susceptibility of this type of soil to erosion with the addition of the impacts of the increased production of the quarry in the area such as soil contamination with oil and grease and the generation of solid and hazardous wastes, RTNMC has been committed in implementing its Soild Waste and Hazardous Waste Management Program as well as the management strategies for oil and grease. These programs are presented in the succeeding sections. Moreover, with the implementation of a progressive rehabilitation which takes place when the final quarry/pit limit of the benches is reached, area of open/bare land is limited reducing the occurrence for soil erosion.

In terms of soil fertility, it ranges from low, medium to high. To preserve the fertility within the area outside of the quarry, a bufferzone around the perimeter of the 13 ha quarry-area is being maintained. In addition, the topsoil stripped from the land during the site clearing is temporarily placed in a stockpile area within the MPSA to be used during rehabilitation. This is also to minimize loss of topsoil. The Reforestation and Rehabilitation Program is further discussed in *Section 2.1.4.2*.

Solid Waste Management

All domestic wastes from RTNMC, CBNC and Brgy. Rio Tuba are properly disposed at GP-28, which is a mined-out pit. Disposed wastes in the pit are covered with a layer of soil twice a week. RTNMC together with CBNC are implementing the guiding principles of DAO 2001-34 and the relevant standards and requirements.

In consideration with the ECC Conditionality 2i of RTNMC which specifically states that the project owner will establish a solid waste management program, this has been properly implemented and the Local Government Unit (LGU) found the plan acceptable. The waste management scheme provides for the segregation of wastes at source and separate containers for biodegradable and non-biodegradable trash at each collection point.

Regular collection of wastes from RTNMC Townsite, minesite, CBNC plant site, Sitio Sto. Niño/Bukid-bukid, Sitio Macadam/Kinurong, Sitio Marabahay and Sitio Tagdalongon is being implemented. The designated disposal at GP-28 has an estimated holding capacity of 240,000 m^3. The pit is estimated to have a technical life of 20 years. The GP-28 dumpsite had undergone a geo-environmental assessment by the MGB on July 2004 and was issued a Notice to Proceed by the DENR Region IVB (MIMAROPA) for the operation of the controlled disposal facility equipped with leachate filtration and odor control system.

Hazardous Waste Management

The used of heavy equipment for the operation in the quarry area will produce wastes such as used batteries, worn-out tire, equipment parts and metal drums.

RTNMC stores its hazardous wastes on designated sites. These wastes are segregated according to the following:

- Used oils (liquid);
- Used oil filters (solid);
- Used batteries (solid); and
- Oil-contaminated ore (solid).

<u>Storage and Labeling</u>

Section 5-2 of DAO 2004-36 requires vessels, containers, and tanks containing hazardous wastes to be properly marked and labeled with the hazardous waste class, sub-category, hazardous waste symbol and container maximum capacity.

<u>Reporting</u>

Recording of the hazardous waste generation is done by the unit generating them. The recorded information is collated by the Pollution Control Officer (PCO), for consolidation into the Self-Monitoring Report (SMR).

<u>Transport and Treatment</u>

RTNMC engaged the services of DENR-accredited hazardous waste transporters and treaters for the transport and treatment of its hazardous wastes such as the Genetron International Marketing for the waste oil and Clean Leaf for the busted bulbs/lamps. Used batteries on the other hand are being donated back to Motolite Batteries. Prior to transport and treatment, storage areas of hazardous wastes are inspected on a monthly basis.

The company is able to achieve the requirements for proper handling, transport and use of hazardous substances as well as their proper waste management. The monitoring of proper storage shall be done on a regular basis.

Oil and Grease Management

The risk of oil and grease leakage from the use of heavy equipment is mitigated through measures such as the installment of oil and water separators. In addition, RTNMC has designated specific sites for washing and maintenance of vehicles and ensure that all wastewater are properly managed.

2.1.4 Terrestrial Biology

2.1.4.1 Methodology

Terrestrial Flora

Flora assessment was conducted in the entire MPSA of the Gotok Limestone Quarry of RTNMC in Bataraza, Palawan last April 2014. With the use of a topographic map of the quarry area, selection of appropriate sites to be used as vegetation study stations was done. Reconnaissance survey was also conducted. For purposes of accurate inventory of floristic components and detailed description of the vegetation, the MPSA was categorized into two (2) ecosystems, namely: closed-canopy forest, and open-canopy ecosystem.

A total of 16 sampling stations were established within the MPSA of the Gotok Limestone Quarry (**Figure 2.1.14**). More sampling stations were established in the closed-canopy forest than in an open-canopy ecosystem. In each sampling station, two (2) quadrats were established to characterize the ecosystems better. **Annex 2.1.8** shows the documentation of the flora assessment.

Table 2.1.16. Relative location and elevation of the sampling stations within Gotok Limestone Quarry of RTNMC and CBNC in Bataraza, Palawan

Sampling Station	Coordinates		Elevation (M)	Remarks
	Northing	Easting		
VS 1	8.60449	117.47008	90	Sampling stations established in a closed-canopy forest
VS 2	8.60409	117.46747	148	
VS 3	8.60443	117.46649	124	
VS 4	8.60443	117.46549	114	
VS 5	8.60559	117.46575	85	
VS 6	8.60324	117.46372	56	
VS 7	8.60343	117.46502	103	
VS 8	8.60311	117.46501	103	
VS 9	8.60134	117.46456	59	
VS 10	8.60012	117.46581	87	
VS 11	8.59893	117.46429	57	
VS 12	8.59864	117.46344	50	
VS 13	8.6017	117.46912	59	
VS 14	8.60311	117.46567	96	Sampling stations established in an open-canopy ecosystem
VS 15	8.60236	117.46646	96	
VS 16	8.60235	117.46613	99	

For impact assessment, comparison of the results of this sampling with the results of the 2001 vegetation sampling conducted for the (HPP Line 1 Project was done.

Terrestrial Fauna

The fauna assessment was conducted within the MPSA and inside the site granted the Tree Cutting Permit. Transect walks were conducted from south to north. The first transect was within the MPSA but outside the area with the Tree Cutting Permit at the forest fringe. At the left side of the trail is a hill where the dominant vegetation is secondary growth forest with some dipterocarps while on the right side is the agricultural farm project of the RTNMC which is being prepared for the next planting period. Two caves are located in the hill, Maginhawa at the higher elevation and Inugong which is located lower and is nearer the trail at the eastern side (**Figure 2.1.15**).

The second transect is located in the trail between two (2) hills, the left side (western) of which is where quarrying is being conducted. The vegetation is mostly wild *gabi* or yam, vines and some trees at the higher elevation at the fringes of the quarry site. The third transect is located at the westernmost periphery of the MPSA at the base of the hill where quarrying operations are on-going. The weather during the survey was mostly clear, sunny and hot.

Table 2.1.17. Terrestrial vertebrates survey sites/transects at the Gotok Limestone Quarry

Transect		Latitude	Longitude	Date and time
1	Start	8˚36'05.0" N	117˚28'11.2" E	April 11, 2014; 1500H-1800H
	End	8˚36'17.8" N	117˚28'11.9" E	April 12, 2014; 0600—1000H
2	Start	8˚36'16.8" N	117˚28'16.0" E	April 12, 2014; 1500-1800H
	End	8˚36'04.5"N	117˚27'56.2" E	April 13, 2014; 0600-1000H
3	Start	8˚35'51.9" N	117˚27'51.0" E	April 14, 2014; 1500-1800H
	End	8˚36'15.2" N	117˚28'01.0" E	April 15, 2014; 0600-1000H

There were four (4) caves assessed within the MPSA but outside the area with the Tree Cutting Permit. Prior to the assessment, the team was able to secure a cave assessment permit from the PCSD (**Annex 2.1.9**). There were no caves found near the quarry site because the ones indicated in the map have either collapsed or the opening of the cave was inaccessible because it has already been closed by huge boulders. **Annex 2.1.10** shows the documentation during the fauna assessment. The following table shows the location of the caves which were assessed.

Table 2.1.18. Caves assessed at the vicinity of the Gotok Limestone Quarry

Name of Cave	Latitude	Longitude	Date and time
Maginhawa Cave	8˚36'12.0" N	117˚28'10.7" E	April 11, 2014; 1000-1200H
Inugon Cave	8˚36'12.0" N	117˚28'13.9" E	April 12,2014; 1000-1200H
Sanang-sanang 1	8˚36'11.2" N	117˚28'03.9" E	April 13, 2014; 1000-1200H
Sanang-sanang 2	8˚36'11.2" N	117˚28'05.1" E	April 14, 1000-1200H

For impact assessment, comparison of the results of this survey with the results of the 2001 wildlife survey conducted for the HPP Line 1 Project was done.

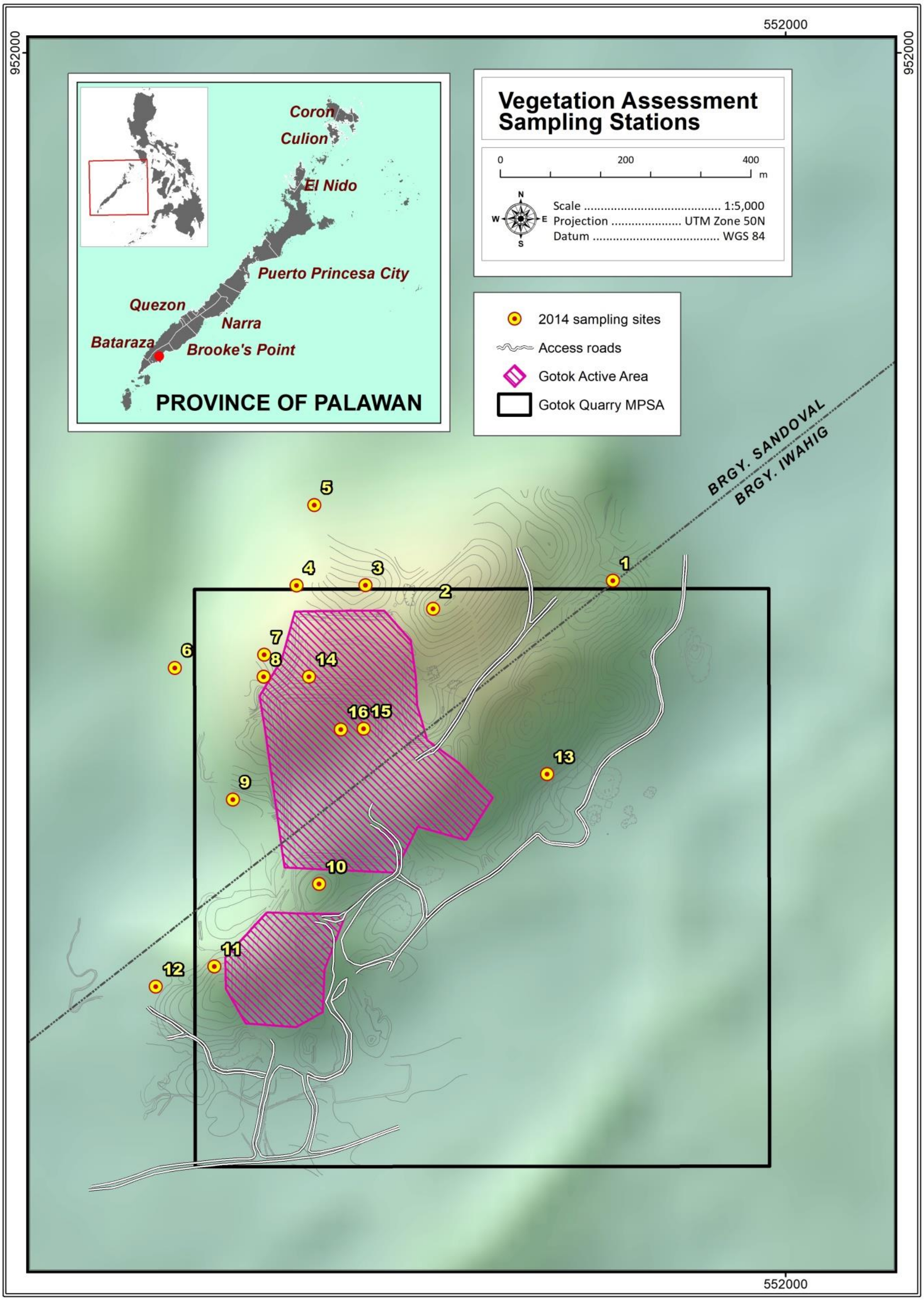


Figure 2.1.14. An overview of the sampling stations within Gotok Limestone Quarry of RTNMC and CBNC in Bataraza, Palawan

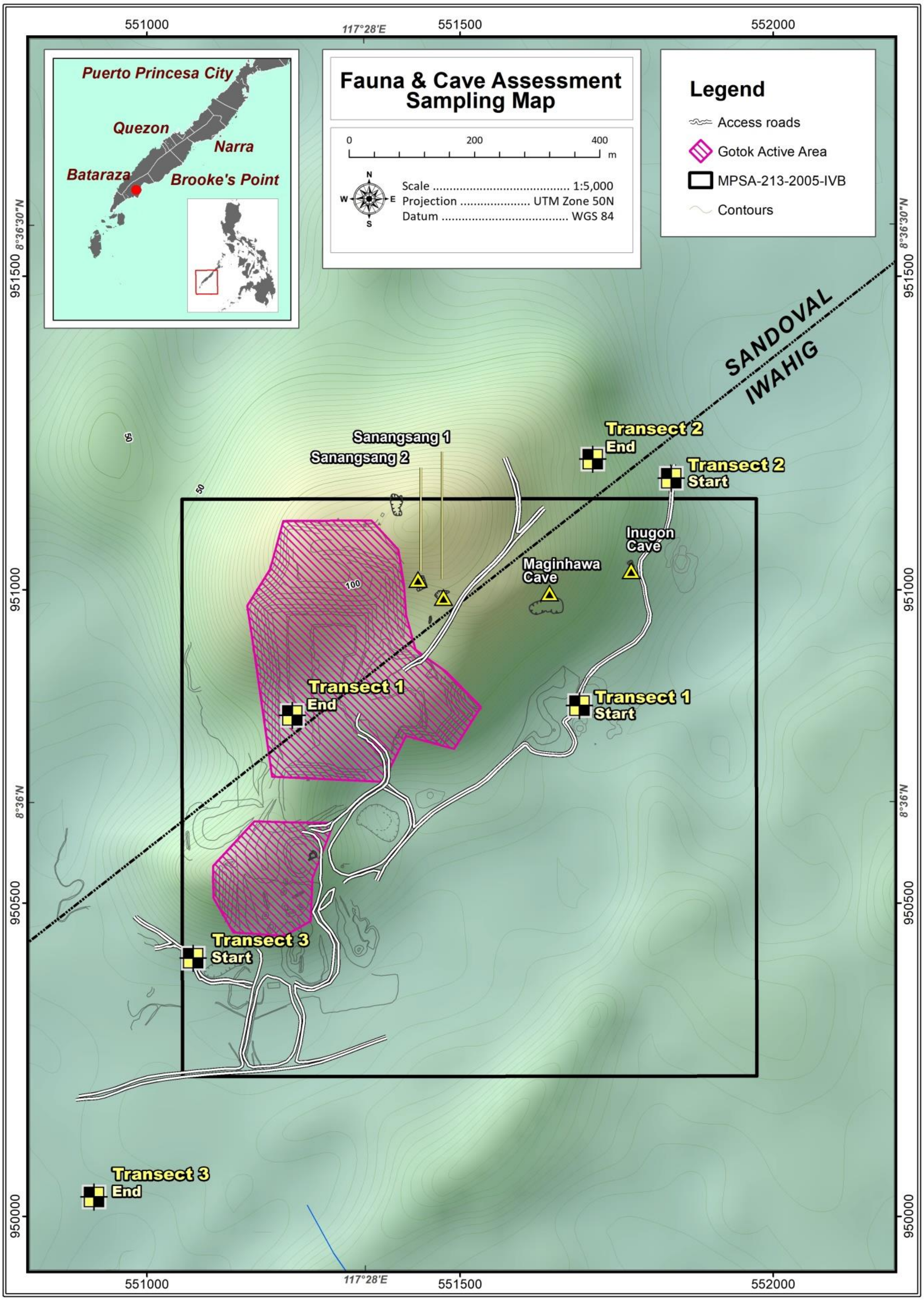


Figure 2.1.15. Location of caves and transects for the terrestrial

2.1.4.2 Findings and Discussion

Terrestrial Flora

General Description and Species Composition

A complete list of species for the inventoried area is given in **Annex 2.1.8a**. There were 148 plant species recorded belonging to 52 families in the sampled areas. These species include trees, shrubs, herbs, ferns, palms, vines and lianas. The species richness of the project area constitutes 4.2% of the estimated flowering plants (roughly 3,000-3,500) found in Palawan (Madulid, 2002). The most speciose (having several species) of all genera is *Ficus* represented by six (6) species followed by *Sterculia* with five (5) species, and *Aglaia* and *Diospyrus* with four (4) species each. Most of the species are classified under family Malvaceae with 13 species, Fabaceae and Moraceae both have 10 species, Annonaceae (9), Euphorbiaceae (9), Meliaceae (6), and Clusiaceae (6).

In general, the vegetation of project area is a limestone forest. Although forested areas as a whole provide wildlife habitat, limestone forests have unique features that make them significant. The limestone forests in the project area occur in karst landscapes, which are underlain by limestone bedrock, contain sinkholes, caves and springs. These communities are habitat of rare plant and animal species adapted to the soils type.

The limestone forest in the project area had both closed-canopy forest and open-canopy ecosystem. The closed-canopy forest is situated at the periphery of the active limestone quarry while the open-canopy ecosystem is located at the disturbed and steep slopes within the active limestone quarry. In a closed-canopy forest, large trees are few and apart, with the intervening spaces filled with small trees. Only 40 individuals have been recorded with diameter at breast height (dbh) greater than 30 cm. Of these 40 individuals, only five (5) species have dbh greater than 60 cm. These species are Balete (*Ficus* sp.1), Balakat (*Zizyphus talanai*), Malapingan (*Trichadenia philippinensis*), Katong matsing (*Chisocheton pentandrus*) and Taluto (*Pterocymbium tinctorium*). Balete (*Ficus* sp.1) had the largest trunk in the closed-canopy forest with dbh of 184.6 cm, followed by Balakat (*Z. talanai*) with dbh of 109.5 cm (**Annex 2.1.8b**).

The open-canopy ecosystem is located on areas previously modified, excavated then abandoned. This ecosystem is an open area and was devoid of vegetation due to limestone quarrying. Natural colonization occurred in this ecosystem wherein opportunistic species inhabit the area. Opportunistic plants exploit this newly opened habitat and recolonized it.

The open-canopy ecosystem is composed of pioneer and herbaceous species such as Badyang (*Alocasia* sp.1) and creeping vines such as species of *Gymnopetalum*, *Argyreia luzonensis*, *Merremia vitifolia* and *Momordica*. The pioneer tree and shrub species that inhabit the open-canopy ecosystem are Binunga (*Macaranga tanarius*), Hamindang (*M. bicolor*) and Lipang aso (*Leucosyke negrosensis*). Opportunistic plants as mentioned above have a rapid growth rate, quickly establishing themselves in this open and new environment. Binuanga, Hamindang, *Argyreia luzonensis*, *M. vitifolia* and species of *Gymnopetalum* and *Momordica* are the most prominent species in the ecosystem during the early stages of ecological succession. These pioneer species took advantage of the opportunity when climax species that are more competitive in the long run are not very abundant in this early stage of ecological succession. Binunga, Hamindang, *Argyreia luzonensis*, *M. vitifolia*, and species of *Gymnopetalum* and *Momordica* have better ability to modify their growth rate, physiology, or behavior to better suit the extreme environmental conditions with which they are faced in this ecosystem.

Structure, Relative Values and Importance Values of the Different Ecosystems

Closed-canopy forest. The vegetation of the closed-canopy forest is composed of few large trees but filled with many small-diametered trees. Mali-mali (*Leea guineensis*), a small tree under the family Vitaceae, is evidently and abundantly present in most of the sampling stations and in this ecosystem. This species is the most dominant species in the area with a total importance value (IV) of 17.15 (**Figure 2.1.16** and **Annex 2.1.8c**). Mali-mali was only found in the intermediate and undergrowth strata because species is an understory species that grows under shade and cover of taller trees. It has the highest IV in both strata and its estimated density is 1,077 individuals/hectare in the intermediate stratum and 5,800 individuals/hectare in the undergrowth stratum (**Annexes 2.1.8d** and **2.1.8e**). The density of Mali-mali in the intermediate stratum is quite many when compared to other species present. More than 15% of the total individuals in the intermediate stratum belong to this species.

Banato (*Mallotus philippinensis*) ranked second to Mali-mali in terms of the IV with a value of 14.83. This species was found and well represent in the canopy, intermediate and undergrowth strata. In the canopy stratum, Banato has a density of 27 individuals per hectare (**Annex 2.1.8b**). The average dbh of this species is 16.6cm with a total basal area (BA) of 0.73m^2/hectare. Amugis (*Koordersiodendron pinnatum*) is the third dominant species in the closed-canopy forest. The IV of this species is 12.86. The computed density of Amugis is 19 individuals per hectare with an average dbh of 23.2 cm and corresponding total BA of 0.96 m^2 per hectare in the canopy stratum.

Aglaia palembanica and *F. cumingii* ranked fourth and fifth in terms of the IV, respectively. *A. palembanica* has several seedlings and saplings in the undergrowth stratum while *Ficus cumingii* has the highest density in the canopy stratum with 33 individuals per hectare. The average dbh of *Aglaia palembanica* is 19.1 cm while 22.0 cm for *Ficus cumingii*.

Other ecologically important species dominant in the closed-canopy forest are Bago (*Gnetum gnemon*), *Cratoxylum* sp.1, Paguringon (*Cratoxylum sumatranum*), Lunas (*Lunasia amara*) and Anang (*Diospyros cauliflora*). These species together with abovementioned dominant species comprised 35% of the total IV in this ecosystem. Lunas and Anang are species usually frequent on limestone forest (Merill 1923, 1925).

Open-canopy ecosystem. The open-canopy ecosystem is located on open, exposed and disturbed areas at the edges of the active limestone quarry. This ecosystem is devoid of large trees and even small-diametered trees, unlike in the adjacent closed-canopy forest. Most of the vegetation cover of this ecosystem is vines and herbaceous plants, and only few saplings are present. The estimated sapling density of this ecosystem is 520 individuals per hectare (**Table 2.1.19**). This value is quite low but understandable because this ecosystem had been altered.

About eight (8) species of saplings have been observed with above 1 m in height. The common tree species observed are Hamindang (*M. bicolor*) and Binunga (*M. tanarius*). More than 50% of the total IV is attributed to these two (2) species. Other species present are Anabiong (*Trema orientalis*), Bogo (*Garuga floribunda*), Paguringon (*C. sumatranum*), Bayok (*Pterospermum diversifolium*) and Wild talong (*Solanum cumingii*). Bogo and Paguringon belonged to the dominant species in the adjacent closed-canopy forest but not in this ecosystem where only few individuals were observed. This is expected because Bogo and Paguringon are climax species wherein they thrive better in a well-established ecosystem.

Table 2.1.19. Pioneering intermediate vegetation in the open-canopy ecosystem within the Gotok Limestone Quarry

Species	Density (per ha)	IV
Macaranga bicolor	180	28.02
Macaranga tanarius	140	24.18
Leucosyke negrosensis	60	12.91
Trema orientalis	40	10.99
Garuga floribunda	40	7.42
Cratoxylum sumatranum	20	5.49
Pterospermum diversifolium	20	5.49
Solanum cumingii	20	5.49
TOTAL	**520**	**100**

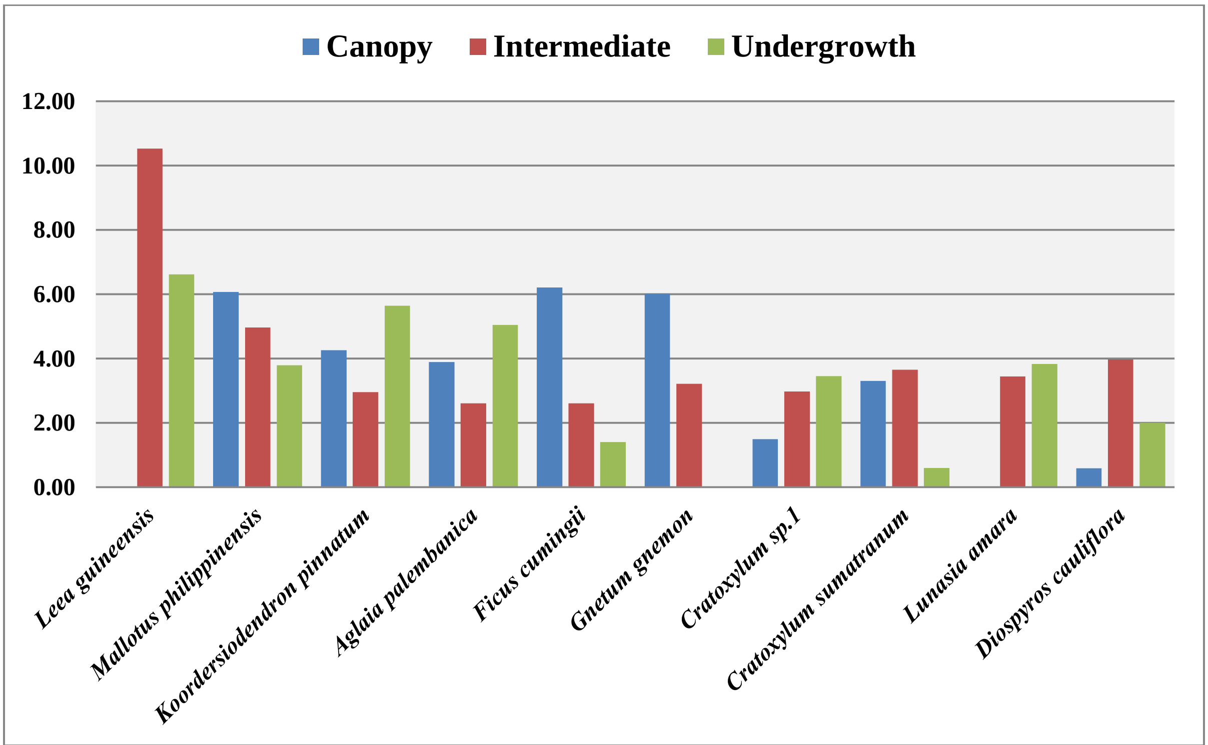


Figure 2.1.16. The 10 species with the highest importance value found within the Gotok Limestone Quarry

Table 2.1.20 shows the species composition of the undergrowth stratum in the open-canopy ecosystem. There is greater abundance of vines in this ecosystem. For instance, *A. luzonensis* and *M. vitifolia* are the most dominant undergrowth species in this ecosystem. *A. luzonensis* has an IV of 20.63 while *M. vitifolia* has an IV of 15.72. Both species serve as cover crop of the open, exposed and disturbed areas at the edges of the active limestone quarry. The estimated densities of both species are 180 and 111 individuals per 100 m^2, respectively. Aroids and fleshy herbs are also present and very abundant in this ecosystem. Badyang (*Alocasia* sp.1), for example, is frequently observed and easily identified because of its large-sized leaves. *Amorphophallus palawanensis* was also seen in this ecosystem. The abovementioned values and the species composition suggest that this ecosystem is in early stage of ecological succession. Opportunistic plants (e.g. pioneer species) are the most prominent species in the early stages of ecological succession because they have greater ability to modify their growth rate, physiology, or behavior to better suit the extreme environmental conditions of the ecosystem.

Table 2.1.20. Pioneer undergrowth vegetation in the open-canopy ecosystem within the Gotok Limestone Quarry

Species	Density (per 100 sq.m.)	IV
Argyreia luzonensis	189	20.63
Merremia vitifolia	111	15.72
Macaranga bicolor	100	11.31
Passiflora foetida	100	10.17
Alocasia sp.1	67	9.05
Macaranga tanarius	89	8.26
Garuga floribunda	44	3.86
Gymnopetalum sp.1	33	3.01
Leucosyke negrosensis	22	2.54
Trema orientalis	22	2.54
Solanum cumingii	11	2.52
Ficus cumingii	11	2.14
Mallotus philippinensis	22	2.01
Momordica sp.1	22	2.01
Amorphophallus palawanensis	11	1.38
Cratoxylum sumatranum	11	1.00
Tridax sp.1	11	1.00
Koordersiodendron pinnatum	11	0.85
Total	**889**	**100.00**

Diversity

Diversity index is a mathematical measure of species diversity in a particular community. It provides more information about community composition than simply species richness (i.e. the number of species present) and it also take the relative abundances of different species into account. In the project area, the overall Shannon diversity index of the closed-canopy forest is 3.737 (**Table 2.1.21**). Based on the 1998 Fernando biodiversity scale, the diversity index of the closed-canopy forest is high. High diversity index means that this ecosystem supports many species and has the ability to withstand some environmental impact. There are 137 species present in the closed-canopy forest and the number of individuals of each species does not vary much from each other. For example, *F. cumingii* and *M. philippinensis* are the two (2) species with highest IV in the canopy stratum. The density of F. cumingii is 33 individuals per hectare and the density of *M. philippinensis* is 27 individuals/hectare. The number of individuals of each species in the closed-canopy forest ranges from 2 to 33 individuals. The number of individuals of each species gradually decreases from the most common species to the uncommon species.

Table 2.1.21. Overall diversity indices of the limestone ecosystems within the Gotok Limestone Quarry

Ecosystem	Shannon's Diversity Index	Species Richness
Closed-canopy forest	3.737	137
Open-canopy ecosystem	1.405	19

On the contrary, the overall Shannon diversity index of the open-canopy ecosystem is 1.405. This value means the habitat is low in species with uniform composition and structure. There are only 19 species found in the open-canopy ecosystem and the number of individuals of each species does vary from each other. For example, *A. luzonensis* and *M.*

vitifolia are the two (2) species with highest IV in the undergrowth stratum. The density of *Argyreia luzonensis* is 189 individuals and the density of *M. vitifolia* is 111 individuals for every 100 m^2. The difference of the density of the two (2) species is quite large. The range of the number of individuals of each species in this ecosystem is 11 to 189 individuals. The number of individuals abruptly decreases from the most common species to the uncommon species making the diversity index low.

Conservation Status

Threatened species is a general term to denote species or subspecies considered as critically endangered, endangered, vulnerable or other accepted categories of wildlife whose population is at risk of extinction (DAO 01 s-2007). Each category is defined below and adopted from Fernando et al, 2008.

1. Critically endangered species refers to a species or subspecies that is facing extremely high risk of extinction in the wild in the immediate future.
2. Endangered species refers to species or subspecies that is not critically endangered but whose survival in the wild is unlikely if the causal factors continue operating.
3. Vulnerable species refers to species or subspecies that is not critically endangered or endangered but is under threat from adverse factors throughout their range and is likely to move to the endangered category in the near future.
4. Other Threatened Species refers to a species or subspecies that is not critically, endangered, endangered nor vulnerable but is under threat from adverse factors such as over collection, throughout its range and is likely to move to the vulnerable category in the near future. This shall include varieties, formae or other infraspecific categories.
5. Other Wildlife Species refers to non-threatened species of plants that have the tendency to become threatened due to destruction of habitat or other similar causes as may be listed by the Secretary upon recommendation of the National Wildlife Management Committee. This shall include varieties, formae or other infraspecific categories.

In the project area, there are seven (7) plant species recorded (**Table 2.1.22**) that are in the redlist of International Union for Conservation of Nature (IUCN) for threatened plant. These species are *Aglaia smithii*, Antipolo (*Artocarpus blancoi*), Ipil (*Instia bijuga*), Hamindang (*M. bicolor*), Mitrephora (*Mitrephora fragrans*), *Sindora inermis*, Xylosma (*Xylosma palawanense*). All of these species are under the category of vulnerable species. These vulnerable species are not critically endangered or endangered yet but is under threat due to deforestation, habitat destruction, over collection, logging, land conversion, etc., and are likely to move to the endangered category in the near future.

Aglaia palembanica and Bayanti (*Aglaia rimosa*) are under the near threatened category. Near threatened is a conservation status assigned to species that may be considered threatened with extinction in the near future, but it does not yet qualify for the threatened status such as critically endangered, endangered or vulnerable. There are other five (5) species listed in IUCN redlist but under the status of least concern. A taxon is least concern when it has been evaluated against the criteria of IUCN and does not qualify to be critically endangered, endangered, vulnerable or near threatened species (IUCN, 2001). Widespread and abundant taxa are included in this category.

Table 2.1.22. List of threatened plant species found in within the Gotok Limestone Quarry

Common Name	Scientific Name	Family	IUCN Status	DENR (DAO 2007-01)
Batukanag	*Aglaia smithii*	Meliaceae	Vulnerable	Vulnerable
Antipolo	*Artocarpus blancoi*	Moraceae	Vulnerable	-
Ipil	*Instia bijuga*	Fabaceae	Vulnerable	-
Hamindang	*Macaranga bicolor*	Euphorbiaceae	Vulnerable	-
Lanutan-banguhan	*Mitrephora fragrans*	Annonaceae	Vulnerable	Vulnerable
	Sindora inermis	Fabaceae	Vulnerable	-
Xylosma	*Xylosma palawanense*	Fabaceae	Vulnerable	-
Aglaia	*Aglaia palembanica*	Meliaceae	Near threatened	-
Bayanti	*Aglaia rimosa*	Meliaceae	Near threatened	Vulnerable
Batino	*Alstonia macrophylla*	Apocynaceae	Least concern	-
Dacryodes	*Dacryodes rostrata*	Burseraceae	Least concern	-
Tui	*Dolichandrone spathacea*	Bignoniaceae	Least concern	-
Bago	*Gnetum gnemon*	Gnetaceae	Least concern	-
Buri	*Corypha utan*	Arecaceae	Least concern	-

Terrestrial Fauna

Species Richness

Birds

Thirty-eight species of birds were observed and recorded from the three (3) transects; 29 from Transect 1, 16 from Transect 2, and 18 from Transect 3 (**Table 2.1.23**). Transect 1 had more species because the area was outside the area of operations of the quarry and the vegetation was mostly secondary growth forest on the hilly part and agricultural on the right side. The middle transect, Transect 2, which had the lowest number of species was the most disturbed. The vegetation at the side of the hill where quarrying is done is mostly wild and cultivated *gabi* (yam), some bananas, vines and intermittent trees. The third transect is a combination of secondary forest growth, coconut trees and vegetation characteristic of a forest over limestone.

It can be observed that there are five (5) species common to all the sites, these are; *Arachnotera longirostra* (Little Spiderhunter), *Collocalia troglodytes* (Pygmy Swiftlet), *Copsychus niger* (White-vented Shama), *Dicrurus leucophaeus* (Ashy Drongo), and *Orthotomus sericeus* (Rufous-tailed Tailorbird). These birds are commonly seen in open spaces, grasslands, and in lowland forests.

Table 2.1.23. List of bird species observed and recorded at the Gotok Limestone Quarry

Species	Common Name	Transect		
		1	2	3
Anthracoceros marchei	Palawan Hornbill	-	3	2
Arachnothera longirostris	Small Spiderhunter	5	6	4
Bubulcus ibis	Cattle Egret	9	-	1
Butoroides striatus	Little Heron	-	-	1
Cacomantis merulinus	Plaintive Cuckoo	2	-	1
Caprimulgus macrurus	Large Billed Nightjar	1	-	-
Centropus bengalensis	Lesser Coucal	1	-	-
Chloropsis palawanensis	Yellow Throated Leafbird	-	4	1
Cinnyris jugularis	Olive-backed Sunbird	6	-	-
Collocalia fuciphaga	Edible nest Swiftlet	1	8	-
Collocalia troglodytes	Pygmy Swiftlet	23	8	3
Copsychus niger	White-vented Shama	4	3	4
Corvus enca	Slender -billed Crow	3	5	-
Alophoixus frater	Palawan Bulbul	1	-	2
Dicaeum pgymaeus	Pygmy Flowerpecker	2	-	2
Dicrurus hottentotus	Spangled Drongo	-	-	4
Dicrurus leucophaeus	Ashy Drongo	3	2	2
Hypothymis azurea	Black naped Monarch	1	-	-

Species	Common Name	Transect		
		1	2	3
Pycnonotus atriceps	Black-headed Bulbul	2	1	-
Pycnonotus plumosus	Olive-winged Bulbul	2	-	8
Macropygia tenuirostris	Philippine Cuckoo Dove	1	-	-
Monticola solitarius	Blue Rock Thrush	2	1	-
Motacilla flava	Yellow Wagtail	-	-	1
Nectarinia shelleyi	Lovely Sunbird	-	3	-
Nectarinia sperata	Purple Throated Sunbird	1	-	-
Orthotomus sericeus	Rufous tailed Tailorbird	6	2	6
Parus amabilis	Palawan Tit	2	-	-
Pericrocotus cinnamomeus	Small Minivet	2	-	-
Phylloscopus borealis	Arctic Warbler	-	1	-
Pitta sordida	Hooded Pitta	4	2	-
Prionochilus plateni	Palawan Flowerpecker	2	-	5
Pycnonotus plumosus	Olive Winged Bulbul	17	-	-
Spilornis cheela palawanensis	Serpent Eagle	1	1	-
Spizaetus cirrhatus	Changeable hawk Eagle	2	-	-
Stachyris hypogrammica	Striped Babbler	-	1	-
Streptopelia chinensis	Spotted Dove	1	-	-
Tersiphone cyanescens	Blue Paradise Flycatcher	1	-	2
Trichastoma cinereiceps	Ashy-headed Babbler	1	-	1

Note: No species in the above table is listed in DAO 2004-15.

The different habitats which birds occupy and the feedings guilds which they belong to can be used as a tool to monitor the effect of anthropogenic activities and/or natural phenomenon such as typhoons and droughts which may disturb the existence of wildlife especially birds.

Majority of the species of birds are forest dependent both as roosting/nesting areas and for feeding. Birds observed at the Limestone Quarry inhabit forests; lowland, secondary and or primary, canopy or understorey. **Figure 2.1.17** shows the percentage of bird species occupying different habitats. Fifty-five percent are forest dwellers, followed by those occupying a combination of forest, grassland and open country (16%) and wetlands (5%), while the others inhabit or live in a combination of two (2) or three (3) habitats, one species dwells in caves (*Colocalia esculenta*, the Edible-nest Swiftlet).

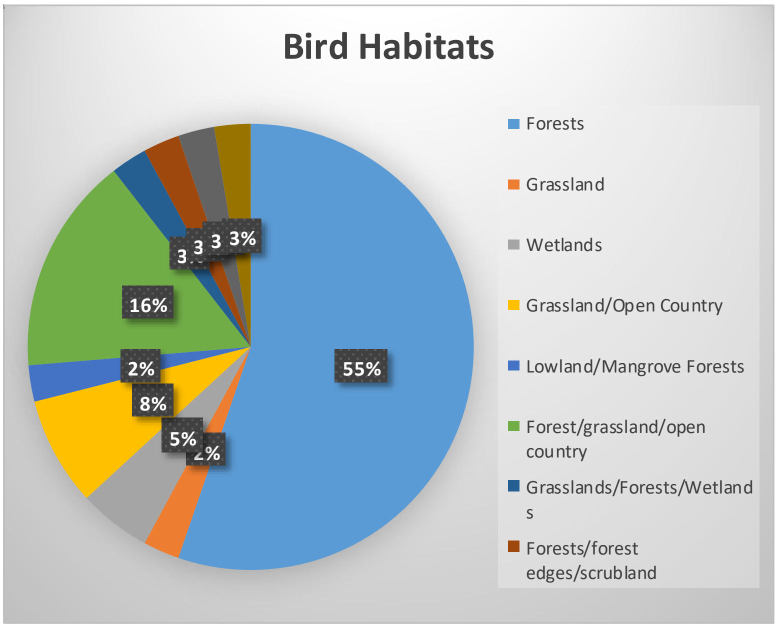


Figure 2.1.17. Percentage of bird species occupying different habitats

Mammals

Both mist-netting and live-trapping were employed to catch volant and non-volant mammals respectively. Seven species of volant mammals, were caught through mist-netting (**Table 2.1.24**). This is composed of four (4) species of fruit-eating bats (frugivores); *Eonycteris spelaea*, *Macroglossus minimus*, *Cynopterus brachyotis* and *Rousettus amplexicaudatus* which are commonly seen in agricultural areas with fruit trees and banana plantations, and three (3) insectivorous species; *Hipposideros diadema*, *Rhinolophus virgo*, and *Megaderma spasma*.

There were three (3) species of non-volant mammals observed and recorded along the transects; *Tupaia palawanensis* (Palawan Tree Shrew), *Macaca fascicularis* (Long-tailed Macaques) and *Sundasciurus steeri* (Southern Palawan Tree Squirrel). The live traps were unsuccessful in catching any rodents. This could be an indication that food availability for this taxa is scant or nil in these sites, even in Transect 1 which was undisturbed and is adjacent to an agricultural area. *Macaca fascicularis* or the Long-Tailed Macaque and *Sundasciurus steeri* (Southern Palawan Squirrel) were observed in Transect 1 while three (3) individuals of *Tupaia palawanensis* (Palawan Tree Shrew) were observed traversing and playing in the trail dividing Transects 1 and 2.

Transect 1 had the highest number of mammalian species with eight (8) (6 volant and 2 non-volant) followed by Transect 3 with six (6) (5 volant and 1 non-volant), while Transect 2 had five (5) (4 volant and 1 non-volant).

Table 2.1.24. Species of mammals observed and recorded from three transects

Species	Common Name	Survey Sites		
		Transect 1	Transect 2	Transect 3
Eonycteris spelaean	Cave-roosting nectar bat	2	41	3
Macroglossus minimus	Dagger-toothed flower bat	1	7	16
Cynopterus brachyotis	Short-nosed fruit bat	10	7	45
Hipposideros diadema	Diadem long-nosed bat	1	-	-
Rousettus amplexicaudatus	Common rousette	2	14	11
Rhinolopus virgo	Philippine lesser horsehoe bat	1	-	-
Megaderma spasma	False Vampire Bat	-	-	2
Tupaia palawanensis	Palawan Tress Shrew	-	3	-
Macaca fascicularis philippensis	Long-tailed Macacque	8	-	1
Sundasciurus steeri	Southern Palawan Squirrel	3	-	-

Table 2.1.25. Species of bats collected through mist netting from 4 caves found within MPSA

Species	Common Name	Maginhawa Cave	Inugon Cave	Sanang-sanang 1	Sanang-sanang 2
Eonycteris spelaea	Common Nectar Bat/ Common Dawn Bat	39	-	-	-
Hipposideros diadema	Diadem long nosed bat	45	-	-	-
Cynopterus brachyotis	Short-nosed fruit bat	-	6	-	-
Emballonura alecto	Greater sheath-tailed bat	-	3	1	1
Megaderma spasma	Lesser false vampire bat	-	-	-	1

Mist nets were also set in the entrance of caves and in the case of Maginhawa, because the entrance was below ground, the nets were set at the mouth/lip of the cave aboveground. A total of five (5) species of bats were caught from the four (4) caves through mist netting; two (2) frugivores (*Eonycteris speleae* and *Cynopterus brachyotis*), and three (3) insectivores

(*Hipposideros diadema*, *Emballonura allecto* and *Megaderma spasma*). Three of the caves, Maginhawa, Inugon and Sanangsanang 2 had two (2) species of bats each while only one (1) species was caught in Sanangsanang 1. In Maginhawa one (1) species of frugivore, *Eonycteris spelaea* and one (1) insectivore, *Hipposideros diadema* were caught in the mist nets, as is in Inugon which had *Cynopterus brachyotis* (frugivore), and *Emballonura alecto* (insectivore). Two species of insectivores were caught in Sanangsanang 2 (*Emballonura alecto* and *Megaderma spasma*), and one in Sanangsanang 1 (*Emballonura alecto*).

Herps

Herping was done in Transect 1 and in the creek (with underground outlet) at the western side of the Limestone Quarry and in the two (2) caves, Inugon and Maginhawa. The frogs and toad were collected by hand while reptiles observed during the transect walks and in the assessment of caves were recorded. Six species of amphibians were recorded from the four (4) sites, five (5) frogs, and the lone species of toad present in Palawan, *Ingerophrynus phillipinicus* (Philippine Toad). One species of frog, *Hoplobatrachus rugulosus* is an introduced and invasive species.

Table 2.1.26. Species of herps (amphibians and reptiles) observed and recorded from four (4) sampling sites

Species	Common	Location			
		Transect 1	Creek	Inugon Cave	Maginhawa Cave
Hylarana moellendorfi	Variable Backed Frog	12	30	20	-
Hylarana nicobariensis	Nicobar Frog	10	50	15	-
Hoplobatrachus rugulosus	Chinese Edible Frog	10		-	-
Fejervarya cancrivora	Asian Brackish Water Frog	-	25	-	-
Ingerophrynus philippinicus	Philippine Toad	-	1	1	1
Chaperina fusca	Yellow Spotted Narrow Mouthed Frog	-	-	5	-
Luperosaurus palawanensis	Palawan Flapped-legged Gecko	1		-	-
Coelognathus eryhtrurus philippinus	Philippine Ratsnake	-	-	1	-
Boiga dendrophila	Mangrove Cat Snake	-	-		1

There were only three (3) species of reptiles recorded from the survey sites, two (2) snakes and one (1) lizard.

Inugon Cave harbors the most number of species of herps at five (5), followed by Transect 1 and the Creek with four (4) and Maginhawa Cave with only two (2) species.

Conservation and Ecological Status

Birds

Table 2.1.27 presents the distribution and conservation status of bird species recorded during the survey. Most of the species were residents; some are endemic while only one (1) species was migratory. **Figure 2.1.18** shows that 58% are residents, 39% are endemic and only 3% are migratory.

Table 2.1.27. Distribution and conservation status of bird species at the Gotok Limestone Quarry

Species	Distribution/ Ecological Status	Conservation Status (IUCN 2013)	DENR 2004-15	Palawan PCSDS No. 15-521
Anthracoceros marchei	Endemic	VU	VU	Endangered
Arachnothera longirostris	Resident	LC	LC	Vulnerable
Bubulcus ibis	Resident	LC	LC	LC
Butoroides striatus	Resident	LC	LC	LC
Cacomantis merulinus	Resident	LC	LC	LC
Caprimulgus macrurus	Endemic	LC	LC	LC
Centropus bengalensis	Resident	LC	LC	LC
Chloropsis palawanensis	Endemic	LC	LC	Vulnerable
Cinnyris jugularis	Resident	LC	LC	LC
Collocalia fuciphaga	Resident	LC	LC	LC
Collocalia troglodytes	Endemic	LC	LC	LC
Copsychus niger	Endemic	LC	LC	LC
Corvus enca	Resident	LC	LC	LC
Alophoixus frater	Endemic	Not recognized (IUCN 3.1)	LC	Vulnerable
Dicaeum pgymaeum	Endemic	LC	LC	LC
Dicrurus hottentotous	Resident	LC	LC	LC
Dicrurus leucophaeus	Resident	LC	LC	LC
Hypothymis azurea	Resident	LC	LC	LC
Pycnonotus atriceps	Resident	LC	LC	LC
Pycnonotus plumosus	Resident	LC	LC	LC
Macropygia tenuirostris	Endemic	LC	LC	LC
Monticola solitarius	Resident	LC	LC	LC
Motacilla flava	Resident	LC	LC	LC
Aethopyga shelleyi	Endemic	LC	LC	Vulnerable
Leptocoma sperata	Resident	LC	LC	LC
Orthotomus sericeus	Resident	LC	LC	LC
Parus amabilis	Endemic	Near Threatened	LC	Vulnerable
Pericrocotus cinnamomeus	Resident	Near Threatened	LC	LC
Phylloscopus borealis	Migratory	LC	LC	LC
Pitta sordida	Resident	LC	LC	LC
Prionochilus plateni	Endemic	LC	LC	Vulnerable
Pycnonotus plumosus	Resident	LC	LC	LC
Spilornis cheela palawanensis	Endemic	LC	LC	Endangered
Spizaetus cirrhatus	Resident	LC	LC	LC
Stachyris hypogrammica	Endemic	Near Threatened	LC	Vulnerable
Streptopelia chinensis	Resident	LC	LC	LC
Tersiphone cyanescens	Endemic	LC	LC	Vulnerable
Trichastoma cinereiceps	Endemic	LC	LC	LC

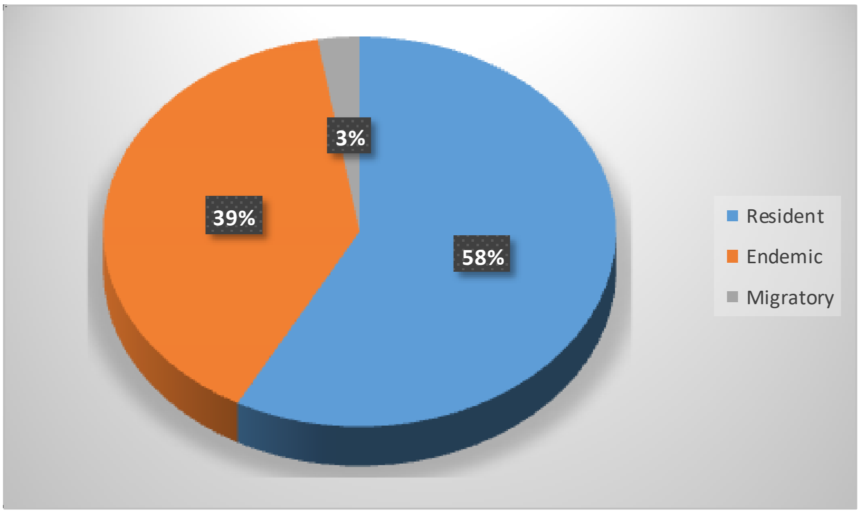


Figure 2.1.18. Percentage of bird species according to distribution

Figure 2.1.19 shows the percentage of species belonging to different conservation status, 89% are of Least Concern, 5% are Near Threatened and others are Vulnerable (2.63%) and Not Recognized by the IUCN (2.63%). The Palawan Hornbill, *Anthracoceros marchei*, is under the Vulnerable category. The species is easily affected by environmental changes and is considered uncommon in Palawan where the population has been found to be dwindling because of the destruction of its habitat. Despite the fact that there are very few canopy species left in the area, three (3) individuals were observed flying and perching in the tallest trees within the quarry area and on the hill/mountain where the Maginhawa and Inugon Caves are located. This is a site outside the quarry area within the MPSA, which is more or less left intact.

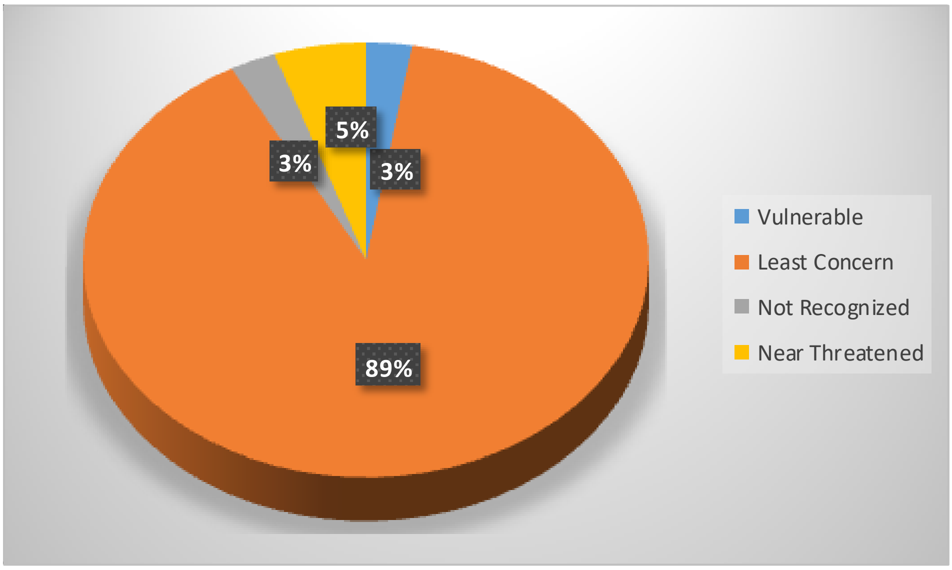


Figure 2.1.19. Species of birds belonging to different conservation status

Two species, *Pericrocotus cinnamomeus* (Small Minivet) and *Stachrys hypogrammica* (Striped Babbler) are given the Near Threatened category because the destruction of the habitat, in this case, forest clearing will cause the decrease of population and the eventual disappearance of these species from the area in the near future. The majority of the species are of Least Concern. One endemic species, *Alophoixus frater* (Palawan bulbul) has not been given any conservation category maybe because studies on the species' population, biology and ecology are inadequate.

Mammals

As shown in **Table 2.1.28**, most of the volant mammals inhabit agricultural areas, secondary forests and caves and feed in trees within and outside the roosting sites. Insectivores and some frugivores roost in caves but still feed in agricultural area and in forests.

All three (3) non-volant species are tree and forest dwellers specially *Macaca fascicularis*.

All of the species of mammals observed during this survey are common, abundant and widespread. Two species are endemic to Palawan, *Tupaia palawanensis* and *Sundasciurus steeri*.

Majority of the mammalian species are considered as species of Least Concern except for *M. fascicularis*, which is under the Near Threatened category because it is threatened by the destruction of its habitat and over extraction through hunting. It is also under CITES II, which means that trading of this species is regulated (maybe restricted).

Table 2.1.28. Habitat (and ecology) and conservation status of mammalian species observed in the survey states

Species	Habitat and Ecology	Conservation Status (including rarity)	DENR 2004-15	Palawan PCSDS No. 15-521
Eonycteris spelaea	roosts in caves and feeds in agricultural areas, 2nd forests	Common; LC	LC	LC
Macroglossus minimus	lives in banana plantations; common in secondary forests	Abundant and widespread; LC	LC	LC
Cynopterus brachyotis	abundant in disturbed lowland habitats	Abundant and widespread; LC	LC	LC
Hipposideros diadema	hollow trees, caves and man-made tunnels	Widespread and common; LC	LC	LC
Rousettus amplexicaudatus	agricultural and residential areas; roosts in caves	Locally abundant; stable ; LC	LC	LC
Rhinolopus virgo	roosts in caves, culverts and crevices; forests	Widespread and moderately common; endemic, LC	LC	LC
Megaderma spasma	roosts in caves	Widespread, locally common to uncommon in primary forests; LC	LC	LC
Embllonura alecto	lowland areas; disturbed forests and agricultural areas	Common; LC	LC	LC
Tupaia palawanensis	forests; agricultural areas, cashew and coconut plantations, brushy areas and logged-over areas	Common, Widespread and stable; endemic, LC	LC	Endangered
Macaca fascicularis philippensis	agricultural areas near forests, mangrove and swamp forests	Widespread in Asia; NT	other threatened species	Endangered
Sundasciurus steeri	lowland forest, coconut groves and banana plantations	Common and Stable in Southern Palawan; endemic, LC	LC	LC

Reptiles and Amphibians

Five of the species of herps observed and recorded during the survey are endemic to Palawan, three (3) are indigenous and one (1) species is introduced. Seven of the species are of Least Concern while one (1) is Near Threatened.

Table 2.1.29. Ecological and conservation status of reptiles and amphibians observed from the study sites

Species	Distribution/ Ecological Status	Conservation Status	DENR 2004-15	Palawan PCSDS No. 15-521
Hylarana moellendorfi	Endemic	NT	LC	LC
Hylarana nicobariensis	Indigenous	LC	LC	LC
Hoplobatrachus chinensis	Introduced	LC	LC	LC
Fejervarya cancrivora	Indigenous	LC	LC	LC
Ingerophrynus philippinicus	Endemic	LC	LC	Vulnerable
Chaperina fusca	Indigenous	LC	LC	LC
Luperosaurus palawanensis	Endemic	DD	LC	Vulnerable
Coelognathus eryhtrurus philippinus	Endemic	LC	LC	LC
Boiga dendrophila multicincta	Endemic	LC	LC	LC

A species of concern is the introduced species, *Hoplobatrachus chinensis* which is invasive and may cause the disappearance of endemic and indigenous species in the area because it is bigger and larger.

More than half of the species of herps are endemic (56%), 33% are indigenous while 11% is introduced.

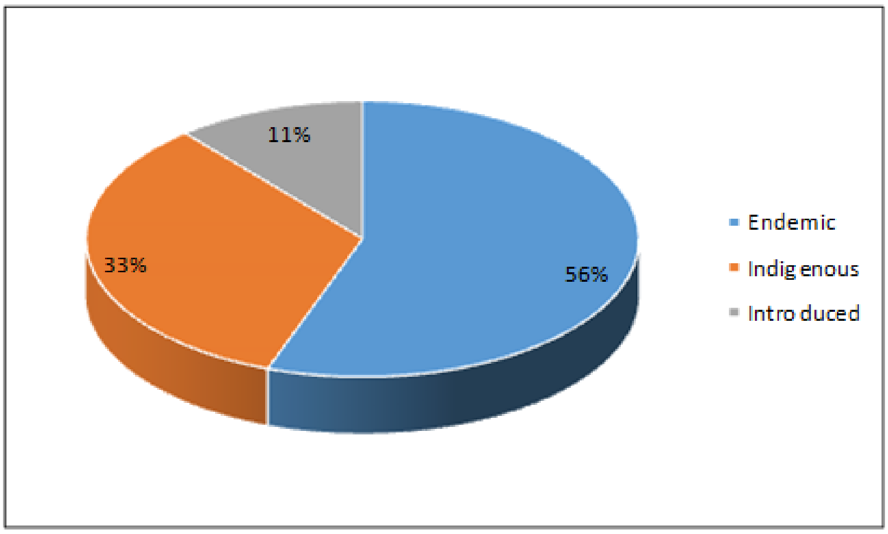


Figure 2.1.20. Percentage of species of herps according to distribution/ ecological status

Ecological parameters and diversity indices

Birds

Figure 2.1.21 shows the comparison of values of diversity indices of birds recorded at the project site. There were 109 individuals counted in Transect 1 followed by Transect 2 (51) and Transect 3 (50), respectively. Species diversity in all the survey sites was moderate with the highest value computed in Transect 1 (2.832), followed by Transect 3 (2.666) and Transect 2 (2.527).

Species richness was high (5.98) in Transect 1 while it is moderate in the two (2) other transects. Evenness was moderate in both Transects 2 and 3 but very low in Transect 1.

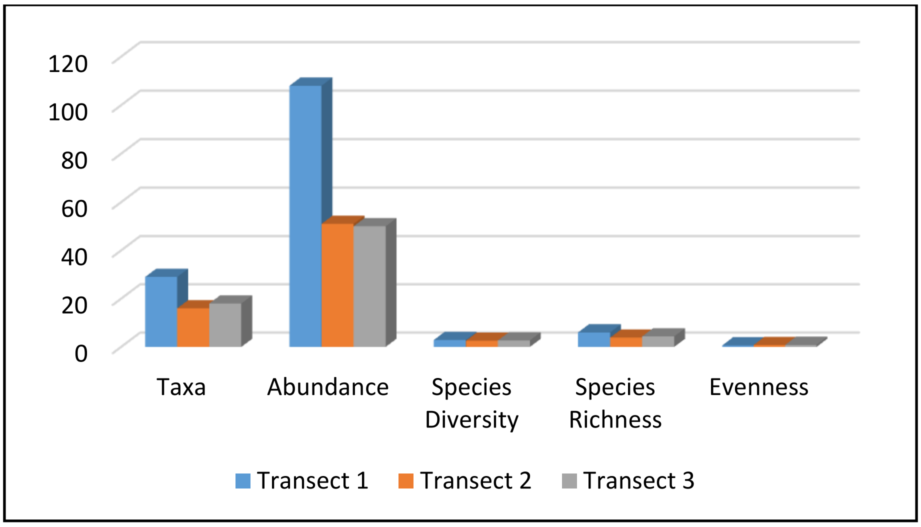


Figure 2.1.21. Comparison of diversity values of bird species observed and recorded from three (3) sampling sites.

Species diversity, richness and abundance were highest in Transect 1 (**Figure 2.1 22**). This may be because the vegetation was lusher in this site and is more diverse (grassland, secondary forest and agricultural crops and fruit trees).

Mammals

Comparison of diversity indices for mammalian species observed from three (3) transects is shown in **Figure 2.1.22**. It should be noted that there were more species in Transect 1 but Transect 3 had more individuals recorded at 78, followed by Transect 2 with 72 and Transect 1 with only 25. Species diversity and richness is very low in all the sites, evenness is moderate.

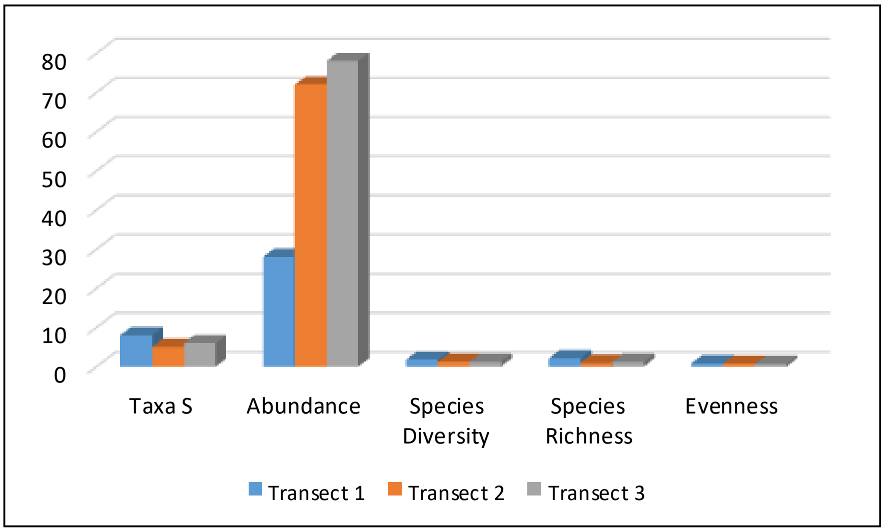


Figure 2.1.22. Comparison of diversity indices of mammals observed from the three (3) transects

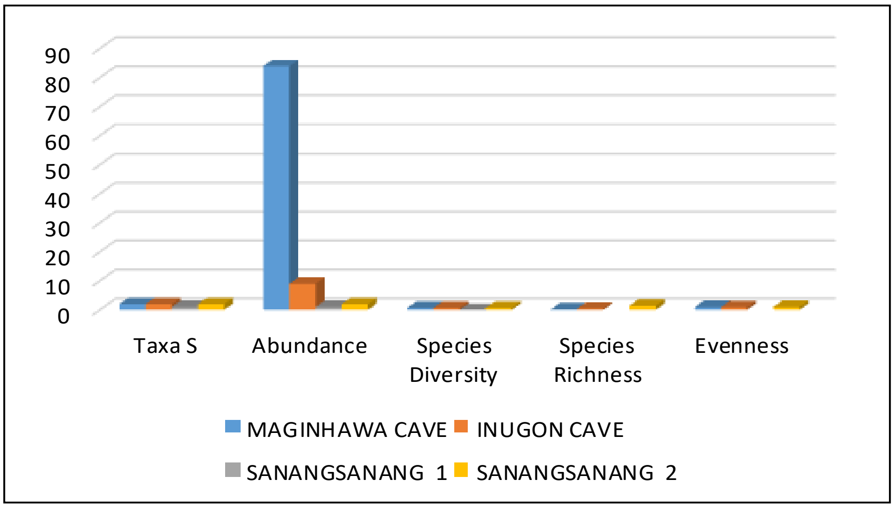


Figure 2.1.23. Comparison of diversity indices of Volant mammals recorded from caves

For volant mammals observed in the caves, the highest numbers of individuals were recorded from Maginhawa Cave, the largest and most intact cave among the four (4) assessed, while nine (9) individuals were caught in Inugon. The Sanangsanang caves were just “holes in the wall” types of caves which had very few individuals of bats present.

Species diversity is very low in all the caves assessed with Sanangsanang 1 having 0. Species richness is very low in Maginhawa while it is low in Sanangsanang 2. Evenness is very high in all the caves except in Sanangsanang 1 (**Figure 2.1.23**).

Herps

Even if Inugon Cave has the highest number of species it is only second in abundance. The most number of individuals were recorded from the Creek with 106 while the lowest number was recorded in Maginhawa Cave with only two (2) individuals, both reptiles, were recorded. Species diversity is very low in Maginhawa Cave and low in all the other sites. Species richness is very low in Transect 1 and in the Creek while it is low in both caves. Evenness is very high in Maginhawa and high in the three (3) other sites (**Figure 2.1.24**).

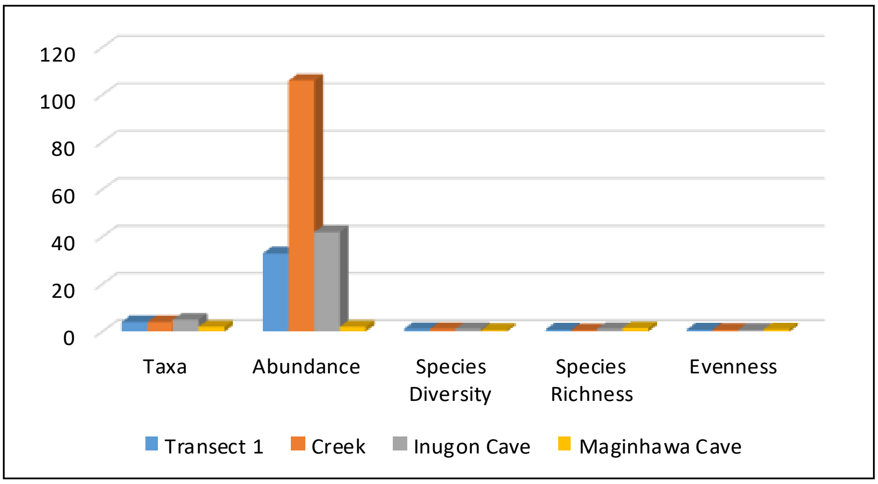


Figure 2.1.24. Comparison of diversity indices of herps recorded from four sites

2.1.4.3 Impact Assessment and Environmental Performance

Predicted Impacts

The following matrix summarizes the potential impacts that may be brought by the increased production of the quarry and modified crushing plant. Each impact was identified as to the period of possible occurrence, duration, likelihood of occurrence, and magnitude. Entries with asterisks are perceived to be not significant or negligible while italicized entries were perceived to be a positive impact of the project.

Table 2.1.30. Impacts assessment and mitigation for terrestrial biology

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
Threat to abundance and/or loss of important local flora and fauna species The impacts of the Gotok Limestone Quarry to the flora biodiversity will be the removal and loss of habitat, loss of important species, and threat to the abundance, frequency and distribution of important local species. These impacts will be concentrated on the area where		✓	✓		• Balling and transplanting of important and threatened plant species of appropriate size. When the balled plants recovered in the nursery they shall be used and transplanted in the buffer zones of the quarry area as well as in the reforestation areas of the company. • Propagation of threatened and ecologically important tree species that

tree cutting was applied for within the MPSA. The area where tree cutting was applied is approximately 10.6 hectares. Quarrying is one example of open-pit mining, which removes surface (and subsurface) materials wholly including vegetation. The felling of trees and the scraping off of ground vegetation will result to the destruction of habitats including roosting and feeding sites of terrestrial fauna, both vertebrates and invertebrates. The area with MPSA for the Gotok Limestone Quarry harbors mostly residents and endemic species of birds, mammals and herps. Removing the trees and the entire vegetation will mean the destruction of roosting and feeding sites which will eventually result to the gradual loss and/or disappearance of endemic species. The removal of the surface soil and original vegetation will most likely cause alien and invasive species of plants and animals to proliferate. Hence, during abandonment, these organisms will prevail and it is not certain if and when original flora and fauna will return. The loss of roosting, nesting and feeding sites brought about by the cutting of trees will lead to the decrease of the number of species and population of wild fauna specially those which are forest and tree dependents. Volant mammals will not be affected if the hill where Maginhawa and Inugon Caves are located will not be touched or disturbed. The creek at the western side (this is where the water flows underground), will eventually be covered with earth and soil because of erosion caused by quarrying. This will affect the habitats of amphibians (mostly frogs) in the area. The presence of *Hoplobatrachus rugulosus* in the pond in the farm beside the hill where the Maginhawa Cave poses danger to the endemic and indigenous species present in the area.					were found in the project area. This can be adopted as flagship species of RTNMC and will be incorporated as part of the strategy of the company in promoting biodiversity conservation.
Hindrance to access to wildlife The felling of trees and the clearing of vegetation will hinder the mobility of wildlife species specially tree and ground dwellers, fragmentation of habitats will occur. Monkeys were observed in Transect 1 and Transect 3 but not in Transect 2, which is in the middle of the two (2) sites. The animals were seldom seen in Transect 2 because there were very few fruiting trees in the area. The only access from Transect 1 to Transect 3 is through the trees. If these are cut, then foraging of monkeys is limited to the site in Transect 1. As for ground dwellers, the animals cannot move from one area to another without vegetation cover. They are in danger of dessication e.g. frogs and toads. Eventually, loss of access will result to loss of species. In the long run, alien or invasive species will proliferate and will prevail over native and endemics.					• Conduct of felling or cutting of trees by section to give time for the animals to adapt to a more suitable habitat.

Impact of the Existing Project to Flora

The project clearly had no effect to the forest beyond the boundary of the active limestone quarry. In 2001, the diversity index was 2.99 with 42 species recorded (**Table 2.1.32**). In 2014 more species were recorded and the diversity increased to 3.74. The forest beyond the boundary of the active limestone quarry had been maintained and protected. The impacts of limestone quarry operations concentrated on the area where tree cutting was applied for within the MPSA. The area where tree cutting was applied is approximately 10.6 hectares and now characterized as open-canopy species with *A. luzonensis* and *M. vitifolia* are the most dominant undergrowth species. Previously this area was characterized to be an agroforestry ecosystem with banana and pineapple as cash crops. Cogon was the dominant species then. Due to the limestone quarry operations, the species diversity decreased from 2.50 to 1.41 and the number of species found decreased as well from 44 to 19 species. In addition, most of the previous species were replaced and new pioneer species inhabited the exposed soil. This is understandable because species found in agroforestry ecosystem is closely similar with the forest ecosystem. Since the vegetation was removed due to the extraction of the limestone, habitat opening was created and pioneer species invaded it. Thus, changing the species composition of the open-canopy ecosystem.

Table 2.1.31. Diversity and species richness comparison of the 2001 and 2014 studies.

	2001	2014
Closed-canopy forest		
Shannon's Diversity Index	2.99	3.74
Species Richness	42	137
Open-canopy ecosystem		
Shannon's Diversity Index	2.50	1.41
Species Richness	44	19

Other impacts of the project such as dust generation and soil erosion may affect the biodiversity and physiological processes of the plants within the area. Dust generation will be caused by hauling of limestone, excavation and other ground works during the operation of the quarry. Dust settling over the leaves of the plants may affect the photosynthesis function of the plants. Soil erosion, on the other hand, will be prevalent during raining because of exposed soils due to the removal of vegetation, and excavation and other ground works. Soil particles due to soil erosion may clog the soil pores, thus, may lead to soil compaction, less soil moisture absorption and less aeration for the root system of the plants.

There were three endangered species mentioned in the 2001 assessment. The species were Ilang-ilang (*Canagna odorata*), Limuran (*Calamus ornatus*) and Pitcher plant (*Nepenthes* sp.). Ilang-ilang was found in the limestone quarry site, and Limuran and Pither plant were found in Water Impounding Dam in Ibelan. There was only one individual of Ilang-ilang recorded in Limestone Quarry Site 2. No detail about the abundance of Limuran and Pitcher plant was mentioned in the 2001 assessment. Probably, these two species were only listed as undergrowth species.

The current assessment was done only in the Gotok limestone quarry site. Thus, Limuran and Pitcher plant were not encountered during the assessment. In addition, no Ilang-ilang was found during the current assessment. This species is kind of difficult to find because of its relative inabundance in the site. But upon checking in the Philippine redlist, Ilang-ilang is no longer considered as endangered or threatened species.

Comparison of Species Documented in 2001 and 2014

Table 2.1.32 shows the comparison of bird species observed and recorded in 2001 and 2014. Twenty-two species of birds were documented in Gotok in 2001 when it was still undisturbed and its vegetation was still intact, compared to 38 species in 2014 when the Gotok Hills or mountains were almost completely flattened and devoid of its original vegetation. Twelve species or 50% of those present in 2001 were not documented in 2014. This may be a result of the loss of habitat of those species specially their roosting and feeding trees. On the other hand, only 9 species of those documented in 2014 were observed in 2001. This may be because of the differences in the sites surveyed and the types of habitat present during the survey periods.

Table 2.1.32. Comparison of bird species documented during the surveys conducted in 2001 and 2014 and the corresponding threatened category of each species according to the IUCN (2016), DENR (2015) and PCSD (2014).

Species	Survey Periods		Threatened Categories		
	2014	2001	IUCN	DENR	PCSD
Alophoixus frater	X		LC	LC	Vulnerable
Anthracoceros marchei	X		Vulnerable	Vulnerable	Endangered
Arachnothera longirostris	X		LC	LC	Vulnerable
Bubulcus ibis	X		LC	LC	LC
Butoroides striatus	X		LC	LC	LC
Cacomantis merulinus	X	X	LC	LC	LC
Caprimulgus macrurus	X		LC	LC	LC
Centropus bengalensis		X	LC	LC	LC
Centropus sinensis		X	LC	LC	LC
Chalcopaps indica	X		LC	LC	LC
Chloropsis palawanensis	X		LC	LC	Vulnerable
Cinnyris jugularis	X		LC	LC	LC
Collocalia fuciphaga	X		LC	LC	LC
Collocalia troglodytes	X		LC	LC	LC
Copsychus niger	X	X	LC	LC	Vulnerable
Corvus enca	X		LC	LC	LC
Dicaeum pgymaeum	X	X	LC	LC	LC
Dicrurus hottentotus	X		LC	LC	LC
Dicrurus leucophaeus	X	X	LC	LC	LC
Ducula aenea		X	LC	LC	LC
Eurystomus orientalis		X	LC	LC	LC
Haliaeetus leucogaster		X	LC	LC	Endangered
Haliastur indus		X	LC	LC	LC
Hypothymis azurea	X	X	LC	LC	LC
Lalage nigra		X	LC	LC	LC
Macropygia tenuirostris	X		LC	LC	LC
Monticola solitarius	X		LC	LC	LC
Motacilla flava	X		LC	LC	LC
Nectarinia shelleyi	X		LC	LC	Vulnerable
Nectarinia sperata	X		LC	LC	LC
Oriolus chinensis		X	LC	LC	LC
Orthotomus sericeus	X	X	LC	LC	LC
Pachycephala grisola		X	LC	LC	LC
Parus amabilis	X		Near Threatened	LC	Vulnerable
Pericrocotus cinnamomeus	X		Near Threatened	LC	LC
Phaenicophaeus curvirostris		X	LC	LC	LC
Phylloscopus borealis	X		LC	LC	LC
Pitta sordida	X	X	LC	LC	LC
Prionochilus plateni	X	X	LC	LC	Vulnerable
Pycnonotus atriceps	X	X	LC	LC	LC
Pycnonotus plumosus	X	X	LC	LC	LC
Rhipidura javanica	X	X	LC	LC	LC

Species	Survey Periods		Threatened Categories		
	2014	2001	IUCN	DENR	PCSD
Spilornis cheela palawanensis	X		LC	LC	Endangered
Spizaetus cirrhatus	X		LC	LC	Endangered
Stachyris hypogrammica	X		Near Threatened	LC	Vulnerable
Streptopelia chinensis	X		LC	LC	LC
Tersiphone cyanescens	X		LC	LC	Vulnerable
Trichastoma cinereiceps	X		LC	LC	Vulnerable
Turnix suscitator		X	LC	LC	LC

According to the IUCN and DENR threatened categories of birds, all of the species of birds documented in 2001 are of Least Concern, while in the PCSD list: one (1) species is Endangered, 11 are Vunerable and 19 are of Least Concern. It should be noted that the PCSD placed endemic species of wild fauna in Palawan under the different threatened categories (Critically Endangered, Endangered and Vulnerable). The reason for this maybe because the PCSD wants to protect the endemic and rare species in the province.

Of the 38 species of birds recorded in 2014, one species is deemed threatened by all three (3) listings (IUCN, DENR and PCSD), *Anthracoceros marchei* Palawan Hornbill. It is listed as Vulnerable by both IUCN and DENR while the PCSD placed it under the Endangered category which means that its population is rapidly decreasing in its range. Three (3) species are deemed Near Threatened by IUCN the rest (35) are of Least Concern. As for DENR, 37 species are of Least Concern. In the PCSD list, three (3) species are Endangered while another 10 are Vulnerable and the rest are of Least Concern.

The list of species of mammals documented in 2001 and 2017 is presented in **Table 2.1.33**. Eleven species were observed and recorded in 2014 compared to 2001 with only 6. Two of the 6 species recorded in 2001 were not observed in 2014. Eight of the species recorded in 2014 are volant species of mammals compared to only 2 in 2001. . There were 4 species of non-volant mammals documented in 2001 and three in 2014. This may be because surveys were done in caves in 2014 where most of the volant mammals were documented while in 2001, the survey was done in forested areas.

Table 2.1.33. Species of mammals documented during the terrestrial vertebrate surveys conducted in 2001 and 2014.

Species	Survey Periods		Threatened Categories		
	2014	2001	IUCN	DENR	PCSD
Eonycteris spelaean	X		LC	LC	LC
Macroglossus minimus	X	X	LC	LC	LC
Cynopterus brachyotis	X		LC	LC	LC
Hipposideros diadema	X		LC	LC	LC
Rousettus amplexicaudatus	X		LC	LC	LC
Rhinolopus virgo	X		LC	LC	LC
Megaderma spasma	X	X	LC	LC	LC
Tupaia palawanensis	X		LC	Vulnerable	Endangered
Macaca fascicularis	X	X	LC	LC/CITESII	Endangered
Sundasciurus steeri	X	X	LC	LC	Vulnerable
Emballonura alecto	X		LC	LC	LC
Hylopetes nigripes		X	Near Threatened	LC	Vulnerable
Rattus tanezumi		X	LC	LC	LC

It is shown in **Table 2.1.33** that most of the species documented in 2001 and 2014 are of Least Concern under the IUCN, even the Long-tailed Macaque *Macaca fascicularis*, which is in Appendix 2 of CITES, trade of the species is regulated. However, one species, Palawan Flying Squirrel *Hylopetes nigripes* is listed under Near Threatened because its population is dwindling because of the destruction of its habitat. Under the DENR List of Threatened Species, only the Palawan Treeshrew *Tupaia palawanensis* is under the Vulnerable category and the rest are listed as Least Concern.

In the Palawan list of threatened terrestrial vertebrate fauna, two (2) of the species documented are deemed Endangered, Tuapia palawanensis and Macaca fascicularis while the Southern Palawan Tree Squirrel *Sundasciurus steeri* and *Hylopetes nigripes* are categorized as Vulnerable. All of the aforementioned species are tree and forest dependents. This means that any destruction or conversion of their habitats will affect the population of these wildlife species.

As for species of herpetofauna (amphibians and reptiles), those documented in 2001 were not observed in 2014 and cannot be compared.

Performance Assessment

Earth Balling of Extant Trees and Other Import Vegetative Cover Species within Gotok Quarry Site

Shown in **Table 2.1.35** is the distribution of planting materials that were recovered and re-conditioned at the Earth Balling Recovery Facility of the Gotok Quarry Site, in 2013.

Table 2.1.34. Distribution of earth-balled planting materials maintained at the Earth-balling Recovery Facility at the Gotok Quarry Site

Potting Size	Number of Materials Produced/ Basal Diameter Class	Location of Out-Planting Site	Number of Materials Outplanted	Year Outplanted	% Survival Rate
1-Tonner Bags	76 (>15cm<20cm)	Gotok Quarry vicinity	76	2014	10
Half-fuel drums	65 (>10cm<15cm)	GP-7	65	2014	70
Half-stoopers	50 (Saplings)	GP-4 GP-7	25 25	2014 2014	60 40
4"X6" Black Polyethylene Bags	11,000 (Wildlings)	GP-7 GP-4 Bohoy Road GK Tagpisa	2,000 1,000 4,000 4,000	2013 2013 2013 2013	10 15 0 0

The materials grown, re-conditioned and maintained in 1-tonner bags, were eventually outplanted within the vicinity of the Gotok Quarry site in the 2014 planting period. Out of the 76 materials, only seven (7) had survived by September 2015, with a survival rate of only 9%.

On the other hand, those grown in half-fuel drums were outplanted at GP-7 in 2014, of which 70% survived by 2015.

For the 50 recovered saplings that were conditioned in half-stoopers, half (25 materials) were outplanted at GP-4 in 2014 with a 60% survival rate by 2015 while the other half were outplanted simultaneously at GP-7 in 2014 with a 40% survival rate by 2015.
Of the 11,000 wildlings reconditioned in 4"x6" black polyethylene bags, all were simultaneously outplanted in 2014 at GP-7 (2,000) with 10% survival; GP-4 (1,000) with 15% survival; Bohoy Road (4,000) with 0% survival due to forest fire; and, GK Tagpisa (4,000) with 0% survival due to forest fire.

Status of Mine Rehabilitation Activities

Progressive Rehabilitation and Accomplishments

Slope stabilization of the mined-out portions of the quarry site has been initiated to comply with the company's commitments on the practice of progressive mine rehabilitation. A composite area of 1.84 hectares has been planted using assorted endemic and indigenous forest tree species and vetiver grass. The former utilizes large planting materials, averaging 2-4 meters in height that has been grown and maintained at the RTNMC Seedling Bank Project Site for 24-36 months. **Table 2.1.36** shows the breakdown of the forest tree species used.

Table 2.1.35. Forest tree species used in the mine rehabilitation program of RTNMC

Species	No. of Seedlings Planted
Narra	560
Calumpang	58
Ipil	113
Kupang	72
Agoho	15
Tibig	5
Amugis	41
Unidentified Native Species	48
Total	**912**

Meanwhile, bare bench walls will be planted with suitable grass/plant. Coconet, whenever applicable, will be used, together with fast-growing species, including creeping vines, to hasten the greening of the quarry walls for aesthetic purpose as well as to mitigate soil erosion.

Mine Rehabilitation Activities

About 1.84 hectares of mined-out portions of the quarry area were completely rehabilitated. As part of the rehabilitation activities, RTNMC has planted a total of 496 seedlings of endemic and indigenous forest tree species and vetiver seedlings. **Table 2.1.37** shows the rehabilitation schedule of Gotok Limestone Quarry project (**Figure 2.1.25**).

Table 2.1.36. Gotok Limestone Quarry Rehabilitation Plan

Year	Rehabilitation Area (hectares)	Cumulative Total (hectares)
2015	0.80	1.84
2016	0.46	2.30
2017	0.42	2.72
2018	0.46	3.18
2019	0.44	3.62
2020	0.41	4.03
2021	5.98	10.01
2022	2.99	13.00
TOTAL	**11.96**	**-**

Note: Actual Rehabilitated area from 2011-2015 is 1.84 hectares

projects of RTNMC

Botanical and Herbal Garden

The Botanical Garden was set up on a 1.5-hectare land within the RTNMC Townsite in August 2005 to provide both in-situ and ex-situ gene pool preservation consistent with the 1992 UN Convention on Biological Diversity (CBD). This contributes to scientific research and knowledge on biodiversity management and conservation of mining impact areas, specifically the southern part of Palawan. The garden served as an educational facility that visitors and residents can visit and use for training purposes. A total of 2,767 seedlings had been planted as of December 31, 2007. To date, the garden has 3,599 trees documented.

Seeding Bank

A seedling bank was set up by RTNMC and CBNC to guarantee the propagation of indigenous forest trees that are being used to rehabilitate mined-out areas of RTNMC. The Seedling Bank Project handles the seed collection, propagation and seedling production of indigenous species of forest trees found within the mining impact areas. This is one alternative livelihood activity initiated for IPs. Some of the activities that have been done include:

- Plant nursery for Apitong, Narra, Kupang, Ipil, Kalumpang, Udling, Tongkat-ali, Mahogany, Auri, Mangium and cover crop species including Autralian peanuts and Vetiver;
- Collection of Rattan (*Calamus merrilli*) seeds;
- Collection of tubers of Native Yams (Tabia and Kadut) belonging to Family Dioscoreaceae;
- Germinated seeds of the above tree species and initiated seedling production; and
- Research on the tabu fruit, a native species, probably endemic to southern Palawan.

Clonal Laboratory

Established in August 2005, the Clonal Laboratory Facility was set up to ensure that endemic, endangered and ecologically significant tree and plant species within the MPSA are preserved for future propagation and planting stock production of indigenous plant species within the Gotok Quarry and the RTNMC mining area.

Among the activities relative to the development of the clonal laboratory include the collection of cuttings from RTNMC mining areas, preparation of clonal cuttings and setting up of clonal chambers.

Green Philippine Highways (GHP) Project

In support with the nationwide program of the DENR in planting only endemic/indigenous species, RTNMC and CBNC have planted about 8,289 seedlings as of December 2012. Areas that were adopted include the Macadam Road, Sumbiling Road, and airport junction to Tagpisa. Amugis, Ipil, Narra, Palawan cherry, Udling, and Agoho are the species being planted.

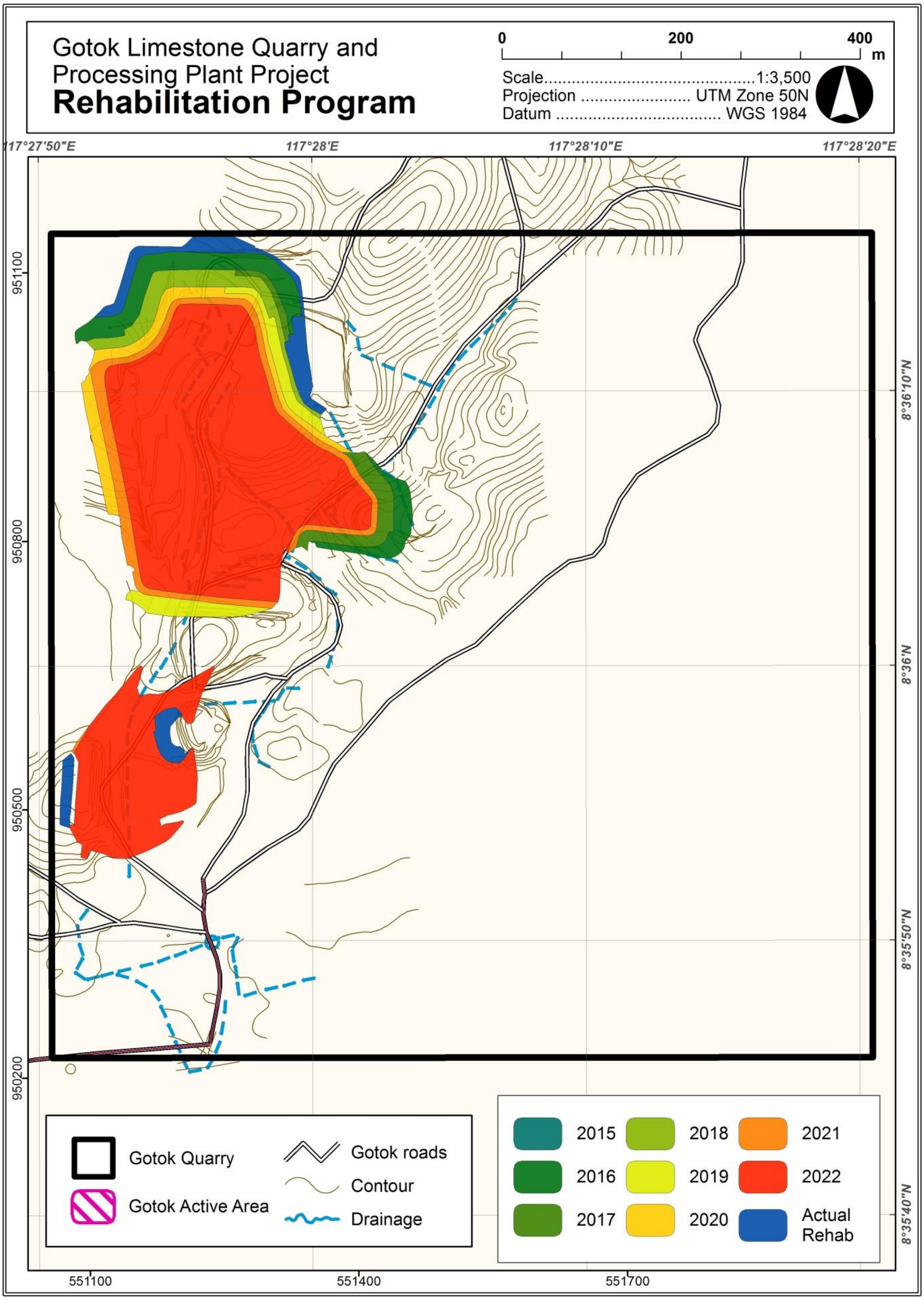


Figure 2.1.25. Current rehabilitation program schedule for the Gotok Limestone Quarry

Post-Mining Ecosystems Restoration Laboratory

As part of the Research and Development (R&D) efforts, the Post-Mining Ecosystems Restoration Laboratory was established at GP-4. This project has been implemented by RTNMC-CBNC, MGB Region IV-B MIMAROPA, ERDS Region IVB MIMAROPA, PENRO Palawan, CENRO Brooke's Point, and PCSDS. Among the project's accomplishment include installation of rain gauge and thermometers for basic meteorological data collection. This project also aims towards the conservation of biodiversity, generation of livelihood and life support systems for upland farmers, presentation of cultural heritage of indigenous people and research and development. Photo-documentation of the progress in rehabilitation activities is attached as **Annex 2.1.11**.

The current efforts of RTNMC in enhancing its programs on progressive rehabilitation of mined-out and denuded non-mineralized areas marked an exceptional labor in sustaining environmental management practices within the areas of RTNMC as one of the conditionalities of the ECC, a mandate of the Philippine Mining Law, and as part of the Corporate Social Responsibility (CSR) of the company.

The tree planting activities of RTNMC including the mangroves require the involvement of Indigenous Peoples (IP) therefore providing additional employment to them and encourages local participation in environment protection.

To rehabilitate the "stripped off" mining area, the Agro/Aqua-Forestry Farming Systems or "*Sakahan/Gulayan sa Minahan*" was established in a mined-out region within their claim. This is an ecosystem wherein a fishpond, nursery, ricefield, agricultural crops and other forestry farming systems are incorporated including silvicultural practices. RTNMC has also developed their strategies in mining rehabilitation such as use of large planting materials to guarantee high rate of survival and use of endemic and indigenous plant species (20-25 species) as shown in **Plates 2.1.6** and **2.1.7**.

It is also important to note the on-going RTNMC Research and Development Project, which includes recolonization of native floral and faunal species in rehabilitated totally mined-out areas and growth development of introduced plant species for the rehabilitation of totally mined-out areas.

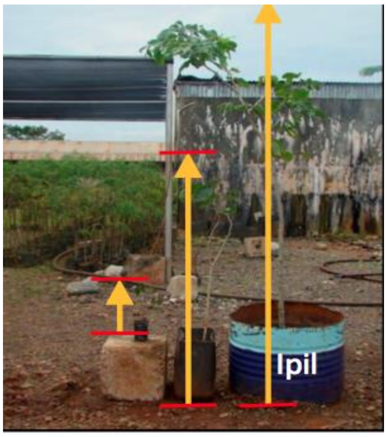


Plate 2.1.6. Use of large planting stock

Plate 2.1.7. Use of indigenous/endemic species

Maintenance of the Bufferzone

In compliance with Conditionality No. 4 of the ECC, a 40-m bufferzone was delineated along the periphery of the quarry area (13-ha ECC approved area). This area is excluded from any quarry activities and the vegetation within are being maintained.

To show the status of the vegetation within the bufferzone as of January 25, 2018, a collage of pictures is presented in **Figure 2.1.26**.

For the preservation and maintenance of the caves, bufferzones were also established around the seven (7) identified caves within the MPSA as seen in **Plates 2.1.8 and 2.1.9**. Within the marked bufferzone, activities such as tree cutting and operation of heavy equipment are prohibited. In addition, during operation controlled blasting techniques such as line drilling and pre-splitting are being utilized by RTNMC. These techniques aim to control ground vibrations and overbreak as well as reduce the impacts from the primary blast.

Plate 2.1.8. Signange of the Gray Cave

Plate 2.1.9. Vegetation around Gray Cave

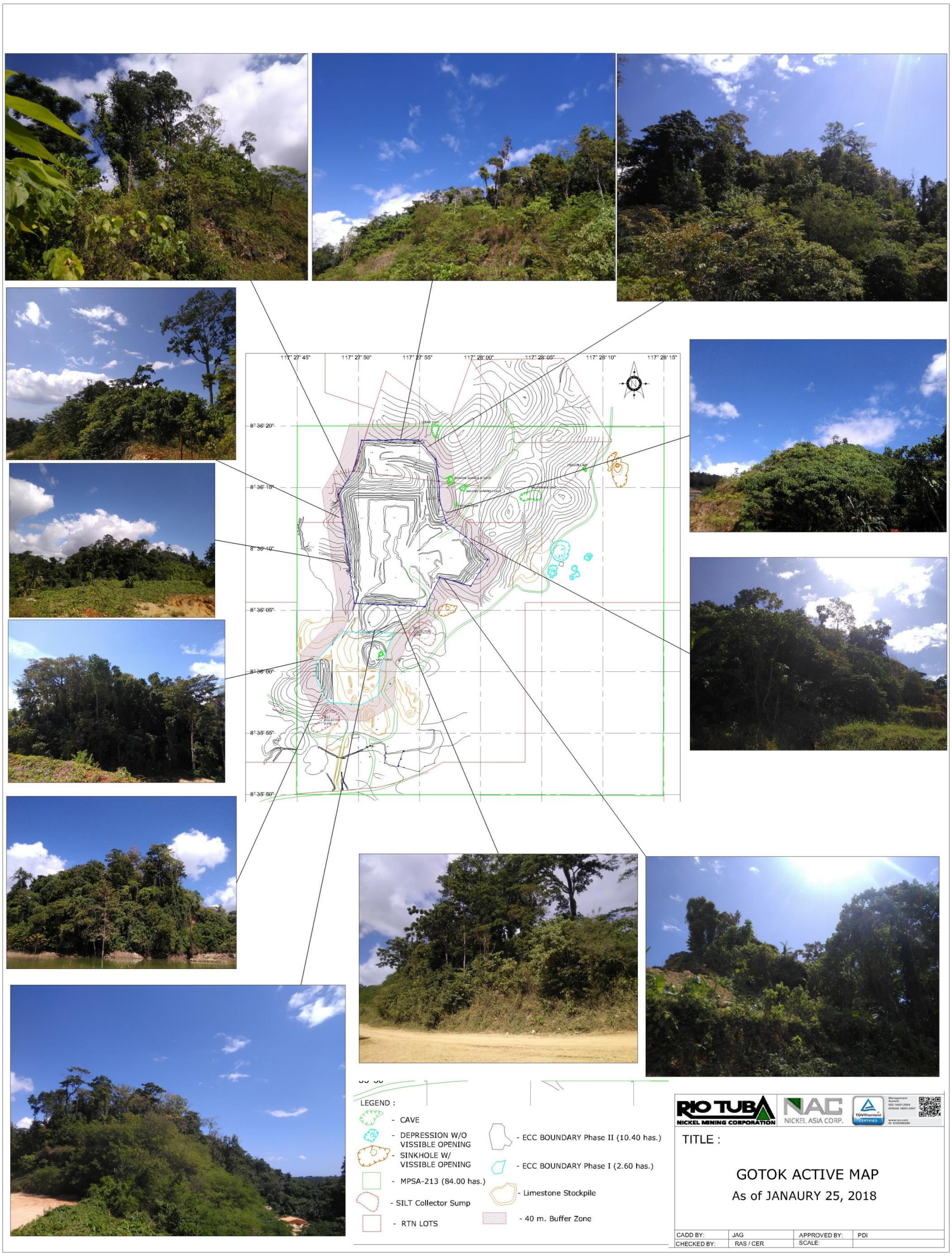


Figure 2.1.26. Status of the bufferzone along the perimeter of the quarry area

2.2 THE WATER

This section includes baseline and impact assessment for the hydrology and hydrogeology, water quality, and freshwater ecology. Sampling procedures in the conduct of the baseline data are outlined in **Annex 2.1.1**.

2.2.1 Hydrology and Hydrogeology

2.2.1.1 Methodology

The hydrology and hydrogeological assessment of the project was based on available secondary data on the geological and climatological properties of the area. Existing data on the surface water and groundwater resources were also used and were validated as part of the field assessment conducted last May 26-30, 2014.

Water source inventory within the vicinity of the project area was conducted which includes onsite measurements of electrical conductivity and pH.

Flood Modelling

Traditionally, flood simulation is conducted for a target watershed through a combination of hydrologic model to determine the flood hydrographs, which are then fed into a hydraulic model to compute the water surface profiles, flow velocity and related parameters.

For this study, flooding conditions of the watershed where the proposed Gotok expansion project of RTNMC in Bataraza, Palawan is developed using direct rainfall method (DRM) approach, which is often used as an alternative to catchment-based, 1D hydrological modeling. Instead of applying the inflows derived from rainfall using a separate hydrological model, the direct rainfall method (DRM) for flood modeling involves the application of rainfall to all cells in a two-dimensional (2D) model, and runoff is routed within the hydraulic model. This allows rainfall to be placed directly over the topography described in the computational domain wherein each grid/ mesh cell is effectively a catchment. 2D refers to the hydraulic modelling where the floodplain is modelled using 2 dimensional methods. Using a grid of topography data the model will estimate not only how high and how fast water will flow but will also calculate the direction of flow across the 2D grid.

The model consists of a short-term storm event simulation module for flooding by overflow from river and deals with the flash flood event with a time scale within a couple of hours to one (1) day.

Areal Coverage of the Flood Model

The sub-basins covered by the river network are delineated for use in the rainfall-on-the-mess flood modeling taking into consideration the location of the Gotok quarry development. The sub-basins were delineated using GIS and are based on freely available 30 m digital elevation model (DEM) for Bataraza, Palawan and its various river systems surrounding the project area, the result of which is shown in **Figure 2.2.1**.

Hydrodynamic Model

Hydraulically, the river systems surrounding the Gotok quarry area are within the sub-basins denoted in the map as WS-3 and WS-4 eventually converge to the Ocayan River. The interconnected network of rivers and creeks upstream are partly affected by tidal fluctuations due to its connection to the open sea. Broadly speaking, channel flows are easier to model accurately with a 1D hydraulic network model (e.g. based on the 1D St-Venant Equations), while 2D models are better suited to modelling overland flows (e.g. based on the 2D shallow water equations).

For this purpose, a free and open source software called ANUGA, developed by Roberts and collaborators from the Australian National University (ANU) and Geoscience Australia (GA), is used. It is devoted to fluid flow simulations, especially shallow water flows, such as floods, tsunamis and dam breaks. The method implemented in ANUGA is a numerical finite volume method used to solve the shallow water equations. Some mathematical explanation of the method is given in the ANUGA User Manual (Roberts, et al, 2010). In two dimensions, the domain is discretised into finite number of triangular elements. ANUGA then evolves the conserved quantities (water depth and momenta) with respect to time to obtain the numerical solution to a given problem.

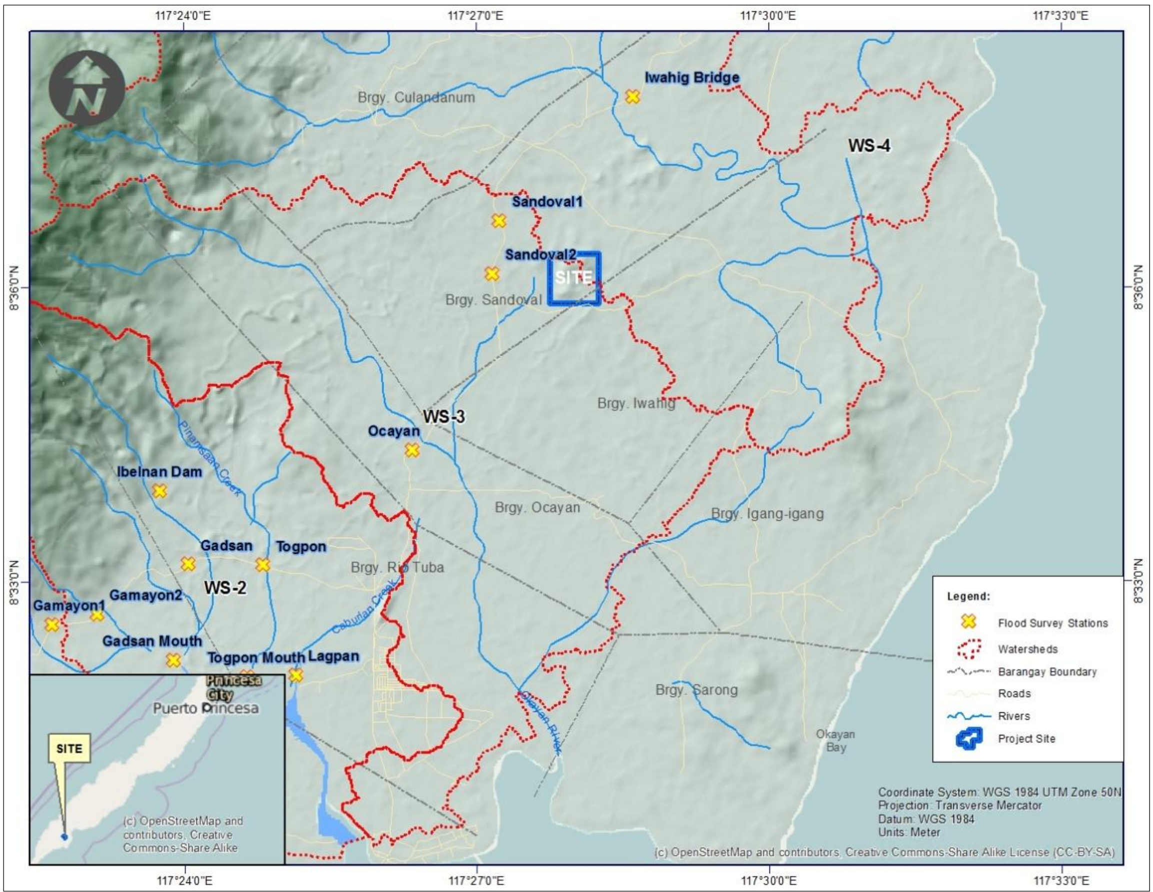


Figure 2.2.1. Polygons outlined in red represent the extent of each sub-basin used for flood simulations

2.2.1.2 Findings and Discussions

Hydrology

Climate

The southeastern section of Palawan including Bataraza Municipality where the Gotok Limestone project lies experiences a Type III climate based on the Modified Coronas Climate Classification Scheme of the Philippine Atmospheric, Geophysical, Astronomical Services Administration (PAGASA, 1992). A long rainy season that does not have a pronounced maximum rain period and a short dry season lasting only 1 to 3 months distinguishes this climate type.

Areas that have a Type III climate are exposed to the Southwest Monsoon and tropical cyclones but are partly shielded from the Northeast Monsoon. The Southwest Monsoon or wind is cloudy, hot, humid and wet (Williams et al., 1993), and is responsible for the high amount of rain that falls from May to November in the country.

The Northeast Monsoon blows from November to March and is a cloudy to partly cloudy and less humid wind than the Southwest Monsoon (Williams et al., 1993). It moves toward the country from the northeast. As it passes through eastern section of the country, it cools and loses much of the moisture through orographic precipitation and is essentially dry by the time it reaches the central and western sections of the country including the southeastern portion of Palawan.

The North Pacific Trades or Easterlies then dominate in the area from April to early May (Williams et al., 1993). This extremely warm wind current approaches the country from the east and is responsible for the hot weather during this period.

Tropical cyclones originate in the Pacific Ocean and move in a northwesterly direction towards the country. These bring additional rain to the area. The tropical cyclone frequency map of PAGASA (1992) indicates that the entire Palawan Island endures an average of one (1) tropical cyclone per year.

Rainfall

RTNMC has three (3) rainfall stations in Rio Tuba that have been in operation since the early eighties. These stations are located at the Guintalunan, Mangingidong and Piersite areas in Bgy. Rio Tuba, Bataraza. The Guintalunan and Mangingidong stations are closest to the Gotok Hill and almost equally represent the amount of rainfall that falls on the catchment areas covering Gotok Hill based on the Thiessen Polygon Method. **Table 2.2.1** lists the average monthly and annual rainfall in the Gotok area as derived from the rainfall averages from these two (2) stations in the last 20 years while **Figure 2.2.2** graphically depicts the monthly rainfall trend.

Table 2.2.1 and **Figure 2.2.1** reveal that the area receives an average rainfall of 2,503 mm per year. The rainy season begins at April and lasts up to January with the average monthly rainfall exceeding 140 mm and peaking at 340 mm in October. February and March constitute the dry season with the average monthly rainfall averaging 70 mm.

Table 2.2.1. Average monthly and annual rainfall

Period	Rainfall (mm)
January	161.9
February	64.9
March	74.2
April	142.4
May	207.4
June	293.1
July	264.6
August	271.4
September	317.4
October	340.0
November	198.0
December	167.8
Annual	2,503.3

Source: 1997-2013 Data of RTNMC Guintalunan and Mangingidong Rainfall Stations

Table 2.2.2 lists the minimum, maximum and mean monthly temperature culled from the weather data of RTNMC and CBNC in the last 20 years. The table indicates that the area is generally warm, experiencing an average annual temperature of 27.1ºC. The hottest period occurs on April and May where the average monthly temperature rises to more than 28ºC. The coldest month is January, which has an average temperature of 26.4ºC.

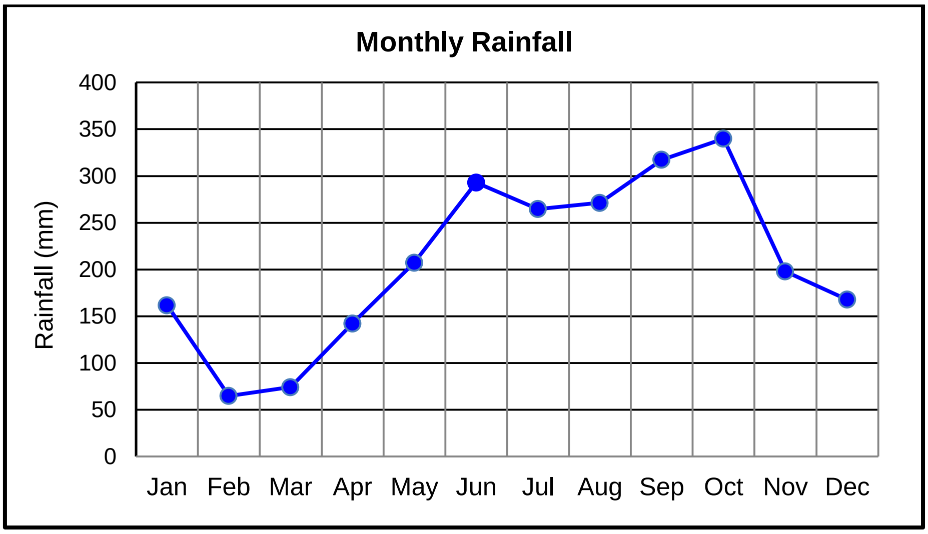


Figure 2.2.2. Monthly rainfall trend stock (*Source: 1994-2013 Data of RTNMC Guintalunan and Mangingidong Rainfall Stations)*

Table 2.2.2. Minimum, maximum and mean temperature

Month	Temperature (^{0}C)		
	Minimum Temp. (^{o}C)	Maximum Temp. (^{o}C)	Mean Temp. (^{o}C)
January	22.5	29.0	26.4
February	22.5	30.3	27.0
March	23.2	30.8	27.6
April	24.0	31.9	28.3
May	24.3	31.4	28.2
June	23.5	31.0	27.2
July	23.1	30.5	26.8
August	23.3	30.0	27.0
September	23.0	29.9	26.8
October	23.1	29.9	26.8
November	23.2	30.4	27.0
December	23.0	29.5	26.7
Annual	**23.2**	**30.4**	**27.1**

Source: 1994-2013 temperature data of RTNMC and CBNC

Evapotranspiration

Evapotranspiration is the amount of water released to the atmosphere by evaporation from the soil and surface-water bodies and by plant transpiration. Potential evapotranspiration (PET) is the evapotranspiration that would occur if sufficient water is always available while actual evapotranspiration (AET) is evapotranspiration that occurs based on the actual amount of water that is available.

The monthly PET in the Gotok area was computed from the RTNMC and CBNC weather data using the FAO Penman-Monteith Method (Allen, et al, 1998). This method expresses the evaporating power of the atmosphere at a specific location and time of the year and requires readily available weather data such as temperature, humidity, wind speed and air pressure. The monthly AET values were then estimated from the PET values using the Turc-Pike Equation (Xu, C.Y and Singh, V.P., 2004). **Table 2.2.3** summarizes the derived monthly and annual PET and AET values.

Table 2.2.3. Monthly and annual PET and AET

Period	PET (mm/mo)	AET (mm/mo)
January	136	104
February	151	60
March	180	69
April	165	108
May	146	119
June	132	120
July	124	112
August	121	110
September	114	107
October	133	124
November	135	112
December	136	106
Annual	1,674	1,251

Table 2.2.3 reveals that the AET in the area does not vary widely throughout the year. The AET is high from May to November where it averages 115 mm per month, peaking at June and October at 120 mm and 124 mm, respectively. It begins to drop thereafter and attains its lowest in the months of February and March where it averages 64 mm per month. The annual estimated AET in the area is 1,251 mm, which constitutes 49.9% of the rainfall.

Drainage Systems

The Gotok limestone hill rests along a northwest trending topographic divide. Its northeastern and southwestern sections lie within the catchment areas of Iwahig and Ocayan Rivers, respectively. The Gotok Limestone Quarry lies at the southwestern section of the limestone hill and is drained by an intermittent tributary of the Ocayan River.

The headwaters of the Iwahig River originate at the eastern flank of Bulanjao Range and flow in a general east direction to coalesce into a main channel upon reaching the base of the mountain range. Northeast-flowing intermittent tributaries drain the northeastern section of the Gotok limestone hill towards Iwahig River. The main trunk of the Iwahig River meanders southwest and empties at San Antonio Bay of Sulu Sea.

South-flowing intermittent tributaries of the Ocayan River drain the southwestern section of the Gotok limestone hill. This river spans a catchment area of 8,746 hectares. Its headwaters originate at the eastern flank of Bulanjao Range and flow in an east-southeast direction. Upon reaching the area south of the limestone hill, these tributaries shift southward to ultimately empty at Ocayan Bay of Sulu Sea.

The tributaries at the middle and upper sections of the Ocayan River system are ephemeral. These include those that drain the vicinity of the limestone hill. They exhibit sustained flow only during and shortly after heavy rains. Meanwhile, estuarine conditions exist at the lower section of the river near its mouth.

Figure 2.2.3 displays the extent of the Ocayan River watershed.

Annual Stream Flow

Actual stream discharge records do not exist for the Ocayan River or any other river in Palawan. The former National Water Resources Council (NWRC) has however estimated the annual dependable stream discharge for many rivers in Palawan including Ocayan River based on their respective drainage areas (NWRC, 1983). They estimated Ocayan River to have an annual dependable stream discharge of 91 million cubic meters (MCM).

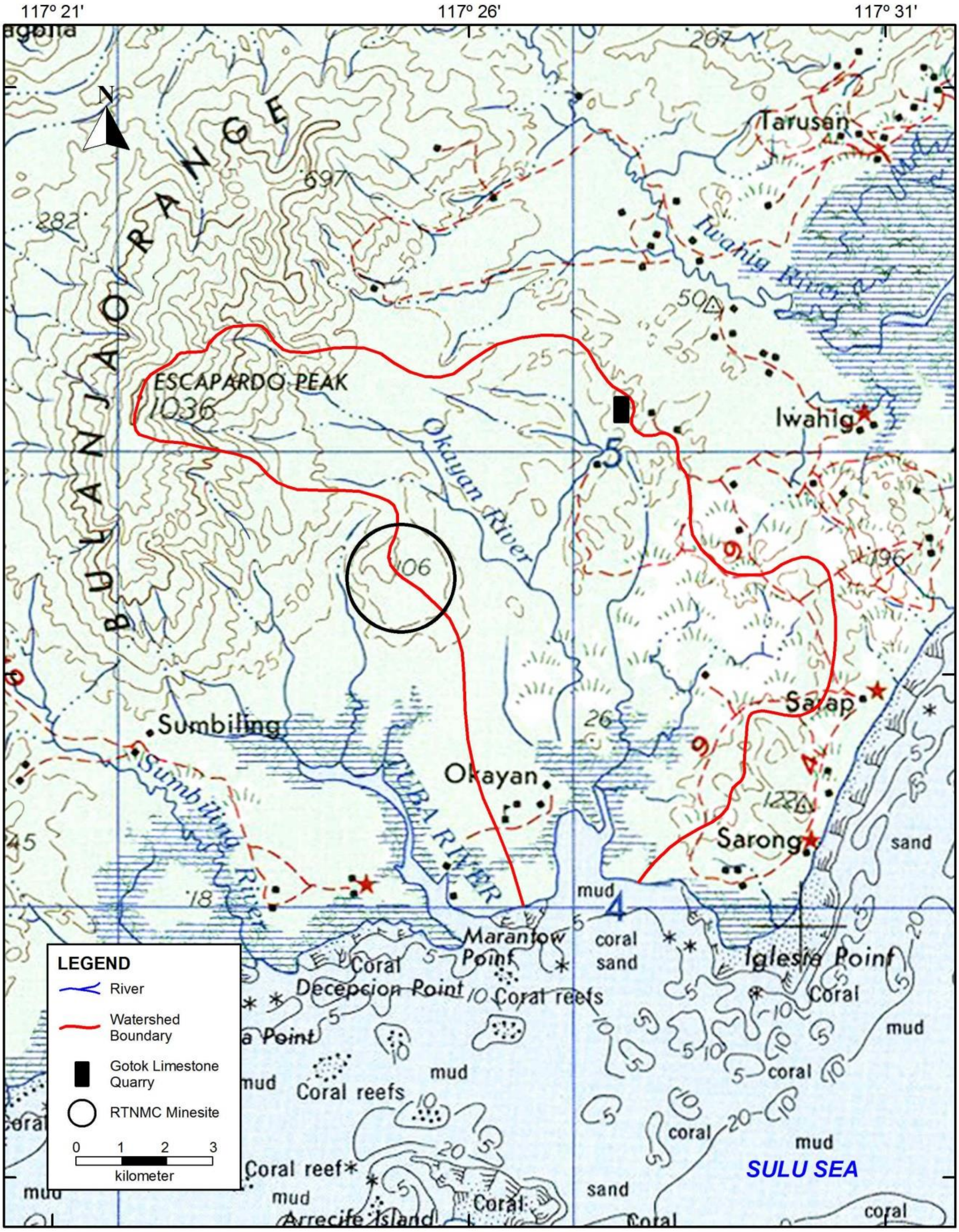


Figure 2.2.3. Drainage and watershed

Annual Water Balance

The annual water balance for the Ocayan River watershed was computed using the Long-Term Water Balance Method (Sokolov & Chapman, 1974). This method is expressed by the equation P = AET – Q – GR, where P, AET, Q and GR represent rainfall, actual evapotranspiration, stream discharge and groundwater recharge, respectively.

The annual rainfall and actual evapotranspiration values presented as depth in *Sections 2.2.1.2* and *2.2.1.4* were multiplied by the catchment area of the Ocayan River to convert them to volume. On the other hand, the annual stream discharge of the Ocayan River is already presented as volume in *Section 2.2.1.6*. The groundwater recharge (GR) is then determined from the equation. **Table 2.2.4** summarizes the annual water balance of the Ocayan River watershed.

Table 2.2.4. Water balance summary of Ocayan River Watershed

Parameter	Amount (MCM/year)	% of P
Rainfall (P)	218.94	-
Actual Evapotranspiration (AET)	109.41	50
Stream Discharge (Q)	91.00	42
Groundwater Recharge (GR)	18.53	8

Table 2.2.4 shows that the annual rainfall, evapotranspiration, stream discharge and groundwater recharge in the Ocayan River watershed amount to 218.94, 109.41, 91.00 and 18.53 MCM, respectively. Evapotranspiration, stream flow and groundwater recharge take up 50%, 42%, and 8% of the rainfall, respectively.

Hydrogeology

Local Geology

Based on the geologic map prepared by Sto. Domingo et al. (1989), five (5) major rock units underlie the vicinity of the study area. These are from oldest to youngest to the Mt. Beaufort Ultramafics, the Espina Formation, the Panas Formation, the Iwahig Formation and the Quaternary Alluvium.

Serpentinized peridotite, dunite, and harzburgite constitute the Late Cretaceous Mt. Beaufort Ultramafics. This assemblage forms the core of Mt. Bulanjao Range. Spilitic basalt flows, pillow lavas, and chert of the Late Cretaceous to early Eocene Espina Formation occur in thrust fault contact with the ultramafic rocks. Both these rocks units are part of the Palawan Ophiolite.

Highly folded and well-bedded sandstone, shale/siltstone, and mudstone belonging to the Paleocene to Early Eocene Panas Formation overlie the Mt. Beaufort Ultramafics and Espina Formation. These rocks outcrop extensively to the northeast, west and south of the Gotok limestone area and are characterized by low undulating hills. Road cut exposures reveal that the sandstone is light brown to gray, thinly bedded and highly indurated, while the shale and siltstone are brown to dark gray, thinly bedded and friable.

The Pliocene Iwahig Formation unconformably overlies the Panas Formation. It has two (2) members, the Pusok Conglomerate and the Panoyan Limestone. Pebbles composed of chert, limestone and indurated sediments make up the Pusok Conglomerate, while the

Panoyan Limestone consists of massive limestone that forms steep karstic hills, which rise above the low-lying terrain. This limestone is the rock found at the Gotok Limestone Quarry. The Quaternary Alluvium consists of poorly sorted, unconsolidated to moderately consolidated gravel, sand, silt and clay derived from the weathering and erosion of the older rocks. These deposits mantle the low-lying areas.

Water Source Inventory

Residents of Barangays Sandoval and Iwahig used to obtain their domestic water requirements from Level 1 water sources consisting of shallow wells and springs. The wells are public and privately owned drilled wells cased with 38 to 102 mm diameter G.I. pipes. The wells reach 9.1 to 15.2 m depth and are fitted with manual jetmatic and pitcher pumps or, less commonly, electric centrifugal pumps (**Plate 2.2.1**).

The wells provide clear and odorless water which total dissolved solids (TDS) content and pH within the standard limits for drinking water. The water from the wells is used for drinking, washing and bathing.

Plate 2.2.1. Water source WS-4 at Brgy. Iwahig. Together with the Level 2 water system installed by RTNMC and CBNC, this well supplies water used for drinking and bathing.

The springs on the other hand, are situated in the areas underlain by the Panoyan Limestone. They are found at low-lying areas, emerging from cavities in the limestone. The largest spring in the immediate vicinity of the quarry is the Oning Spring (**Plate 2.2.2**). It has been previously measured to discharge approximately 50 L/s of water. The spring is used as a source of water for road spraying to control dust generation along the access road to the quarry.

Groundwater from higher areas preferentially flows and discharges along more permeable zones such as cavities and solution channels in the limestones. The springs yield generally clear and odorless water in which TDS content and pH are likewise within the standard limits for drinking water.

Since 2013 however, the domestic water requirements of Brgys. Sandoval and Iwahig as well as portions of Brgys. Ocayan, Igang-Igang, Sarong and Culandanum were supplied mainly by a Level II water system installed by RTNMC and CBNC. The source of the water system is the Pasi-Pasi River, which is a tributary of the Iwahig River.

Plate 2.2.2. The Oning Spring (WS-6) emerging from limestone at Brgy. Sandoval. The spring used to be a major source of water for residents in the area. It is at present used as a source of water for spraying of the Gotok Quarry access road and occasionally used for washing and bathing also.

A dam constructed across a section of this river at the eastern slope of Bulanjao Range diverts a portion of the flow to a series of screens and settling ponds (**Plates 2.2.3** and **2.2.4**). When the water becomes clear and free of suspended particles, it is chlorinated and then distributed by gravity flow through a network of pipes along the provincial highway and barangay roads. Faucets are installed where there are clusters of houses (**Plates 2.2.5** and **2.2.6**).

Plate 2.2.3. The dam constructed across the Pasi-Pasi River diverts river water for use in the Level II water system of RTNMC and CBNC.

Plate 2.2.4. A series of screens and settling ponds ensures that the water of the Level II water system is clear and free of suspended solids before it is chlorinated and piped to the users.

Plate 2.2.5. An outlet of the Level II water system along the provincial highway at Sitio Bicol Village, Bgy. Sandoval. Some hoses were connected to the pipe, allowing the water to reach several homes.

Plate 2.2.6. An outlet of the Level II water system along the barangay road in Brgy. Iwahig.

Because of the presence of the Level 2, some wells have been abandoned while others are still maintained for use during the times when the operation of the Level II system is temporarily suspended such as during heavy rains when the Pasi-pasi River becomes turbid.

Figure 2.2.4 displays the location of the major water sources in the vicinity of the Gotok Limestone Quarry including the Pasi-Pasi River water source while **Table 2.2.5** summarizes the water source data.

Aquifer Characteristics

Based on the geology of the area and the findings of the water source inventory, a shallow unconfined aquifer system exists in the vicinity of the Gotok Limestone Quarry. The shallow unconfined aquifer occurs from the surface down to at least 22 m depth and consists of sandstone and limestone of the Panas and Iwahig formations as well as the silt to gravel deposits of the Quaternary Alluvium.

Considering the folded nature of the Panas Formation, the limited coverage of the limestone and conglomerate members of the Iwahig Formation and shifting, intertonguing nature of alluvial deposition, the unconfined aquifer is not expected to be thick nor extensive but instead thin and locally disconnected.

As observed from the wells in the area, the shallow unconfined aquifer yields generally clear and odorless groundwater that is abundant during the rainy season but diminishes during the dry season.

Distribution of Hydrogeologic Units

The geology of the area and the findings of the water source inventory indicate that the vicinity of the Gotok Limestone Quarry may be delineated into three (3) hydrogeologic units.

The first hydrogeologic unit consists of the rugged hills and mountains of Bulanjao Range. These are underlain ultramafic rocks, spilitic basalt flows, pillow basalts, and chert. Being generally hard and dense, these rocks are deemed to be minimally permeable and are expected to yield little to moderate groundwater.

The low, gently undulating terrain that are underlain by rocks of the Panas and Iwahig formations constitute second hydrogeologic unit. The moderately consolidated nature of the conglomerate and sandstones and the massive but buggy characteristic of the limestone of these formations render them relatively porous and permeable. They are therefore able to store and yield moderate amounts of groundwater.

The Quaternary Alluvium makes up the third hydrogeologic unit. This consists of unconsolidated to loosely consolidated gravel, sand, silt and clay. Their high degree of porosity and permeability permit them to store and transmit relatively large amounts of groundwater. However, alluvial deposits near the shoreline are prone to saltwater intrusion.

Figure 2.2.5 shows the hydrogeologic map of the area.

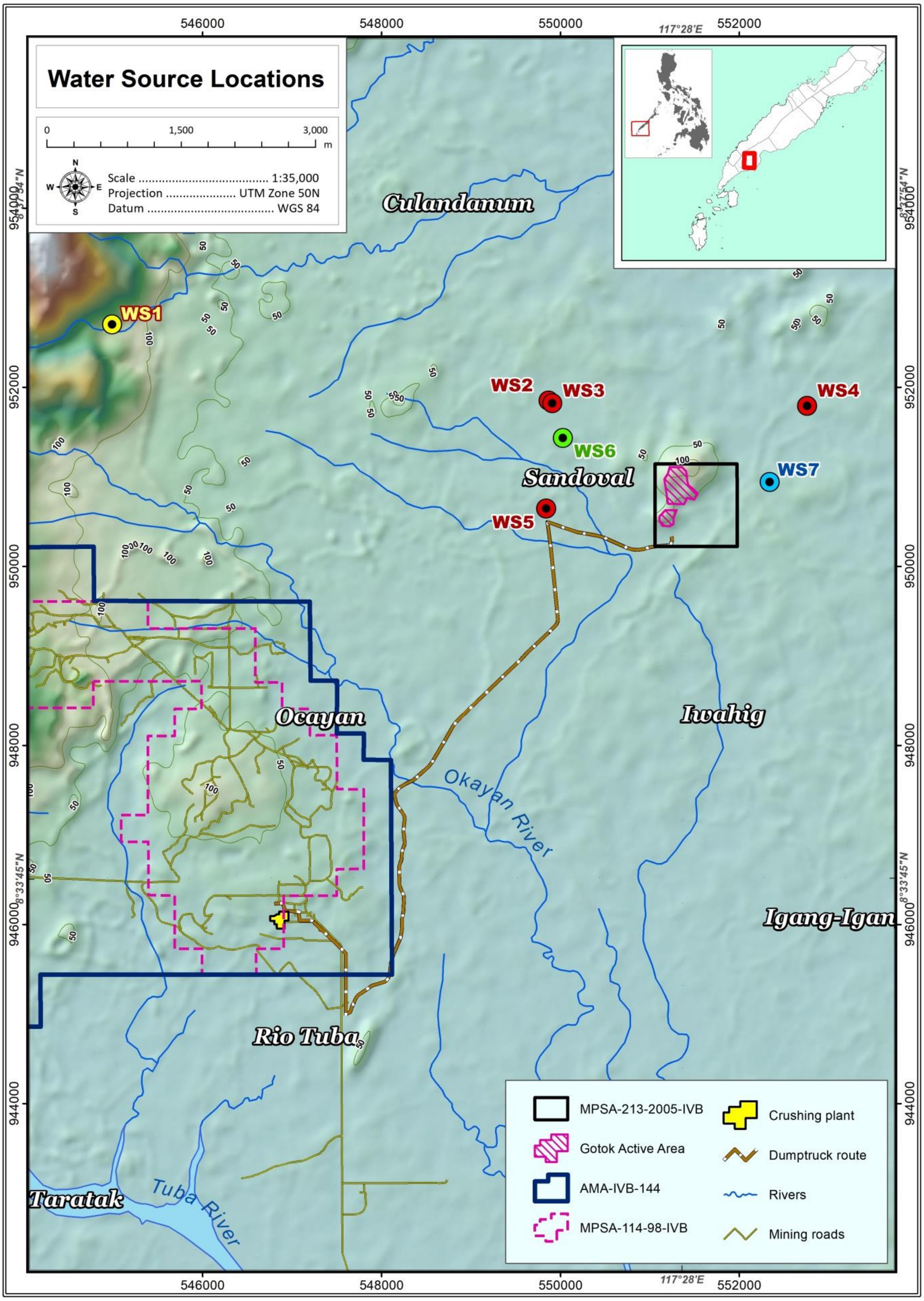


Figure 2.2.4. Water source location map

Table 2.2.5. Summary of water source inventory

Water Source ID	Latitude	Longitude	Location	Source Type	Owner	Depth (m)	Casing ϕ (mm)	Q (L/s)	E.C.* (μS/cm)	pH	Physical Characteristics	Remarks
WS-1	8°37'6.6"	117°24'32.0"	Pasi-Pasi River, Brgy. Sandoval	river	RTNMC & CBNC	-	-	> 30	160	7.4	clear, odorless	Level 2 water system supplying Sandoval, Iwahig & 4 other barangays
WS-2	8°36'38.76"	117°27'11.6"	Brgy. Sandoval	well	BWSA Bicol Village	21.0	102	-	-	-	-	Well is not operational, needs gasket replacement
WS-3	8°36'37.8"	117°27'12.9"	Brgy. Sandoval	well	Feliza Matosalem	12.2	38	-	480	6.7	clear, odorless	Used for washing and bathing
WS-4	8°36'36.7"	117°28'46.1"	Brgy. Iwahig	well	BWSA Pajo	-	102	-	560	6.8	clear, odorless	Used for drinking, washing and bathing
WS-5	8°35'59.5"	117°27'10.6"	Brgy. Sandoval	well	BWSA Gotok	22.4	102	-	540	6.9	clear, odorless	Used for drinking, washing and bathing
WS-6	8°36'25.2"	117°27'16.8"	Oning Spring, Brgy. Sandoval	spring	Private	-	-	~ 50	400	6.8	clear, odorless	Used for washing and bathing
WS-7	8°36'9.0"	117°28'32.4"	Brgy. Iwahig	well	Culantuod GK Village	-	51	-	-	-	-	Abandoned well because of presence of Level 2 water system

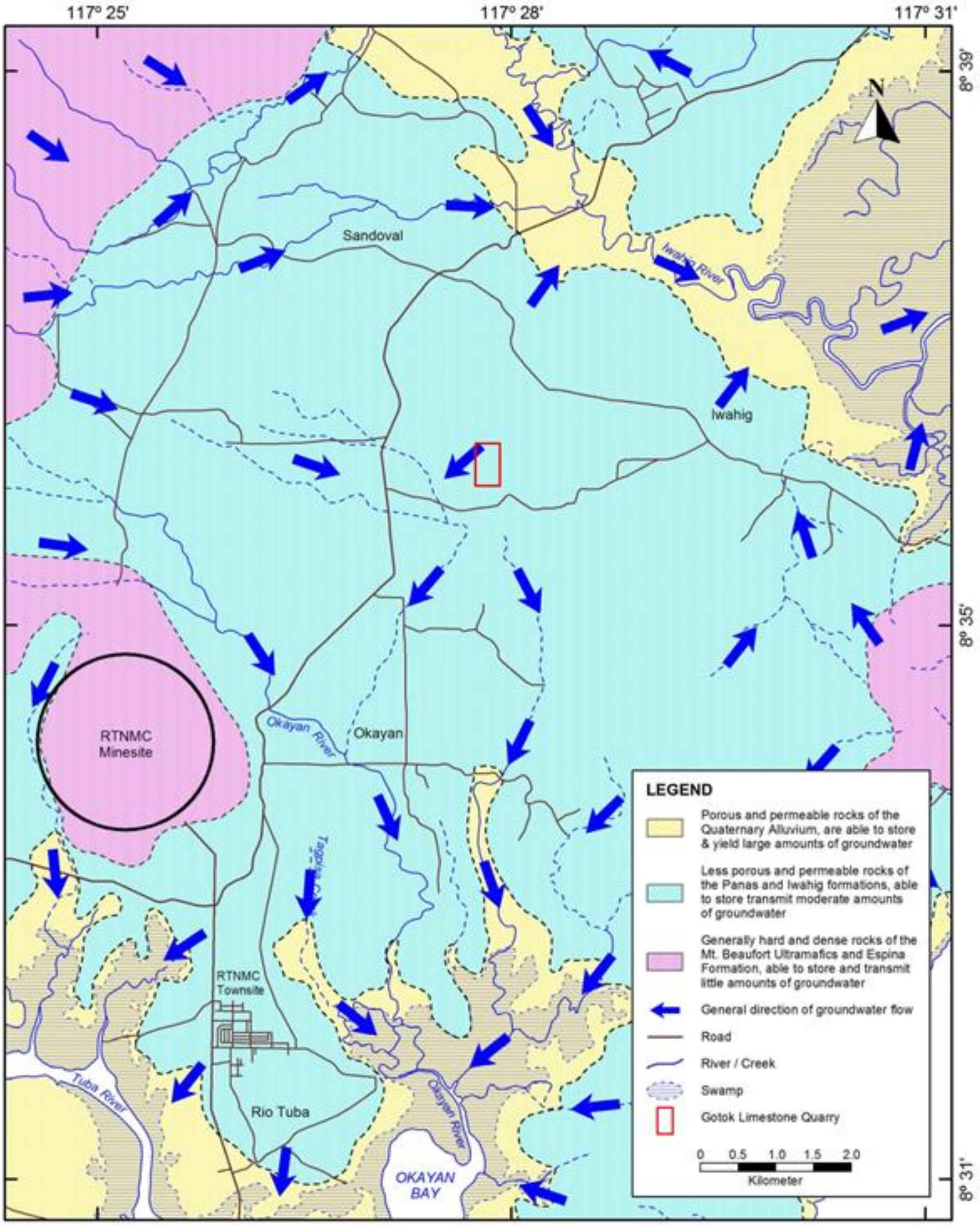


Figure 2.2.5. Hydrogeologic map

Groundwater Levels, Flow Direction and Recharge

The presence of many shallow wells with manual jetmatic and pitcher pumps indicate that the groundwater level is not more than 6 m below the ground level. In low-lying areas, the groundwater level even intersects the surface as revealed by the presence of springs in these areas.

Groundwater moves from high to low elevation head and will therefore follow the topographic gradient. In the vicinity of the Gotok Limestone Quarry, the groundwater from the shallow unconfined aquifer will move downward from the hills and mountains and cross the alluvial and coastal plains following the direction of flow of the drainage systems in the area. The groundwater will ultimately discharge at the surrounding seas. **Figure 2.2.5** also shows the direction of groundwater flow in the area.

The aquifers in the vicinity of the project site are replenished from direct rainfall infiltration, infiltration from the tributaries of the Iwahig and Ocayan Rivers and groundwater movement from high to low areas. Based on the water balance (**Table 2.2.4**), the area takes in approximately 8% of the rainfall as groundwater recharge.

Groundwater Flow in the vicinity of Gotok Quarry

There are no springs or creeks in Gotok Quarry and its immediate vicinity. Instead, presence of several dry caves and sinkholes were observed. The absence of springs and creeks and the presence of caves and sinkholes in the immediate vicinity of Gotok Quarry indicate that the limestone in the area has a high degree of permeability such that water percolates rapidly downward through it. This is supported by the fact that surface runoff collected at the silt collector sumps during heavy rains also rapidly infiltrate into the subsurface.

Groundwater therefore moves downward and outward from Gotok Quarry and the other limestone hills that cluster near the quarry. The presence of intermittent creeks to the south and north of Gotok Quarry suggests that groundwater in the northern section of the quarry moves in a general north direction while groundwater in the central and southern section of the quarry moves southward. The intermittent creeks to the south of Gotok Quarry are tributaries of Okayan River while those located to the north of the quarry are tributaries of Iwahig River.

Figure 2.2.6 displays among others the position of Section Line A-A’ traversing north-south through Gotok Quarry, while **Figure 2.2.7** illustrates the most probable flow direction of groundwater along Section Line A’A’ based on the above hydrogeologic observations

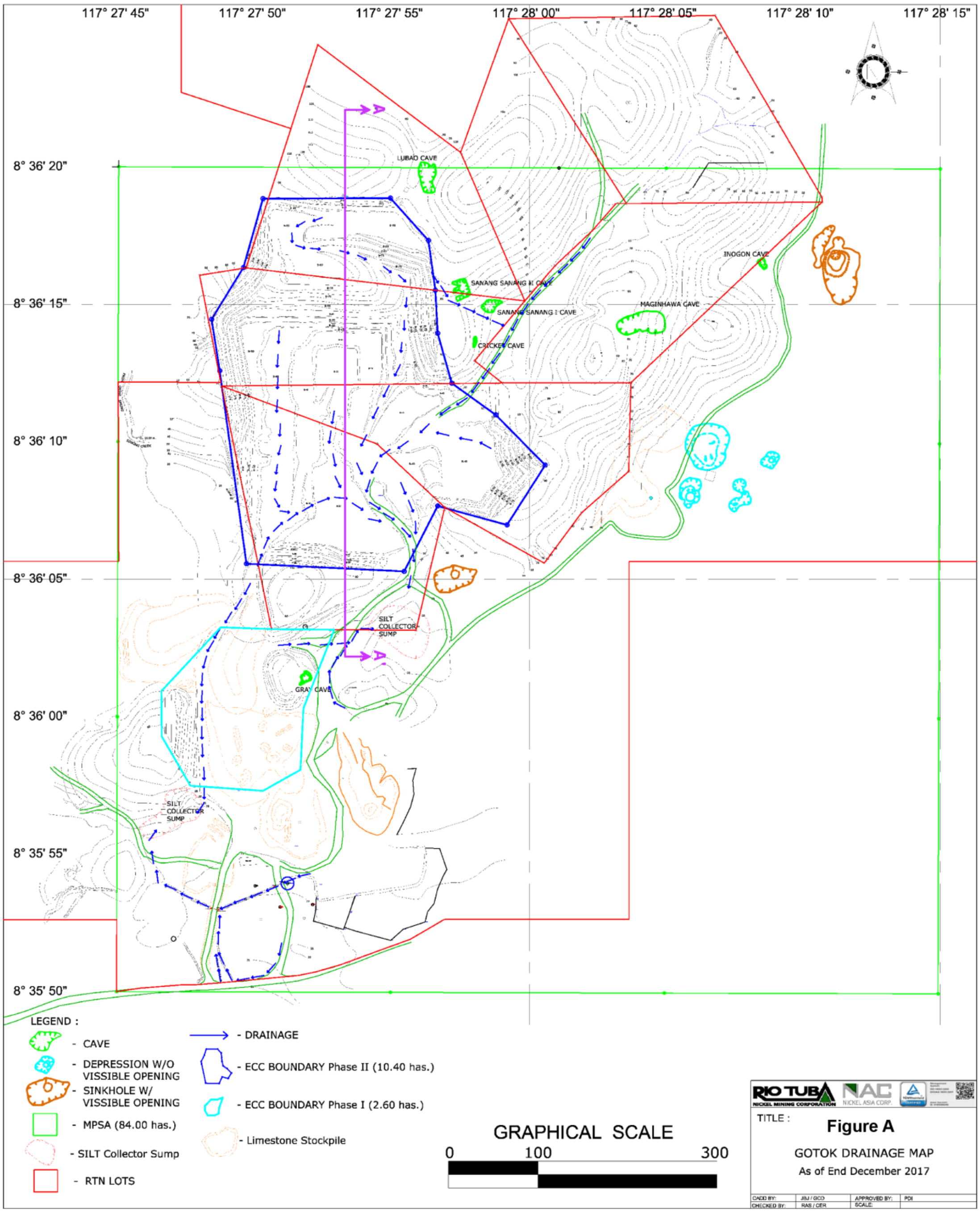


Figure 2.2.6. Gotok drainage map

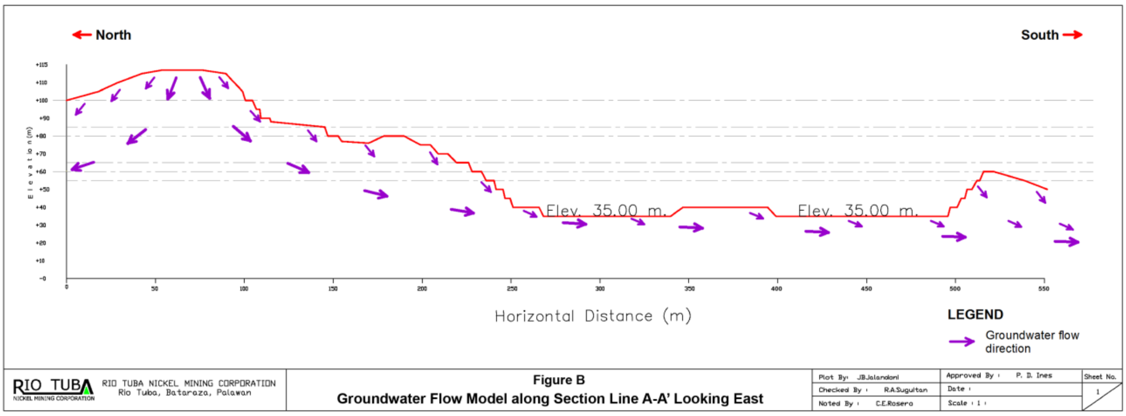
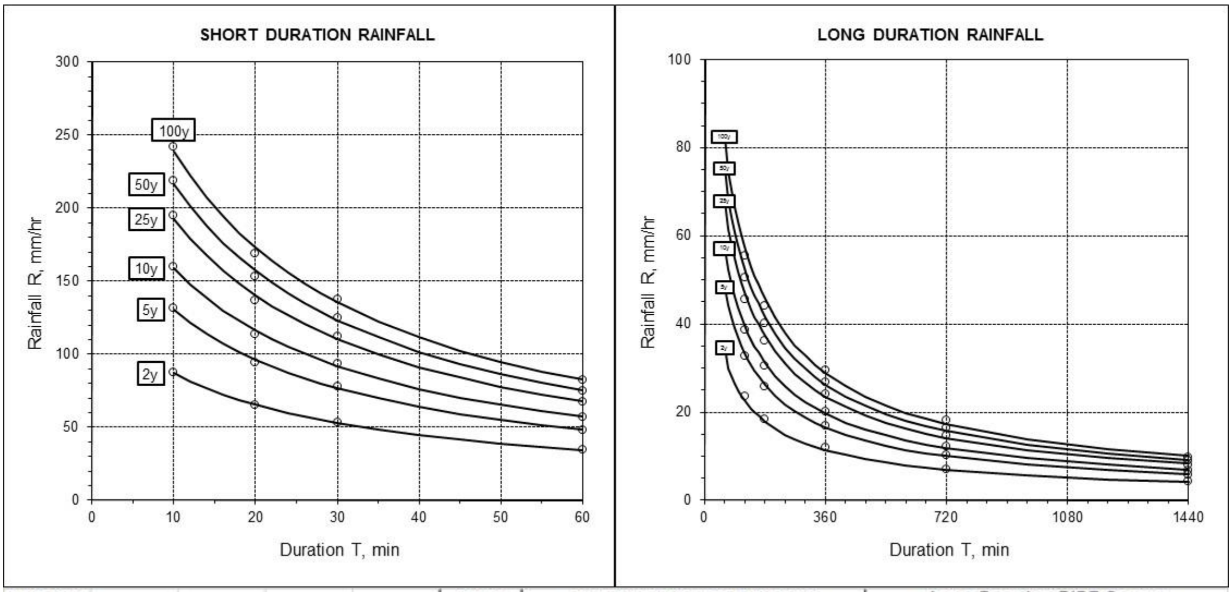


Figure 2.2.7. Most probable flow direction of groundwater along Section Line A'A' based on the above hydrogeologic observations

Flood Modelling

<u>Design Storm for the Project Area</u>

The model hyetograph using a centre-concentrated pattern is prepared using the Rainfall-Intensity-Duration-Frequency curve (RIDF) at Puerto Princesa City, Palawan Synoptic Station (reference: RIDF of Selected Synoptic PAGASA Station, Attachment 4.3 of "Specific Discharge Curve, Rainfall Intensity Duration Curve, Isohyet of Probable 1-day Rainfall", FCSEC, March 2003). The parameters of the RIDF Curves for various return periods are shown in the **Figure 2.2.6**.



Legends:			Return Period, Yr	Short Duration RIDF Curves				Long Duration RIDF Curves			
o	Probable Rainfall			Type	A	C	b	Type	A	C	b
——	Fitted RIDF Curve		2	1	1836.92	13.16	0.90	1	1560.99	21.32	0.81
	Type	Equation	5	1	2987.81	14.07	0.94	2	1987.21	48.87	0.80
	1	$R = A / (C + T^{b})$	10	1	3766.89	14.55	0.96	2	2418.63	50.73	0.80
	2	$R = A / (C + T)^{b}$	25	1	4808.70	15.39	0.98	2	3399.19	60.81	0.82
			50	1	5548.92	15.85	0.99	2	4032.14	64.83	0.83
			100	1	6150.94	15.84	0.99	2	4650.43	68.04	0.84

Figure 2.2.8. Parameters of the RIDF Curves used in the derivision of the model hyetograph

From this RIDF, the model hyetograph for various return periods was derived and is shown **Table 2.2.6**:

Table 2.2.6. Model hyetograph for various return periods

Time	Return Period					
(hour)	2-year	5-year	10-year	25-year	50-year	100-year
1	1.09	1.15	1.71	1.78	1.93	2.13
2	1.21	1.32	1.81	2.12	2.19	2.05
3	1.07	1.49	1.97	2.34	2.38	2.38
4	1.33	1.74	2.1	2.42	2.48	2.82
5	1.49	2.01	2.35	2.74	2.88	3.07
6	1.57	2.19	2.63	3.09	3.39	3.53
7	1.91	2.5	3.17	3.66	3.96	4.18
8	2.25	3.08	3.77	4.4	4.81	5.13
9	2.82	3.86	4.71	5.65	6.2	6.62
10	3.83	5.23	6.42	7.87	8.65	9.24
11	5.93	8.22	10.12	12.6	14.07	15.14
12	12.89	19	23.2	29.13	32.58	35.38
13	31.93	46.64	56	66.69	73.38	78.94
14	8.13	11.58	14.16	17.82	19.89	21.58
15	4.67	6.41	7.82	9.71	10.73	11.56
16	3.32	4.42	5.41	6.61	7.3	7.78
17	2.53	3.36	4.19	5.02	5.49	5.73
18	2.11	2.82	3.35	4.12	4.34	4.64
19	1.79	2.35	2.89	3.39	3.73	3.77
20	1.47	2.09	2.61	2.94	3.08	3.23
21	1.29	1.74	2.24	2.58	2.92	2.84
22	1.27	1.67	1.89	2.22	2.54	2.44
23	1.11	1.58	1.75	1.98	2.13	2.47
24	0.91	1.55	1.73	1.92	1.91	2.15
TOTAL	**97.92**	**138**	**168**	**202.8**	**222.96**	**238.8**
MAX	**31.93**	**46.64**	**56**	**66.69**	**73.38**	**78.94**

Flood assessment – Baseline condition (pre-development) and with the Project (post-development)

In practice, model accuracy is assessed by comparison of water surface profiles with gauge observations in the channels. Despite the absence of such gauging stations in the area, the model was set-up and applied to predict and visualize the extent of the possible flood inundation given the readily available information in the project area.

To simulate extreme flood situation in the project area, a flood magnitude that may occur at least once in a hundred years on average (a 100-year flood) is used to run the hydraulic model.

As for the initial conditions in the model runs, it was assumed that the water surface elevation at the downstream boundary (at the river mouth) is taken to be about one (1) meter above mean sea level, which corresponds to high tide level. Specifying higher-than-normal tide level would ensure decreased water surface profiles in the river mouth, which may provide backwater effects and is therefore representative as extreme event for flood scenario modeling.

An initial simulation runs for about 6 hours using 3 mm of rainfall to the catchment is used for appropriate antecedent condition (so called ‘warm start’) before running the computations for the design storm to remove depressions in the DEM that were not directly connected to the drainage system. The 3 mm was based on the magnitude of rainfall before and after the design 24-hour storm hyetograph.

Figures 2.2.7 and **2.2.8** show the simulated maximum flood depth including portions of the floodplain for a 100-year return period. The model shows the general trends of floodplain inundation. Most of the floodwaters are confined in the main rivers and tributaries, with some patches of inundation visible near the riverbanks indicating overflows and those isolated areas representative of depression storages in the catchment.

As the DRM method generates flow on every grid cell, filtering of the model results were applied, specifically, flood depths less than 0.05 m have been removed from the mapping by making this threshold value transparent in the figures presented. It should be noted that the mapping depicts the maximum flood depth at any given location. The maximum flood depth is the deepest water recorded throughout the 100-year flood computations. This will tend to display maximum depths for short duration storms at the upstream catchment, and maximum depths for the longer duration, accumulated floods as it flow towards the bottom of the catchment. The flood maps include flood extents, flood depths, and flood hazard.

The modeling predicts that the Gotok mining areas is not prone to riverine floods for both simulations of pre and post-development. This is due to the fact that the area is located far upstream of the watershed. For the post-development scenario, the DEM used for topographic representation of the area is reduced by 15 m to represent mining development within the Gotok MPSA (shown as blue polygon). Using this reduced elevation in the mining area revealed no major changes in the flood characteristics of the areas downstream of the project area based on comparative results of the two scenarios. Within the project area, however, depression storage at the downstream-most portion of the mining area which is visible under the pre-development scenario would become moderately larger in scope once the project becomes operational. This can be attributed to the potential changes in topography in that particular area during project implementation.

From the velocity vector plots overlaid in the given map, high flood events occur at the main channel while the inundation areas are within the riverbanks and depression areas specially those located in the downstream and midstream portions of the catchment.

From the maps, it can be seen that some portions in the project site have become prone to overland flooding due to some changes in elevation brought by physical development of the site. With appropriate engineering interventions it can be ensured that once the project is operational, flooding in the area will remain to be minimal.

Note that while the model output is highly dependent on the topographic inputs, which in this study, is too coarse to warrant micro-level analysis of flooding, the result is quite promising. With better detailed model inputs, the maps generated can be used to determine which areas are vulnerable to flood which can then serve as guides in the preparation of flood defences and other flood mitigating measures.

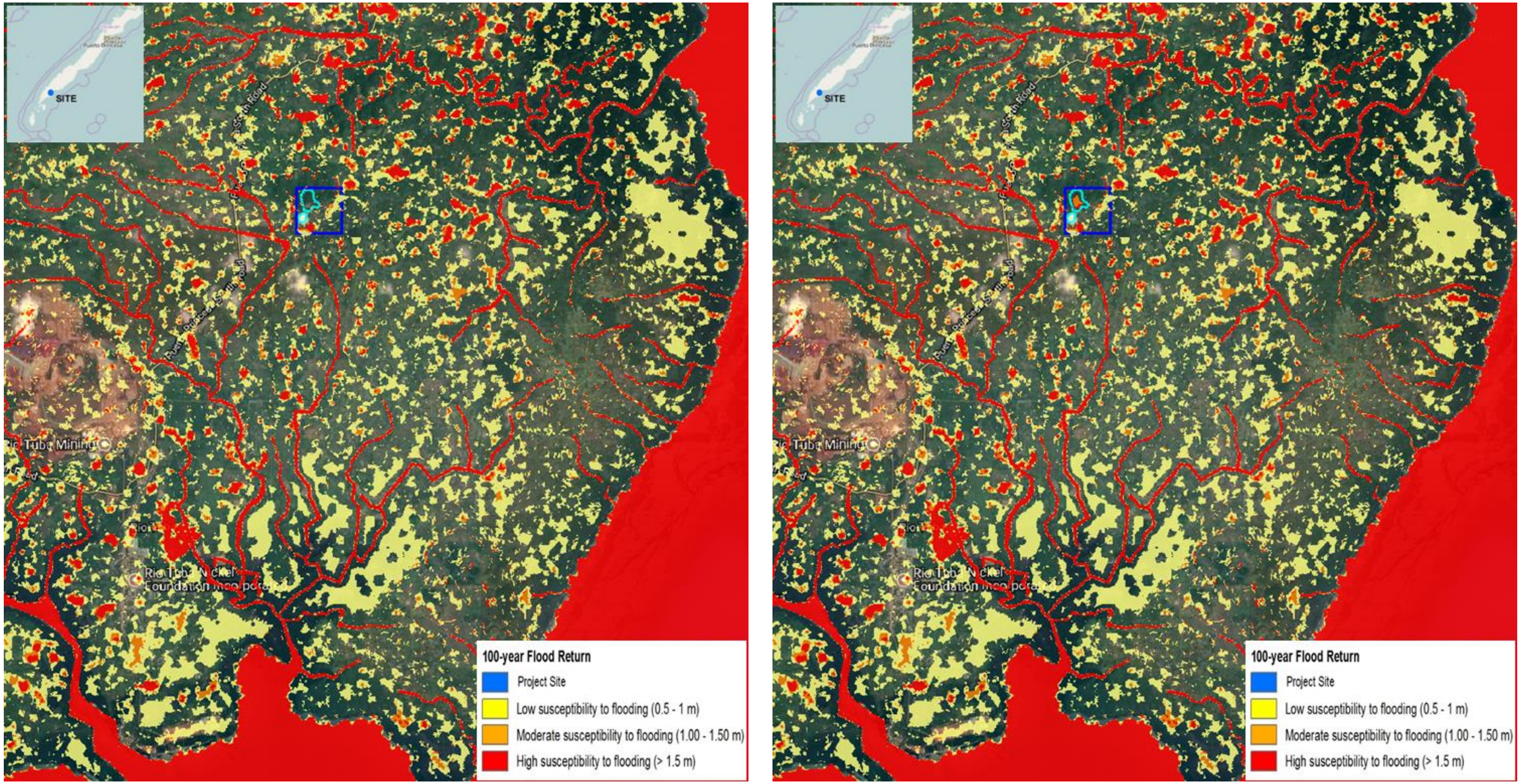


Figure 2.2.9. The predicted flood inundation maps within the sub-basins surrounding the Gotok expansion project area for a 100-year flood event using the baseline condition (pre-expansion, left) and with proposed expansion (right figure).

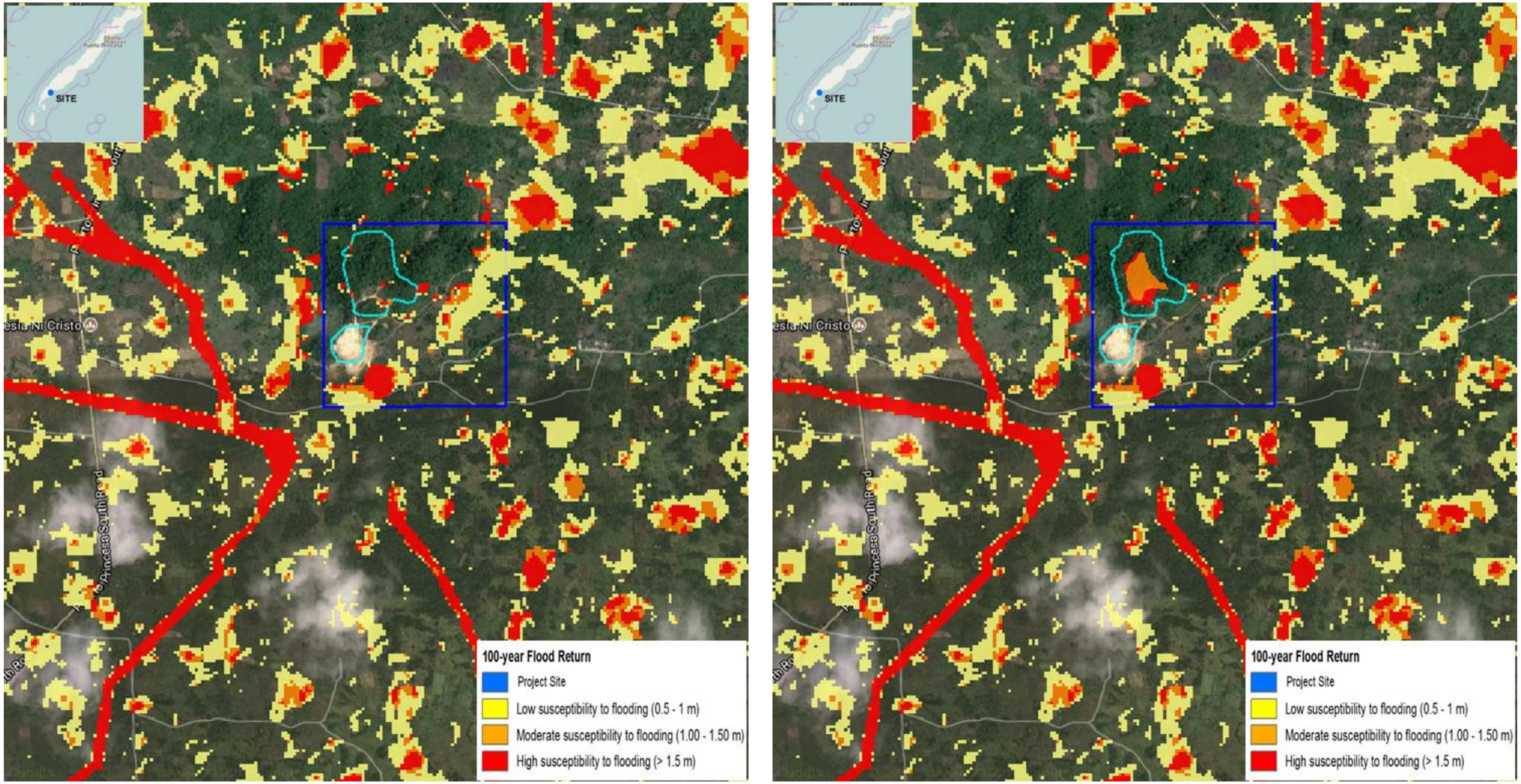


Figure 2.2.10. A closer perspective on the Gotok expansion site showing predicted flood inundation for a 100-year flood event using the baseline condition (pre-expansion, left) and with proposed expansion (right figure).

2.2.1.3 Impact Assessment and Environmental Performance

Predicted Impacts

The following matrix summarizes the potential impacts that may be brought by the increased production of the quarry and modified crushing plant. Each impact was identified as to the period of possible occurrence, duration, likelihood of occurrence, and magnitude. Entries with asterisks are perceived to be not significant or negligible while italicized entries were perceived to be a positive impact of the project.

Table 2.2.7. Impacts assessment and mitigation for hydrology and hydrogeology

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
Change in drainage morphology The area of the Gotok Limestone Quarry Project will be limited to the approved 13.0 ha area within the MPSA.			✓		• Construction of diversion canals on open areas to divert surface runoff to the two existing silt collector sumps constructed within the vicinity of the quarry area.
Change in stream depth The river bed of the downstream portion of Ocayan River may be affected during operation due to earth movement.			✓		• Maintenance of the existing collector sumps within the area.
Inducement of flooding Using the final elevation of the mining area in the flood model (100-year flood return) revealed no major changes in the flood characteristics of the areas downstream of the MPSA based on the comparative results of the two scenarios (**Figures 2.2.7** and **2.2.8**). Within the MPSA, however, depression storage at the downstream-most portion of the mining area which is visible under the pre-development scenario would become moderately larger in scope once the project progress. __Considering climate change scenario__ The climate change projections of PAGASA indicate that rainfall will become more during the rainy season and become less during the dry season. Increasing rainfall intensities will increase the frequency of flooding.			✓	✓	• Improvement and continuous maintenance of the existing drainage channels and sediment control structures within the quarry area
Depletion in water resources/competition in water use The proposed expansion of the quarry will have an insignificant effect on the amount of available groundwater in the vicinity since Gotok Hill is small and the rainwater that percolates into the ground within will still move outward to recharge the groundwater in the surrounding area. It should be noted also that groundwater recharge mainly comes from direct rainfall infiltration throughout the area. The quarry activities will not involve the use of groundwater and will therefore not compete with					

any user of groundwater in the area. There are actually no users of groundwater since there are no wells in the vicinity of the quarry site. The water source of residents in the area is already supplied by the Level II water system of RTNMC and CBNC. The project will also not compete with users of water from Okayan and Iwahig rivers since both the quarry and crushing plant operations will not utilize the water from the said rivers.					

Performance Assessment

Stormwater management system consisting of diversion canals, ditches and two silt collector sumps were constructed by RTNMC to reduce instances of flooding as well as a mitigating measure to lessen siltation. This sump is periodically desilted to insure its effectivity during flooding events.

2.2.2 Water Quality

2.2.2.1 Methodology

The water quality assessment for this study was conducted in accordance with the EMB's Manual on Ambient Water Quality Monitoring.

Four surface freshwater sampling stations were established for this assessment. The samples were collected using grab sampling method, wherein water is collected by submerging sampling containers at a 20-m depth facing opposite direction of the flow. All samples were transported to Ostrea Mineral Laboratories for analysis.

2.2.2.2 Findings and Discussion

Sampling Location

In the 2014 water quality assessment of Gaia South, four (4) stations for the surface water quality: two (2) in Oning Creek (freshwater) and two (2) in Rio Tuba River (brackish water) were established. Oning creek was sampled since it is the only water body in the Gotok quarry area. On the other hand, Rio Tuba River was sampled due to its proximity to the crushing plant. Moreover, the discharge from the crushing plant will eventually be released in Rio Tuba River after passing through silt collector sump at the crushing plant area then to a series of settling ponds. It is important to note that the bodies of water that may be affected by the project are used for bathing, washing clothes and other domestic needs but are no longer used for drinking. **Table 2.2.8** presents the coordinates and details of the 2014 sampling points and the RTNMC monitoring stations while **Figure 2.2.9** shows the sampling map.

Table 2.2.8.Sampling stations for the water quality assessment

Station ID	Coordinates	Description
Gotok WQ1	N 8°36'22.0'' E 117°27'13.0''	Located at the source of the Oning spring/creek. The area is vegetated and adjacent to the farm. Approximately 1.5 km from active Gotok quarry site. Freshwater.
Gotok WQ2	N 8°36'9.7'' E 117°27'46.2''	Located at the downstream of Oning creek where its water falls underground of the boulders. Approximately 300 m from active Gotok quarry site. Freshwater.
Gotok WQ3	N 8°31'45.5'' E 117°24'10.5''	Midstream of Rio Tuba River. Approximately 5 km from the river mouth. Brackishwater.
Gotok WQ4	N 8°32'0.9'' E 117°24'32.1''	Midstream of Rio Tuba River. Approximately 3.5 km from the river mouth. Effluent from the washing plant is discharged into a water settling/recycling pond. Overflow of the pond discharges to the Upper Kinurong, then into the Lower Kinurong which eventually leads to the Rio Tuba River. Brackish water.

RTNMC WQM1	N 8°36'16.99" E 117°27'19.44"	Monitoring station of RTNMC at Oning (Gotok Spring) – Station 14.
RTNMC WQM2	N8°36'6.23" E117°27'50.90"	Monitoring station of RTNMC at Gotok Entry Tunnel (underground) – Station 15.

Water Quality Parameters

Table 2.2.9 presents the water quality parameters that were analyzed to satisfy the requirements of the EIA. Water samples are analyzed by Ostrea Mineral Laboratories, an accredited laboratory by the DENR.

Table 2.2.9. Water quality parameters for surface waters (fresh and marine)

Constituent	Parameter
Conventional/Physico-chemical	pH, temperature, total suspended solid (TSS), oil & grease, dissolved oxygen (DO), and biological oxygen demand (BOD).
Toxic & deleterious	Hexavalent chromium (Cr^{+6}), arsenic (As), cadmium (Cd), lead (Pb), total mercury (Hg)
Bacteriological	Presence of *E.Col,* fecal coliform and total coliform

The DENR DAO 90-34 (DAO 90-34*), "Revised Water Usage and Classification/Water Quality Criteria Amending Section Nos. 68 and 69, Chapter III of the 1978 NPCC Rules and Regulations"* has been used to characterized the physico-chemical and bacteriological characteristics of surface waters. The result was also compared to the DAO 2016-08, Water Quality Guidelines and General Effluent Standards of 2016. **Annex 2.2.1** shows the laboratory certificate for the result of water quality analysis.

Surface water quality

Oning creek is still unclassified by the DENR as to its freshwater category, hence it is classified as Class C water based on the observed activities. Results of analysis were compared to the DENR DAO 90-34 Class C Standards. Since, a new Water Quality Guidelines and Effluent Standards, DAO 2016-08, was released last May 2016, assessment based on the new Class C standard was added in the discussion.

Table 2.2.10 and **Table 2.2.11** depict the results of the analysis for the sample taken from Oning spring and Rio Tuba River, respectively.

The results show that generally the samples are within the standards for Class C freshwater (Oning Spring) and SC for brackish water (Rio Tuba river) except for the bacteriological tests (**Table 2.2.10**). pH, as one of the physico-chemical properties that was analyzed, is a measure of acidity or basicity of a solution. The pH determines the solubility and biological availability of chemical constituents such as nutrients and heavy metals, which reaction can be detrimental for some aquatic organisms (USGS, 2014). The pH of sampled surface waters showed neutral characteristics (pH >7.0).

The current DO levels are way above the minimum DENR standard of 5.0 mg/L for all stations. DO is a good indicator of the water quality. Oxygen in water is measured in its dissolve form as DO. A decline in DO reading indicates that more oxygen is consumed than produced which will result in relocation or even death of sensitive aquatic organisms (US EPA, 2012).

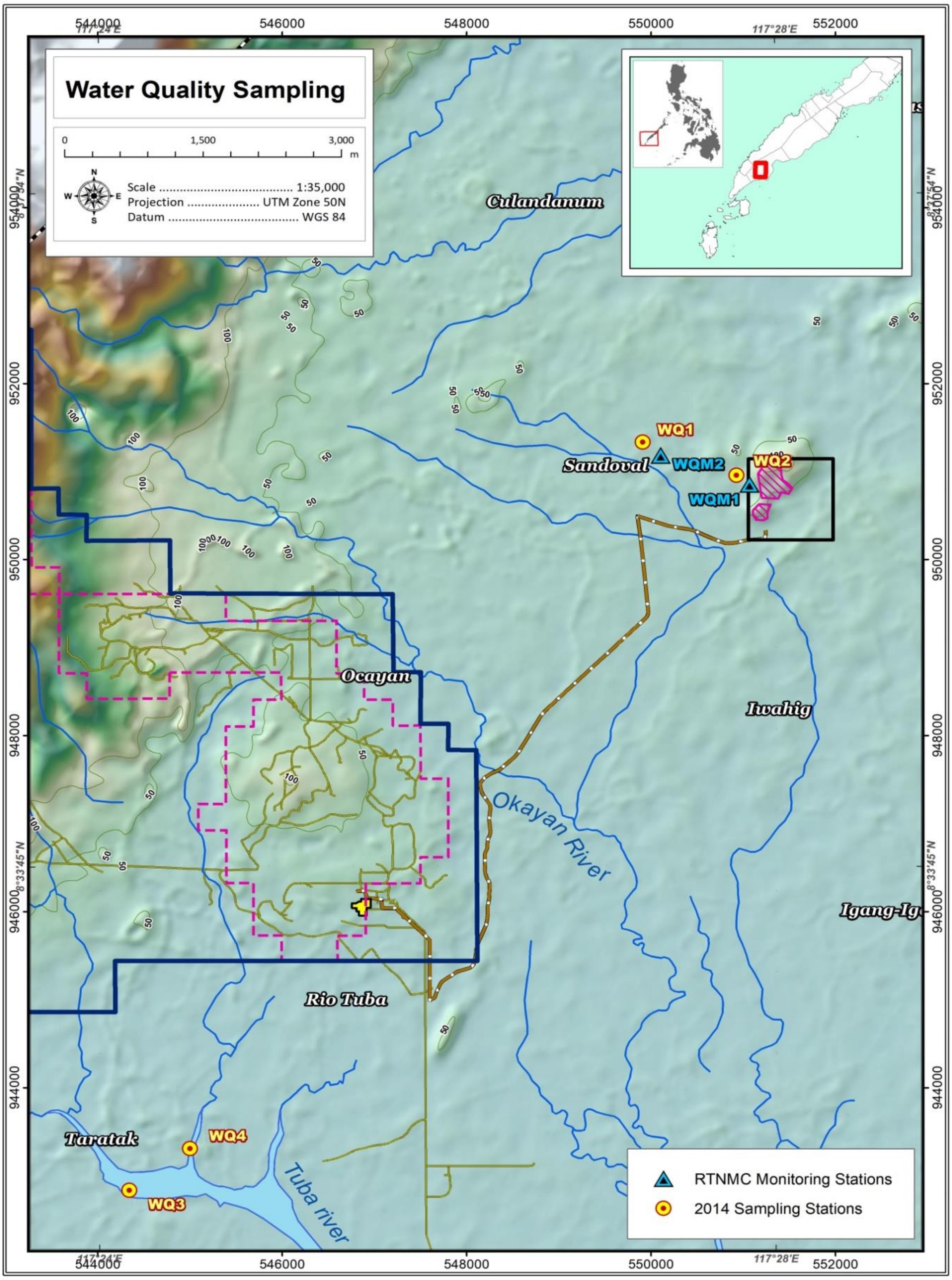


Figure 2.2.11. Water quality sampling stations for the project

Table 2.2.10. Results of analysis of freshwater samples

Parameters	Analysis Method/Instrument	DAO 90-34 Class C	DAO 2016-08 Class C	Gotok WQ1	Gotok WQ2
pH	Glass Electrode	6.5 – 8.5	6.5 –9.0	7.2	7.9
DO, mg/L (min)	Glass Electrode	5 (e)	5.0 (min)	7.0	8.0
Salinity, ppt	Hand Held Refractometer	--	-	0	0
BOD, mg/L	Aside Modification (Dilution Technique)	7(10)	7.0	<1.0	<1.0
TSS, mg/L	Gravimetric (dried at 103 – 105 °C)	(g)	80	2.0	16.0
Oil & Grease, mg/L	Gravimetric (Petroleum Ether Extraction)	2	2.0	<1.0	<1.0
Cr^{6+} mg/L	Diphenylcarbazide	0.05	0.01	<0.01	<0.01
As, mg/L	Hydride Generation – AAS	0.05	0.01	<0.001	<0.001
Cd, mg/L	Flame AAS	0.01	0.003	<0.003	<0.001
Pb, mg/L	Flame AAS	0.05	0.01	<0.01	<0.01
Hg, mg/L	Cold Vapor AAS	0.002	0.001	<0.0001	<0.0001
Total coliforms, MPN/100ml	Multiple Tube Fermentation	5,000 (m)	-	9,200	2,700
Fecal Coliform, MPN/100ml	Multiple Tube Fermentation	-	200	5,400	2,700
E. Coli	Streak Plate	negative	-	positive	positive

Note: (e) sampling taken between 9:00 am to 4:00 pm
(g) not more than 30 mg/L increase

Table 2.2.11. Results of analysis of brackish water samples

Parameters	Analysis Method/Instrument	DAO 90-34 Class SC	DAO 2016-08 Class SC	Gotok WQ3	Gotok WQ4
pH	Glass Electrode	6.5 – 8.5	6.5 –8.5	7.4	7.2
DO, mg/L (min)	Glass Electrode	5 (e)	5.0 (min)	6.0	5.0
Salinity, ppt	Hand Held Refractometer	--	-	30	25
BOD, mg/L	Aside Modification (Dilution Technique)	7(10)	n/a	4.0	6.0
TSS, mg/L	Gravimetric (dried at 103 – 105 °C)	(g)	80	7.0	10.0
Oil & Grease, mg/L	Gravimetric (Petroleum Ether Extraction)	3	3	<1.0	<1.0
Cr^{6+} mg/L	Diphenylcarbazide	0.1	0.05	<0.01	<0.01
As, mg/L	Hydride Generation – AAS	0.05	0.02	<0.001	<0.001
Cd, mg/L	Flame AAS	0.01	0.005	<0.003	<0.003
Pb, mg/L	Flame AAS	0.05	0.01	<0.01	<0.01
Hg, mg/L	Cold Vapor AAS	0.002	0.002	<0.0001	<0.0001
Total coliforms, MPN/100ml	Multiple Tube Fermentation	5,000 (m)	-	17	350
Fecal Coliform, MPN/100ml	Multiple Tube Fermentation	-	200	14	240
E. Coli	Streak Plate	negative	-	positive	positive

Note: (e) sampling taken between 9:00 am to 4:00 pm
(g) not more than 30 mg/L increase

Biological Oxygen Demand (BOD) indicates the concentration of biodegradable organic matter present in the sample. Stations Gotok WQ1 and WQ2 have BOD reading of less than 1.0 mg/L, which indicates an excellent water quality. This implies that the sampled streams have low organic loading. Also, Gotok WQ3 and WQ4 have readings within the DAO 90-34 standard of 4.0 mg/L and 6.0 mg/L, respectively.

There were no observed sources of oil and grease contamination near the sampling stations. This is consistent with the results, which indicate that oil and grease levels in all sampling stations were lower than the standard values.

Total suspended solids (TSS) are organic and inorganic suspended solid materials in the water, which includes silt, plankton and wastes. High concentrations of TSS can lower water quality by absorbing light. As a result, water becomes warmer, less light is received for photosynthesis, and DO is depleted. These factors make it impossible for some aquatic life forms to exist (US EPA 2012). As seen from the result of the analysis, the upstream reading (Gotok WQ1 and Gotok WQ3) have TSS concentrations lower than downstream (Gotok WQ2 and Gotok WQ4) due to the fact that more suspended materials are carried as the water flows downstream.

Salinity is the measure of the dissolve salt content in the body of water. Salinity in Oning Creek (Gotok WQ1 and WQ2) is undetected which is anticipated since freshwater has usually less than 0.5 ppt. However, Rio Tuba River (Gotok WQ3 and WQ4) has salinity values of 30 ppt and 25 ppt, respectively. The brackish water resulted from the back flow of marine water in Rio Tuba River that reaches 10 km from the estuary.

All the stations sampled for heavy metals (Cr^{+6}, As, Cd, Pb and Hg) are within the DAO 90-34 and DAO 2016-08 standards for Class C and SC. Heavy metals are of most concern among other environmental pollutants due to their potential to toxic effect and ability to bioaccumulate in aquatic ecosystems (Censi, et al. 2006).

As mentioned earlier, bacteriological parameters of the sampled stations failed to meet the DENR standard. Coliforms are bacteria that are living in the intestines of warm-blooded animals (humans, pets, farm animals, and wildlife) while fecal coliform bacteria are kind of coliform associated with human or animal wastes that include Escherichia coli (E. coli). According to US EPA (2012), total coliforms are no longer recommended as an indicator for recreational waters. However, total coliforms are still the standard test for drinking water because their presence indicates contamination of a water supply by an outside source. Based on the result of analysis, samples from Oning Creek (Gotok WQ1 and WQ2) have total coliform counts greater than the DENR standard of 5,400 MPN/100ml and fecal coliform count greater than 200 MPN/100ml based on DAO 2016-08 which can be attributed to animal manure, soil, and submerged wood in adjacent area. Moreover, all the sampled stations are positive on *E. Coli*, suggesting that waters from these sources should not be used for drinking.

Annex 2.2.1 is the certificate of laboratory analysis for water quality sampling.

Water quality monitoring

RTNMC conducts monthly internal sampling/monitoring of the water quality in two (2) stations: Oning Spring (WQM1-Station 14) and Gotok Entry Tunnel (WQM2- Station 15).

As seen in **Figure 2.2.10**, pH is relatively within the DAO 90-34 DAO 2016-08 standard of 6.5 to 9.0. On the other hand, **Figure 2.2.11** shows that TSS is under the 80 mg/L limit except for second quarter of 2010. Exceedances of TSS may be due to rainy weather condition and the desilting operation during the time of sampling. Impacts and volume of rainwater and the desilting operation causes resuspension of TSS. Also, as observed, TSS level at Gotok Entry tunnel is relatively higher compared to other stations due to the fact that the station is relatively nearer to the Gotok quarry area.

Figure 2.2.12 show the color trend from 2011 to 2017.

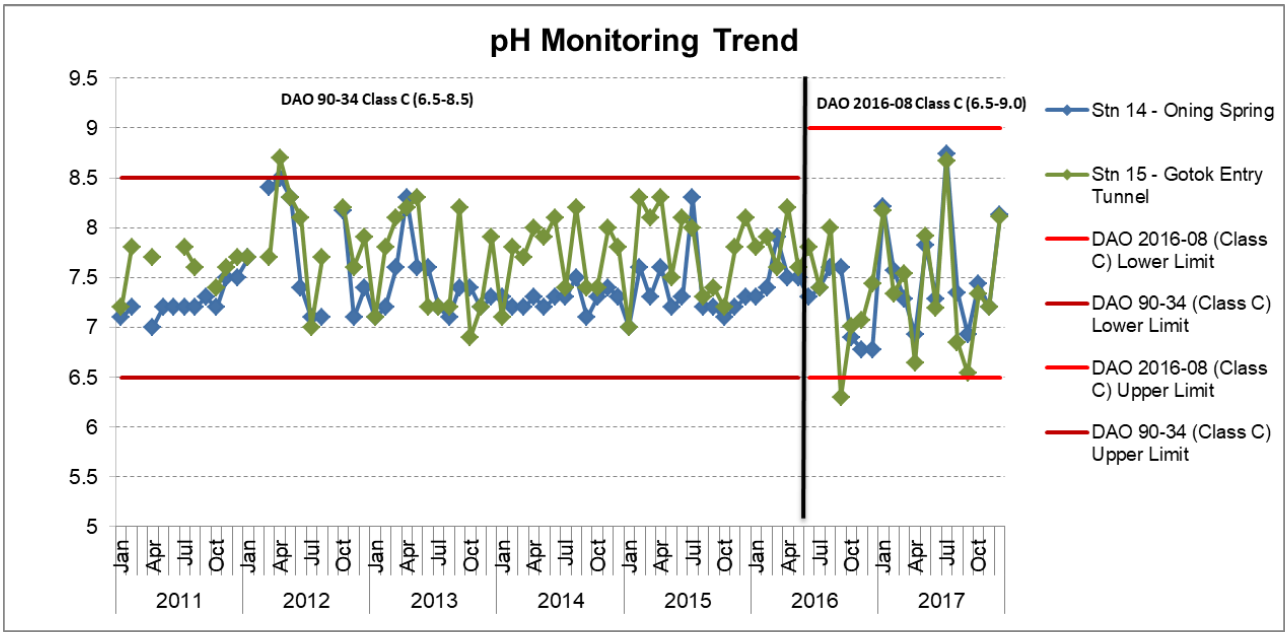


Figure 2.2.12. Water quality monitoring of pH

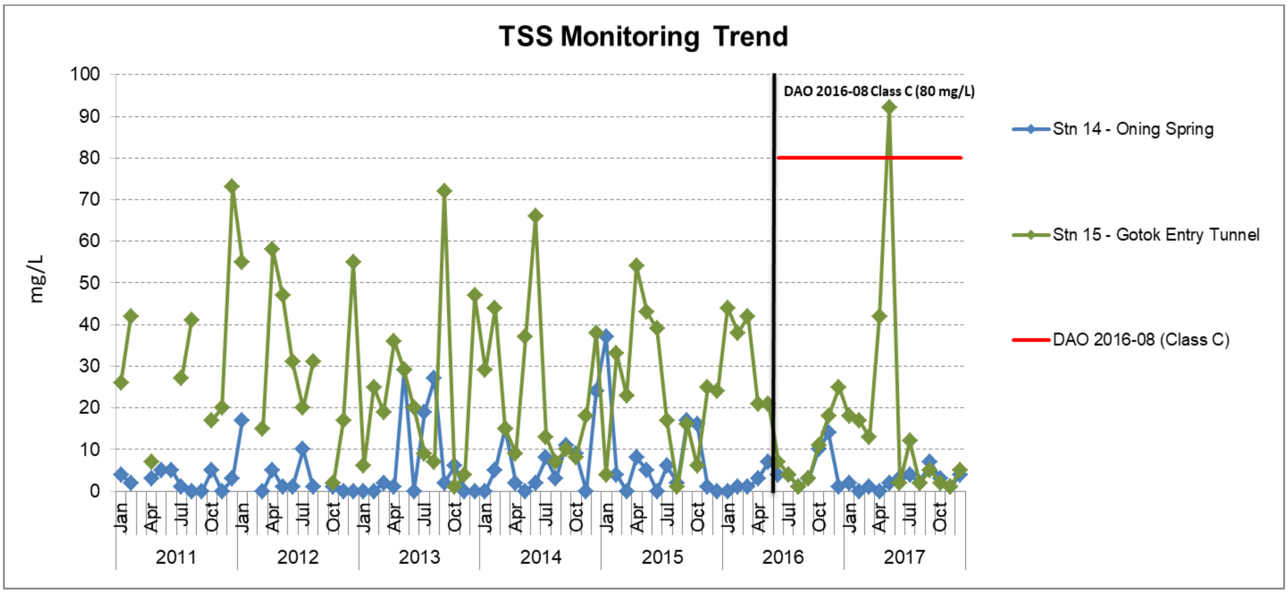


Figure 2.2.13. Water quality monitoring of TSS

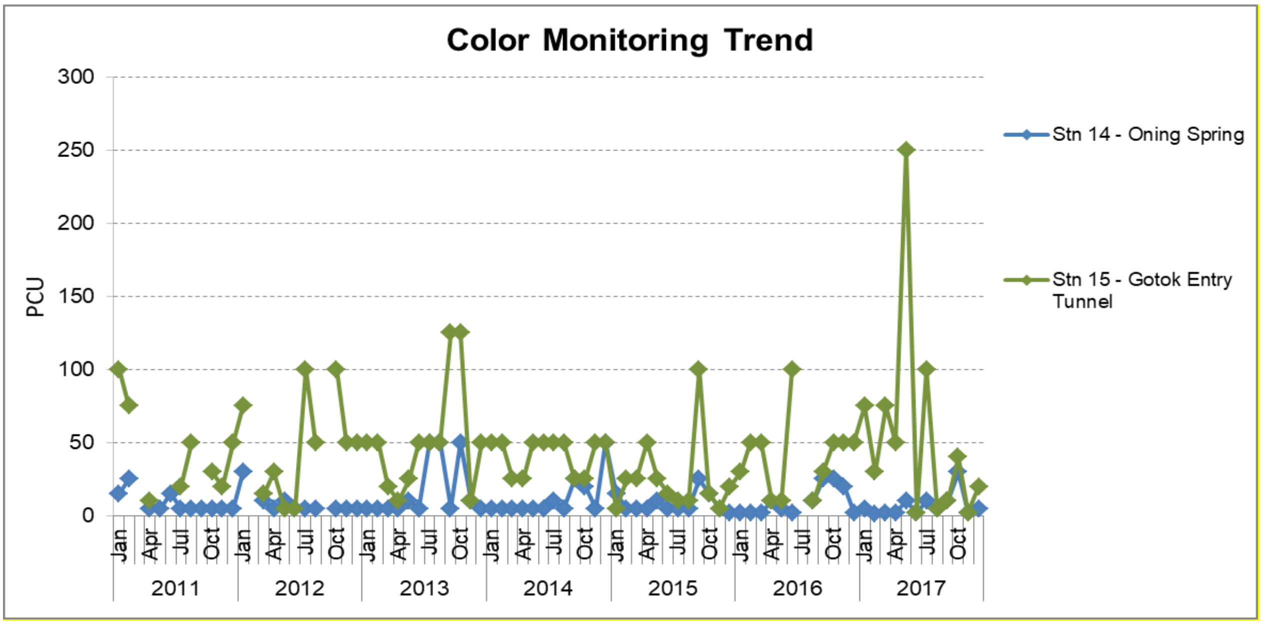


Figure 2.2.14. Water quality monitoring of color

2.2.2.3 Impact Assessment and Environmental Performance

Predicted Impacts

The following matrix summarizes the potential impacts that may be brought by the increased in production of the quarry and modified crushing plant. Each impact was identified as to the period of possible occurrence, duration, likelihood of occurrence, and magnitude. Entries with asterisks are perceived to be not significant or negligible while italicized entries were perceived to be a positive impact of the project.

Table 2.2.12. Impacts assessment and mitigation for water quality

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
Deterioration of water quality *Rio Tuba River* Rio Tuba River is the catch basin of both the industrial and domestic waste in the area. The modified crushing plant produces 313,200 m^3 of wastewater annually. This wastewater is directed to a settling pond. Overflow of the pond is discharged into the Rio Tuba River after it passes thru Upper Kinurong and Lower Kinurong settling ponds. The advantage of the river is the regular inundation of saltwater that dilutes organic materials and allows precipitation of organic matter in the water column. The process allows clarification of water periodically. The ecological process, however, deposits			✓		• Installation and maintenance of the siltation pond designed to contain the wastewater coming from the crushing plant. • Regular maintenance of the drainage system within the offices and motorpool area.

much organic matter into the bottom of the river and increases the sedimentation rate. Benthos, although limited in the brackish environment, is also disadvantaged by the frequent and fast deposition rate. As a catch basin, limiting nutrients to plankton growth also enters the river periodically. Extra nutrient increases the probability of harmful algal bloom occurrences. Consequently, it may increase the probability of fish kill events; spat kills and even unsightly algal accumulation. Current ecological condition of the river points that algal bloom is present. *Oning Spring* Oning Spring, on the other hand, may not be affected in terms of ecological index or water quality, but rather on the overall dynamics, aesthetics, and history of the spring. The proposed maximum depth of 25 masl may affect the cavern where the river disappears and would likely be irreversible. The water quality of the creek that drain the vicinity of the quarry will not experience any adverse impact since surface runoff from the quarry does not reach this creek. The surface runoff is collected in two (2) silt collector ponds and readily infiltrates into the ground.					
Increase in surface run-off and sedimentation of surface water bodies As documented, the quarry operation, which includes ground stripping made a significant alteration to the landscape. During the continued mining operations, it is expected that sediments from exposed and denuded surfaces will contribute to surface run-off and erosion, leading to possible siltation of nearby waterbodies. Stockpiled soil and other waste materials will also be susceptible to erosion during heavy rains.			✓		• Re-evaluation of the existing design of the stormwater collection system and installation of additional components shall be done if needed. • Regular monitoring of the drainage facilities and siltation pond(s) particularly during the rainy season to ensure optimum performance. • Regular cleaning of drainage channels from sediments and debris that may inhibit the flow of water. • Strict implementation of the quarry plan within the approved area.
Contamination of water resources from oil and grease The expansion will require additional equipment and vehicles, which use oil and grease. Furthermore, an increase in daily production will result to more frequent hauling of mined ore from Gotok Quarry to the crushing plant. Surface water contamination with oil and grease will likely occur from leaks and spillages.			✓		• Proper material handling and equipment maintenance. • Good housekeeping practices including proper handling and clean-up of oil at the motorpool site and at the contractor's area.

Performance Assessment

The monitoring data, as observed in the previous section, indicate that water quality in the Oning Spring (WQM1-Station 14) and Gotok Entry Tunnel (WQM2- Station 15) in terms of pH and TSS are generally within the DENR standards except for a few instances mentioned.

To ensure the compliance with the standards, one of the mitigating measures implemented by RTNMC was to provide drainage canals that lead to two (2) collector sumps. This measure ensures that fine particles from the open area will not be carried away by runoff water to adjoining areas during heavy downpour. The sumps will also serve as catch basin and will allow infiltration of the collected water back into the ground. These sumps are periodically desilted to maintain efficiency specially during heavy downpour where increased volume of run-off is expected.

However, there is a need to refine and strengthen the monitoring regime. The recommendations are as follows:

- Regular visual inspection and maintenance of the drainage canals within the quarry area should be strictly implemented specially during wet season.
- It is recommended to include monitoring of the one of the collector sumps located at the southwest portion of the MPSA as water quality stations for effluent. Samples of the effluent should be collected whenever there is an overflow. In case there is absence of overflow, it should be noted in the SMR and a photograph with time stamp should be attached. Proposed sampling map for Water Quality Monitoring is provided in *Chapter 6*.
- Moreover, since there are no prescribed significant effluent quality parameters in the DAO 2016-08, it is recommended to consider the following parameters for the water quality analysis: pH, Total Suspended Solids and oil and grease.

2.2.3 Freshwater Ecology

2.2.3.1 Methodology

Sites were selected based on probable impact of the modification of the crushing plant and the increase in production in the quarry area. Three sites were selected from Rio Tuba River based on the most proximal point that may be affected by wastewater generated from the modified crushing plant. Another two (2) sites were taken from the quarry area to project possible impact of the limestone production.

Detailed methodology for the collection of plankton and benthos samples is presented in **Annex 2.1.1**.

2.2.3.2 Findings and Discussion

Site Description

The first three (3) sampling sites in **Table 2.2.13** represent the Rio Tuba River, the catch basin of tailings in case of accidental spill. The most upstream sampling point, FW1, may be possibly affected by silt ponds from the mine sites and terrogenous materials from the limestone crushing plant. The midstream point, FW2, is the most proximal point to the tailings pond. FW3, mouth of the Rio Tuba River which is a brackish water ecosystem, was considered the downstream point. Brackish water are hydrodynamically active that promotes natural clearing of water. The mixing of the salt water, especially during high tide, with freshwater has a natural clearing effect as ions from salt water reacts with organic particles in fresh water forming coagulates and thus removing organic particulates from water column into the river bed.

The Oning Spring feeds a 1.1 km long creek from inland into the Gotok limestones. The creek disappears into the limestones giving a sound of cascading water. Efforts to trace the downstream of Oning had been naught (pers. comm.). For this study, the biological aspect of Oning Creek is represented by FW4. On the other hand, FW5 is the point by which waters from the creek disappears beneath the rocks.

Freshwater sampling map is depicted in **Figure 2.2.14**.

Table 2.2.13. Site description of the freshwater biology study sampling points for Gotok Limestone Quarry, Bataraza, Rio Tuba Palawan, April 2014

Label	Site	Northing	Easting
FW1	Tugpon-Kinurong Outfall Point	8° 31' 57.1"	117° 24' 37.2"
FW2	Gamayon Outfall Point	8 °31' 41.6"	117° 24 '15.9"
FW3	Rio Tuba River mouth	8 °30' 46.3"	117° 25' 24.4"
FW4	Oning upstream	8 °36' 18.2"	117° 27' 18.0"
FW5	Oning downstream	8° 36' 5.04"	117° 27' 50.9"

Plankton

The Rio Tuba River is a brackish body of water as it opens into the Rio Tuba Bay (see **Figure 2.2.13**). The riverbank is lined with mangrove species indicating the continuous supply of salt water particularly controlled by tidal flow. On the other hand, Oning spring is purely fresh with water emanating from underground sources.

The basic difference in the water quality of the water bodies sampled for this study is very apparent with the phytoplankton profile (**Table 2.2.14).** Rio Tuba River is mostly dominated by marine diatom species with concentrations ranging from more than 30,000 cells per liter to more than a million cells per liter. Diatoms usually proliferate when Silica, the material that they synthesize as their capsule is abundant along with other nutrients such as iron, nitrogen, and phosphorus (Reid and Wood, 1976). A concentration of more than a hundred thousand cells per liter of water may be considered a bloom condition, and depending on the species, may render the water itchy or may result to fish kill.

FW1 is dominated by two (2) diatom species: *Thallasionema* with a concentration of more than 11,000 cells per liter, and *Pleurosigma* with a concentration of more than 7,000 cells per liter. Combined with other species, the total concentration of diatoms exceeds 31,000 cells per liter. On the other hand, FW2 showed a remarkable bloom of diatoms with total concentration of more than 1,000,000 cells per liter of water dominated by *Thallasionema* having more than 800,000 cells per liter and *Chaetoceros* with more than 600,000 cells per liter of water. While *Thallasionema* may be considered a friendly bloom as they are fed on by fish, *Chaetoceros* makes “itchy water” and may cause fish kill. *Chaetoceros* has structural projections hitch with gills becoming an irritant to fish breathing. It also forms chains that projections become abrasive and thus causes itching. The same species dominates in FW3 comprising 98% of the diatom density of more than 600,000 cells per liter of water.

Dinoflagellates are also found in concentrations exceeding 1,000 cells per liter of water from FW1 to FW3. Dinoflagellates are toxin-producing plankton species that caused “red tide” or harmful algal bloom. Their presence in the sample may indicate possible harmful bloom in the future or a historical harmful algal bloom in Rio Tuba River.

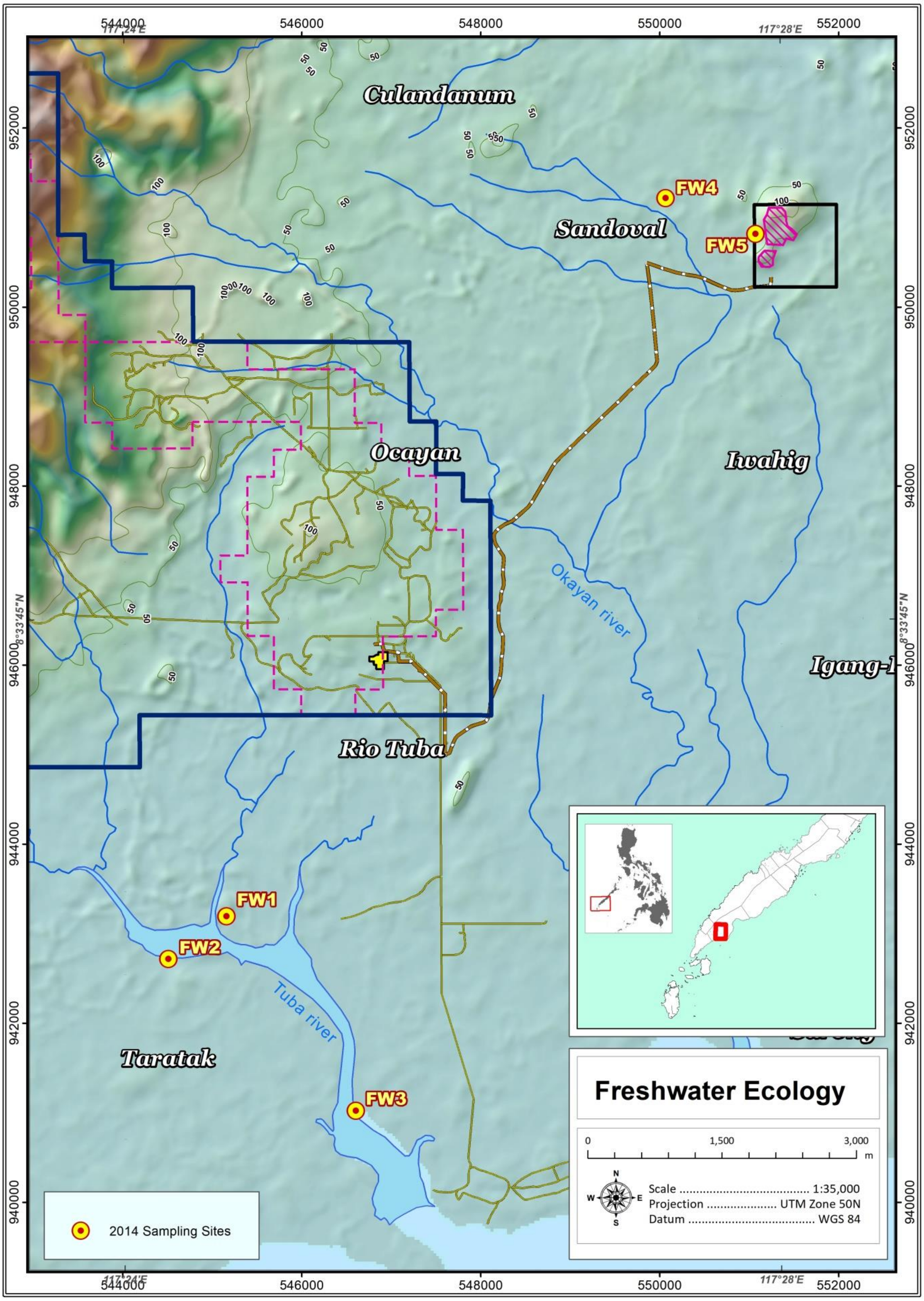


Figure 2.2.15. Freshwater sampling stations for the project

Table 2.2.14. Phytoplankton profile of the sampling stations for Gotok Limestone Quarry, Bataraza, Rio Tuba Palawan, April 2014

TAXA	Abundance (cells/L)				
	FW1	FW2	FW3	FW4	FW5
Blue green algae					
Oscillatoria	-	-	-	1,179	307
Spiraulina	-	-	-	-	139
Trichodesmium	149	20	20	-	-
Sub-total	**149**	**20**	**20**	**1,179**	**446**
Diatoms					
Amphora	-	-	20	-	-
Bacillaria	1,258	317	654	-	-
Campylodiscus	20	-	-	-	-
Chaetoceros	3,339	687,367	4,459	2,477	-
Climacodium	-	-	268	-	-
Coconeis	-	99	-	-	-
Coscinodiscus	178	723	456	327	-
Diploneis	258	-	-	-	-
Ephemera	59	50	20	-	-
Hemiaulus	-	-	248	-	-
Leptocylindrus	50	228	139	-	-
Licmophora	-	20	159	-	-
Navicula	-	99	-	-	-
Nitzschia	594	109	20	-	-
Odontella mobiliensis	79	228	89	-	-
Pleurosigma	7,689	3,904	1,803	337	268
Pseuodonitschia	139	-	-	-	-
Rhizosolenia	456	585	198	20	-
Skeletonema	654	-	-	-	-
Surirella	357	69	-	79	832
Tabellaria	961	585	-	99	139
Thalassionema spp.	11,335	832,687	673,434	6,936	-
Thalassiosira	3,626	1,011	1,139	188	30
Sub-total	**31,052**	**1,528,081**	**683,106**	**10,463**	**1,269**
Dinoflagellates					
Ceratium furca	50	188	614	-	-
Dinophysis caudata	-	-	119	-	-
Diplopsalis	763	-	1,011	10	-
Gonyaulax	168	99	713	-	-
Phalacroma	-	-	149	-	-
Prorocentrum micans	-	-	168	-	-
Prorocentrum rhatymum	-	-	149	-	-
Proroperidnium latispinum	149	20	565	-	-
Protoperidiniu pellucidum	-	159	-	-	-
Protoperidinium conicom	238	386	981	-	-
Protoperidnium divergins	-	30	307	-	-
Protoperidnium palludum	119	-	258	-	-
Protoperidnium pentagonum	-	-	69	-	-
Protoperidnium spp	-	79	168	-	-
Pyrophacus	-	-	79	-	-
Scrippsiella	-	-	149	-	-
Sub-total	**1,487**	**961**	**5,499**	**10**	**-**
Euglenoid					
Phacus	-	-	-	-	30
Euglena	-	-	-	-	436
Sub-total	**-**	**-**	**-**	**-**	**466**
Green algae					
Cosmarium	-	-	-	-	495
Sub-total	**-**	**-**	**-**	**-**	**495**
Silicoflagellate					
Dictyocha	20	-	-	-	-
Tintinopsis	-	149	99	-	-
Sub-total	**20**	**149**	**99**	**-**	**-**

TAXA	Abundance (cells/L)				
	FW1	FW2	FW3	FW4	FW5
Total Abundance (cells/L)	**32,708**	**1,529,211**	**688,722**	**11,652**	**2,675**
No. of species	**25**	**25**	**32**	**10**	**9**

The Gotok spring is also dominated by diatoms but to a lesser extent. Diatoms in FW4 exceed 10,000 cells per liter while the FW5 has only more than 1000 cells per liter of water. Diatoms are photosynthetic organisms proliferate under sunlit areas. FW5 is covered by canopies of trees and saplings.

Following the diatoms, the density of blue green algae is a remarkable feature of FW4 and FW5. FW5 has a density of more than 1,000 cells per liter while FW5 has more than 400 cells per liter of water. This is more than 10 times the concentration of the group in Rio Tuba River. Relative to brackish water, green, blue green and euglenoids are more prevalent in freshwater.

The larval forms of zooplankters are the most dominant group in all sampling points (**Table 2.2.15**). Particularly, the nauplii stage of various organisms is the most dominant group across all stations in Rio Tuba. This may indicate the prevalence of reproduction during the time of sampling. Summer months are the usual reproductive period of most benthos due to warm waters and availability of food.

Table 2.2.15. Zooplankton profile of freshwater sampling stations for Gotok Limestone Quarry, Bataraza, Rio Tuba Palawan, April 2014

Taxa	Density (individual/m^3)				
	FW1	FW2	FW3	FW4	FW5
Adult form					
Arcellidae	-	-	-	117	333
Bdelloid rotifer	-	-	-	-	100
Calanoid	-	33	133	-	-
Cycolpoid	1,249	316	2,165	100	-
Favella	150	17	583	-	-
Harpacticoid	-	50	-	-	-
Globegerina (Foram)	67	-	-	-	-
Sub-total	**1,465**	**416**	**2,881**	**217**	**433**
Larval form					
Barnacle nauplius	133	-	200	-	-
Bivalve veliger	100	-	67	-	-
Gastropod vilger	133	-	-	50	-
Larvacean (Oikipleuran)	-	-	83	-	-
Loricate rotifer	-	-	-	-	433
Nuaplii	2,664	899	9,873	100	133
Polychaete trocophore	-	-	83	-	-
Sub-total	**3,030**	**899**	**10,306**	**150**	**566**
TOTAL COUNT (indv/m^3)	**4,495**	**1,315**	**13,187**	**367**	**999**
NO. OF TAXA	**7**	**5**	**8**	**4**	**4**

Among the adult forms, the Cyclopoid are the most dominant across all sites in Rio Tuba River. Cyclopoids are relative of shrimps that serve as food to larger aquatic organisms and as grazers of phytoplankton. Their presence in concentrations of more than 1,000 organisms per cubic liter of water indicates availability of food for commercially important species.

On the other hand, Arcellidae is the most dominant of the adult forms in FW4 exceeding 100 organisms per liter of water density. It is also the dominant adult zooplankton taxa with a density of more than 300 organisms per cubic liter of water

Relative to the adults, larval forms have higher density both in FW4 and FW5. In FW4, nauplii is the most common with about a hundred organisms per cubic meter of water. However, in FW5 the loricate rotifer predominated at about 400 organisms per cubic meter of water. Rotifers are known organic feeders feeding on detrital materials from plants which cover the banks of FW5.

Benthos

Benthic organisms, or benthos, are organisms living in the interstices of sediments. These are mostly sessile or slow-moving organisms that may mirror the historical event in a body of water. As benthos are exposed to changes in the quality of sediments also reflects the quality of water, benthos are often used as water quality indicators.

Rio Tuba is a brackish environment and not much benthic organisms are observed in such settings. Oning on the other hand, yielded mostly scrapers like snails (*Melanogaster* and *Pomacea*) and shredders (crabs and shrimps) (**Table 2.2.16**). FW4 biota is topped by planktivorous fishes and the omnivorous shrimps. Downstream, the omnivorous crab is the top consumer but biotic population is dominated by *Melanogaster*.

Table 2.2.16. Benthic profile of freshwater sampling stations for Gotok Limestone Quarry, Bataraza, Rio Tuba Palawan, April 2014

Taxa	Family-Level Pollution Tolerance Index	FW4	FW5
Molluska			
Gastropoda			
Melanogaster	7	-	12
Pomacea	7	9	1
Arthropoda			
Decapoda (crab)	8	1	
Decapoda (shrimp)	8		11
Vebtebrata			
Hemiramphus	-	-	1
Gobiidae	-	-	1
Biotic Index		**7.1**	**7.458333333**
Qualitative Description		**Fairly Poor**	**Poor**

Notes: Family-level Biotic Index interpretation: 0-3.75 – excellent (organic pollution unlikely); 3.76-4.25 – very good (possible slight organic pollution); 4.26-5.00 – good (some organic pollution probable); 5.01-5.75 – fair (fairly substantial pollution likely; 5.76-6.50 – fairly poor (substantial pollution likely); 6.51-7.25 – poor (very substantial organic pollution likely); 7.26-10 – very poor (severe organic pollution likely) (Mandaville, 2002).

Based on family-based scores, upstream Oning has fairly poor water quality while downstream Oning has poor waters. While the immediate surroundings of the spring are forested, it is adjacent to agricultural areas and appears to be the catchment basin of run-off from surrounding areas based on topography. The spring also appears to have a multiple-use function – laundry, animal waterhole, picnic area- it appears to be poorly maintained as evidenced by fallen trees on the spring source, soap and shampoo packets, and animal excreta on the bank.

Given the limited biological data, using the Biological Monitoring Working Party (BMWP) score in judging the water quality of the spring maybe biased. Most taxa-level scores for water quality studies are based on multiple samples covering longer periods. For a single sampling period, however, water quality maybe temporary and applies only for the period covered by the sampling period.

2.2.3.3 Impact Assessment and Environmental Performance

Predicted Impacts

The following matrix summarizes the potential impacts that may be brought by the increased in production of the quarry and modified crushing plant. Each impact was identified as to the period of possible occurrence, duration, likelihood of occurrence, and magnitude. Entries with asterisks are perceived to be not significant or negligible while italicized entries were perceived to be a positive impact of the project.

Table 2.2.17. Impacts assessment and mitigation for freshwater ecology

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
Threat to existence and/or loss important local species and **Threat to abundance, frequency and distribution of freshwater species** No important aquatic species in Oning is threatened with the increase in the annual production of Gotok limestone quarry project. However, increased input of wastewater from settling ponds may increase the probability of an algal bloom in Rio Tuba River.			✓		• Installation and maintenance of the siltation pond designed to contain the wastewater coming from the crushing plant.

Performance Assessment

Current freshwater profile suggests that Oning has deteriorating water quality probably attributed to it being the catchment of run-off from surrounding areas. As a multi-use ecosystem, laundrying activities in the area dump phosphate materials in to the water, which may have contributed to its current state.

The uniqueness of Oning is that it runs under the Gotok limestone deposit in an unknown depth into an unknown destination. Current activity however did not show underground cave ins/sinking indicating the underground river system may be small or current limit of mining activities may be superficial relative to the depth of the river.

Current study also showed that diatom bloom in the marine environment (FW3) maybe related to silica enrichment of the river. Several studies have shown that the algal group dominates in areas that receive inland sediment. Dissolved silica is one of the limiting factors of diatoms.

2.3 AIR AND NOISE

This section includes baseline and impact assessment for the meteorology, greenhouse gas emission, air quality and noise level. Sampling procedures in the conduct of the baseline data are presented in **Annex 2.1.1**.

2.3.1 Meteorology

2.3.1.1 Methodology

This section shall describe the prevailing meteorological condition within the project area and its vicinity. The discussion shall revolve around the secondary data gathered from the Puerto Princesa PAGASA station, which is the nearest weather station. These data include the climatological normals and extreme from 1981 to 2010, wind rose diagram from 1971 to 2000, climate maps and climate change projections.

2.3.1.2 Findings and Discussions

The nearest synoptic station to the project site is located in Puerto Princesa, Province of Palawan. **Tables 2.3.1** and **2.3.2** depict the climatic variables, respectively, sourced from PAGASA and onsite.

The area is categorized as Type III climate under the Modified Corona Classification of the Philippine Climate (**Figure 2.3.1**). This type of climate is relatively dry from January to April and wet throughout the year. The southwest monsoon from June to September, northeast monsoon from December to February, and Easterly Waves from March to April are the main atmospheric systems controlling rainfall. During summer, the Intertropical Convergence Zone (ITCZ) also contributes significantly to the rainfall in the area.

__Rainfall__

PAGASA has been measuring rainfall in Palawan since 1949. Brooke's Point Station started its operation in 1971. As recorded in all stations, the monthly minimum rainfall ranges from zero to 188 mm (as observed in Cuyo). The monthly maximum rainfall on the other hand ranges from 22 mm (as observed in Coron) to 4,632 mm (as observed in Brooke's Point). The mean monthly values vary from 3 mm to 613 mm as documented in Cuyo and Brooke's Point. Months of June to October are the wettest seasons of the year.

The mean annual rainfall based from the isohyetal maps of Palawan varies from approximately 1,600 mm within the east coast rain shadow to about 2,500 mm in the north and over 3,000 mm along the central and southwestern coast. The mountainous area catches approximately 3,000 to 5,000 mm of rainfall per year.

Table 2.3.1 shows the climatic variables at Puerto Princesa City while **Figure 2.3.2** depicts the monthly rainfall trend for the three (3) identified rainfall stations at Rio Tuba which shows that the rainy season occurs from May to December wherein October is the rainiest month. These stations are Guintalunan, Pier Site and Mangingidong, which started its operation in 1977, 1980, and 1983, respectively.

Table 2.3.1. Climatic variables at Puerto Princesa City

Months	Rainfall (mm)	No. of rainy days	Temperature (°C)	Relative Humidity	Evaporation (mm)
January	3.2	1	26.3	78	19.82
February	2.6	2	26.7	78	21.06
March	9.5	3	26.2	82	22.37
April	19.8	3	27.9	79	23.75
May	116.4	16	28.2	82	22.37
June	148.8	12	27.3	82	22.37
July	147.6	16	26.6	87	22.37
August	143.5	17	26.8	86	22.37
September	83	12	27	84	22.37
October	145.9	15	26.5	86	22.37
November	118.1	14	26.4	85	22.37
December	52.7	5	26.6	89	22.75
TOTAL	**991.1**	**116**	**26.9**	**83**	**266.34**

Table 2.3.2. Average annual rainfall at Rio Tuba

Rainfall Station	Average Annual Rainfall (mm)
Guintalunan	1,891
Mangigidong	2,198
Piersite	1,510

Source: RTNMC

Thunderstorm and Lightning

The occurrence of thunderstorm normally happens in an average of 1 to 15 days per month from January to December. The most number of thunderstorm days and lightning occurrences is recorded in the month of May. The mean frequency of lightning events ranges from 1 to 18 days in the entire year.

Temperature

The mean annual temperature in the area is 27.5°C with little seasonal variation based on the data from the east coast for a 17-year period. The diurnal temperature range is typically 22.5 – 31.4°C in February and 24.5°C to 32.6°C in the month of May.

Runoff

In year 2000, a study indicated that the estimated annual runoff was determined at 16% of the annual rainfall. This was studied through the use of analogue method described by Sokolov and Chapman (1974) and stream discharge estimates by the NWRC (1983) for comparable river basins in the Province of Palawan.

Relative Humidity

Atmospheric moisture content in the tropics is relatively higher than that in the upper latitude towards the continental areas. The Philippines is situated in the tropics, thus, the relative percentage of atmospheric humidity is higher as compared to other areas. The mean annual relative humidity value in Palawan is 83%.

Evaporation and Evapotranspiration

The estimated annual mean is 1,525.8 mm. The monthly evapotranspiration ranges from 67.8 mm to 126.9 mm having an annual mean computation of 1,068.1 mm.

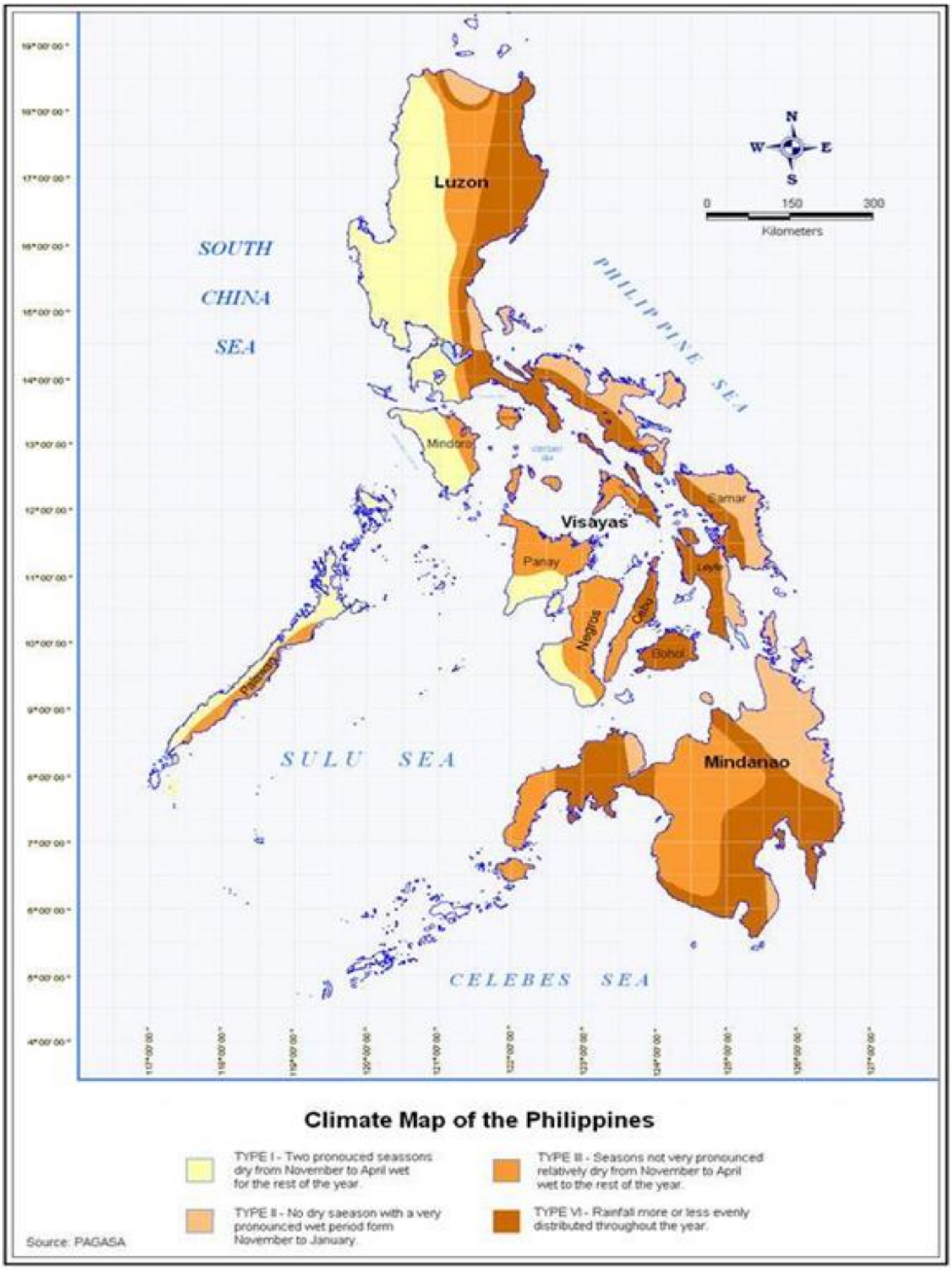


Figure 2.3.1. Climate map of the Philippines

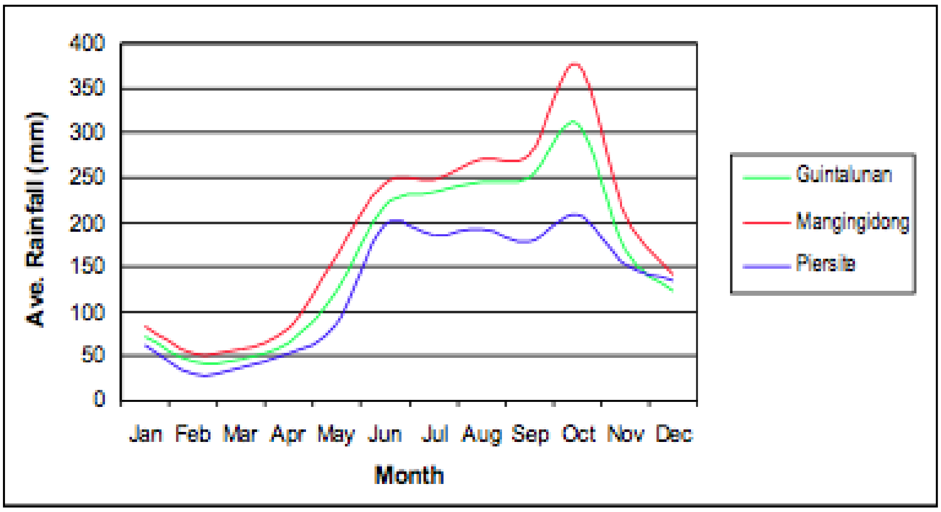


Figure 2.3.2. Monthly rainfall trend for the three (3) stations

Typhoons

The Philippines normally experience about 20 typhoons in a year. Based on the Cyclone Map of the Philippines, the potential occurrence of typhoon in Southern Palawan is once every 20 years. Normally, this happens during the last quarter of the year when the tail end of the cold front moves towards the southern part of the Philippines.

Frequency of Tropical Cyclones

In the Philippines, the mean percentage of frequency of cyclone passage ranges from 0 to 20%. This means that from the average annual typhoons, storms and cyclones that pass through the country in a year, 0 to 4 occurrences only happen in the province between May to November. On the other hand, offshore typhoons may occur occasionally.

Wind

During the months of July and August, the average wind speed is 1.0 m/s while in the month of January, the average wind speed is 2.3 m/s. The annual wind speed is 1.4 m/s, northeast direction. Annual wind rose diagram from PAGASA is shown in **Figure 2.3.3**. The monthly wind rose diagram is presented in **Annex 2.3.1**. **Figures 2.3.4** and **2.3.5** also show the annual wind rose diagram generated from the onsite-meteorological data of CBNC.

Cloudiness

Based on records, the mean annual cloud amount at Puerto Princesa is 5 octas. Months of June to October are expected to be cloudy.

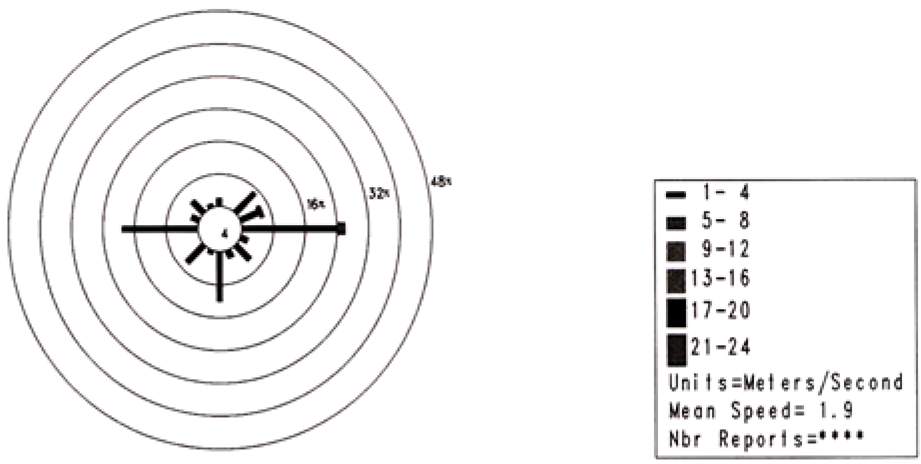
Mean Sea Level Pressure

The mean sea level pressure in Palawan is 1010.5 mbs.

WIND ROSE DIAGRAM, 1971-2000

PUERTO PRINCESA,PALAWAN

Annual



FREQUENCY TABLE
PUERTO PRINCESA, PALAWAN
Wind Speed and Direction
Annual (1971-2000)

Direction / Speed (mps)	N	NNE	NE	ENE	E	ESE	SE	SSE
CALM								
1 – 4	2.1	0.2	6.6	5.1	24.1	2.0	5.4	2.0
5 - 8	0.1	0.0	0.2	1.1	1.9	0.0	0.0	0.0
>8	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
TOTAL	2.2	0.2	6.8	6.3	26.0	2.0	5.4	2.0

Direction / Speed (mps)	S	SSW	SW	WSW	W	WNW	NW	NNW	TOTAL
CALM									4.3
1 - 4	11.8	0.6	6.2	0.5	18.6	2.3	3.6	0.9	92.0
5 - 8	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.0	3.6
>8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
TOTAL	11.8	0.6	6.3	0.5	18.7	2.3	3.7	0.9	100.0

Figure 2.3.3. Annual wind rose diagram (1971-2000)

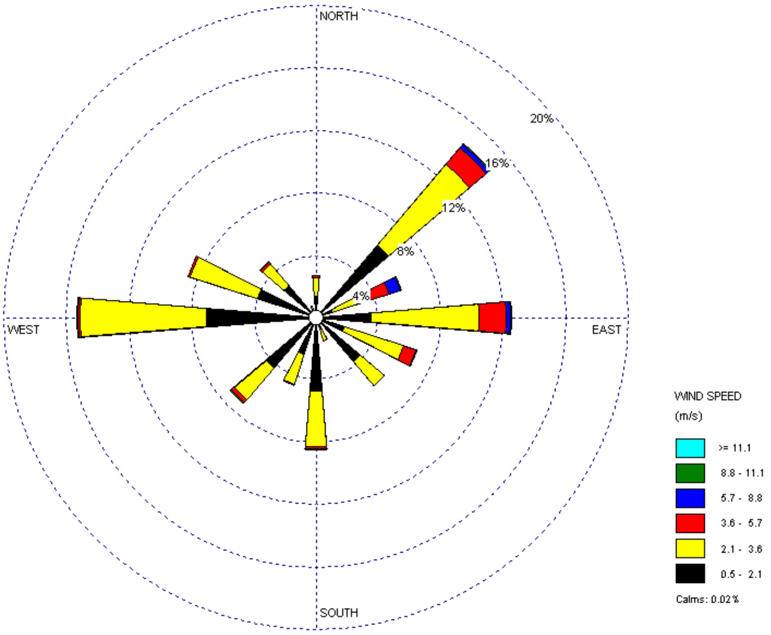


Figure 2.3.4. Annual windrose diagram, Puerto Princesa (Station 618)

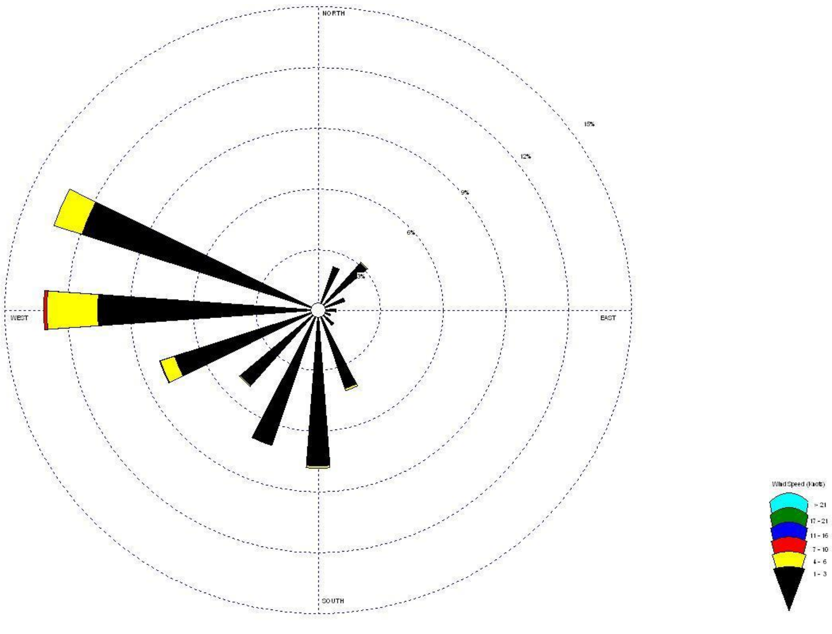


Figure 2.3.5. Annual windrose diagram, CBNC HPP, Brgy. Rio Tuba, Bataraza, Palawan

Climate Change Projections

PAGASA climate change projections for 2020 and 2050 are presented in **Tables 2.3.3** to **Table 2.3.5**. The highest temperature change is the increase of 2.1˚C in 2050 for the months of June-July-August. In terms of rainfall, an increase of 19.6 mm of rain is projected for the months of September-October-November. The number of days with extreme temperature (>35°C) will decrease in 2020 by 24.1% but will increase to up to 924.1% by 2050.

Table 2.3.3. Seasonal temperature change for 2020 and 2050 in Palawan

Months	OBS (1971-2000), °C	2020 (2006-2035)		2050 (2036-2065)	
		Change, °C	Projected Value, ˚C	Change, °C	Projected Value, °C
December-January-February (DJF)	26.9	0.9	27.8	1.8	28.7
March-April-May (MAM)	28.1	1.1	29.2	2.1	30.2
June-July-August (JJA)	27.3	1.0	28.3	2.0	29.3
September-October-November (SON)	27.4	0.9	28.3	1.8	29.2

Table 2.3.4. Seasonal rainfall change for 2020 and 2050 in Palawan

Months	OBS (1971-2000), °C	2020 (2006-2035)		2050 (2036-2065)	
		Change, mm	Projected Value , mm	Change, mm	Projected Value, mm
December-January-February (DJF)	101.8	+ 15.7	117.5	+ 7.3	109.1
March-April-May (MAM)	189.3	- 7.2	182.1	- 9.0	180.3
June-July-August (JJA)	781.7	- 2.6	779.1	- 1.0	780.7
September-October-November (SON)	640.6	+ 19.6	660.2	+ 6.9	647.5

Table 2.3.5. Seasonal extreme events for 2020 and 2050 in Palawan

Parameters	OBS	2020	+/-, %	2050	+/-, %
No. of days with Temperature max >35°C	29	23	-24.14	297	+924.14
No. of days with Dry Days	8,348	6,457	- 22.65	6,455	- 22.68
No. of days with Rainfall >200 mm	2	7	+250.00	7	+250.00

2.3.1.3 Impact Assessment and Environmental Performance

<u>Predicted Impacts</u>

The following matrix summarizes the potential impacts that may be brought by the increased in production of the quarry and modified crushing plant. Each impact was identified as to the period of possible occurrence, duration, likelihood of occurrence, and magnitude.

Table 2.3.6. Impacts assessment and mitigation for meteorology

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
Change in local climate According to projection of PAGASA, Palawan rainfall events (>200 mm) will increase by 250% by year 2020 and 2050. This significant increase may result to localized flooding of the project site considering that quarry activities are designed to culminate at 2022. This impact is			✓		• Progressive rehabilitation and maintenance of the vegetation along the buffer zones. • Re-evaluation of the existing design of the stormwater collection system and installation of additional components shall be done if needed. • Regular monitoring of the drainage

short term, which may occur during extreme rain events.					facilities and siltation pond(s) particularly during the rainy season to ensure optimum performance. • Regular cleaning of drainage channels from sediments and debris that may inhibit the flow of water. • Strict implementation of the quarry plan within the approved area.

2.3.2 Greenhouse Gas (GHG) Emission

2.3.2.1 Methodology

The GHG emission of project was estimated using the calculation tool provided by the Greenhouse Gas Protocol Initiative[1]. GHG estimation for the project is limited to the Scope 1 (all direct emissions) category of Greenhouse Gas Protocol.

2.3.2.2 Findings and Discussions

The scope of the study will be limited to the emission from the transport vehicles, mobile machinery and stationary combustion tool such as generators. It should be noted that the aboveground and belowground biomass from land clearing were not considered in the estimation.

Annex 2.3.2 contains the fuel requirements of the current and the proposed project used as input data for this calculation tool.

The resulting potential CO_2 emission (CO_2-e) for the proposed project is 4,063 metric tonnes per year. It is higher compared to the potential CO_2-e of the current project, which is 1,898 metric tonnes per year since additional sets of heavy equipment are required to handle the increase in production. As expected, majority of the emission for both current and proposed expansion comes from the land transport sector. The summary of the result of the calculation tool is provided in **Table 2.3.6** while the emissions calculation tool worksheet can be seen in **Annex 2.3.3**.

Table 2.3.7. RTNMC estimates of GHG emission (CO_2-e)

RTNMC Sector	Annual CO_2-e (metric tonnes)	
	Current Operation	Proposed Expansion
Land Transport	1,897.784	4,062.932
Water Transport	-	-
Air Transport	-	-
Stationary Equipment	64.452	128.903
Total	**1,962.236**	**4,191,835**

2.3.2.3 Impact Assessment and Environmental Performance

Predicted Impacts

The following matrix summarizes the potential impacts that may be brought by the increased in production of the quarry and modified crushing plant. Each impact was identified as to the period of possible occurrence, duration, likelihood of occurrence, and magnitude.

[1] World Resources Institute (2008). GHG Protocol tool for mobile combustion.Version 2.2.www.ghgprotocol.org

Table 2.3.8. Impacts assessment and mitigation for GHG emission

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
Contribution in terms of Greenhouse Gas Emission Due to the additional requirement of heavy equipment for the proposed increase in production, the GHG Emission is expected to increase. Progressive rehabilitation and maintenance of the vegetation along the buffer zones shall be implemented to aide in the sequestration of the increased GHG emissions from the increased number of vehicles and heavy equipment. Aside from this, regular maintenance of all heavy equipment shall be practiced.			✓		• Progressive rehabilitation and maintenance of the vegetation along the buffer zones.

Performance Assessment

RTNMC is committed in its Reforestation and Rehabilitation Program as discussed in *Section 2.1.4.3*, which contributes to the reduction of carbon footprints. As the potential annual CO_2-e is expected to increase for the proposed project, the current Reforestation and Rehabilitation program shall be intensified.

2.3.3 Air Quality and Noise

2.3.3.1 Methodology

The ambient air quality and noise level within the project site was assessed using the monitoring data lifted from the SMR submissions of RTNMC and the actual field sampling conducted last February 26 to March 2, 2014 at three (3) sampling locations. The sampling was conducted using DENR standard ambient sampling equipment and following analytical procedures. **Annex 2.3.4** shows the ambient air sampling report prepared by Industramach Inc. for the detailed methodology of the sampling.

2.3.3.2 Findings and Discussions

Air Quality

Monitoring data from 2010 to 2017

The monitoring program of RTNMC for the Gotok Limestone Quarry project includes monthly measurement and recording of the concentration of particulates on two (2) sampling stations established near the quarry area. These two (2) stations are included in the submitted SMRs for the said project. As for the operation at the crushing plant, a station established within the admin compound facing the crushing plant was being monitored and reported in the submitted SMR for the Nickel Mining Project up until February of 2014 before it was relocated to the magazine area. The locations of these three (3) stations are presented in **Table 2.3.9**.

Table 2.3.9. Air quality monitoring stations of RTNMC

Station No.	Location
Station 6	Southeast of Gotok Limestone Quarry Area
Station 7	Southwest of Gotok Limestone Quarry Area
Station 4*	Administration Compound facing the Crushing Plant

Source: RTNMC SMR for the Gotok Limestone Quarry
*Note: * Reflected on the SMR for the Nickel Mining Project*

As seen in the **Figure 2.3.6**, the observed particulate concentrations from 2011 to 2014 were below the 300 µg/Ncm maximum standard of DENR. The figure also shows that the level of concentration at the Admin Compound facing the crushing plant is higher compared to the two (2) stations located near the quarry area. The higher values may have resulted from the operation of the crushing plant as well as the nearby industrial activities. From 2015 to 2017, the results of the air quality for the two (2) stations located at the vicinity of the Gotok Quarry Area were still below maximum standard of DENR (**Figure 2.3.7**). For the two stations within the vicinity of the quary, the highest measurement was 236 µg/Ncm recorded in March 2015 at the Southwest Station.

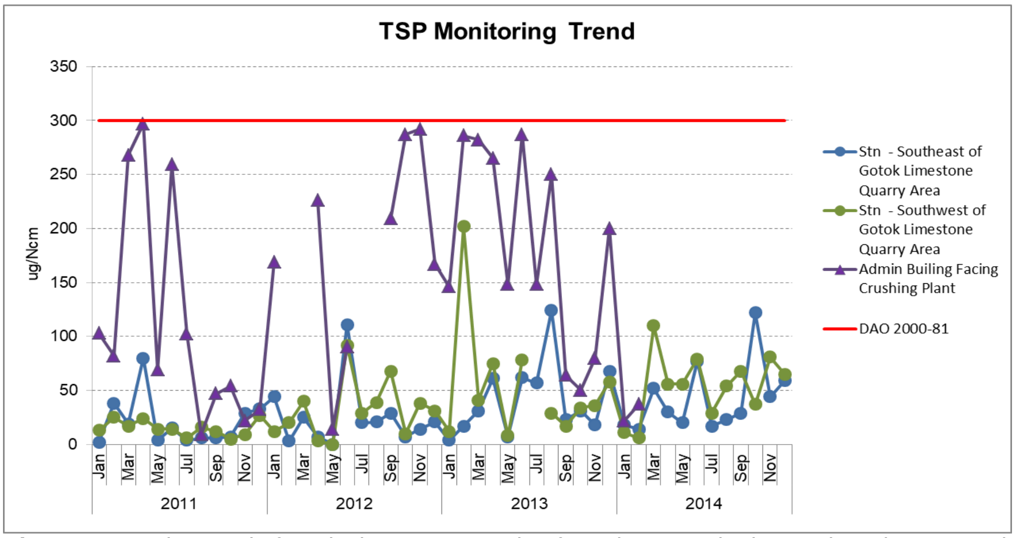


Figure 2.3.6. The trend of particulate concentration from three monitoring stations (2011-2014)

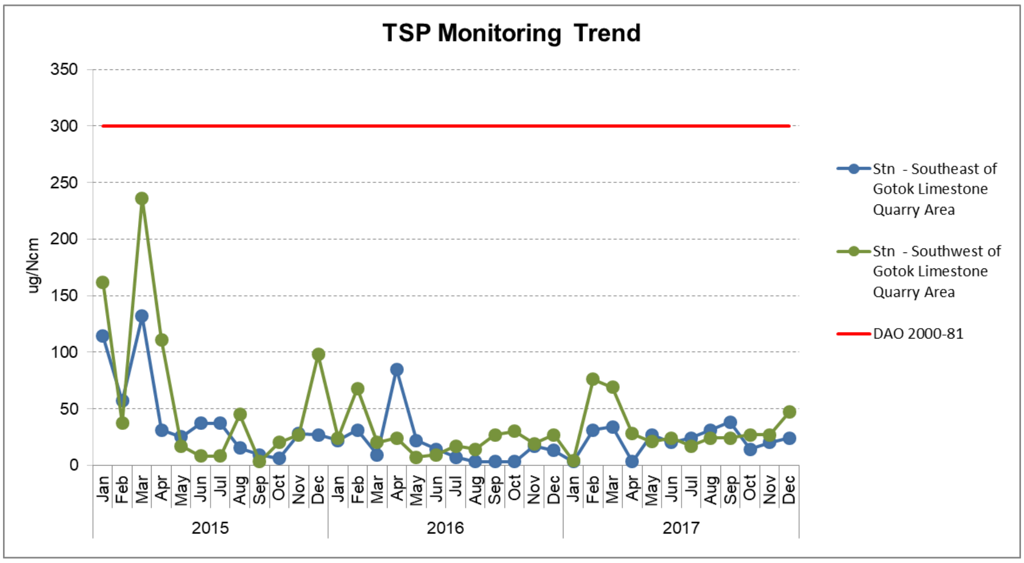


Figure 2.3.7. The trend of particulate concentration from two monitoring stations at the Gotok Quarry area in 2015 to 2017

Ambient air sampling result

For this particular EPRMP, the air quality was evaluated using four (4) parameters: Particulate Matter 10 Microns (PM10), Total Suspended Particulate (TSP), Sulfur Dioxide (SO_2) and Nitrogen dioxide (NO_2). The sampling was done for three (3) stations located near and within the vicinity of the quarry area (**Table 2.3.10**; **Figure 2.3.9**).

Table 2.3.10. Sampling stations for the ambient air sampling

Station	Latitude	Longitude	Location
AQ1/NQ1	8˚35'55.40"	117˚28'32.70"	GK Gotok
AQ2/NQ2	8˚35'54.36"	117˚27'58.67"	200 m south of the Phase 2 of the quarry area
AQ3/NQ3	8˚35'51.82"	117˚27'10.29"	Barangay Gotok
AQM1 /NQM1	8°35'49.85"	117°28'6.98"	Gotok SE
AQM2 /NQM2	8°35'47.02"	117°27'47.02"	Gotok SW

Also included in **Table 2.3.10** and **Figure 2.3.8** are the two monitoring stations of RTNMC located at the quarry area.

The results of the sampling (**Table 2.3.11**) indicate that all four (4) parameters were maintained below the DENR standard limit while regular operation was on-going. Station AQ2 located within the quarry area, although below the limit, was found to have the highest values for PM10 and TSP. This may be attributed to the dust from the loading and hauling activities near the sampling station. In the case of AQ1, the station is located at the upwind position from the limestone quarry area which may have contributed to higher values for PM10 and TSP compared to AQ3 which is located near the hauling road.

Probable sources of SO_2 and NO_2 detected from all stations are from heavy equipment and transport vehicles utilized during operation and some private motor vehicles used by residents.

Table 2.3.11. Result of the ambient air sampling conducted on February 26 to March 2, 2014

Station	PM10 (µg/Nm^3)	TSP (µg/Nm^3)	SO_2 (µg/Nm^3)	NO_2 (µg/Nm^3)
AQ1	33.0	82.0	13.7	0.2
AQ2	47.0	120.0	3.5	0.3
AQ3	26.0	48.0	2.2	0.2
DENR National Ambient Guideline Values (NAAQGV)	**150.0**	**200.0**	**180.0**	**150.0**

In October 2013, as part of the EPRMP for the Rio Tuba Beneficiated Nickel Silicate Ore Expansion Project, a 24-hour ambient air quality sampling was conducted at six (6) stations within the project area. One of the stations established for this sampling is the vicinity of the Admin Building where the crushing plant is also located. The sampling conducted for that station resulted to 31 µg/Nm^3 for PM10, 2.0 µg/Nm^3 for NO2 and 1.02 µg/Nm^3 for SO_2. Results for all three (3) parameters were below the DENR NAAQGV.

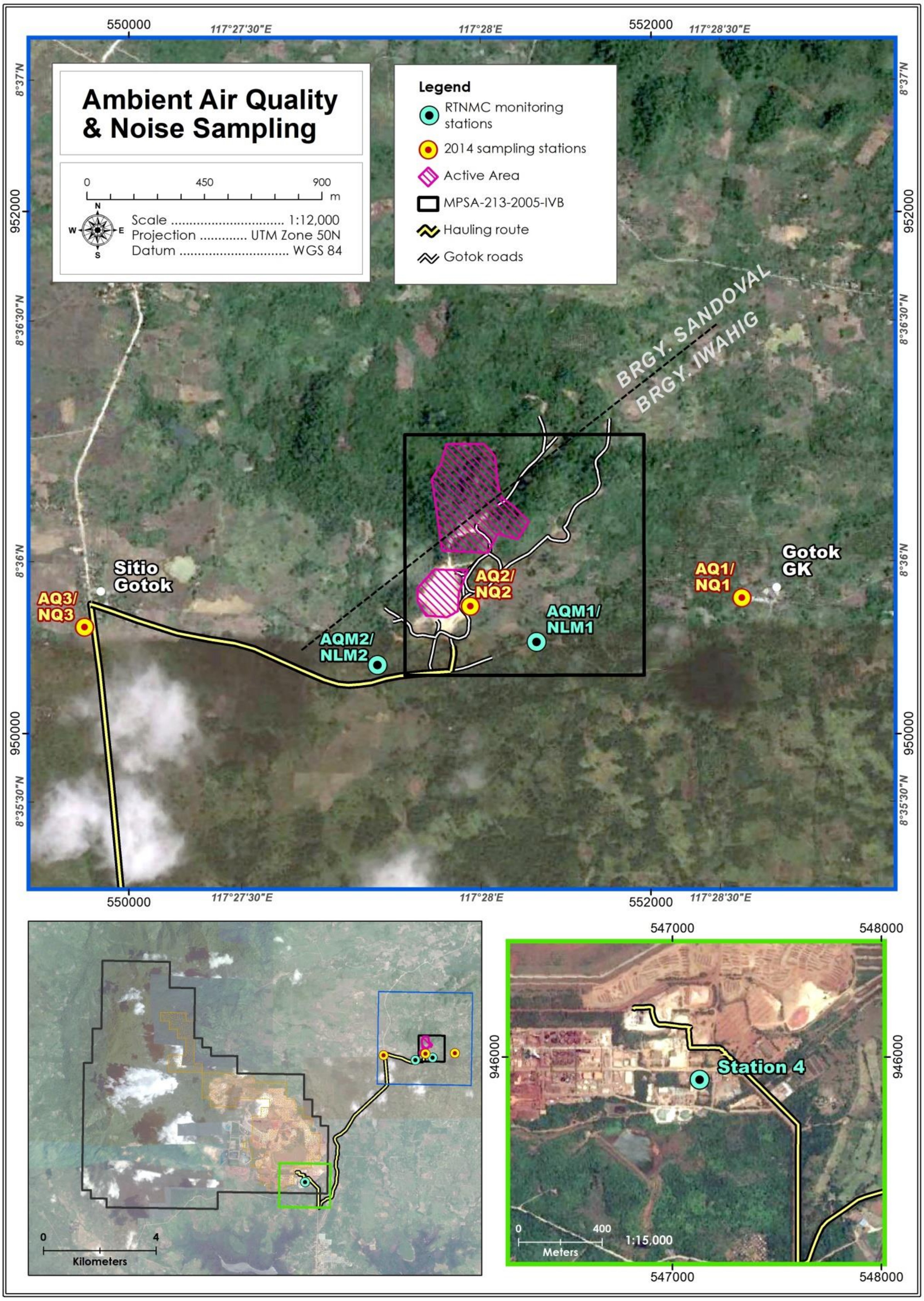


Figure 2.3.8. Sampling station map for air quality

Noise Level

Monitoring data from 2011 to 2017

RTNMC has established stations for the monitoring of the noise level within the vicinity of the quarry operations. **Table 2.3.12** shows the location of the two (2) stations.

Table 2.3.12. Noise level monitoring stations of RTNMC

Station No.	Location
Station 5	Southeast of Gotok Limestone Quarry Area
Station 6	Southwest of Gotok Limestone Quarry Area

Source: RTNMC SMR for the Gotok Limestone Quarry Project

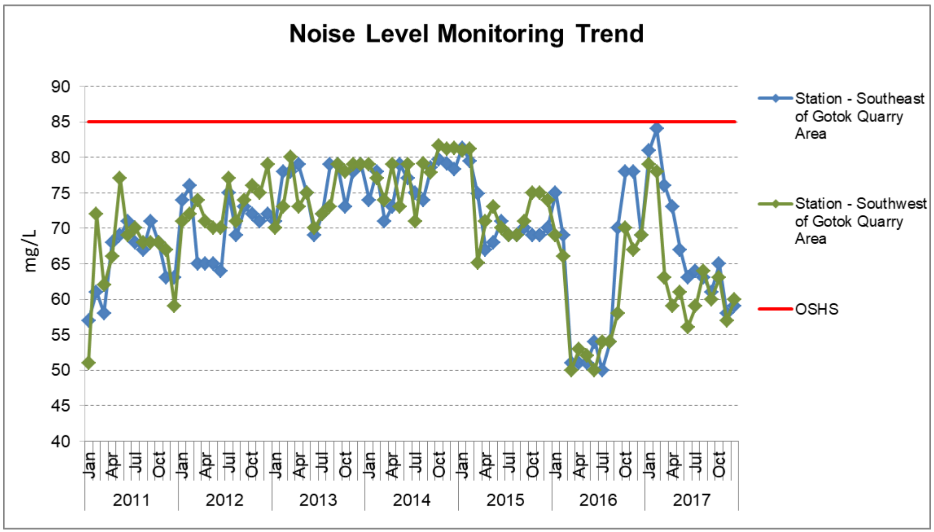


Figure 2.3.9. Morning ambient noise quality monitoring

As seen in **Figure 2.3.9**, the recorded noise level during operation within the quarry area are less than the maximum noise level of 85 db prescribe by the Occupational Safety and Health Standards (OSHS).

Noise Level Sampling Result

A 24-hr noise level sampling was conducted for three (3) stations within and near the vicinity of the quarry area and hauling road from February 26 to March 1, 2014 (**Table 2.3.13; Figure 2.3.10**). The summary of the data recorded during the sampling is presented in **Table 2.3.14**.

As seen in the table, the highest noise level for NQ1 and NQ3, both residential areas (Class A), for all time period were all above the maximum standard. The high level of noise from NQ1 may have resulted from the domestic activities coming from the households situated within the community while the proximity of the NQ3 station to the hauling road and households may have contributed in its exceedance to the limit. In the case of NQ2 (Class C), heavy equipment used during the quarry operations such as drilling, loading and hauling were the source of noise within the area.

Table 2.3.13. Noise level sampling stations of RTNMC

Station	Location	Northing	Easting
NQ1	GK Gotok	8º 35’ 55.40”	117º 28’ 32.70”
NQ2	Entrance to the quarry area	8º 35’ 54.36”	117º 27’ 58.67”
NQ3	Kulantuod Junction	8º 35’ 51.82”	117º 27’ 10.29”

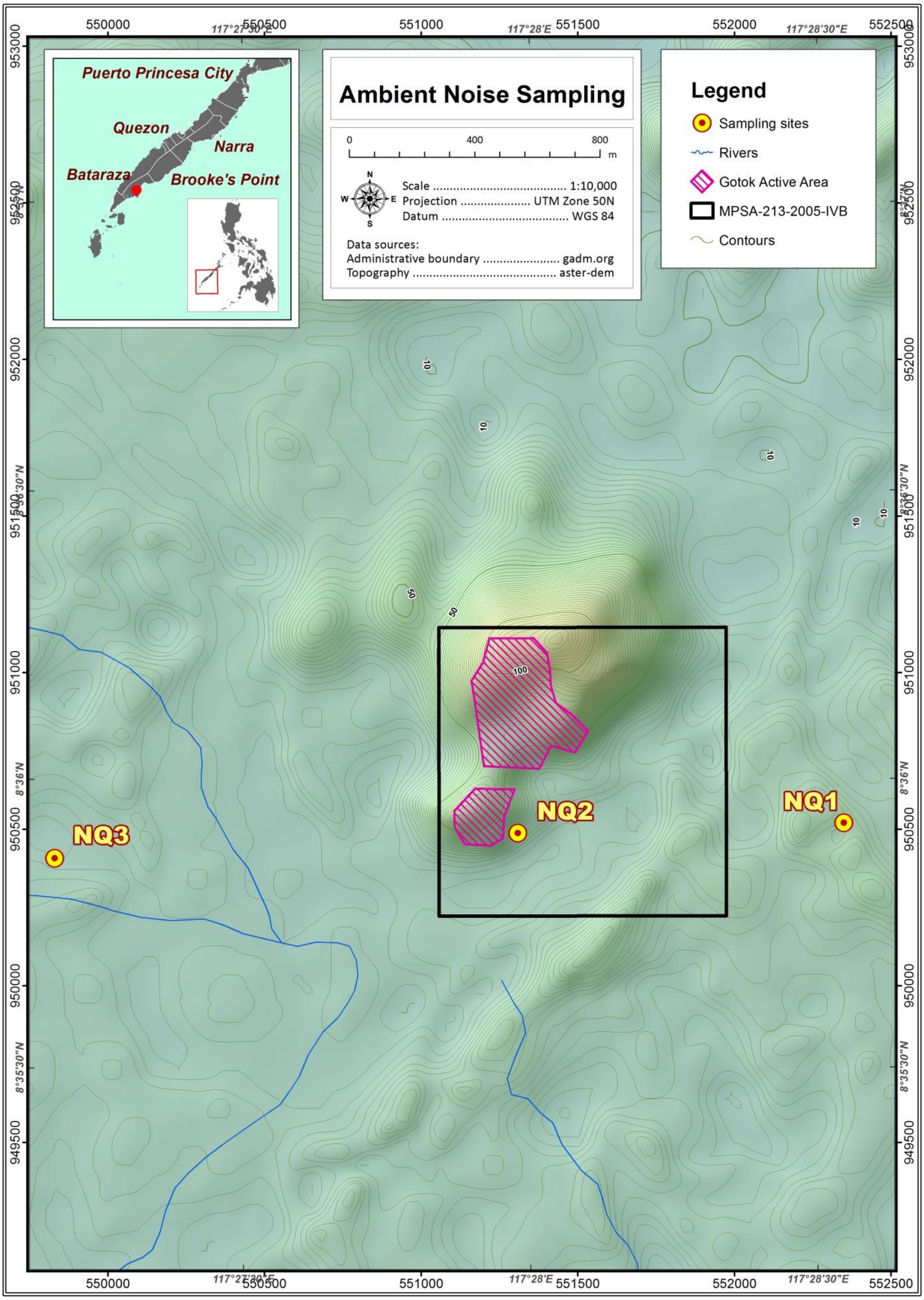


Figure 2.3.10. Noise quality monitoring station map

Table 2.3.14. Result of the noise level sampling

Station		Morning (5:00am-9:00am)	Daytime (9:00am-6:00pm)	Evening (6:00pm-10:00pm)	Nighttime (10:00pm-5:00am)
NQ1 (Class A)	**Min**	48.8	54.4	66.4	47.0
	Max	63.9	69.7	70.3	49.8
	Lowest	42 (8:16-8:20 am)	44.9 (2:31-2:35 pm)	64.4 (9:51-9:55 pm)	41.4 (4:51-4:55 am)
	Highest	93.2 (8:51-8:55 am)	90.3 (1:41-1:45 pm)	79.9 (8:41-8:45 pm)	80.0 (10:46-10:50 pm)
NQ2 (Class C)	**Min**	51.5	50.8	54.2	47.8
	Max	57.3	61.6	57.2	54.1
	Lowest	45.8 (8:41-8:45 am)	35.5 (5:11-5:15 pm)	41.1 (6:00-6:15 pm)	45.0 (4:26-4:30 am)
	Highest	89.0 (7:41-7:45 am)	79.6 (4:21-4:25 pm)	64.5 (6:26:6:30 pm)	70.2 (10:41-10:45 pm)
NQ3 (Class A)	**Min**	50.1	50.7	55.0	50.0
	Max	73.9	73.4	62.2	53.1
	Lowest	45.8 (8:31-8:35 am)	40.9 (4:51-4:55 pm)	41.7 (7:46-7:50 pm)	46.9 (3:56-4:00 am)
	Highest	89.5 (7:00-7:05 am)	88.6 (5:56-6:00 pm)	80.0 (7:46-7:50 pm)	82.2 (1:16-1:20 am)
DENR Standard (Class C)		**65**	**70**	**65**	**70**
DENR Standard (Class A)		**50**	**55**	**50**	**45**

Table 2.3.15. Philippine ambient noise standards

Category	Location		
	Daytime	Morning/Evening	Nighttime
AA	50	45	40
A	55	50	45
B	65	60	55
C	70	65	60
D	75	70	65

Note: Class AA – a section of contiguous area, which requires quietness, such as areas Within100 m from school sites, nursery schools, hospitals and special houses for the aged; Class A – a section of contiguous area, which is primarily used for residential areas; Class B - a section of contiguous area which is primarily a commercial area; Class C – a section primarily zoned or used as light industrial area and Class D – a section, which is primarily reserved, zoned or used as heavy industrial area.

2.3.3.3 Impact Assessment and Environmental Performance

Predicted Impacts

The following matrix summarizes the potential impacts that may be brought by the increased in production of the quarry and modified crushing plant. Each impact was identified as to the period of possible occurrence, duration, likelihood of occurrence, and magnitude.

Table 2.3.16. Impacts assessment and mitigation for air quality and noise

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
Degradation of air quality The increased in production of the quarry and modified crushing plant of the project will have an impact on the area's air quality primarily through elevated levels of dust and to a minor extent, SO_x and NO_x in the mining areas where heavy			✓		• Maintenance of vegetative cover along peripheries of the quarry area. • Installation of windbreakers in the quarry area and the vicinity of the crushing plant to prevent the proliferation of dust particles during dry and windy days. • Implement a lower drop height during

equipment are being used, along access routes and haul roads and within the vicinity of the crushing plant.					limestone loading and speed limit of service vehicles, hauling trucks and other heavy equipment. • Regular water spraying specially on unpaved stretch of the haulage route. • Covering hauling trucks with tarpaulin or canvas to prevent the unwanted discharge of materials and dusts. • Installation of tire-washing platform at the Kulantuod junction.
Increase in ambient noise level Increase in production capacity is accompanied by increase in transport activities within and around the quarry area thus the level of noise is expected to increase. Residents along the hauling route of the dumptrucks will be directly affected by the noise generated from the vehicles that transport limestones to the crushing plant. Within the quarry area, sources of noise are the blasting operation, which is performed using dynamites and ANFO (Ammonium nitrate/Fuel oil) and the hole drilling operation. With the increase in production, blasting activities shall be performed once a week while hole drilling is performed in non-active benches in preparation for the next blasting operation. In addition, the number of heavy equipment used in the quarry operation (drilling, blasting, stockpiling, loading and hauling) such as backhoes, wheel loaders, bull dozer, breaker, drilling equipment, and dumptruck shall be augmented to support the increased production of 725,000 MT. This may result to an increase in the ambient noise level not only within the quarry area but also at the nearby communities.			✓		• Maintenance of existing vegetation near the quarry area to serve as noise barrier. • Proper vehicle and heavy equipment maintenance. • Proper scheduling of equipment operation to avoid disturbance to the nearby communities. • Proper monitoring of noise level especially during blasting activity around the quarry area and nearby communities.

Performance Assessment

For the air quality monitoring, the TSP trends for both stations located within the vicinity of the quarry show erratic behavior but values remain below the standard limit set by the DENR (300 µg/Ncm). As for the 2014 sampling, the two (2) stations were placed in residential areas near the quarry and one (1) station within the quarry vicinity.

To further monitor the impact of the quarry as well as the effectiveness of the mitigating measures, it is recommended to include GK Gotok, which was used in this EPRMP as a sampling station, in the monitoring program.

In the 2014 noise level sampling, same stations as the air quality sampling were used. Two stations (NQ1 and NQ3) are placed in the residential areas while the other one was stationed within the vicinity of the quarry (NQ2). As seen in the results for the residential areas, domestic activities were the cited as the cause for exceedance during day morning and daytime. Since NQ3 is located near the provincial and the barangay road, noise from vehicles also contributed in the increased level. In the case of NQ2, heavy equipment used during the quarry operations such as drilling, loading and hauling were the source of noise within the area. During evening and nighttime sampling, the highest noise level recorded at the residential areas also exceeded the standard. Since, there was no quarry operation at these time frames, the highest noise level recorded at station NQ3 was within standard for the evening and slight exceedance was observed during nighttime.

In terms of the noise monitoring data of RTNMC, the monitoring program only include one time sampling and the time of sampling was not indicated. Since, the monitoring stations are located within the quarry area, RTNMC uses the maximum allowable noise level prescribed by the OSHS as standard.

In order to intensify the monitoring program of RTNMC, it is recommended for RTNMC to use the Philippine ambient noise standards as presented in **Table 2.3.17**. Time of sampling should be reported and the corresponding standard should be used.

Currently, the mitigating measures being implemented by RTNMC to reduce the impacts of noise on its personnel includes:

1. Provision of Personnel Protective Equipment (PPE) - All personnel assigned at the crushing plant are prescribed and issued to wear appropriate PPE such as ear muff model: 2000H with Noise Reduction Rating of 21 decibel per specification when used as directed.
2. Job Rotation – a personnel is tasked to perform duties at the point source equipment for maximum of four (4) hours and then then another four (4) hours doing cleaning activities where noise level are permissible.
3. Strict adherence on the Equipment Operation and Maintenance Procedures as to ensure all equipment are in good running condition thus eliminating the possibility of contributory noise cause from worn parts and mis-operation.

Based on the results of the sampling, mitigating measures for the increased noise level should be intensified in preparation for the additional heavy equipment and vehicles that will be utilized with the increased production. To be able to mitigate the exceedance in noise level, equipment will strictly be operated within working hours and blasting operation will be properly scheduled and announced so as not to cause disturbance to nearby communities. Silencer will be maintained in each equipment.

There is also a need to refine and strengthen the monitoring regime as was already mentioned. To summarize, the recommendations are as follows:

- *The monitoring team should also inspect the maintenance schedules and reports of the vehicles, equipment and machinery, at least on an annual schedule.*
- *The monitoring team should consider the GK Gotok and RTNMC (Nickel) AQ Station 4-Magazine Area, near the Crushing Plant as additional monitoring stations for air quality and noise level;*
- *The monitoring team should also consider the Philippine Ambient Air Standard in monitoring the noise level and should have recordings for all time period.*
- *Also, the MMT should conduct regular inspection of the procedures/measures that will mitigate the increase of noise levels.*

2.4 PEOPLE

2.4.1 Socio-economics

2.4.1.1 Methodology

For the discussion on socio-economics, three (3) primary impact barangays were considered. These are the host barangays: Iwahig and Sandoval for the Quarry Area and

Rio Tuba for the Crushing Plant. For indirect barangay, Ocayan was considered since a portion of the provincial road used for hauling is located at the barangay.

Data and information in this section came from primary and secondary data. Primary data were generated from focus group discussions (FGDs), key informants' interviews (KIIs) and surveys conducted from 21-25 April 2014. Among the participants were municipal officials from Bataraza, barangay officials from Iwahig, Sandoval and Rio Tuba and representatives of sectoral groups such as teachers, barangay health workers, indigenous people (*Palaw-an*), fisherfolk, farmers, women, and senior citizens. The study team also conducted discussions with the ComRel officers of RTNMC and CBNC, and the Rio Tuba Nickel Foundation Inc. (RTNFI) who are in charge of implementing non-SDMP projects.

Secondary data were obtained from local and national government agencies concerned. The secondary data were mostly on the barangay profile, Bataraza Socio-Economic Profile (SEP), Bataraza Comprehensive Land Use Plan, Health Statistics, Community-Based Monitoring System and Census Data of Palawan Province as well as the Municipality of Bataraza. Settlement maps of the three (3) impact barangays are provided in **Annex 2.4.1**.

2.4.1.2 Findings and Discussion

A. Socio-economic Profile

Presented in **Table 2.4.1,** is the result of the 2014 CBMS of the Municipality of Bataraza for the three (3) direct and one (1) indirect impact barangay of the Gotok Limestone Quarry and Processing Plant.

<u>Demography</u>

Among the four (4) identified impact barangays, Rio Tuba has the highest population followed by Sandoval, Iwahig and then Ocayan. Rio Tuba is also the largest in terms of land area with 5,545.29 ha while Ocayan is the smallest with 1,802.52 ha (MCLUP, 2009). All impact barangays have an average household size of 5.

<u>Housing</u>

In Barangay Sandoval, no household was recorded to be living in makeshift housing while around 5.9% of the household in Brgy. Ocayan have makeshift housing, the highest among the impact barangays. Highest proportion of informal settlers was recorded at Rio Tuba and the lowest at 0.3%.

<u>Water and Sanitation</u>

In 2014, no households in Barangay Sandoval were without access to safe water and only 3.0% were without access to sanitary toilet facility. On the other hand, Barangay Ocayan recorded the highest rate of households without access to safe water (5.5%) and sanitary toilet facility (38.6%).

Majority of the residents in Ocayan sourced their water from rivers and springs (69.77%) and deep well (26%). Residents connected to level III are only 7.07% of the population. In terms of sanitation, those with access to toilet facilities were using water sealed and pit type.

Table 2.4.1. Core indicators of the impacts areas of the Gotok Limestone Quarry and Processing Plant Project

Indicator	Municipality of Bataraza		Direct Impact						Indirect Impact	
			Iwahig		Sandoval		Rio Tuba		Ocayan	
	Magnitude	Proportion	Magnitude	Proportion	Magnitude	Proportion	Magnitude	Proportion	Magnitude	Proportion
Demography										
Number of households	10,698		372		472		2,554		254	
Average household size	5		5		5		5		4	
Total Population	48,311		1,798		2,159		12,492		1,055	
Male	24,701	51.1	927	51.6	1,096	50.8	6,366	51.0	535	50.7
Female	23,610	48.9	871	48.4	1,063	49.2	6,126	49.0	520	49.3
Members of the labor force	13,852		408		542		3,540	28.3	311	29.5
Health and Nutrition										
Children under 5 years old who died	253	3.4	1	0.4	2	0.6	239	10.4	0	0
Women who died due to pregnancy related-causes	3	0.2	0	0	0	0	0	0	0	
Malnourished children 0-5 year old	515	6	4	1.2	22	5.3	8	0.32	2	1.0
Housing										
Households living in makeshift housing	122	1.1	1	0.3	0	0	36	1.4	15	5.9
Households who are informal settlers	715	6.7	1	0.3	19	4.0	465	18.2	2	0.8
Water and Sanitation										
Households without access to safe water	2,387	22.3	2	0.5	0	0	38	1.5	14	5.5
Households without access to sanitary toilet facility	3,776	35.3	132	35.5	14	3.0	483	18.9	98	38.6
Basic Education										
Children 6-12 years old not attending elementary	1,627	18.2	44	12.4	70	16.9	273	13.5	29	15.9
Children 13-16 years old not attending high school	2,252	52.7	136	70.8	97	51.9	431	44.3	26	32.5
Children 6-16 years old not attending school	1,935	14.7	72	13.1	76	12.6	255	8.5	20	7.6
Income and Livelihood										
Households with income below poverty threshold	7,459	69.7	322	86.6	343	72.7	1,395	54.6	102	9.7
Households with income below food threshold	6,261	58.5	270	72.6	262	55.5	1,174	46.0	90	8.5
Households who experienced food shortage	454	4.2	0	0.0	19	4.0	6	0.2	0	0
Unemployed members of the labor force	921	9.7	6	1.8	19	4.5	140	5.8	37	11.9
Peace and Order										
Victims of crime	12	0	0	0	1	0.2	1	0.0	0	0

Source : Community-Based Monitoring System of the Municipality of Bataraza, 2014

Presented in **Table 2.4.2** and **Table 2.4.3** are the source of potable water and types of sanitary toilet facilities being utilized by the residents of the impact areas.

Table 2.4.2. Type of water sources being utilized in the impact areas

Water Sources	Percentage to population			
	Direct			Indirect
	Iwahig	Sandoval	Rio Tuba	Ocayan
Piped/Tube/Level III	0.00	30.00	0.00	7.07
Deep well	0.00	0.00	55.00	26.00
Open/Dug well	38.61	0.00	0.00	0.00
Surface (lakes, rivers, spring)	0.00	50.00	0.00	69.77
Commercial water refilling station	0.00	0.00	15.00	0.00
Water tanks/well courtesy of RTNMC	0.00	0.00	30.00	0.00
No response	61.39	20.00	0.00	0.00

Table 2.4.3. Type of sanitary toilet facilities being utilized in the impact areas

Type	Percentage to population			
	Direct Impact			Indirect
	Iwahig	Sandoval	Rio Tuba	Ocayan
Modern type (commercial bowls)	0.00	30.00	No data	0.00
Water sealed	0.00	50.00		24.26
Pit Type	100	0.00		40.44
None	0.00	20.00		39.10

Basic Education

Among the four (4) impact barangays, Iwahig recorded the lowest rate of children 6-12 years old not attending elementary school (12.4%). However it is important to note that its rate for children 13-16 old not attending high school was more than 50% (70.8%), the highest compared to the other impact barangays. There were no public and private high schools located within the impact barangays except Rio Tuba.

For the number of children 6-16 years not attending school, Ocayan recorded the lowest rate (7.6%) while Iwahig recorded the highest.

Table 2.4.4 shows the educational facilities within the impact barangays.

Table 2.4.4. Education facilities within the direct and indirect barangays

Educational Facility	Number of Facilites			
	Direct			Indirect
	Iwahig	Sandoval	Rio Tuba	Ocayan
Pre-school	2	3	5	6
Elementary	4	3	3	5
Secondary	0	0	2	0
College	0	0	0	0
Vocational	0	0	0	0
Indigenous Learning Center	2	0	0	0
Total	**8**	**6**	**10**	**11**

Source: Barangay Profiles

Income and Livelihood

The proportions of households with income below the poverty threshold and below food threshold are highest in Barangay Iwahig at 86.6% and 72.6, respectively. However, no household within the barangay experienced food shortage in 2014 and only 1.8% of its population are unemployed.

Among the four (4) impact barangay, Ocayan recorded the lowest proportions of households with income below the poverty threshold and below food threshold. No household living within the barangay experienced food shortage; however it has the highest rate of unemployment at 11.9%.

Peace and Order

Only two (2) victims of crime were recorded in 2014 for the impact areas: one for Brgy. Rio Tuba and one for Brgy. Sandoval.

Transportation and Communication

According to the barangay profiles of the impact areas, means of transportation for Iwahig and Sandoval are jeepneys and tricycles. In addition to the two modes of transportation, bus and skylab are available in Brgy. Ocayan while bus, vans and sea vessels are available in Rio Tuba.

As for the means of communication, cellular and internet services of Globe and Smart are available in all impact barangays.

B. Socio-economic Survey

There were 277 respondents for the socio-economic survey. The respondents were divided into two (2) categories, namely Quarry Area (Brgys. Iwahig and Sandoval) and Crushing Area (Brgy. Rio Tuba). The quarry area had 151 respondents and crushing area with 126 respondents for a total of 277 respondents. The results of the socio-economic survey are presented in the following paragraphs.
Socio-economics

Annex 2.4.2 shows the socio-economic survey questionnaire.

Information of Respondent

The wives comprised 53.07% of respondents (147) while the husbands accounted for 42.96 % of the respondents. There were 11 respondents who were children of the spouses. The other details are shown in the following table:

Table 2.4.5. Information of respondents

Position of Respondent in the Family	Quarry Area (n=151)				Crushing Area		Combined (n=277)	
	Iwahig (n=70)		Sandoval (n=81)		Rio Tuba (n=126)			
	No.	%	No.	%	No.	%	No.	%
Head	26	9.30	30	10.92	63	22.74	119	42.96
Spouse	41	14.78	48	17.35	58	20.94	147	53.07
Daughter/ Son	3	1.00	3	1.17	5	1.81	11	3.97
Total	**70**	**25.08**	**81**	**29.44**	**126**	**45.49**	**277**	**100.00**

Gender Ratio and Age Distribution

There were 123 male (44.40%) respondents while 154 respondents (55.60%) were females. The gender ratio of respondents was favourable to females in the quarry area accounting for around two thirds of respondents while the gender ratio was reversed in the crushing area with 60.32% males. The ages of respondents ranges from 15 to above 60 years old with more than one half in the 25-39 age bracket. Four fifths of respondents were married. Roman Catholic was the religious affiliation of around 51% of respondents.

Household Size

The average household size is 4.56 persons per household. Comparing the two areas, the average household size of the quarry area is slightly higher with 4.75 persons per household in contrast with 4.33 persons per household in the crushing area.

Highest Educational Attainment

There are 121 respondents (43.68%) that are elementary undergraduates (74 respondents) or graduates (47 respondents). Another 36% were either high school graduates or in the high school level. There were seven (7) respondents who were college graduates while 22 were in the college level.

Table 2.4.6. Highest educational attainment

Highest Educational Attainment	Quarry Area (n=151)				Crushing Area (n=126)		Combined Areas (n=277)	
	Iwahig (n=70)		Sandoval (n=81)		Rio Tuba (n=126)			
	No.	%	No.	%	No.	%	No.	%
Elementary Level	20	7.22	24	8.66	30	10.83	74	26.71
Elementary Graduate	19	6.86	22	7.94	6	2.17	47	16.97
High School Level	12	4.33	14	5.05	30	10.83	56	20.22
High School Graduate	6	2.17	8	2.89	31	11.19	45	16.25
College Level	4	1.44	5	1.81	13	4.69	22	7.94
College Graduate	1	0.36	1	0.36	5	1.81	7	2.53
Vocational	0	0.00	0	0.00	10	3.61	10	3.61
No Education	4	1.44	4	1.44	1	0.36	9	3.25
No Answer	4	1.44	3	1.08	0	0.00	7	2.53
Total	**70**	**25.27**	**81**	**29.24**	**126**	**45.49**	**277**	**100.00**

Comparing the results of the survey between the quarry area and the crushing area, the respondents in the crushing area located in Rio Tuba have higher educational attainment as compared to the respondents in the quarry area which is composed of Brgys. Iwahig and Sandoval.

Occupation

The primary job/occupation of respondents is in selling accounting for 56 respondents. There were 67 respondents who had no job/occupation. However, most of these respondents are housewives who manage their households. One hundred sixty four respondents were working within the barangay with 43% of respondents earning less than Php 5,000 per month.

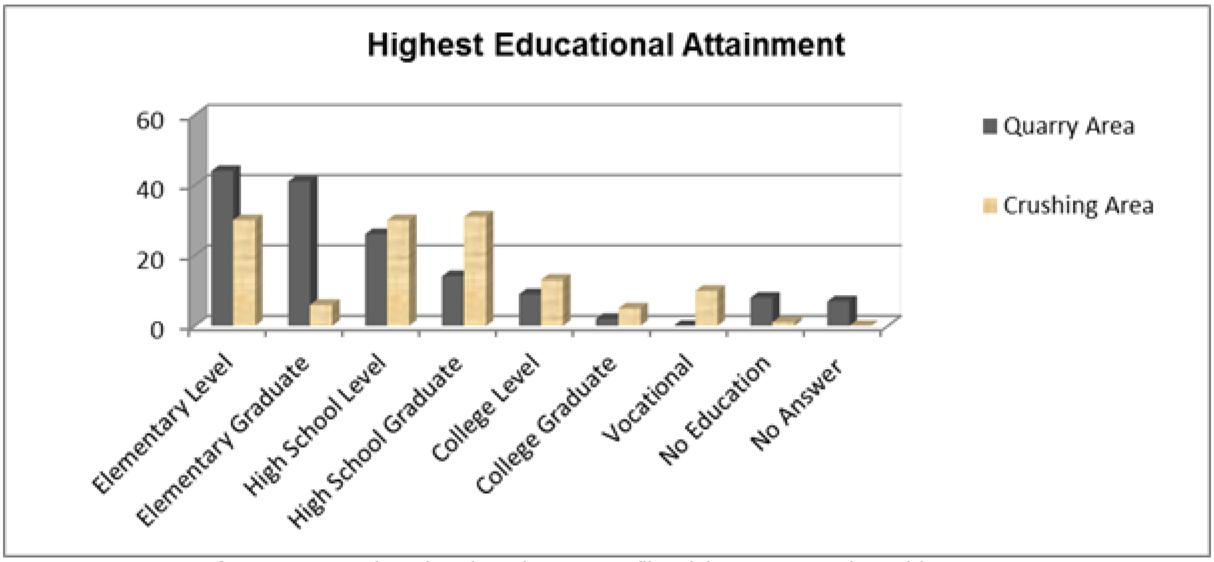


Figure 2.4.1. Educational attainment profile of the quarry and crushing area

Household Information

There were 1,262 persons in 277 households. The average household is 4.56 persons per household, slightly higher than the average household size of 4.7 for Palawan. There were two (4) households with 10 members. The predominant dialect spoken in the households was Tagalog (59.57%) with Cebuano/Bisaya a far second with (7.94%). In terms of ethnic grouping, 56 households considered themselves as "katutubong Palaw'an."

Migration Data

There are 134 households (48.38%) who were there in their barangays since birth while 72 households are residing in their barangays for more than 10 years. Together, these households comprise around 74.37% of the total households. It is interesting to note that in the quarry area, more than two thirds (66.89%) were in the barangay since birth while in the crushing area, slightly more than one forth (26.19%) only were in the barangay since birth. This meant that migrants prefer living in Rio Tuba compared to the rest of the barangays of Bataraza.

Table 2.4.7. Duration in their present address

Duration in the Present Address	Quarry Area (n=151)				Crushing Area (n=126)		Combined Areas (n=277)	
	Iwahig (n=70)		Sandoval (n=81)		Rio Tuba			
	No.	%	No.	%	No.	%	No.	%
Since birth	46	16.61	55	19.86	33	11.91	134	48.38
Less than 1 year	0	0.00	0	0.00	2	0.72	2	0.72
1 - 5 years	1	0.36	1	0.36	16	5.78	18	6.50
5 - 10 years	5	1.81	5	1.81	34	12.27	44	15.88
More than 10 years	14	5.05	17	6.14	41	14.80	72	25.99
No Answer	4	1.44	3	1.08	0	0.00	7	2.53
Total	**70**	**25.27**	**81**	**29.24**	**126**	**45.49**	**277**	**100.00**

Out of the 143 respondents who were not born in their present addresses, 82 respondents were born outside of the province while 61 respondents were born within the province but in different municipality. Twenty-four respondents were born within the municipality but in different barangays.

Out of the 143 respondents who were not born in their present addresses, 114 respondents (79.72%) migrated because of economic reasons while only 29 respondents (20.28%) migrated because of marriage and/or family.

Household Income

The average monthly household income is PhP 6,169.01/month. There were 120 households whose monthly income is below PhP 5,001/month. Twenty-four households (8.86%) were earning below PhP 1,000 a month. Twenty households were earning above PhP 10,000/month. Sixty-four households had no answers.

Table 2.4.8. Monthly household income by income bracket

Highest Educational Attainment	Quarry Area (n=151)				Crushing Area (n=126) Rio Tuba		Combined Areas (n=277)	
	Iwahig (n=70)		Sandoval (n=81)					
	No.	%	No.	%	No.	%	No.	%
<1,000	9	3.25	10	3.61	5	1.81	24	8.66
1,001-2,500	18	6.50	22	7.94	15	5.42	55	19.86
2,501-5,000	13	4.69	16	5.78	12	4.33	41	14.80
5,001-7,500	4	1.44	5	1.81	25	9.03	34	12.27
7,501-10,000	6	2.17	6	2.17	27	9.75	39	14.08
10,001-12,500	2	0.72	3	1.08	4	1.44	9	3.25
12,501-15,000	0	0.00	1	0.36	4	1.44	5	1.81
15,000-17,500	1	0.36	1	0.36	0	0.00	2	0.72
>17,500	0	0.00	1	0.36	3	1.08	4	1.44
No Answer	17	6.14	16	5.78	31	11.19	64	23.10
Total	**70**	**25.27**	**81**	**29.24**	**126**	**45.49**	**277**	**100.00**
Average Monthly Income	**584,000**				**730,000.00**		**1,314,000.00**	
Average Monthly HH Income	**4,949.15**				**7,684.21**		**6,169.01**	

The highest monthly income was exhibited by respondents in the crushing area averaging PhP 7,684.21 per month. The households in the quarry area had a lower monthly income with an average of PhP 4,949.15 per month. This seems to be the main reason why migrants tend to reside in Brgy. Rio Tuba, which offer better employment and/or livelihood as compared to other neighboring barangays.

It should be pointed out that the real monthly income was not captured totally especially in the quarry area because there are many household items that are not sold but consumed by the households such as rice, fruits, vegetables, wild game and fishes from nearly forests and rivers.

One hundred sixty four households (78.1%) are working or have sources of income within their respective barangays while 38 respondents are earning or making a living in the other barangays of Bataraza, outside of their respective barangays. Comparing the two (2) areas, it is obvious that opportunities in earning income are more in the crushing area where 86% of respondents earn their living in their own barangay (Rio Tuba) while it is only 72% in the quarry area.

Sources of Household Income

Selling/vending (26.67%) is the primary source of livelihood/income of surveyed households. This is followed by farming (11.43%), heavy equipment operator/driver (10.95%) and labourer (10.48%) in palm/coconut plantations. Comparing the two areas in terms of sources of income, the quarry area is a typical rural area dependent on farming, labouring in agricultural activities and fishing while sources of income in the crushing area are related to the operations of RTNMC such as heavy equipment operator/driver, construction workers, utility works, security guard, checkers and lead men. Common sources of income for the two areas were selling/vending, teacher, and barangay official/employee.

It should be pointed out that many of the barangays in Bataraza have adopted the palm tree as their main crop and as the trees grow, an increasing number of residents are being employed as labourers in these plantations. This is another magnet for migration, slowly attracting migrants from other places.

In terms of secondary sources of household income, 14 households are engaged in palm and coconut plantation maintenance activities while 13 households are engaged in selling and vending. These activities contribute around PhP 470.00 a month of additional income.

From external sources, 32 households have additional sources of household income with 16 households sourcing their additional household income from remittances abroad. There are six (6) households all from the quarry area, receiving conditional cash transfer (4Ps) amounts from DSWD.

Household Expenses

The average monthly household expense was PhP 5,349.19. More than one half (51.78%) was devoted to food while educational expenses (10.83%) and transportation (10.23%) were second and third respectively of their monthly expenses.

Comparing the expenses between the two (2) categories, the highest monthly expense was incurred by the crushing area with PhP 5,386.96 while the quarry area is slightly lower with PhP 5,318.08 per month. The households in the quarry area spend less for food and more for transportation and vices compared with the households in the crushing area.

Table 2.4.9. Monthly household expenses

Monthly Household Expenses	Quarry Area (n=151)				Crushing Area (n=126) Rio Tuba		Combined Areas (n=277)	
	Iwahig (n=70)		Sandoval (n=81)					
	No.	%	No.	%	No.	%	No.	%
Food	2,393.41	0.47	2,497.05	0.46	3130.08	58.10	2769.67	51.78
Clothes	358.60	0.07	410.81	0.08	360.56	6.69	385.89	7.21
Furnitures/Appliances	307.39	0.06	337.41	0.06	270.65	5.02	305.43	5.71
Transportation	637.69	0.13	728.74	0.13	359.51	6.67	547.17	10.23
Education	598.73	0.12	609.85	0.11	549.11	10.19	579.11	10.83
Health	333.15	0.07	343.35	0.06	272.70	5.06	309.58	5.79
Utilities (i.e., Water, Electricity)	162.86	0.03	178.15	0.03	370.22	6.87	263.92	4.93
Vices	276.88	0.05	285.36	0.05	74.13	1.38	188.42	3.52
Average Annual Expenses	**5,068.72**	**100.00**	**5,371.26**	**100.00**	**5,386.96**	**100.00**	**5,349.19**	**100.00**

The graphical distribution of household expenses is shown in **Figure 2.4.2**.

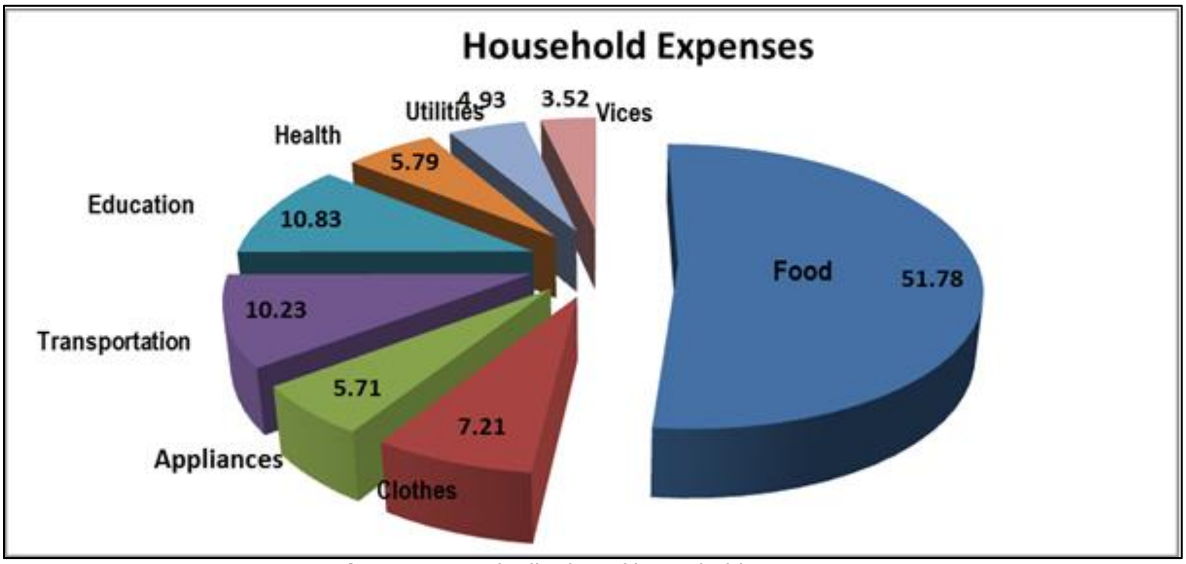


Figure 2.4.2. Distribution of household expenses

Comparing the household income with their monthly household expenses, the respondents in the quarry area were deficit spending of PhP 369 a month, meaning, they were spending more than their income, which cannot be sustained in long period of time. Hence, there were household incomes that were not reported such as food derived from the backyards, rivers and forests.

The households in the crushing area have a monthly savings amounting to an average of around PhP 2,300 a month. Overall, there is a net savings of around PhP 820/month for all respondents.

The primary source of food (92.42%) came from the public market of Bataraza. The rest of respondents source their food from nearby *talipapas* and reinforced by periodic ambulant vendors on motorcycles.

Housing information

Land and House Ownership

More than one half (52.60%) owned the land where their houses are located while the balance of 47.4% are not owners of the land. Out of the 128 households who do not own the land where their houses are located, 81 households are living in the land owned by private persons while the balance of 36.72% are owned by relatives of residents. Out of the 128 households who do not own the land where their houses are located, while the balance of 102 households do not pay rental to the owners of the land.

In terms of house ownership, 211 households (76.17%) own the house where they are residing while 57 households are occupying the houses owned by others. Nine respondents had no answers. Out of the 57 households who do not own the houses where they are residing, 32 households are renting while 25 households are rent-free occupants.

Housing Materials

One hundred twenty-four households have a combination of nipa/cogon while and equal number of households have GI sheets as their roofing materials. The walls of the houses are predominantly wooden (46%) and bamboo materials (23%).

Source of Drinking Water

The primary source of drinking water is from faucets accounting for 219 households (79.06%). This is followed by deep well, which is the water source for 24 households (8.66%). The direct impact barangays of Iwahig, Sandoval and Rio Tuba have their own water systems that were provided through the SDMPs of RTNMC and CBNC.

Table 2.4.10. Source of drinking water

Source of Potable Water	Quarry Area (n=151)				Crushing Area (n=126) Rio Tuba		Combined Areas (n=277)	
	Iwahig (n=70)		Sandoval (n=81)					
	No.	%	No.	%	No.	%	No.	%
Gripo	50	18.05	57	20.58	112	40.43	219	79.06
Deep well	10	3.61	12	4.33	2	0.72	24	8.66
Bukal/Spring	3	1.08	3	1.08	0	0.00	6	2.17
Poso	7	2.53	9	3.25	12	4.33	28	10.11
Total	**70**	**25.27**	**81**	**29.24**	**126**	**45.49**	**277**	**100.00**

Source of Lighting

The main source of lighting is electricity enjoyed by 168 households while 109 households do not have electrical connections. In terms of percentage, 89% of households in the crushing area have electricity while only 43% of households are connected in the quarry area. The electricity comes from the Barangay Power Association while the rest are from generators. Ninety-nine households still use kerosene while nine (9) households had no answers.

Fuel for Cooking

One hundred sixty two respondents (56.06%) use charcoal as their primary fuel for cooking while 99 respondents (34.26%) use firewood as their fuel for cooking. Twenty-one respondents (7.27%) use LPG while seven (7) respondents use electricity.

Toilet Facilities

Two hundred twenty nine households (82.67%) have toilet facilities while 48 households have none. Out of the number of households with toilet facilities, 203 households (88.65%) have the “de buhos” type while 116 households have the pit type. Only 10 households have flush type toilet facilities.

Method of Solid Waste Disposal

The respondent households practice multiple modes of solid waste disposal. The predominant method of disposal is through burning practiced by 154 households (54.61%) while 91 households (32.27%) are serviced by the existing collection system in their barangays.

Community Information

The respondents were asked about their membership in an organization. Almost one third (32.85%) were members of an organization. Seventy-three respondents were members of an economic organization while 17 respondents were members of a civic organization (livelihood or micro lending). There were 10 respondents who are members of a religious organization.

In terms of community problems, 147 respondents cited the lack of employment (30.82%) as the number community problem with the quarry area having a higher percentage of 35%

compared to 26% in the crushing area. The second community problem cited by respondents was the lack of education (19.92%) with 72 respondents in quarry area while only 23 respondents in the crushing area. The third community problem was drug addiction with almost all respondents coming from the crushing area.

Table 2.4.11. Identified problems in the community

**Community Problems	Quarry Area (n=151)				Crushing Area (n=126) Rio Tuba		Combined Areas (n=277)	
	Iwahig (n=70)		Sandoval (n=81)					
	No.	%	No.	%	No.	%	No.	%
Kawalan ng trabaho	39	8.20	46	9.62	62	13.00	147	30.82
Maraming hindi nakapag aral	33	6.94	39	8.15	23	4.82	95	19.92
Drug Addiction	2	0.39	2	0.45	73	15.30	77	16.14
Child Labor	19	3.95	22	4.64	5	1.05	46	9.64
Prostitusyon	3	0.68	4	0.79	37	7.76	44	9.22
Maruming Kapaligiran	6	1.16	6	1.36	26	5.45	38	7.97
Wala	6	1.16	6	1.36	7	1.47	19	3.98
Illegal Logging	1	0.19	1	0.23	3	0.63	5	1.05
Baku-bakong Kalsada	1	0.29	2	0.34	0	0.00	3	0.63
Walang Kuryente	1	0.19	1	0.23	0	0.00	2	0.42
Maagang Pag-asawa	0	0.10	1	0.11	0	0.00	1	0.21
Total	**111**	**23.24**	**130**	**27.28**	**236**	**49.48**	**477**	**100**

*Note: ** Multiple Responses*

The respondents were requested to name any positive characteristics of their communities. One hundred forty three respondents (32.06%) cited high employment for residents in their communities while 108 respondents (24.22%) cited high educational attainment as positive characteristics of their communities.

The major economic activity undertaken by women was selling/vending accounting for 203 respondents (71.99%). Other activities were barangay volunteer (13.83%), dress-making (8.16%) and working in palm oil plantations (5.32%).

The respondents were asked about if the women had any problems in their communities. One hundred thirty nine respondents said that women had problems while 1,130 respondents said that women had no problems in their communities. Twelve respondents said that they were victims of abuses while seven (7) respondents cited lack of electricity. The respondents (210 respondents) suggested that women should have more access to livelihood and employment.

The youth in their communities were involved in sports, particularly basketball (42.22%) while 81 respondents (22.50%) are studying. Sixty-nine respondents (19.17%) said that the youth were involved in helping in household chores while only 13 respondents said that the youth were involved in church activities.

Perception on the effects of operation to the environment

The respondents were asked if they notice any change in their environment. One hundred eighty-eight respondents noticed environmental changes in their communities. The primary environmental change was the electrification of their areas (26.71%). Sixty-one respondents

(22.02%) cited the infrastructure development (34.75%) while 54 respondents (19.49%) cited water access in their communities.

The respondents were asked the causes of these changes. Seventy-eight respondents (28.16%) said that these environmental changes were assistance given by RTNMC/CBNC. Fifty-two respondents (18.77%) said that these environmental changes were initiated and came from the residents. Fifty-two respondents did not mention any cause for these changes.

As a follow-up question, the respondents were asked when they notice these changes. Ninety-six respondents (34.66%) started to notice these changes from 2008 to present while 73 respondents (26.35%) were more specific and said that the changes occurred since the establishment of the plant (CBNC). Sixty-eight respondents had no answers.

Table 2.4.12. Opinion on present environmental conditions

Opinion on the present environmental conditions	Quarry Area (n=151)				Crushing Area (n=126) Rio Tuba		Combined Areas (n=277)	
	Iwahig (n=70)		Sandoval (n=81)					
	No.	%	No.	%	No.	%	No.	%
Contented	18	6.50	22	7.94	62	22.38	102	36.82
Not Contented	35	12.64	41	14.80	35	12.64	111	40.07
No not know	9	3.25	11	3.97	21	7.58	41	14.80
No Answer	8	2.89	7	2.53	8	2.89	23	8.30
Total	**70**	25.27	**81**	29.24	**126**	45.49	**277**	**100.00**

The respondents were asked if there were contented in the present situation of the environment. One hundred two respondents (36.82%) were contented with the present environmental conditions. The highest approval (49.21%) was registered in the crushing area. One hundred eleven respondents (40.07%) were not contented with the present environmental situation while 41 respondents (14.80%) registered “I do not know” answer. Twenty-three respondents had no answers.

One hundred ninety eight (66.89%) out of 277 respondents cited typhoons as the most commonly experienced calamity in their communities. This was followed by flood as cited by 89 respondents (30.07%).

Table 2.4.13. Calamities experienced by the DIA barangays

** Calamities experienced by the community	Quarry Area (n=151)				Crushing Area (n=126) Rio Tuba		Combined Areas (n=277)	
	Iwahig (n=70)		Sandoval (n=81)					
	No.	%	No.	%	No.	%	No.	%
Bagyo	49	16.63	58	19.52	91	30.74	198	66.89
Baha	24	8.24	29	9.67	36	12.16	89	30.07
Lindol	1	0.47	2	0.55	2	0.68	5	1.69
Landslide	1	0.47	2	0.55	1	0.34	4	1.35
Total	**76**	**25.80**	**90**	**30.28**	**130**	**43.92**	**296**	**100.00**

*Note: **Multiple responses*

C. Perception and Opinion about the Project

Most respondents (52.35%) were aware that RTNMC is planning to expand the operation of the Gotok Quarry while 129 respondents (46.57%) were not aware. Out of the total of 145 respondents who were aware of the proposed expansion, 63 respondents (22.74%) said that their information came from employees of RTNMC while 25 respondents cited barangay meetings and consultations as their sources of information.

a. Positive Impacts of Mining

The respondents were asked about their perceptions on the positive impacts of mining. Two hundred eight (75.09%) respondents were aware of the positive impacts of mining. Almost one fourth (24.91%) of respondents were in the opinion that there were no positive impacts of mining. The positive perception on mining was higher in the quarry area (78.81%) compared to the crushing area (70.63%)

Table 2.4.14. Perceived positive impacts of mining

Are there any Positive Impacts brought by mining?	Quarry Area (n=151)				Crushing Area (n=126) Rio Tuba		Combined Areas (n=277)	
	Iwahig (n=70)		Sandoval (n=81)					
	No.	%	No.	%	No.	%	No.	%
Yes	55	19.76	64	23.20	89	32.13	208	75.09
No	15	5.31	17	6.24	37	13.36	69	24.91
Total	**70**	**25.08**	**81**	**29.44**	**126**	**45.49**	**277**	**100.00**

Out of the 208 respondents who saw some positive impacts of mining (multiple responses), all respondents cited employment as the number one positive impact (62.46% of all responses). Seventy-four respondents (22.22%) saw the establishment of businesses as a positive impact while 24 respondents (7.21%) cited medical missions as the positive impact on mining. The details are shown in **Table 2.4.15**.

Table 2.4.15. Perceived positive effects of mining

***Positive effects of mining	Quarry Area (n=151)				Crushing Area (n=126) Rio Tuba		Combined Areas (n=277)	
	Iwahig (n=70)		Sandoval (n=81)					
	No.	%	No.	%	No.	%	No.	%
Trabaho	55	16.44	64	19.30	89	26.73	208	62.46
Negosyo	12	3.45	14	4.05	49	14.71	74	22.22
Medical Mission	7	2.07	8	2.43	9	2.70	24	7.21
Scholarship	10	3.04	12	3.57	0	0.00	22	6.61
Pabahay	1	0.41	2	0.49	1	0.30	4	1.20
Libreng tubig	0	0.00	0	0.00	1	0.30	1	0.30
Total	**85**	**25.42**	**99**	**29.84**	**149**	**44.74**	**333**	**100.00**

*Note: **Multiple responses*

Eighty-six respondents (31.05%) were in the opinion that RTNMC could provide additional positive impact through additional medical assistance (7.94%) and employment (7.58%).

b. Negative Impacts of Mining

The respondents were also asked about any negative impacts of mining. Ninety-seven respondents (35.02%) answered in the affirmative while 180 respondents (64.98%) said that there were no negative impacts of mining. The highest percentages of respondents who saw the negative impacts of mining were in the quarry area with 82 respondents (54.30%). The other details are shown in **Table 2.4.16**.

Table 2.4.16. Perceived negative impacts of mining

Are there any Negative effects of mining?	Quarry Area (n=151)				Crushing Area (n=126) Rio Tuba		Combined Areas (n=277)	
	Iwahig (n=70)		Sandoval (n=81)					
	No.	%	No.	%	No.	%	No.	%
Yes	38	13.72	44	15.88	15	5.42	97	35.02
No	32	11.55	37	13.36	111	40.07	180	64.98
Total	**70**	**25.27**	**81**	**29.24**	**126**	**45.49**	**277**	**100.00**

The causes of the negative effects of mining were different for the quarry and crushing areas. In the quarry area, the causes were shaking of the land (during blasting) and flooding while in the crushing area, the negative effect was the bad smell emanating from the plant. It should be noted that the RTNMC has no plant operating in the area.

c. Perceptions and Opinions on the Proposed Expansion

One hundred twenty-two (44.94%) respondents were in the opinion that the expansion project will provide additional positive effects to them while 155 respondents (55.96%) said otherwise. Comparing the two (2) distinct areas, respondents in the quarry area (62.25%) saw more positive effects than their counterparts in the crushing area (22.22%). The details are shown in **Table 2.4.17**.

Table 2.4.17. Perceived positive effects of the proposed project

Are there any Negative effects of mining?	Quarry Area (n=151)				Crushing Area (n=126)		Combined Areas (n=277)	
	Iwahig (n=70)		Sandoval (n=81)					
	No.	%	No.	%	No.	%	No.	%
Yes	43	15.52	51	18.41	28	10.11	122	44.04
No	27	9.75	30	10.83	98	35.38	155	55.96
Total	**70**	**25.27**	**81**	**29.24**	**126**	**45.49**	**277**	**100.00**

The 94 respondents who saw some positive impacts from the proposed expansion cited employment (52 responses), development of communities (27 responses) and nearness to report for work (21 responses).

Perceived negative impacts of the proposed expansion were expressed by 155 respondents (55.96%). They mentioned flooding (41 responses), destruction of trees, generation of dusts and landslides.

The respondents were asked about their opinions about the project. One hundred twenty-four respondents (44.77%) strongly agree while 72 respondents (25.99%) agree with the proposed expansion of the quarry. In total, 196 respondents (70.76%) approved the proposed project. Twenty-one respondents (7.58%) had no opinion about the project. Forty-nine respondents strongly disagree with the proposed project while 11 respondents disagree. In summary, there were 60 respondents (21.66%) who did not approve the proposed project. The details are shown in **Table 2.4.18**.

Table 2.4.18. Opinion on the proposed expansion of production

Opinion on the Proposed Expansion	Quarry Area (n=151)				Crushing Area (n=126)		Combined Areas (n=277)	
	Iwahig (n=70)		Sandoval (n=81)					
	No.	%	No.	%	No.	%	No.	%
Strongly Agree	22	7.94	26	9.39	76	27.44	124	44.77
Agree	29	10.47	32	11.55	11	3.97	72	25.99
No Opinion	8	2.89	9	3.25	4	1.44	21	7.58
Disagree	5	1.81	6	2.17	0	0.00	11	3.97
Strongly Disagree	6	2.17	8	2.89	35	12.64	49	17.69
Total	**70**	**25.27**	**81**	**29.24**	**126**	**45.49**	**277**	**100.00**

2.4.1.3 Impacts and Performance Assessment

<u>Predicted Impacts</u>

The following matrix summarizes the potential impacts that may be brought by the proposed projects. Each impact was identified as to the period of possible occurrence, duration, likelihood of occurrence, and magnitude. Entries with asterisks are perceived to be not significant or negligible while italicized entries were perceived to be a positive impact of the project. Since people related impacts are crucial in every development project, discussions will be detailed after the summary matrix.

Table 2.4.19. Impacts assessment and mitigation for socio-economics

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
Displacement of settlers (Not Applicable) *Barangay Rio Tuba* -- The influx of migrants seeking employment and livelihood opportunities created by the mining operations triggered the rapid urbanization of Brgy. Rio Tuba from 1996 up to the present. Brgy. Rio Tuba had a population of 7,663 persons in 2000 and the number of inhabitants more than doubled by 2010, with a population of 16,577 persons. Correspondingly, the demand for living space increased resulting in the appreciation of land prices in Rio Tuba, especially along the Macadam Road. The increase in land prices is also being felt in the nearby barangays of Sumbiling, Ocayan, Sandoval and Igang-Igang. *Barangays Iwahig and Sandoval* - The 84.5-ha MPSA covering the Gotok Quarry area (located in Brgys. Iwahig and Sandoval) is uninhabited and the expansion of the quarry will not displace any type of settler or occupant. RTNMC is very aware that their mining operations (including the quarry operations) would result in an increase in demand for decent housing for their employees and workers. Hence, aside from the GK housing project, which has targeted the IPs in the area, regular employees of RTNMC and CBNC are provided with free housing either within the RTNMC Townsite or elsewhere. Aside from the free housing opportunity, water and electrical supply are also subsidized for the regular employees of the two companies. The operations of the mine have resulted in additional demand for housing, which is partially addressed by the private sector especially in Rio Tuba. Households provide halfway houses or temporary shelter to their relatives and town mates who are desirous to partake in the					

employment or livelihood opportunities created by the mining operations. Some households have developed their housing areas to rent rooms or bed spaces for casual workers or migrants who are desirous to work in the mine. There is a possibility that the informal settlement located in Sitio Marabajay, Brgy. Rio Tuba will expand to accommodate additional informal dwellers seeking to partake in the benefits being derived from RTNMC such as employment, livelihood opportunities and improved delivery of basic services. It would be more appropriate if RTNMC would seek LGU intervention through the municipal and barangay officials on the further influx of informal dwellers because they have the legal mandate to maintain public order and protect the public good. Overall, RTNMC is addressing the increase in housing demand brought about by its mining operations including the quarry operations through the IP housing program and in-house housing projects. In addition, the increase in housing demand has created and energized the housing sector and the residents have taken advantage of this opportunity to build additional housing units, remodel old houses and restructure their homes to earn additional income from this housing demand. ***For further details, please see discussion below.***					
In-migration The two (2) main reasons for migrating to Bataraza were livelihood and the migrants' family. In the crushing area, livelihood is higher than in the quarry area. There is a general tendency that migrants tend to settle in Brgy. Rio Tuba because of greater livelihood opportunities that in other adjacent areas. ***For further details, please see discussion below.***			✓		• Priority employment of qualified locals. • Provision of appropriate skills training for workers including local hires to control unnecessary increase in local population. • Proper record-keeping of in-migration survey.
Change/conflict in land ownership (Not Applicable) The MPSA covering the 84.5 hectares covering the Gotok Quarry area (located in Barangays Iwahig and Sandoval) is uninhabited and the expansion of the quarry will not displace any type of settler or occupant. The surface owners and/or occupants have been paid by the company for their surface rights or their possession before the start of the quarry operations and there are no issues or concerns in relations to the purchase of the surface rights of the whole MPSA area. The surrounding areas/parcels of lands which are outside of the MPSA area are planted with coconuts and rice. These crops continue to grow and produce and there are no reported adverse effects of the quarry operations to the agricultural sector. There will be no change/conflict in land ownership as					

the quarry area is uninhabited.					
Cultural/ lifestyle change (especially on Indigenous People) The *Palaw'an* Tribe in Bataraza is on a crossroad of development. Their choices are to go up further to the mountains and minimize interactions with the lowlanders to preserve their cultural identity and traditional ways or embrace the modern ways of information technology, latest techniques in upland agriculture, with all the accessories of modernity but lose or dilute their traditional ways and cultural identity. The *Palaw'an* IP group has been perceived by many of the residents in the direct and indirect impact barangays as a special and privileged group because they are the recipients of special benefits from RTNMC and CBNC such as the Gawad Kalinga Project providing for free housing for the Palaw'ans, free medical services and medicines in the RTN Hospital, fishing and farm equipment. In addition, they have their ILS and have priority for scholarships provided by RTNMC. The SDMP is also disaggregated so that there are specific budget allocations for the IP group in each barangay. Based on the FGDs and KIIs, there are active and deliberate efforts by some tribal elders to preserve their cultural identity by buying back their musical instruments and teaching some promising youth to learn to play these musical instruments. There are some GK areas where the circular pattern of the Palaw'an is still evident and reflective of their traditional spatial orientation. ***For further details, please see discussion below.***			✓		• Program awareness on the preservation of tribal practices. • Conduct of ethnographic study to document culture and traditions • Establishment of a centralized tribal museum to house the cultural artifacts that may be gathered by the tribe.
Threat to the delivery of basic services/ resource competition Rather than a threat, this is perceived to be a positive impact given the efforts and programs implemented by RTNMC in the water supply, power supply, communications, health resources, peace and order, education facilities and recreational/sports facilities. ***For further details, please see discussion below.***			✓		• Provision of adequate school facilities and educational materials; training for teachers
Generation of local benefits (Employment) Some of the benefits from the project implementation include: a.Enhancement of employment and livelihood opportunities; b.Increase business opportunities and associated economic activities; and c.Increased revenue of the LGUs. ***For further details, please see discussion below.***			✓	✓	• Prioritization of qualified local residents in employment. • Introduction of livelihood projects (skills training for local community as part of SDMP). • Proper maintenance of rehabilitated infrastructure /facilities will enhance this positive impact. • Pertinent fees to be paid promptly.

Threat to Public Safety ***Please see discussion below.***					
Traffic congestion Increase in production capacity is accompanied by increase in transport activities within and around the mining area thus the traffic congestion is expected to increase as well.			✓		• Creation and maintenance of a flag man in Kulantuod Junction to warn in-coming vehicles of emerging dump trucks from the quarry site. • Maintenance of traffic aids and street sweepers.
Manpower Requirement ***Please see discussion below.***					

Based on the recommended socio-economic parameters, this section is organized into seven (7) sub-sections namely, (a) displacement of settlers, (b) in-migration, (c) culture/lifestyle change, (d) threat to delivery of basic services, (e) threat to public health and safety, (f) generation of local benefits from the project and (g) traffic congestion. In addition, an eighth sub-section is added under the title of manpower requirements. In each sub-section, there are discussions on how the original project had affected each of the socio-economic parameters and prediction of impacts for the proposed changes that are the subject matter of this expansion of production and/or extraction of limestone.

It should be pointed out that RTNMC was the holder of the original No. 0201-021-313 for the HPP Complex Project which was issued on July 2002. This ECC includes the whole 84.5 hectare limestone quarry. In November 2002, RTNMC assigned all its rights and obligations IN ECC No. 0201-021-313 in favor of Coral Bay Nickel Corporation (CBNC) but retained the ownership and responsibility over the Gotok Limestone Quarry. The assessment and performance of the quarry operations cannot proceed independently of the RTNMC mining operation because there are no past disaggregated data for the Gotok Quarry. The best that this study can do is to treat the impacts and benefits of Barangays Iwahig and Sandoval as emanating from the operations of the Gotok Quarry. Hence, the discussions cannot really avoid discussing the RTNMC nickel mining operations in all of the socioeconomic parameters.

Displacement of Settlers

This sub-section discusses the effects of the project on the existing properties in the area in terms of relocation and changes in property costs with the implementation of the original project and the proposed expansion of the Gotok Quarry. It will also discuss displacement with the implementation of the original project and possible additional displacement arising out of the proposed expansion.

At the start of the mining operations in 1975, Bataraza was a desolated place sparsely inhabited by the Palaw'an, the indigenous tribe in Bataraza. There were few migrants mostly Ilongos and Cebuanos and land was available for settlers who had the muscles or the financial resources to clear and open up the forested areas and cultivate the brush lands in Bataraza.

Barangay Rio Tuba -- The influx of migrants seeking employment and livelihood opportunities created by the mining operations triggered the rapid urbanization of Rio Tuba from 1996 up to the present. Rio Tuba had a population of 7, 663 persons in 2000 and the number of inhabitants more than doubled by 2010, with a population of 16, 577 persons. Correspondingly, the demand for living space increased resulting in the appreciation of land prices in Rio Tuba, especially along the Macadam Road. The increase in land prices are also being felt in the nearby barangays of Sumbiling, Ocayan, Sandoval and Iging-Iging. Households occupying farmlands were able to sell their land titles or land rights for residential purposes and were well rewarded in these transactions.

It is expected that the demand for both residential and agricultural lands will increase because of the anticipated arrival of more migrants who have knowledge on the employment and livelihood opportunities in Rio Tuba. Together with the natural growth rate, the population growth of Rio Tuba is expected to be led by migration and an increase at around 6% to 7% a year for the next five years is expected.

This study cannot isolate the effects of the increase in the volume of processing of lime from the Gotok Quarry to the overall effects of the whole RTNMC/CBNC complex. In addition, the establishment of a separate lime processing plant (Unichamp) to produce lime milk further dilutes the effects of the increase of the volume of the existing lime crushing operations on Barangay Rio Tuba.

Barangays Iwahig and Sandoval -- The MPSA covering the 84.5 hectares covering the Gotok Quarry area (located in Barangays Iwahig and Sandoval) is uninhabited and the expansion of the quarry will not displace any type of settler or occupant. The surface owners and/or occupants have been paid by the company for their surface rights before the start of the quarry operations and there are no issues or concerns in relations to the purchase of the surface rights of the whole MPSA area. The surrounding areas/parcels of lands are agricultural and are planted by coconuts and rice. These crops continue to grow and produce and there are no reported adverse effects of the quarry operations to the agricultural sector.

RTNMC is very aware that their mining operations (including the quarry operations) would result in an increase in demand for decent housing for their employees and workers. Hence, aside from the GK housing project which has targeted the IPs in the area, regular employees of RTNMC and CBNC are provided with free housing either within the RTNMC Townsite or elsewhere. Aside from the free housing opportunity, water and electrical supply are also subsidized for the regular employees of the two companies.

The operations of the mine have resulted in additional demand for housing which is partially addressed by the private sector especially in Rio Tuba. Households provide halfway houses or temporary shelter to their relatives and town mates who are desirous to partake in the employment or livelihood opportunities created by the mining operations. Some households have developed their housing areas to rent rooms or bed spaces for casual workers or migrants who are desirous to work in the mine.

There is a possibility that the informal settlement located in Sitio Marabajay, Rio Tuba will expand to accommodate additional informal dwellers seeking to partake in the benefits being derived from RTNMC such as employment, livelihood opportunities and improved delivery of basic services. It would be more appropriate if RTNMC would seek LGU intervention through the municipal and barangay officials on the further influx of informal dwellers because they have the legal mandate to maintain public order and protect the public good.

Overall, RTNMC is addressing the increase in housing demand brought about by its mining operations including the quarry operations through the IP housing program and in-house housing projects. In addition, the increase in housing demand has created and energized the housing sector and the residents have taken advantage of this opportunity to build additional housing units, remodel old houses and restructure their homes to earn additional income from this housing demand.

In-Migration

This sub-section will discuss the possible influx of informal dwellers in the area and the in-migrations patterns as a result of the implementation of the original project and the possible additional in-migration as a result of the expansion of production/extraction of the quarry operations.

The municipality was created in 1964 from Brooke's Point by virtue of Republic Act 3425. At the start of the mining operations in 1975, Bataraza was a desolated place sparsely inhabited by the Palaw'an, the indigenous tribe in Bataraza. There were few migrants mostly Ilongos and Cebuanos and land was available for settlers who had the muscles or the financial resources to clear and open up the forested areas and cultivate the brush lands in Bataraza. The original Palaw'an occupants were willing to exchange household equipment and goods for their land while others sold their land for cash. When the Macadam Road was opened in 1977, there were only two households living along the seven kilometer road stretch. Rio Tuba was accessible from the Poblacion by sea route because there was no passable existing road to the barangay.

The increase in population specifically caused by migration is due to mining operations in the Rio Tuba. The first nickel shipment by RTNMC was made in 1977. The continued operations of the mine had attracted migrants since there are economic opportunities such as employment, business opportunities, and better provision of social services. This statement can be based on the results of the 1996 and 2010 socio-economic surveys conducted specifically for the project.

In the 1996 socio-economic and perception survey, a large percentage of the respondents are migrants (60.5%) but have lived in their (present) barangays within the last 15 years. Similarly, in the 2010 survey, 61.31% of respondents from the direct impact barangays are migrants while only 34.41% of respondents are migrants.

The main reason for migration in 1996 is to seek employment (53.3%). In the 2010 survey, the main reasons are employment (42.23%) and the search for better life (29.12%). Together with CBNC, RTNMC is the largest employer in Bataraza and migration is largely attributable to the employment and livelihood opportunities, improved delivery of basic services, accessibility and improved peace and order conditions brought about by the two corporations.

In the socio-economic survey that was conducted specifically for this EPRMP, there were 143 respondents (51.62%) who admitted that they were migrants while 134 claimed that they are not migrants from other places. Comparing the results of the two areas, migrants in the quarry area were only one third of respondents while almost three fourths of the respondents in the crushing area claimed to be migrants.

The two main reasons for migrating to Bataraza were livelihood (kabuhayan) accounting for 79.72% of all migrants and family (20.28%). In the crushing area, livelihood is higher than in the quarry area. There is a general tendency that migrants tend to settle in Rio Tuba because of greater livelihood opportunities that in other adjacent areas.

Based on the FGDs and KIIs conducted for this EPRMP, majority of the migrants during the last 20 years have relatives or friends already residing in Bataraza, particularly in the direct impact barangays. Upon arrival in Bataraza, these migrants were temporarily adopted by their relatives and friends, providing food and shelter until they were able to establish their own sources of living, basically from the mining sector. In return, these migrants were expected to assist in agricultural activities while others helped in the small businesses of their relatives and friends until such time that they were able to stand and live on their own.

These social net arrangements encouraged migration, facilitated and hastened the establishment of these migrants in their host communities and persuaded and promoted further migration to Bataraza. This migration trend is expected to continue as the municipality urbanizes due to the economic impacts of the RTNMC and CBNC"s activities.

RTNMC has already exerted its best efforts to prioritize local qualified residents for employment directly or through its sub-contractors. Residents, desirous to be employed but lacking the necessary qualifications were offered skills trainings and seminars to empower them to qualify for the open positions. The company also provided the necessary trainings and seminars for livelihood for residents who were interested in putting up their small businesses. One of the effects of this employment prioritization of local residents is to discourage the influx of migrants to the area. However, migrants kept on coming to the municipality because of employment and livelihood opportunities, improved delivery of basic services and favorable peace and order conditions.

The company has done its best to discourage the influx of migrants without going beyond the accepted legal parameters and the option is just to continue the projects and programs aimed at dampening the pulling power of Bataraza for migrants.

The workers in the quarry are either from the host barangays of the quarry or from the neighboring barangays. The company is providing transportation twice a day from Barangay Rio Tuba to the quarry. Workers residing in the two host barangays can also avail of these buses to be picked up from the designated routes. In this way, RTNMC minimizes the number of would be settlers who will settle in the two host barangay because the workers can maintain their houses because the company provides adequate transportation.

Indigenous People and Culture/Lifestyle

This sub-section will present the demographic and ethnographic data of the dominant indigenous group in the area, the impacts on the culture and lifestyle on the IPs resulting in the implementation of the original project and possible additional impacts on the expansion of the production/expansion of the project.

Culture -- The *Palaw'an Tribe* in Bataraza is on a crossroad of development. Their choices are to go up further to the mountains and minimize interactions with the lowlanders to preserve their cultural identity and traditional ways or embrace the modern ways of information technology, latest techniques in upland agriculture, with all the accessories of modernity but lose or dilute their traditional ways and cultural identity.

The middle ground would be the preservation of their cultural identity while benefiting from modern technology. The interventions of RTNMC were to organize and prepare the tribal youth in surviving in the modern world mainly from the Indigenous Learning System, empowering the tribal communities through various seminars and training and providing livelihood opportunities and special health support to tribal patients among others. Through these efforts, RTNMC hopes to further empower the Palaw'an and provide the platform for the tribal communities to be competitive in this changing world.

Based on the FGDs and KIIs, there are active and deliberate efforts by some tribal elders to preserve their cultural identity by buying back their musical instruments and teaching some promising youth to learn to play these musical instruments. Some informants related their communal efforts to buy back their ancestral lands lot by lot from their royalties that they receive from RTNMC. There are some GK areas where the circular pattern of the Palaw'an is still evident and reflective of their traditional spatial orientation.

These efforts are very laudable but would require a master plan to retain, preserve and reflect their cultural identity. Primarily, the *Palaw'an* would need to document their cultural traditions and efforts are being made by some students in the ILS to document these traditions. It is recommended to RTNMC and the tribal leaders that a full blown ethnographic study be undertaken to document these traditions and a centralized tribal museum be established to house the cultural artifacts that may be gathered by the tribe. There are still some tribal elders that are still living who are very knowledgeable to their customs and traditions. Some members of the tribe may undergo training on the different aspects of ethnography and operations of a tribal museum.

Lifestyle – The *Palaw'an* IP group has been perceived by many of the residents in the direct and indirect impact barangays as a special and privileged group because they are the recipients of special benefits from RTNMC and CBNC such as the Gawad Kalinga Project providing for free housing for the *Palaw'ans*, free medical services and medicines in the RTNFI Hospital, fishing and farm equipment. In addition, they have their indigenous learning System and have priority for scholarships provided by RTNMC. The SDMP is also disaggregated so that there are specific budget allocations for the IP group in each barangay.

These special benefits given to the IPs have created envy and resentment among the non-IPs in Rio Tuba and neighboring barangays. These sentiments may transform into hatred and might create adverse social conditions such as ethnic prejudice and discrimination that would divide the communities along ethnic lines.

On the part of the Palaw'ans, they are aware of their privileged position with the company and are careful not to exacerbate this negative perception. They are trying to erase the ethnic divide by rabidly adopting the lifestyle of the "*tiga patag"* and there are households who no longer teach their native dialect to their off springs to facilitate the acculturation process and try to eradicate any vestige of ethnic origin.

There are negative effects of development and these have been noticed and concerns raised by the residents especially in Rio Tuba. Two out of five respondents have expressed their concerns regarding the deteriorating peace and order conditions. The respondents were asked on their perceptions on the problems relating to peace and order. The respondents were concerned about the presence of vices and theft in their communities. It is very apparent that based on the perceptions of respondents, vices had proliferated in Rio Tuba and the further the communities are from Rio Tuba, the lesser their perception of the presence of vices in their communities.

In areas wherein RTNMC has existing active community interventions such as employment generation and its various programs and projects in education, the perceptions in Rio Tuba, the primary recipient, is better than the rest of the direct and indirect impact barangays. However, based on the results of the survey, there are unintended consequences of development such as prostitution, gambling and alcoholism. These are manifestations of surplus money earned from the mining operations which found their ways into unscrupulous persons who also take advantage of the financial benefits coming from the mining operations.

While these perceived social issues are police or social welfare issues, RTNMC may further discourage the proliferation of these vices through administrative means and support the appropriate government agencies tasked in eradicating or minimizing these social ills through collaborative efforts, support on equipment and logistics to make these agencies more efficient.

The company and residents of Rio Tuba had become aware of these social problems and are trying to address these by providing support to maintain the peace and order conditions in Bataraza especially in Rio Tuba. There is an allocation of 6.74 million for SDMP III under the peace and order program of Barangay Bataraza and1.2 million a year is allocated as incentive for 40 barangay security officers. This highlights the support of RTNMC not only in basic services but also in maintaining the peace and order condition of Rio Tuba.

Threat to Delivery of Basic Services/Resource Competition

This sub-section presents the discussions on how the original project affected the delivery of basic services and resource competition in the area and the prediction of additional impacts (if any) as a result of the expansion of lime production/extraction of RTNMC. The availability of basic services included in the discussions are water supply, power supply, communications, health resources, peace and order, education facilities and recreational/sports facilities. This sub-section also presents the relevant statistical data and information regarding these basic services.

Infrastructure -- The required infrastructure in a local government unit is supposedly the responsibility of both the national and local government units. However, the development patterns in Bataraza, more particularly in the direct impact barangays were not normal. The discovery of nickel in Bataraza forced the company to shoulder the costs of most of the needed infrastructure, mainly roads and bridges, water and power. At great costs and efforts, the company was successful in mining and shipping out the nickel. In addition, it had to develop on its own utilities and basic services such as source of power, potable water supply, solid waste management including final disposal site and health care. Local governance came to Bataraza after RTNMC has pioneered the development of the area.

RTNMC wholeheartedly assisted in the development the neighboring communities in the adjacent barangays without any obligation or compulsion to develop these communities. When the Mining Act of 1995 became effective and operational, the formulation and implementation of the SDMP became mandatory and the approved SDMPs contained provisions for the development of infrastructure and utilities funded by the Social Development Management Fund. In addition, corporate funds separate and distinct from the SDMP funds were allocated by the company to bring further development to the whole of Bataraza.

Water and Power -- RTNMC established most of the utilities required by its mining operation and sharing these utilities with the residents of in the immediate vicinity of their facilities. The costs for the establishment of power and water supplies were shouldered by the company and are shared for free in the neighboring communities. For communities that are inaccessible to the central supply, separate provisions for power and water supplies were provided.

Table 2.4.20 shows the sources of water from the three barangays in 2001. Majority of the residents in Iwahig and Sandoval sourced their water through water pump or well. As for Rio Tuba, water are delivered to their houses through pipelines. In 2014, as discussed in the Hydrology Section of this EPRMP, Barangays Sandoval and Iwahig and many portions of Ocayan, Culandanum, Igang-Igang and Sarong were also connected to a Level 2 water system likewise developed by RTNMC and CBNC in 2013.

Table 2.4.20. Sources of Water in Iwahig, Sandoval and Rio Tuba, 2001

Source of Water	Iwahig		Sandoval		Rio Tuba	
	No.	%	No.	%	No.	%
Water pump	145	74.0	96	41.0	307	32.9
Well	51	26.0	114	48.7	130	13.9
Piped water	0	0.0	0	0.0	359	38.5
Spring	0	0.0	24	10.3	81	8.7
Bought	0	0.0	0	0.0	56	6.0
Total	**196**	**100**	**234**	**100**	**933**	**100**

Source: RTNMC HPP EIS, 2001

For electricity, there were allocations in the previous SDMPs for the purchase of electric generators to provide electricity at least in the barangay centers. However, the issue again is sustainability. Many of these electric generators are not used because ghey are not in running conditions. Many generators need spare parts while other barangays cannot afford to buy fuel for the generators and are depending of RTNMC for dole outs to have their generators running again.

RTNMC commissioned a consultancy group to undertake a social impact assessment (2013) to document and understand the impacts of their projects to the 11 barangays and 24 ICC communities. Nine hundred fifty respondents were asked on what are the most pressing problems in their communities. Six hundred and nine respondents (64%) cited lack of electricity as their most pressing need in their communities. The respondents opined that the electric generators were not enough because only a limited number of households can be supplied and these are located in the barangay centers. These are missionary lines that would only be undertaken if additional funds from other sources are available. One possible source would be the Malampaya funds that is dedicated to electrification including missionary areas.

Communications -- In the area of communication, initially, RTNMC had to establish its own communication network. With the advent of mobile communication, private telecommunication companies such as Smart and Globe Communications had put up their own private systems to service the growing clientele in the municipality especially in Rio Tuba and the adjoining barangays. The upgrading of telecommunication services is largely dependent on the number of users and types of services needed. As the telecommunication requirement grows, these two companies will sufficiently address these particular needs.

Having an anchor customer such as RTNMC and its sister company CBNC had created a critical mass or volume of business for these two telecommunications companies and they will continue to service the needs and, in the process,, also address the needs of the surrounding communities including reliable internet connections. Other telecommunication companies may also find Bataraza an interesting place to provide additional services.

Education – The importance of education to rural areas especially to the Palaw'an cannot be overemphasized. Given the limited employment and livelihood opportunities in Bataraza, education is a great equalizer, providing a glimmer of hope for the poor but educated residents. RTNMC had realized for a long time the importance of education to alleviate the plight of the unfortunate Filipinos and realize that education can empower residents to improve their standard of living and emerge and surface from the poverty line.

The influx of migrants had slowly diluted the culture of the Palaw'an but based on some knowledgeable anthropologists cited in the ethnographic background sub-section, education had played a vital role in the adaptation of the Palaw'an in their changing world. English, Filipino and Mathematics are their new survival tools in interacting with their migrant dominated environment.

The intervention of RTNMC in the field of education is exemplary and should be the benchmark of mining corporations in the country. It has become the de facto Department of Education in Bataraza addressing the needed educational infrastructure including construction of educational facilities, establishing Indigenous learning system and the LSVMS, sponsoring college scholars, etc. These educational initiatives should be sustained because education is a future investment that will be harvested and enjoyed by future generations, especially after the mining life of RTNMC.

For the school year 2013, there were 998 Rio Tuba Nickel Foundation Inc. (RTNFI) scholars and out of this total, 378 scholars are in the elementary level, 22622 scholars in the high school level and 358 scholars in the college level. There were 331 non-IP scholars while 667 scholars were members of the Palaw'an IP. The details are shown in the following table.

Table 2.4.21. Summary of Scholars as of School Year 2013

Number of Scholars	Non-IPs	IPs	Total
College	281	77	358
High School	50	212	262
Elementary	0	378	378
Total	331	667	998

Source: RTNFI, 2014

While the national government has the primary responsibility to provide basic education as part of the basic rights of citizens, RTNMC may still contribute to further improve the conditions of education in Bataraza. There are still room for improvement in the field of education like improving the classroom to student ratio and teacher to student ratio especially in the direct impact barangays like the Rio Tuba Elementary School Annex with a classroom to student ratio of 1:154.

Some participants of the FGDs expressed minor disappointments regarding the failure of some graduates of RTNMC educational scholarship to be employed. There might be some misunderstanding on the arrangements because one participant said "*kaya nga pinagaral para magtrabaho sa mina*." Some kind of levelling off may be helpful to correct the impression that educational scholarships were extended to beneficiaries primarily to create a pool of qualified workers. The primary aim of educational scholarships is to empower qualified and deserving students who lack the financial resources to complete their collegiate courses to become better citizens in nation building. The provision of scholarships is to help the poor but deserving students complete their studies and to have better chances to improve their lives. Employment in RTNMC is only an additional benefit if there are available positions but it is only incidental to the overall primary purpose of improving the lives of beneficiaries.

It is expected that the increase of limestone production will minimally increase the number of drivers and heavy equipment operators to load and transport the limestone. It is also expected that if there is any increase in demand in the field of education, the existing system will be able to cope with this demand.

Social Services -- In terms of social services, the SDMP of RTNMC includes provision for social services for the 11 affected barangays (4 direct impact barangays and 7 indirect impact barangays) and 24 indigenous communities. There were funds that were classified under calamity funds (such as death and burial expenses, natural calamities assistance, etc), operations and maintenance funds (repair of religious structures, transport services, acquisition of equipment, water tanks), festivities and other affairs funds (senior citizens, women's affairs).

The shift from a rural to an urban character of Barangay Rio Tuba brought about by the operations of the mine has partially altered the needs of the community. Social problems arising from rapid urbanization and surplus of disposable income necessitate a modification of social services because of the changing needs of the community.

Based on the records of the company, senior citizens are beneficiaries of certain programs and projects under or outside of SDMP. However, the experience, knowledge and wisdom of senior citizens remained untapped by the company. The category of senior citizens is but a legal creation and most of the time, unduly curtail the remaining productive years of individuals. This arbitrary category is like a gold vein waiting to be mined. It is recommended that the company harness senior citizens in community projects not only as beneficiaries but as partners of development to maximize their moral ascendancy in their respective communities and take advantage of their vast experiences, knowledge and wisdom.

RTNMC has supported the presence of the PNP and several branches of the military in Bataraza through provisions of the needed facilities, equipment and some operating expenses. The perception of residents that one of the more pressing problems is drug addiction is anchored on common knowledge and is reflective on the real conditions in their communities.

It is possible that drug addiction may be introduced by some workers who are not originally from Bataraza and because of their demand for these prohibitive substances, encouraged enterprising persons to transport these substances to Bataraza. RTNMC may address this very real possibility of active drug use by some workers through administrative issuances contained in the company policy. In addition, the company should continue its support to the PNP for the maintenance of peace and order condition in the locality.

RTNMC commitment to sports is very laudable not only for personal development but also to keep its personnel and workers and their dependents preoccupied and minimize the attractions of drinking, gambling and drug use. Sports build personality and produce good citizens and the company would be judicious if it would continue to sponsor sports activities not only to its workers and personnel but also in the direct and indirect impact barangays.

Threat to Public Health and Safety

This sub-section discusses the original project implementation's threat to public health vis-à-vis the baseline health conditions in the area and the additional impacts resulting in the expansion of lime production/extraction. It will also discuss health impacts that may arise from climate change.

In terms of health, the company operates the RTN Hospital (non-SDMP) which provides medical and dental services to the employees and dependents of the company including residents of the neighboring communities. Since 1984, indigent patients particularly members of the indigenous community are treated free. For the period 1990–1996, 53% of patients admitted in the hospital and 18% of outpatients are non-employees and dependents.

In 1999-2000, a total of 464 patients were admitted in the hospital and 35% of admitted patients were non-employees or dependents. For outpatients, 16% of those treated for the same period were non-employees or dependents.

In 2011, 55% of patients treated in the hospital were non-dependents. The total cost of running the RTNFI Hospital amounted to 78.4 million pesos of which 43.4 million pesos is chargeable to SDMP funds.

Since 1991, RTNMC also sponsors annual medical missions. From 1991-1995, a total of 235 surgical operations were conducted during the missions and 83% of the patients were from other barangays and municipalities. For the period of 1999-2000, a total of 109 patients were treated of which 94% were patients from other barangays and even other municipalities. A total of PhP 528,000 was spent for this activity by the company.

The following table summarizes the number of patients served by the RTNFI Hospital. The bulk of patients were out-patients while the more serious medical cases were admitted to the hospital. In 2013, there were a total of 50,389 served patients or an average of 138 patients a day and out of this total, 4,799 patients were admitted.

Table 2.4.22. Number of Served Patients in the Hospital

Year	Admission	Out Patient	Total	Ave Daily Patients
2004	1,371	17,139	18,510	51
2005	No Available Data; Annual Report not Available.			
2006	1,717	18,450	20,167	55
2007	2,191	18,869	21,060	57
2008	2,119	27,874	29,993	82
2009	1,930	33,693	35,623	97
2010	2,761	45,602	48,363	132
2011	3,618	49,859	53,477	147
2012	3,789	45,279	49,068	135
2013	4,799	45,590	50,389	138

Source: RTNFI, 2014

The proposed expansion of the quarry operations would not significantly require additional workers and any additional workers that may be hired by RTNMC would not unduly burden the existing health system in place in Bataraza. However, it is anticipated that the volume of trucks coming from the quarry area to the crushing area in Rio Tuba would significantly increase and may have health implications along the road.

The leading cause of morbidity in Bataraza and Rio Tuba (2005-2010) was acute upper respiratory infection (AURI) with Rio Tuba contributing almost 25% of cases. There is a possibility that this respiratory disease may increase if the dump trucks are permitted to create unnecessary dusts in transporting the lime from the quarry to the crushing plant. Presently, there is a washing area for trucks, before these dump trucks embark to the quarry to get their loads. Street sweepers are employed by the company 12 hours a day to clean the road to ensure that dust will not form. In the 11.5 km unpaved portion starting from the quarry to the national highway, RTNMC has hired a resident who water this portion every day except during rainy season.

The company should continue employing the washing area to clean the dump trucks of mud before these are permitted to return to the quarry. It should also continue cleaning the whole stretch of the highway to ensure that there is no accumulation of mud in the concrete road. During dry season, RTNMC should continue to hire the resident to water the unpaved road to suppress any dust on the road from being air borne.

It is recommended that additional efforts be exerted to provide trainings and seminars among local residents on proper health and sanitation practices. These preventive measures would certainly be more effective and productive that curative measures that are now being addressed by the hospital and other health facilities.

Generation of Local Benefits from the Project

This sub-section presents the impacts on income, employment, livelihood, poverty incidence commercial activities banking and financial institutions. It also discusses the local benefits derived from the implementation of the original project and the additional benefits that are expected to be derived from the expansion of quarry operations. The discussions will be on the household level and local government unit level.
Agriculture -- Agriculture is the main employment/livelihood source in Bataraza with their secondary source from fishing. Nickel is a finite resource that will be depleted and mining in Bataraza will go into the abandonment stage. Persons who rely on the mine for their primary source of livelihood and income will find themselves without a reliable substitute for their mining income when the nickel deposits will have been finally depleted.

The abnormal increase in the population in Bataraza meant that there was also a corresponding increase in the demand for food such as rice and fish, the two leading agricultural products of Bataraza. This meant an assurance for a stable market because the local market grew and enable farmers and fishermen to sell their products in Bataraza instead of selling their products elsewhere.

The second SDMP has been completed in 2013 and the third SDMP is now being implemented in the 11 barangays and 24 IP communities and the general direction is focused on livelihood projects and alternatives to prepare the residents on the eventual depletion of nickel in Bataraza. Presently, there are funds that are available to empower the residents and build up their skills for other economic activities besides mining. RTNMC has invested in livelihood projects and programs for nine years (SDMP 1 and 2) and many of the projects that have been implemented needed improvements.

The focus of the third SDMP is commendable because it will wean off residents from just relying on RTNMC to solve all their problems. RTNMC is their panacea for all their personal and community problems. Unless for compelling instances, the company should limits and restricts the dole out to the communities and reward meritocracy. Communities and projects that were successful should be further supported while projects that failed should be dissected on the elements or factors that contributed to their failures.
Commerce and Trade – The continuous operation of RTNMC will sustain and increase the expansion of the commerce and trade sector because of the continuous demand for goods and services required by households in Bataraza. RTNMC intervention is not required because the private sector composed of small entrepreneurs will sufficiently address and sustained the growth of this sector.

Industry – The size of capital investments of RTNMC and its sister company CBNC in the mining operations and processing in Bataraza was very significant and these two projects became the anchor for industrial development of Bataraza. The projects contributed significantly to the revenues of both the national and local government units as well as to the overall development of Bataraza.

The continued operation of both RTNMC and CBNC is contingent on identifying and mining other nickel ore deposits not only from the existing MPSA but also from the area within AMA-IVB-144A/B. If there is no ECC in favor of this area or other nearby areas, the nickel deposits within the present mining area will be exhausted and the industrial sector of Bataraza would flicker and end and the project would enter into the abandonment phase.

In this scenario, Bataraza would rapidly deteriorate because of out migration, cessation of employment and livelihood opportunities in the mining sector, stoppage diminishing commercial activities, decreasing local government revenues, declining quality of health and educational services and facilities.

Based on the records of RTNMC, during the 5 year period from 2009 to 2013, a total of 1.681 billion pesos was paid as compensation including allowances for workers and personnel (regular, casual/seasonal, sub-contractors) of the company. Majority of this amount was spent in Bataraza and assuming that it has a multiplier effect of 5 at 80%, the total amount that was circulated in Bataraza is around 6.201 billion pesos. The details are shown in the following table.

Table 2.4.23. Estimated Total Compensation (2009-2013)

Classification	2009	2010	2011	2012	2013	Total
Regular	121,860,058.85	148,189,434.45	164,869,155.05	262,971,667.42	283,788,518.65	981,678,834.42
Casual/Seasonal	36,919,183.95	26,024,825.95	29,558,152.80	24,590,192.17	23,789,013.32	140,881,368.19
Sub-Contractors	40,866,000.00	60,453,000.00	97,079,000.00	151,148,426.88	155,281,136.76	504,827,563.64
Food Allowance	7,414,826.13	8,633,171.84	11,896,123.32	12,661,779.10	13,928,363.40	54,534,263.79
Total	**207,060,068.93**	**243,300,432.24**	**303,402,431.17**	**451,372,066.00**	**476,787,032.00**	**1,681,922,030.34**

Source: RTNFI 2014

It is expected that the number of workers and compensation paid by RTNMC will increase further if the expansion of its operation which is the subject matter of this EPRMP document will be approved because of the hiring of additional drivers and heavy equipment operators.

Government Revenues – RTNMC paid two general types of taxes during the period from 2009 to 2013. National taxes composed of income tax, excise tax, custom duties, value added tax, capital gains tax and documentary stamp tax totalled 2.962 billion pesos while local taxes in the form of local business tax, real property tax, occupational tax, community tax, registration fees, wharfage fees, permits and fees and other taxes totalled 153.649 million pesos. The details are shown in the following table.

Table 2.4.24. Summary of Paid National/Local Taxes and Withholding Taxes (2009-2013 in '000)

Taxes/Fees Paid by RTNMC	2009	2010	2011	2012	2013	Total
1) **Taxes & Fees Paid**						
A. National Taxes etc.						
Income Tax	215,868	632,646	852,466	424,336	321,338	2,446,654
Excise Tax	30,077	68,056	119,279	80,764	63,793	361,969
Custom Duties/Fees	3,281	5,485	4,416	7,851	1,698	22,731
VAT	791	31,378	885	68,492	4,775	106,321
Capital Gain Tax			275			275
Doc. Stamp Tax	6,750	-	69	5,269	13	12,101
Other National Taxes					12,309	12,309
Sub-Total	**256,767**	**737,565**	**977,390**	**586,712**	**403,926**	**2,962,360**
B. Local Taxes & Fees						
Local Business Tax	2,458	5,745	9,376	15,010	15,527	48,116
Real Property Tax	6,681	6,141	8,294	6,608	6,628	34,352
Occupational Tax	19	0	2	123	123	267
Community Tax	10	11	11	11	11	54
Registration Fees	508	324	722	470	388	2,412
Wharfage Fees	3,393	9,213	15,573	16,692	17,388	62,259
Permit & Fees	2,694		0	217	351	3,262
Other Local Tax	478	699	562	626	562	2,927
Sub-Total	**16,241**	**22,133**	**34,540**	**39,757**	**40,978**	**153,649**
2) Withheld Taxes						
MT on Payroll	24,231	29,350	40,160	45,020	48,873	187,634
WIT on Dividends	37,800	38,556	63,000	63,000	50,400	252,756
WIT on Interest Exp.	3,454	1,089	2,442	1,947	1,429	10,361
Other W/held Taxes						0
Expanded/Final	16,393	24,425	31,696	44,178	30,897	147,589
Fringe Benefits	658	801	400	2,265	1,242	5,366
Sub-Total	**82,536**	**94,221**	**137,698**	**156,410**	**132,841**	**603,706**
TOTAL	**355,544**	**853,919**	**1,149,628**	**782,879**	**577,745**	**3,719,715**

Source: RTNMC Accounting, 2014

RTNMC withheld taxes of persons and entities transacting business with the company as collecting agent in behalf of the government. While technically, the withheld taxes came from these business and entities transacting business with RTNMC, but without RTNMC, the government will not earn and be entitled to the taxes withheld. Hence, the revenues generated by the government coming from the withheld taxes may also be attributable to RTNMC. During the period from 2009 to 2013, RTNMC withheld various types of withholding taxes amounting to 603.706 million pesos.

In summary, the government (both national and local) earned Php 3.719 billion pesos from RTNMC for the payment of national, local and withholding taxes for the period 2009 to 2013.

It is expected that the government will earn more revenues with the expansion of the operations of RTNMC because the income tax, excise tax and customs duties are positively influenced by the volume of extraction and/or shipment of nickel ore.

As additional information, there are formal moves in Rio Tuba to separate from the municipality of Bataraza and form a separate municipality. This has grave financial implications for Bataraza considering the amount earned by Barangay Rio Tuba from the RTNMC complex which house the RTNMC, CBNC and soon to be operational Unichamp Mineral Corporation. This would in effect dramatically reduce the revenue of Bataraza and concentrate the revenue to the proposed new municipality.

Poverty – A Filipino family of five needed Php 5,590[2] in 2013 to meet basic food needs every month and Php 8,022 to stay above the poverty threshold (basic food and non-food needs) every month. These respective amounts represent the food and poverty thresholds, which increased by 12.4 percent from 2009 to 2012. Such increases can be attributed to inflation of about 4.1% on the average per year between 2009 and 2012. The other poverty statistics are presented in the following table.

Table 2.4.25. National Poverty Statistics

Poverty Statistics (National)	Average Monthly Estimate			
	2006	2009	2012	2013
Food Threshold for a Family of Five (Php)	3,894	4,903	5,458	5,590
Poverty Threshold for a Family of Five (Php)	5,586	7,040	7,821	8,022
Income Gap	30.1	29.0	29.2	27.4
Poverty Gap	7.0	6.6	6.5	5.2
Severity of Poverty	3.0	2.8	2.7	2.1

The food threshold is the minimum income required by a family to meet its basic food needs and satisfy the nutritional requirements set by the Food and Nutrition Research Institute (FNRI), while having individuals in the family remaining economically and socially productive. Put another way, the food threshold helps measure extreme poverty (also called subsistence poverty).The poverty threshold is a similar concept, but this incorporates costs of basic non-food needs, such as clothing, housing, transportation, health, and education expenses, among others, in addition to costs of basic food needs.

He poverty statistics in Palawan continued to improve based on the available statistics of NSCB from 2003 to 2009. In real terms, poor families went down from 51, 554 families in 2003 to 46, 045 families in 22009. In the same period, the number of poor persons also

[2] http://www.nscb.gov.ph/poverty

went down from 315,021 persons in 2003 to 273, 648 persons in 2009. Other poverty statistics are shown in **Table 2.4.26**.

Table 2.4.26. Annual Poverty Statistics for Palawan

Poverty Indicators	2003	2006	2009
Poverty Threshold and Incidence			
Annual Per Capita Poverty Threshold (Php)	9,395	11,317	14,038
Poverty Incidence of Families (%)	30.4	29.8	24
Magnitude of Poor families	51,554	54,567	46,045
Poverty Incidence of Population (%)	39	36.4	29.5
Magnitude of Poor Population	315,021	329,014	273,648
Food Threshold and Subsistence Incidence			
Annual Per Capital Food Threshold	2.8	3.2	2.5
Subsistence Incidence of Families (%)	10.4	11.3	10.2
Magnitude of Subsistence Poor Population	17,588	20,700	19,589
Subsistence Incidence of Population (%)	14.8	14.5	13.2
Magnitude of Subsistence Poor Population	119,700	130,580	122,749
Other Indicators			
Income Gap	24.9	27	26.3
Poverty Gap	6,546	7,931	9,784
Severity of poverty	7.7	8	6.3

Source: NSCB

Applying the national poverty statistics of 2013 on the results of the socio-economic survey, the following table shows the results. The monthly income was bracketed into the food threshold, poverty threshold and above poverty threshold to highlight the poverty incidence in the three DIA barangays.

Table 2.4.27. Food and Poverty Thresholds and Incidences

Monthly Income	Quarry Area (n=151)		Crushing Area (n=126)		Combined Areas (n=277)	
	Frequency	%	Frequency	%	Frequency	%
<5,600(food threshold)	88	58.28	32	25.40	120	43.32
5,601-8,022(poverty threshold)	12	7.95	31	24.60	43	15.52
>8,022 (above threshold)	18	11.92	32	25.40	50	18.05
No Answer	33	21.85	31	24.60	64	23.10
Total	**151**	**100.00**	**126**	**100.00**	**277**	**100.00**
Average Monthly Income	**584,000**		**730,000.00**		**1,314,000.00**	
Average Monthly HH Income	**4,949.15**		**7,684.21**		**6,169.01**	

Gotok Limestone Quarry EPRMP, 2014.

The average monthly income for the three barangays was Php 6,169.01, above the food threshold (Php/5,600) but below the poverty threshold (Php/8,022). Comparing the two areas, the crushing area (Rio Tuba) was better off with an average income of 7, 684.21 per month compared to the quarry area of Php/4,949.15 which was below the food threshold.

There are 120 households (43.32%) who are below the food threshold. Households under the food threshold are significantly higher in the quarry area (58.28%) compared with the number of households in the crushing area (25.40%). There were 43 households (15.52%) whose incomes were between the food and poverty thresholds.

There is a trend that the RTNMC/CBNC massive interventions for the improvement of the standards of living in Rio Tuba have resulted in positive impacts, particularly the increase in the household income. However, the interventions in other affected barangays should also be intensified to approximate the positive effects in Rio Tuba.

Traffic Congestion

This sub-section discusses the existing road network and transportation situation. It also discusses the traffic assessment on the original project and the impacts that may arise from the proposed expansion of production and/or extraction of RTNMC.

The proposed project aims to increase the volume of limestone from 186,000 MT of limestone to 725,000 MT a year. The limestone will be mined in the Gotok Quarry and transported to the crushing plant in RTNMC complex. Depending on the size, the reduced limestone will be delivered to either to CBNC or UMPI, the makers of the limestone milk. Both are also inside the RTNMC complex.

The transport route will start from the Gotok Quarry area and will traverse a 1.5 km unpaved municipal road and upon reaching Kulantuod Junction, the dump trucks will turn left and will further traverse around 7 to 8 km of asphalted national highway passing by Barangay Ocayan before reaching Barangay Rio Tuba and upon reaching Macadam Road will turn right and traverse an additional 500 meters to finally reach the crushing plant.

With the expected increase in volume traffic, RTNMC should maintain a flag man in the Kulantuod Junction to warn on-coming vehicles of emerging dump trucks from the quarry site. Other interventions on traffic such as cleaning the road of mud, maintaining of the truck wash area and traffic aides will remain the same.

Barangay Rio Tuba has allocated 4.5 million for 5 years as incentive for street sweepers under environmental management in their budget allocation in SDMP III. These street sweepers maintain the hauling road of RTNMC particularly to clean the streets of mud brought by the dump trucks that haul the nickel. The trucks bringing limestone from the quarry to the crushing plant will also be serviced by these sweepers.

Manpower Requirements

The presence of employment opportunities is the predominant pull factor of migrants into Bataraza. Based on the 1996 and 2010 socio-economic surveys, the main reason for migrating into Bataraza is the presence of employment and livelihood opportunities. Hence, it is clear that without the mining project, migration would be very minimal into Bataraza and it would remain a rustic and sleepy municipality whose original residents would wallow on the quagmire of poverty, relying mainly from farming and fishing to put scarce food on the family table.

There is a perceptible shift from land and water based economic activities to services and employment in mining and related activities brought about by the continuous presence of RTNMC in Bataraza. It also means that there is also a shift on the skills and qualifications needed in the communities to be able to avail of the employment opportunities in the mining sector. Those that do not have the needed qualifications are downgraded into positions requiring more muscles that skills and knowledge. Because of this standard of admittance to the company, more students are encouraged to attain higher educational attainment or complete some tertiary educational courses to be viable to apply in the company.
The company has formulated a hiring policy to address the manpower requirements of the company and the clamour of the barangays to hire more workers from their respective barangays. Priorities are given to dependents of existing workers, residents of Rio Tuba, residents of other barangays, residents of other municipalities of Palawan and residents of other provinces. This priority list has also been adopted by the sub-contractors of RTNMC.

The mining operations in Barangay Rio Tuba have brought about significant economic and social benefits to the community. The company provides employment for residents of the host barangay and adjacent areas. Employment by RTNMC and its contractors since 1990 – 2005 ranged from 742 to 876 workers. In the period from 2009 to 2013, there was a steady increase in the number of workers of various classifications hired by RTNMC. In 2009, the total number of workers was 1,064 employees and workers and by 2013 the number of workers was 1, 822 employees and workers or an increase of around 71%. The details are shown in the following table.

Table 2.4.28. Summary of Employment (2009-2013)

Classification	2009	2010	2011	2012	2013
Regular	457	539	583	635	665
Casual	0	6	0	0	0
Seasonal	99	89	81	87	45
Temporary	138	148	128	170	102
Sub-Contractors	370	444	546	711	1,010
Total	**1,064**	**1,226**	**1,338**	**1,603**	**1,822**

Source: RTNMC ComRel, 2014

Based on an average of 5 persons per household, the direct employment benefit for 2013 would redound to around 9,000 persons. This total does not include the workers and personnel of its contractors such as the numerous security guards, and street sweepers among others.

Many of the employees and workers of the mine who have retired had remained in Bataraza because they have already established their roots in the communities. Because of the familiarity with the company policies and procedures, some because sub-contractors, suppliers or service contractors of the mine. Many retired personnel have second generation (sons, daughters and other relatives) workers and employees working in the mining operations. These conditions have given rise to "generational loyalty" to the company wherein there is mutual trust and expectations to bilaterally support one another. This generational loyalty is personal and unlike projects wherein communities benefit, it is reliable even in times of need by the company.

Another positive impact from the mining operations is the very significant presence of retailing activities within and around the facilities of RTNMC. Classified as self-employment for those that own and operate these small business establishments, the retailing sector absorbs would be workers and employees of RTNMC but for some reason or another, failed to work in the mining operations. In Rio Tuba, this sector represents 39% of interviewed households and is the largest reported source of income/occupation during the socio-economic survey in 2010.

For the Gotok quarry and crushing plant operation, there were 117 employees and workers as of 2014. The proposed expansion shall require 213 personnel.

Performance Assessment

Deliverables Based on ECC Conditions

Among the 37 conditions in the ECC issued in favor of the project in December 1997, the following table contains the summary of socio-economic-related conditions:

Table 2.4.29. Summary of compliance for the socio-economic conditions (1997 ECC)

ECC #	ECC Condition	Status/Remark
5	Resettlement/Compensation and Livelihood Program for affected families from previous mining operations and directly affected by the proposed project	Monetary claims filed by three (3) households on their crops and trees against RTNMC have been settled as of December 1997. Fertilizers were supplied to these three (3) households as part of the rehabilitation process to restore and improve their economic conditions.
6	Archaeological Survey Report for all areas in which major surface soil disturbance will be undertaken.	As part of the monitoring plan, earthmoving activities especially in undisturbed areas have been monitored for any suspected artifacts of archaeological significance such as bones, potteries and other artifacts. No artifacts have been uncovered up to the present.
15	Portions of Macadam Road linking pier and the quarry areas, especially those adjacent to populated areas shall be permanently paved to mitigate dust pollution.	Concreting of the 2.5 km Macadam Road along populated areas was completed in mid-2005. The balance of 4.5 km road is now fully concreted. Around 50 road sweepers working 12 hours a day have been hired to ensure that the privately owned macadam road is free of mud and dust. A washing station for trucks has been established along the road to ensure that these are cleaned before using the concrete road.
27	Priority in employment of qualified men and women. Adequate public information shall be provided for jobs available to local residents.	Majority of workers of RTNMC are from Bataraza. Contractors of RTNMC are mandated by their contracts to hire qualified workers from Bataraza. Announcements of job opportunities to local residents posted in strategic places and barangay bulletin boards
28	Community assistance for livelihood including assistance in construction of shallow and deep wells for drinking water	Various livelihood projects, trainings and seminars have been established and conducted for the residents of Bataraza. Fifteen water outlets for non-RTNMC employees as well as deep wells as source of potable and domestic water. Jetmatic pumps and stainless water tanks have been provided. A water system has been established covering the six (6) barangays of Bataraza.
29	Implementation of Social Development Program and shall assist the local government units in the provision of health, education and welfare services.	SDMP is being implemented through RTNFI. From 2007 to 2011, a total of PhP 679.645 million has been disbursed for the various components of the social development program (Non-SDMP and SDMP).
30	Assistance/protection to fisherfolk on complaints/problems arising from the mining operations.	Replacement of damaged culverts along tidal channel beneath Macadam Road which accommodates inflow/outflow of brackish water to the Flores fishpond. As part of the SDMP, fishing boats and equipment have been donated to fisherfolk belonging to the Palaw'an tribe.
33	Implementation of an affective and continuing IEC program on the impacts and conditionalities of the ECC.	Continuing IEC program is being undertaken for residents of surrounding communities, visiting students, civic groups. Lectures/briefings are being conducted.
34	Perpetual lease Agreement /Lease Agreement with landowners of the 7 km Macadam Road	Copies of Court decision forwarded to EMB.

Deliverables Based on the Approved SDMP

RTNMC and its sister company CBNC has an integrated social development program composed of the legally mandated Social Development Management Plan (SDMP) and non-SDMP programs that both companies voluntarily implement in favor of the 11 barangays and 24 ICC communities in Bataraza.

SDMP II covered the years 2009 to 2013 and actual disbursements amounted to PhP 276.654 million. This was shared with CBNC with RTNMC shouldering approximately one third of the total amount. The largest amount (PhP 93 million) was spent on education. This was followed by social services with PhP 76 million, livelihood programs with PhP 42 million and finally health and sanitation with PhP 116 million. The amount of health and sanitation did not include the amount spent for the RTNFI hospital, which had a separate budget. The details of the actual disbursements of SDMP II funds are presented in the following table:

Table 2.4.30. SDMP II funds (2007-2013) costs shared with CBNC

Expense	2009	2010	2011	2012	2013	Total
Education	11,425,823	14,876,940	20,305,561	27,857,206	18,703,476	93,169,006
Infrastructure/Utilities	9,454,354	13,238,018	14,120,522	7,894,191	4,090,400	48,797,485
Health and Sanitation	740,137	3,729,082	3,971,083	4,034,265	3,550,266	16,024,833
Livelihood Programs	4,586,165	5,480,897	26,611,759	3,965,390	1,466,450	42,110,661
Social Services	20,563,652	14,280,861	23,062,364	12,242,741	6,403,302	76,552,920
Total	**46,770,131**	**51,605,798**	**88,071,289**	**55,993,793**	**34,213,894**	**276,654,905**

Source: RTNFI, 2014
Combined Non-IP and IP areas

In the educational sector, SDMP II disbursed PhP 93 M and these were spent basically to support the scholarships of 687 students, and assistance to various elementary and secondary schools. A portion of this budget was also used to subsidize an extension campus of the Western Philippine University (WPU).

The budget for health and sanitation was PhP 116 M. This fund was basically used as a quick response budget in response to medical emergencies such as outbreak of diseases (dengue and diarrhea), medical and dental missions, provisions for medicines and health education. The budget for the RTNFI hospital amounted to PhP 243 M for the same period (2009-2013) and is not included in this SDMP budget. The breakdown of disbursements by sector is shown in the following tables:

Table 2.4.31. SDMP II funds (2007-2013) costs shared with CBNC

Sector	Projects/Activities
Education (budget PhP 93 million)	• Scholarship of 687 students (IP & NON-IP); • Subsidy on legal fees in 23 Elementary Schools and 3 Secondary School; • Support to 24 Alternative or Non-Formal Education/Schools; • Subsidy to the Western Philippines University – Rio Tuba Extension Campus; • Provision of salaries and incentives to 50 educators (para-teachers & day care workers); and • Various school assistance and enhancements through provision of supplies, school building repairs, among others.
Health and Sanitation (budget PhP 16 million)	• Provision of medical assistance for medical referral of various cases; • Spraying of Anti-Dengue at selected areas; • Provision of 2 units ambulance; • Support to Lakbayan Medical Mission of the Provincial Government of Palawan; • Barangay Dental Missions; • Distribution of purifying tablets and jerry cans for the affected communities from diarrhea outbreak • Conduct of quick response medical mission during diarrhea outbreak on affected communities • Conduct of health education lectures and recruitment of additional health volunteers and providing them with incentives; • Construction of Health Centers; • Support to training and seminars of health workers and volunteers; • Provision of medicines and medical equipment at different health centers; and • Development of potable water sources.
Livelihood Programs (budget PhP 42 million)	• Establishment of Friendship Women Cooperative Stores; • Support to Magsasaka-Mandaragat Multi-Purpose Cooperative;

Sector	Projects/Activities
	• Buy & Sell Business of Senior Citizens Association; • Hog Raising of Senior Citizens; • Procurement of farm lots for farmers; • Construction of Solar Dryers; and • Animal Dispersal.
Social Services (budget PhP 76.5 million)	• Celebration of various LGU festivities and activities; • Fuel allocation; • Support for capacity & capability enhancement program via training and seminars; • Cultural preservation program through celebration of various activities; and • Enhancements through provision of barangay supplies, materials and equipment.

The disbursements for the livelihood programs amounted to PhP 42 M. These amounts were disbursed on organizing cooperatives and associations, provisions for post harvest facilities and seed money for livelihood projects.

Social services received PhP 76.5 M over a 5-year period. The bulk of these disbursements were support for the cultural preservation program of the IPs in Bataraza, trainings and seminars, provisions for barangay supplies, materials and equipment and support for cultural activities of various LGUs including fiestas and foundation days.

The following table contains the projects on infrastructure for the three (3) DIA barangays. The projects can be disaggregated from the rest of the projects because these projects are site specific. Infrastructure projects identified in a barangay were credited to the said barangays.

The infrastructure projects of the three (3) DIA barangays can be clustered into national and/or local public projects (schools, roads, health facilities, barangay facilities) and private common projects (repairs of churches, mosques), multi-purpose pavements, solar dryers, water systems, and waiting sheds. The breakdown of projects per barangay is shown in **Table 2.4.32**.

Table 2.4.32. SDMP II infrastructure projects for the DIA barangays (2009-2013)

Barangay	Infrastructure Projects Per DIA Barangay
Barangay Iwahig	• Construction of Assemblies of God Church; • Construction of Catholic Church; • Construction of a public toilet; • Construction of Male & Female CR at PES; • Road gravelling and embankment (Maman-Maman); • Road improvement of Proper to Tuka Road; • Fabrication of 231 arm-chairs; • Renovation of Iwahig Barangay Hall; • Construction of Bahay Tarukan at Sitio Pajo (IP); • Construction of Mosque at Proper Iwahig; • Construction of Multi-Purpose Pavement at Sitio Agas; and • Installation of 8 units jetmatic pump.
Barangay Sandoval	• Construction of Barangay Perimeter Fence; • Improvement of Barangay Hall; • Construction of Solar Dryer at Sitio Mapukong; • Installation of Level II Water System; • Construction of Tribal Hall at Sitio Pasi-Pasi; • Construction of semi-concrete Multi-Purpose Hall; • Construction of Health Center at Proper; • Construction of Health Center at Sitio Malatgao; • Construction of Catholic Church at Proper;

Barangay	Infrastructure Projects Per DIA Barangay
	• Construction of Tanod Outpost; • Construction of School Building at Sandoval Elementary School; • Construction of School Stage and CR at Sandoval Elementary School; • Improvement of Perimeter Fence at Gotok Elementary School; • Improvement of Perimeter Fence at Barak-Barakan Elementary School; and • Construction of 3 Waiting Sheds.
Barangay Rio Tuba	• Repainting of stage; • Makeshift stage for RTNES Annex Graduation; • Concreting of 525m Sto. Nino Road (counterpart); • Renovation of barangay hall and other facilities; • Construction of a faculty office at Rio Tuba North Elementary School; • Repair of 1 classroom at Rio Tuba North Elementary School; • Construction of 2-bowl toilet at Rio Tuba North Elementary School Annex; • Construction of a 4-lane garage; • Construction of 2 classrooms and 1 canteen at Rio Tuba National High School; • Construction of a multi-purpose building at GK Bongkol-Bongkol (IP); • Installation of 4 units jetmatic pump; • Construction of a Day Care Center at Tagdalungon; • Construction of a Day Care Center at Bukid-Bukid; and • Construction of 2 classroom school buildings at RTNES.

Non-SDMP Deliverables

The non-SDMP program is a joint project of RTNMC and CBNC for the host and neighbouring communities of Bataraza. This program is funded by corporate funds of both companies and is separate and distinct from the legally mandated SDMP program. This program is implemented by RTNFI, a private foundation.

For the period from 2009 to 2013, the total amount spent under the non-SDMP program totaled PhP 686.507 million. Again, the share of RTNMC is approximately one third of the total amount. The program is composed of specific projects enumerated in the table that follows:

Table 2.4.33. Non-SDMP program (2009-2013) costs shared with CBNC

Expense	2009	2010	2011	2012	2013	Total
RTNFI Hospital	25,189,453.00	39,438,613.00	50,716,861.00	59,865,917.00	67,607,233.00	242,818,077.00
L.S.Virata Memorial School (LSVMS)	17,914,894.00	16,990,402.00	15,639,227.00	14,860,459.00	16,562,516.00	81,967,498.00
Indigenous Learning School (ILS)	8,443,939.00	10,323,603.00	12,218,978.00	17,332,757.00	18,986,744.00	67,306,021.00
Gawad Kalinga (GK)	7,969,296.00	13,129,017.00	5,085,451.00	8,794,732.00	10,986,742.00	45,965,238.00
Community Relations Assistance (CRA)	35,650,817.00	40,575,754.00	33,213,953.00	59,831,037.00	79,178,716.00	248,450,277.00
Total (Php)	95,168,399.00	120,457,389.00	116,874,470.00	160,684,902.00	193,321,951.00	686,507,111.00

Source: RTNFI, 2014

The proceeding discussions present the individual project in terms of composition and the impacts in their respective communities.

RTNFI Hospital

The RTNFI Hospital provides medical and dental services to the employees and dependents of the company including residents of the neighboring communities. Since 1984, indigent patients particularly members of the indigenous community are treated for free. For the period 1990–1996, 53% of patients admitted in the hospital and 18% of outpatients are non-employees and dependents.

In 1999-2000, a total of 464 patients were admitted in the hospital and 35% of admitted patients were non-employees or dependents. For outpatients, 16% of those treated for the same period were non-employees or dependents. In 2011, 55% of patients treated in the hospital were non-dependents.

The following table summarizes the number of patients served by the RTNFI Hospital. The bulk of patients were out-patients while the more serious medical cases were admitted to the hospital. In 2013, there were a total of 50,389 served patients or an average of 138 patients a day and out of this total, 4,799 patients were admitted to the hospital.

Table 2.4.34. Number of served patients in the hospital

Year	Admission	Out Patient	Total	Ave Daily Patients
2004	1,371	17,139	18,510	51
2005	No Available Data; Annual Report not Available.			
2006	1,717	18,450	20,167	55
2007	2,191	18,869	21,060	57
2008	2,119	27,874	29,993	82
2009	1,930	33,693	35,623	97
2010	2,761	45,602	48,363	132
2011	3,618	49,859	53,477	147
2012	3,789	45,279	49,068	135
2013	4,799	45,590	50,389	138

Source: RTNFI, 2014

L. S. Virata Memorial School (LSVMS)

Aside from allowing non-employee dependent students from enrolling in the school, RTNMC provides scholarship grants for all students. Scholarship grants include free tuition, textbook allowance, board and lodging and medical expenses. From 1991 to 2007, a total of 98 scholars have benefited in the program, 96 of which have graduated in their academic field. As of SY 2011, there were 767 scholars broken down in the following table.

Table 2.4.35. Summary of scholars as of school year 2011

Number of Scholars	Non-IPs	IPs	Total
College	292	59	351
High School	128	199	327
Elementary	2	87	89
Total	422	345	767

Source: RTNMC Presentation October 30, 2012

Indigenous Learning School (ILS)

Currently, ILS has a total workforce of 17 teachers and one (1) driver/messenger. For the school year 1999-2000, 35% of the student population are non-employee dependent. Aside from allowing non-employee dependent students from enrolling in the school, RTNMC provides scholarship grants for all students. Scholarship grants include free tuition, textbook allowance, board and lodging and medical expenses. From 1991 to 2001, a total of 50 scholars have graduated wherein 8% are non-employee dependents. Data from RTNMC have shown that for 1999-2000, a total of 23 children have graduated or completed one year of schooling. As of SY 2011, there are around 700 students under the ILS.

Gawad Kalinga (GK)

RTNMC and CBNC thru its common Non-SDMP launched Gawad Kalinga project in 2006 intended for the Palaw'an, an indigenous tribe in the area. As of end of 2011, there are already six (6) GK communities established with three (3) more GK communities in the preparatory stage. There are 161 units turned over to IP beneficiaries while 47 units are under construction for a total of 208 units at a cost of 23 million pesos. The details are shown in the following table.

Table 2.4.36. Performance summary of IP housing (Gawad Kalinga) program of RTNMC

GK Site	Turned Over Units	Units Under Construction	Total Units
Kulantuod GK Village	35 (single)	1 (single)	36
Bongkol-bongkol GK Ville	24 (duplex)	2 (duplex)	52
Ocayan GK Village	13 (duplex)	0	26
Sandoval GK Village	8 (duplex)	4 (duplex)	24
Culimbawang GK Ville	13 (duplex)	7 (duplex)	40
Bohoy GK Village	5 (duplex)	10 (duplex)	30
Racob GK Village	0	(Preparatory Stage)	0
Iwahig GK Village	0	(Preparatory Stage)	0
Sapa GK Village	0	(Preparatory Stage)	0
Total	**161**	**47**	**208**

Source: ASDMP 2011 Annual Accomplishment Report

Corollary to the provisions of housing for qualified Palaw'an households, RTNMC also provides for support programs to facilitate the transition from a nomadic to a more permanent lifestyle such as SIBOL (educational support for kindergarten), SAGIP (tutorial program), Kapitbahayan (guide and empower homeowners associations), Bayanihan (livelihood program), Kalinisan (cleanliness program). All expenses of these support programs for housing are on the account of both RTNMC and CBNC.

Community Relations Assistance (CRA)

The CRA Office of RTNMC serves as the COMREL office. It is in-charge of CRA, a special mechanism implemented by both RTNMC and CBNC to address other needs of the communities which are not embodied in the SDMP programs/projects. The CRA Office is headed by a Manager who is assisted by three (3) staff. The CRA Office is also tasked in conducting IEC activities such as briefings and consultations with the communities, production of the IEC materials. The RTNMC radio program aired over DWRI's Radyo Inogbong is also hosted by the COMREL Manager.

2.4.2 Public Health

2.4.2.1 Methodology

The discussion on public health profile of the impact areas is based on the secondary data gathered from the Rural Health, Barangay Health Stations and from the survey conducted by Gaia South, Inc.

2.4.2.2 Findings and Discussions

A. Public Health Profile

Municipality of Bataraza

The Municipal Health Statistics prepared by the Rural Health Unit (RHU) of the municipality is presented in **Table 4.2.37**.

Table 2.4.37. Health Statistic of the Municipality of Bataraza (2011-2015)

Statistics	2011	2012	2013	2014	2015
Morbidity Rate	152.44	24.28	145.98	75.67	94.96
Infant Mortality Rate	8.96	5.00	11.72	2.40	5.74
Mortality Rate	1.13	1.62	1.29	0.90	1.73
Maternal Mortality Rate	0.00	0.70	2.06	1.20	1.04

As seen in **Figures 2.4.3** and **2.4.4**, the trend for morbidity rate, mortality rate and infant mortality rate is fluctuating. Highest infant mortality rate (11.72%) for the past five years was experienced in 2013 when there was also high rate of maternal mortality.

Health Facilities

In addition to the Rural Health Unit (RHU), 22 barangay health units (BHUs) are available for the 22 barangays in the municipality. These health facilities are being manned by 411 personnel. Provided in **Table 2.4.38** is the breakdown of the municipal personnel profile.

Table 2.4.38. Municipal health personnel profile

Personnel	Number
Doctor	0
Nurse Regular	5
Midwife	17
Dentist	1
Medical Technologist	1
Nutritionist	1
Barangay Health Aide	1
Sanitary Inspector	0
RN HEALS	8
Rural Health Midwives Placement Program (RHMPP)	2
Barangay Health Worker (BHW)	310
Barangay Volunteer Sanitation Inspector (BVSI)	10
Barangay Nutrition Scholar (BNS)	55
Total	**411**

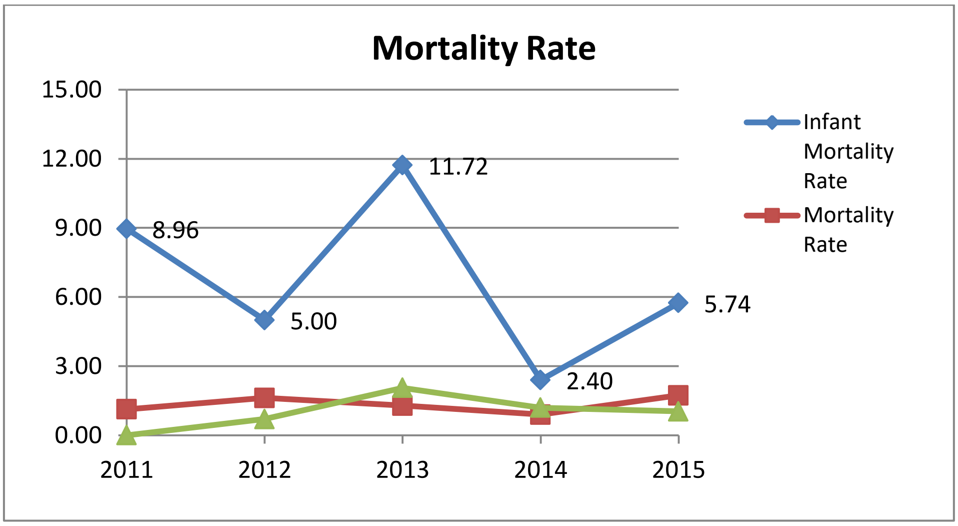


Figure 2.4.3. Trend in mortality rate from 2011 to 2015 (*Source: Bataraza Rural Health Unit, 2016*)

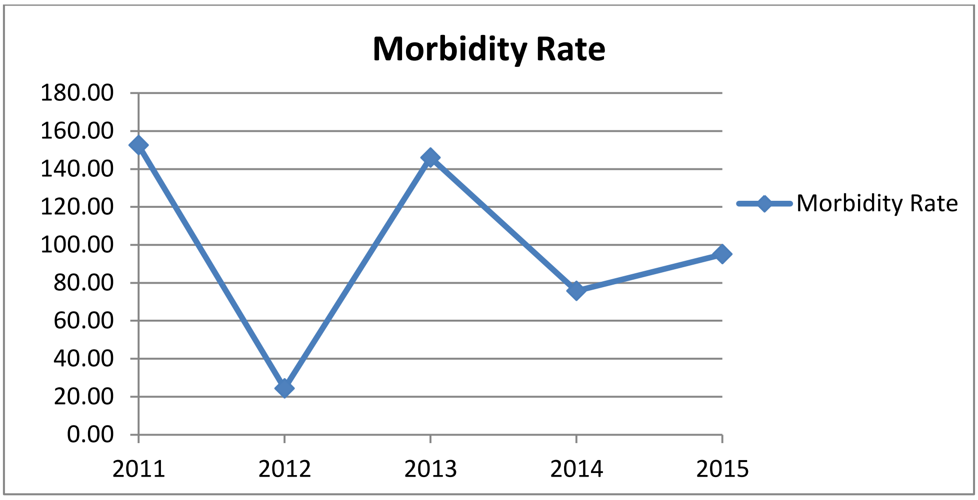


Figure 2.4.4. Trend in morbidity rate from 2011 to 2015 (*Source: Bataraza Rural Health Unit, 2016*)

Impact Barangays

Health statistics of the impact barangays: Rio Tuba, Sandoval, Ocayan and Iwahig are provided in **Table 2.4.39**.

Table 2.4.39. Health statistics of impact barangays (2011-2015)

Barangay	2011	2012	2013	2014	2015
Morbidity Rate (rate per 1,000 populations)					
Rio Tuba	68.19	33.49	44.21	23.09	20.86
Sandoval	146.85	146.04	193.42	115.87	136.81
Ocayan	91.46	97.05	Not available	91.58	48.10
Iwahig	19.67	164.25	280.81	126.09	80.02
Infant Mortality (rate per 1,000 populations)					
Rio Tuba	0.06	0.00	0.24	0.00	0.05
Sandoval	0.00	Not available	Not available	0.00	0.00
Ocayan	0.00	Not available	Not available	0.00	0.42
Iwahig	0.68	0.00	0.47	0.55	0.54
Mortality (rate per 1,000 populations)					
Rio Tuba	1.25	0.59	2.29	0.31	2.11
Sandoval	3.22	2.09	0.34	0.84	2.16
Ocayan	3.31	2.14	Not available	0.87	3.38
Iwahig	4.41	4.83	5.17	5.46	8.17
Maternal Death (rate per 1,000 populations)					
Rio Tuba	0.00	0.06	0.00	0.00	0.00
Sandoval	0.00	Not available	Not available	0.00	0.00
Ocayan	0.00	Not available	Not available	0.00	0.00
Iwahig	0.00	0.00	0.00	0.00	0.54

Source: Barangay Health Profile of Rio Tuba, Sandoval, Ocayan and Iwahig

Based on **Table 2.4.39**, among the four impact areas, Iwahig has the highest mortality and infant mortality rate from 2011 to 2015. The rate of morbidity in Barangay Sandoval has been consistently higher than that of Rio Tuba and Ocayan. In 2013, Iwahig recorded the highest morbidity rate (280.81). This value decreased to 80.02 in 2015 which is still higher than the morbidity rate of Rio Tuba and Ocayan.

For the past five (5) years, the leading cause of morbidity within the impact areas is acute respiratory infection, followed by hypertension, urinary tract infection (UTI), diarrhea, asthma and age-related diseases (**Figure. 2.4.5**).

In terms of infant mortality in the past five years, Ocayan had the highest rate for each year except 2012. Maternal death rate, on the other hand, only recorded two incidents, one in 2012 (Rio Tuba) and another one in 2015 (Iwahig).

Health Facilities

There are BHS for each impact barangay. Nearest private hospital is the RTN Hospital located in Barangay Rio Tuba. There is the South Palawan Provincial Hospital located in Brooke's Point, about 32 km from the Poblacion area of Bataraza. Available services include diagnostic, therapeutic and rehabilitative.

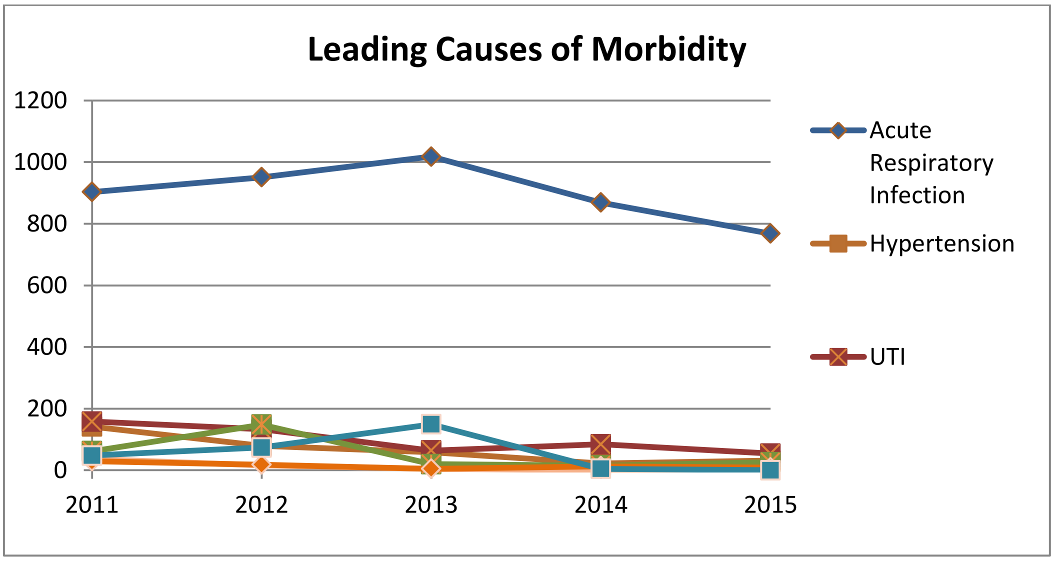


Figure 2.4.5. Leading causes of morbidity from 2011 to 2012 in the impact barangays

<u>Municipal Health Facilities</u>

B. Public Health Survey

The respondents were asked where they go for medical consultations. Almost one half (49.10%) went to barangay centers for medical consultations. One hundred twelve respondents (40.43%) went to barangay health centers while 12 respondents went to private clinics. Seventeen respondents had no answers.

The common causes of morbidity were cough (30.01%), colds (26.28%) and fever (15.35%). There was a higher percentage (2.59) of sickness per respondent in the MPSA area as compared to the causeway area (2.37 illnesses). The details are shown in **Table 2.4.40**.

Table 2.4.40. Leading causes of diseases

**Leading Causes of Diseases (for the last 12 months)	Quarry Area (n=151)		Crushing Area (n=126)		Combined Areas (n=277)	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Ubo	117	28.19	100	32.36	217	30.01
Sipon	109	26.27	81	26.21	190	26.28
Lagnat	53	12.77	58	18.77	111	15.35
Pagdudumi	54	13.01	22	7.12	76	10.51

**Leading Causes of Diseases (for the last 12 months)	Quarry Area (n=151)		Crushing Area (n=126)		Combined Areas (n=277)	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Malaria	40	9.64	12	3.88	52	7.19
Dengue	16	3.86	21	6.80	37	5.12
UTI	11	2.65	7	2.27	18	2.49
Hypertension	8	1.93	6	1.94	14	1.94
Allergy	2	0.48	0	0.00	2	0.28
Sakit sa ngipin	2	0.48	1	0.32	2	0.28
Rayuma	0	0.00	1	0.32	1	0.14
Kagat ng Aso	1	0.24	0	0.00	1	0.14
Typhoid Fever	1	0.24	0	0.00	1	0.14
Ulcer	1	0.24	0	0.00	1	0.14
Total	**415**	**100.00**	**309**	**100.00**	**723**	**100.00**
% of Responses	**2.75**		**2.45**		**2.61**	

*Note: **Multiple responses*

On the average, respondents suffered 2.61 illnesses in the last 12 months. In general, the respondents in the crushing area suffered less (2.45) illnesses compared with the respondents in the quarry area (2.75 illnesses).

The respondents were asked the leading causes of death in their respective communities. The primary cause of death is hypertension/stroke accounting for 136 responses (25.95%). This lifestyle disease is a more prevalent cause of death in the crushing area, which is an urban barangay than in the quarry area composed of two (2) rural barangays. Other causes of death were diarrhea (19.66%), dengue (13.36%), typhoid fever (8.40%), and malaria (8.02%).

Persons who were ill go to the doctor (206 respondents) for medical consultations. Other persons whom they seek medical opinions were barangay health workers (38), midwives (17), and faith healer (22). Sick persons went primarily to their barangay health centers (49.10%), and the RTNMC Hospital (40.43%) for medical consultations and/or treatment.

Table 2.4.41. Identified leading causes of death

**Leading Causes of Death	Quarry Area (n=151)		Crushing Area (n=126)		Combined Areas (n=277)	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Hypertension/Stroke	52	16.35	84	40.78	136	25.95
Pagdudumi/Diarrhea	69	21.70	34	16.50	103	19.66
Dengue	43	13.52	27	13.11	70	13.36
Typhoid Fever	28	8.81	16	7.77	44	8.40
Malaria	23	7.23	19	9.22	42	8.02
Blood Infection	14	4.40	7	3.40	21	4.01
Vehicular accident	12	3.77	7	3.40	19	3.63
Tuberculosis	14	4.40	2	0.97	16	3.05
Cancer	13	4.09	2	0.97	15	2.86
Hika	10	3.14	1	0.49	11	2.10
Kombulsyon	10	3.14		0.00	10	1.91
Pagpatay/ Natural death	10	3.14	0	0.00	10	1.91
Bronchitis	5	1.57	1	0.49	6	1.15
UTI	5	1.57	1	0.49	6	1.15
Others	10	3.14	5	2.43	15	2.86
Total	**318**	**100.00**	**206**	**100.00**	**524**	**100.00**

*Note: **Multiple responses*

2.4.2.3 Impacts and Performance Assessment

Predicted Impacts

The following matrix summarizes the potential impacts that may be brought by the proposed projects. Each impact was identified as to the period of possible occurrence, duration, likelihood of occurrence, and magnitude. Entries with asterisks are perceived to be not significant or negligible while italicized entries were perceived to be a positive impact of the project. Since people related impacts are crucial in every development project, discussions will be detailed after the summary matrix.

Table 2.4.42. Impacts assessment and mitigation for public health

List of Key Impacts	Phase Occurrence				Options for Prevention or Mitigation or Enhancement
	Pre-Construction	Construction	Operation	Abandonment	
Threat to public health and safety The proposed expansion of the quarry operations would require additional workers but any additional workers that may be hired by RTNMC would not unduly burden the existing health system in place in Bataraza. However, it is anticipated that the volume of trucks coming from the quarry area to the crushing area in Rio Tuba would significantly increase and may have health implications.			✓		• Improvement of facilities of RTN Hospital • Continue Health Monitoring Study • Implement dust suppression measures such as covering of trucks during hauling • Regular watering of haulage roads specially along or near the residential and office areas • Strict implementation of the use of Personal Protective Equipment (PPE) among workers • Ensure that vehicles used are well maintained and suitable for the terrain • Adopt and implement the safest methods/ technology • Ensure that persons doing specialized tasks are fully trained • Strictly implement safety protocols • Conduct of training programs/drills for all workers and employees that will include safe job procedures, basic firefighting procedures, good housekeeping, OHSAS Systems, emergency preparedness and response, defensive driving, and first aid • Establishment of clear and adequate signages mainly in accident-prone areas • Avoid operation during inclement weather • Maintain proper security and cordon off hazardous areas • Provision of well-ventilated work area • Improvement in the provision of health facilities/services available to workers and employees during emergencies • Continue monitoring of workers' health • Conduct of regular information campaigns to update worker's health and safety responses

3 Environmental Risk Assessment

Rio Tuba Nickel Mining Corporation

This Environmental Risk Assessment (ERA) was prepared for the increase in annual limestone production and use of the modified crushing plant of Rio Tuba Nickel Mining Corporation (RTNMC). The assessment shall be based on the operation of the quarry and crushing plant discussed in *Chapter 1* and the baseline of the environment within and near the vicinity of the project area discussed in *Chapter 2*. This ERA was done in compliance with the scoping agreement between the Environmental Management Bureau (EMB), Gaia South Inc., and RTNMC. This chapter shall present the objectives, scope and limitations, methodology, results, risk management and recommendations of the ERA conducted.

3.1 OBJECTIVES OF THE STUDY

This ERA aims to analyze the hazards and risks associated with the proposed expansion of the limestone quarry and crushing operations in Brgys. Iwahig, Sandoval and Brgy. Rio Tuba by RTNMC. It aims to identify and characterize the significant hazards and the associated risks.

3.2 SCOPE AND LIMITATIONS

As indicated in the Environmental Management Bureau (EMB) Scoping Checklist for the proposed project, the ERA will be mainly qualitative in nature. As such, identified hazards will be mainly analyzed qualitatively. Risk quantification was mainly based on worst-case accident scenarios and focused on estimation of accident consequences in terms of loss of human lives or injuries and on estimation of accident frequencies.

Risk characterization tackled safety as well as physical risks. Based on EMB's *Checklist of Environmental Performance Report and Management Plan (EPRMP) Contents*, safety risks refer to fire and/or release of toxic substances. Physical risks, on the other hand, refer to "failure of structures which endanger life, property and/or the environment". The status of implementation of safety policies/guidelines and proposed changes for the RTNMC's limestone quarry and crusher project were discussed in this ERA, as agreed upon in the scoping process. Substances and materials of substantive quantity to be used in the project were assessed as to whether these would pose hazards to the environment and surrounding communities. Assessment was also done in the storage and use of liquid fuel (diesel) and the storage and use of explosives (dynamites and ANFO) at the project site. Occupational safety risks were addressed as well. The study does not address the specifics of geological, geotechnical and engineering risks as these issues were already discussed in *Chapter 2*.

3.3 METHODOLOGY

3.3.1 The Environmental Risk Assessment Process

The Procedural Manual for DAO 2003-30 defines environmental risk assessment as "the use of universally accepted and scientific methods to assess the risks associated with a project. It focuses on determining the probability of occurrence of accidents and their magnitude (e.g. failure of containment or exposure to hazardous materials or situations)". Risk is defined as a measure of potential human injury/death, economic loss, or environmental damage in terms of the probability of the loss, injury/death or damage occurring and the magnitude of the loss, injury/ death or damage if it occurs. Risk involves two (2) measurable parameters: consequence and probability. In the context of this study, risk refers to qualitative or quantitative measure of hazards associated with the increased production capacity of the Gotok Limestone Quarry and modified Crushing Plant of RTNMC.

3.3.2 The ERA Framework

The conduct of this ERA involved the following steps: (1) definition of objectives and scope of the study; (2) identification of environmental hazards associated with the project; (3) estimation of the magnitude of consequences in case a hazard is realized and the probability that a hazard may be realized; (4) characterization of project-related risks through integration of magnitude of consequences and probability of occurrence; (5) evaluation of risks; and (6) drawing of conclusions and recommendations for purposes of risk management. As part of an EPRMP, this ERA likewise evaluated the status of implementation of existing safety policies and guidelines, as well as specific plans to address previously identified environmental risks. A thorough review of related literature and documents were undertaken as part of the study.

3.3.3 Hazard Identification

The various hazardous processes, activities and substances associated with the increased production of Gotok Limestone Quarry Project were identified at this stage. Hazardous activities and processes with potential to cause onsite and offsite injuries and/or fatalities to people were determined. The potential of substances to be explosive, flammable, and/or toxic was analyzed. The most likely initiating events and causes of failures leading to the occurrence of hazardous events were likewise analyzed.

3.3.4 Risk Screening of Hazardous Substances

A risk screening procedure was conducted to determine what type of environmental risk assessment should be undertaken and to prioritize the environmental risks presented by the various hazardous substances and activities. The criteria and process used in risk screening was based on *Annex 2-7e* (*Guidelines for the Conduct of Environmental Risk Assessment)* of the *Revised Procedural Manual of DAO 2003-30*.

The screening criteria for hazardous substances are (1) inherent hazardous characteristics of the substance and (2) maximum inventory involved. After classifying the substances according to defined categories (i.e. flammable, oxidizing, toxic, etc.), their respective maximum inventories were compared to DENR's threshold inventory levels (Levels 1 and 2), which are defined in the *Revised DAO 2003-30* guideline. A facility that will manufacture, process or store any hazardous substance in excess of DENR's Threshold Inventory Level 2 is required to undertake a quantitative risk assessment. Those with any hazardous substance exceeding Level 1 threshold inventory but below Level 2 threshold inventory is required to undertake Hazard Analysis Study, and Emergency/Contingency Plan based on the study and worst-case scenario.

As there are more than one hazardous substance involved, the risk screening procedure made use of the ***Total Indicative Sum*** (TIS) equation in deciding as to what level of ERA was to be undertaken. Based on the RPM of DAO 2003-30, the computation of the TIS should be based on the following equation:

$$\mathbf{TIS} = \frac{\mathbf{q1}}{\mathbf{Q1}} + \frac{\mathbf{q2}}{\mathbf{Q2}} + \frac{\mathbf{q3}}{\mathbf{Q3}} \dots + \mathbf{qn/Qn}$$

Where: q_x = the quantity of dangerous substance
Q_x = the indicative threshold level of the dangerous substance

3.3.5 Consequence Analysis

Consequence analysis involved the estimation of magnitude of unwanted consequences, effects, impacts or outcomes in case an identified hazard involving the project is realized. Major hazard incidents mean accidents involving hazardous activities or substances that have an impact in terms of death, injury or evacuation of people, damage to property or lasting harm to the environment.

The consequence analysis focused on accident scenarios that involve the release of flammable/explosive substances or inadvertent explosion of explosives at the project site. Estimated were the consequence of worst-case accident scenario involving liquid fuel in storage (diesel) and explosives in storage.

Industrial Explosives. The consequences from worst-case accident scenarios arising from explosion hazards due to storage of industrial explosives were calculated using the TNT equivalence method. This method is based on the assumption that a blast wave from any explosion will approximate the effects of an explosion from an equivalent amount of TNT, a standard explosive. The blast effects of TNT have been very well studied. All other explosives are compared to TNT in terms of TNT equivalents. As such, the first step in the calculation is to determine the TNT equivalent mass. The TNT equivalent mass of the maximum amount of explosive in a magazine was calculated using the "***IME TNT Equivalence Calculator***" (Institute of Makers of Explosives, 2014). The TNT calculator is primarily designed to assist mining companies in determining if they should submit form 9-4040-A to the U.S. Geological Survey.

Then the distance from the point of a ground-level explosion to peak overpressure was calculated using ***Equation B.56*** in the ***Handbook of Chemical Hazard Analysis Procedures***, which was developed for the ARCHIE model (FEMA, et al, 1989). This equation was based on the equation given by Lees (Lees, 1980), which relates the distance from the point of a ground-level explosion to peak overpressure. The said equation is used in the ARCHIE model for the Unconfined Vapor Cloud Explosion and also used by the USEPA in its Risk Management studies. The equation assumes an explosion at ground level without redirection of the overpressure by structures and terrain. The equation for the distance to peak overpressure is as follows:

$$\mathbf{X = M^{1/3} \exp[3.5031 - 0.7241 \ln(P) + 0.0398 (\ln(P))^2]}$$

Where: **X** = Distance in feet to a given overpressure, P
M = TNT equivalent mass, lbs
P = overpressure, psi (psi = pounds per square inch)

For the explosive materials, number of fatalities among persons was the endpoint of concern in estimating the magnitude of accident consequence. The methodology involved two (2) steps, namely: (a) estimation of the fatality radius; and (b) the estimation of number of fatalities. The estimation of number of fatalities was done by mapping. That is, the fatality zone was drawn on the latest Google map of the area to see if residential and other buildings are involved.

The following assumptions were applied in the estimation of fatality radius and zone:

- The intensity of the source is the maximum possible.
- Fatality criterion for fires: 100% fatalities of the persons exposed within the fire area. The heat flux is not taken into account.
- Fatality criteria for explosions: For a vapour cloud explosion, 100% fatalities among persons engulfed in the volume of the burning cloud; lower flammability limit ignition criterion assumed (i.e. ignition occurs for vapour concentration >LFL). The overpressure is not taken into account.
- For the dispersion of toxic gases, weather stability class D with wind velocity 5 m/s is assumed.

The magnitude of consequences of fire and/or explosion accidents involving diesel in storage was analyzed using a combination of manual calculations of downwind distances to specific thermal endpoints and mapping of affected areas. Calculations of downwind distances to thermal endpoints were done using the pool fire equations (Equations 3.3.1 and 3.3.2) described in USEPA-CEPPO's (1999) *Risk Management Program Guidance for Offsite Consequence Analysis: Technical Background (1999)*. The Pool Fire equations are as follows:

Equation 3.3.1

$$q = \frac{f * m * H_c * \tau_a}{4\pi x^2}$$

Where:

q	=	Radiation per unit area received by the receptor (Watts/ m^2);
f	=	Fraction of H_c radiated;
m	=	Rate of combustion of diesel (kg/s);
H_c	=	Heat of combustion of diesel (J/kg);
τ_a	=	Atmospheric transmissivity; and
X	=	Distance from point source to receptor (m).

Equation 3.3.2

$$m = \frac{0.0010 * H_c * A}{H_v + C_p\,(T_b - T_a)}$$

Where:

m	=	Rate of combustion of diesel (kg/s);
H_c	=	Heat of combustion of diesel (J/kg);
H_v	=	Heat of vaporization of diesel (J/kg);
C_p	=	Liquid heat capacity of diesel (J/kg-K);
A	=	Pool area of spilled diesel (m^2);
T_b	=	Boiling temperature (K) of diesel;
T_a	=	Ambient temperature (K); and
0.0010	=	Constant value.

3.3.6 Frequency Analysis

Frequency analysis for fire and explosion hazards arising from the storage of explosives and diesel were calculated using the methodology described in IAEA-TECDOC-727 (IAEA, 1996). The equation on frequency estimation method for fixed installations was used

(Equation 2 of the Manual) for the postulated accident scenarios. Calculating the frequency ($\mathbf{P_{i,s}}$, number of accidents per year) of accidents involving a hazardous substance (subscript s) for a certain hazardous fixed installation (subscript i), which causes definite consequences, necessitates the calculation of the so-called probability number ($\mathbf{N}_{i,s}$). *Equation 2* in the Manual can be used to calculate $\mathbf{N}_{i,s}$. The formula for *Equation 2* is as follows:

$$\mathbf{N_{i,s} = N^*_{i,s} + n_1 + n_f + n_o + n_p}$$

Where:

$N^*_{i,s}$	=	the average probability number for the installation and the substance
n_1	=	probability number correction parameter for the frequency of loading/unloading operations;
n_f	=	probability number correction parameter for the safety systems associated with flammable substances;
n_o	=	probability number correction parameter for organizational and management safety;
n_p	=	probability correction parameter for wind direction towards the populated area.

The “probability number” **N** has an associated equivalent frequency value **P.** The relationship of **N** to **P** is defined by as:

$$\mathbf{N} = /\log_{10}\mathbf{P}/$$

3.3.7 Risk Characterization

Risk characterization focused on description of the risks associated with the various hazards inherent to activities, substances and conditions at the quarry site. This included natural hazards arising from extreme climate events such as tropical cyclones, flooding, and landslides. For the fire and explosion hazards, risks were characterized using the ERA Guidelines in DAO 2003-30. In particular, it looked into the *Location Specific Individual Fatality Risks (LSIFR)*.

LSIFR is defined by DAO 2003-30 as “the risk of death to an individual person, if present 24 hours per day (in the open) at a particular location for a whole year”. The ERA Guidelines in DAO 2003-30 has set 10^{-6} fatalities per year as the maximum acceptable individual risk criterion, subject to “supplemental guidelines that may be issued by the DENR Secretary”. The Dutch Ministry of Housing, Spatial Planning and Environment (VROM) defined individual risk (IR) as the “probability that an average unprotected person, permanently present at a certain location, is killed due to an accident resulting from a hazardous activity” (Jonkman, 2003). With the assumption that the probability of failure (Pf) approximates the frequency of accident occurrence, values of LSIFR were computed using the equation used by Jonkman (2003) for Individual Risk (IR), which is as follows:

$$\mathbf{IR = Pf * Pd}$$

Where:

IR = Individual Risk
$\mathbf{P_f}$ = the probability of failure
$\mathbf{P_d}$ = the probability of an individual dying in the case of failure, assuming the permanent unprotected presence of the individual

3.4 RESULTS

3.4.1 Hazard Identification

Hazards associated with the Project include fire/explosion hazards from storage and use of liquid fuel (diesel); explosion accidents in the transport, storage and use of explosives (dynamites and ANFO); mass movement of rocks, soil and sediments due to failure of impounding and retaining structures; natural hazards (flooding, extreme climate events); and occupational health and safety hazards.

Occupational hazards may occur at various process operations, such as in topsoil clearing, drilling, blasting, hauling, transport, and crushing of limestone ores. Occupational hazards include vibration, noise, exposure to blast overpressures and projectiles, fall from heights, being struck or crushed by equipment parts or falling rocks/debris, vehicular/equipment accidents, ergonomic injuries, and exposure to limestone dusts, diesel exhausts and chemicals. Natural hazards like typhoons and heavy rains could predispose to mass movement of soil and rocks, as well as breaching of settling ponds that could result to the release of massive amounts of water and sediments.

Hazardous materials/substances involved in the Project are explosives (dynamites and ANFO), liquid fuel (diesel), diesel exhausts (SO_x, NO_x, CO and particulate), and limestone ore dusts ($CaCO_3$, SiO_2 and CaO, etc.).

3.4.2 Risk Screening of Hazardous Substances

As earlier discussed, the project involves the use of the following hazardous substances: diesel fuel and the explosives, dynamites and ANFO. Diesel is used as fuel for vehicles, generator sets and equipment at the quarry site. RTNMC will not add any storage facility for the liquid fuel but will utilize the already existing two (2) vertical, cone-roofed storage tanks. The two (2) tanks are adjacent to each other and are each enclosed with bund walls measuring 1 m in height with total floor area of 2,700.45 m^3. The maximum capacities of the tanks are 1,077 m^3 and 1,711 m^3, respectively. Maximum inventory for each tank is pegged at 1,051 m^3 and 1,670 m^3, respectively. The total maximum inventory therefore, at any one time is 2,721 m^3, which is roughly equivalent to 2,288 tons of diesel (assuming a specific gravity of 0.841).

Explosives are to be kept at the Project site for use in controlled blasting operations at the quarry site. The explosives to be used are mainly dynamites, ammonium nitrate-fuel oil mixture (ANFO), and peripherals. The Project will make use of existing explosives building and magazines for storage of explosives. At present, the Project has one (1) explosives building that houses three concrete explosives magazines and two (2) temporary magazines (container vans). The maximum amount of explosives to be kept at the storage facilities at any one time are 30,000 kgs of ANFO and 7,500 kgs of dynamite. With the expansion project, a maximum of 96 blasting operations per annum (8 blasting per month) is expected to be conducted. Explosives will be transported from the storage area to the blasting site using an explosives truck.

Table 3.4.1 shows the categories, maximum inventories (at any one time) and the corresponding DENR Level 1 and Level 2 threshold inventories for the said substances.

Table 3.4.1. Categories, DENR threshold inventories, maximum inventories of identified hazardous substances and the computed Total Indicative Sum (TIS)

Substance	Category	DENR Threshold Inventory (MT)		Max. Inventory (MT)
		Level 1	Level 2	
1. Diesel	Flammable	5,000	50,000	2,288
2. ANFO	Explosive	10	50	30
3. Dynamite	Explosive	10	50	7.5
TIS (Level 1) = 4.21				
TIS (Level 2) = 0.80				

To determine the Level of ERA coverage of the project the *Total Indicative Sum* (TIS) were computed both for Level 1 and Level 2 Threshold inventories. As shown in the results of TIS computations in **Table 3.4.1**, the total inventories of the hazardous substances would classify the ERA as Level 1 (above Level 1 but below Level 2 thresholds) and as such "shall be required to prepare an Emergency/Contingency Plan based on the worst case scenario (as a result of a Hazard Analysis study.)" (EIAMD, 2007)**. Figure 3.4.1** below shows the risk screening process done.

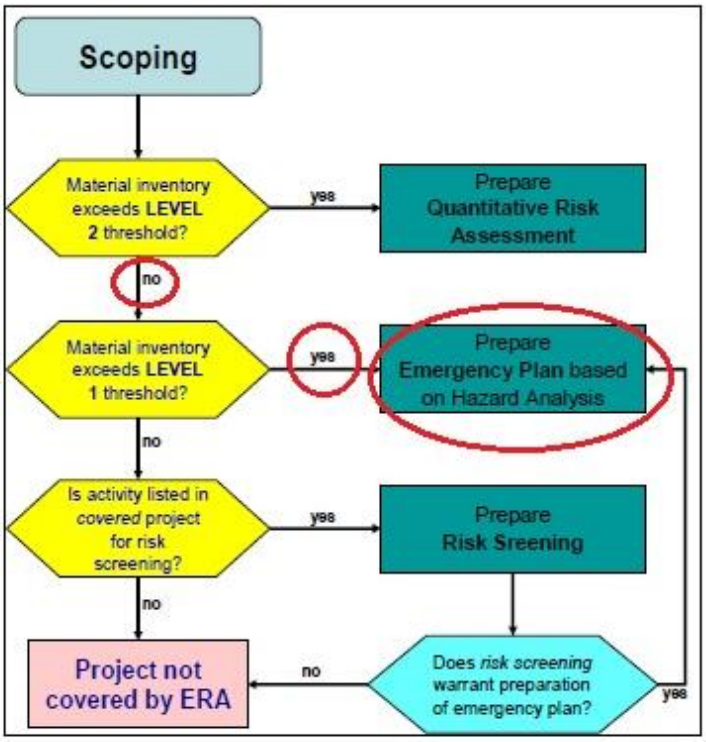


Figure 3.4.1. Risk screening process

3.4.3 Hazard Analysis Matrix

The hazards and risks associated with the various limestone quarry and crushing plant activities are listed in the Hazard Analysis Matrix (**Table 3.4.2**).

Table 3.4.2.Hazard analysis matrix

Hazard Classification/ Unit Operation	Major Hazards	Initiating/ Contributing Factors	At Risk Sector
A. Fire and Explosion			
1. Storage of Diesel	Fire and explosion following major releases/ spills	• Presence of ignition sources; • breach of containment; • mechanical impacts;	Persons, equipment and structures within the hazard area.

Hazard Classification/ Unit Operation	Major Hazards	Initiating/ Contributing Factors	At Risk Sector
		• exposure to fires and high heat; • corrosion; • defective or substandard tank materials; • breach of bund walls; vandalism	
2. Transport and storage of explosives (dynamites, ANFO and peripherals)	Explosion hazards (blast overpressures; vibration; high velocity projectiles; high impact noise)	Accidental charging/ignition of explosives; fire in vicinity; lightnings	Persons, equipment and structures within the hazard area.
B. Failure of Impounding and Retaining Structures			
1. Waste overburden dumps and stock yards	• land and rock slides • siltation of surface water bodies • runoffs from overburden and stock yards may contain too much alkalinity and toxic heavy metals and minerals which may contaminate surface water bodies	heavy rains, typhoons, and defective engineering design	• surrounding communities, personnel and workers • ecological entities
2. Settling and wastewater ponds	Breach of containment of ponds and drainage system could cause flooding of low-lying areas; alkalinization, siltation and contamination of surface water bodies	• natural disasters (extreme weather); and • engineering problems; sabotage	• surface waters • aquatic ecological entities • surrounding communities
C. Occupational Safety and Health Hazards			
1. Site Preparation			
a. Surveying	• fall from heights • vehicular accidents	inherent geological formations; adverse weather conditions; human error; vehicular failure	surveying team
b. Clearing and Waste Stripping	• being struck by felling trees, debris and equipment part • vibration and noise from power saws and other equipment • vehicular and equipment accidents (overturning, fall from heights, etc.)	human error; equipment failure; adverse weather conditions	clearing team
c. Laying Out	• fall from heights; being struck by vehicles and earth moving equipment • vehicular and earth moving equipment accidents • electrocution	• human error, equipment/ vehicular failure • breach of protocols	workers, drivers and operators at site
2. Quarry and Crushing Operations			
a. Drilling	• fall from the edge of a bench • being struck by falling rocks/debris at the foot of a face • inhalation of and contact with limestone dusts (may contain silica and CaO) which predisposes to respiratory and skin diseases • Harmful noise levels • High impact vibration from drilling and other equipment	• Human error • breach of protocols • equipment failure • improperly maintained equipment • face instability	Drilling operators and assistants

Hazard Classification/ Unit Operation	Major Hazards	Initiating/ Contributing Factors	At Risk Sector
	can predispose to peripheral nerve and vascular disorders • Being struck by a moving part of the drilling equipment		
b. Blasting	• blast overpressure impacts • being struck by flying debris and projectiles • impact noise	• breach of protocols • operator error • explosive misfiring	Blasting team, trespassers, quarry workers
c. Limestone ore picking and loading	• exposure to limestone ore dusts (may contain silica, CaO and other harmful dusts), which could predispose to respiratory, skin and eye diseases • Being struck by falling rocks from loading arm • falls while gaining access to operator's cabin • vehicular accidents	• lack of or inappropriate protective equipment • breach of protocols • human error • failure of hydraulic system and other equipment • uneven ground	vehicle drivers, quarry operators and workers
d. Transport of ores	• Vehicular accidents (fall from edge of bench, collision with other vehicles or structures, overturning, etc.) • inhalation of and/or contact with dusts • high level noise	• incompetent driving • heavy rains and flooding • trespassing • breach of protocols • brake failure	driver, pedestrians, other road users
e. Ore Stockpiling	Inhalation of and contact with ore dusts could predispose to respiratory/skin/eye diseases.	airborne dusts especially with strong winds;	workers, nearby communities
f. Ore crushing	• Exposure to airborne dusts; • fly away ore fragments; • body parts being caught in moving machine parts; • high level noise can predispose to hearing impairment.	malfunctioning of pollution control equipment; breach of protocols	ore crusher operators and workers
D. Natural calamities due to extreme climate events (as predicted in years 2020 and 2050)			
1. Increased frequency and intensity of tropical cyclones	flooding of low lying areas; rock and land slides	• poor engineering design; • poor maintenance of structures; • defective warning systems; • infrastructures along riverbanks and flood plains	• personnel and workers of the project; • contractors; • nearby communities esp. along river/stream banks
2. Increased intensity and frequency of rains during rainy season (Sept.-Nov.)	flooding of low lying areas; rock/ land slides; tidal flooding; increased soil erosion and loss of fertility	same as above	• same as above • farmers
3. Drier dry seasons (March to May) and increased frequency extreme high ambient temperatures (>35^{o}C)	fire incidents; increased airborne dusts; drying of water reservoirs and sources	• presence of ignition sources, especially near storage of fuel and chemicals; indiscriminate disposal of live cigarette butt • inadequate dust suppression system; forest/ vegetation denudation	personnel, workers, contractors, nearby communities

3.4.3.1 Hazards of Diesel in Storage

Fire and Explosion Hazards

The potential of diesel storage to pose hazards of fire and/or explosion was assessed. Vapor cloud explosions and vapor cloud fires are not significant hazards to this particular substance and activity due to the low vapor pressure of the liquid (0.042 psia at 21^{o}C). The more probable accident scenario for this type of substance is a pool or tank-top fire. For purposes of this assessment, a worst-case accident scenario was assumed as a pool fire following catastrophic release of two tanks filled to capacity of diesel into bunded areas.

Hazards from fires are associated with their direct heating effect, by convection within the fire itself, and thermal radiation from the fire. In case of fire engulfment, the effects of fire on humans are usually on the skin and on the lungs.

Fires emit radiation, which can produce considerable impact on nearby equipment and may cause harm to people. Thermal radiation levels and their damaging effects on equipment and people are described in **Table 3.4.3** (CCPS-AIChE, 1994).

Table 3.4.3. Effects of radiation from fire

Incident Flux (KW/m^2)	Type of Damage Caused	
	Equipment	People
37.5	Damage to process equipment (steel structure, piping, vessels, etc,) after several minutes of exposure.	100% fatality in 1 minute; 1% fatality in 10 seconds
25.0	Minimum energy level to ignite wood at indefinitely long exposure without flame	100% fatality in 1 minute; Significant injury in 10 seconds
12.5	Minimum energy to ignite wood with a flame; melts or degrades plastic materials	30% fatality in 1 minute; 1st degree burns in 10 seconds
10.0	-	People will feel pain after 5 seconds and receive second-degree burns after 14 seconds. Usually used to define the fatality zone, as this level is expected to quickly cause third degree burns leading to potential fatalities
5.0	-	People will feel pain after 13 seconds and receive second-degree burns after 40 seconds. Usually used to define the injury zone.
4.0	-	Causes pain is duration is longer than 20 seconds; blistering is unlikely
1.6	-	Causes no discomfort even for long exposures

Sources: Taylor, 1994; USEPA, et al., 1990; World Bank Technical Paper No. 55.

Diesel is a moderately flammable liquid fuel. The National Fire Protection Agency (NFPA) of the U.S.A. assigns to diesel a Flammability Rating 2 (ignites when moderately heated). Distillation temperature of diesel at 90% point is between 282-338^{o}C. Its minimum flash point temperature is 52^{o}C. Its other physico-chemical and toxicological properties are listed in **Table 3.4.4**. Fuel oil is less flammable than diesel.

Table 3.4.4. Physico-chemical and toxicological properties of diesel

Property	Value/ Description
CAS RN No(s).	68334-30-5; 68476-30-2; 68476-31-3
UN Number	1993
Maximum Inventory at a site	38 m^3
Flammability Designation/Code	Moderately Flammable
Flash Point, ^{o}C	52

Property	Value/ Description
Lower flammability limits in air (%)	1.3
Upper flammability limits in Air (%)	6
Auto-ignition Temperature, ^{o}C	254-285
Boiling/Condensation point (^{o}C) at 1 atm	282-338
Specific gravity (liquid)	0.841 at 16^{o}C
Vapor pressure	0.0028 bar at 21^{o}C

Sources: CAMEO Chemical Inventory; NREL Liquid Fuels Database, 2007.

Health Hazards of Diesel

The NFPA Health Hazard Rating of Diesel is 1 (slightly hazardous). This slight health hazard is mainly attributable to its volatile organic compound components (VOCs) which comprise about 1.5% of its total weight. These VOCs are benzene, toluene, ethylbenzene, xylene and other alkylbenzenes. The acute effects of exposure to high level concentration of various solvents are generally very similar. High level exposure usually results to disorientation, euphoria, giddiness and confusion, progressing to unconsciousness, paralysis, convulsion, and death from respiratory or cardiovascular arrest. Chronic exposure to levels above the threshold level values may result to specific organ toxicity. The hazardous VOC components of diesel, which may exert deleterious health impacts, are benzene, toluene, ethylbenzene and xylene. Benzene is a proven human carcinogen and is classified as a very hazardous substance. Toxicity to benzene frequently results from inhalation of its vapors with some undefined contribution from skin absorption. Benzene, however, only exist in trace amounts in diesel.

3.4.3.2 Hazards of Explosives (Dynamites and ANFO) in Storage

Hazards associated with explosives are blast waves or blast overpressures, high velocity missiles, vibration and high impact noise. The violence and speed of the reactions taking place during explosion produce blast or shock waves when an explosive material detonates. Blast waves are highly compressed air that rapidly expands in all directions from the point that the explosion is initiated. With speed that can exceed the speed of sound, the strength of the wave is measured in terms of overpressures or peak overpressures, the maximum pressure in the wave in excess of normal atmospheric pressure.

Accidental explosions may occur during transport and storage of dynamites and ANFO, especially if regulations, supplier recommendations and appropriate protocols are not strictly adhered to. During transport, heat and mechanical impacts may contribute to accidental explosion. Exposure to heat, fire, ignition sources and lightning may contribute to accidental explosions during storage. Maximum storage residence time should also be strictly followed. The damaging consequences of explosion arise from the direct impact of blast overpressure or indirectly, from falling objects or missiles produced by the overpressure. **Table 3.4.5** below lists the impacts from varying levels of explosion overpressures.

Table 3.4.5. Effects of varying degrees of blast overpressures

Overpressure* (psig)	Expected Damage
0.06	Occasional breaking of large windows already under stress.
0.04	Loud noise (143 dB); sonic boom glass failure.
0.10	Breakage of small windows under strain.
0.15	Typical pressure for glass failure.
0.30	Some damage to loose ceilings; 10% window glass breakage.
0.40	Limited mirror structural damage.
0.50-1.0	Windows usually shattered; some window frame damage.
0.7	Minor damage to house structures.

Overpressure* (psig)	Expected Damage
1.0	Partial demolition of houses made uninhabitable.
1.0-2.0	Corrugated metal panels fail & buckle. Housing wood panels blown in.
1.0-8.0	Range for slight or serious injuries due to skin lacerations from flying glass and other missiles.
2.0	Partial collapse of walls and roofs of houses.
2.0-3.0	Non-reinforced concrete on cinder block walls shattered.
2.3	Lower limit of serious structural damage.
2.4-12.2	Range for 1-90% eardrum rupture among exposed populations.
2.5	50% destruction of home brickwork.
3.0	Steel frame building distorted and pulled away from foundation.
3.0-4.0	Frameless steel panel building raised.
4.0	Cladding of light industrial buildings ruptured.
5.0	Wooded utility poles snapped.
5.0-7.0	Nearly complete destruction of houses,
7.0-8.0	8-12 in. thick non-reinforced brick fail by shearing of flexure.
9.0	Loaded train box cars demolished
10.0	Probable total building destruction.
14.5-29.0	Range for 1-99% fatalities among exposed populations due to direct blast effects.

Source: FEMA, USEPA, and USDOT, 1989. Handbook of Chemical Hazard Analysis Procedure

Ammonium Nitrate-Fuel Oil Mixture (ANFO)

ANFO is a major industrial explosive used in the mining and quarrying industries. It is relatively safe, and cost effective in terms of energy output. ANFO is safe to handle, as it requires a blasting cap (booster) to detonate. It is also readily available. Ammonium nitrate (‘AN’) is basically commercial fertilizer. Fuel oil (‘FO’) is ordinary No. 2 diesel oil. The stoichiometric proportions of AN to FO is usually 94 to 6%, by weight. The reaction $3NH_4NO_3 + CH_2{\bullet}7H_2O + CO_2 + 3N_2$ calls for 5.65% fuel oil. Based on analyses and experiments, the optimum or near optimum explosive output of ANFO is attained for a fuel oil content of from 5% to 7%.

Classified as a tertiary class high explosive, ANFO is insensitive to shock, requiring an intermediate explosive booster or secondary explosive to detonate. Tertiary explosives are largely used in large-scale mining and construction operations. Ammonium nitrate-fuel oil mixture is used for blasting rock and in mining. It also speeds up the burning of combustible materials. Ammonium nitrate is soluble in water. It may explode if large quantities are involved in a fire. Ammonia, a highly noxious, irritating and corrosive gas, may be generated when exposed to fire. As such, breathing the dusts and fumes from burning material should be avoided.

Dynamite

A detonating explosive, dynamite contains a liquid explosive ingredient (usually nitroglycerine or a similar organic nitrate ester or both) that is uniformly mixed with an adsorbent material such as wood pulp. It usually contains materials such as nitrocellulose, sodium and/or ammonium nitrate. Based on the explosive potential of nitroglycerin, dynamite is considered a “high explosive’, which means it detonates rather than deflagrates. Dynamite is chiefly used in construction, mining, demolition, oil well firefighting and on the battlefield. Replaced by newer explosives in many applications, dynamite is still used, mainly as bottom charge or in underwater blasting. Dynamite is composed of three parts: nitroglycerin, an adsorbent (diatomaceous earth or nitrocellulose), and a small admixture of sodium carbonate or ketone. The mixture is formed into short sticks and wrapped in paper. Nitroglycerin by itself is a very strong explosive. It is shock-sensitive (physical shock can cause it to explode) in its pure form. It can degrade over time to even more unstable forms, making it highly dangerous to transport or use in its pure form. Absorbed into diatomaceous earth or other adsorbents, nitroglycerin is rendered less shock-sensitive. A priming device is used for initiating dynamite.

Maximum storage residence time should also be strictly adhered to, especially for dynamites, as this explosive may weep nitroglycerine in time. The nitroglycerin "sweat" can pool in the bottom of the box or storage area and crystals will form on the outside of the sticks, creating a hazardous situation. The actual possibility of explosion without a blasting cap however is minimal.

3.4.3.3 Mass Movement of Rocks, Soil and Sediments Due to Failure

Quarrying activities may predispose the quarry site and the surrounding areas to landslides and cave-ins, especially if engineering designs and protocols are not adhered to. Initiating factors are heavy rains and high intensity typhoons. Waste dump stockpiles from quarrying and crushing activities may slide and move during inclement weather situations. Runoffs from these wastes can contribute to excess alkalinity and siltation of nearby surface water bodies. Settling ponds may also be breached during extreme natural events, contributing to flooding, siltation and alkalinization of nearby surface water bodies. Rock slides, landslides and cave-in can result to loss of lives and injuries, siltation and contamination surface waters, and damage to terrestrial and aquatic environments.

3.4.3.4 Occupational Hazards

Occupational safety issues in the project area are listed in Hazard Analysis Matrix (**Table 3.4.1**). Safety issues include exposure to explosive blast waves and missiles; exposure to fire hazards; fall from heights; rock falls and soil movement accidents; vehicular/equipment accidents; being struck by equipment parts; exposure to dusts and other hazardous chemicals; constant exposure to vibration; and high impact and high level noise, which can cause or predispose to hearing impairment.

3.4.3.5 Natural Hazards Due to Extreme Climate Events

The increasing frequency and intensity of extreme climate events are being attributed as direct consequences of global climate change, which is primarily due to global warming. As stated by the Manila Observatory (2010) in its paper *Technical Primer on Climate Change in the Philippine*, "Climate change will increase the magnitude and frequency of weather hazards to an unknown degree". This phenomenon poses an increased risk of disasters in the Philippines, as risk is not only proportional to the magnitude of events but on the number of people affected and their capacity to recover from the impacts of an event.

Other direct impacts of climate change in the Philippines are significant increases in frequency of high extreme ambient temperature (>35^{o}C), which manifests as significant increase in the frequency of hot days and warm nights; drier dry seasons (March to May for Palawan); and wetter rainy seasons (September to November for Palawan). Based on climate modeling conducted by PAGASA for the various regions of the Philippines, annual mean temperatures are expected to rise by 0.9ºC to 1.1ºC in 2020 and by 1.8ºC to 2.1ºC in 2050" (Hilario, et al., n.d.). PAGASA likewise predicted that "the drier seasons of March-

April-May will become drier still, while the wetter season of Sept- Oct. and November will become wetter" (Hilario, et al., n.d.).

Based on the modeling conducted by PAGASA, the province of Palawan will experience a 7.2% decrease in rainfall in the months of March to May and a decrease of 2.6% for the months of June to August for the years 2006-2035. However, the wettest season of September to November will experience a mean rainfall increase of 19.6%. By the year 2050 (2036-2065), PAGASA predicts a trend of 9.0% rainfall decrease for the dry months of March to May. The Province is predicted to experience a rainfall increase for all other months (7.3% for December to February, 1.0% for June to August and 6.9% for September to November).

Projected Hazards by 2020

The projected increased rainfall intensity during the wet months of September to November implies greater risks from hazards brought about by flooding, landslides, soil erosion, siltation of surface water bodies. The unusually drier periods during the months of March to May, coupled with ambient temperature extremes, implies greater risks from fire, low water supply, greater airborne dusts, drying up of water reservoir, and dry season related diseases (i.e. respiratory ailments, heat strokes, etc.).

Projected Hazards by 2050

The period from 2036 to 2065 is predicted to experience a decrease in rainfall in the months of March to May. The rest of the months will experience increases in rainfall, with the rainiest months being September to November. The decrease of rainfall in the dry months, coupled with increased frequency in the occurrence of high extreme temperatures, could result to greater risks from drying up of surface water bodies, fire, greater airborne dusts, and diseases that thrive during the dry and hot seasons (i.e. respiratory ailments, heat strokes, prickly heat, nose bleeding, exacerbation of heart conditions, etc.). Assuming that the quarry operations in the area is still ongoing, this could also mean greater risks from occupational safety and health hazards, as workers become more prone to fatigue, dizzy spells, dehydration, and heat stroke in extremely hot conditions. They may also suffer more from skin irritations and contact dermatitis, due to increased sweating and more airborne dusts. The temperature rise is expected to bring about an increase in the frequency, strength and range of tropical cyclones (Manila Observatory, 2010).

3.4.4 Consequence Analysis

Consequence analyses were undertaken assuming worst-case accident scenarios for fire/explosion involving diesel in storage and for explosion accident involving explosives in storage.

Worst-case Accident Scenarios. After the hazard identification stage, the consequences of significant hazards in the facility were calculated using earlier identified methodologies. At the minimum, the consequences of the worst-case accident scenarios involving the said hazardous material and/or activity were analyzed. The consequence analysis focused on significant hazards involving fire/explosion hazards from explosives (ANFO and dynamites) and liquid fuel in storage (diesel).

The accident scenarios were selected/formulated based on the principle that it will give the highest accident consequences. As such, the highest possible amount of the substance in consideration was employed. For hazards involving explosives, the biggest quantity involves explosives in the storage facility at the site. This is likewise true for liquid fuel. The largest inventory of liquid fuel is found at the liquid fuel storage farm. The highest inventory of diesel and explosives were assumed be involved in the accident scenarios. These various accident scenarios are described in **Table 3.4.6**.

Consequence analysis for the worst-case accident scenario for explosives was done using the methodology as described in IAEA-TECDOC-727 (1996) for the estimation of fatality radius. Estimation of the number of fatalities within the fatality zone was done by mapping. For liquid fuel (diesel), estimation of the fatality and injury radii were done using the USEPA-CEPPO's (1999) *Pool Fire Equations* (Equations 3.3.1 and 3.3.2).

Table 3.4.6. Scenarios included in the worst-case accident scenario analysis

Description of Accident Scenario	Scenario code	Substance Involved	Equipment Description/Location	Released/Involved Mass (tons)
A. Explosives				
1. Accidental explosion of all ANFO and dynamites in storage	ANFO-Dynamite	ANFO, dynamite	Explosives magazine	37.5
B. Liquid Fuels				
1.Pool Fire following catastrophic spill of diesel from tanks into bunded areas	Diesel	Diesel	2 Atmospheric diesel storage tanks	2,288

3.4.4.1 Accidental Explosion of ANFO/Dynamites in Storage

For purposes of worst case scenario analysis, the maximum quantity of explosives (30 metric tons of ANFO and 7.5 metric tons of dynamites) that may be contained in all magazines was assumed to be involved in the explosion. The effect distance and area of ANFO/dynamite explosion were estimated using the methodology described in *Section 3.3.5* (TNT Equivalence method and *Equation B.56* by FEMA et al. (1989) relating the distance from the point of a ground-level explosion to peak overpressure). Results of consequence modelling are shown in **Table 3.4.7**.

Table 3.4.7.Results of consequence modelling for ANFO and dynamites

Explosion Overpressure (psi)	Expected Damage/Relevance[1]	Distance from point of Explosion (m)	
		ANFO	Dynamite
1.0	Possible serious injury due to flying glass and missiles; **Probability of injury is 10%;** Fatality not expected.; Partial demolition of houses; Usually used as the threshold overpressure value for regulatory purposes by USEPA.	381	245
3.0	Storage tanks fail**; 20% chance of fatality to a person in a building**.	180	116
5.0	Nearly complete destruction of houses; Threshold of eardrum damage; **50% chance of fatality for a person in a building and 15% chance of fatality for a person in the open**.	132	85
10.0	Threshold of lung damage; **100% chance of fatality for a person in a building or in the open**; Complete demolition of houses	89	57

[1] "Guidelines for Hazard Analysis." Advisory Paper No. 6, Department of Planning. Sydney, Australia.

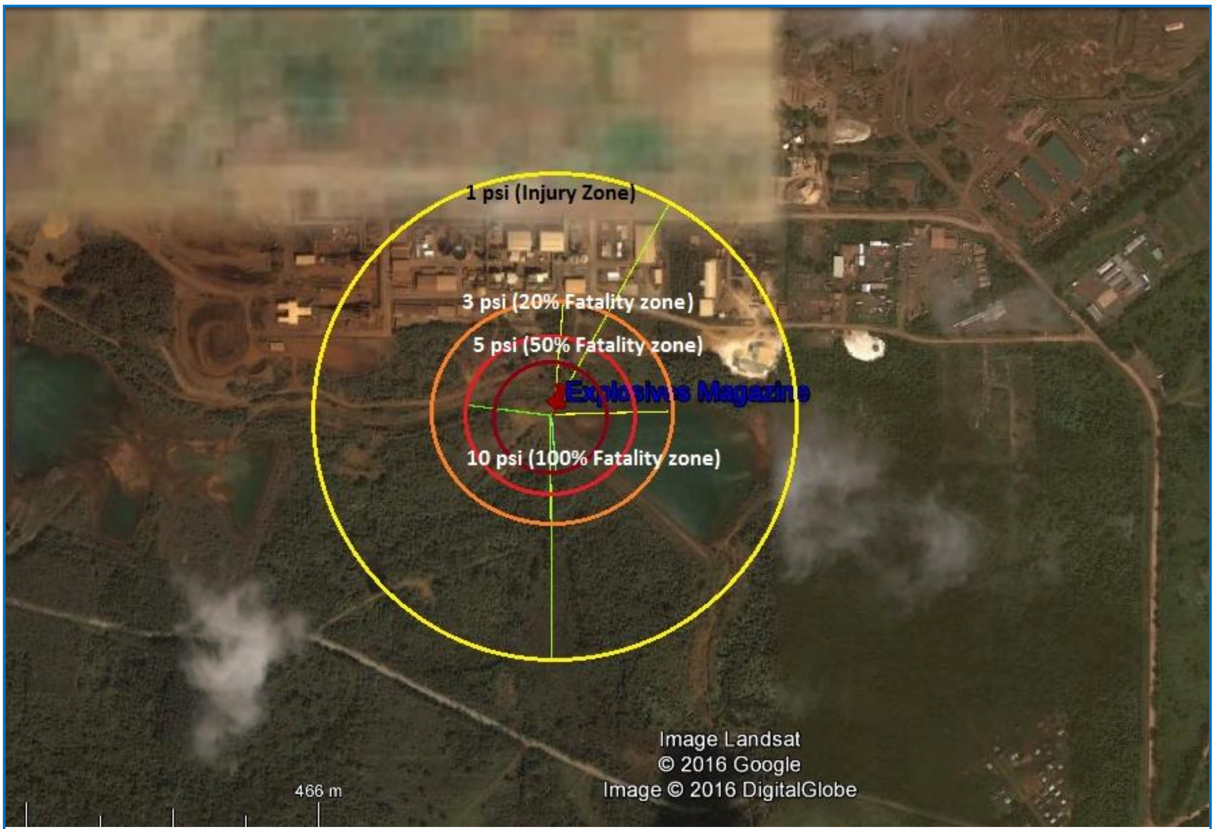


Figure 3.4.2. Hazard footprint for the worst-case explosives accident scenario (detonation of entire maximum inventory of ANFO)

For the worst case explosives accident scenario (detonation of maximum inventory of ANFO), the maximum distance to the threshold overpressure for possible serious injuries (1.0 psi)[1] is 381 m from the magazine location. Ten percent of exposed persons are expected to sustain serious injuries within this zone due to flying glass and missiles. No fatality is expected within this zone. Partial demolition of houses encompassed within this zone may also occur. The overpressure that may possibly result to 20% chance of fatality of persons within a building (3.0 psi) covers a radius of 180 m from the site of explosion. This overpressure magnitude can cause storage tanks to fail. The maximum distance to 50% chance of fatality for a person in a building and 15% chance of fatality for a person in the open due to overpressures of 5.0 psi is 132 m. The overpressure of 5.0 psi at this zone is also expected to damage eardrums and cause almost complete destruction of houses. The hazard radius for threshold lung damage and 100% fatality to persons within a building or in the open due to overpressures of 10.0 psi is 89 meters. At this hazard zone, complete demolition of houses is expected. As shown in **Figure 3.4.2**, the Injury Zone (1.0 psi overpressure threshold) encompassed some structures of the CNBC facility but did not go beyond the Plant's perimeters. All other overpressure endpoints did not reach any of the CBNC Plant's infrastructures. For all explosion overpressure endpoints modeled, consequences of the worst-case explosion accident scenario are not expected to affect any receptor external to the project site.

Summary of Consequences. The consequence analyses for the postulated worst-case industrial explosives' accidental detonation scenarios showed that no external fatalities are

[1] USEPA uses 1.0 psi as the threshold limit for possible serious injuries in risk assessment modeling and for regulatory purposes.

expected from such accidents as the maximum injury radius of the explosion is limited within a radius of 381 meters, an area that does not go beyond the perimeters of the project site and does not involve any residential structures. This hazard zone, however, may encroach on some facilities of the CBNC Plant, in the absence of any mitigation. Given the existing mitigation measures, however, the hazard zones are expected to be contained within the immediate vicinity of the magazines. The maximum fatality radius for the 3 psi explosion overpressure (20% probability of death to an individual within a building) is 180 meters from the site of explosion, an area that does not involve any external or internal inhabited structures. All other hazard zone does not involve any infrastructures within the project site.

It should be emphasized, however, that the estimated hazard radii are overestimated, as these did not take into account the existing mitigating structures such as the impediments posed by the magazine and the perimeter fences. The existing measures to contain the effects of explosion accidents and/or to prevent accidents include the following:

1. Storage of various explosives in three separate reinforced concrete magazines (for ANFO, dynamites and detonators);
2. Separate storage of ammonium nitrate (AN) and fuel oil (FO) components of ANFO within a magazine;
3. Enclosure of magazines within a 2-meter high chain wire perimeter fence; and
4. Strict implementation of existing safety policies, guidelines and procedures on the transport, storage and use of explosives, etc.).

It is worth noting that the location of the explosives magazines is compliant to the standard distances set forth in *Rule 1145 of the Occupational Safety and Health Standards of the Philippines* (DOLE, 1989). For the maximum combined inventory of 37,000 kg of ANFO and dynamites, Rule 1145 of OSH prescribes the following minimum distances from the explosives magazines:

Structures	**Distance (m)**
1. Inhabited buildings (outside of Plant)	527.3
2. Passenger railways	214
3. Public highways	158.5
4. Separation of magazines	51.8

3.4.4.2 Fire/Explosions Involving Diesel in Storage

Assumptions: A worst-case accident scenario was assumed, wherein the two (2) storage tanks containing diesel to maximum inventory (2,288 metric tons) catastrophically spilled their entire contents into the bunded area measuring 2,700 m^2. The spilled fuel eventually ignited and burned as a diked pool fire. No fuel escaped the diked area. People subjected to specific thermal radiation doses were assumed to be fully exposed and not protected by shelter and other protection. Ambient temperature was assumed at 30^oC.

Two thermal radiation endpoints were modelled to determine the injury endpoint (5.0 kW/m^2) and the fatality endpoint (10.0 kW/m^2), respectively. A thermal radiation dose of 5.0 kW/m^2 is used as a standard endpoint for delineating the injury zone, as at this radiation dose people are expected to receive second degree burns after 40 seconds of exposure. A thermal radiation dose of 10.0 kW/m^2 is usually used as standard to delineate the fatality zone, as this radiation dose is expected to quickly cause third degree burns to exposed individuals leading to potential fatalities (USEPA, et al., 1990). The probability of death to unprotected individuals (no protection of clothing or shelter) at this thermal radiation dose is estimated at 2%.

Using the earlier described equations in *Section 3.3.5*, the maximum distances to the two (2) thermal radiation endpoints were calculated to determine the injury radius, the 2% fatality radius and the corresponding injury and fatality footprints. The values used in the calculations are shown in **Table 3.4.8**. Results of the calculations are shown in **Table 3.4.9**.

Table 3.4.8. Values used in the calculation of maximum distances to specified thermal endpoints

Variables	Value
Heat of combustion of diesel (H_c)	45,000,000 J/kg
Fraction of H_c radiated (f)	0.1
Heat of vaporization (H_v)	176,000 J/kg
Liquid heat capacity (C_p)	1,951.5 J/kg-K
Ambient Temperature (T_a)	303 K
Boiling temperature of diesel (T_b)	583 K
Atmospheric transmissivity (τ_a)	0.5
Constant	0.0010

Table 3.4.9. Maximum downwind distances to specified thermal radiation endpoints for the diesel pool fire

Particulars	Thermal Radiation Endpoint	
	5.0 kW/m^2	10.0 kW/m^2
Endpoint description	Injury endpoint	2% Fatality Endpoint
Maximum distance to endpoint (m)	77.6	54.9
Maximum combustion duration (hrs.)	3.78	3.78
Effect area (m^2)	18,918	9,469

Table 3.4.9 above shows that the maximum injury radius for the postulated worst-case scenario for diesel diked pool fire is 77.6 m, corresponding to an area of approximately 18,918 m^2. Any unprotected person who is exposed within the said zone is expected to sustain second degree burns if exposed for at least 40 seconds. The fatality radius, on the other hand, is 54.9 m, corresponding to an area of around 9,469 m^2 surrounding the immediate vicinity of the pool fire. Unprotected persons caught in the said area are expected to sustain third degree burns quickly and may eventually die. Based on the probit equation on the probability of death due to thermal radiation (given in VROM's *Purple Book* (VROM, 2005)), computation of the probability of death to unprotected persons exposed to 10 kW/m^2 thermal radiation for 20 seconds is 2%.

Using the derived fatality and injury radii, the injury and fatality zones were drawn on a Google map. The injury and fatality zones are shown in **Figure 3.4.2**. The mapped hazard areas show that the fatality zone in case of worst-case accident scenario may involve at least one (1) building in the vicinity of the postulated fire accident scenario. At least two (2) buildings, on the other hand, may be involved in the injury zone area. But since the assumption of injury and fatality results from unprotected exposure, it could be assumed that persons within the said buildings will have enough time to escape once they feel the heat. The said thermal radiation doses are not enough to burn the buildings. A minimum thermal radiation dose of 35 kW/m^2 is needed to burn clothing and buildings after 20 seconds (duration assumed to be enough for people to escape) of exposure (VROM, 2012, p.) A minimum thermal radiation dose of 37.5 kW/m^2 is required to damage equipment (steel structure, piping, vessels, etc.) after several minutes (Taylor, 1994).

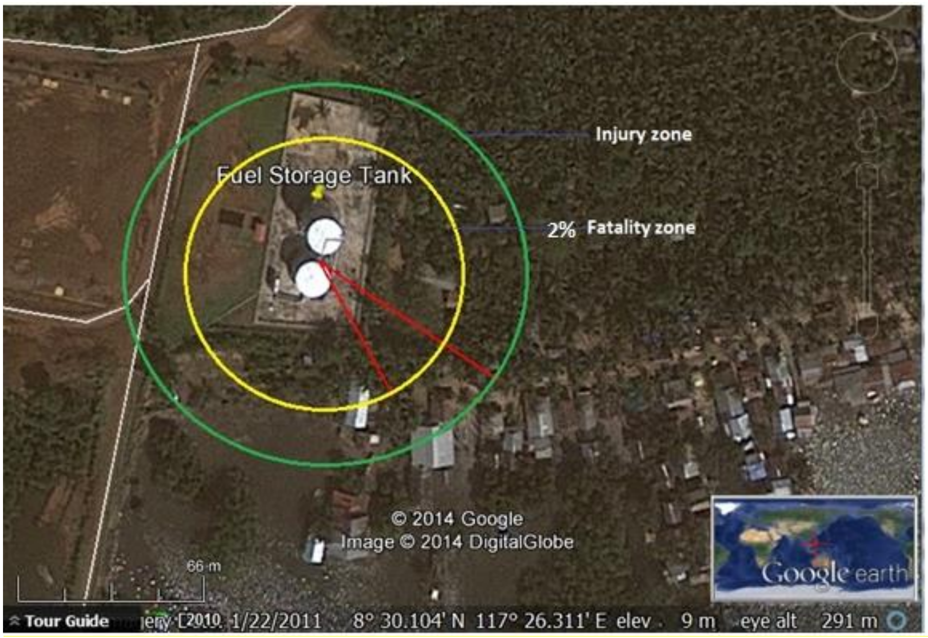


Figure 3.4.3. Potential injury and fatality zones resulting from bunded diesel pool fire

3.4.5 Frequency Analysis

The frequency of accident occurrence for the described worst-case accident scenarios were estimated using the methodology described in IAEA-TECDOC-727 (IAEA, 1996). The same assumptions in the consequence calculation section were applied. Results of the frequency calculation for the various scenarios are listed in **Table 3.4.9**, together with the parameters and basis of the computations. Explosion accident scenario, involving ANFO/dynamites in the explosives magazines, has a frequency of 1 X10^{-7} events per year or the probability of one accident happening per 10 million years. The frequency of the postulated diesel diked pool fire accident scenario has the same frequency, that is, the probability of the said accident to happen is also one in 10 million years.

Table 3.4.10. Frequency values and basis of calculations for the two accident scenarios

Parameters	ANFO	Dynamite	Diesel	Reference/ Explanation
Reference Number	14	14	3	Table IVa
Effect Category	CI	BI	BI	Table IVa
$N^*_{i,s}$	7	7	7	Table IX
n_1	0	0	0	Table X(a)
n_f	n.a.	n.a.	n.a.	Table XI
n_o	0	0	0	Table XII (average industry practice)
n_p	0	0	0	Table XIII
Probability Number ($N_{i,s}$)	7	7	7	Calculated based on Eq. 3.3.3
Frequency ($P_{i,s}$), events per year	1 x 10^{-7}	1 x 10^{-7}	1 x 10^{-7}	Table XIV

3.4.6 Risk Characterization

Location-specific Individual Fatality Risks for Diesel and Explosives Storage

Risks were calculated and characterized from the results of the consequence analysis and frequency analysis of the two (2) postulated worst-case accident scenarios. Associated risks were characterized and prioritized through the use of a criteria prescribed by DENR, the Location-specific Individual Fatality Risk (LSIFR) criterion. LSIFR was calculated and compared with the criteria set by DENR.

The ERA Guidelines in DAO 2003-30 has set 10^{-6} fatalities per year as the maximum acceptable individual risk criterion, subject to "supplemental guidelines that may be issued by the DENR Secretary". LSIFR is defined by DAO-2003-30 as "the risk of death to an individual person, if present 24 hours per day (in the open) at a particular location for a whole year".

The process of individual risk estimation involves the combination of two (2) calculated values, that of accident consequence and its probability or frequency of occurrence. Since the concern is consequence of the event to an individual, the value of one (1) for consequence is assumed.

Results of LSIFR Calculation. The LSIFR values for the ANFO, Dynamite and diesel worst-case accident scenarios are listed in **Table 3.4.11**. **Figure 3.4.4** shows the LSIFR contours for the worst case explosives accident scenario. **Figure 3.4.5** shows the LSIFR contour for the diesel pool fire accident scenario.

Table 3.4.11. LSIFR Values for the Diesel and Explosives Accident Scenarios

Hazard Dose	Scenario Description	Effect Distance (m)	Accident Frequency (per year)	Prob. of Death, Pd	LSIFR (deaths/year)
I. ANFO (Explosion)					
1.0 psi	Detonation of maximum inventory of ANFO	381	1.00E-07	0	0.00E+00
3.0 psi		180	1.00E-07	0.2	2.00E-08
5.0 psi		132	1.00E-07	0.5	5.00E-08
10.0 psi		89	1.00E-07	1	1.00E-07
II. Dynamite (Explosion)					
1.0 psi	Detonation of maximum inventory of dynamites	245	1.00E-07	0	0.00E+00
3.0 psi		116	1.00E-07	0.2	2.00E-08
5.0 psi		85	1.00E-07	0.5	5.00E-08
10.0 psi		57	1.00E-07	1	1.00E-07
III. Diesel (Pool Fire)					
5 kW/m^2	Diked area pool fire	77.6	1.00E-07	0	0.00E+00
10 kW/m^2		54.9	1.00E-07	0.02	2.00E-09

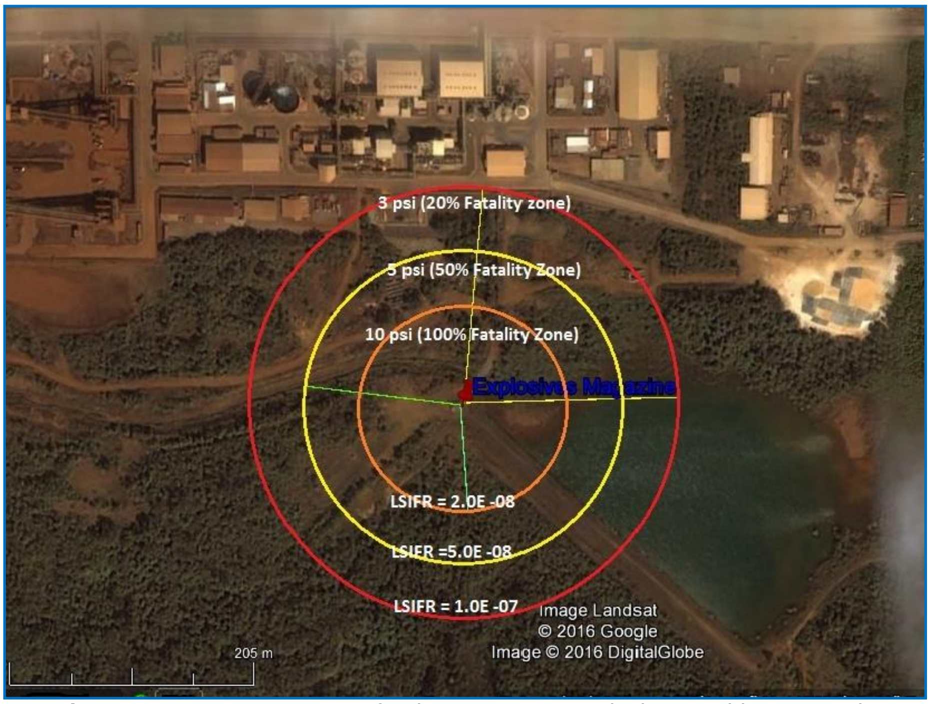


Figure 3.4.4. LSIFR contours for the worst case explosives accident scenario

Figure 3.4.5. LSIFR Contour for the worst case diesel pool fire accident scenario

Summary. The LSIFR values for the worst case accident scenarios involving ANFO, dynamites and diesel are listed in **Table 3.4.11.**. The worst case accident scenario for explosives involves ANFO, the values of which ranged from 2.0 x10^{-8} to 1.0 x10^{-7} chance of death per year. A plot of the LSIFR contour lines (**Figure 3.4.4)** shows that the highest LSIFR (1.0 x10^{-7}) is lower than the DENR standard of 10^{-6} fatalities per year. All LSIFR contour lines for the ANFO accident do not encroach on any inhabited buildings or on any buildings of the CBNC Plant. As such, it could be said that a worst case accident involving explosives will not affect external receptors. The sectors at risk are the workers of the CBNC facility and the explosives handlers and delivery persons. The highest risk of dying from such an accident is 1.0 x10^{-7} chance of death per year if they are within the 180 m radius of the explosives magazines.

For the diesel worst case accident scenario, the chance of a person dying as a consequence of exposure to thermal radiation is 2.0 x10^{-9} per year if that person is within the 54.9 m radius from the bund walls of the diesel storage tanks. This LSIFR is well below the DENR standard of 10^{-6} fatalities per year. The LSIFR contour line involves one (1) possibly inhabited building (refer to **Figure 3.4.5).** As such, it could be said that an accident involving diesel pool fire may involve both workers and the some members of the community in the immediate vicinity but the chance of dying from such an accident is much lower than the DENR LSIFR standard value of 10^{-6} fatalities per year.

3.4.7 Changes in Environmental Risks Due to Project Expansion

The types of hazards associated with the expansion of the quarry operations are basically the same in the existing quarry project of RTNMC. Expected risks from the identified hazards, however, may change due to the expected intensification of quarry operations to meet the 725,000 WMT of limestone per annum target.

Table 3.4.12 below summarizes the expected changes in the risks associated with the identified hazards due to the proposed expansion.

Table 3.4.12. Expected changes in environmental risks attributable to project expansion

Hazards	Expected Change	Reasons
Fuel (Diesel) Spill and Fire	Likelihood of occurrence: greater	• Greater frequency of delivery of fuel by sea vessels; • Greater frequency of fuel refilling activities; • Greater volume of fuel that may be accidentally spilt; • More vehicles and quarry equipment utilizing fuel that may be involved in accident
	Magnitude of consequences per event: Higher	Higher number of employed workers and employees in the vicinity that may be exposed to fire
	Extent of risk-prone areas: no change	No additional storage facilities will be installed.
Detonation of stored explosives	Likelihood of occurrence: greater	• Greater frequency of delivery of explosives by truck explosives; • Greater frequency of explosives disposition to blasting areas
	Magnitude of consequences per event: no change	No change in the maximum inventory at the storage site
	Extent of risk-prone areas: no change	No additional storage facility will be installed
Traffic Accidents	Likelihood of occurrence: greater	• More vehicles and quarry equipment are deployed per unit time and per segment of road; • More personnel and workers will be working at the site per shift
	Magnitude of consequences per event: no change	Types of vehicles and equipment still the same
	Extent of risk-prone areas: greater	Expansion of quarry site within the 13-hectare area – greater area used for vehicular/equipment traffic
Mass Movement of Rocks, Soil and Sediments	Likelihood of occurrence: higher	• Greater extent of exposed, disturbed and quarried areas; • Predicted increased severity and strength of typhoons and wetter rainy seasons due to climate change
	Magnitude of consequences per event: could be higher	More workers employed at the quarry site
	Extent of risk-prone areas: greater	• Greater extent of exposed, disturbed and quarried areas; • Predicted increased severity and strength of typhoons and wetter rainy days due to climate change
Failure of water/ silt impounding structures leading to flooding, landslides, and contamination/ siltation of surface water bodies	Likelihood of occurrence: greater	More water/silt impounding structures to be built; greater amount of water and silt to be produced
	Magnitude of consequences per event: depends on location of structures and characteristics of site	Discharge of water/silt into flood prone areas would entail more severe consequences
	Extent of risk-prone areas: greater	• Presence of more impounding structures; • Greater amount of wastewater and silt
Natural Disasters: Flooding	Likelihood of occurrence: greater	• More denuded areas and less vegetation to hold surface run offs; • Predicted increased severity and strength of typhoons due to climate change; heavier rains during the wet season
	Magnitude of consequences per event: could be greater	• More workers deployed at quarry site; • Expected growth of nearby communities due to greater work opportunities at the quarry site
	Extent of risk-prone areas: greater	• More denuded areas and less vegetation to hold surface run offs; • Predicted increased severity and strength of typhoons due to climate change; heavier rains during the wet season.

3.5 RISK MANAGEMENT

Based on the worst-case accident scenario modelling, the fire and explosion risks associated with the proposed expansion of quarry and crushing plant operations of RTNMC are within acceptable limits based on DENR standards and criteria. Notwithstanding the acceptability of involved major risks, it would be for the interest of the company and the surrounding community that risks be consistently managed and reduced to as low as can be reasonably attained. Reasonable in this context means a balance between the values of increased safety, environmental protection or lives saved and the costs involved in the process of risk reduction.

Physical risks such as landslides and collapse of structures, which may be predisposed by natural hazards, can be mitigated through institution of appropriate management schemes. Other risks arise from natural hazards and the nature of the occupation.

Appropriate plant/quarry designs; compliance with standards in the design, materials, construction and maintenance of quarry equipment and facilities; well-maintained safety systems; well-trained and motivated workforce; and the strict implementation of *Safety and Health Program* are major considerations in risk management.

3.5.1 Status of Implementation of Safety Policies and Guidelines

From the findings of this risk assessment it could be concluded that as far as the limestone quarry project and operations is concerned, the RTNMC is compliant with all required safety and health planning and reporting requirements. It has consistently and regularly formulated and implemented an annual *Safety and Health Program (SHP) and Emergency Response and Preparedness Plans* (ERPP) from the years 2011-2015. In compliance with DAO 2000-98, RTNMC provided copies of the SHPs to the Regional MGB. The Company has regularly allocated a sizable budget for its annual SHP. It has a dedicated hospital for its workers, employees and their dependents. Each SHP contains a well-defined safety policies, rules and protocols, and organization. It likewise contains a geo-hazard map of its various sites, which identifies the landslide susceptible areas as well as the flood prone areas. In conjunction with this, it has formulated detailed plans of action for identified contingency situations. It also has plans for training and equipping personnel to face various contingency situations.

Pursuant to its SHP, RTNMC has implemented safety trainings for management personnel, employees and contractors. It also provided its workers and employees with appropriate PPEs such as hard hats, gloves, and safety goggles. Its facilities are provided with fire fighting equipment and facilities. Fuel storage tanks are provided with proper bund walls.

It has likewise complied with safety and health reporting requirements, such as the following:

- Monthly General Accident Report;
- Combined Man-hours Report;
- Safety Performance Report;
- Clinical Report (includes morbidity data); and
- Employer’s Work Accident/ Illness Report.

3.5.2 Occupational Health and Safety Statistics (2011-2015)

Table 3.5.1 below presents the accident statistics for the RTNMC operations for calendar years 2011 to first half of 2015. The statistics were based on the *Monthly General Accident Report* (GAR) submitted by the company to the Mines and Geosciences Bureau (MGB). The *Disabling Injury Frequency Rates (DIFR)* and the *Disabling Injury Severity Rates (DISR)* were part of the GAR. OSHS of DOLE defines DIFR as the number of disabling injury or illness per million man-hour units. DISR, on the other hand "is based on the total of all scheduled charges for all deaths, permanent total and permanent partial disabilities, plus the total actual days of the disabilities which occur during the period covered by the loss in terms of million man-hour unit" (DOLE, n.d., pp. 27-28).

Table 3.5.1. Safety statistics for the RTNMC Operations (Jan. 2011- June 2015)

Parameter	Calendar Year					
	2011	2012	2013	2014	2015	Total
Total Manhours Worked	6,155,333	8,014,788	7,040,597	8,007,366	4,788,913	34,006,997
Total Manpower	no data	2,734	2,102	2,582	2,599	
Accident statistics						
NLTA	57	56	48	56	23	240
LTA - Non-fatal	0	0	1	0	0	1
LTA -Fatal	1	0	0	0	0	1
Total accidents reported	58	56	49	56	23	242
Total Days Lost (days)	6,000	0	14	0	0	0
DIFR	0.16	0.00	0.14	0.00	0	-
DISR	981.14	0.00	1.99	0.00	0.00	-

Source: RTNMC MGAR (2011-2015)
Legends: NLTA = Non Lost Time Accident LTA = Lost time Accident; DIFR = Disabling Injury Frequency Rate (lost time injuries per million man-hours); DISR = Disabling Injury Severity Rate (days lost per million man-hours)

Factors contributing to the occurrence of accidents were identified as follows:

- Non-compliance with standards;
- Lack of training/instruction;
- Poor planning/coordination;
- Unsafe working conditions;
- Unfit to work;
- Use of defective tools; and
- Others.

Non-compliance with set standards of the Company, lack of training/instruction and poor planning/coordination were the top contributors to the occurrence of accidents.

The statistics cited in **Table 3.5.1** covers all workers of RTNMC, including workers of contractors. In the period from January 2011 to June 2015, there was one (1) reported fatality among workers of RTNMC, which occurred in 2011. A total of 242 accidents occurred during the period (240 NLTA, one (1) fatal LTA and one (1) non-fatal LTA). The total number of lost days was biggest in 2011 (6,000 days), which is attributed to one (1) fatality during the time. Lost time amounting to 14 days also occurred in 2013 due to non-fatal lost time accident. No lost time were recorded in 2012.

3.5.3 Emergency Preparedness and Response Plan

RTNMC's *Emergency Response and Preparedness Plan* (ERPP) has well-defined objectives, organization, SOPs and courses of action for each identified threat, which include the following: tropical typhoons, floods, vehicular accidents, blasting/explosion, acid spills (at the leaching plant), methanol fire, fire, aircraft incidents, breach of siltation dikes, and H_2S leaks. The ERPP has specific SOPs and contingency procedures for the following contingencies:

- Material transportation Spills;
- Bomb Treat and Explosion;
- Natural Disasters (landslide, flood and strong typhoons);
- Fire and Explosion;
- Tailings Dam and Other Silt and Water Impounding Structure Failure; and
- Oil Spills (sea-based, in-plant).

The Company has organized fire brigades, first aid teams and disaster brigades to respond immediately in case of emergencies.

Detailed discussion on the ERPP of RTNMC approved by the MGB in 2017 for Gotok Limestone Quarry is provided in *Chapter 7*.

3.6 SUMMARY AND RECOMMENDATIONS

Hazards associated with the expansion of quarry and crushing plant operations of RTNMC are basically the same as those prior to expansion. However the magnitudes and probability of occurrence of adverse outcomes associated with the said hazards may increase due to intensification of quarrying activities, increased frequencies of loading and unloading of hazardous materials (liquid fuel and explosives), increased manpower requirements, increase in the number of required equipment, and expected increasing severity of natural hazards in the area due to climate change.

Identified hazards were fire due to liquid fuel (diesel) storage; explosion arising from the storage; transport and use of explosives (ANFO and dynamites), risks from natural hazards (flooding, landslides, siltation), as intensified by climate change; and occupational hazards.

Climate change, which is expected to bring about increased intensity of typhoons, wetter rainy seasons, drier dry seasons, and greater frequency of high temperature extremes (>35^{o}C) in the years 2020 and 2050, are expected to heighten the risks from flooding, landslides and siltation during the typhoon and rainy months. Greater risks from fire, are however, expected during the dry months. Quarrying activities could further increase risks from flooding, landslides and siltation due to greater denudation, soil/earth disturbances, lowering of topography at the quarry sites, and the existence of several water/silt impounding structures.

As in any quarrying operations, occupational safety and health hazards are expected. Such hazards include exposure to blast overpressures and projectiles, high level noise, chemicals (limestone dusts, silicates, heavy metals, fuel exhausts, etc.), vibration, ambient heat, and other safety hazards (fall from heights, body parts being caught in moving machine parts, mechanical impacts, etc.).

Particular recommendations to mitigate and manage identified hazards are listed in **Table 3.6.1**. As reported, there was no occurrence of fire and/or explosions as well as failure of settling/silt containment dikes and of overburden retaining structures and occupational health and safety hazards. Due to elevated location of project facilities, there was no flooding that occurred due to heavy rains or typhoons. Earthquakes in the area did not result to any injury to persons or damage to properties. The cited mitigating and management measures, as well as the existing Safety and Health Program (SHP) and ERPP are deemed adequate and effective to meet the challenges and risks involved in the proposed project.

In summary, as to the potential contributing factors of accidents, various activities are being implemented by RTNMC such as the following:

- Daily "Tool Box" talks are being implemented to regularly remind the workers of the existing hazards and the need to strictly follow set procedures and mitigating measures;
- Training needs identification, planning and implementation of identified trainings;
- Intensification of training for supervisors, especially on the area of coordination;
- strict implementation of regular annual examinations and special medical examinations. Workers are constantly reminded to report for check up to the Company hospital and to refrain from reporting to work if feeling sick or physically challenged; and
- regular inspection of tools, implements and machineries is strictly being implemented. Workers are constantly reminded to report any problem/ defect on the tools they are using.

Table 3.6.1. Recommended mitigating and management measures for the identified hazards

Hazard Classification/ Unit Operation	Major Hazards	Occurrence	Initiating/ Contributing Factors	At Risk Sector	Mitigating Measures
A. Fire and Explosion					
1. Liquid Fuel Storage (Diesel)	Fire and explosion following major releases/ spills	No occurrence as reported in the 2017 Monthly GAR (**Annex 3.6.1**)	Presence of ignition sources; breach of containment; mechanical impacts; exposure to fires and high heat; corrosion; defective or substandard tank materials; vandalism	Persons, equipment and structures within the hazard area.	• Strict implementation of the Company's SHP on fire/explosion prevention; • Eliminate ignition sources in the fuel storage area; • Continue to ensure regular inspection and maintenance bund containments (bund capacity should at least be 110% of the tank's capacity); • Continue to ensure regular inspection and maintenance of tanks, pipings, hoses, valves, gauges and other accessories. • Maintain a safety radius or buffer zone around the facility; • Continue to ensure provision of fire control devices and systems; • Continue to ensure strict adherence to Emergency Response and Preparedness Program (ERPP); and • Continue to ensure maintenance of properly functioning fire trucks, fire extinguishers and other fire fighting equipment.
2. Transport, Storage and Use of Explosives (ANFO, Dynamites and peripherals)	Explosion hazards (blast overpressures, high velocity projectiles, high impact noise)	No occurrence as reported in the 2017 Monthly GAR (**Annex 3.6.1**)	Accidental charging/ignition of explosives, fire in the vicinity, lightning, mechanical impacts	Persons, equipment and structures within the hazard area.	• Continue with strict implementation of SHP and ERPP, particularly sections on explosives; • Continue to ensure elimination of ignition sources in the vicinity of explosives; • Continue to maintain the lightning arrestors in the vicinity of the explosives storage area; • Continue strict implementation of

Hazard Classification/ Unit Operation	Major Hazards	Occurrence	Initiating/ Contributing Factors	At Risk Sector	Mitigating Measures
					security and safety protocols in the explosives warehouse; • Continue regular inspection of stored explosives, especially for signs of deterioration, leakage or "weeping"; and • Continue to maintain a safety radius or buffer zone around the facility.
B. Failure of Impounding and Retaining Structures					
1. Waste Overburden Dumps	• Land and rock slides • Heavy siltation of surface water bodies; • Runoffs from overburden and stock yards may contain too much alkalinity, toxic heavy metals and minerals which may contaminate surface water bodies	No occurrence as reported in the 2017 Monthly GAR (**Annex 3.6.1**)	• heavy rains, typhoons, defective engineering design, sabotage	• personnel, workers and contractors, • surrounding communities • ecological entities	• Continue to ensure regular inspections and proper maintenance of containment berms; • Use wastes and overburden as backfill; • Continue implementation of rehabilitation planned of waste dumps; and • Ensure proper siting of new overburden/waste storage facility.
2. Settling and Wastewater Ponds	Breach of containment of ponds and drainage system could cause flooding of low-lying areas; alkalanization, siltation and contamination of surface water bodies.	No occurrence as reported in the 2017 Monthly GAR (**Annex 3.6.1**)	• natural disasters (extreme climate events); • engineering problems; sabotage	• surface waters • aquatic ecological entities • surrounding communities • quarry personnel, workers and contractors	• Ensure appropriate siting, design and construction of new impoundment facilities; • Continue to ensure regular, as well as emergency inspections and monitoring of structures; • Continue to ensure proper and regular maintenance of impoundment structures; and • Continue to strictly implement security measures to sabotage of infrastructures.
C. Occupational Safety and Health Hazards					
1. Site Preparation					
a. surveying	• Fall from heights • Vehicular accidents	No occurrence as reported in the	inherent geological	surveying team	• Ensure that vehicles used are well maintained and suitable for the

Hazard Classification/ Unit Operation	Major Hazards	Occurrence	Initiating/ Contributing Factors	At Risk Sector	Mitigating Measures
	• Snake bites	2017 Monthly GAR (**Annex 3.6.1**)	formations; adverse weather conditions; human error; vehicular failure		terrain; and • Strictly implement safety protocols.
b. Clearing and Waste Stripping	• Being struck by felling trees, debris and equipment part; • Vibration and noise from power saws and other equipment; and • Vehicular and equipment accidents (overturning, fall from heights, etc.).	No occurrence as reported in the 2017 Monthly GAR (**Annex 3.6.1**)	human error; equipment failure; adverse weather conditions	clearing team	• Adopt and implement the safest methods/ technology; • Ensure that persons doing specialized tasks are fully trained; • Use of well-maintained fully protected equipment; and • Ensure wearing of personal protection gears.
c. Laying Out	• Fall from heights; being struck by vehicles and earth moving equipment; • Vehicular and earth moving equipment accidents; and • Electrocution.	No occurrence as reported in the 2017 Monthly GAR (**Annex 3.6.1**)	• human error, equipment/ vehicular failure • breach of protocols	workers, drivers and operators at site	• Use of well-maintained and suitable equipment and vehicles; and • Use of properly trained crew and operators, especially drivers of large equipment like cranes and earth moving vehicles.
2. Quarry and Crushing Operations					
a. Drilling	• Fall from the edge of a bench; • Being struck by falling rocks/debris at the foot of a face; • Inhalation of and contact with dusts which predisposes to respiratory and skin diseases; • Harmful noise levels; and • Being struck by a moving part of the	No occurrence as reported in the 2017 Monthly GAR (**Annex 3.6.1**)	• human error • breach of protocols • equipment failure • face instability	Drilling operators and assistants	• Use of well-maintained and suitable equipment and vehicles; and • Use of properly trained crew and operators, especially drivers of large equipment like cranes and earth moving vehicles.

Hazard Classification/ Unit Operation	Major Hazards	Occurrence	Initiating/ Contributing Factors	At Risk Sector	Mitigating Measures
	drilling equipment.				
b. Blasting	• Blast overpressure impacts; • Being struck by flying debris and projectiles; and • Impact noise.	No occurrence as reported in the 2017 Monthly GAR (**Annex 3.6.1**)	• breach of protocols • operator error • explosive misfiring	Blasting team, trespassers, quarry workers	• Continue the strict implementation of rules, regulations, safety and security protocols and SOPs regarding blasting operations.
c. Limestone picking and loading	• Exposure to limestone ore dusts (may contain silica, CAO and other harmful dusts), which could predispose to respiratory, skin and eye diseases; • Being struck by falling rocks from loading arm • Falls while gaining access to operator's cabin; and • Vehicular accidents	No occurrence as reported in the 2017 Monthly GAR (**Annex 3.6.1**)	• lack of or inappropriate protective equipment; • breach of protocols; • human error; • failure of hydraulic system and other equipment; and • uneven ground	vehicle drivers, quarry operators and workers	• Ensure use of appropriate personal protection equipment; • Use of appropriate equipment and vehicles with protective operator cabin; and • Continue monitoring of workers' health.
3. Transport of limestones	• Vehicular accidents (fall from edge of bench, collision with other vehicles or structures, overturning, etc.) • Inhalation of and/or contact with dusts; and • High level noise	No occurrence as reported in the 2017 Monthly GAR (**Annex 3.6.1**)	• incompetent driving • heavy rains and flooding • trespassing • breach of protocols • brake failure	driver, pedestrians, driver of smaller vehicles	• Avoid operation during inclement weather; • Maintain proper security and cordon off hazardous areas; • Ensure good maintenance and regular testing vehicles, especially of brakes; • Driver/operator cabs are protected from dusts and heat; and • Restrict access to vehicles.
4. Limestone Stockpiling	Inhalation of and contact with dusts and heavy metals could predispose to respiratory/skin/eye diseases and heavy metal-induced diseases.	No occurrence as reported in the 2017 Monthly GAR (**Annex 3.6.1**)	• airborne dusts especially with strong winds	• workers, drivers of equipment	• Provide workers and operators with personal protection equipment (e.g. masks, gloves, and goggles).
D. Natural calamities due to extreme climate events (as predicted in years 2020 and 2050)					
1. Increased	Flooding of low lying	No occurrence as	poor engineering	personnel and	• Continue to ensure the regular

Hazard Classification/ Unit Operation	Major Hazards	Occurrence	Initiating/ Contributing Factors	At Risk Sector	Mitigating Measures
frequency and intensity of tropical cyclones	areas; rock and landslides; storm surges and tidal flooding	reported in the 2017 Monthly GAR (**Annex 3.6.1**)	design; poor maintenance of structures; defective warning systems; infrastructures along riverbanks and flood plains	workers of the project; contractors, nearby communities esp. along coastlines and in river banks	review of the Project's SHP and ERPP to ensure its adequacy and effectiveness to respond to changing situations; • Ensure strict implementation of and compliance with the safety and health program, especially the ERPP; • Review zoning and location of buildings and infrastructures, especially those within the flood prone and landslide prone areas; • Ensure regular and timely inspections and monitoring of containment dikes, retaining walls, and other retaining structures; • Ensure that all personnel, workers and contractors are properly oriented of the ERPP and ensure the regular conduct of emergency drills for situations such as fires, tsunami and flooding; and • Implement seminars, workshops, and other education/ information campaigns on climate change, its impacts and appropriate responses to mitigate impacts (tailored to the specific condition in the area).
2. Wetter wet season (Sept. to Nov.)	Flooding of low lying areas; rock/ landslides; tidal flooding; increased soil erosion and loss of soil fertility	No occurrence as reported in the 2017 Monthly GAR (**Annex 3.6.1**)	same as above	same as above farmers	
3. Drier dry seasons (March to May) and increased ambient temperatures	Fire incidents; increased airborne dusts; drying of water reservoirs and sources; increased diseases (i.e. respiratory, skin diseases, heat strokes, dizzy spells other diseases linked with hot, dry seasons)	No occurrence as reported in the 2017 Monthly GAR (**Annex 3.6.1**)	• presence of ignition sources, especially near storage of fuel and chemicals; indiscriminate disposal of live cigarette butts • inadequate dust	personnel, workers, contractors, nearby communities	• Ensure the implementation of the rehabilitation and reforestation program of mined-out areas and other denuded areas; • Strictly implement fire prevention and control measures and protocols; • Ensure strict implementation of dust suppression measures; and • Provide personnel protective

Hazard Classification/ Unit Operation	Major Hazards	Occurrence	Initiating/ Contributing Factors	At Risk Sector	Mitigating Measures
			suppression system; forest/ vegetation denudation		equipment to workers, especially dust masks, eye goggles.

4 Impact Management Plan

Rio Tuba Nickel Mining Corporation

In *Chapters 2* and *3*, impacts and risks of the increase in annual limestone production were identified and classified according to its magnitude and duration. These identified impacts and risks and their corresponding mitigating measures are presented below. The matrix presented constitues the impact management plan that will be implemented by RTNMC to mitigate impacts of the proposed project.

4.1 CONSTRUCTION PHASE

Project Phase/ Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee/ Financial Arrangements
Land clearing for access roads and new quarry areas within the 13-hectare land	LAND	• Encroachment in Environmentally Critical Areas (ECA) • Change/ inconsistency in land use, slope and subsurface geomorphology	• RTNMC should strictly comply with its approved quarry plan, which involves incremental quarry development and progressive rehabilitation to minimize ground disturbance • Maintain vegetation cover in the designated buffer zones and in the peripheries of roads and quarry area	• Quarry Engineering • PCO/ MEPEO	• Part of the operation cost • Mine rehab cost	• Include in the AEPEP • Slope Management Plan • Compliance Monitoring Report
		Threat to abundance and/or loss of important flora and fauna species	• Balling and transplanting of important and threatened plant species of appropriate size. When the balled plants recovered in the nursery, they shall be used and transplanted in the buffer zones of the quarry area as well as in the reforestation sites of the company • Propagation of threatened and ecologically important tree species that were found in the project area. This can be adopted as flagship species of RTNMC and will be incorporated as part of the strategy of the company in promoting biodiversity conservation.	• PCO/ MEPEO • Contractor	• Part of Refo Program costs • Part of the operation cost	• Include in the AEPEP • Include in the TOR of the Contractor • Compliance Monitoring Report

Project Phase/ Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee/ Financial Arrangements
		Hindrance to access to wildlife	Conduct of felling or cutting of trees by section to give time for the animals to adapt to a more suitable habitat	• Quarry Engineering • PCO/ MEPEO • Contractor	• Part of the operation cost • Mine rehab cost	• Include in TOR of Contractor • Include in the AEPEP • Slope Management Plan • Compliance Monitoring Report
		Soil erosion	• RTNMC should strictly comply with its approved quarry plan to limit the extent of exposed soil • Application of appropriate engineering measures to erosion-prone areas within and around the quarry site	• Quarry Engineering • PCO/ MEPEO • Contractor	• Part of the operation cost • Mine rehab cost	• Include in TOR of Contractor • Include in the AEPEP • Slope Management Plan • Compliance Monitoring Report

4.2 OPERATION PHASE

Project Phase/ Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee/ Financial Arrangements
Daily operation	LAND	Change / inconsistency in land use, slope and subsurface geomorphology	RTNMC should strictly comply with its approved quarry plan, which involves incremental quarry development and progressive rehabilitation to minimize ground disturbance	• Quarry Engineering • PCO/ MEPEO • Contractor	• PhP 130,000 for 0.5 hectare progressive rehabilitation as per AEPEP budget	• Include in TOR of Contractor • Include in the AEPEP • Slope Management Plan • Compliance Monitoring Report
			Maintain vegetation cover in the designated buffer zones and in the peripheries of roads and quarry area			
			Maintain the 50m buffer zone around the known opening of the Gray Cave and other caves in the quarry area. These buffer zones are demarcated on the ground and excluded from all quarry activities to protect the integrity of the natural cave structure and			

Project Phase/ Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee/ Financial Arrangements
			to protect the cave-dependent organisms.			
		Inducement of landslides	• For potential occurrence of landslides, ensure strict implementation of and compliance with the safety and health program, especially the ERPP; • Ensure that all personnel, workers and contractors are properly oriented of the ERPP and ensure the regular conduct of emergency drills	• Safety Group	• Part of the operation cost	ERPP and SHP
		Soil erosion	RTNMC should strictly comply with its approved quarry plan to limit the extent of exposed soil Maintenance of existing stormwater management system (interceptors, drains, berms and siltation ponds) and installation of other erosion control structures	• Quarry Engineering • PCO/ MEPEO • Contractor	• PhP 2,000,000 per year as per AEPEP budget	• Include in TOR of Contractor • Include in the AEPEP • Slope Management Plan • Compliance Monitoring Report
		Loss of top soil	Proper stockpiling of recovered topsoil if immediate re-application is not possible	• PCO/ MEPEO • Contractor	• PhP 100,000 costs for topsoil recovery and stockpiling	• Include in TOR of Contractor • Include in the AEPEP • Topsoil Conservation Plan • Compliance Monitoring Report
			Use of native plant species for rehabilitation (when feasible, vegetation established on rehabilitated land should be similar to the vegetation type and community that was present before quarry started. It is also essential that as much of the local seeds and propagules contained within the top few centimeters of soil be nurtured for later revegetation programs)	• PCO/ MEPEO	• PhP 35,000 for wildling collection and cloning	• Include in the AEPEP • Compliance Monitoring Report
		Threat to abundance, frequency and distribution of important flora and fauna species	Balling and transplanting of important and threatened plant species of appropriate size. When the balled plants recovered in the nursery, they shall be used and	• PCO/ MEPEO • Contractor	• Part of Refo Program costs • Part of the	• Include in the AEPEP • Include in the TOR of the Contractor

Project Phase/ Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee/ Financial Arrangements
			transplanted in the buffer zones of the quarry area as well as in the reforestation areas of the company		operation cost	• Compliance Monitoring Report
			Propagation of threatened and ecologically important tree species that were found in the project area. This program will be adopted as part of the strategy of the company in promoting biodiversity conservation.	• PCO/ MEPEO	• Part of Refo Program costs • Part of the operation cost	• Include in the AEPEP • Part of the Environmental Program • Compliance Monitoring Report
		Hindrance to wildlife access	Conduct of felling or cutting of trees by section to give time for the animals to adapt to a more suitable habitat	• PCO/ MEPEO • Contractor	• Part of Environmental Program • Part of the operation cost	• Include in the TOR of the Contractor • Include in the AEPEP
		Siltation of drainage system	Installation of sufficient number of diversion canals, interceptors, drains, and berms to avert run-off away from erosion-prone areas	• PCO/ MEPEO	• Part of the operation cost	• Include in the AEPEP • Part of the Environmental Program • Compliance Monitoring Report
			Regular inspection and maintenance of erosion control structures, drainage channels, culverts and siltation ponds			
		Generation of solid and hazardous waste	Intensification of the implementation of a Solid Waste Management Program within the quarry area, plantsite, and townsite	• PCO/ MEPEO	• Part of the operation cost	• Part of the Environmental Program • Compliance Monitoring Report
		Soil contamination with oil and grease.	Maintenance of vehicles/heavy equipment strictly within the motorpool	• PCO/ MEPEO	• Part of the operation cost	• Part of the Environmental Program • Compliance Monitoring Report
			Regular maintenance of existing storage area for hazardous wastes such as used oil and used oil filter			
			Regular maintenance of the oil and water separator should be done to ensure optimum performance			
			Good housekeeping practices including proper handling and clean-up of oil at the motorpool			

Project Phase/ Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee/ Financial Arrangements
			Use of auto shut off valves for refueling/re-oiling activities			
	WATER	Change in drainage morphology/inducement of flooding/ reduction in stream volumetric flow	Construction of diversion canals with silt traps directed to the existing silt collector sumps	• PCO/ MEPEO	• Part of the operation cost	• Include in the AEPEP • Compliance Monitoring Report
			Maintenance of the two (2) silt collector sumps			
		Deterioration of water quality due to the discharge of wastewater from plantsite (crushing plant, offices, motorpool) and townsite	Installation and maintenance of the siltation pond designed to contain the wastewater coming from the crushing plant	• PCO/ MEPEO	• Part of the operation cost	• Include in the AEPEP • Compliance Monitoring Report
			Regular maintenance of the oil water separator facility in the plantsite and the wastewater treatment facility located at the townsite			
		• Increase in surface run-off and sedimentation of surface water bodies within the vicinity of the quarry area • Inducement of flooding	Re-evaluation of the existing design of the stormwater management system and installation of additional components shall be done if needed	• PCO/ MEPEO	• Part of the operation cost	• Include in the AEPEP • Part of the Environmental Program • Compliance Monitoring Report
			Regular monitoring of the drainage facilities and silt collector sump(s) particularly during the rainy season to ensure optimum performance			
			Regular cleaning of drainage channels from sediments and debris that may inhibit the flow of water			
			Strict implementation of the quarry plan within the approved area			
		Contamination of water resources from oil and grease within quarry area, crushing plant, motorpool and along haulage roads	Installation and maintenance of the siltation pond designed to contain the wastewater coming from the crushing plant	• PCO/ MEPEO	• Part of the operation cost	• Part of the Environmental Program • Compliance Monitoring Report
			Proper handling and storage of diesel, fuel oil and lubricants in covered areas with impermeable flooring and installation of proper bund walls will reduce risk from this environmental aspect.			
			Discharge for all OWS should be monitored to ensure compliance to standards. Used oil collected should be continuously hauled			

Project Phase/ Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee/ Financial Arrangements
			and treated by DENR accredited hazwaste hauler and treater			
	AIR	Contribution in terms of Greenhouse Gas Emission	Progressive rehabilitation and maintenance of the vegetation along the buffer zones	• PCO/ MEPEO	• Part of the operation cost	• Include in the AEPEP • Part of the Environmental Program • Compliance Monitoring Report
			Regular maintenance of vehicles and other heavy equipment	• PCO/ MEPEO • Mechanical Group		
		Degradation of air quality (Increase in dust generation)	Maintenance of vegetative cover along peripheries of the quarry area	• PCO/ MEPEO	• Part of the operation cost	• Include in the AEPEP • Part of the Environmental Program • Compliance Monitoring Report
			Installation of windbreakers in the quarry area and the vicinity of the crushing plant to prevent the proliferation of dust particles during dry and windy days	• PCO/ MEPEO • Safety Group	• Part of Dust Emission Control costs	• Include in the AEPEP • Part of the Environmental Program • Compliance Monitoring Report
			Implement a lower drop height during limestone loading and speed limit of service vehicles, hauling trucks and other heavy equipment			
			Regular water spraying specially on unpaved stretch of the haulage route			
			Covering hauling trucks with tarpaulin or canvas to prevent the unwanted discharge of materials and dusts			
			Installation of tire-washing platform at the Kulantuod junction			
		Increase in ambient noise level	Maintenance of existing vegetation near the quarry area to serve as noise barrier	• PCO/ MEPEO	• Part of Dust	• Include in the

Project Phase/ Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee/ Financial Arrangements
			Proper vehicle and heavy equipment maintenance	• Mechanical Group	Emission Control costs	AEPEP • Part of the Environmental Program • Compliance Monitoring Report
			Proper scheduling of equipment operation to avoid disturbance to the nearby communities			
			Proper monitoring of noise level especially during blasting activity around the quarry area and nearby communities			
	PEOPLE	Cultural/ lifestyle change (especially on Indigenous People)	Program awareness on the preservation of tribal practices	• ComRel	• Part of SDMP Budget/ CRA	• Include in the SDMP
			Conduct of ethnographic study to document culture and traditions			
			Establishment of a centralized tribal museum to house the cultural artifacts that may be gathered by the tribe			
		In-migration	Priority employment of qualified locals	• ComRel • Admin	• Part of the operation cost	• Include in the TOR of the Contractor • HR Program
			Provision of appropriate skills training for workers including local hires to control unnecessary increase in local population	• ComRel • Admin	• Part of the operation cost • SDMP budget for skills training	• Include in the SDMP Plan
			Proper record-keeping of in-migration survey	• ComRel • LGU	• Part of the operation cost	• Proponent's commitment to LGU
		Improved educational system	Provision of adequate school facilities and educational materials; training for teachers	• ComRel	• Part of SDMP Budget	• Include in the SDMP
		Threat to public health and safety (Health and nutrition)	Improvement of facilities of RTN Hospital	• RTNFI	• Part of SDMP Budget	• Include in the SDMP

Project Phase/ Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee/ Financial Arrangements
			Continue Health Monitoring Study	• ComRel • Safety group	• Part of the operation cost	• Compliance Monitoring Report
		Threat to public health and safety (Health risk due to respiratory diseases)	Implement dust suppression measures such as covering of trucks during hauling	• PCO/ MEPEO	• Part of Dust Emission Control costs	• Include in the AEPEP • Part of the Environmental Program • Compliance Monitoring Report
		Threat to public health and safety (Health risk due to respiratory diseases)	Regular watering of haulage roads specially along or near the residential and office areas	• PCO/ MEPEO	• Part of the operation cost	• Include in the AEPEP • Part of the Environmental Program • Compliance Monitoring Report
		Threat to public health and safety (Occupational health and safety risk)	Strict implementation of the use of Personal Protective Equipment (PPE) among workers Ensure that vehicles used are well maintained and suitable for the terrain Ensure good maintenance and regular testing vehicles, especially of brakes Adopt and implement the safest methods/ technology Ensure that persons doing specialized tasks are fully trained Strictly implement safety protocols Conduct of training programs/drills for all workers and employees that will include safe job procedures, basic firefighting procedures, good housekeeping, OHSAS Systems, emergency preparedness and response, defensive driving, and first aid Establishment of clear and adequate signages especially in accident-prone areas Avoid operation during inclement weather Maintain proper security and cordon off hazardous areas	• Safety group	• Part of the operation cost	• Compliance Monitoring • Safety and Health Program

Project Phase/ Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee/ Financial Arrangements
			Provision of well-ventilated work area			
		Threat to public health and safety (Occupational health and safety risk)	Improvement in the provision of health facilities/services available to workers and employees during emergencies Continue monitoring of workers' health	• Safety group	• Part of the operation cost	• Compliance Monitoring • Safety and Health Program
			Conduct of regular information campaigns to update worker's health and safety responses	• ComRel	• Part of the operation cost • Part of IEC cost	• Include in the IEC Plan • Compliance Monitoring
		Generation of local benefits (employment and livelihood)	Prioritization of qualified local residents in employment	• Admin • Contractor	• Part of the operation cost	• Include in the TOR of the Contractor
			Introduction of livelihood projects (skills training for local community as part of SDMP)	• ComRel	• Part of the SDMP cost	• Include in the SDMP
		Generation of local benefits (Capital investment)	Proper maintenance of rehabilitated infrastructure /facilities will enhance this positive impact.	• PCO/ MEPEO • ComRel	• Part of the operation cost	• Include in the AEPEP • Compliance Monitoring
		Generation of local benefits (Tax generation)	Pertinent fees to be paid promptly	• Admin	• No cost	• Included in requirements for permits application at municipal level
		Traffic congestion	Creation and maintenance of a flag man in the Kulantuod Junction to warn in-coming vehicles of emerging dump trucks from the quarry site Maintenance of traffic aids and street sweepers	• Safety group • Admin • ComRel	• Part of the operation cost	• Traffic Management Plan

4.3 ABANDONMENT PHASE

Project Phase/ Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entity	Cost	Guarantee/ Financial Arrangements
Abandonment and Decommissioning Phase	LAND	Change/inconsistency in land use (existence of open areas)	Implementation of extensive Rehabilitation Program	• PCO/ MEPEO	• Part of Abandonment Cost	• Include in the Abandonment Plan/ FMRDP
		Generation of solid and hazardous waste	Implementation of SWMP			
			Management of the hazardous wastes through DENR-recognized Hazardous Waste Treater			
	PEOPLE	Generation of local benefits (Displacement of workers) Loss of revenue – To inform the local government unit about this impact, RTNMC will conduct legal and formal discussions prior to abandonment	Consultation with workers and concerned stakeholders prior to displacement.	• ComRel • Admin		
		Generation of local benefits (Loss of revenue)	Legal and formal discussions with LGU prior to abandonment	• ComRel • LGU		
		Threat to public health and safety (hazards on the existing mine)	Provision of proper signages/notices.	• Safety group		

5 Social Development Plan and IEC Implementation

Rio Tuba Nickel Mining Corporation

This chapter includes discussion on the existing projects/programs under the Social Development Plan (SDP) being implemented by the Rio Tuba Nickel Mining Corporation (RTNMC) and the course of action to be taken that will further improve the SDP based on the assessment of the socio-economic baseline data presented in *Chapter 2*. Also included in this chapter is the current Information, Communication, and Education (IEC) campaigns and the proposed components to be adapted specifically for Gotok Limestone Quarry Project.

5.1 SOCIAL DEVELOPMENT AND MANAGEMENT PROGRAM (SDMP)

Under the Mining Act, a mining company should have a five (5)-year Social Development and Management Program (SDMP) approved by the Mines and Geosciences Bureau (MGB). RTNMC implemented SDMP I for 2004-2008 and SDMP II for 2009-2013. The implementation of SDMP III (2014-2018) presently known as the Poverty Alleviation Program has begun after various consultations have been conducted in the direct and indirect impact barangays as well as in the 24 Indigenous Cultural Communities (ICC). The bottom up approach has elicited various issues and concerns as well as lessons from previous projects and programs. RTNMC and various stakeholders are in agreement that the focus of SDMP III will be economic empowerment, weaning off the residents from the dole-out approach that previously characterized the past two (2) SDMPs. Identified projects and programs that are ill-fitted to include in SDMP III may be included as non-SDMP projects.

It should be pointed out that the needed infrastructure for economic activities are already in place, compliments of RTNMC such as an airport, pier, roads, bridges, water supply, irrigation system, and power. RTNMC also delivered or augmented many of the basic social services in the fields of education, health, social services and private companies have provided the needed communications which is vital in any business endeavor. Hence, it is but logical that the focus of SDMP III would be for the economic empowerment of the stakeholders of Bataraza to address poverty.

The three (3) DIA (Direct Impact Area) barangays of the Gotok quarry operations are included in the approved SDMP III. Barangay Rio Tuba is the host barangay of the majority of the facilities and operations of RTNMC, hence the budget allocated to Brgy. Rio Tuba represents allocations as host community for the RTNMC and CBNC operations. The crushing plant which is a component of the Gotok quarry is located in Brgy. Rio Tuba, therefore, it is impossible to disaggregate the portion of the crushing plant in the SDMP budget allocated for the said barangay. However, for the two (2) barangays in the quarry area – Brgys. Iwahig and Sandoval, it can be safely assumed that all amounts allocated for them arose due to the contribution of the quarry operations.

The SDMP III budget allocated for Brgy. Iwahig amounted to PhP 31.88 M for a five (5)-year period. In terms of sectoral allocation, human resource development was given the biggest share of PhP 8.89 M, followed by education with PhP 7.57 million. Livelihood was given an allocation of PhP 5.25 M for 2014 and 2015. In terms of releases, 2014 was provided with the largest target release of PhP 11.85 M; the yearly target amount is gradually decreasing each year until in 2018 where the budgeted amount will only become PhP 2.7 M. Physical Accomplishment for 2014 SDMP budget was 93% while the Financial Accomplishment was recorded at 73% as of September 2015.

The SDMP budget for Brgy. Sandoval amounted to PhP 25.59 M for a five (5)-year period. In terms of sectoral allocation, education was given the biggest share of PhP 8.03 M, followed by livelihood with PhP 7.04 M. Around 86% of the budget will be released for the first two (2) years. Year 2014 was given the largest target release of PhP 8.08 M; the yearly amount gradually decreases each year until 2018 where the budgeted amount will only become PhP 2.50 M. **Table 5.1.1** shows the budget allocation for the three (3) DIA barangays in SDMP III.

Table 5.1.1. SDMP III budget allocation for the three (3) DIA barangays

Barangay/ Sector	Date of Implementation/Release					Total
	2014	2015	2016	2017	2018	
Iwahig						
Livelihood	5,050,000	200,000	-	-	-	5,250,000
Education	1,460,000	1,580,000	1,910,000	1,310,000	1,310,000	7,570,000
Health	2,047,700	1,300,000	1,450,000	1,389,000	1,290,00	7,476,700
Human Resource Devt.	2,492,900	3,457,900	1,199,145	1,167,900	567,900	8,885,745
Land Use & Environment	800,000	900,000	400,000	300,000	300,000	2,700,000
Sub-total	**11,850,600**	**7,437,900**	**4,959,145**	**4,166,900**	**3,467,900**	**31,882,445**
Sandoval						
Livelihood	4,045,000	2,000,000		1,000,000		7,045,000
Education	1,459,000	1,908,618	1,752,000	1,152,000	1,152,000	8,038,618
Health	1,357,000	1,352,000	1,152,000	742,000	652,000	5,255,000
Human Resource	650,000	1,740,000	195,000	100,00	450,000	3,135,000
Land Use & Environment	570,000	500,000	500,000	300,000	250,000	2,120,000
Sub-total	**8,081,000**	**7,500,618**	**3,599,000**	**3,294,000**	**2,504,000**	**25,593,618**
Rio Tuba						
Infrastructure	4,050,000	3,400,000	900,000	50,000	50,000	8,450,000
Health	4,301,000	2,106,000	2,066,000	1,666,000	1,666,000	11,805,000
Education	6,143,000	5,478,000	5,403,000	5,403,000	5,403,000	22,427,000
Livelihood	1,220,000	700,000	175,000	100,000	100,000	2,295,000
Peace and Order	1,500,000	1,440,000	1,280,000	1,240,000	1,280,000	6,740,000
Environmental Management	938,000	1,431,000	937,000	931,000	937,000	5,174,000
Brgy SDMP Administration	1,810,000	1,310,000	1,810,000	1,310,000	1,810,000	8,050,000
Others	1,680,000	680,000	680,000	680,000	680,000	4,400,000
Sub-total	**21,642,000**	**16,545,000**	**13,251,000**	**11,380,000**	**11,926,000**	**69,341,000**
Total (Php)	**41,573,600**	**31,483,518**	**21,809,145**	**18,840,900**	**17,897,900**	**126,817,063**

Source: RTNMC Community Relations Office, 2014

Barangay Rio Tuba was given the largest SDMP budget amounting to PhP 69.341 M for a 5-year period or an average of PhP 13 M a year. As mentioned earlier, the barangay is host to almost all of the facilities of RTNMC including the stockpile area, RTNMC economic zone, loading and unloading facilities, Macadam Road, power plant and other support facilities and the whole CBNC complex, hence, it is appropriate that the largest amount be allocated to this barangay.

The sector with the largest budget allocation is education with PhP 22.42 M. This is followed by health with PhP 11.805 M, and infrastructure with PhP 8.45 M. There are also items that are not part of the budget allocation of the other two (2) barangays such as peace and order (PhP 6.74 million), barangay SDMP administration (PhP 8.05 million), and others (PhP 4.4

million). The budget for livelihood is PhP 2.57 million. As in the budget allocation for the other two (2) barangays, the amount gradually decreases toward the end of SDMP III.

Provided as **Annex 5.1.1** is the matrix of the implementation status of the SDMP projects for the last five (5) years (2011-2015).

Projects for the Indigenous People under the SDMP

RTNMC has programs for the indigenous people, composed mainly of the *Palaw'an* tribe, within the direct and indirect impact areas. This development program is composed of (a) access to education and educational support program; (b) access to health services, facilities and professionals; (c) assistance of infrastructure development and support services; and (d) enterprise development and networking.

The access to education and educational support program consisted of sponsorship to RTNMC scholars in the elementary, high school and college levels, school supplies, improvement of existing learning facilities, payment of legal fees, honoraria for additional teachers. This program enabled deserving students to graduate and find jobs within RTNMC or in other companies. From 2014 to 2017, the educational programs provided by RTNMC amounted to PhP 2,806,454.86. The summary per year is shown in **Table 5.1.2**. The details of each program are shown in **Annex 5.1.2**.

Table 5.1.2. Summary of the actual expenditures for the projects/programs for the IPs

Programs	2014	2015	2016	2017	Total (PhP)
Educational Programs	799,017.48	770,926.22	1,042,016.63	194,494.53	2,806,454.86
Health Programs	107,132.56	169,389.29	50,916.39	369,466.40	696,904.64
Infrastructure Development	324,777.48	55,476.40	9,006.81		389,260.69
Enterprise Development	120,048.14	368,172.67	4,424.20	805,194.70	1,297,839.71
Total (PhP)	**1,350,975.66**	**1,363,964.58**	**1,106,364.03**	**1,369,155.63**	**5,190,459.90**

The access to health services, facilities and professionals consisted to supply of medicines, improvement of health facilities and medical referrals made and sponsored by RTNMC to other medical facilities outside of its hospital. These enabled IPs to have better health conditions because of availability of health services and facilities. The total amount disbursed from 2014 to 2017 amounted to PhP 696, 904.64.

Assistance to infrastructure development and support services consisted of construction/ rehabilitation of halls, buildings and post-harvest facilities, supply of farm implements and water supply. These were constructed/bought exclusively to the IPs in Barangays Sandoval and Iwahig and amounted to PhP 389, 260.69.

Enterprise development and networking involved the provisions for farm inputs, trainings on organic farming, cattle raising including goats and carabao dispersal, chicken raising, supply of hand tractors. These enabled IPs to have better farm harvests and outputs and improved their standards of living.

5.2 SOCIAL DEVELOPMENT PLAN

The Social Development Plan Framework of RTNMC is presented as **Table 5.1.1**. The framework covers projects concerning economic assistance, health and safety, education, social services and infrastructure development funded thru SDMP and the Community

Relations Assistance (CRA). Identified projects and programs that are not consistent with the framework and objectives of SDMP III may be included as non-SDMP projects.

Presently, the SDMP is being handled by both the RTNMC and CBNC while the non-SDMP programs are being handled by the CRA Office. The ComRel Office of RTNMC is in-charge of CRA, a special mechanism funded by both RTNMC and CBNC to address other needs of the communities, which are not embodied in the SDMP programs/projects.

5.2.1 Economic Assistance

5.2.1.1 Agricultural Assistance

The terms of economic base of Bataraza, Brgy. Rio Tuba is agriculture. Considering that the town and Brgy. Rio Tuba is an agricultural area with around 22,500 ha, assistance in the sector will have a significant impact to the population. In addition, nickel ore is a finite resource and would be depleted through time in Bataraza. It would be very prudent if RTNMC would wholeheartedly support this sector in preparing the stakeholders to continue their lives without the mine. The main strategy is to increase the inputs of existing farms and tap the uncultivated agricultural land in the municipality.

Key informants from the municipal as well as the barangay level have emphasized the obvious decrease of crop production over the years citing high cost of inputs as well as lack of support facilities as major reasons for the trend. According to the local government officials, agricultural support will have significant and long-term positive impact on the local economy, where majority of the population is still dependent on agriculture.

The proponent may address the gaps in the agricultural sector by being the conduit of technology transfer, partially subsidizing farm inputs (seeds, fertilizers and pesticides) for a limited duration, provide the needed pre- and post-harvest facilities (for rice, coconut and corn), and provide the marketing linkages for these agricultural products.

Active farmers groups and associations can be tapped to implement these types of programs. Capacity to implement, operate and maintain projects should be one of the criteria for choosing a beneficiary group. There are local government offices such as the Department of Agriculture (DA), Provincial and Municipal Cooperative and Economic Development Offices that are willing to give training assistance to enhance or build capacity of the farmers. Any form of assistance should require an equity or counterpart from the beneficiary group to ensure ownership and responsibility on the project. All projects should require a reporting system for progress monitoring and technical support should be available.

Marketing support for the three (3) major crops may be extended to enable farmers to earn more by partially by-passing middlemen who often earn more than the farmers. To wean off the farmers from middlemen, RTNMC may establish an agricultural fund to provide loans for pre-selected farmers. It is usual that middlemen supply the necessary credit to farmers during planting season provided that the farmers will sell their agricultural produce to the middlemen. To break this cycle, RTNMC may extend loans not to individual farmers but to farmer groups with a group guarantee to pay collectively the loans in cases of default.

The municipality has partnerships with some institutions like the International Rice Research Institute (IRRI) and Philippine Rice Research Institute (PhilRice). In addition, there is the Palawan State University (PSU) that can also assist the agricultural sector. To increase the likelihood of success in implementing projects, these types of institutions that have expertise in the sector can be tapped. This will also maximize and provide complementation of the available resources of private and government institutions.

5.2.1.2 Agro-forestry Assistance

Around 33,000 ha are classified as forest land in Bataraza and out of this total, around 13,000 ha are classified as production forest while the balance of around 20,000 ha are classified as protection forest. RTNMC may engage a third party to conduct a study on how to sustainably utilize the production forest, taking into consideration the present occupants, terrain, soil suitability, accessibility, suitable timber/fruit tree species and their corresponding demands. The study should include how residents would participate in these agro-forestry initiatives and provide additional household income. The study should also cover the feasibility of utilizing fruit trees as part of the reforestation projects considering that people would be reluctant to cut trees if their fruits would be more valuable that the timber. Special consideration should be undertaken to ensure that the proposed projects and programs would strictly comply with the provisions of the Strategic Environmental Plan (SEP) Law and other pertinent regulations.

Initially, the budget for this master study on forest land may be taken from the annual budget of EPEP as part of project management. However, viable projects and programs should receive their separate budget allotments either from the proposed SDMP or non-SDMP programs.

5.2.1.3 Coastal Livelihood Assistance

There are 18 coastal barangays in Bataraza with around 900 households relying on the sea as their primary source of income. Fishing is the secondary source of income for the whole municipality. The fishing grounds of Bataraza are large beginning in the boundary with Brooke's Point to the southern tip of mainland Palawan. In addition, there are around 7,000 ha classified as mangrove and nipa areas within Bataraza.

Possible interventions of RTNMC would be the identification of potential municipal marine sanctuaries that would serve as nurseries for different fish species, possible areas for the establishment of artificial reefs, protection and utilization of mangrove areas such as mud crab fattening and other similar livelihood projects. It is important that these activities would provide additional household income to the participants of any marine project or program. RTNMC may engage an expert third party who will conduct the marine protection and utilization study and recommend specific sustainable plans especially suited to the marine environment of Bataraza.

5.2.1.4 Home-based Livelihood Assistance

Based on the CLUP of Bataraza, poultry and livestock are raised in the backyards of residents basically to supply the requirements of their respective communities. These poultry and livestock products are either consumed by households and/or sold to local buyers. RTNMC should evaluate the possibility of enhancing the capabilities of participating households to increase their household income through sustainable livestock dispersal projects.

There may be other projects that residents may identify to be viable and sustainable. These projects may be supported not through grants but through soft loans as preparatory activities to wean off their dependency from the company.

5.2.1.5 Capacity Building

Success of livelihood projects is greatly dependent on the preparedness of the beneficiary group in terms of capability to conduct project planning or development, manage day to day operations, fund management, as well as regular monitoring and assessment of the project. RTNMC shall continue to provide trainings based on the local needs and interests, such as skills-development or enhancement, small business or financial management, basic bookkeeping and accounting, and values formation, etc.

RTNMC shall continue to coordinate with the government or private agencies that have the expertise to provide the identified training needs. These agencies may include TESDA, Palawan or Bataraza Cooperative and Economic Development Office, among others. As part of its undertaking to enhance the capability of the population in the defined impact area, the company's SDP shall also provide farmer's assistance in the form of technology transfer. Other bureaus of the Department of Agriculture (DA) shall also be considered in providing updated technology and information to the farmers, which should include climate change adaptation and mitigation.

5.2.2 Employment Assistance

5.2.2.1 Economic Assistance through Direct Employment

RTNMC will continue to implement a gender responsive employment policy. In consonance with this policy of giving priority to local residents, RTNMC shall continue to ensure that job vacancies are advertised and notice or announcements are posted in conspicuous places in the locality. Residents who meet the minimum qualification but lack work experience shall be trained to increase the chance of employability. Likewise, to create additional business opportunities for the local entrepreneurs, RTNMC shall continue to encourage the participation of the local suppliers in all aspects of its mine development. The company will ensure that local groups or individual suppliers are invited to bid on job contracts for services as well as material procurement during the different project phases. Opportunities for the elderly and Persons with Disabilities shall also be considered through the provision of livelihood programs that will boost their morale as members of the community. Benefitting projects shall be established to train these individuals at the level of their capacity and capability.

5.2.2.2 Economic Assistance through Indirect Employment

RTNMC is utilizing sub-contractors such as security and janitorial services. RTNMC should compel its sub-contractors to prioritize local employment. This will offer lower labor costs, accessibility and familiarity with the area and residents.

5.2.3 Health and Safety

RTNMC shall continue the operations of the RTNFI Hospital in Rio Tuba under the present set-up, providing quality health services to the general population of Bataraza especially to senior citizens, IPs and persons with disabilities. It will continue to conduct medical support especially to far-flung barangays, complementing the delivery of health services by the Rural Health Unit (RHU) of Bataraza and the Barangay Health Stations (BHS).

On the other hand, RTNMC may be amenable to further empower and capacitate the rural health unit (municipal level) and barangay health stations (barangay level) to slowly assume the lead in providing primary health care in Bataraza, weaning off the residents' dependency on RTNFI Hospital. Based on the records of the hospital, out of 227, about 193 patients were served from 2004 to 2011 (excluding 2005), around 7% of these patients were admitted while 93% were outpatients.

If the BHS and RHU were functioning and had the proper medical personnel, equipment and medicines, the number of outpatients seeking medical treatment will be treated properly.

Hence, as part of empowering not only the residents but also increasing the capacities of local government units, RTNMC may consider partial "devolution" of its medical services by assisting and enhancing the capacities of the municipality and the barangays in addressing the less serious medical cases of the residents of Bataraza.

If the municipality is amenable, the operational upgrade of barangay health stations may be started by clustering adjacent barangays and upgrading certain barangay health stations as intermediate medical facilities before cases are forwarded to the hospital for further treatment. These selected barangay health stations would be the priority areas for medical upgrade, in terms of medical personnel, infrastructure, equipment and medicines.

This re-organization on the delivery of medical services would (a) decongest the patients seeking medical services in the hospital; (b) enable the hospital to focus on the more serious medical cases; (c) provide better access to patients, saving time and money spent for transport to Rio Tuba; (d) focus in addressing prevalent preventable diseases in the communities (malaria, tuberculosis, cholera and diarrhea); (e) empower and capacitate LGUs in fulfilling their legal mandate to provide primary health care; and (f) prepare the residents to be self-reliant and independent of the mine.

5.2.4 Education

RTNMC shall continue to implement its existing projects and programs in the field of education, particularly the operation of the LS Virata Memorial School, Indigenous Learning System (ILS), and SDMP scholarships. The following paragraphs briefly describe these educational components:

Leonides S. Virata Memorial School - The Leonides S. Virata Memorial School (LSVMS) is a Catholic private school operated by RTNFI under the supervision of University of St. La Salle. Established in 1986, the school offers Kindergarten, Elementary and High school educational services to 1,403 students on a merit system. Sixty-nine percent of the students are dependents of CBNC, RTNFI, or RTNMC; while 31% are non-dependents. The school envisions a globally competitive community that is founded on the genuine La Salle virtues at the service of others. In 2013, it had a manpower complement of 68 faculty and staff.

Indigenous Learning System - Beyond the formal educational system, RTNMC with the help from CBNC initiated the Indigenous Learning System (ILS), which is an alternative literacy program designed specifically for ICCs in Bataraza. Indigenous Peoples (IPs) in Bataraza comprise a considerable percentage of the municipal population but are the most vulnerable of the different population groups in the municipality. The ILS was formally launched in 21 September 2006 with the vision of helping IPs educate themselves. The ILS mission goals are to eradicate illiteracy among IPs; raise the level of functional literacy of the indigenous people; finish the equivalency of elementary and high school levels of education; hone employable skills to become more productive and effective citizens; and, develop proper values and attitude necessary for personal, community and national development. As of 2015, there are 34 ILS sites in 11 barangays with a total of 1,683 enrollees spread across three (3) levels.

SDMP Scholarships - An integral component of the SDMP is the scholarship program. The SDMP has supported an increasing number of College students who graduated from a total of 85 college graduates during SDMP 1 (2004-2008) to 145 graduates during SDMP II (2009-2013). SDMP III has already produced 40 college graduates as of 2014.

As previously discussed, some kind of leveling off may be helpful to correct the impression that educational scholarships were extended to beneficiaries primarily to create a pool of qualified workers for RTNMC. The primary aim of educational scholarships is to equip qualified and deserving students who lack the financial resources to complete their collegiate courses to become better citizens in nation building. The provision of scholarships is to help the poor but deserving students complete their studies and to have better chances to improve their lives. Employment in RTNMC is only an additional benefit if there are available positions that fit the scholars' educational background.

5.2.5 Social Services

RTNMC had provided ambulance service, fire-truck, multi-cabs, motorcycles with sidecars, electric generators, petromax, I-Com radios, and cell phones to assist in the development of the affected communities in SDMP I and II (2004 – 2012) and currently through SDMP III. While these provisions helped in facilitating community development, they are subject to loss of value and depreciation and benefited only a limited number of stakeholders.

It would be judicious in terms of disbursement if provisions of this nature would be minimized to the really important purchases and instead commit financial resources to basic services such as water supply. In built-up areas, water system similar to the water system covering the six (6) barangays of Ocayan, Sandoval, Culandanum, Iwahig, Igang-igang and Sarong should be emulated and developed. FGD participants recommended to establish a similar water supply project in southern barangays of Taratak and Sumbiling. Barangay leaders vowed to have this water supply project included in SDMP III for their barangays. In isolated clusters, RTNMC may consider providing water supply through provisions of impounding systems from nearly springs, water tanks and water pumps, if feasible.

Access to water is a basic necessity for a household and usually, women have the responsibility to fetch water for the family. Depending on the distance, the time used for getting water may be used for more productive activities that would generate additional income for the household. Access to water is so important that it also included as an indicator of non-income measurement of poverty.

5.2.6 Infrastructure Development

RTNMC had, through two (2) phases of SDMP, provided various infrastructure projects to the 11 affected barangays and 24 ICCs, both in SDMP I and II (9 years) such as day care centers, health centers, tribal halls, road repairs, gym and plaza, public library, irrigation system, multi-purpose pavements, church/mosques repair, and other public buildings. Majority of these infrastructure projects were the responsibilities of different government agencies such as Departments of Health (DOH), Agriculture (DA), Public Works (DPWH), Social Welfare (DSWD), National Irrigation Administration (NIA), and LGUs. These voluntary infrastructure interventions of RTNMC are very admirable and helpful toward the realization of a progressive municipality and this is being nurtured continuously through the implementation of SDMP III.

RTNMC can now focus on the needed economic infrastructure that will increase the household income in Bataraza such as post-harvest facilities. In one of the FGDs conducted, some participants pointed out that their rice harvests are adversely affected when heavy rains come during the harvest season.

The participants shared their dreams of having a multi-purpose dryer using agricultural waste as fuel that can be used for their rice, corn and even coconut harvests. These dryers will increase and improve the quality of their farm harvests and will consequently augment their household income because of lesser spoilage and higher selling prices of their products. In the production side, residents will be encouraged to plant more because they have the assurance that their products will reach the markets in good condition.

RTNMC should seriously investigate the economic infrastructure needs of the communities because ordinary residents are aware of these deficiencies such as irrigation systems for farmers and fishing equipment and processing facilities for fisherfolk. RTNMC should endeavor to address the infrastructure gaps of the communities which government agencies cannot provide. Government agencies will not provide these needs because their mandates are limited to infrastructure such as health centers, schools, and day care centers.

Table 5.2.1. Social Development Plan (SDP) Framework

Concern	Responsible Community Member/ Beneficiary	Government / Non-Government Agency	Proponent	Timeline	Source of Fund
Economic Component					
Agricultural Assistance	Farmers Cooperatives or Associations in Barangay Rio Tuba and other affected barangays	Department of Agriculture (DA); Cooperative and Economic Development Office (CEDO) (province & municipal); and	RTNMC ComRel Office	From expansion to abandonment	Shall be part of the RTNMC SDMP Program; un-programmed portions from non-SDMP budget

Concern	Responsible Community Member/ Beneficiary	Government / Non-Government Agency	Proponent	Timeline	Source of Fund
		Other Groups			
Agro-Forestry Assistance	Farmers Cooperatives or Associations in Barangay Rio Tuba and other affected barangays	Department of Environment and Natural Resources, Forest Management Bureau	RTNMC ComRel Office	From expansion to abandonment	Initially, planning under EPEP budget, project components part of the RTNMC SDMP and non-SDMP budget
Coastal Livelihood Assistance	Fishermen's Cooperatives or Associations in Barangay Rio Tuba and other affected barangays	Bureau of fisheries and Aquatic Resources	RTNMC ComRel Office	From expansion to abandonment	Shall be part of the RTNMC SDMP Program; un-programmed portions from non-SDMP budget
Home-Based Livelihood Assistance	Farmers, Fishermen and Neighborhood Associations in all affected barangays	Department of Trade and Industry (DTI), barangay officials	RTNMC ComRel Office	From expansion to abandonment	Shall be part of the RTNMC SDMP Program; un-programmed portions from non-SDMP budget
Capacity Building	Cooperatives, Associations and Organizations; Barangay Leaders of Rio Tuba & Workers/ Qualified working-age group in Rio Tuba including Indigenous People	TESDA, DTI, DA, CEDO, other relevant agencies	RTNMC ComRel Office / CSR Office / Community Organizer; Human Resources Department	From expansion to abandonment	Shall be part of the RTNMC SDMP Program; un-programmed portions from non-SDMP budget
Employment Assistance					
Direct Employment (including referral System and Job Advertisements at Conspicuous Places, programs for the Elderly and Senior Citizens)	Barangay Leaders of Rio Tuba nearby barangays & Workers/ Qualified working-age group population of the concerned barangays and sitios, Senior Citizens Group and Persons with Disabilities	Department of Labor and Employment (DOLE)	RTNMC ComRel Office; Human Resources Department	From expansion to abandonment	Shall be part of the RTNMC SDMP Program; un-programmed portions from non-SDMP budget
Indirect Employment	Barangay Leaders of Rio Tuba nearby barangays & Workers/ Qualified working-age group population of the concerned barangays and sitios, Senior Citizens Group and Persons with Disabilities	Department of Labor and Employment (DOLE)	RTNMC ComRel Office; Human Resources Department Sub-contractors of RTNMC	From expansion to abandon-ment	Shall be part of the RTNMC SDMP Program; un-programmed portions from non-SDMP budget
Health and Safety					
Continue operations of RTNFI Hospital Medical	Bataraza RHU & BHS of Rio Tuba/ Residents (Adult and Children), Senior Citizens, and	Department of Health (DOH) and other Partner Private	RTNMC ComRel Office, RTNFI,	From expansion to abandon-ment	Shall be part of the RTNMC SDMP Program; un-programmed

Concern	Responsible Community Member/ Beneficiary	Government / Non-Government Agency	Proponent	Timeline	Source of Fund
Missions, Information Campaign on Health Concerns	Persons with Disabilities	Medical Companies & NGOs	Health & Safety Office		portions from non-SDMP budget
Empowerment of RHU and BHS	Bataraza RHU & BHS of all affected barangays	DOH and other Partner Private Medical Companies & NGOs	RTNMC ComRel Office, RTNFI, Health & Safety Office	From expansion to abandon-ment	Shall be part of the RTNMC SDMP Program; un-programmed portions from non-SDMP budget
Education					
Continue operation of LS Virata Memorial School	Principal, Teachers or Officers of Schools/ students from LSVMS	DepEd, La Salle	RTNMC ComRel Office	From expansion to abandon-ment	Shall be part of the RTNMC SDMP Program; un-programmed portions from non-SDMP budget
Continue operations of Indigenous Learning System (ILS)	Indigenous Cultural Communities	NCIP, DepEd,	RTNMC ComRel Office	From expansion to abandon-ment	Shall be part of the RTNMC SDMP Program; un-programmed portions from non-SDMP budget
Continue Educational Scholarships	Principal, Teachers or Officers of Schools/ students from LSVMS	CHED, Participating universities and colleges	RTNMC ComRel Office	From expansion to abandon-ment	Shall be part of the RTNMC SDMP Program; un-programmed portions from non-SDMP budget
Social Services					
Water Supply Projects	Municipal Engineer Barangay Officials/ Sitio Leaders/ IP Leaders/ Barangay Health Workers/ Residents	Municipality of Bataraza, Department of Public Works and Highways (DPWH), RHU, and Other concerned	RTNMC ComRel Office	From expansion to abandonment	Shall be part of the RTNMC SDMP Program; un-programmed portions from non-SDMP budget
Utilization of Senior Citizens in SDMP projects	All senior citizens in the affected barangays	DSWD	RTNMC ComRel Office	From expansion to abandonment	Shall be part of the RTNMC SDMP Program; un-programmed portions from non-SDMP budget
Infrastructure Development					
Economic Infrastructure	Farmers', Fishermen, barangay officials and residents of all affected barangays	DTI, DA, BFAR, Municipal and barangay officials	RTNMC ComRel Office	From expansion to abandonment	Shall be part of the RTNMC SDMP Program; un-programmed portions from non-SDMP budget
Disaster Preparedness Program					
Emergency	Barangay officials, IP Leaders,	Local Disaster Coordinating	RTNMC ComRel	From expansion to	Shall be part of the RTNMC

Concern	Responsible Community Member/ Beneficiary	Government / Non-Government Agency	Proponent	Timeline	Source of Fund
	Principals/Teachers, Barangay Health Workers/ Residents	Council	Office, Safety	abandonment	SDMP Program; un-programmed portions from non-SDMP budget

It should be noted that almost all of the components of the SDP framework such as education, health and safety, social services, infrastructure development and some sub-components of the economic component are already adopted in SDMP III in the form of specific projects in the three (3) DIA barangays.

There are also budget items within SDMP III that are not covered by the SDMP framework such as budget allocations for barangay site development plan, land titling in Iwahig and Sandoval, support for maintaining peace and order, environmental management, land acquisition for community facilities such as day care center, basketball court and a materials recovery facility.

The projects contained in SDMP III are fruits of comprehensive and extensive consultations involving all sectors in the barangays. The stakeholders have identified their needs and priorities and these are contained in SDMP III.

5.3 SOCIAL DEVELOPMENT PLAN FOR IPS

The proposed SDP contained in the *Section 5.2* covers the whole population of the three (3) impacted barangays of Rio Tuba, Iwahig and Sandoval including the IPs, predominantly the Palaw'ans. However, in addition to the general SDP, the following paragraphs contain additional SDP provisions for the IPs specifically residing in these three (3) barangays.

5.3.1 Educational Support

Indigenous Learning System - Beyond the formal educational system, RTNMC with the help from CBNC initiated the Indigenous Learning System (ILS), which is an alternative literacy program designed specifically for ICCs in Bataraza. Indigenous Peoples (IPs) in Bataraza comprise a considerable percentage of the municipal population but are the most vulnerable of the different population groups in the municipality. The ILS was formally launched in 21 September 2006 with the vision of helping IPs educate themselves. The ILS mission goals are to eradicate illiteracy among IPs; raise the level of functional literacy of the indigenous people; finish the equivalency of elementary and high school levels of education; hone employable skills to become more productive and effective citizens; and, develop proper values and attitude necessary for personal, community and national development. As of 2015, there are 34 ILS sites in 11 barangays with a total of 1,683 enrollees spread across three (3) levels.

RTNMC shall continue this Indigenous Learning Program by adopting this in their SDMP and allocating the sufficient funds from non-SDMP budget. This program will be undertaken in coordination with NCIP and the Department of Education. This can be supervised by the ComRel Office of RTNMC.

5.3.2 Preservation of Indigenous Cultural Identity

Based on the FGDs and KIIs, there are active and deliberate efforts by some tribal elders to preserve their cultural identity by buying back their musical instruments and teaching some promising youth to learn to play these musical instruments. Some informants related their communal efforts to buy back their ancestral lands lot by lot from their royalties that they receive from RTNMC. There are some GK areas where the circular pattern of the Palaw'an is still evident and reflective of their traditional spatial orientation.

These efforts are very laudable but would require a master plan to retain, preserve and reflect their cultural identity. Primarily, the *Palaw'an* would need to document their cultural traditions and efforts are being made by some students in the ILS to document these traditions.

It is recommended to RTNMC and the tribal leaders that a full blown ethnographic study be undertaken to document these traditions and a centralized tribal museum be established to house the cultural artifacts that may be gathered by the tribe. There are still some tribal elders that are still living who are very knowledgeable to their customs and traditions. Some members of the tribe may undergo training on the different aspects of ethnography and operations of a tribal museum.

It will be part of the SDMP and shall be funded from the non-SDMP budget. It will be undertaken in coordination with NCIP and the National Museum with the assistance of ComRel Office of RTNMC.

5.3.3 Mitigation of Unintended Consequences of Development

RTNMC has existing active community interventions such as employment generation and its various programs and projects in education, the perceptions in Brgy. Rio Tuba, the primary recipient, is better than the rest of the direct and indirect impact barangays. However, based on the results of the survey, there are unintended consequences of development such as prostitution, gambling and alcoholism. These are manifestations of surplus money earned from the mining operations which found their ways into unscrupulous persons who also take advantage of the financial benefits coming from the mining operations.

While these perceived social issues are police or social welfare issues, RTNMC may further discourage the proliferation of these vices through administrative means and support the appropriate government agencies tasked in eradicating or minimizing these social ills through collaborative efforts, support on equipment and logistics to make these agencies more efficient.

The company and residents of Brgy. Rio Tuba had become aware of these social problems and are trying to address these by providing support to maintain the peace and order conditions in Bataraza especially in Rio Tuba. There is an allocation of PhP6.74 million for SDMP III under the peace and order program of Bataraza and PhP1.2 million a year is allocated as incentive for 40 barangay security officers. This highlights the support of RTNMC not only in basic services but also in maintaining the peace and order condition of Brgy. Rio Tuba.

RTNMC shall continue to provide funding support for Bataraza as was done in SDMP III. ComRel shall coordinate with the pertinent municipal officials to ensure that the unintended consequences of development in Bataraza are sufficiently addressed.

Table 5.3.1. Social Development Plan Framework for IPs

Concern	Responsible Community Member/ Beneficiary	Government / Non-Government Agency	Proponent	Timeline	Source of Fund
Continue operations of Indigenous Learning System (ILS)	Indigenous Cultural Communities	NCIP, DepEd,	RTNMC ComRel Office	From expansion to abandon-ment	Shall be part of the RTNMC SDMP Program; un-programmed portions from non-SDMP budget
Preservation of Indigenous Cultural Identity	Indigenous Cultural Communities	NCIP, National Museum	RTNMC ComRel Office	From expansion to abandonment	Shall be part of the RTNMC SDMP Program; un-programmed portions from non-SDMP budget
Mitigation of unintended consequences of development	Indigenous Cultural Communities	Municipality of Bataraza, barangays of Rio Tuba, Iwahig and Sandoval.	RTNMC ComRel Office	From expansion to abandonment	Shall be part of the RTNMC SDMP Program;

5.4 INFORMATION, EDUCATION AND COMMUNICATION (IEC) FRAMEWORK

From the start of its operation up to the present, the Gotok Limestone Quarry was part of the scope of the overall IEC activities of RTNMC because the company retained its ownership and responsibility over the quarry operations. It should be pointed out that Brgy. Sandoval was included in the DIA area of the nickel mining project of RTNMC because of the presence of the quarry in Gotok which subsequently has a territorial dispute with Brgy. Iwahig – both claiming that the quarry is within their respective territorial jurisdictions. Hence, the Solomonic decision was to name the two (2) barangays as host barangays of the quarry operations without prejudice to any decision on who is really the host barangay.

The matrix below (**Table 5.4.1**) was culled from the general IEC activities conducted by the RTNMC in the last two (2) years to show specific information campaigns in the quarry area. Provided as **Annex 5.4.1** is the matrix of the implementation status of the IEC activities for the last five (5) years (2011-2015).

Table 5.4.2. Information, Education and Communication (IEC) Matrix for 2011 – 2013

Year Implemented	IEC Project or Activity	Number/ Type of Audience	Medium Used
2011-2013	Regular IEC in Barangays Sandoval and Iwahig (Presentation of the Company's operation and SDMP accomplishment)	Community residents (IP and Non-IP) Averaging 80 persons	meeting
2013	IEC for the granting of cutting permit	Community residents	Community consultation
2013	Barangay Development Planning (BDP) Presentation of the SDMP II accomplishment	Barangay & tribal Council, PO's, teachers,	meeting

Year Implemented	IEC Project or Activity	Number/ Type of Audience	Medium Used
	and eradication program of the company (meetings)	health workers; About 70 persons	
2013	FGD regarding Gotok quarry expansion	PO leaders, Barangay Council (10-15 persons)	FGD
2014	Regular IEC in Brgys. Sandoval and Iwahig (SDMP III Presentation and EPEP initiatives)	BLGU officials, PMC and residents	Meeting/ Forum
2014	Annual SDMP Planning and consultation for 2015 SDMP	BLGU officials and PMC members	Consultation Forum
2015	Regular IEC in Brgys. Sandoval and Iwahig (SDMP III Status and EPEP initiatives)	BLGU officials, PMC and residents	Meeting/ Forum
2015	Annual SDMP Planning and consultation for 2016 SDMP	BLGU officials and PMC members	Consultation Forum

Source: RTNMC ComRel

RTNMC shall ensure that the stakeholders are informed about the project, its status and activities by maintaining regular communication through various media. Considering that both the nickel mining and quarry operations are owned and operated by RTNMC, it is recommended that the IEC framework and plan for the nickel mining operation be expanded to accommodate the quarry operations - meaning that the IEC of the quarry be subsumed under the IEC for the nickel mining operations. Hence, the recommended IEC mode for the nickel mining operation is shown in the following paragraphs and made integral part of this report.

Project activities from pre-construction to operation phase will be documented and shared with the project stakeholders through the company's IEC Program. The IEC activities shall include consultation meetings with the use of audio-visual presentation (AVP); timely releases of monitoring reports, distribution of handouts, and community relations work which may include among others presence in or sponsorship of community activities. A regular venue where information can be gathered and disseminated is the Multi-Partite Monitoring Team (MMT), which has been set-up for RTNMC and CBNC.

5.4.1 Target Sector

The primary audiences of the IEC are the project stakeholders, including the following:

- LGU officials and community leaders from the Province of Palawan, Municipality of Bataraza and Barangays Iwahig, Sandoval and Rio Tuba;
- Local NGOs and other interest groups; and
- Schools, health centers and other concerned government and private agencies.

5.4.2 Overall Scheme

The IEC Program Strategy shall use:

- One-way delivery of messages, facts and statements through the use of handouts, AVP and reports; and
- Two-way exchange of opinions, facts, statements, or sentiments about the messages through multi-partite meetings or group discussions.

5.4.3 Message

The topics to be covered in the IEC activities shall include the project and the processes involved, results of the self-monitoring activities conducted by RTNMC as well as the MMT and the company's performance in complying with the conditions of the ECC and other agreements that may be arrived at during the project life. Likewise, efforts to protect the environment and apply conservation methods shall be reported and disseminated through the IEC. Discussions with concerned individuals or institutions, as beneficiaries or as implementing partner, during the planning, implementation, monitoring or evaluation of the programs identified in the SDP shall also be part of the IEC program.

5.4.4 Timeline and Frequency

The IEC activities shall continue to be implemented as part of the original IEC. Information shall be disseminated to the concerned target sectors as soon as information is available. For monitoring reports, these shall be prepared and disseminated on a regular basis. For social development projects, communication and information dissemination with the concerned partners or stakeholders shall begin prior to the implementation of the project.

Table 5.4.3. Information, Education and Communication (IEC) Framework

Target Sector for Project IEC	Major Topics	IEC Scheme/ Strategy / Methods	Information Medium	Indicative Timeline Frequency	Indicative Cost (Php)
Province of Palawan, Municipality of Bataraza, Barangay Rio Tuba, and Local NGOs	Project Process & Pollution Control/ Monitoring Devices	Group Method	Audio Visual Presentation, Handouts	From Expansion / As necessary	50,000.00/qtr
Municipality of Bataraza, Barangay Rio Tuba & Local NGO	ECC Compliance Report	Group Method thru MMT/ Regular Meetings with the LGUs	Reports / Consultation Meetings	From Expansion / Quarterly	50,000.00/qtr
	Monitoring Statistics		Reports / Consultation Meetings	From Expansion / Quarterly	
	SDMP & SDP Compliance		Reports / Consultation Meetings	From Expansion / Quarterly	
RHUs, BHS, Schools, People Organizations, Other Concerned Government Agencies & Private Companies	Programs and Projects under the SDP (SDMP 3 and non-SDMP programs	Individual Method, Group Method	Letters / Communications Consultative Meetings Focused Group Discussion Newsletter	From Expansion / As necessary	50,000.00/qtr
Barangay, Senior Citizens, PWD, ands IP Leaders of impacted barangays	Presentation of SDMP III and other benefits from the proposed project. Discussion on parity issues and gathering of suggestions to improve the	Group Method	Reports/ Consultation Meetings	From Expansion / As necessary. A series of consultation dates may be set for updates	50,000.00/qtr

Target Sector for Project IEC	Major Topics	IEC Scheme/ Strategy / Methods	Information Medium	Indicative Timeline Frequency	Indicative Cost (Php)
	implementation of projects towards sustainability				
Barangay, IP Leaders, Schools, BHWs	Disaster Preparedness program	Group Method	Audio visual presentations, brochures, drill	From expansion to abandonment	15,000/qtr

5.5 CITATION OF COMPANY ACHIEVEMENTS AND AWARDS

For over 40 years in the mining business, RTNMC was able to accomplish projects that supported economic growth and environmental protection. **Plate 5.3.1** shows some of the awards received by RTNMC. Among these remarkable awards are the following:

Environmental and Socio-economic

- Titanium Achievement Award (1998);
- 3rd Runner-up Best Mining Forest (1999);
- Platinum Achievement Award (1999);
- Platinum Achievement Award (2000);
- Platinum Achievement Award (2001);
- Presidential Mineral Industry Environmental Award (2002);
- Titanium Achievement Award (2009)
- Platinum Achievement Award (2010);
- 2011 Special Award for Best Mine Rehabilitation Strategy
- Platinum Achievement Award (2013);
- Platinum Achievement Award (2014);
- Presidential Mineral Industry Environmental Award (2015); and
- 3rd Runner-up Best Mining Forest (2015);

Safety

- 13.7 Million Manhours Without Lost Time Accident (1992-1994);
- 20 Million Manhours Without Lost Time Accident (1992-1996);
- 2 Million Manhours Without Lost Time Accident (2006-2007);
- 4 Million Manhours Without Lost Time Accident (2007-2008);
- 6 Million Manhours Without Lost Time Accident (2008-2009);
- 9.5 Million Manhours Without Lost Time Accident;
- 10 Million Manhours Without Lost Time Accident (2009-2010);
- First aid Champion, 1st RAMSEC (2003-2004);
- First Aid, 1st Runner-up, PMIEA (2007-2008);
- First Aid, 1st Runner-up, PMIEA (2008-2009);
- Safest Surface Mine, 2nd Runner-up (2004-2008);
- Plaque of Recognition for Accident Free Fiscal Year (2006-2007);
- Plaque of Recognition for Accident Free Fiscal Year (2007-2008);
- Plaque of Recognition for Accident Free Fiscal Year (2008-2009);
- Tug of Peace, 2nd Runner-up (2003-2004);
- Tug of Peace, Champion (2007-2008);
- Fire Fighting, Champion (2015); and
- Safest Surface Mine Winner
  - 1983-1984
  - 1984-1985
  - 1986-1987

- 1987-1988
- 1992-1993
- 1993-1994
- 1994-1995
- 1995-1996
- 1997-1998
- 1998-1999
- 1999-2000
- 2001-2002
- 2003-2004
- 2005-2006
- 2009-2010

- Most Improved Safety Performance Record
  - 1984-1085
  - 1986-1987
  - 1987-1998
  - 1999-2000
  - 2001-2002
  - 2002-2003;
  - 2014-2015
- Safest Surface Mine, 1st Runner-Up
  - 1980-1981
  - 1982-1983
  - 1985-1986
  - 1988-1989
  - 1989-1990
  - 1990-1991
  - 1991-1992
  - 2000-2001
- DENR-Region IVB Special Award (Plaque of Commendation for Implementing the Rehabilitation and Development Initiative of Mined-Out Areas thru Rapid Reforestation as of March 2010; and
- Presidential Mineral Industry Excellence Award (PMIEA) for Outstanding Environment and Community Development Programs.

Plate 5.4.1. RTNMC awards

6 Environmental Compliance Monitoring

Rio Tuba Nickel Mining Corporation

This chapter will focus on the Environmental Compliance Monitoring (ECM) of Rio Tuba Nickel Mining Corporation (RTNMC) for its current operation in the Gotok Limestone Quarry area and crushing plant. The environmental compliance monitoring program ensures that environmental parameters which serve as indicators of the degree of impact on the environment are within the Philippine standards. Indicative parameters of the previously identified impacts brought by the proposed expansion, as discussed in *Chapter 2*, shall be incorporated in the current ECM program. The ECM shall function as a tool in assessing the effectiveness of the management measures incorporated in the Impacts Management Plan (IMP) of RTNMC as presented in *Chapter 4*.

6.1 ENVIRONMENTAL COMPLIANCE FRAMEWORK

As a good member of the regulated community, RTNMC strictly complies with all environmental regulatory requirements. Permits/licenses/clearances/certificates are dutifully procured from the Department of Environment and Natural Resources (DENR) as listed in **Table 6.1.1**.

Table 6.1.1. DENR Environmental Laws

Environmental Laws	Permits		Date of Issue	Expiry Date
RA 9275 Philippine Clean Water Act of 2004	A/C No.			
	PO No.	-	-	-
PD 1586 Environmental Impact Statement System	ECC 1	0201-021-313 [a]	10 July 2002	Superseded
	ECC 2	0701-002-3721 [b]	01 February 2007	N/A
	ECC 3			
RA 6969 Toxic Substances and Hazardous and Nuclear Control Act of 1990	DENR Registry ID	GR-4B-53-00012	11 September 2015	N/A
	CCO Registry	CCO-PCB-R4B-RIO-1	22 October 2015	N/A
	Importer Clearance No.	-	-	-
	Permit to Transport	-	-	-
RA 8749 Philippine Clean Air Act of 1999	A/C No.	-	-	-
	PO No.	2016-POA-D-0453-027	18 April 2016	17 April 2021

Source: Self-Monitoring Report of RTNMC – Gotok Limestone Quarry Project, 2016

Note: [a] ECC of the Hydrometallurgical Plant Complex Project, where the ECC conditions pertaining to the Gotok Limestone Quarry Project, the compliance of which the responsibility of RTNMC are incorporated.

[b] ECC of the Hydrometallurgical Plant Complex Project Line 2 superseding [a]ECC

In compliance with these regulatory requirements, RTNMC submits the following reports on a regular basis:

- Self-Monitoring Report (SMR) on a quarterly basis to Environmental Management Bureau (EMB Region IVB); and
- Compliance Monitoring Report (CMR) on a semi-annual basis to EMB-Region IVB.

6.2 SELF MONITORING FRAMEWORK

The Mine Environmental Protection and Enhancement Office (MEPEO) of RTNMC was created in compliance with *Condition No. 29* of ECC No. 0201-021-31. The MEPEO performs various monitoring activities in accordance with the approved monitoring plan.

Monitoring activities are documented in the SMR submitted to the EMB Region IVB (MIMAROPA) by the Pollution Control Officer (PCO). The CMR is also being submitted to the same office. The preparation and submission of SMR is in compliance with the regulations stated in DAO No. 2003-27, Series of 2003. **Table 6.2.1** shows the summary of the monitoring activities of RTNMC.

As seen in **Table 6.2.1**, the parameters being analyzed for water quality of Gotok sampling stations are the same with the parameters of RTNMC's Nickel operation. In order to correct the monitoring program of RTNMC and update it based on DAO 2016-08, this EPRMP propose a new Environmental Monitoring Plan (EMoP) presented in **Table 6.2.2**. The EMoP specifies the parameters being analyzed in every monitoring activity including the corresponding Environmental Quality Performance Level (EQPL). **Plates 6.2.1** to **6.2.2** show the monthly in-house environmental sampling of RTNMC. **Annex 6.2.1** shows the submitted SMR for the 4th quarter of 2016.

Table 6.2.1. The self-monitoring activity of RTNMC

Aspect	Parameters	Stations
Gotok Quarry Operation	-	Entire operation area
Solid waste characterization*	•Average quantity of solid wastes generated per month, m^3 •Total quantity of solid wastes collected per quarter, m^3	Quarterly
Hazardous Materials	•Waste chemical generated •Waste Storage, treatment and disposal	Entire operation (quarry area, crushing plant and offices)
Water	•Wastewater characteristics for conventional pollutants: - Total Suspended Solids (TSS), mg/L - Color - pH	Monthly/ Quarterly • Station 14 – Oning (Gotok Spring) • Station 15 – Gotok Entry Tunnel (Underground) *- coordinates are reflected in Section 2.2.3.1 of Chapter 2*
	•Wastewater characteristics for other pollutants - Arsenic (As), mg/L - cadmium (Cd), mg/L - cobalt (Co), mg/L - hexavalent chromium (Cr^{+6}), mg/L - iron (Fe), mg/L - lead (Pb), mg/L - manganese (Mn), mg/L - nickel (Ni), mg/L	Monthly/ Quarterly • Station 14 – Oning (Gotok Spring) • Station 15 – Gotok Entry Tunnel *- coordinates are reflected in Section 2.2.3.1 of Chapter 2*
Air	•Ambient air quality monitoring -Particulates (µg/Ncm)	Monthly/ Quarterly • Station 6 – Southwest of Gotok Limestone Quarry Area • Station 7 – Southeast of Gotok Limestone Quarry Area *- coordinates are reflected in Section 2.3.3 of Chapter 2*
Noise	•Noise level monitoring - Noise level (dB)	Monthly/ Quarterly • Station 6 – Southwest of Gotok Limestone Quarry Area • Station 7 – Southeast of Gotok Limestone Quarry Area *- coordinates are reflected in Section 2.3.4 of Chapter 2*
ECC Conditions	•Status of Compliance •Action/s Taken	Quarterly
Environmental Management Plan/Program	•Enhancement/Mitigation Measures •Status of Implementation •Action/s Taken	Quarterly

Aspect	Parameters	Stations
Accidents and Emergency Records	•Area/Location •Findings and Observations •Action/s Taken	Quarterly
Personnel/ Staff training	•Date conducted* •Course/Training Description •Number of Personnel Trained	Quarterly

Source: 4th Quarter Self-Monitoring Report of RTNMC for the Gotok Quarry Project, 2016.

Plate 6.2.1. Air sampling activity at the Gotok area

Plate 6.2.2. Noise level monitoring at the Gotok area

For the proposed water quality monitoring, an additional station for effluent (WQM3) was added to the current monitoring program of RTNMC for Gotok which currently includes two (2) ambient freshwater body (WQM1-Oning Spring and WQM2-Gotok Entry Tunnel).

In addition, to strengthen the monitoring program for the Air Quality and Noise level monitoring, a residential area near the vicinity of the quarry is recommended as monitoring station. All existing monitoring stations of RTNMC as well as the proposed stations are presented in **Table 6.2.3**. Maps of the monitoring stations are provided as **Figures 6.2.1** and **6.2.2**.

Table 6.2.2. Environmental Monitoring Plan with EQPL

Key Environmental Aspects per Project Phase	Potential Impacts per Envt'l. Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EQPL Management Scheme					
								EQPL Range			Management Measure		
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
CONSTRUCTION PHASE													
Land Clearing for access roads and new quarry areas within the 13 hectare land area stated in the ECC 0201-021-313	➢ Threat to abundance and/or loss of important flora and fauna species ➢ Hindrance to wildlife access	Diversity and species richness	Quadrat sampling for flora and transect monitoring for fauna	Annual	Buffer zone and adjacent areas of the active quarry area; Rehabilitated areas	MEPEO Third party consultant	PhP 400,000 per monitoring event	30% abundance and frequency reduction of flora along the monitoring stations 30% reduction of abundance and frequency of common and endemic avian species observed on site as based on the baseline data	40% abundance and frequency reduction of flora along the monitoring stations 40% reduction of abundance and frequency of common and endemic avian species observed on site as based on the baseline data	50% abundance and frequency reduction of flora along the monitoring stations 50% reduction of abundance and frequency of common and endemic avian species observed on site as based on the baseline data	Assess extent of vegetation clearing Use indigenous and native species as well as fruiting trees reforestation species Minimize revving-up of vehicles and heavy equipment	Maintain green corridors and shelterbelts Conduct immediate rehabilitation once mined out Establish off-limit zone for vehicles along areas identified as conservation areas and shelterbelts	Assess areas prone to soil creep or landslide and stabilize slope area and rehabilitate Institute biodiversity offset areas Conduct enrichment planting with emphasis on Assisted Natural Regeneration (ANR)
	➢ Loss of topsoil ➢ Soil erosion	Volume of topsoil conserved and stability of stockpile	• Record keeping of topsoil volume conserved • Inspection of stockpiles to check for soil erosion • Mapping of storage sites	Semi-annual	Within the tenement area	RTNMC MEPEO Officer/ PCO	Minimal cost (Part of job description of staff assigned)	Volume of topsoil conserved is less than 70% of the estimated volume needed for future rehabilitation	Volume of topsoil conserved is less than 60% of the estimated volume needed for future rehabilitation	Volume of topsoil conserved is less than 50% of the estimated volume needed for future rehabilitation	Notify heavy equipment operator to set aside topsoil and identify additional storage area	Implement volume quota to heavy equipment operator to set aside top soil and maximize additional storage area	Future acquisition of topsoil from adjoining areas to be used for rehabilitation
		Rate of erosion	• Photo-documentation • Use of bottle caps (caps protects soil underneath and form pillar overtime; height of pillar will indicate erosion rate) • Use of erosion monitoring box	Monthly	Within and adjacent to construction sites	RTNMC MEPEO Officer/ PCO	Minimal cost (Part of job description of staff assigned)	Presence of several rill erosion along cleared areas	Presence of gullying along cleared areas	Occurrence of severe erosion, soil creep and landslide	Construction of drainage canal to divert storm run-off	Implementation of slope stabilization techniques	Installation of gabions and engineering techniques to control severe erosion
OPERATION PHASE													
Daily operation ➢ Drilling and blasting operation ➢ Stockpiling ➢ Loading and hauling of limestone	➢ Loss of topsoil ➢ Soil erosion	Volume of topsoil conserved and integrity of stockpile	• Record keeping of topsoil volume conserved • Inspection of stockpiles to check for soil erosion • Mapping of storage sites	Semi-annual	Within the tenement area	RTNMC MEPEO Officer/ PCO	Minimal cost (Part of job description of staff assigned)	Volume of topsoil conserved is less than 70% of the estimated volume needed for future rehabilitation	Volume of topsoil conserved is less than 60% of the estimated volume needed for future rehabilitation	Volume of topsoil conserved is less than 50% of the estimated volume needed for future rehabilitation	Notify heavy equipment operator to set aside topsoil and identify additional storage area	Implement volume quota to heavy equipment operator to set aside top soil and maximize additional storage area	Future acquisition of topsoil from adjoining areas to be used for rehabilitation

Key Environmental Aspects per Project Phase	Potential Impacts per Envt'l. Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EQPL Management Scheme					
								EQPL Range			Management Measure		
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
		Rate of erosion	• Photo-documentation • Use of bottle caps (caps protects soil underneath and form pillar overtime; height of pillar will indicate erosion rate) • Use of erosion monitoring box	Monthly	Within the tenement area	RTNMC MEPEO Officer/ PCO	Minimal cost (Part of job description of staff assigned)	Presence of several rill erosion along cleared areas	Presence of gullying along cleared areas	Occurrence of severe erosion, soil creep and landslide	Construction of drainage canal to divert storm run-off	Implementation of slope stabilization techniques	Installation of gabions and engineering techniques to control severe erosion
	➢ Threat to abundance, frequency and distribution of important flora and fauna species ➢ Hindrance to wildlife access	Diversity and species richness	Quadrat sampling for flora and transect monitoring for fauna	Annual	Buffer zone and adjacent areas of the active quarry area; rehabilitated areas	MEPEO Third party consultant	PhP 400,000 per monitoring event	30% abundance and frequency reduction of flora along the monitoring stations 30% reduction of abundance and frequency of common and endemic avian species observed on site as based on the baseline data	40% abundance and frequency reduction of flora along the monitoring stations 40% reduction of abundance and frequency of common and endemic avian species observed on site as based on the baseline data	50% abundance and frequency reduction of flora along the monitoring stations 50% reduction of abundance and frequency of common and endemic avian species observed on site as based on the baseline data	Assess extent of vegetation clearing Use indigenous and native species as well as fruiting trees reforestation species Minimize revving-up of vehicles and heavy equipment	Maintain green corridors and shelterbelts Conduct immediate rehabilitation once mined out Establish off-limit zone for vehicles along areas identified as conservation areas and shelterbelts	Assess areas prone to soil creep or landslide and stabilize slope area and rehabilitate Institute biodiversity offset areas Conduct enrichment planting with emphasis on Assisted Natural Regeneration (ANR)
	Soil contamination with oil and grease	Oil and grease	Visual inspection	Weekly	Washing area and maintenance area of vehicles; Storage area of used oil; quarry area	PCO	Minimal cost (Part of job description of staff assigned)	Presence of wet-like smudges and sheen within the RTNMC active operation area	Evidence of leakage, spillage or signs of damage of oil and grease.	Major accidental leakage/spillage	Identification of areas with high concentration of oil and grease. Removal of oil and grease in observed areas.	Use of absorbent pads and saw dust to remove oil spills.	Assess the category of the oil spill and activate the appropriate oil leak/spill contingency procedure
	Generation of solid waste	Solid waste generated (quarry area, satellite office, crushing plant)	Visual inspection	Daily/ Quarterly	Quarry area; crushing plant	PCO	Minimal cost (Part of job description of staff assigned)	Accumulation of domestic wastes, scraps and junks within the quarry area	Accumulated waste became hazard to both vehicle and employees	Wastes become toxic or serve as breeding ground for pests which can be a vector for infectious diseases	Review of housekeeping practices Appropriate labelling of waste containers Establishment of Materials Recovery Facility (MRF)	Regular audits and maintenance of waste management system	Immediate hauling and disposal of waste by a DENR-accredited waste transporter and treater

Key Environmental Aspects per Project Phase	Potential Impacts per Envt'l. Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EQPL Management Scheme					
								EQPL Range			Management Measure		
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
	Generation of Hazardous waste	Hazardous waste	Visual inspection for accumulation of potentially hazardous wastes	Weekly	HazWaste storage area	PCO	Minimal cost (Part of job description of staff assigned)	Accumulation of hazardous wastes	Evidence of leakage, spillage or signs of damage of hazardous wastes	Wastes become a health hazard for employees	Review of housekeeping practices Inspection of storage area Proper labelling of Hazardous waste according to Globally Harmonized System (GHS) Provision of spill kits and construction of bund wall around storage area	Immediate containment and clean-up of affected area	Immediate hauling and disposal of hazardous waste by a DENR accredited waste transporter and treater
	Potential contamination of water resources from eroded soil, oil and grease within quarry area	TSS, O&G, pH and Temperature	In-situ sampling, grab sampling and laboratory analysis	<u>Ambient</u> Monthly	Station: • WQM1 – Oning Spring • WQM2 – Gotok entry tunnel	RTNMC PCO	PhP 50,000 per sampling event	<u>Freshwater body</u> ➢ TSS – 68 mg/L ➢ O&G – 1.8 mg/L	<u>Freshwater body</u> ➢ TSS – 72 mg/L ➢ O&G – 1.9 mg/L	DENR Standard Limit for Class C as stipulated in DAO 2016-08[1] ➢ TSS – 80 mg/L ➢ O&G – 2.0 mg/L ➢ pH – 6.5–9.0 ➢ Temperature – 25 - 31 °C[2]	Identification of possible source of pollutant	Regular updating of the drainage map to assess the stormwater management system Perform maintenance check and desilting on all stormwater management system Re-assess soil erosion control measures	Construct and install additional structures to increase efficiency of the stormwater management system Halting operation of the component identified as source of pollutant.
				<u>Effluent</u> Whenever there is overflow	Station: • WQM3 – Silt collector sump (downstream of phase 1)	RTNMC PCO		<u>Effluent</u> ➢ Temperature – 2.5 °C[4] ➢ TSS – 85 mg/L ➢ O&G – 4.3 mg/L	<u>Effluent</u> ➢ Temperature – 2.7 °C[4] ➢ TSS – 90 mg/L ➢ O&G – 4.5 mg/L	DENR Standard Limit for Class C as stipulated in DAO 2016-08[3] ➢ Temperature – 3 °C[4] ➢ TSS – 100 mg/L ➢ O&G – 5.0 mg/L ➢ pH – 6.0–9.5	Identification of possible cause	Immediate desilting of settling pond	Reconsider design of the silt ponds to ensure effectiveness

[1] The Water Quality Guidelines and General Effluent Standards of 2016 was used for the monitoring of the water quality parameters of freshwater
[2] The natural background temperature as determined by EMB shall prevail if the temperature is lower or higher than the WQG; provided that the maximum increase is only up to 10 percent and that it will not cause any risk to human health and the environment
[3] The Water Quality Guidelines and General Effluent Standards of 2016 was used for the monitoring of the water quality parameters of effluent
[4] Values for temperature refer to the temperature difference of the background value and discharge point

Key Environmental Aspects per Project Phase	Potential Impacts per Envt'l. Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EQPL Management Scheme					
								EQPL Range			Management Measure		
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
	Increase in surface run-off and sedimentation of surface water bodies within the vicinity of the quarry area	Volume of accumulated sediment and volume of desilted sediments from sediment control structures	Visual inspection, photo documentation, manual and mechanical desilting	Weekly for inspection of siltation and quarterly or semi-annual for desilting of sediment control structures	Silt collector sumps and the Ocayan River	RTNMC PCO	Include in MEPEO budget	Accumulation of silt along portions of the Ocayan River adjacent to quarry area	Shallow depths along portions of the Ocayan river previously characterized as deep adjacent to project site	Heavy flooding and siltation of the river despite occurrence of only light precipitation	Assess if silt collector sump holding capacity is sufficient	Re-evaluate the efficiency of storm water management measures e.g. silt traps, silt collector sumps, diversion canals	Construct additional water impounding structures downstream of the quarry area
	Contribution in terms of Greenhouse Gas Emission	Number of seedlings planted and survival rate of seedlings Percent accomplishment for target plantation area per annum	Survey and performance monitoring	Annual	Within quarry buffer zone and areas established for Carbon Sink and Reforestation program	RTNMC PCO Third party consultant	Include in MEPEO budget	If number of seedlings planted is 10% below the projected number of trees planted per year and if survival rate is 80% Targeted plantation is not 100% accomplished	If number of seedlings planted is 20% below the projected number of trees planted per year and if survival rate is 70% Accomplishment for targeted plantation is below 80%	If number of seedlings planted is 30% below the projected number of trees planted per year and if survival rate is 50% Accomplishment for targeted plantation is below 50%	Assessment of the number of propagules and seedling output of nursery Assessment of planting area condition to include possible infestation/ ascertain debilitating factors	Improve nursery management practices and set target for seedling production schedule Restocking or replanting of seedlings	Contract outside seedling producers and coordinate with locals as part of livelihood program to additional seedlings for the company Immediate assessment of soil viability and if necessary soil amelioration should be done prior to replanting
	Degradation of air quality (Increase in dust generation)	Ambient PM-10, TSP, SO_x, and NO_x	24-hour ambient air monitoring for PM-10, TSP, SO_x,and NO_x	Quarterly	Station: • AQM1 • AQM2 • AQM3 • AQM4	RTNMC PCO Third party consultant	Include in MEPEO budget	➢ SO_x – 144.5 µg/Ncm ➢ NO_x – 120.5 µg/Ncm ➢ TSP – 184.5 µg/Ncm ➢ PM-10 – 120.5 µg/Ncm	➢ SO_x – 162.5 µg/Ncm ➢ NO_x – 135.5 µg/Ncm ➢ TSP – 207.5 µg/Ncm ➢ PM-10 – 135.5 µg/Ncm	DENR Standard Limit as stipulated in the IRR of Clean Air Act ➢ SO_x – 180 µg/Ncm ➢ NO_x – 150 µg/Ncm ➢ TSP – 230 µg/Ncm ➢ PM-10 – 150 µg/Ncm	Identification of possible source of pollutants Periodic emission testing of heavy equipment as required in the Clean Air Act	Temporarily halt operation and do corrective measures Conduct of maintenance of equipment/ machinery identified as the source of pollution Increase frequency of water spraying	Stop operations and resume only when corrective measures were in place Replace equipment that emits high concentration of pollutants or use better fuel Increase frequency of water spraying
	Increase in ambient noise level	Sound level (db)	24-hour sound measurement using hand-held sound meter Noise Meter	Monthly	Station: • NLM1- • NLM2 • NLM3 • NLM4	RTNMC PCO	Minimal cost	3 dB less than limit	2 dB less than limit	1 dB less than limit	Identification of possible source of noise Issuance of ear plugs	Maintenance, adjustment or replacement of mufflers and installation of noise reduction apparatus	Change of equipment or noise minimization device Limit operations

Key Environmental Aspects per Project Phase	Potential Impacts per Envt'l. Sector	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost	EQPL Management Scheme					
			Method	Frequency	Location			EQPL Range			Management Measure		
								Alert	Action	Limit	Alert	Action	Limit
													during daytime hours
	Threat to public health and safety (Occupational health and safety risk)	Safety record, accident/ fatality incidence/ occurrence	Record keeping	Daily	Quarry area, access roads, hauling roads and crushing plant	RTNMC Safety officer	Minimal cost	Increase in frequency of non-lost time accident	Occurrence of non-fatal lost time accident	Occurrence of fatal lost time accident	Conduct quarterly safety briefing and orientation to laborers and workers Installation of safety signages along accident prone areas	Conduct daily inspection at project site Conduct daily briefing on safety program	Work stoppage along accident area and implement measures as instructed in the Safety and Health Program of the company
	Generation of local benefits (employment and livelihood)	Number of jobs generated for locals; training programs; and other social development programs	Record keeping; Social Impact Assessment (SIA)	Monthly Every five (5) years for SIA	Host communities and secondary impact areas	RTNMC HR and ComRel SIA Third party consultant	Minimal cost	Number of locally hired employees fall down to less than 40% of the total workforce SDMP accomplishment falls below 80% of target	Number of locally hired employees fall down to less than 20% of the total workforce SDMP accomplishment falls below 60% of target	No locals are employed by the company in the last six months SDMP accomplishment falls below 40% of target	Review hiring policies Review SDMP and determine reasons for the poor implementation of the program	Implement more skills training program to empower residents Identify alternatives for the SDMP projects to improve accomplishment	Conduct consultative meeting with the barangay officials of the impact barangay to resolve the issues
	Complaints management	No. of valid complaints	Record keeping	Daily	Host communities and secondary impact areas	RTNMC MEPEO, PCO and ComRel	Minimal cost	Formal complaint submitted can be resolved at the ComRel level	Intervention from the Upper Management is needed to resolve a formal complaint	Complaint is broadcasted over mass media	Institution of grievance system Conduct regular IEC to inform and justify the activities being undertaken by RTNMC Classification of complaints whether valid or not	Notify RTNMC Admin for complaint and take remedial measures to address complaints Investigate all complaints, conduct dialogue with communities and implement mitigating measures Compensate affected communities	Conduct in depth investigation and identify root cause for all valid complaints Institute measures to avoid occurrence of similar problems

Table 6.2.3. Monitoring stations of RTNMC

Station ID	Name	Northing	Easting
Water Quality			
WQM1	Oning (Gotok Spring)	8°36'16.99"	117°27'19.44"
WQM2	Gotok Entry Tunnel (underground)	8°36'6.23"	117°27'50.90"
WQM3* (Effluent)	Silt Collector sump (downstream of Phase 1)	8°35'51.08"	117°27'51.51"
Air Quality			
AQM1	Gotok SE	8°35'49.85"	117°28'6.98"
AQM2	Gotok SW	8°35'47.02"	117°27'47.02"
AQM3*	GK Gotok	8°35' 55.40"	117° 28' 32.70"
AQM4*	Magazine Area	8°33' 13.62"	117° 25' 29.28"
Noise Level			
NLM1	Gotok SE	8°35'49.80"	117°28'6.98"
NLM2	Gotok SW	8°35'47.02"	117°27'47.02"
NLM3*	GK Gotok	8°35' 55.40"	117° 28' 32.70"
NLM 4*	Magazine Area	8°33' 13.62"	117° 25' 29.28"

*Note: *Proposed additional station*

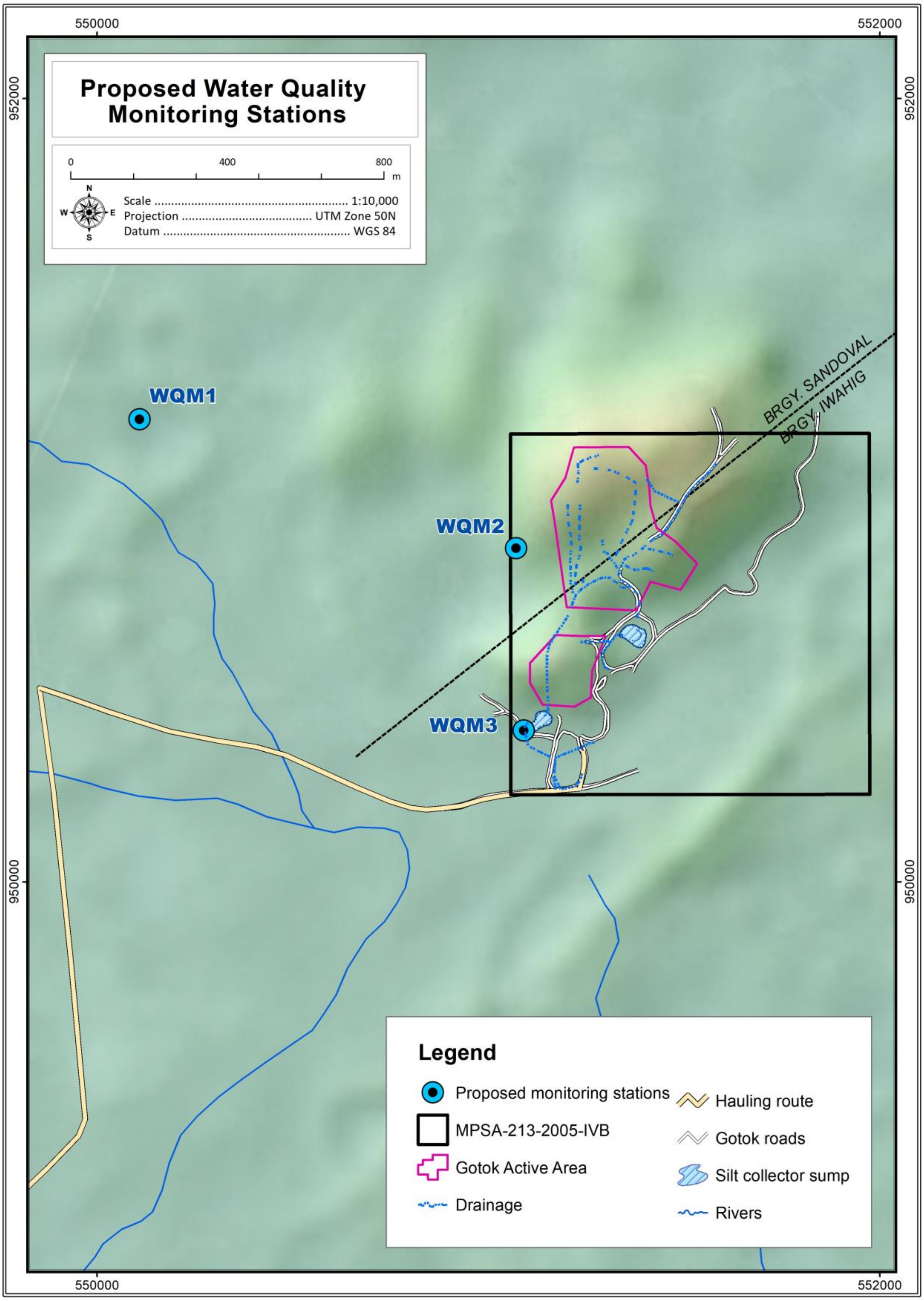


Figure 6.2.1. Proposed water quality monitoring stations

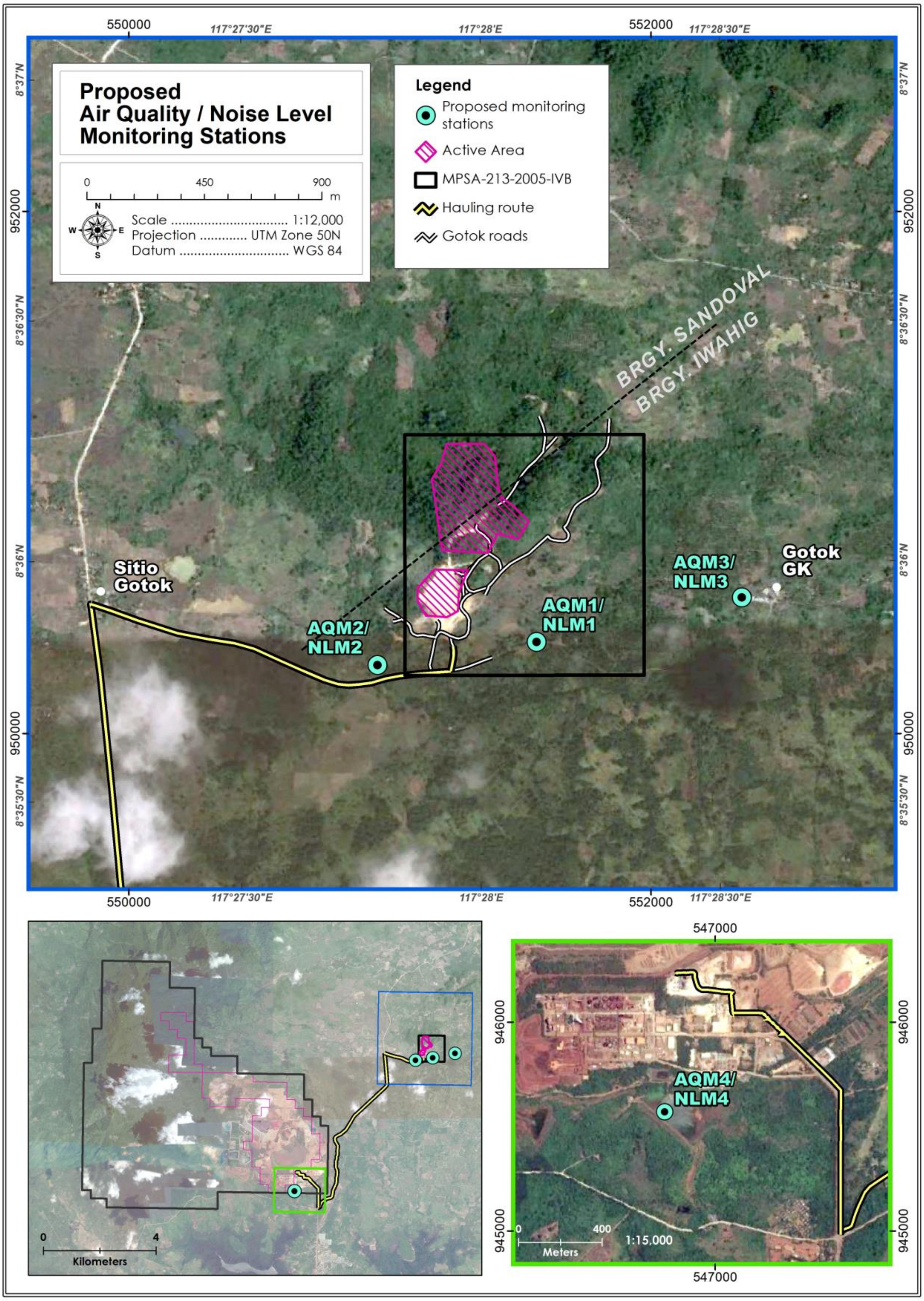


Figure 6.2.2. Proposed air quality and noise level monitoring stations

6.3 MULTI-SECRORAL MONITORING FRAMEWORK

The Multi-Partite Monitoring Team (MMT) was organized in compliance with *Condition No. 22.3* in the 1997 ECC. The MMT functions to ensure that RTNMC is in compliance with the ECC conditions including applicable environmental regulatory requirements in the Philippines. The program of the MMT includes validation of the environmental accomplishment for both the nickel mining and limestone quarry projects.

At the current set-up, the MMT of RTNMC is composed of various representatives from the following groups/ offices/organizations:

- MGB Region IVB (MIMAROPA);
- DENR-EMB Region IV-B;
- Palawan Council for Sustainable Development (PCSD);
- Provincial Environment and Natural Resources Office (PENRO);
- City Environment and Natural Resources Office (CENRO) Brooke's Point;
- Department of Health (DOH);
- LGU-Bataraza;
- LGU-Rio Tuba, Iwahig and Sandoval;
- Bureau of Fisheries and Aquatic Resources (BFAR);
- Philippine Economic Zone Authority (PEZA);
- Apostolic Vicariate of Puerto Princesa;
- HARIBON-Palawan;
- Indigenous People; and
- RTNMC.

The LGU of Barangays Iwahig and Sandoval shall be included in the MMT set-up. **Table 6.3.1** details the environmental monitoring program of the MMT of RTNMC.

Table 6.3.1. The program of RTNMC MMT

Aspect	Parameters	Stations
Water	- Color (Apparent, PCU) - pH - Total Suspended Solids (TSS), mg/L - Cobalt, mg/L - Cadmium, mg/L - Lead, mg/L - Hexavalent Chromium (Cr^{6+}), mg/L	Quarterly • Station 14 – Oning (Gotok Spring) • Station 15 – Gotok Entry Tunnel (Underground) *- coordinates are reflected in Section 2.2.3.1 of Chapter 2*
Air	• Dust - TSP	Quarterly • Station 6 – Southwest of Gotok Limestone Quarry Area • Station 7 – Southeast of Gotok Limestone Quarry Area *- coordinates are reflected in Section 2.3.3 of Chapter 2*

Source: 2nd Sem Compliance Monitoring and Validation Report (CMVR) for the Rio Tuba Nickel Silicate Ore Project and Gotok Limestone Quarry Project of RTNMC, 2016

6.4 ENVIRONMENTAL COMPLIANCE MONITORING

The ECC issued to RTNMC on July 10, 2002 for the HPP Line 1 Project covers the operation of the Gotok Limestone Quarry. Upon the request of RTNMC, the name of the proponent of the ECC was change to Coral Bay Nickel Corporation (CBNC) and the rights and obligations for the components specified in the ECC were later re-assigned to both companies thru a Memorandum of Agreement and a Deed of Assignment on the Delineation of Responsibilities (**Annex 1.1.2**) submitted to the EMB. It was agreed in the deed of assignment that the ownership and the responsibility over the Gotok Limestone Quarry Project shall remain under RTNMC.

In addition to the assignment of the ownership, responsibility over the compliance of the conditions of the ECC was also delineated. Presented in **Table 6.4.1** is the result of the compliance monitoring of the MMT for the conditions under the commitment of RTNMC.

Table 6.4.1. RTNMC Status of environmental compliance

No.	ECC Conditions	Complied? Yes	Complied? No	Proof of Compliance
1	This certificate covers the establishment of a Hydrometallurgical Processing Plant Complex that includes the following: Hydrogen Sulfide Plant, Limestone Quarry, Water Supply and Drainage System, Two (2) Tailings Dam, Nine point Nine (9.9) MW Coal-Fired Plant, Port Facilities and other Support Facilities			
	1.1. The plant complex shall have the capacity to produce 10,000 dry metric tonnes (DMT) of nickel and a maximum of 750 DMT of cobalt per year as mixed sulfide at the final stage, through high pressure acid leaching using low-grade ore and laterite as raw materials;			CBNC's commitment
	1.2. The hydrogen sulfide plant shall be initially designed to meet daily consumption of 21.7 metric tonnes per day (MTPD), expandable as the plant increases production;			CBNC's commitment
	1.3. The limestone quarry shall employ open cast mining method using conventional drilling and blasting technique. It shall be limited the 13 hectares in Sitio Gotok, Brgy. Iwahig, Bataraza, Palawan within the geographic coordinates of 8°35'50" to 8°36'20" North Latitude and 117°27'45" to 117°28'15" East Longitude; The proponent shall conduct a thorough study of the limestone quarry area underground system, including flora and fauna and groundwater resource potential and shall provide complete mitigation plan for submission to EMB within 90 days upon approval of this certificate, to serve as basis for the development of the quarry area and/or commencement of limestone quarry activities;	4		RTNMC's commitment. RTNMC requested the DENR that the first paragraph of this conditionality be modified to "The limestone quarry shall employ open cast mining method using conventional drilling and blasting techniques and /or manual method. The actual quarrying site shall be limited to 13 hectares in Sitio Gotok. The requested modification provides the company option to maximize the economic benefits to the host community This was complied
	1.4. The main source of water supply shall be a from 300 m3 capacity dam that will be constructed at the intake point of the East Ibelnan River. Other sources shall be from the Togpon, Magas-Magas and Tagpisa siltation ponds;	4		RTNMC's commitment.
Remarks: Ibelnan Intake dam is being used as a source of water for the operation of the HPP. It is under the management of CBNC.				
	1.5. Two (2) tailings dam shall be constructed north and northeast of the HPP to collect and impound materials generated from the process. The first shall be similar to the second here it is limited to a height of 33m. Design of the dams shall be in accordance with DENR Memorandum Order No. 99-32 on Policy Guidelines and Standards for Min Waste and Mine Tailings Management dated November 24, 1999 and that in case of deviations, justifications shall be provided;			CBNC's commitment
	1.6. Power distribution shall be from a coal-fired boiler			CBNC's commitment

No.	ECC Conditions	Complied? Yes	Complied? No	Proof of Compliance
	and turbine not exceeding 9.9 MW;			
	1.7. A 380 meter long causeway shall be constructed using boulders and gravel and connected to 1,080 m long southwest trending trestle that is mounted on steel pipes. The trestle shall be 5m high from sea level and no more than 30 m wide; The modeling shall further seriously consider the sediment discharge from the nearby Ocayan River, the results of which shall be submitted to EMB within ninety (90) days upon approval of this certificate; The borrow areas areas for sand and gravel shall be a part of malatgao River located in Sitio Pasi-Pasi-, Brgy. Sandoval, Municipality of Bataraza, Palawan. It shall be limited to a total of 1.98 hectares with dimensions of 276 m long and 72 m wide;	4		RTNMC's commitment. RTNMC requested the DENR that the trestle height be reduced from 5 m as indicated in the ECC to 4.5 m. The maximum wave height experienced in the area based on studies and historical records is only three (3) m.
Remarks: The causeway and trestle are now situated at the Coral Bay and are being operated by CBNC.				
2	The proponent shall provide quality assurance program for the construction materials to be used for the causeway and tailings dam.	4		RTNMC was responsible for the quality assurance program of the construction materials for the causeway while CBNC was responsible for the quality assurance program of the construction materials for the tailings dam.
Remarks: The causeway and trestle are now situated at the Coral Bay and are being operated by CBNC.				
3	Details of air and water pollution sources (power plant, sulfide processing and other facilities shall be submitted for review by EMB within ninety (90) days upon approval of this Certificate as basis for the endorsement for the issuance of the Authority to Construct for the air and water pollution/control facilities based on the guaranteed operating guaranteed operating emissions/effluent and ambient limits of these facilities;	4		RTNMC and CBNC submitted details of the air and water pollution sources under their respective areas of concern.
4	Forty (40) meters wide buffer zones measured landward along the river/streams bank's high water line and along the entire periphery of the project site shall be established. Fast growing vegetation, indigenous where possible, shall be planted and maintained in these zones.	4		RTNMC was responsible for the green buffer zones at the limestone quarry, causeway and trestle, ore supply stockpile, siltation ponds include canals, water intake dam, road network and other existing RTNMC facilities. CBNC, on the other hand, established a green buffer zone of the required area at the HPP Complex to include the HPP, H2S Plant, power plant water supply and piping facilities, tailings dam and effluent discharge facilities, pier site, coal and sub-material stock yard areas, among others.
5	The proponent shall ensure that its contractors and sub-contractors properly comply with the relevant conditions of this certificate.	4		RTNMC and CBNC continue to ensure that all contractors they hire comply with the relevant conditionalities of the ECC.
Remarks: RTNMC ensures continues compliance of its contractors working at the quarry and crushing plant operation with the relevant conditionalities of the ECC.				
6	Noise levels, emissions and effluents generated from project activities shall conform with the	4		Noise level emissions at the quarry site are regularly monitored.

No.	ECC Conditions	Complied? Yes	No	Proof of Compliance
	prescribed DENR Standards			
Remarks: RTNMC regularly submits its self-monitoring reports containing the results of its air quality, water quality and noise level monitoring. Discussed below are the results of the monitoring from 2011 to 2015.				
7	The proponent shall provide adequate safety gadgets to protect its employees/workers from health and occupational hazards posed by project implementation.	4		RTNMC is responsible for compliance of this requirement at the limestone quarry, causeway and trestle, ore stockpile, siltation ponds including canals, water intake dam, road network and others.
Provided as **Annex 7.1.1** is the approved Safety and Health Program and Emergency Response and Prepared ness Plan submitted on March 4, 2014.				
8	Qualified local residents and women shall be given priority in employment. Adequate public information shall be provided for jobs available to local residents in the affected areas as the as part of its livelihood support, the proponent shall undertake appropriate skills training and job preparation. A report on the hiring activities shall be submitted to the Department of Labor and Employment (DOLE) Regional Unit.	4		
9	The proponent shall undertake an effective and continuing Information, Education and Communication (IEC) Program to explain publicly its EIS mitigating measures for negative impacts as well as conditions of ECC for a greater awareness, understanding and acceptance of the project among the local residents. It shall open opportunities to educate the workers, contractors, sub-contractors and affected communities through sectoral and small group consultations on environmental and human safety measures in quarrying. The IEC activities shall be funded by the proponent but implemented in coordination with the MGB Region IV-B and EMB Region IV-B,	4		Joint responsibility of RTNMC and CBNC
10	The proponent shall coordinate with the DENR Coastal Environment Program (CEP) and the Bureau of Fisheries and Aquatic Resources (BFAR) in the rehabilitation of mangroves and sea grasses found affected by the project operations in and around the HPP	4		CBNC's commitment
11	List of all the stations to be monitored for barren areas with discharge from the mine tailings ponds shall likewise be submitted to EMB Region IV-B prior to project implementation;	4		CBNC's commitment
12	All other permits and requirements of concerned government agencies shall be secured prior to operations	4		RTNMC complies with all permitting requirements relative to the limestone quarry and all RTNMC facilities.
Remarks: **Table 6.1.1** shows all the permits secured by RTNMC for this project.				
13	This Certificate shall be considered automatically revoked if the project has not commenced, i.e. horizontal development, within five (5) years from the date of issuance.	4		The project commenced.
14	Any expansion and/or modification of the currently approved mining and processing operations shall be subject to new EIA requirements	4		
15	Transfer of ownership of the Project carries the same conditions in this ECC for which written notification shall be made by herein grantee to the EMB and MGB within fifteen (15) days from such transfer.	N/A		The "transfer of ownership" provision is, at the moment, cannot be complied with and, therefore, not applicable.
16	The proponent shall submit to EMB a detailed vegetation analysis of the limestone area for	4		RTNMC complies with continuous planting and rehabilitation of the

No.	ECC Conditions	Complied?		Proof of Compliance
		Yes	No	
	quantitative and qualitative analysis for endemic/indigenous plants			affected area.
Remarks: Attachment 6 is the Assessment Report of the Trees at the Gotok Quarry and the CENRO report on the 100% inventory conducted within the quarry area in 2008.				
17	The proponent shall establish a clonal laboratory and nursery for the multiplication and maintenance of endemic/indigenous plants that will be used for the rehabilitation and restoration of damaged areas and those that shall be subjected for mining. All wildings of the endemic plants shall be uprooted/earthballed accordingly. A tri-partite Memorandum of Agreement shall be established among the PENRO/CENRO, community or NGO and the proponent for proper monitoring	4		Joint responsibility of RTNMC and CBNC
Remarks: The clonal laboratory is currently being maintained. Further study /monitoring shall be done by RTNMC to assess the need for the continuous operation of clonal laboratory since the current nursery is already enough to comply with the reforestation needs of RTNMC.				
18	A storm water/runoff management plan shall be submitted to the EMB for approval prior to project implementation. It shall include the provision for effective drainage system through construction of silt traps/siltation ponds and establishment of vegetative buffers to filter sediments and sediment bound pollutants.	4		RTNMC complies with all permitting requirements relative to the limestone quarry and all RTNMC Facilities Silt Collector Sumps 1 and 2 are maintained
Remarks: Based on the 2014 MMT Validation/Inspection report (**Annex 6.4.1**), RTNMC submitted a map and drainage plan for the new 13 hectares opened within the MPSA.				
19	A community assistance program for livelihood and skills training shall be submitted to the EMB Region IVB prior to project implementation. The program shall also include assistance in the construction of shallow and deep wells for potable drinking water and other domestic uses, establishment of credit facilities/cooperatives and improvement of the fishing system in and around the Municipality of Bataraza.	4		
RTNMC and CBNC are jointly implementing the SDMP which includes the abovementioned projects. Status of the SDMP implementation is presented in Chapter 5.				
20	The proponent shall implement a Social Development Program and shall assist the local government units in the provision of health, education and welfare services to the residents of the impact areas and vicinities in coordination with the Department of Health, the Department of Education, Culture and Sports and the Department of Social Welfare and Development. The proponent shall undertake special consideration of the growing Muslim community dependent on trade and commerce indirectly resulting from activities of project.	4		Joint responsibility of RTNMC and CBNC
Remarks: RTNMC and CBNC are jointly implementing the SDMP for the impact areas. Status of the SDMP implementation is presented in Chapter 5.				
21	All environmental hazards and risks (i.e., reagent as well as radioactive contamination, if any, slope failure, explosive hazards) identified in the revised Environmental Risk Assessment (ERA) which will include a Disaster-Preparedness Program and flood routing studies shall be conducted in order to assess and mitigate the possibility and risk of storm surges.	4		All environmental hazards and risks in relation to the limestone quarry project are carefully assessed and mitigating measures relatively thereto are contained in the Safety and Health and Emergency Response and Preparedness Plan

No.	ECC Conditions	Complied? Yes	Complied? No	Proof of Compliance
				being prepared and submitted annually to the MGB IV-B
Remarks: Provided as **Annex 7.1.1** is the approved Safety and Health Program and Emergency Response and Prepared ness Plan submitted on March 4, 2014.				
22	The proponent must implement environmental management and protection requirements of the pertinent provisions of the Philippine Mining Act of 1995 (RA 7942) and its Implementing Rules and Regulations (DAO 96-40), as well as the Memorandum of Agreement (MOA) between the EMB and MGB executed on April 16, 1998. It must establish a Contingent Liability and Rehabilitation Fund (CLRF) to cover expenses of multi-sectoral monitoring activities, short- and long-term rehabilitation programs and/or indemnification of damages to life and property that should include an Environmental Trust Fund (ETF) to cover payment. The absence of the CLRF shall cause the cancellation of this ECC.	4		Joint responsibility of RTNMC and CBNC
Remarks: Provided as **Annex 6.5.1** is the Memorandum of Agreement between RTNMC, CBNC, MGB Region IV-B, LGU, PCSD and the community for the establishment of the CLRF. Additional discussion on the said fund is provided in Section 6.5 of this chapter.				
23	A Solid Waste Management Program acceptable to the LGU leadership to include specific disposal of waste must be developed and submitted to EMB prior to project implementation.	4		Joint responsibility of RTNMC and CBNC
Remarks: Provided as **Attachment 7** is the copy of the Integrated Waste Management Program of RTNMC was submitted to EMB Region IVB.				
24	Slope stabilization and erosion control of the tailings dam, as well as the affected side slopes if the nearby gullies/creeks/rivers within the project site, shall be stricltly affected throughout project implementation;			CBNC's commitment
25	An Environmental Audit must be submitted to EMB after one (1) year of operation and every three (3) years thereafter;	4		
Remarks: **Attachment 8** is received copy of the Third Environmental Audit Report submitted by CBNC to EMB in 2016.				
26	The proponent shall design and construct roads with minimal land and ecological disturbance and with adequate drainage. It shall likewise maintain access roads and other public/private roads within the quarry site	4		
27	Detailed safety management plans and programs focusing on high risk areas shall be submitted to MGB and DOLE thirty (30) days upon the issuance of the certificate.	4		
Remarks: Provided as **Annex 7.1.1** is the approved Safety and Health Program and Emergency Response and Prepared ness Plan submitted on March 4, 2014.				
28	Any infrastructure development relative to the port facilities shall be conducted with minimal disturbance to the mangrove ecosystem	4		
29	The proponent shall conduct quarterly monitoring of air/water quality and emissions/effluent generated from the operations as well as the bioassay of fish in terms of heavy metals, the result of which shall be submitted to the EMB Region IV-B and the EMB. Should monitoring results indicate that there is exceedance of DENR Standards, the proponent shall immediately cease its operation and institute remedial	4		RTNMC and CBNC conduct quarterly air/water quality and emissions/effluent in their respective areas of concern

No.	ECC Conditions	Complied? Yes	No	Proof of Compliance
	measures until such time that the monitoring results conform with the DENR Standards.			
Remarks: RTNMC regularly submits its self-monitoring reports containing the results of its air quality, water quality and noise level monitoring. Discussion on the self-monitoring program of RTNMC is provided in *Section 6.2* of this chapter.				
30	The proponent shall observe good vegetative practices, proper land use, and sound soil management. All used/open areas in the site shall be planted with appropriate species. Direct use of the recovered topsoil for re-soiling or as soil cover on waste dumps and for camp beautification in general shall be undertaken. Stockpiling on designated suitable areas shall be done and maintained at not more than one (1) meter in height and temporarily vegetated to protect the soil from erosion.	4		
31	The proponent shall undertake the following:	4		Joint responsibility of RTNMC and CBNC except for 31.5, which is CBNC's responsibility
	31.1. Period inspection of the stability of all earthworks such as silt dams, waste dumps, stockpiles, tailing pond embankments, road cuts, airport, pier and open pits;			
	31.2. Periodic inspection of the capacities and stability of the drainage canals, culverts, stormwater pond and sedimentation ponds;			
	31.3. Continuous de-silting of drainage canals and sedimentation ponds;			
	31.4. Clearing of rocks and boulders along slopes, especially in road cuts;			
	31.5. Periodic testing of the chemical and physical characteristics of decant water from tailings pond being discharge to the sea; and			
	31.6. Annual monitoring of faunal diversity			
32	An abandonment plan shall be submitted to the EMB, copy furnished EMB Region IV-B and MGB, after a year of the project's operations. Alternatives shall be presented and the same shall be consistent with the long term zoning and land use development plan for the local and provincial government	4		
Remarks: **Annex 8.1.1** is the Final Mine Rehabilitation/Decommissioning Plan of RTNMC submitted to MGB Region IVB on February 28, 2017.				
33	Relevant provisions of the revised EPEP on abandonment shall be strictly implemented	4		
Attachment 9 is the approved EPEP of CBNC for its HPP project which includes the Gotok Limestone Quarry component. An annual EPEP is being submitted by RTNMC to the EMB Region IV-B for compliance. Once, this ECC application is approved, a new EPEP solely for the components of the Gotok Limestone Quarry Project shall be prepared.				

Source: 3rd Quarter Compliance Monitoring and Validation Report (CMVR) for Gotok Limestone Quarry Project of RTNMC, 2015

6.5 CONTINGENT, LIABILITY AND REHABILITATION FUND

A Memorandum of Agreement (MOA) was entered on 28 July 2003 among RTNMC, CBNC, MGB-IVB, Provincial Government of Palawan, Municipal Government of Bataraza, PCSD, residents of Brgy. Rio Tuba, residents of Sitio Gotok, Brgy. Iwahig, *Katutubong Palawan*, HARIBON Foundation, and Bataraza Christian Muslim Palawano Asso., Inc. (BACHRISMUPAL). The MOA states that pursuant to *Section 181* of the *DENR Administrative Order (DAO)*, a Mine Rehabilitation Fund (MRF) shall be established. The current MRF of RTNMC/CBNC is in two (2) forms: Monitoring Trust Fund (MTF) and

Rehabilitation Cash Fund (RCF). The MTF committed as per MOA to cover the expenses of the monitoring activities is PhP 50,000.00 and the current amount deposited in the Development Bank of the Philippines (DBP) is PhP 62,266.61. On the other hand, the RCF committed as per MOA to ensure compliance with the approved rehabilitation activities is PhP 5,000.000.00 and the current amount deposited is 5,496,378.55. In addition, an Environmental Trust Fund (ETF) amounting to PhP 250,000.00 was established by RTNMC. The current amount deposited under the ETF is PhP 249,066.46.

Annex 6.5.1 shows the signed MOA while **Annex 6.5.2** includes the Statement of Account from the government bank indicating the available funds as of September 30, 2015.

As mentioned previously, the CLRF of the Gotok Quarry is part of the CLRF created for the operation of the HPP of CBNC. However, for the monitoring expenses of the MMT, RTNMC does not utilize the MTF. Instead of withdrawing the deposited fund, RTNMC uses its operational fund.

Once the separate ECC for the Gotok Limestone Quarry has been issued, an Environmental Protection and Enhancement Program (EPEP) and Final Mine Rehabilitation/ Decommissioning Program (FMRDP) shall be formulated for the operation of the Gotok Quarry and the Crushing plant. Subsequently, the CLRF fund exclusively for the said project shall be created.

7 Emergency Response Policy and Guidelines

Rio Tuba Nickel Mining Corporation

Previously discussed in *Chapters 2* and *3* of this EPRMP are the potential hazards and risks brought about by the increase in annual limestone production. To prevent and/or alleviate the impact of these hazards on the safety of the workers and the community within the project area, Rio Tuba Nickel Mining Corporation (RTNMC) formulated its Emergency Response and Preparedness Plan (ERPP). This chapter will provide an overview of the emergency procedures as contained in the 2017 ERPP, which covers operations related to the Gotok Limestone Quarry Project and the nickel mining project. **Annex 7.1.1** shows the 2017 ERPP of RTNMC.

7.1 THE EMERGENCY RESPONSE AND PREPAREDNESS PROGRAM

In compliance with Section 144 of the DENR Administrative Order (DAO) No. 2010-21, RTNMC had submitted its ERPP for CY 2017 which was approved by MGB Region IVB on March 14, 2017. Attached as **Annex 7.1.1** is the Certificate of Approval.

As stated in the ERPP, its primary objective is to ensure effective and systematic response to any emergency situation thus minimizing and/or avoiding possible losses and risk exposure of the company such as the employees, equipment, materials, machineries, the environment and the residents of the community. Moreover, per recommendation of the EMB, RTNMC may adopt an ERPP patterned after the UNEP Awareness and Preparedness for Emergencies and Local Level (APELL) to ensure that an integrated multi-hazard approach at local level and emphasize the importance of multi-stakeholder. The draft ERPP is attached as **Annex 7.1.2**.

7.2 SCOPE OF THE PLAN

The ERPP covers the local limestone quarry site, Crushing plant area and Macadam road. It provides procedures for the following situations:

- Accident at work place;
- Natural disasters
    - Earthquake
    - Landslide
    - Typhoon
    - Flood
- Bomb threat and Explosion;
- Fire and explosion; and
- Pressurized tanks and vessels.

7.3 REQUIREMENTS

The ERPP describes control and support coordination which are the requirements to counter the effects of a threatening event.

7.3.1 Control

The Safety Engineer is tasked to direct and coordinate all actions needed during an emergency. The Resident Mine Manager on the other hand instructs and advises the Safety Engineer as needed.

7.3.2 Control

The Safety Engineer is tasked to direct and coordinate all actions needed during an emergency. The Resident Mine Manager on the other hand instructs and advises the Safety Engineer as needed.

7.3.3 Support Coordination

The Safety Engineer has authority to assign and direct personnel and to ensure that needed service vehicle or equipment are available as may be required by the emergency situation. Thru Warning and Information, the Crisis Management Team is made aware of the an event likely to happen/occur.

7.4 DUTIES AND RESPONSIBILITIES

7.4.1 Emergency Response Teams (ERT)

Upon the advice of the Resident Mine Manager, Safety Manager/or Safety Engineer, the Emergency Response Teams shall execute appropriate emergency procedures.

7.4.2 Resident Mine Manager

The RMM is the Overall Commander of the Emergency Response Team and will hold the ultimate responsibility for ensuring the development and effective implementation of the ERPP. He is responsible for the immediate action of trained personnel and deployment of equipment to the accident scene.

7.4.3 Safety Manager

The Safety Manager is responsible for the preparation of an Emergency Response Plan and shall ensure that all staff and contractors on site are made aware with the requirements of the emergency procedures.

7.4.4 Safety Engineer

The Safety Engineer will act as the Incident Commander of the Emergency Response Team and shall be the Drill Officer.

7.4.5 Safety Supervisor

He is responsible for coordinating with Senior Safety Inspectors and other department Managers and Supervisors to ensure that measures are being observed, effectively executed and communicated to the workplace.

7.4.6 Company Legal Officer

The Company Legal Officer shall be responsible for ensuring planned media response, monitoring incident to identify current or potential inter-organizational issues. He shall also advise the Incident Commander.

7.4.7 Crisis Management Team

The Crisis Management Ream is composed of Division and Department Managers, Safety Manager, Security Consultant, Medical Director, Chief Mine Engineer, Accounting Head, COMREL Manager, Legal Officer, IT Head and RTNW Union President.

7.4.8 Fire Brigade Team

In case fire emergency occurs, the Fire Brigade Team shall execute appropriate emergency response procedures with the Safety Supervisor acting as the Fire Captain/On-Scene Commander of the team.

7.4.9 First Aid and Rescue Team

In case first aid incident occurs, the First Aid and Rescue Team shall execute appropriate emergency response procedures with the selected supervisors and employees from Mechanical, Mine Operation, Admin and Pier Site designated as the leaders of the team. The Occupational Health Nurse shall be the On-scene Commander of the Team.

7.4.10 Natural Disaster Response Team

In case a natural disaster such as earth quake and landslide occurs, the Natural Disaster Response Team shall execute appropriate emergency response procedures. The whole ERT will act as the Natural Disaster Team

7.4.11 Support Group

The following support groups shall coordinate with the Safety Engineer and shall have the following responsibilities:

Support Group	Responsibility
1. Mine Operation department	Shall provide additional manpower and heavy equipment as needed.
2. Maintenance Department	Shall provide additional mechanical equipment as needed; Food
3. Transport Section	Shall provide transport vehicle as needed
4. Finance Section	Shall provide funds for emergency purchase of additional and needed materials during emergency
5. Relief Section	Shall provide relief assistance during emergency
6. Medical Section	Shall provide medical assistance during emergency
7. Security Section	Shall provide security personnel for the traffic and crowd control at the emergency site
8. PCO Section	Shall provide PCO personnel to assist at the emergency site
9. Safety Section	Shall provide Safety personnel to assist at the emergency site
10. Electrical	Ensures that essential communication lines are in working order at all times such as Telephone, Mobile Radio and etc.

7.5 EMERGENCY COMMUNICATION SYSTEM

RTNMC has made available an emergency communication network which utilizes two-way radios, telephones and cell phones. The protocol in using the emergency communication system is found in the 2017 ERPP (**Annex 7.1.1**, **pages 9** to **11**). The following list contact information provided below may be used in case of emergency. This is also available in the 2017 ERPP.

Organization	Position	Contact no.	
		Cellphone No.	Local No.
1. RTNMC Minesite	Resident Mine Manager	0917-893-7697	821
	Division Manager, Production	0929-817-2806	837
	Division Manager, Services	0917-893-7715	828
	Division Manager, Mine Engineering	0916-285-3941	859
	Division Manager, Mechanical	0916-366-7227	831

Organization	Position	Contact no.	
		Cellphone No.	Local No.
	CPFMS Head	0906-745-2597	806
	Safety Engineer	0907-323-8004	811
	Dept. Manager, Power Electrical	0927-240-9718	825
	Gotok Limestone Quarry Operation Manager	0998-984-9361	837
	Mine Rehabilitation and Reforestation Officer	0915-643-5387	801
	Pollution Control Officer	0917-590-0387	829
2. Security	Security Manager	0947-288-2862	805
	Detachment Commander, GSSI	0916-781-0098	
	RTN Plant Site Gate		857
	Bataraza Police Station, Chief of Police	0908-862-7451	-
	Medical Director, RTNF Hospital	0927-319-5984	-
	Brookes Point Hospital	(048) 433-2156	-
3. Community	Rio Tuba Barangay Disaster Council	0939-916-6347	-
4. Government Agencies	DENR	(632) 920-4352	-
	MGB Central Office	(632) 302-1369	-
	MGB Regional Office	(632) 536-0214	-
	EMB Regional Office	(632) 536-9786	-
	Philippine Port Authorities	(632) 433-2351	-
	PNRC Chapter Administrator, Palawan	(048) 433-6362	-

7.6 SUMMARY OF EMERGENCY PROCEDURES

Table 7.6.1 provides an overview of the contingency procedures for various accidents or events as contained in the ERPP.

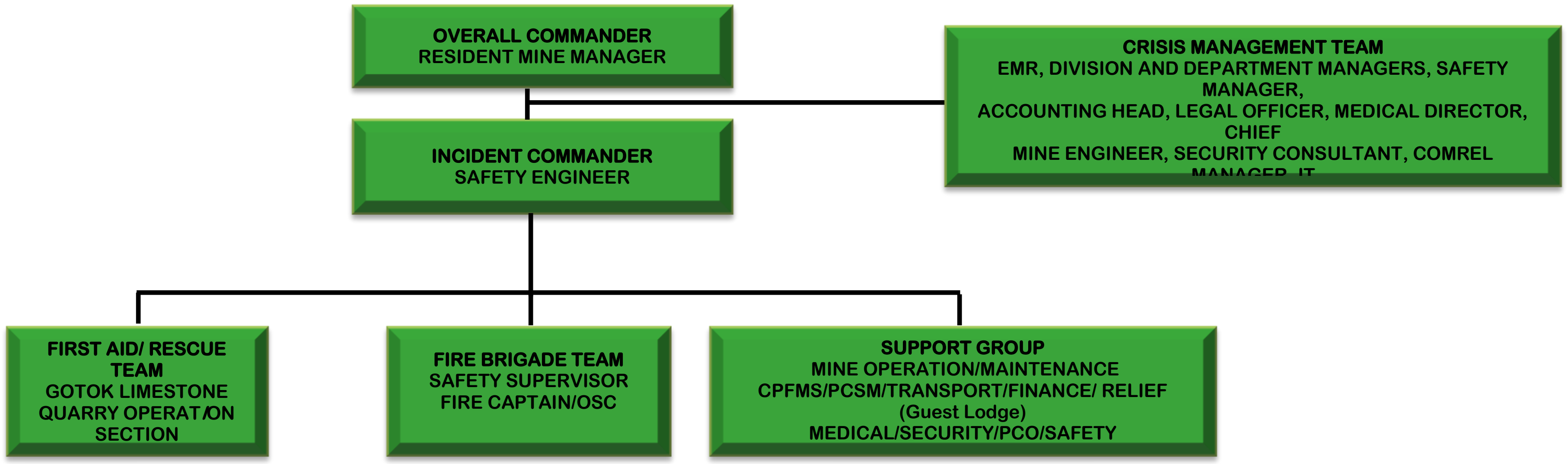
Table 7.6.1. Contingency procedures

Incident	Responsible Person/s	Contingency Procedure
Accident at Work Place	• First Aid and Rescue Team	• Refer to **Annex 7.1.1**, Section 5.0, Pages 11 to 19
Natural Disasters	• Resident Mine Manager • Safety Engineer • Emergency Response Team • Support Group • Crisis Management Team • PCO	• Refer to **Annex 7.1.1**, Sections 6.0, Pages 19 to 20
Bomb Threat and Explosion	• Resident Mine Manager • Security Coordinator • Security Manager • GSSI Detachment Manager	• Refer to **Annex 7.1.1**, Section 7.0, Pages 21 to 23
Fire and Explosion	• Resident Mine Manager • Safety Engineer • Safety Supervisor • Fire Brigade Team • Support Group	• Refer to **Annex 7.1.1**, Section 8.0, Pages 23 to 26
Explosion of pressurized tanks and vessels	• Department Manager – Overall in-charge • Supervisor – shall lead and direct the actual firefighting activities • Leadman – responsible in the smooth and orderly evacuation	• Refer to **Annex 7.1.1**, Section 9.0, Pages 26 to 28

Source: Approved Emergency Response and Preparedness Plan (ERPP) for the Nickel Mining Operation of RTNMC, 2014

7.7 EMERGENCY RESPONSE TEAM

The RMM shall act as the Overall Commander of the ERT while the Safety Engineer shall act as the Incident Commander. Provided in **Figure 7.7.1** is the ERT Chart.



EMERGENCY RESPONSE TEAM CHART

RESIDENT MINE MANAGER/ OVERALL		: Philipp D. Ines	
SAFETY ENGINEER / INCIDENT COMMANDER		: Eloisa G. Bautista	
CRISIS MANAGEMENT TEAM		Reginaldo Z. Mia	: Medical Director
Rodolfo T. Campos	: Division Manager, Production	Ernesto Benitez	: Security Coordinator
Ruben B. Nifas	: Division Manager, Technical Services	Eugenia H. Tuyak	: Accounting Head
Constante V. Peralta	: Division Manager, Mechanical	Jerome B. Sadongdong	: Legal Officer
Cynthia E. Rosero	: Division Manager, Engineering Services	Leo N. Pascua	: Head, Information Technology
Ventutimo S. Masindo:	: Division Manager, Admin	Reynaldo dela Rosa	: COMREL Manager
Remedios C. Camo	: Safety Manager	Avelino M. Abiog	: Asst. to the RMM
Ricky Jay B. Bernardez	: Dept. Manager, Heavy Equipment	Bibiano P. Ranes	: Company Forester
Carmelita V. Catacutan	: Head, MEPED	Ricardo L. dela Torre	: RTNW Union President
Ronelbert A. Suguitan	: Chief Mine Engineer	Rodante D. Pring	: SUPERTECHS President

FIRST AID/ RESCUE TEAM

J. GONZALES	: On-scene Commander
M. REYES/C. UBAY	: Leaders, Gotok Quarry
E. RIOVERS/T. DELA CRUZ	: Leaders, Crushing Plant

FIRE BRIGADE TEAM

BERNARD O. BALINO	: Fire Captain/OSC
JEFREY G. PIZARRO	: Assistant OSC/FT operator
RHEY A. FAMILLARAN	: Assistant OSC/WT-19 operator
RICKY MAGALLANES	: FT operator

SUPPORT GROUP

Contact Persons

MINE OPERATION	: Rodolfo T. Campos
MAINTENANCE & TRANSPORT	: Constante V. Peralta
CPFMS	: Roger P. Malnegro

SUPPORT GROUP

Contact Persons

RELIEF	: Jean L. Panes
MEDICAL	: Reginaldo Z. Mia
SECURITY	: Pedro C. Dulos

SUPPORT GROUP

Contact Persons

FINANCE	: Eugenia H. Tuyak
	: Rose Campos
	: I. Diogenes

SUPPORT GROUP

Contact Persons

MINE OPERATION	: Rodolfo T. Campos
MAINTENANCE & TRANSPORT	: Constante V. Peralta
CPFMS	: Roger P. Malnegro

Figure 7.7.1. Emergency Response Team Composition for Gotok Limestone Quarry

7.8 COMPLIANCE WITH HEALTH AND SAFETY PROGRAM COMMITMENTS

Table 7.8.1 shows the compliance of RTNMC with the health and safety program commitments for its Nickel Ore and Limestone Production Projects lifted from the 2015 Compliance Monitoring and Verification Report (CMVR) prepared by the Multi-Partite Monitoring Team (MMT).

Table 7.8.1. RTNMC's compliance with health and safety program commitments as reported by the MMT

Elements	Specific Program to be Validated	Complied?		Remarks
		Yes	No	
Leadership and Administration	Safety Statistics Board/Environmental Policy	✓		Data from the safety statistics board which show zero fatal accident reflects the effectiveness of the implementation of the company's ASHP and its commitment in the protection of the environment.
Organizational Rules	The company has its own general safety and health rules anchored in DAO 2000-98 otherwise known as the Mine Safety and Health Standards and conducts regular program monitoring.	✓		The company should continue the implementation of the general safety and health rules.
Meetings	Central Safety and Health Committee should meet at least once a month	✓		Three (3) Central Safety and Health Committee meetings were conducted and attended by the Resident Mine Manager, Safety Engineer, contractors, union members and safety officers, Department/Section Managers.
	Department meetings on safety and health matters should be held at least once a month	✓		A total of 29 Department meetings were conducted. Department meetings, which were postponed as per schedule shall be conducted on the following day.
	Pep talks or toolbox meetings should be held before employees are deployed to their respective workplaces	✓		For the 92 days toolbox meeting, a total of 374 toolbox meetings were conducted
	Contractors' safety meeting should be conducted at least once a month	✓		Three (3) Contractors' meetings were conducted after the safety patrol to discuss safety concerns at the contractors' work area
	Production meeting should be conducted at least three (3) times a week	✓		40 Production meetings were conducted
Management and Employee Trainings	- BLS and First Aid	✓		One (1) First Aid and BLS training as per schedule for the quarter was conducted last Sept. 2-8, 2015 with a total of 11 participants.
	Weekly Defensive Driving Course	✓		12 Defensive Driving Course were conducted with a total of 76 participants
	New employees orientation training on safety and health consciousness, responsibilities and on the use of Personal Protective Equipment	✓		51 Safety orientations were conducted
	Firefighting Training/Seminar	✓		The Company has targeted one (1) firefighting training for the quarter, however RTNMC conducted two (2)

Elements	Specific Program to be Validated	Complied? Yes	Complied? No	Remarks
				firefighting Training last Sept. 24, 2015. **Annex 7.8.1** shows the photo-documentation of the training.
Planned Inspections	Electro/mechanical Facilities inspections	✓		19 safety action memos were issued on sub-standard acts/conditions
	Mine, axillary facilities and base camp safety audit	✓		220 safety action memos issued on sub-standard acts/conditions during the daily inspection
	Contractors' camp safety audit	✓		Two (2) safety inspections were conducted. The cancelled safety inspection shall be conducted the following day.
	Monthly Departmental Safety Audit	✓		12 Departmental Safety Audits were conducted
	Firefighting equipment inspection and maintenance	✓		Three (3) monthly inspections and maintenance of fire extinguishers were conducted and one (1) fire hydrant flushing was as well conducted.
Accident/ Incident Investigation	Monthly Statistics Recording	✓		Three (3) Monthly Statistics Recording were conducted
	Monthly submission of reports	✓		Three Monthly General Accident Reports (MGAR) were submitted to MGB-IVB
Health Control and Services	Provision of medical examination to employees (Charge to HRD) a) Annual Physical examination	✓		106 personnel were scheduled to undergo annual physical exam
	Provisions of medicines, vitamins and dental services to employees (HRD)	✓		A total of 2,752 employees and dependents were given medical and dental services.
Emergency Response and Preparedness Program	First Aid/Fire Fighting Drill	✓		LSVMS Exit Drill was conducted on September 2015 **(Annex 7.8.1)**.
Good Housekeeping	Perform housekeeping for every end of shift.	✓		92 days daily housekeeping were conducted
Provision for Personal Protective Equipment	Procurement of returnable and consumable PPEs: a) Men's & Ladies' Rain boots	✓		Remaining Personal Protective Equipment (PPEs) have already arrived at the mine site enough until the year ends as per Safety Engineer.
	b) Anti-napping device	✓		
	c) Rain coats	✓		
	d) Steel Toe SS (for Ladies/Men)	✓		
	e) Skull Guard Harness w/ Sweatband	✓		
	f) Reflective Traffic Hand Gloves	✓		
Safety/Health Incentives	Safety Incentive bonus were given monthly to different departments/sections	✓		PhP 26,000.00 were given to different departments/sections
	Signage posting	✓		95 signage were posted at strategic locations within the MPSA area
Community Consultation and Program Dissemination	Consultation/dissemination conducted	✓		Six (6) IECs were conducted for the quarter under review.

8 Abandonment/Decommissioning/ Rehabilitation Policy

Rio Tuba Nickel Mining Corporation

This chapter describes the current Final Mine Rehabilitation and/or Decommissioning Plan (FMR/DP) submitted by RTNMC on May 31, 2013 to the Mines and Geosciences Bureau (MGB) IVB (MIMAROPA) for the existing operation scheduled to end in 2021. Once the ECC for the proposed operation scheduled to end in 2022 has been granted, a revised FMR/DP containing adjustments on the costing and project schedule will be submitted.

8.1 INTRODUCTION

Section 187 of the DENR AO No. 2010-21 states the Final Mine Rehabilitation and/or Decommissioning Plan (FMR/DP) or Mine Closure Plan shall be integrated in the Environmental Protection and Enhancement Program (EPEP) and submitted to the Mine Rehabilitation Fund Committee (MRFC) through the Regional Office and to the Contingent Liability and Rehabilitation Fund (CLRF) Steering Committee through the Bureau. The FMR/DP includes financial estimates covering decommissioning, rehabilitation, maintenance and monitoring, employee and other social costs including residual care, over a 10-year period.

8.2 FINAL MINE REHABILITATION/DECOMMISSIONING PLAN

The outline of the FMR/DP as provided by the MGB (2006) shall consist of the following:

- Company Information;
- Executive Summary;
- Background Information;
- Stakeholder Involvement;
- Risk Assessment;
- FMR/DP or Mine Closure Plan;
- Schedule of Operations and Costs;
- Plan Showing Proposals; and
- Technical Appendices.

Contents of the Risk Assessment, FMR/DP and Schedule of Operations and Costs sections are provided in the succeeding paragraphs.

8.2.1 Risk Assessment

It was identified that following risks sources and event shall be apparent:

- Landforms
  - Mass movement, e.g., land sliding
  - Rill and gully erosion
- Soil substrate
  - Inadequacy of growing substrate
  - Inadequacy of soil quality in terms of texture, structure, organic matter, cation exchange capacity, soil, pH and nutrients for plant growth

- Revegetation
  - Low survival rate and percent cover of planted species
  - Forest fire
- Quarry
  - Failure of quarry walls
  - Ponding due to breakage or clogging of drainage

8.2.2 Final Mine Rehabilitation and/or Decommissioning Plan or Mine Closure Plan

The submitted FMR/DP identified four (4) potential alternative post-mining land uses for the project site namely: industrial tree plantation, aquaculture, ecological park, and forestland. A market study relative to the identified alternative land use shall be done by the Rio Tuba Nickel Mining Corporation (RTNMC) at least five (5) years before the end of Project life to ensure the adoption of the most appropriate land use.

In the absence of a market study, the specific post-mining land use adopted in this FMR/DP and the closure criteria is shown in **Table 8.2.1**. The general closure criteria for the RTNMC Project are based on the DENR-prescribed goals of mine closure, namely, physical and chemical stability, visual acceptability, and productivity or self-sustaining condition. The slope and other FMR/DP requirements of the mine components are shown in **Table 8.2.2**.

Table 8.2.1. Specific post-quarry land-uses and closure criteria

Project facility or structure	Specific post-mining land use	Required Works
Quarry benches	Forestland	• Stable slopes where applicable as provided in **Table 8.2.2**; • Lined drainage channels. Drainage channel designed for 24 hours 1:1000 years' rainfall with ample width and size to allow for partial blockage of sediment established and surface regarded for long-term erosion control; and • Vegetative cover using a combination of fast growing grass as understory component and to cover the ground immediately. Shrub and trees will also be part of the vegetative cover. Soil conditioned to enhance plant growth based on field trial tests.
Quarry voids / Bottom	Water bodies for aquaculture, recreation and for watering livestock	• Stable slopes where applicable as provided in **Table 8.2.2**; • Drainage channel designed for 24 hours 1:1000 years' rainfall with ample width and size to allow for partial blockage of sediment established and surface regarded for long-term erosion control; • Pond water compliant with DENR standards for a class C water body; and • 20-m buffer zone replanted with grass and other endemic species.
Access roads and slopes	Some as forestland; others for road	• Flattened embankments **(Table 8.2.2)**; • Planting should be dense enough to provide ground cover as soon as possible; • Lined drainage channels; • Hardstands deep ripped and covered with conditioned soil to enhance plant growth based on field trial tests; • Revegetated with endemic species;

Project facility or structure	Specific post-mining land use	Required Works
Access roads and slopes	Some as forestland; others for road	• Flattened embankments **(Table 8.3.2)**; • Planting should be dense enough to provide ground cover as soon as possible; • Lined drainage channels; • Hardstands deep ripped and covered with conditioned soil to enhance plant growth based on field trial tests; and • Revegetated with endemic species.
Crushing / Screening Plant, Power Plant	Forestland	• Spillages and wastes removed; • Used and unused chemicals removed; • Cables, pipes, concrete, masonry, storage tanks, equipment, structures, and unnecessary materials removed; • Sludge, wastes, oil, and chemical-contaminated soils and materials hauled out; and • Revegetated with endemic species.
Offices	Forestland	• Cables, pipes, concrete, masonry, storage tanks, equipment, structures, and unnecessary materials removed; • Sludge, wastes, oil, and chemical-contaminated soils and materials hauled out; • Hardstands deep ripped and covered with conditioned soil to enhance plant growth based on field trial tests; and • Revegetated with endemic species.

Source: Gotok Limestone Quarry Project FMRDP, 2013

Table 8.2.2. Slope and other FMR/DP requirements

Mine Component	Slope	Slope Length	Others
Hilltop of fluve	20H :1V or flatter		Overall positive drainage
Hillslope or pitwall	4H : 1V, 5H : 1V	15 to 30m, less than 50m	Use of cross-slope ditches or furrows; preferred hillslope shape is concave and complex
Toe or pit floor	20H : 1V or flatter		Overall positive drainage
Drainage channel or emergency spillway	To mimic natural streams in grade	To mimic natural streams in banks and armoring	Design rainfalls is 24-hr 1:1,000 years in event
Forest Plantations			Preference to endemic species; post-planting maintenance works are critical. CENRO's help is needed to train the communities on the care and maintenance of the plantations.

Source: Gotok Limestone Quarry Project FMRDP, 2013

The activities to be done under the FMR/DP are sub-divided into three (3) components: decommissioning plan, rehabilitation plan, and maintenance and monitoring plan. These components are briefly discussed in the succeeding paragraphs. A summary of the activities under each component and its corresponding schedule are also provided in **Table 8.2.4** and **Table 8.2.5**, respectively. It should be noted that the proposed schedule was based on the existing quarry plan of RTNMC. The adjusted quarry schedule shall be provided in the revised and updated FMR/DP to be submitted to the MGB once the Environmental Compliance Certificate (ECC) for this proposed project has been granted.

8.2.2.1 Decommissioning Plan

The FMR/DP provides the following basic approaches for the mine decommissioning of the Gotok Limestone Quarry project:

- Removal from the site of any materials, equipment or structures having residual value or any existing or potentially hazardous substance, equipment or structures;
- Treatment at site of any existing or potentially hazardous materials, equipment or structures by various means such as chemical treatment, fixing in solids (cementation or backfilling), burial or underground storage; and
- Containment at site of any existing or potentially hazardous substances, equipment or structures through collection and storage in the smallest contaminated area possible, encapsulation, capping, burial, etc.

8.2.2.2 Mine Rehabilitation Plan

The goals of mine rehabilitation are to achieve both physical and chemical stability, productivity and self-sustaining condition. The following rehabilitation works shall be done to accomplish these goals:

- Earth and grading works to achieve the desired slopes and slope lengths;
- Fixing of drainage channels, inlets and outlets in terms of gradient, side slopes, armoring, and sinuosity; and
- Revegetation works which include nursery operations, soil amelioration, planting, plantation maintenance and protection.

8.2.2.3 Maintenance and Monitoring Plan

To evaluate the effectiveness of the closure and final rehabilitation measures, the proposed mine closure monitoring plan (**Table 8.2.3**) shall be implemented.

Table 8.2.3. Mine closure monitoring plan

Area	Parameter	Monitoring Approach	Frequecy
Quarry benches	Bench wall stability	Visual – Look for tension cracks, gully erosion, alluvial fans, and other signs of failure	Weekly, then monthly and quarterly
	Berm Stability	Visual – Look for tension cracks, gully erosion, alluvial fans and other signs of failure Visual – Look for ponding and scouring	Weekly, then monthly and quarterly
Quarry voids/bottom	Drainage channels stability	Visual – inspect channel for blocks and scour	Weekly during wet season, monthly during dry
	Impound water quality	Sampling water quality	Monthly analysis then quarterly
	Effluent quality	Visual - Turbidity	Weekly, then monthly and quarterly
	Aquatic biology	Sampling – plankton, benthos, insects, fishes	Annually
Crushing/ screening plant, power plant and office area	Erosion	Visual – look for gully sheet, or rill erosion	Weekly, then monthly and quarterly
	Dust	Visual – look for suspended particulates during windy and dry days	Monthly
	Vegetation	Transects, density cover, diversity,	Annually

Area	Parameter	Monitoring Approach	Frequecy
	establishment	EFA, regeneration	
Adjacent and downstream areas	Dust	Visual – look for suspended particulates during wind and dry days	

Table 8.2.4. Summary of activities under the FMR/DP

Activities	Coverage	Details
Decommissioning		
Removal of concrete/hardstone	Quarry area, plantsite and admin office	*Annex 8.1.1, Section 6, Page 6-3 to 6-5*
Removal of equipment, buildings, wirings, pipings		
Rehabilitation		
Grading and drainage works	Mined out areas, buffer zone of sedimentation ponds, condemned access roads and industrial and office areas	*Annex 8.1.1, Section 6, Page 6-5 to 6-6*
Revegetation works		
Maintenance and monitoring		
Mine closure monitoring	Quarry area, plantsite and admin office, adjacent and downstream areas	*Annex 8.1.1, Section 6, Page 6-7 to 6-8*
Water and air quality monitoring		
Equipment operation and maintenance		

Table 8.2.5. Schedule under the FMR/DP

Activities	Schedule	
	Start	Finish
Decommissioning		
Removal of concrete/hardstone	2 June 2021	1 July 2021
Removal of equipment, buildings, wirings, pipings	2 June 2021	28 December 2021
Rehabilitation		
Grading and drainage works	2021	2021
Revegetation works	2021	2022
Maintenance and monitoring		
Mine closure monitoring	2021	2025
Water and air quality monitoring	2021	2025
Equipment operation and maintenance	2021	2025

8.2.3 Cost of FMRDP

The cost for FMR/DP is estimated at PhP23.8 M spread over a period of five (5) years. The breakdown details are listed in **Table 8.2.6**.

Table 8.2.6. Summary of FMR/DP cost (in PhP)

Activity	2021	2022	2023	2024	2025	Total
1. Decommissioning and demobilization of equipment						
• Decommissioning of equipment and facilities	1,797,720	0	0	0	0	**1,797,720**
• Decommissioning of equipment and facilities	200,000	0	0	0	0	**200,000**
2. Grading and Drainage works	388,755	0	0	0	0	**388,755**
3. Revegetation						
• Topsoil application	1,043,860	811,890	811,890	811,892	0	**3,479,533**
• Nursery operation	102,149	51,074	51,074	51,074	0	**255,372**
• Plantation establishment	235,096	78,363	78,363	78,363	0	**470,185**
• Maintenance	97,235	97,235	97,235	97,235	0	**388,939**
• Management	41,791	41,791	41,791	41,791	0	**167,164**
Sub-total	1,520,131	1,080,354	1,080,354	1,080,356	0	**4,761,194**
4. Environmental Maintenance & monitoring	3,440,700	3,440,700	2,595,700	2,595,700	2,595,700	**14,668,500**
5. Capacity building and development	0	0	26,525	26,525	0	**53,050**
6. Contingency	402,474	402,474	402,474	402,474	402,474	**2,012,370**
Total FMR/DP	**7,749,780**	**4,923,528**	**4,105,053**	**4,105,055**	**2,998,174**	**23,881589**

9 Institutional Plan for IMP Implementation

Rio Tuba Nickel Mining Corporation

This chapter discusses the institutional plan of Rio Tuba Nickel Mining Corporation (RTNMC) for the implementation of the Impact Management Plan (IMP) presented in *Chapter 4*. This chapter also provides an overview of the operations of the Environment Management Unit (EMU), Community Relations (ComRel) Office, Safety Office, and the Multi-partite Monitoring Team (MMT).

9.1 POLICY STATEMENT

Driven by the principle of sustainable development, RTNMC envisions fostering a progressive economy that embraces environmental conservation, occupational safety, a healthy lifestyle, and a good interrelationship with the government and the impact community dwellers. As an organization, RTNMC aims to create a strengthened company that focuses on achieving the following objectives:

- To continuously implement its various community development initiatives to enhance the socio-economic progress of our host community and other stakeholders under a sustainable framework of development;
- To continuously promote the concept of sustainable development as the company firmly believes that mining can be sustainable;
- To continuously implement the various environmental and pollution control programs to mitigate the adverse impact of mining operation to the environment;
- To continuously promote the safety and health of its personnel and religiously comply with all pertinent policies, rules and regulations relative thereto; and
- To continuously undertake appropriate information and education campaign among members of the mining community and stakeholders to increase their level of knowledge and awareness on the mining operations, safety, health and environmental programs that the company is undertaking.

The minesite organizational table is shown as **Figure 9.1.1**. The operation of the limestone quarry as well as the saprolite and laterite operations are headed by Production Division Manager. In the new organizational structure, the operation of the quarry and its support services will no longer be under the Production Division, instead it will be managed by a Project Manager as seen in **Figure 9.1.2**. The Project Manager shall directly report to the Resident Mine Manager.

2016 RTNMC TABLE OF ORGANIZATION

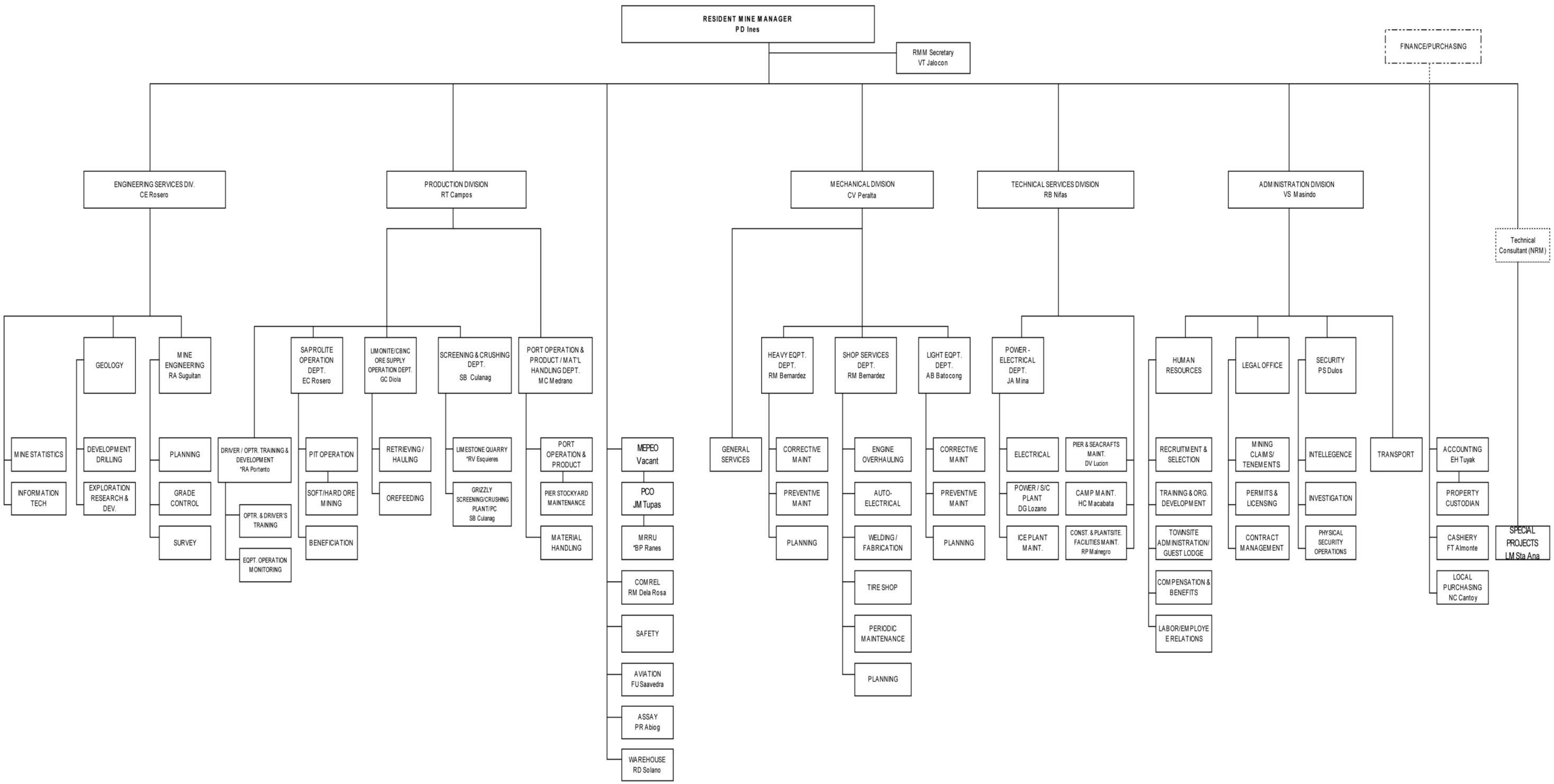


Figure 9.1.1. Mine site organizational structure

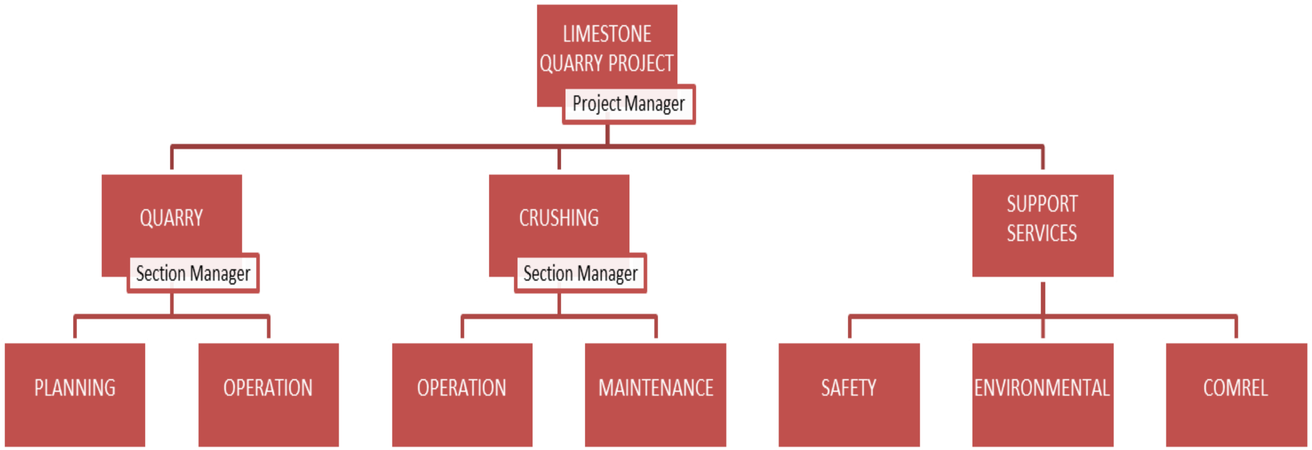


Figure 9.1.2. Proposed organizational structure for the Gotok Limestone Quarry Project

9.2 MINE ENVIRONMENTAL PROTECTION AND ENHANCEMENT OFFICE (MEPEO)

The functions of an environmental office/unit in RTNMC are performed by the Mine Environmental Protection and Enhancement Office (MEPEO). The MEPEO was organized in compliance with the DENR Administrative Order No. 2010-21. The primary task of MEPEO is environmental management especially in the implementation of environmental programs of RTNMC.

The MEPEO is led by the Environmental Officer who reports directly to the Resident Mine Manager. **Figure 9.2.1** shows the MEPEO Organizational Chart. Among the essential duties of the EMU Manager are:

- Plans and manages the implementation of the environmental management plans (EMP);
- Monitors and evaluates the effectiveness of the mitigating and enhancement measures;
- Monitors compliance of Contractors on their implementation of provisions of the Environmental Management Plan (EMP) in their respective activities;
- Plans, recommends, and implements modifications or additional environmental measures deemed necessary to effectively protect the environment;
- Coordinates with relevant agencies including the Local Government Units (LGUs) to ensure their effective participation in the implementation of the EMP; and
- Initiates, plans, and implements rehabilitation and abandonment programs.

The MEPEO of RTNMC is both responsible for the operation of the Nickel Laterite Project and the Gotok Quarry Project. However, personnel shall be appointed specific for the operations of the quarry.

9.3 COMMUNITY RELATIONS (COMREL) OFFICE

As stipulated in its Environmental Compliance Certificate (ECC), a Community Relations Office (CRO) headed by a ComRel officer was established by RTNMC. This office is tasked to communicate with stakeholders before, during and after the implementation of projects covered in the Social Development and Management Program (SDMP). The ComRel Office is also tasked to coordinate with the residents of the impact communities regarding the on-going and planned activities of the company to keep the stakeholders updated about the operations of RTNMC. In general, the ComRel group needs to observe the following:

- Implement and monitor Social Development and Management Program (SDMP);
- Initiate linkages and partnership with other organizations; and
- Implement the Information, Education, and Communication (IEC) Campaign.

As an affiliated company, RTNMC and Coral Bay Nickel Corporation (CBNC) also established a Community Relations Assistance (CRA) program to provide flexible social support to stakeholders. The CRA provides health services, welfare, social services, sponsorships, donations and general assistance not covered in the SDMP. Both companies approve the requests course through the CRA program.

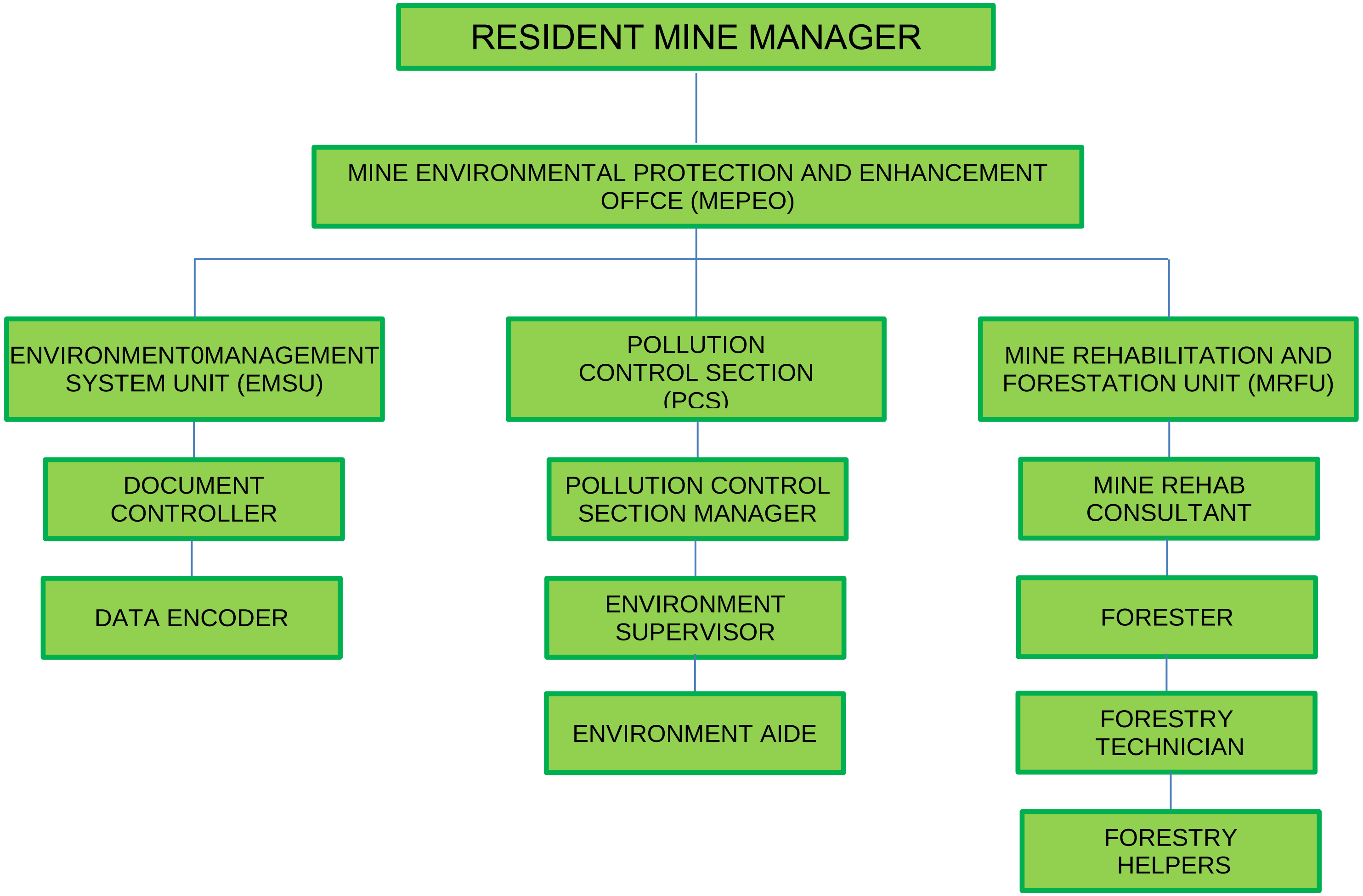


Figure 9.2.1. RTNMC MEPEO organizational

The Rio Tuba Nickel Foundation, Inc. (RTNFI) was established in 2003 with the vision to *"uplift the lives of people through the implementation of relevant endeavors and various effective community programs and projects within the context of responsible mining for sustainable development*" and the mission to "*maintain an empowered and fully supported mining constituency for enhancement and promotion of tangible partnership between mining operations and stakeholders, as central to the operationalization of the joint corporate responsibility of RTNMC and CBNC."*

9.4 SAFETY DEPARTMENT

The safety of all workers in the mine site is primary mandate of the Safety Department. It is the responsibility of this office to strictly implement the guidelines stipulated in the Safety Plan and regularly conduct safety inspection among workers and the work place especially on areas where critical activities are being done.

The Safety Department directly reports to the Resident Mine Manager and is headed by the Safety Manager. It is composed of one (1) full time Safety Manager, one (1) Safety Engineer, one (1) Safety Coordinator, one (1) Occupational Health Nurse, one (1) Clerk, one (1) Sign Art Painter, one (1) Animator- PPE Custodian and to (2) Senior Safety Inspectors who supervise ten (10) Macadam/ Mine site monitoring personnel and ten (10) Safety Inspectors.

The health management system is also being reviewed and enhanced by the same office. **Annex 9.4.1** includes the approved Safety and Health Program for the year 2017.

9.5 MULTI-PARTITE MONITORING TEAM (MMT)

The current set-up of the MMT of RTNMC is composed of representatives from various sectors and stakeholders:

- MGB Region IVB (MIMAROPA);
- DENR-EMB Region IVB (MIMAROPA);
- Palawan Council for Sustainable Development (PCSD);
- Provincial Environment and Natural Resources Office (PENRO);
- Community Environment and Natural Resources Office (CENRO) Brooke's Point;
- Department of Health (DOH);
- LGU-Bataraza;
- LGU-Rio Tuba;
- Bureau of Fisheries and Aquatic Resources (BFAR);
- Philippine Economic Zone Authority (PEZA);
- Apostolic Vicariate of Puerto Princesa;
- HARIBON-Palawan;
- Indigenous People; and
- RTNMC.

This composition is subject to reconstitution based on *Section 16* - Rationalization of the Multi-Partite Monitoring Team (MMT) Existence, Composition and Leadership of the DAO 2017-15 or the Guidelines on Public Participation under the Philippine EIS System. With respect to this Order, the following significant modifications in the MMT set-up shall be recognized:

a. *Section 16.1* – MMTs shall only be for ECPs.
b. *Section 16.2* – The project proponents and EMB-DENR shall no longer be member of the MMT. The EMB shall only take part in recommending in the impact and compliance evaluation of the MMT reports and conduct of performance audit of the MMTs. The project proponent on the other hand shall provide funds for the MMT activities based on the Annual Work and Financial.
c. *Section 16.3* – Composition of the MMT. This has limited the participation of the LGU (MENRO, RHU Chief, concerned Barangay Captain, LGU-accredited local NGO related to environmental management, locally recognized community leaders who can represent vulnerable sectors, government agencies with related mandate on the type of project and its impacts during project implementation).
d. *Section 16.4* – The representative from MENRO or lead government agency shall serve as the MMT Chair or other members of the MMT if the representative declines the chairmanship.
e. *Section 16*.5 – The existing MMTs for ECPs shall reconstitute themselves accordingly though a MOA between EMB-CO and proponent with conformity by the members on *Section 16.3*, integrating the EGF provisions in the MOA with EMB CO Director as the Chairperson of the EGF.
f. *Section 16*.6 – *In the case of existing MMTs for mining projects, the EMB representatives shall likewise be removed as member of the MMT.*

Based on Article VII of this Administrative Order, one (1) year transition period will be given for the restructuring of the MMT.

9.6 COMPLAINTS MANAGEMENT

RTNMC maintains a grievance mechanism to which the stakeholders will have the comfort of conveying their observations and concerns in relation to the project operation. Most importantly, the filed complaints if properly reported to the RTNMC officials will be documented and given proper action. RTNMC follows the following procedure as described in the diagram below (**Figure 9.6.1**).

Detailed discussion of the procedure is provided in **Annex 9.6.1**.

Figure 9.6.1. RTNMC Procedure diagram for filed complaints