



Environmental Performance Report and Management Plan
Calabar Quarry Operations Project
 Island Quarry and Aggregates Corporation (IQAC)
 Brgys. Pantok and Palangoy, Binangonan, Rizal

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EXECUTIVE SUMMARY

BACKGROUND

ISLAND QUARRY AND AGGREGATES CORPORATION (“IQAC”) is the holder of Placer Patent Nos. 9, 11, 12 and 14 which are currently evidenced by transfer certificates of title (the “Mining Patents”). The said Mining Patents were granted under the Philippine Bill of 1902 sometime during the period 1912 to 1914. These Mining Patents are valid and subsisting over the project area.

IQAC acquired these Mining Patents from its predecessor-in-interest/grandparent company, Rizal Cement Company, Inc. (“Rizal Cement”). Copy of its Securities and Exchange Registration is attached in Annex A. As part of a corporate restructuring exercise in 2001, Rizal Cement transferred all its rights, title and ownership over all its real properties including the Mining to IQAC.

The Mining Patents are currently covered by land titles issued by the Register of Deeds, to wit:

PLACER PATENT NO.	DATE GRANTED	AREA COVERED (in hectares)	CURRENT TCT NO.	DATE OF ISSUANCE OF CURRENT TCT
Placer Patent No. 9	July 20, 1912	37.3275	M-109592	December 18, 2001
Placer Patent No. 11	February 12, 1913	39.2925	M-112715	October 16, 2002
Placer Patent No. 12	May 26, 1914	7.5601	M-109594	December 18, 2001
Placer Patent No. 14	April 17, 1913	17.1505	M-112709	October 16, 2002

The certificates of title originally issued during the period 1912 to 1914 covering the Mining Patents have been cancelled and replaced by transfer certificates of title which have been issued over the years. The copies of the latest transfer certificates of title covering these Mining Patents and indicating reference to the patents are hereto attached in Annex B. Also attached as Annex C is a copy of Mines and Geosciences Bureau Certification dated 6 May 2016.

In most facets of the mining activities, there is always the potential for environmental and ecological problems from the construction of mining facilities, the extraction of ore, to the processing of minerals. In order to assess the likely impacts on the environment and to have a tool of environment management, Island Quarry and Aggregates Corporation (IQAC), submitted an Environmental Performance Report and Management Plan (EPRMP) for the Calabar Quarry Operations Project.

This EPRMP was made in compliance with the provision of Presidential Decree No. 1586, otherwise known as the Philippine Environmental Impact Statement (PEIS) System. The information used in this EPRMP was based on data, plans and documents provided by the management of IQAC. Secondary data sources include previous studies and reports from the IQAC, Department of Environment and Natural Resources (DENR), Environmental Management Bureau (EMB), Mines and Geosciences Bureau (MGB), National Statistics Office (NSO), Philippine Statistics Authority (PSA), the Socio Economic Profile of Binangonan, Rizal and other pertinent Government Agencies and researches conducted within the vicinity.

The assessment focused on the description of the project, its location and evaluation of project's expected impacts on the environment including its impact to the adjoining community. This report also provides mitigating measures to abate any adverse environmental impact resulting during the construction, operation and abandonment phase of the project

An ECC for the Aggregates Crushing Plant was issued by EMB Regional Office 4A on January 24, 2018. Copy of the ECC is attached in Annex O.



I. PROJECT FACT SHEET

Project Title	: Calabar Quarry Operations Project
Project Location	: Brgys. Palangoy and Pantok, Binangonan, Rizal The Project is to be situated within the 101.33 hectares existing quarry area covered by Mining Placer Patent Nos. 9, 11, 12 and 14 which are duly annotated on Transfer Certificates of Title (TCT) Nos. M109592, M-112715, M-109594 and M-112709, respectively.
Project Cost	: PhP 270,000,000.00
Background and Nature of Project	: The Calabar Quarry Operations Project involves an increase in production capacity of its existing mining operation. Calabar Quarry is the source of pozzolan and limestone of IQAC. The previous activities in Calabar Quarry commenced before the effectivity of the EIS System and thus exempted from securing ECC. Its Aggregates Crushing Operation however, is covered by ECC Ref. No. ECC-OL-R4A-2018-0057 issued on Jan. 24, 2018. This project will involve increased extraction capacity of pozzolana and limestone, as well as increased capacity of crushing operations including its support facilities and auxiliaries, thus this amendment.
Size and Scale	: Extraction started as early as 1912 with the issuance of Patent No. 9 in the name of applicant's predecessors-in-interest. Patent Nos. 11, 12 and 14 were subsequently issued in 1913 and 1914 and mining operation in the area were then immediately conducted by applicant's predecessor-in-interest. This project involves increased extraction of pozzolan from 380,000 MTPY to 1.50MMTPY, as well as extraction of limestone from 500,000 MTPY to 10.89MMTPY for use as cement raw materials, construction materials and materials for various industries (such as but not limited to glass, hygienic products and power). The Project area is 101.33 hectares. The project also includes development of access road, increase in capacity of the installed Aggregates Crushing Facilities from 1.5MMTPY to 2.5MMTPY capacity which include auxiliary and support equipment and other associated facilities and equipment as follows: <ul style="list-style-type: none"> • Water pumps and pipelines • Power supply connection and power generator • Crushing facility system consisting of crushers, conveyors, screen and other associated facilities • Dust Management System • Concrete block making equipment • Mortar production equipment • Road construction equipment • Sand bagging equipment • Weighing scales and Scale Equipment and Office • Motor pool • Equipment Maintenance Facility • Stockpile • Stockpile Area • Storage Area • Laboratory or Material Testing Facility



	<ul style="list-style-type: none">• Administrative Office• Safety offices and facilities• Parking Area• Bunkhouses• Development of access road.																																																																																																																					
Objective	: To increase the extraction capacity of limestone and pozzolan and aggregates crushing																																																																																																																					
Geographical Coordinates	: Provided below are the coordinates of the Project area: <div><table><tr><th colspan="3">TECHNICAL DESCRIPTION PATENT 9</th></tr><tr><th>LINE</th><th>BEARING</th><th>DISTANCE</th></tr><tr><td colspan="3">LOT 16232 TCT# M- 109592</td></tr><tr><td>1 – 2</td><td>N.00° 53'E.</td><td>795.48 M.</td></tr><tr><td>2 – 3</td><td>S.89° 57'E.</td><td>455.86 M.</td></tr><tr><td>3 – 4</td><td>S.10° 19'W.</td><td>1,092.20 M.</td></tr><tr><td>4 – 5</td><td>N.61° 42'W.</td><td>171.28 M.</td></tr><tr><td>5 – 6</td><td>N.61° 51'W.</td><td>139.70 M.</td></tr><tr><td>6 – 1</td><td>N.00° 38'E.</td><td>132.58 M.</td></tr><tr><td colspan="3">TIE LINE: S.55° 19'E.,515.00 M.; From RLM# 2, RIZAL</td></tr></table> <table><tr><th colspan="3">TECHNICAL DESCRIPTION PATENT 11</th></tr><tr><th>LINE</th><th>BEARING</th><th>DISTANCE</th></tr><tr><td colspan="3">LOT 16278 TCT# M- 112715</td></tr><tr><td>1 – 2</td><td>N.73° 09'W.</td><td>98.57 M.</td></tr><tr><td>2 – 3</td><td>N.00° 38'E.</td><td>781.36 M.</td></tr><tr><td>3 – 4</td><td>N84° 05'E.</td><td>101.46 M.</td></tr><tr><td>4 – 5</td><td>N.06° 43'E.</td><td>150.86 M.</td></tr><tr><td>5 – 6</td><td>N.05° 45'E.</td><td>158.00 M.</td></tr><tr><td>6 – 7</td><td>N.04° 02'E.</td><td>185.43 M.</td></tr><tr><td>7 – 8</td><td>N.06° 26'W.</td><td>449.32 M.</td></tr><tr><td>8 – 9</td><td>S.41° 17'E.</td><td>599.63 M.</td></tr><tr><td>9 - 10</td><td>S.39° 28'E.</td><td>241.74 M.</td></tr><tr><td>10 - 11</td><td>S.15° 45'W.</td><td>169.90 M.</td></tr><tr><td>11 - 12</td><td>S.15° 51'W.</td><td>169.70 M.</td></tr><tr><td>12 - 13</td><td>S.89° 57'W.</td><td>455.86 M.</td></tr><tr><td>13 - 1</td><td>S.00° 53'W.</td><td>795.48 M.</td></tr><tr><td colspan="3">TIE LINE: S.55° 19'W.,515.00 M.; From RLM# 2, RIZAL</td></tr></table> <table><tr><th colspan="3">TECHNICAL DESCRIPTION PATENT 12</th></tr><tr><th>LINE</th><th>BEARING</th><th>DISTANCE</th></tr><tr><td colspan="3">LOT 13814 TCT# M- 109594</td></tr><tr><td>1 – 2</td><td>S.17°49'W.</td><td>327.18 M.</td></tr><tr><td>2 – 3</td><td>S.04°13'W.</td><td>304.20 M.</td></tr><tr><td>3 – 4</td><td>S.81° 40'W.</td><td>62.97 M.</td></tr><tr><td>4 – 5</td><td>N.05° 31'W.</td><td>379.07 M.</td></tr><tr><td>5 – 6</td><td>N.17° 25'E.</td><td>327.60 M.</td></tr><tr><td>6 – 1</td><td>S.61° 51'E.</td><td>139.70 M.</td></tr><tr><td colspan="3">TIE LINE: S.47° 58'E.,734.02 M.; From RLM# 2, RIZAL</td></tr></table> <table><tr><th colspan="3">TECHNICAL DESCRIPTION PATENT 14</th></tr><tr><th>LINE</th><th>BEARING</th><th>DISTANCE</th></tr></table></div>	TECHNICAL DESCRIPTION PATENT 9			LINE	BEARING	DISTANCE	LOT 16232 TCT# M- 109592			1 – 2	N.00° 53'E.	795.48 M.	2 – 3	S.89° 57'E.	455.86 M.	3 – 4	S.10° 19'W.	1,092.20 M.	4 – 5	N.61° 42'W.	171.28 M.	5 – 6	N.61° 51'W.	139.70 M.	6 – 1	N.00° 38'E.	132.58 M.	TIE LINE: S.55° 19'E.,515.00 M.; From RLM# 2, RIZAL			TECHNICAL DESCRIPTION PATENT 11			LINE	BEARING	DISTANCE	LOT 16278 TCT# M- 112715			1 – 2	N.73° 09'W.	98.57 M.	2 – 3	N.00° 38'E.	781.36 M.	3 – 4	N84° 05'E.	101.46 M.	4 – 5	N.06° 43'E.	150.86 M.	5 – 6	N.05° 45'E.	158.00 M.	6 – 7	N.04° 02'E.	185.43 M.	7 – 8	N.06° 26'W.	449.32 M.	8 – 9	S.41° 17'E.	599.63 M.	9 - 10	S.39° 28'E.	241.74 M.	10 - 11	S.15° 45'W.	169.90 M.	11 - 12	S.15° 51'W.	169.70 M.	12 - 13	S.89° 57'W.	455.86 M.	13 - 1	S.00° 53'W.	795.48 M.	TIE LINE: S.55° 19'W.,515.00 M.; From RLM# 2, RIZAL			TECHNICAL DESCRIPTION PATENT 12			LINE	BEARING	DISTANCE	LOT 13814 TCT# M- 109594			1 – 2	S.17°49'W.	327.18 M.	2 – 3	S.04°13'W.	304.20 M.	3 – 4	S.81° 40'W.	62.97 M.	4 – 5	N.05° 31'W.	379.07 M.	5 – 6	N.17° 25'E.	327.60 M.	6 – 1	S.61° 51'E.	139.70 M.	TIE LINE: S.47° 58'E.,734.02 M.; From RLM# 2, RIZAL			TECHNICAL DESCRIPTION PATENT 14			LINE	BEARING	DISTANCE
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	LOT 16274 TCT# M- 112709		
	1 – 2	S.00° 38'W.	132.58 M.
	2 – 3	S.17° 25'W.	327.60 M.
	3 – 4	N.78° 21'W.	188.13 M.
	4 – 5	N.20° 51'W.	596.64 M.
	5 – 6	S.73° 08'E.	419.83 M.
	6 – 1	S.73° 09'E.	98.57 M.
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Manpower	<p>Manpower complement will be composed of men and women who are fit to work and of no particular working age.</p> <p>During quarry development, an estimated manpower of 30 workers will be hired for the Project, 10 are directly hired by IQAC and 20 to be employed by the Contractor.</p> <p>During Construction, Erection and Installation Stage, an estimated manpower of 52 workers for the project will be required, 3 are directly hired by IQAC and 49 to be employed by the Contractor.</p> <p>During Aggregates operations, an estimated manpower of 28 workers for the project will be required, 5 are directly hired by IQAC and 23 to be employed by the Contractor.</p> <p>During Quarry Operations, 70 workers will be required, 9 are directly hired by IQAC and 61 to be employed by the Contractor.</p> <p>During decommissioning, work will be outsourced to contractors supervised by the MEPEO of IQAC.</p> <p>The Company complies with the equal opportunity principle in hiring persons with disability (PWD) as well as women. This means that the Company gives employment opportunities to PWDs and women provided the person is qualified to the position. A qualified employee, whether a woman or with disability is subject to the same terms and conditions of employment and the same compensation, privileges, benefits, incentives and allowances as any qualified employee of the Company.</p> <p>For plantilla-based/regular employees, monthly salaries or wages for services rendered by an employee are timely paid twice a month via bank transfer. For transparency, the said payments are duly acknowledged by the employees through electronic and/or manual pay slips. Thirteenth month pay is likewise paid to all qualified employees in compliance with the relevant laws, rules and regulations. Qualified employees also enjoy various benefits such as vacation leaves, sick leaves, overtime pay, health insurance, health plan, separation pay, retirement plan and allowances, as well as safety provisions like Personal Protective Equipment (PPE) and personal emergency kits, contributions and remittances for SSS, Philhealth and Pag-IBIG fund and other welfare benefits. Employees who have queries on the salaries or benefits they receive or are entitled to may bring their concerns with the Human Resources Department.</p> <p>For contractors or manpower agencies who engage contractuels, the Company undertakes an accreditation process wherein contractors are required to submit documents to establish that they are duly registered with the Securities and Exchange Commission or Department of Trade and</p>		

Environmental Performance Report and Management Plan**Calabar Quarry Operations Project**

Island Quarry and Aggregates Corporation (IQAC)

Brgys. Pantok and Palangoy, Binangonan, Rizal



		<p>Industry and with the Bureau of Internal Revenue and that they have substantial capital and/or investments to ensure that they can perform the work to be done and are compliant with relevant laws and regulations, specifically on the prohibition against labor-only contracting. Without this accreditation, the Company will not engage the services of the contractor and ensure compliance by the contractors with all the rights and benefits under labor laws, rules and regulations. The Company strictly enforces such contractual provisions in order to ensure that the contractor's employees are paid all statutory benefits and that the contractor comply with all the requirements as provided by law.</p> <p>For all of these manpower requirements, applicants from the host community are given priority subject to the qualifications of the applicant to the position. Job vacancies/openings are posted in the barangay and municipal bulletin boards for qualified locals to have an opportunity to work for IQAC. Local officials sometimes provide recommendations for qualified workers.</p>
Duration of Project	:	After securing all the required and necessary clearances and permits, increased extraction and aggregates crushing activities will immediately follow and quarry operations will last approximately for 32 years for limestone and 17 years for pozzolan.
Project Components	:	<p>The components of the Project are:</p> <ul style="list-style-type: none"> Extraction of pozzolana, limestone and limestone aggregates with increased capacity Operations of Crushing Plant with increased capacity with its ancillary facilities as follows: <ul style="list-style-type: none"> Crushers Conveyors Screen Water pumps and pipelines Power supply connection and power generator Dust Management System Concrete block making equipment Mortar production equipment Road construction equipment Sand bagging equipment Weighing scales and Scale Equipment and Office Motor pool Equipment Maintenance Facility Stockpile Stockpile Area Storage Area Laboratory or Material Testing Facility Administrative Office Safety offices and facilities Parking Area Bunkhouses Development of access road.

PROPONENT PROFILE

Project Proponent	:	Island Quarry and Aggregates Corporation (IQAC)
Address	:	Brgys. Pantok and Palangoy, Binangonan, Rizal
Contact No.	:	(632) 697-7000 loc. 3801
Contact Person	:	ENGR. NINO BERT V. ADVINCULA IQAC Tenements Manager Email: ninobert.advincula@cemex.com

EIA CONSULTANTS' PROFILE

Team Leader	:	Ms. Matilde J. Fernando Project Manager / EIA Team Leader (+63917) 5064499; mediatrixbusinessconsultancy@gmail.com
Business Address	:	L29 Joy-Nostalg Centre, 17 ADB Ave., Ortigas Centre Pasig City, 1600
Contact No.	:	(+632) 6897114
Team Members		Company
Engr. Ria Caramoan	:	Mediatrix Business Consultancy
Engr. Reynaldo Tejada	:	
Mr. Alexis Fernando	:	
Mr. Juvinal Esteban	:	
Mr. Hernani Bayani	:	
Mr. Abraham R. Lucero	:	Freelancer
Ms. Myra Talosig	:	Simmons Consult
Mr. Rodolfo Romarante	:	
Aileen Redondo	:	
Ryan Dela Cruz	:	
Michelle Ebasan	:	

II. PROCESS DOCUMENTATION

a. EIA Team

The preparation of this **Environmental Performance Report and Management Plan (EPRMP)** was prepared by different individual experts. Provided in Table 1 is the list of the EIA Preparers assisted by the company's authorized personnel, who provided the necessary technical data, information and description of the project operation which is essential to the project study.

Table 1: EIA Team

NAME	DESIGNATION	IPCO / LICENSE NO.	EXPERTISE	PARTICIPATION
Ms. Matilde Fernando	Project Manager / EIA Team Leader	IPCO-035	Socio-Economics and Public Participation	Preparation/consolidation of Study/ Report and consolidation of documents for the whole project study relevant to the requirements needed for the application
Engr. Ria Caramoan	Assistant Team Leader	IPCO-106	Air and water	Preparation of Project Description and water module
Engr. Reynaldo Tejada	Air and Noise expert	IPCO-036	Air and noise quality, air and noise modeling	Preparation of the air and noise module
Mr. Alexis Fernando	Researcher	IPCO-034	Research and community engagement	Gathering of secondary information
Mr. Juvinal Esteban	Social Worker	IPCO-091	Social work and community engagement	Preparation of socio module
Mr. Abraham R. Lucero	Geologist	NA	Geology	Preparation of Geology Module
Ms. Myra Talosig	Modular Preparer	IPCO-190	ERA, EIA, EM	Preparation of Terrestrial flora and fauna Freshwater ecology
Mr. Rodolfo Romarante	Modular Preparer	IPR4B-016	ERA, EIA	
Aileen Redondo	Modular Preparer	NA		
Ryan Dela Cruz	Modular Preparer	NA		
Michelle Ebasan	Modular Preparer	NA		

b. EIA Study Schedule

Table 2 below summarizes the EIA study schedule for the project. Activities already conducted are the Information, Education and Communication (IEC) activities, Public Scoping, Technical Scoping, conduct of additional baseline studies and preparation of the Environmental Performance Report and Management Plan (EPRMP). Upcoming activities include EIARC reviews, conduct of public hearing and site visit before issuance of the Environmental Compliance Certificate.

Table 2: EIA Schedule Study Activities

Activity	Date
Site assessment and validation and IEC	6/2015
Public Scoping	11/2015
Submission of PSR and PDS with request for Technical Scoping	1/16
Technical Scoping	7/17
Data gathering	6/15-10/17
Report preparation	3/16-10/17
Procedural screening by EMB Casehandler	3/18
1 st review by EIARC	5/18/18
2 nd EIARC Review	7/9/18
Public Hearing	
Final Review by EIARC	
Complete staff work	
ECC issuance	

c. EIA Study Area

The study areas in general are the primary and secondary impact areas. The primary impact areas of the project are the project area itself an, i.e. Brgys. Palangoy and Pantok and the sensitive receptor areas such as St. Monique and Ynares Subdivisions in Binangonan, Rizal which way may be affected or enhanced by the impacts of the project particularly in its quarry and aggregates operation.

The secondary impact areas comprise the haul roads where the trucks will pass through to transport the materials. These secondary impact areas are the Manila East Road and East Ridge Avenue in Binangonan. The possible social and economic impacts of the project during its construction and operational phase are being considered. These areas have been delineated as the primary and secondary area as per environmental sector (air, water, terrestrial, people) and per sensitive receptors in the impact area map.

d. EIA Methodology

The EIA was prepared in accordance with the Philippine Environmental Impact Statement System. Provided below is the EIA methodology for each environment sector/component.

Table ES3: EIA Methodology

Table E33: EIA Methodology			
EIA Study Module	Parameters/Scope	Baseline Methodology	Sampling and
Land			
Geology /Geomorphology, Pedology, Land Use & Classification	Reconnaissance, land use, land classification assessment, slope, soil types and classification, erosion	Secondary data, soil sampling and testing, review of geological reports and maps, soil site assessment	
Terrestrial Biology – Wildlife and Vegetation	Flora and fauna species inventory, species endemism and conservation status, species abundance, frequency and distribution	Use of secondary data and inventory	
Water			

EIA Study Module	Parameters/Scope	Baseline Methodology	Sampling and
Hydrology/ Hydrogeology	Regional hydrogeology, catchment and drainage system	Spring & well inventory, flow measurements, use of secondary data, water balance analysis, flow duration and water flow analysis and groundwater recharge and production analysis, interviews	
Water Quality	Physico-chemical and bacteriological characteristics of rivers, wells, springs, and coastal water	Primary data were secured through water sampling and laboratory analysis with additional sampling station within Primary Homes' subdivision.	
Freshwater Ecology	Full accounting of all existing benthic habitats, species, composition, density, and diversity of sea grass resources and associated macro benthic algae in front of the project site , commercially-important macro invertebrates in the inter-tidal areas, plankton community	Use of primary and secondary data and interviews	
<i>Air</i>			
Air Quality	Ambient air quality and noise levels	Primary data through sampling and laboratory analysis with additional sampling station noise within Primary Homes' subdivision	
Meteorology/ Climatology	Monthly average rainfall, climatological normal and extremes, wind rose diagrams, and frequency of tropical cyclones	Use and review of secondary data	
Noise	Characterization of ambient noise level	DENR standard methods and procedures for sampling and measurement	
<i>Climate Change</i>			
Temperature change	Seasonal Temperature increase (in °C) in 2020 and 2050 under medium range emission scenario in Tanay Monthly Average Temperature without Climate Change Monthly Average Temperature with Climate Change (2006-2035)	<i>Effects of Temperature Increase</i>	
Rainfall change	Seasonal rainfall change (in %) in 2020 and 2050 under medium range emission scenario in Tanay Monthly Average Rainfall without Climate Change (1980-2010) Monthly Average Rainfall with Climate Change (2006-2035) Monthly Average Rainfall with Climate Change (2006-2065)	Effects of change in rainfall pattern	
Greenhouse Assessment	as GHG Emissions based on IPCC 2006 Guidelines and USEPA Procedure	Bunker oil consumption vs GHG emissions	



EIA Study Module	Parameters/Scope	Baseline Methodology	Sampling and
<i>People: Socio-Economic, Health</i>			
Public health and Demography	Morbidity and mortality trends, Demographic data of impact area: - Number of households and household size - Land area, - Population, - Population density /growth - gender and age profile, - literacy rate, profile of educational attainment	Interviews with key elected officials of the barangays (from barangay captains to councilors and the social welfare barangay officers/ barangay health workers); analysis of secondary health data; Use of secondary data from RHU and NSO; Interviews with the locals; household-level survey	
Socio-economics	Socioeconomic data: Main sources of Income, Employment rate/ profile, sources of livelihood, Poverty incidence, commercial establishments and activities, banking and financial institutions	Perception surveys, Interviews with municipal and barangay officials; analysis of secondary data; analysis of survey results Provision of traffic management flow in a traffic management plan Provision of housing options for workers within the vicinity	
<i>Environmental Risk Assessment</i>			
Risk Assessment	Safety risks and physical risks	Consequence and Frequency analyses to be undertaken using the methodology described in the Revised Procedural Manual for DAO 2003-30	

e. Public Participation

1. Scoping

Public participation through Public Scoping was conducted as early as 04 November 2015. Full Scoping Report is provided in Annex I. Among the issues and concerns raised during the activity include the following:

- Effects and mitigating measures for blasting to neighboring communities
- Type of minerals that will be mined
- Hauling road to be used and no. of trucks per day
- Lagoon rehabilitation
- Invitation to affected communities to participate in public consultations
- Coverage of EIA Study
- Difference of the previous operations from the proposed expanded operation
- Provision of Mitigation measures
- Climate Change Adaptation and Disaster Risk Reduction and Disclosure of its Plans to the local DRRMO
- Buffer zone between the quarry area and the community especially St. Monique subdivision
- Consideration of adapting the Programs of the Governor in the project's implementation
- Provide Water Treatment

The Proponent responded positively in all of these concerns raised. Full Public Scoping Report is attached in Annex I.

2. Perception Survey

Perception survey was also conducted in September 2017. The Host barangays, Pantok and Palangoy were surveyed including the specific residential areas/subdivisions within

these barangays such as St. Monique and Eastridge and nearby/neighboring barangays such as Mahabang Parang and Darangan in Binangonan, Rizal. Results of the survey show that most residents are concerned on the environmental effects of the project especially generation of dust and impact of blasting.

III. EIA SUMMARY

Summary of alternatives considered in terms of siting, technology selection/operation processes and design

There is no other project alternative considered for this project because the primary consideration is the Mining Patents that IQAC have which Patents were dated back as early as 1913.

In terms of routes for the transport of materials, the route used is the existing Eastern Rizal road network from Antipolo City using the Kaytikling road thru the Ortigas Extension after Junction Cainta, Rizal passing thru Mahabang Parang of Angono where the entrance of the quarry site is located. This route is used because most of the materials are transported to Solid Cement Corporation (SCC).

For the mode of extraction or mining, mitigation or enhancement measures, there are no other Alternatives and Criteria for the Mining Method and Technology used by IQAC for this Project because it has proven through its other claims in other project areas that the mining methodology including the controlled blasting technology being implemented by its contractors are effective, environment and people-friendly. Surface mining with multiple benching will be implemented for the project and no underground works will be undertaken.

IQAC used the following mining parameters as basis in its preparation of the extraction plans for the entire life of the project:

Mining Parameters	
Bench height	10 meters
Final bench width	5 meters
Working bench width	> 10 meters
Ramp width	>10 meters
Road gradient	1:10
Bench slope	80 degrees
Pit slope	68 degrees

Concise integrated summary of the main impacts and residual effects after applying mitigation

The main impact for this project are change in elevation, removal of topsoil and vegetation, siltation, erosion, generation of dust and noise by the quarry activities particularly the conduct of blasting which also causes vibration. These are being mitigated by IQAC by employing the proper controlled blasting protocol. More importantly, among the main impacts of the project is the positive impact of community benefits that will be generated under the SDMP, progressive rehabilitation under the EPEP and final mine rehabilitation for FMR/DP.

Provided in Table 3 is a summary of the findings from the baseline surveys conducted. The presentation follows the EPRMP sections that describe the existing environment in the project site. Data are presented per module that corresponds to the land, water, air and people environments.

Table 3: Summary of Baseline Characterization

MODULE	BASELINE CHARACTERISTICS
LAND	
Land	The Project area which is located in Barangays Palangoy and Pantok in Binangonan, Rizal is classified as mineral land by the municipality of Binangonan. Since it has started operations from the time it acquired jurisdiction and authority over the area up to now, IQAC implements environmental management and mitigating measures to ensure safety of the project and its project environs such as implementation of safe controlled blasting through its licensed and experienced contractors.

MODULE	BASELINE CHARACTERISTICS
	<p>Todate, there are no mined out areas yet declared by IQAC because the previous operations remain constant in terms of production/extraction capacity.</p> <p>The Official land classification status of the mining project area is Alienable and Disposable land, covered with Transfer Certificates of Title (Private Land, TCTs are provided in the Annexes). Based on the Land Use Map of the Municipality of Binangonan, the area is within Industrial Zone (Figure 2.1). The land cover is a combination of wooded grassland, annual crop, open/barren and built up area based from NAMRIA.</p>
Topography	<p>About 65% of Binangonan are hilly terrain while the rest are generally plain. The highest peak is Mt. Susong Dalaga 750 meters above the sea level. There are seven barangays with slopes ranging from 0-3 degrees; eight barangays with 3-8; fifteen barangays with 8-18; and nine barangays with 18-30.</p>
Pedology	<p>Soil classification is based on the data gathered from the soil survey division of the bureau of soil and water management, these are:</p> <ul style="list-style-type: none"> • BOULEVARD CLAY • BARAS CLAY • BINANGONAN CLAY • TERESA CLAY • ANTIPOLO CLAY • TUTULO CLAY • CALANTAS CLAY <p>Soil sampling was conducted at the project site in September 2017. The results on current soil baseline information will not be affected with the project implementation of the expanded capacity because the land use is the same and the quarry methodology will not use chemicals which may contaminate the soil. Also, since the Project is extraction of limestone and operations of the aggregates facility, the project will maintain the same soil quality.</p>
Terrestrial Ecology	
Flora	<p>Local forest is generally classified as Savana. Its vegetation is characterized by the growth of talahib cogon, native ipil-ipil, madre cacao and bamboos. Fruit bearing trees like mango, atis, duhat, bignay are grown in both upland and lowland. Trees of dipterocarp species, the source of lumber, are seldom found the municipality. However, there are species like narra and mahogany cultivated in the lowland.</p> <p>Flora surveys were conducted on September 15 to 19, 2017 using the Belt - transect method (Plate 2). In each station transect lines, 250 meters in length and 4 meters in width were laid across the sampling stations. All tree species intercepted along the belt- transect with diameters greater than 5m were identified and counted. Presence of shrubs and grasses were also identified.</p> <p>A total of 37 species were observed within the study area. The species can be resolved into 17 floral families. Below are representative species of flora that were observed within the sampling stations. Representative species were collected from the four patents.</p>
Fauna	<p>Terrestrial communities, especially forests are complex. A thorough study of such an area could take years. But to get a good picture of community interrelationships a brief study is enough to generally represent a community.</p> <p>Avifaunal survey was conducted through transect count, mist netting (Plate 3) and incidental survey. Transect count, was used to survey birds in large open areas. All birds seen or heard on either sides of each transect were identified and counted within a fixed distance from the observer. Mist nets were also used; nets were laid</p>

MODULE	BASELINE CHARACTERISTICS
	<p>along possible travel lanes for birds. Birds were identified according to their local names, acoustic calls and visual representations with the aid of a field guide (Tañedo, 2015). Birds were released right after photo documentations.</p> <p>Sampling for Volant mammals was conducted using mist nets (see photograph above). The nets were placed along travel lanes of bats at dawn and checked every 8 hours. In each station at least two mist nets measuring 4 m x 12 m with 36 mm mesh size were installed near fruiting trees, in ridge tops or probable flyways. Bats were identified using the Key to Philippine Bats (Ingle and Heaneys, 1992). Captured bats were removed individually and were placed in temporary holding devices such as cloth bags. After documentation, bats were revitalized with sugar solution and released back into the wild.</p> <p>Frogs were sampled using cruising methods or opportunistic sampling. Streams and creeks were search for frogs. All captured individuals were subjected to morphometric measurement. Frogs and other herpetofaunal species were identified based on Amphibians and Reptiles of Luzon Island (Philippines), VII: Herpetofauna of Ilocos Norte Province, Northern Cordillera Mountain Ranged (Brown et. al 2012). Amphibians and Reptiles of Luzon Island, V: The Herpetofauna of Angat Dam Watershed, Bulacan Province, Luzon Island, Philippines (McLeod et. al 2012).</p>
Geology	<p>Based on the published Bureau of Mines geologic map of the Manila & Quezon City quadrangle, the study area in Barangays Palangoy and Pantok, Binangonan, Rizal is underlain by two (2) rock formations. These are the younger Pleistocene age Guadalupe Formation and the older Early Miocene age Angat Formation.</p> <p>The Guadalupe Formation is confined in the entire western sections of the study area. It consist of thin to medium-bedded, fine grained vitric tuffs and welded volcanic breccias with subordinate amount of tuffaceous, fine to medium grained sandstone. This type of rock deposit in the area was once quarried as Pozzolan component of cement raw material of the previous Rizal Cement Corporation.</p> <p>The eastern section of the study area is underlain by the older Early Miocene Angat Formation. It generally consist of well bedded to massive limestone associated with thin siliceous layers and limy sandstone partings, lower clastic facies compose of thinly bedded sequence of calcareous shale, clayey sandstone, sandy limestone and conglomerate. Other authors identified this type of limestone belonging to the upper Limestone Member of the Binangonan Formation with an age of Late Oligocene to Early Miocene. The limestone in the area is generally massive, light cream to pink to bluish gray and fossil-rich. This carbonate unit, which attains a thickness of 900 meters, represents deposits of shallow-water reef complexes (MGB, 2003).</p> <p>This type of limestone deposit in the area was also once quarried as high lime component of cement raw material of the previous Rizal Cement Corporation.</p>
The Water	
Water Quality	<p>There are no other water bodies present in the project site or near the area. Thus, sampling and analysis were undertaken from the lagoon and siltation ponds in the quarry area for its upstream, midstream and downstream areas. Sampling was conducted on July 20, 2017. To identify and assess project impact in terms of degradation of groundwater and surface water quality, DENR standard methods and procedures for sampling and analysis was employed. Results showed compliance to DENR standards as per DAO 2016-08.</p>
Freshwater Ecology	<p>Freshwater ecology was undertaken on Sept. 15 to 19, 2017 to study the interrelationship of organisms and their environments were undertaken; in this study only the macroinvertebrates, epilithic assemblages and freshwater fish were studied because they are good indicators of the water quality in aquatic ecosystems like lagoons. Moreover, these organisms are sensitive to slight changes in water quality</p>

MODULE	BASELINE CHARACTERISTICS
	<p>and are greatly affected by environmental stressors such as pollution. There were no researched related studies conducted prior to the conduct of sampling.</p> <p>Freshwater Biota Survey was conducted in the accessible part of the Calabar quarry lagoon. The area of the lagoon which is approximately 3.72 hectares is within the area of Patent 10. The lagoon was once a quarried area that accumulated water from years of rain. Only one sampling station was done because most parts of the lagoon is inaccessible and no means of transportation like boats were not allowed in the lagoon. Macroinvertebrates were sampled on a stream connecting to the lagoon.</p>
The Air	
Air Quality	<p>Ambient air sampling was undertaken on March 25, 2017 in 3 locations, namely: Within Aggregates Operation, Near Pantok/East - Ridge Side and Quarry area. Results show that the ambient air quality is within the DENR Standards except for TSP results where the Aggregates Operation sampling location exceeded the standards which have been influenced by ongoing operation of crusher machine, vehicles and equipment operations.</p>
Noise	<p>Noise monitoring was conducted on the same date and sites as the ambient air on a 1-hour monitoring. Measurement of each station was conducted 4 times every 15 minutes for 1 hour so that a representative reading of noise level propagation will be monitored with respect to the time increment based on a 1-hour monitoring test. Monitoring was conducted on a sunny weather associated with light to moderate winds. The prevailing winds at the time of sampling came mostly from Southwest to Northeast (SW-NE) and West to East (W-E) directions.</p>
Climate	<p>Binangonan has two distinct seasons: dry from November to April and wet during the rest of the year. The heaviest rains usually occur in the months of July, August and September. The coolest period occurs the months of November to February.</p>
Noise	<p>Ambient noise results passed the DENR Standard for Noise Quality. Provided in Chapter 2 is the details of the sampling and test results.</p>
The People	
Population	<p>Binangonan's population is 249,872 as of May 10, 2010 according to the Philippine Statistics Authority.</p> <p>A Household Perception Survey was conducted in September 2017. The Host barangays, Pantok and Palangoy were surveyed including the specific residential areas/subdivisions within these barangays such as St. Monique and Eastridge and nearby/neighboring barangays such as Brgy. Darangan also in Binangonan, Rizal and Mahabang Parang in Angono, Rizal. Results of the survey show that most residents are concerned on the environmental effects of the project especially generation of dust and impact of blasting.</p> <p>Based on the assessment of the peoples' socio-economic condition as part of the survey, more than half of the respondents are employed wherein 30% have their own livelihood with enough income for their family. Almost three-fourths of the respondents were mostly college graduates which enable them to earn enough and provide for their family.</p> <p>There are only 8 households or families that will be affected or relocated resulting from the project implementation. Direct negotiation/discussion with them will be undertaken.</p>

The environmental performance of Calabar Quarry from 2014-2017 provided compliance to DENR standards on air and water. The monitoring conducted was Proponent-driven thru a creation of a Multi-partite Monitoring Team (MMT) in 2014. This monitoring activity was not anchored on an ECC compliance mechanism because the project existed before the effectivity of the EIS System. It will also be noted that for some aspects and parameters, only 2016 and 2017 performances were provided



because the Proponent together with the MMT have just established the parameters and stations for semestral monitoring. Please note that monitoring is semestral that is why some columns and rows have no information. Also, instead of Self-Monitoring Reports (SMRs), Compliance Monitoring and Validation Reports (CMVRs) were submitted as per the project's MMT. Proof of submission of CMVR is provided in Annex E.

This Study showed comparison between a no-project and with project scenario has formed a Summary matrix of Environmental Issues and Impacts, to enable the EIA team conclude and analyze environmental degradation and/or improvements. The analysis briefly presents the main environmental issues and possible impacts scenarios. Ratings of Impacts are qualitative only.

Risks and uncertainties relating to the findings and implications for decision making

Among the risks of the project which could be a potential show stopper or could have a material or significant impact on the decision making of the government as well as the project proponent is the uncontrolled and irresponsible blasting activities that may be undertaken by the Proponent's possible Blasting Contractor. To avoid this, a strict contract and monitoring of the Contractors will be undertaken as what is being undertaken in IQAC's other contract areas.

CHAPTER 1: PROJECT DESCRIPTION

BACKGROUND

ISLAND QUARRY AND AGGREGATES CORPORATION (“IQAC”) is a corporation duly registered with the Securities and Exchange Commission (SEC). Copy of the SEC Registration is attached in Annex A.

IQAC is the holder of Placer Patent Nos. 9, 11, 12 and 14 which are currently evidenced by transfer certificates of title (the “Mining Patents”). The said Mining Patents were granted under the Philippine Bill of 1902 sometime during the period 1912 to 1914. These Mining Patents are valid and subsisting over the project area.

IQAC acquired these Mining Patents from its predecessor-in-interest/grandparent company, Rizal Cement Company, Inc. (“Rizal Cement”). As part of a corporate restructuring exercise in 2001, Rizal Cement transferred all its rights, title and ownership over all its real properties including the Mining to IQAC.

The Mining Patents are currently covered by land titles issued by the Register of Deeds, to wit:

PLACER PATENT NO.	DATE GRANTED	AREA COVERED (in hectares)	CURRENT TCT NO.	DATE OF ISSUANCE OF CURRENT TCT
Placer Patent No. 9	July 20, 1912	37.3275	M-109592	December 18, 2001
Placer Patent No. 11	February 12, 1913	39.2925	M-112715	October 16, 2002
Placer Patent No. 12	May 26, 1914	7.5601	M-109594	December 18, 2001
Placer Patent No. 14	April 17, 1913	17.1505	M-112709	October 16, 2002

The certificates of title originally issued during the period 1912 to 1914 covering the Mining Patents have been cancelled and replaced by transfer certificates of title which have been issued over the years. The copies of the latest transfer certificates of title covering these Mining Patents and indicating reference to the patents are hereto attached as Annex B. Also attached as Annex C is a copy of Mines and Geosciences Bureau Certification dated 6 May 2016.

In most facets of the mining activities, there is always the potential for environmental and ecological problems from the construction of mining facilities, the extraction of ore, to the processing of minerals. In order to assess the likely impacts on the environment and to have a tool of environment management, IQAC submitted an Environmental Performance Report and Management Plan (EPRMP) for the Calabar Quarry Operations Project.

This EPRMP was made in compliance with the provision of Presidential Decree No. 1586, otherwise known as the Philippine Environmental Impact Statement (EIS) System. The information used in this EPRMP was based on data, plans and documents provided by the management of IQAC and primary data from baseline data gathering. Secondary data sources include previous studies and reports from the IQAC, Department of Environment and Natural Resources (DENR), Environmental Management Bureau (EMB), Mines and Geosciences Bureau (MGB), Philippine Statistics Authority (PSA) formerly National Statistics Office (NSO), perception surveys, the Socio Economic Profile of Binangonan, Rizal and other pertinent Government Agencies and researches conducted within the vicinity.

The assessment focused on the description of the project, its location and evaluation of project’s expected impacts on the environment including its impact to the adjoining community. This report also provides mitigating measures to abate any adverse environmental impact resulting during the construction, operation and abandonment phase of the project.

An ECC for the Aggregates Crushing Plant was issued by EMB Regional Office 4A on January 24, 2018. Copy of the ECC is attached in Annex O.

1.1 PROJECT LOCATION AND AREA

The project will be located within the 101.33 hectares existing quarry area covered by Mining Placer Patent Nos. 9, 11, 12 and 14 which are duly annotated on Transfer Certificates of Title Nos. M-109592, M-112715, M-109594 and M-112709, respectively. Shown in Figure 1.1.1 is the project location map.

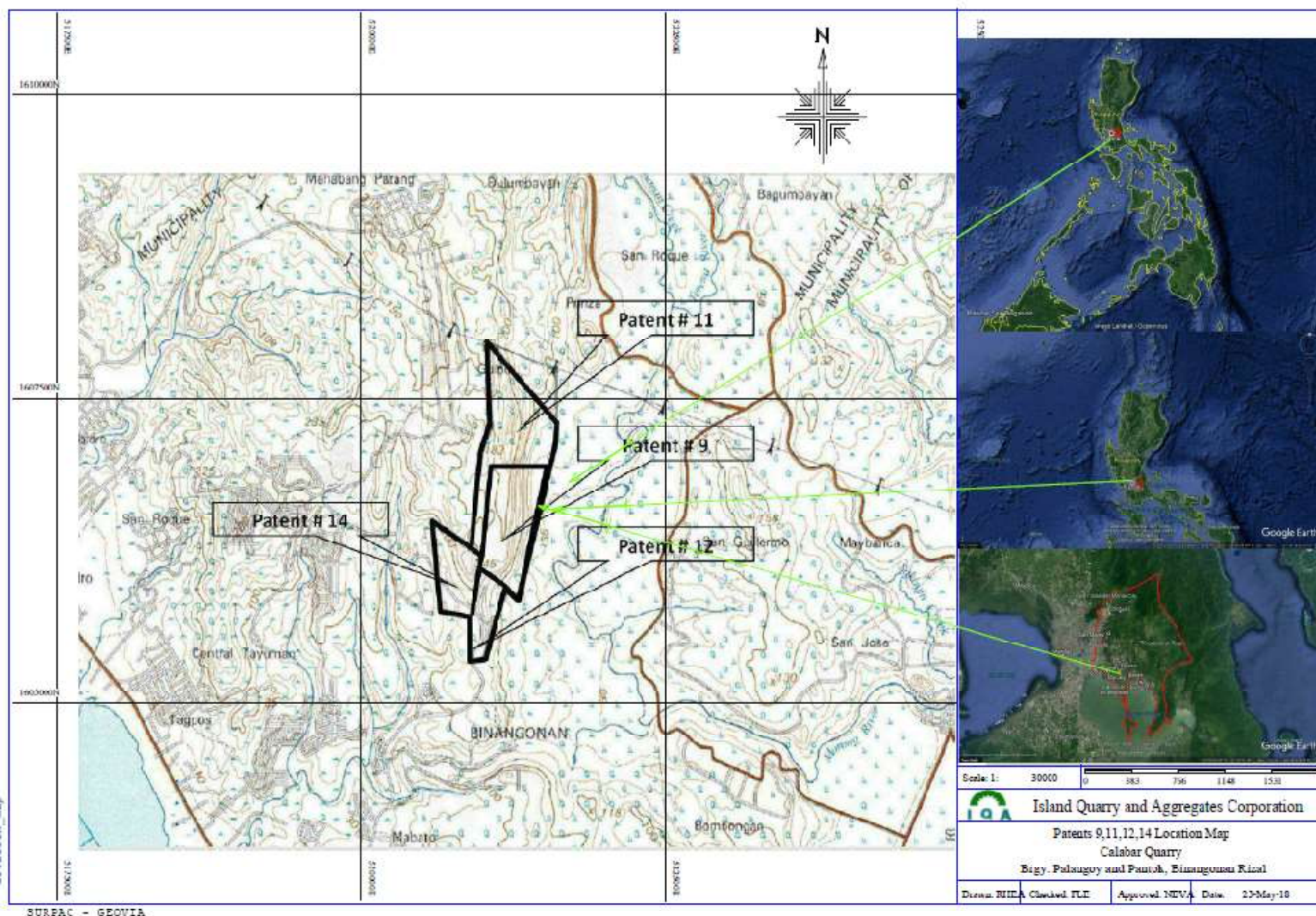


Figure 1.1.1: Project Location Map (Source: NAMRIA 2015)

Provided in Plates 1 and 2 are the photographs of the project site.



Plate 1: Photographs of the project site (limestone)

Pozzolana Quarry



Plate 2: Photographs of the project site (pozzolan)

Primary & Secondary Impact Areas

The guidelines provided by the Revised Procedural Manual relevant to this project are used for the delineation of the primary or direct impact area (DIA) and secondary or indirect impact area (IIA):

The primary impact areas of the project are the project area itself, i.e. Brgys. Palangoy and Pantok and the sensitive receptor areas such as St. Monique and Ynares Subdivisions in Binangonan, Rizal which way may be affected or enhanced by the impacts of the project particularly in its quarry and aggregates operation.

The secondary impact areas comprise the haul roads where the trucks will pass through to transport the materials. These secondary impact areas are the Manila East Road and East Ridge Avenue in Binangonan. The possible social and economic impacts of the project during its construction and operational phase are being considered. These areas have been delineated as the primary and secondary area as per environmental sector (air, water, terrestrial, people) and per sensitive receptors in the impact area map below in Figure 1.2.

IQAC –CALABAR Aggregate Plant Impact Areas



Figure 1.1.2: Map showing the location of the impact areas in and around the project area

Provided in Figure 1.1.3 below is the Settlement Map showing the communities surrounding the project area.

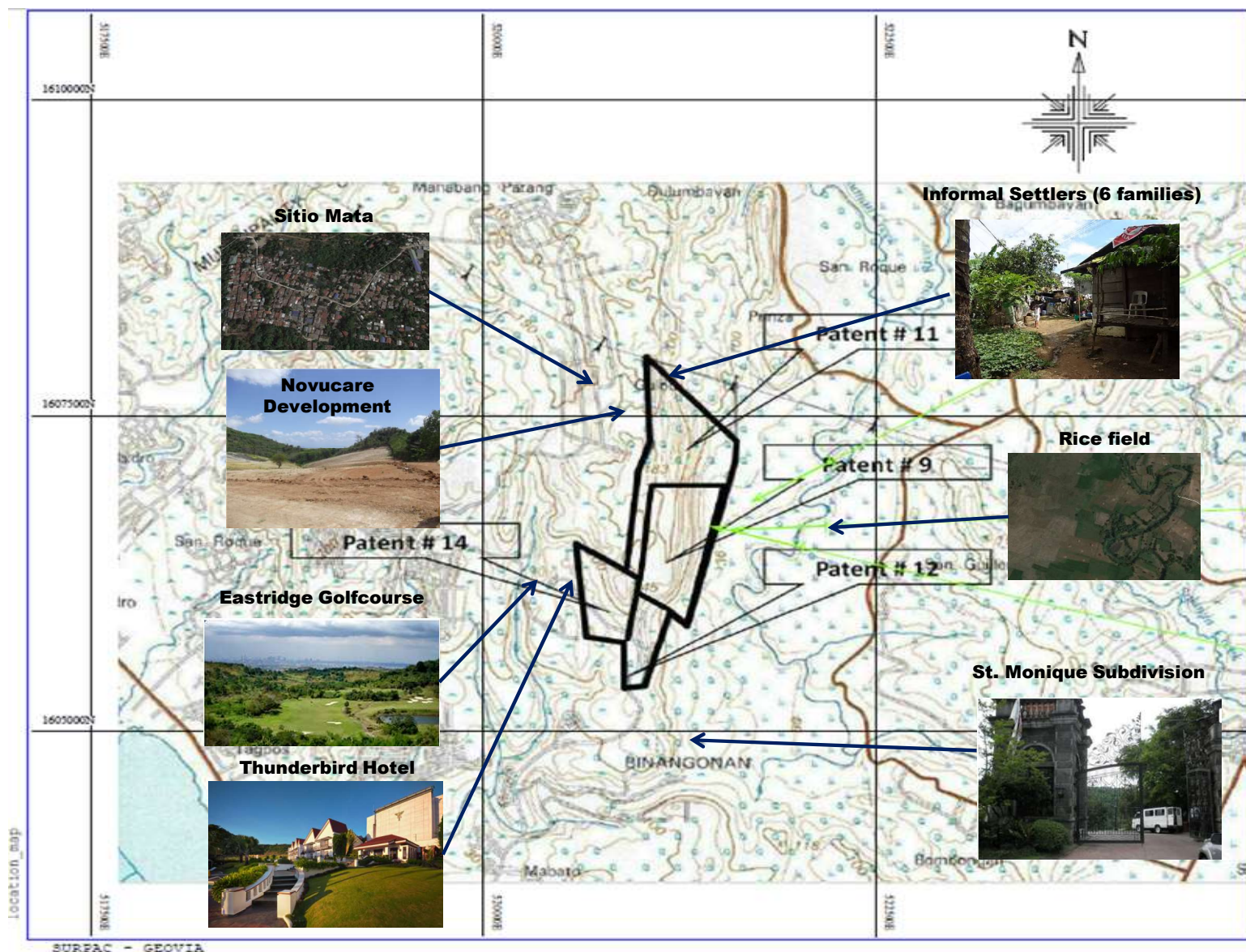


Figure 1.1.3: Settlement Map (source: IQAC)

Geographic coordinates (shape file data) of project area

Provided below is the geographic coordinates of the project area:

TECHNICAL DESCRIPTION PATENT 9		
LINE	BEARING	DISTANCE
LOT 16232 TCT# M- 109592		
1 - 2	N.00° 53'E.	795.48 M.
2 - 3	S.89° 57'E.	455.86 M.
3 - 4	S.10° 19'W.	1,092.20 M.
4 - 5	N.61° 42'W.	171.28 M.
5 - 6	N.61° 51'W.	139.70 M.
6 - 1	N.00° 38'E.	132.58 M.
TIE LINE: S.55° 19'E.,515.00 M.; From RLM# 2, RIZAL		

TECHNICAL DESCRIPTION PATENT 11		
LINE	BEARING	DISTANCE
LOT 16278 TCT# M- 112715		
1 - 2	N.73° 09'W.	98.57 M.
2 - 3	N.00° 38'E.	781.36 M.
3 - 4	N84° 05'E.	101.46 M.
4 - 5	N.06° 43'E.	150.86 M.
5 - 6	N.05° 45'E.	158.00 M.
6 - 7	N.04° 02'E.	185.43 M.
7 - 8	N.06° 26'W.	449.32 M.
8 - 9	S.41° 17'E.	599.63 M.
9 - 10	S.39° 28'E.	241.74 M.
10 - 11	S.15° 45'W.	169.90 M.
11 - 12	S.15° 51'W.	169.70 M.
12 - 13	S.89° 57'W.	455.86 M.
13 - 1	S.00° 53'W.	795.48 M.
TIE LINE: S.55° 19'W.,515.00 M.; From RLM# 2, RIZAL		

TECHNICAL DESCRIPTION PATENT 12		
LINE	BEARING	DISTANCE
LOT 13814 TCT# M- 109594		
1 - 2	S.17°49'W.	327.18 M.
2 - 3	S.04°13'W.	304.20 M.
3 - 4	S.81° 40'W.	62.97 M.
4 - 5	N.05° 31'W.	379.07 M.
5 - 6	N.17° 25'E.	327.60 M.
6 - 1	S.61° 51'E.	139.70 M.
TIE LINE: S.47° 58'E.,734.02 M.; From RLM# 2, RIZAL		

TECHNICAL DESCRIPTION PATENT 14		
LINE	BEARING	DISTANCE
LOT 16274 TCT# M- 112709		
1 - 2	S.00° 38'W.	132.58 M.
2 - 3	S.17° 25'W.	327.60 M.
3 - 4	N.78° 21'W.	188.13 M.
4 - 5	N.20° 51'W.	596.64 M.
5 - 6	S.73° 08'E.	419.83 M.
6 - 1	S.73° 09'E.	98.57 M.
TIE LINE: S.55° 19'E.,515.00 M.; From RLM# 2, RIZAL		

Vicinity and accessibility of the project site/area

The site can be reached from Manila by land by means of the existing Eastern Rizal road network from Antipolo City. It is accessible thru the Ortigas Extension after Junction Cainta, Rizal. Kaytikling road may be used to reach the City proper of Antipolo. Upon reaching Antipolo City proper, look for the Shopwise establishment then turn right going to Lores area where the boundary between Antipolo and Angono may be seen. Pass thru Mahabang Parang of Angono just straight ahead and the entrance of the quarry site will be seen. Figure 1.1.4 shows the accessibility of the project site.

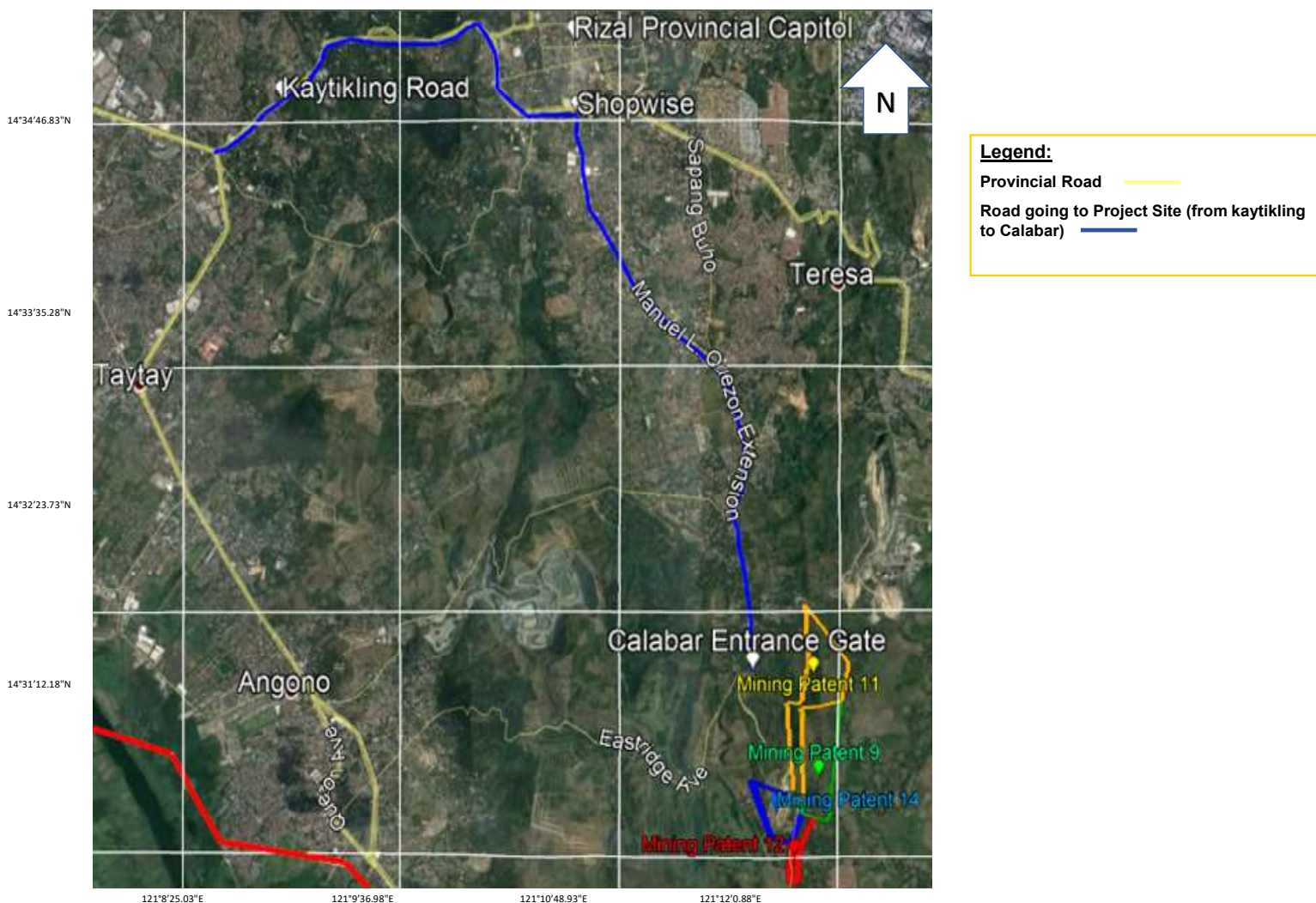


Figure 1.1.4: Road Map showing accessibility of the project area (Source: IQAC)

1.2 Project Rationale

President Rodrigo Duterte's Administration has lined up an infrastructure plan which includes the restoration of the country's roads and bridges, trains and airports. The government's infrastructure plan will include the country's first subway, Mindanao's first mass transit railway, the development of Clark Green City, and another commuter railway linking Tutuban, Manila to Clark, Pampanga. Other projects are the Bonifacio Global City to Ortigas Road Link Project, Mandaluyong Main Drainage Project Phase II, and Cebu Bus Rapid Transit, among others. With these lined up projects, a huge amount of raw materials will be required where the Calabar Quarry Operations will help through the supply of Aggregates and the need for cement's raw materials to support this Build-Build-Build Project. IQAC's primary customer for these materials is Solid Cement Corporation which is located in Brgy. San Jose, Antipolo, Rizal undertaking cement manufacturing and production.

Regionally, the project will provide a boost in the income of the province, the municipality and the barangays hosting the project. Excise tax, Occupation fee and other local government revenues will be generated from the Project.



The project will not only support the economic agenda of the government but will also provide social development programs that will have direct impact to the lives of the host and neighboring community where the project is located. The 1.5 per cent of the project cost will be allocated solely for social development and management program (SDMP).

1.3 Project Alternatives

A. *Criteria used in determining options for facility siting, development design, process/technology selection, resource utilization and discuss how the decisions on the preferred options were made*

Siting: The rationale for the selection of the site and the justification why there are no other sites feasible is because the project area is the subject area of the Mining Patents which has been effective as early as 1912.

Area selection on disposal facilities was also not considered because the project has almost nil in waste thus there is no need for waste dump area.

Technology Selection/Operation Processes and design Selection for storage: There are no other Alternatives and Criteria for the Mining Method and Technology Selection used by IQAC for this Project because it has proven through its other claims in other project areas that the mining methodology including the controlled blasting technology being implemented by its contractors is the efficiency of the technology to produce the target production rate at the equipment's rated capacity as experienced in other IQAC quarry projects and the environment and people-friendliness of the technology being used.

Resources: Although there is no other alternative site, alternative sources of power, water, raw materials and other resources needed including factors significant to the selection such as supply sustainability and climate change projections are not of concern because the project's power requirement is only 2mVA and power supply connection and power generator will also be provided in the project.

In terms of environmental hazards such as Liquefaction, Ground Shaking, Ground Rupture, Earthquake induced Landslides Volcanic eruptions, tsunami (PHIVOLCS), Rain-induced landslide and flooding (MGB), Storm surge as well as extreme climatologic conditions (PAGASA), assessment showed that proper mitigation measures can address the potential impacts to the project.

Following factors are the rationale for the selection of the site and the justification why there are no other sites feasible:

- Project areas are mining Patents of IQAC;
- Accessibility of the area to the market where there is demand for the product;
- Availability of raw materials and existence of relevant license;
- Familiarity with the impact areas such that the potential impacts of the Project is easily identifiable, it being similar to an existing quarry project of IQAC in Pamias 2 and Pantay Quarry with Solid Cement Corporation, an affiliate company of IQAC

B. *Summary of the comparative environmental impacts of each alternative*

This is not applicable since no other alternative was considered.

C. *No Project Option*

If the project will not proceed, there will be no additional disturbance to the environment. However, the 'no project' option must be weighed against the economic benefit that the project would bring to the host barangays and to the national and regional economies. The economic benefits that would be derived from the project are:

- Potential to create jobs during the construction phase;
- Local taxes include the local distribution of real property taxes and local business tax;
- Capital investment;
- Contribution to the combined Gross Regional Domestic Product (GRDP) for Region IVA;
- The overall impact of these economic contributors from the project to the national economy will be added to the annual GDP.



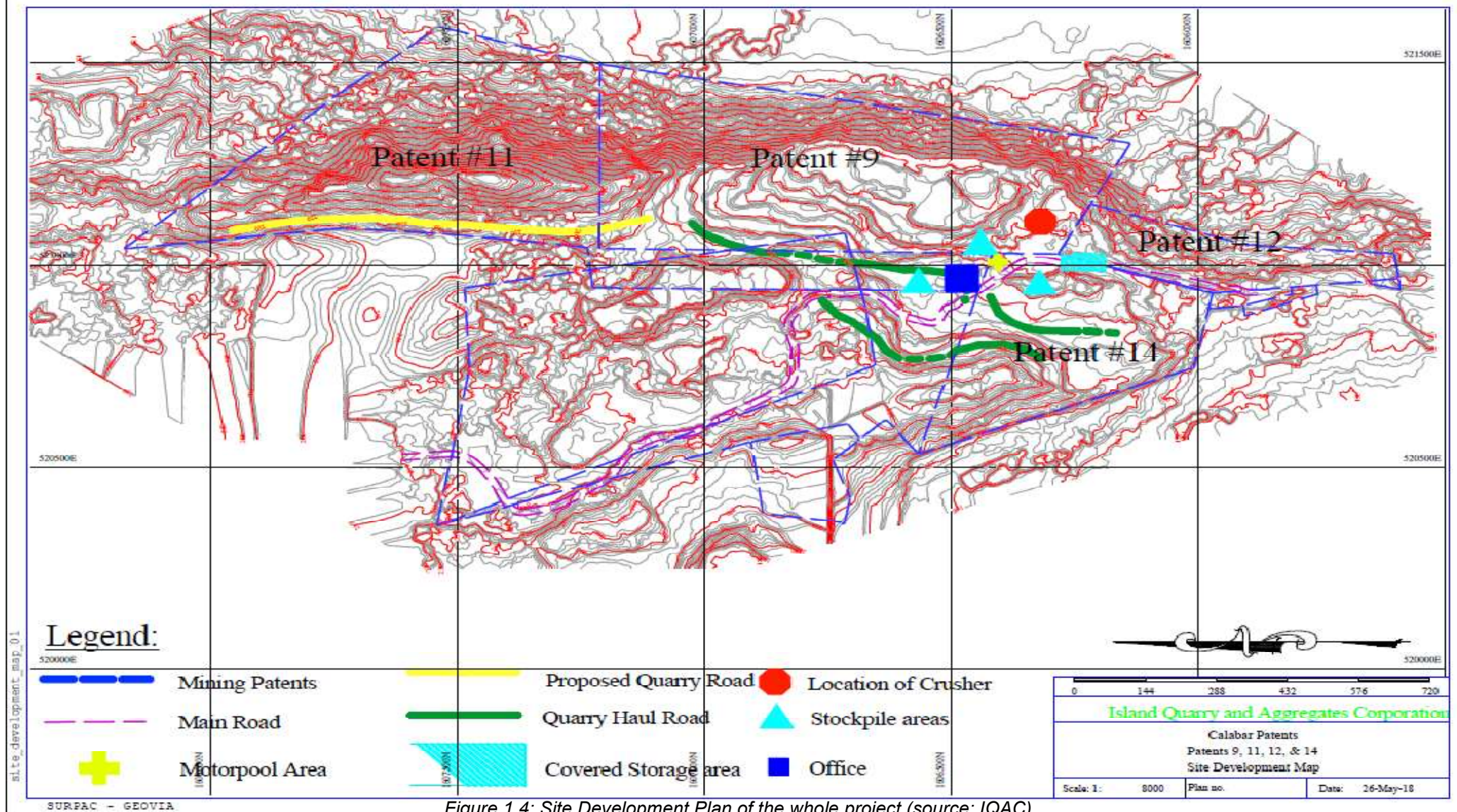
If the project will not proceed, the above benefits will not materialize.

1.4 Project Components

The components of the Project are:

- Extraction of pozzolana, limestone and limestone aggregates with increased capacity
- Operation of Crushing Plant with increase in capacity from 1.5MMTPY to 2.5MMTPY capacity which include auxiliary and support equipment and other associated facilities and equipment as follows:
- Water pumps and pipelines
- Power supply connection and power generator
- Crushing facility system consisting of crushers, conveyors, screen and other associated facilities
- Dust Management System
- Concrete block making equipment
- Mortar production equipment
- Road construction equipment
- Sand bagging equipment
- Weighing scales and Scale Equipment and Office
- Motor pool
- Equipment Maintenance Facility
- Stockpile
- Stockpile Area
- Storage Area
- Laboratory or Material Testing Facility
- Administrative Office
- Safety offices and facilities
- Parking Area
- Bunkhouses
- Development of access road.

Provided in Figure 1.4 is the Site Development Plan of the whole project indicating the different barangay boundaries. The location of the storage area for explosives magazine is not provided because the 3rd party-controlled blasting contractor is the one in charge of the activity and brings in explosives and magazine on as-needed basis.



[illegible]

Figure 1.4.1: Site Development Plan of the Aggregates Facility

Shown below is the table of comparison of the existing and proposed facilities involved in the project:

Table 1.4: Project Components of the existing and increased capacity

Component	Existing		Proposed	
	Capacity	Area	Capacity	Area
Quarrying: Increased extraction of pozzolana, limestone and limestone aggregates	380,000 MTPY (pozzolan) 500,000 MTPY (limestone)	101.33 hectares	1.5M MTPY pozzolana 10.89MMTPY limestone	101.33 hectares
Crushing Plant increased production including the following ancillary facilities:			2.5M MTPY	2.22 hectares
• Water pumps and pipelines				
• Concrete block making equipment				
• Mortar production equipment				
• Road construction equipment				
• Sand bagging equipment				
• Weighing scales and Scale Equipment and Office				
• Motor pool equipment				
• Maintenance Facility: Stockpile				
• Stockpile Area				
• Storage Area				
• Laboratory or Material Testing Facility				
Support facilities				
• Power requirement • Power supply connection and power generator • Administrative Office • Safety offices and facilities • Parking Area • Bunkhouses			2mVA	
Air pollution and waste management				
Dust Management System – water cannons				
Development of access road				

1.5 Process

a) Extraction

Mining operations, in this case, quarry operations, start with the Development Stage which include the stripping of over burden, digging/breaking/loosening the materials. Clearing of vegetation particularly trees shall be covered with tree cutting permit issued by DENR. Quarrying equipment digs, breaks and loosens the materials to produce muck before scooping and loading into the trucks. Digging hard materials will require full throttle of engine power which results to generation of exhaust smoke. Smoke emissions are lesser for brand new and slightly used equipment which has higher breakout force.



In this process, following are the waste streams:

- Air emission of criteria pollutants such as CO, particulates, NO₂, and SO₂,
- Land contamination due to solid wastes such as domestic wastes, sludge or residue
- Hazardous wastes such as busted bulbs, lamps and used batteries
- Water contamination due to potential sediment and silt

Next is Drilling and Blasting where appropriate size and number of holes per development blast, blasting accessories, charging of explosives will be implemented to limit air blast and ground vibration that will be lead and implemented by a competent blasting contractor to ensure that the activity will be handled by an expert. Blasting during development activity will be done during day time only and will be guided by the existing IMS of IQAC. The drilling and blasting will be conducted by an expert contractor with own explosives magazine near the project site. Drilling activity will be performed using percussion drills (pneumatic and hydraulic) to penetrate hard rock surface for blast holes. Blasting is the breaking of in-situ deposit into smaller pieces for easy handling and loading of materials suitable for commination. The explosives to be used are dynamite and Ammonium Nitrate Fuel Oil (ANFO). This is a non-volatile explosive that can only be initiated using blasting caps. The blasting pattern will be designed to ensure safe and efficient blasting. Blasting will use non-electric delay detonators to minimize ground vibration and sound wave and eliminate occurrence of fly rocks.

IQAC will hire a competent blasting contractor to ensure that the blasting operation will be handled by the expert. It will use appropriate blasting pattern, charging of explosives and firing sequence to limit the ground vibration that will be generated during blasting. IQAC will follow the Australian Standard for blasting for the ground vibration and airblast limit (25 mm/sec ground vibration limit and 130 db airblast limit). Most importantly, IQAC will adhere to its (Integrated Management System) IMS Policy.

To minimize the boulder breaking activity, the output from development blast should already yield desired size of limestone materials to minimize the amount of boulders to be broken by breaking equipment. The equipment that will be used for breaking activity should also be well maintained so that the amount of breaking penetration is maximized immediately to attain the desired size of limestone lessening the noise that will be generated during this activity.

Deployment of brand new equipment or not too old backhoe digging equipment will eliminate/minimize the noise during travelling, digging and loading because the moving parts, such as the bushing of track shoe, bucket arm pin and hinges are still tight/no clearance for metal to metal contact. Contractors will be required to conduct regular PMS and daily applications of grease and lubricants to the moving parts of the equipment and replacement of bucket tooth.

Proper technique of digging hard materials especially in high banks will be employed to avoid boulder materials from dropping to the ground. Chipping thinly the material instead of one bucketful grab will eliminate the production of boulders. Operators will be advised to drop the first bucket load of material close enough to the dump box of the truck. Boulder materials will be mixed with fine materials to avoid the banging noise when materials drop to the dump box of the truck.

Following are the waste streams in this Phase:

- Air emission of criteria pollutants such as CO, particulates, NO₂, and SO₂,
- Land contamination due to solid wastes such as domestic wastes, sludge or residue
- Hazardous wastes such as busted bulbs, lamps and used batteries
- Water contamination due to potential sediment and silt

During Loading and Hauling, the materials are loaded in buckets at a height higher than the level of the dump box of the truck. The booms are slewn at appropriate swing speed to avoid fine materials to spill down from the bucket when swept by strong winds. Materials are then hauled by trucks which is the significant source of dust. Constant passage of truck tires pulverizes/mills the road surface creating fine particles that cling onto the thread of tires, and as tire rolls, fine particles will be ejected by the momentum of the speeding trucks; and when swept by strong winds, will be dispersed as dust. Smoke emissions are common to old and dilapidated hauling trucks.

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Upon loading of the blasted materials to the dump trucks, it will be transported to crusher traversing a 4.5-kilometer inner road. Dust dispersal during loading can be minimize by observing proper loading procedure of dropping the first bucket load at same level with the dumb box, avoid overfilling of bucket and reduce speed when slewing the bucket to drop the load. Conduct regular dust suppression of the loading bay and hauling road by wetting/sprinkling with water using water truck. Regular maintenance and PMS schedule of hauling trucks will be enforced to lessen the smoke emission. Trucks more than fifteen (15) years will be grounded.

Following are the waste streams:

- Air emission of criteria pollutants such as CO, particulates, NO₂, and SO₂
- Land contamination due to solid wastes such as domestic wastes
- Hazardous wastes such as busted bulbs, lamps and used batteries

Provided below is the Flowsheet of Mining Operation with waste streams:

Flowsheet of Mining Operation



Development (stripping of over burden)

Waste streams:

- Air emission of criteria pollutants such as CO, particulates, NO₂, and SO₂,
- Land contamination due to solid wastes such as domestic wastes, sludge or residue
- Hazardous wastes such as busted bulbs, lamps and used batteries
- Water contamination due to potential sediment and silt



Drilling and Blasting

Waste streams:

- Air emission of criteria pollutants such as CO, particulates, NO₂, and SO₂,
- Land contamination due to solid wastes such as domestic wastes, sludge or residue
- Hazardous wastes such as busted bulbs, lamps and used batteries
- Water contamination due to potential sediment and silt



Loading and Hauling

Waste streams:

- Air emission of criteria pollutants such as CO, particulates, NO₂, and SO₂,
- Land contamination due to solid wastes such as domestic wastes, sludge or residue
- Hazardous wastes such as busted bulbs, lamps and used batteries

Figure 1.5: Flowsheet of Mining Operation with waste streams

Provided below are plates where Calabar Quarry areas are shown and how mining activities are and will be undertaken.





Description of the pollution control devices (e.g. siltation ponds, etc.) and waste management system (including management of waste dumps, topsoil, waste rocks, overburdens)

The pollution control devices involved in this project are as follows:

- Dust enclosures: Collection of dust inside an enclosure in the Aggregate Facility will be undertaken and recovery of dust will be done through sweeping and with the use of a skid loader. Recovered dust will be placed in dust boxes and disposed of and transferred to sand stockpile.
- Water cannon: A multi-directional water cannon, mist spray. Mist water spraying directed opposite to the direction of wind to control airborne dust from travelling. Water will combine to the airborne dust and will free fall along the stockpile grounds.

Description of the operations and maintenance of facility

For this project, heavy equipment and vehicles will be the ones subject to operations and maintenance. Regular maintenance schedules for change oil and checking of spare parts for both equipment and vehicles will be undertaken.

b. Crushing Process

Provided in Figure 1.5.2.1 is the crushing process in the Aggregates Facility.

Estimated daily production is 3,500-4,000 metric tons per day of finished products. Approximately 35% of the product becomes 3/4 product, 25% becomes 3/8 product, 10% becomes G1 product, 15% becomes sand and 15% becomes base course. The percentage of product mix depends on the type and size of materials fed to the crusher. ASTM C33 standard defines the grading and quality of the aggregates product. Shown below is the material balance of the quarrying and crushing process.

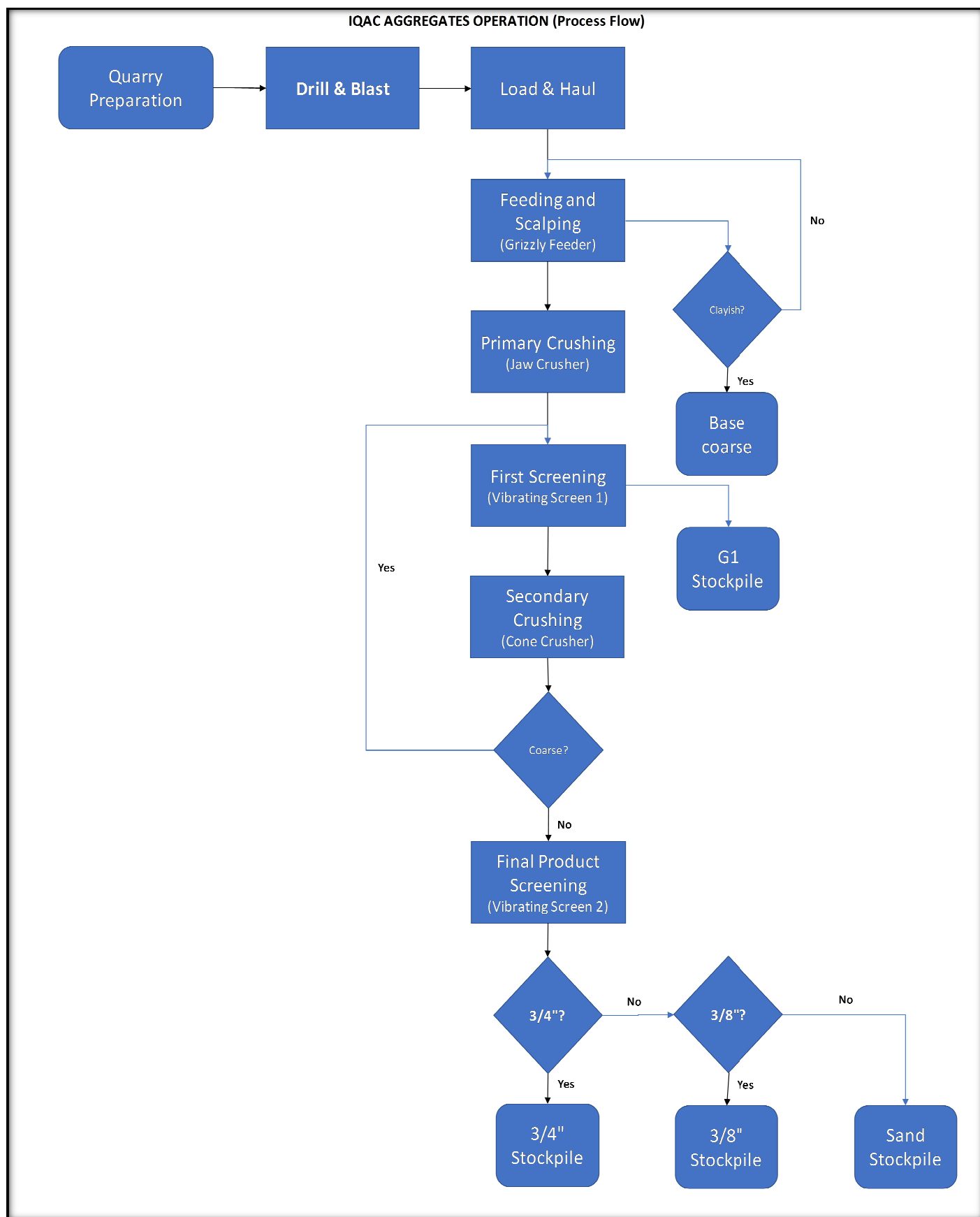


Figure 1.5A: Material Balance of the Quarry/Mine Process

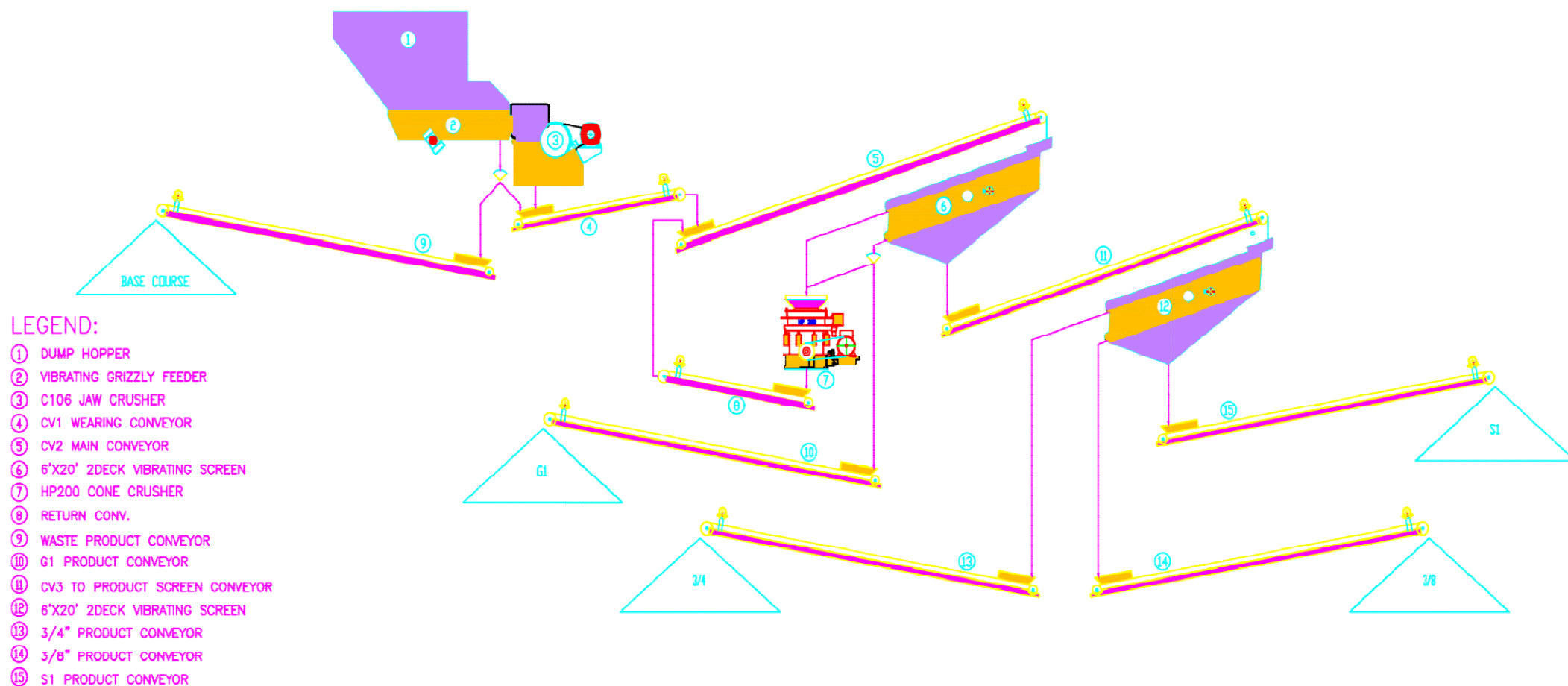


Figure 1.5.2.1: Aggregates crushing process



Waste Management Systems

For the mining project, only CO, particulates, solid wastes such as domestic wastes, sludge or residue, hazardous wastes such as busted bulbs and lamps are among the wastes that may be generated.

Provided in Figure 1.5 is the Flowsheet of Mining Operation with waste streams.

1.5.2 Description of the operations and maintenance of facility

For this project, heavy equipment and vehicles will be the ones subject to operations and maintenance. Regular maintenance schedules for change oil and checking of spare parts for both equipment and vehicles will be undertaken.

1.6 Project Size

1.6.1 Production capacity

a) Total Amount of Ore/Mineral Reserves in the project area based on exploration data

CALABAR QUARRY RESOURCE AND LIFE OF MINE		
Resource	Limestone (in Million MT)	Pozzolana (in Million MT)
Measured Resource	144.21	11.41
Indicated Resource	208.82	15
Total:	353.03	26.41
Quality	52.46 % CaO	> 90 % PAI, 17.31 % Al ₂ O ₃
Proposed Annual Extraction (in Million Mt/Yr)	10.98	1.5
Life of Mine (in Years)	32.15	17.61

Based on the Final Report of Core Drilling and Resource Estimate, the measured resource computed for limestone is 144.21 Million MT while the Indicated Resource is 208.82 Million MT which is an in-house estimation. For Pozzolana, the measured resource computed is 11.41 Million MT while the Indicated Resource is 15 Million MT which is also an in-house estimation. For aggregates, the coarse aggregates reserve is 98.065 million MT.

Production rate is approximately 1,000 - 2,000 metric tons per day (mtpd) of pozzolana materials and approximately 2,000 – 2,500 metric tons of limestone per day at 312 working days per year. During summer time the company produces more pozzolana for operation and stockpiling activity were being done in preparation for rainy season.

b) Total amount of Ore/Mineral Reserves to be extracted, rate of extraction and timetable

This project involves increased extraction of pozzolan from 380,000 MTPY to 1.50MMTPY, as well as extraction of limestone from 500,000 MTPY to 10.89MMTPY for use as cement raw materials, construction materials and materials for various industries (such as but not limited to glass, hygienic products and power).

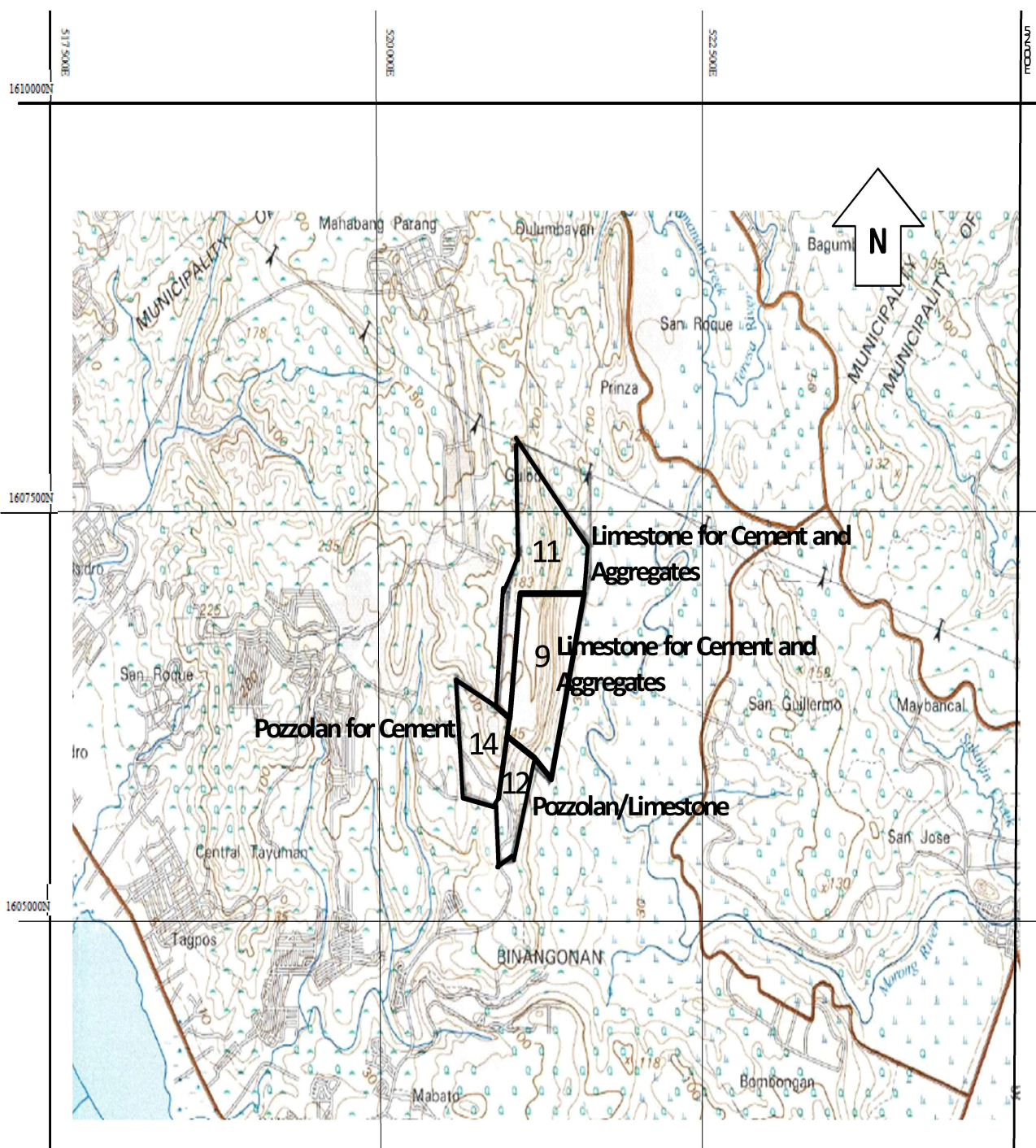


Figure 1.6.1: Mining Commodity per Mining Patent (Source: IQAC 2018)

1.6.2 Project area in square meters or hectares

The Project is to be situated within 101.33 hectares existing quarry area covered by Mining Placer Patent Nos. 9, 11, 12 and 14 which are duly annotated on Transfer Certificates of Title (TCT) Nos. M-109592, M-112715, M-109594 and M-112709, respectively.

1.7 Development Plan, Description of Project Phases and Corresponding Timeframes

The Project will be implemented in phases which include: a) project preparation phase that directly links to production phase because of resource situation/availability; b) quarry operations phase; and c) abandonment phase. The schedule of the different project phases is summarized in the sections below.

1.7.1 Project Preparation Phase

This phase is dedicated mostly to activities like clearing of the Project Site, procurement of permits and clearances from concerned government agencies and local government units and design conceptualization for all the civil works that will be undertaken during the developing stage.

Since the project is an operating one, permits and licenses have been secured. These include the following:

Applicable Regulations	Specific Requirement/s	Agencies Involved	Verifiable Documents/ Records	Frequency of Monitoring	Responsible Party	Monitoring/ Compliance Status
LOCAL						
	Articles of Incorporation	Antipolo City Hall Binangonan City Hall	Articles of Incorporation	No Expiration	IQAC	N/A
	Business Permit	Pantok, Binangonan	2018-0032350	Annual	IQAC	Issued on January 17, 2018
	Certificate of Occupancy	Pantok, Binangonan	02-2357	Annual	IQAC	Issued on February 5, 2018
	Sanitary Permit to Operate	Pantok, Binangonan	2484-18	Annual	IQAC	Issued on February 5, 2018
	Business Permit	Palangoy, Binangonan	2018-0032351	Annual	IQAC	Issued on January 17, 2018
	Certificate of Occupancy	Palangoy, Binangonan	02-2356	Annual	IQAC	Issued on February 5, 2018
	Sanitary Permit to Operate	Palangoy, Binangonan	2483-18	Annual	IQAC	Issued on February 5, 2018
BFP						
	Fire Safety Evaluation Clearance	Calabar Quarry	R04A - 55530	No Expiration	IQAC	Complied
DOLE						
	Registration	DOLE	Proof of Payment	No Expiration	IQAC	Complied
	Registration (Registration of Establishments)	DOLE	Proof of Payment	No Expiration	IQAC	Complied
EMB						
DAO-2014-02	Certificate (Pollution Control Officer Accreditation)	EMB	Certificate of Accreditation 2016-8900 (Francisco L. Esteban Jr.)	Every 3 years	IQAC	Renew on December 2019
RA 7942 (Philippine Mining Act)	Certificate (Safety Engineer / Safety Inspector)	MGB	Certificate of Accreditation 1610-32-SE	Every 3 years	SCC (Support Services)/IQAC	
	Certificate of Non-Coverage	Calabar Mobile Crusher Operation	CNC-OL-R4A-2016-06-06652	No Expiration	IQAC	Complied
RA 8749/DAO 2000-81	Permit to Operate (Air Pollution Source and Control Installation) (CALABAR QUARRY)	EMB	Permit to Operate No. 2017-POA-0458-045	Every 5 years	IQAC	to be renewed on December 2022

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LLDA						
DAO-2014-02	Pollution Control Officer Certificate of Accreditation	LLDA	PCO-COA No. 2017-00329	Every 3 years	IQAC	To be renewed on April 2019
RA 4850	LLDA Clearance	LLDA	PC-04-97247	No Expiration	IQAC	Complied
PD 1067	Surface Water Permit (Water Permit Extraction)	LLDA	SWP-2016-012-005	Every 5 years	IQAC	To be renewed on May 10, 2020
RA 9275(CLEAN WATER ACT)	Discharge Permit	LLDA	DP-01c-011-00357	12/6/2013	IQAC	Applied for Discharge Permit Exemption last December 2017 upon resumption of operations from October 5 to December 2017
MGB						
RA 7942 (Philippine Mining Act)	Certificate of Approval (Care and Maintenance Program)	Mining Patent 11 & 12	060117-R04A-0163	Annual	IQAC	Renewed last November 29, 2017
RA 7942 (Philippine Mining Act)	Certificate of Approval (Environmental Protection and Enhancement Program)	Mining Patent 14	AEPEP 2017-01-217	26/1/2018	IQAC	Renewed last November 29, 2017
RA 7942 (Philippine Mining Act)	Certificate of Approval (Safety and Health Program) (CALABAR)	Mining Patent 9, 11, 12 & 14	SHP # 2017-01-02	28/2/2018	IQAC	Renewed last November 29, 2017
RA 7942 (Philippine Mining Act)	Certificate of Approval (Social Development and Management Program) - Pambias II / Pantay	MGB	ASDMP 2017-05-IV	30/3/2018	IQAC	Renewed last November 29, 2017
RA 7942 (Philippine Mining Act)	Certificate of Approval (Social Development and Management Program) - Calabar	MGB	ASDMP 2017-03-IV	30/3/2018	IQAC	Renewed last November 29, 2017
DAO No. 2010-21	Certificate of Electrical Inspection	Calabar Quarry	RIVA-2EI-170613-21	Annual	IQAC	Issued on June 12, 2017 – for renewal

The project is currently operating while preparing the areas that will be mined to increase the extraction capacity.

1.7.2 Project Development Phase

Mining operations, in this case, quarry operations, start with the Development Stage which includes the stripping of overburden, digging/breaking/loosening the materials. Quarrying equipment digs, breaks and loosens the materials to produce muck before scooping and loading into the trucks. Digging hard materials will require full throttle of engine power which results to generation of exhaust smoke. Smoke emissions are lesser for brand new and slightly used equipment which has higher breakout force.

In this stage, following are the waste streams:

- Air emission of criteria pollutants such as CO, particulates, NO₂, and SO₂,
- Land contamination due to domestic solid wastes
- Hazardous wastes such as used oil and batteries
- Water contamination due to potential sediment and silt

This stage also includes the following:

- Construction of access roads
- Construction of quarry administration facilities
- Construction of pollution control devices

Provided in Table 1.7 is the Project Development Timetable.

Table 1.7: Project Schedule

Activities ¹	FIRST YEAR				2 ND YEAR			
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
Clear the property of Informal Settlers (IS)								
Road development								
Construction of catchment benches								
Full commercial quarrying operations for the increased capacity								

1.7.3 Quarry Operations Phase

The overburden to be removed is very minimal or almost none as the company is employing blending of materials. Excavation and blending activity is guided by the established quarrying parameters and core drill data used in the generation of final mine life plan or bench plan. Pit design parameters guides the excavation for safety (slope stability) and quarry reserve optimization.

Volume of material extracted during the road widening and construction will be utilized as feed material and will be delivered to the crusher and others will be used as safety catchment berm to ensure full control of rock falls and will serve as a barricade. The main haulage road width will be designed at least 3.5 times the width of the truck that will be used for hauling and the safety catchment berm height that will be installed will be >50% of the height of the tire of biggest hauling

Drilling and Blasting to appropriate size and number of holes per development blast, blasting accessories, charging of explosives will be implemented to limit air blast and ground vibration that will be lead and implemented by a competent blasting contractor to ensure that the activity will be handled by an expert. Blasting during development activity will be done during day time only and will be guided by the IMS of IQAC. The drilling and blasting will be conducted by an expert contractor with own explosives magazine near the project site. Drilling activity will be performed using percussion drills (pneumatic and hydraulic) to penetrate hard rock surface for blast holes. Blasting is the breaking of in-situ deposit into



smaller pieces for easy handling and loading of materials suitable for commination. The explosives to be used are dynamite and Ammonium Nitrate Fuel Oil (ANFO). This is a non-volatile explosive that can only be initiated using blasting caps. The blasting pattern will be designed to ensure safe and efficient blasting. Blasting will use non-electric delay detonators to minimize ground vibration and sound wave and eliminate occurrence of fly rocks.

IQAC will hire a competent blasting contractor to ensure that the blasting operation will be handled by the expert. It will use appropriate blasting pattern, charging of explosives and firing sequence to limit the ground vibration that will be generated during blasting. IQAC will follow the Australian Standard for blasting for the ground vibration and airblast limit (25 mm/sec ground vibration limit and 130 db airblast limit. Most importantly, IQAC will adhere to its (Integrated Management System) IMS Policy.

To minimize the boulder breaking activity, the output from development blast should already yield desired size of limestone materials to minimize the amount of boulders to be broken by breaking equipment. The equipment that will be used for breaking activity should also be well maintained so that the amount of breaking penetration is maximize immediately to attain the desired size of limestone lessening the noise that will be generated during this activity.

Deployment of brand new equipment or not too old backhoe digging equipment will eliminate/minimize the noise during travelling, digging and loading because the moving parts, such as the bushing of track shoe, bucket arm pin and hinges are still tight/no clearance for metal to metal contact. Contractors will be required to conduct regular PMS and daily applications of grease and lubricants to the moving parts of the equipment and replacement of bucket tooth.

Proper technique of digging hard materials especially in high banks will be employed to avoid boulder materials from dropping to the ground. Chipping thinly the material instead of one bucketful grab will eliminate the production of boulders. Operators will be advised to drop the first bucket load of material close enough to the dump box of the truck. Boulder materials will be mix with fine materials to avoid the banging noise when materials drop to the dump box of the truck.

In this phase, following are the waste streams:

- Air emission of criteria pollutants such as CO, particulates, NO₂, and SO₂,
- Land contamination due to domestic solid wastes
- Hazardous wastes such as used oil and batteries
- Water contamination due to potential sediment and silt

During Loading and Hauling, the materials are loaded in buckets at a height higher than the level of the dump box of the truck. The boom are slewn at appropriate swing speed to avoid fine materials to spill down from the bucket when swept by strong winds. Materials are then hauled by trucks which is the significant source of dust. Constant passage of truck tires pulverizes/mills the road surface creating fine particles that cling onto the thread of tires, and as tire rolls, fine particles will be ejected by the momentum of the speeding trucks; and when swept by strong winds, will be dispersed as dust. Smoke emissions are common to old and dilapidated hauling trucks.

Upon loading of the blasted materials to the dump trucks, it will be transported to crusher traversing a 4.5-kilometer inner road. Dust dispersal during loading can be minimized by observing proper loading procedure of dropping the first bucket load at same level with the dumb box, avoid overfilling of bucket and reduce speed when slewing the bucket to drop the load. Conduct regular dust suppression of the loading bay and hauling road by wetting/sprinkling with water using water truck. Regular maintenance and PMS schedule of hauling trucks will be enforced to lessen the smoke emission. Trucks more than fifteen (15) years will be grounded.

Following are the waste streams:

- Air emission of criteria pollutants such as CO, particulates, NO₂, and SO₂,
- Land contamination due to domestic solid wastes
- Hazardous wastes such as used oil and batteries



1.7.4 Abandonment

Island Quarry and Aggregates Corporation (IQAC) will conduct a progressive rehabilitation of the quarried out areas during the entire production period towards attaining the desired final land form and use that is environmentally-sound and beneficial to the community. It is the objective of the proponent to successfully restore the area nearest to its original state after cessation of quarry operation. Fast-growing trees, among others, will be used to convert the area to its ultimate land use which may be a forestland, agro-forest or eco-tourism area.

Quarry closure should be integral to the whole quarry life for a mining project to be successful and planning for closure should commence as early as during the pre-feasibility phase of an operation. Quarry closure should be technically, economically, environmentally and socially feasible without incurring long-term liabilities. The Conceptual Closure Plan should address preliminary land use objectives and should be an integral component of final project design. Stakeholder involvement in deciding decommissioning options will facilitate long-term economic and social sustainability of communities associated with the quarry.

The final land use for the mined out will be a re-vegetated area. The final use will be that which may be an agro-forestry area or a forest area or an eco-tourism area. Whatever is the legal and appropriate utilization of the property shall be evaluated and considered.

- Tree planting will commence at the start of commercial operation in an area that definitely will not be disturbed, particularly beside the haul;
- Quarried out areas; and
- At the end of MPSA life, the company envisioned that there will be no high bench wall left.

Quarry Closure Criteria and Performance Standards

The quarry closure criteria presented are specific to the project component being rehabilitated or closed. These criteria are a set rehabilitation indicators, which, upon being met, will demonstrate successful rehabilitation of a site. The re-vegetation of the quarried out area and enhancement of the buffer area will be the final criteria. The survival rate of the plants used for re-vegetation will dictate the performance standards.

Quarry Closure Activities

In the demobilization, safety is the primary concern, thus following activities will be implemented:

1. Using of trailer (if necessary) to haul off-road heavy equipment;
2. Small equipment items (i.e., jackhammer, drill steels, etc.) will be loaded to truck manually;
3. Heavy items will be loaded by backhoe and will be tightened by binders in order not to move while traveling. Unloading will be done by a crane;
4. No riders will be allowed during the transportation of equipment and machineries except for the assigned helper / spotter;
5. In case of very heavy load (like backhoe), service vehicle will be provided ahead of the truck, equipped with two-way radio in order to warn the driver about the situation ahead; and
6. Safety Rules and Regulation will be implemented specially Chapter XX, Section 72 of DENR DAO No. 2000-98 and all the safety measure during the duration of demobilization.

Quarry Closure Strategies

At quarry closure, the quarry residue surface will be stabilized and re-vegetated, potentially into productive cropping areas such as rice or corn growing. The quarry residue has a moderate potential to form acid quarry drainage which will be controlled by deposition under shallow water. The quarry closure plan envisages capping the siltation ponds with clay and soil, capping the waste rock dump with soil and letting the quarry lakes fill naturally with water to be lakes for the local population to enjoy.

Final Quarry Rehabilitation Plan

The final land use for the disturbed area will be a stabled re-vegetated area.

Rehabilitation Strategy

To ensure the success of rehabilitation, the area will be cleared of loose rocks, structures and non-biodegradable materials and materials that are detrimental to plant growth.



The final land configuration will incorporate road network to make as many areas accessible as possible with provisions for drainage system. Below are the other activities to be undertaken:

- Continuous planting/ mortality replacement activities;
- Constant monitoring and inspection of re-vegetated area;
- Monitoring of high wall for any movement or irregularities;
- Discouraging fire wood gatherers and
- Employing local personnel to maintain monitor and guard the area.

Criteria for Measuring Objectives

Below are the criteria for measuring the objectives:

- Photo-documentation starting from the implementation period and yearly comparison, taken from a fixed point;
- Survival rate of plants; and
- Incident of erosion along floor slopes.

Objectives and Methodology

The objective of rehabilitation is the attainment of re-vegetated quarried out area. The general methodology will be surface preparation thru site clearing/ clearing, spreading of topsoil; and rehabilitation by planting of the designated vegetation cover.

Materials, Operational and Financial Resources

The materials to be used for backfilling are the top soil stockpile at designated areas. The plants will be sourced from the nursery and the community when necessary. The equipment used in mining like off road dump truck, dozers, loaders will be utilized for rehabilitation.

The financial requirements of the rehabilitation will be provided by the company thru the Final Quarry Rehabilitation and Decommissioning Fund.

Monitoring Program

The Mine Rehabilitation Fund Committee (MRFC) through the Multi-partite Monitoring Team (MMT) shall monitor the implementation of the FMR/DP. The Contingent Liability Rehabilitation Fund (CLRF) Steering Committee and/or the Mine and Geosciences Bureau (MGB) will audit the implementation of the FMR/DP. An in-house monitoring headed by the MEPEO will be likewise implemented.

Currently, a Multi-Partite Monitoring Team (MMT) consisting of members of MGB, EMB, LLDA, company representative, host barangay representative and other stake holders are monitoring the operations of Calabar Quarry quarterly based on the approved Annual Environment Protection and Enhancement Program (AEPEP) submitted by IQAC.

As part of the commitment of the company to temporarily rehabilitate a portion of the quarry in areas which are not yet active at the moment for Patent 14, the company identified around 3,800 square meters that will be planted with grasses and other small plant species identified in the terrestrial flora and fauna assessment. The company hired 3 personnel who will actively monitor the trees planted during tree planting activities.

Provided below is the area for temporary rehabilitation.

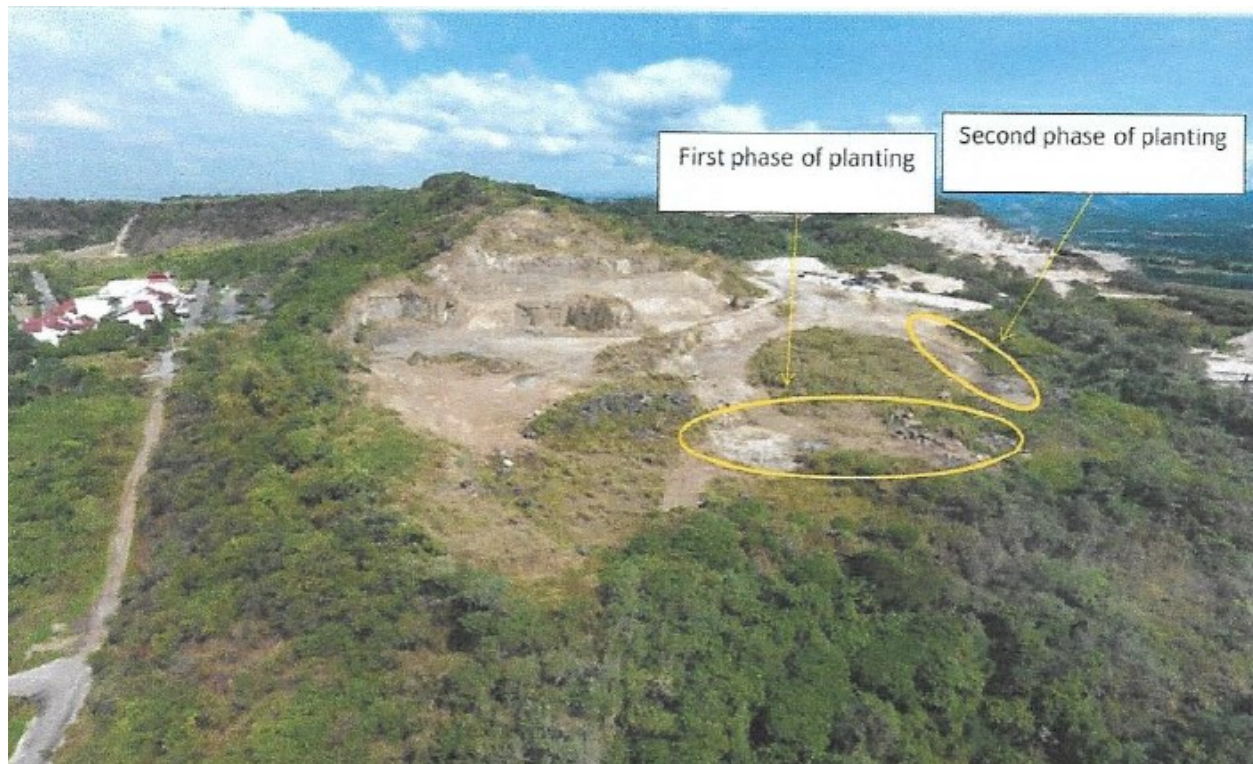


Figure 1.7.4.1: Area for Temporary Rehabilitation

Details of Social Plan

Retrenchment Packages

The company maintains regular employees from all ranks. If ever retrenchment occurs, the Company will give what is due to the employees as mandated by Labor Law such as:

- At least one month for every year of service;
- Pro-rated 13th month pay;
- Monetary equivalent of unused sick leave and vacation leaves

The Company has likewise set up a retirement plan for its employees.

Labor Support Policies and Programs

The Company believes that every employee is an asset and a partner in the business. At present, retired employees are given the opportunity to be contractors. Since majority of them are skilled workers, opportunities in other companies are available to affected personnel after closure.

Maintenance and Monitoring Plans

Monitoring shall include:

- Safety of the site;
- Growth rate and the density of the plants including the return of non-sown desirable species and weeds;
- Return of native flora and fauna;
- Evidence of erosion or land degradation;
- Water quality; and
- Structural condition of surrounding land

Maintenance

Maintenance activities other than re-working rehabilitated areas that failed would include:

- Provision of fences and signage to discourage entry to the area;



- Watering the seedlings to ensure their survival and sustained growth;
- Control pest and weed accumulation;
- Fertilize as needed; and

Conduct annual or semi-annual inventory of planted species on every plantation area.

1.8 Manpower

Manpower complement will be composed of men and women who are fit to work and of no particular age.

During quarry development, an estimated manpower of 30 workers will be hired for the Project, 10 are directly hired by IQAC and 20 to be employed by the Contractor.

During Construction, Erection and Installation Stage, an estimated manpower of 52 workers for the project will be required, 3 are directly hired by IQAC and 49 to be employed by the Contractor.

During Aggregates operations, an estimated manpower of 28 workers for the project will be required, 5 are directly hired by IQAC and 23 to be employed by the Contractor.

During Quarry Operations, 70 workers will be required, 9 are directly hired by IQAC and 61 to be employed by the Contractor.

During decommissioning, work will be outsourced to contractors supervised by the MEPEO of IQAC.

The Company complies with the equal opportunity principle in hiring persons with disability (PWD) as well as women. This means that the Company gives employment opportunities to PWDs and women provided the person is qualified to the position. A qualified employee, whether a woman or with disability is subject to the same terms and conditions of employment and the same compensation, privileges, benefits, incentives and allowances as any qualified employee of the Company.

For plantilla-based/regular employees, monthly salaries or wages for services rendered by an employee are timely paid twice a month via bank transfer. For transparency, the said payments are duly acknowledged by the employees through electronic and/or manual payslips. Thirteenth month pay is likewise paid to all qualified employees in compliance with the relevant laws, rules and regulations. Qualified employees also enjoy various benefits such as vacation leaves, sick leaves, overtime pay, health insurance, health plan, separation pay, retirement plan and allowances, as well as safety provisions like Personal Protective Equipment (PPE) and personal emergency kits, contributions and remittances for SSS, Philhealth and Pag-IBIG fund and other welfare benefits. Employees who have queries on the salaries or benefits they receive or are entitled to may bring their concerns with the Human Resources Department.

For contractors or manpower agencies who engage contractuels, the Company undertakes an accreditation process wherein contractors are required to submit documents to establish that they are duly registered with the Securities and Exchange Commission or Department of Trade and Industry and with the Bureau of Internal Revenue and that they have substantial capital and/or investments to ensure that they can perform the work to be done and are compliant with relevant laws and regulations, specifically on the prohibition against labor-only contracting. Without this accreditation, the Company will not engage the services of the contractor and ensure compliance by the contractors with all the rights and benefits under labor laws, rules and regulations. The Company strictly enforces such contractual provisions in order to ensure that the contractor's employees are paid all statutory benefits and that the contractor comply with all the requirements as provided by law.

For all of these manpower requirements, applicants from the host community are given priority subject to the qualifications of the applicant to the position. Job vacancies/openings are posted in the barangay and municipal bulletin boards for qualified locals to have an opportunity to work for IQAC. Local officials sometimes provide recommendations for qualified workers.



During the several phases of project implementation, the following manpower requirements are estimated to be employed:

Table 1.8: Manpower Requirements

Quarry Development				
Labor Type		Skill / Designation	Employee Type	No. of Personnel
Quarry Development Stage	IQAC Aggreates Manager	Engineer	Plantilla Position	1
	Tenement Manager	Mining Engineer	Plantilla Position	1
	Quarry Superintendent	Mining Engineer	Plantilla Position	1
	IQAC Quarry/Aggregates Supervisor	Engineer	Plantilla Position	1
	IQAC Quarry Supervisor	Mining Engineer	Plantilla Position	1
	Community Relations Officer	Trained HR and Community Relations Management / Engineering Graduate	Plantilla Position	1
	Quarry Planners	Engineer	Plantilla Position	2
	Environmental Officer	Trained for Environmental Management / Engineering Graduate	Plantilla Position	1
	Safety Officer	Safety Officer	Plantilla Position	1
	Quarry Supervisor	Certified H.E. Operator / Experience in Quarry Operations	Outsourced	1
	Heavy Equipment Operator	Certified Backhoe/Dozer Operator	Outsourced	1
		Certified Backhoe / Breaker Operator	Outsourced	1
		Certified Dumptruck Driver with Professional Drivers License	Outsourced	3
	Drill & Blast	Project Manager: Mining Engineer	Outsourced	1
		Driller: H.E. Operator	Outsourced	2
		Driller Helper: High School Gradute	Outsourced	2
		Blasting Foreman: Certified Balster	Outsourced	1
		Blasting Crew: High School Gradute	Outsourced	8
Total Manpower				30



Construction, Erection and Installation Stage Manpower				
Labor Type		Skill / Designation	Employee Type	No. of Personnel
Construction Stage	Aggregate Manager	Manager / Engineer	Plantilla Position	1
	Aggregates Superintendent	Quarry and Crusher Leader / Engineer	Plantilla Position	1
	Safety	Safety Officer / Engineer	Plantilla Position	1
	Project Management	Project Manager / Engineer	Outsourced	1
	Civil / Structural Foreman	Civil Engineer	Outsourced	1
	Scaffolder	Certified Scaffolder	Outsourced	3
	Scaffolders Helper	Trained / Experienced Scaffolder	Outsourced	6
	Steel man / Fabricator	Engineering Undergrad / Experience Fabricator	Outsourced	3
	Steel man / Fabricator Helper	Experience Fabricator	Outsourced	6
	Carpenter	High School Graduate / Experience Carpenter	Outsourced	2
	Mason	High School Graduate / Experience Mason	Outsourced	2
	Crane Operator	Certified Crane Operator	Outsourced	1
	Rigger	Certified Crane Rigger	Outsourced	2
	Mechanical Foreman	Mechanical Engineer	Outsourced	1
	Mechanical Fitter	Engineering Undergrad / Experience Mechanical Fitter	Outsourced	3
	Welder	Certified Welder	Outsourced	3
	Mechanical Helper	High School Graduate / Experience Mechanical Fitter	Outsourced	6
	Electrical Foreman	Electrical Engineer	Outsourced	1
	Master Electrician	Certified Master Electrician	Outsourced	2
	Electrical Helper	Undergrad Electrical Technician	Outsourced	6
Total Manpower				52

Quarry Operations Manpower				
Labor Type		Skill / Designation	Employee Type	No. of Personnel
Quarry Operations Stage	Tenement Manager	Mining Engineer	Plantilla Position	1
	Quarry Superintendent	Mining Engineer	Plantilla Position	1
	IQAC Quarry/Aggregates Supervisor	Engineer	Plantilla Position	1
	IQAC Quarry Supervisor	Mining Engineer	Plantilla Position	1
	Community Relations Officer	Trained HR and Community Relations Management /	Plantilla Position	1



	Engineering Graduate		
Quarry Planners	Engineer	Plantilla Position	2
Environmental Officer	Trained for Environmental Management / Engineering Graduate	Plantilla Position	1
Safety Officer	Safety Officer	Plantilla Position	1
Pozzolan Quarry Operations	Project Manager	Outsourced	1
	Quarry Supervisor	Outsourced	1
	Loader and Backhoe Operator	Outsourced	2
	Mobile Crusher Operator/Helper	Outsourced	4
	Mechanic	Outsourced	2
	Mechanic Helpers	Outsourced	2
	Electrician	Outsourced	1
	Housekeeping	Outsourced	4
	Dumptruck Drivers	Outsourced	12
Limestone Quarry Operations	Quarry Supervisor	Outsourced	1
	Backhoe/Dozer Operator	Outsourced	2
	Loader Operator	Outsourced	5
	Dumptruck Drivers	Outsourced	2
	Crusher Operator	Outsourced	4
	Crusher Helper	Outsourced	4
Drill & Blast	Project Manager: Mining Engineer	Outsourced	1
	Driller: H.E. Operator	Outsourced	2
	Driller Helper: High School Graduate	Outsourced	2
	Blasting Foreman: Certified Balster	Outsourced	1
	Blasting Crew: High School Graduate	Outsourced	8
Total Manpower			70

Aggregates Operation Manpower				
Labor Type		Skill / Designation	Employee Type	No. of Personnel
Crushing Operations	Aggregate Manager	Manager	Plantilla Position	1
	Admin Assistant	Accounting / Planner	Plantilla Position	1
	Aggregates Superintendent	Quarry and Crusher Leader	Plantilla Position	1
	Safety Officer	Safety Practitioner	Plantilla Position	1
	IQAC Quarry/Aggregates Supervisor	Engineering Graduate	Plantilla Position	1
	Company Driver	Professional Driver's License Holder	Outsourced	1
	Heavy Equipment Operator	Certified Heavy Equipment/ Pay Loader Operator	Outsourced	5
	Crusher Operator	Engineering Graduate / College Undergrad Experienced Operator	Outsourced	4
	Crusher Tender	Engineering Graduate / College Undergrad Experienced Operator	Outsourced	4
	Maintenance Technician	Engineering Graduate	Outsourced	2
	Q.A / Material Tester	Engineering Graduate / College Undergrad Experienced Operator	Outsourced	1
	Crusher Checker	College Undergrad / Experienced Operator	Outsourced	3
	Logistics / Truckscale Operator	Engineering Graduate / College Undergrad Experienced Operator	Outsourced	3
Total Manpower				28

Company Policy on Hiring

Island Quarry and Aggregates Corporation ("IQAC" or the "Company") recruits employees based on their ability, career experience and personal alignment with its corporate values. The selection and hiring processes are carried out respectfully and in adherence to local laws and practices.

Policy on hiring men and women; Policy on PWDs and Age

The Company seeks to provide a safe and productive work environment to maximize individual potential and creativity and to foster collaboration and teamwork. To this end, the Company assigns high priority to complying with labor laws and regulations, respecting individual differences and opinions and preventing all forms of discrimination and harassment.

The Company upholds fundamental human rights by never discriminating against others based on their legally-protected traits. The Company makes its employment decisions based solely on merit, and not on any legally-protected traits such as age, race, ethnicity, religion, disability, marital status or sexual orientation, among other factors.

The Company complies with the equal opportunity principle in hiring persons with disability (PWD). This means that the Company gives employment opportunities to PWDs and hires a PWD provided that the person is qualified to the position and his safety will not be compromised. A qualified employee with disability is subject to the same terms and conditions of employment and the same compensation, privileges, benefits, incentives and allowances as any qualified employee in the Company.



The Company likewise does not discriminate on applicants based on their age and abides by the rules as provided under Republic Act No. 10911 or the “Anti-Age Discrimination in Employment Act.”

Mechanism in implementing these policies as well as payment of statutory benefits for all forms of engagements

Monthly salaries or wages for services rendered by an employee are timely paid twice a month via bank transfer. For transparency, the said payments are duly acknowledged by the employees through electronic and/or manual payslips. Thirteenth month pay is likewise paid to all qualified employees in compliance with the relevant laws, rules and regulations. Qualified employees also enjoy various benefits such as vacation leaves, sick leaves, overtime pay, health insurance, health plan, separation pay, retirement plan and allowances, as well as safety provisions like Personal Protective Equipment (PPE) and personal emergency kits, contributions and remittances for SSS, Philhealth and Pag-IBIG fund and other welfare benefits. Employees who have queries on the salaries or benefits they receive or are entitled to may bring their concerns with the Human Resources Department.

The Company is also committed to offering continuous training, development, individual recognition, promotion on the basis of merit, candid communication and effective feedback. The Company likewise respects and abides by the security of tenure of each employee. In addition, the Company observes all applicable wage and hour laws that govern the work of its employees. As a company that believes in the power of acting with integrity, the Company seeks to advance respect for human rights. Therefore, the Company sets a positive example by:

- Upholding the fundamental human rights of people by complying with child and forced labor prohibitions, and never discriminating against others based on their legally-protected traits
- Making employment decisions based solely on merit, and not on any legally protected traits such as age, race, ethnicity, religion, disability, marital status or sexual orientation, among other factors
- Recognizing the right to freedom of association which includes the right to self-organization, collective bargaining and peaceful concerted activities
- Focusing on providing safe, healthy, productive work environments and humane working conditions
- Improving its processes and procedures to minimize the impact on the environment and the communities that support it.

It is crucial to the Company’s goals and operations that it respects and complies with laws which govern basic human rights. In addition, it is the responsibility of each employee to make a report if they suspect that a violation of human rights has occurred. This includes any act of retaliation that an employee may witness as the result of our colleagues standing up for their rights or the rights of others.

In order to implement the foregoing policies, the Company maintains a Code of Ethics and it encourages all its employees to report any suspected violation thereof. The Company thoroughly investigates all good faith reports of violations. Any concerns may be reported to a grievance hotline, the Human Resources Department, Legal Department, Ethics Committee and Audit Committee.

For contractors or manpower agencies, the Company undertakes an accreditation process wherein contractors are required to submit documents to establish that they are duly registered with the Securities and Exchange Commission or Department of Trade and Industry and with the Bureau of Internal Revenue and that they have substantial capital and/or investments to ensure that they can perform the work to be done and are compliant with relevant laws and regulations, specifically on the prohibition against labor-only contracting. Without this accreditation, the Company will not engage the services of the contractor. Moreover, the Company incorporates in its service contracts certain provisions that would ensure compliance by the contractors with all the rights and benefits under labor laws, rules and regulations. The Company strictly enforces such contractual provisions in order to ensure that the contractor’s employees are paid all statutory benefits and that the contractor comply with all the requirements as provided by law.

1.9 Project Cost

The mining project will entail an estimated capital cost of PhP 270 million.



CHAPTER 2: ANALYSIS OF KEY ENVIRONMENTAL IMPACTS

2.1 THE LAND

2.1.1 Land Use and Classification

2.1.1.1 Impact in terms of compatibility with existing land use

ISLAND QUARRY AND AGGREGATES CORPORATION ("IQAC") is the holder of Placer Patent Nos. 9, 11, 12 and 14 which are currently evidenced by transfer certificates of title (the "Mining Patents"). The said Mining Patents were granted under the Philippine Bill of 1902 sometime during the period 1912 to 1914. These Mining Patents are valid and subsisting over the project area.

IQAC acquired these Mining Patents from its predecessor-in-interest/grandparent company, Rizal Cement Company, Inc. ("Rizal Cement"). As part of a corporate restructuring exercise in 2001, Rizal Cement transferred all its rights, title and ownership over all its real properties including the Mining to IQAC.

The Mining Patents are currently covered by land titles issued by the Register of Deeds, to wit:

PLACER PATENT NO.	DATE GRANTED	AREA COVERED (in hectares)	CURRENT TCT NO.	DATE OF ISSUANCE OF CURRENT TCT
Placer Patent No. 9	July 20, 1912	37.3275	M-109592	December 18, 2001
Placer Patent No. 11	February 12, 1913	39.2925	M-112715	October 16, 2002
Placer Patent No. 12	May 26, 1914	7.5601	M-109594	December 18, 2001
Placer Patent No. 14	April 17, 1913	17.1505	M-112709	October 16, 2002

The certificates of title originally issued during the period 1912 to 1914 covering the Mining Patents have been cancelled and replaced by transfer certificates of title which have been issued over the years. The copies of the latest transfer certificates of title covering these Mining Patents and indicating reference to the patents are hereto attached in Annex B. Also attached as Annex C is a copy of Mines and Geosciences Bureau Certification dated 6 May 2016.

The Official land classification status of the mining project area is Alienable and Disposable as shown in the land classification map (Figure 2.2). These areas as private lands are covered with Transfer Certificates of Title (TCTs). These TCTs are provided in Annex B.

Based on the Land Use Map of the Municipality of Binangonan, the area is within Industrial Zone (Figure 2.1 while the land cover is a combination of grassland, brush/shrubs, inland water (lagoon) and small areas of annual crop and built-up area as shown in Figure 2.3.

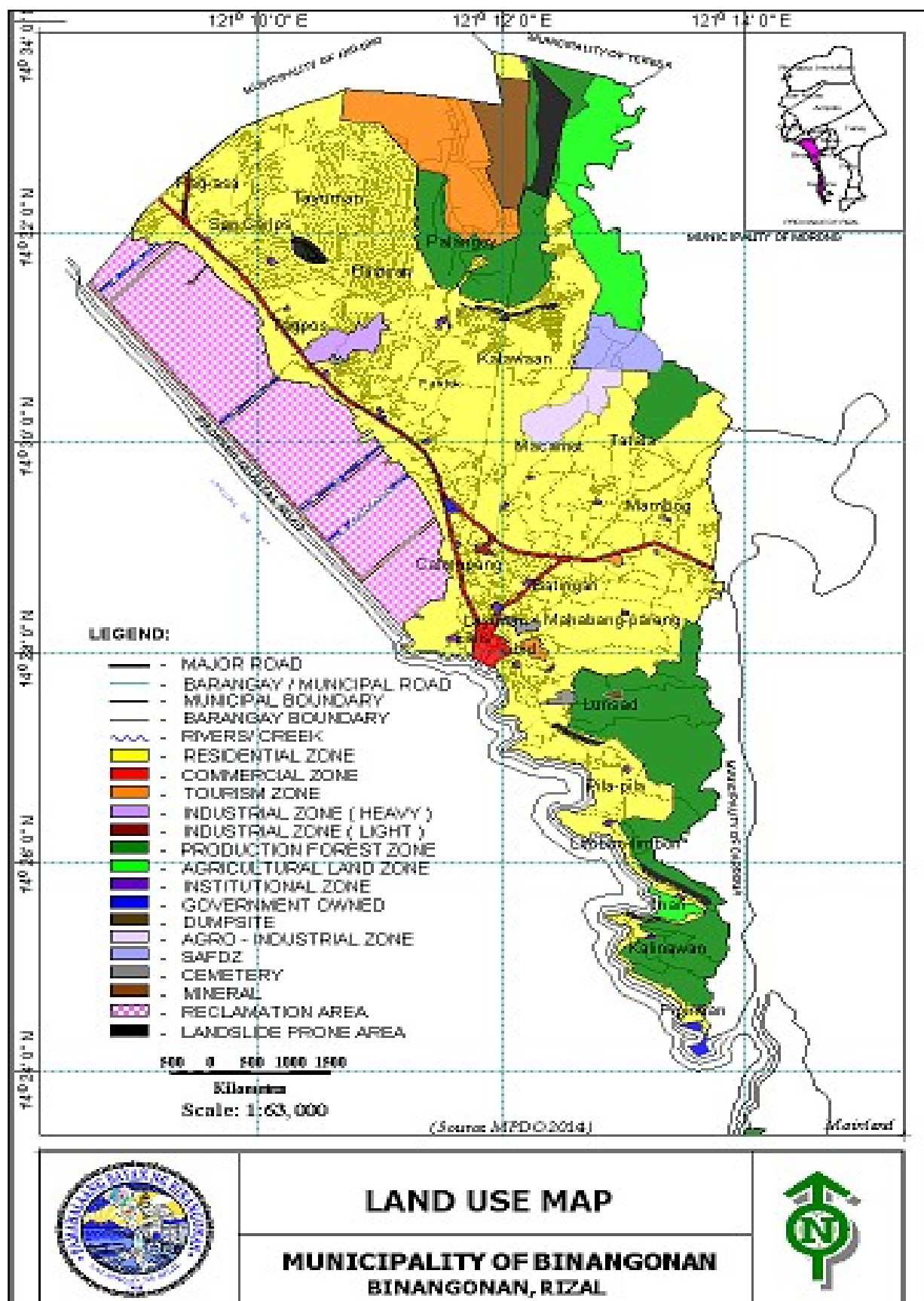


Figure 2.1: Land Use Map of Binangonan (source: Binangonan LGU 2014)

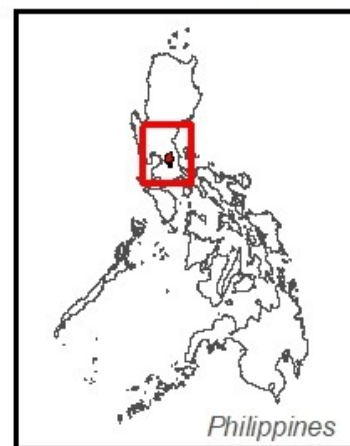
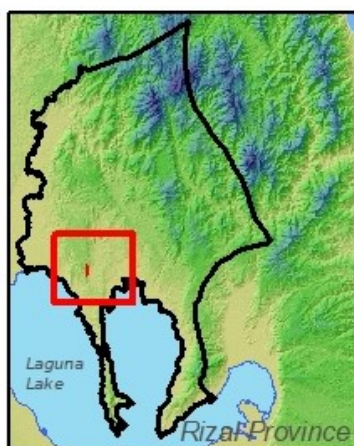
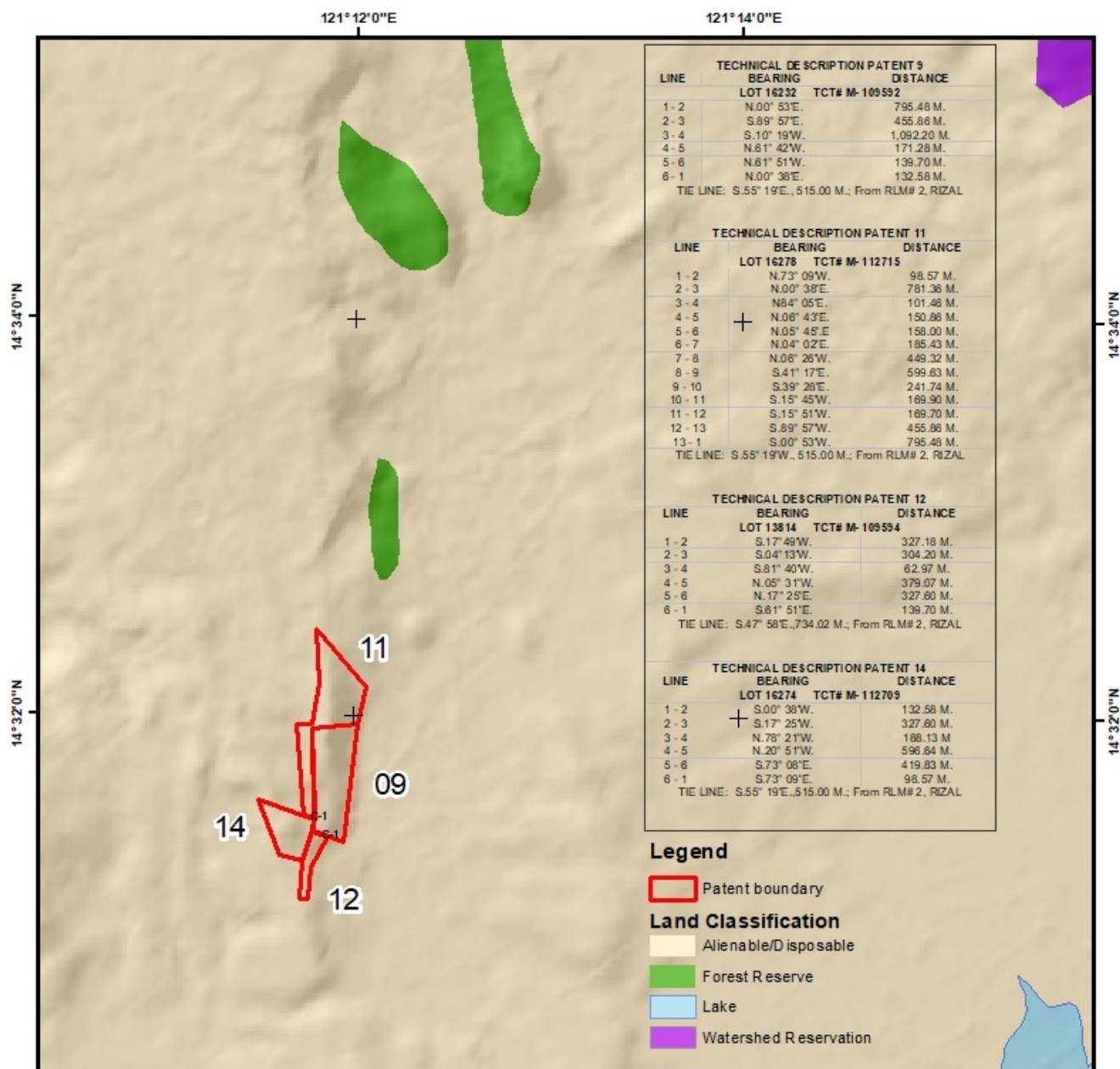


Figure 2.2: Land Classification Map of Binangonan (source NAMRIA 2015)

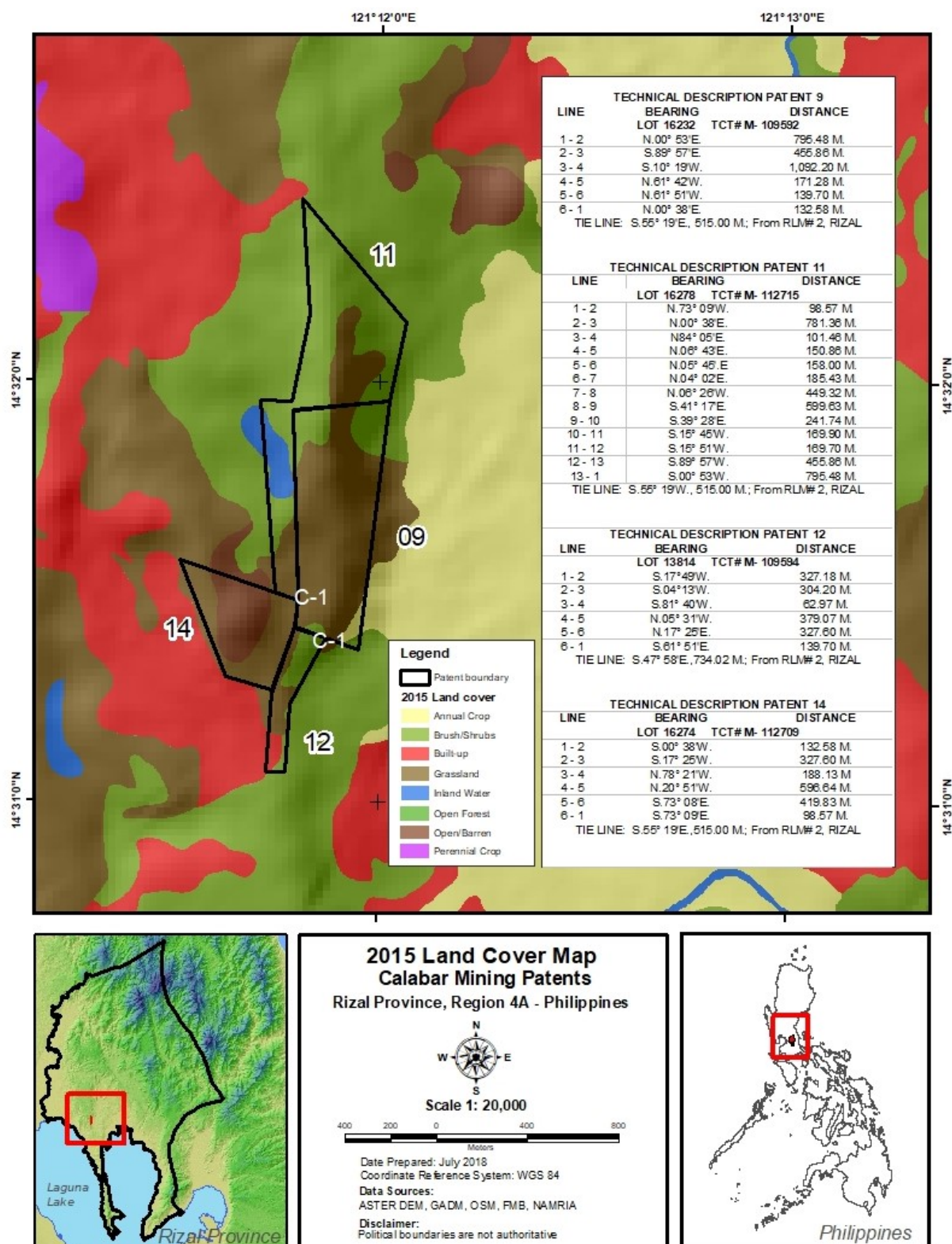


Figure 2.2: Land Cover Map of Binangonan (Source: NAMRIA 2015)

Because IQAC has acquired the claims through mining patents, it has both the surface (private land fully titled) and mining rights over the property and thus can implement programs according to its plan.

2.1.1.2 Impact in terms of compatibility with classification as an Environmentally-Critical Area (ECA)

There is no ECA within the 2 km radius of the project area, thus, no impact on ECA. Provided in Figure 2.1.1.2 is the Google Earth Map showing the project area as against the nearest ECA which is Laguna Lake with a distance of more than 2 kms, i.e. 2.55 kms.

2.1.1.3 Impact in existing land tenure issue/s

The project area is not under CARP or with CAD/CADT/CALC/CALT, IFMA or CBFMA. Attached in Annex B are the copy of the TCTs where the Mining Patents were annotated and Annex C provides a copy of Mines and Geosciences Bureau Certification dated 6 May 2016.

With respect to land tenure issues, discussions with informal settlers will be prioritized since there are eight (8) families that will be affected. IQAC is proposing a Relocation Area for these informal settlers which are located within and in the adjacent municipality which were also identified as relocation areas of IQAC for its other project areas.



Figure 2.1.1.2: Map showing the Distance of Calabar Quarry to Bilibiran River and Laguna Lake (Source: Google Earth)

2.1.1.4 Impairment of visual aesthetics

There are no visually significant landforms/ landscape/structures near the project site. Also, in terms of aesthetics of the project operations, phased / progressive mining will be implemented.

2.1.1.5 Devaluation of land values as a result of improper solid waste management and other related impacts

The Project will not contribute to the devaluation of land value resulting from improper solid waste management and other related impacts because the Project will faithfully comply with the provisions of RA 9003 and adhere to Binangonan's Ordinances on solid waste and environmental programs because



the municipality of Binangonan is one of the LGUs which fully implement the Republic Act 9003 otherwise known as the Ecological Solid Waste Management Act

2.1.1.2 Geology / Geomorphology

2.1.1.2.1 Geology/Geomorphology

2.1.1.2.1.1 General Geology

2.1.1.2.1.1.1 Tectonic Setting

The Philippine Island Chain has evolved from the collision between the Eurasian Plate, South China Sea Plate, the Philippine Sea Plate, and the Pacific Plate. The collision resulted to several subduction zones marked by oceanic trenches. The development of the archipelago was caused by the active squeezing and magma rise producing a chain of volcanoes from the remelting of the subducting lithosphere.

The Philippine Sea Plate is being subducted on the eastern side of the archipelago along the Philippine Trench and the East Luzon Trench. On the other side of the archipelago, the seafloor of the South China Sea Plate subducts near the western side of Luzon along the Manila Trench, producing an opposite dipping subduction zone.

As a result of the colliding and subducting plates, a broad zone of active deformation characterized by pronounced seismicity and volcanism runs longitudinally throughout the entire length of the archipelago. Convergence is further absorbed by internal deformation along the 1,200 kilometers long Philippine Fault, a major strike-slip fault extending from Luzon to Mindanao (Refer to 2.2.2.2.23.2.1.1).

The most prominent structures in the region is the northeast trending Valley Fault, a geomorphologically active fault that extends to the north across Marikina Valley towards Bulacan and to the south along Batangas-Cavite boundary. Other active faults include the Lubang Verde Passage Fault and the Philippine Fault.

2.1.1.2.1.2 Regional Geology

The Mines and Geosciences Bureau published a synthesis of the geology of the Philippines. The Municipality of Binangonan is underlain by four rock formations namely; the Kinabuan Formation (KF) of Cretaceous age, Madlum Formation (MF) of Middle Miocene age, by the Guadalupe Formation (GF) and Alluvium of Quaternary age (Figure 6).

The Kinabuan Formation (KF) consists mainly of altered spilitic basalt basalt flows with intercalated highly indurated sandstone, chert and shale beds. This formation was dated Cretaceous and is noted occurring as windows north of the project area.

The Angat Formation (AF) consists of well bedded to massive limestone associated with the siliceous layer and limy sandstone partings; lower clastic facies composed of thinly bedded sequence of calcareous shale, clayey sandstone, sandy limestone and conglomerate.

The Madlum Formation (MF) consists of upper member (Buenacop Limestone), middle member (Alagao Volcanics), and the lower clastic member. The Buenacop is purely fossiliferous, cream to buff, massive or obscurely bedded in the upper part and thin to medium bedded in the lower part; The Alagao includes Antipolo basalt of Irving, which is commonly aphanitic and porphyritic with oriented vesicles; and the Clastic member is a thick sequence of thin to thick bedded calcareous sandstone and silty shale with conglomerate at the base. Geological age is Middle Miocene.

The Guadalupe Formation (GF) consisting of the upper member (Diliman Tuff) is thin to medium bedded, fine grained vitric tuffs and welded volcanic breccias with subordinate amount of medium to coarse - grained tuffaceous sandstone, and minor conglomerate. This rock formation underlies the study area.

The Quaternary Alluvium (QAI) constitutes the Marikina River Valley (west of the site) and the Laguna de Bay. It consists of detrital deposits mostly silt, sand, and gravel.

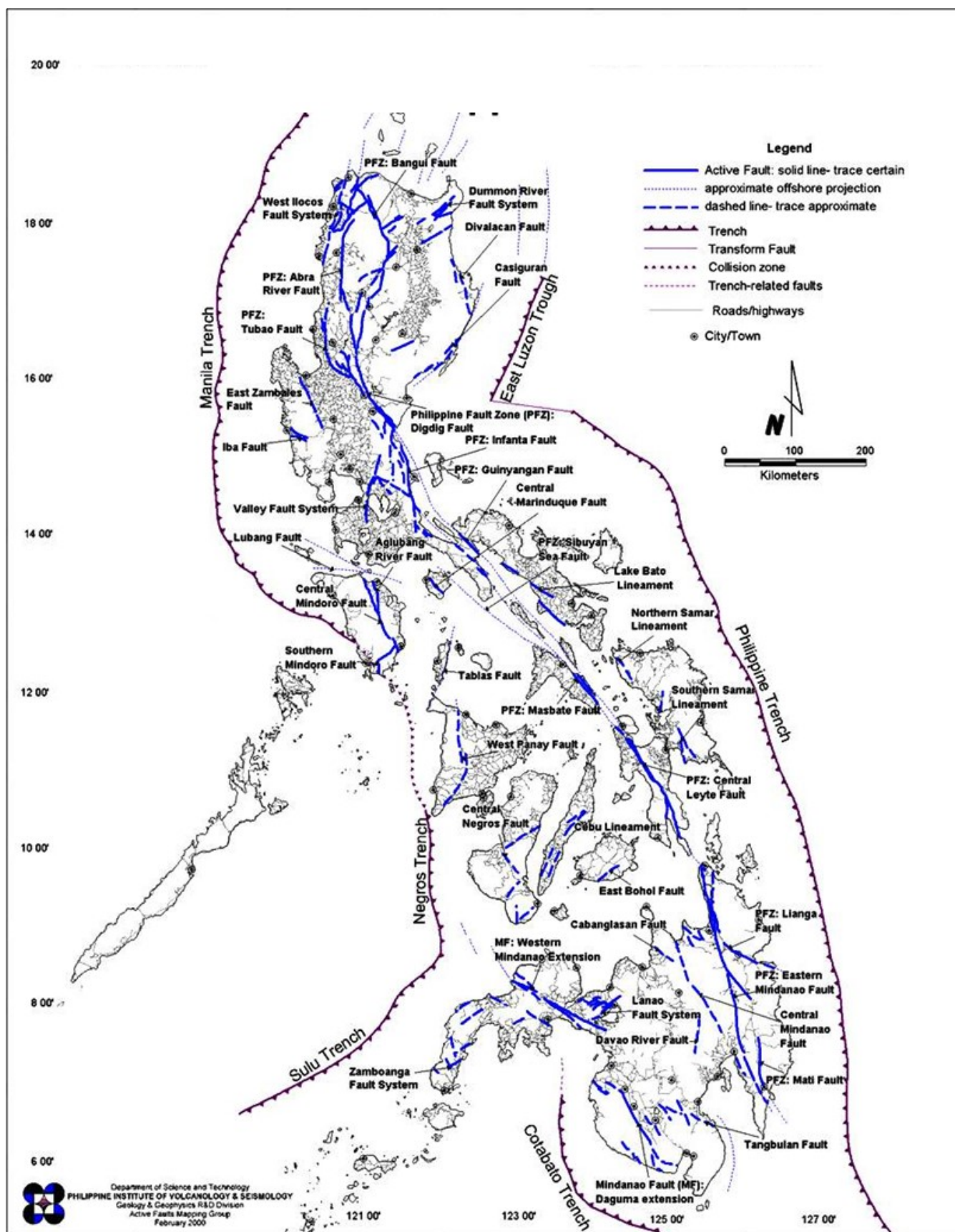


Figure 2.1.1.2.1: Tectonic Map of the Philippines (Source: Phivolcs 2000)

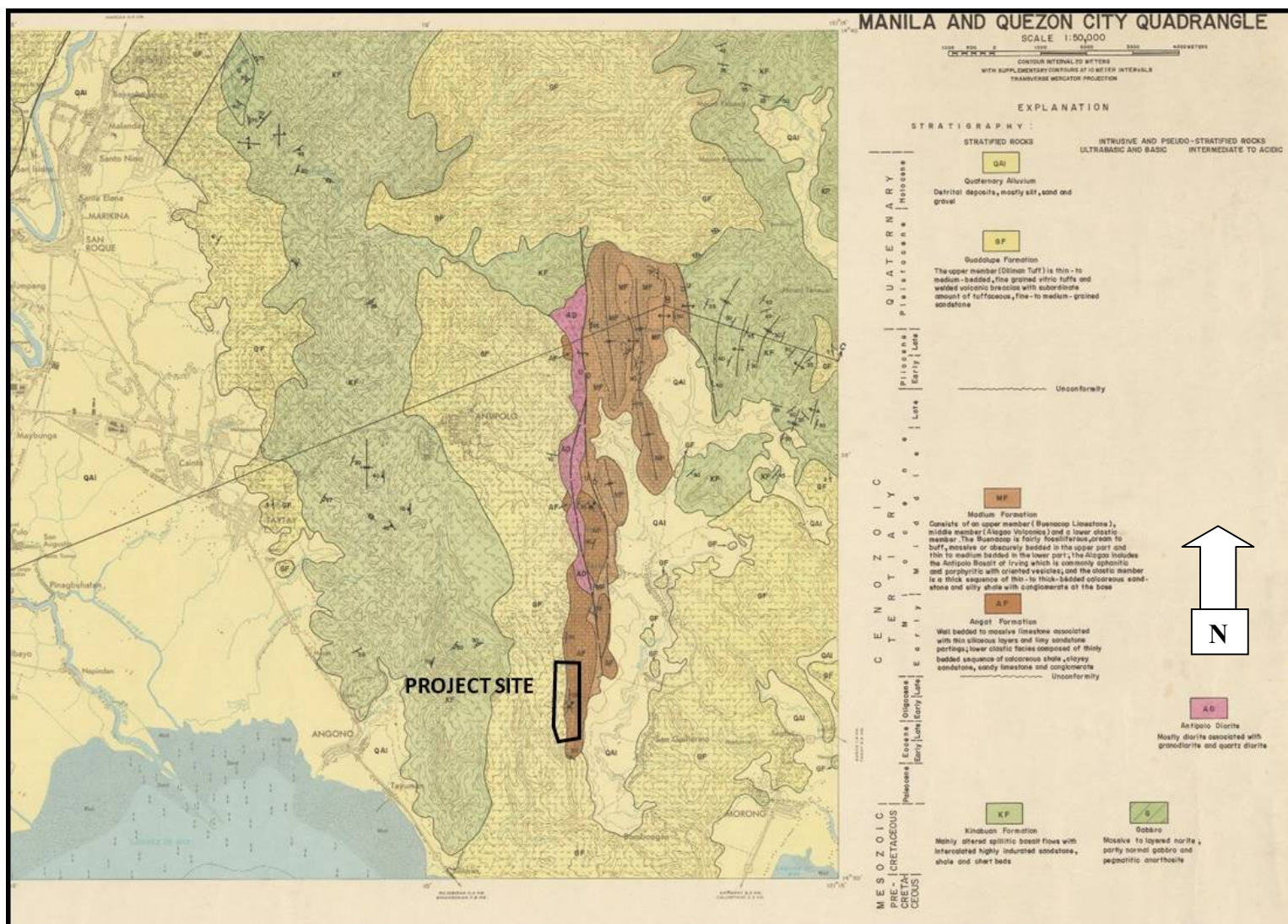


Figure 2.1.1.2.2: The Regional Geologic Map (source: MGB)

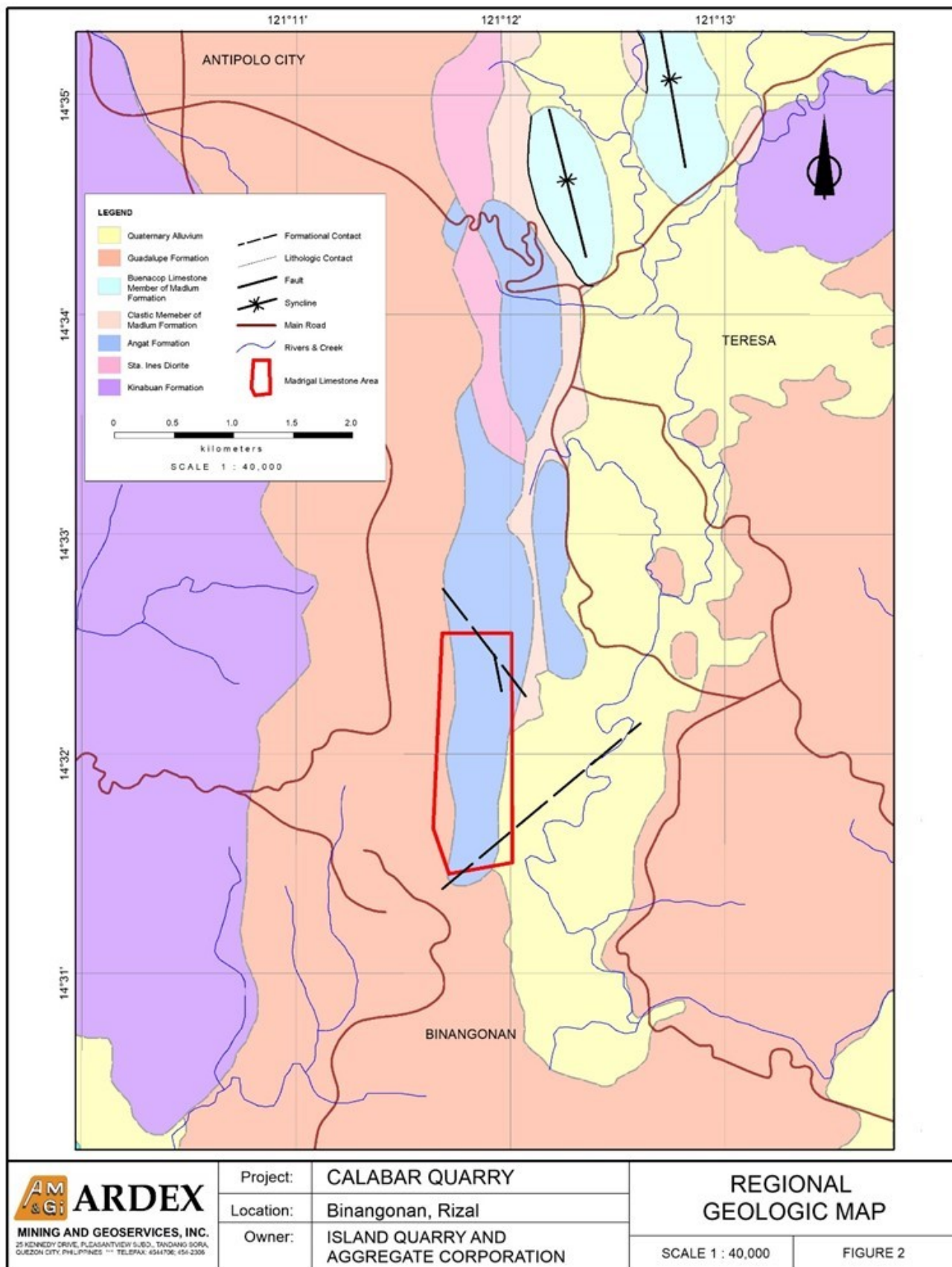


Figure 2.1.1.2.3: Another Regional Geologic Map Showing the Project Area (source: IQAC 2017)



2.1.1.2.1.3 Local Geology

Six (6) lithologic units are mapped in the immediate vicinity of the Calabar Quarry. These include the massive to bedded limestone, marly limestone, calcareous sandstone and conglomerate, clayey to pebbly tuff, calcareous colluvium and alluvial deposits. **Figure 2.1.1.2.1.3.1** shows the distribution of the lithologies in the area.

Massive to Bedded Limestone

The upper limestone member of the Angat Formation cover most of the area and is the target for cement production. This limestone is the north-south trending karstic hill that rises above the Teresa Valley, extending from farther north and terminates to the southern end of the property.

Outcrops are hard, vary from white to cream and occasionally light gray, and massive to bedded limestone. The massive portion is coralline, probably the central part of the biohermal mound of a former coral reef. Vugs and cavities are abundant and it is occasionally cavernous.

On the other hand, the bedded limestone contains abundant coral fragments probably is the outer portion of the biohermal mound of a former coral reef. The limestone beds trend northwest and moderately dip to the northeast.

Limestone exposures are moderately fractured and fractures are generally tight.

Marly Limestone

Limited exposures of the marly limestone are mapped on the western portion of the property. This limestone varies from moderately hard to soft, cream to buff and marly. The limestone usually has thin interbeds of light gray calcareous mudstone and siltstone. Outcrops are generally moderately fractured.

Clayey to Pebbly Tuff

The Diliman tuff member of the Guadalupe Formation lies unconformably on the massive to bedded and marly limestones units. The tuff is extensive to the far west and south of the Madrigal area. To the south is the old workings of Rizal Cement Corporation where tuff was quarried for pozzolan cement production.

This rock is generally light to dark brown, moderately weathered and varies from clayey, sandy to pebbly or lapilli textures. Thickness of the tuff beds range from 1 to 2 meters, trend almost due north and dip steeply to the west.

Calcareous Colluvium

The colluvium is of Quaternary age and is mapped as a narrow continuous band of poorly sorted calcareous materials on the eastern section of the limestone area. This unit consists of loose, gravel to boulder sized limestone fragments set on a silty to clayey matrix formed along the steep slope of the limestone hill.

Calcareous Sandstone and Conglomerate

The Buenacop Limestone member of the Madlum Formation is the calcareous sandstone and conglomerate unit mapped at the northeastern portion of the property. Regionally, the unit lies conformably on the Angat Formation however the contact is masked by the calcareous colluvium locally. Outcrops of the sandstone and conglomerates are generally soft and moderately weathered.

Alluvium Deposits

The Quaternary alluvium cover the entire floor of the Teresa Valley at the south of the Madrigal Area. The deposit is composed of loose to moderately consolidated clay, silt, sand and gravel weathered and eroded materials from the older rocks in the area.

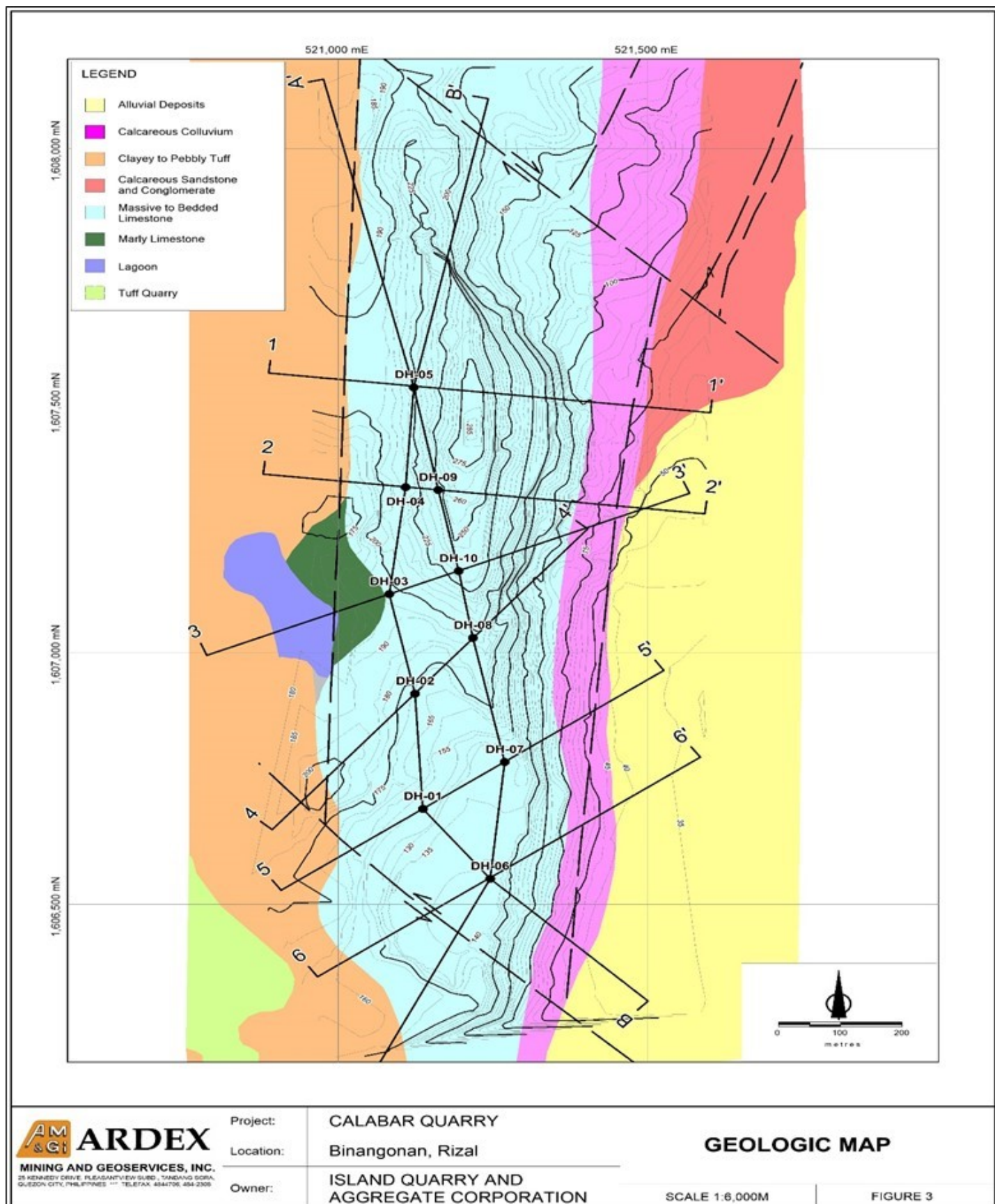


Figure 2.1.1.2.1.3.1: Local Geologic Map of Calabar Quarry Project (source: IQAC 2017)



2.1.1.2.1.4 DIAMOND DRILLING

Ten (10) vertical holes with an aggregate meterage of 915.805 meters were drilled from April to June 2014 (See Figure 2.1.1.2.1.4.1- Drill Hole Location Map). Depth of the holes range from 41.67 to 190.65 meters with hole diameter of 2 ½" to 3" (NQ bit size). Summary of drillholes is as follows:

Table 2.1.1.2.1.4: Summary of Drillholes

HOLE ID	Date Started	Date Completed	Depth (m)	Recovery (%)
DH-01	30-May-14	1-Jun-14	41.67	84.71
DH-02	7-Jun-14	17-Jun-14	79.36	94.78
DH-03	22-Mar-14	3-Apr-14	109.30	97.27
DH-04	24-May-14	6-Jun-14	126.82	91.67
DH-05	5-May-14	17-May-14	96.00	84.88
DH-06	28-Apr-15	19-May-14	50.00	95.53
DH-07	23-May-14	26-May-14	50.00	98.82
DH-08	9-Jun-14	15-Jun-14	108.19	85.30
DH-09	10-Apr-14	28-Apr-14	190.65	94.58
DH-10	18-Jun-14	23-Jun-14	63.43	89.05
TOTAL / AVERAGE			915.42	91.66

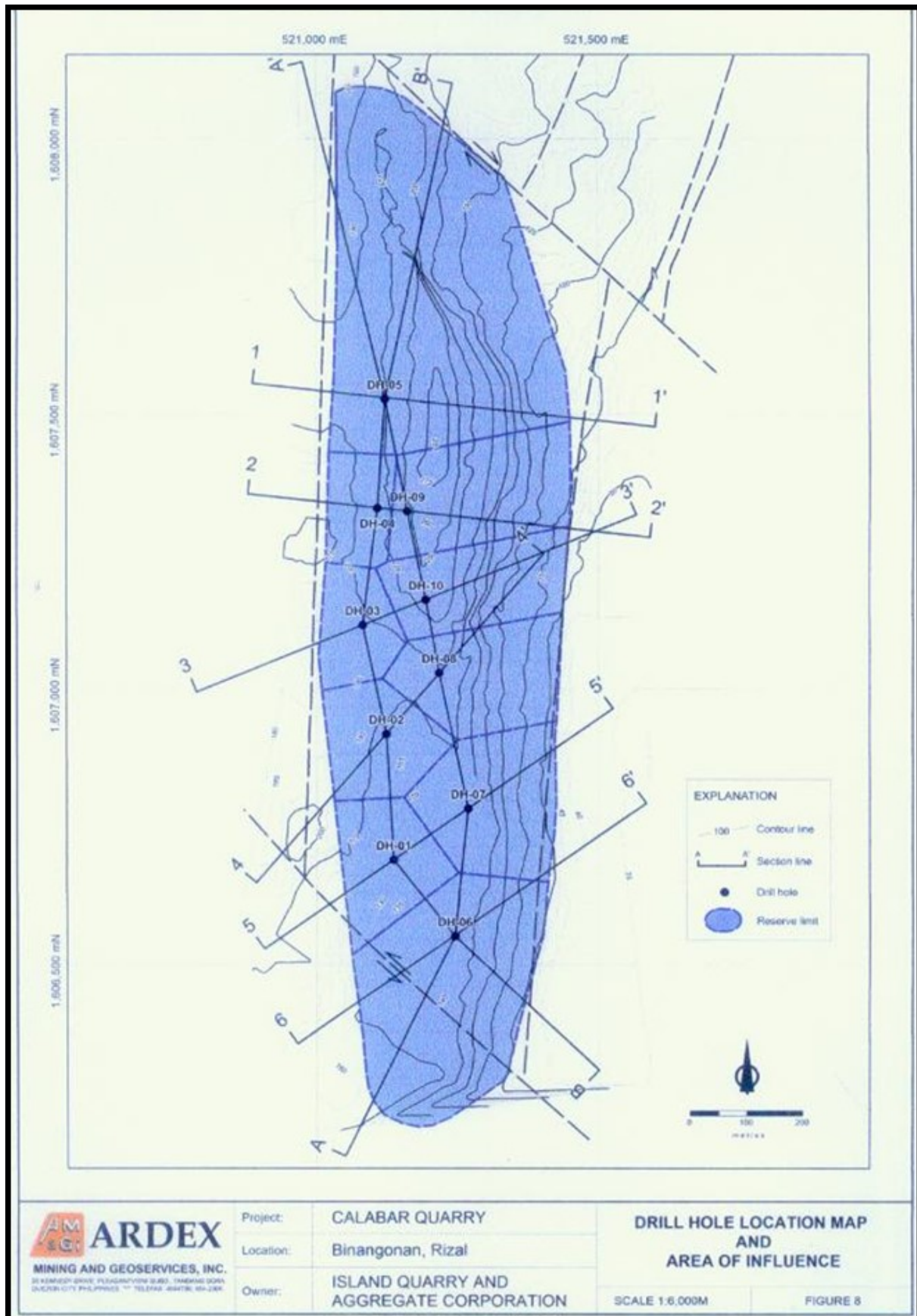


Figure 2.1.1.2.1.4.1: Local Geologic Map of Calabar Quarry Project (source: IQAC 2017)

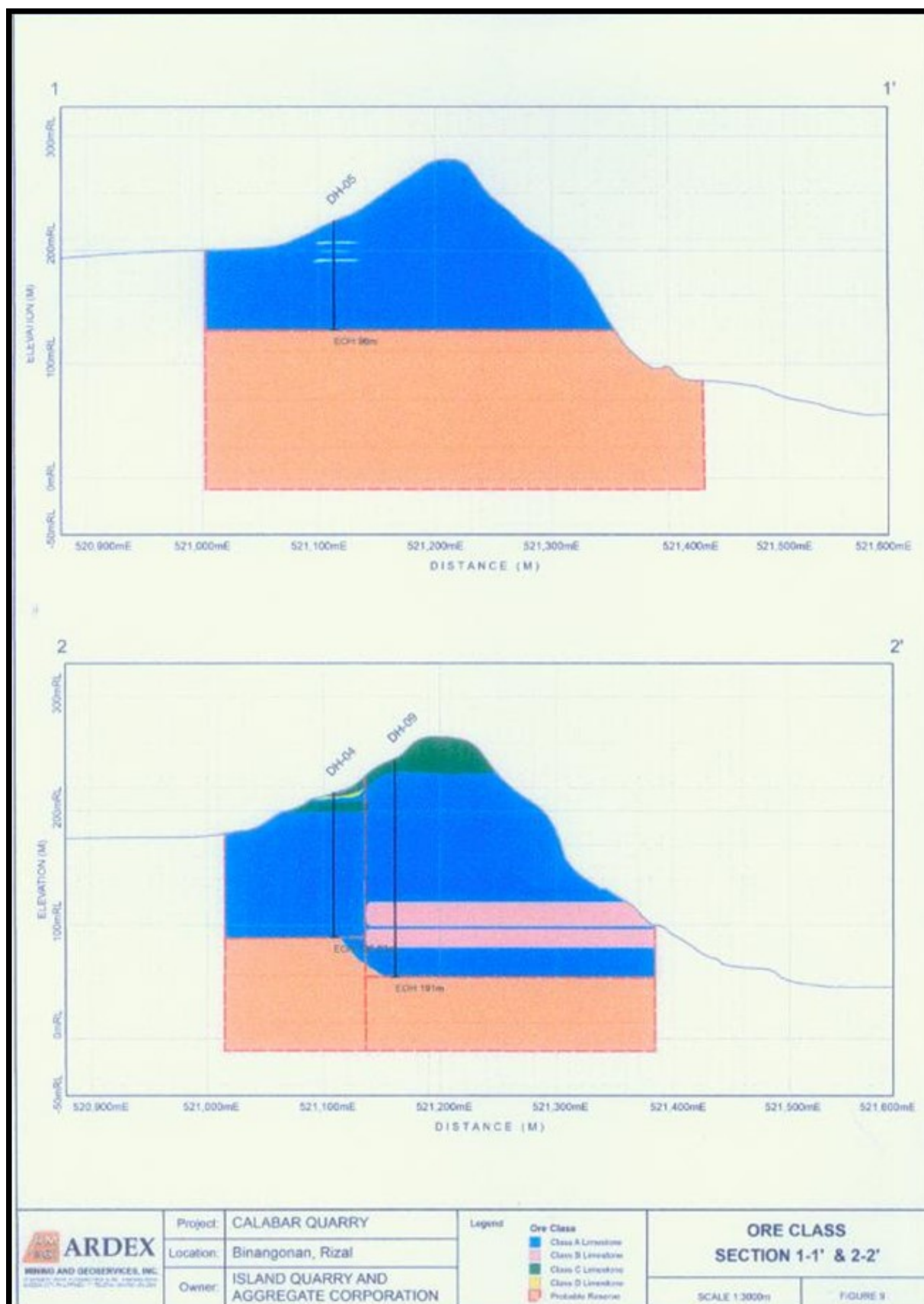


Figure 2.1.1.2.1.4.2: Geologic Cross Section Along Line 1-1' and 2-2' (source: IQAC 2017)

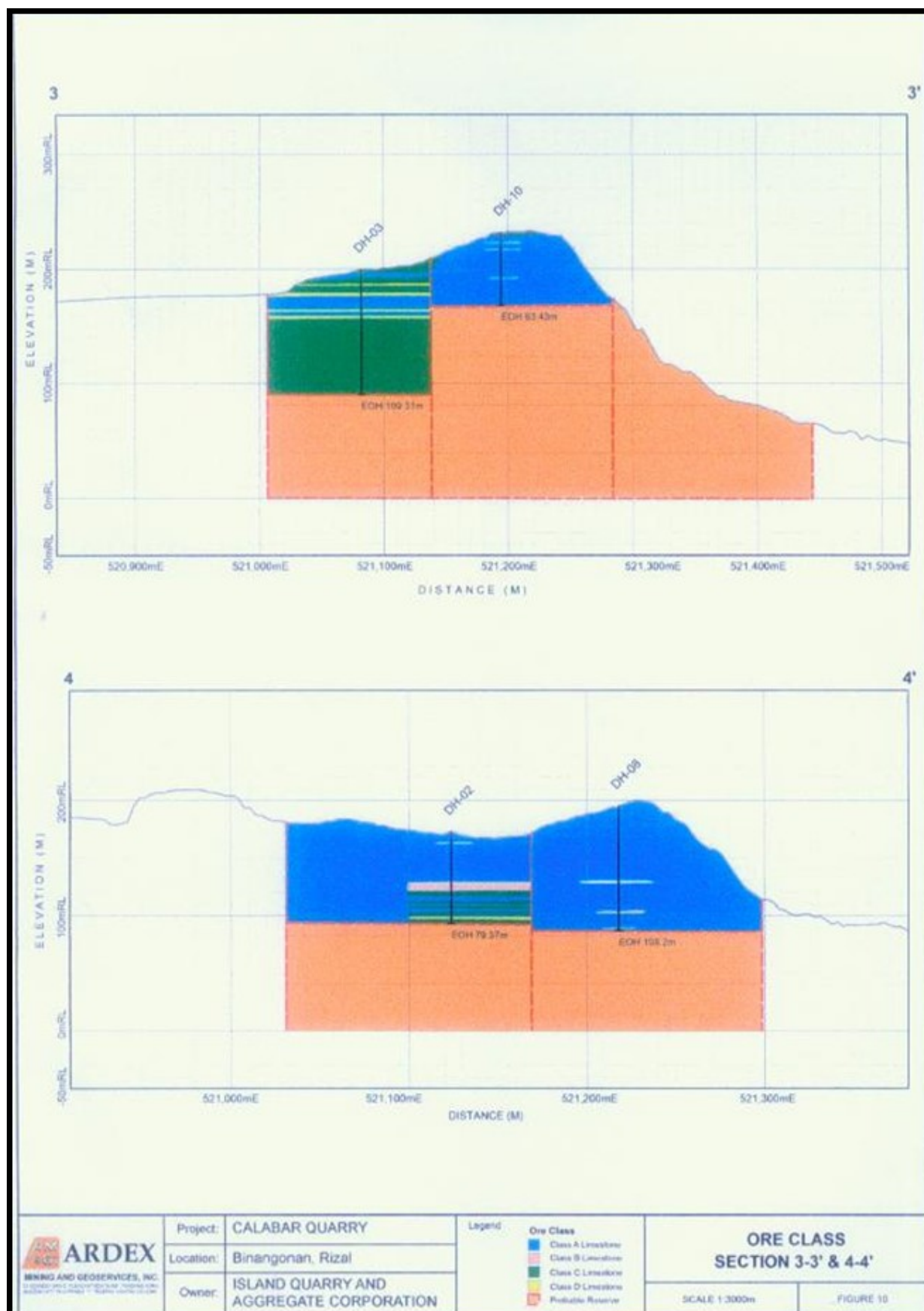


Figure 2.1.1.2.1.4.3: Geologic Cross Section Along Line 3-3' and 4-4' (source: IQAC 2017)

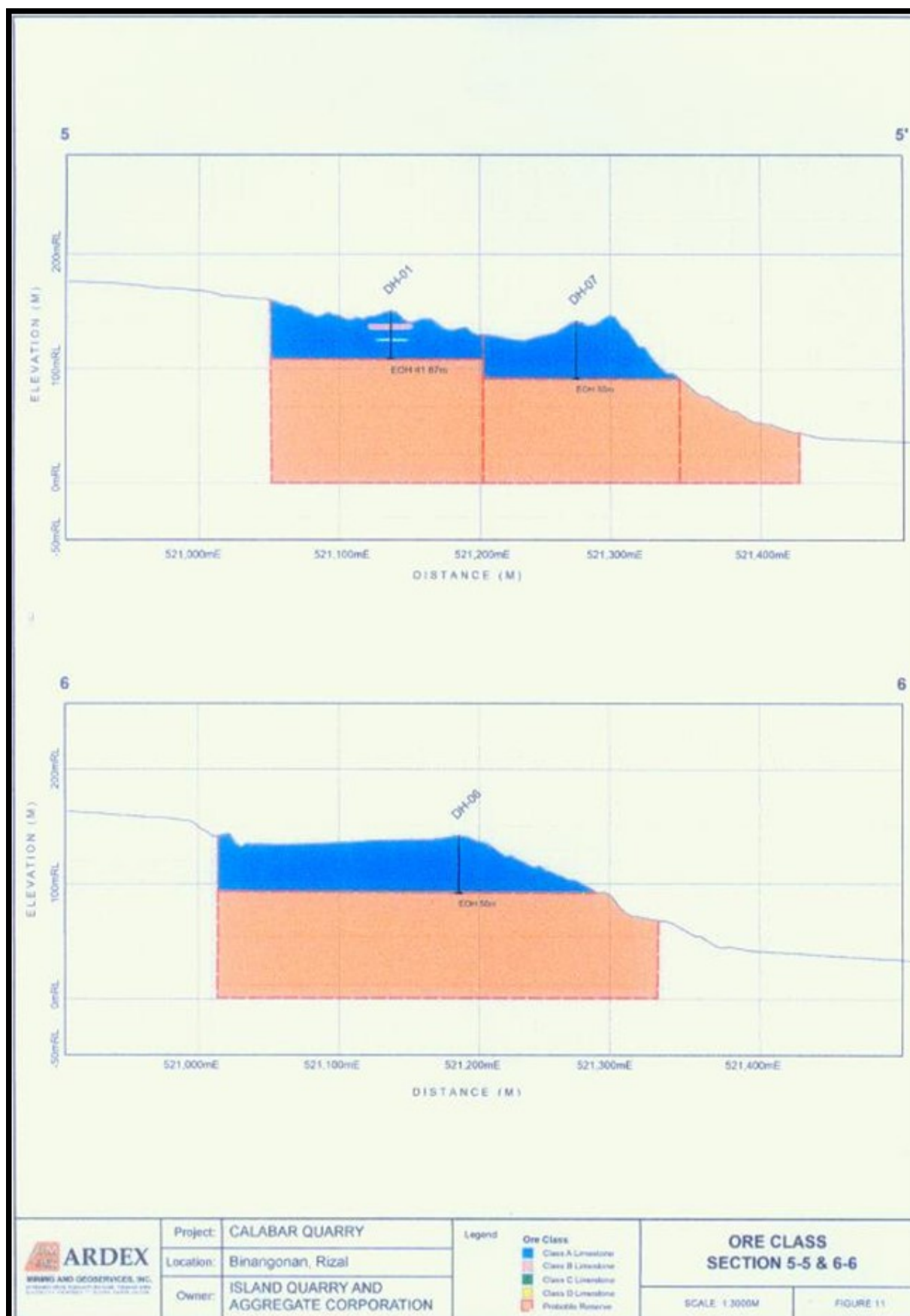


Figure 2.1.1.2.1.4.4: Geologic Cross Section Along Line 5-5' and 6-6' (source: IQAC 2017)

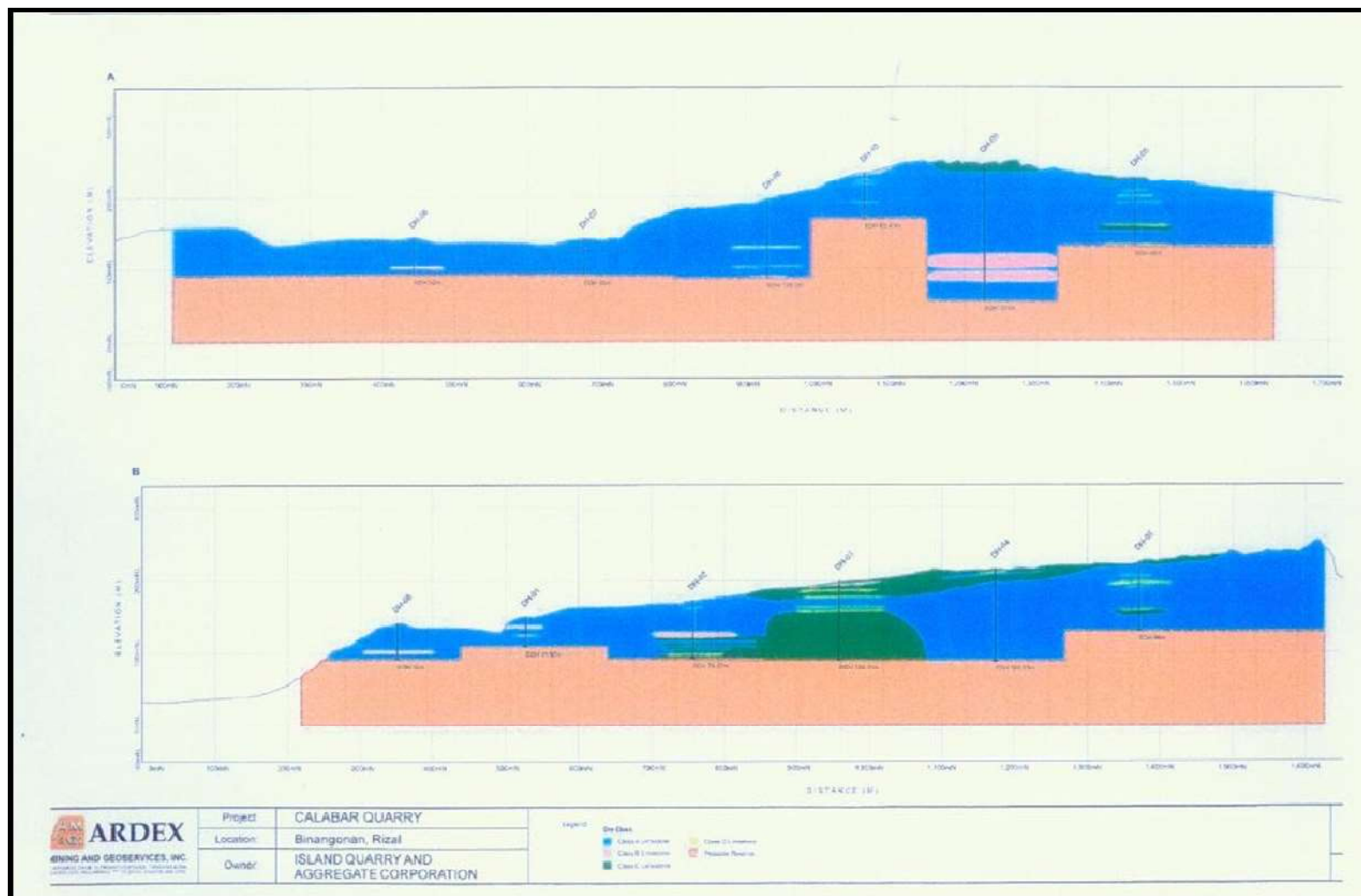


Figure 2.1.1.2.1.4.5: Geologic Cross Section Along Line A-A' and B-B' (source: IQAC 2017)

CORE LOGGING

Brief description of materials encountered are as follows:

- **SILTY CLAY** - soil cover, residual weathered, dark brown to brown with occasional limestone boulders
- **LIMESTONE** - marbleized, beige to gray, fractured to relatively massive, thickly bedded, occasionally with open hole/cavities
- **SILTSTONE/SANDSTONE** - calcareous, brown, fine to medium grained highly fractured

The amount of open holes/cavities in percent within the limestone per hole are as follows:

Table 2.1.1.2.1.5: Percentage of Voids Measured Per Drillhole

DDH No.	Length of Voids (m)	% Voids
DH-01	5.7	13.6%
DH-02	0.0	0.0%
DH-03	0.0	0.0%
DH-04	0.0	0.0%
DH-05	4.4	4.6%
DH-06	0.0	0.0%
DH-07	0.0	0.0%
DH-08	5.1	4.7%
DH-09	7.0	3.7%
DH-10	3.5	5.5%

LABORATORY ANALYSIS

Core samples were analyzed for the standard cement raw material parameters: CaO, Al₂O₃, Fe₂O₃, MgO, SiO₂, Na₂O, K₂O, SO₃ and LOI. Using cut-off values of CaO > 37%, Al₂O₃ < 2.5% and MgO < 1.8% for usable limestone, the marbleized limestone was further classified into four (4) namely:

- Class A – high CaO, low Al₂O₃, low MgO, low Fe₂O₃ and low SiO₂
Class B – high CaO, low Al₂O₃, high MgO, low Fe₂O₃ and low SiO₂
Class C – high CaO, high Al₂O₃, low MgO, low Fe₂O₃ and high SiO₂
Class D – low CaO, high Al₂O₃, low MgO, low Fe₂O₃ and high SiO₂

For the above classification, average limestone assay values are as follows:

Table 2.1.1.2.1.6: Average Limestone Assay Values

LIMESTONE CLASS	CaO	Al ₂ O ₃	MgO	Fe ₂ O ₃	SiO ₂	K ₂ O	SO ₃
A	53.82	0.46	1.09	0.19	1.39	0.06	0.06
B	51.89	0.44	1.82	0.15	1.63	0.08	0.09
C	48.27	2.26	0.73	1.04	5.52	0.18	0.12
D	42.34	3.87	1.05	1.59	10.21	0.28	

Total Positive Limestone Reserve at Calabar Quarry

Based on the drilling results and using the above assumptions, the total positive limestone reserve is 144.21 million metric tons of 52.46% CaO, 0.84% Al₂O₃, 1.12% MgO, 0.34% Fe₂O₃, 2.36% SiO₂, 0.09% K₂O and 0.08% SO₃. Below is a summary of estimated positive quarry materials (See Table 3.2.1.5):

Table 2.1.1.2.1.7: Summary of Estimated Positive Quarry Materials

LIMESTONE CLASS	TONNAGE (MT)	WEIGHTED AVERAGE (%)						
		CaO	Al ₂ O ₃	MgO	Fe ₂ O ₃	SiO ₂	K ₂ O	SO ₃
A	116,733,480	53.82	0.46	1.09	0.19	1.39	0.06	0.06
B	9,030,425	51.89	0.44	1.82	0.15	1.63	0.08	0.09
C	5,499,750	48.27	2.26	0.73	1.04	5.52	0.18	0.12
D	12,951,006	42.34	3.87	1.05	1.59	10.21	0.28	0.21
TOTAL	144,214,660	52.46	0.84	1.12	0.34	2.36	0.09	

Total Probable Limestone Reserve at Calabar Quarry

Upon correlation of drilling results and lithologic intersections, the total probable limestone reserve is **208.82 million metric tons of Class A – B limestone**. Below is a summary of estimated probable quarry materials for each drillhole (*See Table 2.1.1.2.1.8*).

Table 2.1.1.2.1.8: Total Probable Limestone Reserve Per Drillhole

DRILLHOLE ID	TONNAGE (MT)	EXPECTED QUALITY
DH-01	11,316,525	A - B
DH-02	10,871,234	B - C
DH-03	12,471,470	C
DH-04	5,957,136	A
DH-05	78,645,576	A - D
DH-06	28,551,444	A
DH-07	13,032,026	A
DH-08	11,944,095	A
DH-09	15,491,200	A - B
DH-10	20,539,761	A - B
TOTAL	208,820,467	A - D

2.1.1.2.1.1.5 Change in surface landform/ topography/ terrain/slope

Slope and Elevation/Topographic Map;

Topography

Karstic features, rolling hills and a valley characterize the topography within the Calabar Quarry.

The north-south trending ridge, known locally as the Kaytulis Hill, is the prominent topographic high in the area. Kaytulis Hill reaches up to about 280-300 meters above sea level, sloping from an elevation of 130 meters on its southern portion. The mining will cover a height of about 150 meters but could be extended downward if the probable ore below the positive reserve is proven to be feasible for mining.

Decades of quarrying has significantly lowered the elevation of this area. The previous quarry is presently vegetated and unremarkable when viewed along the highway.

From the Kaytulis Hill, the terrain drops sharply to a valley floor of about 30 meters elevation to the east forming the southern limit of the Teresa Valley. To the west of the area is the rolling terrain underlain by flat-lying beds of tuffaceous material which was the source of tuff for the pozzolan cement of the formerly Rizal Cement Corporation quarry.

Tributaries of the Morong and Angono Rivers drain the property on its east and west, respectively, and discharge to the south to Laguna de Bay.

The project which is an open cut mining will have a great impact on the present terrain of the area and will result in flattening of the terrain. The mined-out area, however will be properly rehabilitated and be planted to fruit bearing trees, be developed to subdivision or resort area.

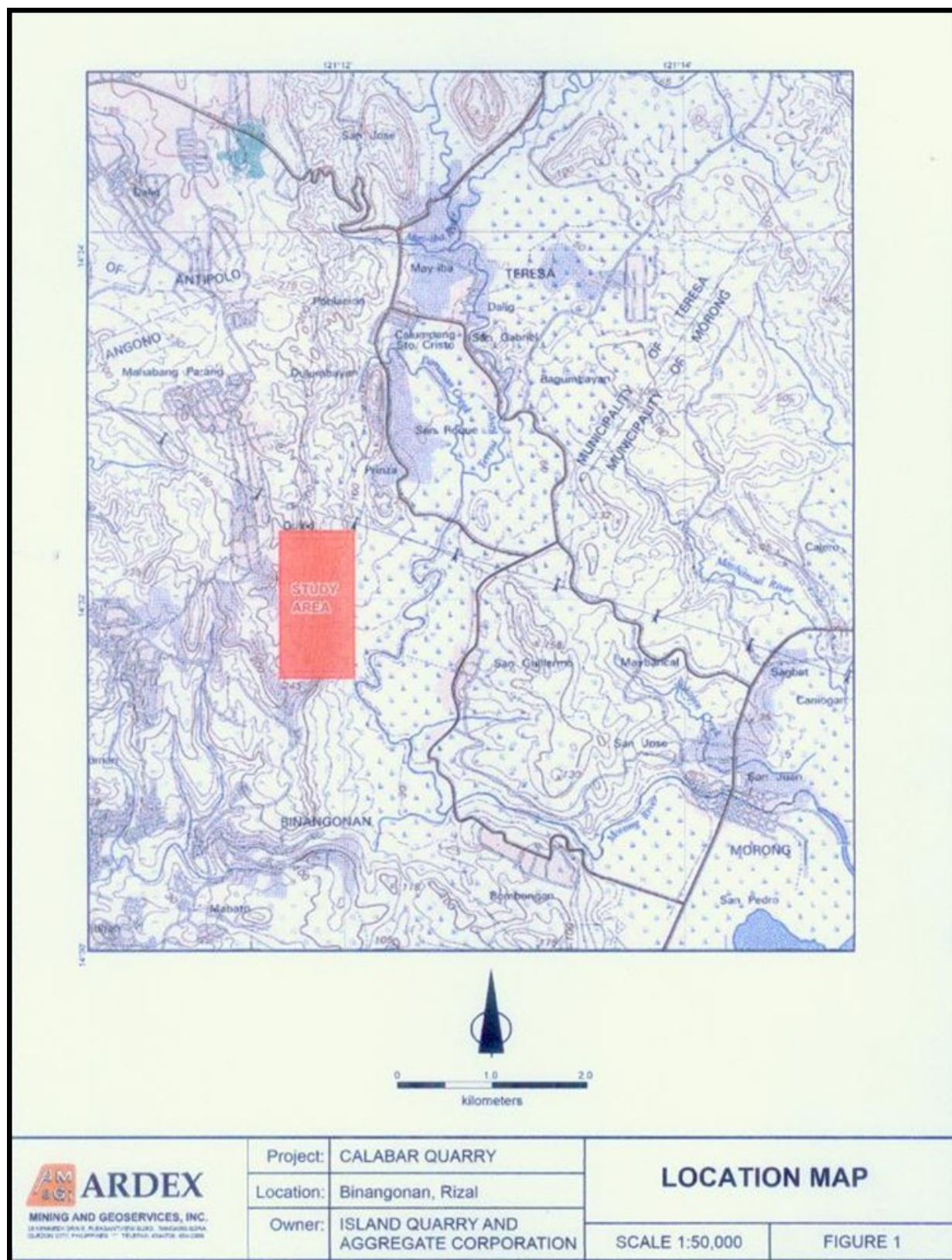


Figure 2.1.1.2.1.1.5.1: Topographic Map of Calabar Quarry at Binangonan, Rizal (Source: IQAC 2017)

2.1.1.2.1.1.6 Hazard Maps and Discussions of Impacts/Effects of Natural Hazards on the Project

“Natural Hazards” are the natural processes or phenomena occurring in the biosphere that may constitute a damaging event. It can be classified by origin: geological, hydrometeorological or biological.

2.1.1.2.1.1.6.1 Geologic Hazard

2.1.1.2.1.1.6.1.1 Volcanic Hazards

The absence of active volcano in the province indicates that eruption-related hazards are unlikely to occur.

2.1.1.2.1.1.6.1.2 Earthquake Hazards

Earthquake is the perceptible trembling to violent shaking of ground caused by either tectonic or volcanic activity. The Philippines is located near or along the so called “earthquake belt” and is prone to seismic hazards. Areas that are susceptible to this seismic hazard are those underlain by unconsolidated sediments deposited on the low-lying areas (**Figure 2.1.1.2.1.1.6.1.2.1**).

The area investigated is prone to ground shaking hazards due to the presence of several earthquake generators in and near the region. These possible seismogenic structures include the active Valley Fault, Lubang Verde Passage Fault, and the Philippine Fault. The site considered a low seismic area has recorded and experienced intensity VI during the 1990 Luzon Earthquake (**Figure 2.1.1.2.1.1.6.1.2.2**).

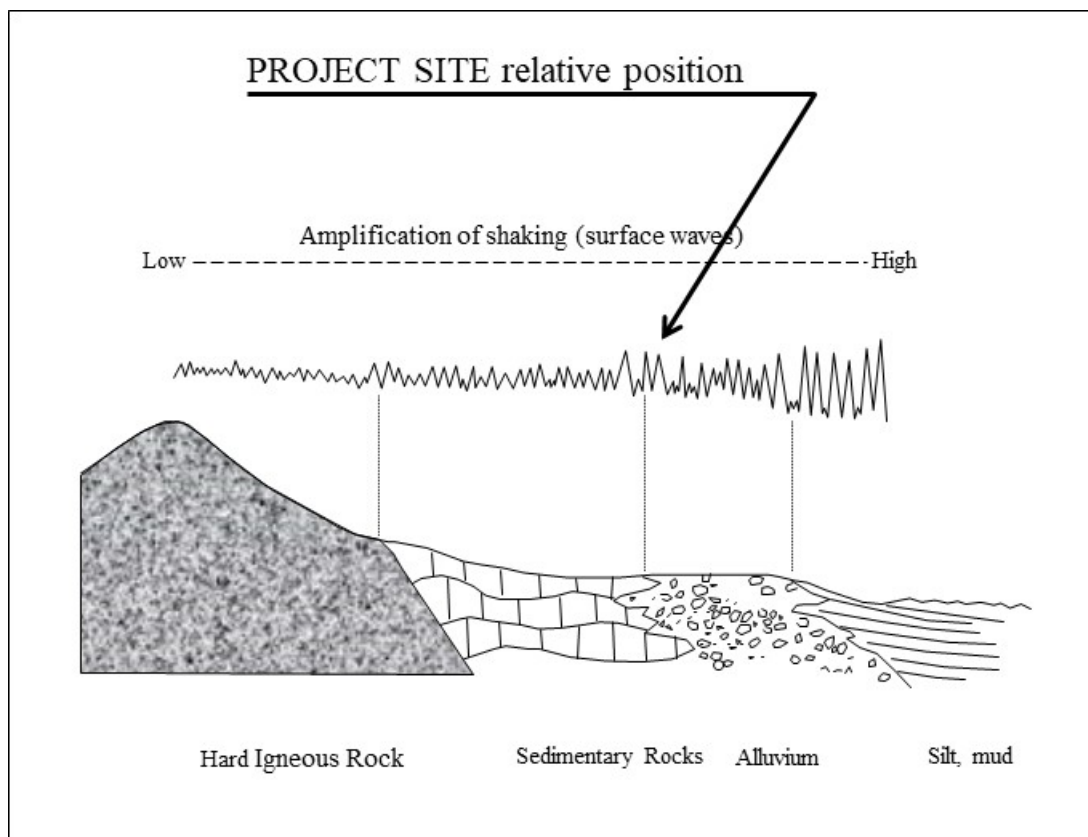


Figure 2.1.1.2.1.1.6.1.2.1: Generalized Relationship Between Near Surface Earth Material and Amplification of Shaking During a Seismic Event (Keller E. A. 1985)

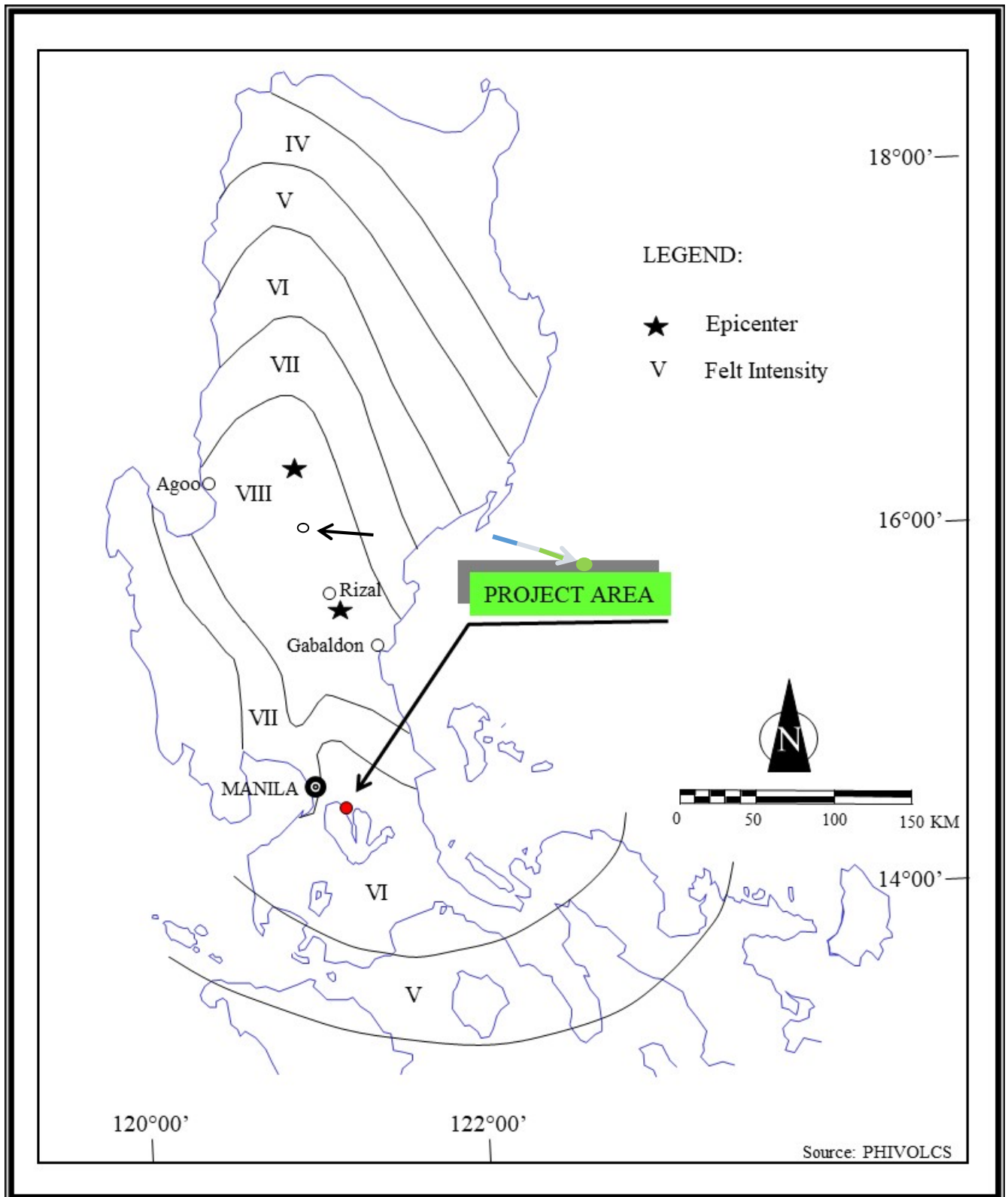


Figure 2.1.1.2.1.6.1.2.2: Intensity Map of 16 July 1990 Earthquake

2.1.1.2.1.1.6.1.3 Ground Acceleration

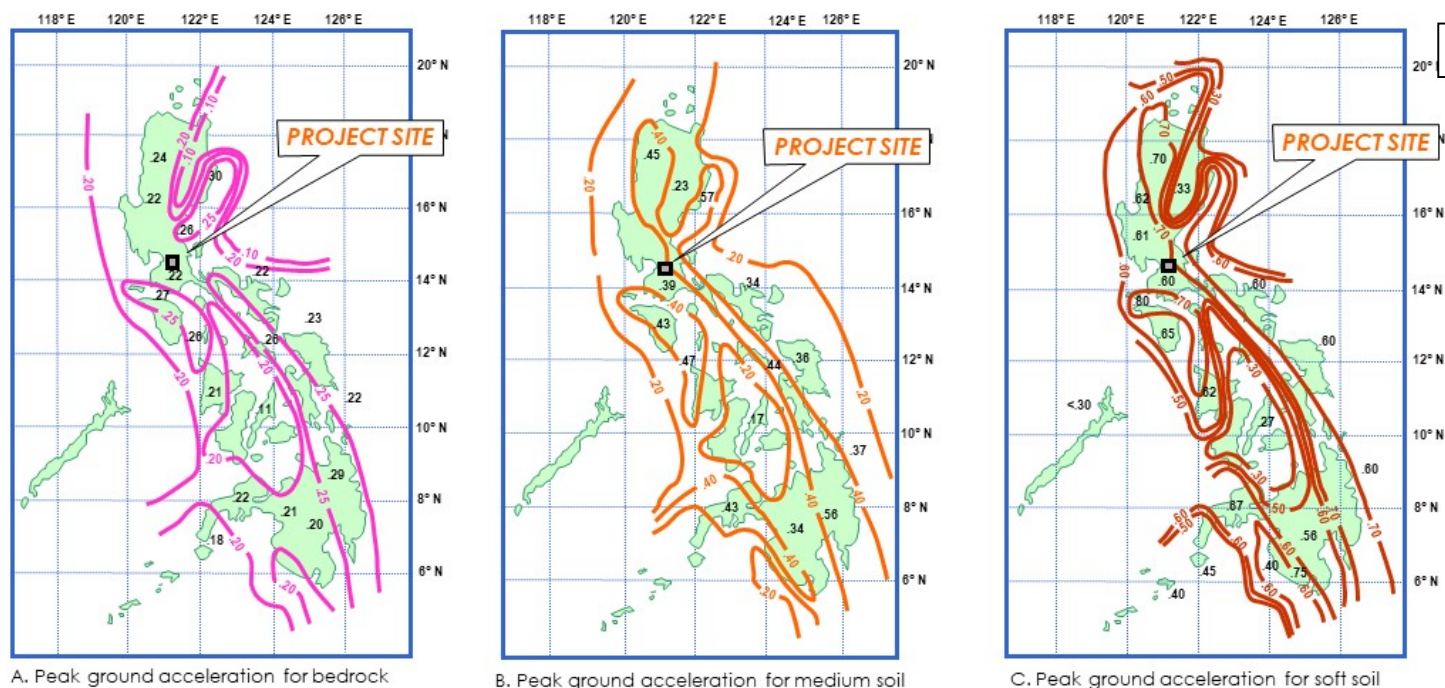
Ground acceleration caused by earthquakes may result to great damage and destruction to property and infrastructure accompanied by loss of life. Factors that influence the intensity of ground shaking include the magnitude of the earthquake, distance of the site in relation to the earthquake generator, characteristics of the underlying rocks, and the soundness of the building. The Philippines is a tectonically active place with noted active faults that are usually the source of major earthquakes. The reason why the Philippine Institute of Volcanology and Seismology (PHIVOLCS) and the United States Geological Survey (USGS) conduct ground motion hazard mapping in terms useful to engineering design using modern probabilistic methodology. In the study, the peak horizontal ground accelerations that have a 10 % probability of being exceeded in 50 years have been uniformly estimated for rock, hard soil, medium soil, and soft soil site condition. Result of the study shows an estimate on rock ranging from a low of 0.11g in Visayas to a high of 0.30g in the vicinity of Casiguran fault zone in eastern Luzon (Thenhaus et al, 1994). Estimates for soft soil conditions are considerably higher and range between 0.27g for Visayas and 0.80g along the Casiguran fault zone.

The project site is underlain mainly by thick limestone deposits and fall under the .39g to 0.60g as shown in the delineated Acceleration Map for Medium Soil and Soft Soil (**Figure 2.1.1.2.1.1.6.1.3.1**).

Using the deterministic method of Tanaka and Fukushima with the following attenuation relation:

$$\text{Log}_{10}A = 0.41M - \log_{10}(R + 0.032 \times 10^{0.41M}) - 0.0034R = 1.30$$

Where : A= mean of the peak acceleration from two horizontal components at each site (cm/sec²)
 R= shortest distance between site and fault rupture (km)
 M= surface-wave magnitude



SOURCE: Thenhaus et al, 1994

Figure 2.1.1.2.1.1.6.1.3.1. Maps Showing Peak Horizontal Acceleration Amplitude on Bedrock, Medium Soil and Soft Soil for the Philippine Region

and considering an earthquake magnitude of 7.2 and distance of the site of 18.00 kilometers from the Valley Fault, the following peak ground acceleration (PGA) values of 0.203g, 0.295g, and 0.471g for bedrock, medium soil and soft soil, respectively. The project falls on the medium to soft soil condition.

2.1.1.2.1.6.1.4 Ground Rupture

Ground rupture occurs when a new rupture is created or when renewed movement of old fractures takes place (Punongbayan 1994). Phivolcs is recommending a buffer zone of at least 5 meters on both sides of a fault trace or from the edge of deformation zone. This is seemingly absent in the project since Valley Fault, the nearest active fault is located 18.00 kilometers away (**Figure 2.1.1.2.1.6.1.4.1**).

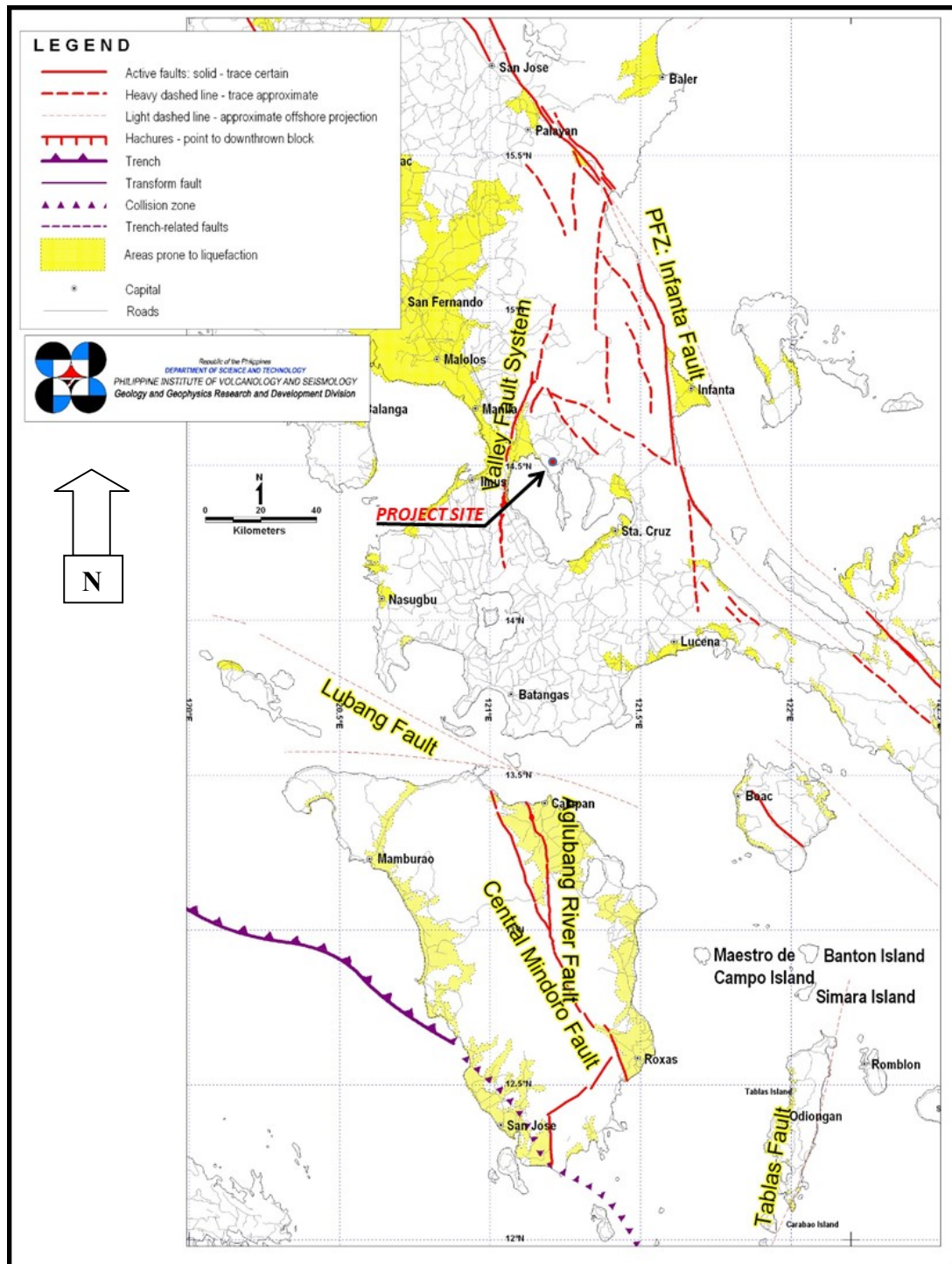


Figure 2.1.1.2.1.6.1.4.1: Active Faults and Liquefaction Susceptibility Map of Region 4A (Source: Philvolcs 2015)

2.1.1.2.1.6.2 Hydrologic Hazard

2.1.1.2.1.6.2.1 Flood Hazard

Floods usually occur during or after heavy rainfall wherein the river channels are saturated with water resulting to river swelling and overflowing of floodplains. The project is located on a mountain with elevation of 130m to 300m MASL and is not susceptible to flooding (**Figure 2.1.1.2.1.6.2.1.1**).

LANDSLIDE AND FLOOD SUSCEPTIBILITY MAP OF QUEZON CITY QUADRANGLE QUEZON CITY, PHILIPPINES

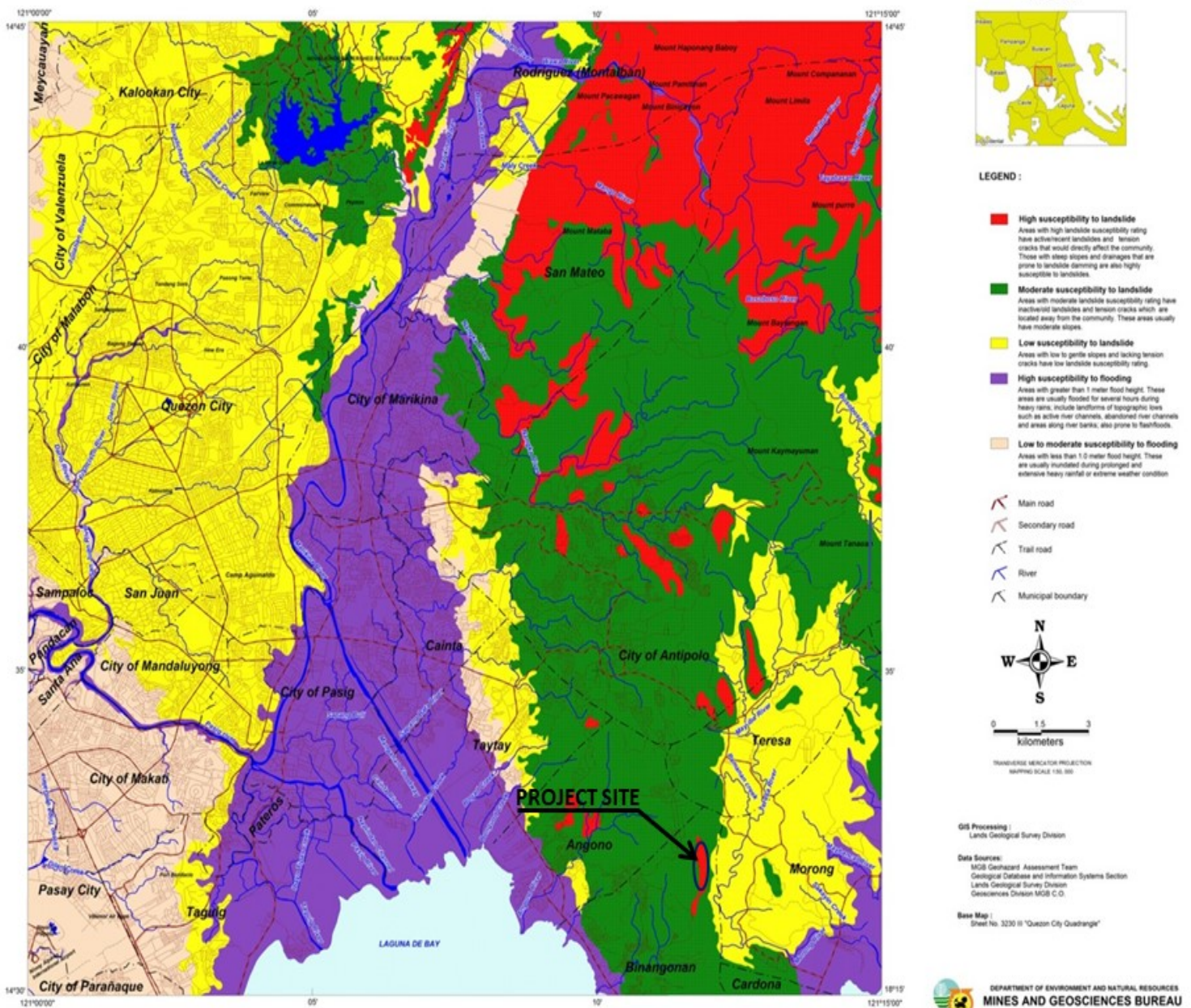


Figure 2.1.1.2.1.6.2.1.1: Landslide and Flood Susceptibility Map of Quezon City Quadrangle (source MGB 2010)

2.1.1.2.1.1.6.2.2 Landslide

Mass movement involves the bulk transfer of earth masses under the influence of gravity. Common downslope hazards include landslide, slumping, and increased erosion, which commonly occur along steep slope, escarpments, steep terrain, underlain by highly weathered, fractured and loose material. This is usually triggered by heavy precipitation and prolonged rains during monsoon rains, ground shaking, and in some cases, man-made slope excavations.

Based from the Landslide Susceptibility Mapping of Quezon City Quadrangle conducted by the Mines and Geosciences Bureau, Region 4A, the project site falls under the highly susceptible to landslide (Figure 3.2.1.8.2.1).

2.1.1.3 Pedology

2.1.1.3.1 Soil erosion / Loss of topsoil/overburden

Erosion is a geologic phenomenon involving the removal of surface soil particles by the action of water or wind and the transport of the removed soil to another location. Erosion can be triggered by a combination of factors such as: steep slopes, type of soil, cycle of dry and rainfall events, sparse vegetation or forest fires. For this project the erodibility at site is a function of several parameters other than those cited above such as soil compaction, formation of sinkholes, loss of soil structure, poor internal drainage, salinisation and soil acidity problems and other serious soil degradation conditions which can also accelerate the soil erosion process.

2.1.1.3.2 Change in soil quality/fertility

Soil sampling was conducted at the project site in September 2017. Soil sampling was conducted to investigate the elements, particularly heavy metals, which are present in the soil matrix within the project site. Heavy metals are a special concern since these substances are hazardous, even in small amounts and have a potential to contaminate the surrounding environment. Also, the aspects of soil erosion/soil quality/fertility were taken into consideration as there are some farming activities ongoing at the project site. Soil quality test was conducted at the quarry area using Dutch Target and Intervention Values (2013), as there are no standards under Philippine law.

Heavy metals such as mercury, arsenic, cadmium, chromium, copper, iron, manganese, zinc, nickel, cobalt and lead were tested. Results of soil sampling were compared with Dutch Target and Intervention Values (2013), which was established to determine whether soil require urgent remediation due to unmitigated contamination. Although all of the parameters were detected in the Project area, they are all below the Dutch target values. This shows that the operation has minimal effect on pedology in terms of heavy metal contamination. Although the present DENR-EMB guideline does not have a definitive acceptable standard or limits on the presence of heavy metals on soils, IQAC conducted the sampling to establish a baseline on soil quality which was compared with Dutch Target and Intervention Values (2013).

The results on current soil baseline information will not be affected with the project implementation of the expanded capacity because the land use is the same and the quarry methodology will not use chemicals which may contaminate the soil. Also, since the Project is extraction of limestone and operations of the aggregates facility, the project will maintain the same soil quality.

Soil test results are provided below while copy of the full test results is provided in Annex D.

Table 2.1.1.3.2: Dutch Target and Intervention Values (2013)

Type of Heavy Metals Analyzed	Dutch 2013 Target Values (mg/kg)	Results (ug/g)		
		Patent No. 9	Patent No. 11	Patent No. 14
Total Mercury	40	Less than 0.05	Less than 0.05	Less than 0.05
Total Arsenic	76	2.57	0.68	2.79
Total Cadmium	13	Less than 0.08	Less than 0.08	Less than 0.08
Total Chromium	258	No results	No results	No results
Total Lead	530	2.51	Less than 0.60	Less than 0.60



Total Barium	The standard for barium has been temporarily repealed. It turned out the Interention Value for barium was lower than the natural concentration in soil. In case of increased concentration of barium vis-à-vis the natural background due to an anthropogenic source, this concentration can be assessed on the basis of the former Intervention Value for barium of 920 mg/kg. This former Intervention Value is substantiated in the same way as the Intervention Values for most of the other metals, and includes a natural Background Concentration of 190 mg/kg for barium.	No results	No results	No results
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Provided in Figure 2.1.1.3.2 is the Soil Sampling Map showing the location of the sampling stations.

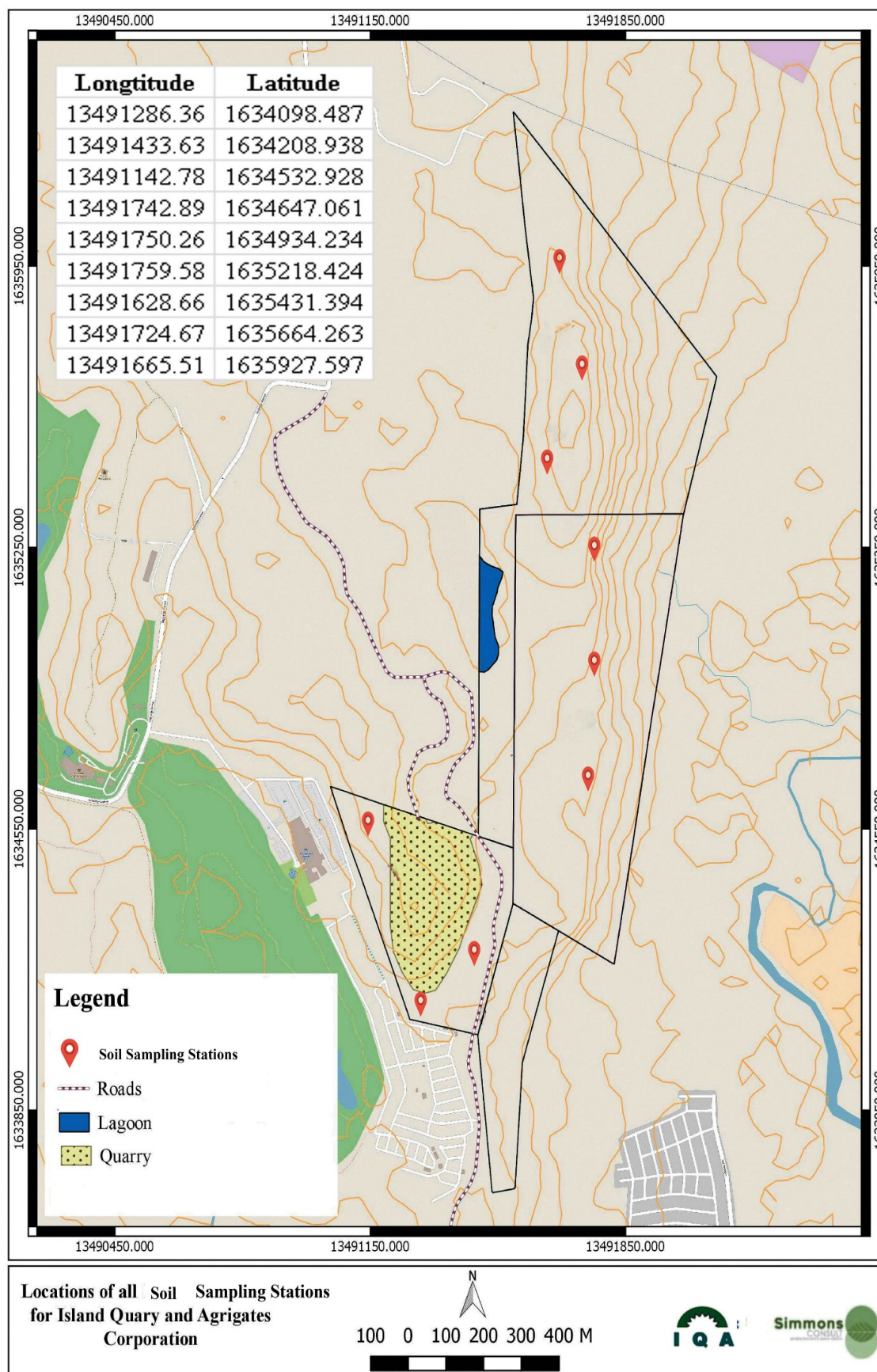


Figure 2.1.1.3.2: Soil Sampling Map (Source: IQAC 2017)

2.1.1.4 Terrestrial Ecology

Terrestrial surveys were conducted on September 15 to 19, 2017 at the project area.

Terrestrial Flora

2.1.1.4.1 Vegetation removal and loss of habitat

Local forest is generally classified as Savana. Its vegetation is characterized by the growth of talahib cogon, native Ipil-Ipil, madre cacao and bamboos. Fruit bearing trees like mango, atis, duhat, bignay are grown in both the upland and lowland. Trees of dipterocarp species, the source of lumber, are seldom found in the municipality. However, there are species like narra and mahogany cultivated in the lowland. There are no more wild animals, only birds in the town upland areas.

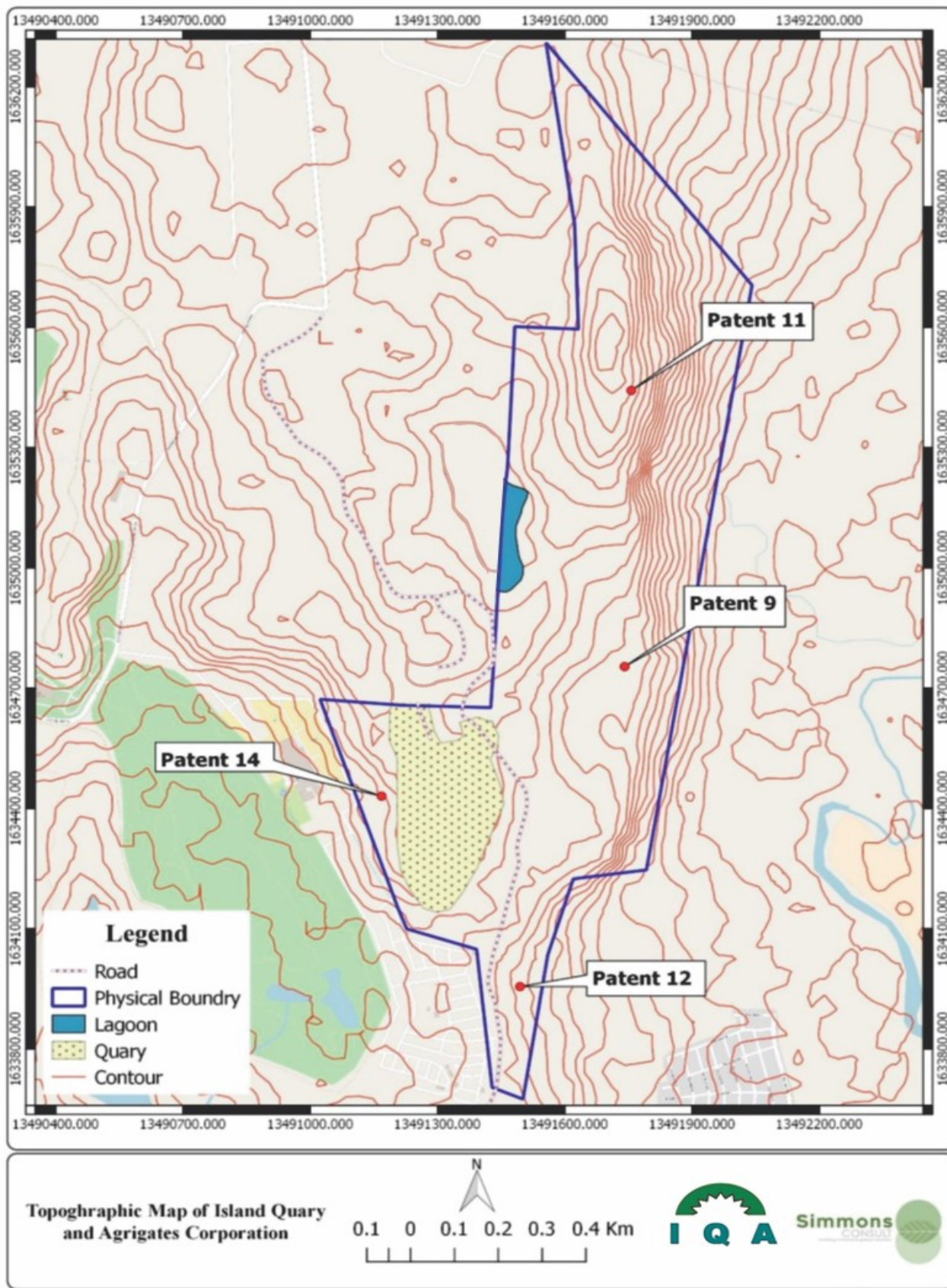
Flora surveys were conducted using the Belt - transect method (Plate 2). In each station transect lines, 250 meters in length and 4 meters in width were laid across the sampling stations. All tree species intercepted along the belt- transect with diameters greater than 5m were identified and counted. Presence of shrubs and grasses were also identified.



Plate 2-1. Transect-belt used in the flora survey

3.2.1.1 Sampling Stations

A total of 10 stations were established within the quarry area covering the 4 patents. The table below shows the flora sampling stations, patents 9 and 11 had 3 stations each while 12 and 14 both had 2 stations each.



Map 3-1. Project Site showing the flora stations in the study (source: IQAC 2018)

Table 3-2: Geographical Location of Sampling Stations for Flora Survey

Patent	Station	Latitude	Longitude	Elevation
9	1	14.52746 N	121.19917 E	461 ft
9	2	14.52721 N	121.19798 E	452 ft
9	3	14.53167 N	121.19808 E	720 ft
11	1	14.53306 N	121.19792 E	716 ft
11	2	14.53496 N	121.19786 E	709 ft
11	3	14.53569 N	121.19772 E	716 ft
12	1	14.52109 N	121.19606 E	504 ft
12	2	14.52131 N	121.19546 E	511 ft
14	1	14.52446 N	121.19335 E	670 ft
14	2	14.52364 N	121.19331 E	648 ft

3.2.1.2 Species Richness

A total of 37 species were observed within the study area. The species can be resolved into 17 floral families. Below are representative species of flora that were observed within the sampling stations. Representative species were collected from the four patents.



Plate 3.2-1: Banaba (Lagerstroemia speciosa)



Plate 3.2-2. Banato (Semicarpus philippinensis)



Plate 3.2-3: Coronitas (Lantana camara)



Plate 3.2-4: Bignai-pugo (Antidesma pentandrum)



Plate 3.2-5: Hauili (Ficus hauili)



Plate 3.2-6. Himbabao (*Broussonetia luzunica*)



Plate 3.2-7. Ipil-ipil (*Leucaena leucocephala*)



Plate 3.2-8. Kamiring (*Semecarpus philippinesis*)



Plate 3.2-9. *Lanete* (*Wrightia pubescens*)



Plate 3.2-10. *Mali-mali* (*Wrightia pubescens*)



Plate 3.2-11. *Susong Kalabaw* (*Uvaria rufa*)

2.1.1.4.2 Threat to existence and/or loss of important local species

Conservation Status

The International Union for Conservation of Nature (IUCN) lists and identifies the threatened species as a group of 3 categories: Vulnerable, Endangered and critically endangered species. The aim of the

system is to provide a framework for the broadest classification of species in relation to their corresponding extinction risk.

DAO 2017-11: An updated list of threatened species of plants in the Philippines issued by the Department of National Resources; species of plants listed here are considered threatened and are monitored by the DENR.

The categories fall under critically endangered, endangered, vulnerable and other threatened species. The list is based on scientific and internationally accepted criteria. (DAO 2017-11).

Below is the conservations status of different tree species recorded within the sampling stations. The table summarizes all plants identified in this study are not listed in the IUCN and DAO 2017-11. Therefore the flora assessed in this study are considered non- threatened and is far from extinction.

Table 3-1. Conservation status of floral species observed

Common name	Famliy	Scientific name	IUCN	DAO 2017-11
Alagaw	Lamiaceae	<i>Premna odorata</i>	Not Listed	Not Listed
Alatiris/Datiles	Tileaceae	<i>Muntingia calabura</i>	Not Listed	Not Listed
Alibangbang	Fabaceae	<i>Bauhinia malabarica</i>	Not Listed	Not Listed
Alim	Euphorbiaceae	<i>Melanolepis multiglandulosa</i>	Not Listed	Not Listed
Atis	Annonaceae	<i>Annona squamosa</i>	Not Listed	Not Listed
Banaba	Lythraceae	<i>Lagerstroemia speciosa</i>	Not Listed	Not Listed
Banato	Euphorbiaceae	<i>Mallolus philipinensis</i>	Not Listed	Not Listed
Bayog	Poacea	<i>Dendrocalamus merrilianus</i>	Not Listed	Not Listed
Bignai-pugo	Euphorbiaceae	<i>Antidesma pentandrum</i>	Not Listed	Not Listed
Binunga	Euphorbiaceae	<i>Macaranga tanarius</i>	Not Listed	Not Listed
Camachile	Fabaceae	<i>Pithecelubium dulce</i>	Not Listed	Not Listed
Caronitas	Verbenacea	<i>Lantana camara</i>	Not Listed	Not Listed
Hauili	Moraceae	<i>Ficus septica</i>	Not Listed	Not Listed
Himbabao	Moraceae	<i>Broussonetia luzunica</i>	Not Listed	Not Listed
Ipil-ipil	Fabaceae	<i>Leucaena leucocephala</i>	Not Listed	Not Listed
Is-is	Moraceae	<i>Ficus ulmifolia</i>	Not Listed	Not Listed
Jatropha	Euphorbiaceae	<i>Jatropha spp.</i>	Not Listed	Not Listed
Kahoy-dalaga	Rubiaceae	<i>Mussaenda philippica</i>	Not Listed	Not Listed
Kalios	Moraceae	<i>Streblus asper</i>	Not Listed	Not Listed
Kalumpang/ Malatae	Malvaceae	<i>Sterculia foetidia</i>	Not Listed	Not Listed
Kamiring	Anacardaceae	<i>Semecarpus philippinesis</i>	Not Listed	Not Listed
Lanete	Apocynaceae	<i>Wrightia pubescens</i>	Not Listed	Not Listed
Lanka/Nangka	Moraceae	<i>Streblus spp.</i>	Not Listed	Not Listed
Mahogany	Meliaceae	<i>Swietenia macrophylla</i>	Not Listed	Not Listed
Malatae	Malvaceae	<i>Sterculia foetida</i>	Not Listed	Not Listed
Mali- mali	Vitaceae	<i>Leea aculeata Blume</i>	Not Listed	Not Listed
Malunggay	Moringaceae	<i>Moringa oliefera</i>	Not Listed	Not Listed
Mangga	Anarcadiaceae	<i>Mangifera indica</i>	Not Listed	Not Listed

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Mangium	Fabaceae	<i>Acacia mangium</i>	Not Listed	Not Listed
Niyog-niyogan	Moraceae	<i>Ficus pseudopalma</i>	Not Listed	Not Listed
Pandakaki	Apocynaceae	<i>Tabernaemontana pandacaqui</i>	Not Listed	Not Listed
Rain tree	Fabaceae	<i>Samanea saman</i>	Not Listed	Not Listed
Sablot	Lauraceae	<i>Litsea glotinos</i>	Not Listed	Not Listed
Sablot	Apocynaceae	<i>Tabernaemontana pandacaqui</i>	Not Listed	Not Listed
Susong kalabaw	Annonaceae	<i>Uvaria rufa</i>	Not Listed	Not Listed
Talisay	Combretaceae	<i>Terminia Catappa</i>	Not Listed	Not Listed
Tibig	Moraceae	<i>Ficus nota</i>	Not Listed	Not Listed

Presence

The table below shows the presence of the plant species that were recorded within the four patents and ten stations. Fifteen species were identified in all patents and 8 species were specific in one patent only.

Table 3-3: Floral species observed in the four patents.

Species	Patent 9	Patent 11	Patent 12	Patent 14
<i>Acacia mangium</i>			x	
<i>Annona squamosa</i>		x	x	x
<i>Antidesma pentandrum</i>		x		
<i>Bauhinia malabarica</i>		x		
<i>Broussonetia luzunica</i>	x	x		x
<i>Dendrocalamus merrillianus</i>			x	
<i>Ficus nota</i>	x	x	x	x
<i>Ficus pseudopalma</i>	x	x		
<i>Ficus septica</i>	x	x	x	x
<i>Ficus ulmifolia</i>	x	x	x	x
<i>Jatropha spp.</i>			x	
<i>Lagerstroemia speciosa</i>	x		x	x
<i>Lantana camara</i>	x	x	x	x
<i>Leea aculeata</i> Blume	x			
<i>Leucaena leucocephala</i>	x	x	x	x
<i>Litsea glotinos</i>	x	x	x	
<i>Macaranga tanarius</i>	x	x	x	x
<i>Mallotus philippensis</i>	x	x	x	x
<i>Mangifera indica</i>		x	x	
<i>Melanolepis multiglandulosa</i>	x	x	x	x
<i>Moringa oliefera</i>	x			
<i>Muntingia calabura</i>		x	x	
<i>Mussaenda philippica</i>	x		x	x
<i>Pithecelubium dulce</i>				x
<i>Premna odorata</i>	x		x	

<i>Samanea saman</i>	X	X	X	X
<i>Semicarpus philippinensis</i>	X	X	X	X
<i>Sterculia foetida</i>	X			
<i>Sterculia foetida</i>			X	
<i>Streblus asper</i>	X	X	X	X
<i>Streblus spp.</i>		X		
<i>Swietenia macrophylla</i>		X		
<i>Tabernaemontana pandacaqui</i>	X	X	X	X
<i>Terminia Catappa</i>	X			
<i>Uvaria rufa</i>	X	X	X	X
<i>Wrightia pubescens</i>	X	X	X	X

Relative Abundance

3.2.4.1 Patent 9

Three stations were assessed for flora abundance in patent 9; *Leucaena leucocephala* was the most abundant with 44% relative abundance followed by *Melanolepis multiglandulosa* with 11% and *Macaranga tanarius* with 9%. Three species of trees had the lowest abundance that was less than 1%, *Premna odorata*, *Lagerstroemia speciosa* and *Ficus nota*.

Leucaena leucocephala under the family *Fabaceae* or locally known as “ipil-ipil” originated in Central America. It adapts easily in almost all types of soil but grows best in neutral to calcareous soils. It is well adapted to clay soils and requires good levels of phosphorus and calcium for best growth .It grows quickly and forms dense thickets that crowd out all native vegetation in an area.

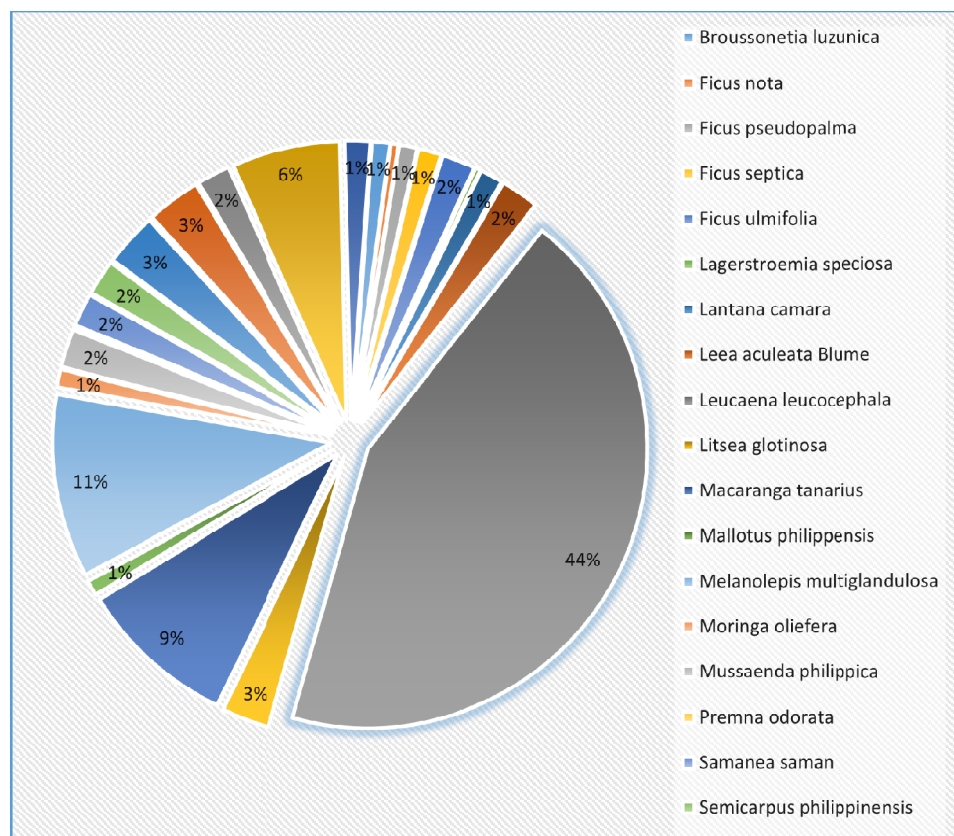


Figure 1. Relative abundance of flora species from Patent 9

3.2.4.2 Patent 11

From the three stations in patent 11, *Leucaena leucocephala* was the most abundant species, the same as in patent 9 with 19% relative abundance followed by *Melanolepis multiglandulosa* and *Streblus asper* with 10%. *Melanolepis multiglandulosa* from the family Euphorbiaceae, grows in areas like roadside, regrowth thickets, depleted open forests or in old gardens. This species is a good choice as a pioneer species in restoring native woodland areas.

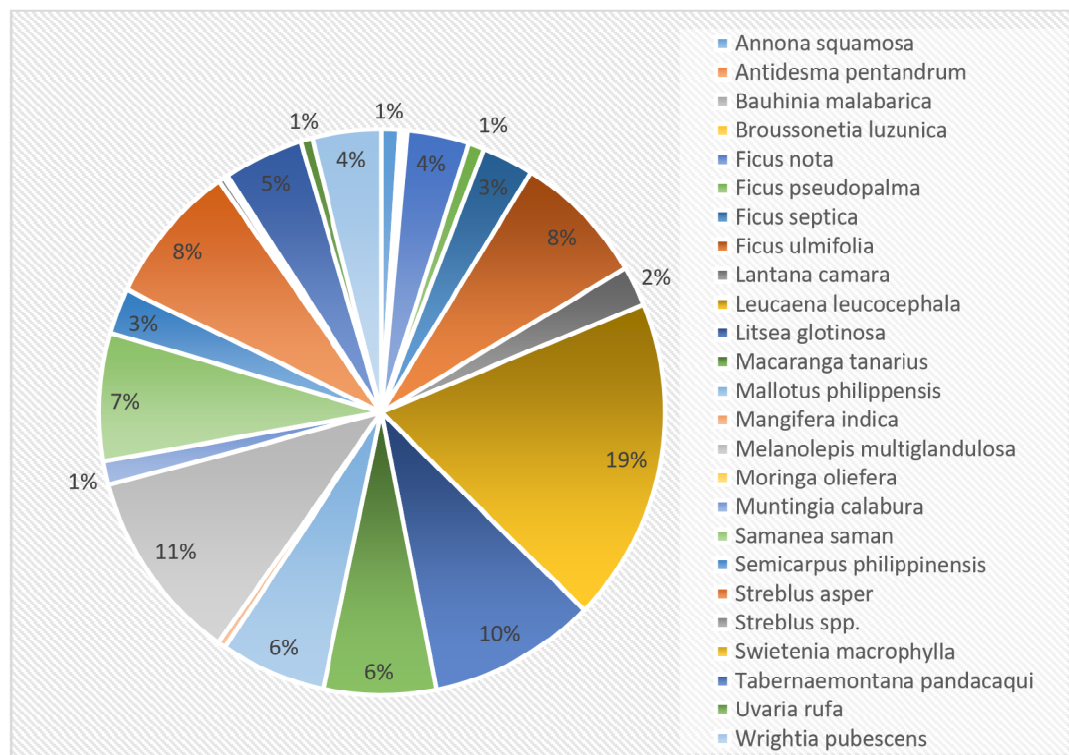


Figure 2: Relative abundance of flora species from Patent 11

3.2.4.3 Patent 12

Among the 2 stations in the patent *Leucaena leucocephala* had the highest abundance of 23%, the same as the other two previous patent where this species commonly called “ipil-ipil” thrives. The next abundant species are *Melanolepis multiglandulosa* with 11% and *Lantana camara* with 7% *Streblus asper*. The Lowest abundance in the patent with abundance lower than 1% are *Acacia mangium* and *Dendrocalamus merrilianusb* with 0.2 %.

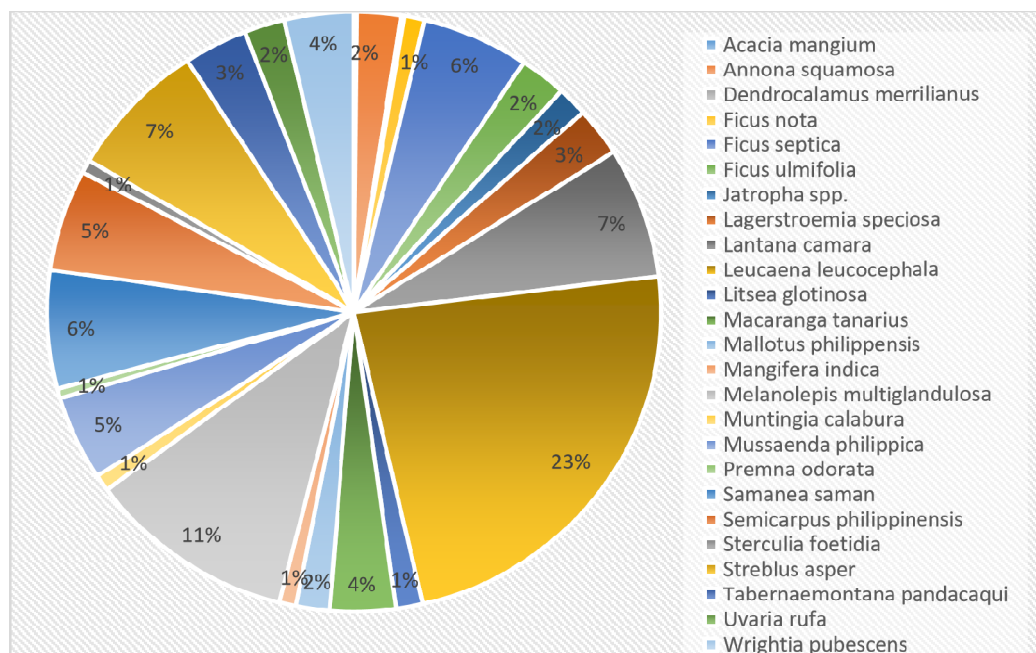


Figure 3. Relative abundance of flora species from Patent 12

3.2.4.4 Patent 14

The highest abundance in the patent is again *Leucaena leucocephala* with 19% followed by *Lantana camara* with 10%. The lowest abundance in the patent with 1% abundance are *Broussonetia luzunica*, *Pithecelubium dulce* and *Tabernaemontana pandacqui*.

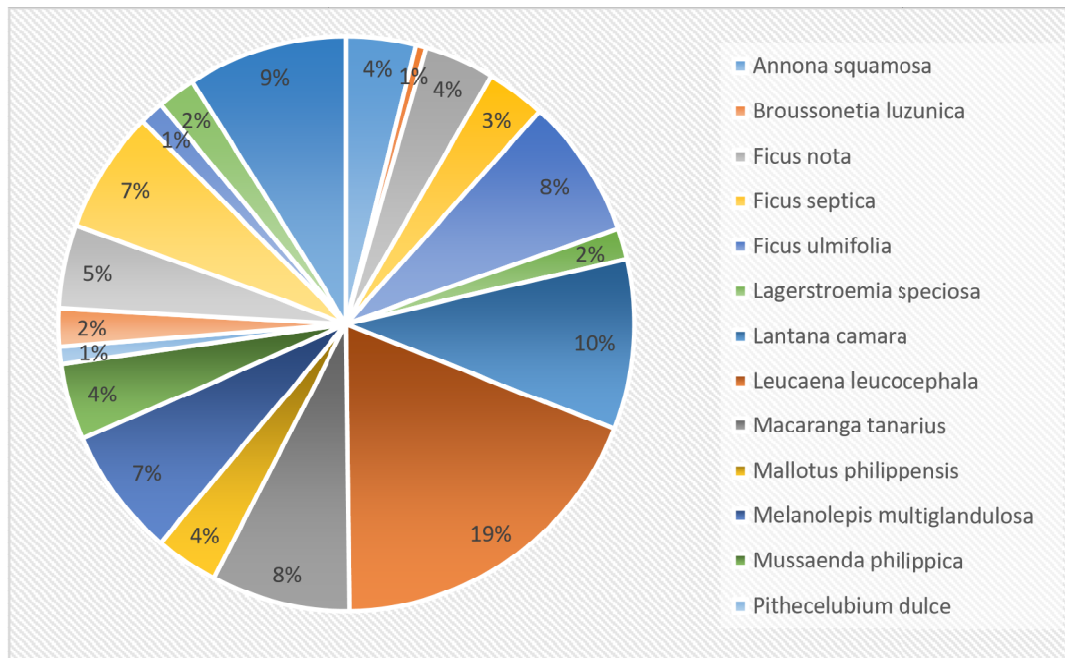


Figure 4. Relative abundance of flora species from Patent 14.

2.1.1.4.3 Threat to Abundance, frequency and distribution of important species

Biodiversity

Biodiversity according to the convention on Biological diversity is “biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes

diversity within species, between species and of ecosystems". Biodiversity refers to all variety of life that can be found here on earth such as the species of flora, fauna and fresh water life as well as the habitats where they live and the communities they form.

Shannon-Weiner information theoretic index is a popular index used to determine the quality of every species in an ecosystem but in monitoring it refers to the loss or gain of biodiversity. The computed index ranges from $H' = 0$ which indicates low biodiversity to 3.5 above that indicates high biodiversity of plants. Below is the table for the relative values and the corresponding diversity indices.

Table 3.3 Biodiversity and Evenness Indices (1988) Relative Values

Relative Values	Shannon Biodiversity (H') Index	Pielou (J') Evenness Index
Very High	3.5 and above	0.75-1.00
High	3.0 – 3.49	0.50-0.74
Moderate	2.5 – 2.99	0.25-0.49
Low	2.0 – 2.49	0.15-0.24
Very Low	1.9 and below	0.05-0.14

The whole project with the four patents were assessed; Shannon-Weiner and evenness indices were computed on the table below. A total of 2,635 individuals were identified patent 12 had the most individuals identified with 879 individuals. In every patent the taxa identified ranges from 19-25. The highest taxa identified belonged to patent 12 with 25 while the lowest taxa identified belonged to patent 14. In terms of Shannon-Weiner index for the whole project it ranges from $H' = 2.2 - 2.7$ indicating a low level of diversity to moderate. The lowest Shannon –wiener index is patent 9 and the highest diversity index is patent 12.

Table 3.4 Biodiversity and Evenness Indices (1988) Relative Values

Patent	Patent 9	Patent 11	Patent 12	Patent 14
Taxa_S	24	24	25	19
Individuals	679	879	567	510
Shannon_H	2.204	2.659	2.722	2.666
Evenness_e ^{H/S}	0.3777	0.595	0.6084	0.7569

2.1.1.4.4 Hindrance to wildlife access

Changing the landscape will directly impact movement ecology of wildlife. This impact will be more severe for species whose movements are assisted by certain habitats. For example, some mammals may not be able to cross the barrier created by roads. However, since the landscape is predominantly of grassland, shrub land, there will be very few forest-dependent species directly impacted. Having said that, the project might prevent dispersal of some endemic birds that probably use this area as stepping stone to their ideal habitats.

Proposed Mitigating and Enhancement Measures

- Replacement of trees cut due to land clearing

Prior to project implementation the proponent will coordinate with the DENR to seek clearance for the identification of required documents for the issuance of needed tree cutting permit (PD 705). Moreover, to compensate the loss vegetation, the proponent will replace the number of trees removed/cut and plant them to nearby areas or in accordance with the advice of the DENR. Species that will be used for the reforestation must be indigenous trees and/or fruit bearing trees which are endemic in the place that can attract the return of wildlife.

- Measures to minimize decrease/migration of faunal species

Land clearing will be confined on designated sites only. During quarry operation, the contractor will prohibit his employee's to engage in any mode of wildlife collection and/or hunting, rather, the contractor shall promote conservation and protection of remaining wildlife species. Promote wildlife protection using innovative means such as putting up of warning signage's on strategic areas for public information and warning. Areas not intended for quarry operation must be immediately planted with fruit bearing trees to attract faunal species. Left un-touched vegetation's will serve's as abode to some faunal species.

- **Gradual Land Clearing**

Gradual land clearing and removal of vegetation is encouraged to provide sufficient time for wildlife species to transfer in the nearby habitat. Further, it is recommended that intact vegetation within the project area shall be protected (in patches) to serve as refuge and forage/ feeding area for wildlife species that can thrive in disturbed area. Planting of naturally growing tree species in the designated areas might encourage other wildlife species / migratory birds which may use the sites as a stopover point during migration.

2.1.1.4.5 Terrestrial Fauna

Terrestrial communities, especially forests are complex. A thorough study of such an area could take years. But to get a good picture of community interrelationships a brief study is enough to generally represent a community.

2.1.2.1 Avifauna

Avifaunal survey was conducted through transect count, mist netting (Plate 3) and incidental survey. Transect count, was used to survey birds in large open areas. All birds seen or heard on either sides of each transect were identified and counted within a fixed distance from the observer. Mist nets were also used; nets were laid along possible travel lanes for birds. Birds were identified according to their local names, acoustic calls and visual representations with the aid of a field guide (Tañedo, 2015). Birds were released right after photo documentations.



Plate 2-2: Mist-netting method for volant fauna

2.1.2.2 Volant Mammals

Sampling for Volant mammals was conducted using mist nets (see photograph above). The nets were placed along travel lanes of bats at dawn and checked every 8 hours. In each station at least two mist nets measuring 4 m x 12 m with 36 mm mesh size were installed near fruiting trees, in ridge tops or probable flyways. Bats were identified using the Key to Philippine Bats (Ingle and Heaneys, 1992). Captured bats were removed individually and were placed in temporary holding devices such as cloth bags. After documentation, bats were revitalized with sugar solution and released back into the wild.



2.1.2.3 *Herpetofauna*

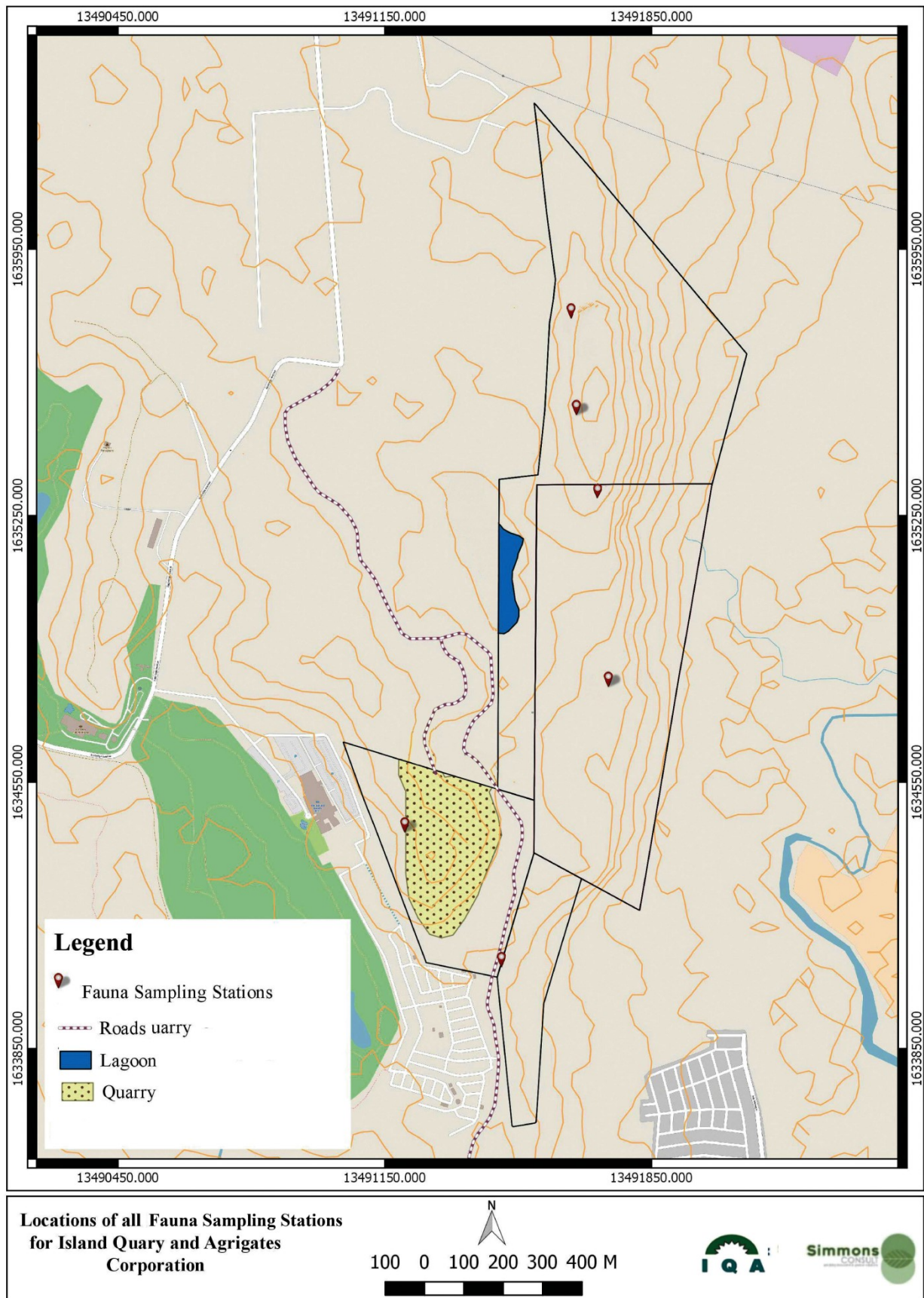
Frogs were sampled using cruising methods or opportunistic sampling. Streams and creeks were search for frogs. All captured individuals were subjected to morphometric measurement. Frogs and other herpetofaunal species were identified based on Amphibians and Reptiles of Luzon Island (Philippines), VII: Herpetofauna of Ilocos Norte Province, Northern Cordillera Mountain Ranged (Brown et. al 2012). Amphibians and Reptiles of Luzon Island, V: The Herpetofauna of Angat Dam Watershed, Bulacan Province, Luzon Island, Philippines (Mcleod et. al 2012).

2.1.2.4 *Sampling Station*

There are six total sampling stations within the four patents. Patent twelve and fourteen have one stations each while patent nine and eleven hves two. Below is the geographical and flat representation of the sampling stations.

Table 2.2-1: Geographical Location of all Fauna Sampling Stations

Patent	Station	Latitude	Longitude	Elevation (ft.)
12	1	14.520969°	121.195789°	504
14	1	14.526389°	121.193889°	668
9	1	14.527373°	121.198307°	457
9	2	14.531667°	121.198056°	727
11	1	14.533581°	121.197554°	797
11	2	14.535254°	121.197230°	726



Map 3.2-2.12: Visual Representation of the sampling Area (source: IQAC 2018)

2.1.2.5 Species Richness

A total of 26 species of birds were observed in all sampling stations for avifaunal species, below are representative birds that were recorded within the sampling stations.



Plate 3.2-11: Zebra Dove (Geopelia striata)



Plate 3.2-12: Common kingfisher (Plate 3-13)



Plate 3.2-13: Philippine Bulbul (Hypsipetes philippinus)



Plate 3.2-14: White eared brown dove (Phapitreron leucotis)



Plate 3.2-15: Shrike (Lanius schach)



Plate 3.2-16: Common emerald dove (Chalcophaps indica)



Plate 3.2-17: Pygmy flowerpecker (Decaeum pygmaeum)



Plate 3.2-18: Pied fantail (Rhipidura nigritorquis)



Plate 3.2-19: Red turtle dove (Streptopelia tranquebarica)



Plate 3.2-20: Spotted dove (*Spilopelia chinensis*)



Plate 3.2-21: White throated kingfisher (*Halcyon symnensis*)

3.2.5.1 3.2.2.3 Presence

Below is a table showing the presence of the different bird species recorded within the sampling stations. The table shows that there are more species of birds present within patent eleven (22) and patent nine (21) as compare to patent twelve (15) and fourteen (17). Base from the actual observation, patent nine and eleven have more vegetation cover and are most likely undisturbed which might be one of the reasons why more bird species were observed within them. Whereas within patent twelve and fourteen, some areas were already quarried and less vegetation cover was observed. Passing and working heavy equipment is also one of the reasons why there are few bird species in the area.

Table 3-3: Presence of different species of birds recorded within the sampling areas

Scientific Name	Patent 9	Patent 11	Patent 12	Patent 14
<i>Alcedo atthis</i>			x	
<i>Callocalia vanikorensis</i>	x	x		x
<i>Caprimulgus macrurus</i>	x			

<i>Centropus viridis</i>	x			
<i>Chalcophaps indica</i>	x	x	x	x
<i>Cinnyris jugularis</i>	x	x		x
<i>Decaeum pygmaeum</i>	x	x		
<i>Gallus gallus</i>	x			
<i>Geopelia striata</i>	x	x	x	x
<i>Halcyon smyrnensis</i>		x	x	
<i>Lanius schach</i>	x	x	x	x
<i>Lonchura atricapilla</i>	x	x	x	x
<i>Megalurus timoriensis</i>	x	x	x	x
<i>Merups philippinus</i>	x	x	x	x
<i>Motacilia cinera</i>	x	x	x	x
<i>Oriolus chinensis</i>	x	x	x	x
<i>Passer montanus</i>	x	x	x	x
<i>Phapitreron leucotis</i>		x	x	x
<i>Pitta sordidad</i>		x		
<i>Pynonotus goiavier</i>	x	x	x	x
<i>Rhipidura nigritorquis</i>	x	x	x	x
<i>Saxicola carpata</i>	x	x		x
<i>Spilopelia chinensis</i>	x	x		x
<i>Streptopelia tranquebarica</i>	x	x	x	x
<i>Turnix ocellatus</i>	x	x		
<i>Tyto capensis</i>	x			

3.2.2.5 Conservation Status

IUCN conservation Status

The list of categories and criteria of IUCN are intended to be an easy and widely understood system for classifying species at high risk of global extinction. The general aim of the system is to provide an explicit, objective framework for the classification of the broadest range of species according to their extinction risk. However, while the Red List may focus attention on those taxa at the highest risk, it is not the sole means of setting priorities for conservation measures for their protection. Below are definition of conservation status and or criteria.

Table 3-5: Definition of Conservation Status and/or Categories.

Conservation Status / Categories	International Union for the Conservation of Nature (IUCN)
EXTINCT (EX)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.
EXTINCT IN THE WILD (EW)	A taxon is Extinct when there is no reasonable doubt that the last individual has died. A taxon is presumed Extinct when exhaustive surveys in known and/or expected habitat, at appropriate times (diurnal, seasonal, annual), throughout its historic range have failed to record an individual. Surveys should be over a time frame appropriate to the taxon's life cycle and life form.

CRITICALLY ENDANGERED (CR)	A taxon is Critically Endangered when the best available evidence indicates that it meets any of the criteria A to E for Critically Endangered (see Section V), and it is therefore considered to be facing an extremely high risk of extinction in the wild.
ENDANGERED (EN)	A taxon is Endangered when the best available evidence indicates that it meets any of the criteria A to E for Endangered (see Section ENDANGERED (EN) V), and it is therefore considered to be facing a very high risk of extinction in the wild.
VULNERABLE (VU)	A taxon is Vulnerable when the best available evidence indicates that it meets any of the criteria A to E for Vulnerable (see Section V), and it is therefore considered to be facing a high risk of extinction in the wild.
NEAR THREATENED (NT)	A taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or NEAR THREATENED (NT) Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future.
LEAST CONCERN (LC)	A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category
DATA DEFICIENT (DD)	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution are lacking. Data Deficient is therefore not a category of threat. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and a threatened status. If the range of a taxon is suspected to be relatively circumscribed, and a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.
NOT EVALUATED (NE)	A taxon is Not Evaluated when it has not yet been evaluated against the criteria.

The table below shows the conservation status of the different bird species recorded within the sampling stations. The table shows that the twenty-five (25) recorded bird species are listed under least concern category while one was not yet evaluated. Bird species that were observed within the sampling stations are almost common and populations are widespread.

Table 3-4: Conservation Status of Birds recorded within the sampling stations

Common Name	Scientific Name	IUCN Status
Common Kingfisher	<i>Alcedo atthis</i>	Least Concern
Island Swiftlet	<i>Callocalia vanikorensis</i>	Not Evaluated
Large-tailed nightjar	<i>Caprimulgus macrurus</i>	Least Concern
Philippine coucal	<i>Centropus viridis</i>	Least Concern
Common emerald dove	<i>Chalcophaps indica</i>	Least Concern

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Olive backed Sunbird	<i>Cinnyris jugularis</i>	Least Concern
Pygmy flowerpecker	<i>Decaeum pygmaeum</i>	Least Concern
Red jungle fowl (female)	<i>Gallus gallus</i>	Least Concern
Zebra Dove	<i>Geopelia striata</i>	Least Concern
White throated kingfisher	<i>Halcyon smyrnensis</i>	Least Concern
Long-tailed Shrike	<i>Lanius schach</i>	Least Concern
Chestnut munia	<i>Lonchura atricapilla</i>	Least Concern
Striated grass bird	<i>Megalurus timoriensis</i>	Least Concern
Blue Tailed Bee Eater	<i>Merups philippinus</i>	Least Concern
Grey wagtail	<i>Motacilia cinera</i>	Least Concern
Black napped Oriole	<i>Oriolus chinensis</i>	Least Concern
Eurasian Tree sparrow	<i>Passer montanus</i>	Least Concern
White Eared brown dove	<i>Phapitreron leucotis</i>	Least Concern
Hooded pitta	<i>Pitta sordidad</i>	Least Concern
Yellow vented bulbul	<i>Pynonotus goiavier</i>	Least Concern
Pied fantail	<i>Rhipidura nigritorquis</i>	Least Concern
Pied bush chat	<i>Saxicola carpata</i>	Least Concern
Spotted Dove	<i>Spilopelia chinensis</i>	Least Concern
Red turtle dove	<i>Streptopelia tranquebarica</i>	Least Concern
Spotted Burttonquail	<i>Turnix ocellatus</i>	Least Concern
Grass Owl	<i>Tyto capensis</i>	Least Concern

3.2.5.2 Relative Abundances

3.2.5.2.1 General Relative Abundance

The general relative abundance of all patents is presented on the figure below. The figure shows that *Pynonotus goiavier* (24%) followed by *Passer montanus* (11%), *Lonchura actricapilla* (10%), *Cinnyris jugularis* (5%) and *Streptopelia tranquebarica* (5%) are the most abundant bird species in the area. Among the recorded species, *Geopelia striata* (4.64%), *Merups philippinus* (4.48%), *Spilopelia chinensis* (4.31%), *Lanius schach* (4.15), and *Oriolus chinensis* (4.15%) are also abundant within the area. While *Halcyon smyrnensis* (0.83%), *Caprimulgus macrurus* (0.66), *Turnix ocellatus* (0.50%), *Pitta sordidad* (0.33%), *Alcedo atthis* (0.17%), *Gallus gallus* (0.17) and *Tyto capensis* (0.17%) have the least number in terms of percent abundance.

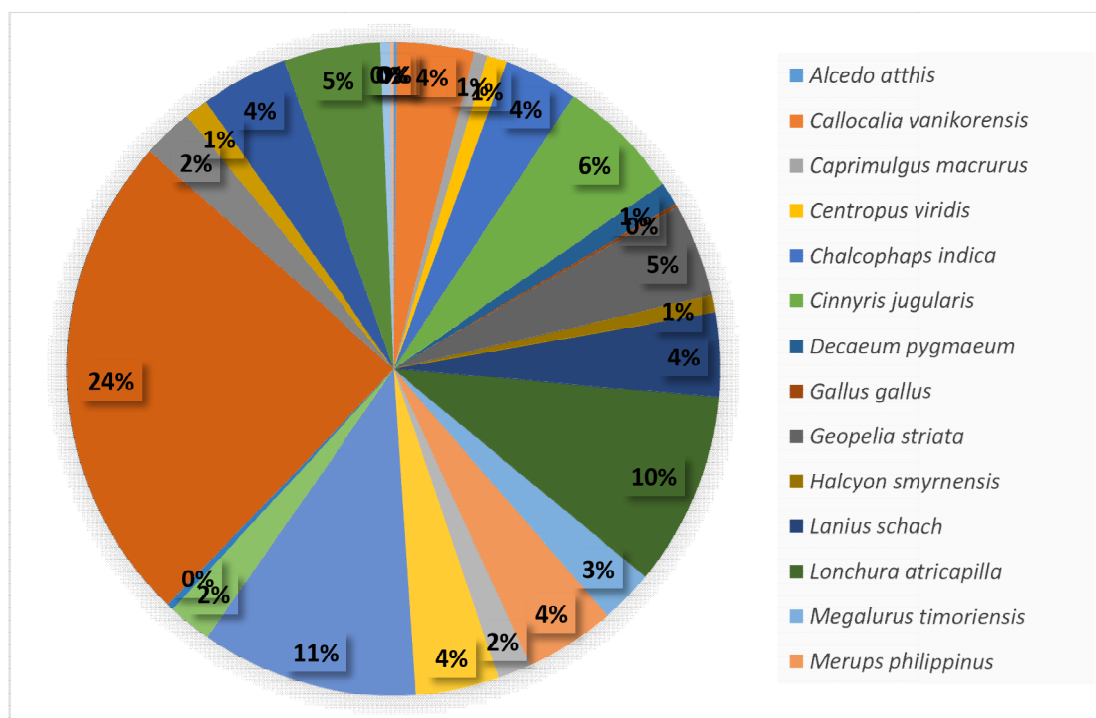


Figure 1-0: General Relative Abundance of the area.

3.2.5.2.2 Patent 9

Relative abundance of birds within patent 9 is presented on the figure below. There are one hundred eighty-four (184) individuals of bird recorder within patent 9 which consist of twenty-two (22) different species. The figure shows that Yellow vented bulbul (*Pynonotus goiavier*) has the highest (20%) number in terms of percent abundance followed by Eurasian Tree sparrow (14%) or *Passer montanus* and Chestnut munia 11% (*Lonchura atricapilla*). During the actual field observations, a female red jungle fowl (*Gallus gallus*) was spotted including a grass owl (*Tyton capensis*). Key informants, also confirmed the presence of such species in the area they usually see them during morning while working.

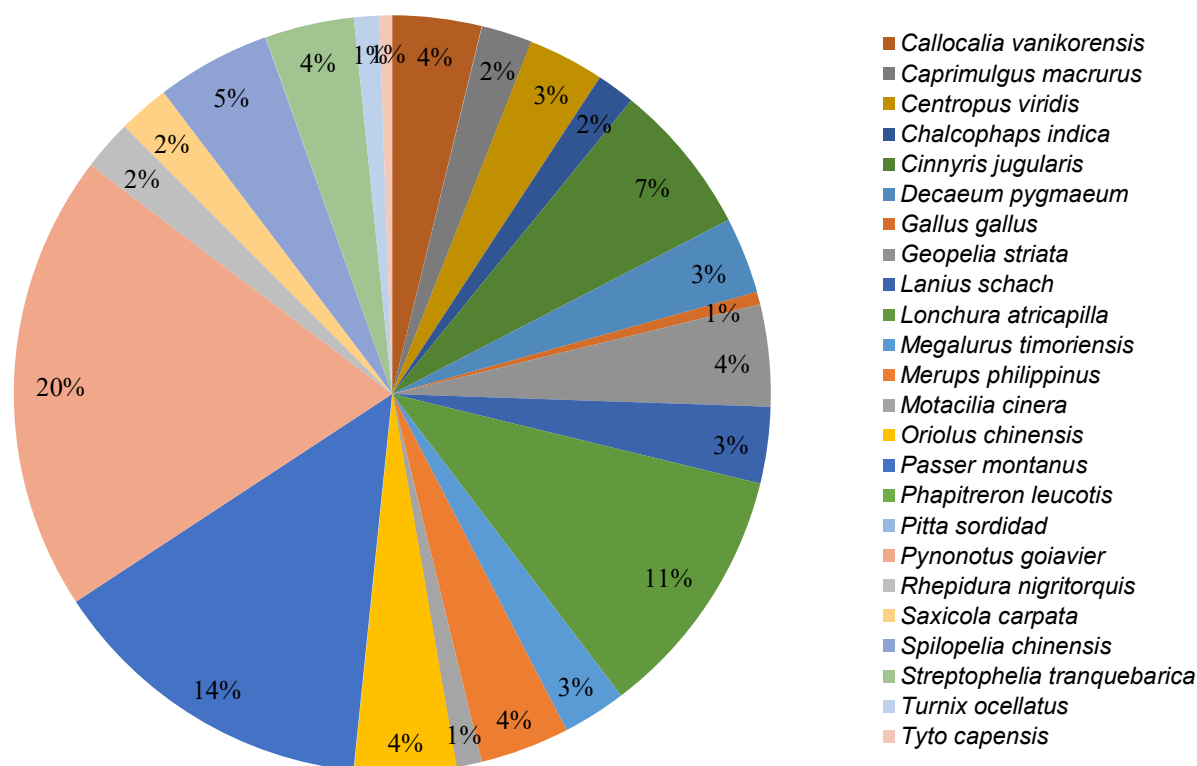


Figure3-2. Relative Abundance of Birds within Patent 9

3.2.5.2.3 Patent 11

For patent eleven, there were two hundred nineteen individuals recorded within the area. The total recorded individual is comprised of twenty-one different bird species. Patent eleven is the largest among patents and has the highest elevation. The area is most likely undisturbed and was observed to have more vegetation cover compared to other areas. More vegetation cover may attract more birds and other fauna species in the area. The figure below shows that Yellow vented bulbul (*Pynonotus goiavier*) has the highest number in terms of percent abundance (20%) followed (11%) by Eurasian tree sparrow (*Passer montanus*), Chestnut munia (*Lonchura atricapilla*) 8%, Olive backed sunbird (*Cinnerys jugularis*) 8%. It is also noted that there are four recorded species of dove in the area. Among these species are spotted dove (*Spilopelia chinensis*) 5%, zebra dove (*Geopelia striata*) 5%, Common emerald dove (*Chalcophaps indica*) 5% and white eared brown dove (*Phapitreron leucotis*) 3%. There is also one (0.46%) spotted buttonquail or "Pugo" (*Turnix ocellatus*) recorded in the area.

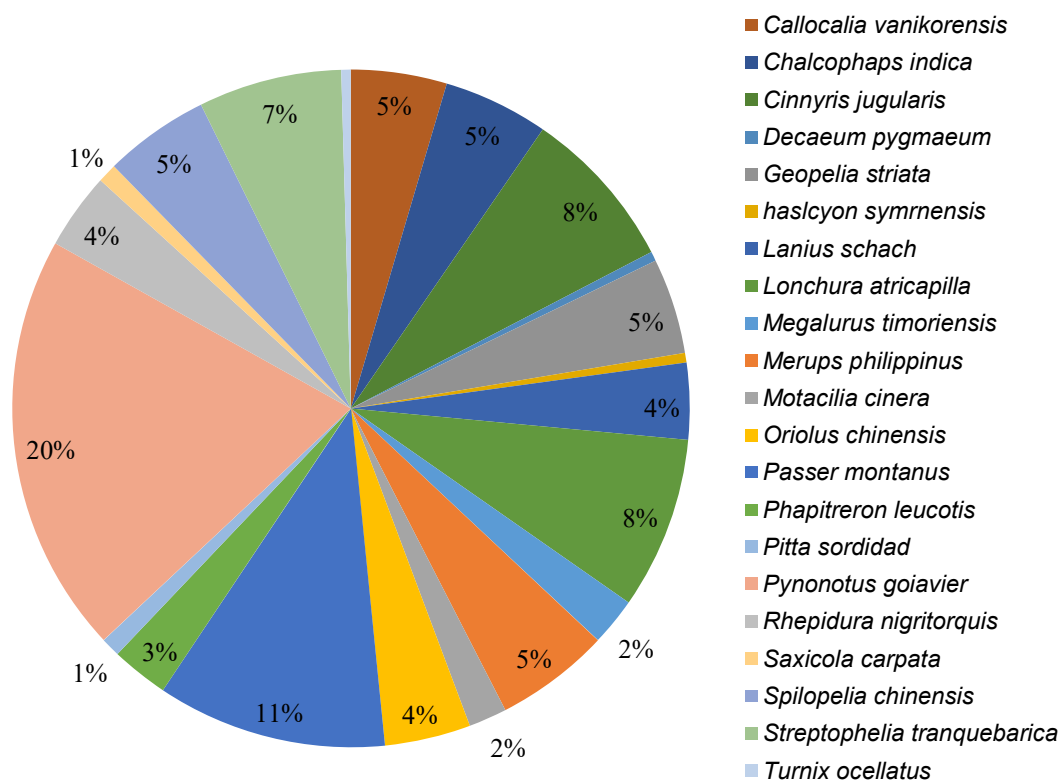


Figure 3-3. Relative Abundance of Birds within Patent 11

3.2.5.2.4 Patent 12

Patent twelve is the smallest among patents in terms of area. The vegetation cover of the patent twelve is a combination of grassland with patches of shrubs and secondary forest. The area is also proximate to a crushing site and staff house. It is observed that it has the least number of bird species recorded with only eighty-four individuals. It is also noted that some part of the patent was already quarried. Disturbance from the crushing equipment and passing heavy equipments may have an effect on the number of birds recorded within the area. The figure below shows the percent abundance of patent twelve. The figure below shows that yellow vented bulbul (*Pynonotus goiavier*) is the most (32.56%) abundant followed by Chestnut munia (*Lonchura atricapilla*) 11.63%, Eurasian tree sparrow (*Passer montanus*) 10.47%, and white eared brown dove (*Phapitreron leucotis*).

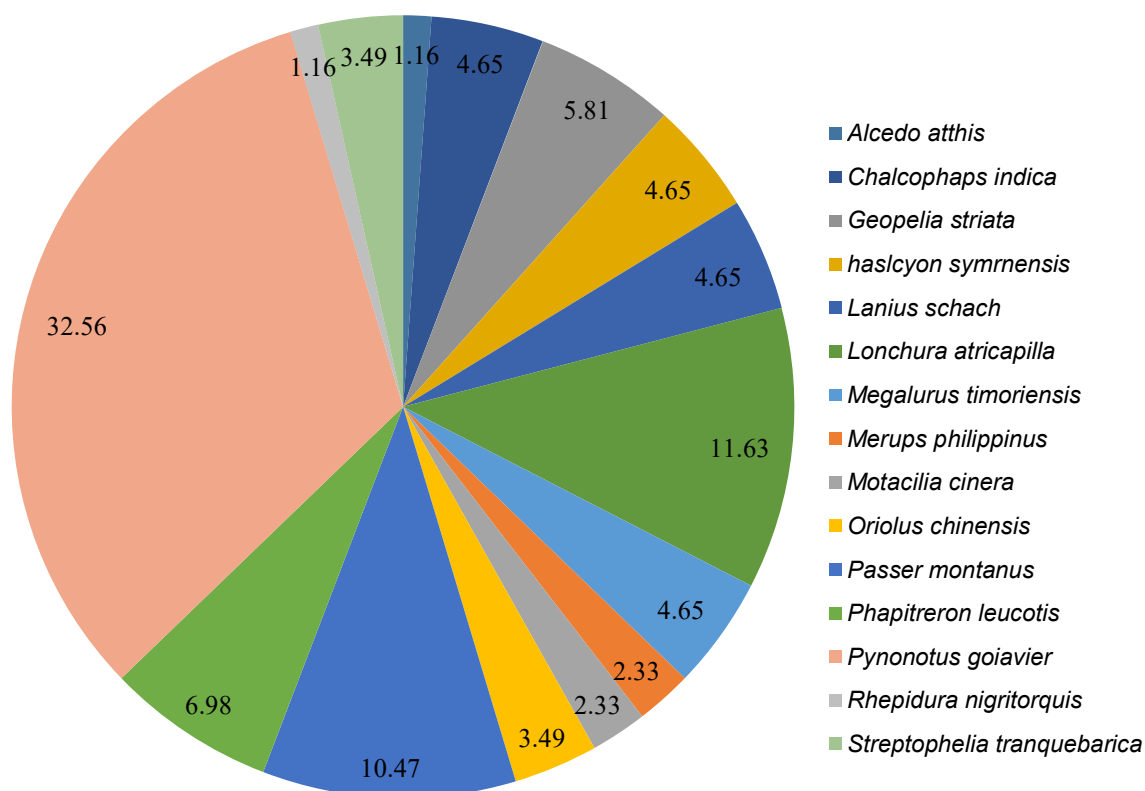


Figure 3-4. Relative Abundance of Birds within Patent 12

3.2.5.2.5 Patent 14

The area of patent fourteen was almost quarried and most of the vegetations is replaced by grass and shrub like tree species but there are areas where patches of trees are located. There are one hundred fourteen total individual species of birds recorded within the area which comprise of eighteen different species. According to the figure below, yellow vented bulbul (*Pynonotus goiavier*) 34.21% has the highest percent abundance. It is obvious that this particular species is present within the four sampling areas because they are common throughout the country. Since grasses dominated the area, munias especially chestnut munias (*Lonchura atricapilla*) 8.77% was recorded as second highest in terms of percent abundance. Olive backed Sunbird (*Cynniris jugularis*) 7.02%, Long tailed shrike (*Lanius schach*) 6.14%, Eurasian tree sparrow (*Passer montanus*) 5.26% and Blue tailed bee eater (*Merups philippinus*) 5.26% was also observed within the sampling station.

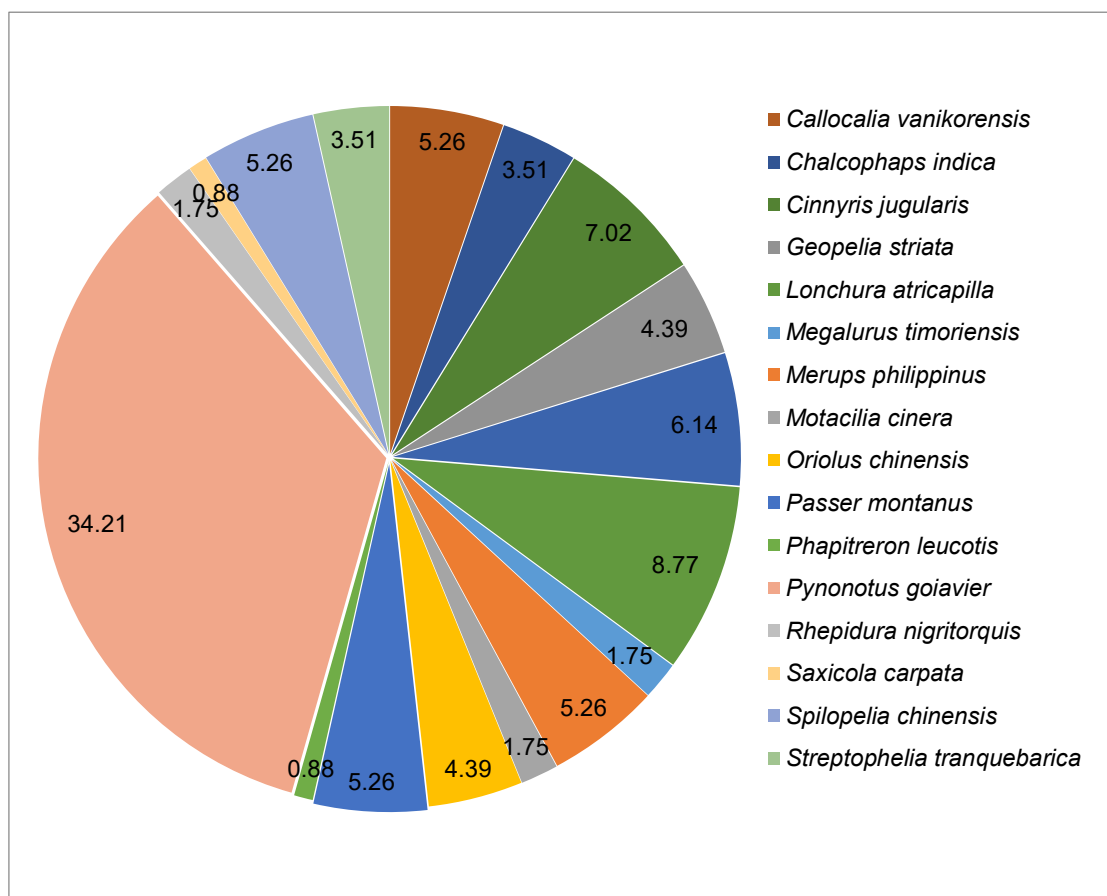


Figure 3-5. Relative Abundance of Birds within Patent 14

3.2.5.2.6 Biodiversity index

One of the most popular method of determining diversity and quality of the ecosystem is the Shannon -wiener Index. The index was used as indicator for biodiversity loss or gain when applied to monitoring. Result from the obtained values ranges from 0 indicating low community complexity to 3.5 and above which implies very high community of fauna or flora. Below is the formula for Shannon Weiner Biodiversity Index:

$$H' = - \sum [(p_i) \ln(p_i)]$$

where p_i is the proportion of individuals found in species i . For a well-sampled community, we can estimate this proportion as $p_i = n_i/N$, where n_i is the number of individuals in species i and N is the total number of individuals in the community. Since the p_i s will all be between zero and one, the natural log makes all the terms of the summation negative, which is why we take the inverse of the sum.

Table 3-6. The Fernando Biodiversity and Evenness Indices (1988).

Relative Value	Shannon Biodiversity (H') Index	Pielou (J') Evenness Index
Very High	3.5 and above	0.75-1.00
High	3.0-3.49	0.50-0.74
Moderate	2.5 – 2.99	0.25-0.49
Low	2.0 – 2.49	0.15-0.24
Very Low	1.9 and below	0.05-0.14

The table below shows the comparison of biodiversity and evenness of species within the four patents. Base from the result, the four patents have almost the same relative value but Patent 9 has the

moderate Shannon biodiversity index ($H' = 2.65$) and high evenness index (0.67). The result can be attributed to the undisturbed condition of the area. Patent 11 has the second highest Shannon biodiversity index ($H' = 2.61$) and a very high evenness (0.67). For patent 14, it has moderate Shannon biodiversity index (2.277) and high evenness (0.61). Patent 12 is the smallest among other patents but still it has moderate Shannon biodiversity index (2.25) and high evenness.

Table 3-7. Biodiversity index of the four patents.

	Patent 9	Patent 11	Patent 12	Patent 14
Taxa	21	20	14	16
Individuals	177	209	85	108
Shannon (H)	2.652	2.618	2.249	2.277
Evenness ($e^{H/S}$)	0.6755	0.6855	0.6771	0.6092

Non-Volant Mammals

3.2.6.1 Species Listing

Bats

One of the most diverse and poorly known mammalian order in the Philippines is the order Chiroptera. It is believed that there are at least sixty-eight known species of bats in the Philippines. In number of species, bats exceeds even rodent of which sixty-seven are now known. About twenty two species of bats that was discovered are endemic to the Philippines. Species richness and endemism are factors of special importance currently because of the rapid rate loss of natural habitat in the Philippines. Below are list of bats species that were observe in the area.



Plate 3.2-2 6: Common dawn bat (Eonycteris spelaea)



Plate 3.2-2 2: Geoffroy's rousette (*Rousettus amplexicaudatus*)



Plate 3.2-23: Greater Musky Fruit Bat (*Ptenochirus jagori*)

3.2.6.2 Presence

There are three different species of bats recorded within the sampling areas. All recorded bats belong to family Pteropodidae, which are fruit eating bats but there is also nectar and pollen-eating bats recorded and is a member of pteropodidae family (*Eonycteris spelaea*). Below is a table showing the presence of bats species within each patent. There are three different bats species within patent 11 and two for the rest patent. It was observed that patent 17 has the most vegetation cover among all areas this might be one of the reasons why there are more species of bats recorded within the area.

Table 3.2.6-1: Presence of different bat species within each patent

Common Name	Scientific Name	Patent No.			
		12	9	11	14
Geoffroy's rousette	<i>Rousettus amplexicaudatus</i>	x	x	x	x
Greater Musky Fruit Bat	<i>Ptenochirus jagori</i>	x	x	x	x
Common Dawn Bat	<i>Eonycteris spelaea</i>		x		

3.2.6.3 Conservation Status

Conservation status of bats that was recorded within the sampling stations is presented below. All species are listed under least concern category due to their wide range distribution and populations are unlikely to decline.

Table 3.2.6-2: Conservation Status of recorded bats

Common Name	Scientific name	IUCN Status
Geoffroy's rousette	<i>Rousettus amplexicaudatus</i>	Least Concern
Greater Musky Fruit Bat	<i>Ptenochirus jagori</i>	Least Concern
Common Dawn Bat	<i>Eonycteris spelaea</i>	Least Concern

3.2.6.4 Percent Abundance

3.2.6.4.1 Patent 9

Percent abundance of bats within patent 9 is presented below. There are twenty two total individual bats recorded which comprise two different species and one family. Geoffrey's rousette (*Rousettus amplexicaudatus*) has the highest (82%) percent abundance followed by Greater Musky fruit bat (*Ptenochirus jagori*) 18%. Greater musky fruit bats are endemic to the country while Geoffrey's rousette is uncommon. Patent 9 was one of the largest in terms of area and is also one having the most vegetation cover. There was also *Ficus spp.* observed within the area, which is a known diet for these bats.

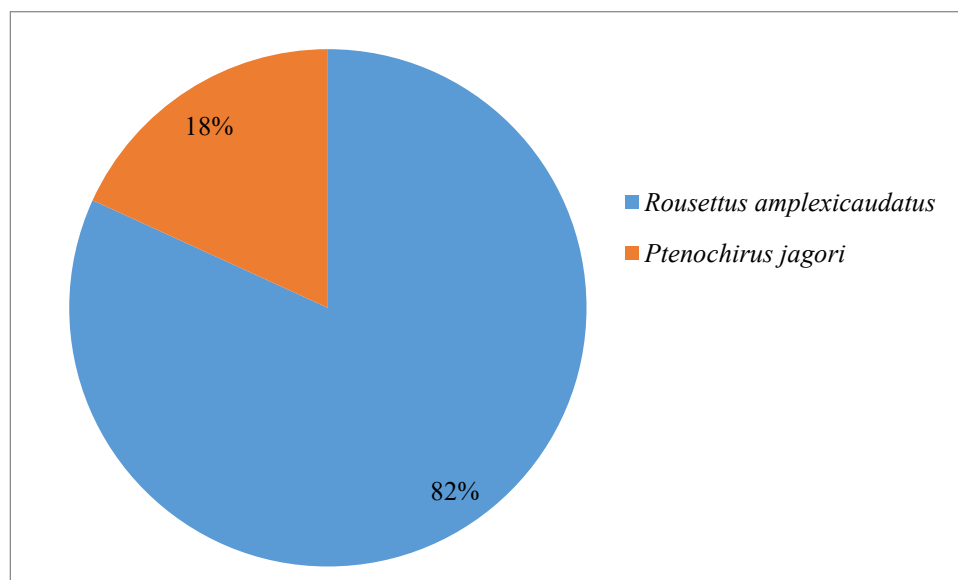


Figure 3.2.6.1 .Percent Abundance of bats within the area.

3.2.6.4.2 Patent 11

For patent 11, there are twenty-nine individual species of bats which comprise of three different species recorded within the area. In terms of status there are two uncommon (*Rousettus amplexicaudatus*, *Eonycteris spelaea*) and one endemic (*Ptenochirus jagori*) species. In term of percent abundance, *Rousettus amplexicaudatus* (73%) is the highest followed by *Ptenochirus jagori* (17%) and *Eonycteris spelaea* (10%). Patent eleven was the largest among the patents in terms of area. It is also observed that the area has the most vegetation cover and most undisturbed.

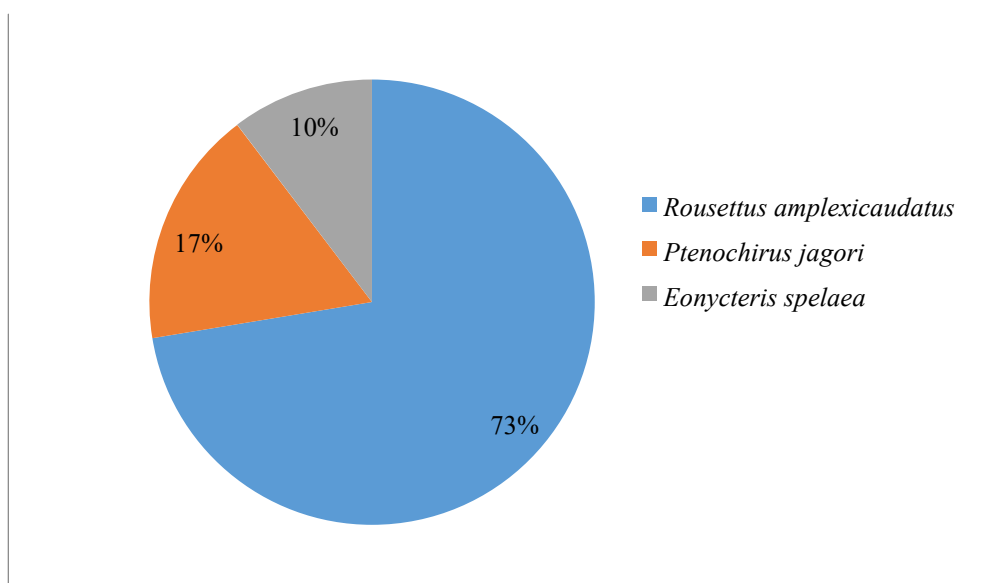


Figure 3.2.62 Percent Abundance of bats within the area.

3.2.6.4.3 Patent 12

Patent 12 is the smallest in terms of area and some parts were already quarried but there are still covers of vegetation. During data gathering, only nine individual bats were recorded which comprise two different families. The area is proximate to a crushing site and a passageway for heavy equipment which may be the reasons why there are only a few number of bats recorded. The figure shows that *Roussettus amplexicaudatus* (67%) is the most Abundant followed by *Ptenochirus jagori* (33%).

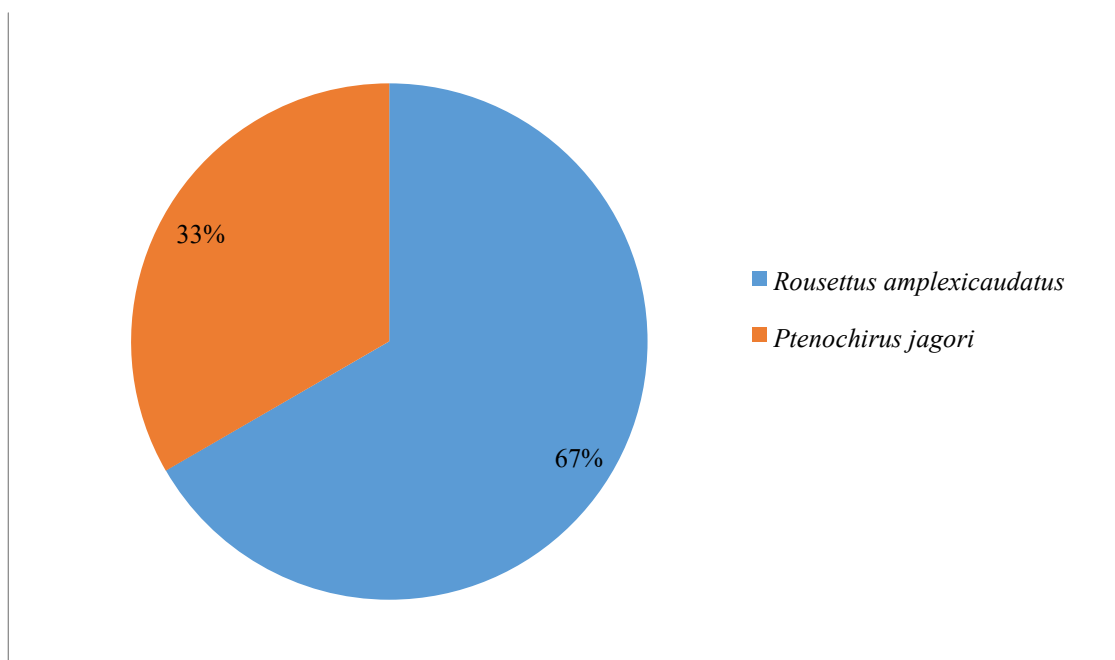


Figure 3.2.63 Percent Abundance of bats within the area.

3.2.6.4.4 Patent 14

For patent 14, there are only eight individuals, which comprise two different species. Some areas within the patent were already quarried but still there is vegetation cover. The figure below shows that among the two species *Rousettus amplexicaudatus* (75%) is the most abundant follow by *Ptenochirus jagori* (25%).

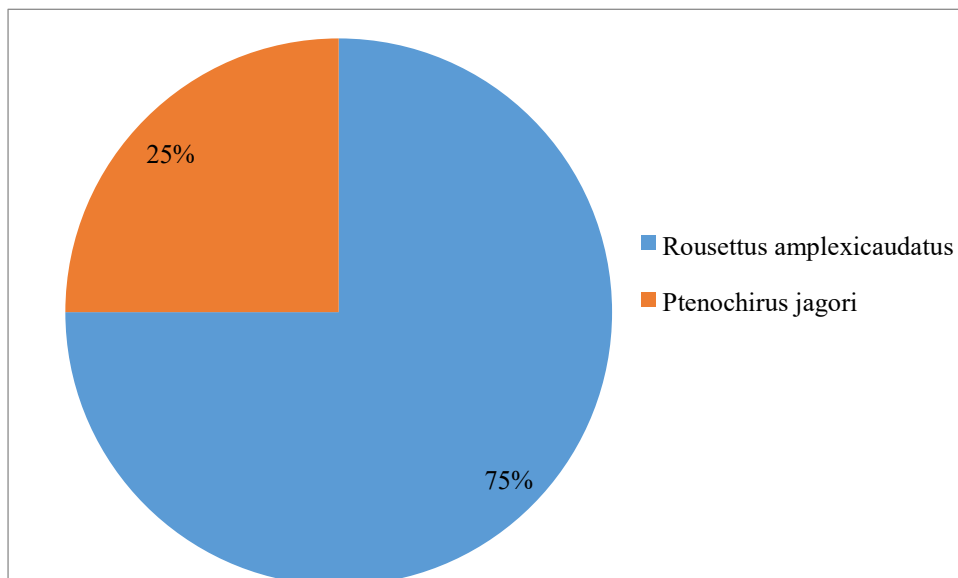


Figure 3.2.64 Percent Abundance of bats within the area.

3.2.7 Herpetofauna

3.2.7.1 Herpetofauna

Only one individual species of amphibians was recorded within the area. As to its conservation status, it is listed under least concern category due to its wide distribution, tolerance of a broad range of habitats, presumed large population, and because it is unlikely to be declining fast enough to qualify for listing in a more threatened category. The painted narrow mouth toad (*Kaloula picta*) is endemic in the country. In spite of the recorded number, it does not mean or indicates that the area is degraded but it may be due to the absence and or they manage to escape before they were discovered.

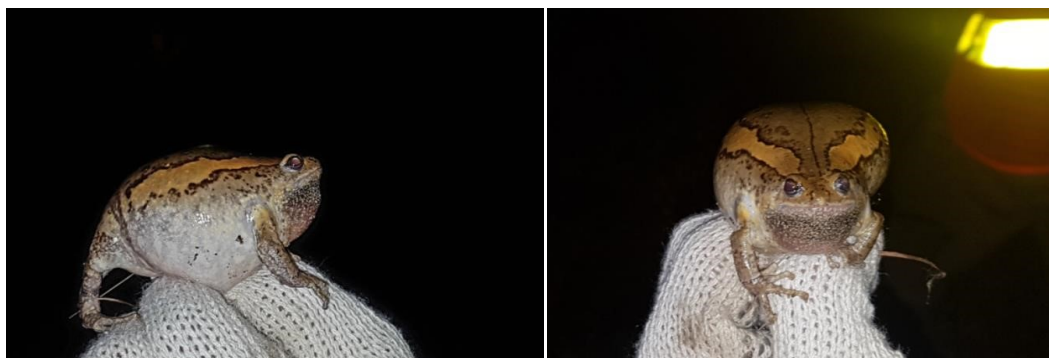


Plate 3.2-26 .Painted narrowmouth toad (*Kaloula picta*)

3.2.7.2 Reptiles

According to key informants the area has a lot of snakes in the project site due to its physical characteristics such as the presence of dry holes on the ground and thick vegetation cover in some areas. During data gathering no snakes were captured but a dead Banded Philippine Burrowing Snake (*Oxyrhabdium leporinum*) was discovered along the road its head was severed by heavy equipment

passing. As for its conservation status, it was listed under least concern category and it is endemic to Luzon.



Figure 7: Philippine Burrowing Snake (Oxyrhabdium leporinum)

Fauna sampling map is provided in Figure 8 below.

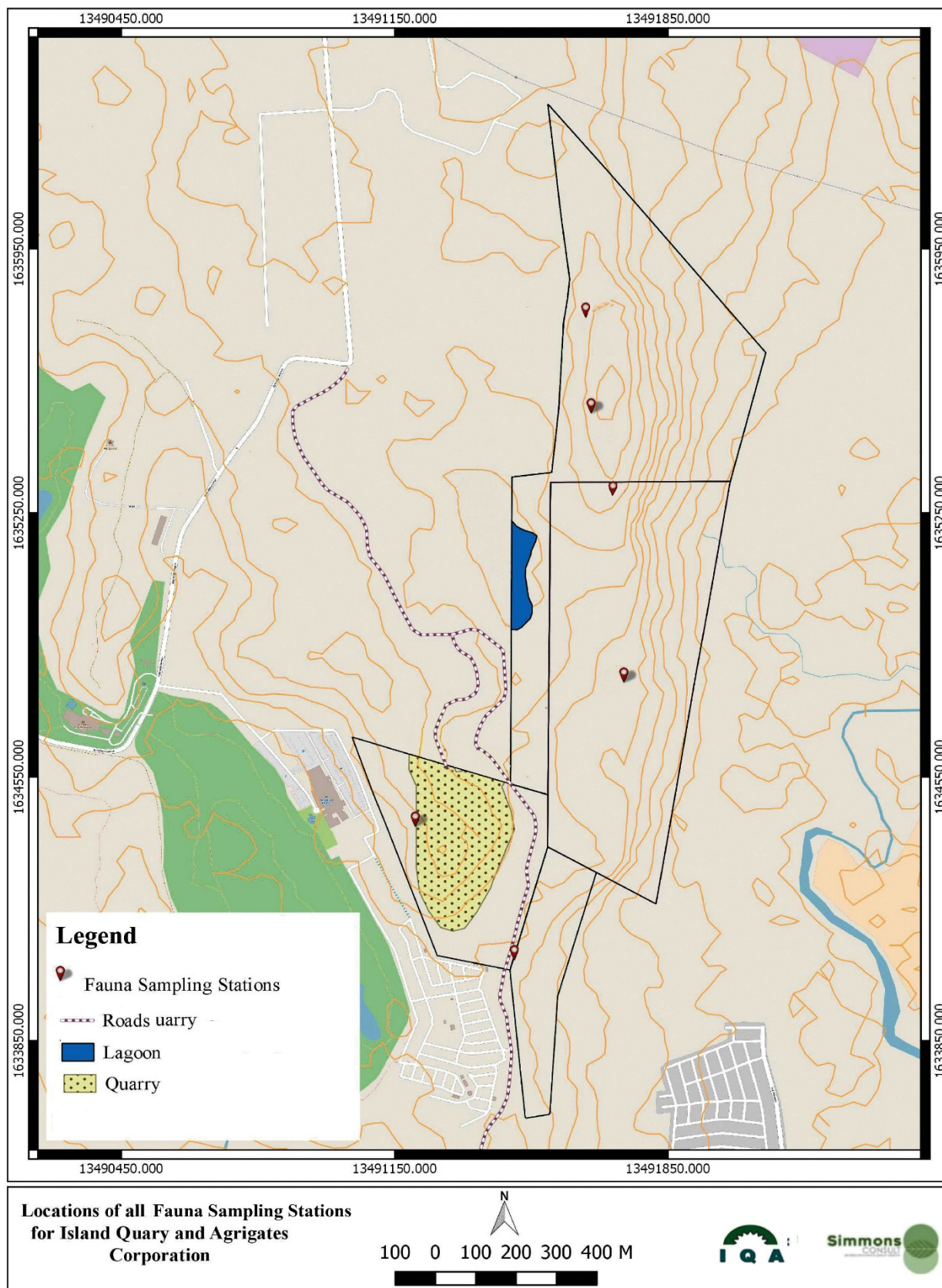


Figure 8: Fauna Sampling Map (source IQAC 2017)



2.2 THE WATER

2.2.1 Hydrology / Hydrogeology

2.2.1.1 Change in drainage morphology / inducement of flooding/ Reduction in stream volumetric flow

There are three rivers and one creek serving as natural drainage and Laguna Lake tributaries. These are rivers Lasi, Bilibiran and Darangan and Gupiing creek. The Lasi River serves as the draining area of the Poblacion. The river source lies between the hilly portion of Mahabang Parang, passes the northern slopes of Kalbaryo in Libid, circles around the Poblacion and flows out to Laguna Lake. It does not have a spring and its source of water is the rain. The twisting river in Bilibiran continuously feeds Laguna Lake with cool, fresh water coming from a spring located in the hilly pasture land called Ray Tupas. The river is also a rich source of fresh water fish particularly water eels which are considered a delicacy. It is also a source of irrigation for ricefields along the bank and it nestles duck raising ventures in the area. Darangan River serves as a repository of water from upland area during Rainy season. It is used as canal for irrigation system installed between the riverbank and Laguna Lake. Natural processes silted the mouth of the river but it is widened and deepened by dredging to induce inflow of lake water. In Talim Island, each barangay has at least one natural creek which drains rainwater coming from mountainous areas to the Laguna Lake.

The Laguna Lake provides food supply and livelihood to countless families in the community and it is the nearest and largest source of potable water for domestic use. As such, it must be protected from disturbances pollution coming from industrial, agricultural and domestic sources, siltation due to erosion and man-made structures that are environmentally disastrous. The concentration of industries in Metro Manila and Laguna side of the lake makes the Central Bay, the municipal territorial water, a dumping area of the waste discharge from industries that have no waste water treatment facilities. Forty-one percent (41%) of these industrial waste discharges contain toxic and hazardous substances which exceed the safe criteria for the protection of aquatic life. Domestic wastes are being discharge through the river tributaries. Other pollutants include pesticides and fertilizers used by farmers and thriving livestock industries not only in Binangonan but the whole coastal areas of the lake. The total pesticide used in 1976 amounted to 104,000 kg. (dry form) and 184,000 kg. (liquid form) which increased by 20 to 25% with the completion of the Regional Irrigation Projects. The major BOD loading to the lake by major contributors are as follow:

- Industries - 225 kg/day
- Domestic - 226,000 kg/day
- Agri-business- 300,000 kg/day

Based on the household perception survey conducted, some residents are still using deepwell. Of the respondents surveyed, 22 out of 100 respondents in St. Monique Subdivision in Brgy. Darangan are using deepwell in washing their clothes while 89 out of 100 in Ynares Subdivision are using deepwell in washing clothes, drinking water, farming and in cooking. These subdivisions are located on the western side of the project area with a distance of more than 1 km from the project boundary.

Sedimentation and siltation of the lake, as a result of forest denudation within the basin watershed, is another factor. The average volume of derived sediments is approximately 1.5×10^{-6} cubic meters/day retaining 2/3 of sediments in the lake. This decreases the lake's depth thereby increasing water turbidity affecting the productivity. The quality of lake water generally meets class C standard. This can be used for propagation of fish and aquatic resources, recreational boating, and industrial water supply class which is used for manufacturing processes after treatment. But class C standard is not met in areas near the mouths of polluted rivers. Water quality even in Central Bay is generally worse than in the East and South Bays bordering Laguna because it has the highest contents of nitrates, inorganic phosphates and MPN coliform. The lake water is below the more desirable class B used for recreation, and classes A and AA used for public water supply. Man-made structure like the Napindan locks prevents the entry of saline water from Manila Bay necessary to maintain the lake ecosystem. The thermal pollution, traceable to about 1,075 industries that use the lake water

as cooling agent and ultimately discharge it as heated water, has negligible effect on the biotic-abiotic relationships. To address the pressing problems of the lake basin, the following solutions are recommended for the LGU to undertake:

1. *A program for effective control of urban/domestic and agro-industrial waste.*
2. *A program for the reforestation of areas identified with moderate and severe erosion potentials*
3. *Evaluation of the benefits of pollution control and other forms of technology*
4. *Re-assess tourism as a key to development without negating environment protection.*
5. *Provide a ceiling for urban and industrial development.*
6. *Intensification of Zero Waste technology.*

For the Project to avoid siltation, the company maintains catchbasins to contain silt and soil materials carried by surface run-off from the active quarry area. Clear water was observed at the regularly dredged catchbasins. De-silting activities were conducted and drainage system is maintained and free of obstructions.

Provided below are plates of photographs of the siltation ponds in Calabar Quarry.



Siltation Pond 1



Siltation Pond 2



Siltation Pond 3



2.2.1.2 Change in stream, lake water depth

- *Regional hydrogeological map*
- *Identify and assess project impact in terms of change in stream, lake water depth*

2.2.1.3 Depletion of water resources / competition in water use Current / projected water use (groundwater/surface water) in the area and adjacent areas

Inventory of water supply source including springs and wells (indicate depth of water table) and show location in a map of appropriate scale

Identify and assess project impact on the existing water resources and the resulting competition in the water use using analysis/estimation of water availability. Include discussions taking into consideration the PAGASA medium to long term projections

The above items are not applicable because there is no waterbody present in the project area other than the lagoon which is the source of water for dust mitigation of the project.

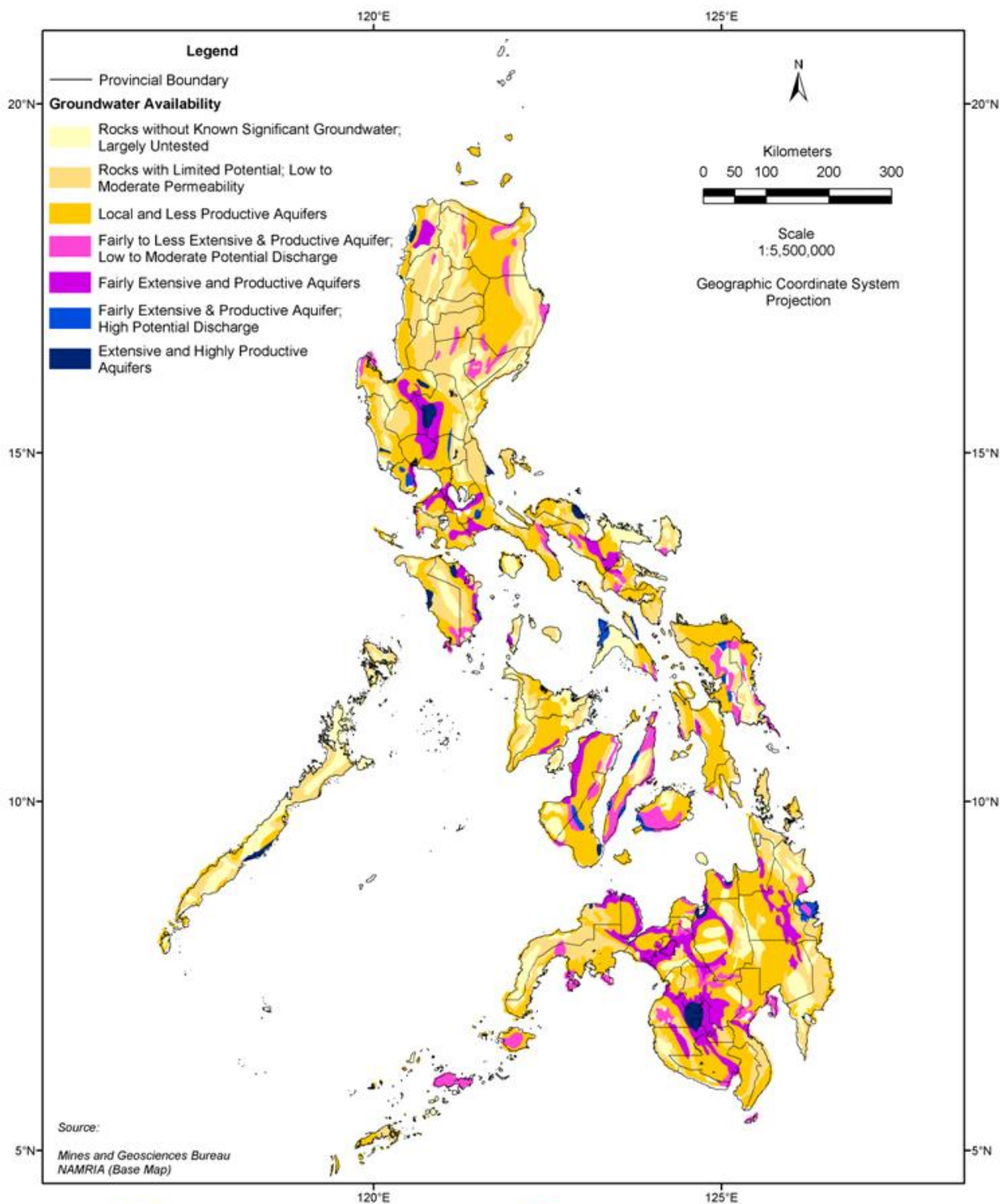
Based on the 1997 Groundwater Availability Map of the Philippines, the project sites falls under local and less productive aquifers which is shown in Figure 2.2.1. This classification is attributed to the low level wells in the area. The classification is attributed to the scarcity of productive wells in the area.

There will be no water resource competition that will be brought about by the project because the water requirement is mainly for domestic use which is supplied by Manila Water and water for dust management is supplied from the lagoon.

2.2.2 Oceanography

This module is not applicable to this Project because there is neither ocean nor marine body present near the project site.

Groundwater Availability



MANILA OBSERVATORY



DEPARTMENT OF ENVIRONMENT AND
NATURAL RESOURCES

Figure 2.2.1: Groundwater availability Map of the Philippines (source: MGB)

2.2.3 Water Quality

2.2.3.1 Degradation of groundwater quality

2.2.3.2 Degradation of surface water quality

2.2.3.3 Degradation of coastal/marine water quality

To identify and assess project impact in terms of degradation of groundwater and surface water quality, DENR standard methods and procedures for sampling and analysis was employed. See Table for the water quality parameters and corresponding methods of analysis.

Regular water quality monitoring is conducted to assess the water quality of Kaynaog Creek and water bodies near the quarry sites. Samples were collected in each sampling station. The collected samples were subjected to physical, chemical, microbiological, nutrient and heavy metal analyses. Water samples were preserved in iced boxes prior to transport to the laboratory facility for analysis.

For marine / coastal water quality it will not be tested as there is no ocean nor marine body present in and near the project site.

Wastewater generated during construction and operational Wastewater generated during construction and operational phase which include domestic wastewater may enter groundwater through seepage or through freshwater bodies as surface runoff.

This wastewater may degrade water quality in these areas and may increase fecal contamination, levels of heavy metals, turbidity and TSS. The Project provides wastewater management plan that should be in place and should be strictly implemented. Monthly monitoring of quality of groundwater and fresh water will be continuously be conducted. Storm runoff will be directed through the siltation pond system. Contaminated rainwater in the maintenance area will be directed to the oil and water separator before discharged to the drainage system. Regular inspection and maintenance of the siltation ponds will be conducted to avoid leakage, which can pollute the drainage and waters.

Table 4 provides the Water Quality Parameters and Corresponding Methods of Analysis as per DAO 2016-012 Series of 2016 or the Approved Methods of Analysis.

Table 4: Water Quality Parameters and Corresponding Methods of Analysis

Parameters	Method of Analysis
pH	Electrometric
Total Suspended Solids (TSS)	Gravimetric
Oil & Grease	Petroleum Ether Extraction
Biochemical Oxygen Demand (BOD ₅)	Azide Modification (Dilution Technique)
Chemical Oxygen Demand (COD)	5220 B. Modified Open reflux Dichromate
Dissolved Oxygen (DO)	Dissolved Oxygen Meter
Temperature	Alcohol-filled Thermometer
Lead	Flame AAS-EPA Method 7420
Mercury	Flame AAS-EPA Method 7420
Cadmium	Flame AAS-EPA Method 7130
Chromium Hexavalent	Diphenylcarbazide-SM Method 3500CrB
Copper	Flame AAS-EPA Method 7210
Arsenic	Colorimetry- SDDC SM Method 3500
Fecal Coliform	Multiple tube Fermentation – Method 9221B&E
Total Coliform	Multiple tube Fermentation – Method 9221B&E

Source: DAO 2016-012, Series of 2016, Approved Methods of Analysis

It may be seen in the following water test results that all parameters passed the or compliant to DENR standards as per DAO 34 and 35 which were the applicable standards before 2016 and are also compliant to DAO 2016-08 except for fecal coliforms which exceeded on all stations and dissolved oxygen which exceeded in stations silt pond, lagoon and quarry upstream. The reason is

unknown to the Proponent but some workers are saying that they sometime smell some foul odor coming from the mud deposits in the lagoon.

The water quality trend analysis from 2015 to 2017 is provided in Chapter 6 but the trending started inly in 2015 because project monitoring including water quality monitoring has just been in place together with the Multi-partite Monitoring Team (MMT) during that time.

Shown below are the latest results of the water sampling conducted from the siltation ponds and lagoon.

Test Description	Results	Units	REG LIMIT	Test Methods	Date Analyzed	By	Ref*
Sample No.: p00073270-01				Date Sampled: 07-20-17 11:19			
Sample ID: SILTATION POND				Matrix: Surface Water			
-Metals-							
Cadmium**	<0.003	mg/L	0.005	Flame AAS	07/28/17	RDO	105
-Microbiology							
Total Coliforms**	35,000	MPN/100mL	-	Multiple Tube Fermentation Technique	07/21/17	CBS	
Fecal Coliforms**	35,000	MPN/100mL	200	Multiple Tube Fermentation Technique	07/21/17	CBS	105
-Wet Chemistry-							
Ph**, onsite	7.2	*	6.5-9.0	Electrometric Method	07/20/17	-	105
Temperature**, onsite	26.1	*C	25-31(d)	Laboratory and Field Method	07/20/17	-	105
Color**	20	TCU	75	Visual Comparison	07/21/17	MPT	105
Settleable Solids**	0.1	ml/L	-	Imhoff cone method (SM2540 F)	07/21/17	SEZS	
Biological Demand**	Oxygen 2	mg/L	7	Azide Modification Winkler (SM 52108)	07/21/17	MLJ	105
Chemical Demand**	Oxygen 11	mg/L	-	Open Reflux Method (SM52208)	08/01/17	BKTB	
Total Solids**	Dissolved 156	mg/L	-	Gravimetry (SM2540-C)	07/26/17	EMA	
Surfactants (MBAS as LAS, MW=348.48 g/mole)	<0.02	mg/L	1.5	Colorimetry Chloroform Extraction	07/21/17	SEZS	105
Total Solids**	Suspended 37	mg/L	80	Gravimetry (SM2540 D)	07/27/17	JEC	105
Oil and Grease	0.7	mg/L	2	Gravimetry (n-Hexane Extraction)	07/25/17	SEZS	105
Chloride**	1.5	mg/L	350	Argentometric Method (SM4500 Cl-B)	07/25/17	EMA	105
Dissolved Oxygen** onsite	6.5	mg/L	5(e)	Winkler- Titrimetric	07/20/17	-	105
Nitrate **	1.6	mg/L	7	Colometry- Brucine	07/21/17	JEC	105
Phosphate- p**	<0.006	mg/L	0.5	Stannous Chloride Method (SM45000-P D)	07/21/17	MPT	105



Test Description	Results	Units	REG LIMIT	Test Methods	Date Analyzed	By	Ref*
Sample No.: P00073270-012		Date Sampled: 07-20-17 11:48					
Sample ID: CALABAR LAGOON		Matrix: Surface Water					
-Metals- Cadmium**	<0.003	mg/L	0.005	Flame AAS	07/28/17	RDO	105
-Microbiology Total Coliforms**	1,600	MPN/100mL	-	Multiple Tube Fermentation Technique	07/21/17	CBS	
Fecal Coliforms**	1,600	MPN/100mL	200	Multiple Tube Fermentation Technique	07/21/17	CBS	105
-Wet Chemistry- Ph**, onsite	7.8	*	6.5-9.0	Electrometric Method	07/20/17	-	105
Temperature**, onsite	29.6	*C	25-31(d)	Laboratory and Field Method	07/20/17	-	105
Color**	8	TCU	75	Visual Comparison	07/21/17	MPT	105
Settleable Solids**	<0.1	ml/L	-	Imhoff cone method (SM2540 F)	07/21/17	SEZS	
Biological Oxygen Demand**	1	mg/L	7	Azide Modification Winkler (SM 52108)	07/21/17	MLJ	105
Chemical Oxygen Demand**	6.1	mg/L	-	Open Reflux Method (SM52208)	08/01/17	BKTB	
Total Dissolved Solids**	362	mg/L	-	Gravimetry (SM2540-C)	07/26/17	EMA	
Surfactants (MBAS as LAS, MW=348.48 g/mole)	<0.02	mg/L	1.5	Colorimetry Chloroform Extraction	07/21/17	SEZS	105
Total Suspended Solids**	5.0	mg/L	80	Gravimetry (SM2540 D)	07/27/17	JEC	105
Oil and Grease	0.5	mg/L	2	Gravimetry (n-Hexane Extraction)	07/25/17	SEZS	105
Chloride**	3.0	mg/L	350	Argentometric Method (SM4500 Cl-B)	07/25/17	EMA	105
Dissolved Oxygen** onsite	5.9	mg/L	5(e)	Winkler- Titrimetric	07/20/17	-	105
Nitrate **	0.2	mg/L	7	Colometry- Brucine	07/21/17	JEC	105
Phosphate- p**	<0.008	mg/L	0.5	Stannous Chloride Method (SM45000-P D)	07/21/17	MPT	105

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Brgys. Pantok and Palangoy, Binangonan, Rizal



Test Description	Results	Units	REG LIMIT	Test Methods	Date Analyzed	By	Ref*
Sample No.: P00073270-03				Date Sampled: 07-20-17 14:30			
Sample ID: QUARRY UPSTREAM				Matrix: Surface Water			
-Metals- Cadmium**	<0.003	mg/L	0.005	Flame AAS	07/28/17	RDO	105
-Microbiology Total Coliforms**	1,600	MPN/100mL	-	Multiple Tube Fermentation Technique	07/21/17	CBS	
Fecal Coliforms**	1,600	MPN/100mL	200	Multiple Tube Fermentation Technique	07/21/17	CBS	105
-Wet Chemistry- Ph**, onsite	7.8	*	6.5-9.0	Electrometric Method	07/20/17	-	105
Temperature**, onsite	29.6	*C	25-31(d)	Laboratory and Field Method	07/20/17	-	105
Color**	8	TCU	75	Visual Comparison	07/21/17	MPT	105
Settleable Solids**	<0.1	ml/L	-	Imhoff cone method (SM2540 F)	07/21/17	SEZS	
Biological Oxygen Demand**	1	mg/L	7	Azide Modification Winkler (SM 52108)	07/21/17	MLJ	105
Chemical Oxygen Demand**	6.1	mg/L	-	Open Reflux Method (SM52208)	08/01/17	BKTB	
Total Dissolved Solids**	362	mg/L	-	Gravimetry (SM2540-C)	07/26/17	EMA	
Surfactants (MBAS as LAS, MW=348.48 g/mole)	<0.02	mg/L	1.5	Colorimetry Chloroform Extraction	07/21/17	SEZS	105
Total Suspended Solids**	5.0	mg/L	80	Gravimetry (SM2540 D)	07/27/17	JEC	105
Oil and Grease	0.5	mg/L	2	Gravimetry (n-Hexane Extraction)	07/25/17	SEZS	105
Chloride**	3.0	mg/L	350	Argentometric Method (SM4500 Cl-B)	07/25/17	EMA	105
Dissolved Oxygen** onsite	5.9	mg/L	5(e)	Winkler- Titrimetric	07/20/17	-	105
Nitrate **	0.2	mg/L	7	Colometry- Brucine	07/21/17	JEC	105
Phosphate- p**	0.2	mg/L	0.5	Stannous Chloride Method (SM45000-P D)	07/21/17	MPT	105

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Brgys. Pantok and Palangoy, Binangonan, Rizal



Test Description	Results	Units	REG LIMIT	Test Methods	Date Analyzed	By	Ref*
Sample No.: P00073270-04				Date Sampled: 07-20-17 14:47			
Sample ID: QUARRY MIDSTREAM				Matrix: Surface Water			
-Metals-							
Cadmium**	<0.003	mg/L	0.005	Flame AAS	07/28/17	RDO	105
-Microbiology							
Total Coliforms**	54,000	MPN/100mL	-	Multiple Tube Fermentation Technique	07/21/17	CBS	
Fecal Coliforms**	54,000	MPN/100mL	200	Multiple Tube Fermentation Technique	07/21/17	CBS	105
-Wet Chemistry-							
Ph**, onsite	8.1	*	6.5-9.0	Electrometric Method	07/20/17	-	105
Temperature**, onsite	29.6	*C	25-31(d)	Laboratory and Field Method	07/20/17	-	105
Color**	40	TCU	75	Visual Comparison	07/21/17	MPT	105
Settleable Solids**	0.1	ml/L	-	Imhoff cone method (SM2540 F)	07/21/17	SEZS	
Biological Oxygen Demand**	1	mg/L	7	Azide Modification Winkler (SM 52108)	07/21/17	MLJ	105
Chemical Oxygen Demand**	13	mg/L	-	Open Reflux Method (SM52208)	08/01/17	BKTB	
Total Dissolved Solids**	389	mg/L	-	Gravimetry (SM2540-C)	07/26/17	EMA	
Surfactants (MBAS as LAS, MW=348.48 g/mole)	<0.02	mg/L	1.5	Colorimetry Chloroform Extraction	07/21/17	SEZS	105
Total Suspended Solids**	42	mg/L	80	Gravimetry (SM2540 D)	07/27/17	JEC	105
Oil and Grease	0.4	mg/L	2	Gravimetry (n-Hexane Extraction)	07/25/17	SEZS	105
Chloride**	37	mg/L	350	Argentometric Method (SM4500 Cl-B)	07/25/17	EMA	105
Nitrate- N **	0.9	mg/L	7	Colometry- Brucine	07/21/17	JEC	105
Phosphate- p**	0.2	mg/L	0.5	Stannous Chloride Method (SM45000-P D)	07/21/17	MPT	105



Test Description	Results	Units	REG LIMIT	Test Methods	Date Analyzed	By	Ref*
Sample No.: P00073270-05				Date Sampled: 07-20-17 15:02			
Sample ID: QUARRY DOWNSTREAM				Matrix: Surface Water			
-Metals- Cadmium**	<0.003	mg/L	0.005	Flame AAS	07/28/17	RDO	105
-Microbiology Total Coliforms**	70,000	MPN/100mL	-	Multiple Tube Fermentation Technique	07/21/17	CBS	
Fecal Coliforms**	14,000	MPN/100mL	200	Multiple Tube Fermentation Technique	07/21/17	CBS	105
-Wet Chemistry- Ph**, onsite	8.1	*	6.5-9.0	Electrometric Method	07/20/17	-	105
Temperature**, onsite	29.5	*C	25-31(d)	Laboratory and Field Method	07/20/17	-	105
Color**	40	TCU	75	Visual Comparison	07/21/17	MPT	105
Settleable Solids**	0.1	ml/L	-	Imhoff cone method (SM2540 F)	07/21/17	SEZS	
Biological Oxygen Demand**	2	mg/L	7	Azide Modification Winkler (SM 52108)	07/21/17	MLJ	105
Chemical Oxygen Demand**	15	mg/L	-	Open Reflux Method (SM52208)	08/01/17	BKTB	
Total Dissolved Solids**	380	mg/L	-	Gravimetry (SM2540-C)	07/26/17	EMA	
Surfactants (MBAS as LAS, MW=348.48 g/mole)	<0.02	mg/L	1.5	Colorimetry Chloroform Extraction	07/21/17	SEZS	105
Total Suspended Solids**	39	mg/L	80	Gravimetry (SM2540 D)	07/27/17	JEC	105
Oil and Grease	0.7	mg/L	2	Gravimetry (n-Hexane Extraction)	07/25/17	SEZS	105
Chloride**	33	mg/L	350	Argentometric Method (SM4500 Cl-B)	07/25/17	EMA	105
Nitrate **	0.9	mg/L	7	Colometry- Brucine	07/21/17	JEC	105
Phosphate- p**	0.2	mg/L	0.5	Stannous Chloride Method (SM45000-P D)	07/21/17	MPT	105

Provided below is the water sampling map.

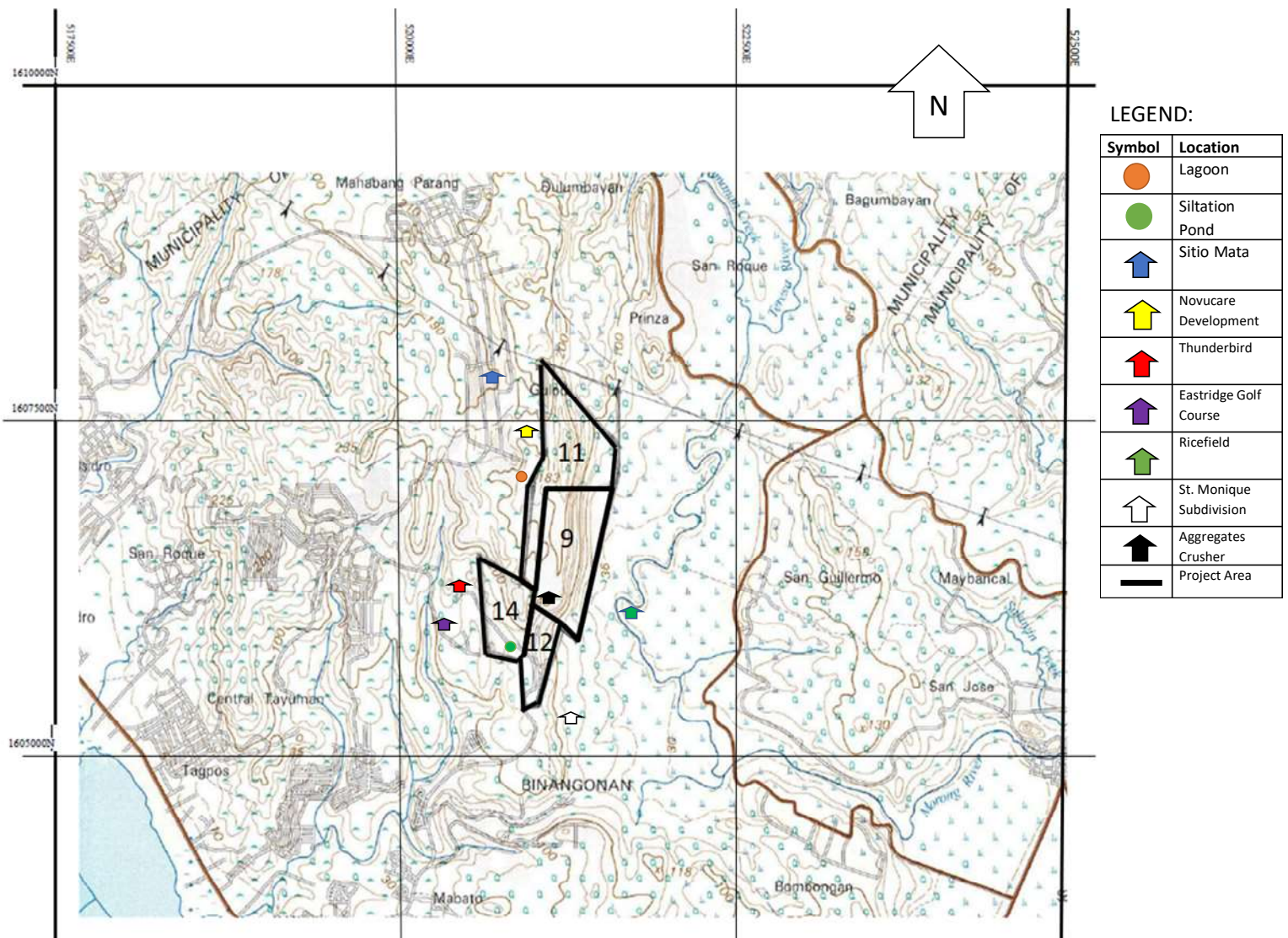


Figure 2.2.3.1: Water Sampling Map

2.2.4 Freshwater Ecology

Freshwater ecology survey was conducted in September 2017. Study showed that other than the manmade lagoon, there is no other significant water body present in the project area. Thus, the study was limited to species present in the lagoon.

Additional assessment of freshwater biota was conducted in three sampling stations in the lagoon located inside the premises of the Calabar Quarry of Solid Cement Corporation in Binangonan, Rizal on 19 May 2018. The assessment focused on (i) sampling of benthic macro-invertebrates, (ii) identification of plankton communities, and (iii) conduct of test fishing to determine common species of fish present.

The survey area is a lagoon, a quarry depression created during previous operations of the previous companies in the same area and measures 3.78 hectares. The area was eventually filled up with rain water and freshwater outfall from a seasonal creek that created the present lagoon. It was noted that the lagoon is completely enclosed by uphill slopes and no natural outflow channels were observed. The lagoon shoreline is comprised of loose sand, rocks and boulders and since the survey was done during hot summer season, there were no significant shoreline vegetation except small foliage and grass (Figure 2.2.4.1; Plate 2.2.4.1).

The objective of the aquatic ecology baseline study is to determine presence of important aquatic biota in the lagoon, including fish and crustaceans, macro-invertebrates, plankton and other macro-benthos communities that can be susceptible to possible anthropogenic issues emanating from the expansion project of the Calabar quarry operations.

Sampling locations were distributed in western, eastern and middle portion of the lagoon (Figure 2). The coordinates of the sampling stations are shown in Table 2.2.4.1.

Table 2.2.4.1: *Coordinates of freshwater ecology sampling stations investigated in the Calabar Lagoon, Binangonan, Rizal; 19 May 2016*

Plankton sampling (PLK) Station coordinates

WP Code	LATITUDE	LONGITUDE	REMARKS
PLK1	N 14.531840°	E 121.195177°	Northern/upper portion of lagoon
PLK2	N 14.530736°	E 121.196020°	Middle of lagoon
PLK3	N 14.529062°	E 121.195866°	Southern/lower portion of lagoon

Benthos sampling station coordinates

WP Code	LATITUDE	LONGITUDE	REMARKS
BNT1	N 14.532163°	E 121.195069°	Northern/upper portion of lagoon
BNT2	N 14.530787°	E 121.196263°	Middle of lagoon
BNT3	N 14.528744°	E 121.195898°	Southern/lower portion of lagoon

Test Fishing (TSF) Stations

WP Code	LATITUDE	LONGITUDE	REMARKS
TSF1	N 14.531840°	E 121.195177°	Northern/upper portion of lagoon
TSF2	N 14.530787°	E 121.196263°	Middle of lagoon
TSF3	N 14.529062°	E 121.195877°	Southern/lower portion of lagoon

Sampling for freshwater fish species was generally conducted in the same sampling sites for plankton and macrobenthos, involving actual test fishing operations with the use of a 2-meter diameter *cast net*. Fish and crustacean species, as well as macro-invertebrates of significant value as food, were identified *in-situ*. For plankton community sampling three stations were subjected to biotic sampling that included phytoplankton, zooplankton, and epibenthic macro-benthos. All samples were labeled with the site identification, type of sample, analysis required, and date of collection.

Phyto-and zooplankton were collected at the three sampling sites by filtering 1 liter samples into a composite sample. Phytoplankton samples were filtered through a 20 µm mesh sieve; zooplankton were filtered through a 33 µm mesh sieve. Phytoplankton samples were then fixed using Lugol's solution; zooplankton samples were fixed with 10% buffered formalin. Samples were then sent to the UP MSI laboratory for counting and identification. Counting and identification of organisms were conducted using a Sedgwick-Rafter plate. For phytoplankton, a compound light microscope was used, while for zooplankton, a dissecting microscope. Phytoplankton were counted and identified to the lowest taxonomic level (genera) possible while zooplanktons were identified to major groups using available references. Phytoplankton and zooplankton densities are presented as number of cells or organisms per liter. Benthic macrobenthos were collected in the three stations employing the standard kick net. The net is thrust into productive habitats and substrates (e.g., riffle areas, flooded vegetation, submerged root mats and other woody debris) to collect specimens. Macro-benthos were identified up to species level. Documentation of aquatic biota was supplemented with actual observation of fish and crustaceans in the rocky portions of the lake shoreline.



Plate 2.2.4.1. The Calabar lagoon inside the quarry/aggregate site in Binangonan, Rizal



Figure 2.2.4.1: The 'Calabar' lagoon and location of sampling stations for plankton, benthos and other macro-invertebrates

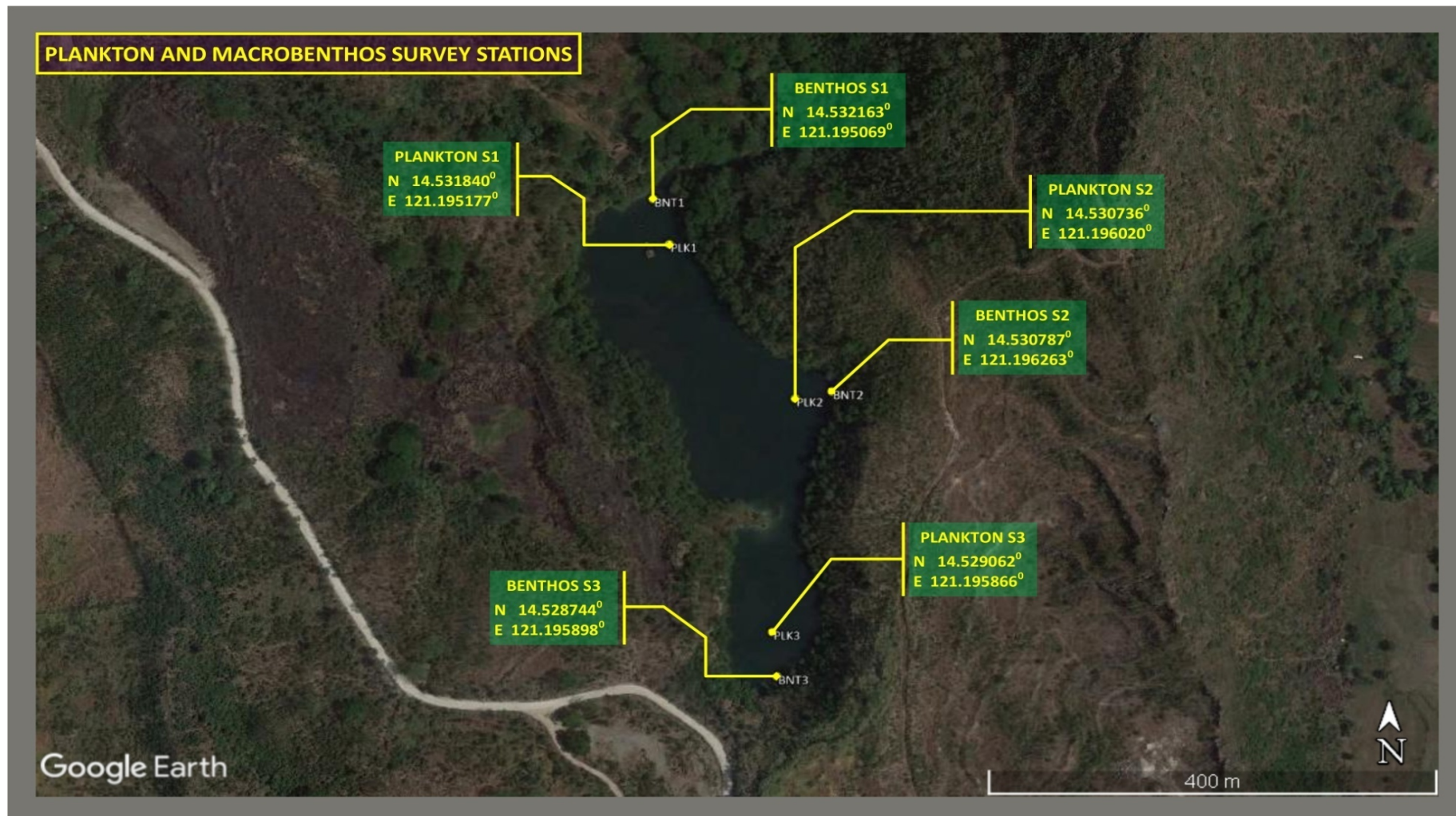


Figure 2.2.4.2: Location of sampling stations for plankton, benthos and other macro-invertebrates during additional freshwater ecology survey conducted in the 'Calabar' lagoon on 19 May 2018.



Plate 2.2.4.2: The survey team undertaking plankton community sampling and macro benthos survey in the Calabar lagoon, Binangonan, Rizal; 19 May 2018.

1. Results and Discussion

Plankton

Plankton are microscopic, free drifting organisms comprised of phytoplankton and zooplankton. Phytoplankton play a key role in the primary production and global nutrient cycles of the earth (Daniel 2001) by making up the main producers in any given water body (Biddanda and Benner 1997). Phytoplankton communities are among the first group of organisms that respond to environmental changes and therefore their total abundance, composition and diversity are used as indicators of water quality (Reynolds et al. 2002; Brettum and Andersen 2005). Zooplankton on the other hand, are one of the most important biotic components influencing all the functional aspects of an aquatic ecosystem, such as food chains, food webs, energy flow and cycling of matter (Supritam pal et al., 2015). Zooplankton inhabiting freshwater responds quickly to environmental changes and hence their species indices fluctuate (Avinash 2014).

A total of 30 plankton taxa belonging to Bacillariophyceae (diatoms) with twelve (12) genera, Chlorophyte (green algae) with and Dinophyceae (dinoflagellates) with one (1) genus and Cyanophyceae (Blue-green algae) with two (2) genera and zooplankton with six (6) taxa (Table 2.2.4.2) was identified in three sampling stations in the 'Calabar' lagoon in Binangonan Rizal. Generally, diatoms dominated the phytoplankton community constituting for almost 61% of the total phytoplankton count (Fig. 2.2.4.3). They are also the group with the highest number of genera observed. This was followed by dinoflagellates which accounted for almost 27 % of relative abundance. *Aulacosiera* spp. alone comprised the bulk of the diatoms accounting for 44% and total cell density of 3,816cells/L. Other plankton taxa that recorded high relative abundance were *Spirogyra* (green algae) with 7%. The dinoflagellate genus with the highest abundance was *Peridinium* spp. which constituted for almost 7% and total density of 647 cells/L. *Aulocosiera* sp. is common tropical diatom typically found in eutrophic reservoir. *Peridinium* spp. on the other hand is a non-harmful dinoflagellate that usually forms harmless bloom in freshwater ecosystem. These two plankton taxa are generally abundant in the water body sampled in Binangonan Rizal. They are usually found at higher abundance than other species because they are local opportunist or respond rapidly to nutrient pulses and water turbulence (Reynold 2006). Photomicrographs of common plankton genera identified from water sample collected in the three sampling stations are shown in Figure 2.2.4.5.

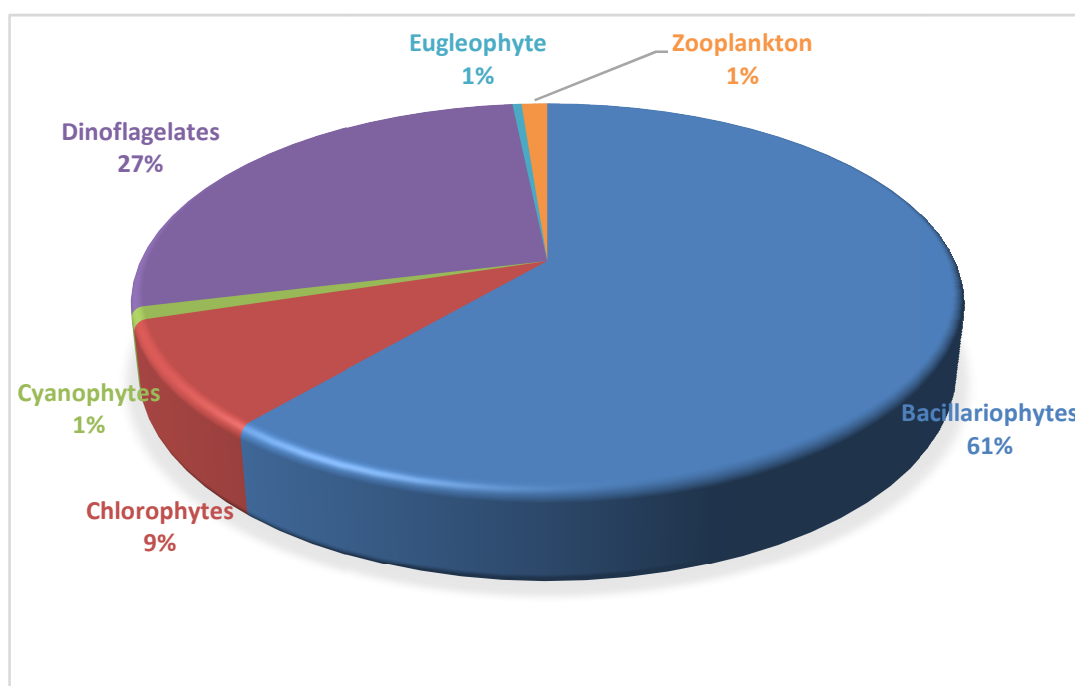


Figure 2.2.4.3: Percentage composition of major phytoplankton groups recorded in Binangonan Rizal during the May 2018 sampling in Calabar lagoon.

Table 2.2.4.2: Plankton composition abundance diversity and abundance (cells or ind /L) during the May 2018 sampling in Calabar lagoon

Taxa	Station 1	Station 2	Station 3	Grand Total	Re. Abund.
Bacillariophytes	1,772	1,815	1,707	5,294	61.24
<i>Asterionella</i>		5		5	0.06
<i>Aulacosiera</i>	1,151	1,349	1,317	3,816	44.15
<i>Cymbella</i>	5	11	15	30	0.35
<i>Ephemera</i>		3		3	0.03
<i>Fragillaria</i>	471	301	195	967	11.19
<i>Gyrosigma</i>	14	5	22	41	0.47
<i>Navicula</i>	3			3	0.03
<i>Nitzschia</i>		3	5	8	0.09
<i>Pinnularia</i>	26	21	28	75	0.87
<i>Surirella</i>	86	117	98	301	3.48
<i>Synedra</i>	14		12	25	0.29
<i>Terpsinoe</i>	5		15	20	0.23
Chlorophytes	362	203	205	769	8.90
<i>Closterium</i>	14	13	8	35	0.41
<i>Cosmarium</i>	26	27	17	69	0.80
<i>Geminella</i>	5			5	0.05
<i>Pediastrum</i>	2	5	5	12	0.14
<i>Spirogyra</i>	317	157	173	647	7.49

<i>Tetraedron</i>			2	2	0.02
Cyanophytes	15	74	2	91	1.05
<i>Merismopedia</i>	11	74		85	0.98
<i>Nostoc</i>	5		2	6	0.07
Dinoflagelates	818	1,017	516	2,351	27.19
<i>Peridinium</i>	818	1,017	516	2,351	27.19
Eugleophyte	18	15	3	37	0.42
<i>Euglena</i>		3		3	0.03
<i>Phacus</i>		5		5	0.05
<i>Trachelomonas</i>	18	8	3	29	0.34
Zooplankton	21	36	47	104	1.20
Bdelloid rotifer	2	5	8	14	0.16
Calanoid	3	6	5	14	0.16
Copepod nauplius		11	6	17	0.19
Cyclopoid	6	5	12	23	0.26
Insect larvae	2	2	6	9	0.10
<i>Keratella</i> (rotifer)	9	9	11	29	0.33
Grand Total	3,005	3,160	2,480	8,644	100
Richness	23	24	23		
Evenness	0.53	0.49	0.50		
Diversity	1.65	1.57	1.56		

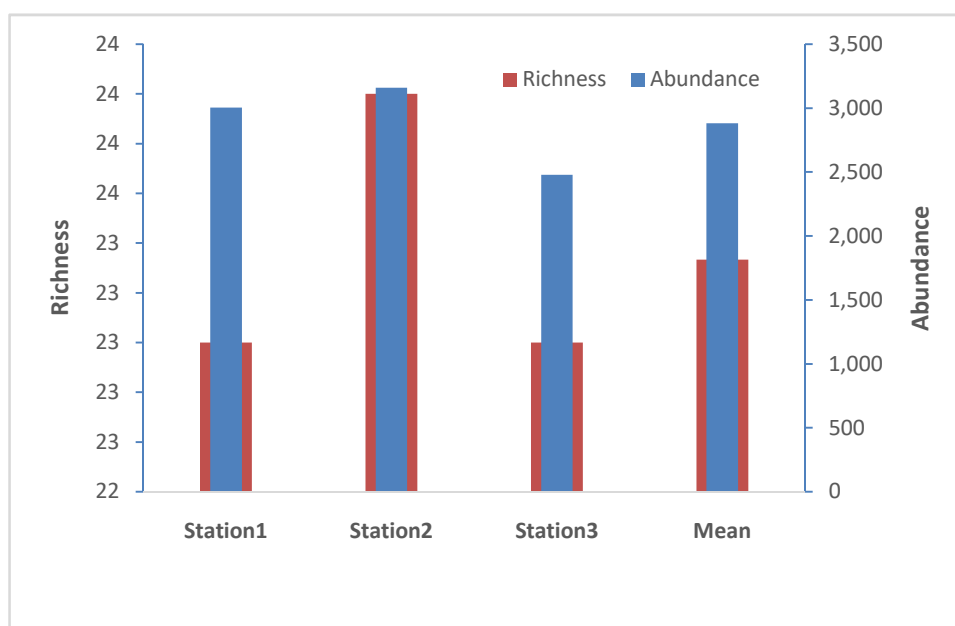


Figure 2.2.4.4: Total phytoplankton abundance in three stations during the March 2018 sampling in the Calabar lagoon

In terms of spatial distribution, station 2, the central station, had the most number of phytoplankton genera observed and highest total plankton abundance with 3,160 cell/L and 24 taxa identified

(Fig.2.2.4.4). In terms of dominance, all stations were dominated by diatoms particularly the genus *Aulacosiera*. The lowest total plankton abundance was quantified in station 3 or the station located in the lower portion of the water body. Generally, diversity values were low (<2) with the highest calculated diversity index based on Shannon-Weiner (H') observed in station 1 with 1.65 while the lowest was observed in station 3 with 1.56 (Table 1). The computed index of evenness was relatively low ranging from 0.49 to 0.53 due to high density of *Aulacosiera* and *Peridinium* relative to other genera. The overall impression of the plankton community in the area is *poor as indicated by low abundance, evenness and diversity*.

Zooplankton community was very low consisting of only six (6) taxa dominated by Cyclopoid, Bdelloid rotifer and Calanoid. This condition indicates *very poor zooplankton community diversity and recruitment*.

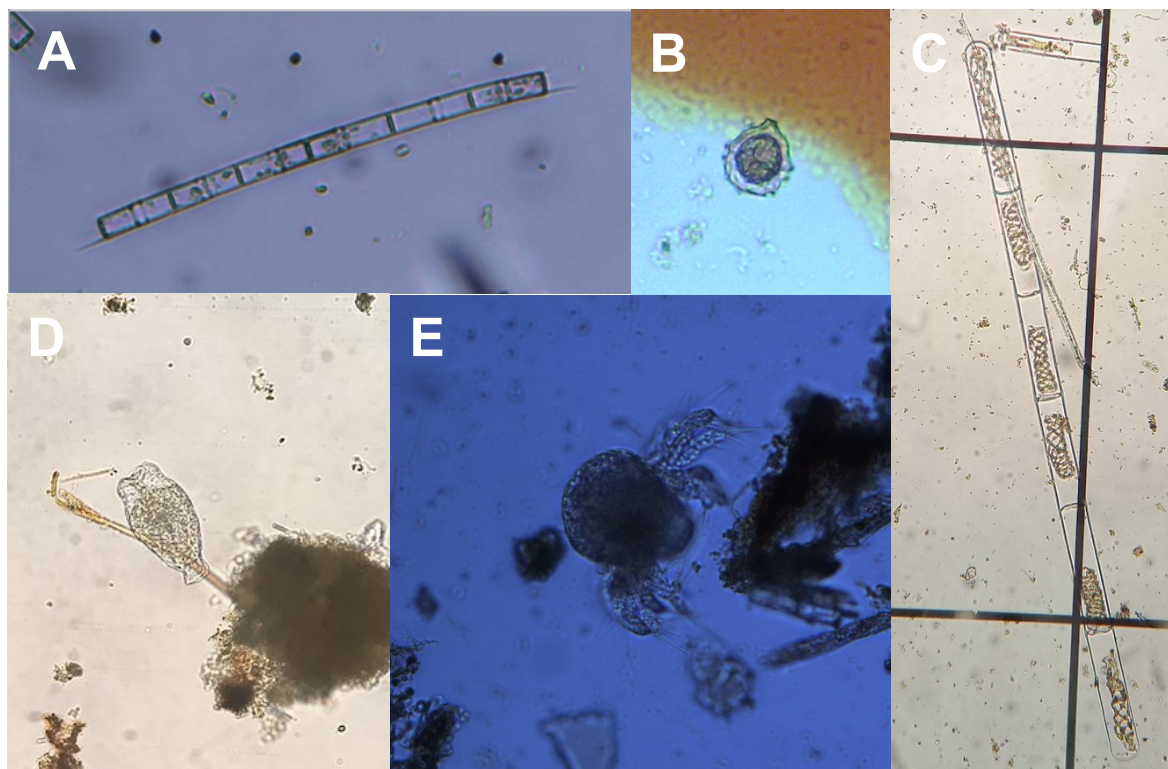


Figure 2.2.4.5: Photomicrographs of common plankton observed in three sampling stations (A) *Aulacosiera* (B) *Peridinium* (C) *Spirogyra* (D) *Bdelloid rotifer* (E) *Copepod nauplius*

Macrobenthos

Macrofauna, also called macrobenthos, are important components of estuarine and coastal ecosystems because they serve as critical links between a variety of primary producers and organic matter sources (e.g., phytoplankton, benthic microalgae and macroalgae, detritus) and economically, ecological, and recreationally important fish and crustaceans. Communities of macrobenthos provide many ecosystem services that help to maintain good water and sediment quality. Filter feeders remove particles from the water column, which may result in enhanced water clarity. Given the importance of light in shallow water estuarine ecosystems, filter feeding may improve shallow water habitat for submerged aquatic plants and benthic microalgae. Accordingly, the changes in benthic species composition and abundances could aid as an alarm system and even allow the quantification of environmental alterations (Hutchinson, et.al, 1993). A macrobenthos survey was conducted on September 2017 covering one station. In addition three (3) stations was surveyed last May 19, 2018 which eventually increased the profile of macrobenthic community in the lagoon.

For the September 2017 survey, a total of 270 individuals were collected in the sampling station with 2 kicknet trials. Macroinvertebrates under Family Chirominidae was the most abundant among the 17 observed families comprising of about 26% of the total sampled individuals. Individuals under Family Helicopsychidae ranked second in the most abundant, which was followed by Family Hydrospsychidae with a population of about 16% out of the 270 individuals sampled.

For the latest survey, a total 209 individuals belonging to 16 families was recorded in three survey stations in Binangonan last May 2018. The macrobenthos recorded in this survey was represented by four major phyla i.e Arthropoda, Mollusca, Annelida and Chordata. Phylum Mollusca was the most abundant group accounting for 75% of the total macrobenthic community, followed by phylum Arthropoda constituting for 20% (Fig.2.2.4.6). Mollusks were most represented by bivalve belonging to family Corbiculidae particularly *Corbicula* sp. which accounted for 37% and gastropods belonging to family Thiariidae particularly *Melanoides* spp. with 34%. *Melanoides* sp. is commonly eaten by molluscivorous fish, such as some cichlid species (Tilapia) and carp, but its use as a commercially interesting food source in fish farming requires confirmation. *Corbicula* sp. occurs in rivers, lakes, ditches and pools of fresh or brackish waters. The soft body of this species is used as a food for humans. They can also be used as food for fish, poultry, livestock, and as a fertilizer of agricultural fields. The shell may be used to produce lime, and the species is also the material of traditional Chinese medicine. Both species are highly invasive species and considered as least concern in terms of conservation status according to IUCN. Arthropods are the most family rich phyla with 11. The top three (3) arthropod families in terms of overall relative abundance were Caenidae (7%), Palaemonidae (3%) and Coenagrionidae (2%) while the remaining families accounted for 7% of the macrobenthic community. Phylum Chordata was only represented by family Gobiidae while phylum Annelida was represented by order Oligochaeta. The midges, *Chironomous* sp, belonging to family Chironomidae which was most abundant macrofauna in September 2017, is a most widely distributed and frequently the most abundant group of insects in freshwater, with representatives in both terrestrial and marine environments. A very wide range of gradients of temperature, pH, oxygen concentration, salinity, current velocity, depth, productivity, altitude and latitude have been exploited, by at least some chironomid species, and in grossly polluted environments chironomids may be the only insects present. The ability to exist in such a wide range of conditions has been achieved largely by behavioral and physiological adaptations with relatively slight morphological changes (Armitage et al 1995). The detailed abundance and composition of macrobenthic community for three stations sampled is shown in Table 2.2.4.4.

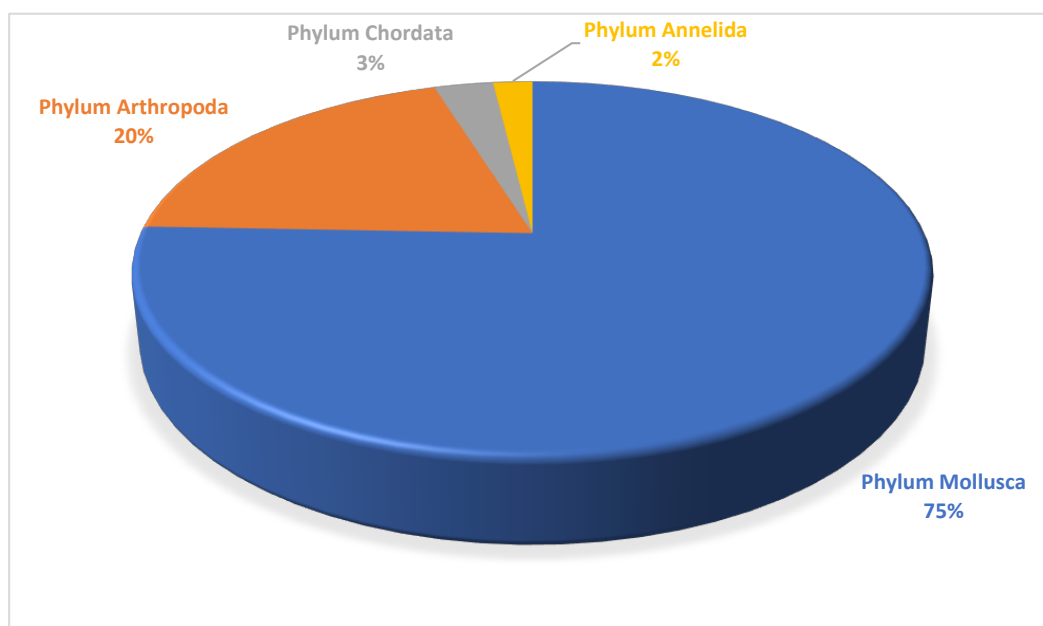


Figure 2.2.4.6: Percent composition of major benthic macroinvertebrates in Binangonan Rizal

Table 2.2.4.4: Macroinvertebrates composition, abundance and distribution in three sampling stations in Binangonan, Rizal.

Taxa	Station			Grand	Rel.	Remarks
	St1	St2	St3	Total	Abund.	
Phylum Mollusca	109	33	16	158	75.60	
Class Bivalvia						
Family Corbiculidae	45	28	5	78	37.32	<i>Corbicula</i> sp. abundant but least concern (IUCN)
Class Gastropoda						
Family Thiariidae	64	3	4	71	33.97	<i>Melanoides</i> spp. abundant but least concern (IUCN)
Family Ampullariidae		1	7	8	3.83	
Family Planorbidae		1		1	0.48	
Phylum Arthropoda	23	9	9	41	19.62	
Subclass Crustacea						
Class Malacostraca						
Order Decapoda						
Family Palaemonidae	2	3	2	7	3.35	
Order Amphipoda						
Family Gammaridae			1	1	0.48	Indicator of relatively good water quality
Class Insecta						
Order Ephemeroptera						
Family Baetidae	2		1	3	1.44	
Family Caenidae	2	1	0	3	1.44	
Order Odonata						
Family Coenagrionidae	1	2	1	4	1.91	
Family Calopterygidae						
Order Coleoptera						
Family Dytiscidae	2	1		3	1.44	
Family Noteridae			1	1	0.48	
Family Hydrophilidae	1			1	0.48	
Order Hemiptera						
Family Gerridae			3	3	1.44	
Order Diptera						
Family Chironomidae	13	2		15	7.18	most abundant insect family
Phylum Chordata	1	3	2	6	2.87	
Class Actinopterygii						
Order Perciformes						
Family Gobiidae	1	3	2	6	2.87	
Phylum Annelida	2	1	1	4	1.91	
Order Oligochaeta	2	1	1	4	1.91	
Total	135	46	28	209	100	

Table 2.2.4 shows the macroinvertebrates abundance, richness, evenness and diversity index values computed in three stations. In terms of abundance, the upper station (St1) recorded the highest with 122 individuals, mostly comprised of family Corbiculidae while the lowest was recorded in central station with 11 individuals. The most taxa rich station was also recorded in lower station (St3) with 11 taxa while the most depauperate was recorded in upper station with 10 taxa. Diversity index based in Shannon-Wiener was generally low with the highest computed value in station three at 2.25, while the lowest was computed in station 1 with 1.16. The index of evenness based on Pielou's Index was variable ranging from 0.50 to 0.90. However, the overall low diversity index in all stations is indicative of some stressor affecting their taxa richness and community balance.

Table 2.2.4.5: Diversity indices in three stations surveyed in Binangonan Rizal.

Stations	Richness (s)	Abundance (N)	Evenness (I')	Diversity (H')
1	10	122	0.50	1.16
2	11	57	0.68	1.62
3	12	30	0.90	2.25

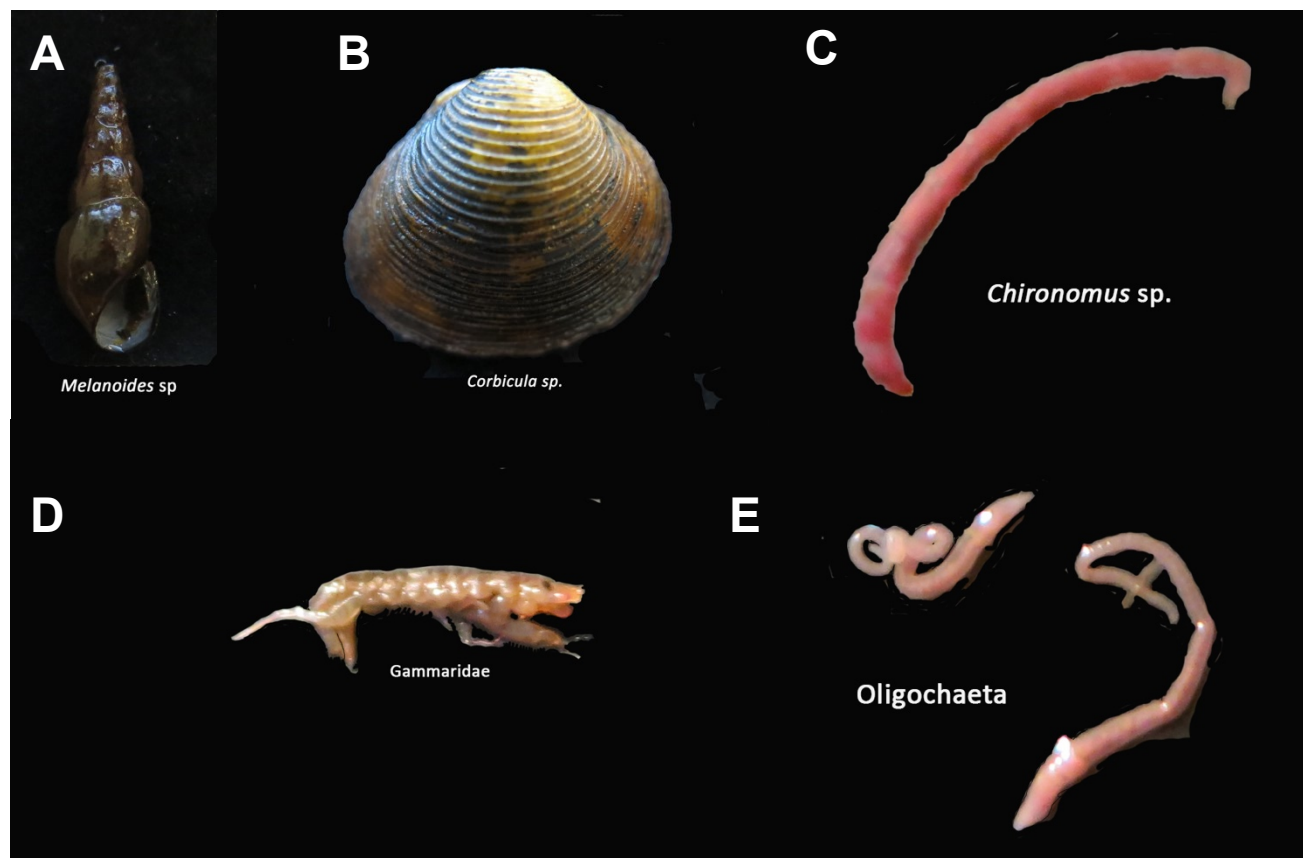


Figure 2.2.4.7: Images of most abundant and important macrobenthos from three survey stations in Binangonan Rizal

Fish Biota

In the first survey, two modified fish traps were used to catch fish and other benthic life forms in the lagoon. The fish traps were made up of chicken net. To trap the fish, feeds were placed inside the trap to attract fishes then the traps were submerged in the lagoon and left in the area overnight.

In the additional survey on 19 May 2018, three sites were subjected to test fishing operations using a cast net thrown from nearshore positions near branches of trees submerged in the water suspected of hosting grazing fish.

The three actual fishing operations yielded no fish even after repeated cast net operation. Key informants alleged that Tilapia (*Oreochromis* sp), “Dalag” (*Channidae*) “Hito” (*Clariidae*) and an unidentified freshwater snapper inhabits the lake but could only be captured by bottom set gill nets in the 6-meter deep lake. Indeed small schools of juveniles of the greasyback penaeid shrimps, suspected to be endeavour shrimp *Metapenaeus ensis* (“Suahe”), were seen by the survey team. This species of shrimp is omnivorous- feeding on plants, algae, mollusks, worms, and fish. In rock crevices, small groups of gobies (*Glossogobius* sp) were also seen (Table 2.2.4.6). In the downstream portion (Station 1), five pieces of dead Tilapia were observed (Plate 2.2.4.3). It is presumed that Tilapia dominates the fish population in the lagoon and mortality of the floating fish have been caused by low dissolved oxygen in the lake in previous days owing to the extremely hot weather followed by sudden rainfall.



Plate 2.2.4.3: Floating dead *Tilapia* in the 'Calabar' lagoon; 19 May 2018

Table 2.2.4.6: Diversity of finfish and crustaceans observed in the Calabar lagoon during the additional freshwater ecology survey conducted on 19 May 2018

	Family	Species Name	Local Name	Common Name
1.	Gobiidae	<i>Glossogobius sp</i>	Biya	Goby
2.	Penaenidae	<i>Metapenaeus ensis</i>	Suahe	Greasyback shrimp
3.	Channidae	<i>Channa icropeltes</i>	Dalag	Snakehead
4.	Clariidae	<i>Clarias sp</i>	Hito	Freshwater catfish
5.	Tilapia	<i>Oreochromis sp</i>	Tilapia	Tilapia

In summary, the freshwater biota of the lake has low species variety in all stations surveyed, with the exception of the Asian clam which is an invasive, filter-feeding species with very fast reproduction rate. In few documented cases, the Asian clam has been identified to cause biofouling, clogging intake pipes, canals and irrigation systems. The Tilapia- a hardy and prolific species is expected to grow in population and will continue to dominate the fish population in the lagoon.

2.2.4.1 Threat to existence and/or loss of important local species and habitat

Summary of endemcity/conservation status

The Tilapia, Asian clam and local snakehead species are of good commercial value as foodfish, although they are not reported as threatened and endangered. None of the species catalogued are endemic to the area.

Presence of pollution indicators species

Marine fish and shellfish species have not been used as indicators of pollution, except where biotixins are involved (e.g. plankton-filtering fish species in PSP-affected areas). Apart from the community of clam bivalves observed, there were no species of fish or shellfish encountered in the sampling stations that can be employed as indicators of pollution. The clam *Corbicula sp* is, however, known to cause biofouling during massive growth of its population.

In many cases, increased nutrient loading through sediment transport has been observed to be a more likely pathway for occurrence of HABs in coastal areas if the suspended organic matter (OM) causes hyper-nutrient levels and eutrophication. The present plankton survey did not reveal the presence of any of the HAB-causing species in excessive densities. The overall impression from results of the phytoplankton survey is that the plankton community in the lake ecosystem based on overall diversity, richness and total abundance is relatively low. In conclusion, the present plankton community in the project area signifies normal but poor levels of these organisms in the river. The likelihood of algal blooms is ruled out by the findings in the study, due to the extremely low number of HAB-causing plankton.

Epibenthic fauna (macroinvertebrates or macrobenthos), on the other hand, serve a number of ecosystem roles at various levels of the food chain, ranging from consumers of plant material to prey for

fish. Macro-invertebrates are good integrators of environmental conditions over time and can be used as indicators of heavy metal pollution, especially sessile, filter-feeding macro-invertebrates. Shellfish species such as oysters and epibenthic bivalves can be utilized for biotoxin analysis, including detection of cyanide in bivalve tissue. However, the low diversity of epibenthic and infaunal benthos in the sampling areas already indicate a stressed aquatic environment and no significant population of a diverse community of bivalves have been observed in the stations studied.

2.2.4.2 Threat to abundance, frequency and distribution of species

Freshwater ecology studies the interrelationship of organisms and their environments; in this study only the macroinvertebrates, epilithic assemblages and freshwater fish were studied because they are good indicators of the water quality in aquatic ecosystems like lagoons. Moreover, these organisms are sensitive to slight changes in water quality and are greatly affected by environmental stressors such as pollution. There were no researched-related studies conducted prior to the conduct of sampling.

Freshwater biota survey was conducted in the accessible part of the Calabar quarry lagoon. The area of the lagoon is approximately 3.72 hectares that belonged to patent 10. The lagoon was once a quarried area that accumulated water from years of rain. Only one sampling station was done because most parts of the lagoon is inaccessible and no means of transportation like boats were not allowed in the lagoon. Macroinvertebrates were sampled on a stream connecting to the lagoon.



Plate 2-3: Macroinvertebrate sampling using kick-net method at the end of the stream connected to the lagoon

Epilithic Invertebrates

Three stones with possible algal growth were collected along the two sampling stations in the lagoon, a 7 mm diameter PVC pipe was placed in the surface of the stone and the inside part was brushed and was rinsed with water using squirt bottle to a basin. Samples were then placed in a dark bottle with 5% ethyl alcohol. Subsamples were obtained from each bottle and microalgae were identified and counted under a compound microscope. Identification was up to family level only.



Plate 2-4. Modified fish traps used to catch fishes within the lagoon

2.2.4.3 Mitigation

Overall impacts of the project on the freshwater ecology

The overall impacts are deemed not highly significant because of the following:

- There is no significant water use competition for the lagoon; fishing and collection of macro-invertebrates is prohibited
- In the absence of outflow systems, the low lagoon water mixing during the summer months can lead to conditions of oxygen depletion in the water column;
- The lagoon does not host a diverse population of freshwater organisms;
- The lagoon will not be blocked and the project will ensure to prevent fluid discharge into the said water body;
- The potential impact that may be experienced may include heavy siltation caused by typhoon-induced rainfalls. However, extensive planting of vegetation along the lagoon's banks is being undertaken by the company;

The following are mitigation measures to ensure that there will be no harm to the body of water near the project site:

Prevention of Siltation and Sedimentation

The main strategy to curtail potential sediment and silt waste streams from spilling over to the lake waters is to contain erosion at source and entrap fugitive sediments in project waterways and drainage system by installing a series of filters and settling ponds. During construction of any infrastructure near the lagoon, silt curtains or geo-textile materials will be installed in strategic points to filter sediments and substantially reduce suspended sediment in waters released to the water channel that may end up in the lagoon or the seasonal creek that empties into the lagoon. In construction sites and earthworks, the sediment prevention will be reinforced by the construction of entrapment screens in the waterways and drainage canals that divert waste streams into settling ponds.

Periodic monitoring of total suspended solids (TSS) will be undertaken.



Conduct of Biodiversity Monitoring System (BMS)

BMS is an activity being conducted repeatedly, to monitor the changes/trends of the species within the locality. The BMS will be conducted biannually employing standard methods in consistent sampling stations and similar sampling periods to enable comparison of data sets generated bi-annually. The biodiversity monitoring will include fish biota, plankton, macrobenthos and macro-invertebrates.

Curtailment of Domestic Wastewater Pollution that can Affect Lagoon Water Quality

The use of 3-chambered septic tanks shall be adopted in all project facilities where wastewaters and other effluents are generated. Waste minimization will be practiced in all aspects of project operation. The objective is to ensure that pollution-causing effluents that can be potentially carried downstream and into the lagoon are treated at the source.

Prevention of Oil and Grease Spill Contamination

Clean practices in oil and fuel dispersal will be strictly enforced in the fuel dispensing facilities that can leach to waterways leading to the lagoon. Fuel and oil-based residues will be collected and disposed of properly. An oil and grease containment and fuel waste contingency plan will be formulated and enforced in all aspects of project operations.

Potential Impacts Arising from Climate Change Scenarios

Climate change projections of the PAGASA indicate that mean temperatures in all areas in the Philippines are expected to rise by 0.9 °C to 1.1 °C in 2020 and by 1.8 °C to 2.2 °C in 2050, with the largest seasonal temperature increase anticipated to occur during the summer (MAM) season (PAGASA, 2011). As a parallel project strategy that aims to contribute to the overall national effort for mitigation of climate change impacts through establishment of carbon sinks, the Project will support reforestation and re-greening of open areas and development and implementation of a Reforestation and Carbon Sink Program. Reforestation of the lakeshore banks will be particularly pursued employing species that can effectively stabilize sloping soils and compacting of shoreline sediments.

2.3 THE AIR

2.3.1 Meteorology/ Climatology

2.3.1.1 Change in the local micro-climate e.g. local temperature

The climate at the proposed Project site falls under Type I Climate category based on the Modified Coronas Classification of Philippine Climate (Figure 2.3-1). Seasons for Type I climate marked by two distinct seasons- dry from November to April and wet during the rest of the year. Wind coming from the Pacific Ocean is generally blocked by the Sierra Madre Mountain Range several kilometres east of the city.

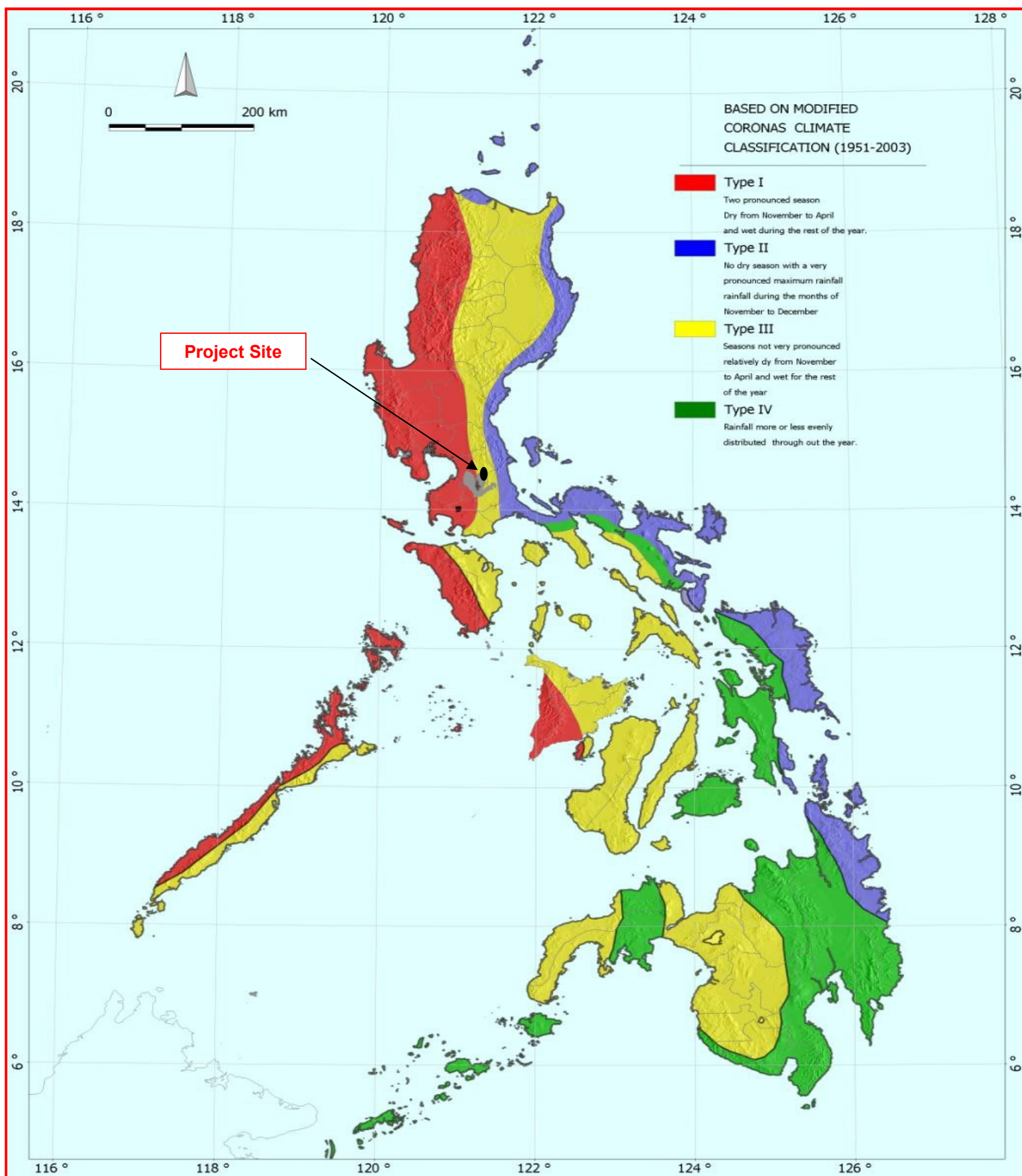


Figure 2.3-1 Philippine Climate Map (Source: PAGASA)

2.3.1.1.1 Wind Regime

The Tanay PAGASA Synoptic Station located in Barangay Sampaloc, Tanay Rizal is the nearest meteorological station in the proposed Project site. The geographical position of the surface synoptic station is 121°22'09.30"E and 14°34'53.22"N.

The windrose plot as shown in the figure below shows that winds prevailing from northeast comprises of about 19.5% followed by east comprises of about 17%, a significant event produce northwest, north-northeast, and east-northeast comprises of about 36% over the site. Of all hourly wind direction with an average wind speed of 4.33 meter per seconds, few winds exceed 11 meter per seconds and winds less than 2 meter per seconds occur from all directions. Calm conditions were observed 0.00% of the time. Strongest winds come from north-northeast, northeast, east-northeast, and east occupying 1 % of the time. Windrose diagram is presented in Figure 2.3-2.

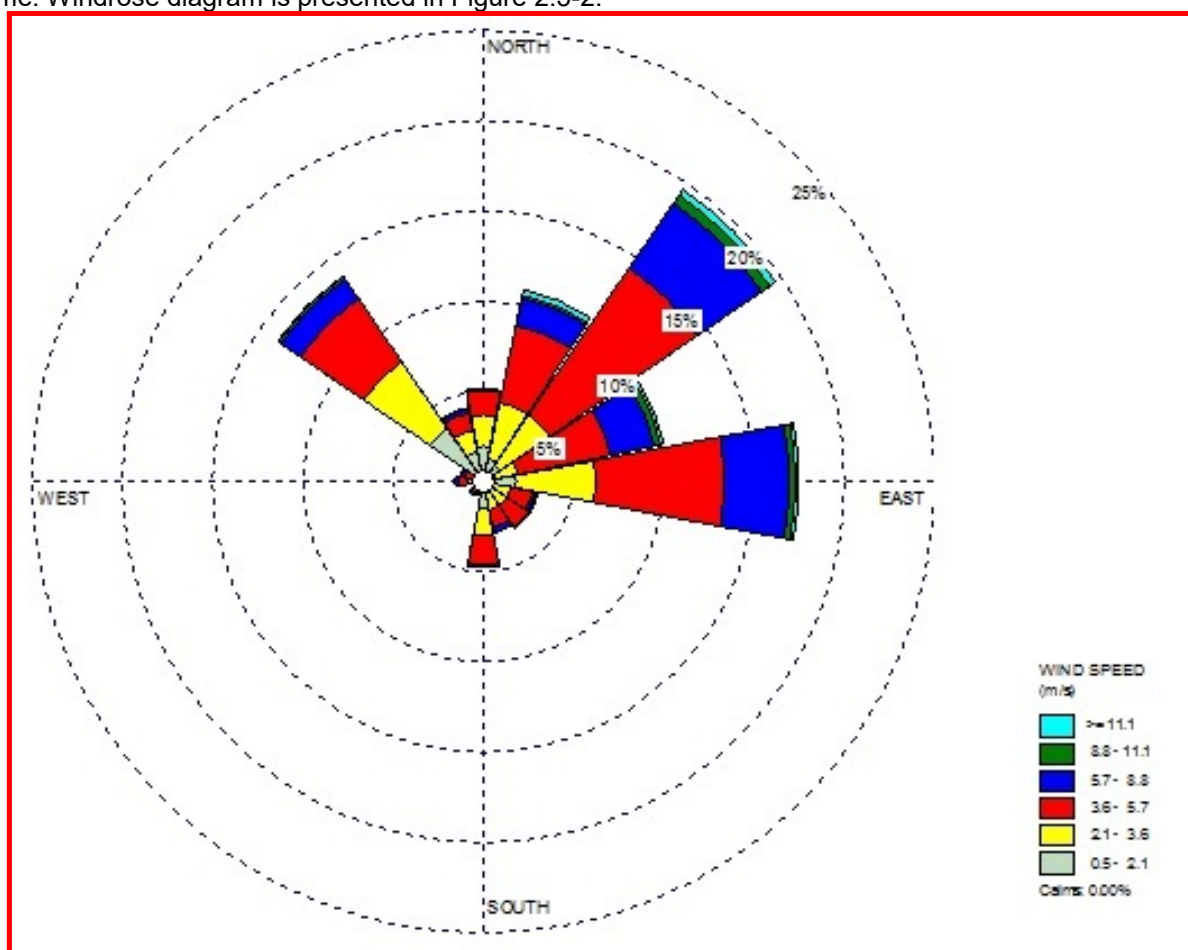


Figure 2.3-2: Windrose Diagram for Tanay Synoptic Station

The tropical condition can be attributed to the location of the project which is between 13 to 14 degrees north of equator. The monsoonal condition, on the other hand, refers to two seasonal wind regimes, the northeasterly winds and the southwesterly winds. From November to May the wind blows on a northeasterly direction with an average wind velocity of 3.08 meters per seconds. From June to October the southwesterly winds prevail with an average wind velocity of 1.96 meters per seconds.

The majority of wind speed of Tanay Synoptic Station occupying 40.1% of the total wind as shown in **Figure 2.3-3** is 3.6 to 5.7 meters per second.

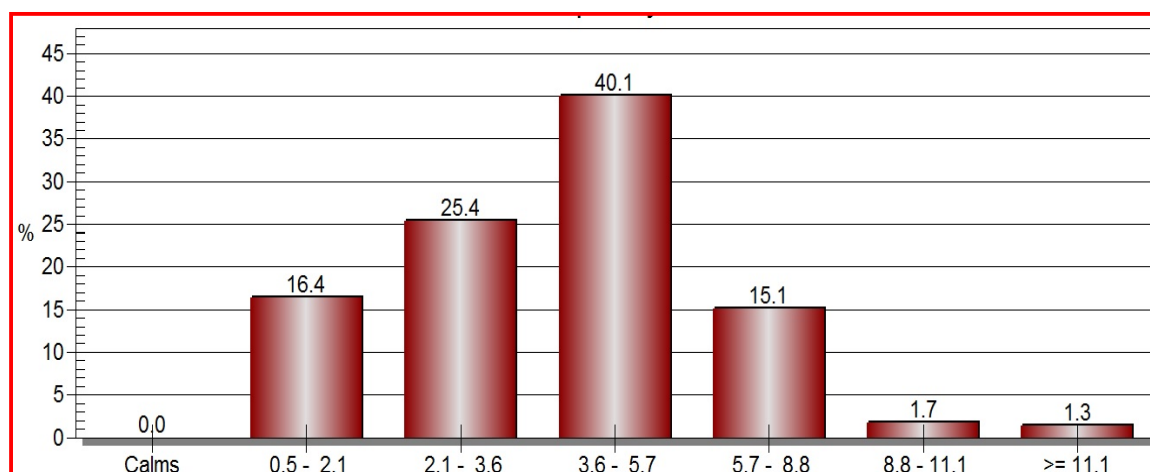


Figure 2.3-3 Wind Class Frequency Distributions

2.3.1.1.2 Rainfall

The project area receives an annual mean rainfall of 2931.9 mm as described in the nearest PAGASA meteorological station which is the Tanay Synoptic Station. The said synoptic station is located 28 km northwest of the project site. Table below shows the rainfall data of the station collected from 1999-2012. April is the driest month with 50.6 mm monthly rainfall with six (6) rainy days while July is the wettest month with an average monthly rainfall of 534.2 mm.

The typhoon season normally occurs between May and November and usually coincides with the onset of the southwest monsoon rains. This situation brings excessive amounts of rainfall that causes extensive flooding in the low lying area. From 1948 to 1978, out of 325 typhoons that crossed the country, twenty (20) of these passed approximately within the Quezon Province. Compiled records of past flooding obtained from DPWH and PAGASA between 1964 and 1990 indicated that at least twelve (12) typhoons caused flooding in conjunction with the SW monsoon rains.

Table 2.3-1: Amount of Rainfall and Number of Rainy Days from Tanay Synoptic Station fr 1999-2012

Month	Rainfall	
	Amount (mm)	No. of Rainy Days
January	70.7	10
February	63.0	9
March	59.0	8
April	50.6	6
May	196.3	14
June	257.6	18
July	534.2	22
August	474.1	23
September	482.8	21
October	276.5	18
November	264.8	18
December	202.3	16
Annual	2931.9	183

Source: PAGASA

2.3.1.1.3 Relative Humidity

Relative humidity refers to the amount of water vapour in the air, expressed as a percentage of the maximum amount that the air could hold at a given time. The mean annual relative humidity recorded at the Tanay Synoptic Station is 89% with seasonal variation (i.e. mean monthly relative humidity range of 85 to 93% from the period 1999-2012 data). Factors affecting humidity are changes in temperature and atmospheric circulation. The air is said to be saturated when it contains the maximum amount of water vapour possible at a given temperature. When the temperature of the air falls below the dew point, some

of the water vapour contained in the air condenses, clouds form, and precipitation can result in the form of rain.

2.3.1.1.4 Temperature

The annual average temperature is 23.1°C with January being the coldest month at an average of 21.4°C and May is the warmest with an average of 24.7°C.

The highest and lowest temperatures occur in the months of April to June and December to February, respectively. The annual maximum and minimum temperatures range from 24.4-24.3°C and 21.7-21.9°C, respectively.

Table 2.3-2 Climatological Average Values Recorded at Tanay Synoptic Station from 1999-2012

AVERAGE VALUES																
Station Name : TANAY, RIZAL											Latitude : 14°34'53.22" N					
Period : 1999-2012											Longitude: 121°22'09.30"E					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	
	Rainfall		Temperature									Wind			No. Days w/	
Month	Amount	No.	Max	Min	Mean	Dry	Wet	Dew	Vapor	Rel.	MSLP	DIR	SPD	Cloud	TSTM	LTNG
		of				Bulb	Bulb	Pt.	P r e s s u r e	H u m .				A m o u n t		
	(mm)	RD	(°C)	(°C)	(°C)	(°C)	(°C)	(°C)	(mbs)	%	(mbs)	(16 pt)	(mps)	(okta)		
JAN	70.7	10	24.2	18.6	21.4	21.0	19.7	19.1	22.3	89	1013.0	NE	4	5	0	1
FEB	63.0	9	24.9	18.8	21.9	21.3	20.0	19.4	22.6	89	1012.7	NE	4	5	1	1
MAR	59.0	8	26.4	19.4	22.9	22.3	20.7	20.0	23.6	87	1011.9	NE	3	5	2	2
APR	50.6	6	28.2	20.5	24.4	23.8	21.9	21.1	25.1	85	1010.8	NE	3	4	4	7
MAY	196.3	14	28.3	21.0	24.7	24.2	22.6	22.0	26.5	87	1008.8	W	3	6	15	15
JUN	257.6	18	27.4	21.1	24.3	23.8	22.6	22.1	26.7	90	1008.6	W	3	6	17	16
JUL	534.2	22	26.4	20.7	23.6	23.1	22.1	21.7	26.1	92	1007.9	W	3	6	15	13
AUG	474.1	23	25.8	20.5	23.2	22.9	22.1	21.8	26.1	93	1007.8	W	3	7	14	9
SEP	482.8	21	26.2	20.4	23.3	23.0	22.1	21.8	26.1	92	1008.3	W	3	7	14	13
OCT	276.5	18	26.2	20.4	23.3	22.9	21.8	21.4	25.4	91	1009.5	NE	3	6	10	13
NOV	264.8	18	25.6	19.9	22.8	22.4	21.3	20.8	24.7	91	1010.3	NE	3	6	5	7
DEC	202.3	16	24.3	19.1	21.7	21.5	20.4	19.9	23.3	90	1011.4	NE	4	6	1	1
ANNUAL	2931.9	183	26.2	20.0	23.1	22.7	21.4	20.9	24.9	89	1010.1	NE	3	6	98	98

Source: PAGASA

Climatological extreme values are from the 14-year monthly and annual summaries of temperature, rainfall, and wind speed in **Table 2.3-3**. The recorded annual extreme high and low temperature is 33.0°C and 13°C, respectively. The amount of extreme greatest rainfall is 331.8 mm while the extreme highest wind is 42 m/s.

2.3.1.1.5 Cyclone Frequency

The most number of cyclones occur during the months of June to December. These tropical cyclones are associated with the occurrence of low pressures areas (LPA) normally originating over the North Western Pacific Ocean side of the Philippine Area of Responsibility (PAR) and generally moving northwestward. Tropical cyclones also originate in the South China Sea or at the western part of the country, having unusual motions, and quite rare with 52 occurrences in fifty (50) years (Perez, 2001). PAGASA categorized these cyclones as tropical depressions (TD), with wind speeds up to 63 kph;

tropical storm (TS) with wind speeds from 64-117 kph, and tropical typhoon (TY), with wind speeds over 117 kph.

From 1948-2013 (period of 66 years) PAGASA determined an annual average of 20 tropical cyclones in the PAR with nine of these passing through the Philippine landmasses. Overall, PAGASA had tracked 137 tropical cyclones that crossed in the Province of Rizal up to 100 km boundary which is shown in **Figure 2.3-4**. However, the project site is under the medium typhoon risk area as shown in **Figure 2.3-5**.

Table 2.3-3 Climatological Extreme Recorded at Tanay Synoptic Station as of 2013



Republic of the Philippines
 Department of Science and Technology
Philippine Atmospheric, Geophysical and Astronomical Services Administration
Climatology and Agrometeorology Division
CLIMATE AND AGROMET DATA SECTION
 PAGASA Science Garden Complex, Agham Road, Diliman Quezon City, Philippines
 Telefax: (632)-434-2696

CLIMATOLOGICAL EXTREMES

STATION: **TANAY, RIZAL**
 YEAR: **AS OF 2017**

LATITUDE: **14°34'53.22"N**
 LONGITUDE: **121°22'09.30"E**
 ELEVATION: **650m**

MONTH	TEMPERATURE (°C)				GREATEST DAILY RAINFALL (mm)		STRONGEST WINDS (mps)			SEA LEVEL PRESSURES (mbs)			
	HIGH	DATE	LOW	DATE	AMOUNT	DATE	SPD	DIR	DATE	HIGH	DATE	LOW	DATE
JAN	28.1	01-28-2003	14.8	01-22-2003	62.2	01-18-2015	22	NNE	01-31-2011	1020.1	01-21-2005	1005.4	01-19-2006
										1020.1	01-24-2017		
FEB	29.5	02-11-2011	13.0	02-02-2007	79.8	02-22-2013	18	E	02-16-2013	1023.1	02-14-2017	1005.4	02-01-2001
MAR	31.0	03-28-2006	13.0	03-27-2012	52.8	03-01-2011	18	NNE	03-07-2004	1020.5	03-07-2005	1004.7	03-21-2004
	31.0	03-24-2016											
APR	32.5	04-25-2013	16.0	04-24-2012	98.8	04-25-2009	17	ENE	04-02-2017	1018.1	04-03-2017	1005.2	04-21-2001
			16.0	04-03-2017									
MAY	34.0	05-16-2014	15.5	05-22-2012	146.5	05-07-2009	17	NW	05-08-2011	1016.3	05-15-2011	1003.2	05-11-2008
JUNE	32.0	06-02-2014	15.0	06-13-2012	169.1	06-21-2008	25	SW	06-30-2004	1013.6	06-14-2017	994.9	06-21-2008
		06-03-2014								1013.2	06-27-2015		
JULY	31.5	07-20-2015	16.0	07-13-2007	204.2	07-05-2000	42	NNE	07-13-2010	1014.6	07-26-2015	993.8	07-04-2001
AUG	31.0	08-11-2017	13.5	08-06-2005	206.2	08-07-2007	25	W	08-21-2015	1014.3	08-15-2011	998.6	08-17-2001
SEP	29.5	09-01-2008	15.0	09-15-2005	331.8	09-26-2009	27	WNW	09-26-2011	1015.5	09-18-2005	994.1	09-26-2011
	29.5	09-27-2014											
OCT	30.1	10-07-2003	15.0	10-01-2006	204.6	10-28-2000	30	E	10-30-2009	1015.7	10-10-2011	916.5	10-28-2000
NOV	29.0	11-03-2003	15.0	11-13-2005	163.2	11-02-2000	30	N	11-02-2000	1017.4	11-28-2002	991.1	11-02-2000
	29.0	11-02-2014	15.0	11-18-2005									
	29.0	11-15-2017											
DEC	28.5	12-07-2012	13.5	12-09-2005	145.6	12-02-2004	24	NNE	12-08-2014	1018.7	12-28-2015	994.1	12-02-2004
ANNUAL	34.0	05-16-2014	13.0	02-02-2007	331.8	09-26-2009	42	NNE	07-13-2010	1023.1	02-14-2017	916.5	10-28-2000
			13.0	03-27-2012									
Period of Record	2000-2017				2000-2017		2000-2017			2000-2017			

PREPARED BY: **CADS/CAD/PAGASA**

Source: PAGASA

In September 26 of 2009, Typhoon Ondoy (International Code Name:"Ketsana") battered the City of Manila, pouring a month's worth of rain in half a day. As the rains persisted, major roads and



neighbourhoods were instantaneously flooded forcing people to scramble to higher grounds and structures. Media coverage of the typhoon vivified the terror of families on their rooftops as they desperately called for rescue, while other homes and cars were swept away by the deluge. Within hours, huge portions of Marikina, Pasig, Rizal and Quezon City became virtual extensions of rivers. In its wake, Typhoon Ondoy left 880,175 families severely affected, 682 casualties (337 dead, 308 injured and 37 missing), and damaged infrastructure and agriculture amounting to PhP 10.5 billion (National Disaster Coordinating Council, 2009).

Flood risk management includes different types of objectives that aim to provide protection in a particular community. One of which can be the number of measures that can be adapted for safety purposes. In addition, these measures may also lead to a multi-layer safety in which introduces flood risk probability-reducing instruments in a sense that prior measures are being implemented to contribute to the community's flood risk management before, during and after a typhoon. Loss mitigating measures, on the other hand, establish protection system in terms of an individual's very existence, assets and properties. Developing multi-layer safety varies among countries wherein it depends on the level of priority, awareness and preparedness. In the case of Philippines in which it is classified as a developing country, limited resources is one common dilemma that affects the overall flood management plan as well as the measures specified above (Esteban et al., 2015). On September 28, 2006, super typhoon Milenyo struck the Philippines that caused severe damages on different aspects of Filipino life. According to The Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA), Milenyo had maximum sustained winds of 130 kilometers per hour and gusts of up to 160 kilometers per hour which can be considered as a deadly typhoon. Milenyo had its first land fall on Samar Island which eventually moved further north where Bicol region suffered greatly on this disaster. Following Bicol, CALABARZON region that includes provinces of Cavite, Laguna, Batangas, Rizal and Quezon had also accumulated a large amount of damages. Generally, typhoon Milenyo had indeed caused torment to the lives of victims especially because their livelihood suffered which prevent them to recover immediately. Filipino households, on the other side, shouldered substantial amount of damages due to this disastrous event (Carnaje & Cabanilla, 2009).

Typhoon Mirinae or also called and known Typhoon Santi in the Philippines causes damages such as 39 people were killed and left roughly \$15.1 million in damage. According to PAGASA, Storm Santi intensified steadily, eventually becoming a Category 2 typhoon with peak winds of 105 mph (165 km/h). The eye of the typhoon was located at 145 km East Southeast of Baler, Aurora and has been forecasted moving West at 15kph. Typhoon Santi destroyed some of the agricultural areas of those living in the low-lying areas because of its strong winds. (Mallari, 2014).

For the year 2017, 22 cyclones visited the Philippines. Typhoon Paolo lasted the longest which stayed almost 6 days in October from Oct. 16 to 21.

Table 2.3-4 provides the list of tropical cyclones which crossed the Philippines in 2017.

Table 2.3-4: List of Tropical Cyclones which crossed the Philippines in 2017

**LIST OF TROPICAL CYCLONES WHICH CROSSED THE PHILIPPINES
 FOR THE YEAR 2017**

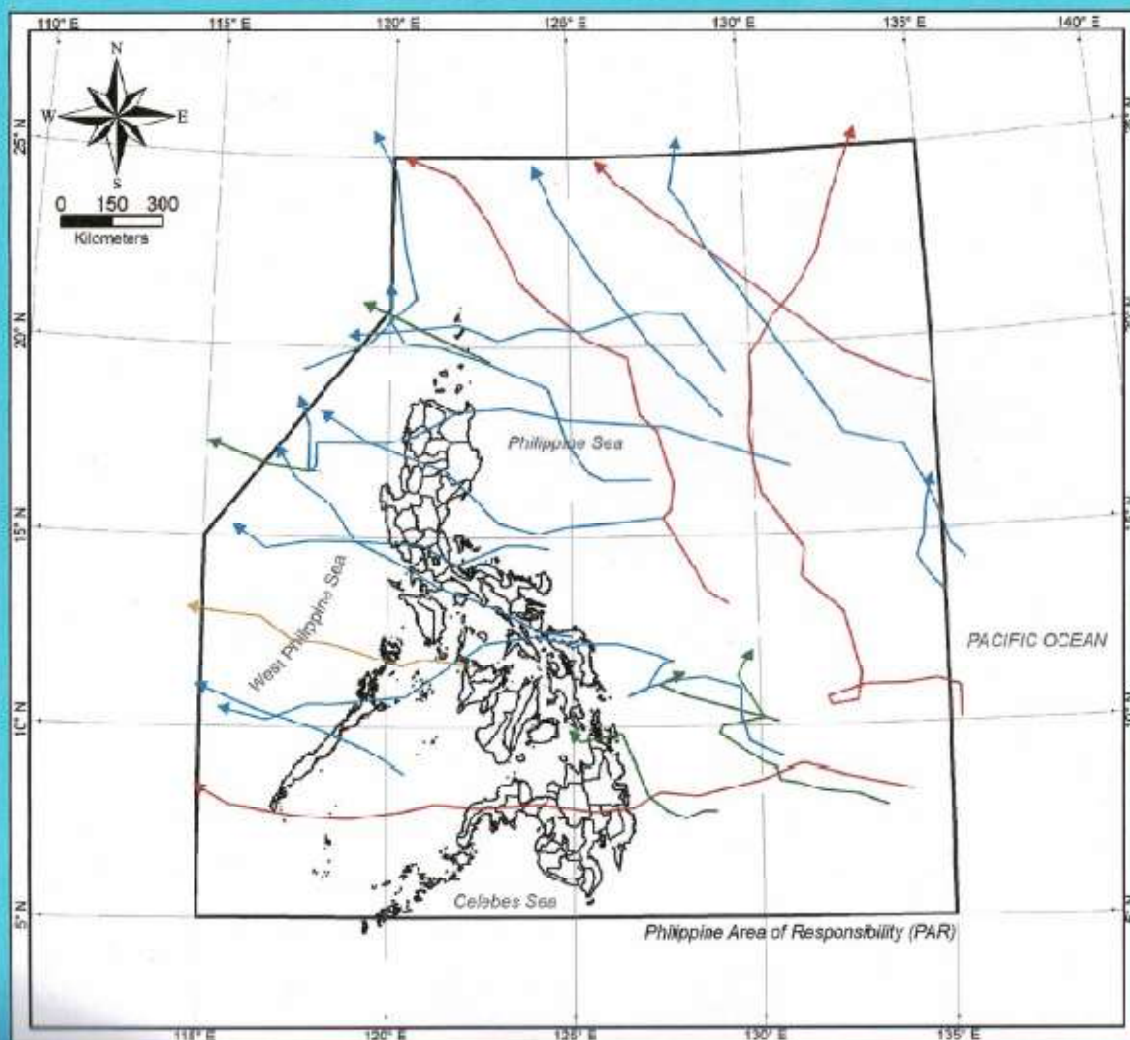
YEAR	MONTH	TYPE	TC NAME	PAR BEG	PAR END
2017	1	TD	AURING	1/7/2017	1/8/2017
2017	2	TD	BISING	2/3/2017	2/6/2017
2017	4	TD	CRISING	4/14/2017	4/15/2017
2017	4	TS	DANTE	4/26/2017	4/27/2017
2017	7	TS	EMONG	7/1/2017	7/2/2017
2017	7	TD	FABIAN	7/21/2017	7/22/2017
2017	7	TY	GORIO	7/25/2017	7/29/2017
2017	7	TS	HUANING	7/29/2017	7/30/2017
2017	8	TS	ISANG	8/20/2017	8/22/2017
2017	8	TS	JOLINA	8/24/2017	8/26/2017
2017	9	TS	KIKO	9/4/2017	9/6/2017
2017	9	TY	LANNIE	9/11/2017	9/13/2017
2017	9	TS	MARING	9/11/2017	9/13/2017
2017	9	TD	NANDO	9/23/2017	9/23/2017
2017	10	TS	ODETTE	10/11/2017	10/14/2017
2017	10	TY	PAOLO	10/16/2017	10/21/2017
2017	10	TS	QUEDAN	10/25/2017	10/28/2017
2017	10	STS	RAMIL	10/31/2017	11/2/2017
2017	11	TS	SALOME	11/8/2017	11/10/2017
2017	11	TS	TINO	11/17/2017	11/18/2017
2017	12	TS	URDUJA	12/13/2017	12/19/2017
2017	12	TY	VINTA	12/20/2017	12/24/2017

NOTE :

** means Tropical Cyclones with multiple entry in PAR

PREPARED BY: CADS/CAD/PAGASA

TRACKS OF TROPICAL CYCLONES WHICH CROSSED THE PHILIPPINES FOR THE YEAR 2017



Philippine Atmospheric,
 Geophysical and
 Astronomical Services
 Administration (PAGASA)

LEGEND:

- Tropical Depression
- Tropical Storm
- Severe Tropical Storm
- Typhoon
- Super Typhoon

Month	No of TC
January	1
February	1
March	0
April	2
May	0
June	0
July	4
August	2
September	4
October	4
November	?
December	2
TOTAL	22

TC Type	No of TC
Tropical Depression	5
Tropical Storm	12
Severe Tropical Storm	1
Typhoon	4
Super Typhoon	0
TOTAL	22

Projection:
 UTM Zone 61N

PREPARED BY:
 Climate and Agromete. Data
 Section (CADS)

Figure 2.3-4: Track of Tropical Cyclones

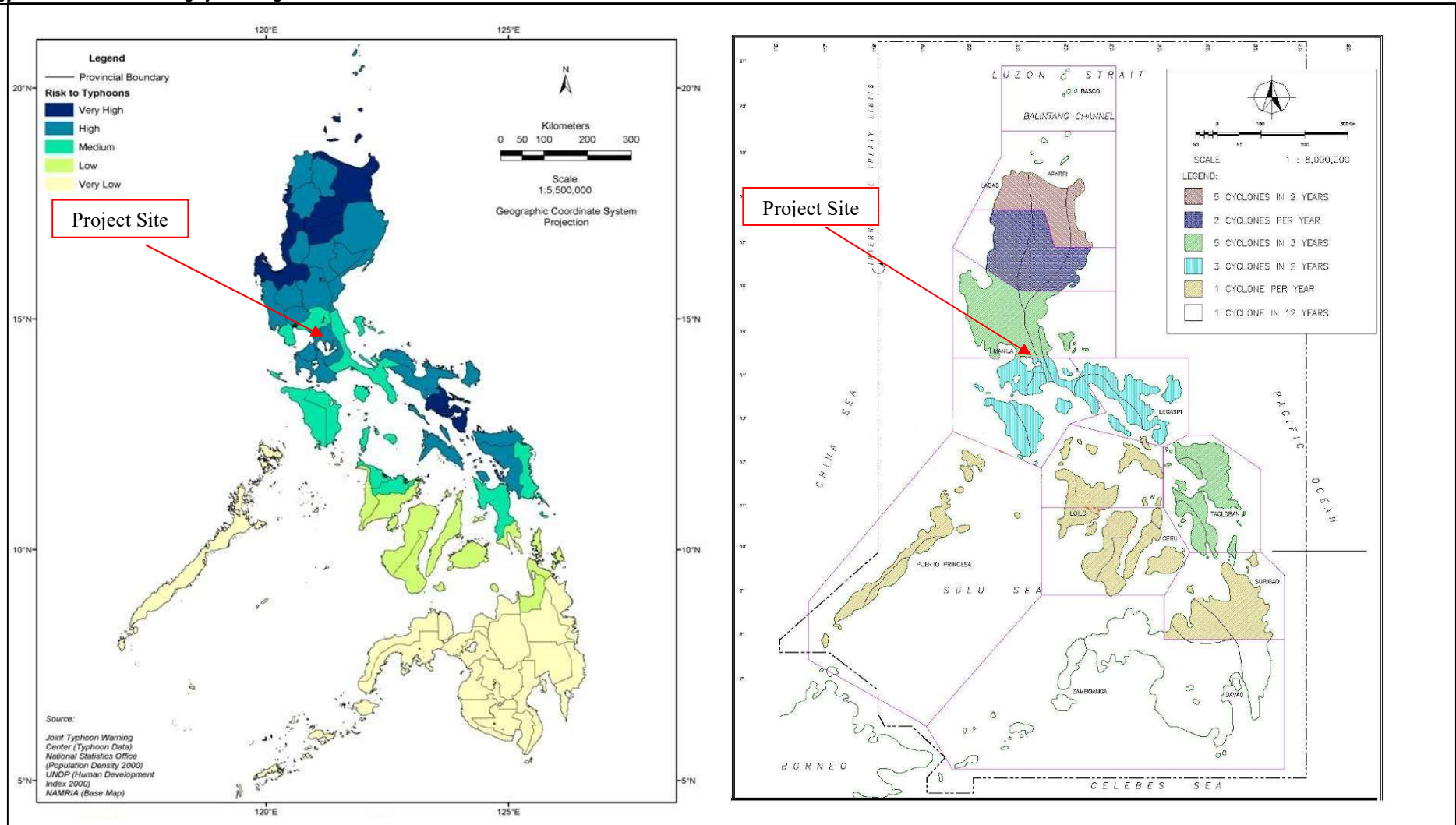


Figure 2.3-5 Philippine Typhoon Map (source: NAMRIA 2000)

2.3.1.1.6 Impact Assessment and Mitigation

2.3.1.1.6.1 Change in the Local Micro-Climate

Climate Change Projections for 202 and 2050

The climate change scenario for the Philippines published by PAGASA in February 2011 indicated that the Province of Rizal will have an increase and decrease in rainfall and an increase in mean temperature. It is projected that average daily ambient temperature over the period 2006–2035 will increase by 0.9°C to 1.1°C while temperature period 2036–2065 will increase by 1.8°C to 2.1°C.

The seasonal rainfall change in 2006–2035 will have an increase of 12.4% for the months of July–August while a decrease by 0.9 to 30.7% for the months of September to June. For the 2036–2065 rainfall change, there is an increase of 24.8% for the months of July to August while a decrease by 0.8 to 39.8% for the months of September to June.

The projected seasonal temperature increase and seasonal rainfall change events in 2020 and 2050 under the medium-range emission scenario in Rizal Province are presented in **Tables 2.3-4 & 2.3-5**, respectively.

Table 2.3-4 Seasonal Temperature increase (in °C) in 2020 and 2050 under medium range emission scenario in Rizal Province

Observed Baseline (1971-2000)				Change in 2020 (2006-2035)				Change in 2050 (2036-2065)			
DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
25.4	27.9	27.6	26.8	0.9	1.1	0.9	1.0	1.9	2.1	1.8	1.9

Source: Climate Change in the Philippines, 2011 PAGASA

Table 2.3-5 Seasonal rainfall change (in %) in 2020 and 2050 under medium range emission scenario in Rizal Province

Observed Baseline (1971-2000)				Change in 2020 (2006-2035)				Change in 2050 (2036-2065)			
DJF	MAM	JJA	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
262.4	241.5	1001.3	821.8	-13.1	-30.7	12.4	-0.9	-11.5	-39.8	24.8	-0.8

Source: Climate Change in the Philippines, 2011 PAGASA

Temperature Change

The historic average annual mean temperature projected values in 2020 is 27.9°C at PAGASA Tanay Synoptic Station. With climate change, it is projected that average daily ambient temperature over the period 2006–2035 will increase by 0.9°C to 1.1°C while temperature period 2036–2065 will increase by 1.8°C to 2.1°C as shown in **Table 2.3-4**.

Table 2.3-6 shows the monthly average temperature without climate change and **Table 2.3-7** is the calculated monthly average temperature with climate change (2006–2035) while **Table 2.3-8** with climate change (2036–2065).

Table 2.3-6 Monthly Average Temperature without Climate Change

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max	24.2	24.9	26.4	28.2	28.3	27.4	26.4	25.8	26.2	26.2	25.6	24.3
Min	18.6	18.8	19.4	20.5	21	21.1	20.7	20.5	20.4	20.4	19.9	19.1
Ave	21.4	21.9	22.9	24.4	24.7	24.3	23.6	23.2	23.3	23.3	22.8	21.7

Source: PAGASA Tanay Synoptic Station

Table 2.3-7 Monthly Average Temperature with Climate Change (2006-2035)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max	25.1	25.8	27.5	29.3	29.4	28.3	27.3	26.7	27.2	27.2	26.6	25.2
Min	19.5	19.7	20.5	21.6	22.1	22.0	21.6	21.4	21.4	21.4	20.9	20.0
Ave	22.3	22.8	24.0	25.5	25.8	25.2	24.5	24.1	24.3	24.3	23.8	22.6

Note: Calculated based in the PAGASA Climate Change in the Philippines, 2011

Table 2.3-8 Monthly Average Temperature with Climate Change (2036-2065)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max	26.1	26.8	28.5	30.3	30.4	29.2	28.2	27.6	28.1	28.1	27.5	26.2
Min	20.5	20.7	21.5	22.6	23.1	22.9	22.5	22.3	22.3	22.3	21.8	21.0
Ave	23.3	23.8	25.0	26.5	26.8	26.1	25.4	25.0	25.2	25.2	24.7	23.6

Note: Calculated based in the PAGASA Climate Change in the Philippines, 2011

With climate change, it is projected that average daily ambient temperature over the period 2006–2035 will increase by 0.9°C to 1.1°C while temperature period 2036-2065 will increase by 1.8°C to 2.1°C as shown in **Table 2.3-4**. The **Figures 2.3-6 & 2.3-7** below shows the graph of computed average temperature (Tave) with climate change (Tave CC) and without climate change (Tave base).

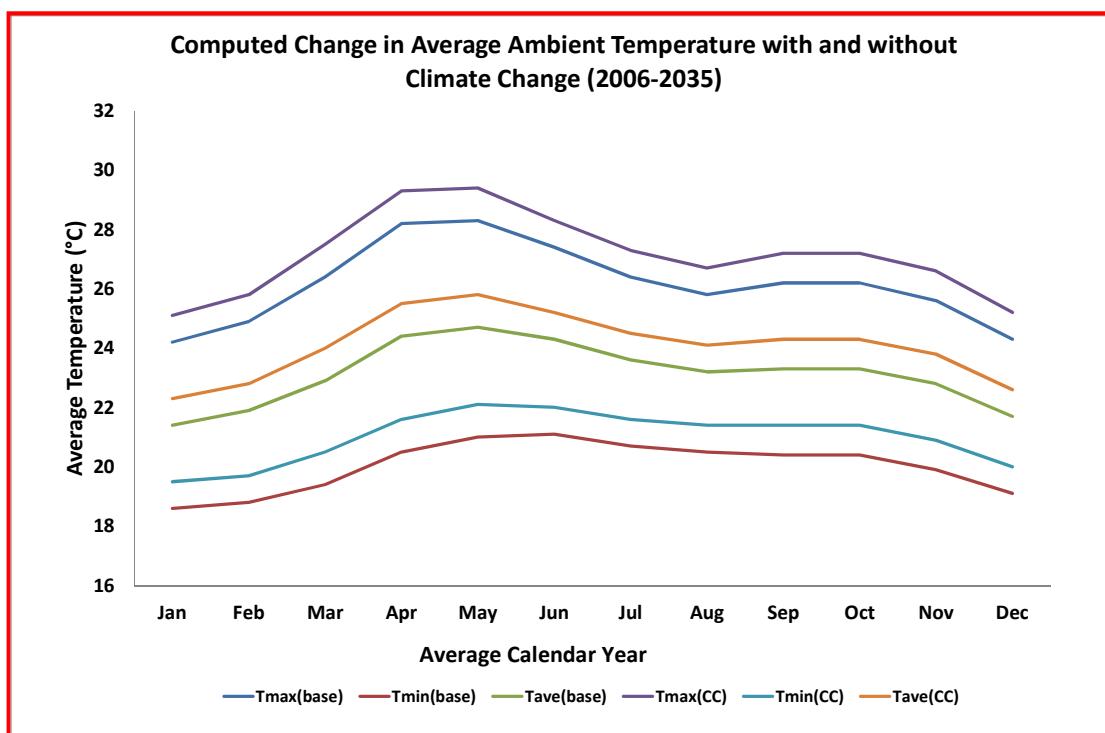


Figure 2.3-6: Graph of Computed Change in Temperature (2006-2035)

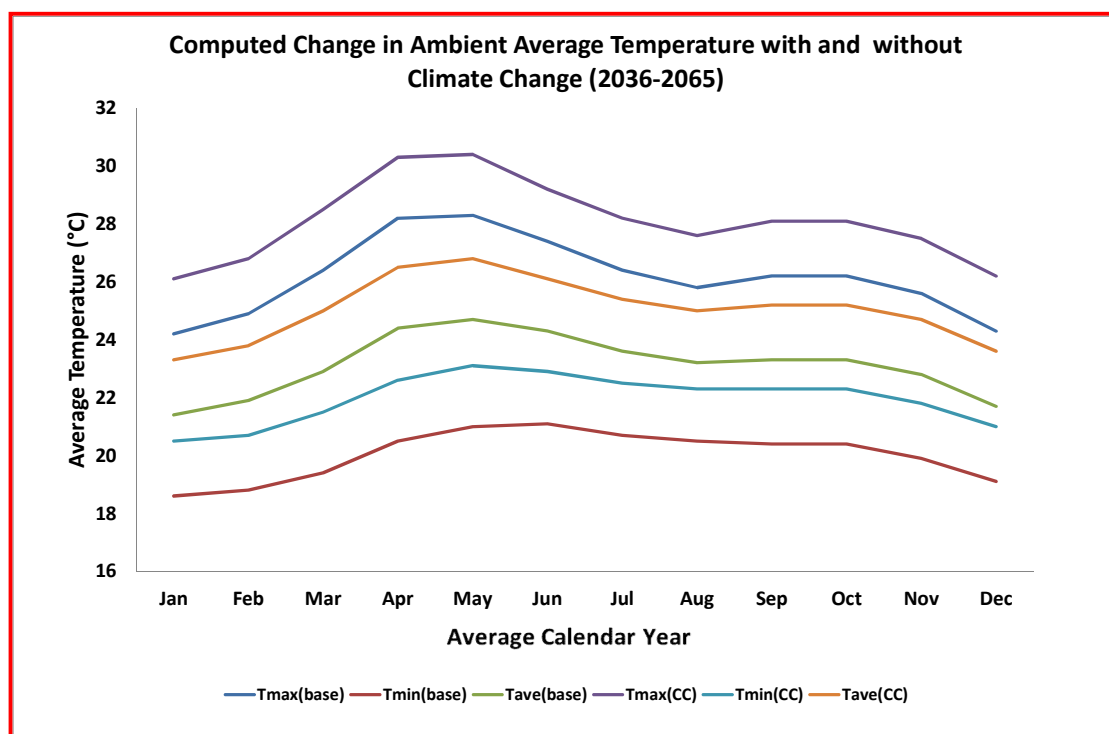


Figure 2.3-7: Graph of Computed Change in Temperature (2036-2065)

While climate change is a global phenomenon, intensity varies on spatial temporal basis and specific areas should tailor their own catchment management approaches and policies to cushion water resources and energy sector from the effect of climatic events like precipitation, temperature variation and evaporation rates.

Rainfall Change

Table 2.3-9 shows the monthly average rainfall without climate change and Table 2.3-10 is the calculated monthly average rainfall with climate change (2006-2035) while **Table 2.3-11** with climate change (2036-2065).

Table 2.3-9 Monthly Average Rainfall without Climate Change (1980-2010)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ave	70.7	63.0	59.0	50.6	196.3	257.6	534.2	474.1	482.8	276.5	264.8	202.3

Source: PAGASA Tanay Synoptic Station

Table 2.3-10 Monthly Average Rainfall with Climate Change (2006-2035)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ave	61.4	54.7	40.9	35.1	136.0	289.5	600.4	532.9	478.5	274.0	262.4	175.8

Note: Calculated based on the PAGASA Climate Change in the Philippines, 2011

Table 2.3-11 Monthly Average Rainfall with Climate Change (2006-2065)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ave	62.6	55.8	35.5	30.5	118.2	321.5	666.7	591.7	478.9	274.3	262.7	179.0

Note: Calculated based on the PAGASA Climate Change in the Philippines, 2011

With climate change, the projected average rainfall over the period 2006–2035 will decrease by 0.9-30.7% from the months of December to May, however, a significant increase of 12.4% from July to August will occur on the rainy season. The projected rainfall for period 2036-2065 will have a decrease by 0.8-39.8% from December to May and a significant increase of 24.8% will occur during the rainy period of July to August. **Figure 2.3-8** shows the graph of computed average rainfall with and without climate change.

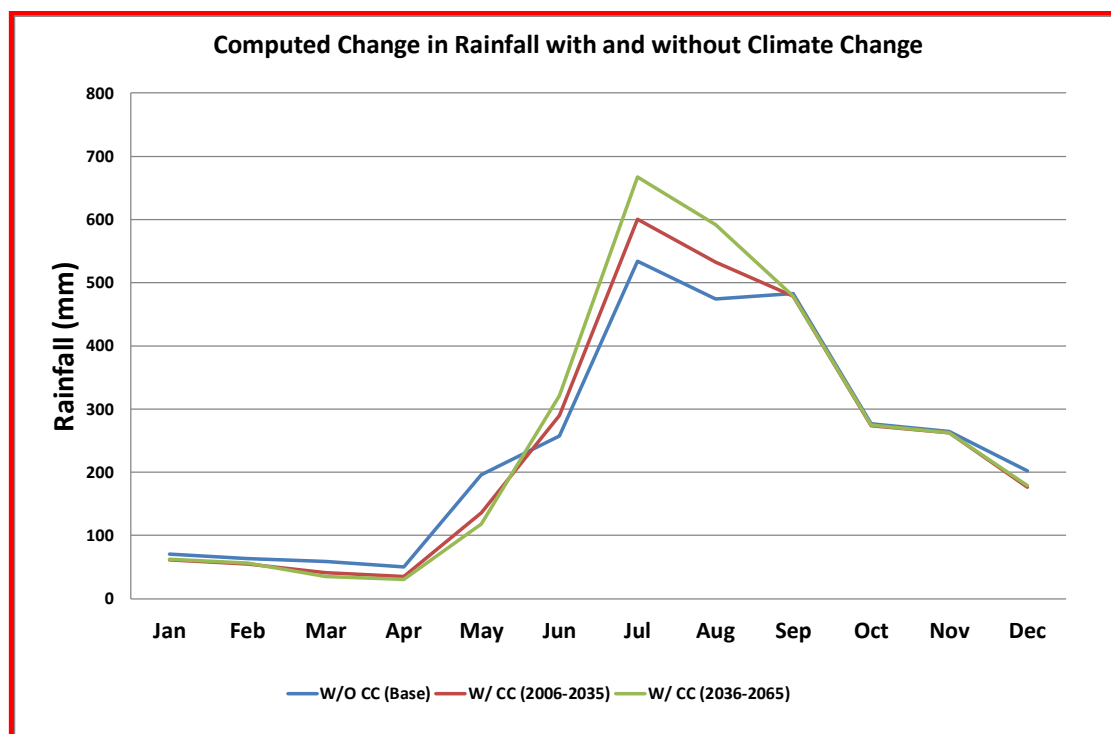


Figure 2.3-8: Computed Average Rainfall with and Without Climate Change

2.3.1.2 Contribution in Terms of Greenhouse Gas Emissions

One of the most important environmental changes now in progress is a buildup of atmospheric carbon dioxide (CO₂). Undoubtedly, the added CO₂ in the atmosphere is coming from the burning of fossil fuels, the cutting of forests and the wastage of soil humus (the colloidal organic complex in the soil). The main outcome of the buildup is likely to be a change climate, notably toward greater warmth. The atmospheric CO₂ content is usually measured in terms of its concentration relative to all other gases in parts per million by volume (ppmv).

The buildup of greenhouse gases inevitably influences the temperature of the atmosphere and the earth's surface. Carbon dioxide emits and absorbs radiation at wavelengths typical of the earth atmosphere. If its concentration increases, the atmosphere offers increased resistance to the necessary escape of radiation to space.

The IPCC Guidelines provide a general approach to estimate CO₂ emissions from quarrying, in which the amount of clinker produced is multiplied by an emission factor.

The total overall estimated CO₂ emission based on IPCC 2006 is 2 million metric tons per year. The Philippines Initial National Communication (INC) on Climate Change has projected 122,344 Gg of CO₂ for 2008. Using these projections of INC, the Project operation is expected to contribute an approximately 1.6576% of the total CO₂ emission. In the global levels projection of CO₂ emission for 2020 under the United States Environmental Protection Agency (USEPA) Sectoral Trend in Global Energy Use and Greenhouse Gas Emissions, Climate Protection Division, Office of Air and Radiation, the estimated contribution of the Project globally is 0.0278%. When such a comparison is made, this total emerges as a small contribution to the total global anthropogenic CO₂ load. If this total is a measure of responsibility for global warming, on an absolute magnitude, the Project can still be considered to be on the low-end greenhouse gas emitters in the world.

Table 2.3-13 INC/SNC Data

Year	Gg CO ₂ /yr	GHG %
Global Level^a		
2000	6,118,000	0.0331
2010	7,936,000	0.0256
2020	9,042,000	0.0224
Energy Sector		
SNC		
2000	69,667	2.9110
2020	100,402	2.0199
INC		
2008 (Projected)	122,344	1.6576

Note: ^a – Sectoral Trend in Global Energy Use and Greenhouse Gas Emissions

Climate Protection Division, Office of Air and Radiation, US EPA, 2006

INC – Initial National Communication on Climate Change

SNC – Second National Communication on Climate Change

2.3.2 Air Quality and Noise

2.3.2.1 Degradation of air quality

Baseline Environmental Condition

IQAC established three (3) ambient air quality monitoring station. The monitoring stations are also used to monitor noise level. The establishment of the air quality and noise level monitoring stations is part of the compliance plan based on the issued ECC. The collected ambient air and noise data generated from the said stations are used to represent the baseline data of the Proposed Quarry Project. Station identification and geographical location are presented in **Table 2.3-14**, while **Figure 2.3-9** shows the location of the stations.

Table 2.3-14 Station Identification for Ambient Air Quality & Noise Monitoring

Sampling Station Name/Description	Latitude	Longitude	Parameters Tested*	
			Ambient	Noise
Station A1 - Within Aggregates Operation	14°31'25.08" N	121°11'47.43" E	TSP, PM ₁₀ , NO ₂ , SO ₂ , CO	Yes
Station A2 - Near Pantok/East - Ridge Side	14°31'43.19" N	121°11'49.78" E	TSP, PM ₁₀ , NO ₂ , SO ₂ , CO	Yes
Station A3 - Quarry Area	14°31'13.82" N	121°11'43.75" E	TSP, PM ₁₀ , NO ₂ , SO ₂ , CO	Yes

*TSP = Total Suspended Particulate Matter; PM₁₀ = Particulate Matter at 10µ; NO₂ = Nitrogen Dioxide; SO₂ = Sulfur Dioxide; CO = Carbon Monoxide

Table 2.3.15: Observed Ambient Air Concentrations of parameters listed on Table 1.A in comparison with the NAAQS/ NAAQGV (in µg/Ncm)

Station No.	Location	Date and Time of Sampling	TSP	PM10	CO	NO ₂	SO ₂
A1	Within Aggregates Operation	25-Mar-17	412	146.9	ND	13.6	ND
		1320H - 1420H					
A2	Near Pantok/East - Ridge Side	25-Mar-17	51.2	8.9	ND	11.4	ND
		1445H - 1545H					
A3	Quarry Area	25-Mar-17	52.8	7.8	ND	ND	ND
		1610H - 1710H					
DENR Standard (NAAQS/NAAQGV)		1-hr Sampling	300	200	30	260	340

ND = Detected or Below the Instrument/Method Detection Limits for CO = 1ppm; NO₂ = 0.25µg; SO₂ = 0.60µg

Environmental Performance Report and Management Plan

Calabar Quarry Operations Project

Island Quarry and Aggregates Corporation (IQAC)

Brgys. Pantok and Palangoy, Binangonan, Rizal



The exceedance in TSP in station A1 was brought about by the truck passing through the area when he sampling was conducted. However, immediately, water cannons were deployed to mitigate the dust emission.

Table 2.3.16 presents the results of sampling and analysis conducted from the three (3) stations in comparison with the NAAQS/NAAQGV prescribed limit under Republic Act 8749 (Clean Air Act) Implementing Rules and Regulations.

Table 2.3.16: Ambient Air Monitoring Result/Conclusion

Parameters	Result/Conclusion
TSP	All Stations Passed except Station 1 Exceeded the DENR Standard
PM10	All Stations Passed the DENR Standard
NO ₂	All Stations Passed the DENR Standard
SO ₂	All Stations Passed the DENR Standard
CO	All Stations Passed the DENR Standard

Table 2.3.17: Observed 1-hour Noise Level Propagation in Decibels dB(A) at three (3) monitoring points

Station No.	Location	Noise Level (Leq), dB(A)	DENR Standard Maximum Allowable Noise Level, dB(A) *
A1	Within Aggregates Operation	66.6	75
A2	Near Pantok/East - Ridge Side	54.7	75
A3	Quarry Area	50.9	75

* Class "D" (A Section which is primarily reserved as a heavy industrial area)

Table 2.3.18 present the results of noise level monitoring recorded in decibels dB(A) [Logarithmic equivalent (L_{eq}) form]. The results are compared with the DENR Ambient Noise Quality Standards Sec. 78 Chapter IV, Article 1 of National Pollution Control Commission (NPCC) Rules and Regulations, 1978 standard limits for class D category.

Table 2.3.18: Noise Monitoring Result/Conclusion

Station Name/Description	Result/Conclusion
Station A1 - Within Aggregates Operation	Passed the DENR Standard
Station A2 - Near Pantok/East - Ridge Side	Passed the DENR Standard
Station A3 - Quarry Area	Passed the DENR Standard

REMARKS

Noise monitoring was conducted on a 1-hour monitoring. Measurement of each station was conducted 4 times every 15 minutes for 1 hour so that a representative reading of noise level propagation will be monitored with respect to the time increment based on a 1-hour monitoring test. Monitoring was conducted on a sunny weather associated with light to moderate winds. The prevailing winds at the time of sampling came mostly from Southwest to Northeast (SW-NE) and West to East (W-E) directions.

2.3.2.2 Impact Assessment and Mitigation

• Construction Phase

Construction operations are significant source of dust emissions that may have a substantial temporary impact on local air quality. This emission source category includes both residential and non-residential construction as well as road construction. Dust emissions during the construction of buildings or roads are associated with land clearing, drilling and blasting, ground excavation, and cut and fill operations (i.e., earth moving). Dust emissions can vary substantially from day to day, depending on the level of activity, the specific operations, and the prevailing meteorological conditions. A significant amount of the dust emissions results from construction vehicle traffic over temporary roads at construction sites.



Possible sources of air pollution from construction activities will consist of the following:

- Truck loading and unloading;
- Bulldozing;
- Dust from vehicle moving on unpaved road; and
- Site erosion.

Management Measures

A dust particle is a potential environmental impact during construction activities such as removal of the surface layers of the soil. The generated dust particles will increase the concentration of TSP and PM₁₀ that will lead to health hazard for workers and surrounding resident at close proximity to the project site. All construction related emissions would be temporary and vary from day to day depending on the type of work being done.

During construction, emissions of TSP & PM₁₀ are expected to generate mainly from soil excavation, vehicle traffic on unpaved road, bulldozing, and site erosion.

The following measures are recommended to minimize fugitive dust emission from construction activities:

- ***Access Road***

Every main haul road (i.e. any course inside a construction site having a vehicle passing rate of higher than four (4) in any 30 minutes should be paved with concrete, bituminous materials, hardcores or metal plates, and kept clear of dusty materials; or sprayed with water or a dust suppression chemical so as to maintain the entire road surface wet; and

The portion of any road leading only to a construction site that is within 30 m of a discernible or designated vehicle entrance or exit should be kept clear of dusty materials.

- ***Use of Vehicle***

Immediately before leaving a construction site, every vehicle should be washed to remove any dusty materials from its body and wheels; and

Where a vehicle leaving a construction site is carrying a load of dusty materials, the load should be covered entirely by clean impervious sheeting to ensure that the dusty materials do not leak from the vehicle.

- ***Excavation and Earth Moving***

The working area of any excavation or earth moving operation should be sprayed with water or a dusty suppression chemical immediately before, during and immediately after the operation so as to maintain the entire surface wet; and

Exposed earth shall be properly treated by compaction, turfing, hydroseeding, vegetation planting or sealing with latex, vinyl, bitumen, shotcrete or other suitable surface stabilizer within 6 months after the last construction activity on the construction site or part of the construction site where the exposed earth lies.

- ***Stockpiling of Dusty Materials***

Any stockpile of dusty material should be either covered entirely by impervious sheeting; placed in an area sheltered on the top and the three (3) sides; or sprayed with water or a dust suppression chemical so as to maintain the entire surface wet.

- **Operation Phase**

Particulate matter (PM & PM₁₀), and carbon monoxide (CO) are the primary emissions in quarrying. Emissions may also include residual materials from the fuel and raw materials or products of incomplete combustion that are considered to be hazardous. The following air pollutants and causes of emission are described below.

The largest emission source of PM are from quarrying and crushing, storage area, and unloading facilities.



The rate of carbon monoxide (CO) emissions from combustion sources depends on the oxidation efficiency of the fuel. By controlling the combustion process carefully, CO emissions can be minimized. Thus, if a unit is operated improperly or not well maintained, the resulting concentrations of CO (as well as organic compounds) may increase by several orders of magnitude.

The presence of CO in the exhaust gas of combustion system results principally from incomplete fuel combustion. Several conditions can lead to incomplete combustion, including insufficient oxygen (O₂) availability; poor fuel/air mixing; cold-wall flame quenching; reduced combustion temperature; decreased combustion gas residence time; and load reduction (i.e., reduced combustion intensity). Since various combustion modifications for NO_x reduction can produce one or more of the above conditions, the possibility of increased CO emissions is a concern for environmental, energy efficiency and operational reasons.

Greenhouse gas specifically carbon dioxide (CO₂) is produced during fuel oil combustion. CO₂ emissions from quarrying are generated through calcining of limestone or other calcareous material.

The current air quality management measures being implemented are still effective. However, immediate and prompt implementation of mitigation measures for air emission are required to avoid proliferation of dust in the air.

2.3.2.3 Increase in ambient noise level

2.3.2.3.1 Baseline Environmental Condition

The main sources of noise and vibration will be the equipment during construction and vehicle operations. There will be a short term noise that will be created by the operations of the construction equipment. This equipment may consist of earth moving machines such as, graders, trucks, scrapers, generators and compressors.

2.3.2.3.2 Impact Assessment and Mitigation

- Development Phase

Quantitative Analysis

During construction phase, noise will be generated by the heavy equipment and earth moving activities. Initially, vegetation in the area is graded or cut using chainsaws and mowers. Trucks are used to haul away material that cannot be stockpiled or disposed on-site and to bring in necessary construction materials. Typical construction vehicles include bucket trucks, cranes or digger derricks, backhoes, pulling machines, pole trailers, or dumpsters. Foundation structures are constructed using a standard drill rig to bore a hole to the required depth. If water is encountered, pumps will be used to move the water to either adjacent low land areas or to waiting tanker trucks for proper disposal. After the construction is completed, the project area is graded up to the desired level and cleaned up.

All of these operations produce noise that may impact adjacent communities/residential areas within the immediate vicinity of the project. However, normal work schedules usually restrict noise producing activities to daytime hours.

The mechanical equipment and its equivalent sound power levels are presented in Table 46. The equipment listed in the table is the typical equipment used during construction. As a worst case scenario for this modeling, it is assumed that all equipment listed is running at the same time during construction. The predicted noise measurement for construction activities were determined by summing logarithmically the sound power levels. Since there is no EMB published noise modeling guidelines and procedures, the computation used are based on international technical guidelines and procedures.

This assessment was carried out based upon the preliminary estimates of likely construction activities, plant selection and utilization. In the absence of reference, the noise data for individual items of construction equipment (in terms of source Sound Power Level (PWL) was taken from Hong Kong Environmental Protection Department's "Technical Memorandum on Noise from Construction Work other than Percussive Piling and Technical Memorandum of Noise from Percussive Piling."

An inventory of typical equipment items expected to be used during the construction phase and their indicative sound power levels are presented below.

Table 2.3.4.2.1: Equivalent PWL of Power Mechanical Equipment during Construction Phase

Power Mechanical Equipment	PWL, dB(A)
Jackhammer	104
Air compressor	96
Bulldozer	89
Lejeune gun	89
Backhoe	86
Forklift	85
Hand hammer	85
Chopsaw	80
Truck	78
Heavy-duty bulldozer	99
Vibrating road roller	97
Crawler crane <35 ton Non-insulated cab	94
Laborers	90
Power shovel	88
Shop work	95
Dozer	102
Paver	90
Front-end loader	90
Roller	98
Heavy equipment	90
Crushing plant	102

Source: Neitzel, R., N. Seixas, M. Yost, and J. Camp., 1998

Based on Table 2.3.4.2.1, the highest sound power level among these construction equipment is 104dB(A).

The modeling guidelines used is the Technical Memorandum on Noise of Hongkong Environmental Protection Department, Noise Control Authority. Noise levels should be summed in a pairwise fashion and the final total rounded to the nearest whole dB(A), with values of 0.5 or more being rounded up.

Table 5 shows the summation of noise levels. The summed noise assumed to be at the centre of the project site.

Table 5 - Summation of Noise Levels

Difference in dB(A) Between Two Noise Levels Being Summed	Amount in dB(A) to Add to the Higher Noise Level
0 to 0.5	3.0
1.0 to 1.5	2.5
2.0 to 3.0	2.0
3.5 to 4.5	1.5
5.0 to 7.0	1.0
7.5 to 12.0	0.5
More than 12.0	0

Source: Technical Memorandum on Noise, Hongkong Environmental Protection Department

The total power level takes into account assumed maximum numbers of equipment and an assumed 'on-time' for the equipment, that is, period in percentage terms during which the equipment will be operating. Construction or development activities are predicted to be its worst case scenario where 24-hour operation is expected.

Provided below is the ambient air and noise quality sampling map.

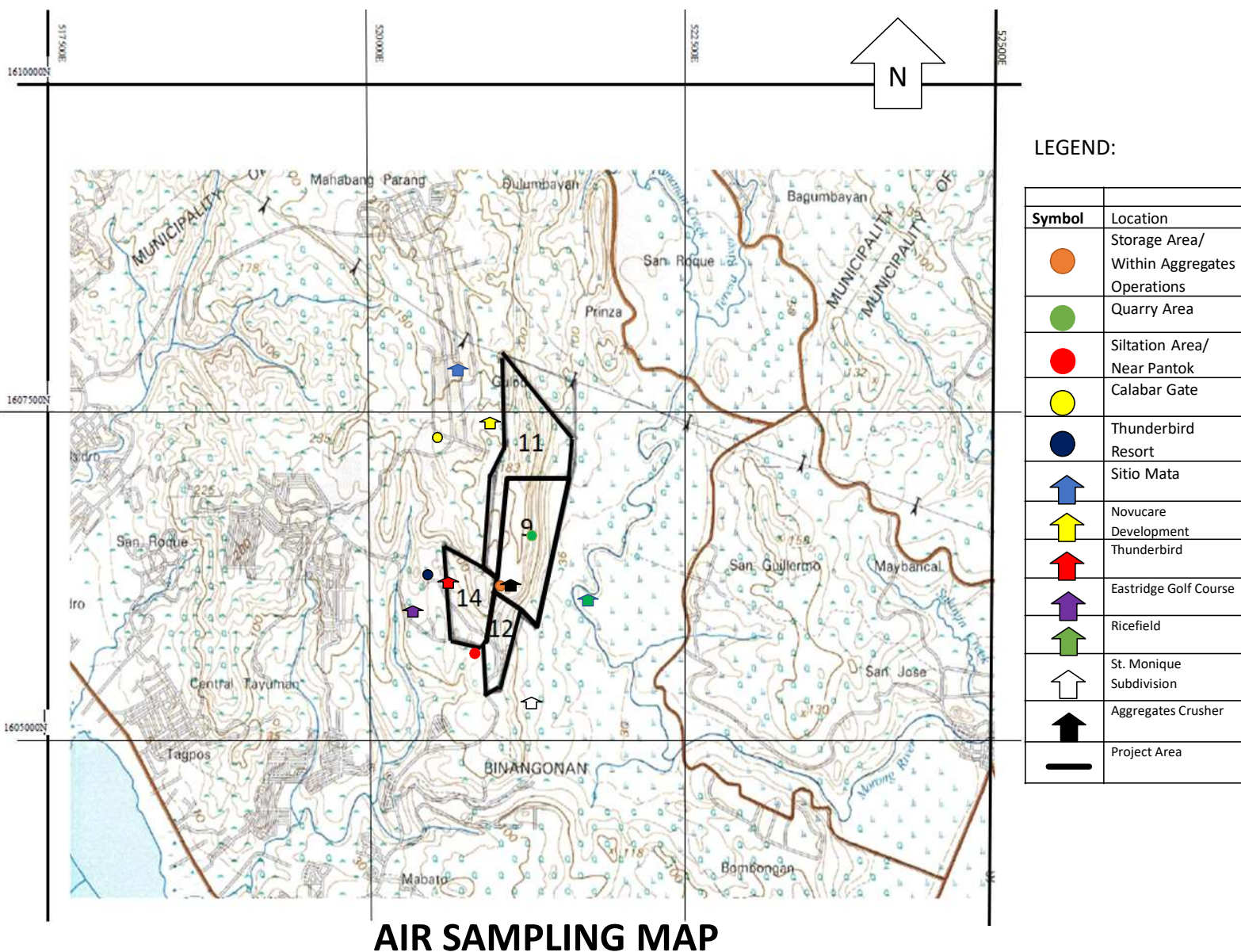


Figure 2.3.2.1: Ambient Air and Noise Sampling Map

Management and Mitigation Measures

The need for the following measures should be considered prior to commencement of construction activities:

- Scheduling certain high noise emitting works to more acceptable times of day;
- Use of the most environmentally acceptable equipment which is properly maintained and silenced;
- Use of the least intrusive method of work;
- Proper instruction and supervision of staff; and
- Acoustic screening.

The following are the noise control measures that will be applied for the protection of employees working on site as well as the nearest sensitive receptor:



- It is advisable that electrically powered plant should be preferred, where practicable, to mechanically powered alternatives. If mechanically powered plant will be used, it should be fitted with suitable silencers and mufflers;
- Defective equipment/parts with abnormal noise and/or vibration will be either repaired or replaced;
- Schedule use of equipment/machines emitting high noise like pile driver during day time operation while, minimize use during night time operation;
- All employees working on site will be provided with proper ear protectors;
- During truck transport along or beside the residential area, traffic transportation will be limited during night operation; and
- The Contractor shall at all times comply with all current statutory environmental legislation.

Operation Phase

Quantitative Analysis

The sound power level during operation was assumed to be at steady state base load and bypass operations and will not consider following activities:

- Commissioning phase;
- Failure conditions;
- Emergency conditions; and
- Other abnormal operating conditions.

The sound levels derived/anticipated for each equipment item identified during the operation of the quarrying activity were based on the given equipment noise data/sizes/dimensions.

2.4 PEOPLE

2.4.1 Impact Area

The Municipality of Binangonan has a total of forty (40) barangays, 23 mainland and 17 island barangays. It is located at 37 kilometers from Manila with a total land area of 7,270 hectares. As of 2015, Binangonan has a projected population of 282,474 residents with 146,530 registered voters. A local income of P129,072,269.79 and an IRA of P223,810,958.00 (C.Y. 2012).

The direct impact area is Barangays Pantok and Palangoy where the Project areas are located.

Demography

Provided below is the demographic profile of Binangonan, Rizal.

Table 2.4.1: Demographic profile of Binangonan, Rizal

Region	REGION IV-A (CALABARZON)	Code	040000000
Province	RIZAL	Code	045800000
Municipality/City	BINANGONAN	Code	045804000
Income Classification:	1st Class	Registered Voters (2010): 126,981	
Population : (as of May 1, 2010): 249,872			
District:	1st		



Barangays (Number: 40)

Name	Code	Urban/Rural	Population (as of May 1, 2010)
Bangad	045804001	Urban	1,505
Batingan	045804002	Urban	12,999
Bilibiran	045804003	Urban	15,490
Binitagan	045804004	Urban	680
Bombong	045804005	Urban	2,932
Buhangin	045804006	Urban	2,086
Calumpang	045804007	Urban	15,793
Ginoong Sanay	045804009	Urban	1,588
Gulod	045804010	Urban	1,184
Habagatan	045804011	Urban	1,587
Ithan	045804012	Urban	2,907
Janosa	045804013	Urban	2,606
Kalawaan	045804014	Urban	28,611
Kalinawan	045804015	Urban	2,023
Kasile	045804016	Urban	502
Kaytome	045804017	Urban	2,241
Kinaboogan	045804018	Urban	1,164
Kinagatan	045804019	Urban	1,442
Libis (Pob.)	045804020	Urban	6,668
Limbon-limbon	045804021	Urban	1,457
Lunsad	045804022	Urban	10,375
Mahabang Parang	045804023	Urban	7,228
Macamot	045804024	Urban	8,168
Mambog	045804025	Urban	7,614
Palangoy	045804026	Urban	13,505
Pantok	045804027	Urban	13,110
Pila Pila	045804028	Urban	8,247
Pinagdilawan	045804029	Urban	664
Pipindan	045804030	Urban	2,841
Rayap	045804031	Urban	1,886
Sapang	045804032	Urban	2,050
Tabon	045804033	Urban	834
Tagpos	045804034	Urban	12,332
Tatala	045804035	Urban	7,256
Tayuman	045804036	Urban	10,825
Layunan (Pob.)	045804037	Urban	3,370
Libid (Pob.)	045804038	Urban	7,085
Malakaban	045804039	Urban	1,197
Pag-Asa	045804040	Urban	15,392
San Carlos	045804041	Rural	10,428

Notes:

1. Figures on registered voters are partial data from Commission on Elections (COMELEC) which may still be subject to corrections/adjustments from their field offices
2. Figures on registered voters exclude data on absentee voters.
3. Figures on registered voters are as of January 2010.



4. PSGC Information are as of 31 December 2017.
5. Income Classification based on Department of Finance Department Order No.23-08 Effective July 29, 2008.
6. Urban/rural classification based on 2000 CPH, Report No. 4 Urban Population, National Statistics Office, June 2006.
7. Legislative District Source: Records and Statistics Division, Commission on Elections (COMELEC): As of May 2013.
8. Population (as of May 1, 2010): a) Total Population Count by Region, Province, City/Municipality and Barangay as of May 1, 2010 ; b) Population of Highly Urbanized Cities (HUCs) are excluded in the total population of their respective provinces but are included in the regional total; and c) Population of barangays with boundary disputes are excluded in total population of their respective municipalities and cities but are included in the provincial and regional total.

Source: 2010 Census of Population: Philippine Statistics Authority (PSA)

Indigenous Peoples and Informal Settlers

There are no IPs at the project site in Brgys. Pantok and Palangoy. However, the Proponent has identified a total of eight (8) informal settler households occupying the perimeter of the property covered by Transfer Certificate of Title (TCT) No. M-112715 registered in the name of the Proponent. The informal settlers are found along the edge of the northern portion of the said property and occupy approximately 1,000 square meters of the property. They hold no legal document entitling them to possess the property. Their occupation of the same is by mere tolerance of the Proponent. The said informal settlers are aware of the rights of the Proponent over the property and have signified their intent to vacate once the Proponent requires the property for its operations. IQAC is proposing a Relocation Area for these informal settlers which are located within and in the adjacent municipality which were also identified as relocation areas of IQAC for its other project areas.

Perception survey was conducted in September 2017. The Host barangays, Pantok and Palangoy were surveyed including the specific residential areas/subdivisions within these barangays such as St. Monique and Eastridge and nearby/neighborhood barangays such as Darangan also in Binangonan, Rizal and Mahabang Parang in Angono, Rizal. Results of the survey show that most residents are concerned on the environmental effects of the project especially generation of dust and impact of blasting.

Survey Questions

Questions in the survey covered the following:

- | | |
|----------------------------------|--|
| • Name | • Type of House |
| • Age | • Type of Toilet |
| • Gender | • Source of Drinking Water |
| • Address | • Kinds of kitchen utensils |
| • Occupation | • Kinds of appliances |
| • Monthly income | • Illnesses experienced |
| • Religious affiliation | • Occurrence of calamities |
| • Civil status | • Garbage Disposal |
| • Educational attainment | • Perception about the Current Environmental Conditions |
| • Number of family members | • Awareness on the Proposed Project |
| • Place of work | • Impacts of Proposed Power Project: Positive and Negative |
| • Number of years earning income | • Perception and attitude towards the Project |
| • Length of stay in the area | |
| • Intention to out-migrate | |

Copy of the survey questionnaire is provided in Annex Q.

Perception Survey Result

SOCIO PROFILE

St. Monique Subdivision, Brgy. Pantok, Binangonan, Rizal

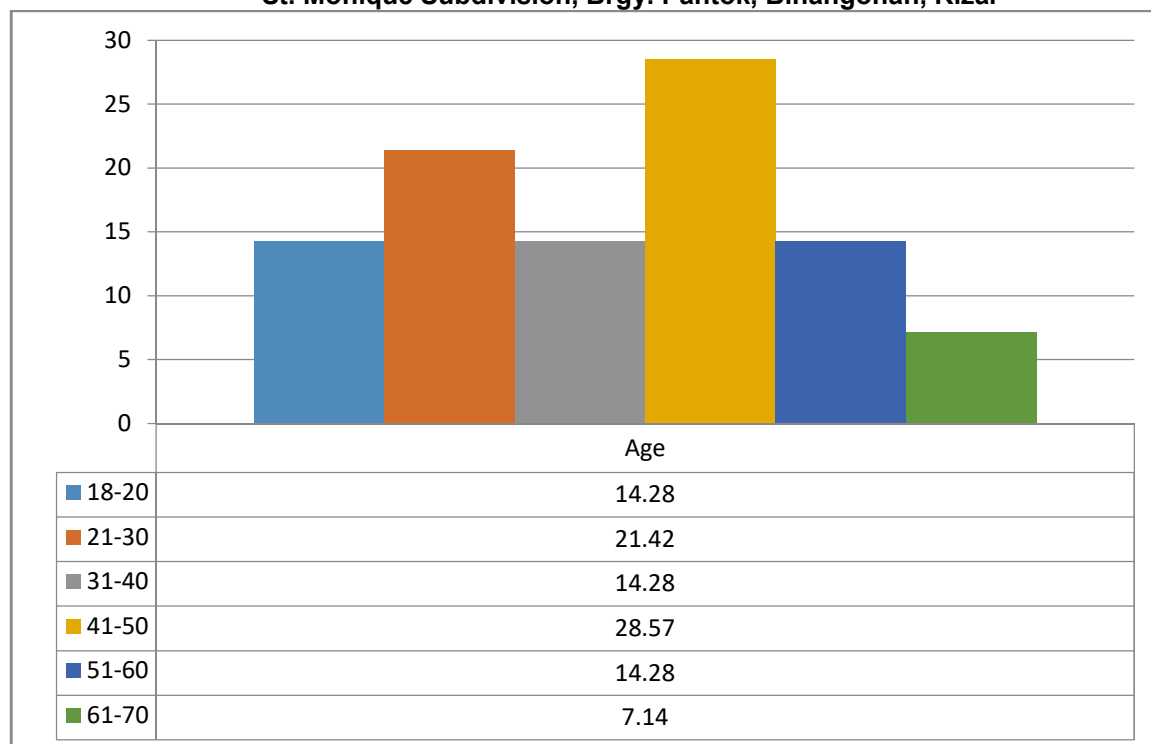


Figure 1: Age

Gender

Most respondents are female accounting for 64.28% of the survey population.

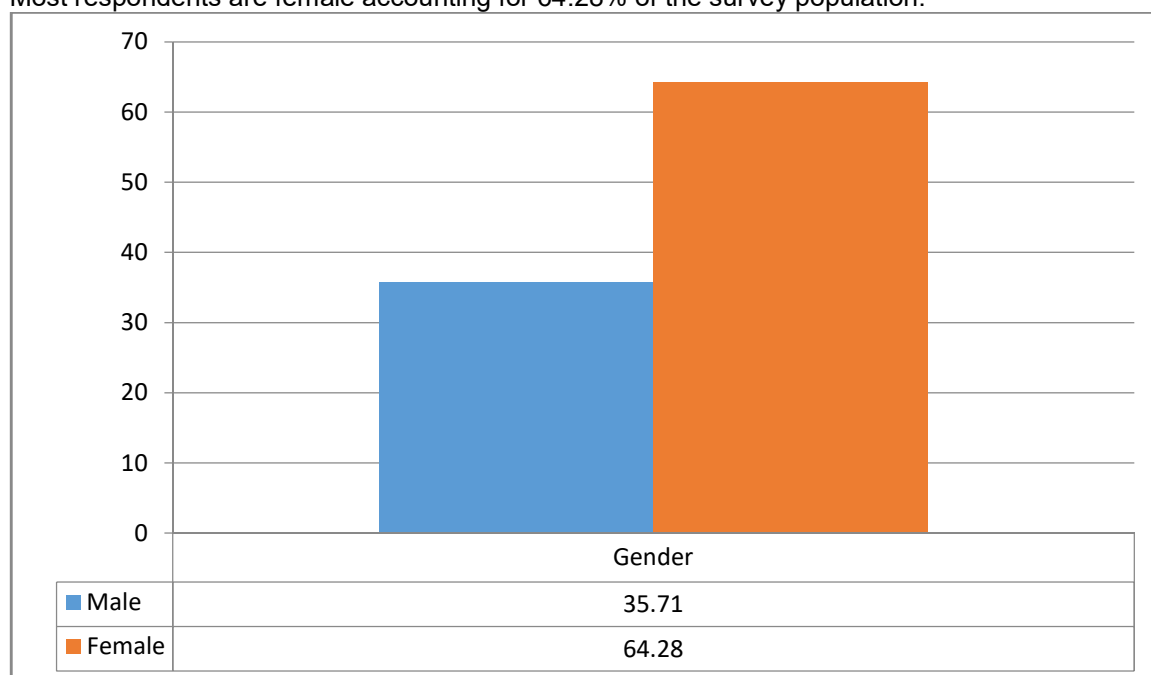


Figure 2: Gender

Occupation

35.71% of the respondents were unemployed, 28.57% have their own livelihood. And the rest of the respondents are government employees and laborer.

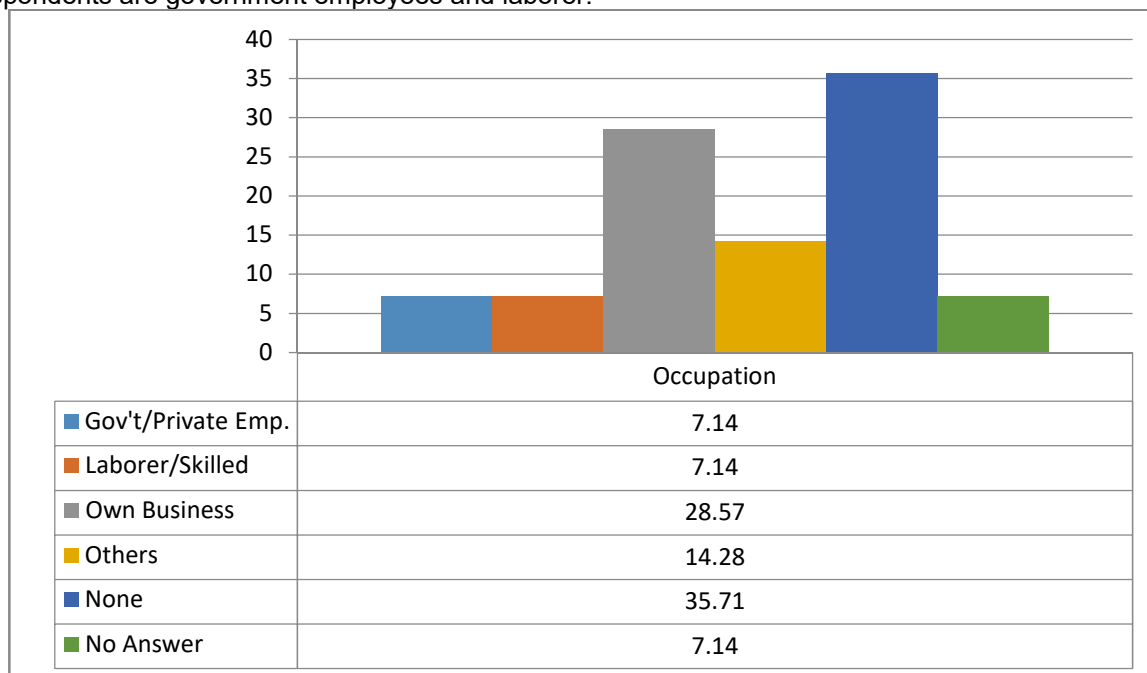


Figure 3: Occupation

Monthly Income

28.57% of the respondents are earning 10000 and above monthly, 14.28 earn 1-5000, 7.14% earn 5000-10000 monthly, and 21.42% of the respondents did not provide the response.

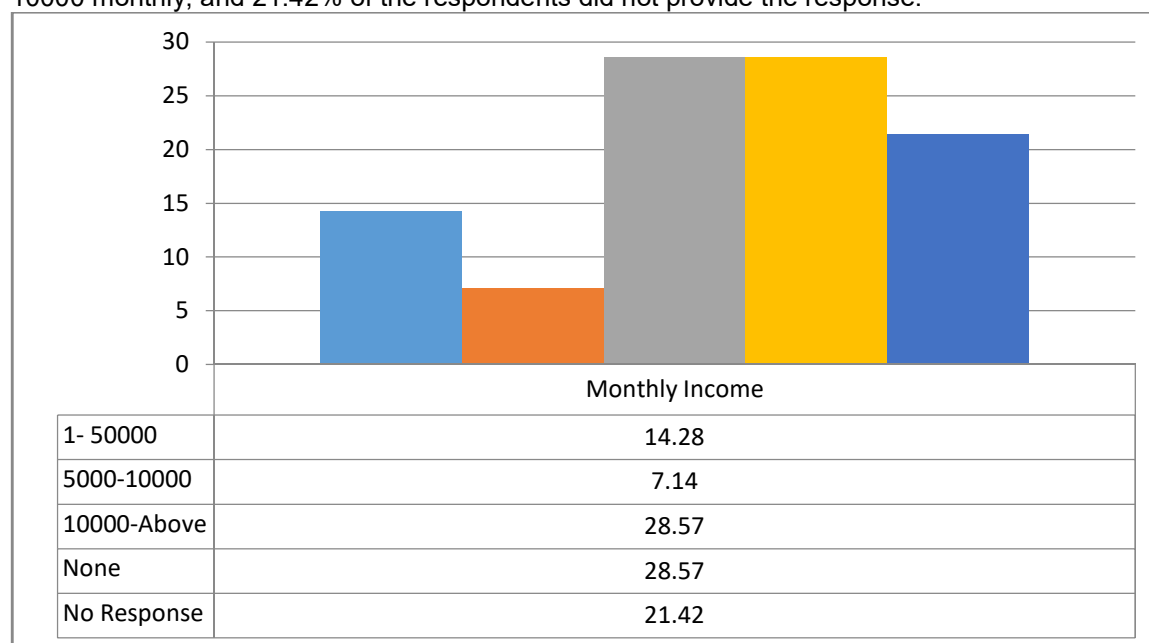


Figure 4: Monthly Income

Religion

Most of the Respondents are Catholic accounted for 57.14%.

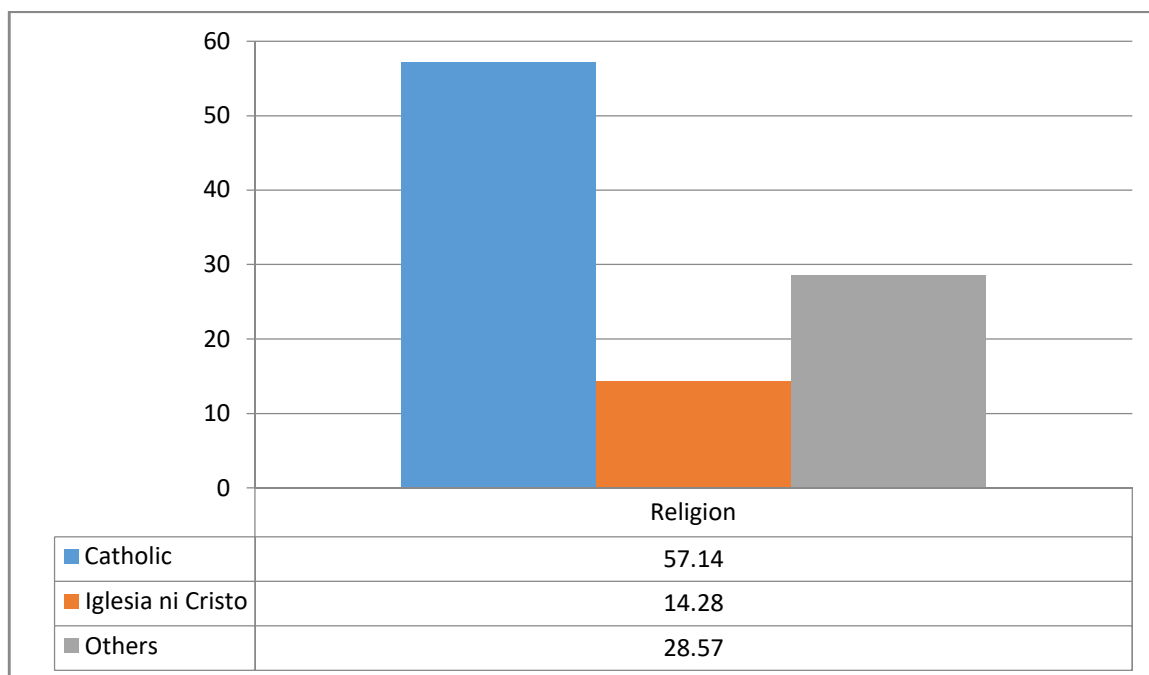


Figure 5: Religion

Educational Attainment

The respondents were mostly college graduate ranging 71.42%, then 14.28% of the respondents are highschool graduate.

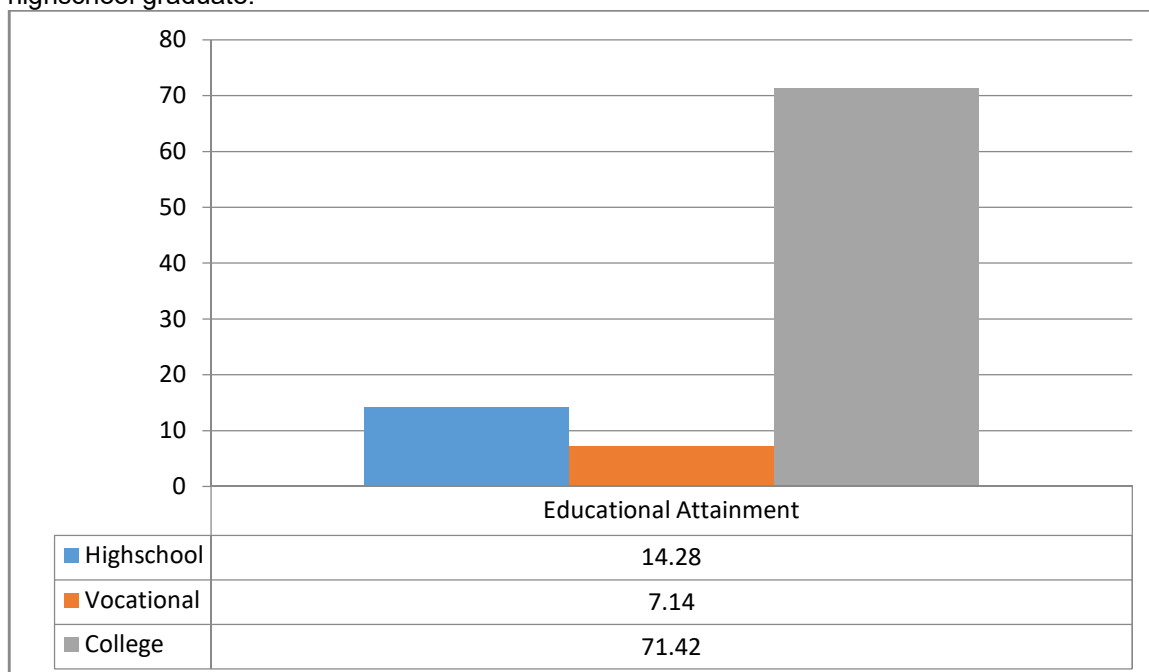


Figure 6: Educational Attainment

Civil Status

Most of the respondents were Married 71.42%, and 28.57% of the respondents are single.

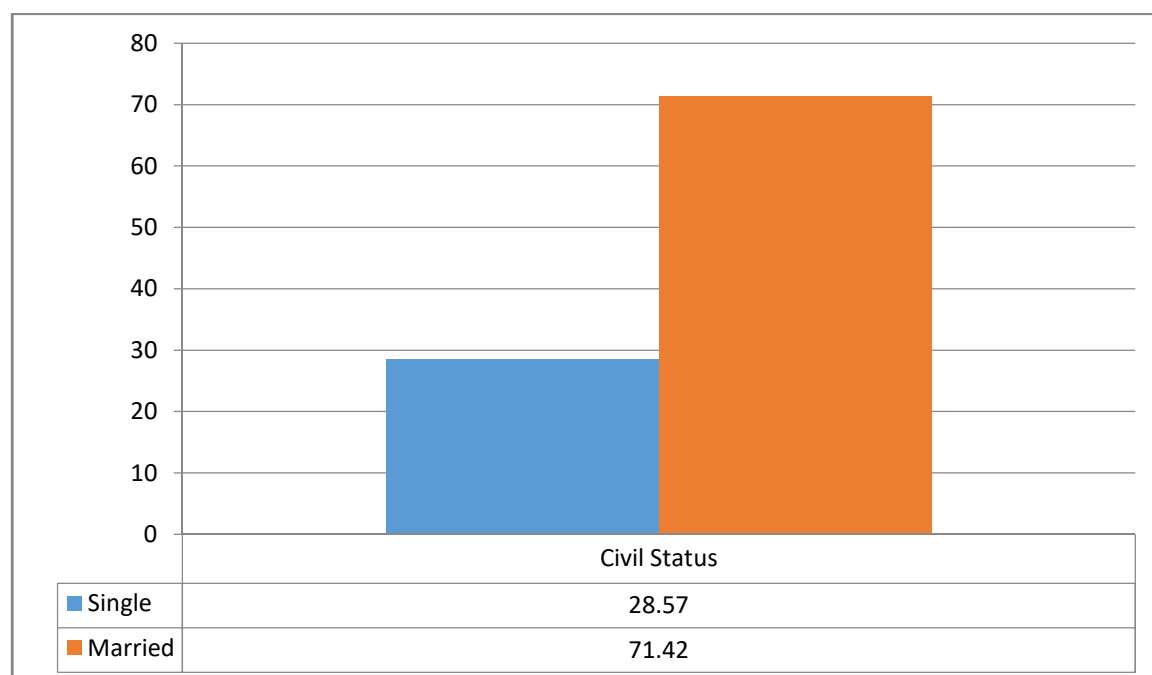


Figure 7: Civil Status

No. Of Family Members

64.28% of the respondents have members of the family from 2 to 5, while 35.71% have 6 to 10 members.

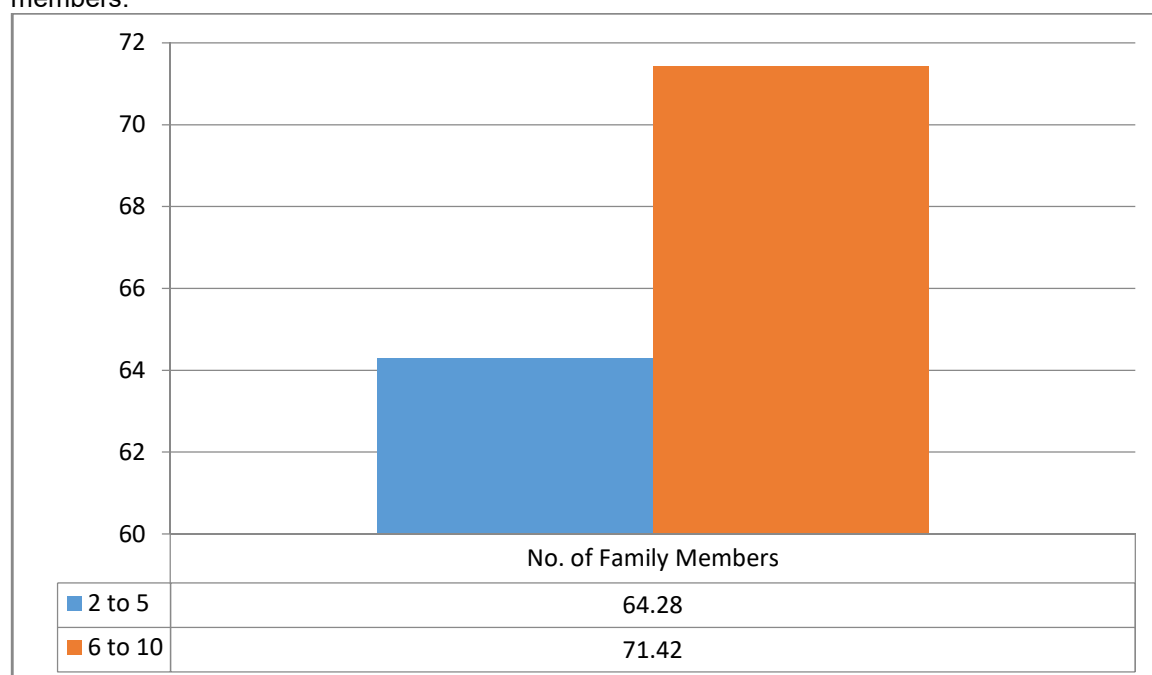


Figure 7: No. of Family Members

Origin

44.28% of the respondents are locals of Brgy. Pantok, while the rest of the respondents are not locals and used to lived in Makati, Quezon City, Caloocan, Taguig, Cainta, and Bicol.

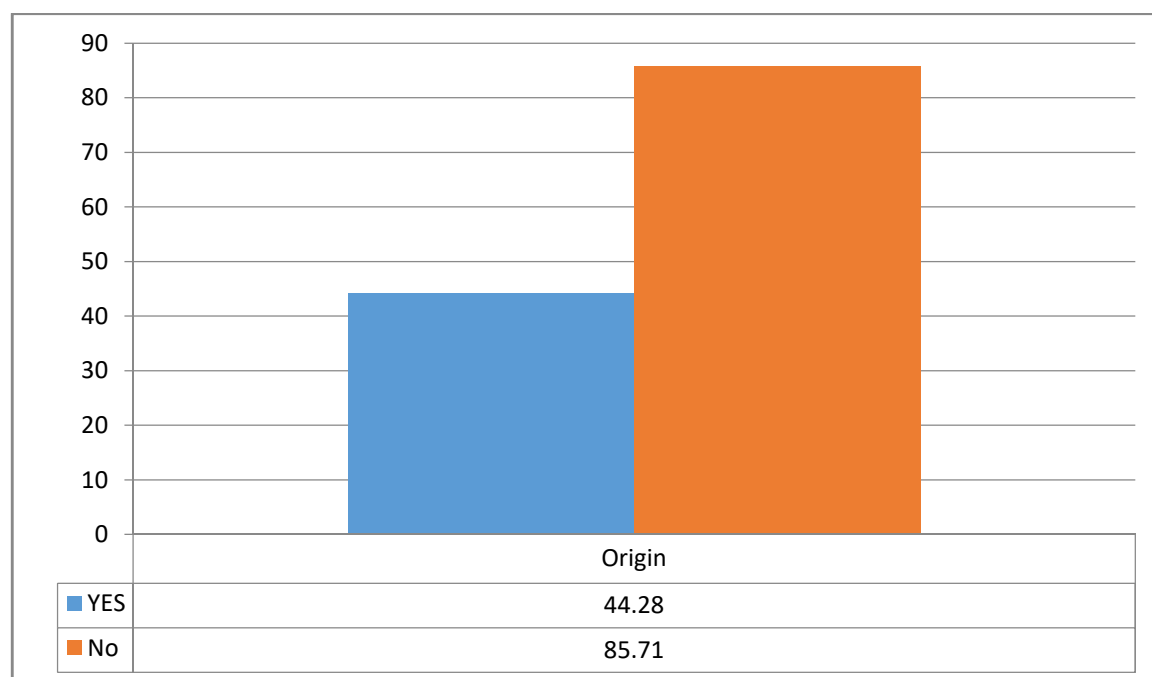


Figure 8: Origin

No. of years Staying in the area

35.71% of the respondents lived in Brgy. Pantok from 10 to 15 years, while 7.14 of the respondents said they are living in the area for 1 to 10 years, 42.85% have no response.

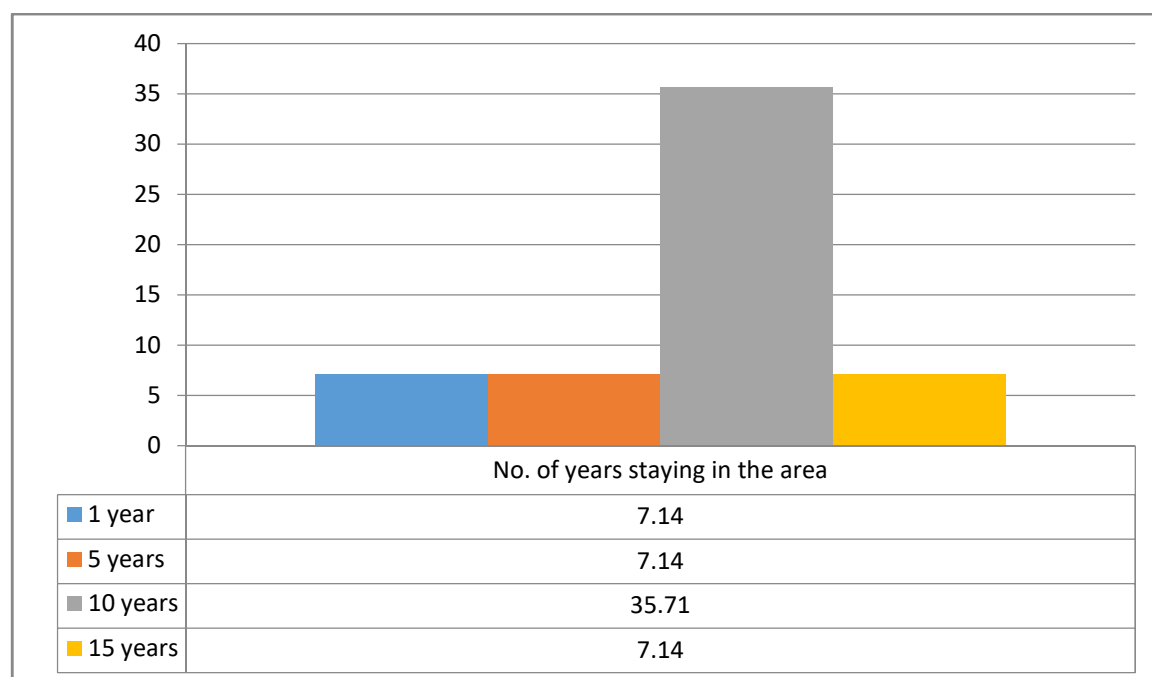


Figure 9: No. of Years staying in the area

Sources of Water:

For drinking and cooking: 50% of the respondents get their water from Nawasa/Mineral, then the other half have no response. For farming: 100% of the respondents have no response. For Washing Clothes, most of the respondents have no answer, while 14.28% of the respondents washed their clothes with water from Nawasa.

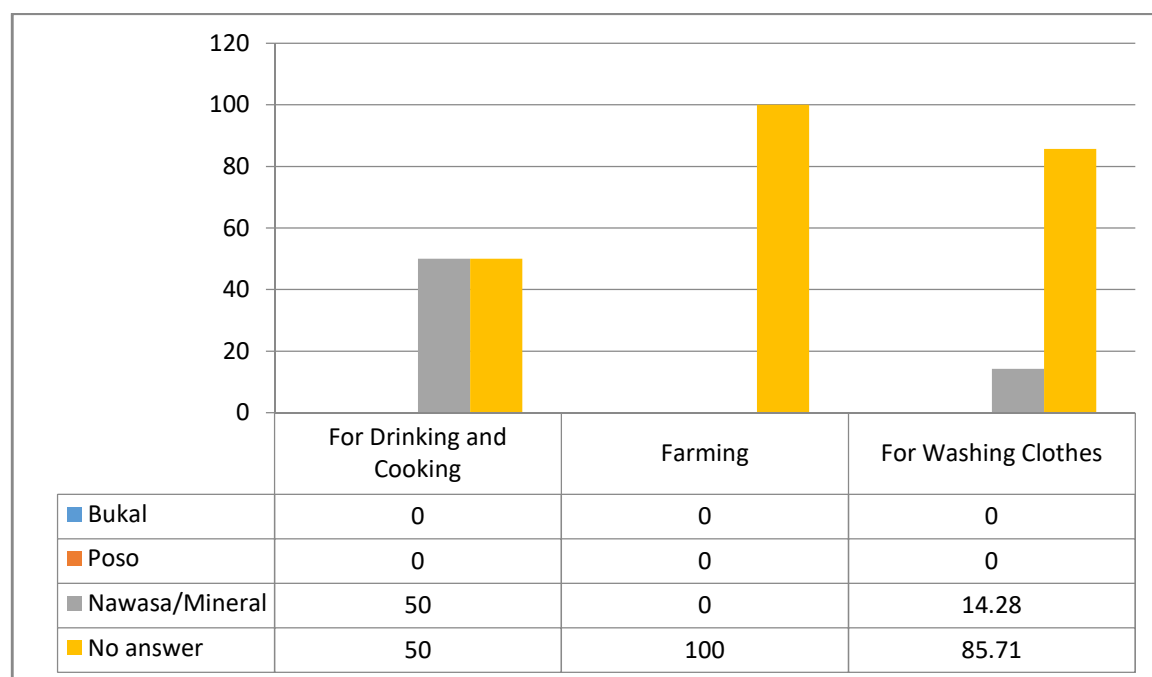


Figure 10: Sources of Water

Type of Vehicle

Majority of the respondents have Motorcycle, 14.28% have the other types of vehicle, 21.42% have no vehicle, and 14.28% have no answer.

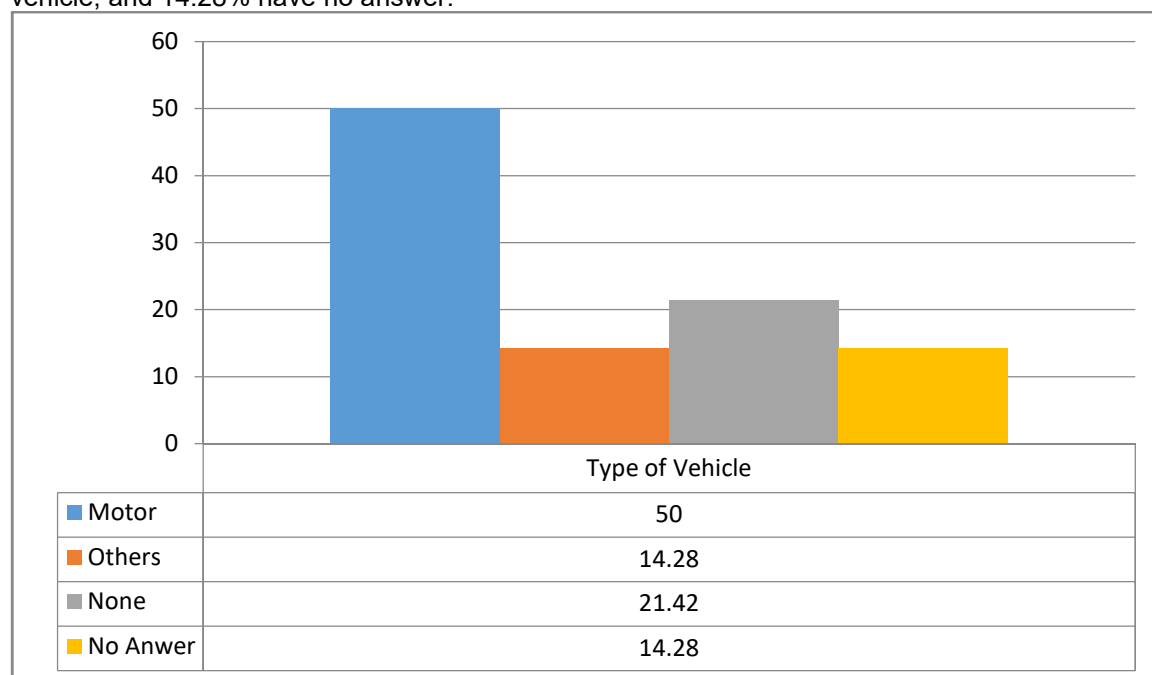


Figure 11: Type of Vehicle

Comfort Room

85.71% of the respondents used water Closet, while 14.28% used open pit.

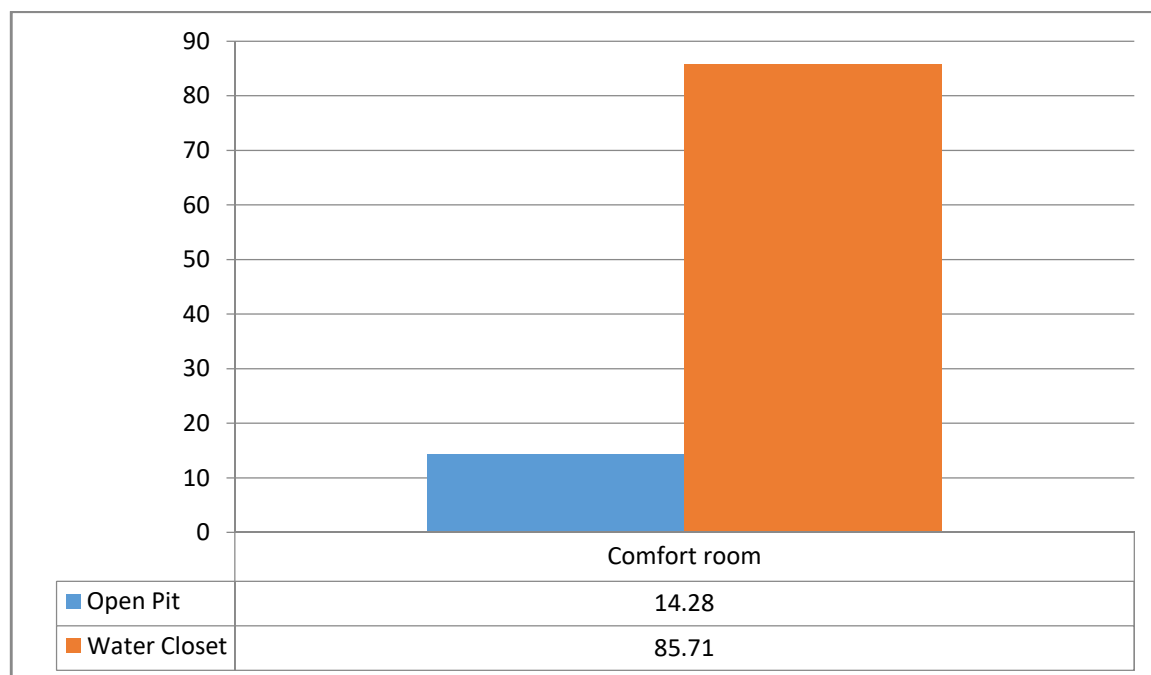


Figure 12: Comfort Room

Calamities Experienced

Majority of the respondents did not experience calamities. 42.85% respondents said Yes and 57.14 respondents said No. these include typhoon and earthquake. Following are some of the ways they did to confront the situation:

- Pray together
- No Response

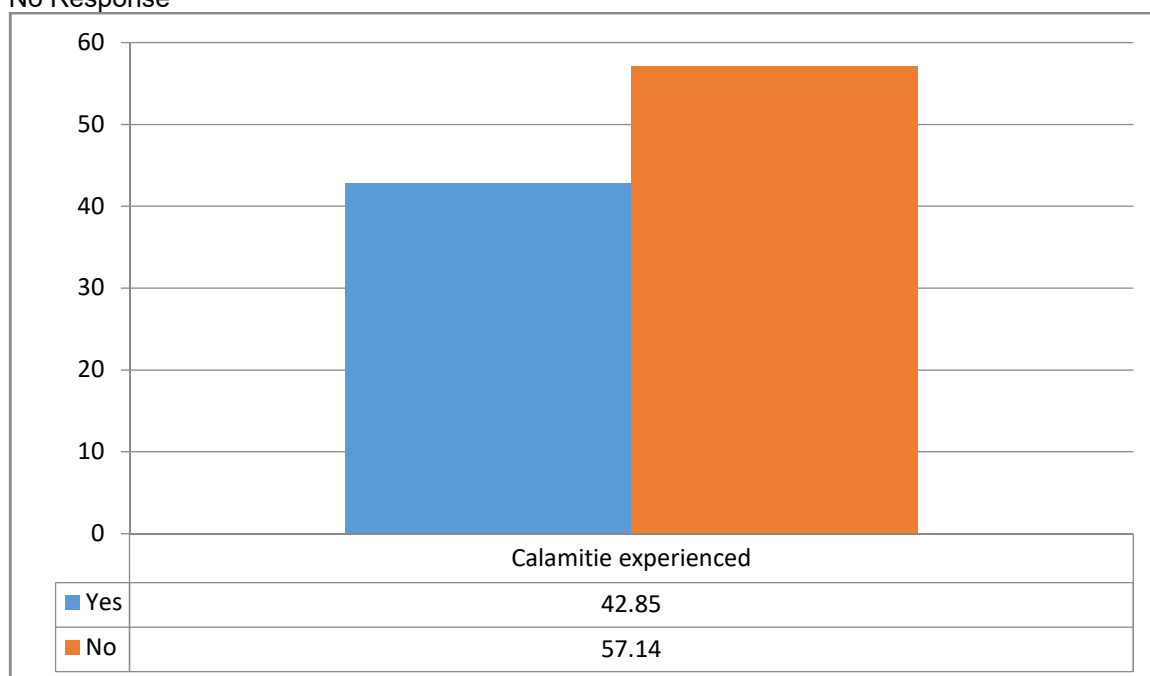


Figure 13: Calamities Experienced

Age

55.55% of the respondents were between 31 to 40 years old, while most of the respondents were mature adults.

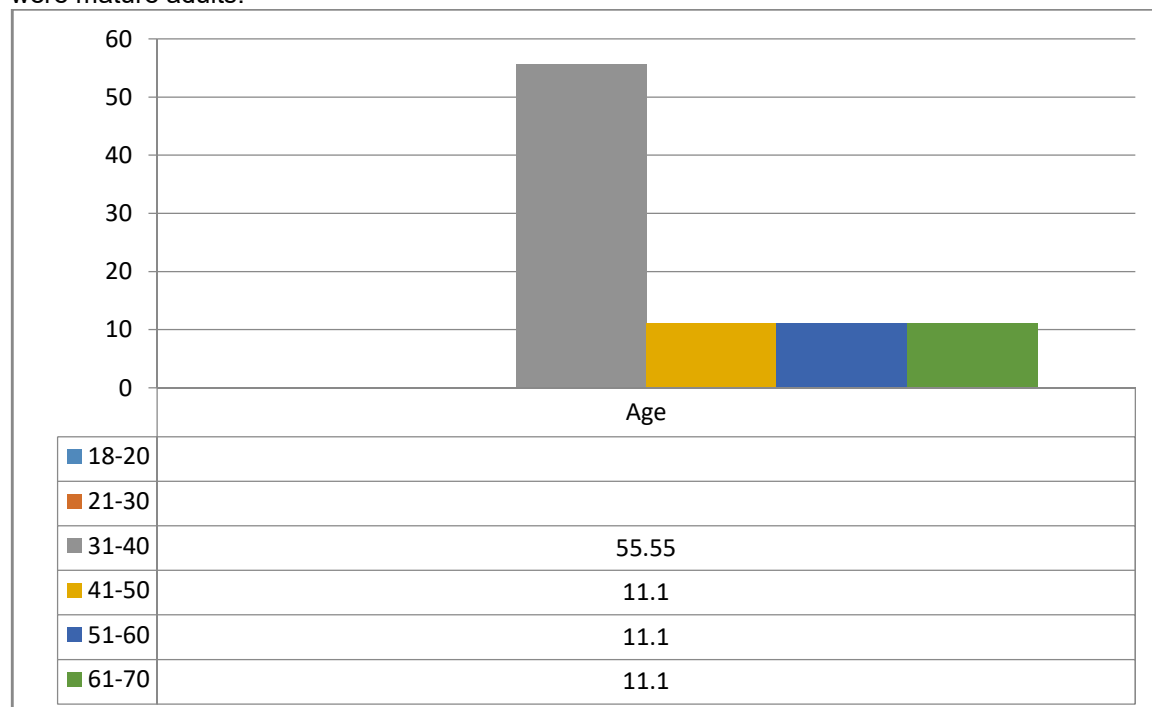


Figure 1: Age

Gender

Most respondents are female accounting for 64.28% of the survey population.

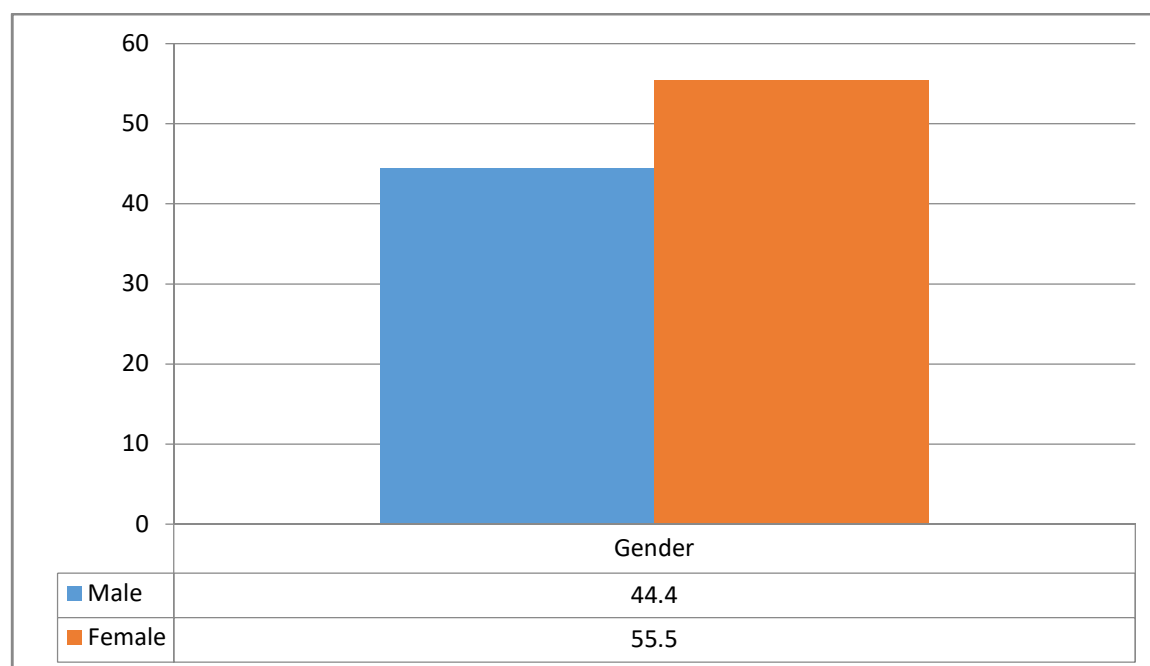


Figure 2: Gender

Occupation

2 of the respondents have their own livelihood, 1 is laborer, 3 respondents are unemployed, and the other 3 have no response.

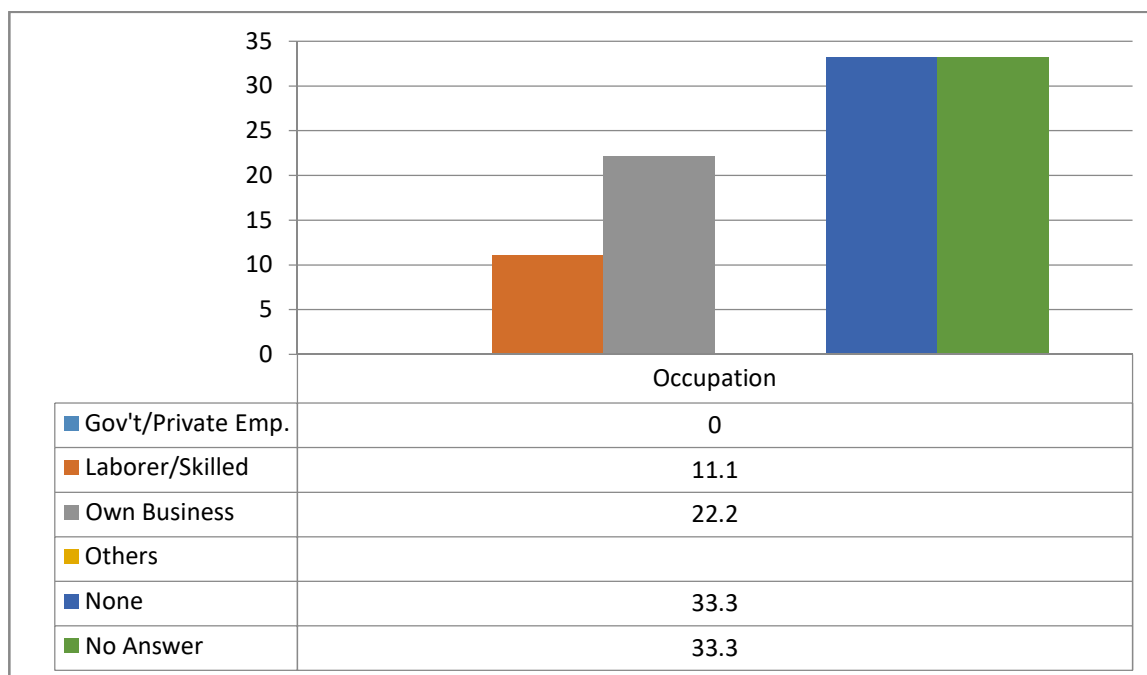


Figure 3: Occupation

Monthly Income

Most of the respondents didn't answer the question, 2 of the respondents have no work income, 1 respondents earned 1 to 5000, and 1 respondents also earned 10000 and above.

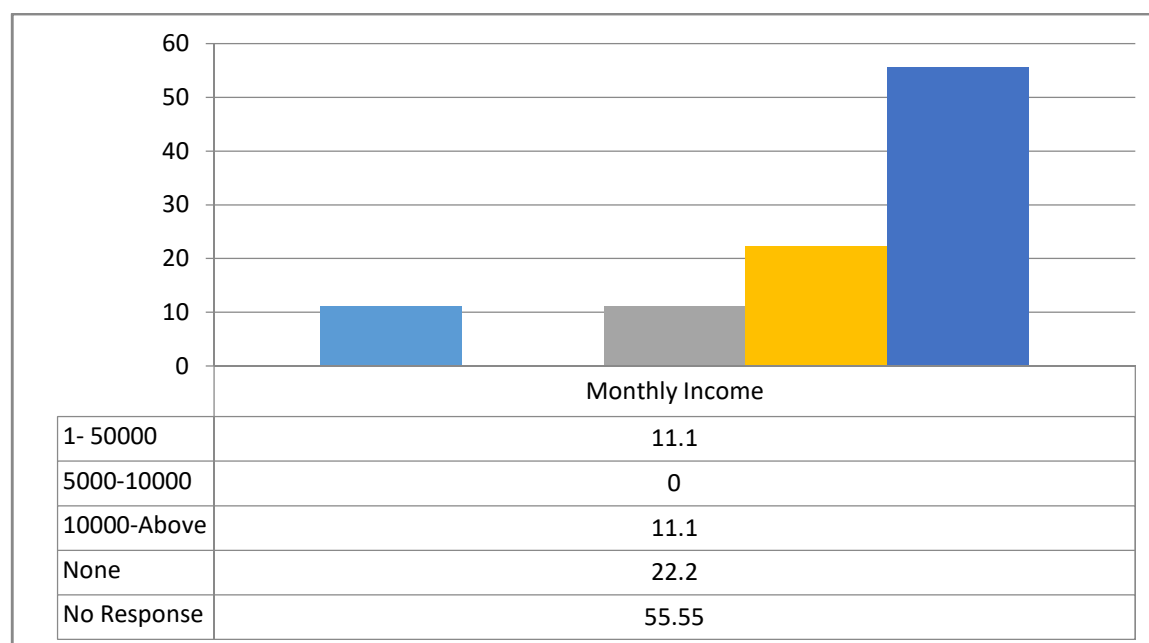


Figure 4: Monthly Income

Religion

Most of the Respondents are Catholic are 55.55%. The other religion being referred here is Born Again, and 33.3% have no response

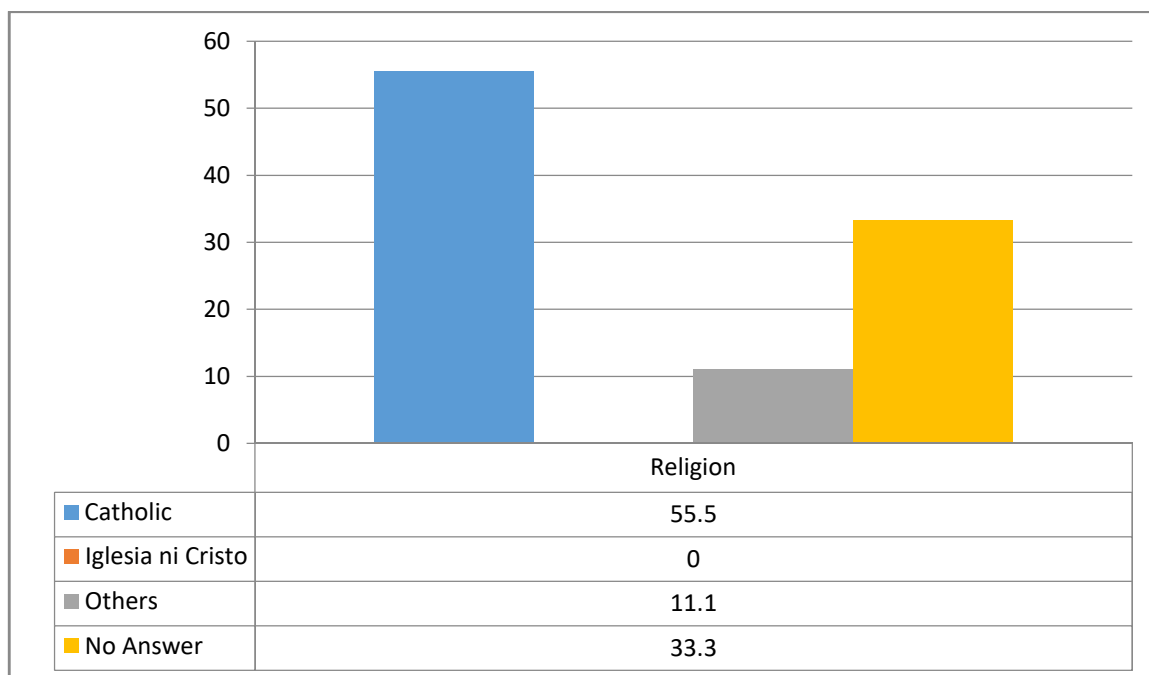


Figure 5: Religion

Educational Attainment

The respondents were mostly highschool and college level with both 33.3%, while 22.2% are elementary graduates and 11.1% finished vocational.

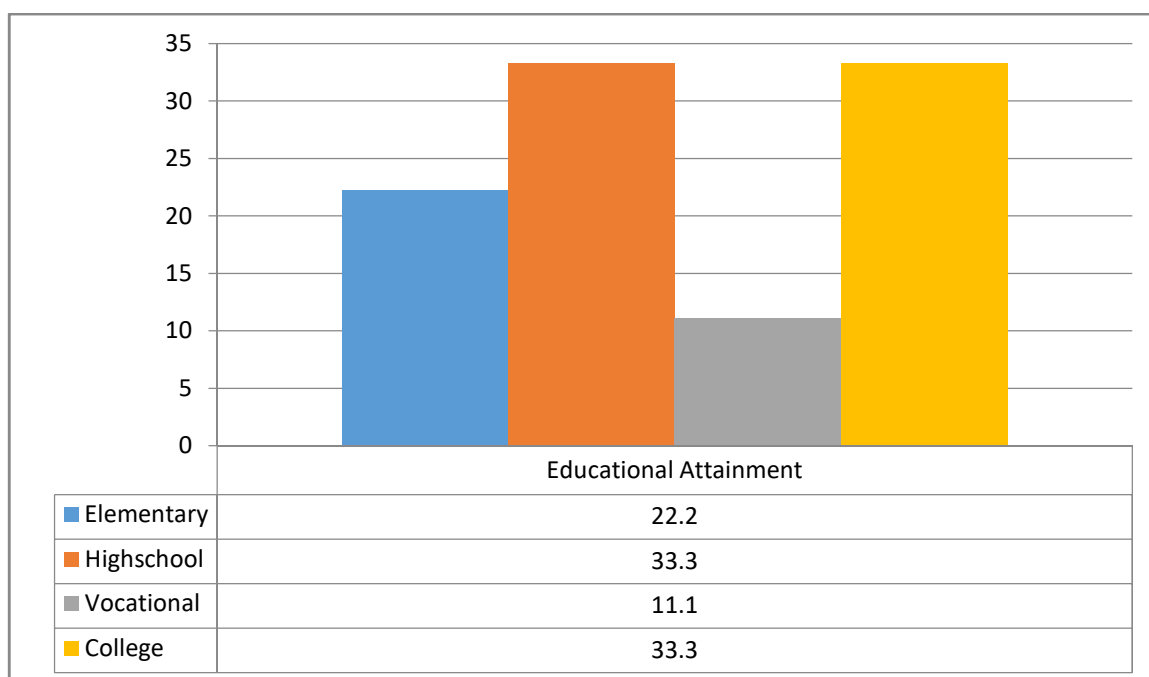


Figure 6: Educational Attainment

Civil Status

Most of the respondents were Married 44.4%, Single and widowed is both 22.2% , and 11.1% didn't answer the question.

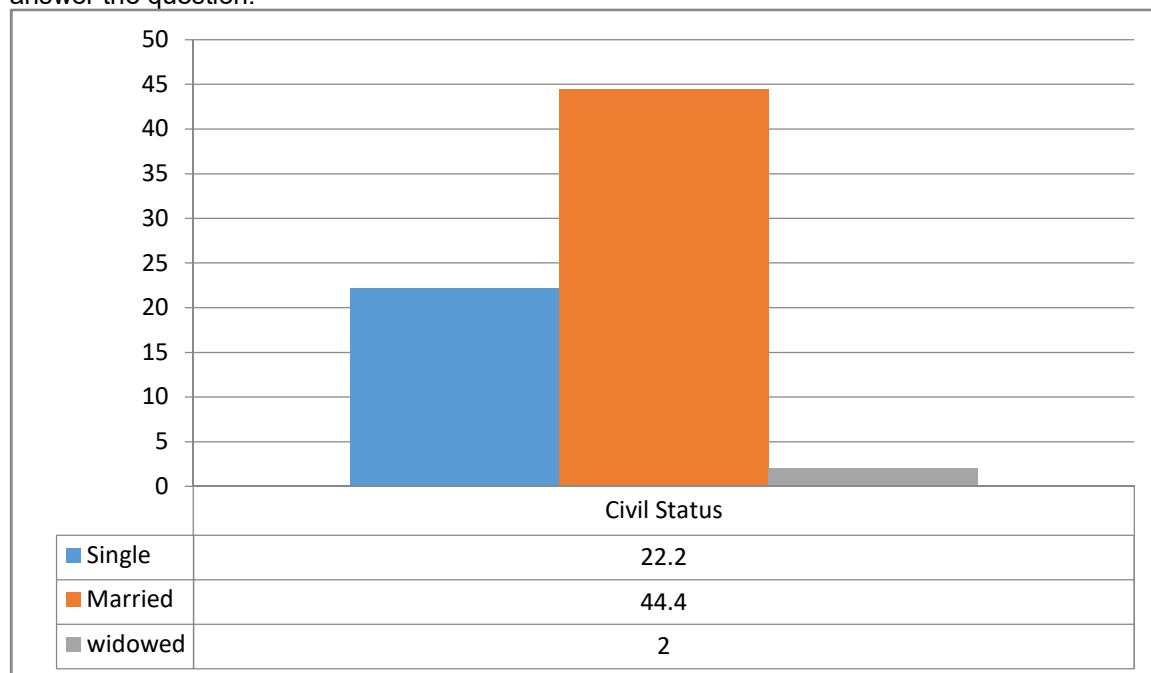


Figure 7: Civil Status

No. Of Family Members

66.6% of the respondents have members of the family from 2 to 5. 22.2% have 6 to 10 members, while 11.1% didn't answer the question.

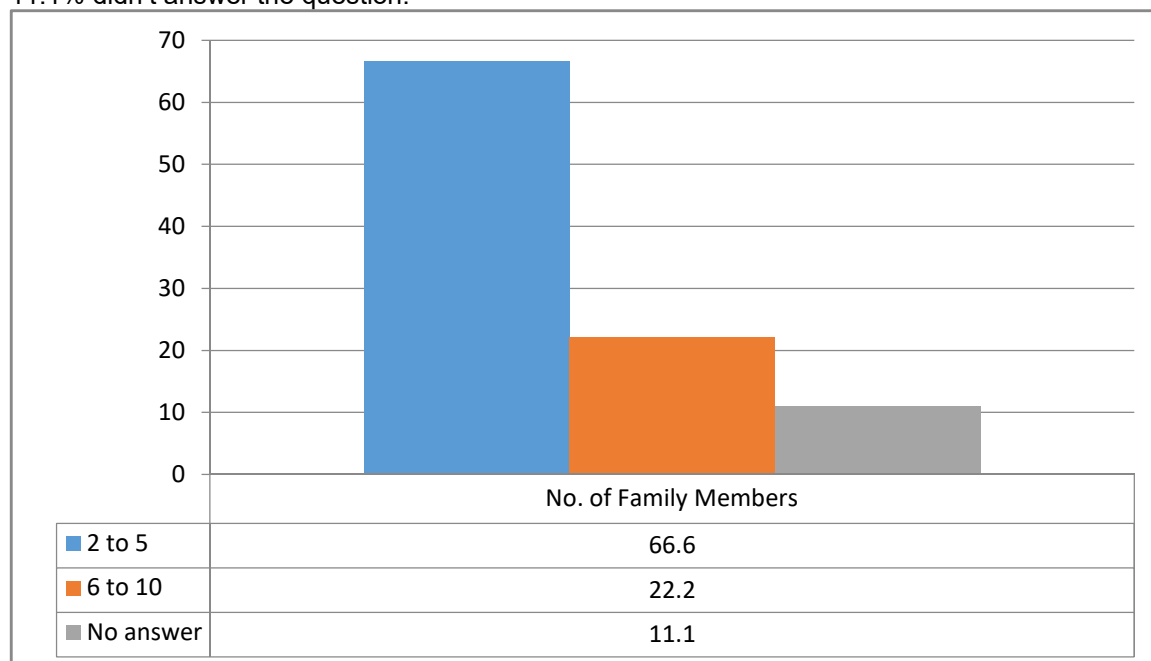


Figure 7: No. of Family Members

Origin

Majority of the respondents are not locals of Brgy. Darangan, they used to live in Taytay, Cainta, Novaliches, Pasig, and Manila.

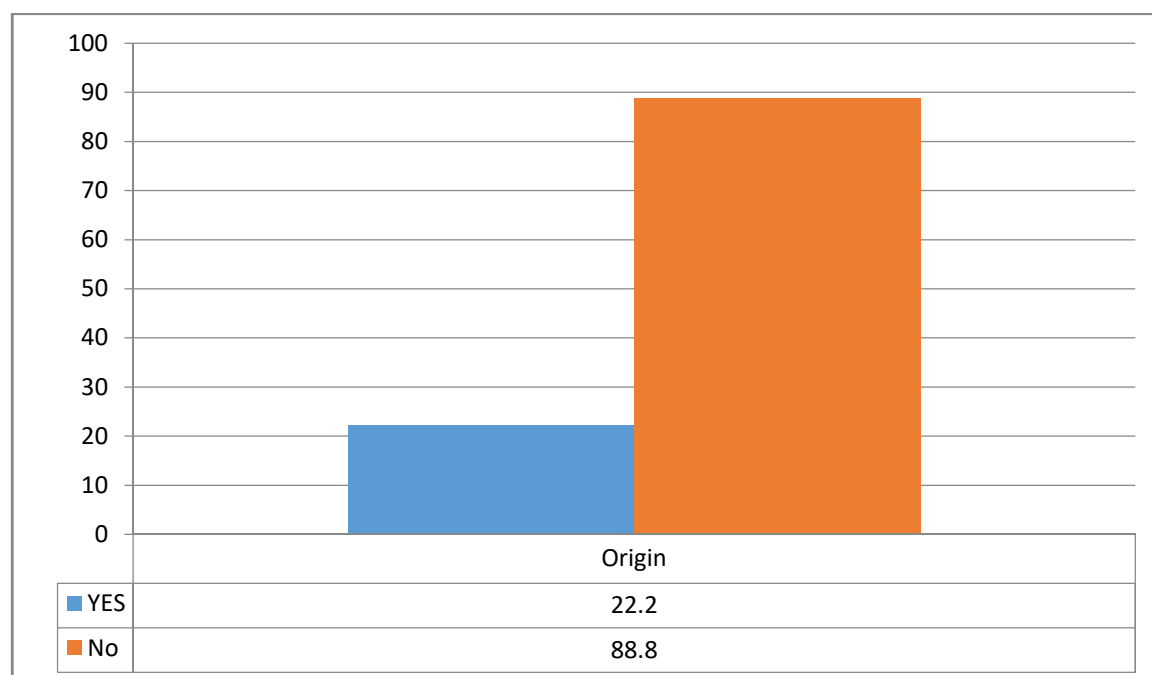


Figure 8: Origin

No. of years staying in the area

Majority of the respondents have lived in Brgy. Darangan for 1-5 years

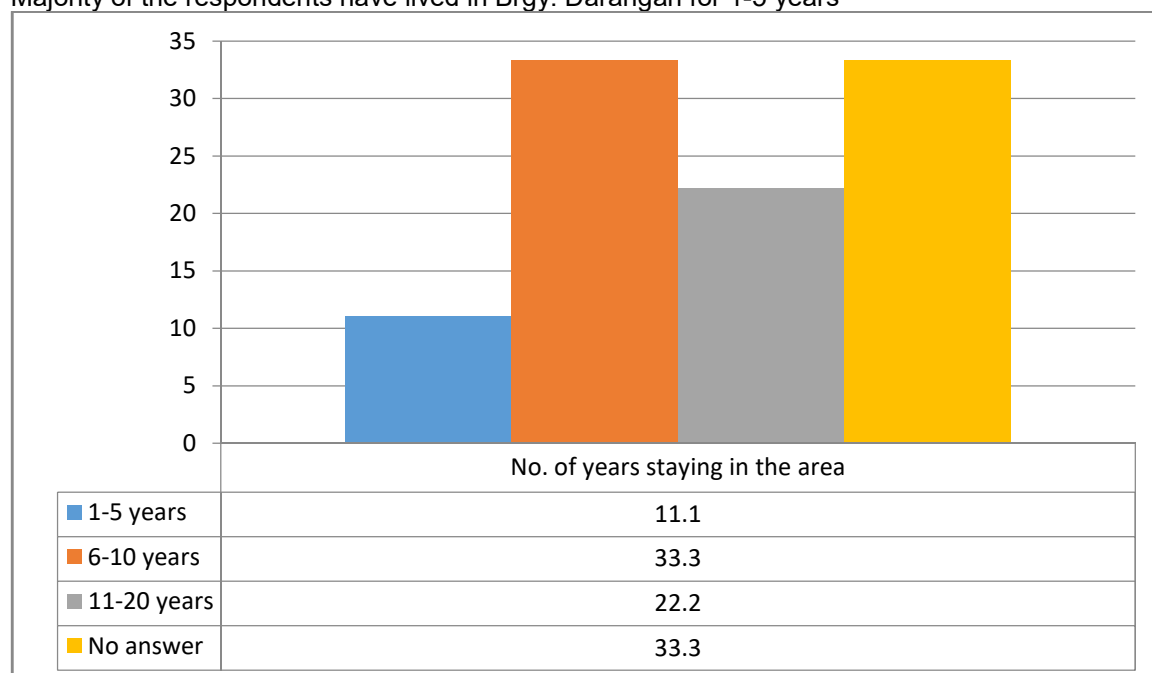


Figure 9: No. of Years staying in the area

Sources of Water:

In all areas surveyed, majority of the respondents have no answer, while the others get the water from Nawasa.

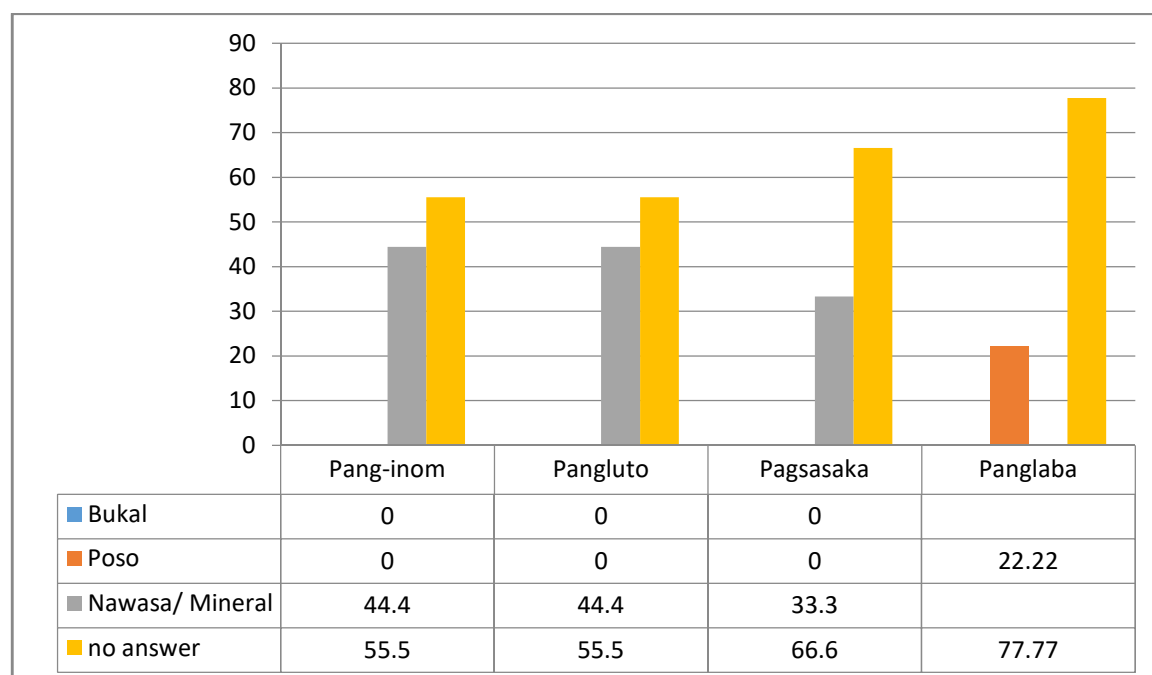


Figure 10: Sources of Water

Type Of Vehicle

Majority of the respondents have Motorcycle, 1 have bicycle, 1 have no vehicle, and 2 of the respondent didn't answer.

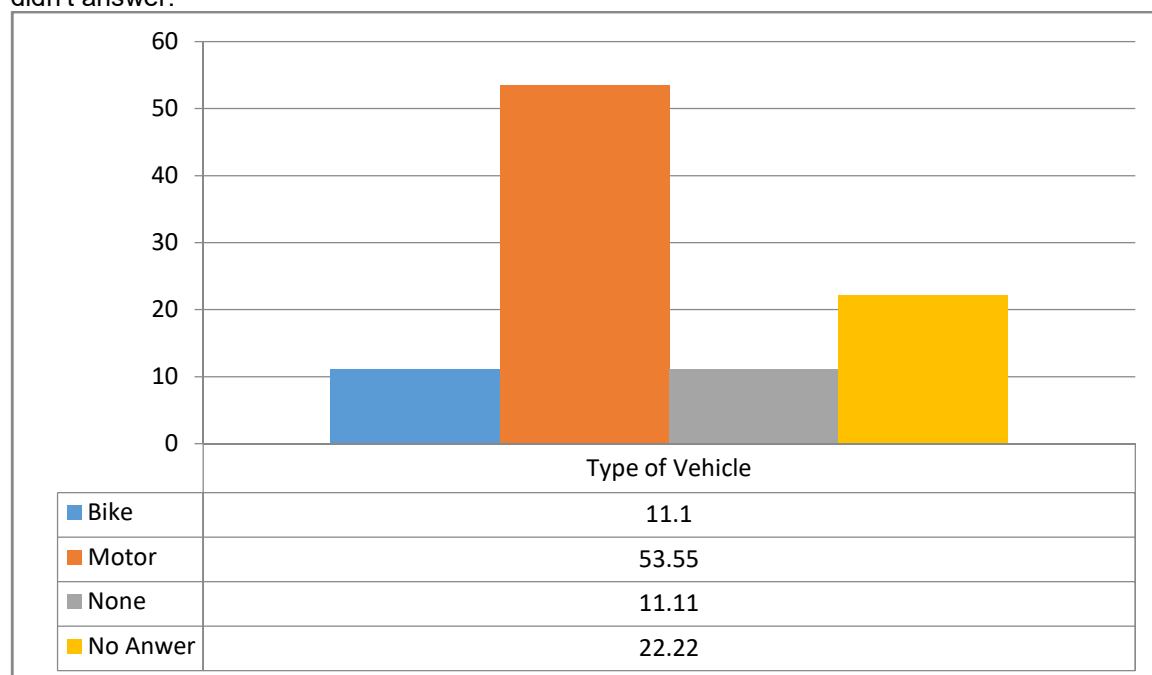


Figure 11: Type of Vehicle

Comfort Room

44.44% used water closet, 11.11 used open pit, and 44.44% have no answer.

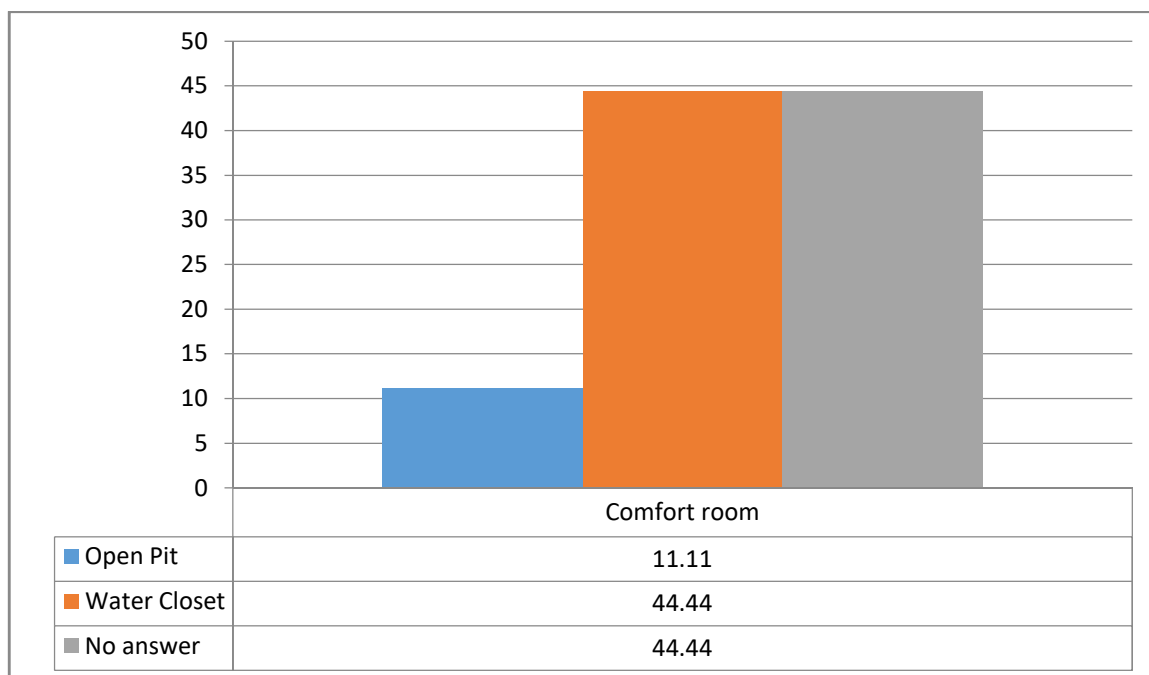


Figure 12: Comfort Room

Calamities Experienced

Majority of the respondents experienced calamities while 33.33% said No, these include typhoon.

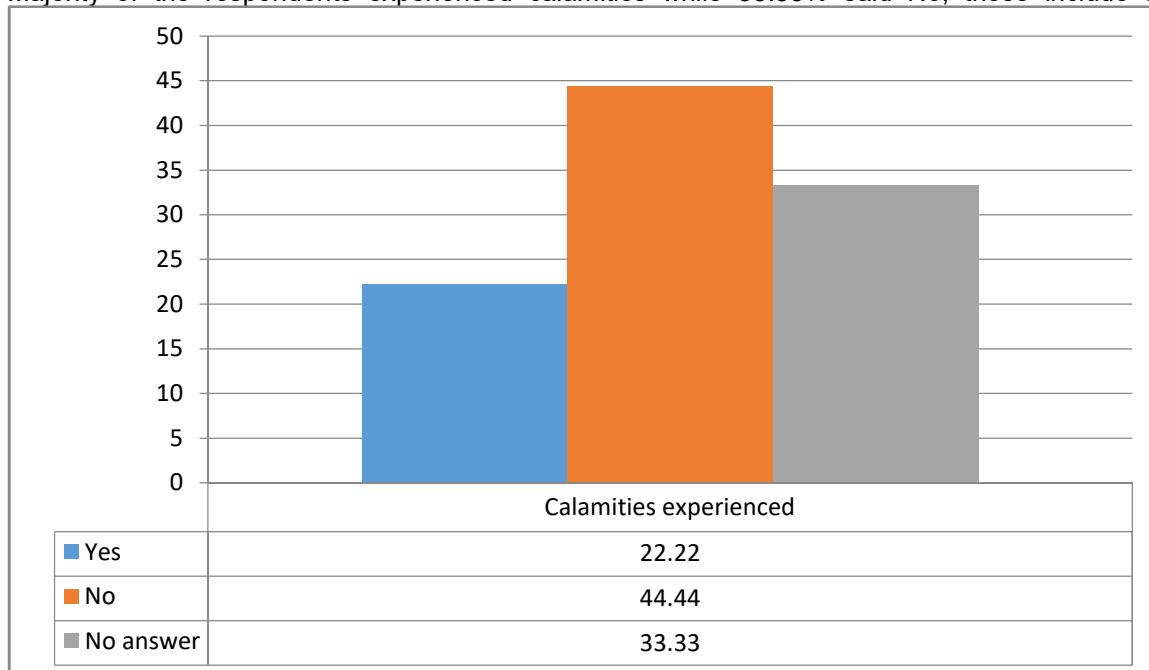


Figure 13: Calamities Experienced

Sitio Dayap, Brgy. Pantok, Binangonan, Rizal

Age

Most of the respondents were mature adults. These were evident with 8 respondents were at age range 31-40, 5 were between 21 to 30 years old and another 5 were between 41-50 years of age.

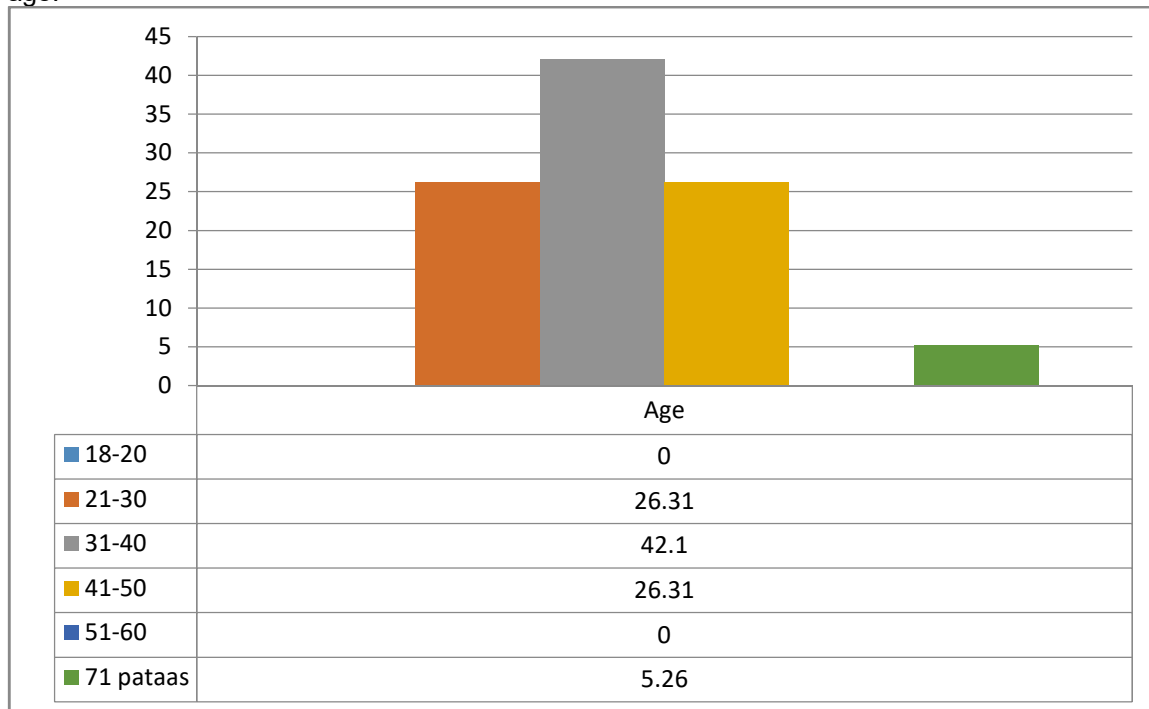


Figure 1: Age

Gender

Most respondents are female accounting for 31.57% of the survey population.

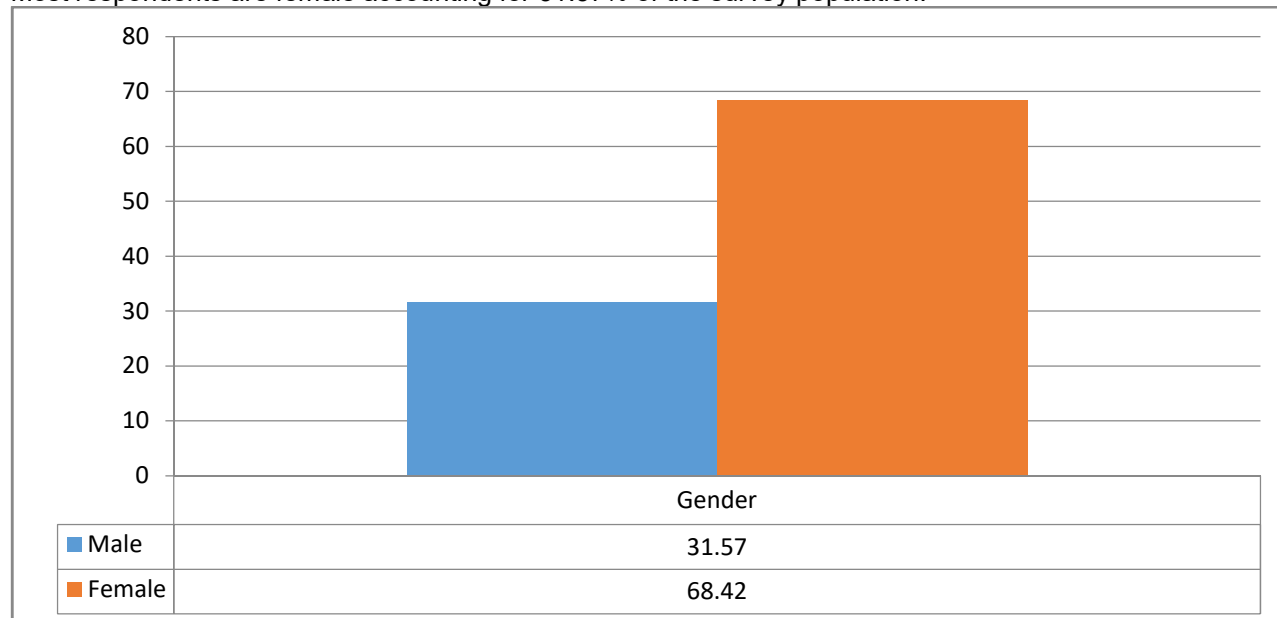


Figure 2: Gender

Occupation

5 of the respondents have their own livelihood, 1 is driver, and last one have no response.

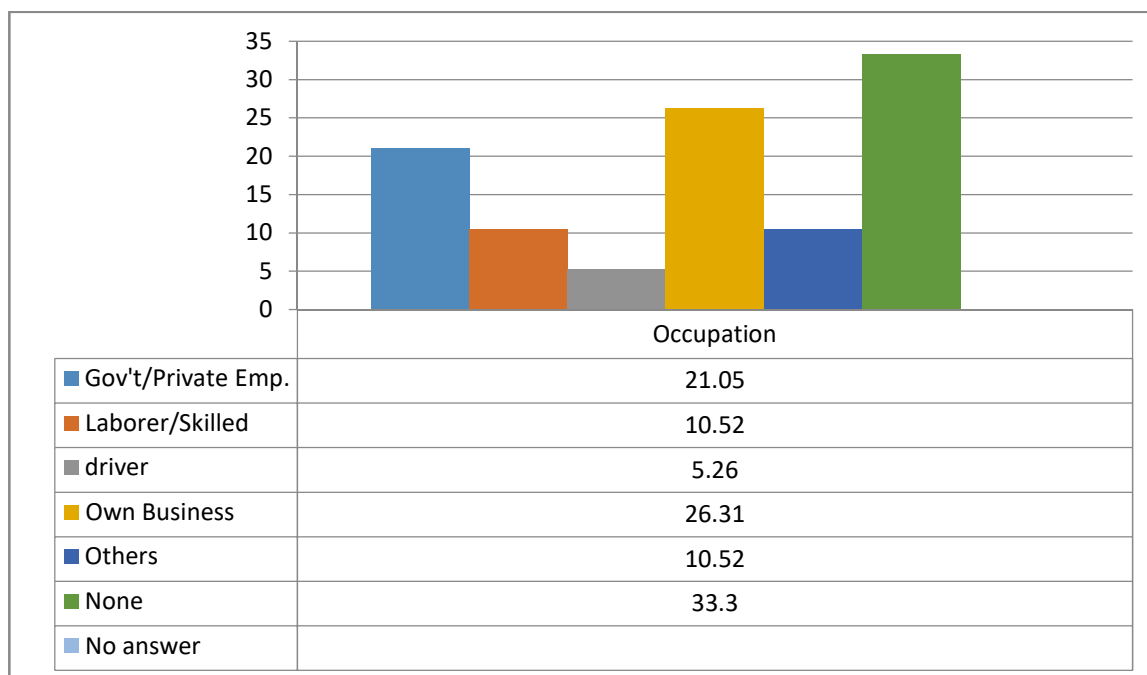


Figure 3: Occupation

Monthly Income

42.10% of the respondents are earning 1000 to 5000, 26.31% earned 5000 to 10000, 5.26% earned 10000 and above, 21.05% have no work, while 5.26% did not provide response.

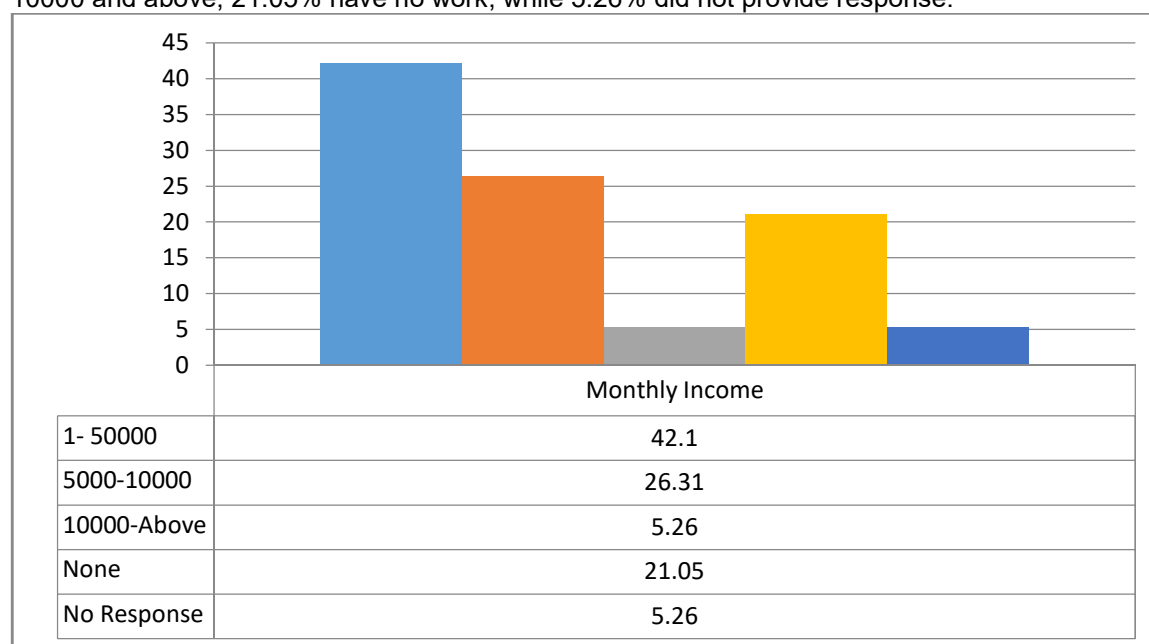


Figure 4: Monthly Income

Religion

Most of the respondents are catholic for 73.68%. The other religion being referred here are Iglesia ni Cristo and Born Again.

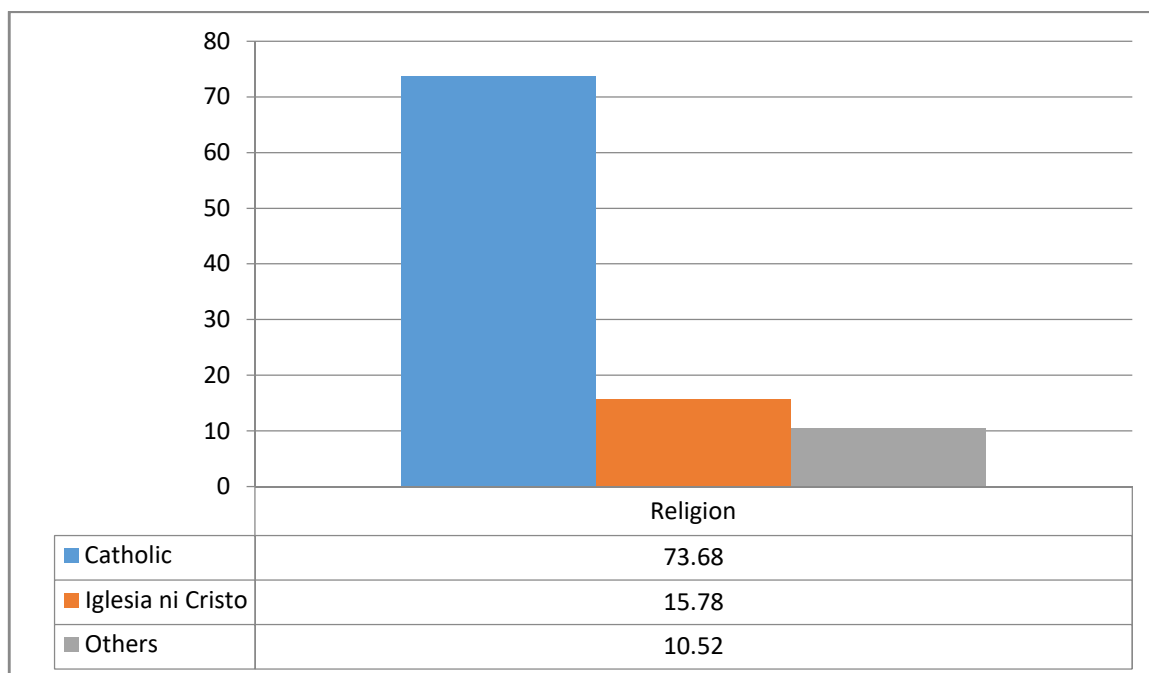


Figure 5: Religion

Educational Attainment

The respondents were mostly highschool graduated which accounted for 57.89%, 21.05% were elementary graduate, 5.26% finished vocational, 10.52% were college graduate, and 5.26% have no response.

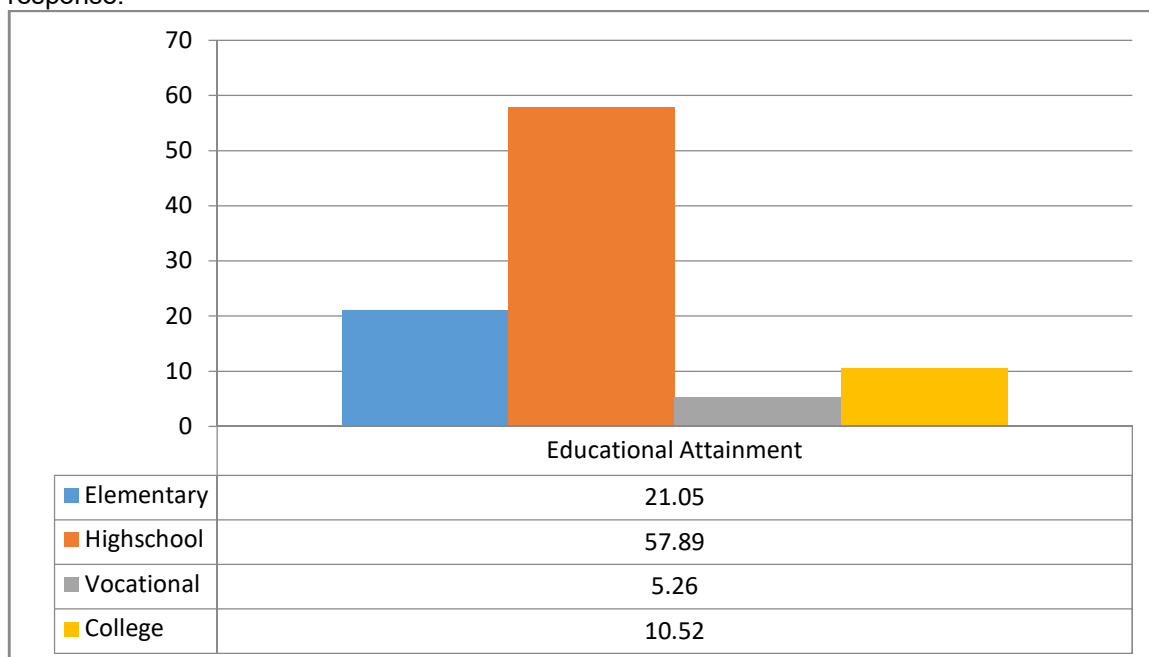


Figure 6: Educational Attainment

Civil Status

Most of the respondents were Married 63.15%, 26.31% are single, 5.26% is widowed and the remaining respondents are live-in.

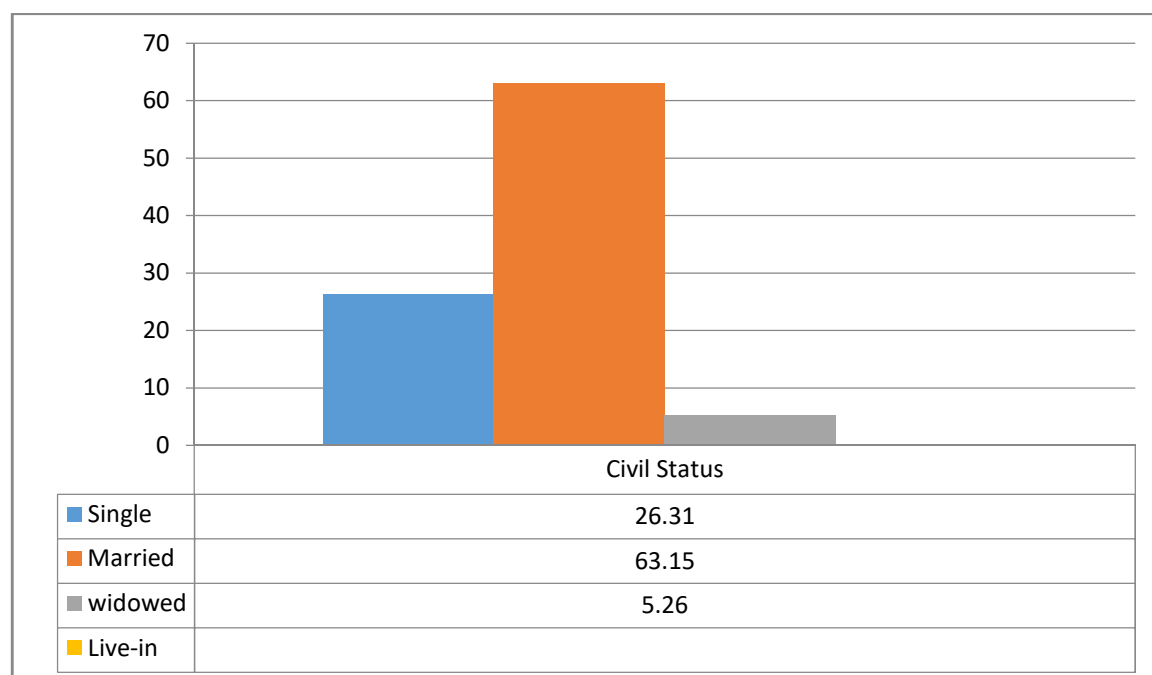


Figure 7: Civil Status

No. Of Family Members

63.15% of the respondents have members of the family from 1 to 5, 26.31% have 6 to 10 members. 10.52% have no response.

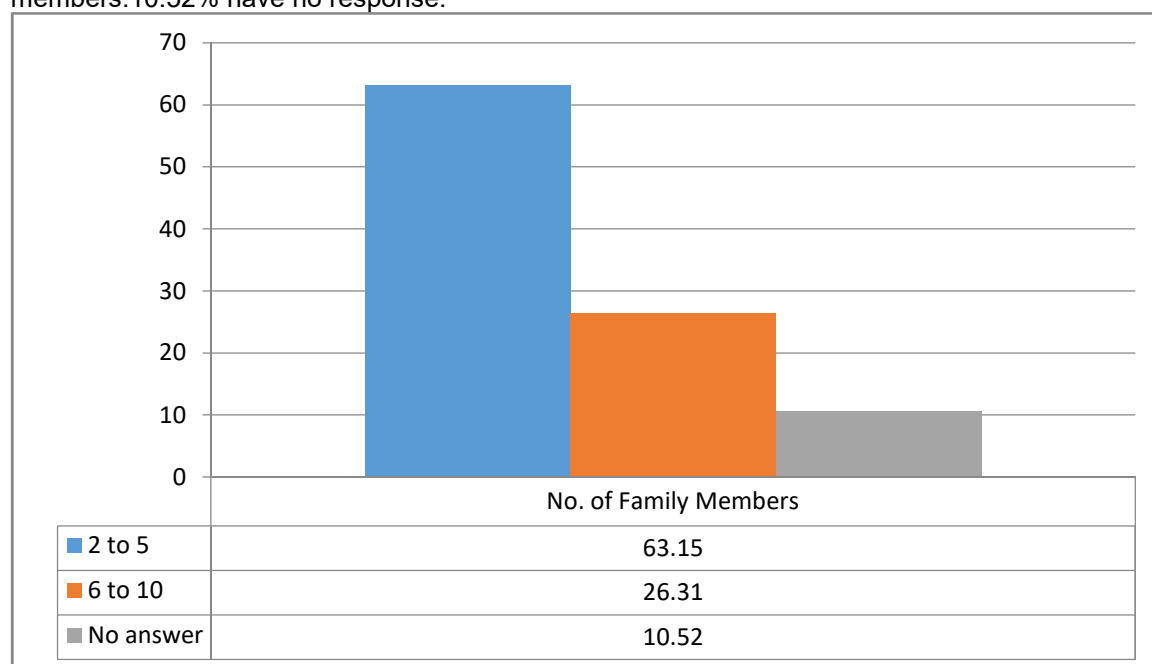


Figure 7: No. of Family Members

Origin

Majority of the respondents are not locals of Brgy. Pantok, while the rest of the respondents are not locals and used to live in San Andres, Bicol, Brgy. Medalria, Antipolo, and Cebu.

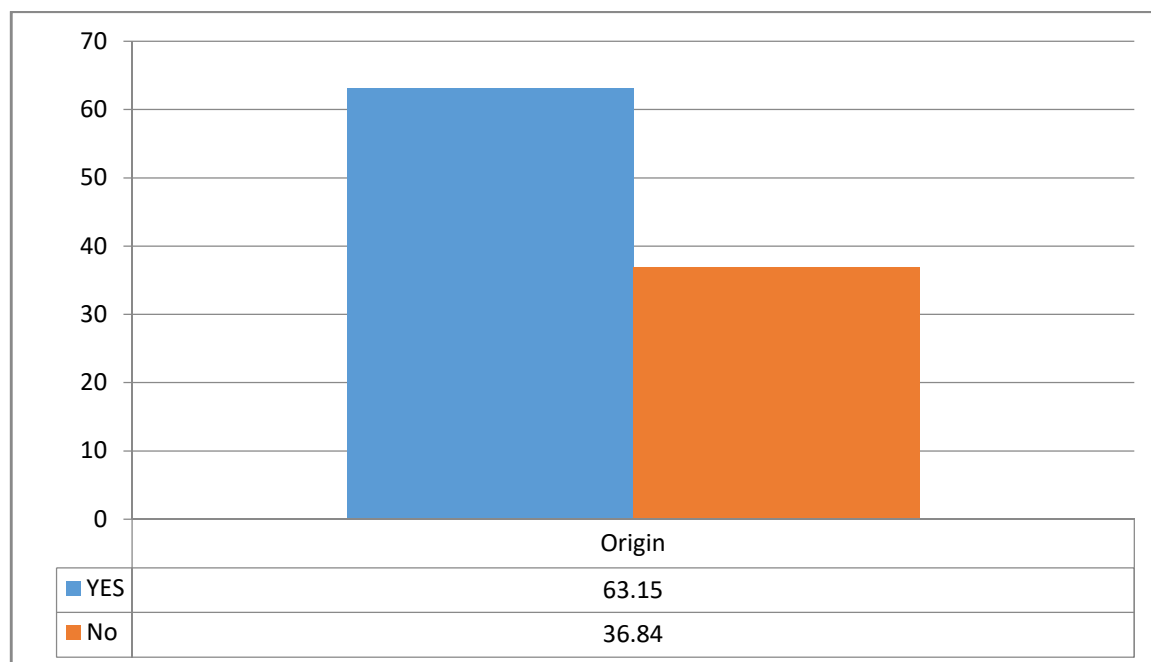


Figure 8: Origin

No. of years Staying in the area

15.78% of the respondents live in Brgy. Pantok from 1 to 5 years, 10.52 \% lived for 6 to 10 years, 10.52% lived for 11 to 15 years, 31.57% lived for 16-20 years, while 21.05% lived in Brgy. Pantok since Birth.

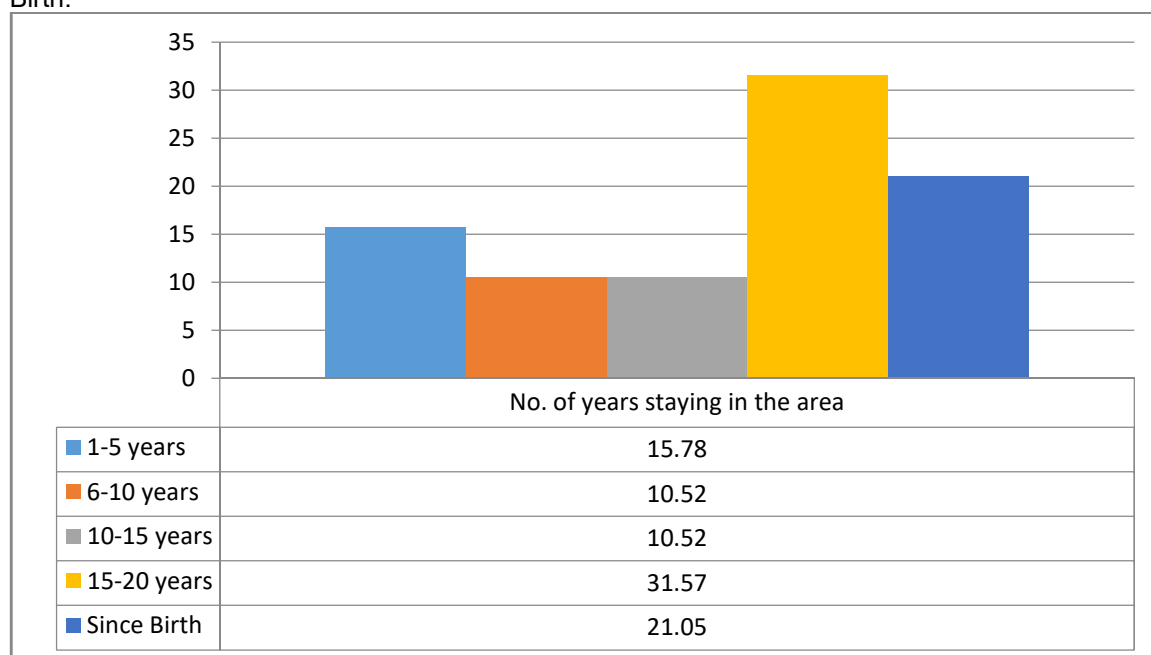


Figure 9: No. of Years staying in the area

Sources of Water

In all areas surveyed, majority of the respondents have no answer, while the others get the water from Nawasa/Mineral and Bukal.

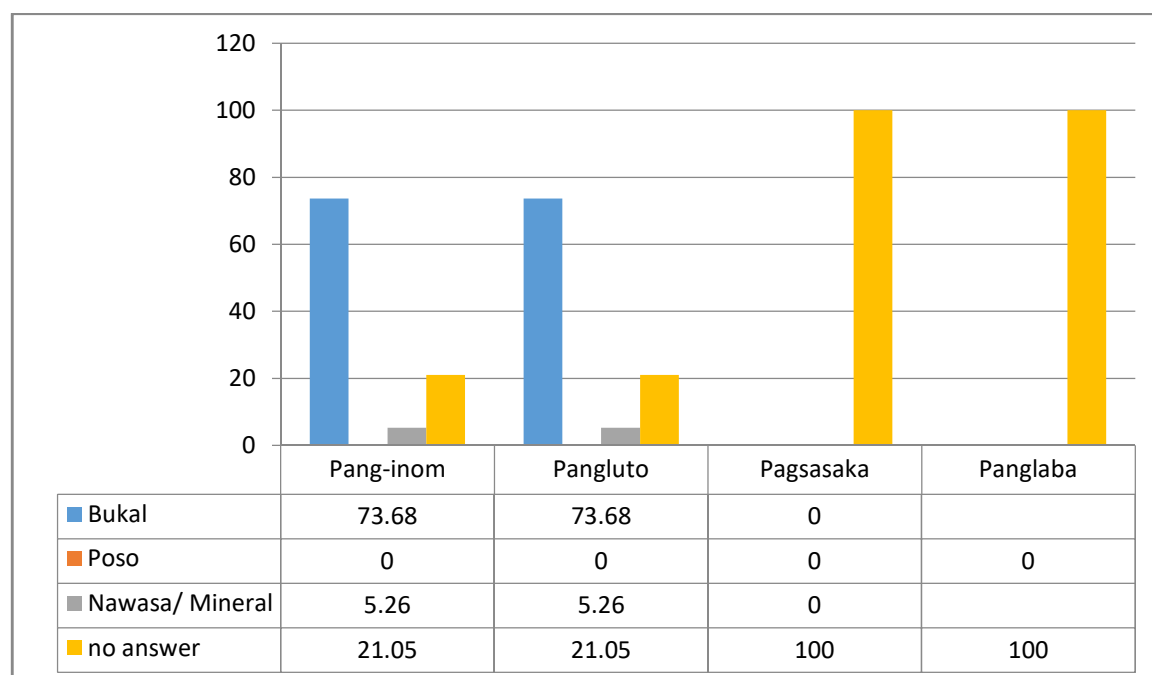


Figure 10: Sources of Water

Type Of Vehicle

Majority of the respondents have Motorcycle, 26.31% have no vehicle, and 10.52% of the respondent didn't answer.

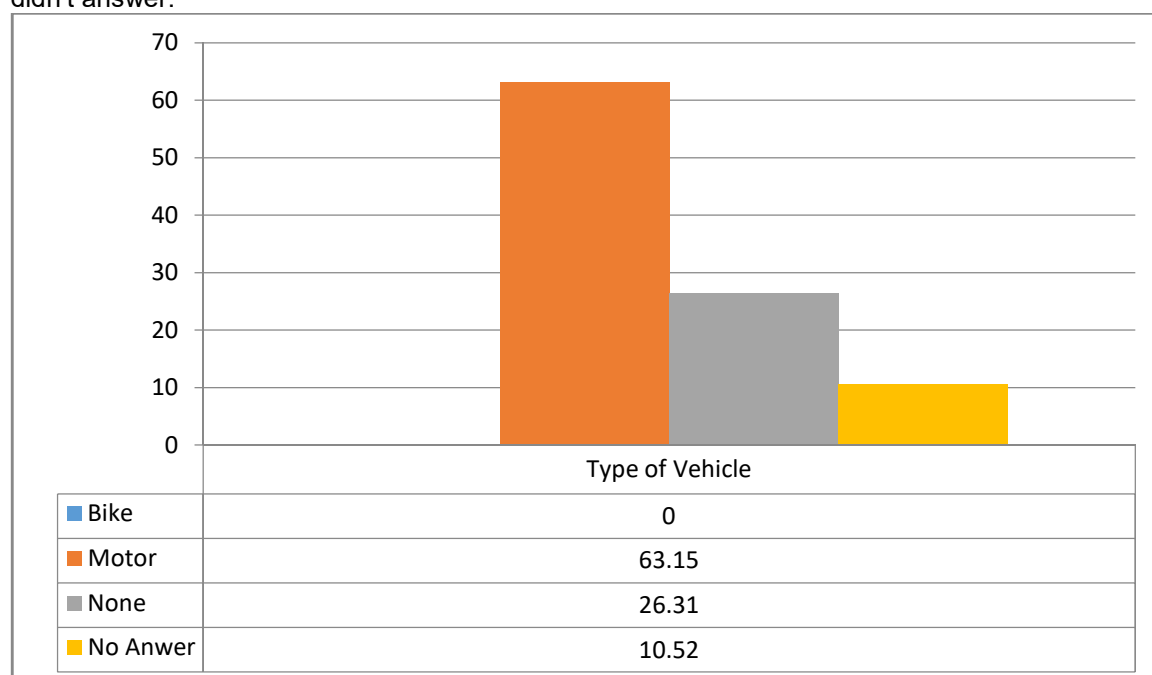


Figure 11: Type of Vehicle

Comfort Room

63.15% used water closet, 21.05% used open pit, and 15.78% have no toilet.

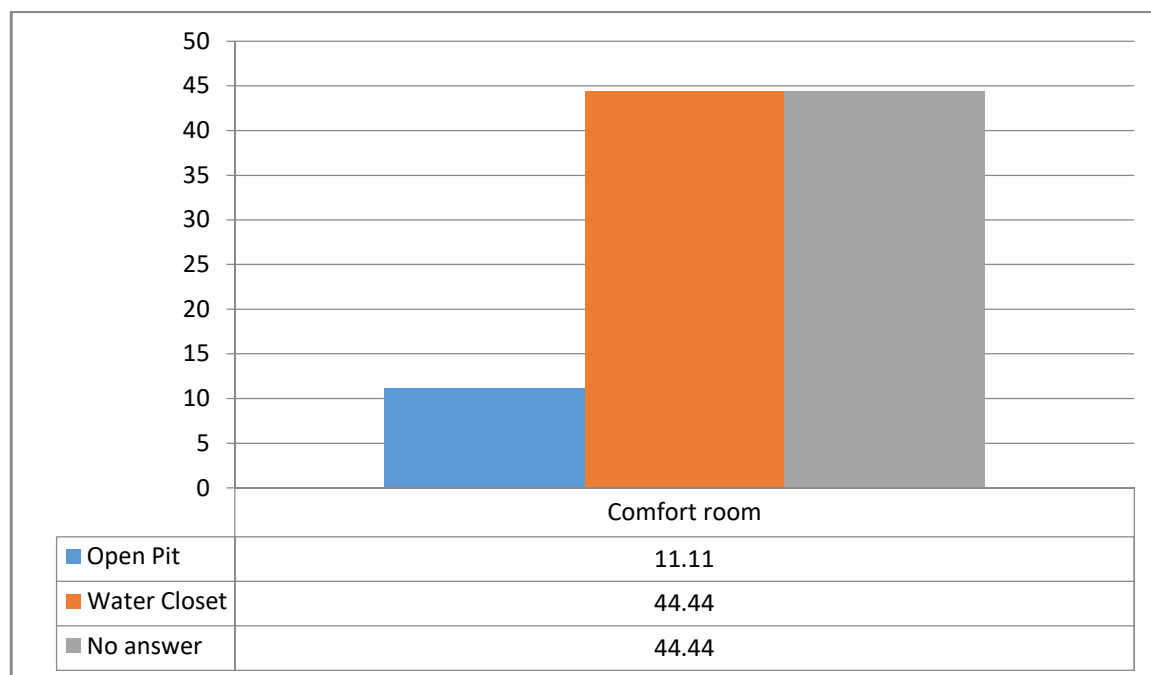


Figure 12: Comfort Room

Calamities Experienced

Majority of the respondents experienced calamities while 26.31% said no. these include typhoon and earthquake. The following are some of the ways they did to confront the situation

- Be Prepared
- Pray together

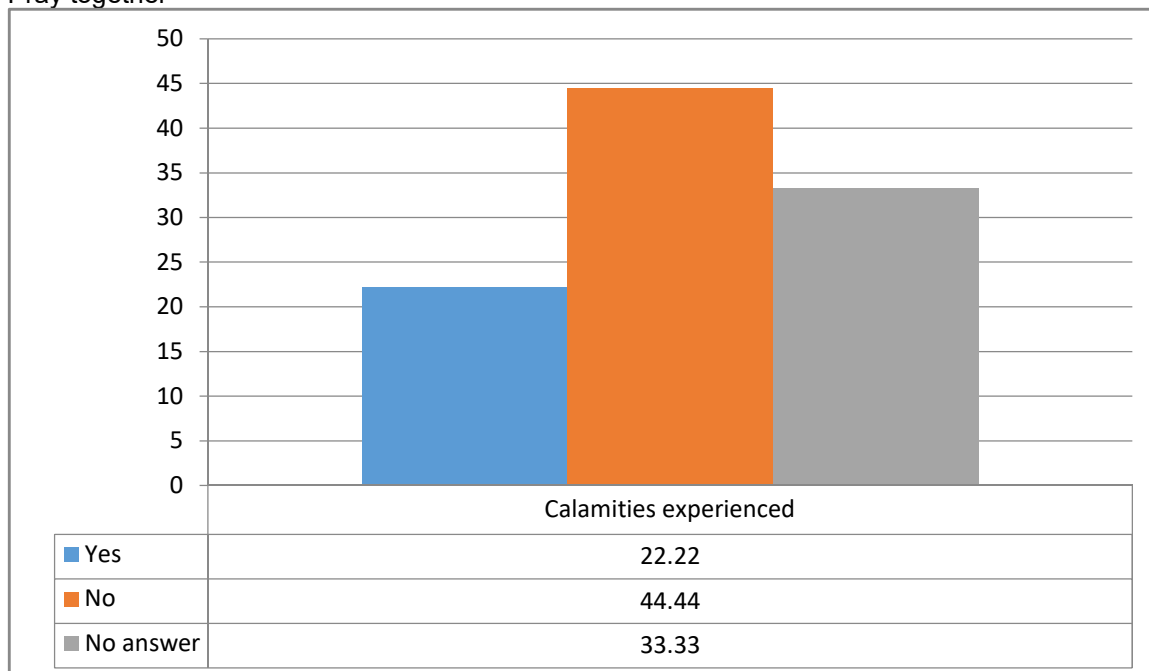


Figure 13: Calamities Experienced

Brgy. Mahabang Parang, Angono Rizal

Age

4 of the respondents were between 21 to 30 years old, the other 4 respondents were between 61 to 70 years old, 2 respondents' answer are 31 to 40 years old, also 2 respondents were 71 and up, 3 respondents answered 41 to 50 years old and 1 respondent were between 51 to 60 years of age.

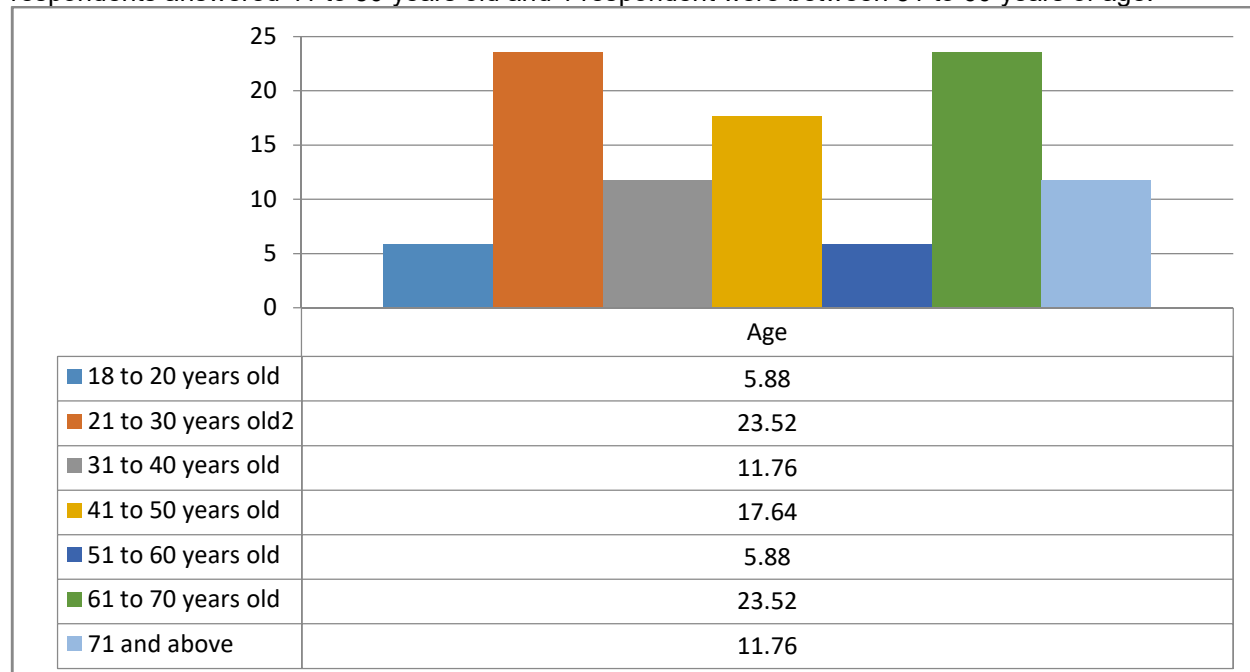


Figure 1: Age

Gender

Most respondents are female accounting for 58.82% of the survey population.

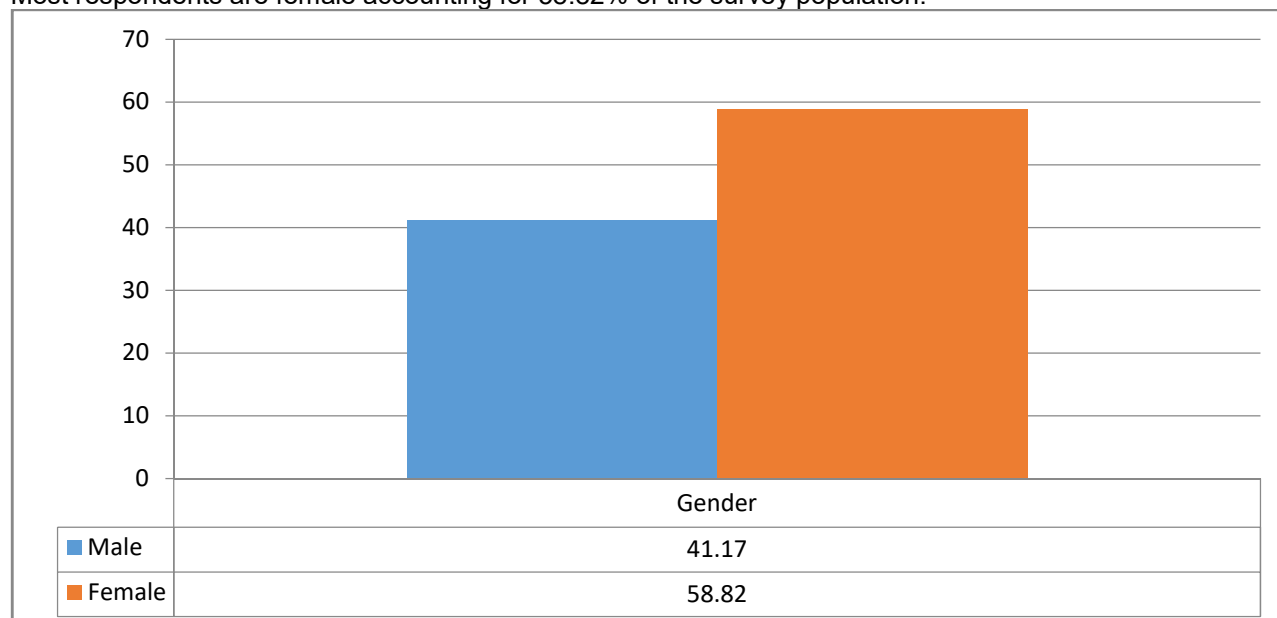


Figure 2: Gender

Occupation

3 of the respondents have their own livelihood, 3 are drivers, 1 is a farmer, 2 are government employees, 6 have no work and 1 respondent have no answer.

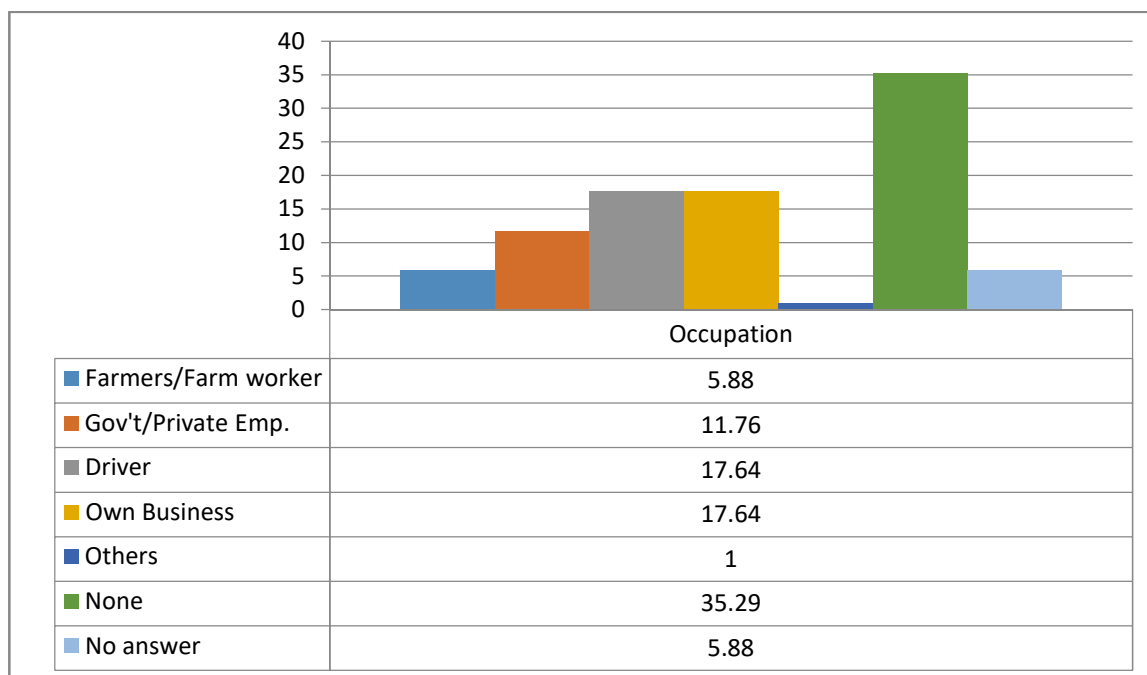


Figure 3: Occupation

Monthly Income

29.41% of the respondents are earning 1000 to 5000, 5.88% earned 5000 to 10000, 29.41% earned 10000 and above, 23.52% have no work, while 11.76% did not provide response.

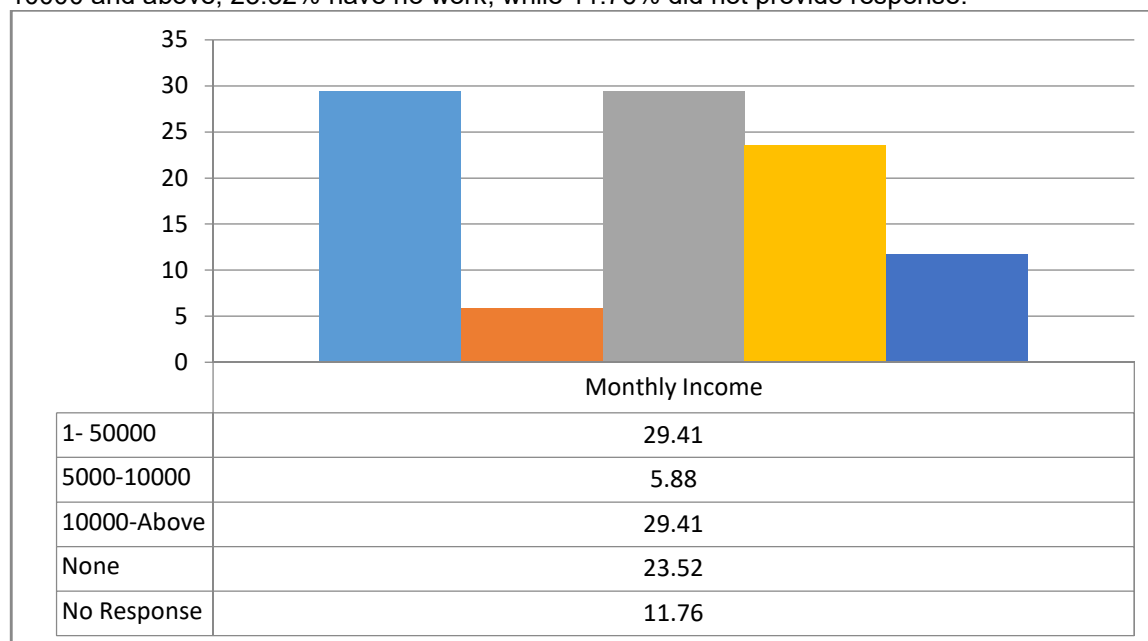


Figure 4: Monthly Income

Religion

Most of the respondents are catholic for 64.70%. 17.64% are protestant, and the other religion are Born Again and Jehova's Witness.

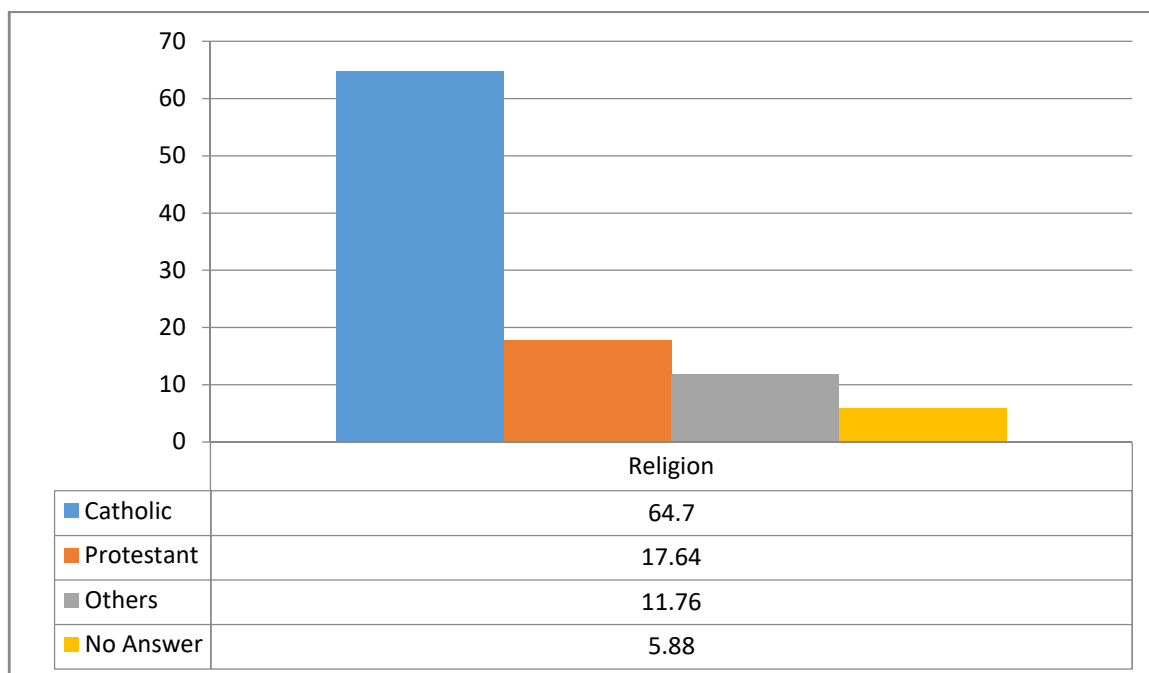


Figure 5: Religion

Educational Attainment

The respondents were mostly highschool graduates which accounted for 64.70%, 11.76% were elementary graduate, 5.88% finished vocational, and 17.64% were college graduates.

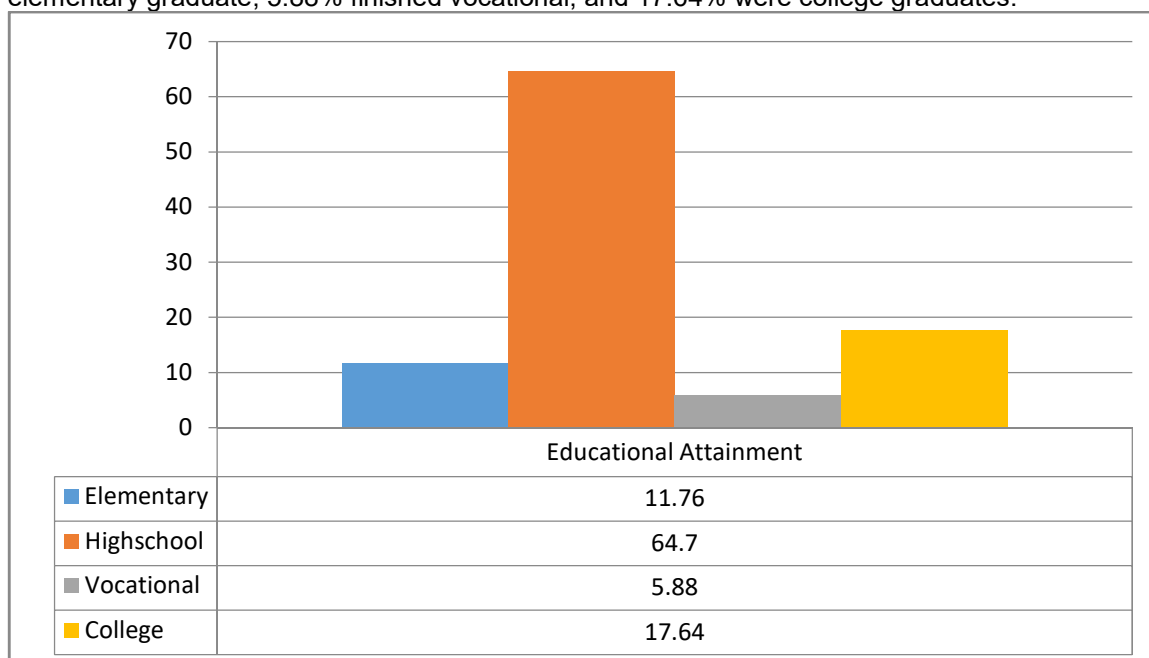


Figure 6: Educational Attainment

Civil Status

Most of the respondents were Married 52.94%, 23.52% are single, 11.76% is widowed, and the remaining are live-in.

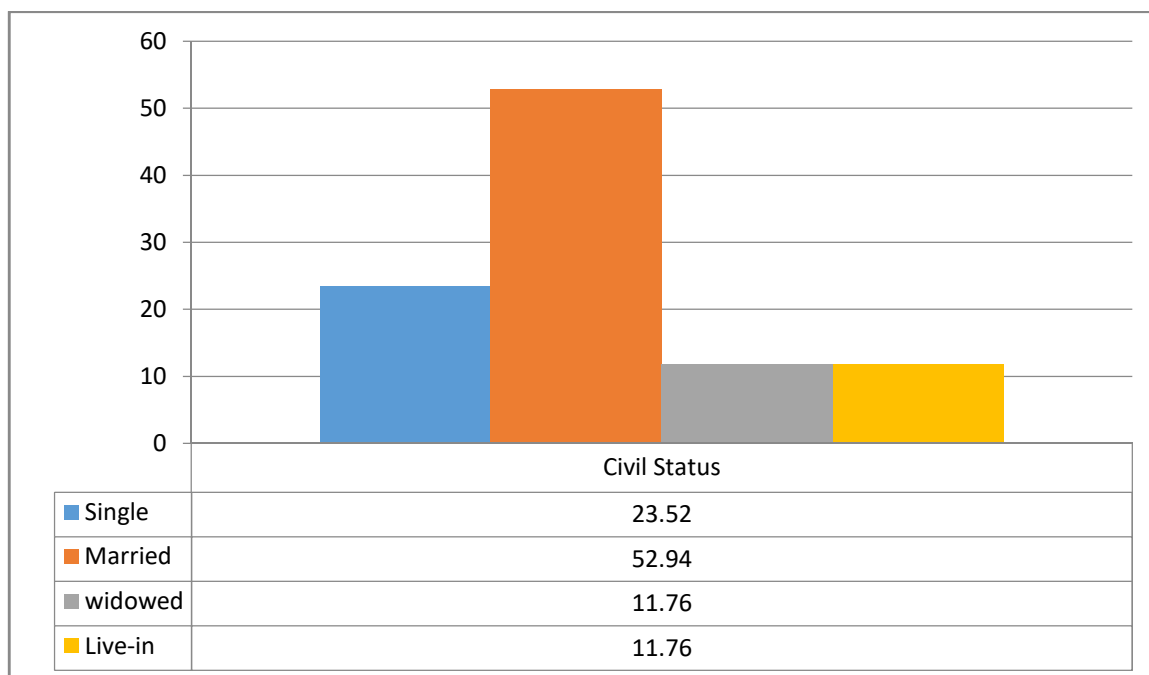


Figure 7: Civil Status

No. Of Family Members

52.94% of the respondents have members of the family from 6 to 10, 41.17% have 2 to 5 members, and 5.88% have 11 to 15 members.

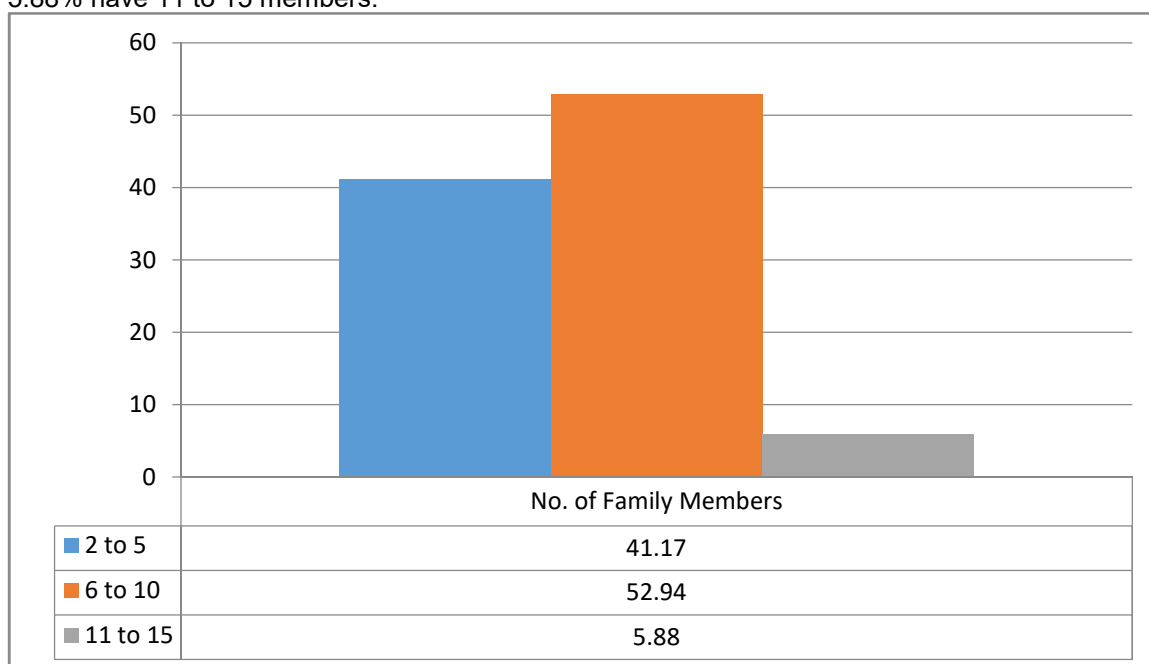


Figure 7: No. of Family Members

Origin

Majority of the respondents are not locals of Brgy. Mahabang Parang, Angono Rizal. The rest of the respondents are not locals and used to live in Quezon city, Antipolo, San Roque, Taytay Rizal, Masbate, Las Piñas and Bicol.

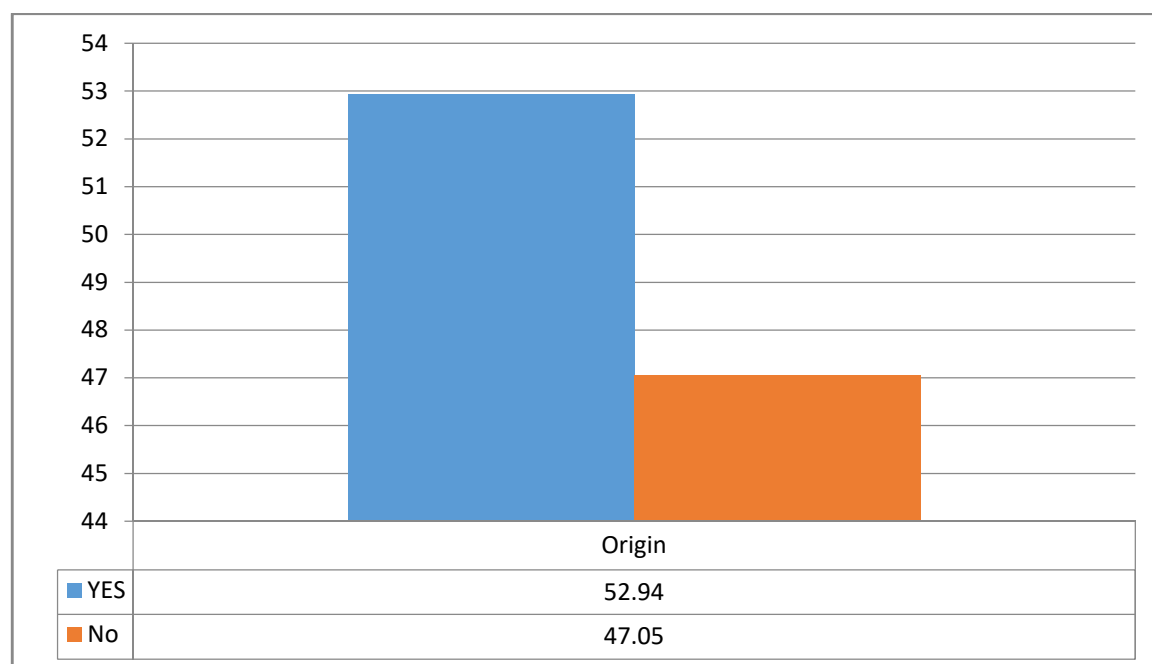


Figure 8: Origin

No. of years Staying in the area

11.76% of the respondents live in Brgy. Mahabang Parang from 1 to 5 years, 23.52% lived for 6 to 10 years, 11.76% lived for 11 to 20 years, 29.41% lived in Brgy. Pantok since Birth and the remaining 23.52% didn't response to the question.

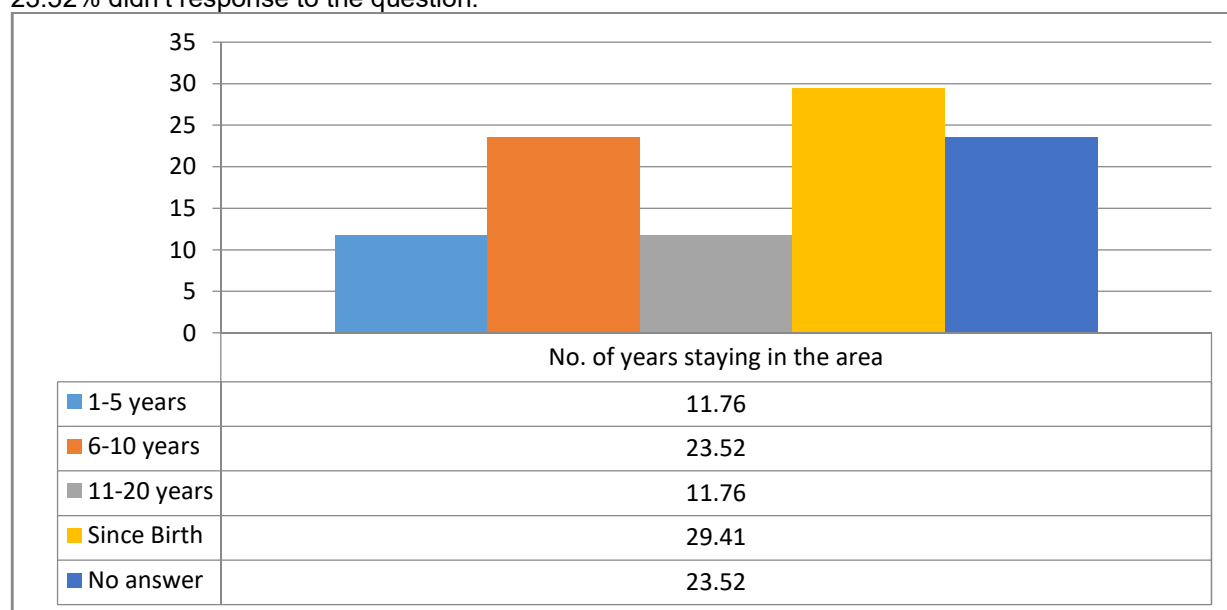


Figure 9: No. of Years staying in the area

Sources of Water

In all areas surveyed, majority of the respondents have no response, while the others get the water from Nawasa/Mineral.

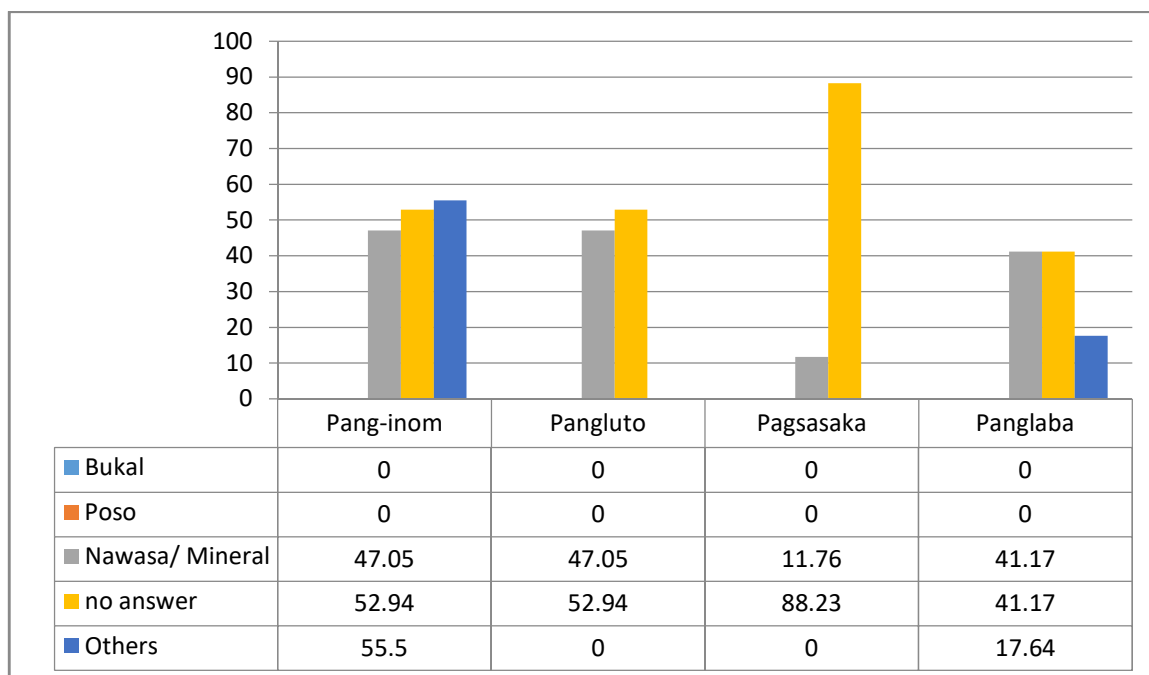


Figure 10: Sources of Water

Type Of Vehicle

Majority of the respondents have Motorcycle, 29.41% have no vehicle, and 11.76% of the respondent didn't answer.

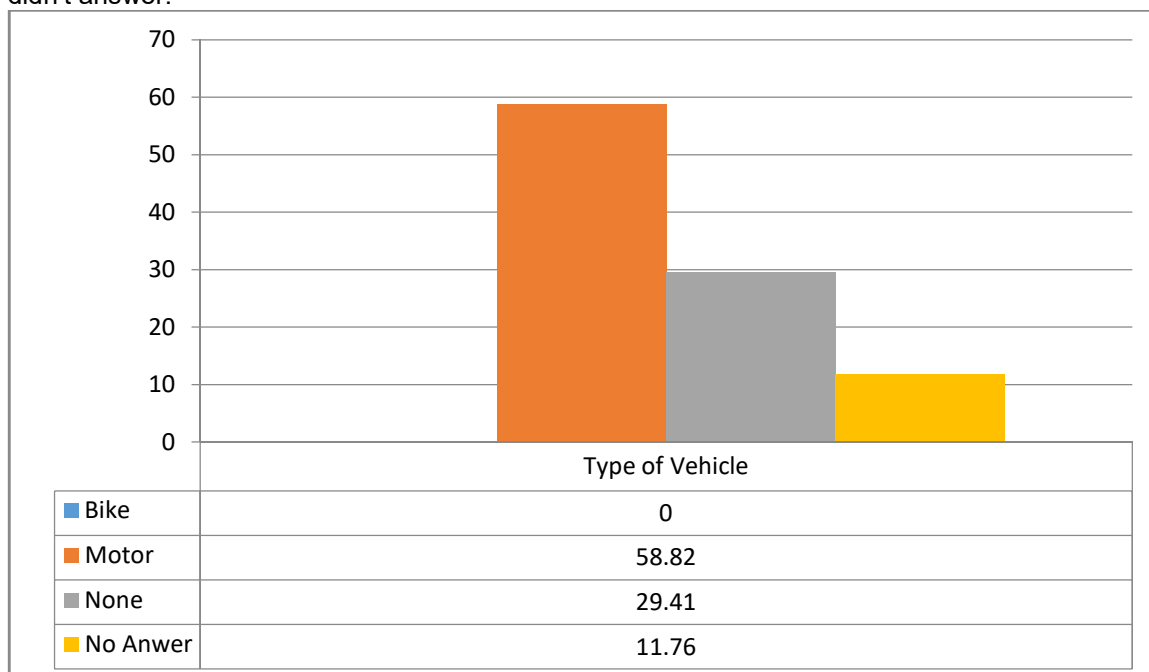


Figure 11: Type of Vehicle

Comfort Room

70.58% used water closet, 11.76% used open pit, and 17.64% have no answer.

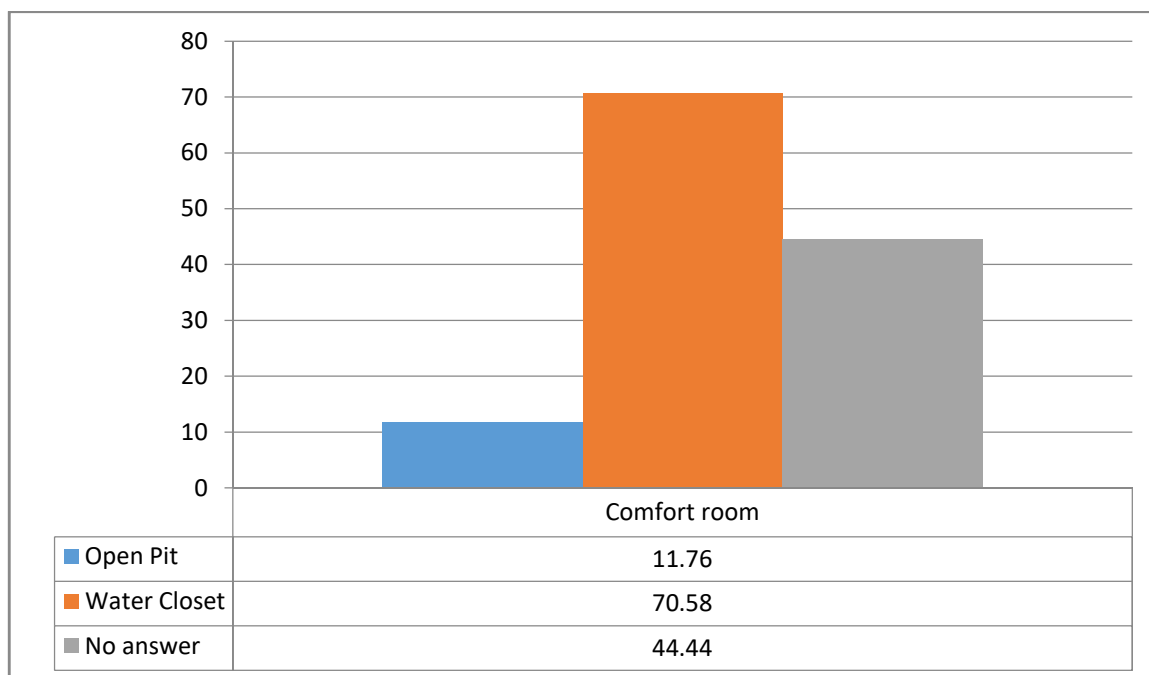


Figure 12: Comfort Room

Calamities Experienced

Majority of the respondents experienced calamities while 41.17 % said no. these include typhoon and earthquake. The following are some of the ways they did to confront the situation

- Be Prepared
- Pray together

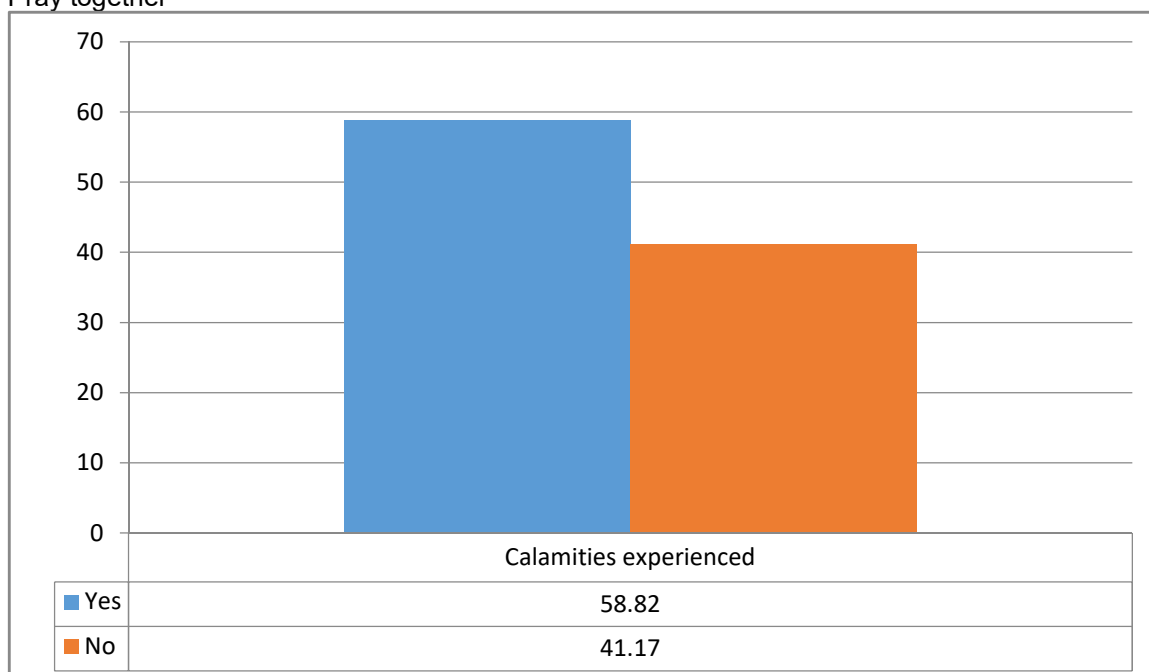


Figure 13: Calamities Experienced

Brgy. Pantok, Binangonan, Rizal

Sitio Ynares Village

Age

Most of the respondents are 21-30 years old, 2.75% are 18-20 years old, 20% are 31-40 years old, another 20% fall between the age of 41 to 50 years old, 18.62% are 51-60 years old, 7.58% are 61-70 years old, and 11.76% of the respondents are 71 and above.

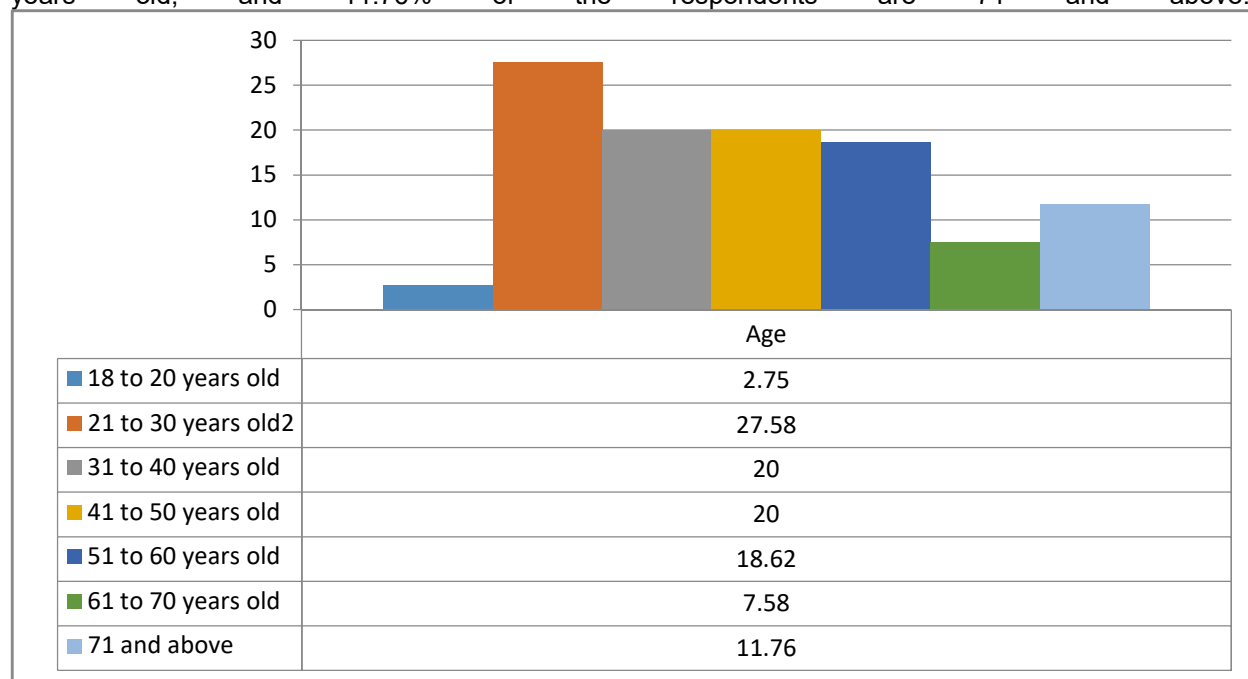


Figure 1: Age

Gender

Most respondents were female accounting for 74.48% of the surveyed population.

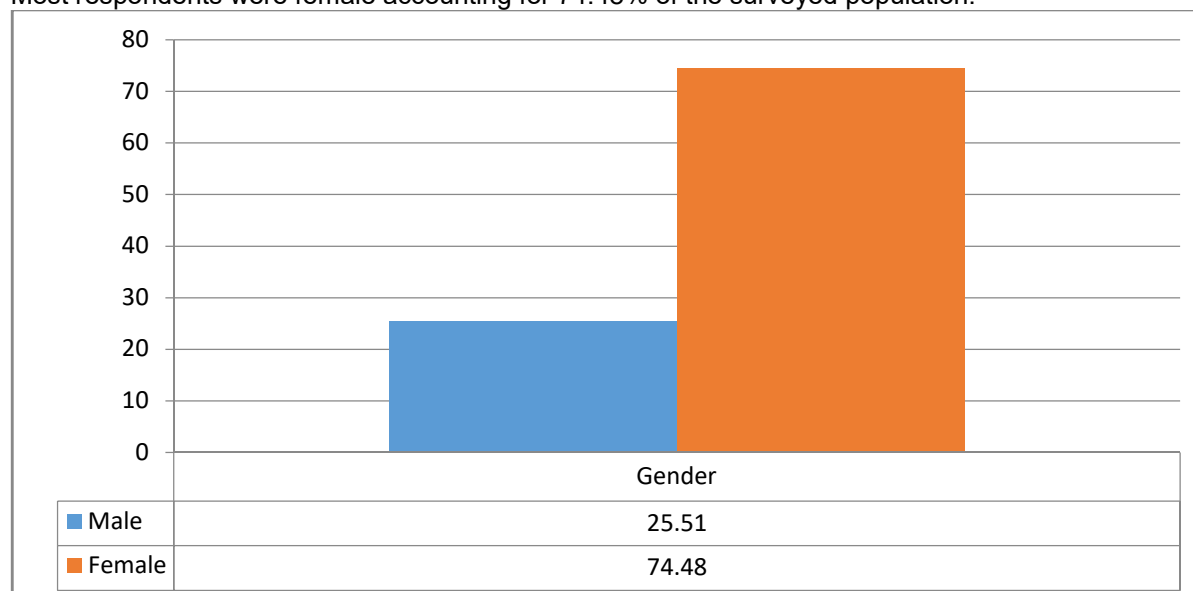


Figure 2: Gender

Occupation

Environmental Performance Report and Management Plan

Calabar Quarry Operations Project

Island Quarry and Aggregates Corporation (IQAC)

Brgys. Pantok and Palangoy, Binangonan, Rizal



Most of the respondents were unemployed, 22.06% have their own livelihood, and 17.93% were into laborer/skilled, 8.27% were Government/Private Employee, 6.89% were driver, 2.06% were farmers, and 6.89% have no work at all.

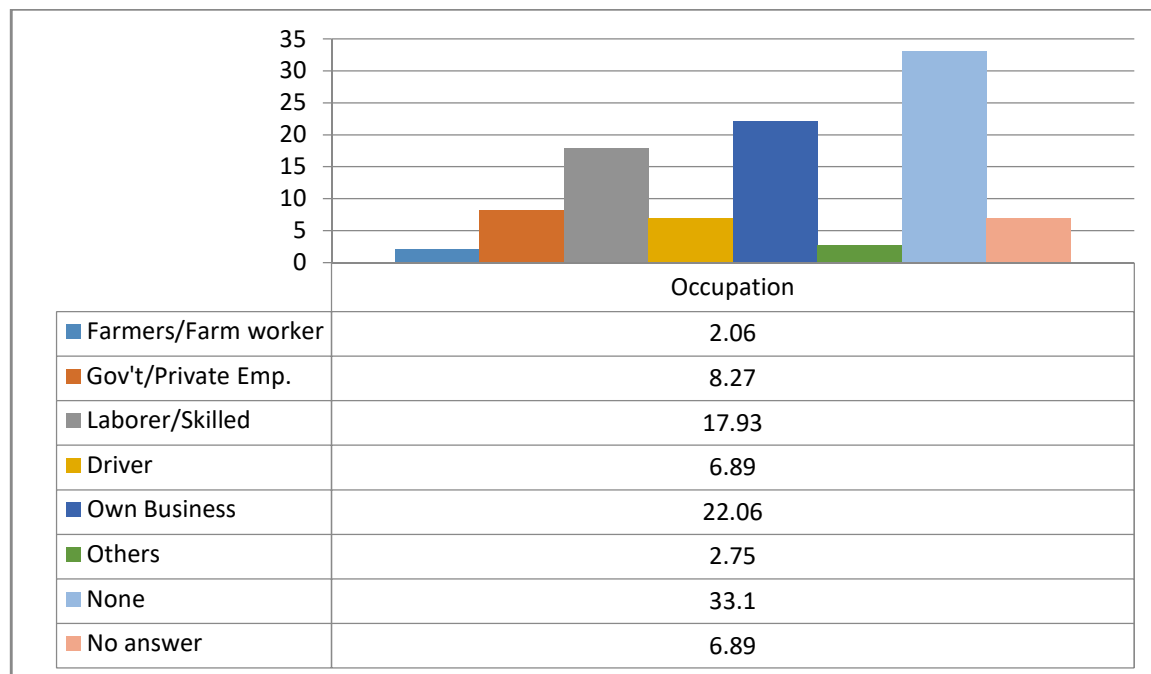


Figure 3: Occupation

Monthly Income

in terms of their monthly income, 33.79% of the respondents gain Php 1000-5000 per month, 26.2% of the respondents obtain a salary of Php 5,000-10,000, 16.55% gain monthly income of 10,000 and above, 13.1% have no monthly income, and 10.34 have no answer.

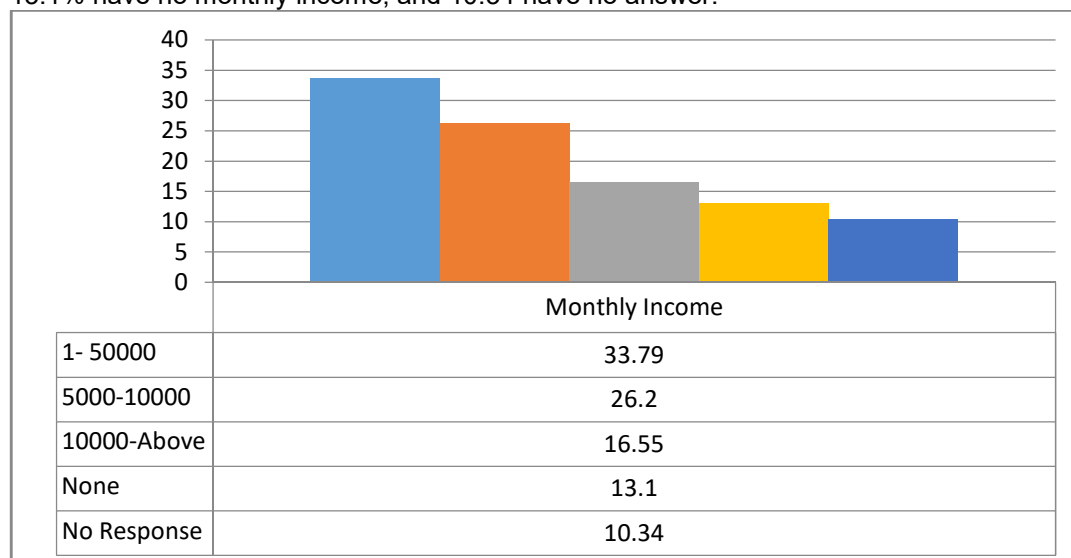


Figure 4: Monthly Income

Religion

Majority of the respondents is catholic, 2.06% are Iglesia ni Cristo, 6.89% answered the other choice, and 2.75% have no answer.

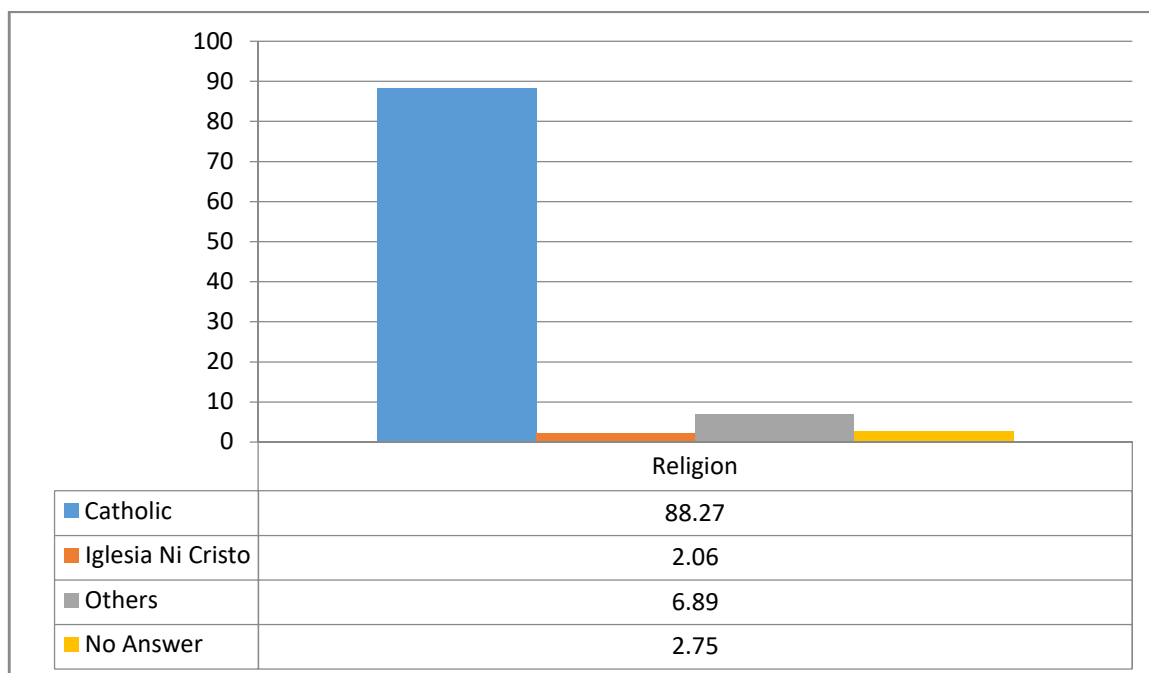


Figure 5: Religion

Educational Attainment

For their educational attainment, 15.86% reached elementary level, 51.03% acquired high school education, 6.89% obtained vocational training, and 25.51% reached college level.

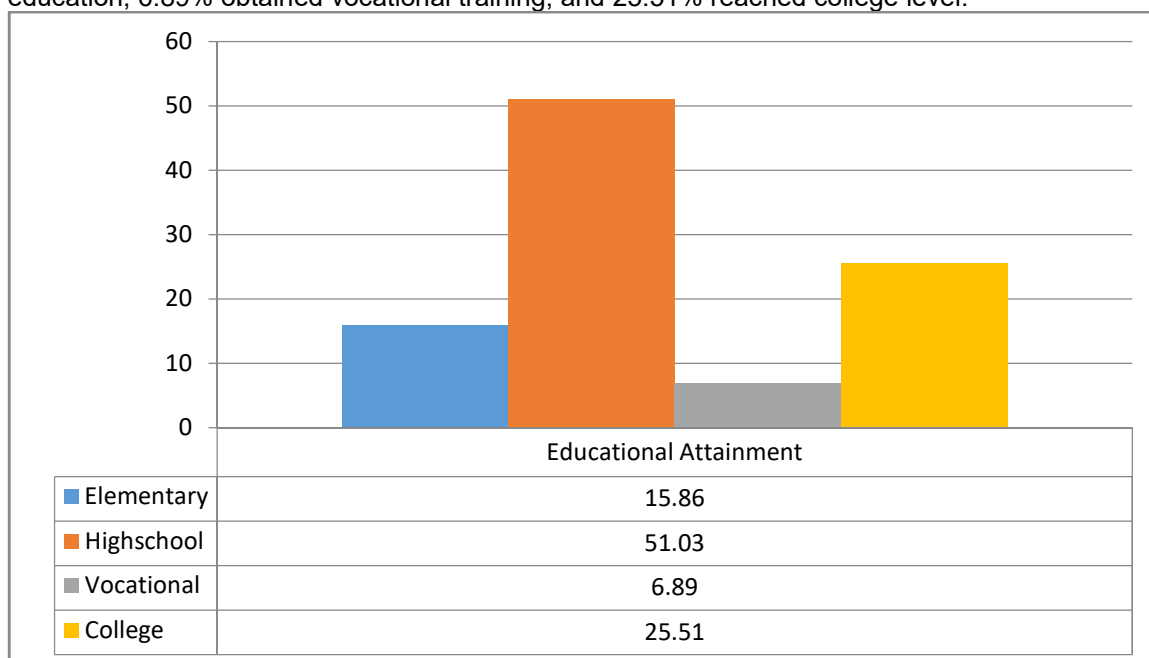


Figure 6: Educational Attainment

Civil Status

27 of the respondents are single, 78 are married, 12 respondents are widowed, 27 respondents are living together, and 1 respondent have no answer.

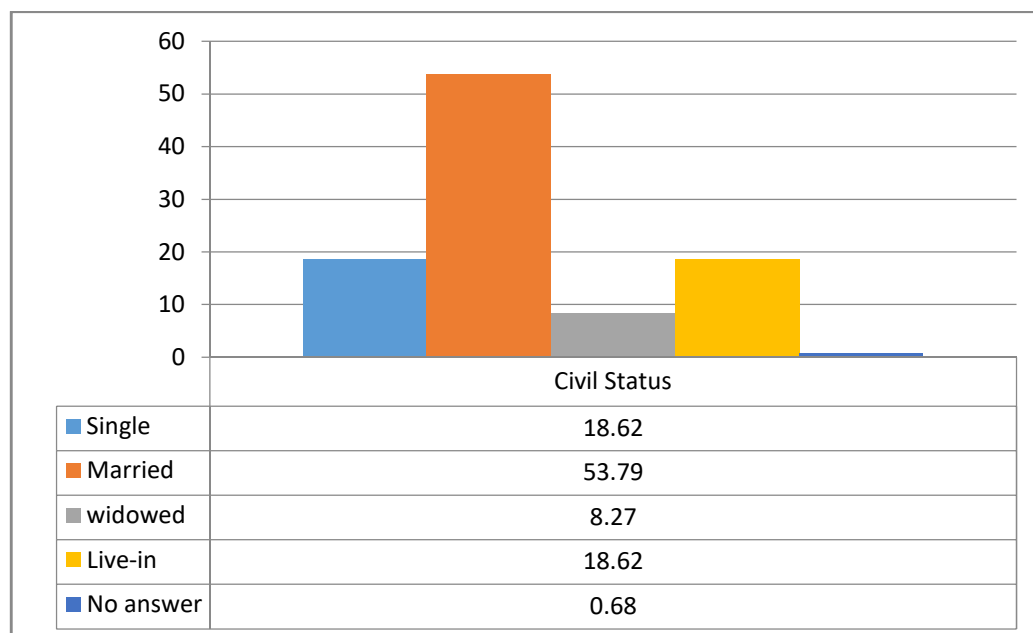


Figure 7: Civil Status

No. Of Family Members

Majority of the respondents have 2-5 members in their family, 46 respondents have 6-10 members in their family, 11 respondents have 11-15 members in their family, while 4 respondents have no answer.

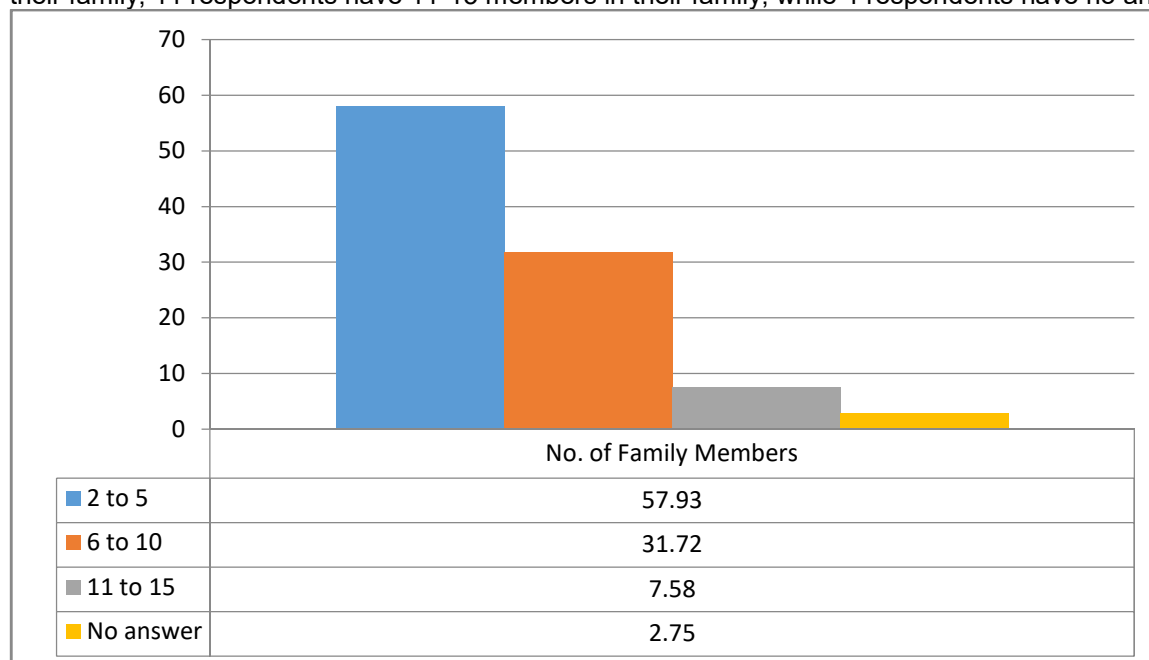


Figure 7: No. of Family Members

Origin

48.27% of the respondents are locals of Brgy. Pantok, Binangonan Rizal, while the rest of the respondents are not locals and used to live in Angono, Pampangga, Rizal, Manila, Quezon City, Pasig, Ilocos Norte, Cainta, Tagaytay, Bohol, Tarlac and Bulacan.

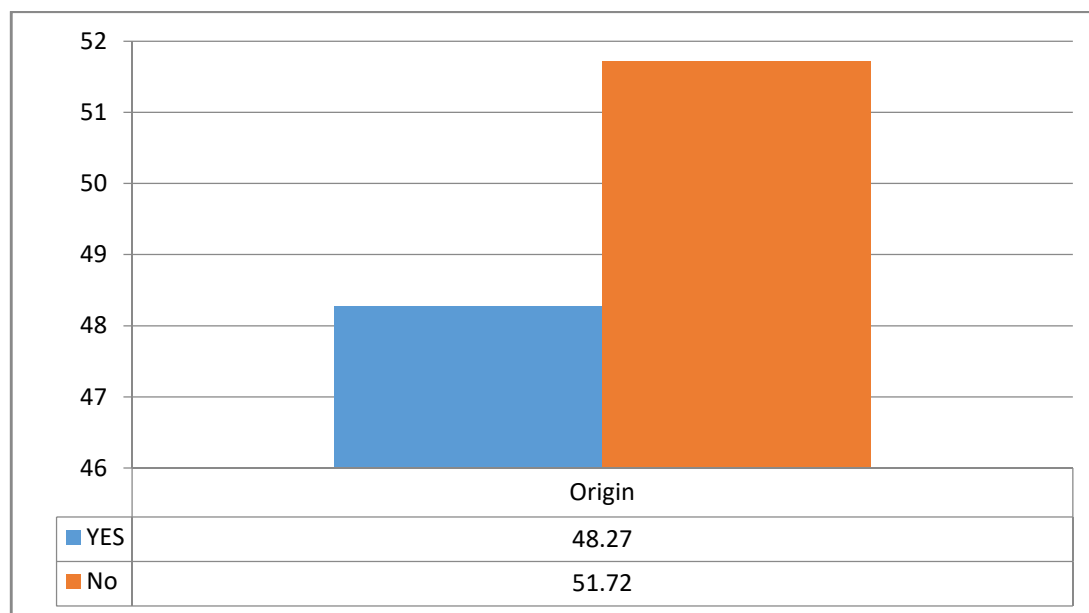


Figure 8: Origin

No. of years staying in the area

15 respondents lived in Brgy. Pantok from 1 to 10 years, 28 of the respondents lived for almost 11-20 years, 26 respondents lived in Brgy. Pantok for 21-30 years, 52 respondents lived there since birth, and 24 respondents have no answer.

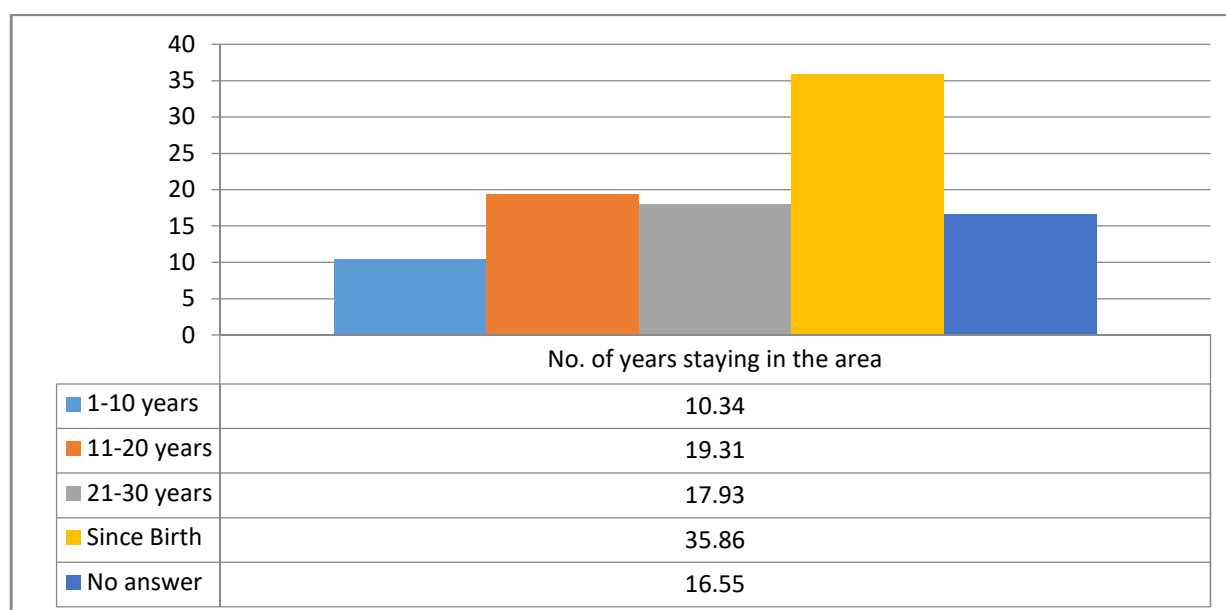


Figure 9: No. of Years staying in the area

Sources of Water:

In all areas surveyed, majority of the respondents get their water from Nawasa/Mineral.

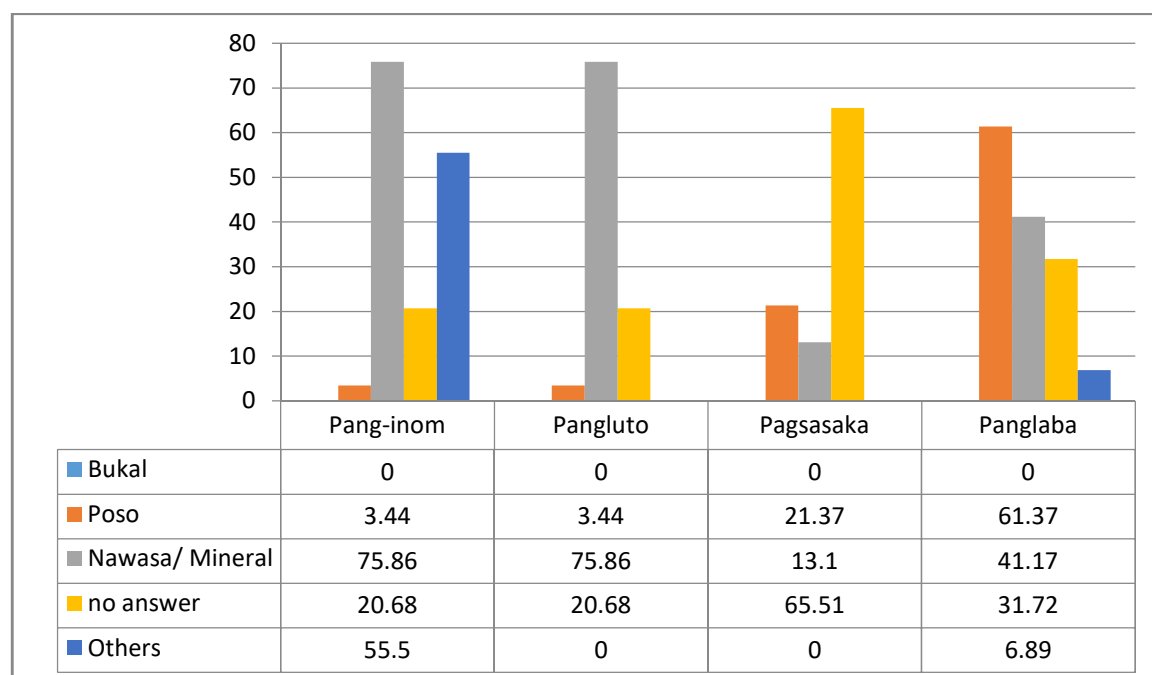


Figure 10: Sources

Type of Vehicle

In terms of Vehicle, 6 respondents own a bicycle, 56 respondents possess motorcycle, 6 respondents have other types of vehicle, 2 respondents own jeepney, 55 respondents have no vehicle, and 20 respondents have no answer.

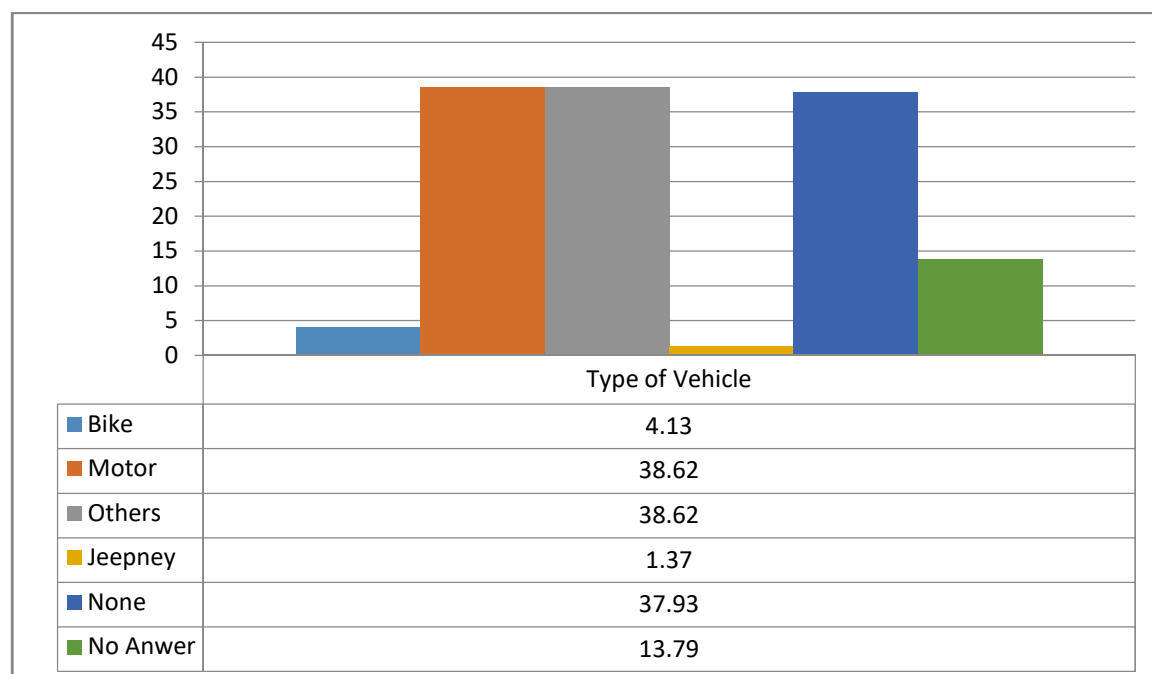


Figure 11: Type of Vehicle

Comfort Room

54 of the respondents used open pit, while 89 of the respondents used water closet, and 2 respondents have no answer.

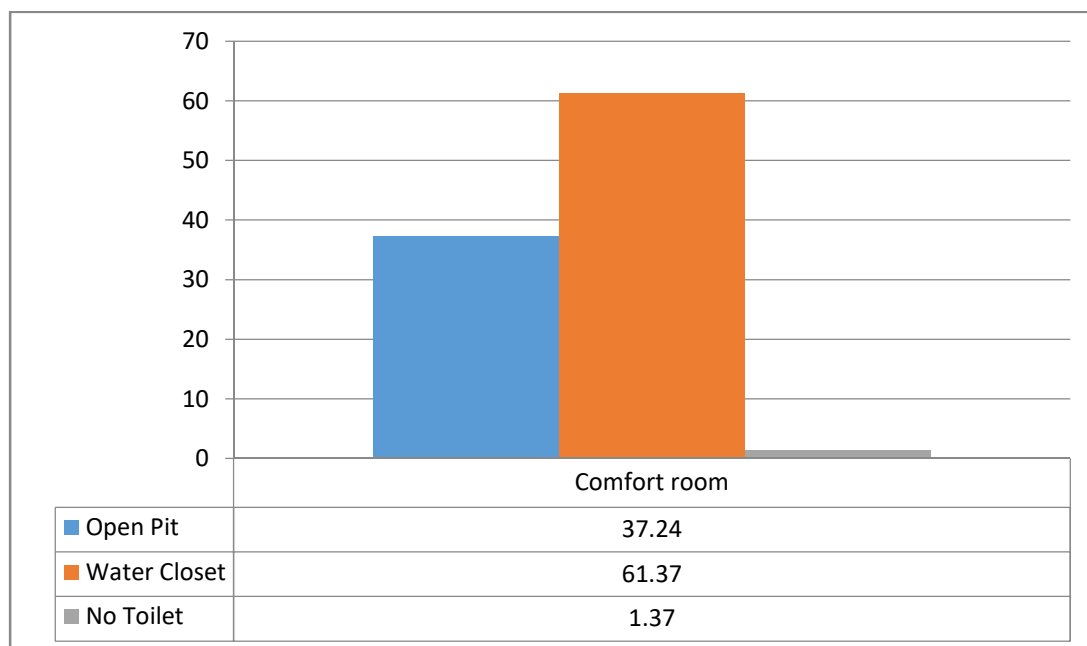


Figure 12: Comfort Room

Calamities Experienced

Majority of the respondents experienced calamities, while 32 respondents said no. These include typhoon and earth quake. Following are some of the ways they did to confront the situation:

- Pray together
- Be prepared
- Followed safety precaution

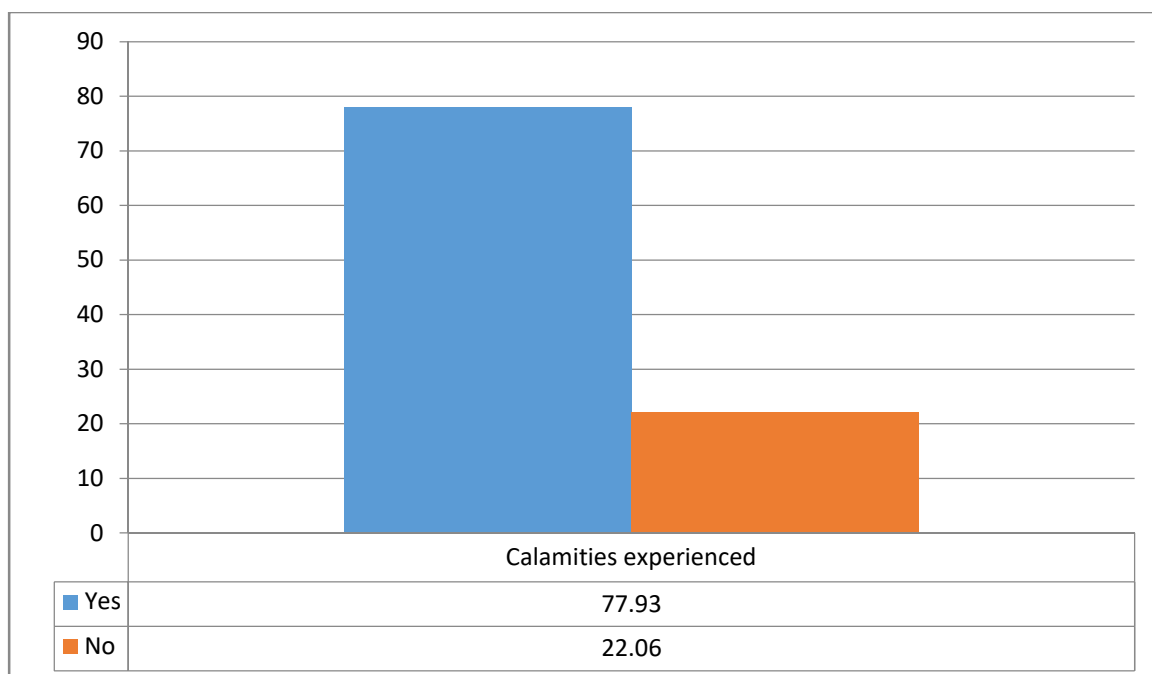


Figure 13: Calamities Experienced

Perception

88 of the respondents are aware of the proposed project while 57 respondents are not. Majority of them respondents attended meeting, 18 of them got informed through Brgy/Municipal officials, and 50 of the respondents posted no answer.



Perceived positive effects from the proposed project

89 of the respondents believed that the proposed project will generate employment for the local residents while 52 respondents believed that the said project can help the community while 4 respondents posted no answer.

Perceived negative effects from the proposed project

33 respondents said that the proposed project can be a health hazard, 21 respondents believed that it will cause pollution, 48 respondents have no idea and 42 respondents posted no answer.

Opinions of the project

Majority of the respondents stated that the project can greatly help in improving the community and the local residents, while 23 of them posted no answer.

All of these information gathered will be further processed by IQAC especially the COMREL and the Health, Environment and Safety Technical Team to look closely at the results and the concerns raised by each respondent and incorporate in their respective programs and revert to the community for responses/action.

2.4.2 Displacement of Settlers

There are only 8 households or families that will be affected or relocated resulting from the project implementation. Direct negotiation/discussion with them will be undertaken.

2.4.3 In-Migration

The Project will contribute to the in-migration because people will be encouraged to apply for work because of the possible benefits that the project may offer. With this, the existing demographic data will be affected, specifically with respect to the following:

- Increased population of host barangays
- increased economic activity in the area

However, influx of migrants may be expected to be confined to locals from different barangays only within the Binangonan area because preference will be given to the host community, i.e. host barangays and municipality of Binangonan as a whole. Only if there are expertise lacking in the manpower that are provided by the locality will the Proponent look for other workers from other areas. In case these migrants will be competing with the local services available to the locals of the area, IQAC will assist in the provision of basic services through its SDMP. To avoid this, IQAC will also ensure that qualified residents of the host barangay and of the municipality in general will be given priority in hiring and employment.

2.4.4 Cultural/Lifestyle Change (especially on indigenous people)

There are no indigenous people in the area. However, the cultural lifestyle of the residents may change because of the project due of the following factors:

- increased population the host barangays
- increased economic activity in the area
- increased cost of living because of the additional needs and wants that the people can afford to buy

2.4.5 Impacts on Physical Cultural Resources

There are no cultural resources near or within the project site.

2.4.6 Threat To Delivery Of Basic Services /Resource Competition

The Project will not pose threat to delivery of basic services because it will not compete with the services being provided by the local and national government. The Project will even be a partner to deliver and improve the delivery of the basic services for the people because the Project has social development component.



2.4.7 Threat to Public Health and Safety

The Project will not pose threat to public health because all management and mitigating measures will be implemented especially the controlled blasting activity.

Diseases that may be affected by Climate Change

Climate change phenomenon is necessarily viewed from a global perspective. Thus although combustion process will necessarily result in the production of ghg CO₂, the operation of the cement grinding plant itself will not in any way impact on climate change. Thus it may be noted that diseases affected by climate change resulting from the project is not germane to health effects.

Safety

Safety is number one in the priority of project implementation. Adequate emergency and safety equipment and procedures, and regular training will be implemented. Occupational health and safety of the workers and people around the work site will also be among the priority.

Following are the health institutions present in Binangonan Rizal.

- Binangonan Municipal Hospital, Barangay Libis
- Binangonan Lakeview Hospital, Barangay Tagpos
- Brgy. Health Centers in 40 barangays
- Pag-asa Hospital, Brgy. Pag-asa
- Margarito A. Duavit Memorial Hospital - RPHS, Binangonan (Annex)

Public Services are also available in Binangonan as follows:

- Binangonan Fire Station
- DPWH: Public Works Department · 1930 Manila E Rd
- Binangonan Health Office: Public Health Department · Manila E Rd
- DARANGAN WATER SERVICE DEVELOPMENT COOPERATIVE (DWSDC)
- Philippine Postal Corporation
- Hall Of Justice
- Binangonan Public Cemetery
- Binangonan Lakeview Hospital
- Sports Department - Government Binangonan, Rizal
- Binangonan Municipal Hospital
- Binangonan Municipal Hall
- Communication: 105.1 Crossover DWBM-FM Transmitter
- Segunda Compound Sun site
- Globe Cell Site (GRACEVILLEX)

Transportation

1. UV Express Las Piñas
2. UV Express Terminal
3. Partas Transportation
4. B-Jeep
5. UV Express Terminal: SM Megamall
6. The Fort Bus
7. MRT Ayala Station
8. Project 6 FX Terminal
9. SM City North Edsa Bus Bay
10. LRTA- Vito Cruz Station

2.4.8 Generation of Local Benefits from the Project

Binangonan's economy remained docile for almost four decades, subsisting only with fair performance in the aquaculture and agricultural ventures with no new developments in-place to create job opportunities in the commercial sector. Tourism industry's growth remains to be seen in the long-term. Industries relative interests to the town has to be developed and the corresponding infrastructure must be funded and implemented accordingly to create and sustain future development. Overall expectations to encourage investment must be prioritized.



The present administration under the leadership of Cecilio M. Ynares elected during May 2017 and has served for three (3) years consecutively focuses on the economic development of the municipality. The tourist spots in Binangonan namely as follows East Ridge Golf and Country Club, Thunderbird Resorts, Talim Island, Mount Tagapo, Vicente Manansala Shrine, Sta. Ursula Parish Church, Ang Kalbaryo, Marian Hill, Tabon and Binangonan Recreation and Conference Center attracts tourists and business people to invest in the municipality. The current mayor has been supported to uplift the well-being of the Binangonanons.

Local benefits may be generated from the Project. These include but not limited to the following:

- Potential to create jobs during the construction phase;
- Local taxes include the local distribution of real property taxes and local business tax;
- Capital investment;
- Contribution to the combined Gross Regional Domestic Product (GRDP) for Region IVA;
- The overall impact of these economic contributors from the project to the national economy will be added to the annual GDP.

Enhancement of Employment and Livelihood Opportunities

In response to a question raised during the Public Scoping, and even without such being asked, the Proponent will give priority for employment to qualified residents under mutually acceptable employment terms and conditions and subject to compliances with the rules of the Department of Labor and Employment (DOLE).

Increased Business Opportunities and Associated Economic Activities

Cement and other building materials is one of the most basic need for infrastructure required by business, industries and economic activities. With the project, increased business opportunities and its multiplier effect may be generated.

Increased Revenue of LGUs

Taxes will be paid the LGUs the amount of which will be determined when all the parameters for the operation of the Plant shall have been established.

Social development and Management Programs are currently being implemented. The copy of the SDMP for 2015-2019 is provided in Chapter 5.

2.4.9 Traffic Congestion

The Project may bring about traffic congestion because of the volume of trucks that will be generated by the project. Traffic management thru assignment of Traffic Enforcers and LGU counterparts will be assigned to facilitate traffic. Signages will also be installed. Also, three to four hectares of the project area will be devoted to truck parking only. The Traffic Management Plan that will be designed will consider the rerouting schemes that may be implemented especially during peak seasons of travels.

The characteristic of traffic in an area is best influence by the land use pattern within and the surrounding vicinity. Commercial land use zones are prone to traffic congestion as commercial establishments within this zone are inherently traffic generators. However, traffic issues and management could not be limited on one establishment, nor one block of commercial buildings but rather it has to be taken in the context of not only of the municipality of Binangonan alone, but to include neighboring cities and municipalities comprising the Province of Rizal.



CHAPTER 3: ENVIRONMENTAL MANAGEMENT PLAN

The Environmental Management Plan (EMP) is formulated to minimize the potential adverse impacts while enhancing the beneficial effects of implementation of the project. This EMP shall serve as the environmental monitoring and implementing guidelines for the project. This is a more generic plan because prior to project implementation, an Environmental Protection and Enhancement Program (EPEP) and Final Mine Decommissioning and/or Rehabilitation Plan will be formulated and submitted to the Mines and Geosciences Bureau (MGB).

With the identification of the key project activities at each phase and key impact thereof and the delineation of the important baseline conditions this Section summarizes the significant impacts and corresponding management plan/mitigating measures.

Provided in Table 3.1 is the Summary Matrix of the Impact Management Plan.



Table 3.1: Summary Matrix of the Impact Management Plan

Project Phase / Environmental Aspect (Project Activity Which will likely Impact the Environmental Component)	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation* or Enhancement	Responsible Entry	Cost in PhP	Guarantee/ Financial Arrangements
PRE SITE PREPARATION	Sourcing of equipment and contractors; Securing of approvals like MGB approval for AEPEP, ASDMP, etc.					
SITE PREPARATION						
<ul style="list-style-type: none">• Site Clearing• Quarry development• Construction of quarry access roads	Terrestrial Ecology	<ul style="list-style-type: none">• Trampling of understorey vegetation• Loss of vegetation due to site clearing• Disturbance or loss of habitat and/or food source for affected wildlife• Physiological stress to natural life cycle of wildlife floral and fauna species• Change in floral community structure• Death to wildlife due to accidental strike with the heavy equipment and other accidental encounter	<ul style="list-style-type: none">• Avoiding trees in laying out the road network• Localized movement of equipment and personnel• Clear only areas absolutely necessary for quarry and equipment movement• Leave a five-meter-wide easement of grass shrubs and bushes surrounding the headwaters / intermittent rivers within quarry area• Just as standard orientation component, workers and contractors should be oriented with the importance of wildlife species that they would possibly encounter during the course of work• Rehabilitation and maintenance of green riparian buffer zones to screen out silt and run-offs• Develop, enhance the forest standards in steep areas in adjacent buffer zone, to recreate wildlife sanctuary• Potential mother trees for ecologically important species shall be locate and seeds/propagules shall be collected to serve as genetic source for these important species• Vegetation to be cleared should be	Proponent thru Contractor	5,000,000.00	Agreement with contractor

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			<p>properly delineated to avoid unnecessary clearing</p> <ul style="list-style-type: none"> • Poaching of wildlife must be strictly prohibited to mitigate its population reduction • Lure out wildlife from target quarry sections / block and carefully transfer captured wildlife to nearby forested zone or wildlife sanctuary • Operators of heavy vehicles should be made aware of the presence of wildlife (particularly large species) within the buffer zone. They should be instructed to avoid as much as possible running into wildlife that crosses the access road • Hunting should be banned at all cost. Strict penalties should be imposed • Establish a plant nursery in buffer zone with seeds and planting materials from the natural vegetation in quarry site to provide quality and adequate volume of planting materials for use in progressive mine rehabilitation and carbon sequestration • Establish and enforce speed limits for drivers operating project vehicles and equipment to minimize undue noise and speed that unnecessarily disturb remaining wildlife 			
	Land, Local hydrology	Change in land form and	Careful bench mining cut and haul method. Careful to provide controlled waterways and silt / flood detention ponds, scaled to be adequate to mitigate accelerated soil erosion and surface run-off impact of newly disturbed land surface	Proponent thru Contractor		Life EPEP

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	Water Quality	<ul style="list-style-type: none"> • Soil erosion, siltation in surface water bodies by eroded soils and/or dumping or accidental large volume of spilled materials during handling • Deterioration of surface water quality resulting from increased siltation of surface runoff or discharge of spilled oil and/or other hazardous materials from vehicles and equipment; 	<ul style="list-style-type: none"> • Follow the approved final pit design which includes erosion control structures, drainage system, and silt/ flood detention ponds; • Minimize ground clearing and other earth works to what is necessary for the present and next mining block; • Install small buffer zones along waterways such as rows of planted bushes or sand bags in the meantime that the vegetative silt traps and silt detention ponds are not yet fully developed; regularly desilt settling ponds and clogged waterways; • Provide a small cemented and lipped equipment repair platform with oil sump and oil and grease separator in quarry site for in-site change oil and emergency equipment repairs; • Minimize vehicle & equipment maintenance within quarry area and limit stored fuel to needs at site by equipment with limited mobility. store petroleum products in tightly sealed containers, located in secured areas far from fire hazards and floods; 	Proponent	2,000,000.00	Life EPEP
		<ul style="list-style-type: none"> • Increased oxygen demand in waterways due to accumulated wastes 	<ul style="list-style-type: none"> • On-site collection and segregation of wastes • Haul out of non-biodegradable and recyclable waste materials 			
	Water quality in lagoon	<ul style="list-style-type: none"> • Increased turbidity resulting from dust settlement, sediment run-off and silt from nearby construction works 	<ul style="list-style-type: none"> • Ensure sediment settling ponds, erosion control structures, drainage system, and silt/ flood detention ponds will prevent sediment intrusion into lake; • Conduct dust control measures thru regular sprinkling of unpaved roads 		600,000.00	Contract with service provider

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		<ul style="list-style-type: none"> • Reduced plankton primary productivity which in turn will affect fish and benthos biota food web • Disruption in fish reproductive and larval development processes 	<ul style="list-style-type: none"> • during dry days or use of water cannons • Conduct biodiversity monitoring bi-annually; • Conduct periodic water quality monitoring 			
	Lagoon fauna	Potential demise of fish and macro-invertebrate population in lake due to oil and grease contamination	<ul style="list-style-type: none"> • Implement oil and grease containment plan and recovery measures; • Conduct Biodiversity Monitoring System (BMS) biannually to monitor freshwater species (macrobenthos) • Implement Tilapia re-seeding program when necessary. 			Contract with service provider
	Air quality	<ul style="list-style-type: none"> • Increased dust accumulation • Increased noise generation • Increased CO2 emissions from transport vehicles and heavy equipment 	<ul style="list-style-type: none"> • Strictly enforce covering of hauling trucks cargo; • Conduct dust control measures thru regular sprinkling of unpaved roads during dry days or use of water cannons • Proper maintenance of vehicles and equipment following manufacturer's manual; • Enforcement of speed limits of 30 KPH for project vehicles and equipment plying public roads. • Implement compensation tree planting to capture the equivalent amount of carbon and carbon dioxide emitted by project vehicles and heavy equipment. • Distribute suitable quality planting materials to residents beside the road for tree planting, to buffer road noise 	Proponent	25,000,000.00	Life EPEP

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			and screen dust			
	People	<ul style="list-style-type: none"> • Public health and safety issues related to project implementation; • Employment and livelihood opportunities for local people and entrepreneurs • Delivery of supplemental basic social services to local people; • Uncontrolled developments around the project site 	<ul style="list-style-type: none"> • Increase effort in dust control: twice daily watering of haul roads; expand settling pond dimensions and appropriate bottom construction to serve as water reservoir to serve dry season water requirements • Provision and maintenance of signage's demarcating quarry buffer zone, wildlife sanctuary, safety precaution on road near quarry area; location of fault line (if confirmed) • Practice good housekeeping among construction staff and contractors. • Provide the affected local people with supplemental livelihood training • IEC to Barangay LGU and local community on nature and qualification of jobs the proponent needs. • Prioritize local labour in employment; • Strict screening of migrant labour, require Barangay clearance and certificate of good moral character, etc.; • IEC to orient employees especially migrants on local customs, tradition and ordinances. • Proponent to coordinate with TESDA or other vocational institution for the conduct of skills training for local residents especially affected persons to upgrade their (local residents) skills to a level that would qualify them to work in the project or other places of employment. • Generation of livelihood opportunities by 	Proponent	17,000,000.0 IEC	Part of IEC

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			allowing local entrepreneurs to provide support services to the project and its workers (i.e. carinderia, variety stores, market stalls, laundry, transport, internet cafe and other services) thereby creating local employment.			
	Peace & Order	Unauthorized entry of outsiders and establishments which might cause peace and order related problems.	<ul style="list-style-type: none"> • Coordination with the Barangay LGU to ensure only authorized establishments are able to operate in the area; and control of unauthorized entry of outsiders into the project area and villages beside it; • Buffer zones will be established and maintained around the perimeter 			
	Health and Safety	Entry of migrant workers with families, which might cause problems of congestion, peace and order and security breaches. In like manner, cause health problems due to contagious or sexually transmitted diseases (HIV/AIDS), overuse of public utilities /services, competition of resources, social conflicts due to cultural differences, peace and order issues due to theft/robberies, and introduction of other social evils (i.e. drug abuse, prostitution,	<ul style="list-style-type: none"> • Proponent to establish and maintain strict hiring policy for migrant workers. • Proponent to require all local job applicants to secure working permit from LGU, unless own recruit and because skill is not available locally; • Proponent to coordinate with Municipal & Barangay LGUs to limit issuance of working permits only to local residents most especially the project affected persons; • Increase and train Barangay tanods to be deployed in areas where migrant workers reside, for maintenance of public order and proper management of waste. • Proponent to provide Health clinic manned by a Doctor, Nurse and Health workers; • Health certificate for workers prior to hiring into the project • Partner with the LGU for the 			

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		human trafficking, etc.), and increase in pollution due to improperly handled solid and liquid wastes;	<p>implementation of the Social Development Program;</p> <ul style="list-style-type: none"> Organizing and training of men and women for Project related Disaster Risk Reduction Management in the Barangays; DENR Special Order 2007653, adaptation measures that include protection of water aquifer affected by the Project, identification of areas most vulnerable to natural hazards within the Project site; and conduct of IEC involving the LGU and local residents, about possible impending calamities and support the establishment of a “disaster risk reduction” plan by the local people. 			
OPERATIONS PHASE						
<p>Surface quarry operation</p> <p>Material Extraction</p> <ul style="list-style-type: none"> Transport of produced quarry materials; Progressive compensation forestation; Rehabilitation of quarried-out areas 	Land	<ul style="list-style-type: none"> Alteration of topography Soil erosion and subsequent siltation of water bodies; Disturbance of soil profile, change in soil suitability Land contamination 	<ul style="list-style-type: none"> Carefully design slope cut to always end the work day with stable working slopes and quarry faces Design slope cuts always with adequate drainage and silt control provisions Follow approved / agreed rehabilitation schedule Vegetative slope protection should be regularly maintained Consider visual aesthetics in land rehabilitation design. Preserved top soils are to be re-arranged in target landscaping sections, as per FMRDP. Provision of silt ponds No use of chemicals Motorpool is not located near the waterways 			

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		<ul style="list-style-type: none"> • Solid waste generation 	<ul style="list-style-type: none"> • The project will not establish a field office or workers' quarters in the production area. Should there be solid waste generated in addition to excavated soil and clay, these will be collected, transported and placed in suitable containers at the IQAC yard for disposal to the municipal waste facility. 			
	Terrestrial flora and fauna	<ul style="list-style-type: none"> • Clearing of Vegetation outside of the pit area due to uncontrolled influx of migrants and illegal establishments outside project area; • Reduction of wildlife population due to hunting and/or gathering of forest products serving as food. • Loss of habitat to aquatic life in streams draining project area 	<ul style="list-style-type: none"> • Local authorities to control the influx of migrants and illegal establishments into the area; • Protection and maintenance of the cluster trees located in-between pits • DENR and local authorities to educate local residents and migrants on the value of forest conservation and protection of wildlife species; • Develop and enforce guidelines to control hunting and gathering for forest products. 			
	Geology	<ul style="list-style-type: none"> • Subsidence, mass movement, collapse of slopes especially in areas with sink holes or limestone caverns. • Risk due to earth movement along active fault line that traverse production area 	<ul style="list-style-type: none"> • Implement final pit design that has slope protection benches and silt detention ponds; • Progressive rehabilitation of quarried-out sections & progressing forward preparation of new mining block in small increments • Request PhilVolcs to confirm presence of fault line in production site prior to operations; 			

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			<ul style="list-style-type: none"> • Implement the recommendations of the geotechnical studies; • Develop and implement a suitable and appropriate slope / ground failure monitoring plan guided by the results of the geotechnical studies, to detect instability at an early and non-critical stage so that safety measures could be initiated to prevent or minimize impacts • Coordinate with PhilVolcs and PNRC to conduct a Community-based Risk Reduction Planning in the area. 			
	Air	<ul style="list-style-type: none"> • Increase in TSP • Increase in noise levels • Increase in air emissions from operations of project vehicles and heavy equipment 	<ul style="list-style-type: none"> • Proper and regular maintenance of vehicles and equipment following manufacturer's manual; • implement dust control thru water spraying on unpaved roads and benches used as access roads especially during dry days; • conduct compensation tree planting to sequester carbon emissions from quarry and transport operations; • Establish and implement speed limits for company drivers and heavy equipment operators; • Cover the cargo of trucks hauling materials thru public roads; • Conduct IEC to inform local people on quarry operations, dust and noise control measures. 			
	Water	<ul style="list-style-type: none"> • Deterioration of surface water quality due to increase in TSS and turbidity levels in 2 streams 	<ul style="list-style-type: none"> • Approve and implement the final pit design which has erosion control structures, drainage, catch basins and sediment settling ponds; • Regular desilting of catchment basins / 			

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		draining project area; <ul style="list-style-type: none"> Reduction of water resources available for use of local people due to water pollution or resource use competition 	settling ponds <ul style="list-style-type: none"> Recycling of surface water run-off collected in the silt basin for dust control and watering of vegetative rehabilitation measures. 			
	People – Local Economy	<ul style="list-style-type: none"> Local government generation of revenues from taxes, permits and LGU share in the mining of cement raw materials Royalties and taxes paid locally and shared by municipal and barangay 	<ul style="list-style-type: none"> Benefit from development programs through IQAC equivalent to 1.5% of operating cost Total taxes paid to the national government will exceed Excise Tax: 60% goes to national government; 40%, to the local government 20% for host Provinces 45% for host Municipalities 35% for host Barangays Real Property Tax to province and municipalities Development of small and medium enterprises like transport, construction and utility services, food services and sundry supplies Alternative farm land to respond in increase demand for food products to sustain the operation of the quarry New businesses will create more jobs 			
		<ul style="list-style-type: none"> Maintenance of employment 	<ul style="list-style-type: none"> IEC on preservation of existing jobs, public posting of new vacancies, qualifications, and deployment schedule; Local hiring priority for qualified Barangay residents IEC on goods and services 			

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			<p>requirements that can be provided by local entrepreneurs;</p> <ul style="list-style-type: none"> • Skills training to upgrade local skills of residents that can be sponsored by the project 			
		<ul style="list-style-type: none"> • Uncontrolled influx of migrants and illegal structures for speculation will create social problems (i.e. congestion, competition for food and water, peace & order issues, theft/crime, prostitution, illegal-drug use/sale, etc., illegal quarry.) 	<ul style="list-style-type: none"> • LGU to be aware of the need to control immigration; • IQAC will require Barangay Clearance as part of employment requirement. • IQAC will coordinate with the Barangay LGU in case proliferation of new business establishments around quarry site to ensure these are within LGU oversight • Buffer zones will be established around the perimeter of the quarry 			
	People-Health and safety	<ul style="list-style-type: none"> • Entry of migrants with families which might cause social and public health problems due to infectious diseases/HIV/AIDS, overuse of public utilities /services, competition of limited natural resources & social services, social conflicts, peace and order, increase in pollution due to solid and liquid wastes. 	<ul style="list-style-type: none"> • Hiring, if any, will prioritize local residents • Medical clearance will be part of employment requirements • Proponent to provide Health clinic, with regular visits from Doctor, a regular Nurse and Health workers to augment existing government health services • Health certificate for workers prior to hiring into the project • Partner with the LGU on the implementation of the Social Development Program • Other applicable activities started during preparation phase. 			

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ABANDONMENT						
	Terrestrial Ecology, post quarry land use suitability	<ul style="list-style-type: none"> • Loss of top soil, soil nutrient loss, alteration of top soil characteristics • Contamination of soil with hydrocarbon residues from • spilled oil and fuel 	<ul style="list-style-type: none"> • Top soil with organic materials stripped from quarry surface should be carefully stockpiled in level, well drained area and grassed. • Vermiculture to produce vermicast for conditioning of nursery soil and reforestation areas • Quarry bench design to consider inverse super elevation for sediment runoff to settle in land-side contour canal. Regular desilting of contour canals. • Refilling (fuel) and maintenance of equipment in quarry shall be limited to quarry equipment, excluding transport equipment. • Construct at site a concrete platform with lip, surfaces lightly dipping to an oil collection sump with oil and grease separator unit. Collected used oil and fuel storage should be on concrete flooring with containment lip in case of spillage. • Used oil should be hauled out only by DENR accredited waste handler and treater 	Proponent thru Contractor		Life EPEP
<ul style="list-style-type: none"> - Rehabilitation of quarried-out areas - Dismantling of structures 	A. Physical	<ul style="list-style-type: none"> • Erosion and / or collapse of rehabilitated areas; • Solid waste generated from dismantling of structures in the site, 	<ul style="list-style-type: none"> • Ensure that geotechnical considerations are considered in the final pit design and these followed in the progressive restoration of the quarried-out areas; • Proper and regular maintenance of vegetative slope protection and contour canals and drainage system of quarried-out areas to ensure that terraces and benches have nil erosion potential and 			

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			<p>drainage facilities are functional during the decommissioning phase</p> <ul style="list-style-type: none"> • Low survival of tree plantations and re-vegetation need to be promptly replanted with suitable tree or shrub species; 			
	B. Biological	<ul style="list-style-type: none"> • Re-establishing vegetative cover in the project area • Return of the avifauna and increase in population of small animals due to restoration of habitat 	<ul style="list-style-type: none"> • Use indigenous species that were once thriving in the area for reforestation. Shrubs, trees and other plants removed due to land clearing will be replanted and nursed in the nursery for eventual replanting into project site for site rehabilitation. • No exotic species will be introduced. 			
	C. Socio-Economic	<ul style="list-style-type: none"> • Abandonment of project site in an ecologically poor and environmentally deteriorated condition • Reduction and eventual termination of employment 	<ul style="list-style-type: none"> • Do progressive compensation planting by continuous tree planting in steep areas within the buffer zone and the final quarry face, as soon as these are attained • Ensure that contour canals are provided in all benches to accumulate run off and soil, and allow transported sediment to collect nutrients • Development of project site to serve the final land use that will be determined through the updating of the CLUP; • Prepare the communities that participate in the project through capability building and assistance in the development of alternative sustainable livelihood based on resource strengths in the area. 			

CHAPTER 4: ENVIRONMENTAL RISK ASSESSMENT AND EMERGENCY RESPONSE POLICY AND GUIDELINES

The implementation of the safety policies/guidelines of IQAC has been effective. In fact, the table of safety statistics below shows its effectiveness because of zero accidents:

E-Employee C-Contractor	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C
2014	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LTI	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Total	
E-Employee C-Contractor	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C	E	C
2014	0	0	0	0	0	2	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4
2015	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2017	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Island Quarry and Aggregates Corporation (IQAC) has highest regard to the environment and safety is its number one policy. It is committed to serving its consumers' and stakeholders' social and economic needs by providing livelihood projects, technical trainings and career opportunities to deserving local residents of Binangonan. DAO 2003-30's RPM defined ERA as "a process of analyzing and describing the risks associated with a project activity to ecosystems, human health and welfare".

Scope and Coverage

As required in the technical scoping agreement, the ERA details for this section will only be limited to the information provided in the succeeding section. This information will also provide the basis for further quantitative risk assessment in case will be required in the post EIA stage/process.

- Presentation of the different type of safety associated risk relative to the project's operation:
 - Includes discussion on the conditions, events and circumstances which could be significant in bringing about identified safety risks
 - Description & assessment of the possible accident scenarios
 - Description of the hazards, both immediate (acute effects) and delayed (chronic effects) for man and the environment posed by the release of toxic substance (include unloading of raw materials/fuel), as applicable
- Presentation of the different type of physical risk associated to the project's operation;
 - Identification of conditions, events and "trigger" which could be significant in bringing about identified physical risks
 - Description & assessment of the possible accident scenarios
 - Description of the hazards both immediate (acute effects) and delayed (chronic effects) for man and the environment posed by the failure of structure, as applicable.
- Risk or Hazards Management measures or the general emergency procedures during the worst case scenario



Type of Risks

Safety Risks:

Fire:

Description and assessment of the possible accident scenarios

Probable major fires may not occur at the quarry site. Nonetheless, as an emergency measure, firefighting facilities, principally fire water lines and fire extinguishers will be installed at the Project's premises.

Blasting:

Identification of conditions, events and circumstances which could be significant in bringing about identified safety risks

IQAC has designed a safety procedure for all blasting operations in both limestone and pozzolan quarries.

Procedure for Conducting Job Hazard Analysis prior to performance of any activity and strict instruction to wear Proper Protective Equipment

NO.	ACTIVITY	RESPONSIBILITY
1.	The contractor's Blasting Engineer shall be provided a copy of the drill plan together with the depth of the drill holes. The drill plan shall be the basis in the preparation of the shot plan.	Quarry Superintendent/ Quarry Supervisor
2.	Site inspection shall be conducted prior to the preparation of the shot plan to give due consideration to site conditions which may need to be considered in the design of the explosive load and blasting sequence. Sounding of all drill holes shall also be conducted (Refer to Activity No. 9 of Procedures for Drilling Operation).	Contractor's Blasting Engineer, Quarry Superintendent/ Quarry Supervisor
3.	The shot plan and projected explosives consumption report shall be prepared and submitted to the approving authority for approval. The shot plan shall contain the following information: <ul style="list-style-type: none"> • Location of the blast • Hole Diameter • Hole Pattern • Number of Holes • Location of Lead In • Blast Sequence • Computed Tonnage • Powder Factor 	Contractor's Blasting Engineer
4.	The shot plan and projected explosives consumption report shall be reviewed and approved/rejected for revision by the approving authority and a specific date shall be scheduled for the blast. All blasting operations should have an approved shot plan before implementation.	Quarry Engineer
5.	The Provincial PNP Office shall be informed of the scheduled blast and a request for a PNP escort shall be made at least a day ahead. The duly designated PNP escort, who is the only person in possession of the keys to the explosives magazine, should be present during the actual withdrawal	Contractor
6.	On the day of the scheduled blast, red warning flags shall be placed at the following specific locations to inform nearby residents of the scheduled blasting activity: <ul style="list-style-type: none"> • Access ramp to Calabar Quarry <p>The red warning flags shall remain in place until the blast have</p>	Contractor's Blasting Crew

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	been completed and cleared.	
7.	Withdrawal of all the required explosives and accessories shall be made and properly recorded in the presence of the duly designated PNP escort	Contractor's Blasting Crew as supervised by the OEPI-Blasting Engineer, Quarry Engineer
8.	The withdrawn explosives and accessories shall be transported to the blasting site. Safety rules and regulations governing the transport and handling of explosives should be strictly adhered to. (Refer to JRN-SCC-007 - Revised Mines Safety Rules and Regulations)	Contractor's Blasting Crew as supervised by the OEPI-Blasting Engineer
9.	The explosives shall then be loaded according to the approved shot plan. Loaded holes shall be filled with the corresponding stemming. Safety rules governing the safe handling of explosives should be strictly adhered to. (Refer to JRN-SCC-007 – Revised Mines Safety Rules and Regulations)	Contractor's Blasting Crew as supervised by the OEPI-Blasting Engineer
10.	In the event that difficulties such as the following are encountered during the loading of explosives the following steps shall be taken: <ol style="list-style-type: none"> 1. Cavernous drill holes <ul style="list-style-type: none"> • The ammonium nitrate-fuel oil shall be packed in plastic tubes before loading into the holes. 2. Water seepage at holes <ul style="list-style-type: none"> • Water shall be pumped out before loading the holes with explosives • The ammonium nitrate-fuel oil shall be packed in plastic tubes before loading into the holes. • The de-watered hole shall be quickly loaded with explosives and filled with the corresponding stemming. Problems such as those mentioned above shall be properly recorded and incorporated in the after blast shot plan.	Contractor's Blasting Crew as supervised by the OEPI-Blasting Engineer
11.	All incomplete drill holes or those found to be with cave-ins are to be re-drilled until the required depth is met.	Drilling Crew
12.	If there is no on-going operation, all equipment working within the quarry shall be transferred to a safe area. If there is an on-going operation, all units involved in the operation shall only be transferred to a safe area after the all-clear signal has been relayed by the Safety Engineer so as not to unduly hamper the operation. (Please refer to activity no. 16)	Contractor, Quarry Engineer
13.	The clearing operation shall commence upon completion of the loading and stemming. The clearing operation shall include the following: <ul style="list-style-type: none"> • The designated blast guards shall be posted in their respective area of assignments and secure the area. • The designated blast guards shall make the rounds of the nearby community to inform affected residents to temporarily vacate the danger zone. The danger zone, for purposes of definition, is the area within the 300-meter radius of the blast location. • Roadblocks with warning signs shall be placed at all entry points to the danger zone. • The warning siren shall be sounded upon the start of the clearing operation and shall remain so until the signal to initiate has been given and the mode of the siren shall be changed to indicate that initiation has commenced. • Hand held radio transceivers shall be double checked to ensure unhampered communication between all personnel 	Contractor's Blasting Crew, Safety Officer,

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	involved in the blasting and clearing operation. <ul style="list-style-type: none"> A seismograph/vibrometer shall be placed in a pre-designated area to monitor the noise and vibration level of the blast All posts shall be checked and double checked for stray people, animals or vehicles. 	
14.	The all clear signal shall be relayed to the Contractor - Blasting Engineer and the Quarry Engineer.	Safety Officer/ Safety Engineer
15.	If there is an on-going operation at the quarry, upon confirmation that all areas are clear, all equipment shall be transferred to a safe area	Quarry Engineer
16.	Upon confirmation that all areas are clear, capped fuse shall be connected to the firing end of the blast.	Contractor – Blaster/Shot firer as instructed by the Blasting Engineer
17.	Information shall be relayed to the Safety Engineer that everything is ready for initiation. The Safety Engineer shall in turn advise the Contractor -Blasting Engineer whether the initiation may proceed or not. If there are problems that may need to be addressed before initiation, the Safety Engineer shall advise the Contractor - Blasting Engineer to stand-by and await further instructions. All blast guards should likewise be informed. Initiation may only proceed with the express permission of the Safety Engineer.	Contractor's Blasting Engineer, Safety Officer/ Engineer
18.	Upon permission of the Safety Engineer, the Contractor -Blasting Engineer shall advise the Contractor -Blaster/Shot firer to initiate the blast. Upon lighting of the capped fuse, the Contractor - Blaster/Shotfirer shall inform all posts that the blast has been initiated. The Contractor -Blaster/Shotfirer shall then leave the area immediately. The service vehicle used for the initiation should always be on the ready to leave the area. In case the service vehicle stalls, the Contractor -Blaster/Shotfirer shall immediately cut-off the capped fuse connection.	Contractor's Blaster/Shot firer, Contractor's Blasting Engineer
19.	Upon receiving the Contractor -Blaster/Shot firer's advice that the blast has been initiated, the designated Contractor personnel shall then activate the seismograph/vibrometer to monitor the noise and vibration levels of the blast. Printed reports shall then be submitted to the Quarry Manager.	Contractor's Blasting Crew
20.	After the blast has been fired, the Contractor -Blaster/Shot firer shall then inspect the site for possible misfires. <ul style="list-style-type: none"> If there are no misfires, the Contractor -Blaster/Shotfirer shall then advise the Contractor -Blasting Engineer and the Safety Engineer. The Contractor -Blasting Engineer shall then advise all blast guards that the blast has been completed and shall advice them to lift all road blocks. 	Contractor's Blaster Shot firer
21.	Upon completion of the blasting operation, all excess explosives and accessories shall be returned to the explosives magazine and shall be properly recorded in the presence of the PNP escort. Safety rules and regulations governing the transport and handling of explosives should be strictly adhered to. (Refer to JRN-SCC-007 - Revised Mines Safety Rules and Regulations). <ul style="list-style-type: none"> If a misfire has occurred, the Contractor -Blaster/Shotfirer shall then advice the Contractor -Blasting Engineer and the Safety Engineer. The Contractor -Blasting Engineer shall in turn advice all blast guards to stand-by and await further instruction. Misfires shall then be handled accordingly. (Please refer to Procedures for Handling Blasting Misfires) 	Contractor 's Blasting Crew as supervised by the Contractor's Blasting Engineer, Safety Officer/Engineer, Quarry Engineer
22.	Upon confirmation of a completed blast, all roadblocks shall then be lifted. All affected residents shall also be allowed to return and vehicular traffic to pass through. All red warning flags shall also	Contractor's Blasting Crew

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	be removed and the warning siren stopped	
23.	An inspection of all affected areas shall be made. If damages due to the blasting are found, a damage report shall be submitted to the Quarry Engineer for his disposition.	Safety Officer/Engineer
24.	Evaluate the results of blasting. (Rock fragmentation with corresponding estimated percentage, presence of back break, color of blasted material) Weather during blasting should also be taken note of.	Contractor's Blasting Engineer, Quarry Engineer
25.	In terms of emergency, please refer "STOP WORK" and coordinate supervisor. (refer to plant emergency procedure)	Supervisor

IQAC has also designed its own Hazard Identification, Risk Assessment and Determining Controls or HIRAC. For the following activities, specific controls will be employed:

1. Explosives cargo truck Inspection
3. Travel explosives cargo truck from parking area to loading area
4. Withdrawal of Explosive
5. Parking of Explosive cargo truck
6. Distribution of explosive and accessories per drill hole
7. Loading of explosives (Dynamite & ANFO)
8. Priming of Dynamite
9. Connection of delay per drill holes
10. Actual Firing
11. Clearing/ Inspection of area after the Blast

Following are the Safety Management Measures/Controls that will be implemented to handle the risks and hazards of explosives for extraction:

1. Familiarization, conduct emergency drills, emergency response training of plant personnel. Provide instruction in case of emergency (IMS-IQAC-MAN-ERP-002 Procedure for Dealing with Emergency). Available medical facility, personnel and first aid kits.
2. Installation of containment pan for chemicals; Machine guardings; required maintenance of pipelines, valves, equipment; prescribed container for chemicals. Provide signages/ Labels/ Work Instructions/ Emergency Preparedness and Response Procedure/ Competency requirements for handlers; Incident reporting procedure; Work permit procedure; Restrict access to areas/ activity with chemicals. Wear proper PPE (Hand gloves, face mask, apron or hazmat suit).
3. DOLE policy for maximum working time
4. Machine guardings; Required maintenance of equipment/ machine signages/ Work Instructions/ Emergency Preparedness and Response Procedure/ Competency requirements for handlers; Incident reporting procedure; Available First-aider and first-aid kit; Hot work permit
5. Provide personal Protective Equipment and Devices (Dust mask). Conduct WEM.
6. Training for the earthquake drill, first aid, fire drill. Form ERT within the company. First aid should always available for use.
7. Provide Personal Protective Equipment (Dust masks). Required maintenance of exhaust/ ventilation facilities. Housekeeping procedure; WEM. Prescribed mask per activity
8. Required maintenance of exhaust/ ventilation facilities; Wellness program; Medical/ Physical exam; WEM; Prescribed PPE
9. Provide additional lightings if necessary. Repair of busted lights. Conduct WEM
10. Required inspection of facilities and structures; First-aid kit and medical facilities. Trained first-aider, Competency requirements for personnel; Reporting requirements for DOLE; Competency/ Training requirements for personnel working at heights; Work permit system; Housekeeping procedure; EPR procedure
11. Provide Guarding. Inspection and maintenance of elevated platforms;
12. Ergonomic designs of equipment/ infrastructure. Annual medical/ physical exam; Wellness programs/ ergonomic guidelines for workplaces and activities
13. Annual medical/ physical exam; WEM; Reporting requirements to DOLE; EPR procedure; Trained first-aider; Wellness program
14. Annual medical/ physical exam; WEM; Reporting requirements to DOLE; EPR procedure; Trained first-aider; Wellness program



15. Work Instructions/ Emergency Preparedness and Response Procedure/ Competency requirements for operators; Available first-aid kit; Reporting requirements to DOLE, Lightning arresters
16. Treatment facilities for air emission; Required maintenance of stack/ vehicles/ mobile equipment/Establishment of CEMS; Required monitoring for vehicle emission/ mobile equipment
17. Required Fire fighting equipment; Required fire hydrant boxes/ fire extinguisher; Required Fire exit, emergency light, fire alarm; PM of machines, equipment/EPR procedure; Trained first-aid; Fire fighting Team; Operational procedure/ work instructions; competency/ orientation requirements for operators/ personnel; Required Fire drills/ fire exit drills; Labeling requirements/ signages; Hot work permits; Reporting requirements for DOLE/Fire suit, SCBA
18. Solid Waste Management Programs; waste segregation practices, Waste bins; Waste management facilities.
19. Guidelines on proper lifting
20. Competency/ training/ orientation requirements for operators and personnel
21. Housekeeping procedure; Work instructions/ Operational procedure
22. Operation and maintenance of vibration source equipment
23. Signages/ Work Instructions/ Emergency Preparedness and Response Procedure/ Competency requirements for operators; Available first-aid kit; Reporting requirements to DOLE; Machine guardings; Required maintenance of mechanical parts/ equipment; Stacking and storage requirements; Medical facilities; Prescribed PPE

Description and assessment of the possible accident scenarios

The possible accident scenarios and the affected population are related to the operation of the heavy equipment and auxiliaries which are present in this Project.

Movement of vehicles:

Delivery trucks for materials will necessarily enter the premises. Only accredited vehicles and drivers may be allowed. Road signages will be posted conspicuously at strategic places.

On-site or off-site contamination of oil or any hazardous waste during plant's operation

In case of on-site or off-site contamination of oil/lubricants or any hazardous waste during quarry operation, management procedure or plan for the rehabilitation or corrective measures such as the following will be undertaken:

- procedure or plan for the rehabilitation or corrective measures will be identified and implemented
- investigate source of contamination and implement corrective measures
- investigate and strengthen implementation of measures
- Review and implement changes to further mitigation for hazwaste management

The following regular management measures will be implemented on a regular basis to avoid on-site or off-site contamination:

1. For hazardous wastes that will be generated such as busted bulbs and lamps, LED lamps, used oil and used batteries, disposal will be done thru 3rd party DENR-accredited Treaters. Used oil will be collected and put inside sealed drums, stored in a company designated Material Recovery Facility (MRF) inside the plant. It will be transported and treated by a DENR accredited TSD facility.
2. Busted Fluorescent Bulbs will be put in a container, stored inside the plant MRF in accumulation until there are sufficient inventory for proper disposal through a DENR accredited TSD facility.
3. Contaminated rags and gloves will also be put in bags, stored inside the plant MRF in accumulation until there is sufficient inventory for proper disposal through a DENR accredited TSD facility.
4. Used automotive batteries will be traded-in to designated suppliers.
5. Remedial measures will be undertaken for soil contamination.

Administrative controls:

- Workplace and community level monitoring for noise, dust and vehicle and equipment emissions;
- information, education and training strategies for workers
- dialogue, information and education of community members on health hazards of concern;



- provision of adequate housing and sanitary facilities for workers;
- personal hygiene facilities for workers; and
- immunization and/or medical prophylaxis for areas where endemic diseases are present.

Personal protective equipment (PPE):

- dust mask and other respiratory protection for workers;
- ear protectors (either muffs or plugs) for workers; and
- hard hats and other safety PPE for workers.

Disaster management prevention and minimization:

- there must be a provision for a medical clinic at the quarry site;
- first aid and emergency plan for accidents which needs trained people and detailed steps to include transport facilities and communication with the referral hospitals;
- disaster plan in case of excessive emissions of pollution

Hazard Analysis

Natural Hazards

“Hazard is a potentially damaging physical event, phenomenon or human activity, which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. It can include latent conditions that may represent future threats and can have origins.

“Natural Hazards” are the natural processes or phenomena occurring in the biosphere that may constitute a damaging event. It can be classified by origin: geological, hydrometeorological or biological.

Earthquake

Earthquake is the perceptible trembling to violent shaking of ground caused by either tectonic movements or volcanic activity. The Philippines is located near or along the so called “earthquake belt” and is prone to seismic hazards. Areas that are susceptible to this seismic hazard are those underlain by unconsolidated soils and sediments deposited on the low-lying areas.

The area investigated is prone to ground shaking hazards due to the presence of several earthquake generators in and near the region. These possible seismogenic structures include the active Valley Fault, Lubang Verde Passage Fault, and the Philippine Fault. The site considered a low seismic area has recorded and experienced intensity VI during the 1990 Luzon Earthquake.

Ground Acceleration

Ground acceleration caused by earthquakes may result to great damage and destruction to property and infrastructure accompanied by loss of life. Factors that influence the intensity of ground shaking include the magnitude of the earthquake, distance of the site in relation to the earthquake generator, characteristics of the underlying rocks, and the soundness of the building. The Philippines is a tectonically active place with noted active faults that are usually the source of major earthquakes. The reason why the Philippine Institute of Volcanology and Seismology (PHIVOLCS) and the United States Geological Survey (USGS) conduct ground motion hazard mapping in terms useful to engineering design using modern probabilistic methodology. In the study, the peak horizontal ground accelerations that have a 10 % probability of being exceeded in 50 years have been uniformly estimated for rock, hard soil, medium soil, and soft soil site condition. Result of the study shows an estimate on rock ranging from a low of 0.11g in Visayas to a high of 0.30g in the vicinity of Casiguran fault zone in eastern Luzon (Thenhaus et al, 1994). Estimates for soft soil conditions are considerably higher and range between 0.27g for Visayas and 0.80g along the Casiguran fault zone.

The project site is underlain mainly by thick limestone deposits and fall under the .39g to 0.60g as shown in the delineated Acceleration Map for Medium Soil and Soft Soil (**Figure 2.1.1.2.1.1.6.1.3.1**).

Landslide

Mass movement involves the bulk transfer of earth masses under the influence of gravity. Common downslope hazards include landslide, slumping, and increased erosion, which commonly occur along



steep slope, escarpments, steep terrain, underlain by highly weathered, fractured and loose material. This is usually triggered by heavy precipitation and prolonged rains during monsoon rains, ground shaking, and in some cases, man-made slope excavations.

Based from the Landslide Susceptibility Mapping of Quezon City Quadrangle conducted by the Mines and Geosciences Bureau, Region 4A, the project site falls under the highly susceptible to landslide.

According to the Philippine Institute of Volcanology and Seismology (PHIVOLCS) and the United States Geological Survey (USGS) which conducted ground motion hazard mapping in terms useful to engineering design using modern probabilistic methodology, the peak horizontal ground accelerations that have a 10% probability of being exceeded in 50 years have been uniformly estimated for rock, hard soil, medium soil, and soft soil site condition. Result of the study shows an estimate on rock ranging from a low of 0.11g in Visayas to a high of 0.30g in the vicinity of Casiguran fault zone in eastern Luzon (Thenhaus et al, 1994). Estimates for soft soil conditions are considerably higher and range between 0.27g for Visayas and 0.80g along the Casiguran fault zone.

After a natural hazard such as Earthquake, Typhoon and Landslide

1. Secure the site affected with damage.
2. Rescue injured persons and apply first aid or bring to clinic.
3. Survey damage and estimate cost.
4. Survey safety hazards, live wires, structural damage, etc. and implement control measures.
5. Implement salvage and repair works to affected facility, process or equipment.
6. Call in contractors to assist salvage or repairs.
7. Call the telephone or power utility companies and report damaged lines.
8. Do not energize equipment or lines until everything is clear.
9. Implement housekeeping efforts as soon as possible.
10. Wet or damp electrical equipment must not be operated.
11. Call in contractors to assist in salvage and repairs.
12. Resume back operations, if safe to do so.
13. A clean-up will be done and a proper disposal will be made. If the material is Contaminated with hazardous material, the PCO, Pollution Control Officer will advise on the proper storage and disposal.

The Emergency Response Team (ERT) Chairman shall be responsible in advising employees of the company work schedule, temporary suspension of operation, duration and other personnel-related information. He shall likewise be responsible in communicating to external groups i.e., media,

Corporate Heads, Government about the overall situation of the plant. All questions asked from employees should be referred to him for proper actions and/or answers. Status of plant operation should be verified and reported from their respective managers by the Plant Director. Members of the ERT shall provide the ERT Chairman the necessary inputs.

CHAPTER 5: SOCIAL DEVELOPMENT PLAN / FRAMEWORK (SDP) AND IEC FRAMEWORK

5.1 The Social Development Plan (SDP)

Community development or livelihood programs/activities, projected beneficiaries, partner institutions, timeframe of implementation as well as source and amount allotted per activity has been institutionalized by IQAC because of its experience in operating several mining areas. Because of this, its Social Development and Management Program (SDMP) truly responds to the local needs and conditions (not off-the-shelf/ generic programs copied from other projects). These programs resulted from workshops and consultations with the stakeholders and approved by the Mines and Geosciences Bureau Region 4A. This approved SDMP covers 5 years programs and will be implemented on annual basis as required by the Mining law. Funds allocated is 1.5 per cent of the operating cost of the Project.

The project's SDMP aims to prevent/mitigate and/or enhance a project's adverse and positive impacts, respectively, on people's livelihood, health and environment. The process of formulating the project's SDMP were actively participated in by Barangay Council, the City Planning and Development Office (CPDO), MGB 4A and other Government Agencies whose mandates cover the management of impacts posed by project operations.

Provided in Table 5.1.1 is the MGB-approved 5-Year SDMP of IQAC for Calabar.

Table 5.1.1: 5 Year SDMP of IQAC

5-YEAR SDMP PROJECTS (2015-2019)										
PROJECT DETAILS						TOTAL COST PER YEAR				
Category	Location	Stakeholders	Specific Activity	Timeframe	Expected Result	2015	2016	2017	2018	2019
Livelihood	Impact barangays	Residents of Impact Brgy.	Coordinate with TESDA on specific training / technical courses that can provide / improve the livelihood of community constituents (e.g. sewing for rags, eco bag, paper bag production; diesel mechanic course, etc)	Quarterly	To produce trained / certified personnel who could then get livelihood and/or employment (i.e. at least 10 graduates per year)	150,000.00	150,000.00	150,000.00	150,000.00	150,000.00
Education	Impact barangays	Residents of Impact Brgy.	Adopt a school and implement renovation / construction works to improve school facilities (i.e. classrooms, libraries, rest rooms). Brigada Eskwela	Annually	A public school with improved / enhanced facilities; school children to directly benefit from such facilities	100,000.00	100,000.00	100,000.00	100,000.00	100,000.00
Health	Impact Barangays	Residents of Impact Barangays	Implement a sustainable health program for the Barangay (i.e. sponsor doctor visitations / health checks	Annually	Better health and wellness program implementation for the sitios	204,751.83	204,751.83	204,751.83	204,751.83	204,751.83

			for all sitios)							
Infrastructure	Impact Barangays	Residents of Impact Barangays	Repairs of pathways / renovation of tanod hall	Annually	Community projects that would foster collaboration among constituents.	200,000.00	200,000.00	200,000.00	200,000.00	200,000.00
IEC Programs	Impact barangays	Residents of impact barangays	Provide / conduct various trainings / seminars to sitio residents; conduct information campaigns to help community take care of their environment (and also address community issues and concerns)	Quarterly	Enhanced awareness / knowledge for residents to address their community issues and concerns (target attendees are sitio chairmen, barangay officials, day care center workers, health workers, and barangay tanods)	130,930.36	130,930.36	130,930.36	130,930.36	130,930.36
Development Of Mining technologies	Impact barangays	Residents of impact barangays	Continuous improvement on quarry operation	Annually	To harness newly developed technologies on sustainable mining	87,286.91	87,286.91	87,286.91	87,286.91	87,286.91
TOTAL						872,969.10	872,969.10	872,969.10	872,969.10	872,969.10

Since this SDMP will be ending in 2019, following table provide the proposed SDMP for the next four years to be submitted to MGB for approval.

Table 5.1.2: Proposed SDMP Projects for 2019-2020

Project	# of Beneficiaries	Objectives
Skills & Livelihood		
1. Experto Ako (Fishermen)	100	To provide basic training on improving catch through provision of fingerlings & tools for fishing
2. Rugmaking/Tokens/ Merchandise	50	Train women to produce quality rugs/ tokens/ merchandise where a portion of their produce will be purchased by company.
3. Financial Management	150	To train participants of 1 & 2 on how to properly manage capital & earnings.
Education		
1. Scholarship program	Engineering students	Support excellent students who can later possibly join construction/mining companies in the province.
2. Feeding, Malnutrition and Literacy Program	100 students	Provide support to undernourished kids in the community, in partnership with CSWD and DepEd
Health & Safety		
1. Disaster Training Program for community leaders	50	Train sitio leaders on how to respond to disaster, as well as how to help others during disasters.

Table 5.1.3: Proposed SDMP Projects 2021-2022

Project	# of Beneficiaries	Objectives
Skills & Livelihood		
1. Heavy equipment operation	50	Train men on how to operate heavy equipment for possible employment in construction/ mining companies in Rizal, in partnership w/ TESDA.

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2. Food Processing	50	Train women on food processing such that whatever they produce may be purchased by offices or even be a start up business for them for eateries.
Education		
1. Batch 2 of Scholars	engineering students	Support excellent students who can later possibly join construction/mining companies in the province.
3. Forming a Cooperative	50	Support/trained community members in organizing as a cooperative, w/ possible seed money from company.
Health & Safety		
1. Quarterly Talk on relevant diseases	100	Help community residents understand the danger of sickness and how to prevent them(e.g. Dengue, skin diseases)
2. Provide rescue equipment and first aid for barangay & barangay health center	50	Enhance capacity of LGU in providing adequate help during disaster.

5.2 The Information, Education and Communications (IEC) Implementation Plan

The IEC for the project is a component of the SDMP of IQAC. Provided in Table 5.2 is the IEC that will be implemented resulting from the projects expansion. The programs are always derived from and aligned with the LGU's existing development plans.

Grievance Redress Mechanism (GRM)

At present, IQAC implements the following Complaint Management System as its GRM:

1. Provision of Bulletin Boards on the Barangays which serve both as grievance redress and IEC mechanism
2. Dedicated Community Relations Officer, i.e. Mr. Ariel Yson
3. Partnerships with Barangay Councils and Municipal Government of Binangonan
4. Membership to the MMT
5. LGU's mechanism of reporting any issue or concern to the barangay and/or to the LGU of Municipal Government of Binangonan

IQAC is also looking at the following strategies for implementation:

- Provision of Suggestion Boxes in different Sitios
- Text Hotline
- Komiks-type Newsletter

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Table 5.2.1: IEC Program

Target Sector Identified as Needing Project IEC	Major Topic/s of concern in Relation to Project	IEC Scheme / Strategy Methods	Information Medium	Indicative Timelines and Frequency	Indicative Cost
1. Residents of impact barangays and City Government of Binangonan and accredited NGOs/Pos	<ul style="list-style-type: none"> Awareness for the people on the actual impacts & mitigating measures of the Project Identification of trucks used by IQAC 	Group methods Multi-media: The Rizal Weekly Post: a local newspaper in Rizal	<ul style="list-style-type: none"> Stakeholders' Consultative Planning Session / Community Projects Planning Sessions Informal discussion/ / meeting with stakeholders 	Annually Monthly	35,000.00
2. Students of elementary schools of impact barangays	<ul style="list-style-type: none"> Identification and description of all projects undertaken by IQAC 	Group methods	<ul style="list-style-type: none"> Educational Tour 	Once a year	50,000.00
3. Stakeholders meeting	<ul style="list-style-type: none"> New DENR Guidelines on Public Participation 	Group methods	<ul style="list-style-type: none"> Stakeholder's meeting 	Once a year	25,000.00
4. IQACs employees	Awareness and safety	Group methods	<ul style="list-style-type: none"> Road Safety awareness Annual Safety program Safety Inspectors Training First Aid Training Hazard Identification and Risk Assessment Training 	Once a year	Part of company budget for employees

CHAPTER 6: ENVIRONMENTAL COMPLIANCE MONITORING

6.1 Environmental Performance

Provided below is the environmental performance of Calabar Quarry from 2014-2017. Please note that the monitoring conducted was Proponent-driven thru a creation of a Multi-partite Monitoring Team in 2014. This monitoring activity was not anchored on an ECC compliance mechanism because the project existed before the effectivity of the EIS System. It will also be noted that for some aspects and parameters, only 2016 and 2017 performances were provided because the Proponent together with the MMT have just established the parameters and stations for semestral monitoring. Please note that monitoring is semestral that is why some columns and rows have no information. Also, instead of Self-Monitoring Reports (SMRs), Compliance Monitoring and Validation Reports (CMVRs) were submitted as per the project's MMT.

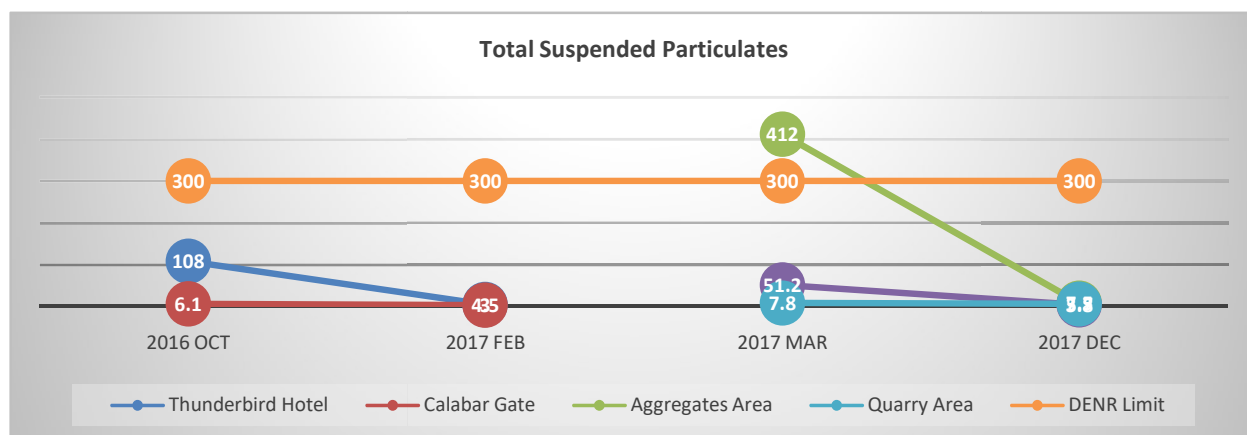
Proof of submission of CMVR is provided in Annex E.

6.1.1 Ambient Air

6.1.1.1 Total Suspended Particulates

Table 6.1.1.1: Total Suspended Particulates

Total Suspended Particulates	2016 Oct	2017 Feb	2017 Mar	2017 Dec
Thunderbird Hotel	108	4.5		
Calabar Gate	6.1	3		
Aggregates Area			412	7.5
East-Ridge Side			51.2	3.8
Quarry Area			7.8	5.7
DENR Limit	300	300	300	300

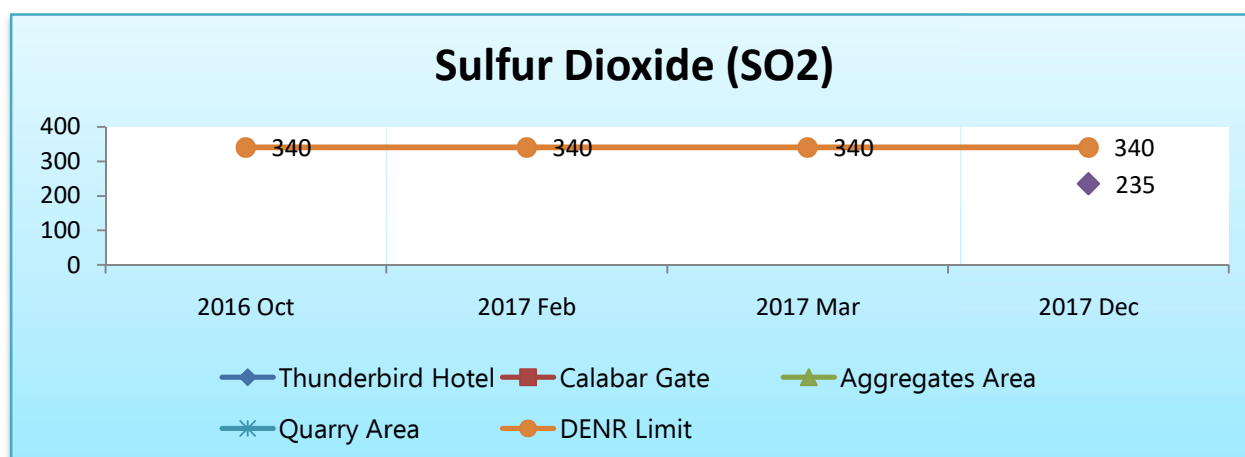


Results showed that the performance is compliant to the DENR standards for TSP except for March 2017 where the aggregates crushing plant is located. The exceedance in TSP in station A1 was brought about by the truck passing through the area when he sampling was conducted. Dust mitigation has been immediately implemented in this area by deploying water cannons.

6.1.1.2 Sulfur Dioxide (SO₂)

Table 6.1.1.2: Sulfur Dioxides (SO₂)

Sulfur Dioxides (S)	2016 Oct	2017 Feb	2017 Mar	2017 Dec
Thunderbird Hotel				
Calabar Gate				
Aggregates Area				
East-Ridge Side				235
Quarry Area				
DENR Limit	340	340	340	340

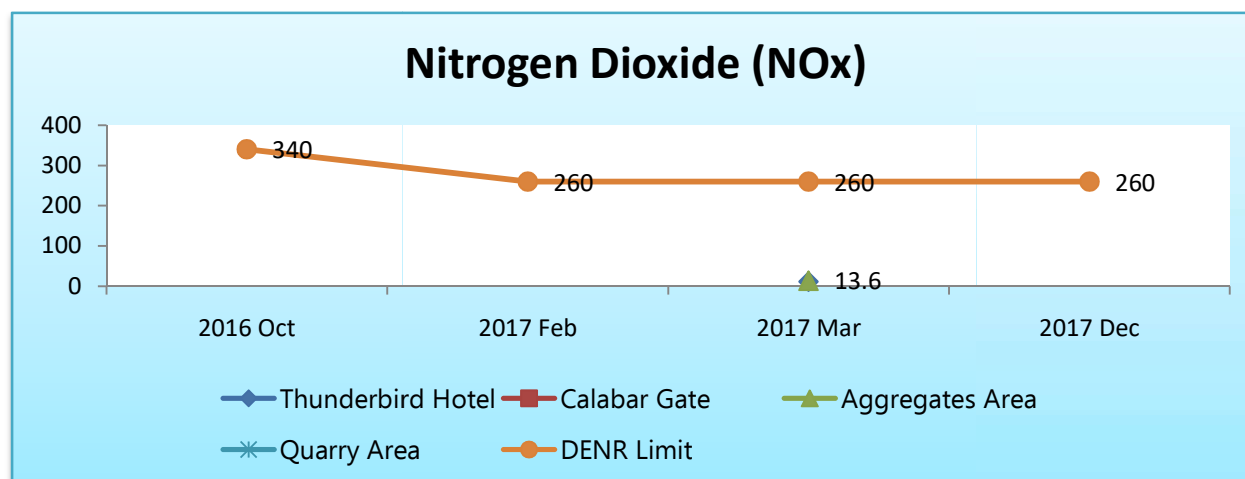


Results showed that the performance is compliant to the DENR standards for SO₂.

6.1.1.3 Nitrogen Dioxide (NO₂)

Table 6.1.1.3: Nitrogen Dioxide (NO₂)

Nitrogen Dioxide (NO ₂)	2016 Oct	2017 Feb	2017 Mar	2017 Dec
Thunderbird Hotel			11.4	
Calabar Gate				
Aggregates Area			13.6	
East-Ridge Side				
Quarry Area				
DENR Limit	340	260	260	260



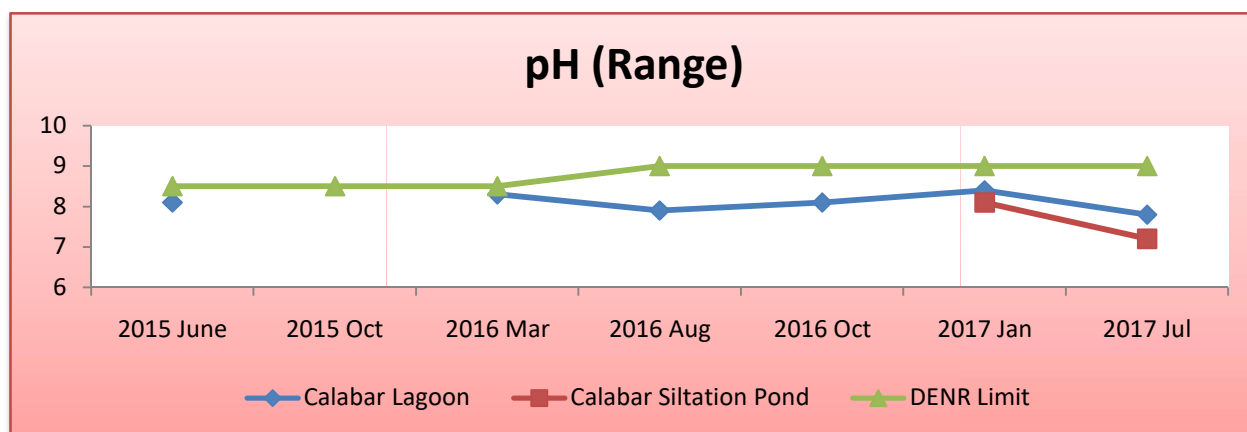
Results showed that the performance is compliant to the DENR standards for NO₂.

Water cannons are the device used to mitigate dust emission in Calabar quarry and aggregates areas. This shoots a high-velocity stream of water. It can deliver a large volume of water over dozens of meters. This air quality management measure being implemented is still effective. However, immediate and prompt implementation of mitigation measures for air emission are required to avoid proliferation of dust in the air.

6.1.2 Water

Table 6.1.2.1: pH

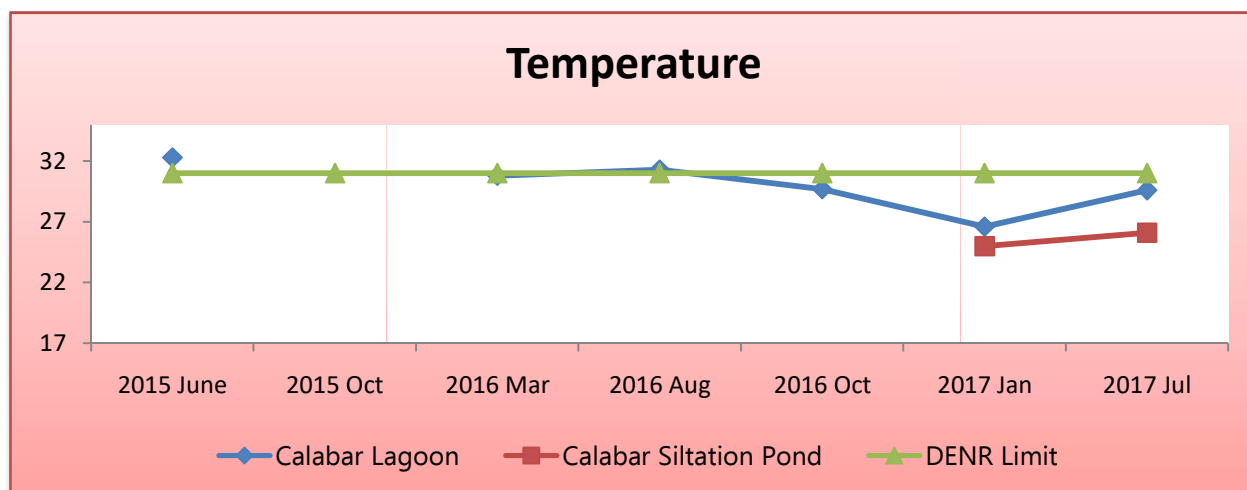
pH (Range)	2015 June	2015 Oct	2016 Mar	2016 Aug	2016 Oct	2017 Jan	2017 Jul
Calabar Lagoon	8.1		8.3	7.9	8.1	8.4	7.8
Calabar Siltation Pond						8.1	7.2
DENR Limit	8.5	8.5	8.5	9	9	9	9



Results showed that the performance is compliant to the DENR standards for pH.

Table 6.1.2.2: Temperature

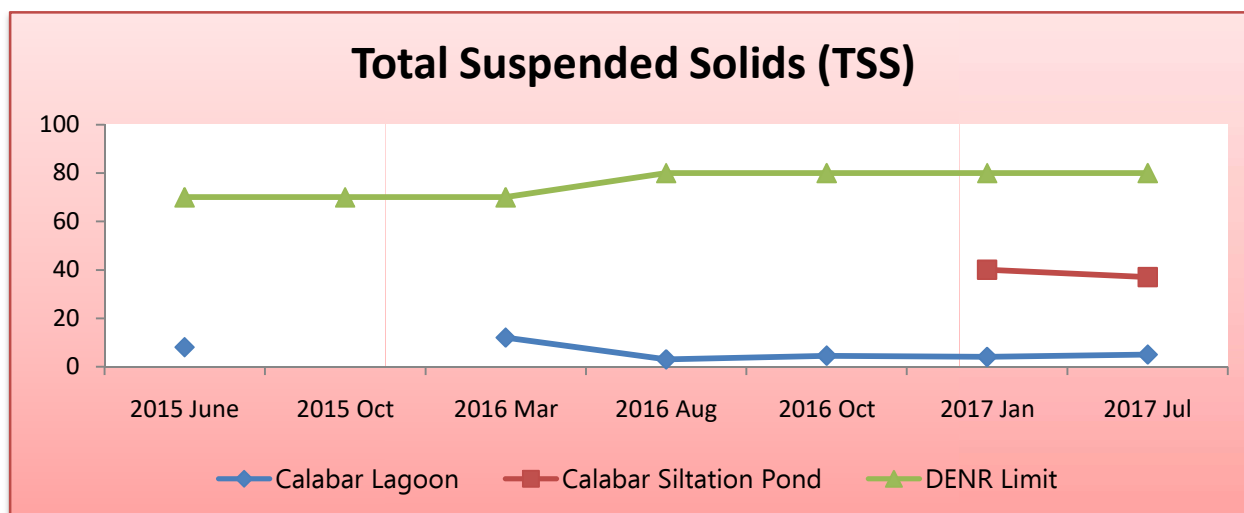
Temperature	2015 June	2015 Oct	2016 Mar	2016 Aug	2016 Oct	2017 Jan	2017 Jul
Calabar Lagoon	32.3		30.8	31.3	29.7	26.6	29.6
Calabar Siltation Pond						25	26.1
DENR Limit	31	31	31	31	31	31	31



Results showed that the performance is compliant to the DENR standards for temperature except for the lagoon in June 2015.

Table 6.1.2.3: Total Suspended Solids

Total Suspended Solids	2015 June	2015 Oct	2016 Mar	2016 Aug	2016 Oct	2017 Jan	2017 Jul
Calabar Lagoon	8		12	3	4.5	4	5
Calabar Siltation Pond						40	37
DENR Limit	70	70	70	80	80	80	80



Results showed that the performance is compliant to the DENR standards for TSS.

Table 6.1.2.4: Total Dissolved Solids

Total Dissolved Solids	2015 June	2015 Oct	2016 Mar	2016 Aug	2016 Oct	2017 Jan	2017 Jul
Calabar Lagoon	356		339	359	348	334	362
Calabar Siltation Pond						141	156
DENR Limit	No stds provided under DAO 2016-						

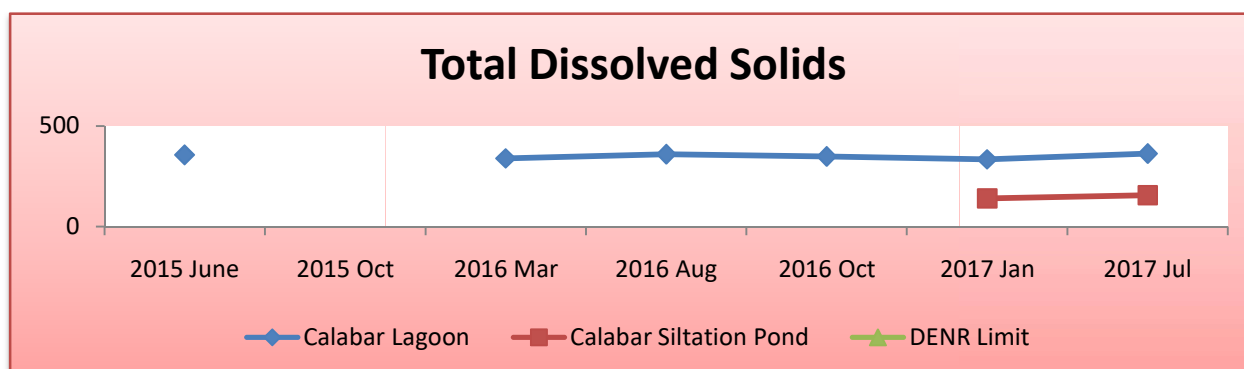


Table 6.1.2.5: Settleable Solids

Settleable Solids	2015 June	2015 Oct	2016 Mar	2016 Aug	2016 Oct	2017 Jan	2017 Jul
Calabar Lagoon	0.09		0.09	0.09	0.09	0.09	0.09
Calabar Siltation Pond						0.1	0.1
DENR Limit	0.5	0.5	0.5				

Results showed that the performance is compliant to the DENR standards for settleable solids.

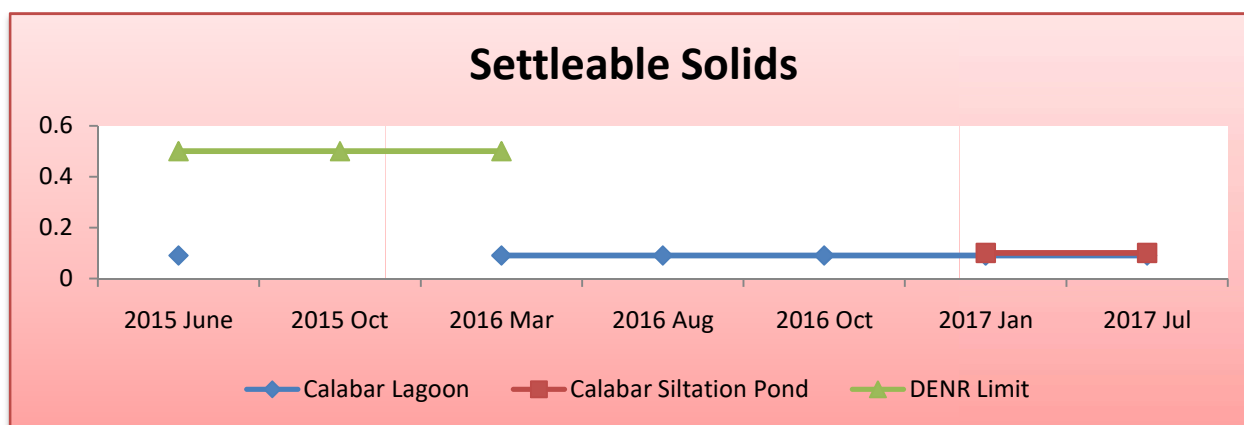


Table 6.1.2.6: Oil and Grease

Oil & Grease	2015 June	2015 Oct	2016 Mar	2016 Aug	2016 Oct	2017 Jan	2017 Jul
Calabar Lagoon	0.4		0.4	0.4	0.4	0.6	0.5
Calabar Siltation Pond						0.5	0.7
DENR Limit	5	5	5	2	2	2	2

Results showed that the performance is compliant to the DENR standards for oil and grease.

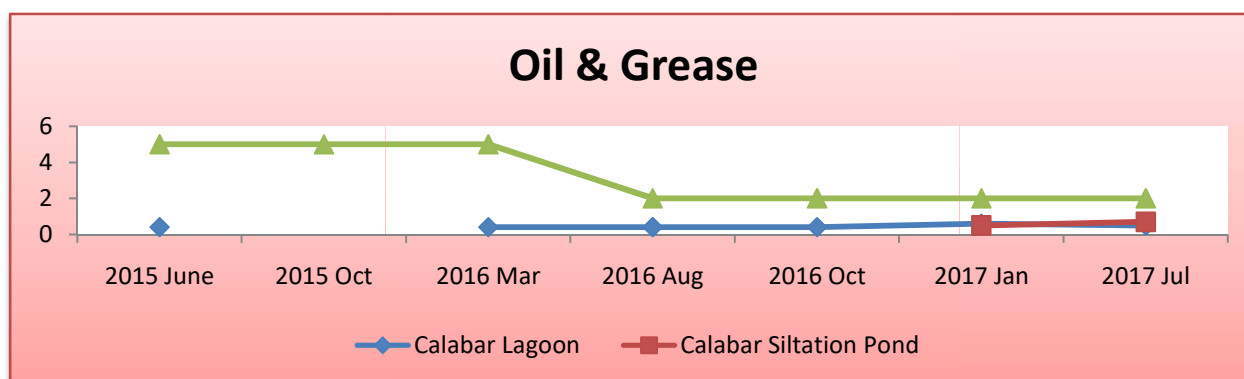
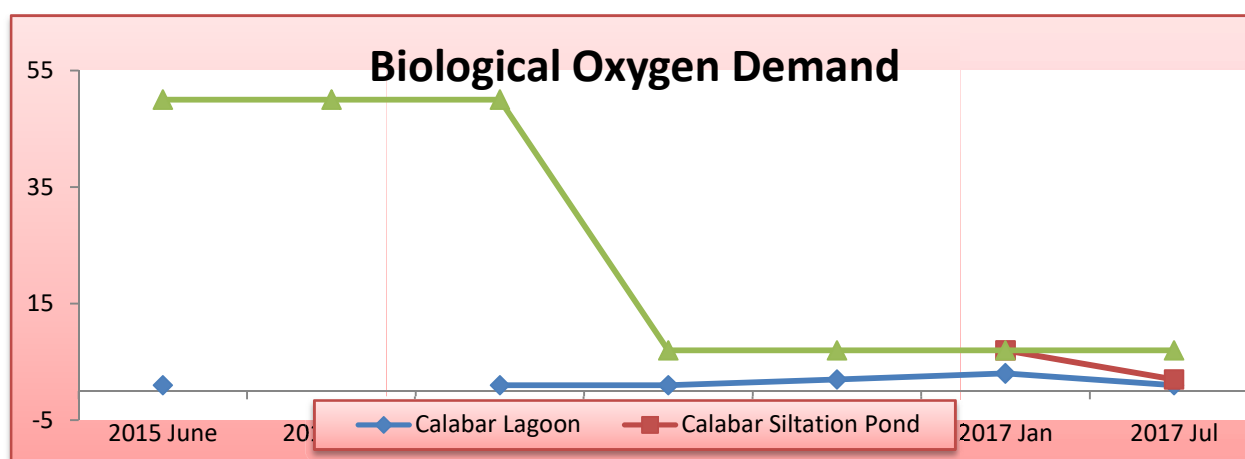


Table 6.1.2.6: Biological Oxygen Demand

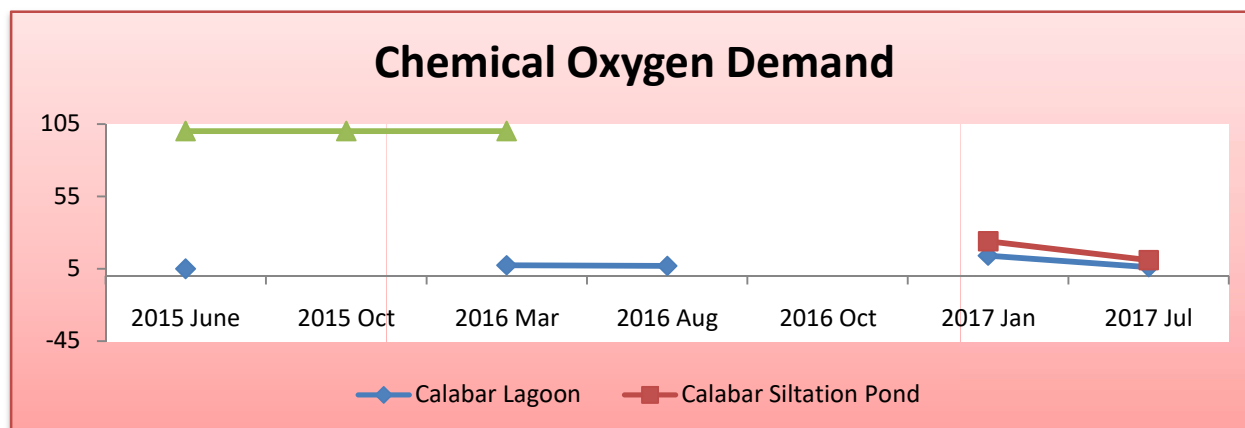
Biological Oxygen Demand	2015 June	2015 Oct	2016 Mar	2016 Aug	2016 Oct	2017 Jan	2017 Jul
Calabar Lagoon	1		1	1	2	3	1
Calabar Siltation Pond						7	2
DENR Limit	50	50	50	7	7	7	7



Results showed that the performance is compliant to the DENR standards for BOD.

Table 6.1.2.7: Chemical Oxygen Demand

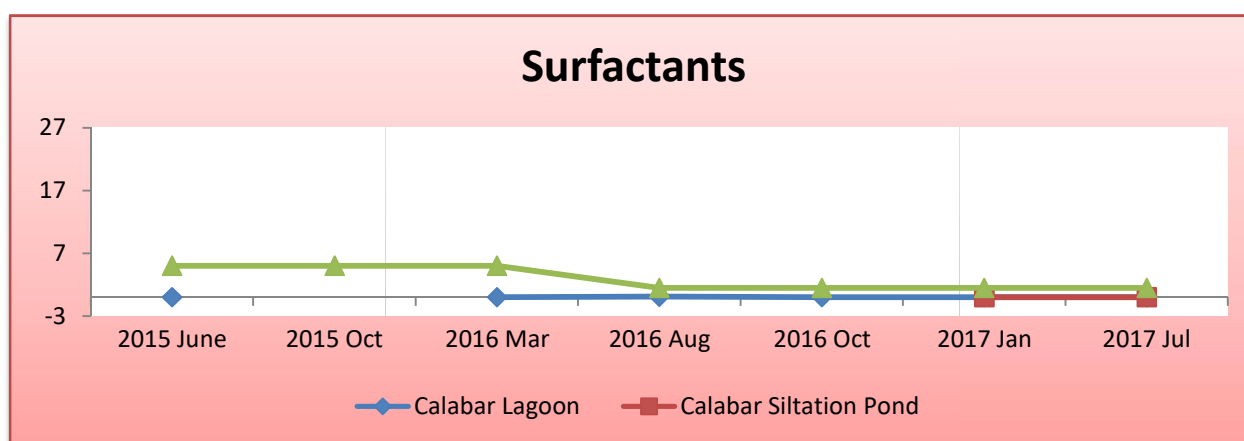
Chemical Oxygen Demand	2015 June	2015 Oct	2016 Mar	2016 Aug	2016 Oct	2017 Jan	2017 Jul
Calabar Lagoon	4.9		7.5	7		14	6.1
Calabar Siltation Pond						24	11
DENR Limit	100	100	100	No stds under DAO 2016-08			



Results showed that the performance is compliant to the DENR standards for CODTSS.

Table 6.1.2.8: Surfactants

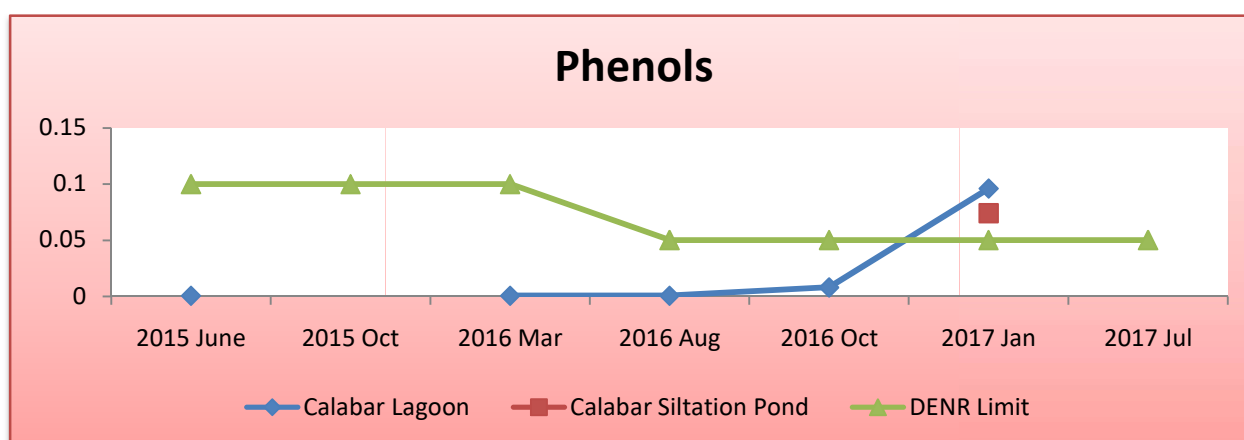
Surfactants	2015 June	2015 Oct	2016 Mar	2016 Aug	2016 Oct	2017 Jan	2017 Jul
Calabar Lagoon	0.019		0.019	0.1	0.019	0.019	0.019
Calabar Siltation Pond						0.019	0.019
DENR Limit	5	5	5	1.5	1.5	1.5	1.5



Results showed that the performance is compliant to the DENR standards for surfactants.

Table 6.1.2.9: Phenols

Phenols	2015 June	2015 Oct	2016 Mar	2016 Aug	2016 Oct	2017 Jan	2017 Jul
Calabar Lagoon	0.00059		0.00059	0.00059	0.008	0.096	
Calabar Siltation Pond						0.074	
DENR Limit	0.1	0.1	0.1	0.05	0.05	0.05	0.05



Results showed that the performance is compliant to the DENR standards for Phenols.

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Table 6.1.2.10: Color

Color	2015 June	2015 Oct	2016 Mar	2016 Aug	2016 Oct	2017 Jan	2017 Jul
Calabar Lagoon	10			8	8	8	8
Calabar Siltation Pond						32	20
DENR Limit	No stds under DAO 2016-08						

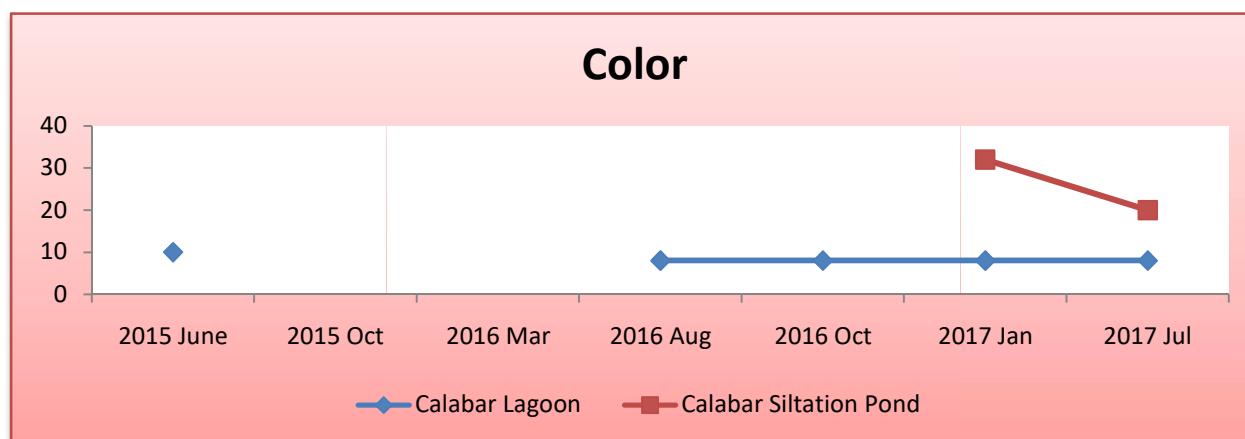
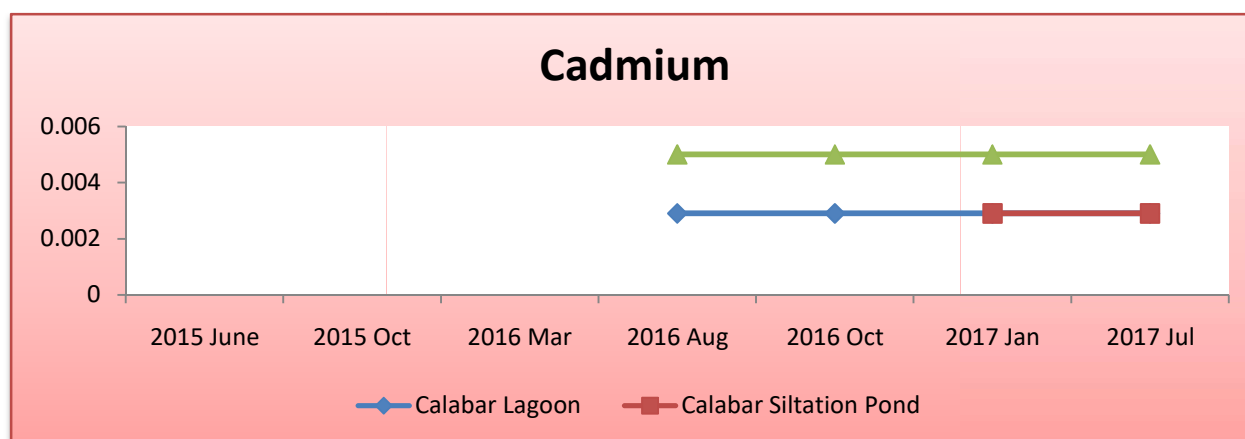


Table 6.1.2.11: Cadmium

Cadmium	2015 June	2015 Oct	2016 Mar	2016 Aug	2016 Oct	2017 Jan	2017 Jul
Calabar Lagoon				0.0029	0.0029	0.0029	0.0029
Calabar Siltation Pond						0.0029	0.0029
DENR Limit				0.005	0.005	0.005	0.005



Results showed that the performance is compliant to the DENR standards for Cadmium.

6.2 Self-Monitoring Plan

Provided in Table 6.1 is the Environmental Monitoring Plan (EMoP) with ENVIRONMENTAL QUALITY PERFORMANCE LEVELS (EQPLs). Provided below is the definition of EQPL-Environmental Quality Performance Level:

EQPL Level	Description
Alert or Red Flag	early warning
Action Level	point where management measures must be employed so as not to



	reach the regulated threshold or limit level, or to reduce deterioration of affected environmental component to pre-impact or optimum environmental quality
Limit Level	regulated threshold of pollutant (standard that must not be exceeded); point where emergency response measures must be employed to reduce pollutants to lower than standard limit.

6.3 Multi-Sectoral Monitoring Framework

Presently, an MMT has been set up as per MGB Rules. The members include the following:

- a. MGB Region IVA
- b. EMB PEMO
- c. IQAC
- d. Municipal LGU Binangonan
- e. Brgy. LGU Palangoy
- f. NGO/PO

This set up was just constructed in 2015 when IQAC insisted on having their own MMT. As discussed in this EPRMP, Calabar Quarry operations started as early as 1913 before the EIS System and the Mining Law were put in place.

With the effectivity of DAO 2017-15, the list of stakeholder-members of the MMT provided below will be the new MMT ORGANIZATION for the project:

Table 6.2-1: MMT Composition

Stakeholder-Members
LGU Representatives
• Municipality of Binangonan / CENRO
• Rural Health Office Chief
• Brgy. San Jose Captain
• Brgy. San Luis Captain
LGU-Accredited Local NGO
2 reps from locally-recognized community leaders
3 reps from government agencies with related mandate on the type of project and impacts during operations

6.3.1 Functions of the Multi-Partile Monitoring Team (MMT)

As an independent entity whose membership represents the stakeholders / public, the MMT is expected to add credibility by being open and transparent in monitoring environmental impacts and compliance with the Philippine EIS System requirements.

The MMT shall have the following specific functions:

- a.) Conduct quarterly ocular site visit to validate the proponent's compliance with the ECC conditions and the Environmental Management and Monitoring Plan including the requirement to conduct self-monitoring and submit corresponding reports regularly. The MMT may observe sampling activities conducted by the project proponent.
- b.) Prepare and submit its reported to EMB-CO and EMB-RO concerned using EMB-prescribed format at least semi-annually not later than July 30 for the first semester report and January 30 for the 2nd semester report
- c.) Institute and environmental emergency and complaints receiving and management mechanism which shall include systems for transmitting recommendations for necessary regulatory action to EMB in a timely manner to prevent adverse environmental impacts.

6.3.2 MMT Formation and Operationalization

- a. After the issuance of ECC for ECPs, the project proponent shall initiate the formation of the MMT based on the above policy updates in compliance to the relevant ECC condition. A Memorandum Agreement (MOA) between EMB-CO and PROPONENT based on a pro-forma to be provided by EMB shall be executed with conformity of members of the MMT as identified based on Section 15.3

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of this Order. The MOA signed by the proponent and the new members the project proponent shall submitted to EMB CO for final approval within the deadline specified in the ECC.

- b. A MMT Manual of Operations (MOO) shall be formulated / updated based on these policy updates. The MOO shall guide the MMT in planning its activities.
- c. In the conduct of its quarterly site visit, the MMTs shall implemented the usual procedures including a closing meeting where the MMT findings shall be discussed with the representative of the project proponent.
- d. MMTs who do not submit the required reports, those who fail to submit its report before the deadlines or submits incomplete reports for one (1) year shall be suspended until such time that such requirements are complied with.
- e. Individual MMT Members who violate the code of ethics shall be subject to suspension/ removal/replacement/ by the chairman of MMT or any other disciplinary action as indicated in the MOO.
- f. All other existing guidelines consistent with the provisions of this DAO shall still be in effect.

6.4 Environmental Guarantee and Monitoring Fund Commitments

DAO 2017-15 laid down the new guidelines for the fund commitments.

Presently, Board resolutions have been approved for Rehabilitation Cash Fund, Monitoring Trust Fund and Environmental Trust Fund. IQAC is just awaiting approval for the release of funds for the opening of account. These Funds will later be increased once the ECC for this applied increased capacity has been approved.



Table 6.16: SUMMARY OF MONITORING PLAN (EMoP) with ENVIRONMENTAL QUALITY PERFORMANCE LEVELS (EQPLs)

Key Environmental Aspects per Project Phase	Potential Impacts Per Env't'l Sector	Parameter to be Monitored	Method	Frequency	Location	Lead Person	Annual Estimated Cost in PhP	EQPL MANAGEMENT SCHEME						
								EQPL RANGE			MANAGEMENT MEASURE			
								ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT	
PRE-CONSTRUCTION/DEVELOPMENT PHASE														
Environmental Aspect # 1: The Land – solid wastes brought about by quarrying	Soil erosion	Benches	Proper quarrying methodology	Daily	Active Quarry areas	Proponent Quarry Manager	Part of EPEP/part of Agreement with Contractors	70% Bench limit in exploration report	85% bench limit in exploration report	90% Bench limit in exploration report	Bench limit in exploration report	Check quarry methodology	Strict implementation of bench limit	
	Loss of vegetation, displacement of avian habitat	Vegetation	Replacement of vegetation in mined our areas	Annual	Active Quarry areas	Proponent Quarry Manager	250,000	Unattended mined out areas	80% rehabilitation of mined out area	60% rehabilitation of mined out area	Immediate planting of trees and revegetation	Review rehabilitation and revegetation plan	Further study or revision of the plan	
Environmental Aspect # 3: The Air – Quarry operation of equipment and vehicles	Generation of dust	TSP	(S)24 hr High Volume (A)Gravimetric USEPA 40 CFR, Part 50	Quarterly	Construction site	Proponent through MMT	100,000.00	400 ug/Ncm	500 ug/Ncm	600 ug/Ncm	Immediate repair, conduct regular maintenance	Replacement of parts and conduct regular maintenance	Stop operation	
	Air pollution from motors/ engine of construction equipment and vehicles	SO2	(S)24 hr Gas Bubbler (A) Pararosaniline Method (West and Gaeke Method)				Part of Operating Cost	126	144	180				
		NO2	S)24 hr Gas Bubbler (A) Griess-Saltzman or Chemi luminescence Method				Part of Operating Cost	105	120	150				
	Generation of Noise	Sound levels/ noise	Actual noise measurement using Handheld Noise Meter	Quarterly	Station A1 - Within Aggregates Operation	Proponent Quarry Manager/ MEPEO/PCO	Part of EPEP / FMRDP Cost	does not exceed 71.6dB	does not exceed 76.6 dB	does not exceed 81dB	Investigate and identify source of noise	Identification of the source of noise and check buffer zones and noise attenuation measures	Assess performance of the attenuation measures, employ corrective measures and install additional measures if necessary	
								Station A2 - Near Pantok/East - Ridge Side	does not exceed 59.7dB	does not exceed the 64.7				does not exceed 69.7dB
								Station A3 - Quarry Area	does not exceed 55.9dB	does not exceed the 60.9dB				does not exceed 65.9dB
SITE PREPARATION PHASE														
Environmental Aspect #	Generation of	Sound	Sound	Quarterly	Station A1 -	Proponent	Part of	does not	does not	does not	Investigate and	Identification of the	Assess	

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Key Environmental Aspects per Project Phase	Potential Impacts Per Env'tl Sector	Parameter to be Monitored	Method	Frequency	Location	Lead Person	Annual Estimated Cost in PhP	EQPL MANAGEMENT SCHEME					
								EQPL RANGE			MANAGEMENT MEASURE		
								ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
3: The Air – Quarry operation of equipment and vehicles	Noise	levels/noise	measurements using handheld sound meter		Within Aggregates Operation		EPPE/FMRDP Cost	exceed 71.6dB	exceed 76.6 dB	exceed 81dB	identify source of noise	source of noise and check buffer zones and noise attenuation measures	performance of the attenuation measures, employ corrective measures and install additional measures if necessary
					Station A2 - Near Pantok/East - Ridge Side			does not exceed 59.7dB	does not exceed the 64.7	does not exceed 69.7dB			
					Station A3 - Quarry Area			does not exceed 55.9dB	does not exceed the 60.9dB	does not exceed 65.9dB			
	Air pollution from construction vehicles and equipment	TSP	(S)24 hr High Volume (A)Gravimetric USEPA 40 CFR, Part 50	Quarterly	Construction site	Proponent through PCO MMT	100,000.00	400 ug/Ncm	500 ug/Ncm	600 ug/Ncm	Immediate repair, conduct regular maintenance	Replacement of parts and conduct regular maintenance	Stop operation
		SO2	(S)24 hr Gas Bubbler (A) Pararosaniline Method (West and Gaeke Method)				Part of Operating Cost	126	144	180			
		NO2	S)24 hr Gas Bubbler (A) Griess-Saltzman or Chemi luminescence Method				Part of Operating Cost	105	120	150			
Environmental Aspect # 4: The People	Traffic congestion	Traffic condition / Road Accessibility	Visual: Number of vehicles per report of Receiving Clerk Representation with the LGU regarding road network and its infrastructure plans Traffic Impact Assessment	Daily	Access Road	Project Proponent	Part of the Proponent's responsibilities	20 minutes traffic	Half hour traffic	1 hour traffic	Strengthen implementation of traffic management plan	Increased deployment of traffic enforcers	Review traffic management plan and impact assessment and revise if necessary
	Accidents	Incident reports	Records from Clinics Safety Records Monitoring of use of PPEs	Monthly	NA	Health and Safety		5 NM or MTI	1 LTI	3 LTI	Review safety procedures, check equipment and facilities	Regular and more frequent IEC on Safety and Health Program/	review of Safety and Health Program and revise if necessary

Environmental Performance Report and Management Plan
Calabar Quarry Operations Project
Island Quarry and Aggregates Corporation (IQAC)
Brgys. Pantok and Palangoy, Binangonan, Rizal



Key Environmental Aspects per Project Phase	Potential Impacts Per Envit'l Sector	Parameter to be Monitored	Method	Frequency	Location	Lead Person	Annual Estimated Cost in PhP	EQPL MANAGEMENT SCHEME					
								EQPL RANGE			MANAGEMENT MEASURE		
								ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
												strategies	
OPERATIONS PHASE													
Environmental Aspect # 2: The Water – water quality and resilience of fish biota and aquatic fauna in Calabar lagoon	Impacts on freshwater/lagoon ecology- risk of mortality of fish biota, plankton, benthos	Species composition, density and relative abundance of phytoplankton, zooplankton, bottom benthos, fish	Plankton community sampling, benthos survey, fish surveys (actual fishing and swim transect) Key Informant Interview	Bi-annual	Same stations during baseline study	Consultant	600,000.00	Noticeable decrease in aquatic fauna as compared to baseline findings; discoloration of freshwaters	Significant decrease (≈50%) decrease in baseline findings and discoloration of freshwater; and increase in HABs	Noticeable mortality of fish and macro-invertebrates; discoloration of freshwater; and increase in HABs; Comp to check if effluent released complies with DAO 2016-08	Conduct marine biota monitoring; Company to check if sediment control measures are not sufficient in lagoon area; check water quality for waste contamination including fish bio-assay examination	Increase the frequency of conduct of marine biota monitoring to quarterly; Install additional silt and wastewater control measures	Increase the frequency of conduct of marine biota monitoring to Quarterly; Cease all aspects of operation contributing to lagoon pollution until more effective control measures are instituted
Environmental Aspect # 3: The Air – Quarry Operation	Increase in dust generation and sound levels from quarry operation	Noise TSP	(S)24 hr High Volume (A)Gravimetric USEPA 40 CFR, Part 50	Quarterly	Access roads	Proponent through PCO	100,000.00	400 ug/Ncm	500 ug/Ncm	600 ug/Ncm	Identify possible sources including external factor	Check APCD	Stop operation
Environmental Aspect # 4: The People	Traffic congestion	Traffic condition / Road Accessibility	Visual: Number of vehicles per report of Receiving Clerk Representation with the LGU regarding road network and its infrastructure plans Traffic Impact Assessment	Daily	Access Road	Project Proponent	Part of the Proponent's responsibilities	20 minutes traffic	Half hour traffic	1 hour traffic	Deployment of traffic enforcers	Increased deployment of traffic enforcers	Review traffic management program and impact assessment and revise
	Accidents	Incident reports	Records from Clinics Safety Records Monitoring of use of PPEs	Monthly	NA	Health and Safety		5 NM or MTI	1 LTI	3 LTI	Review safety procedures, check equipment and facilities	Regular and more frequent IEC on Safety and Health Program/strategies	Revise Safety and Health Programs
People	Socio-economic impacts	No. of employees/workers		Quarterly	Palangoy and Pantok	Comrel	Part of Operating Cost	70% of workers hired from	60% of workers hired from	50% of workers hired from	Review hiring procedures	Identify problem areas and check	Assess hiring procedures and

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								EQPL RANGE			MANAGEMENT MEASURE		
								ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
		rs employed/hired	Survey / FGD				Part of SDMP	Pantok and Palangoy and in Binangonan	Pantok and Palangoy and in Binangonan	Pantok and Palangoy and in Binangonan		bottlenecks	implement improvements
		No. of Livelihood Programs Implemented						90% of target programs implemented	80% of target programs implemented	70% of target programs implemented	Review programs	Revise programs	Enhance program implementation
	Generation of local revenues from taxes, permits and LGU share in quarrying	<ul style="list-style-type: none"> Total taxes paid to the national government Development of small and medium enterprises like transport, construction and utility services, food services and laundry supplies 	<ul style="list-style-type: none"> Real Property Tax payments Payments of occupation tax SDMP allotments EPEP Fund FMRD Fund 	Quarterly	Palangoy and Pantok	Comrel	<ul style="list-style-type: none"> 60% goes to national government; 40%, to the local government 20% for host Provinces 45% for host Municipalities 35% for host Barangays 	90% availment	70% availment	60% availment services	Review availment and identify issues	Coordinate with LGU to determine if there are revisions/ improvement needed	Revisit policy and implement amendments and enhancements
IV. ABANDONMENT PHASE													
Environmental Aspect # 1: The Land: oil spill	Soil contamination	Contaminated soil TPH (C6-C36) USEPA priority pollutant metals (Sb, As, Be, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag, Ti, Zn) VOCs SVOCs	USEPA 8260C USEPA 8015C USEPA 7470A USEPA 6020A USEPA 8260 USEPA 8270	Once before decommissioning	Hazardous Waste Storage Area	PCO	50,000	80	90	100	Investigate source of contamination and implement corrective measures	Investigate and strengthen implementation of measures	Review and implement changes to further mitigation of hazwaste management
								0.8	0.9	1.0			
								1.6	1.8	2.0			
								40	45	50			
Environmental Aspect # 2: The Water	Water pollution/contamination		Environmental Site Assessment (ESA) that will be conducted prior to abandonment			Proponent thru PCO; MMT	To be determined				Investigate source of contamination and implement	Conduct periodic monitoring of the groundwater	Review and implement changes to mitigate water contamination



Key Environmental Aspects per Project Phase	Potential Impacts Per Env'tl Sector	Parameter to be Monitored	Method	Frequency	Location	Lead Person	Annual Estimated Cost in PhP	EQPL MANAGEMENT SCHEME					
								EQPL RANGE			MANAGEMENT MEASURE		
								ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
		TPH (C6-C36)	USEPA 8260C USEPA 8015C					80	90	100	corrective measures	via the monitoring wells to detect if the COPCs Contaminant of Potential Concern (COPC) in groundwater are increasing or decreasing over time. The sampling and testing of the monitoring wells for TPH should be included in the periodic monitoring programme established by the company's environmental management system	measures.
		USEPA priority pollutant metals (Sb, As, Be, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag, Ti, Zn)	USEPA 7470A USEPA 6020A					0.8	0.9	1.0			
		VOCs	USEPA 8260					4	4.5	5			
		SVOCs	USEPA 8270					16	18	20			



CHAPTER 7: DECOMMISSIONING/ ABANDONMENT/ REHABILITATION POLICY

The Decommissioning Plan

The decommissioning of this Project will abide by good environmental practices and principles, especially the management of wastes resulting from the dismantling process.

By the nature of the project, there are no anticipated residual soil, water and air contamination with hazardous substances in event of project abandonment.

Project closure will result to the following:

Loss/decrease taxes by the National Government. These taxes are Corporate Income Tax, Excise Tax on Minerals, Customs Duties, Value Added Tax, Documentary Stamp Tax and Capital Gains Tax. On the local government level, the following taxes will be affected such as Business Tax, Real Property Tax, Registration Fees, Occupation Fees, Community Tax and other Local Taxes. Other taxes such as Withholding Taxes on Payroll, Interest Income in Banks and Stockholders Dividends will likewise be affected.

Loss of financial allocations for approved plans/programs such as the Social Development and Management Plan, Environmental Protection and Enhancement Program and Final Rehabilitation and Decommissioning Plan.

Loss of employment. The closure of the project will have meant loss of income or business opportunities derived from the project such as the transport sector, the Small-Medium Enterprises like stores, eateries, etc.

Loss of funding for various company supported social work projects such as medical missions, outreach programs, support to education, etc.

Reforestation/rehabilitation measures to be conducted for the inactive/used-up quarry/mined-out areas

The company will implement its reforestation/tree planting on all mined-out areas thru progressive rehabilitation and immediate reforestation of mined out areas.

IQAC proposes a final land use of a stable and vegetated area for the disturbed areas and the conversion of the support structures to other productive uses such as offices, warehouses, etc. Eventually, the area can become a residential and/or commercial area.

The selection of the final land use for the Project was based on the following four (4) point criteria:

1st criteria. The naturally occurring hazard in the area that may render it unusable or unfit for other productive land use. There are no naturally occurring hazards in the area. The area is not traversed by major active faults, it is not located within typhoon belt, it is not located in steep and landslide prone areas, etc. Hence, the area can be revegetated after the commercial life of the Project.

2nd Criteria. The level of environmental and social impacts cause by the operation. The environmental impacts of the project will not render the area unusable after the life of the project. There are no toxic wastes generated by the Project. It has lesser impact to the environment considering that it is a non-metallic project. Moreover, the impact area of the project remains constant throughout the operating life. No additional areas are disturbed. On the social impacts of operations, the Project provided a positive effect to the host community in particular and to the national government in general. These are in terms of employments provided, taxes paid, etc.

3rd Criteria. The expected post-closure operational use of the land. The development of other industries and residential areas near the project and within the municipality of Binangonan. The proximity of the project to Metro Manila makes it also an ideal for the proposed final land use that could eventually become a residential and/or commercial area.



4th Criteria. The productivity of the land surrounding the site. The proposed final land use will adapt and fit in with the surrounding land use of the municipality of Binangonan. Currently, there are other quarrying/manufacturing industries and residential areas near the project as well as residential areas and agricultural lands.

CHAPTER 8: INSTITUTIONAL PLAN FOR EMP IMPLEMENTATION

Introduction/Rationale

This section provides the instrument required to establish a proactive institutional requirement to guarantee compliance with environmental regulations and policies and implementation of environmental safeguards and commitments. It is important to set up capable and competent unit/group with properly defined roles in the process of the monitoring and evaluation of post EIA requirements and commitments as well as with other environmental regulations. It is important to identify and provide the group that will implement said requirements for a sustainable project operation.

Function

The Environment Unit/Team is responsible for the environmental performance of the project. It ensures implementation of the environmental safeguards and controls for the project implementation (for all phases of the project) and is responsible for overseeing environmental compliance of IQAC activities, environmental requirements and regulatory obligations.

Core Function of the team/unit includes the following:

- Systems and Procedures
- Environmental Safeguards and Implementation
- Government Regulatory Compliance
- Environment Health Safety Program and Awareness
- EHS Program Compliance

Set Up

In many cases, the environmental unit leads the post EIA compliance and implementation process in collaboration with the other technical team/groups to provide technical support. There are no generally applicable, rigid rules, so many variations are possible depending on IQAC's personnel capacities and structures.

Roles and Responsibilities

In order to have a better understanding of the roles and responsibilities of the main actors in the institutional framework, below provides a brief explanation of the role of the key personnel, the technical team, and collaborating units/groups.

Key Personnel	Roles and Responsibilities
MEPEO	Monitoring of the implementation of the FMR/DP together with the Contingent Liability Rehabilitation Fund (CLRF) Steering Committee and/or the Mine and Geosciences Bureau (MGB).
Pollution Control Officer/ Engineer	Compliance to environmental regulations & standards; maintenance of reports that are submitted to internal and external agencies.
Safety Engineer	Responsible for implementation of emergency response procedures, handling of hazardous materials and environmental management systems and requirements of DOLE on occupational safety and health
CSR and SDP personnel	Community relations, design, training and implementation of CSR and SDP programmes

Following are the functions, roles and responsibilities of each departments:

A. Operations – The operations department is responsible for acquiring the inputs and devising the best quarry operation methods. In addition, following are inherent responsibilities of the Operations Department:

- Full Quarry Operations
- Safety and Morale of the Department
- Schedule attainment
- Continuous Improvement
- Leadership and Direction
- Customer interface

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- Company policy enforcement
- Start-up / launch

B. Maintenance

This department is in charge for the schedule and regular inspection, maintenance and repair of equipment.

C. Engineering Support

This Department is in charge of the control, optimization, safety and testing of necessary support needed by the quarry project.

D. Admin. And Finance

Administrative and Financial Department is a unit to be assigned with various responsibilities concerning personnel, finance, publications, public relations, conferences, sale of documents and similar administrative functions; in particular:

1. Personnel affairs;
2. Organization of training of officials and supervision of programs established to that effect;
3. General services including the general register of the staff and services;
4. Rendering consultations to other Departments on organizational matters;
5. Preparation of studies on the administrative organization;
6. Maintaining and auditing the accounts of the Company;
7. Supervision of storage and purchasing;
8. Preparation of the budget;
9. Organization of administrative services for conferences and meetings;
10. Maintaining and organization of the library and the archives as well as their use.

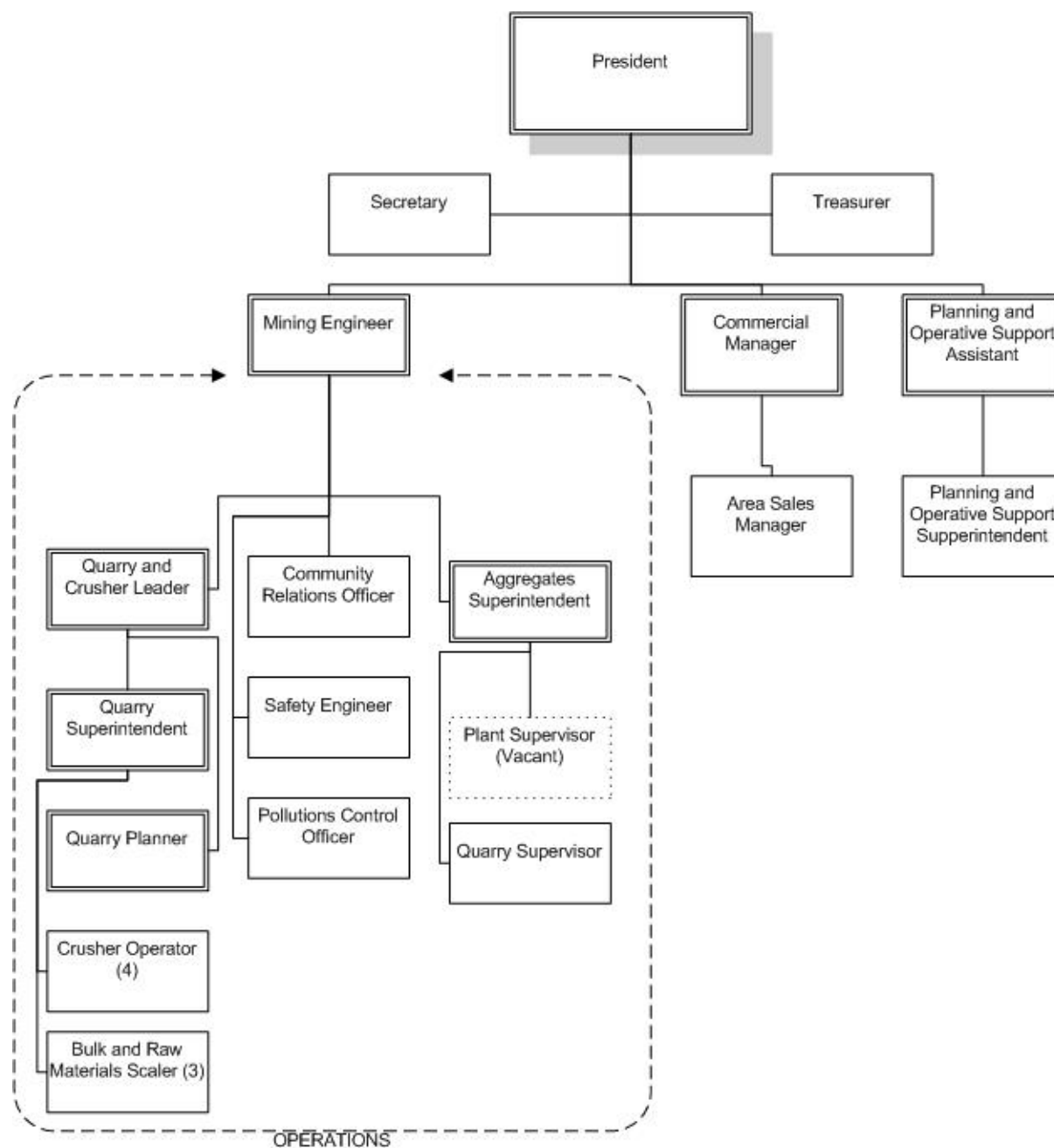
Skills and Competency

Selection of competent and effective personnel comprising the environmental unit will be crucial in the institutional or organization building. Qualifications for the members may include the following:

- Understanding of environment management, legal regulatory framework, environmental impact assessment and reporting, and environmental compliance and audit management. Well-versed and familiar with the application of local laws and regulations on Environmental regulatory compliance.
- Experience in integrated environmental assessment
- Good relationship with the environmental regulatory authority
- Capacity to dialogue with different stakeholders from both the public and private sector, and ability to build consensus on key environmental issues
- Oral and written communication skills; people skills; project coordination; monitoring and audit; scientific research and development; project planning; policy formulation; and training and facilitation

The management of IQAC ensures that the responsibilities and authorities of its personnel, particularly those functions whose work may affect its EHSQ performance shall be clearly defined and documented. The management also ensures that Top Management appointees such as the MRs and members of the management team are known by the employees and other parties working within the company premises.

Responsibilities and authorities are assigned to individuals to ensure that IMS practices are integrated with their respective functions. More specific descriptions of the responsibilities and authorities of personnel whose work affect the EHSQ performance of the IQAC are described in related procedures and job descriptions. Figures 8.1 shows the Table of Organization for EMP implementation.



Figures 8.1: Table of Organization for EMP Implementation

Interaction or coordination of the environmental unit with the MMT for the said project will be to monitor the project on environmental aspects including implementation of SDMP and IEC.

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CHAPTER 10: ANNEXES

ANNEX A:	SEC Registration of Island Quarry and Aggregates Corporation
ANNEX B:	Copy of TCTs annotating Mining Placer Patents/Claims
ANNEX C:	Mines and Geosciences Bureau Certification dated 6 May 2016
ANNEX D:	Test Results/Analysis for Air, Noise, Water and Soil
ANNEX E:	Proof of submission of CMVR
ANNEX F:	4 th Quarter SDMP Accomplishment
ANNEX G:	Copy of duly received EPEP by MGB
ANNEX H:	IQAC Internal Exploration Report with justification
ANNEX I:	Public Participation: Public Scoping Report
ANNEX J:	Emergency Preparedness and Response
ANNEX K:	PEMAPS Questionnaire with Accountability
ANNEX L:	Accountability of Project Proponent
ANNEX M:	Accountability of Preparers
ANNEX N:	Checklist of Must Requirements
ANNEX O:	Copy of ECC COL-R4A-2018-0057
ANNEX P:	Copy of Permits of IQAC Calabar
ANNEX Q:	Perception Survey Questionnaire