ENVIRONMENTAL IMPACT STATEMENT OF THE PROPOSED MABUHAY FILCEMENT GRINDING AND PACKING FACILITY

Submitted To:

Department of Environment and Natural Resources
Environmental Management Bureau

Prepared By:

Philippine Center for Environmental Awareness and Sustainability, Inc.

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May 2019

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EXECUTIVE SUMMARY

1. Project Fact Sheet:

Name of Project / Location	Mabuhay FilCement Grinding and Packing Facility Calaca Industrial Seaport Zone, Brgy. Lumbang Calzada, Municipality of Calaca, Province of Batangas.
Project Proponent	Mabuhay FilCement Inc., (MFI)
Address	Doña Emilia Benedicto Bldg. No. 7 E. Benedicto St. Zapatera, Cebu City, 6000, Cebu, Philippines Tel. No.: (6332) 255-3200 /255-3207 /488-9788 Email : <mfcement@gmail.com>
Contact Person & Proponent authorized Representatives	Enrison T. Benedicto Rose D. Encallado Joselito M. Palacio Tel.No.: (6332) 488-9788 / Mobile No.: (63-917) 417-8403 Email: <jmpalacio@mfcement.com
Background & Nature of Project	MFI regional business expansion for the manufacturing and production of affordable local brand cement products. The Project is primarily a Cement Grinding and Packing Facility.
Project Description & Location	MFI will grind clinker and other Non-metallic material (e.g. Limestone, gypsum, and pozzolanic material) to final product cement, and will be packed into 40 kg bags, one (1) Ton Cement Bags, or directly to Bulk Trucks; Located within a 3.9 hectares land which is identified as Lot 12 of Phase III-B of Calaca Industrial Seaport Zone, Calaca, Batangas.
Size & Scale of Project	The estimated maximum production capacity of the grinding and packing plant is 8,800 MT per day, about 220,000 bags cement per day (or 3.2 million metric tons per year) .
Rationale	Cement is an important construction material with an increasing demand especially with reference to the government's build-build programs. Thus, the proposed project of Mabuhay FilCement, Inc. will contribute to the country's infrastructure growth and development while considering the wellness of the surrounding environment of the area. Specifically, the goal of the project is to address the requirements of the construction industry in the Province of Batangas and its surrounding areas in Region 4A
Project Components It will source raw materials (i.e., clinker, limestone, pozzolanic material, & fly ash either locally or abroad) where it will be temporarily stored within the plant site through silos, steel bins and covered	***Facilities:*** ***(Total Area, sq. m.)*** Admin. Building: Office & QA Laboratory - 810 . 3 Truck-scale rooms/ 3Truck-scales - 240 3 Clinker Storage -3,900 1 Clinker Bin Silo/ 1 Fly Ash Silo - 295 Cement Mill Workshop with 3 grinding mills & roller press -2,400 Material Storage, Mixing Shed &

storages. The cemment production processes will only involve clinker and additives grinding and mixing.	Feeding System -4,500 3 Cement Silo -1,500 Packing House & Loading Area -5,210 Water Pump Room - 50 Air Compressor Room - 50 Cement Mill Power Room - 450 Packing House Power Room - 160 Finished Cement Warehouse - 765 Machine Shop - 600 Sub-Station / Switch Yard - 610 Pay-loader Parking / Motor-pool - 225 3 Water Closet/CR - 150 Service Vehicles /Motorcycles Parking - 1,125 2 Guard House - 20 4 Cistern Tank - 32 1 WTF / 1 MRF - 75 ***Total Area of All Facilities*** **23,167** **Open Spaces** **16,473** ***TOTAL AREA OF PROJECT SITE*** ***39,640***
Duration of Project	The Project is expected to have an economic life of at least 20 years.
Project Schedule	Pre-construction: April 2018- March 2019 (11.5 months); Construction: January 2019 - June 2021 (2.5 years); Commissioning: June 2021- August 2021 (2.0 months); Commercial Operation: September 2021
Total Project Cost	The capital investment to establish and operate the cement grinding and packing facility is estimated at **PhP 1.20 billion**

Process Documentation of the Conduct of EIA

The EIA Team

Mabuhay FilCement Inc. engaged the services of PCEAS to conduct the EIA for the Project and to prepare the EIS Report. The EIA team, composed of professional experts on their respective fields and with the coordination and the technical people from the proponent, were organized based on the Project's EIA needs.

Table ES 1: EIA Team

EIA Team	Registration as Preparer	Areas of Expertise
Rogelio N. Tagarino	Registered as Team Leader in the old accreditation system	Team Leader & Socio-economics
Socorro L. Patindol	IPCO-336	Co-team Leader, Social & EMP
Florante A. Panganiban		Land & Terrestrial Ecology
Reynaldo Tejada	IPCO-036	Air Quality & Dispersion Modelling, ERA
Ma. Luisa Martinez	IPCO-133	Water Quality, ERA
Rodolfo A. Romarate II		Marine Quality
Teodoro P. Guerrero	IPCO-121	EIA, EM
Consultant/Technical Person from Proponent		
Engr. Joselito M. Palacio		Environmental, Health, Safety & Security

Engr. Lysa B. Inot		Quality Assurance
Engr. Mark Anthony B. Genayas		Plant Operation
Engr. Frenzy Mae T. Alfeche		Pollution Control

EIA Study Period/Schedule:

PCEAS was engaged by Mabuhay FilCement, Inc. last May 24, 2018. Immediately, PCEAS together with the Project Proponent proceeded on EIA planning, stakeholder profiling and conducted initial EIA processes. **Public Scoping** was held on September 14, 2018 at the Conference Hall of Leonora Cecilia Restaurant Brgy. Lumbang Calzada, Calaca, Batangas while the **Technical Scoping** was conducted last October 8, 2018. Baseline studies and impact assessment were then conducted.

Table ES 2: EIA Milestone and Schedules

EIA Activity/Stage	Date
Preliminary IEC & Consultation with the officials of THE Municipality of Calaca, and Brgy. Lumbang Calzada, Calaca	May 25-26, 2018 August 1- 3, 2018
Public Scoping	September 14, 2018
EIA Study, Impact Assessment & Mitigation Plan	Sep 15 – Oct 30, 2018
Public Hearing	Mar 22, 2019

EIA Study Area

The proposed cement grinding project will be located within the Calaca Industrial Seaport Zone at Brgy. Lumbang Calzada, Calaca, Batangas. **Figure 1** presents the project site.

Figure 1- Location of the Project in the Maps of Calaca and the Philippines

EIA Methodology

The EIA was prepared in accordance with the prescribed standards and procedures under the Philippine Environmental Impact Statement System, DAO 03-30. Table below presents the detailed EIA methodology per environment sector/component.

Table ES 3: EIA Methodology

EIA Study Module	Parameters/Scope	Baseline Sampling and Methodology
Land		
Geology/Geomorphology, Pedology, Land Use & Classification	Reconnaissance, land use and classification assessment, slope, soil types and classification, erosion	Secondary data, , review of geological reports and maps, soil site assessment
Terrestrial Biology – Wildlife and Vegetation	Flora and fauna species inventory, species endemicity and conservation status, species abundance, frequency and distribution	Use of secondary data
Water		
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; Conventional water quality parameters to be used are ff: 1. pH 2. BOD_5 3. COD 4. DO 5. Oil and grease 6.TSS 7. Fecal/total coliform 8. Phosphates and Others.	Water sampling and laboratory analysis, use of secondary data
Surface Water Ecology		use of secondary data, interviews
Air		
Air Quality	Ambient air quality and noise levels	Sampling and laboratory analysis
Meteorology/Climatology	Monthly average rainfall, climatological normal and extremes, wind rose diagrams, and frequency of tropical cyclones	Use and review of secondary data
Air Dispersion and Noise Modeling	Worst case scenario identification, use of meteorological data	Use of SCREEN3 Model and AERMOD Model (Tire 4) and CUSTIC 2 Software for Noise Modelling

Climate Change		
Temperature change	Seasonal Temperature increase under medium range emission scenario in Batangas Province; Monthly Average Temperature without Climate Change; Monthly Average Temperature with Climate Change.	Effects of Temperature Increase in the Project
Rainfall change	Seasonal rainfall change (in %) under medium range emission scenario in Batangas Province; Monthly Average Rainfall without Climate Change; Monthly Average Rainfall with Climate Change.	Effects of change in rainfall pattern to the grinding plant project
Greenhouse as Assessment	CO_2, CH_4, and N_2O Emissions based on IPCC 2006 Guidelines and USEPA Procedure	Power consumption vs CO_2, CH_4, and N_2O emissions
People: Socio-Economic, Health		
Public health and Demography	Morbidity and mortality trends, Demographic data of impact area: - Number of households and household size - Land area, - Population, density /growth, - Gender and age profile, - Literacy rate, educational attainment profile	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
Environmental Risk Assessment		
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

Statement of the Risks and Uncertainties During the EIA Study which may Delimit the Results of the Study

The EIA study was conducted in a limited time, coverage and sample population and area in Calaca, Batangas. These limitations pose risks and uncertainties in the analysis of impacts and may delimit the results of the study, thus, constraining the identification/ formulation of better mitigations and corresponding environmental management and monitoring plan.

Public participation Activities
Scoping and Consultation in the Conduct of the EIA Study

As provided in DAO 2003-30 and MC 14 Series of 2010, public consultation is mandatory for this Project. Mabuhay FilCement Inc. conducted pre-scoping consultation and informal discussion with the Officials of primary impact barangay (Brgy. Lumbang Calzada, Calaca) from May 25, 2018 to September 10, 2018 regarding the Project proposal.

On September 14, 2018, the public scoping with the stakeholders was held to discuss about the Proposed Prject of MFI. provide their clarifications on pertinent matters concerning the same project. Consultations were done through public scoping and these were attended by officials and community leaders of Brgy. Lumbang Calzada, representative of Calaca Municipal Government, DENR Batangas, and officials of Calaca Industrial Seaport Zone. On Nov 8. Consultation with the BGU of Bgy. Lumbang Calzada on the EMP and SDP was also conducted. During the formal consultations and community discussions, majority of the stakeholders expressed concern about the possible effects of the project, although they believe that the mitigating measures will be sufficient to protect them. They believe that they will benefit from the development that the project will bring to them.

Activities prior to scoping were conducted as required by EMB:

Activity	Dates	Venue	Participants
Meeting with Stakeholders and IEC	July 22 - 28, 2018	Barangay Lumbang Calzada and Municipal Level of Calaca	30 BGU and LGU heads, School principal, People's Organization, MPDC, MENRO, Calaca Seaport Zone Office

During various barangay meeting and IEC activities prior to the public consultation, barangay officials and residents of the Barangay acknowledge the benefits that the project will bring to their barangay and to the residents. During the public scoping, attendees expressed their concerns on possible impact of the project such as

- generation of solid wastes
- dusts/ air pollution
- noise
- water shortage.

These concerns were reiterated during the Public Hearing. The MFI reiterated its commitment to implement the mitigating measures to minimize if not eradicate the negative impacts.

EIA Summary:

Summary of alternatives considered:

Project Site	MFI considered the following criteria in its site selection: climatic conditions- not flood prone, labor can be procured easily and economically; area should be accessible to its market to minimize cost of transport and the chances of spoiling the cement during transport; there is available and reliable power supply; raw materials are available near and can be transported to site easily; transport facilities are available for raw materials and finished product. In view thereof, it considered various areas in Luzon, such as Laguna, Batangas and Pampanga. It found the area within the Calaca Industrial Seaport Zone as the best choice.

	Proponent found the following advantage in selecting CISZ: site is within an established industrial area bordering coastal zone with operating "port"; the site is an idle land area not use for agricultural production and free of settlements/residence. Also, the site is near the port and national highway which is very accessible through the well establish road network of CISZ.
Technology Selection	In view of the requirement of the Clean Air Act and its IRRs, MFI searched for technologies and equipment that will ensure compliance and sustain production and operation of the plant. New grinding system will be adopted as an alternative to the existing technology to ensure production processes will be cost-effective and environment-friendly. Hybrid grinding system –combination of roller press and ball mill, will be used to pulverize the raw materials cement components. Hence, the efficient energy usage of roller press for pre-grinding operation and the grinding ability of ball mill are combined for better pulverization with higher capacities.
Operation Processes & Design	MFI's criteria for its operation processed and design is basically cost effectiveness and business continuity. Finish grinding is one of highest energy consuming operation in cement manufacturing plant. Nowadays there are different grinding systems which have been designed and operated to improve the process in addition to the closed-circuit, two compartment ball mills known for decades. With this interest, Mabuhay Filcement Inc. opted to employ the combined or hybrid grinding system.

Integrated summary of the main impacts and residual effects after applying mitigation:

Project Phase / Environmental Aspect	Environmental Component Likely to be Affected	Potential Impact	Options for Prevention or Mitigation or Enhancement
Pre-Construction Phase: Sourcing of equipment and contractors; Securing of approvals like ECC issuance, etc.			
CONSTRUCTION PHASE			
Generation of debris, solid wastes and scraps due to various construction works	Land	Land pollution	• Good housekeeping; • Reduce, re-use, recycle of wastes • Reuse and sell of scraps • Use of the Warehouse Facility as the temporary facility during construction to save on space and resources
Soil erosion due to cut and fill		Land degradation at site and nearby areas Increased sediment and deposition in adjacent areas	• Further minimize cut and fill because land is already developed • Protect loose soil from rain

Generation of hazardous wastes		Land contamination	• Good housekeeping • Proper Containment of oil and used oil
Release/ discharges of waste water due to construction activities	Water	Pollution of ground water	• Use of Portable toilets • Good housekeeping
Use of limited water resource		Water depletion due to groundwater extraction	• Provision of water conservation measures • Source water from CISC
Emissions to air due to land clearing and construction activities	Air	Air pollution	• Regular spraying of water where earthwork activities are concentrated • Compacting of exposed soil and immediate hauling of spoils • Cover on trucks loaded with construction materials • Impose speed restrictions for trucks • Road water sprinkling • Tree nursery and tree planting
Increase of noise level	People	Nuisance to nearby communities	• Limit activities during day time
Physical Attributes and Nuisance		Increase in traffic congestion	• Implement Traffic management plan
Employment and livelihood generation	People	Increase in livelihood opportunities and community income	• To enhance, give priority to qualified locals • Implement Social Development Program (SDP) and information and Education Campaign (IEC) •
Operation Phase			
Solid waste accumulation	Land	Land pollution	• Good housekeeping • Implement Proper Waste Management Plan • Implement reduce, re-use and recycle program. • Provision of compost pit for biodegradable waste • Set-up a Material Recovery Facility
Hazardous wastes		Contamination and improper management of	• Proper labeling, segregation and storage

discharge to land		hazardous waste materials	• Transport, treatment and disposal through a DENR accredited third party contractors • Provision of hazardous waste storage area with secondary containment • Separate area for the plant personnel working station to prohibit hazardous waste exposure and health hazard as well.
Release/Discharge to Water	Water	Water pollution domestic wastes	• Use of multi-chamber septic tanks • Desludging by accredited service provider
Use of limited water resource		Water depletion due to groundwater extraction	• Water conservation measures • Source water from CISC not from ground water
Emissions to Air	Air	Air pollution from fugitive dusts, equipment and vehicles	• Use/installation of dust collector system • Closed system for transfer and storage • Manual/ mechanized sweepers and /or truck mounted cisterns to control dust • Proper maintenance of dust collector including replacement of filter bags • Road water sprinkling • Tree nursery & tree growing
	Air	Greenhouse gas emission	• Implementation of a greenhouse gas emission reduction and management program
Noise from equipment and vehicles	People	Increase of ambient noise levels	• Establish and maintain Buffer zone and tree growing • Ensure proper maintenance of equipment and vehicles • Provision of earplugs to workers • Maintain OSH prescribed noise criteria • Impose and implement strict policies on hired vehicles
Health aspects	People	Increase in health incidence attributable to operation of plant	• Ensure all mitigating measures to control air pollution are in place and operational at all times
Employment and income generation for the people		Increase in livelihood opportunities and community income	• To enhance, give priority to qualified locals • Implement Social Development Program (SDP) and information and Education Campaign (IEC)

Income generation for the Barangay and Calaca Local Government		Increase in local government's income	• Pay appropriate fees and taxes on time and
Physical Attributes and Nuisance		Increase in traffic congestion	• Implement Traffic management plan
Decommissioning Phase			
Discharge to land	Land	Solid waste pollution /contamination brought about by scraps and debris from demolition; Change in land form and use	• Good housekeeping • Conduct Environmental site assessment (ESA) prior to abandonment
Emissions to air	Air quality	Air pollution due to dust from demolished structure Noise Pollution due to demolition	• Sprinkling of water in affected areas • Limit activity during daytime
Loss of livelihood	People	Loss of Jobs and community programs	• Retrenchment package • Labor support programs

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

No apparent major risks and uncertainties have been identified / anticipated on the proposed Project. However, the existing Environmental Laws and DENR policy, rules and regulations are more than adequate to address whatever risks and uncertainties that may arise / emanate from the development and operation of this Project

Summary matrix of environmental parameters to be measured

Key Env'tal Aspect / Phase	Potential Impacts Per Envit'l Sector	Parameter to be Monitored
Construction Phase		
Aspect #1: Emissions to Air	Increase in Ambient TSP	TSP, (µg/Ncm)
		PM_{10}, (µg/Ncm)
		SO_2, (µg/Ncm)
		NO_2, (µg/Ncm)
		Sound Levels
Operation Phase		
Aspect #1 Emissions to Air	Increase in Ambient TSP	TSP, (µg/Ncm)
		PM_{10}, (µg/Ncm)
		SO_2, (µg/Ncm)
		NO_2, (µg/Ncm)

		Sound Levels
Aspect #2 Discharge of Wastewater	Water and Land Pollution due to discharge from Sewage Treatment Plant	PSIC 37000: BOD,
		Surfactants
		Oil and Grease
		Fecal Coliform
		Ammonia
		Nitrate
		Phosphate

SECTION I. PROJECT DESCRIPTION

Introduction: Mabuhay Filcement Inc. (MFI) is a 100% Filipino owned corporation established in 2003 by the Benedicto Family of Cebu City, Philippines. It is duly organized and existing under and by virtue of the laws of the Philippines primarily to engage in the manufacture and production cement products. Its corporate mission and goals include: (a) the advancement of nation building by providing affordable and good quality cement; (b) the increase of production capacity to help sustain the increasing demand; (c) providing employment and livelihood to the locals; and (d) generate income to both local and national government.

Since 2003, MFI is efficiently operating its cement plant in South Poblacion, San Fernando, Cebu. With gained technical experiences and proven track record in cement business operation, this corporation aims to pursue "regional expansion" of producing local brand cement. Thus, it proposes to establish the Mabuhay Filcement Grinding and Packing Facility **- "the Project"** in the Calaca Industrial Seaport Zone at Brgy. Lumbang Calzada, Calaca, Batangas. However, before the actual development of this proposed Project can be implemented, all the applicable local and national laws, rules and regulations must first be pursued, most particularly the procurement of its Environmental Compliance Certificate (ECC).

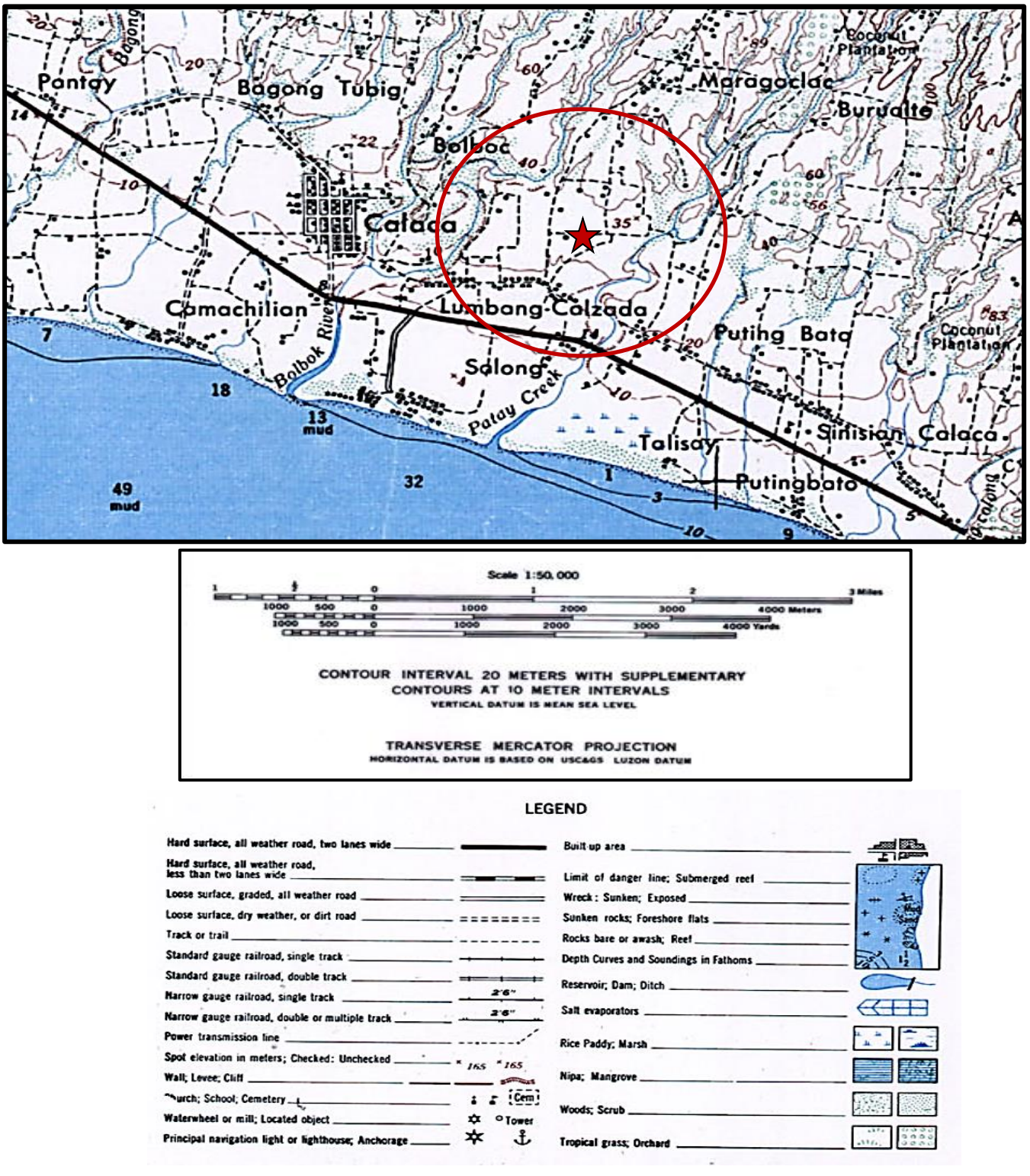
Copy of the Securities and Exchange Commission (SEC) Registration of Mabuhay FilCement Inc. is presented in ***ANNEX 1.***

1.1. Project Location and Area

The proposed Project will be located within **39,640 sq. m. (3.964 hectares)** land of Mabuhay Filcement Inc. which is identified as Lot 12 of Phase III-B of the Calaca Industrial Seaport Zone, at Brgy. Lumbang Calzada, Calaca, Batangas ***(see, ANNEX 2 –Contract to Sell for the Purchase of Parcel of Land).***

Figure 1-1 shows the Project location in the map generated by the National Mapping and Resources Information Agency (NAMRIA); The 1-kilometer radius is used to delineate the extent of the indirect impact area, as commonly used in the assessment of environmental risks and impact assessment, i.e. usually referring to distance to ECA, distance to water source, distance to settlement. **Figure 1- 2** pin-points the location of the project within the Calaca Industrial Seaport Zone (CISZ) Phase III-B; **Figure 1-3** and **Figure 1-**4 show the vicinity of the Project area, and the geographic coordinate of the Project site is Latitude $13^0$55'50.03" and Longitude $120^0$49'28.26", while **Figure 1-5** presents the map of the Calaca Industrial Seaport Zone.

Figure 1-1. NAMRIA Map showing the Project Site and Impact Areas



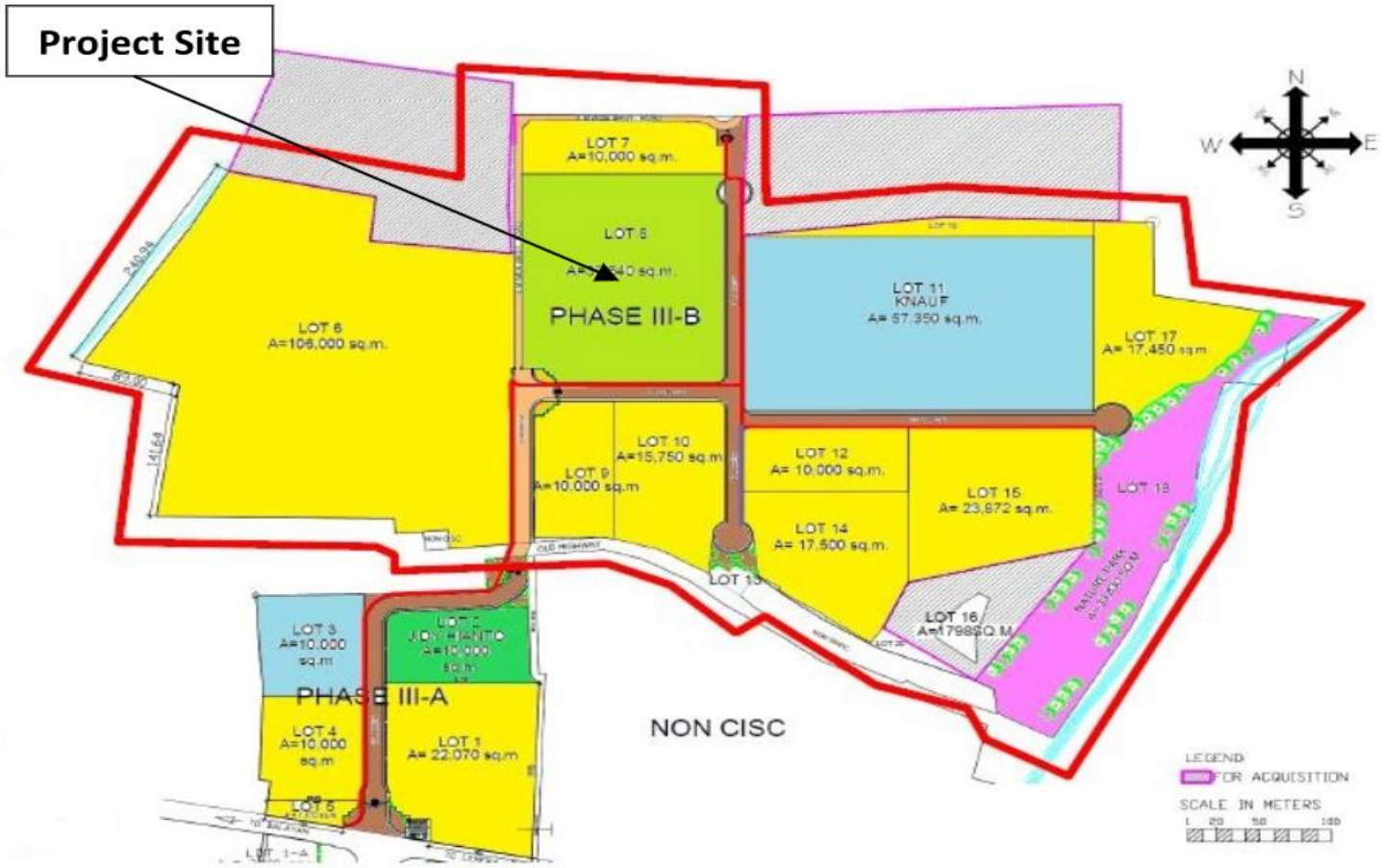


Figure 1-2. Location of MFI Cement Grinding and Packing Facility in CISZ

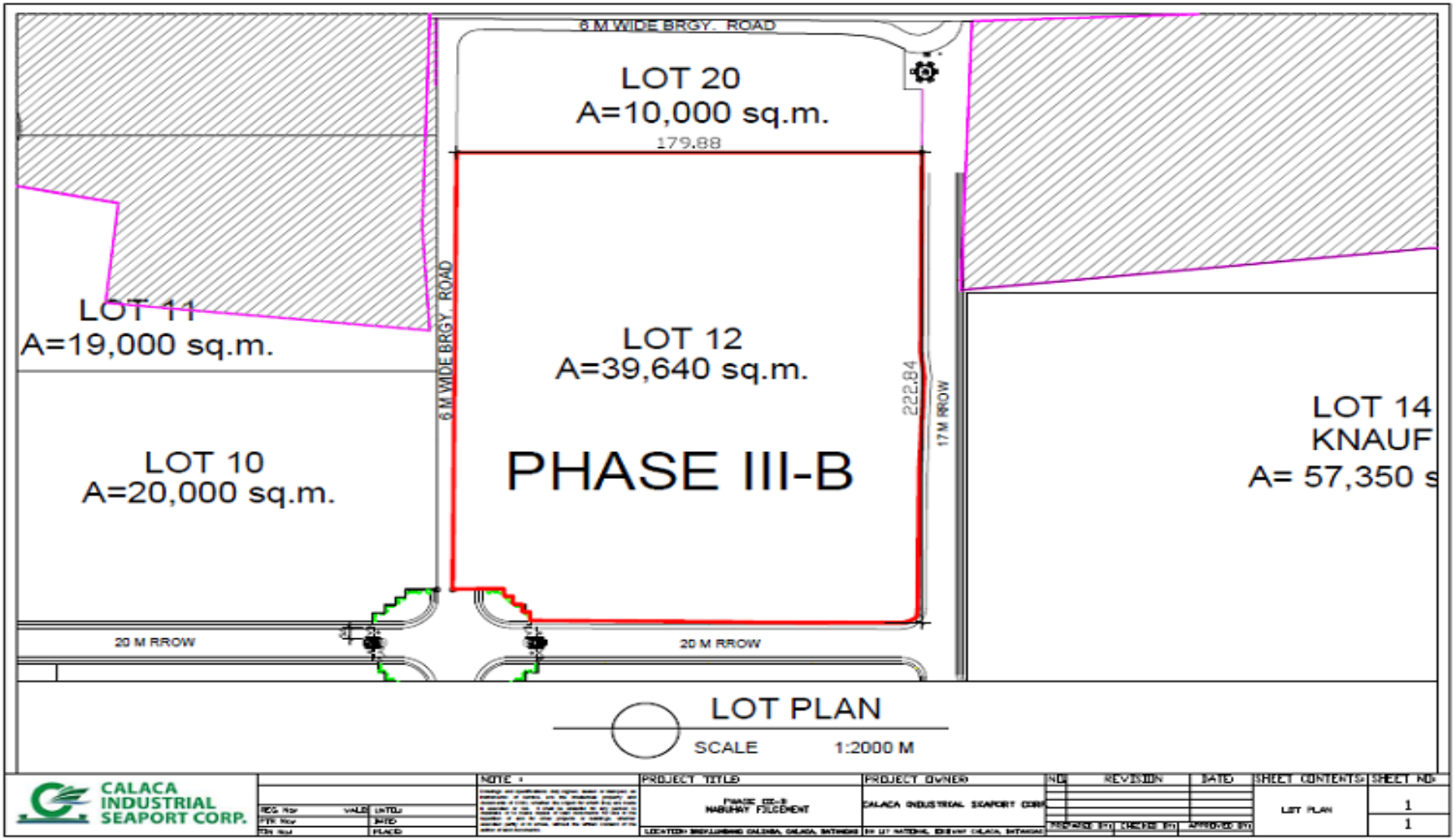


Figure 1-3. Project Vicinity Map

LEGEND:

- Project Site
- Calaca Public Cemetery
- San Rafael Arcangel Parish Church
- Old Municipal Hall

Figure 1-4 Coordinate Map of the Site and the Municipality of Calaca

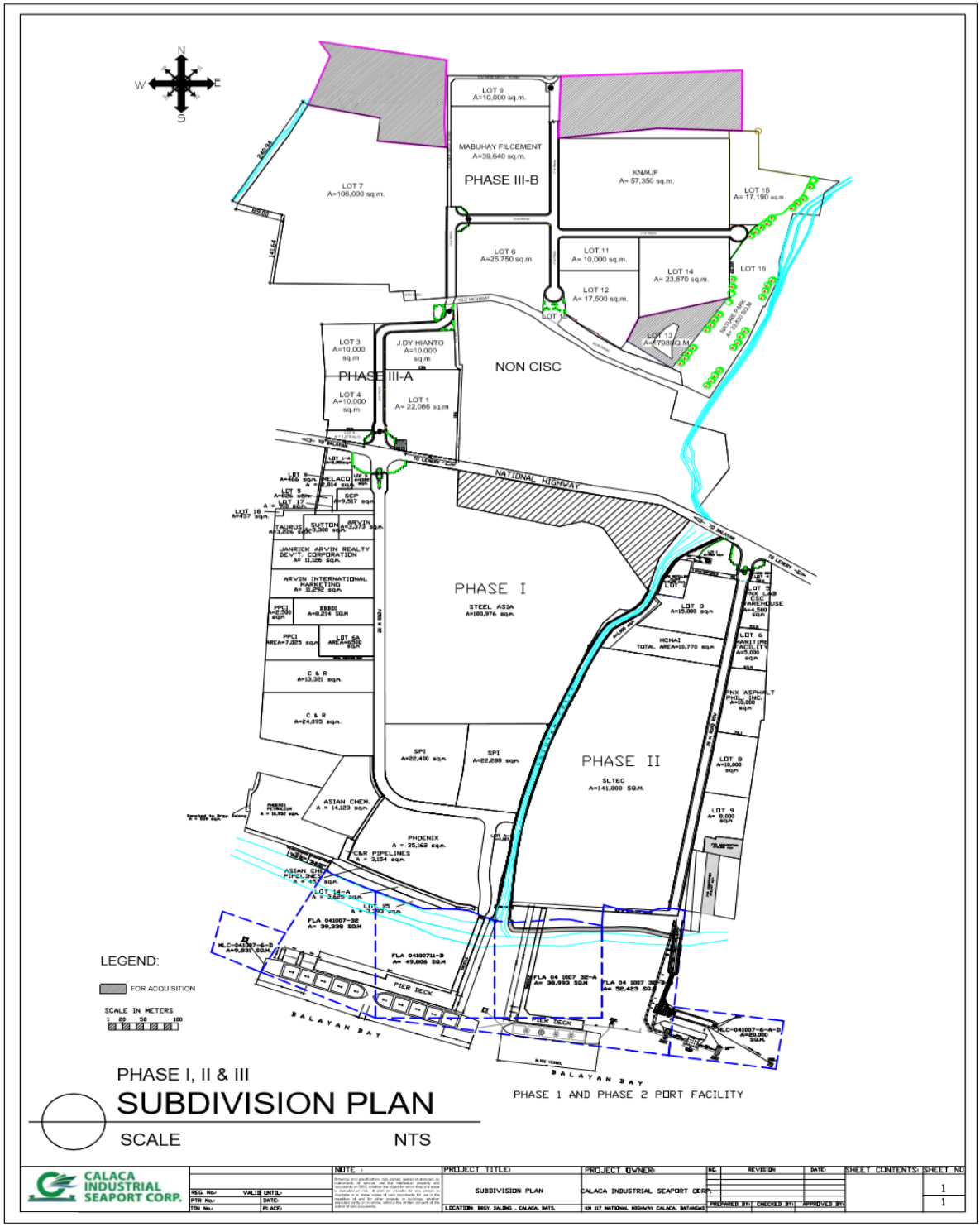


Figure 1- 5. Map of the Calaca Industrial Seaport Zone

1.2. Project Rationale

The country's recent socio-economic development initiatives necessitated the establishment of appropriate infrastructures such as roads, bridges, public and commercial buildings, shelters/ housing, etc. This has influenced the need to support the construction industry most particularly the supply of affordable and excellent quality raw materials (e.g., sand and gravels, cement, steel bars and sheets, etc). Cement is an important material in the construction and development of various kinds of infrastructures in the different parts of the country. Hence, the demand for affordable and quality cement materials continued to increase significantly. Thus, the propose Project of MFI will not only create economic opportunities in the project area but also will contribute to the country's infrastructure growth and development while considering the wellness of the surrounding environment of the area.

Specifically, the goal of the Project is to address requirements of the construction industry in the Province of Batangas and its surrounding areas in Region 4A. It is set to answer the significant amount of unanswered demand for cement in the various rural areas of the country with relatively smaller developments including local government infrastructure projects. Also, there is scarcity of supply in the rural areas due to constraints in the storage of cement and the difficulty in the transportation brought by the conditions of the local weather and climate and the underdeveloped transportation infrastructure.

1.3. Project Alternatives:

Considering the significant relation between cement consumption in modern infrastructure and construction alongside the level of economic development in the country, it is timely and viable that Mabuhay Filcement Inc. regional expansion will focus on Cement Grinding and Packing Facility by way of response to the growing demand of cement material in the local and national scene.

1.3.1 Criteria Used in Determining Preliminary Options for Facility Siting, Development Design, Process/Technology Selection, Resource Utilization.

Siting:

MFI considered the following criteria in its site selection: climatic conditions- not flood prone, labor can be procured easily and economically; area should be accessible to its market to minimize cost of transport and the chances of spoiling the cement during transport; there is available and reliable power supply; raw materials are available near and can be transported to site easily; transport facilities are available for raw materials and finished product.

In view thereof, it considered various areas in Luzon, such as Laguna, Batangas and Pampanga. It found the area within the Calaca Industrial Seaport Zone as the best choice.

Proponent found the following advantage in selecting CISZ: site is within an established industrial area bordering coastal zone with operating "port"; the site is an idle land area not use for agricultural production and free of settlements/residence. Also, the site is near the port and national highway which is very accessible through the well establish road network of CISZ.

Mabuhay Filcement has not found a better and ideal site than the area in CISZ. It takes advantage that the Project site is within an established industrial area -the Calaca Industrial Seaport Zone with port facility for large vessels, only about 2.5 km. distance, accessible through well-developed road network traversing the National Highway.

The site is generally flat, idle grassland not used for agriculture and free of settlements by virtue it is declared industrial area.

Development Design: Finish grinding is one of highest energy consuming operation in cement manufacturing plant wherein grinding optimization becomes a continuous requirement in the design development in order to achieve higher efficiency from the system. Furthermore, nowadays there are different grinding systems have been designed and operated to improve the process in addition to the closed-circuit, two compartment ball mills known for decades. With this interest, Mabuhay Filcement Inc. opted to employ the combined or hybrid grinding system.

Operation Processes & Design	MFI's criteria for its operation processed and design is basically cost effectiveness and business continuity. Finish grinding is one of highest energy consuming operation in cement manufacturing plant. Nowadays there are different grinding systems which have been designed and operated to improve the process in addition to the closed-circuit, two compartment ball mills known for decades. With this interest, Mabuhay Filcement Inc. opted to employ the combined or hybrid grinding system.

Process/Technology Selection: The facility will involve the processes of grinding and packing cement. By means of a new grinding system adopted as an alternative to the existing technology which will ensure that the processes will be done in a cost-effective and environmentally-friendly manner. Accordingly, hybrid grinding system combined with roller press and ball mill will be used to reduce the particle size of the cement components. Hence the efficient energy usage of roller press as a pre-grinding operation and with the grinding ability of ball mill, are combined to get high reduction ratios with higher capacities. Thus, the produce cement will be pack depending on customer's preferences either by small or tonner bag and by bulk for dispatch.

Technology Selection	In view of the requirement of the Clean Air Act and its IRRs, MFI searched for technologies and equipment that will ensure compliance and sustain production and operation of the plant. New grinding system will be adopted as an alternative to the existing technology to ensure production processes will be cost-effective and environment-friendly. Hybrid grinding system –combination of roller press and ball mill, will be used to pulverize the raw materials cement components. Hence, the efficient energy usage of roller press for pre-grinding operation and the grinding ability of ball mill are combined for better pulverization with higher capacities.

Resource Utilization: The following are the techniques adopted to efficiently used the resources of the cement grinding operation;

Raw materials

Use of suitable waste as an alternative raw material of the naturally available mineral by way of lowering the clinker content in producing cement while maintaining its quality/performance. This can be done by adding fillers such as synthetic or phospho-gypsum which is a by-product from a fertilizer plant as an alternative to natural gypsum and fly-ash which is a waste from a coal-power plant as an alternative to natural pozzolan.

Energy

The usage of roller press as a pre-grinding operation prior to ball mill is an alternative for decreasing power consumptions and increasing feeding rates which will result to energy savings.

Water

Recycled water from production processes and rain water will be used as an alternative source of water supply for the cement facility operation and management. .

1.3.2. Comparison of Environmental Impacts

Compared to the "No-project scenario", the proposed project will have environmental impacts such as possible pollution of air, water, land and probably effect on the people. However, as proposed, there will be corresponding mitigation measures that will be employed to avoid the possible aspects and impacts and protect the environment.

Compared to the "with project scenario", the "no-project scenario" is not an assurance that the environment will not be affected by the on-going developments in the CISZ. Even if this proposed project of MFI will not push through, another project may be put up, which aspects and impacts might affect the environment and people in a more adverse way.

1.3.3. Consequences

Possible consequences of not proceeding with the implementation of the project would be the lost of potential economic opportunities in the project area.

1.4. Project Components

1.4.1 General Layout of Facilities

Figure 1-6 is the proposed plant layout of the MFI.

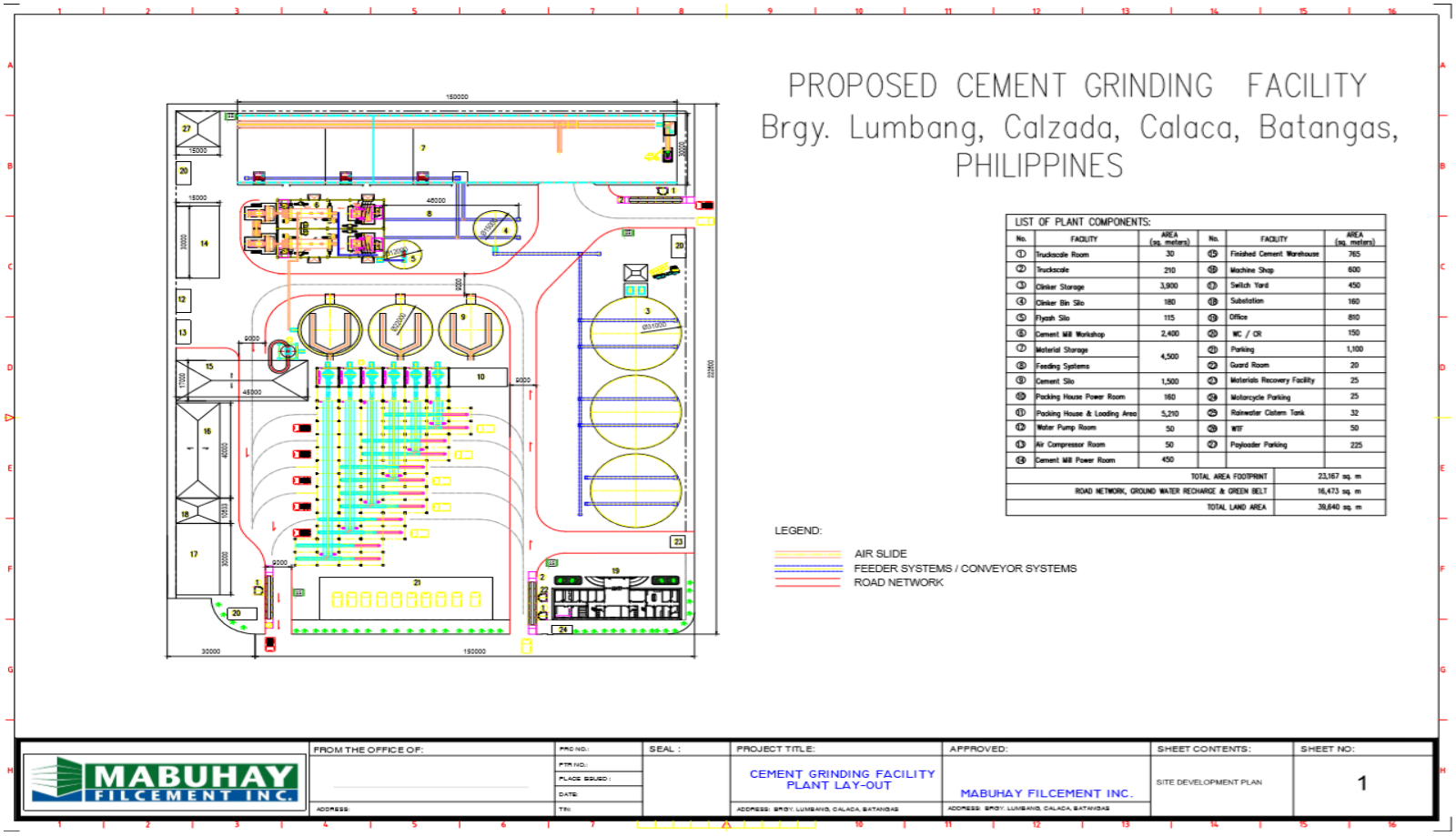


Figure 1-6. Plant Layout

The Project will be developed to be efficient and environment friendly. It will use an advance cement processing technology.

The energy requirements of the plant management and operation will be sourced from the Calaca Thermal Power Plant while the water supply requirement will be coming from the deep-well water source of Calaca Industrial Seaport Zone.

Except grinding/mixing and packing, the Project will not involve the pyroprocessing of basic raw material (limestone, clay & etc.) into an intermediate raw material (clinker). Instead, it will source raw materials (clinkers, limestones, gypsum, pozzolan and fly-ash) from either local or foreign supplier which will be transported to the facility through the port of Calaca Industrial Zone and will be temporarily stored within the Project site through silos, steel bins and covered storages. The cement production process will only involve clinker and additives grinding.

The Project will consist of three (3) grinding mills with roller press, storage silos and packing houses where cement are bagged into individual 40 kg bags, one tonner bags and bulk trucks. Support facilities will also be in place such as administration building, QA laboratory, sub stations, warehouse, and others which are required in a cement processing and production operation. The Project component/facilities are presented in **Table 1-1.**

Table 1-1. Project Components/ Facilities Description:

Facilities	***No. of Units***	***Area (sq.m.) & capacity (tons /hour)***	***Specification / Description***
1. Major Component			
Material storage facilities for:			
a. Raw, chemical and process materials: -clinker storage -clinker bin silo -fly ash silo -cement silo	 3 1 1 3	 3,900 180 115 1,500	The auxiliary material storage steel structure plant floor plans are in **Figure 1-7a and 1-7b.** Specification and details of the clinker equipment are presented **in Figure 1-7c and 1-7d**
b. Fuel, lubricants and similar materials			Storage for the GenSet requirements for fuel, lubricants, etc.
c. Finished product -finished cement warehouse	1	765	
Processing facilities:			
a. Processing (e.g., mixing, blending, milling, refining); -cement mill workshop; -mixing shed/feeding system;	 1 1	 2,400 4,500	The cement mill floor plan is in **Figure 1-8a** while the specs and details of the cement mill is in **Figure 1-8b.** Ball mill specs and separator are presented in **Figure 1-8c** Mill conveyor and chute model is presented in **Figure 1-8d**

Facilities	***No. of Units***	***Area (sq.m.) & capacity (tons /hour)***	***Specification / Description***
b. Finishing (e.g. sorting, filling, packaging, assembly etc.) -packing house /loading area	1	5,210	The specifications and details of the pack house and cement bulk are in **Figures 1-9a, 1-9b, 1-9c and 1-9d**
Support Facilities / Infrastructures:			
a. Administrative office/ canteen / staff & quest quarters/ clinic	1	810	**Figure 1-10** presents the drawing of the Office Elevation.
b. Truck scale room / truck-scale	3/3	30 / 210	
c. Switch yard / substation	1/1	450 / 160	
d. Power room: -cement mill -packing house	1 1	450 160	
e. Rooms: -water pump -air compressor	1 1	50 50	
f. Machine shop	1	600	
g. Payloader Parking/ Motorpool	1	225	
h. Parking i.	1	1,100	
j. Guard house	2	20	
k. Motorcycle parking	1	25	
l. Water closet / CR	3	150	
2. Pollution Control Facility / Waste Management Facility:			Dust Collectors

Facilities	***No. of Units***	***Area (sq.m.) & capacity (tons /hour)***	***Specification / Description***
a. Domestic wastewater treatment facility -cistern tank; -WTF	4 1	32 50	Septic tank
b. Solid waste management facility for:			
i. Domestic solid waste -MRF	1	25	Materials Recovery Facility
ii. Process solid waste: a. toxic and hazardous; b. non-toxic and non hazardous			Disposal thru 3rd party DENR-accredited Treaters
c. Air Pollution Control Facility			The Air Pollution Control Device (APCD) in the cement mill is illustrated in **Figures 1-11a** while the APCD for Cement Packer is in **Figure 1-11b.**
3.Drainage System:			Drainage for rain water outflow from MFI will be through the CISZ Storm drainage layout shown in **Figure 1-12**
Total Area of all facilities ***Open Space*** ***Total Area of Project Lot***		23,167 16,473 39.640	

Utilities/Requirements (Operation Phase):

Utilities	**Estimated Demand/ Consumption (Total)**	**Source Breakdown**	**Projected Amount from Source specified**
Power/Electricity	2 MW per month during construction and 10MW per month during operation	Calaca Coal Fired-Power Plant	All
Water	330 cu/m /day but 88% to be recycled; 12%loss	Calaca Industrial seaport Zone	all

1.5. Process /Technology

Mabuhay Filcement Grinding and Packing Facility will employ the combined/hybrid grinding system –which is a new grinding process using roller press as a pre-grinding operation prior to ball mill. This technology offers less energy requirements and improved capacities. The following processes are the major steps in cement grinding and packing facility**. Figures 1- 13 , 1-14 and 1-15** show the Cement Grinding and Packing and Dispatch Facilities' Process Flow Chart with Pollution Control Devices in every stages.

1.5.1 Cement Grinding and Packaging:

Cement Milling

Cement is produced by pre-grinding of clinker with gypsum and other cement additives like limestone and pozzolanic material, using roller press which weakens the particles by compression and micro-cracks formed on the particles. The fine particles during pre-grinding operation are carried upwards with the air through the separating channels of V-separator, and the coarser particle will be circulated back into the roller press. The transported fine material from V-separator goes to the dynamic separator in which the fine product stream is collected in the filter bag system. Coarser particles, which are collected at the bottom of the dynamic separator, will be further grind using ball mill in order to achieve the desired cement fineness. The pulverized material will be separated through a high efficiency separator in which the coarser particle will be re-circulated back to the mill through the reject conveyor. The fine particles together with the dry particulates that are captured on the fabric filter of dust collector system periodically falls to the collection hopper and transported to the cement silos through air slide and bucket elevator.

Cement Storing

The product cement is directly conveyed to the cement silos for homogenization and proper storage in order to preserve the cement quality before dispatch.

Cement Packing

Cement is packed to a 40-kilogram cement bags and 1 tonner cement bags. It is also dispatched by bulk depending upon the customer's preferences.

Packing of a 40-kilogram cement bags is done through a pneumatic conveying systems with vibrating screen removing cement lumps and any foreign components. By means of the cement bin, the material is vented with a constant pressure to control the flow of material feeding to the automatic roto-packing machine. After filling the cement bags, it will be distributed through belt conveyor as a distribution system to the dispatch terminal for palletizing or direct truck loading. The overflow from roto-packing machine is reclaimed through air slide and returned to the distributing bins. Transfer points are equipped with de-dusting connected to the dust collector system wherein collected materials from dust collector are returned to the bins.

Dispatch Operations

Bags of cement (40 kilogram or 1 tonner) will be transported through trucks stockpiled in a pallet going to the local market. For bulk loading, cement is withdrawn from bulk bins and transported by trucks.

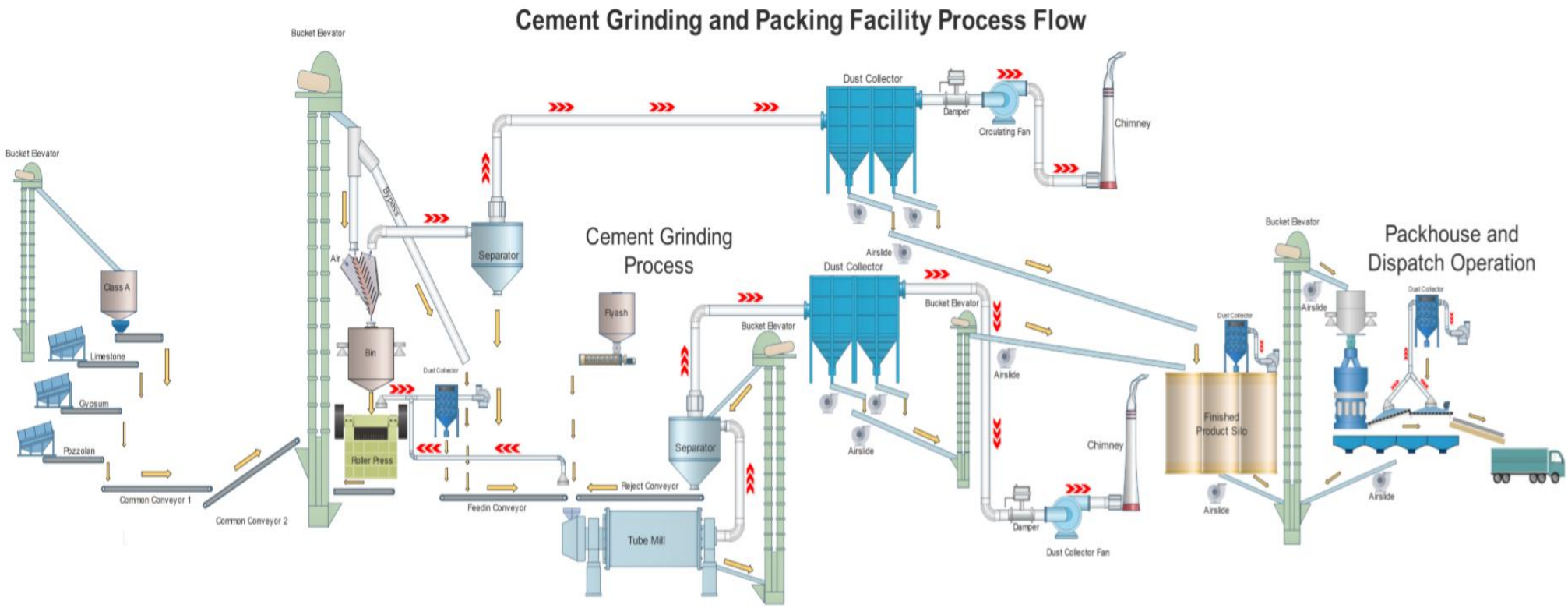
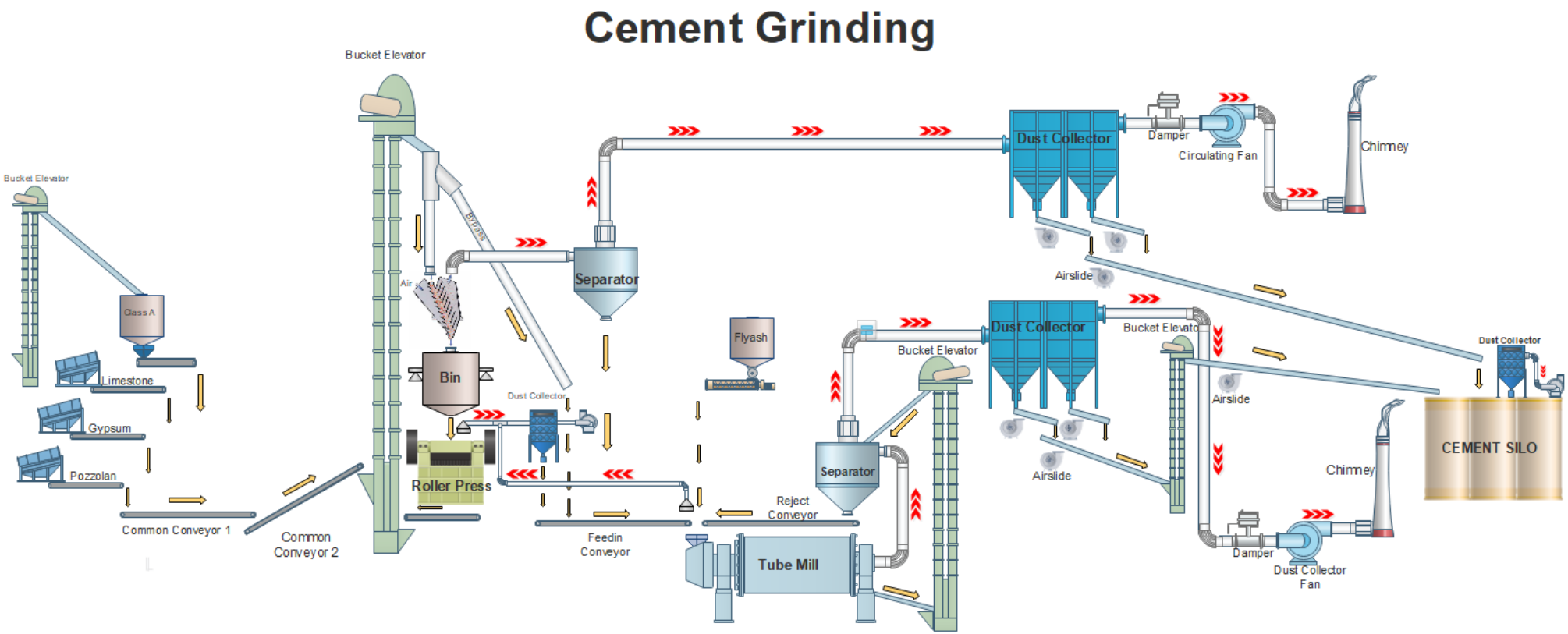


Figure 1-13. Cement Grinding and Packing Facility Process Flow Chart with Pollution Control Devices in every Stages

Figure 1-14. Cement Grinding Process Flow Chart with Pollution Control Devices in every Stages



Packing and Dispatch

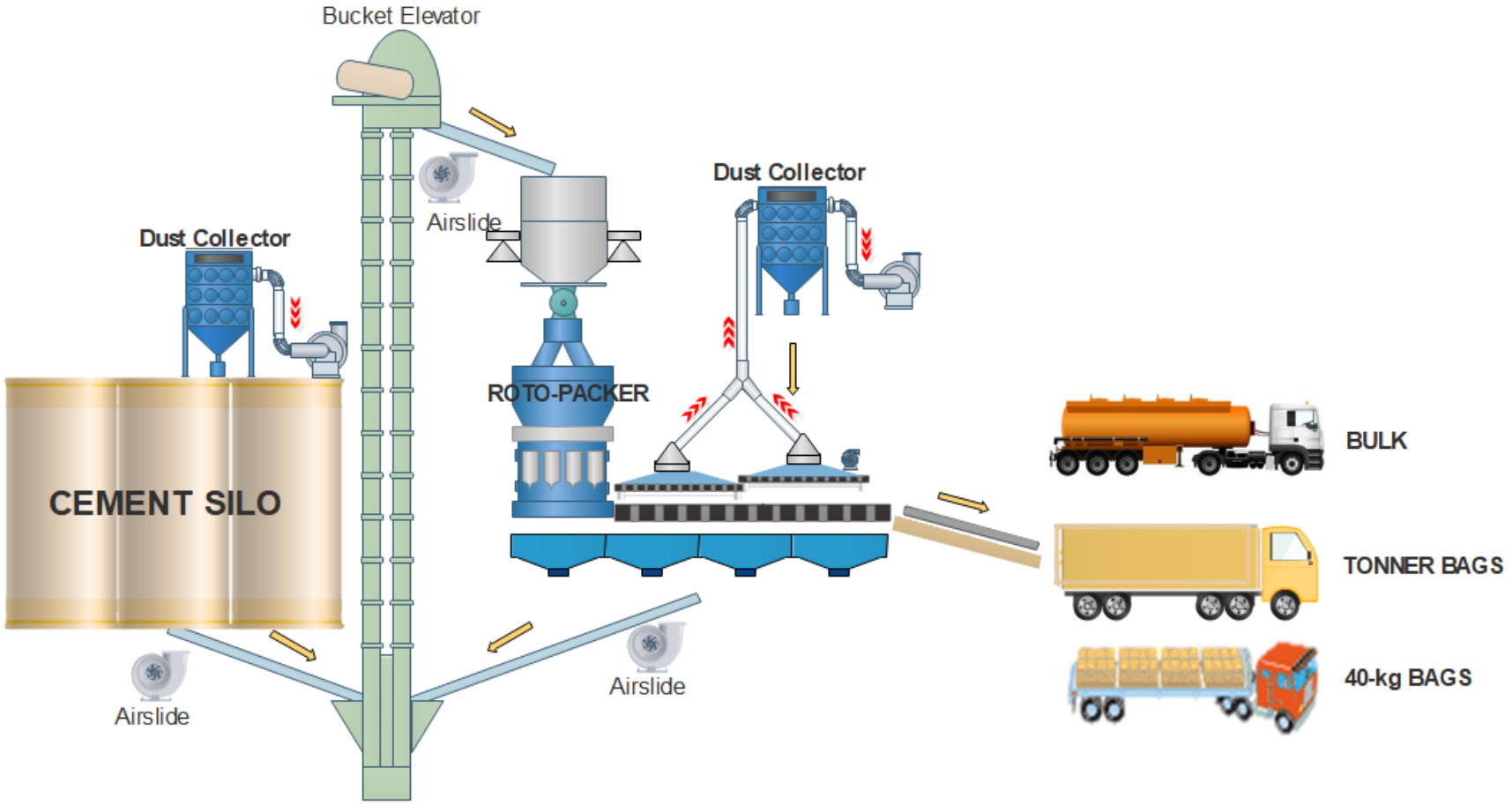


Figure 1-15 Packing and Dispatch Process Flow with APCD

Mass Balance of 1 kg of Portland and Blended Cement

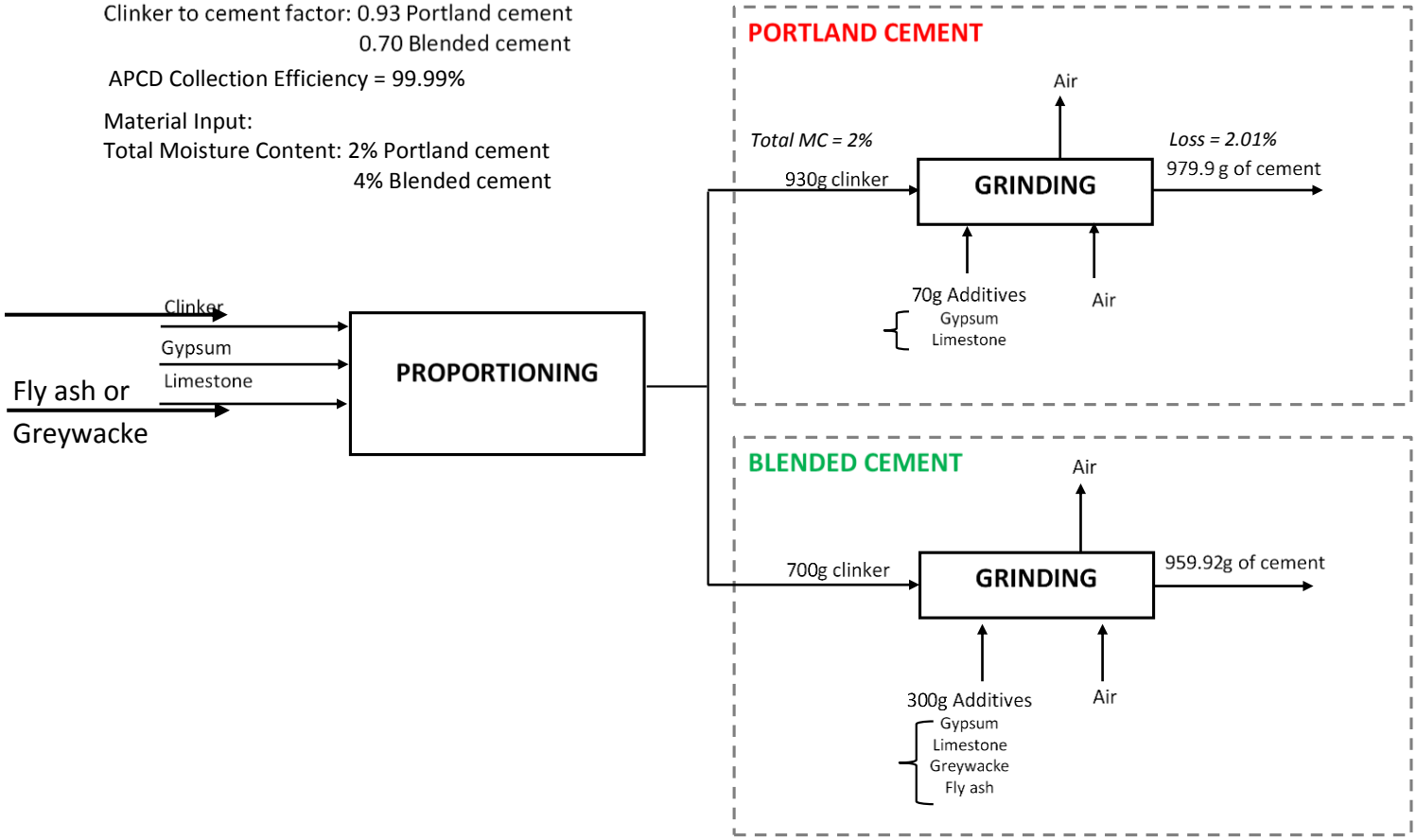
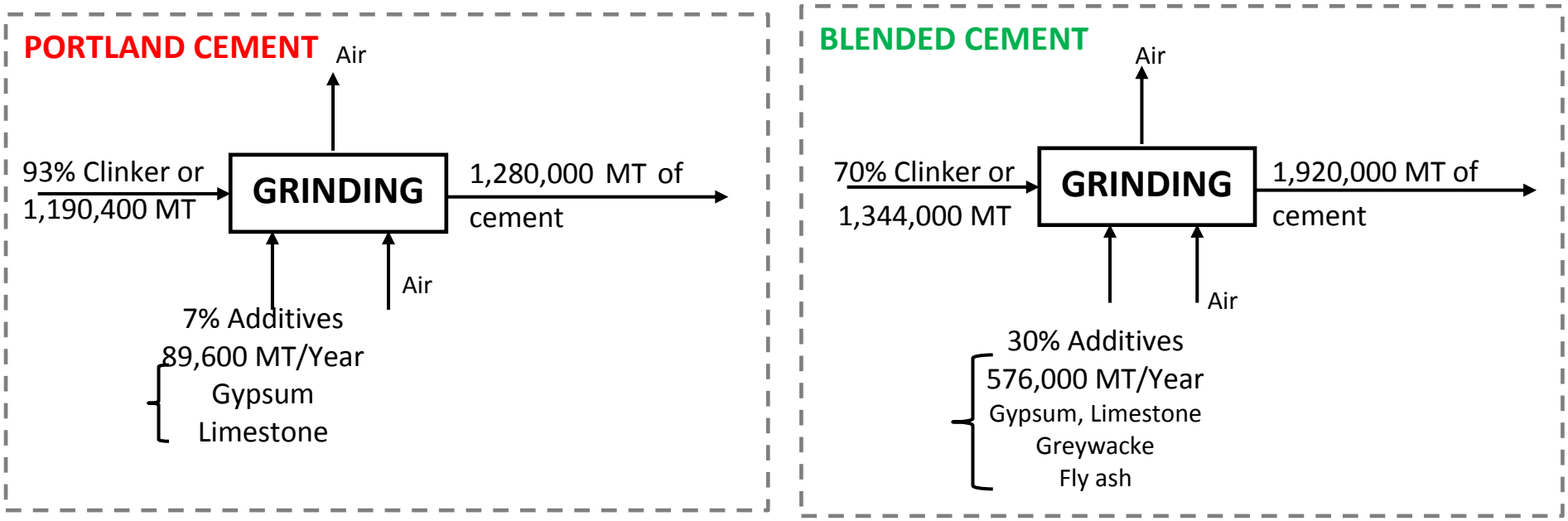


Figure 1-15. Mass Balance of 1-kg Cement
(revised)

CEMENT PRODUCTION CAPACITY: 3,200,000 MT / Year

BASIS:

PRODUCT SHARE
40% PORTLAND = 1,280,000 MT/Year
60% BLENDED CEMENT = 1,920,000 MT/Year



NOTE:

Cement proportioning will vary depending upon the quality of its raw materials

Figure 1-16. Cement Grinding Assumption of Raw Material Utilization

Figure 1-17. Perspective of the Site Development Plan

1.5.3 Description of the Pollution Control Devices and Waste Management System

Cement generally use fabric filters or dust collector system as a pollution control device in cement grinding, packaging and loading operations in order to achieve high collection efficiencies on both coarse and fine particulates. It is a gas-solid separation device associated with conveying systems that will recover the conveyed material back to the system and to minimize pollution of the environment.

The particle collection mechanisms in a fabric filter is through dust-laden gases enter to the fabric bags by means of a positive pressure where the heavier dust particles fall off at the conveying system while the lighter dust particles along with gas get carried upward to the bags. Then, after enough dust has built up on the filters as indicated by a build-up in pressure across the fabric, dust is periodically removed by blowing air back through the fabric pulsing the fabric with a blast of air, such that the dust from the fabric then falls to a collection hopper. With that periodic cleaning of the filter medium is therefore necessary to control the pressure drop across the filter. The pressure drop through a baghouse is caused due to the air flow's resistance when air passes through the filtering bag and the filter cake. It is very helpful to note that a sudden drop in the differential pressure denotes a leak in the system. Whereas a sudden or sharp rise in the differential pressure denotes that the filter bags are becoming blinded or “caked” with particulate. Hence the differential pressure gauge is the best indicator of baghouse’s current operating status; it also offers critical information for troubleshooting and its need to be clean.

Furthermore, depending on the type of baghouse, cleaning can be carried out while the baghouse is on-line (filtering) or is off-line (in isolation). This is the reason why fabric filter should have multiple compartments which can be individually isolated in case of bag failure and it should be sufficient of these to allow adequate performance to be maintained if a compartment is taken off line. Thus, fabric filters can collect over 99.9% of the entering particulates, even fine particulate matter.

Waste Management System

The proposed project adopts a waste management system in which the waste produced is efficiently recycled so that amount of material resources to be use is reduced. This will result to a sustainable and environment friendly usage of natural resources and will also reduce the burden of waste disposal considerably.

Waste management is the actions required to manage waste from its inception to its final disposal. This includes collection, transport, treatment and disposal of waste together with monitoring and regulation. Waste management methods such as reduction and reuse, recycling and composting are implemented. Figure 1-18.

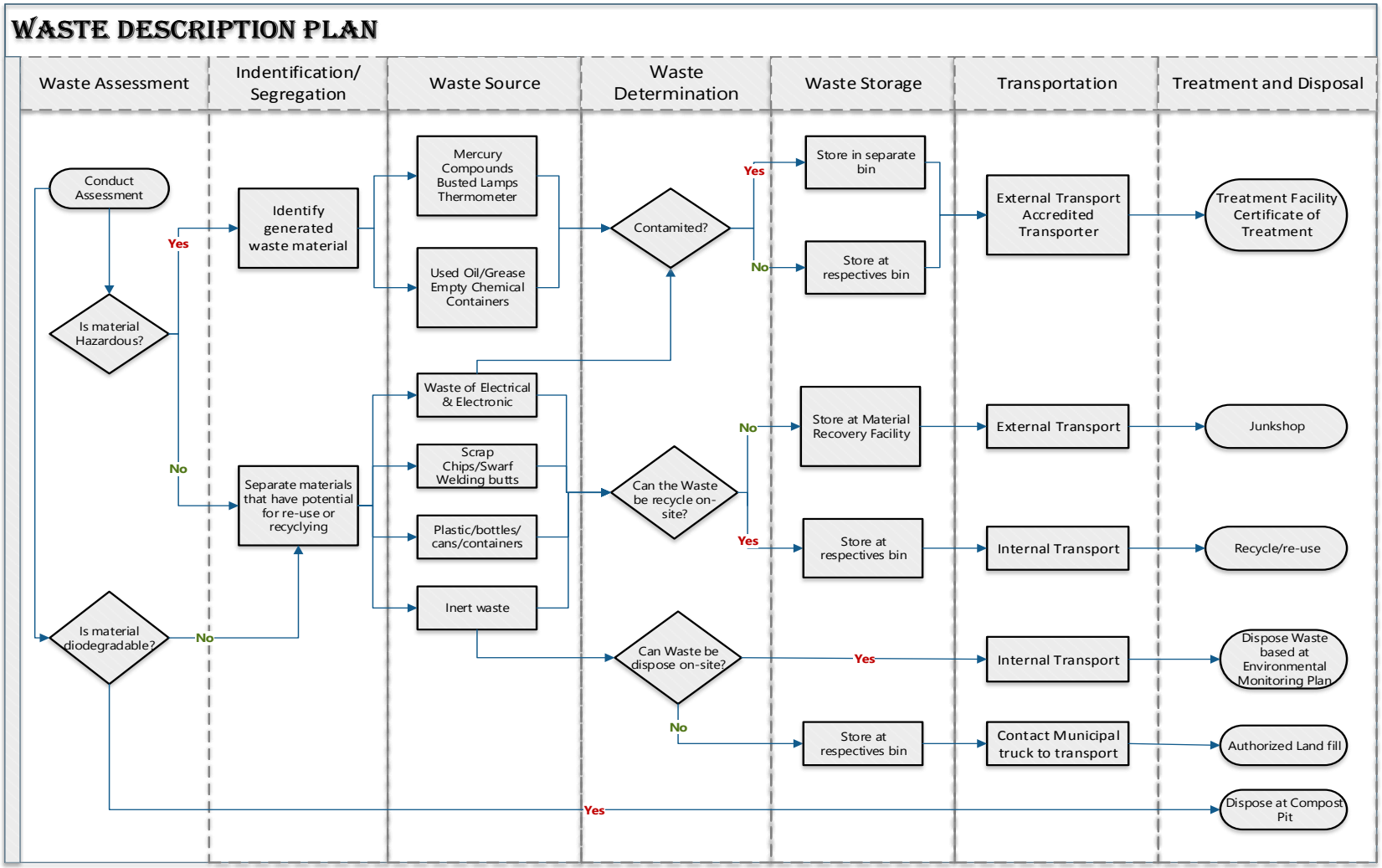


Figure 1-18. Waste Description Plan

Industrial Process Water

In this grinding and packaging facility, water is used only for cooling operation of the manufacturing process. Such that the water used for cooling purpose is recycled and reused in the process through water treatment facility with the following mechanism. Raw water is being softened through an ion-exchange system, in which the soft water will be utilized for cooling water and laboratory usage. The industrial process water from cooling system will be stored at the settling basin for suspended solid reduction where an estimated 88% of the process water generated is being recycled while the remaining 12% is the volume loss due to the following activities; (a) washing, (b) road and plant watering, (c) domestic use and (d) evaporation loss, Refer to Figure 1-19. Water Balance showing Recycling Stream.

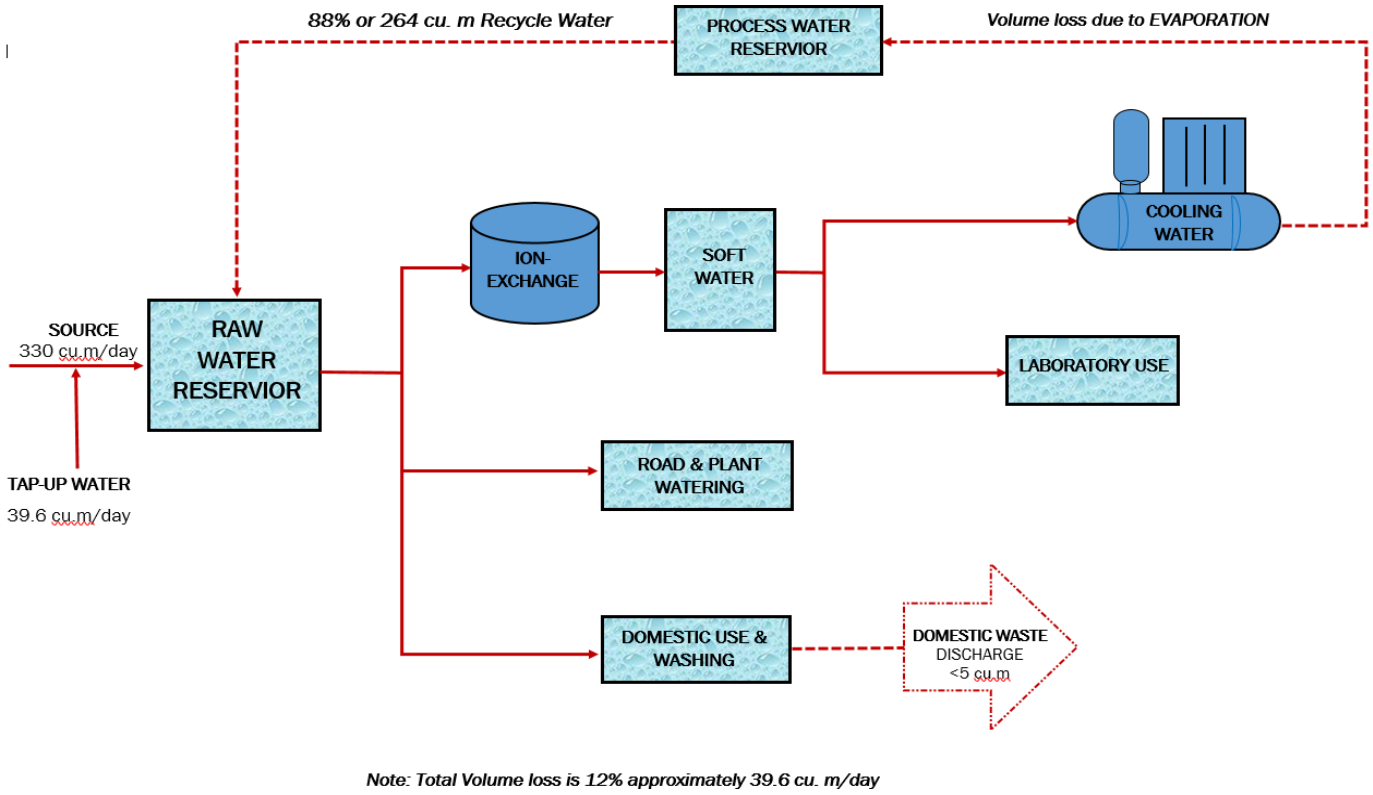


Figure 1-19. Water Balance showing Recycling Stream

Water is essential requirement to have a successful cement grinding operation and for the proposed project it will be supplied by the Calaca Industrial Seaport Zone. Its main purpose is for cooling system which has an estimated volume requirement of 330 cubic meters during MFI Cement Grinding and Packaging operation. With this high amount of water volume consumption, the industrial process water generated is being recycled and reuse repeatedly by means of an ion-exchange treatment. Consequently, a reduction of ground water extraction and effluent problems will be eliminated. Through this closed loop water system, an estimated 88% or approximately 264 cubic meter of the generated process water is recycled. Approximately 12% from the total water requirement is utilized for laboratory washing, domestic use, evaporation loss, road watering and plant watering. Thus, through this Water Conservation Method, the possible competition of water supply between the facility and the local community will be eliminated.

Dust

Collected dust will be recycled to the production processes whenever practicable. This recycling may take place directly into the ball mill or by blending with finished cement products. Alternative uses may be found for material that cannot be recycled.

1.5.4 Description of the Operation and Maintenance Facility

The proposed cement grinding and packing facility will operate at a demand and supply basis. With the increasing competition in cement industry nowadays, lowering the product cost has become the main goal of every cement producer. An effective measure to reduce the production cost is by optimization of cement mill operations; Such that cement mill system efficient operations will be done through running the system on its optimum capacity. Since optimization implies high energy saving potentials. The parameters that hold potential energy savings are load level, revolution speed, combination of the ball charge, lining design and the adjustment of the separator. Such that deviating from the optimum load range by under or overloading the grinding circuit causes the grinding power to change and can lead to premature wear of machinery internals which will cause breakdown or unplanned maintenance.

This is why Maintenance Program is adopted in order to increase profitability by improving reliability and achieving high productivity and availability of equipment. It is the actions necessary for retaining or restoring a piece of equipment, machinery or system to the specified operable condition to achieve its maximum useful life. The objective is to maximize the performance of equipment by ensuring that the equipment function regularly and efficiently. Also to increase profitability by minimizing the losses incurred by breakdowns or failures.

Preventive Maintenance will be done to manage the equipment or machinery maintenance needs, to define the type and frequency of each maintenance task. Table below shows an example of lubrication maintenance. It is performed at schedule intervals such that each cycle repeat based on its intervals. Consequently, this maintenance approach requires planning, to ensure that company staff always have the knowledge, manpower and parts on hand to give equipment the attention it needs. Thus, maintenance must be controlled in a way that the equipment is stopped for maintenance in a planned stoppage schedule in order to achieve the high level of productivity and quality of product.

EQUIPMENT LUBRICATION INTERVAL					
No	Equipment	Monthly	Every Two (2) Months	Every Six (6) Months	Yearly
1	Bucket Elevators	1. Change oil or regease transmission chains 2. Regrease head and tail pulley bearings		Change oil of reducer or gearbox	
2	Belt Conveyors	1. Change oil or regrease transmission 2. Regrease head and tail pulley bearings		Change oil of reducer or gearbox	
3	Screw Conveyors	Regrease bearings		Change oil of reducer or gearbox	
4	O-Separators (Cement mills)			Change oil of reducer or gearbox	
5	Circulating Oil System		Clean oil filters		Change circulating oil
6	Big Fans and Blowers (Mill fans, Dust collectors)	Regrease bearings		Change oil of bearing housing	
7	Rotary Packing Machine (Pack House)	Regrease roto packers bearing.	Re-grease moving parts	Change oil of reducer or gearbox	
8	Roots Blowers Cement silo	Regrease head and tail pulley bearings		Change oil	
9	Chain Conveyors	Regrease head and tail pulley bearings		Change oil of reducer or gearbox	
10	Rotary Feeders	Change oil or regease transmission chains		Change oil of reducer or gearbox	

Figure 1-20. Sample of Lubrication Maintenance

1.6. Project Size

The Mabuhay Filcement Grinding and Packing Facility will have a maximum total annual production capacity of **3.2 million metric tons cements,** or about 220,000 bags (40 kgs. per bag) per day operation.

The actual area to be utilized by the completed Project facilities is **23,167 sq. m. (2.3167 hectares)** within the MFI land area of **39,640 sq. m. (3.964 hectares).** Temporary facilities required during construction will cover about **4,500 sq. m.** within the land area.

1.7. Development Plan, Description of Project Phases and Corresponding Timeframe

The following is the proposed schedule of activities of this Project from pre-construction to operation:

Project Phase	Proposed Schedule	Duration
Pre-construction	April 2018- March 2019	11 months and 2 weeks
Construction	January 2019 - June 2021	2 years and 6 months
Commissioning	June 2021- August 2021	2 months
Commercial Operation	September 2021	

1.7.1. Pre-construction/ Pre-operational phase

This Phase involves land acquisition, project development planning, project design and securing of various governmental permits.

a. Land Acquisition
- As early as May 2018, Mabuhay Filcement Inc. purchased a parcel of land in Calaca Industrial Seaport Corporation an industrial zone located at Barangay Lumbang, Calzada, Calaca, Barangays.

b. Project Development Planning
- Consists of preparation of feasibility study, site planning and detailed engineering design.

c. Project Design
- Includes plans and drawings such as structural, mechanical, electrical, pipping and plant lay-out.

d. Securing of Various Governmental Permits
- Securing of necessary permits such as Environmental Compliance Certificate (ECC) from EMB Central Office. Followed by permits from local government unit such as fencing permit, building permit, electrical permit, mechanical permit, sanitary permit, zoning certificate and business permit.

1.7.2. Construction / Development phase

This phase involves of the following:

a. Land Development
- Involve the following activities; land clearing, compacting and tree planting intended for buffer zone.

b. Civil and Structural Work
- Involves mainly in construction of the following: perimeter fence, material storages, cement and clinker silos, cement mill workshop, packing house, warehouse, machine shop, office, drainage system, parking area and road network.

c. Mechanical and Electrical Installation
- Installation works will comprise of the mechanical and electrical equipment such as air pollution source equipment, air pollution control device, auxiliary equipment, truck scale, switchyard and power station.

d. Construction of Support Facilities
- Support Facilities includes the construction of cistern tank, material recovery facility, fuel tank, hazardous waste facility and waste water treatment facility, motor pool and compressor room.

e. Water and Air Pipping Installation
- Installation of water and air pipping system for the operation and office connection.

f. Hiring and Training of Staff

g. Purchase of Support heavy equipment

1.7.3. Operational phase

This phase involves mainly of the following:

a. Testing
- Individual testing of equipment followed by testing of equipment without load to established baseline data.

b. Commissioning
- This involves of continuous testing of grinding and packing facility operated with the aid of the central control room using Distributed Control System (DCS) to established data of confirmation that will be the basis when Commercial Operation will commence.

c. Commercial Operation

1.7.4. Abandonment Phase

This Phase will involve cessation of project operations, decommissioning of Plant and its facilities, and payment of social packages to employees resulting from the closure of the project. Monitoring activities of the MMT will also end at this Phase but a detailed Abandonment Plan to include contractor demobilization requirements or Environmental Site Assessment shall be submitted to EMB prior to actual abandonment.

1.8. Manpower Requirements:

Project/Development Phase	Skilled		Unskilled		TOTAL		OVER ALL
	M	F	M	F	M	F	
Pre-construction/Pre-operational	8	5	2	2	10	7	17
Construction/Development	125	75	175	125	300	200	500
Operational	75	50	100	75	175	125	300
Abandonment Phase	4	2	8	6	12	8	20

Skilled Workers for Construction:

-Welders
-Fitters
-Erectors
-Fabricators
-Machinist
-Mason
-Foreman
-Scaffolders
-Carpenters
-Pipe Fitters
-Plumbers
-Tower Crane Operator
-Rigger
-Insulation Installers
-Painters
-Electrical Technicians
-Electrical Installers
-Mechanical Installers
-Heavy Equipment Operator

Skilled Workers for Operation:

-Machinist
-Millwright
-Welders
-Plumbers
-Heavy Equipment Operators
-Heavy Equipment Mechanic
-Electrical Technicians

1.9. Project Cost:

The capital investment to establish and operate the grinding and cement packing facility is estimated at ***PhP 1.2 billion.***

Section 2. ASSESSMENT OF ENVIRONMENTAL IMPACTS

2.1 The Land

2.1.1 Land Use Classification

The Municipality of Calaca is one of the 31 municipalities of the province of Batangas. It is located at 13° 56' latitude and 120° 49' longitude at the southwestern mouth of Luzon Island along the western part of Batangas Province. It is situated east of the municipalities of Balayan, Tuy and Nasugbu, west of the municipalities of Lemery and Laurel and north of Balayan Bay. It lies within the southwest slopes of Talisay. Calaca is a coastal town, being bounded by Balayan Bay on the south. It is a plain near the shore, gently rolling in the middle and going steep on the northern most part adjacent to Gulod ng Batulao.

2.1.1.1 Impact on Land Use

The project study area is approximately centered at geographic coordinates of 13^{O}55'51.03" Latitude and 120^{O}49'28.26" Longitude. The project conforms to the Comprehensive Land Use and Zoning Plan approved by the Sangguniang Bayan of Calaca (**Figure 2.1-1**). Proposed project will be located inside the Calaca Industrial Seaport Zone, at Brgy. Lumbang Calzada, Calaca, Batangas. The map below shows the project site location inside the Calaca Seaport (***Figure 2.1-2***).

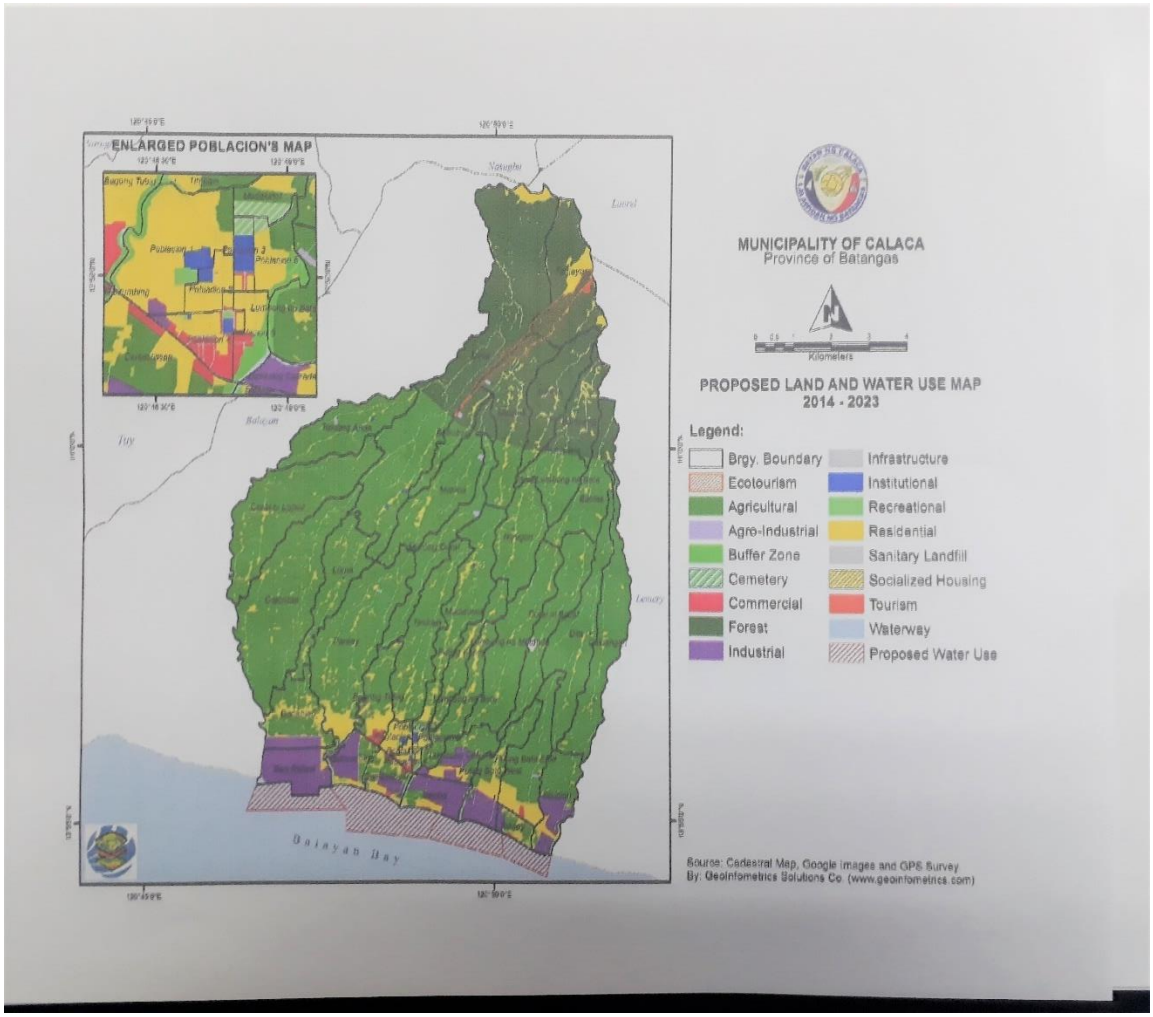


Figure 2.2-1. Land Use Map of Calaca

Figure 2.1-2. Aerial photo of the project site location

2.1.1.2. Encroachment in Environmentally Critical Area (ECA)

The project site is identified as an area that is not susceptible to flooding by PAGASA and MGB. Please see Flood Hazard Map below (***Figure 2.1-3***) showing that the project site is located in a Low Flood Susceptibility Area. The site is not in a declared environmentally critical area (ECA) as defined by Presidential Proclamation No. 2146, series of 1981 and Table 1 (Technical Definition of ECA and Corresponding Operationalization Guide) of DENR-EMB MC 2014-005.

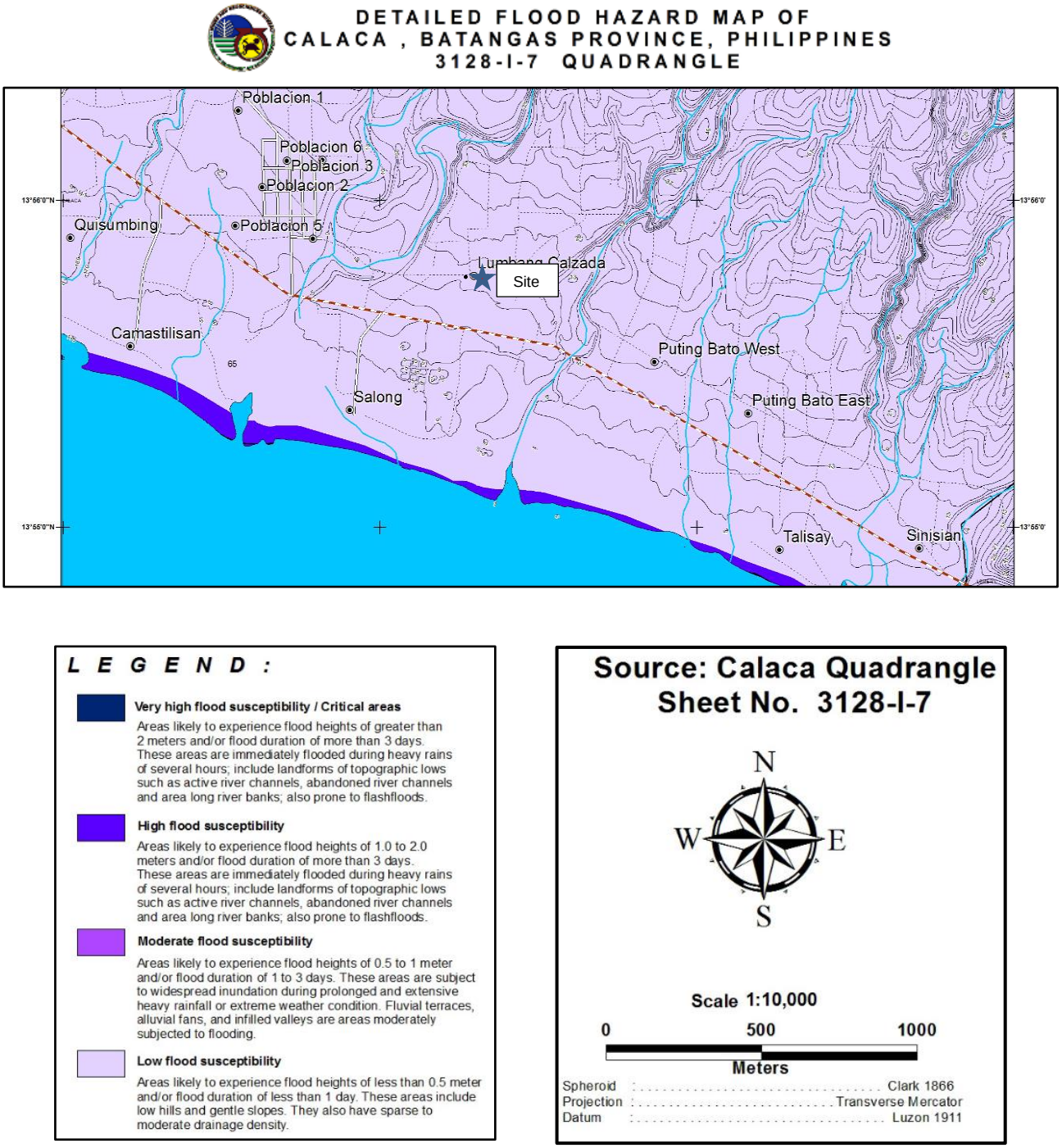


Figure 2.1-3. Detailed Flood Hazard Map of Calaca, Batangas

2.1.1.3. Tenurial / Land Issue

There is no tenurial or land issue on the property. The 3.964-hectare lot area project site is owned by Mabuhay Filcement Inc. It is 100% Filipino owned corporation duly organized and existing under and by virtue of the laws of the Philippines primarily to engage in the manufacture and production cement products. Therefore, there is no tenurial or land issues in relation to implementation and operation of the project.

2.1.1.4. Impairment of Visual Aesthetics

The project site is located inside the Calaca Industrial Seaport Zone which is a developed area intended for industrial activities. Hence, there is no visually significant landforms/ landscape/structures within the vicinity of the project site.

2.1.1.5. Devaluation of Land Value

One of the land management schemes during project construction is flood and soil erosion control through adequate drainage system. Aesthetics to improve and develop green surroundings is part of project site development. Potential source of solid waste from Filcement's operation is disposal of packaging materials. These wastes will be segregated for recycling and proper disposal in accordance with the requirements of RA 9003 - Solid Waste Management Act. Generated dusts from dust collection equipment is will be returned to production to eliminate further solid waste generation. Domestic solid wastes from construction and operation activities will be properly managed and segregated for disposal in order to address impact on land degradation and contamination.

2.1.2 Geology and Geomorphology

Calaca has a total land area of 11,270.943 hectares. Tephra deposits of calderas, maars, tuff rings and cones including large scale surge deposits led to the formation of Calaca. The process is called volcanism, upon the formation of the Taal Volcano Calderas some 140,000 years ago. Mt. Batulao located at the northwestern tip of Calaca, then was a volcano and acted as a barrier in such a way that it blocked pyroclastic materials coming from erupting Taal Volcano.

Pyroclastic materials are ejecta consisting of unconsolidated materials of different sizes that are explosively or aerially deposited from volcanic vents. The upland portion of Calaca came from pyroclastic materials due to continuous base surges from series of volcanic eruption of Taal Volcano.

The low land area is classified as volcanic tuff that was formed mainly due to ash fall and continued lahar flow. Volcanic tuffs are ejecta from Taal Volcano and formed underwater resulting to consolidation.

The coastal area came from weathered materials due to rain and sedimentation, thus giving birth to alluvial soil. Alluvial soil consists of fluvialite segments of unsorted and unconsolidated clay, silt, sand and gravel reworked pyroclastic and volcanic rock segment.

It can be concluded therefore that the upland area of Calaca is composed mostly of igneous materials and the lowland area of sediment origin carried in the coastal area by water and wind actions. Continuous based surges from past eruption of Taal Volcano made the slope of Calaca in the upland area very steep. The areas along river channels as well as their tributaries have steep slopes, since the soil is loosely consolidated and easily eroded. Generally, Calaca has a terrain described as highly dissected due to the presence of several sub-parallel streams or barrancas.

2.1.2.1. Change in surface landform/geomorphology/ topography/ terrain/slope

Topography

The municipality is divided into **three ecosystems**. The **coastal ecosystem** generally, has a slope of 0-3%. The following barangays, including the project site fall under this ecosystem: Dacanlao, San Rafael, Quisumbing, Camastilisan, Lumbang Calzada, Salong, Talisay, Puting Bato East, and Puting Bato West (***Figure 2.1-4***).

The **lowland ecosystem** generally has a slope level of 3-8%. The barangays under this ecosystem are Barangays 1-6, Bagong Tubig, Puting Kahoy, Lumbang na Bata, Pantay Madalunot and Timbain, Coral ni Lopez, Loma, portion of Dila, Coral ni Bacal, Lumbang na Matanda and Calantas. The lowland plane is where the project site is located which is very suitable for land development.

The **upland barangays** generally have a slope level of 18-50%. The barangays are Taklang Anak, Balimbing, Matipok, Niyugan, Caluangan, Dila, Munting Coral, Makina, Cahil, Bisaya, Bambang, Baclas and Tamayo.

The highest elevation in Calaca is located in Barangay Cahil with an elevation of 613 meters above sea level.

Figure 2.1-4. Topographic Map, Calaca Batangas

Soil Type

There are two soil types that can be found in Calaca, namely: Taal loam which Is located in the northern portion of the municipality covering an area of 7,889.66 hectares. This soil type came from weather materials from pass-based surges of pass eruption of Taal Volcano. It is generally grayish brown to light gray when dry and dark brown when wet. This type of soil should have limited cultivation and requires very careful land management.

Taal sandy loam on the other hand can be found in the southern portion of the municipality and covers an area of 3,381.28 hectares. This soil requires careful land management.

Physiography

The physiography of Calaca is of three types: Scarpment, broad alluvial plains, volcanic hills and mountain. The coastal ecosystem of Calaca is located along the broad alluvial plains. The lowland ecosystem is located mainly along broad alluvial plain while some portions are along volcanic hills. Majority of the upland ecosystem lies along volcanic hills and some belong to the mountain type, scarpments are present in all three ecosystems except within Barangays 1-6.

Permeability

Permeability is the property of soil to allow air and water to move into the soil layers. The coastal ecosystem that is 1 kilometer away from the coastline has moderately slow permeability. This is due to slope level of 0-3% and its soil type, which is mostly sandy in nature. Water from the uplands generally retains in this area therefore making it flood prone.

The lowland ecosystem, which has a slope level of 3-8% and a soil type of Taal loam has moderate to moderately rapid permeability.

Land Capability

The coastal ecosystem has land capability class moderate soil condition limitations with shallow profile, low fertility, doughtiness, and slight salinity. Those adjacent to streams and rivers have low to medium fertility, susceptible to seasonal overflow, and have a slight soil condition limitation.

The lowland ecosystem has a land capability class of slight soil condition limitation, with deep soil profile having loamy to clayey soil with none to slight flooding hazard and possible severe erosion in some areas.

The upland ecosystems have moderate soil condition limitation with none to slight flooding hazard but severe erosion may also occur.

Soil Suitability

The coastal ecosystem has moderate to high suitability rating for residential and recreational use. Agriculture is not generally advisable in this ecosystem.

The lowland ecosystem is moderately and high suitable for residential, recreational and light industry purposes. Wet diversified crops, pasture tree crops and industrial trees are fairly to moderately suitable in this area.

The upland ecosystem has moderate to high suitability for residential and recreational use. Barangay Bambang, Bisaya, Tamayo and Cahil have poor to moderate suitability for residential and recreational uses. All these barangays, however have high suitability for forest use.

*2.*1.2.2. Change in sub-surface geology/underground conditions

The nearest active fault from the project site is West Valley Fault which is 32.2 kilometers away. Please refer to picture below from Phivolcs' active fault map (***Figure 2.1-5***). At this distance, the project has little or low impact in terms of changes in sub-surface geology and inducement of subsistence, liquefaction and landslides mud/debris flow to the environment including the possibility of aggravating existing natural hazards. On the other hand, Lubang Fault is almost of the same distance from the project site as that of West Valley Fault.

Figure 2.1-5. West Valley Fault and Lubang Fault Maps

2.1.2.3. Inducement of subsidence, liquefaction, landslides, mud / debris flow, etc.

Nearest active volcano that may have an impact to the project site is Taal Volcano. It is 20.65 kilometers away in terms of areal distance. The nearest dormant volcano within the province of Batangas is Mt. Makulot in the town of Cuenca. It is 23.51 kilometers far using areal distance measurement. Please see map below (***Figure 2.1-6***).

There is no identified risk of landslide in the project are as identified in the detailed landslide hazard map below from Mine and Geosciences Bureau (MGB), Region 4A (***Figure 2.1-7***). There is a low landslide susceptibility as the project site is located in a flat terrain. At any rate, appropriate safety measures will be implemented in case of excavation works or planned earthworks on the project facilities.

Since the project site is located 1.8 kilometers inland from the existing port of Calaca Seaport, it can still be affected in case there is a tsunami triggered by an earthquake from Lubang Fault underground movement. Lubang Fault is located between Mindoro Island and Batangas, which is the locus of small to large-magnitude earthquakes. It is the major geologic structure nearest the project site. The site has moderate vulnerability to ground rupture and ground shaking; low susceptibility to liquefaction hazard; safe against earthquake-induced landslides; and low susceptibility to settlement.

Strong typhoons that may create storm surge due to effects of climate change will not likely to affect the project site. However, the project site is vulnerable to structural damages due to flood and strong winds brought about by heavy precipitation as a result of climate change.

Figure 2.1- 6. Map showing the distance of project site from nearest active and dormant volcanoes such as Taal Volcano and Mt. Maculot in Cuenca, Batangas

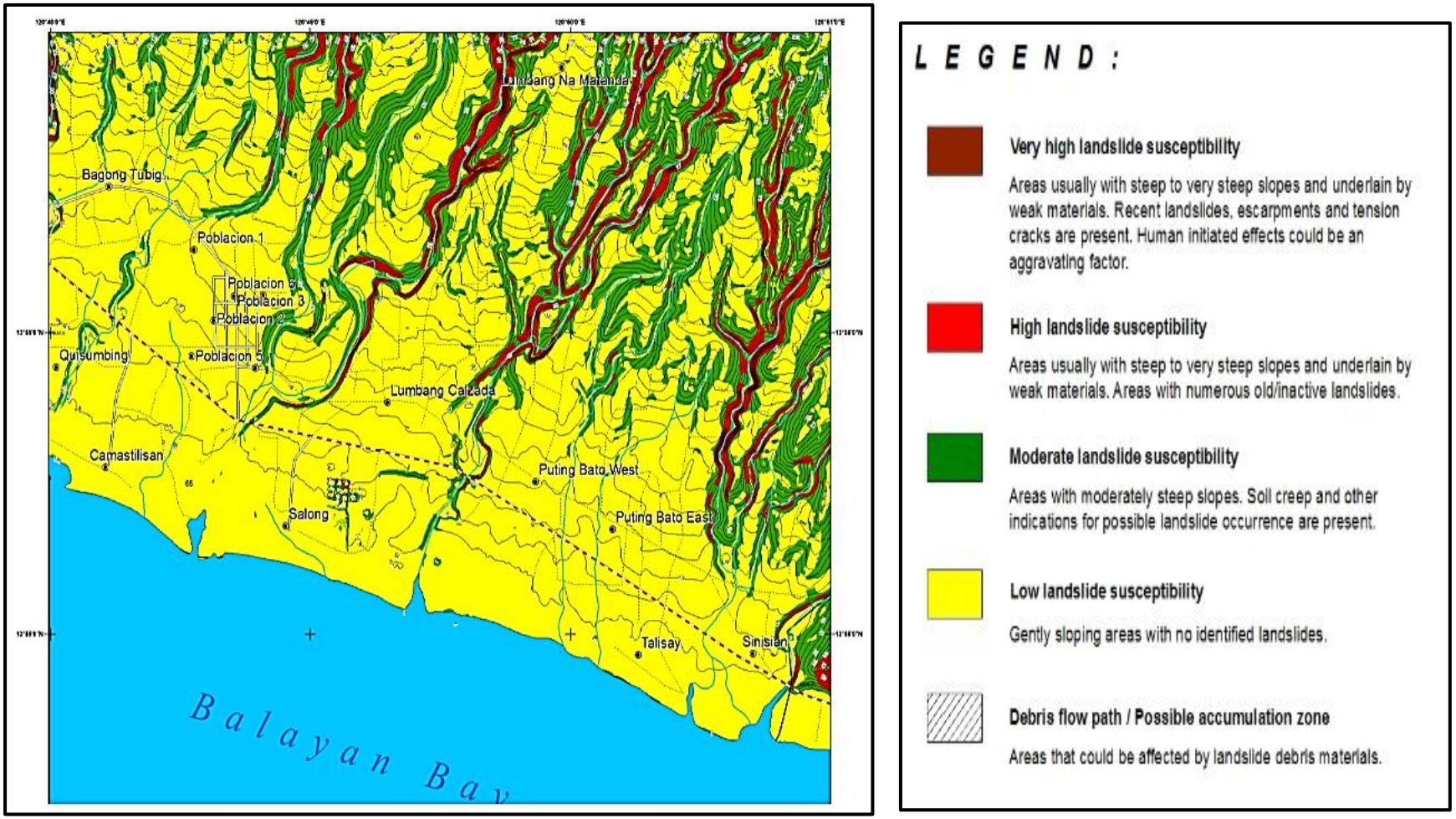


Figure 2.1-7. Detailed Landslide Hazard Map of Calaca, Batangas

2.1.3 Pedology

2.1.3.1 Soil erosion / loss of topsoil / overburden

Soil erosion is the process of detachment and transport of soil materials by the erosive and transport agents such as wind and water. It is a result of many factors, such as rainfall intensity, steepness of slope, length of slope, vegetation cover, and management practices. Besides all this, the inherent properties of a soil influence the ability of water to detach and transport soil particles. This intrinsic property is classified as soil erodibility.

The project site is located in flat terrain and within the developed property of Calaca Industrial Seaport Zone. Soil type in this area of Calaca is classified as sandy loam. The erodibility potential of the soil is from moderate to low considering its permeability and low flooding hazard.

Top soil in the surrounding area is still covered with vegetation and the ongoing soil erosion can be attributed to localize rain water run-off. Erosion due to wind is not significant. Soil erosion is a three-step process. It begins with particle detachment, followed by particle transport and ends by deposition of transported sediment in a new location. These steps are largely affected by soil properties (soil texture, soil structure, organic matter content, and permeability).

2.1.3.2 Change in soil quality / fertility

The Project area of 3.9 hectares parcel of land in the Calaca Industrial Seaport Zone will be generally covered by the necessary infrastructures of the cement grinding and packing facility. Thus, changes in soil quality / fertility will not be a concerned in this assessment.

2.1.4 Terrestrial Ecology

Figure 2.1-8 presents the aerial view of the project site showing the existing vegetation and its location inside the Calaca Industrial Seaport Zone.

2.1.4.1 Vegetation removal and loss of habitat

The project site covers only 3.9 hectare of bare land located inside an industrial zone and is not considered as ecologically sensitive site. Vegetation removal during clearing activities does not pose treat to loss of habitat for flora and fauna endemic in the area. There is also no significant threat to existence and/or loss of important local species, threat to abundance, frequency and distribution of important species and hindrance to wildlife access.

Terrestrial biology in the project area is affected by human disturbance. The animals are primarily composed of domesticated animals while the plant species are composed of ipil-ipil, acacia, gmelina, mahogany, narra, neem tree, raintree and some fruit-bearing trees, shrubs and grasses. There are no known endangered or threatened species at the project site.

Potential emission of excessive dust from cement plant operation may happen in case of breakdown of dust control equipment. This may affect the surrounding trees and vegetation due to dust particles which can be visible covering the plant leaves. In order to ensure continuous operation and efficiency of dust collectors, preventive maintenance and repair of equipment will be implemented as planned.

Tree planting activities and greening of surroundings especially on the perimeter of the facility will serve as environmental enhancement to regain and improve the flora and fauna. This will also create buffer zone to mitigate dust emission. Fast growing trees will also absorb carbon dioxide emission which will offset the quantity of greenhouse gas emission from plant operation including indirect CO2 emission from electricity consumption and other sources. Further carbon sequestration program will be pursued through tree growing and nurturing activities with the goal of attaining carbon neutral cement plant operation.

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

The Project will not impose any threat to existence and/or loss of important local species, considering that the site is not forested or with important tree species and local indigenous shrubs which endangered.

2.1.4.3 Threat to abundance, frequency and distribution of important species

Not threat to the abundance, frequency and distribution of important species for obvious reason.

2.1.4.4 Hindrance to wildlife access

The Project site is an industrial area wherein various large infrastructures are already existing and operating, populated and with busy access roads/highway. Thus, the Project area is not expected to be an access route of wildlife.

Figure 2.1-8. Aerial view of the project site showing the existing vegetation and its location inside the Calaca Industrial Seaport Zone

2.2. The Water

2.2.1 Hydrology/Hydrogeology

Aquifer Characteristics: The nature and distribution of the major rock units together with the characteristics of existing wells indicate that the region may be classified into two (2) hydro-geologic units. These are the coastal plain, which contain relatively extensive aquifers that are moderate to highly productive and the slope and upland areas, which host local, disconnected aquifers that are slight to moderately productive. Except for the near shore area of the coastal plain where salty wells occur, the aquifers in the area yield water that is clear, odorless, low in dissolved solids content and generally fit for drinking.

Loose to moderately compacted sand and gravel of the Quaternary Alluvium comprise the main aquifers at the coastal plain. These deposits are moderately to highly permeable and are prolific aquifers capable of producing more than 20 liters per second (l/s) of water. Their highly permeable nature, however, becomes a disadvantage to wells located near the shoreline as heavy groundwater extraction makes them susceptible to saltwater intrusion.

The examination of wells reveals the occurrence of a multi-layered aquifer system at the coastal plain. Shallow wells tap a shallow unconfined aquifer while deeper wells obtain water from confined aquifers that appear at around 70 meters depth. Some wells that tap the confined aquifer exhibit free-flowing conditions.

The slope and upland areas consist of volcanic and tuffaceous rocks of the Taal Tuff. Though less porous and permeable than the Quaternary Alluvium, the Taal Tuff contains slight to moderately compacted, tuffaceous conglomerate, gravel and sand layers that develop local, disconnected aquifers. These aquifers likewise produce appreciable amounts of clear water generally fit for drinking. Historical well data from the Municipalities of Calaca, Lemery and Tuy show that wells drilled in these areas attain specific capacities of 3.1 to 3.4 liters per second per meter.

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

The Project site is far from natural drainage system such rivers, streams and creeks. . Dacanlao River, a major River System in the general area, is about 6 kilometer and the Bolbok Stream is only about 0.75 kilometers to the left from the proposed cement plant. Thus, the construction and development of the cement grinding and packing facility will affect not the drainage morphology, nor induce flooding and affect stream flow.

2.2.1.2 Change in stream, lake water depth

Except for the Dacanlao River and Bolbok Stream, no water bodies such as lake are present in general area of the Project site. Obviously, there will be no changes in stream and lake water depth.

2.2.1.3 Depletion of water resources/ competition in water use

The process water requirement for the cement plant grinding ball cooling system is 330 cu m /day. The process water shall be sourced from a deep-well within the plant site inside the Calaca Industrial Seaport Corp. The raw water from the deep-well shall be treated with softener before it is used for the process as cooling water for the cement plant grinding ball cooling system. Eighty-eight percent (of the process water used for cooling shall be recycled while 12% shall be used for domestic purposes, washings, road and plant watering, some will evaporate and only less than 5 cu m will be discharged. The 5 cum/day being discharged shall be treated in sewage treatment plant (STP).

The Calaca Industrial Seaport Corp. has its own deep-well for sources of freshwater of their locators.

Based on the groundwater assessment for the town of Calaca below, the resource is still capable of supplying the process and domestic requirement of the cement plant without disrupting the supply for the community although using these wells for drinking water supply is not advisable. The well supplying the process and domestic requirement of the plant draws water from the deep confined aquifer that is not normally used by residents.

A well inventory in Calaca in 2010 shows, that the residents, institutions, commercial and industrial establishments in Calaca utilize groundwater for their water requirements. These cased wells are mostly shallow and many are used for drinking. All the wells in the coastal plain reportedly do not weaken or dry up during the summer.

Majority of houses in the area have its own well and the preponderance of private wells indicate that the groundwater is abundant. The barangays in the area therefore do not have a water system except for Dacanlao, which was given one by NPC as part of its social development program. This water system serves the central portion of the barangay.

The wells in Calaca area yield water that is clean, odorless and generally fit for drinking in terms Ph suspended solids content. However, some wells near the shoreline are salty due to seawater intrusion. The shallow wells of Sem-Calaca have in fact been abandoned due to saltwater intrusion. The wells in Brgy. Quisumbing, are likewise salty and are used for washing only.

The proposed cement plant in all project phases, i.e., during pre-construction, construction, operation and abandonment phases shall not deplete nearby water resources.

Based on the above groundwater assessment for the town of Calaca, the resource is still capable of supplying the process and domestic requirement of the cement plant without disrupting the supply for the community although using these wells for drinking water supply is not advisable. The well supplying the process and domestic requirement of the plant draws water from the deep confined aquifer that is not normally used by residents.

Moreover, process water shall be recycled. Eighty-eight percent (of the process water used for cooling cement grinding ball shall be recycled while 12% shall be used for domestic purposes, washings, road and plant watering, some will evaporate and only less than 5 cu m will be discharged. The 5 cum/day being discharged shall be treated in sewage treatment plant (STP).

A feasibility study on the integration of rainwater harvesting and domestic wastewater treatment and reuse shall be done as a potential alternative to reduce, not only potable water consumption, but also to minimize wastewater generation at the proposed cement plant. Integrating rainwater harvesting with treatment of domestic water discharges shall contribute, not only in reducing potable water consumption and decreasing the necessities of treatment of wastewater, but will also contribute to achieving important economic savings for water users and water and wastewater system operators; denoting that integrating rainwater harvesting and domestic water discharges reuse becomes a more feasible and reliable strategy than strategies based only in rainwater harvesting. Furthermore, incorporating the benefits associated with wastewater minimization, normally ignored, such schemes become more economically viable and the investments can be amortized in a shorter period of time.

The feasibility study shall be composed of the following general activities:

1. Determination of the potential volume of rainwater harvestable by considering among others the rainfall data from the site from meteorological data at the nearest climatological station;
2. Determination of potable water consumption and domestic wastewater generation;
3. Selection and design of treatment processes for rainwater and domestic wastewater;
4. Sizing of water storage tanks; and
5. Economic assessment.

2.2.2. Oceanography

Except for the services of Calaca Seaport for the transport of raw materials, the Project will not involve any construction and development activities in the Calaca coastal and marine areas. Thus, the Project will not have any effect/influence on the following:

2.2.3. Water Quality

2.2.3.1. Degradation of Groundwater Quality

Results of analyses of a groundwater sampling from the deep-well maintained by Calaca Industrial Seaport, Inc where the Mabuhay Cement Grinding Facility shall source its shows compliance with the groundwater quality guidelines of DENR Administrative Order (DAO) No. 2016-08: Water Quality Guidelines (WQG) and General Effluent Standards (GES) of 2016. ***Table 2.2-1*** presents the results of analyses of the said groundwater sample. **ANNEX 3** presents the copy of Certificate of Analysis of the groundwater sample.

Table 2.2-1. Results of Analyses of Groundwater Sample from the Deep-well of Calaca Industrial Seaport, Inc.

Parameter	Concentration	DAO 2016-08: Groundwater Quality Guidelines Limit	Method of Analysis
pH	7.5	6.5 – 8.5	Electrometric
Turbidity	0.11 NTU	---	Nephelometric
Conductivity	566.3 µs/cm	---	Conductivity Meter
T-Alkalinity as $CaCO_3$	254.0 mg/L	---	Potentiometric
Total Suspended Solids (TSS)	1 mg/L	50 mg/L	Gravimetric, dried at 103-105°C
Oil and Grease	<1.0 mg/L	1 mg/L	Liquid-Liquid, Partition – Gravimetric
Phosphate	0.07 mg/L	---	Stannous Chloride
Chloride (Cl^-)	9.7 mg/L	250 mg/L	Argentometric
Sulfate (SO_4^{2-})	41 mg/L	---	Turbidimetric
Silica (SiO_2)	95 mg/L	---	Gravimetric
Aluminum (Al)	<0.10 mg/mL	<0.10 mg/L	Direct Nitrous Oxide-Acetylene Flame
Calcium (Ca)	54.19 mg/mL	---	Direct Nitrous Oxide-Acetylene Flame
Copper (Cu)	<0.005 mg/L	0.02 mg/L	Direct Air-Acetylene Flame
Iron (Fe)	<0.02mg/L	1 mg/L	Direct Air-Acetylene Flame

Magnesium (Mg)	15.3 mg/L	---	Direct Air-Acetylene Flame
Total Coliform	8.0 MPN/100 ml	<1.1 MPN/100 ML	Multiple Tube Fermentation

Date of Sampling: July 18, 2018

The groundwater quality at the site which shall be the source of process water for the cement grinding ball cooling system will not be affected by the implementation of the proposed Mabuhay Cement Grinding Facility. The final discharge water is very minimal at about 5 cum/day only. Furthermore, the discharge water shall be treated through an STP, the final treated discharge shall be coursed through properly designed drainage systems.

2.2.3.2. Degradation of Surface Water Quality

As the proposed Mabuhay Cement Grinding facility is 1.9 kilometers away from Balayan Bay, the nearest marine water, its operation shall not affect the water quality of Balayan Bay. Likewise, since the proposed location of the Mabuhay Cement Grinding facility is about 6 kilometers from Dacanlao River, a major River System in the area, the proposed cement plant shall not affect anymore the water quality of Dacanalo River. The proposed operation of the cement plant shall not also adversely affect the water quality of the Bolbok River which is only about 750 m to the left of the proposed location of the cement plant.

2.2.3.3 Degradation of Coastal/Marine Water Quality

The Project location within a 3.9 hectares lot of the Calaca Industrial Seaport Zone is about 1.9 kilometers from the Balayan Bay. The area is relatively flat land that will not involve any major ground levelling which may induce oil erosion that would be carried to the coast area during monsoon months. Thus, the construction and development of MFI cement grinding and packing facility is not expected to cause the degradation of the coastal/marine water quality of Balayan Bay.

2.2.4 Freshwater Ecology

Except for Dacanlao River which about 6.0 kilometers and the Bolbok River which is 0.750 kilometers distances from the project site, there are no nearby freshwater bodies that would be affected by development and operation of MFI cement grinding and packing facility. Thus, this Project will not impose any effects on the freshwater ecology with respect to the following:

2.2.5 Marine Ecology

The Mabuhay FilCement, Inc. (MFI) is an industrial "locator'' at the Calaca Industrial Seaport Zone (CISZ). Thus, MFI will be entitled with the support facilities and services available in the CISZ. Hence, it is allowed to use the CISZ port at all times, based on the terms and condition of the Contract to Sell for the Purchase of the Parcel of Land entered into the Calaca Industrial Seaport Corporation (CISC)-the Seller and the MFI-the Buyer (***see ANNEX* 2- Contract to Sell**). The use of CISZ port facilities at all times shall be subject to all policies and guidelines as promulgated by the CISC and the Philippine Port Authority (PPA) rules and regulations.

The CISZ port will serve primarily as the transhipment point of bulk raw materials (e.g. clinker, gypsum, limestones, etc.) of the MFI cement production operation. The unloading of raw materials from the water

vessel to trucks for delivery to the cement facility will be in accordance with established guidelines and procedures of port operation (***see ANNEX 2a- CISC General Port Policy and Restriction***).

The operation and management of the port is under the direct responsibility of CISC and PPA. Thus, whatever the implications of the port operations within its general marine ecology, shall be taken into considerations by the CISC and PPA. Except for the transhipment of bulk raw materials, the operation of MFI cement facility will not affect the port's marine ecology considering that it is more 2.9 kilometers away.

2.2.5.1 Threat to existence and/or loss species of important local and habitat
The development and operation of the MFI cement grinding and packing facility is not expected to impose threats to existence and/or loss of important local and habitat.

2.2.5.2 Threat to abundance, frequency and distribution of species
Likewise, the abundance, frequency and distribution of species in marine ecology will not be affected.

Baseline condition of the port marine ecology:

For future assessment of any possible changes of the port's marine ecology, inspection, surveys and interviews were undertaken. The results are as follows:

Apparently, the presence of corals, seagrass and mangrove does not exist in the area.

Fisheries

For fisheries, interview with the local fisher folks was conducted in Barangay Salong where there is a huge fishing community which is near the proposed site. Most of the interviewed fisher folks conduct their fishing activity in other areas, an estimated of greater than 5 kilometers away from the shoreline of the barangay, they don't conduct their activity near the Calaca Seaport Zone since the area is highly guarded with high fences and personnel in the area. most of the interviewed locals are aware of the activities being conducted inside the industrial complex. Upon the ocular inspection in the area, there is not that much solid waste in the coastline fronting the industrial zone. When interviewed regarding threats and problem that they encounter due to the activities done in the industrial zone, they don't recall a time that there was environmental problem that were encountered since most them fish far from the coastline area as stated in the earlier. Most of the fish that they catch are *Euthynnus affinis* (Tulingan/Mackarel Tuna), *Upeneus suphureus* (Waray-waray/Dumpilas) and *Decapterus sp.*

Ocular inspections and local interviews were made to assess the site. There were no coral areas and fishing areas near the proposed project site. Though the locals of Barangay Talisayan and Salong are mostly fishers folks, they usually go out of Balayan Bay just to fish which is about 3 hours boat ride from these barangays.

Interviews of locals have accounted that ever since before the industrial park and jetty was established, fish resources have been scarce. High fishing pressures due to high number of fishers have driven the decline of fisheries.

The coastline of Barangay Salong is a built-up area with quite a number of houses. On the other hand, the Coast of Barangay Talisayan has more beach resorts compared to Salong. Locals have been using also this coastline for bathing purposes. Solid waste management in these areas is a problem as observed during the inspection, which may pose a great threat to the water quality.

Plankton

Plankton comes from the Greek word "planktos" which means wanderer or drifter, they are also known for its general terms as "floaters" since these organism drift with the current of the ocean. They are classified

into two (2) groups according to their components, the plant components of the plankton are known as phytoplankton which are single celled organism that are the considered the most abundant primary producer since they can perform photosynthesis while the animals are referred to as zooplankton and composed of mostly copepods and larval stages of invertebrates. They are the main consumer of the phytoplankton and are considered food for higher trophic level especially fishes.

Three (3) sampling stations were done to assess the plankton community of the project area (***Table 2.2-2***) and (***Figure 2.2-1***).

Table 2.2-2.: Geographical Location of Plankton Sampling Station in Calaca Seaport Batangas

Station	Latitude	Longitude
Station 1	120.82885	13.914731
Station 2	120.826431	13.914845
Station 3	120.824307	13.915270

Figure 2.2-3: Relative Location of Sampling Stations

Station 1 is located on the farthest part of the seaport zone which is considered to be in Gate 3. It is in the periphery of the South Luzon Thermal Energy Corporation and some coastal community near the seaport.

For station 2, it is near the Port of PPIP. It is almost parallel to the South Luzon Thermal Corporation, but it is much closer to jetty area which makes it passable to boats.

While for station 3 it is located in the center of the seaport on which two jetty area are found on its left and right side. At the same time, a river is located parallel to the station on which its mouth changes position in response to the tide of the water.

Collection of samples

A plankton net that has a hoop radius of 15 cm and porosity of 0.44 m was used for the collection of plankton samples. The net was towed vertically from a certain depth and a total of three (3) replicate sample must be collected from each station. Samples that were collected was then transferred from the bucket to a 250 ml dark bottles that has an equal volume of five percent buffered formalin solution. The samples were then bought to the laboratory for identification and counting with the help of a binocular or compound microscope. The identification of the plankton species was done by examining its external morphological structures using Yamaji (1977) as its reference.

Species identified

Phytoplankton:

A total of fifteen (15) plankton species were identified in the coastal area of the Calaca Seaport zone which belongs to two phyla, Phylum Bacillariophyta and Phylum Protozoa. The highest number of species classified are under Phylum Bacillariophyta which has a total of thirteen (13) species which is also commonly called as “Diatoms”: a kind of phytoplankton that comprises of yellow-brown chloroplasts that able them to photosynthesize. These species are: *Bacteriastrum sp*., *Thallasionema sp*., *Chaetoceros sp*., *Cosconodiscus sp*., *Navicula sp*., *Asterionella sp*., *Biddulphia sp*., *Pleurosigma sp*., *Diploneis sp*., *Cocconeis sp*., *Rhizosolenia sp*., *Cocconeis sp*., *Amphora sp*. and *Thallasiothrix sp*. while the least number of species classified are under Phylum Protozoa which are only comprised of *Perdinium sp*. and *Dinophysis sp*., these are commonly called as Dinoflagellates: which has a presence of transverse flagellum and are able to thrive in low nutrient waters and blooms in favorable nutrient conditions thus can result to red tides that are harmful to marine ecosystem most especially the fishes. Shown below, the classification of the Phytoplankton identified in respond to their phyla and class

Zooplankton

A total of eight (9) zooplankton species were identified in the coastal area of Calaca Seaport zone which belongs to two (2) phyla: Arthropoda and Protozoa. Species of zooplankton that comprises Phylum Arthropoda are Decapoda, Calanoida and Harpacticoida while the species under Phylum Protozoa are mostly under Class Ciliata which comprises of 3 Orders (Tintinnida, Radiolaria and Foramiifera). Order Tintinnida has the highest number of species classification: *Favella sp*., *Parafavella sp*., *Tintinnopsis sp*., and *Eutintinnus sp*., are under this order while *Amphilonche sp*., and *Globigerina sp*., comprises Radiolaria and Formanifera respectively.

Relative Abundance

Phytoplankton

Summary of the assessment of phytoplankton species in the three sampling stations is presented as follows (***Table 2.2-3***):

Table 2.2-3. Relative Abundance Assessment of phytoplankton Species by Sampling Station

Species	Station 1 (%)	Station 2 (%)	Station 3 (%)
Bacteriastrum	17	20	20
Thallasionema	25	24	21
Chaetoceros	36	36	37
Rhizosolenia	6	3	3
Cosconodiscus	1	1	0
Navicula	0	0	
Asterionella	11	13	6
Biddulphia	3	3	1
Pleurosigma	0	0	0
Cocconeis	1	-	-
Diploneis	-	0	-
Amphora	-	-	1
Thallassiothrix	-	-	11
Peridinium	-	0	0
Dinophysis	-	-	0
Favella	-	-	0

Station 1: A total of 365 phytoplankton is identified in station 1 that were classified into 10 species. All identified plankton are under the Phylum Bacillariophyta that is commonly called as diatoms. Among the species identified, *Chaetoceros sp*. has the highest relative abundance of 35.89% then followed by *Thallasionema sp*. with a relative abundance of 24.93 while the least are the species of Navicula and *Pleurosigma* with a relative abundance of 0.27%.

Station 2: There are a total of 428 phytoplankton species identified, which is much higher compared to Station 1. A total of 11 species are identified but compared to the previous station which is only composed of diatoms, presence of dinoflagellate and diatoms are identified in this station 2. Dinoflagellate present is *Peridnium sp.* while the rest are diatoms. Both stations have the same phytoplankton species for having the highest relative abundance which are *Chaetoceros sp.* and *Thalassionema sp.* with a relative abundance of 36.45% and 23.60% respectively. *Pleurosigma sp*., *Navicula sp*., and *Diploneis sp.* are diatoms with the lowest relative abundance of 0.23% which also apply to the only dinoflagellate, *Peridinium sp*.

Station 3: Among the three stations, station 3 has the highest number of identified phytoplankton species with a total of 1047 species. 12 species are identified which is the highest among the rest of the stations, 10 species are classified as diatoms which are *Bacteriastrum sp*., *Thallasionema sp.*, *Chaetoceros sp.*, *Rhizosolenia sp.*, *Cosconodiscus sp.*, *Navicula sp.*, *Asterionella sp.*, *Biddulphia sp.*, *Pleurosigma sp.*,

Diploneis sp., *Apmhora sp.*, and lastly *Thallassiothrix sp.* while the remaining species are considered dinoflagellates which are *Peridinium sp.* and *Dinophysis sp.* The highest relative abundance of 36.58% is *Chaetoceros sp*. which is then followed by *Thallasionema sp.* and the least relative abundance plankton species are *Dinophysis sp.* and *Favella sp.*

Zooplankton:

Summary of the zooplankton species assessment in three sampling stations is presented as follows (***Table 2.2-4***):

Table 2.2-4. Relative Abundance Assessment of Zooplankton Species by Sampling Station

Zooplankton Species	Station 1 (%)	Station 2 (%)	Station 3 (%)
Calanida	92		
Tintinnopsis	8		
Globorofalia		5	
Harpacticoida		70	20
Decapoda		4	
Amphilonche		5	39
Eutintinnus		5	41
Parafavella		11	

Station 1: A total of 78 zooplankton species are identified which are composed of *Calanoida sp*. and *Tintinnopsis sp*. these are under Phylum Arthropoda and Phylum Protozoa respectively. *Calanoida sp*. has the highest relative abundance of 92.31% while *Tintinnopsis sp*. has only 7.70%

Station 2: In station 2, 220 zooplankton species are identified and classified as *Globorotalia sp.*, *Harpaticoida sp*., *Decapoda sp*., *Amphilonche sp*., *Eutintinnus sp*., and *Parafavella sp*. this is much higher in terms of zooplankton count and species identified as compared to Station 1. The species with the highest relative abundance is *Harpaticoida sp*. which has 70% while the least relative abundance is the species of Decapoda with only 3.63%.

Station 3: While lastly in station 3, 56 zooplankton species are only identified which is the lowest as compared the two stations but differ with the number of species identified that is much higher as Station 1. In total 3 zooplankton species are identified which are classified as *Harpacticoida sp.*, *Amphilonche sp.*, and *Eutinnus sp.*, among the three species *Eutinnus sp*. has the highest relative abundance which is 41.07% while the least is the species of Harpacticoida with only 19.64 %.

2.3 The Air

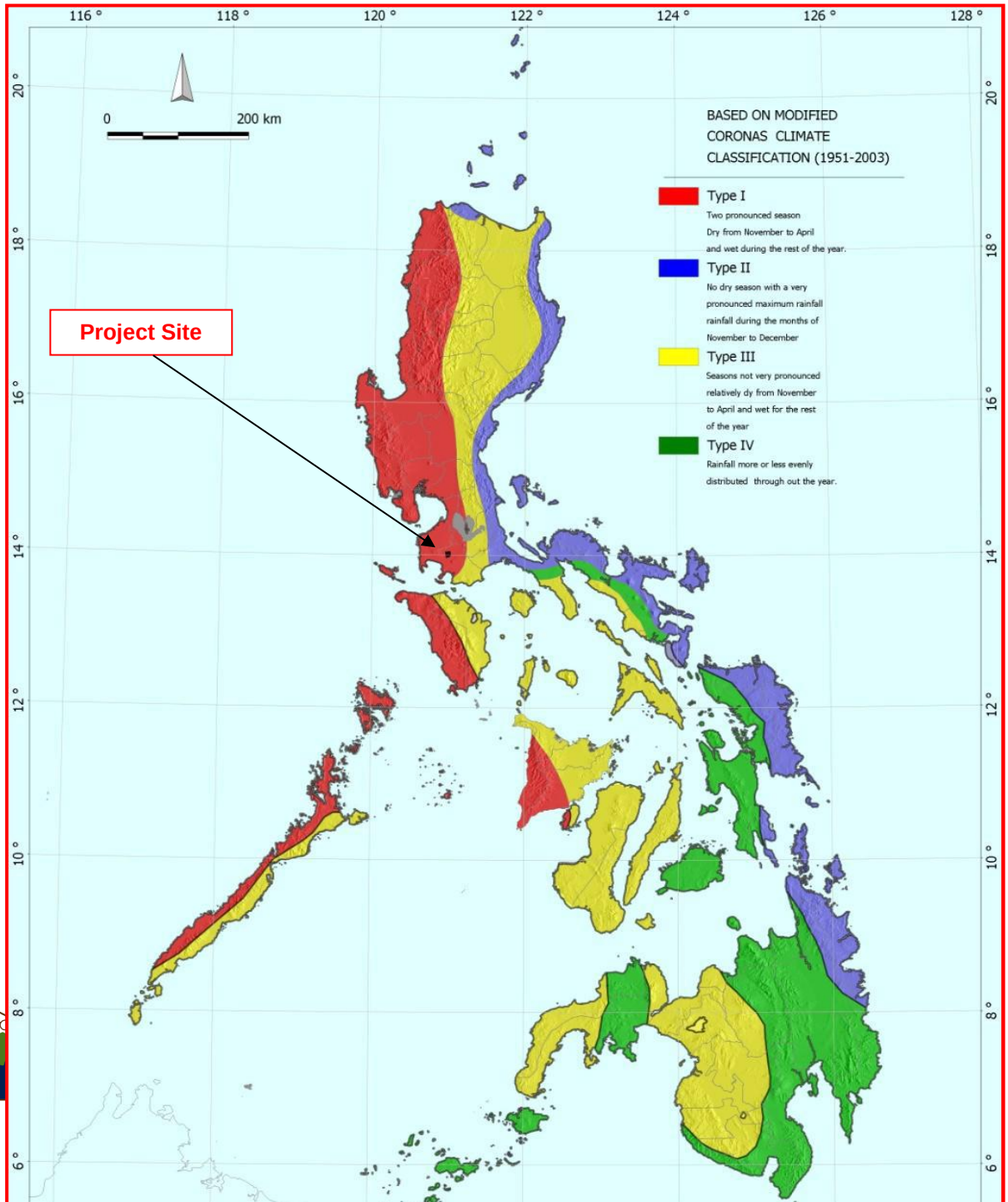
2.3.1 Climatology and Meteorology

The climate at the proposed Project site was described based on Climate Map of the Philippines while the meteorological considerations were described using the meteorological data from PAGASA Ambulong Synoptic Station located in Ambulong, Tanauan City Batangas with coordinates 14°05'24.49" N;

121°03'18.88" E. Ambulong Station is approximately 31 aerial kilometer northeast of the project site. The data recorded from Ambulong Station Climatological Normals from 1981-2010 was used to characterized the climate and meteorology of the project site.

2.3.1.1 Climate Type

Based on the Modified Coronas Climate Classification System, the proposed Project site fall under a Type I climate classification as indicated in the Climate Map of the Philippines (Figure 2.3-1). Type I Climate is characterized by two (2) pronounced seasons, dry season from November to April and wet season from May to October with a maximum period from June to September. Areas under this type of climate are generally exposed to the southwest monsoon during rainy season and get a fair share of rainfall as brought about by the tropical cyclones occurring during the maximum rainy period.



Source: PAGASA

Figure 2.3-1. Philippine Climate Map

2.3.1.2 Climatological Normals at Ambulong Station

Impacts to the local climate at the proposed project site were done by analyzing trends of relevant parameters like temperature, rainfall, and relative humidity. Table below shows the recorded meteorological data in Ambulong Station.

Table 2.3-1. Meteorological Data Recorded at Ambulong Synoptic Station (1981-2010)

Month	Rainfall Data		Temperature						Relative Humidity (%)	Wind Direction/Speed	
	Amount (mm)	No. of Rainy Days	Max (°C)	Min (°C)	Mean (°C)	Dry Bulb (°C)	Wet Bulb (°C)	Dew Point (°C)		Wind Direction (16 pt)	Wind Speed (m/s)
January	22.7	5	30.4	22.2	26.3	25.9	23.1	22	79	NE	2
February	16	3	31.6	22.1	26.9	26.4	23.3	22.1	77	NE	2
March	21.5	3	33.2	22.9	28.1	27.7	24.1	22.8	74	NE	2
April	35	4	34.5	23.9	29.2	29	25.1	23.8	73	NE	1
May	116.6	10	33.9	24.6	29.2	29.1	25.7	24.6	76	NE	1
June	228.7	16	32.5	24.6	28.6	28.4	25.6	24.7	80	SW	1
July	329.6	19	31.4	24.1	27.8	27.6	25.3	24.5	83	SW	1
August	286.9	18	31	24.3	27.6	27.5	25.3	24.5	84	SW	2
September	255	17	31.4	24.1	27.8	27.5	25.3	24.5	84	SW	1
October	218.4	15	31.6	23.9	27.7	27.4	25.1	24.3	83	NE	1

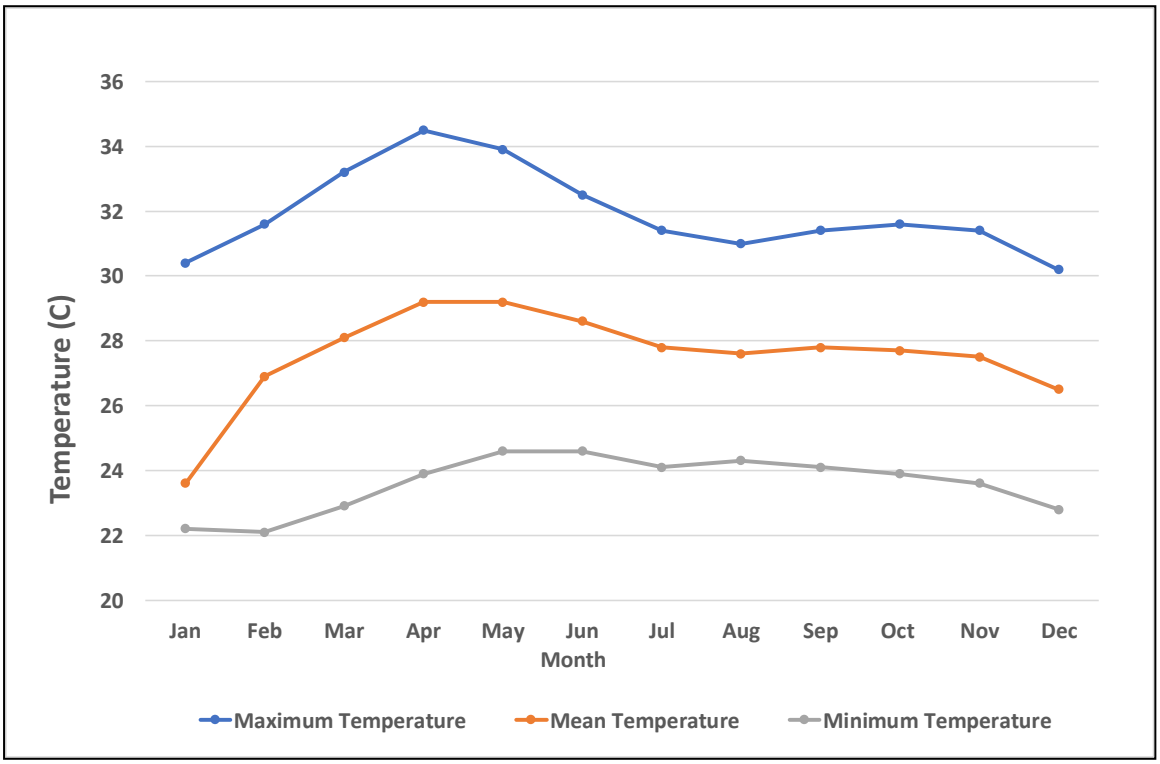
November	144.7	13	31.4	23.6	27.5	27.1	24.6	23.7	81	NE	2
December	92	9	30.2	22.8	26.5	26.2	23.6	22.6	80	NE	2
Annual	1767	132	31.9	23.6	27.8	27.5	24.7	23.7	80	NE	2

Source: PAGASA Ambulong Station Climatological Normals 1981-2010

2.3.1.3 Temperature

The mean annual average temperature in Batangas is 27.8°C recorded in Ambulong Station. January being the coldest month having a mean temperature of 26.3°C, while the month of April and May is the warmest with a mean temperature of 29.2°C. The average monthly temperature of Batangas tends to decrease during wet season based on the data from ***Table 2.3-1***.

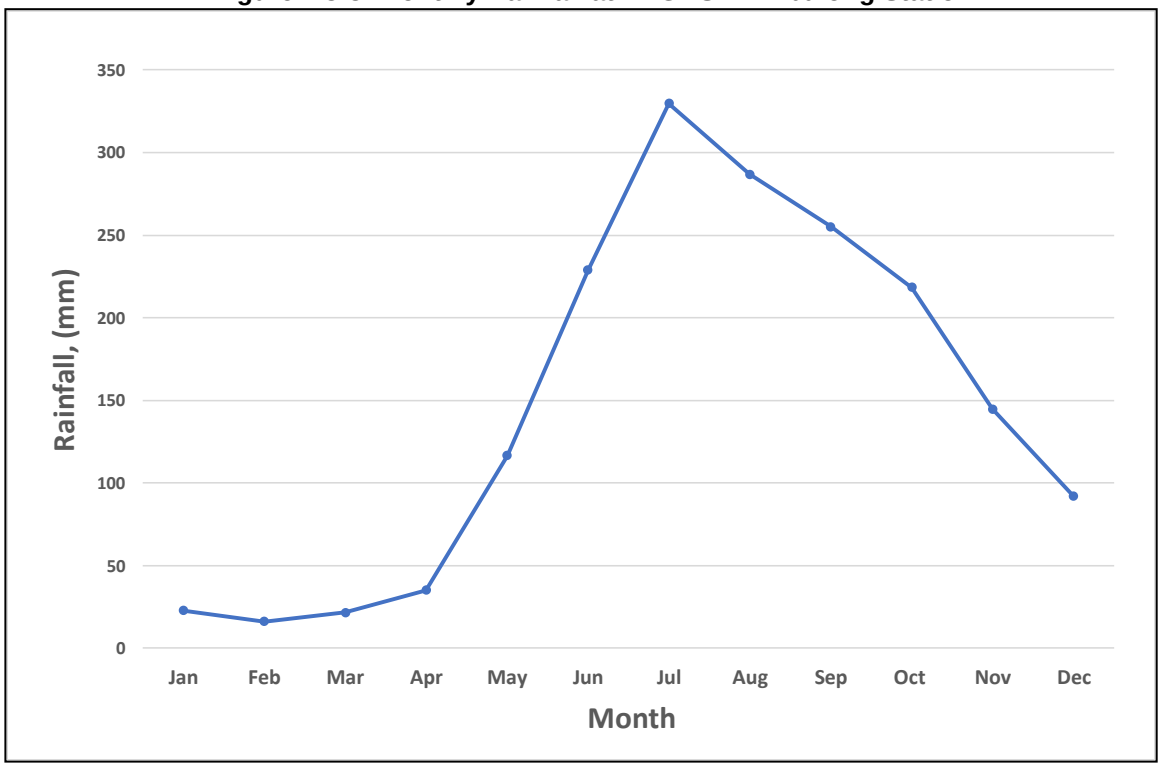
Figure 2.3-2. Monthly Temperature at PAGASA Ambulong Station



2.3.1.4 Rainfall

Based from the 30-year record in PAGASA Ambulong Station, the rainfall in Batangas has a very distinct monthly pattern (***Figure 2.3-3***). Heavy rain has been known to occur, usually between May to November with maximum period from June to October causing flooding in low lying areas. The total annual amount of rainfall in Batangas is 1,767 mm with annual average number of rainy days of 132 days. The heaviest precipitation occurred in the month of July with an average of 329.6 mm.

Figure 2.3-3. Monthly Rainfall at PAGASA Ambulong Station



2.3.1.5 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 hot at a given time. The annual average dry and wet bulb temperature from Ambulong Station are 27.5°C and 24.7°C, respectively. This translate to annual average relative humidity of 80% with August and September are the most humid months having an average relative humidity of 84% while the month of April is the least humid at 73% (***Figure 2.3-4***).

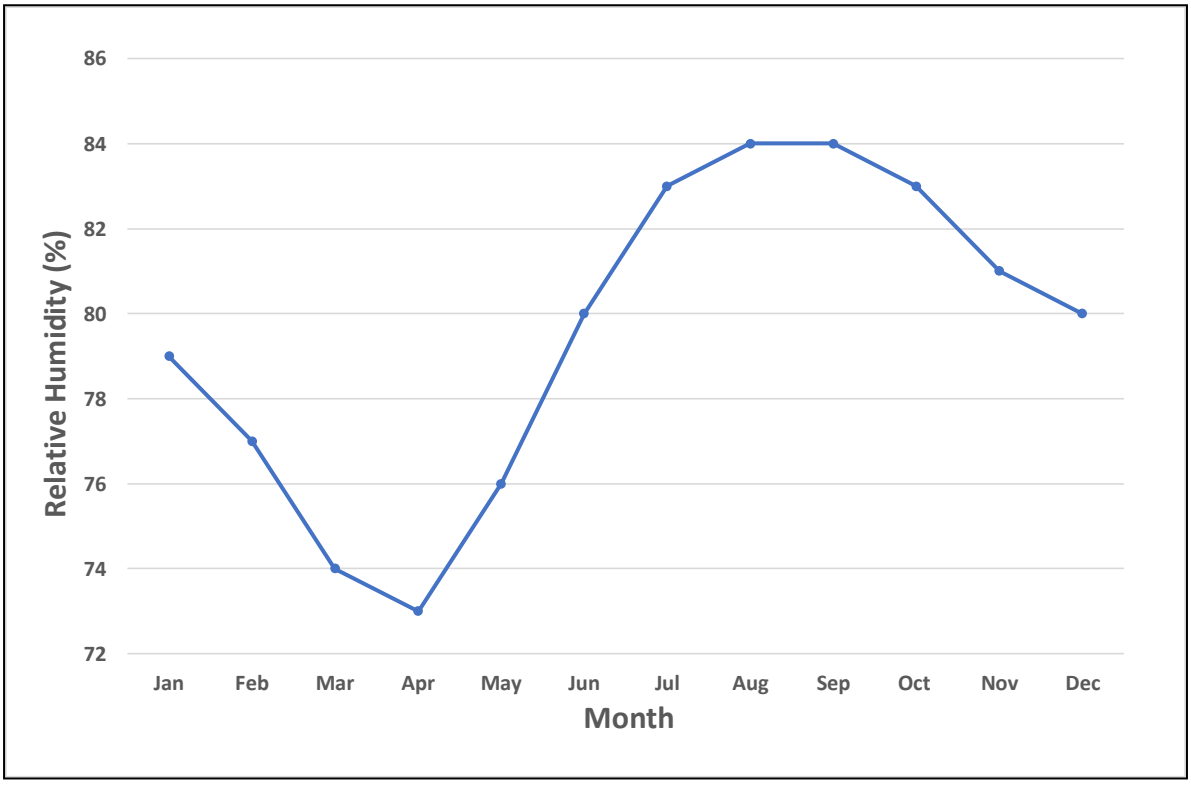
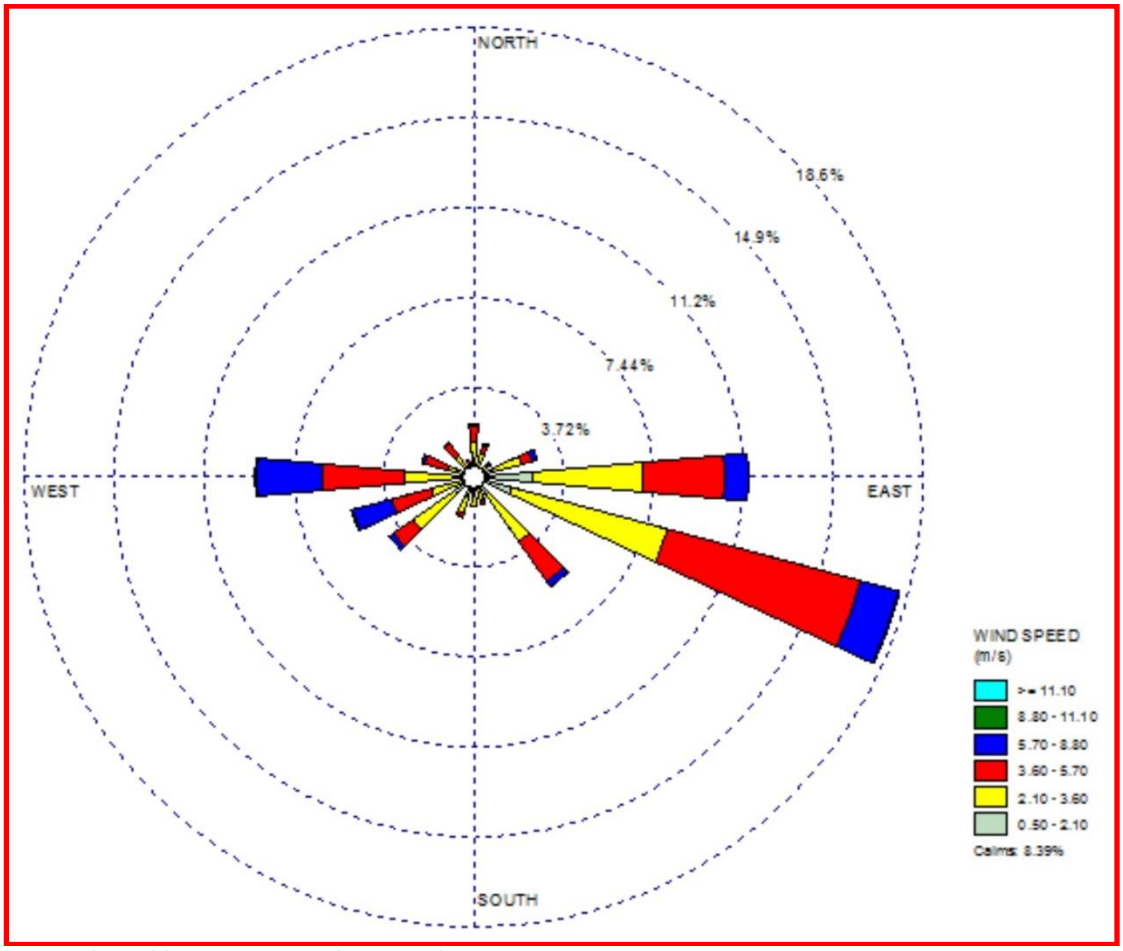


Figure 2.3-4. Monthly Relative Humidity PAGASA Ambulong Station

2.3.1.6 Annual Wind Rose Diagram

The prevailing wind are from east-southeast comprises of about 18% over the site followed by east covering 12% over the site, respectively and can be reflected in the plotted windrose diagram below at Ambulong Station from January 1 to December 31, 2016. The average wind speed is 3.12 meters per

second, few winds exceed 11.1 meters per second and winds less than 2.10 meter per second occur from all directions. Calm conditions were observed 8.39% of the time. Strongest wind comes from west followed by west-southwest about 7.11% of the time.



Note: Plotted by AERMET View Version 9.6.0

Figure 2.3-5. Windrose Diagram PAGASA Ambulong Station

2.3.1.7 Tropical Cyclone

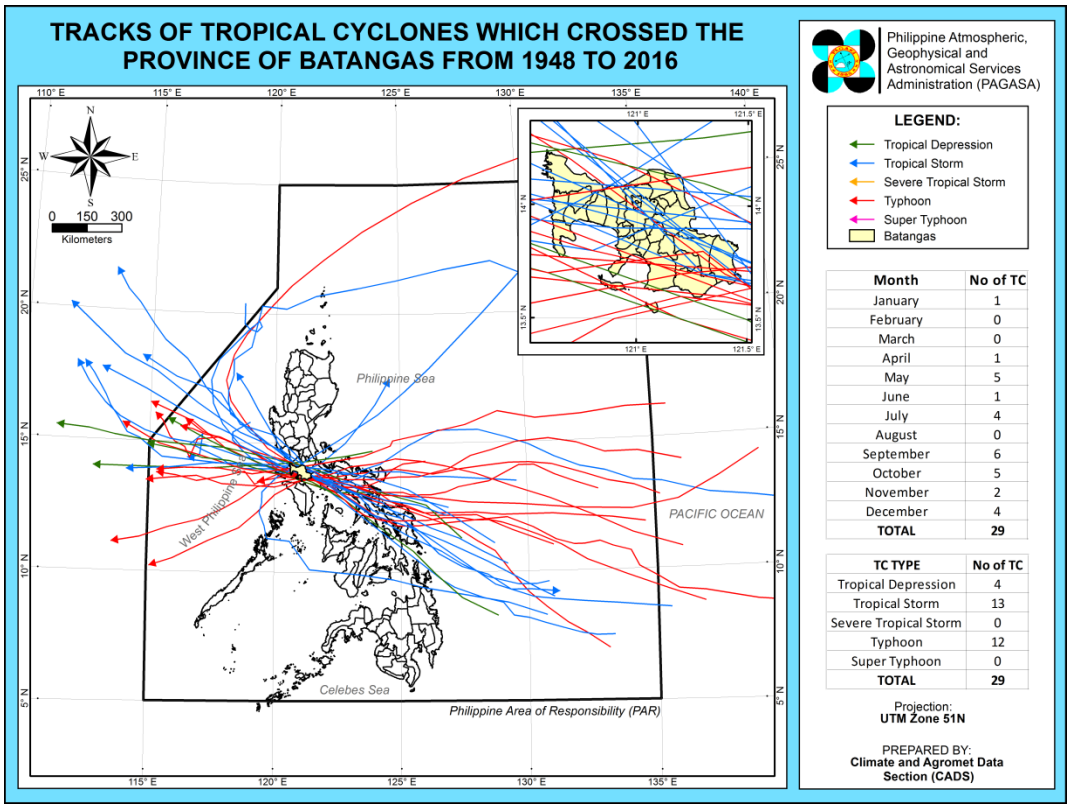
The Philippines is located in the northwest Pacific Ocean cyclone basin and tropical cyclones. The greatest number of cyclones in the Philippines occur during the months of June to December. These tropical cyclones are associated with the occurrence of low pressures areas (LPA) normally originating over 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 1948-1993 (period of 46 years) PAGASA determined an annual average of 20 tropical cyclones in the PAR with nine of these passing through the Philippine landmasses. The PAGASA had tracked 29 tropical cyclones that crossed in the province of Batangas from 1948-2016 which gives an average of 2-3 tropical cyclones per year. There was no recorded severe tropical storm and super typhoon that enter in the province of Batangas. ***Figure 2.3-6*** is the track of tropical cyclone that crossed the province of Batangas while ***Figure 2.3-7*** is the monthly distribution of tropical cyclone.

For the past 10 years the Philippines experiencing number of extremely damaging tropical cyclones. In May 18, 2015, PAGASA updated the tropical cyclone classification system for the Philippines.

The new public storm warning signal system are as follows:

- PSWS No. 1 – tropical cyclone winds of 30-60 kph are expected within the next 36 hours
- PSWS No. 2 – tropical cyclone winds of 61-120 kph are expected within the next 24 hours
- PSWS No.3 – tropical cyclone winds of 121-170 kph are expected within the next 18 hours
- PSWS No. 4 – tropical cyclone winds of 171-220 kph are expected within the next 12 hours
- PSWS No. 5 – tropical cyclone winds of more than 220 kph are expected within 12 hours



Month	No of TC
January	1
February	0
March	0
April	1
May	5
June	1
July	4
August	0
September	6
October	5
November	2
December	4
TOTAL	**29**

TC TYPE	No of TC
Tropical Depression	4
Tropical Storm	13
Severe Tropical Storm	0
Typhoon	12
Super Typhoon	0
TOTAL	**29**

Figure 2.3-6. Track of Tropical Cyclone in Batangas

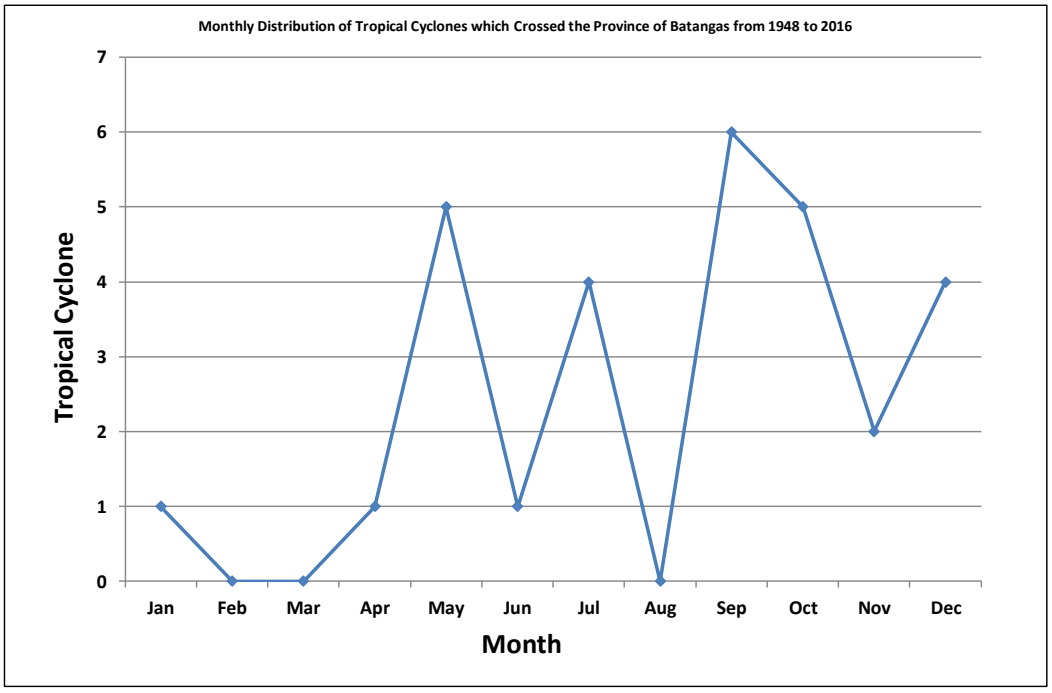


Figure 2.3-7. Monthly Distribution of Tropical Cyclone in Batangas

2.3.1.8 Frequency of Extreme Event

Climatological extremes values are from the 30-year monthly and annual summaries of temperature, rainfall, and wind speed in ***Table 2.3-2***. The recorded annual extreme high and low temperature is 38.8°C occurred in May 15, 1921 and 16.0°C occurred in January 9, 1985 and January 24, 2014, respectively. The amount of annual average extreme greatest rainfall is 499.2 mm occurred in May 21, 1976 while the annual average extreme highest wind is 75 meters per second westerly direction occurred in July 15, 1983.

Table 2.3-2. Climatological Extreme Recorded at Ambulong Station as of 2016

Month	Temperature (°C)				Greatest Dailly RF (mm)		Strongest Winds (m/s)		
	High	Date	Low	Date	Amount	Date	Speed	Dir	Date
Jan	34.9	01-03-1958	16.0	01-09-1985	118.1	01-01-1960	20	ENE	01-29-1989
			16.0	01-24-2014					
Feb	37.2	02-28-1985	16.1	02-03-1976	92.7	02-21-2013	24	NE	02-06-1982
Mar	38.0	03-30-1984	16.2	03-03-1963	60.6	03-24-1980	22	ENE	03-10-1989
Apr	38.3	04-05-1987	17.5	04-05-1963	57.0	04-23-1996	18	SE	04-25-1989
May	38.8	05-15-1921	20.0	05-21-1974	499.2	05-21-1976	41	SW	05-17-1989
Jun	38.0	06-14-1983	20.6	06-18-1976	301.5	06-27-1961	40	SW	06-23-1984
Jul	36.8	07-15-1999	19.2	07-19-2014	218.5	07-13-2010	75	W	07-15-1983
	36.8	07-23-2016							
Aug	36.7	08-23-1969	19.0	08-31-2015	283.6	08-24-1990	40	NNE	08-12-1987
Sep	35.7	09-14-1984	19.5	09-04-1991	270.8	09-05-1962	54	SSW	09-09-1982
	35.7	09-07-2016							
Oct	37.3	10-11-1975	18.9	10-31-1969	183.2	10-28-2000	70	S	10-11-1989
Nov	36.5	11-02-1956	18.3	11-29-1974	277.2	11-03-1995	45	NE	11-25-1987
			18.3	11-22-1975					
Dec	35.3	12-25-1962	16.8	12-16-1960	151.9	12-09-1971	54	NE	12-30-1950
Annual	38.8	05-15-1921	16.0	01-09-1985	499.2	05-21-1976	75	W	07-15-1983
			16.0	01-24-2014					

Source: PAGASA Climatological Extremes as of 2016

2.3.2 Contribution in Terms of Greenhouse Gas Emissions

Majority of greenhouse gas (GHG) emissions that the proposed Project may generate are expected to come from activities associated with the construction (fuel/ electricity uses for the operation of construction vehicles and equipment), cement mill and plant operation (electricity uses for the whole plant operations) of the Project. The fuel combustion and electricity consumption activities release three (3) major GHGs, namely: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Of these gases, the major gas emitted is CO_2 and the bulk of the GHG emissions calculations involve determining the amount of CO_2 emissions as CH_4 and N_2O emissions have a very low share in terms of emissions. As such, this report only focused on CO_2 emissions.

2.3.2.1 Methodology

The CO_2 were calculated using emission factor-based estimation method. The methodology estimates the CO_2 emissions by multiplying a level of activity data (AD) by an emission factor (EF). Activity data is a quantified measure of activity resulting in emissions during a given period of time (e.g. data on fuel consumption (liters/km) and purchased electricity (kWh reading)) while emission factor is the average emission rate of a given GHG for a given source, relative to units of activity. The general equation is shown below. This is based on The Greenhouse Gas Protocol, A Corporate Accounting and Reporting Standard, Revised Edition, World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI), 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National GHG Inventories and 2014 IPCC Assessment Report.

Equation: **GHG Emissions = AD x EF**

2.3.2.2 Results and Analysis

The emissions associated with the Project are categorized into direct and indirect emissions. Direct GHG emissions of Scope 1 are from sources that are owned and/or controlled by the proponent. This is usually applicable during the operational phase (e.g. use of generator set and equipment owned by the proponent). Indirect emissions, on the other hand, are further categorized into Scope 2 and Scope 3. Scope 2 emissions are a consequence of the project's operations at sources owned and/or controlled by another entity which include purchased electricity consumption. Scope 3 emissions are a consequence of the proponent's activities but to which the proponent has no direct control over which include tailpipe emissions from contracted equipment/ vehicles during construction.

Table 2.3-3. Items to Consider for Each Scope

Scope	Construction	Operation
1	**1. Stationary combustion** Emissions from fuel use of entity-owned/ controlled stationary equipment (e.g. standby genset) **2. Mobile combustion** Tailpipe emissions from entity-owned/ controlled vehicles (e.g. service van)	**1. Stationary combustion** Emissions from fuel use of entity-owned/ controlled stationary equipment (e.g. genset) **2. Mobile combustion** Tailpipe emissions from entity-owned/ controlled vehicles (e.g. service van)
2	**1. Stationary combustion**	**1. Stationary combustion**

	Emissions from the consumption of purchased electricity for construction works	Emissions from the use of purchased electricity during operations
3	**1. Stationary combustion** Emissions from fuel use of contracted construction equipment (e.g. standby genset) **2. Mobile combustion** Emissions from transportation of purchased construction materials/ construction wastes using contracted vehicles (e.g. trucks, pickup)	**1. Mobile combustion** Emissions from fuel use of contracted vehicles (e.g. service vans)

2.3.2.3 CO_2 Emissions from Construction Equipment

In calculating Scope 3 emissions, fuel consumption for each construction equipment, including service vehicles in transporting of construction materials were estimated and presented in ***Table 2.3-4***. This construction equipment/ vehicles are diesel-powered, the emission factor for diesel will be based from the US EPA Emission Factors for Greenhouse Gas Inventories, which was last modified on November 19, 2015. Presented below are the activity data, emission factor as well as the results of the computation. The total CO_2 emissions during construction are estimated at 640.7 MT CO_2/yr.

Table 2.3-4. Calculated CO_2 Emission from Heavy Equipment and Mobile Sources

Emission Sources	No. of Units	Fuel Type	Fuel Consumption (L/100km)[a]	Assumed distance travelled (km/yr)	Fuel Consumption (L/yr)	Emission Factor (kg CO_2/L)[b]	Calculated CO_2 Emission (MT CO_2/yr)
Heavy Equipment	30	Diesel	31.6	10,000	31,600	2.7	25.6
30-tonner Truck	50	Diesel	20.9	15,000	156,750	2.7	432.2
Pick-up	20	Diesel	12.1	12,000	43,560	2.7	117.6
Service Van	20	Diesel	12.1	10,000	24,200	2.7	65.3
Total CO_2 Emission							640.7

Source: a – 2017 Fuel Consumption Guide, Natural Resources Canada
b – Emission Factors for Greenhouse Gas Inventories USEPA

2.3.2.4 CO_2 Emissions during Construction and Operation from Electricity Purchased

The indirect CO_2 emission during construction and plant operation is calculated under Scope 2 emissions which is electricity consumed through purchased. The electricity consumption provided by the Proponent during construction is 2 MW per month and 10 MW per month for operation. GHG Protocol's Purchased Electricity Calculation Tool with emission factor from the GWP values of the 2014 IPCC Fifth Assessment Report was utilized to automatically calculate

the total CO_2 emissions. Presented below are the activity data as well as the results of the computation. The total CO_2 emissions during operation are estimated at 7.24 MT CO_2/yr.

Table 2.3-5. Calculated CO_2 Emission during Construction and Operation

Emission Sources	Annual Electricity Consumption (MW/yr)	Calculated CO_2 Emission (MT/yr)
Construction	24	1.21
Operation	120	6.03
Total CO_2 Emission		7.24

The total calculated annual CO2 emissions of the project during construction and operation is 647.94 metric tons per year. The estimation only included the expected construction equipment and plant operation. Other GHG emissions that may produce by the project such as fugitive emissions and other Scope 3 emissions are not included due to limited information at this stage.

The Project is expected to contribute approximately 0.00063% during the construction phase and approximately 0.0000072% during the operation phase, which are calculated based on the Philippines Second National Communication (SNC) on Climate Change projection data.

2.3.3 Climate Risk/Climate Change

2.3.3.1 Change in Local Climate

According to PAGASA, future climate changes in the Philippines are likely in terms of trends in seasonal values of temperature, rainfall and extreme events.

2.3.3.1.1 Temperature Change

The PAGASA published a climate change scenario for the Philippines in February 2011. Under the published climate change scenario, the Province of Batangas will have an increase in temperature in 2020 and 2050. ***Table 2.3-6*** show, the seasonal temperature increase in 2020 and 2050 under medium range emission scenario in the Province of Batangas.

Table 2.3-6. Seasonal Temperature Increase (in °C) in 2020 and 2050 under Medium Range Emission Scenario in the Province of Batangas

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
Batangas	24.2	26.5	25.9	25.6	1.0	1.2	0.9	1.0	1.9	2.2	1.8	1.9

The PAGASA projections for the province of Batangas under the medium range scenario projected the average monthly temperature over the period of 2006–2035 will increase by 1.0°C to 1.2°C while temperatures for the period of 2036-2065 will increase by 1.8°C to 2.2°C. With these projections, the project site may experience temperature rise of 27.7 covering the period of 2006-2035 and 28.7 covering the period of 2036-2065 as shown in ***Table 2.3-7***. ***Figures 2.3-***

8 and ***2.3-9*** present the projected monthly average temperature with climate change (Tmean CC) and without climate change (Tmean base).

Table 2.3-7. Projected Seasonal Mean Temperature in 2020 and 2050 under Medium Range Emission Scenario in the Province of Batangas

Quarter	DJF	MAM	JJA	SON
Observed Baseline (1971-2000)				
Mean	24.2	26.5	25.9	25.6
With Climate Change Scenario (2006-2035)				
Mean	25.2	27.7	26.8	26.6
With Climate Change Scenario (2036-2065)				
Mean	26.1	28.7	27.7	27.5

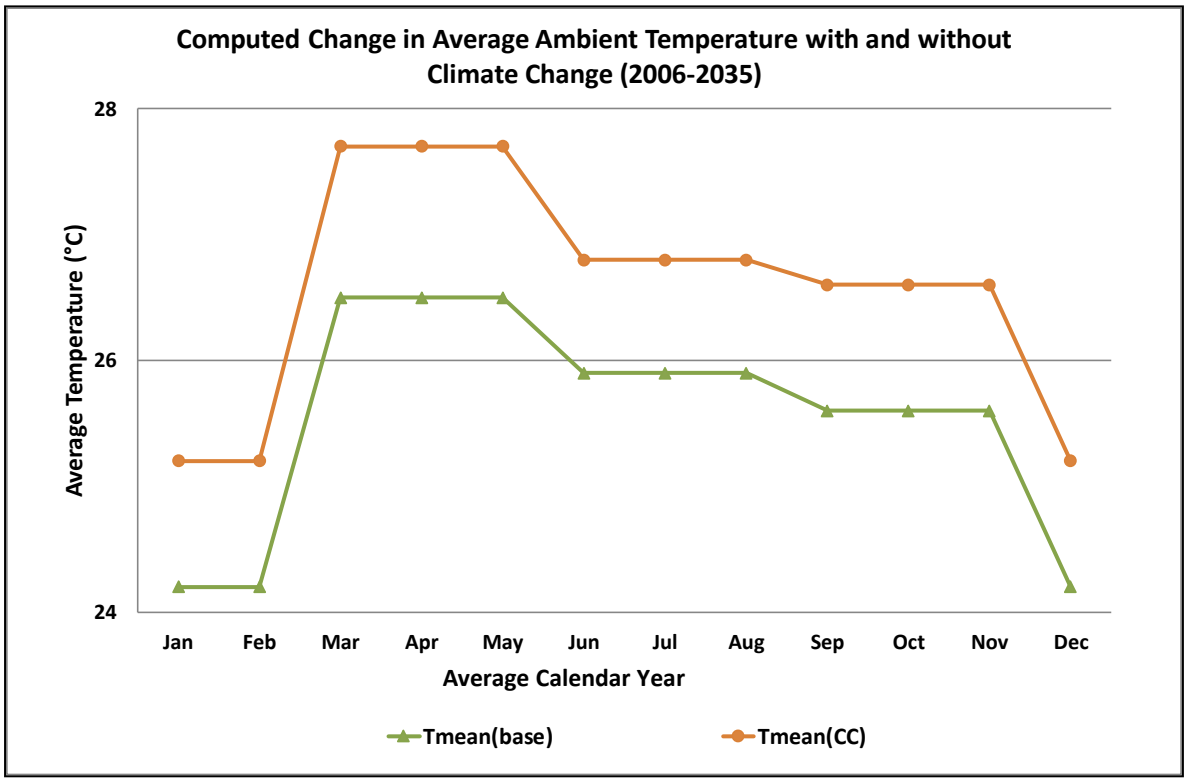


Figure 2.3-8. Change in Monthly Average Temperature for the Period 2006-2035

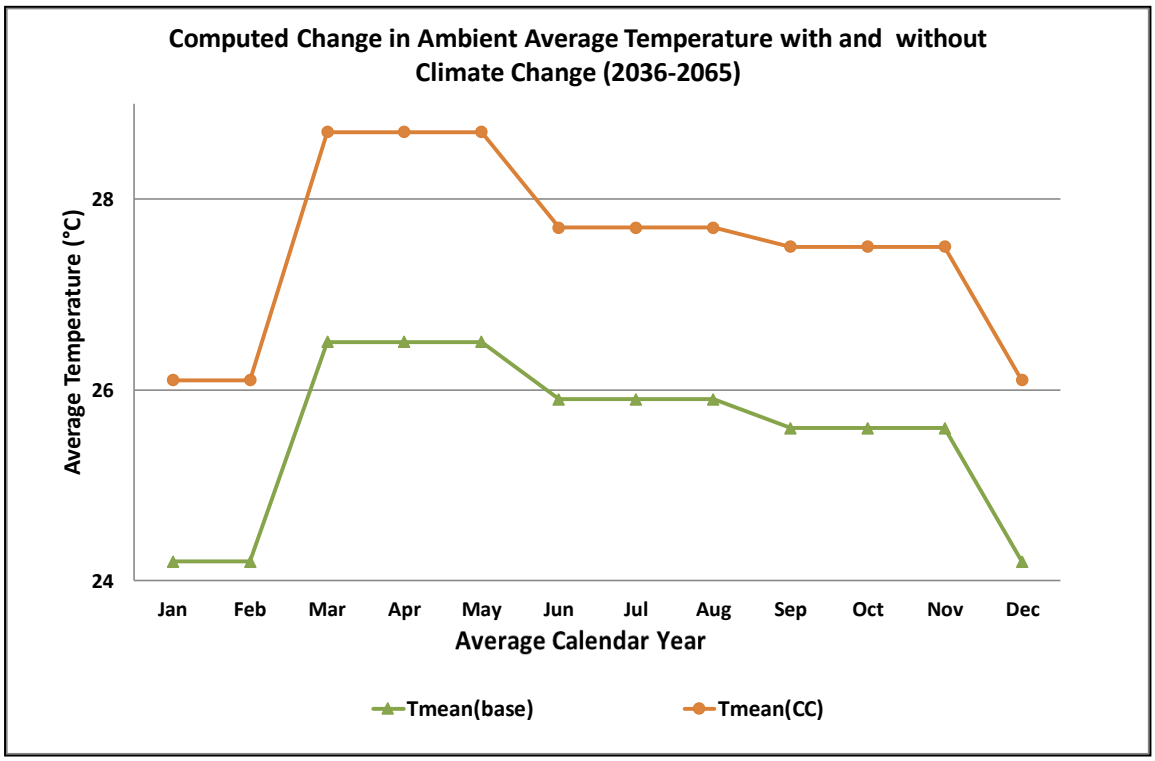


Figure 2.3-9. Change in Monthly Average Temperature for the Period 2036-2065

2.3.3.1.2 Rainfall Change

The PAGASA projection under medium range scenario in the province of Batangas showed a rainfall decrease and increase in 2020 and 2050 from the observed baseline data. ***Table 2.3-8*** present the seasonal rainfall change under medium range scenario.

Table 2.3-8. Seasonal Rainfall Change (in %) in 2020 and 2050 under Medium Range Emission Scenario in the Province of Batangas

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
Batangas	231	280.4	856.5	746.4	-29.9	-24.1	9.1	0.5	-11.1	-23.1	17.2	6.3

The PAGASA projections for the province of Batangas under the medium range scenario projected the average monthly rainfall over the period of 2006–2035 will decrease by 24.1 to 29.9% from December to May and it will increase by 0.5 to 9.1% from June to November; while the rainfall for the period of 2036-2065 will decrease by 11,1 to 23.1% from December to May and will increase by 6.3 to 17.2% from June to November.

Applying the rainfall change projection for 2020, the rainfall for the months of December to February will decrease by 61.1 mm and 67.6 mm for the months of March to May. However, a rainfall increase may happen during the months of June to August by 81.4 mm and 3.7 mm for the months of September to November. Moreover, the rainfall change for 2050 will decrease by 25.6 mm for the months of December to February and will further decrease to 64.8 mm for the months of March to May. For the months of July to August, a rainfall rise will happen by 147.3 mm which is the biggest rainfall increase and will further increase by 47 mm for the months of September to November which is shown in ***Table 2.3-9***. ***Figure 2.3-10*** present the projected monthly average rainfall with climate change scenario for 2006-2035 and 2036-2065.

Table 2.3-9. Projected Seasonal Mean Rainfall in 2020 and 2050 under Medium Range Emission Scenario in the Province of Batangas

Quarter	DJF	MAM	JJA	SON
Observed Baseline (1971-2000)				
Mean	231	280.4	856.5	746.4
With Climate Change Scenario (2006-2035)				
Mean	161.9	212.8	937.9	750.1
With Climate Change Scenario (2036-2065)				
Mean	205.4	215.6	1003.8	793.4

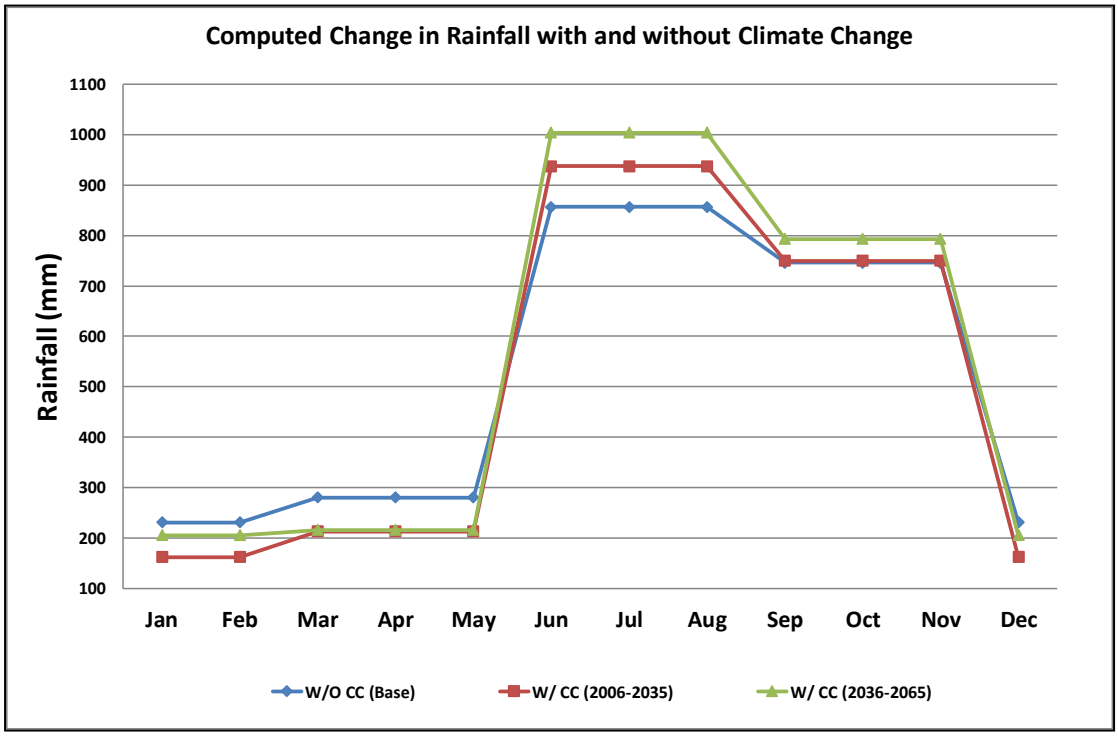


Figure 2.3-10. Projected Seasonal Mean Rainfall in 2020-2050

2.3.3.1.3 Frequency of Extreme Weather Events

Table 2.3-10 below shows the projected occurrences of extreme weather events in the province of Batangas under the medium-range scenario. Batangas will have 8,010 days with extreme or maximum temperature greater than 35°C while the number of dry days or days with rainfall less than 2.5 mm/day showed decreasing trend in both 2020 and 2050. The number of days with daily rainfall greater than 200 mm will increased by 133% in 2020 and 50% in 2050.

Table 2.3-10. Frequency of Extreme Events in 2020 and 2050 under Medium Range Emission Scenario in the Province of Batangas

Province	No. of days w/ Tmax >35°C			No. of Dry Days			No. of Days w/ Rainfall >200mm		
	OBS (1971-2000)	2020	2050	OBS	2020	2050	OBS	2020	2050
Batangas	928	8010	8016	8226	6081	6049	6	14	9

2.3.3.2 Impact Identification, Prediction and Assessment, and Mitigation

2.3.3.2.1 Pre-Construction and Construction Phase

2.3.3.2.1.1 Change in Local Climate

Variations in climate will affect the schedule of construction works, potentially delaying the progress of construction. Consideration of effects of climate variabilities will mitigate the delays in the work schedule.

The changes in the rainfall pattern and significant local temperature changes shall be included in the design criteria of the Project. Material selection and technologies to be used in the Project will take into consideration the effects of climate variations and the effects of extreme temperature changes to operating conditions of project components. The selection of the design temperature reflects an optimization of plant productivity, operational and capital costs based on historical conditions.

Workers' exposure to extreme local climate conditions may have negative effects to their health and compromise their safety and productivity. Climate variations shall have to be integrated to designing work policies, proper work clothing, equipment safety features, etc. to minimize health effects and work hazards for the workers.

2.3.3.2.2 Contribution in Terms of Greenhouse Gas Emissions

The project contribution in terms of GHG emissions during construction is 0.00063% which is considered a small contribution to the total anthropogenic CO_2 load.

The project will implement measures to minimize unnecessary CO_2 generation from construction activities. These are:

- Minimize vegetation removal and alteration of topography if possible;
- Implement regular inspection and preventive maintenance of heavy equipment, machineries and service vehicles to meet the DENR Emission Standard; and
- Use electric or fuel-efficient equipment, machineries and vehicles and maximize its operation if possible.

2.3.3.3 Operation Phase

2.3.3.3.1 Change in Local Climate

The Project will consider the temperature increase for 2020 and 2050 in their plant design. The selection of the design temperature reflects an optimization of plant productivity, operational and capital costs based on historical conditions.

The changes in the rainfall pattern will be included in the design criteria of the Project. Design improvement of the internal drainage system will be considered to accommodate storm water run-off during rainfall increase based on the PAGASA projection.

2.3.3.3.2 Contribution in Terms of Greenhouse Gas Emissions

The Project can be considered to be on the low-end greenhouse gas emitters based on its estimated CO_2 contribution. However, necessary measures shall be enforced to further minimize its possible impact. In addition, essential enhancement shall be implemented to lessen impact of climate change to the Projec

The necessary measures during operation shall be enforced including tree planting, energy/water conservation program implementation as well as:

- Planting of vegetation as much as possible to open areas at the facility and in the buffer zone.
- Energy/water conservation program such as use energy efficient products (i.e. LED lights) and carbon footprint monitoring.
- Regular inspection and proper maintenance of structural facilities, equipment, and machinery.

2.3.4 Air Quality and Noise

2.3.4.1 Ambient Air Quality

Ambient Air Quality is defined by RA 8749 as the general amount of pollution present in a broad area, and refers to the atmosphere's average purity as distinguished from discharge measurements taken at the source of pollution. An ambient air monitoring conducted by Mediatrix Business Consultancy last September 7-10, 2016 is used to characterized the ambient air quality at the project site and its vicinity. Further, ambient data from the monitoring station of High Street located in Phoenix Petroterminal & Industrial Park and Residential Area in Lumbang Calzada is also used as baseline data.

The ambient air monitoring covers the area of Barangays Lumbang Calzada, Salong, Talisay, Puting Bato West, Puting Bato East, and Sinisian, Calaca Batangas. Parameters measured at established stations are total suspended particulates (TSP), particulate matter less than 10-microns (PM_{10}), sulfur dioxide (SO_2), nitrogen dioxide (SO_2). Noise measurement was also conducted at the same stations.

Ambient air samples are collected using the prescribed standard method of sampling and analysis in DAO 2000-81, Implementing Rules and Regulations (IRR) of the Philippine Clean Air Act of 1999. The collected samples were brought to AERONICS Inc., a DENR recognized laboratory for analysis.

The locations of the monitoring stations are described in ***Table 2.3-11*** and shown in ***Figure 2.3-11***.

Table 2.3-11. Ambient Air Quality Monitoring Stations Descriptions and Coordinates

Sampling Station	Description	Coordinates	
		Latitude	Longitude
AAQ-1	Behind the house of Cecile Magsumbol, Brgy, Puting Bato East, Calaca	13°55'11.58"	120°50'28.18"
AAQ-2	Beside the house of Wilmar Bangalisan, Barangay Talisay, Calaca	13°54'50.71"	120°50'15.81"
AAQ-3	Beside the house of Merly Landicho, Brgy. Lumbang Calzada, Calaca	13°55'42.97"	120°49'29.43"
AAQ-4	Silangan, Barangay Salong Calaca	13°55'07.45"	120°49'10.45"
AAQ-5	At the open field in Brgy. Puting Bato West, Calaca	13°55'34.67"	120°50'02.45"
AAQ-6	Near SLTEC ash pond, Brgy. Sinisian, Calaca	13°54'46.39"	120°50'54.35"
AAQ-7	Phoenix Petroterminals and Industrial Park, Brgy. Lumbang Calzada, Calaca	13°55'32.65"	120°49'23.46"
AAQ-8	Residential Area, Baranggay Lumbang Calzada, Calaca	13°55'26.95"	120°49'43.86"

Source: Mediatrix Business Consultancy, 2016; SMR-High Street, 2017

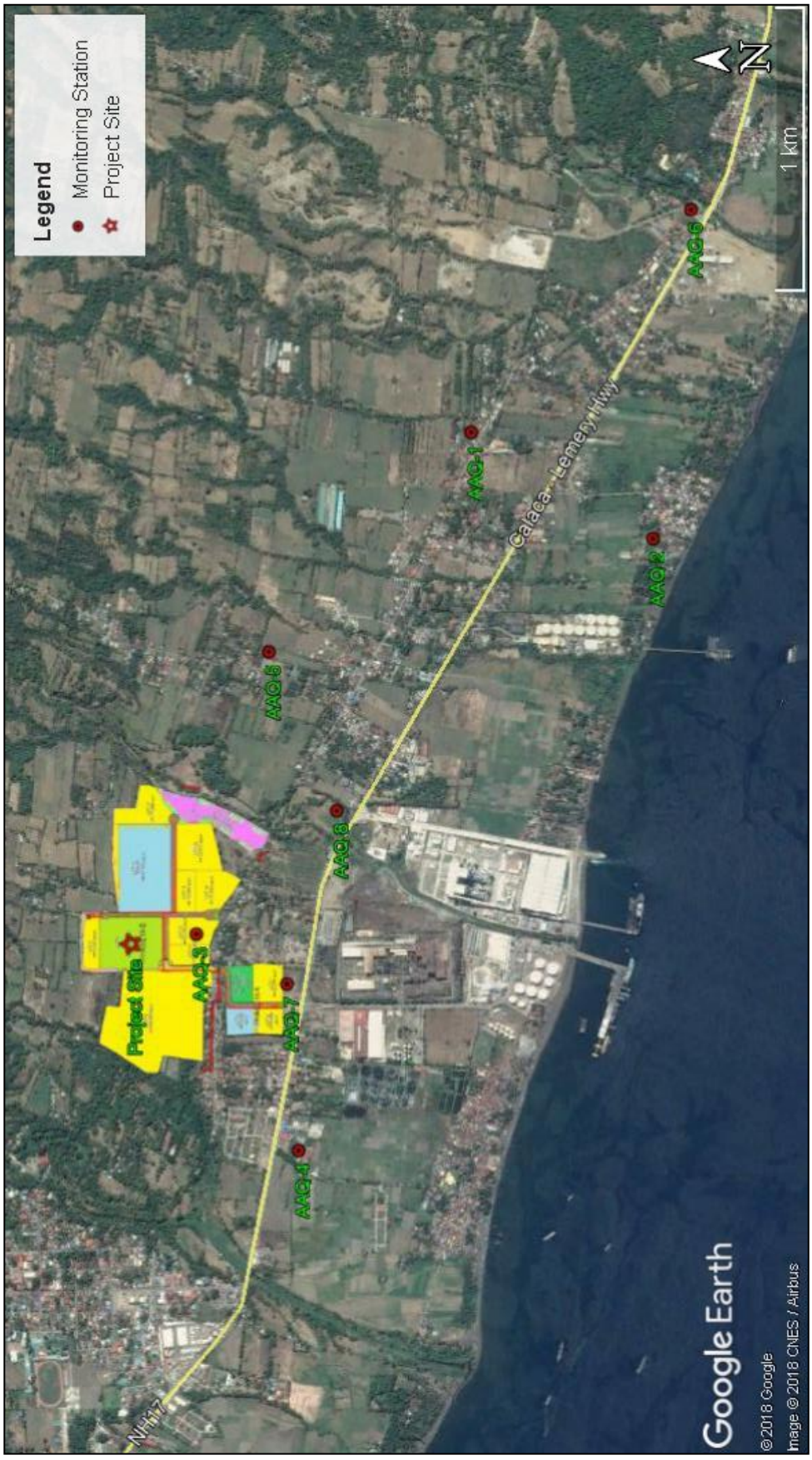


Figure 2.3-11. Map of Ambient Air Quality Monitoring Station

2.3.4.1.1 Criteria Assessment of Ambient Air Quality

The monitoring results of ambient air quality were compared with the National Ambient Air Quality Standard for Source Specific Air Pollutants (NAAQSSSAP) provided in the PCAA of 1999 for 1-hour averaging period. On the other hand, the 24-hour sampling results was compared with the National Ambient Air Quality Guideline Value (NAAQGV).

Table 2.3-12. Relevant Guideline Values for Ambient Air Quality

Pollutant	Averaging Period	NAAQGV ($\mu g/m^3$)	NAAQSSSAP ($\mu g/m^3$)
SO_2	1-hour	-	340
	24-hour	180	-
NO_2	1-hour	-	260
	24-hour	150	-
TSP	1-hour	-	300
	24-hour	230	-
PM_{10}	1-hour	-	200
	24-hour	150	-

2.3.4.1.2 Results and Analysis

Table 2.3-13 and ***Table 2.3-14*** present the results of air quality monitoring for 24-hour and hourly averaging period conducted on September 7-10, 2016. The results show the concentrations of particulates (TSP & PM_{10}), SO_2, and NO_2 for 24-hour averaging period are all below the CAA limit of 230 µg/Ncm for TSP; 150 µg/Ncm for PM_{10}; 150 µg/Ncm for NO_2; and 180 µg/Ncm for SO_2. All samples collected for hourly averaging time in all stations were also below the CAA limit of 300 µg/Ncm for TSP, 200 µg/Ncm for PM_{10}, 260 µg/Ncm for NO_2, and 340µg/Ncm for SO_2.

The highest concentration of TSP is 94 µg/Ncm recorded at AAQ-6, while the lowest concentration is 14 µg/Ncm recorded at AAQ-5. For PM_{10}, the highest concentration is 44 µg/Ncm recorded at AAQ-6 while the lowest concentration is 8 µg/Ncm recorded at AAQ-1 & AAQ-4. The highest concentration of SO_2 is 18 µg/Ncm recorded at AAQ-1 while the lowest concentration is 10 µg/Ncm recorded at AAQ-2 & AAQ-5. For NO_2, the highest concentration is 14 µg/Ncm recorded at AAQ-1 while the lowest is 6 µg/Ncm recorded at AAQ-2, AAQ-3, & AAQ-5.

Table 2.3-13. Results of 24-hour Ambient Air Quality Monitoring

Items	Description/Values

Sampling Station Date of Sampling Time of Sampling	AAQ-1 Sept. 7-8, 2016 0930H-0930H	AAQ-2 Sept. 8-9, 2016 1100H-1100H	CAA Limit (µg/Ncm)
TSP, (µg/Ncm)	62	59	230
PM_{10}, (µg/Ncm)	33	31	150
SO_2, (µg/Ncm)	18	15	180
NO_2, (µg/Ncm)	14	13	150

Table 2.3-14. Results of hourly Ambient Air Quality Monitoring

Items Sampling Station Date of Sampling Time of Sampling	Description/Values						CAA Limit (µg/Ncm)
	AAQ-1	AAQ-2	AAQ-3	AAQ-4	AAQ-5	AAQ-6	
	Sept. 9, 2016 1200H-1300H	Sept. 9, 2016 1435H-1535H	Sept. 9, 2016 1725H-1825H	Sept. 9, 2016 2025-2125H	Sept. 10, 2016 0840H-0940H	Sept. 10, 2016 1035H-1135H	
TSP, (µg/Ncm)	15	15	18	16	14	94	300
PM_{10}, (µg/Ncm)	8	9	9	8	9	44	200
SO_2, (µg/Ncm)	11	10	11	11	10	13	340
NO_2, (µg/Ncm)	7	6	6	7	6	11	260

2.3.4.1.3 Impact Identification, Prediction and Assessment, and Mitigation

2.3.4.1.3.1 Pre-construction and Construction Phase

Due to the nature of construction process, emissions will not be constant and will fluctuate based on operating periods and the combination equipment to be used at any one time. Intensive construction activities will not be generally carried out at night time. Potential receptors such as residents will not be continually exposed during construction for extended period and limited daily exposure.

The major sources of impacts on air quality by the Project in the construction phases are as follows:

- Exhaust emission from movement of equipment by vehicles, excavated soil carrying by vehicle and other heavy loaders;
- Earthworks including excavation activities;
- Site clearance including removal of topsoil at the construction site;
- Construction site's generation of dust from construction materials, waste, loose earth, and moving excavated material and transporting wastes on vehicles;
- Use of diesel-based construction machineries which may cause huge air quality impacts; and
- Loading and unloading of construction materials.

2.3.4.1.3.2 Dust Generation

The construction activities will generate dust from the removal of top soil and the excavation of earth for footing foundation lay-out of the buildings. The expansion of impacts from dust will depend on the location of construction activities and types of vehicles. Weather also plays an important factor for dust generation. Stronger winds and dry condition will increase the transfer of dust, whereas damp or wet conditions will reduce the impact.

Transportation of earth and establishment of the material will involve use of heavy machinery like compactors, rollers, water tankers, and dumpers. This activity is machinery intensive resulting in dust and gaseous emissions generation. However, this activity will only be short-term and the air pollution during construction is localized and only around the project site only.

The following are the proposed mitigating measures:

- Minimize alteration of topography and removal of vegetation to lessens earthworks;
- Conduct regular cleaning and clearing of construction access /sites and the surfaces of spoils and debris from construction equipment and vehicles and wetting of ground soil in the construction site when necessary;
- Store excavated materials at designated disposal area. Stock pile construction and trucks loaded with spoils shall be covered;
- Undertake daily cleaning of paved routes around the construction sites;
- Control vehicle movement maintaining the speed limit within the construction site to <10kp;
- Store excavated materials outside road reserve, but where there is no area, spoils shall be loaded and transported immediately; and
- Plant vegetation on bare ground as early as possible and create vegetated buffer zone where possible.

2.3.4.1.3.3 Exhaust Generation

Transportation of construction materials and excavated soil by trucks that use diesel for fuel will cause impacts on ambient air quality. Operation of construction machineries will cause exhaust gas emissions. However, the air quality impacts associated with the vehicular and operational equipment emissions during construction activities will be less significant as the construction period will be short term.

The proposed mitigating measures are as follows:

- Undertake regular preventive maintenance of heavy equipment, machineries and service vehicles to meet the DENR Emission Standards. Wherever possible, use electrically-powered equipment;
- Minimize vehicle transport by maximizing the use of site-generated materials.

Air quality will be monitored at identified baseline sampling point including nearby sensitive receptors (residential, school and hospital areas) including ecologically significant area/s (if any) likely to be affected by the operation and evaluate effectiveness of the air pollution reduction measures. Monitor actions on complaints, if any, based on Grievance Redress Mechanism.

2.3.4.1.4 Operation Phase

The Project production process will only involve clinker and other Non-metallic material (e.g. Limestone, gypsum, and pozzolanic material) grinding to final product cement, and will be packed into 40 kg bags, one (1) Ton Cement Bags, or directly to Bulk Trucks.

2.3.4.1.4.1 Cement Milling, Storing, Packing, and Dispatching

Clinker together with cement additives such as limestone, gypsum and pozzolan will pass through a proportioning weigh feeder, the proportioned materials will then feed to the ball mill through a common belt conveyor. The pulverized material will pass through a separator in which the course particles and the fine particles will separated. The course particles will be re-circulated back to the mill through the reject conveyor for further grinding. The fine particles together with the dry particulates that are captured on the fabric filter of dust collector system which periodically falls to the collection hopper will be transported to the cement silos through an air slide and bucket elevator.

The product cement is directly conveyed to the cement silos for homogenization. The homogenized cement will be withdrawn from cement silos through a pneumatic positioner, conveyed through an air slide and bucket elevator and distributed to the different roto-packing bins.

Cement is packed to a 40-kilogram cement bags and 1 tonner cement bags. It is also dispatched by bulk depending upon the customers preferences. Packing of 40-kilogram cement bags is done by an automatic roto packing machine then down to a receiving belt conveyor and a telescopic conveyor for dispatching. Packing machine overflow is reclaimed by screw conveyor through a bucket elevator and returned to the distributing bins. Transfer points are equipped with dedusting connected to the dust collector system. Collected materials from dust collector are returned to the bins.

Bags of cement (40 kilogram or 1 tonner) will be transported through trucks stockpiled in a pallet going to the local market. For bulk loading, cement is withdrawn from bulk bins and transported by trucks. All of these activities and processes produces particulates that will impact to the surrounding environment.

Particulate matter is emitted from mill vents, air separator vents, and material-handling system vents. The plant is equipped with pulse-jet fabric filters with high-efficiency separators. The cement dust collected by the fabric filter is restored to the system. In cold weather, a plume may develop at the baghouse vent; this may be mistaken for particulate matter, but actually is condensed water vapor from the cooling system.

In the cement packing and loading, particulate matter is emitted from the silos and the handling and loading operations. Active and passive fabric filters are used to collect this dust. In the same manner, all sections in the cement packing and loading are fitted with pulse-jet dust collectors to ensure dust-free operation.

Adopting the following pollution prevention measures to minimize air emissions;

- Install equipment covers and filters for crushing, grinding, and milling operations.
- Use enclosed adjustable conveyors to minimize drop distances.
- Wet down intermediate and finished product storage piles.
- Operate control system to achieve the required emissions levels.
- Develop a strong unit or division to undertake environmental management responsibilities.

2.3.4.1.5 Air Dispersion Modeling

The potential air quality impacts of the facility were based on an estimate of the air emissions and the modeling of their dispersion in the atmosphere. The only pollutant of importance that is

released from the facility is particulates specifically particulate matter less than 10-microns (PM_{10}) and particulate matter less than 2.5-microns ($PM_{2.5}$).

2.3.4.1.5.1 Air Dispersion Modeling Methodology

Air dispersion models use mathematical and numerical techniques to simulate physical and chemical processes that affect air pollutants as they disperse and reach the atmosphere. Several factors impact the fate and transport of pollutants in the atmosphere including meteorological conditions, site configuration, emission release characteristics, surrounding terrain, among others.

The Environmental Management Bureau, Memorandum Circular 2008-03 "Guidelines for Air Dispersion Modeling" uses a tiered approach in assessing air contaminants concentrations against the PCAA of 1999 air quality guidelines and standard. The tiered approach follows the US Environmental Protection Agency (USEPA) that includes:

- Screening-level dispersion modeling techniques conducted using worst-case input data rather than site-specific data, and
- Refined level dispersion modeling techniques conducted using site specific meteorological data or derived regional meteorological data.

A fundamental assumption of the tiered approach to model selection is that the simpler modeling techniques always yielded more conservative results. It is assumed that screening level models would always predict higher ground-level concentrations than refined modelling techniques, and that the refined models would predict higher impacts than the 'best-estimate' models[1].

2.3.4.1.5.2 Method used to Estimate Emissions from the Proposed Project

Emission estimates are based on the emission factors in the US EPA AP-42 Compilation of Air Pollutant Emission Factor. PM_{10} emission rates are derived from the relevant sections of AP-42 (Section 11.6 – Cement Manufacture; Section 11.12 – Concrete Batching; Section 11.19.2 – Crushed Stone Processing; Section 13.24 – Aggregate Handling and Storage Pile; and Section 13.2.1 – Fugitive Sources: Paved Roads). A PM_{10} emission factor for clinker grinding was not available therefore, emission factor for PM was used. PM_{10} emission factor for cement silo is also not available therefore, unloading cement to elevated silos in a concrete batch plant was used. This assumption will result in a higher estimate since the mass of PM would be greater than PM_{10}. The general equation to calculate emissions using emission factor from AP-42 are shown below.

Equation 1:

$$E = A \times EF \times (1-(EC/100))$$

Where:
E = emission rate
A = activity rate (tons/hr)
EF = emission factor (lb/1000 gal burned)
EC = efficiency of air pollution control device (%)

Particulate emissions would also arise from the movement of vehicles delivering raw materials and transporting the final product over roadways within the plant. An equation below is used to calculate emission factor for vehicles traveling on paved road.

[1]MC 2008-003 "Guidelines on Air Dispersion Modeling", December 2008

Equation 2:

$$E = k \times (sL/2)^{0.65} \times (W/3)^{1.5} - C$$

Where:
E = particulate emission factor
k = particle size multiplier for particle size range (k=4.6 g/VKT)
sL = road surface silt loading content (g/m^2)
W = vehicle average weight (ton)
C = emission factor for vehicle fleet exhaust, brake & tire wear (0.2119)

Dust emissions will also occur during the loading and unloading of materials onto storage piles, disturbance of the pile and the movement of trucks in the storage pile. The quantity of dust emissions depends on the volume of material passing through the storage cycle and on the age of the pile, moisture content and proportion of aggregate fines (AP-42 Section 13.2.4). The emission factor is calculated using the equation below:

Equation 3:

$$E = k \times (U/2.2)^{1.3} / (M/2)^{1.4}$$

Where:
E = emission factor (kg/Mg)
k = 0.0016
U = mean wind speed (m/s)
M = moisture content (0.7% for limestone; 5% for gypsum; and 0.5% for clinker)

2.3.4.1.5.3 Modeling Assumptions

The following assumptions are used in calculating emission rates for PM_{10} during operation:

- A 30-ton truck capacity for raw materials delivery and 10-ton capacity to receive products.
- Trucks traveling at 10 mph inside the plant for a total round-trip distance of 0.35 km.
- Road surface silt loading of 12 g/m^2.
- Source Classification Code of Stone Quarrying Processing is used for the loading, crushing and transfer of raw materials to the cement mill (Grinding Mill Feed Belt and Finish Grinding Mill Weigh Hopper).
- PM emission factor is used in the absence of PM_{10} emission factor.
- Baghouse flow rate 6400 m^3/hr
- Cement silo flow rate 3228 m^3/hr

These assumptions are considered highly conservative that will give higher concentration in the modeling result.

Delivery of raw materials and frequency of truck trips and duration provided by the Mabuhay Filcement Inc. (MFI) is shown in ***Table 2.3-15*** below.

Table 2.3-15. Number of Delivery Trucks, Frequency, and Trips

Materials	Delivery Frequency	Number of Delivery Trucks	Number of Trips
Clinker	Twice a month	20	24
Gypsum	Once a month	10	24
Limestone	Daily	7	3
Pozzolan	Daily	10	3
Fly Ash	Daily	2	12

Cement (Finished Products)	Daily	160	Full operation

Source: MFI

2.3.4.1.5.4 Emission Rates Estimates

The sources and the estimated emission rate for each type of source are summarized in ***Table 2.3-16***. Assuming the plant will operate 8 hours per day and 330 days per year. Emission rates were estimated for the plant operating at maximum capacity of 8800 tons/day cement. The cement composition is assumed to be 80% clinker (7040 t/d); 15% gypsum (1320 t/d); and 5% limestone (440 t/d).

The emissions from clinker grinding and cement silos are treated as the point sources due to the presence of filter baghouses while the other emissions are treated as area sources.

Table 2.3-16. Calculated Emission Rates using USEPA AP-42

Activity	Emission Rate (g/s)		Gas Velocity (m/s)	Exit Temperature (°C)	Equivalent stack height above the ground (m)	Equivalent stack diameter (m)
	PM10	PM2.5[a]				
Point Sources						
Cement Mill	1.18E-05	8.26E-06	14.20	27	3	0.8
Cement Silo	6.72E-06	4.70E-06	7.2	27	12	2
Activity	**Emission Rate ($g/s\text{-}m^2$)**		**Equivalent Length (m)**	**Equivalent Width (m)**	**Covered Area (m^2)**	**Distance travelled (m)**
	PM10	**PM2.5[a]**				
Area Sources						
Materials Handling and storage piles (raw materials)	8.24E-05	5.77E-05	56	18	1008	144
Vehicle traffic on paved road (Raw materials)	4.74E-04	3.32E-04	63	31	3212	101
Vehicle traffic on paved road (Cement)	9.12E-05	6.38E-05	54	17	918	90

Note: a – $PM_{2.5}$ assume to be 70% of PM_{10}; Source: Atmospheric Environment; Relationship between size segregated mass concentration, January 1999

2.3.4.1.5.5 Screening Model (Tier 1)

The SCREEN3 model was developed to provide an easy-to-use method of obtaining pollutant concentration estimates. The model was used to simulate the ambient concentrations of particulates (PM_{10} & $PM_{2.5}$) using default meteorological condition to model an emission from area source. SCREEN3 will only model one source at a time for a site with multiple sources. Model runs were performed using rural area and for flat terrain option. The model inputs are summarized in ***Table 2.3-16***.

SCREEN3 model outputs are given in 1-hour average concentration only. In order to achieve a 24-hour average, the model outputs were multiplied by 0.4 which is the recommended factor to convert 1-hour average concentration to the equivalent 24-hour average (MC-2008-003).

2.3.4.1.5.5.1 SCREEN3 Modeling Results

The ground level concentrations of modeled parameters (PM_{10} and $PM_{2.5}$) are above the CAA limits for 1-hour and 24-hour averaging period. The result also exceeded the 50% of the EMB guideline criteria (GLC/CAA of MC-2008-003). Therefore, the modeled parameters are subject for Tier 4 modeling to further assess this finding. The SCREEN3 Modeling Output files are provided in ***Annex 4***.

Table 2.3-17. Summary of Modeling Results (SCREEN3)

	1-hr Maximum Predicted Concentration (µg/m³)		24-hr Maximum Predicted Concentration (µg/m³)	
	PM_{10}	**$PM_{2.5}$**	**PM_{10}**	**$PM_{2.5}$**
Point Source				
Cement Mill	0.691E-02	0.484E-02	2.764E-03	1.936E-03
Cement Silo	0.542E-03	0.378E-03	2.168E-04	8.672E-05
Area Source				
Materials Handling and storage piles (raw materials)	1207	845	483	338
Vehicle traffic on paved road (Raw materials)	12240	8576	4896	3430
Vehicle traffic on paved road (Cement)	1260	882	504	353
Total Emissions	**14707**	**10303**	**5883**	**4121**
CAA Limit	200	150	50	25
GLC/CAA	7353%	6869%	11766%	16484%

2.3.4.1.6 Refined Dispersion Modeling

2.3.4.1.6.1 AERMOD Model (Tier 4)

The MC 2008-003 (Tier 4) adopted the use of American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD). AERMOD was developed to replace the Industrial Source Complex Short-Term Version 3 (ISCST3) model. AERMOD includes a state-of-the science downwash algorithm and utilizes AERMET, a meteorological data processor that utilizes current planetary boundary layer theory to calculate the dispersion coefficients (σy and σz).

The most current version of AERMOD (Version 9.6.5) model is used in this study to estimate maximum off-property concentrations of pollutants at three vertical levels. In this analysis, modeling with AERMOD is performed using the regulatory default option.

2.3.4.1.6.2 Modeling Domain

Dispersion modelling domain is 8km x 8km centre of the project site with a grid interval of 500 meters. A nested grid is included with an interval of 200 meter centred of the project site extending 6km x 6km. A more refined grid of 4km x 4km centred of the project site with an interval of 100 meter is also included. ***Figure 2.3-12*** show the modeling domain; and Figure 2.3-13 is the cartesian grid in the modelling domain.

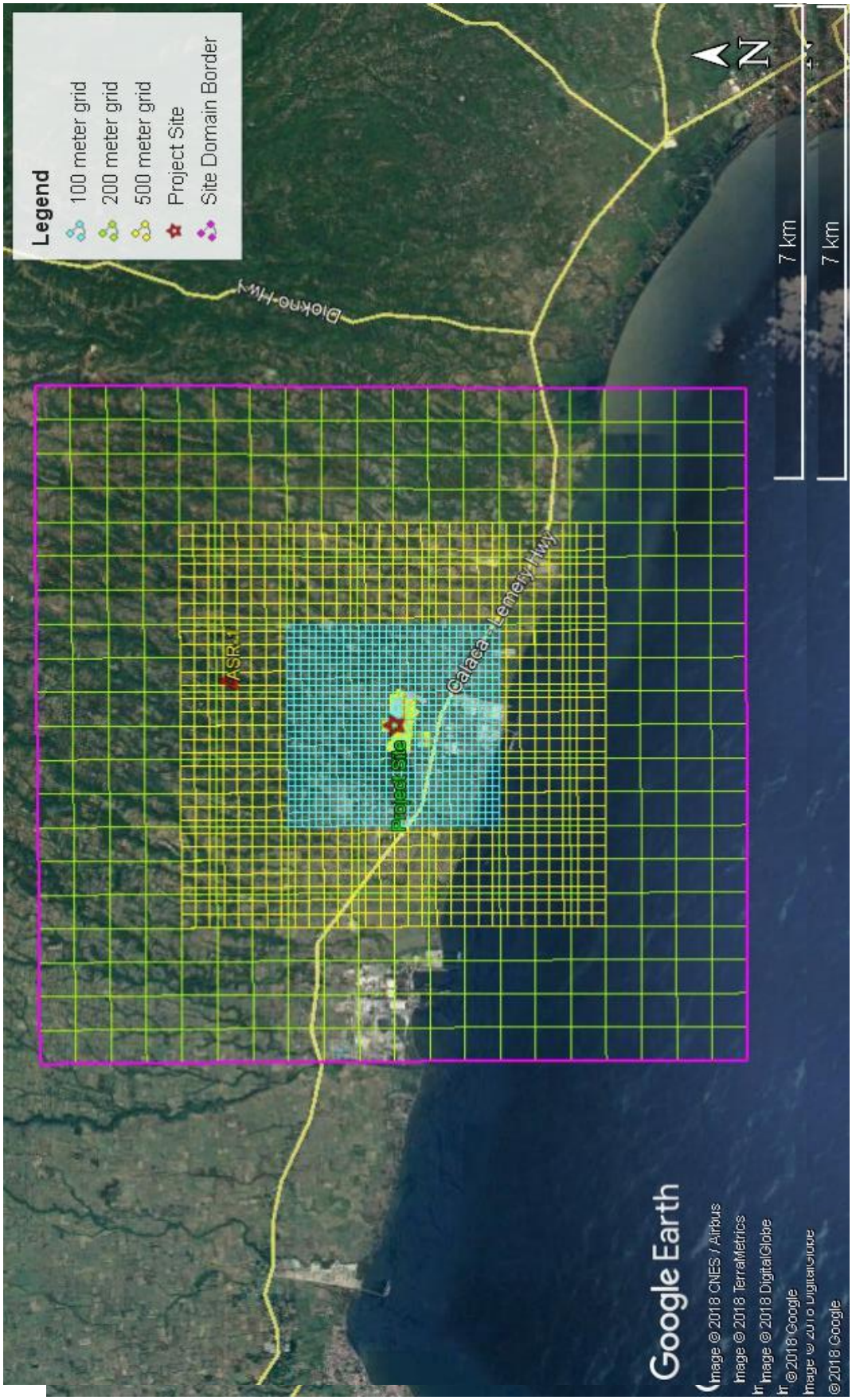


Figure 2.3-12. 8km x 8km Modeling Domain

Air Sensitive Receptors (ASRs) within the Modeling Domain

The location of any particular air sensitive receptors such as residences, schools and hospitals used in the modelling is provided in ***Table 2.3-18*** and the locations of the sensitive receptors are shown in the figure below. The air sensitive receptors were initially identified using Google Earth satellite imagery.

Table 2.3-18. Description, and Location of Area Sensitive Receptors

Station	Description	Distance from the source (m)	Direction from the source (m)	Coordinates	
				Easting (m)	Northing (m)
ASR-1	Residential Area Barangay Salong	786	W	264214.22	1539923.91
ASR-2	Residential Area Barangay Camstilisan	2,164	W	261833.51	1540359.03
ASR-3	Calaca Public Market	1,738	WNW	263495.93	1540969.71
ASR-4	Calaca Elementary School	2,004	NW	263525.49	1541434.40
ASR-5	St. Raphael Parish Church Calaca	1,904	NW	263796.94	1541541.62
ASR-6	Residential Area Barangay Lumbang Calzada	885	NNW	264529.78	1540819.34
ASR-7	Residential Area Barangay Talisay	719	NE	265679.55	1540320.63
ASR-8	Residential Area Barangay Talisay	724	SE	265508.21	1539549.55
ASR-9	Residential Area Barangay Sinisian	2,184	ESE	267084.05	1539411.81
ASR-10	Residential Area Barangay Talisay	1,704	SW	266452.44	1539166.18

Figure 2.3-13. Cartesian Grid in the Modeling Domain

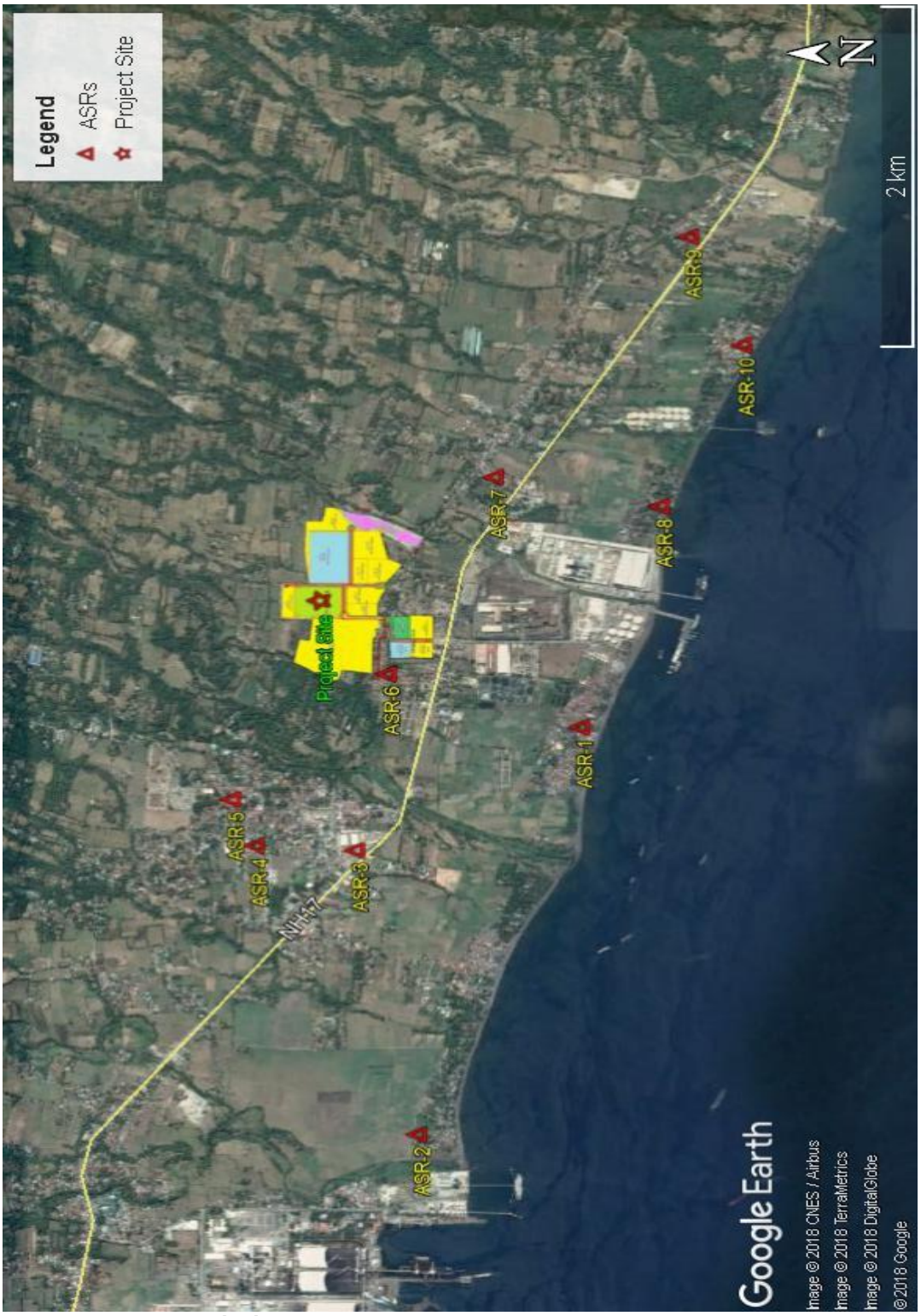


Figure 2.3-14. Location of Area Sensitive Receptors

2.3.4.1.6.3 Emission Inventory

An emission inventory used to run AERMOD Model is tabulated in ***Table 2.3-16***. Parameters modeled is particulates (PM_{10} $PM_{2.5}$) emission.

2.3.4.1.6.4 Modeling Results

The maximum predicted ground level concentrations from the operation of the proposed project is shown in the table below (***Table 2.3-19***) using the meteorological data from PAGASA Ambulong Station for the period January 1 – December 31, 2017.

The overall summary of the predicted concentrations, i.e. maximum modeled concentrations is provided in the table below. The predicted peak 1-hour and 24-hour emissions of particulates (PM_{10} and $PM_{2.5}$) are within the CAA limit. The highest ground level concentrations of PM_{10} and $PM_{2.5}$ for 1-hour averaging period in the whole modeling domain falls at coordinates 265158.56 m E; 1541328.05 m N. while the 24-hour averaging period falls in coordinates 265058.56 m E; 1541528.05 m N. at approximately 290 m and 430 m, respectively northeast of the Project which are both occurred in Barangay Lumbang Calzada, Calaca.

The selected output files of the model run are attached in ***Annex 5.***.

In the succeeding figures are the isophlets of each modeled parameter corresponds to its averaging periods.

Table 2.3-19. Summary of Modeling Results

Maximum Predicted Ground Level Concentration (µg/m^3)					
Receptor ID	**PM_{10}**			**$PM_{2.5}$**	
	1hr	**24hr**	**1yr**	**24hr**	**1yr**
98th Percentile	42.31	18.57	4.20	13.01	2.94
ASR-1	8.39	0.72	0.22	0.50	0.02
ASR-2	14.81	1.26	0.65	0.88	0.08
ASR-3	16.11	2.13	1.14	1.49	0.26
ASR-4	14.51	2.62	1.67	1.83	0.52
ASR-5	26.52	7.23	4.62	5.05	1.38
ASR-6	33.11	2.18	0.91	1.53	0.10
ASR-7	23.21	1.60	0.44	1.12	0.05
ASR-8	18.30	0.93	0.47	0.65	0.04
ASR-9	1.68	0.10	0.05	0.07	0.003
ASR-10	15.32	1.26	0.54	0.88	0.05
NAAQGV:	**-**	**150**	**60**	**50**	**25**
NAAQSSSP:	**200**	**-**	**-**	**-**	**-**

Isopleths

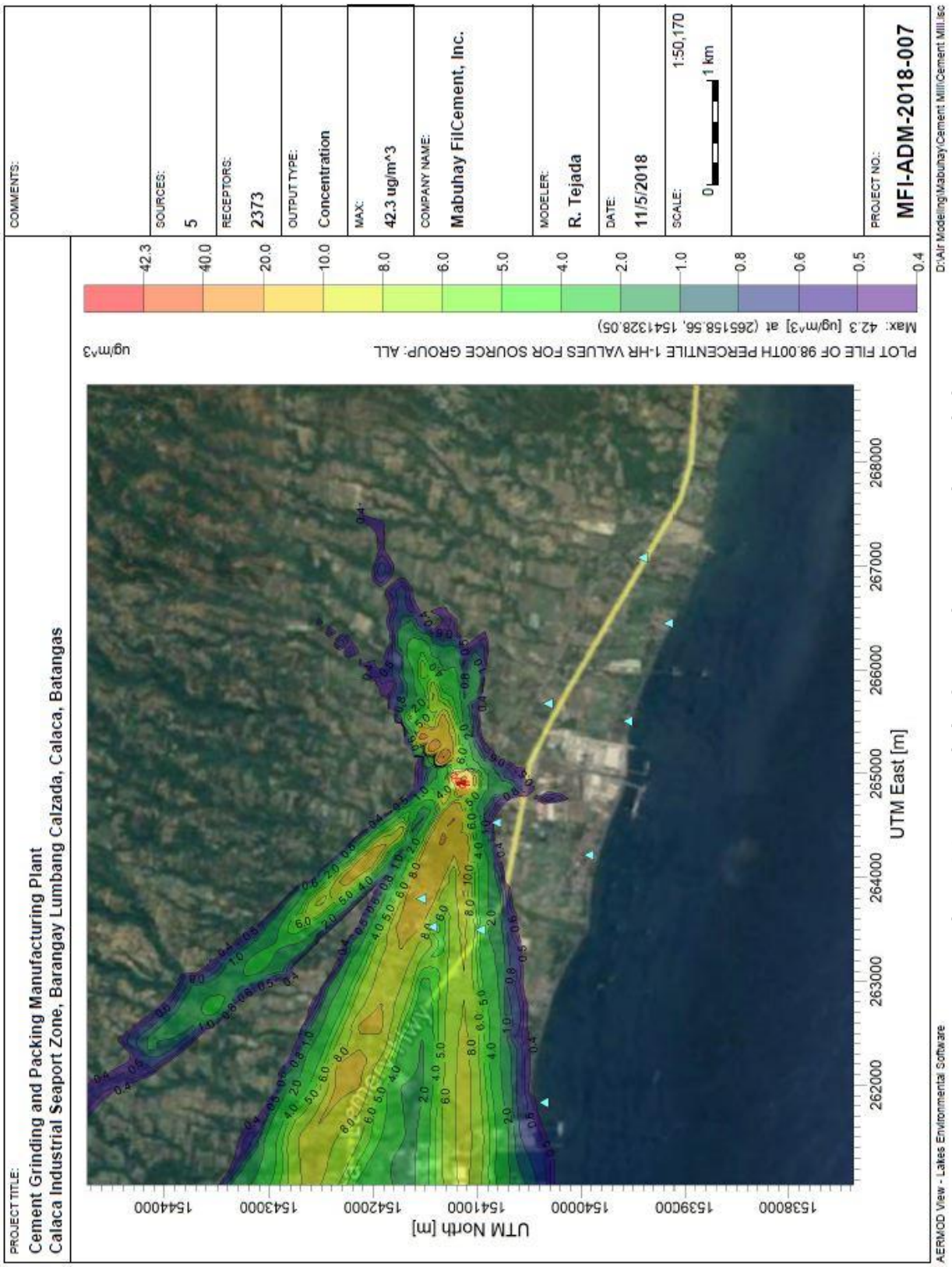


Figure 2.3-15. Isopleth of PM_{10} 1-hour Averaging Period

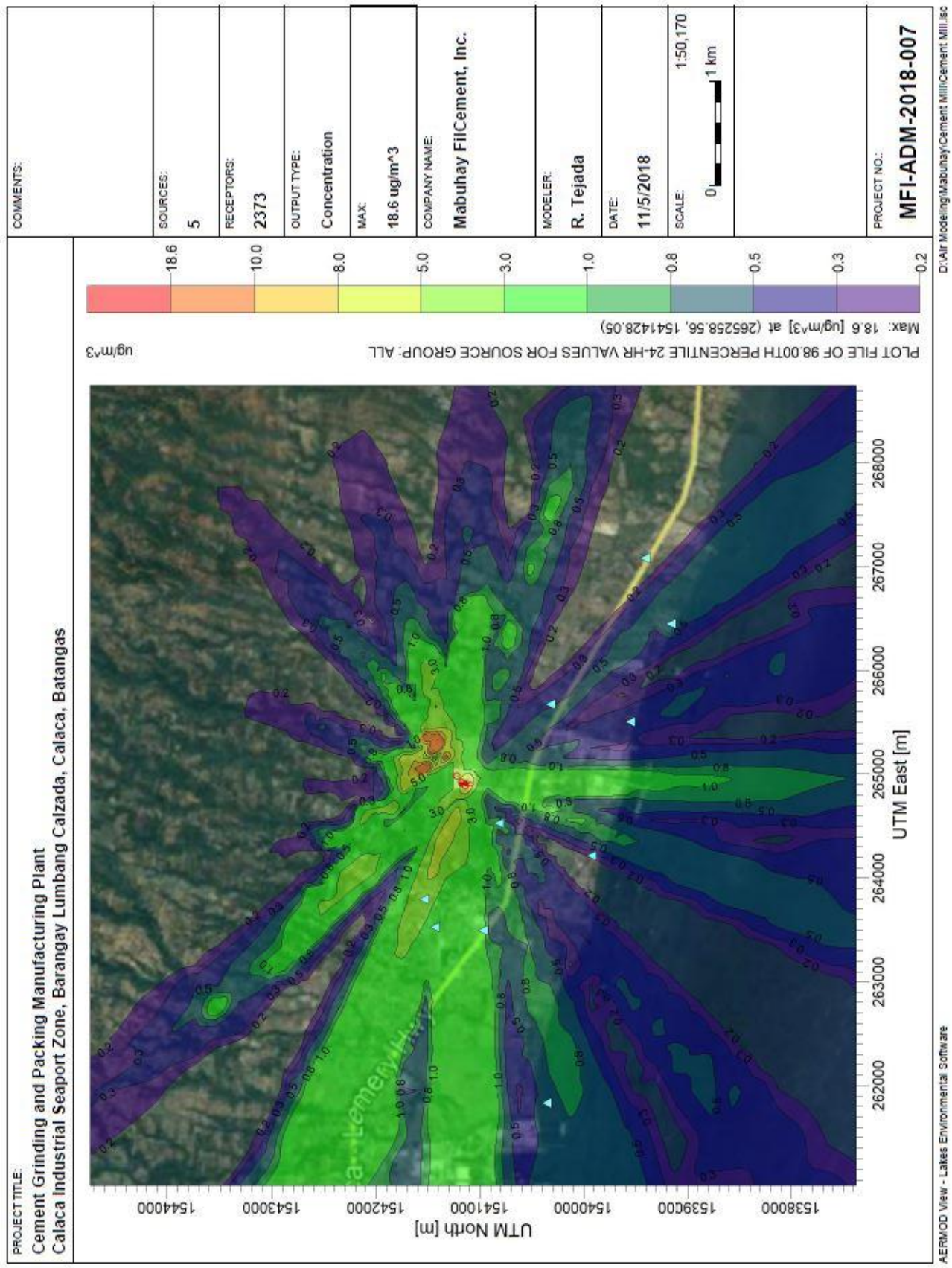


Figure 2.3-16. Isopleth of PM_{10} 24-hour Averaging Period

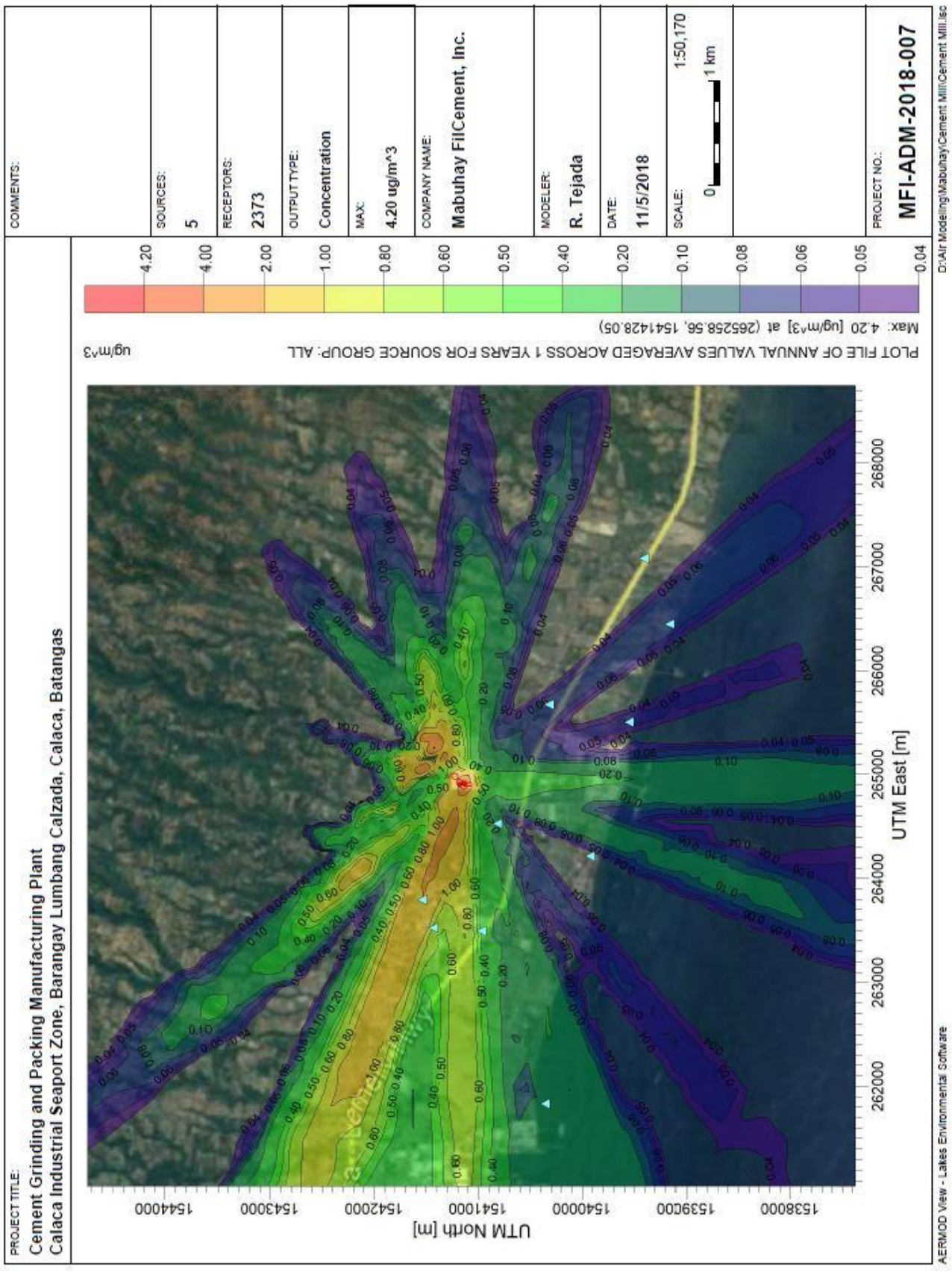


Figure 2.3-17. Isopleth of PM_{10} Annual Averaging Period

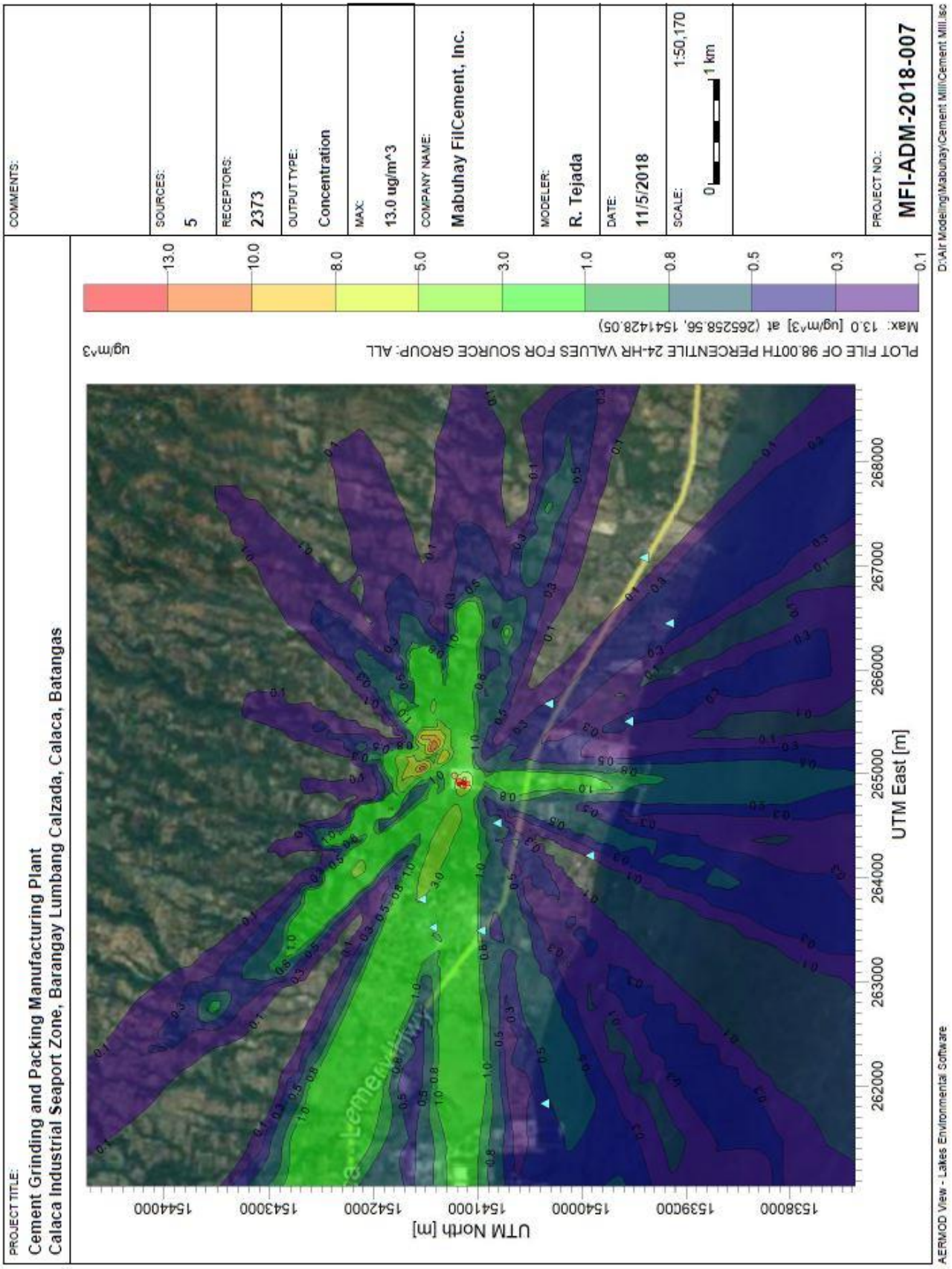


Figure 2.3-18. Isopleth of $PM_{2.5}$ 24-hour Averaging Period

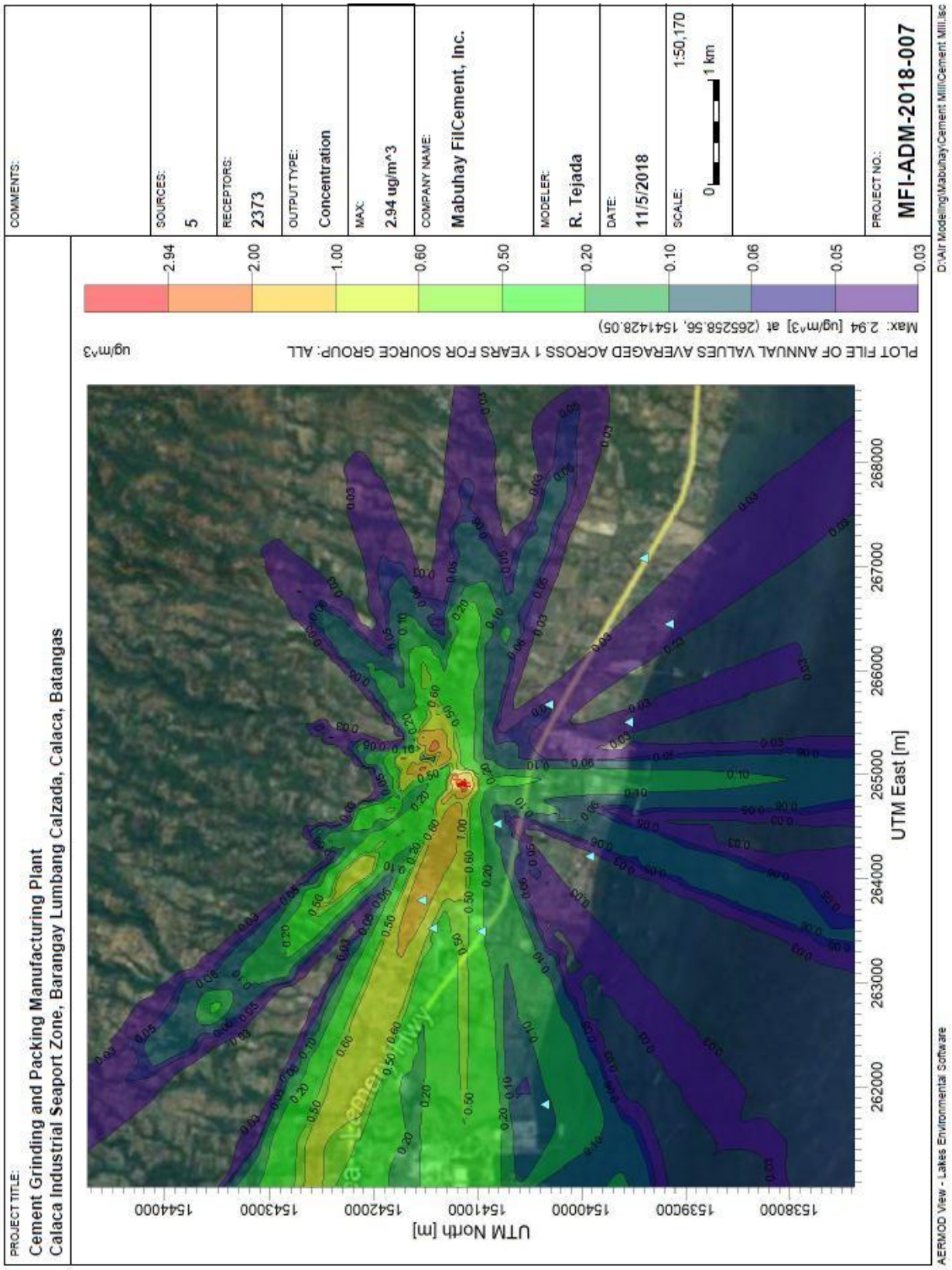


Figure 2.3-19. Isopleth of $PM_{2.5}$ Annual Averaging Period

2.3.4.2 Noise Quality

2.3.4.2.1 Ambient Noise Level

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.

Field Survey

Noise level measurement was conducted in six (6) sampling locations. The measured noise level from the established stations is used to represent the baseline data of the project. The noise monitoring station is the same as the ambient air station. Refer to ***Tables 2.3-13*** and ***Figure 2.3-10*** which shows the station identification and the geographical position.

Criteria Assessment for Noise Quality

The measured noise levels were compared to the 1978 National Pollution Control Commission Rules and Regulations under Section 78, Table 1, Environmental Quality Standards for Noise in General Areas as amended by the NPCC Memorandum Circular No. 1980-002. The noise standards are set according to land use and time of day as can be seen in the table below.

Table 2.3-20. Noise Standard in General Areas

Class	Maximum Allowable Noise Level, (dB)		
	Daytime	Morning/Evening	Nighttime
AA	50	45	40
A	55	50	45
B	65	60	55
C	70	65	60
D	75	70	65

Notes:

Morning	0500H – 0900H
Daytime	0900H – 1800H
Evening	1800H – 2200H
Nighttime	2200H – 0500H

AA	-	a section or contiguous area which requires quietness, such areas With 100m from sites, nursery schools, hospitals and special homes for the aged.
A	-	a section or contiguous areas which is primarily used for residential purposes
B	-	a section or contiguous areas which is primarily a commercial area
C	-	a section primarily reserved as a light, industrial area
D	-	a section which is primarily reserved as a heavy industrial area

Noise Level Measurement Result

The noise monitoring results have found to be within the limit of 55 dBA for daytime; 50 dBA for morning/evening; and 45 dBA for nighttime as compared to the allowable noise standards in Section 78, Table 1 of the 1978 NPCC Rules and Regulations, Environmental Quality Standard for Noise in general areas as amended by NPCC Memorandum Circular No. 1980-002. Table 2-3-16 present the results of noise level monitoring conducted from September 7-10, 2016 at the monitoring stations described in ***Table 2.3-11***.

Significant noise was contributed by vehicles plying near the stations which were situated in populated communities, with houses close to each other. Cars, Jeepneys, Motorcycles and tricycles were the main modes of transportation in the area. There were also few trucks passing along the main road.

During sampling, there were also activities that contribute to the noise levels measured, like youths playing games, karaoke singing, etc. Activities like these are part of the community culture and so they were considered valid for inclusion in the measurement of baseline noise data.

Table 2.3-21. Results of Noise Level Measurement

Station	Period	Date	Time	Median SPL db(A)	DENR Noise Level Standard dB(A)
STN-1	Morning	Sept. 8, 2016	0625H-0640H	33.7	45
	Daytime	Sept. 7, 2016	0935H-0950H	33.8	55
	Evening	Sept. 7, 2016	1900H-1915H	35.6	50
	Nighttime	Sept. 7, 2016	2230H-2245H	26.1	45
STN-2	Morning	Sept. 9, 2016	0815H-0830H	34.6	50
	Daytime	Sept. 8, 2016	1310H-1325H	34.5	55
	Evening	Sept. 8, 2016	2005H-2020H	31.1	50
	Nighttime	Sept. 8, 2016	2245H-2300H	28.9	45
STN-1	Daytime	Sept. 9, 2016	1155H-1210H	31.3	55
STN-2	Daytime	Sept. 9, 2016	1440H-1455H	35.1	55
STN-3	Daytime	Sept. 9, 2016	1730H-1745H	33.5	70
STN-4	Evening	Sept. 9, 2016	2030H-2045H	30.1	50
STN-5	Morning	Sept. 10, 2016	0815H-0830H	40.8	55
STN-6	Daytime	Sept. 10, 2016	1035H-11050H	34.5	55

Source: Mediatrix Business Consultancy, 2016

2.3.4.2.2 Impact Assessment and Mitigation

2.3.4.2.2.1 Construction Phase

During construction, noise will be generated by the construction 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 power mechanical equipment and its equivalent sound power levels are presented in ***Table 2.3-22***. 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."

Table 2.3-22. Equivalent PWL of Power Mechanical Equipment during Construction Phase

Power Mechanical Equipment	PWL, dB(A)
Jackhammer	104
Chipping gun	93
Air compressor	96
Bulldozer	89
Lejeune gun	89
Backhoe	86
Forklift	85
Hand hammer	85
Welding torch	84
Chopsaw	80
Truck	78
Heavy-duty bulldozer	99
Vibrating road roller	97
Crawler crane <35 ton Non-insulated cab	94

Power Mechanical Equipment	PWL, dB(A)
Laborers	90
Power shovel	88
Shop work	95
Rubber tired crane, <35 ton Insulated cab	81
Truck-mounted crane	79
Tower crane	74
Dozer	102
Paver	90
Front-end loader	90
Roller	98
Heavy equipment	90
Gravel plant	102
Crane	99

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

From the above table, the total estimated sound power level for all construction equipment is 109.8 dB(A). To depict the worst-case condition, it is assumed that all construction equipment listed in the table above are working at the same time

The total power level considers 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 activities are predicted to be its worst-case scenario where 24-hour operation is expected.

Noise Prediction

Noise prediction for construction activities in the Project was derived using CUSTIC 2.0 modeling software. CUSTIC 2.0 is capable of executing predicted noise contours showing sound pressure as it moves away from the source. CUSTIC software predict a continuous operation simulated continuously for 24- hours.

Noise Modeling Methodolog

The CUSTIC 2.0 software uses numerical algorithms for noise modeling which give possibility to study the noise pollution in the environment. Mathematical model the software uses provide option to model noise emissions from a wide range of sources that might be present whether industrial or urban areas. The modeling is based on estimates for dispersion of noise in free field by mean of numerical simulations which give as results approximate values for the noise levels, regardless of source type.

The CUSTIC 2.0 software accepts meteorological data records to define the conditions for sound propagation. The model estimates the noise level for each source/receptor combination and calculates user-selected averages. The model calculates attenuation due to noise source enclosures and other noise control measures, the distance from the source to the receiver, the noise source size, type and directivity, barriers and natural topographical features and sound absorption in the air.

The snap shot of the input and output data is shown in the figure below

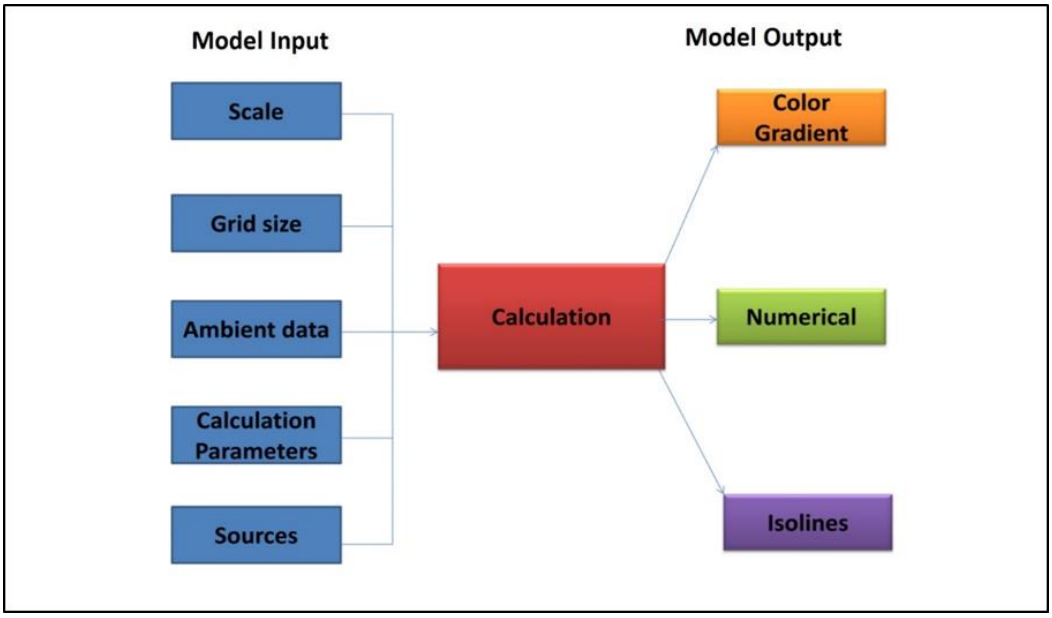


Figure 2.3-20. CUSTIC Screenshot of Input and Output

Noise Sensitive Receivers (NSRs)

Noise sensitive receiver can be defining as those locations or areas where dwelling units or other fixed, developed sites frequent human use occur (FHWA). For this project, expected noise from the project is simulated to determine the noise level at the boundary of the plant. The description and identification of the boundary is shown in ***Figure 2.3-21***.

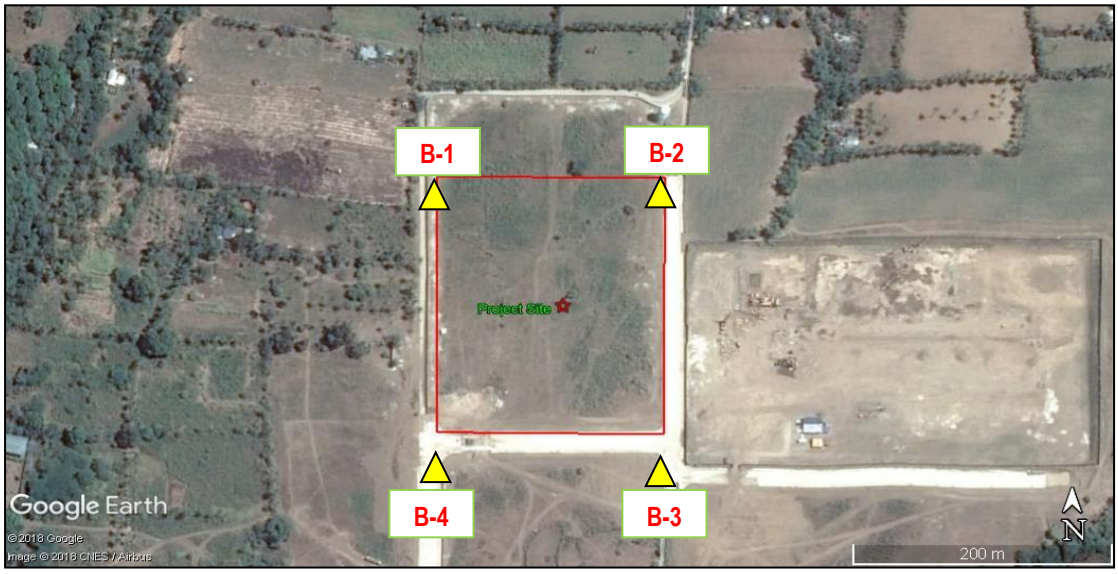


Figure 2.3-21. Location of Noise Receiver at the Plant Boundary

Modeling Input Data

The following input data were used to execute the noise simulation for the construction of the project:

- External source: External means a noise source placed out of a building (for example, a vehicle engine).
- Ambient Data: Ambient conditions are defined by the land and atmospheric conditions in the vicinity of the pollutant emission.
- Terrain – the data will use to draw topographical lines.
- Scale command – Use to set the scale in the X-axis width (in meters)
- The scale use for the model is 5,000 m x 5,000 m.

Modeling Assumption

The following assumptions were made to execute the model:

- Ambient Temperature - 25°C
- Relative Humidity – 80%
- Frequency – 500 Hz
- The calculated noise power is 109.8 dB(A): This is the noise power at source position in decibels. It is assumed that all construction equipment listed in Table xxxx are working at the same time in 24 hours to depict the worst-case scenario.

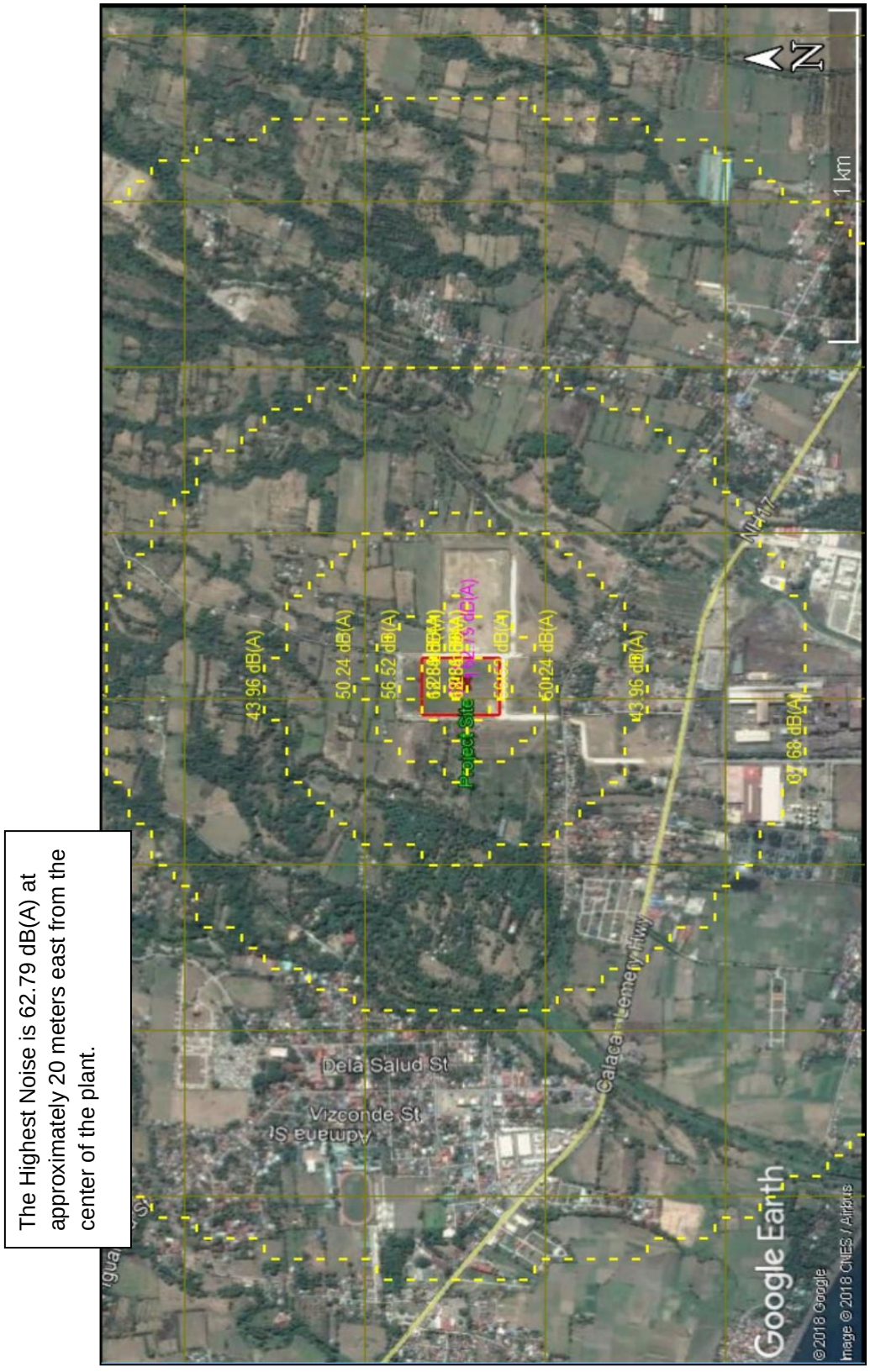
Noise Modeling Results

The predicted noise levels in all noise sensitive receivers for the construction of the cement grinding plant as exhibited in ***Table 2.3-23*** are all below the noise condition during daytime, morning/evening and night time. The highest noise level falls within the plant site at 62.79 dBA at approximately 20 meters east from the center of the Plant. The noise contribution from the construction of the Project is not expected to cause any significant noise impacts to the surrounding environment. The predicted noise contours for the operation is presented in ***Figure 2.3-22***.

Table 2.3-23. Predicted Noise Level at Nearest Sensitive Receiver for Operation

Station No	Predicted Noise Level (SPL), dB(A)	Allowable Noise Level, dB(A)		
		Daytime	Morning/ Evening	Nighttime
B-1	59.75	70	65	60
B-2	53.60	70	65	60
B-3	53.60	70	65	60
B-4	55.70	70	65	60

Note: The allowable noise standard used is from the Rules and Regulations of the National Pollution Control Commission (1978), Section 78, Table 1, Environmental Quality Standards for Noise in general areas as amended by NPCC MC-1980-002.



The Highest Noise is 62.79 dB(A) at approximately 20 meters east from the center of the plant.

Figure 2.3-22. Plot of Noise Isolines for Construction

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;
- Restrict the operation and use of noise-generating equipment to regular working hours;
- 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 mechanical 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 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.

2.3.4.2.2.2 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 power levels derived/anticipated for each equipment item identified during the operation of the cement plant were based on the given equipment noise data / sizes / dimensions extracted from a previous project. The list of power mechanical equipment during operation is presented in ***Table 2.3-24***. However, it is advised that the detailed design should be updated to reflect equipment data whenever the design changes.

Table 2.3-24. Equivalent PWL of Power Mechanical Equipment for Operation Phase

Power Mechanical Equipment	PWL, dB(A)
Cement Mill (finish grinding mill)	105
Raw grinding mill	103
Rotary Compressor	97
Bucket elevator	88

Source: Mill noise level at the proposed Coega and Empangeni Clinker Grinding Mill, 2012

The total power level considers 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. The operational activities are predicted to be its worst-case scenario where 24-hour operation and without barrier. CUSTIC software predict a continuous operation where it simulated continuously for 24- hours.

Modeling Input Data

The following input data were used to execute the noise simulation for the operation of cement grinding project:

- Internal source such as cement mill, grinding mill, compressors or any other noise source placed inside of a building.
- Noise power (dB): This is the noise power at source position in decibels.
- Ambient Data: Ambient conditions are defined by the land and atmospheric conditions in the vicinity of the pollutant emission.
- Terrain – the data will use to draw topographical lines.
- Scale command – Use to set the scale in the X-axis width (in meters)
- The scale use for the model is 5,000 m x 5,000 m.

Modeling Assumption

The following assumptions were made to execute the model:

- Ambient Temperature - 25°C
- Relative Humidity – 80%
- Frequency – 500 Hz
- The total estimated sound power level for the operational equipment is 95 dB(A) from Table xxx above.

Noise Modeling Results

The predicted noise levels at the plant boundary for the operation of the cement grinding mill as exhibited in ***Table 2.3-25*** are all below the noise condition during daytime, morning/evening and night time. The highest noise level is 47.99 dBA falls at approximately 20 meters east-southeast from the center of the Plant. The noise contribution from the operation of the Project is not expected to cause any significant noise impacts to the surrounding environment. The predicted noise contours for the operation is presented in ***Figure 2.3-23***.

Table 2.3-25. Predicted Noise Level at Nearest Sensitive Receiver for Operation

Station No	Predicted Noise Level (SPL), dB(A)	Allowable Noise Level, dB(A)		
		Daytime	Morning/ Evening	Nighttime
B-1	40.90	70	65	60
B-2	38.80	70	65	60
B-3	38.80	70	65	60
B-4	40.90	70	65	60

Note: The allowable noise standard used is from the Rules and Regulations of the National Pollution Control Commission (1978), Section 78, Table 1, Environmental Quality Standards for Noise in general areas as amended by NPCC MC-1980-002.

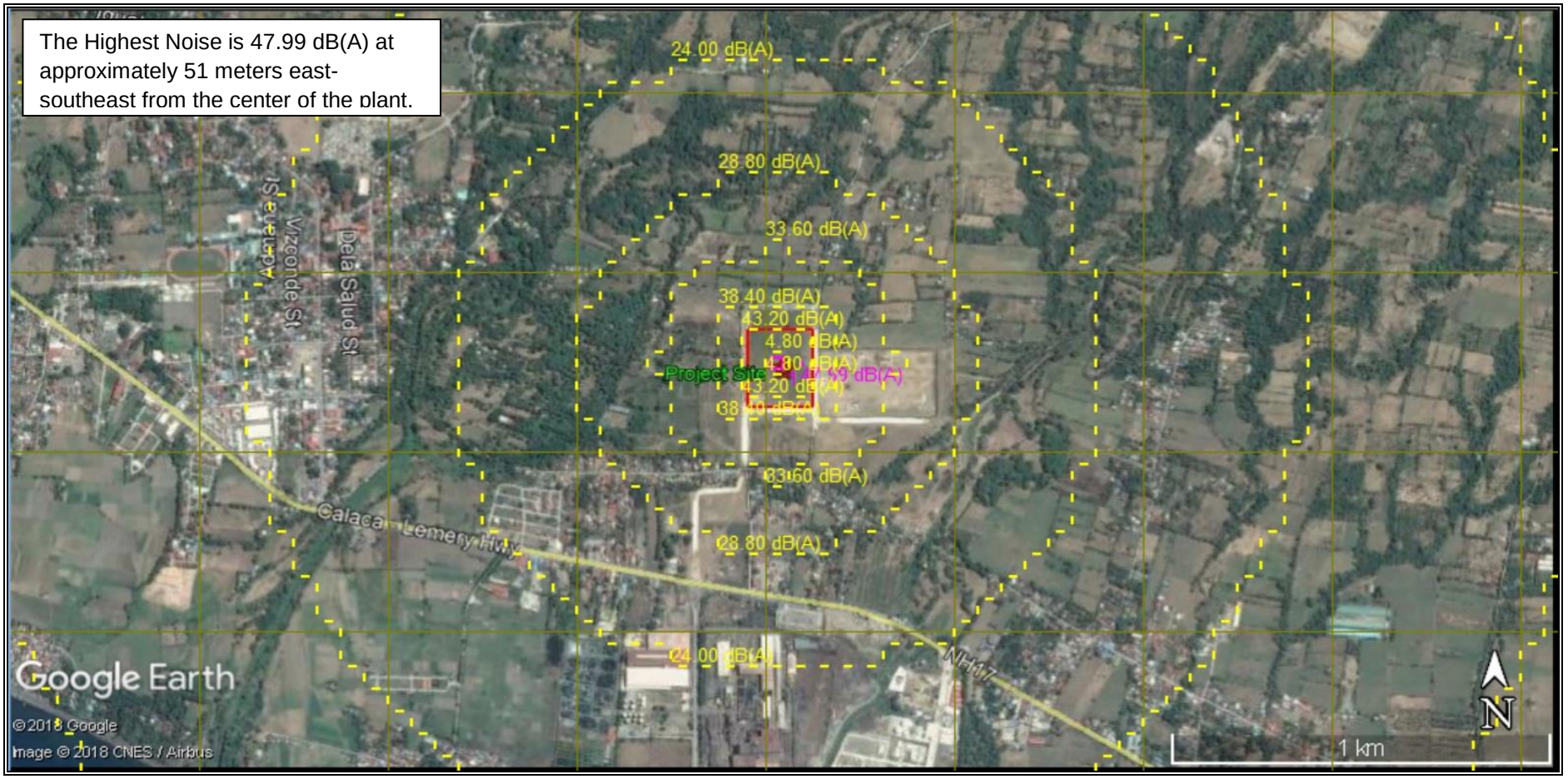


Figure 2.3-23. Plot of Noise Isolines for Operation

Management and Mitigation Measures

It is clearly important to limit the noise emission of all major noise sources in the production area for both environmental and occupational reasons. The specific noise limit to be placed on an individual item of equipment may be dictated by either the on-plant requirements or by the boundary noise limit, depending on the source size, location and elevation.

It is important therefore to ensure that appropriate noise limits are specified within the equipment tender documents and that guarantees are obtained for all major equipment. A detailed noise control study should be carried out as part of the detailed design of the cement grinding to ensure that appropriate limits and noise control measures are incorporated.

Protective measures for reducing the negative impacts of noise on the working and living environment include the following:

- The engines of the equipment should be equipped with silencers, maintained in proper condition and used in accordance with the manufacturer's recommendations in order to prevent the creation of excessive noise;
- If the noise level in the surrounding settlements exceeds legally allowed values, barriers should be set – sound protection panels for the reduction of noise;
- If it is practically possible and feasible, noise sources should be enclosed, which directly depends on the source nature;
- It is necessary to provide the equipment for protecting the hearing of the machines operators from the harmful consequences of excessive noise; and
- Planting a green belt around the plant, especially in the part where the level of noise in the vicinity of an inhabited place is the highest.
- Defective equipment/parts with abnormal noise and/or vibration will be either repaired or replaced.

2.4 The People

2.4-A. Baseline Environmental Conditions:

The proposed project of MFI will be established inside the Calaca Seaport Industrial Zone (CSIZ) in Barangay Lumbang Cazada, Municipality of Calaca, Province of Batangas, Philippines.

Most data on the socio-economic status of the Municipality of Calaca and Barangay Lumbang Calzada were generated from various secondary sources such as the website of Calaca (calaca.gov.ph) and from other available secondary sources in the municipality. Secondary data of the barangay were mostly from the Barangay Lumbang Calzada Socio-economic Profile. To augment the data on the impact area, a socio-economic survey was conducted on August 11, 2014.

The Municipality of Calaca

The Municipality of Calaca is a 1st class municipality in the province of Batangas. About 75 kilometers away from Manila, it is in 13° 56' North, 120° 49' East (13.9304, 120.8128), along the coasts of Balayan Bay and surrounded by the municipalities of Balayan, Lemery, Agoncillo, Tuy and San Luis. **Figure 2.4-1** below is the geographical location of Calaca in Batangas Province.

Figure 42.4-1 Location of Calaca in Calabarzon Region

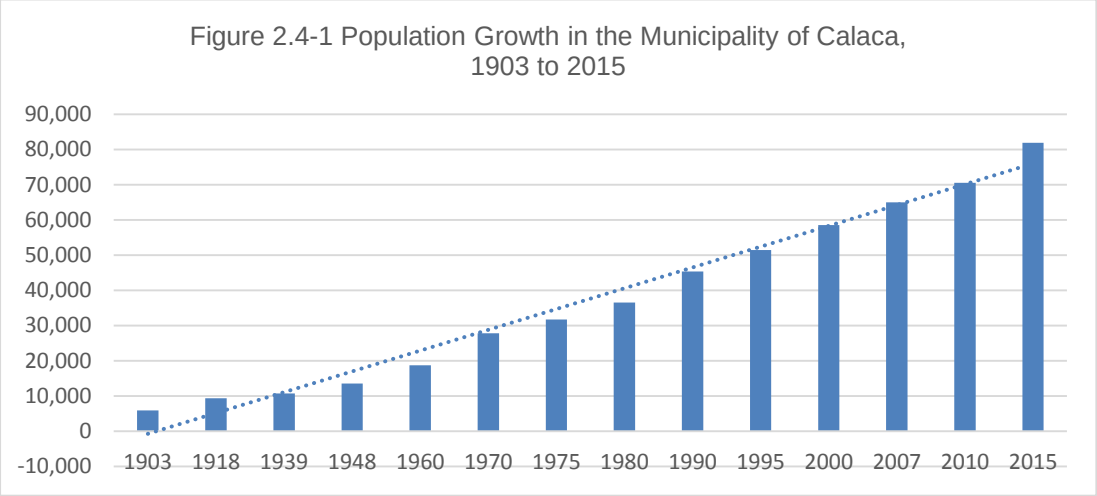
Source: https://zamboanga.com/z/index.php

According to the 2015 census of the Philippine Statistics Authority, it has a population of 81,859 people, which accounts for 3.04% of the population of Batangas Province. Given its land area of 114.58 square kilometers and 40 barangays, Calaca's population density in 2015 was 715 inhabitants per square kilometer.

Table 2.4-1. Barangays of the Municipality of Calaca

1. Bagong Tubig	2. Bisaya	3. Loma	4. Puting Bato West
5. Baclas	6. Cahil	7. Lumbang Calzada	8. Puting Kahoy
9. Balimbing	10. Caluangan	11. Lumbang Na Bata	12. Puting Bato East
13. Bambang	14. Calantas	15. Lumbang Na Matanda	16. Quisumbing
17. Barangay 1 (Pob.)	18. Camastilisan	19. Madalunot	20. Salong
21. Barangay 2 (Pob.)	22. Coral Ni Lopez (Sugod)	23. Makina	24. Sinisian
25. Barangay 3 (Pob.)	26. Coral Ni Bacal	27. Matipok	28. Taklang Anak
29. Barangay 4 (Pob.)	30. Dacanlao	31. Munting Coral	32. Talisay
33. Barangay 5 (Pob.)	34. Dila	35. Niyugan	36. Tamayo
37. Barangay 6 (Pob.)	38. Batulao	39. Pantay	40. Timbain

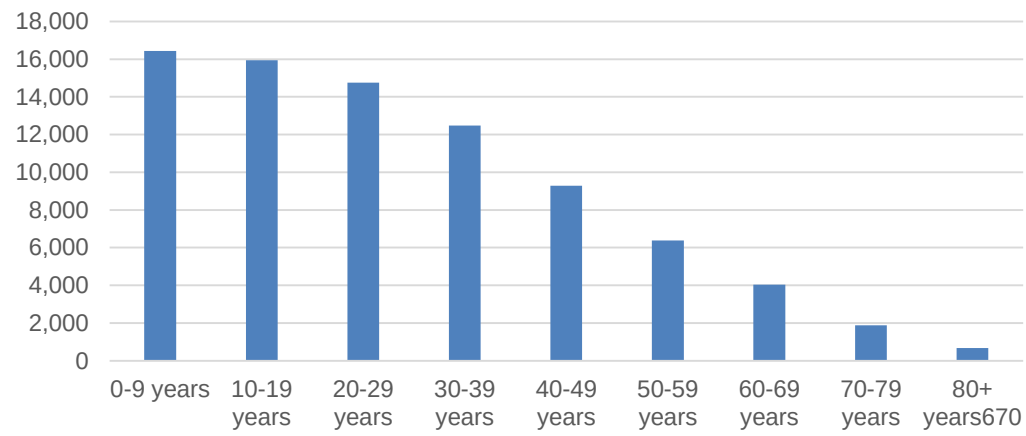
Based on the Census of Population from 1903 to 2015, the municipality's population had increased from 5,838 in 1903 to 81,859 in 2015. (***Figure 2.4-1***). The latest increase of 11, 338 people from that of the previous census of 70,521 (2010 to2015) was at 2.88%. The increase in population is basically due to the higher number of births than the number of deaths in a year. Likewise, the presence of major industries within the CSIZ with available employment and sources of income could be considered as pull factors for the inhabitants to stay, rather than move out of Calaca.



Source: Philippine Statistics Authority

Based on the 2015 Census, the age group with the highest population in Calaca is 0 to 9, with 16,435 individuals. Conversely, the age group with the lowest population is 80 and over, with 670 individuals.[2] The sex ratio in Calaca in 2015 census is 99.6 male, which is less than 100. Thus, indicating predominance of the female population, 49.9% is male while 50.1% are female.

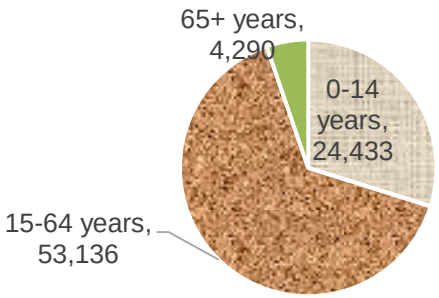
Figure 2.4-2 Age Distribution in the Municipality of Calaca, 2015



Labor Force

Figure 2.4-2 shows the population distribution by age. The age bracket of 15-64, which is the productive or working age indicates a high distribution as they constitute the potential labor force of the municipality and economic activity. This implies that labor intensive and income generating activities should be given greater emphasis to meet the needs of the labor force as well as the dependent population at 61% and 35% are in the age bracket of 14 and below. Only 4% of the population is above 65 years old.

Figure 2.4-3 Population Age Group Distribution of Calaca, 2015



Fertility in the area is high, which accounts for the high young dependency ratio of 57.2%. The old dependency ratio is 6.36%. The total dependency ratio is 63.5%.

[2] Source: http://citypopulation.info/php/philippines-luzon-admin.php

Socio-economic Services and Facilities

The following are presented by the Municipality of Calaca in their website.

As of May 2017, there a total of 40 educational institutions, broken down as follows:

Educational Institutions	
Technical and vocational Schools	1
High School (public/private)	3/1
Senior High School (public/private)	1/1
Elementary (public/private)	31/2

Source: http://calaca.gov.ph

Basic Services

Basic Facilities	
Hospitals	1
Clinics	5
Lying-in	2
Market (public)	1
- Cellular Phones (service provider)	Globe, Smart, PLDT, Continental
- Landline (service provider)	Globe, PLDT, Continental
- Postal Service (courier service)	PhilPost
Recreational Facilities	Multi-Purpose Gymnasium Calaca Track and Field Oval
Transportation	Land & Sea
Power Supply	Batangas Electric Cooperative(BATELEC I)
Water Source/s	Various:Sources: Level 1, 2 & 3

Source: http://calaca.gov.ph

Power Supply

BATELEC 1 provides power to 100% of barangays of Calaca and serving 99% of all households.

Banking and Financial Institution

The following are the list of banks and other financial institutions in Calaca:

• Rural bank of Calaca	• M. Lhulier
• Rural bank of San Antonio	• Jaro Pawnshop
• Ibaan Rural Bank	• Palawan Pawshop

• Lemery Savings and Loan Bank	• PBW Investors and Lending Corporation
• Cebuana Pawnshop	• Henry Lhuiller

Communication/Transportation

The site is located in the poblacion area where almost all forms of communication and satellite is available such as PLDT, Smart, Globe, Sun Cellular, Talk and Text, among others.

Almost all modes of land transportation are accessible in the area. The project site is located at an industrial area accessible near the Calaca - Lemery Highway connecting the municipality to nearby towns of Balayan, Tuy and Nasugbu in the west and the towns of Lemery and Laurel in the east. Being a coastal town bounded by Balayan Bay in the south, the town can also be accessible through water transportation.

Generation of Local Benefits from the Project

Main Sources of Income
The main sources of income of the people of Calaca come from regular employment from private and public establishments, construction workers, small and medium business entrepreneurs, marketing and sales personnel, overseas workers, fishing and farming among others.

Commercial Establishment and Activities

Calaca is a first-class municipality. From a thriving fishing community along the shores of Balayan Bay, it is now an important commercial and industrial center being the home to various industrial parks. There are many large contributors in the economy of the municipality. Here is the list of significant business establishments within the town:

• Balayan Distillery Inc. • Phoenix Petroterminal and Industrial Park • Asian Chemical Corporation • High-Street (SPV-AMC) Inc. • Phoenix Petroleum Phils. Inc. • Janrick Arvin Realty and Development Corporation	• Pozzolanic Philippines, Inc. • SEM-Calaca Power Corporation • Southbay Bulk Terminal, Inc. • Holcim Philippines Manufacturing Corporation • DMCI Power Corporation • Arvin International Marketing

The local government of Calaca is likewise active in promoting its tourism industry in the locality by means of the annual Calacachara Festival. The name of the festival is actually a portmanteau of two words: Calaca (the host town) and atchara (a trademark delicacy native to Calaca). Atchara is a popular appetizer that consists of pickled raw papaya, definitely a must-sample when in Calaca. The Calaca Batangas Festival lasts for a week, with events culminating into a celebration on the 24th day of October

every year. The epicenter of activity during this festival has got to be the street dancing contest that attracts participants from all over the world.

Literacy and Educational Status

As reported by the Municipality of Calaca, the population has a high level of literacy. The population were able to enter primary and reach post graduate education. At present, 7.35% (4,269) of the population are college graduates, while 3.48% (2,230) are college undergraduate, 18.79% (10,914) have finished high school education while 14.06% (8,167) are elementary graduates and 10.88% (5,855) were reported to be not going in school, while only 2.74% have no education at all.

The average student-classroom ratio is 33:1 for the elementary level and 56:1 for the secondary level. The average student-teacher ratio is 31:1 for the elementary level and 40:1 for the secondary level.

Health Profile

The 2015 health statistics of Batangas Province is given below.

	Number	Rate
Total Population	1,820,208	
Live births:	19,387	10.85 (per 1000 Population)
Total Deaths	7,299	4.01(per 1000 Population
Maternal Deaths	5	25.79 per 1000 livebirths
Infant Deaths	79	4.07
Below 5 years old	126	6.5 per 1000 population

- Source: Department of Health Region 4A

The Municipality of Calaca reported that in 2015, its birth rate was 22.9% and death rate was 0.1%. The town's birth rate is relatively higher than that of the province. Death rate on the other hand is significantly lower than the provincial rate. Other health indices for Calaca and Barangay Lumbang Calzada were not available at the time of study. Primary data were gathered at the barangay, data of which are presented in the survey results.

The Municipality of Calaca, Batangas has one hospital, **Ospital ng Calaca**.

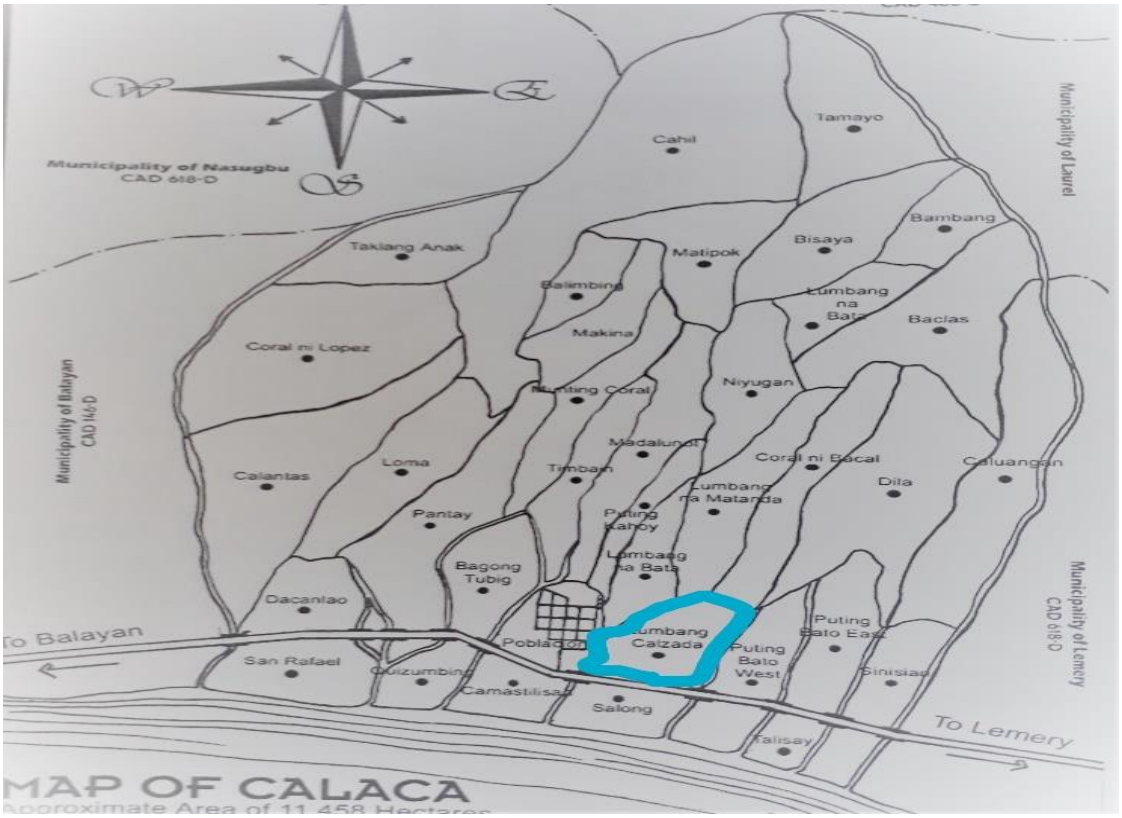
The following are the reported health facilities in Calaca, Batangas

- No. of Health Centers (Public) – 1
- No. of Medical Clinics (Private) – 1
- No. of Ambulance – 2

Health Personnel
No. of Doctors (Gov't Employee) – 2
No. of Doctors (Private Sectors) – 8
No. of Nurses (Gov't Employee) – 55
No. of Nurses (Private Sectors) – 3
No. of Dentists (Private Sectors) – 12
No. of Midwives (Gov't Employee) – 13
No. of Midwives (Private Sector) – 13

Barangay Lumbang Calzada, Calaca

Lumbang Calzada is one of the 40 barangays of Calaca with a land area of 156 hectares. Its population as determined by the 2015 Census was 2,820. This represents 3.44% of the total population of Calaca.[3]



The Barangay Profile of Lumbang Calzada accounts that as of 2017, its total population is 2,163 with 653 households. On the average, the household size is composed of 3 to 4 members.

Of the total population 1,056 (49%) are males and 1,107 (51%) are females. Figure _ shows tha population growth in the barangay.

The population of Lumbang Calzada grew from 1,332 in 1990 to 2,820 in 2015, an increase of 1,488 people. The latest census figures in 2015 denote a positive growth rate of 3.71%, or an increase of 491 people, from the previous population of 2,329 in 2010.

[3] Source: https://www.philatlas.com

Population by age group

According to the 2015 Census, the age group with the highest population in Lumbang Calzada is *20 to 24*, with 309 individuals. Conversely, the age group with the lowest population is *80 and over*, with 25 individuals.

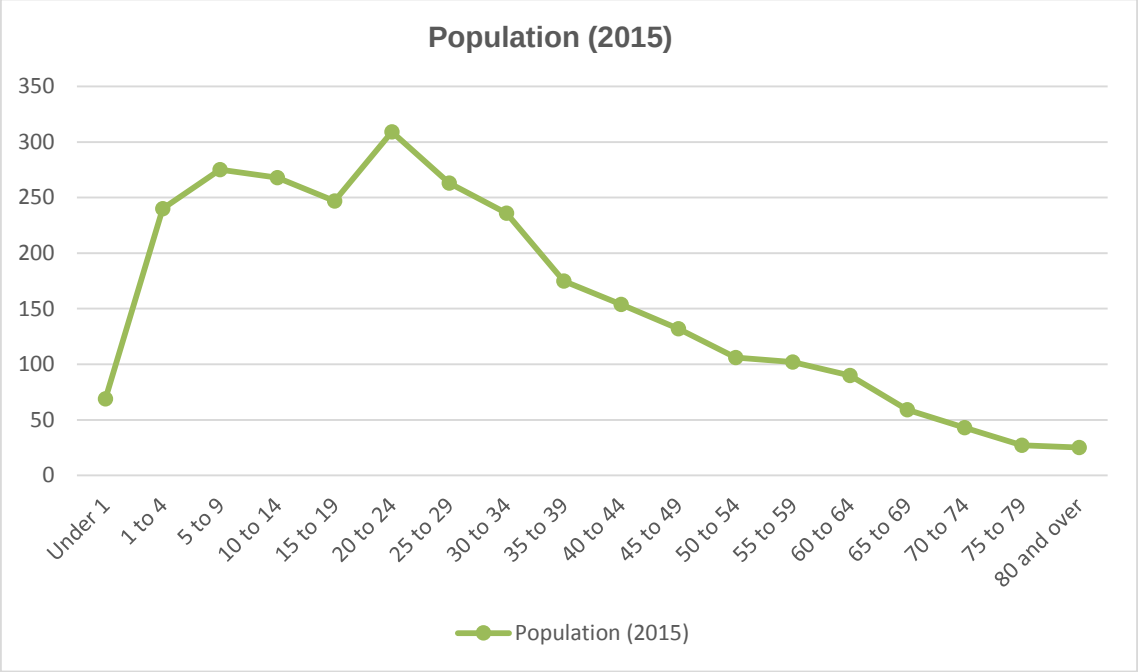


Figure 2.4-4 Population of Brgy. Lumbang Calzada, by age group, in 2015.

Population by age group

According to the 2015 Census, the age group with the highest population in Lumbang Calzada is 20 to 24, with 309 individuals. Conversely, the age group with the lowest population is 80 and over, with 25 individuals.

2.4-B. Impact Assessment and Mitigating Measures

2.4.1 Displacement of Settlers

The proposed project site is inside the Calaca Seaport Industrial Zone; thus, no settlers will be displaced.

There is no change or conflict in land ownership as the land was really devoted for industrial use.

2.4.2 In-migration

At present and in the near future, there is no in-migration within the CISZ areas. However, due to the development of the zone, possibilities of in-migration to Barangay Lumbang Calzada and/or to the Municipality of Calaca can happen.

The proposed project site, while inside the CISZ is about half kilometer away from the nearest residential area (***Figure 2.4-5***).

Figure 2.4-5. Location of Nearest Residential Area

Drawn in “white and brown ink” is the location of the nearest residential area in Barangay Lumbang Calzada.

The proposed project will contribute to the in-migration because people will be encouraged by 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 Brgy. Lumbang Calzada, being the host barangay
- increased economic activity in the area

2.4.3 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 of Brgy Lumbang Calzada being the host barangay
- increased economic activity in the area
- increased cost of living because of the additional needs and wants that the people can afford to buy

2.4.4 Impacts on Physical Cultural Resources

Here are Physical cultural resources and religious sites in Calaca, Batangas[4].

- Old ancestral homes include those of Dr. Mariano Marella, Colonel Timoteo Marella, Captain Ireneo Arriola and the De Leon and Ilagan families.
- Church of St. Raphael the Archangel
- The century-old convent
- The century-old municipal hall
- La Pieta Missionary Foundation
- Salesian Society of St. John Bosco
- St. Raphael Archangel Parish
- Century-old Parish Convent

The Project will not pose threat nor impact to these sites because the project area is located far away/kilometers away from these sites and environmental impacts of the project will be properly managed thru mitigation measures and pollution control devices that will be in place

[4] Source: http://wowbatangas.com

2.4.5 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 nation al 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.

Water supply in the municipality and barangay are Levels 1,2 and 3 and sourced mainly from deep wells, springs and free-flowing waters. The project water needs will be supplied by CSIC, which has its separate source from that of the municipality/ barangay.

2.4.6 Threat to Public Health and Safety

The Project will not pose threat to public health because all management and mitigating measures will be implemented

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 MFI compound will also be among the priority.

2.4.7 Generation of Local Benefits from the Project

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).

Based on 2009-2019 historical data of MFI's hiring in its existing plants at other sites, an average of 55% of its manpower requirement was hired through manpower agency and an average of 45% were hired directly by the company as shown in the Table below.

Year	MFI Direct	Agency A	Agency B	Agency C	Total Manpower
2009	28	45			73
2010	31	118	116		265
2011	40	97	96	38	271
2012	53	105	48	10	216
2013	84	171	32	25	312
2014	98	209	27	28	362
2015	108	182	39	119	448
2016	103	179			282
2017	97	170			267
2018	89	173			262
2019	87	176			263

Increased Business Opportunities and Associated Economic Activities. Cement 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 to the Barangay Government Unit and to LGUs. The amount will be determined when all the parameters for the operation of the MFI Plant shall have been established.

2.4.8 Traffic Congestion

Traffic congestion is one of the challenges that this Project might bring due to the volume of trucks that will be deployed daily. However, congestion phenomenon can be terminated/mitigated by adhering to the right techniques for Traffic Management System to manage the flow of 200 trucks (average no. of trucks/day operation) plying the roads of Batangas. MFI Traffic management adopts a system to include effective traffic control measures and proper scheduling of deliveries of raw materials and cement haulers. The following control measures will be adopted: (a) assignment of Spotter, Traffic Enforcers and LGU counterparts to manage the traffic especially during peak hours; (b) enforcement of speed limit; (c) posting of traffic and safety signages at strategic location; (d) adopting one-way system to cement haulers truck within the vicinity; and (e) assignment of designated route for cement haulers and raw material truck delivery. Consequently, proper scheduling is thru; (a) ensuring that there will be no ovelapping of raw material shipment via sea transport in order to reduce the possibility of congestion and (b) there should be a proper sequence of all trucks within the vicinity to ensure safety and reduce the likelihood of collision. Only when needed, designated parking areas within the CSIZ will be utilized as temporary parking area.

Thus, the Traffic Management Plan that will be followed by MFI will consider the policies and guidelines of CSIC and the Municipal Ordinance of Calaca, specifically Ordinance No. 14-271- An Ordinance Enacting the Traffic Code of the Municipality of Calaca, ***ANNEX 6***.

2.4-C. Socio-Economic Profile of Project Affected Households

Given the 653 total household population of Lumbang Calzada, a 20% sample size equivalent to 131 households was generated to determine the profile of the affected community. The Pro-forma Form used in the Household Survey is attached as ***ANNEX 7.***

Profile of the respondents

Most of the respondents (20%) belong to the age group of 60 years old and above. More than half the respondents (68%) are female and about 80% are married.

Age profile

Age bracket	Number	Percentage (%)
20 – 24 years old	1	0.76
25 – 29 years old	7	5.34
30 – 34 years old	12	9.16
35 – 39 years old	13	9.92
40 – 44 years old	19	14.50
45 – 49 years old	13	9.92
50 – 54 years old	10	7.63
55 – 59 years old	17	12.98
60 – 64 years old	24	18.32
65 years old and above	15	11.45
Total	131	100.00

Gender

Gender	Number	Percentage (%)
Male	42	32.06
Female	89	67.94
Total	131	100.00

Civil status

Status	Number	Percentage (%)
Married	104	79.39
Single	7	5.34
Widow	16	12.21
Live-in	4	3.01
Total	131	100.00

Majority of the respondents (98%) are Roman Catholic, while very few are Muslim and Born Again Christian.

Religious affiliation

Religion	Number	Percentage (%)
Roman Catholic	129	98.47
Islam/ Muslim	1	0.76
Born Again	1	0.76
Total	131	100.00

All of the respondents are literate as they have entered elementary level. Half of the respondents (56%) have reached or completed high school level and very few were able to earn a college degree (8%) or completed a vocational course (4%).

Highest educational attainment

Educational level	Number	Percentage (%)
Elementary level	16	12.21
Elementary graduate	17	12.98
High school level	23	17.56
High school graduate	51	38.93
College undergraduate	9	6.87
College graduate	10	7.63
Vocational graduate	5	3.82
Total	131	100.00

Economic Profile

Average household size for all respondents is computed at 5 household members. Thirty-four percent (34%) of the total respondents have more than 5 household members.

Household size

	Number	Percentage (%)
1/ solo	2	1.53
2	13	9.92
3	23	17.56
4	22	16.79
5	26	19.85
6	20	15.27
7	12	9.16
8	6	4.58
9	2	1.53
10	4	3.05
11	1	0.76
Total	131	100.00

Less than half (43%) of the respondents are employed. For those who are working, about 35 percent are self-employed and about 33 percent are either working for the government or private company. Only 14 percent are farmer, either tilling their own land or works as farm worker or share-tenant. Only 1 respondent own the land he tills.

Employment status of the respondents

Status	Number	Percentage (%)
Working	57	43.51
Not working	74	56.49
Total	131	100.00

Occupation of the respondents

	Number	Percentage (%)
Farmer	8	14.04
Fisherman	1	1.75
Government employee	5	8.77
Employed in private companies	14	24.56
Self-employed or with business	20	35.09
Service provider	9	15.79
Total	57	100.00

One third of the respondents (38%) rely on the salary working from private companies as their family's major source of income. Other major sources of income by the respondents include working and/or providing services (driver, carpenter, house helper, etc.) and having business. About thirty-four percent have secondary sources of income from backyard farming, financial assistance from other family members or those working abroad and income from small business.

Major sources of income

Sources	Number	Percentage (%)
Farming	13	9.92
Fishing	3	2.29
Employment if government office	3	2.29
Employment in private companies	50	38.17
Business	27	20.61
Providing service	29	22.14
Remittance from family member working abroad	5	3.82
Pension	1	0.76
Total	131	100.00

About thirty-five percent (35%) of the respondents have family income of P5,000 or less, while 38 percent indicated a household income ranging from P 5,000 to P 10,000 and the remaining 46 percent with income more than P 10,000.

Monthly household income

Income	Number	Percentage (%)
Less than P 1,000	4	3.05
P 1,000 to P 5,000	43	32.82
P 5,001 to P 10,000	38	29.01
P 10,001 to P 20,000	33	25.19
Above P 20,000	13	9.92
Total	131	100.00

Major household expenses include food (100%), electricity (98%), water (94%) and education (54%). Some respondents cited house rental, medicine, business and savings as part of their major expenses.

Monthly household expenses

Items	Number	Percentage (%)
Food	131	100.00
Electricity	129	98.47
Water	123	93.89
Education	71	54.20
House	9	6.87
Business	7	5.34
Savings	2	1.53
Total	131	100.00

Half of the respondents (5250 spend less that P500 for electricity and about 34% pay from P 501 to P 1000 for their monthly electricity bill. The remaining 15%

Housing Profile

Majority of the respondents (82%) have Level III water supply from which they source their drinking water. Some get their drinking water from deepwell (7%) while 10% buy mineral water.

Almost all of the respondents (98%) have their own electricity line and only 2% tap electricity from neighbor or nearby house.

For cooking, majority of the respondents (85%) use LPG, followed by wood (41%). A few use stove or cooking equipment dependent on electricity (5%) charcoal (3%) and kerosene (1%).

Type of fuel for cooking

	Number	Percentage (%)
LPG	111	84.73
Wood	54	41.22
Electricity	7	5.34
Charcoal	4	3.05
Kerosene	2	1.53

Almost all the respondents have water sealed type of toilet. A few (5%) have flushed type toilet.

Toilet facility

	Number	Percentage (%)
Water sealed	121	92.37
Flush type	7	5.34
Others	1	0.76
No toilet	2	1.53
Total	131	100.00

Ninety-one percent (91%) of the respondents own their house which are mostly have roof made of GI sheets and the main house made of concrete (86%).

Mortality and Morbidity

For the past 5 years, common illnesses experienced by the respondents include cough (88%), colds (86%) and fever (76%). Some experienced other ailments such as flu, asthma and headache.

Illnesses for the past 4 years

	Number	Percentage (%)
Cough	116	88.55
Colds	113	86.26
Fever	100	76.34
Flu	42	32.06
Diarrhea	9	6.87
Asthma	6	4.58
Headache	8	6.11
Stomach ache	3	2.29
Cardiovascular/ hypertension	7	6.11
Diabetes	3	2.29

When sick, about 85% of the respondents consult a physician or medical doctor. Some seek the help of barangay health worker (29%) and very few consult albularyo (8%) or do self-medication (3%).

Consulted when sick

	Number	Percentage (%)
Doctor	112	85.50
Barangay health worker	38	29.01
Albularyo	11	8.40
Self-medication	4	3.05

Causes of death in the barangay as reported by the respondents include natural death (66%), major illness (27%), accident (39%) or cardiovascular related illnesses (28%).

Causes of death for the past 5 years

	Number	Percentage (%)
Old age/ natural death	86	65.65
Major illness	35	26.72
Accident	51	38,93
Cardiovascular disease	37	28.24
Cancer	8	6.11
TB	5	3.82

2.4-D. Summary of Perception Survey Results

Awareness about the project and source of information

More than half of the total respondents (68%) are not yet aware of the project as initial engagement was done only at the barangay officials' level and with health workers that helped in the conduct of the survey.

Respondents' awareness about the project

	Number	Percentage (%)
Aware	42	32.06
Not aware	89	67.94
Total	131	100.00

Information about the project mostly come from relatives/ friends or neighbors (18%), barangay officials (6%) and a few by attending the barangay meetings (2%).

Respondents' source of information about the project

	Number	Percentage (%)
Barangay official	8	6.11
Relatives/ friends/ neighbors	23	17.56
During barangay meetings	3	2.29
Not applicable	89	67.94
Total	131	100.00

Perceived positive and negative impacts of the project

Majority of the respondents (88%) believe that the project will provide positive impacts such as: employment/ livelihood generation, improvement of the barangay, improvement in social services, housing project. A few mentioned increases in population as a positive impact and about 12% of the respondents said it will not have positive impact or is not able to determine its impact at all.

Positive impacts of the project identified by the respondents

	Number	Percentage (%)
It will generate employment/ livelihood/ income	83	63.36
It will improve the barangays	38	29.01
It will improve social services	15	11.45
It will provide housing	6	4.58
No impact	4	3.05
I do not know	1	0.76
No answer	11	8.40

** totals do not add up to 100% due to multiple answers

A few of the respondents (5%) said that the project will not have negative impact to their barangay, while 34% have no answers or could not identify possible negative impacts. More than half of the respondents (61%) identified negative impacts to include: air/ water/ noise pollution, possible displacement of houses, may cause sickness, etc.

Negative impacts of the project identified by the respondents

	Number	Percentage (%)
It will cause air pollution	68	51.91
It will cause loss of houses/ displacement	17	12.98
It will cause water pollution	13	9.92
It will increase the population	13	9.92
It will cause sickness	12	9.16
It is a threat to safety/ possible cause of accident	8	6.11
It will result in cutting of trees	6	4.58
It will affect (decrease) water supply	6	4.58
It will affect (decrease) harvest – plant, fish	3	2.29
It will cause job loss	2	1.53
It will cause noise pollution	2	1.53
It will cause environment destruction	1	0.76
No negative impacts	6	4.58
I don't know/ No answer	45	34.35

** totals do not add up to 100% due to multiple answers

However, to mitigate the negative impacts, respondents recommended the conduct of consultation and close coordination with the barangay. Some of the respondents identified the importance of the project proponent addressing the negative effects including construction of proper facilities, waste management, compliance to the laws and regulations, prevent pollution/ protect the environment and conduct of medical mission. Very few or about 2% said that the project should not push through, while another 2% recommended the closure of business if it will have negative impacts to the barangay.

Respondents' recommendations to address the negative impacts
Negative impacts of the project identified by the respondents

	Number	Percentage (%)
No recommendation	78	59.55
With recommendation	53	40.45
Consult, discuss, work closely with the barangays	10	7.63
Company to (ensure) address/ Mitigate negative effects	8	6.11
Company not to push through with Its operation	6	4.58
Construction of proper facilities	5	3.82
Waste management	4	3.05
Company not to push through if With negative impacts	3	2.29
Compliance to the laws/ Regulations	2	1.53
Closure of the company	2	1.53
Prevent pollution	2	1.53
Tree planting	2	1.53
Protect the environment	1	0.76
Conduct medical mission	1	0.76
Communicate with one another	1	0/76
I will leave the barangays	1	0.76
Nothing to do if project is already Operational	1	0.76
Report to concerned agencies	1	0.76
Implement/ develop ordinance	1	0.76
Assign a group that will facilitate Consultation	1	0.76
Construct water infrastructure	1	0.76

Perception on the overall impact of the project to community development

Majority of the respondents (81%) said that the project will contribute to barangay development. Only 15% of the respondents have the general perception that it will have negative impact, and very few (4%) said that it will neither contribute to the development nor have negative impact to the barangay.

Respondents' perception on overall impact of the project

	Number	Percentage (%)
It will greatly contribute to community development	65	49.62
It will somehow contribute to the development	41	31.30
It will not have contribution to community development	5	3.82
It will have negative impact to the community	18	13.74
It will have major negative impact to the community	2	1.53

For the 81% of the respondents who believed that the project will contribute to the barangay development, majority stated that the said project will provide source of livelihood and generate

employment. Other cited that the project will provide additional income to the barangay and general development.

Respondents' reasons for saying that the project will help the barangay

	Number	Percentage (%)
It will generate employment/ source of livelihood	44	41.51
It will increase barangay income	10	9.52
It will contribute to barangay development but will have health impact	4	3.77
It will provide additional costumer to existing business	1	0.94
It will help people	1	0.94
No reply	47	44.34

n = 106

Attitude towards the project

About 31% of the respondents support the project. However, 6% expressed support if the barangay residents will be hired as workers of the company or if will be prioritized for employment. Other conditions stated include: if the project will not have negative impacts and if infrastructures will be properly constructed.

About 25% of the respondents do not have decision yet due to lack of information, while others are still waiting for the conduct of barangay consultations.

Some respondents (33%) still do not know what to answer, while 17% said they are not supporting the project mainly because it is perceived to be a possible source of pollution and cause of illnesses.

Respondents' attitude towards the project

	Number	Percentage (%)
Supporting the project	33	25.19
Supporting the project, but	8	6.11
The residents should be provided/ prioritized for work	5	3.82
The project will not negatively Affect the residents	2	1.53
Infrastructures should be properly Constructed	1	0.76
No decision yet, because	25	19.08
No information yet about the Project	5	3.82
It will still be discussed in barangay Meeting	3	2.29
No answer	17	12.98
Not supporting the project, because	22	16.79
No answer	6	4.58
I don't like factories	1	0.76
It has negative impact to people	2	1.53
It will cause sickness	3	2.29

It will cause pollution	10	7.63
I don't know, because	43	32.82
No answer	23	17.56
I don't like	1	0.76
May negatively affect people	1	0.76
No factory constructed yet	3	2.29
I still don't know the impact	12	9.16
No information about the project	3	2.29

SECTION 3. ENVIRONMENTAL MANAGEMENT PLAN

3.1. Impacts Management Plan

The Impact Management Plan (IMP) is formulated to minimize the potential adverse impacts while enhancing the beneficial effects of implementation of the project. This IMP shall serve as the environmental monitoring and evaluation implementing guidelines for the project.

With the identification of the key project activities at each phase and key impact thereof (Section 2) and the delineation of the important baseline conditions (Section 3) this Section summarizes the significant impacts and corresponding management plan/mitigating measures.

For the discussions, **"impact"** is differentiated from "**risk incidents**", the former arising from regular activities while the latter are neither daily nor regular occurrences or occurrences at abnormal situation.

3.1.1. Project Phase - Construction

Impact and Environment Sector to be Affected	Mitigation Measures
Land	• Use of dust collectors • Replacement of filter bags • Proper Maintenance of dust collectors • Tree nursery & tree planting • Proper labeling, segregation & storage • Transport, treatment & disposal by DENR-accredited third-party contractors • Separate area for the plant personnel working station to prohibit hazardous waste exposure & health hazard as well.
Water	• Use of septic vaults • Recycling of process water • Water quality monitoring using the following parameters: -Fecal and total coliform -BOD -TSS -pH
Air	• Implementation of dust management system • Regular ambient and stack monitoring • Use of Dust Collector System
Noise Emission Full plant operations produce noise that may impact adjacent communities/ residential areas within the immediate vicinity of the project.	• Compliance with DENR Standards on noise through regular noise monitoring • Normal work schedules usually restrict noise producing activities to daytime hours.
People	The project offers the following enhancement (not impacts) to the people: • Employment opportunities • Livelihood opportunities • SDMP Benefits

3.1.2. Project Phase- Operations

Impact and Environment Sector to be Affected	Mitigation Measures
Land	• Use of dust collectors • Manual sweeping • Replacement of filter bags • Road water sprinkling • Tree nursery and tree planting • Proper labeling, segregation and storage • Transport, treatment and disposal by DENR-accredited third-party contractors • Provision of Hazardous waste facility with secondary containment • Separate area for the plant personnel working station to prohibit hazardous waste exposure and health hazard as well.
Water	• Use of septic vaults • Water quality monitoring using the following parameters: - Fecal and total coliform - BOD_5 - TSS - pH
Air	• Implementation of dust management system • Regular ambient and stack monitoring • Use of Dust Collector System • Proper maintenance of dust collectors
Noise Emission Full plant operations produce noise that may impact adjacent communities/ residential areas within the immediate vicinity of the project.	Compliance with DENR Standards on noise through - Normal work schedules - Restrict noise producing activities to daytime hours.
People	The project offers the following enhancement (not impacts) to the people: • Employment opportunities • Livelihood opportunities • SDP Benefits

MFI extends equal opportunity to men and women in its hiring process without regard to race, religion, color, sex, national original, disability, age, genetic information and any other status protected under national and local laws. Policy on hiring process for men and women, PWDs and age as well as payment of statutoty benefits, are presented as **Annex 8-A**.

3.1.3. Project Phase – Decommissioning/Abandonment

Demolition of Structure:	
Land * Solid waste pollution/contamination brought about by scraps and debris from demolished structures * Oil spill	> Good housekeeping Use as filling materials for construction works > Conduct of Environmental Site Assessment (ESA) prior to abandonment
Air * Air pollution because of dusts from demolished Structures; * Noise pollution from structures being Demolished	 > Sprinkling of water > Limit the activity during daytime
Plant closure or operation stoppage	
People * Loss of jobs	> Provide alternative sources of livelihood; > Pay appropriate separation benefits

See Section 7 for the MFI decommissioning, abandonment and rehabilitation policy.

3.2 Summary Matrix of the Impact Management Plan

Table 3.2.1 summarizes all the potential impacts and options for prevention.

Table 3.2.1: Summary Matrix of the Impact Management Plan

Project Phase / Environmental Aspect (Project Activity will likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation* or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee / Financial Arrangements**
I- PRECONSTRUCTION PHASE	Sourcing of equipment and contractors; Securing of approvals like ECC issuance, etc.					
II- CONSTRUCTION PHASE						
Generation of debris, solid wastes and scraps due to various construction works	Land	Land pollution	• Good housekeeping; • Reduce, re-use, recycle of wastes • Reuse and sell of scraps	Proponent and Construction Contractor	Include in construction Cost	Contract with Contractor specifying

Project Phase / Environmental Aspect (Project Activity will likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation* or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee / Financial Arrangements**
Soil erosion due to cut and fill		Land degradation at site and nearby areas Increased sediment and deposition in adjacent areas	• Further minimize cut and fill because land is already developed • Protect loose soil from rain			Commitment to EMP Contract accredited waste hauler and scrap buyer Budget for solid waste management
Generation of hazardous wastes		Land contamination	• Good housekeeping • Proper Containment of oil and used oil			Contract accredited TSD facility
Release/ discharges of waste water due to construction activities	Water	Pollution of ground water	• Use of Portable toilets • Good housekeeping	Proponent and Contractor	Part of contract	Agreement with contractor
Use of limited water resource		Water depletion due to groundwater extraction	• Provision of water conservation measures • Source water from CISC	Proponent and Contractor CISC		Contract with CISC

Project Phase / Environmental Aspect (Project Activity will likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation* or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee / Financial Arrangements**
Emissions to air due to land clearing and construction activities	Air	Air pollution	• Regular spraying of water where earthwork activities are concentrated • Compacting of exposed soil and immediate hauling of spoils • Cover on trucks loaded with construction materials • Impose speed restrictions for trucks • Road water sprinkling • Tree nursery and tree planting	Proponent and Contractor	Part of Contract	ECC Conditions Agreement with contractor
Increase of noise level	People	Nuisance to nearby communities	• Limit activities during day time	Contractor and Proponent	N/A	-ECC Conditions -Agreement with contractor
Physical Attributes and Nuisance		Increase in traffic congestion	• Implement Traffic management plan	Contractor		Compliance to CISC Policy and CALACA Ordinance on traffic

Project Phase / Environmental Aspect (Project Activity will likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation* or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee / Financial Arrangements**
Employment and livelihood generation	People	Increase in livelihood opportunities and community income	• To enhance, give priority to qualified locals • Implement Social Development Program (SDP) and information and Education Campaign (IEC)	Contractor and Proponent	Include in Construction Cost	
III- OPERATION PHASE						
Solid waste accumulation	Land	Land pollution	• Good housekeeping • Implement Proper Waste Management Plan • Implement reduce, re-use and recycle program. • Provision of compost pit for biodegradable waste • Set-up a Material Recovery Facility	Proponent	Include in Operational Costs	Operating Manual on Waste Management
		Generation of sludge from septage	• Septic tank management by desludging	Proponent		Contract with accredited Service provider

Project Phase / Environmental Aspect (Project Activity will likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation* or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee / Financial Arrangements**
						Manual of Operation
Hazardous wastes discharge to land		Contamination and improper	• Proper labeling, segregation and storage	Proponent		Proper Hazwaste Management per DAO 2013-22 Compliance
		management of hazardous waste materials	• Transport, treatment and disposal of DENR accredited third party contractors • Provision of hazardous waste storage area with secondary containment • Separate area for the plant personnel working station to prohibit hazardous waste exposure and health hazard as well.			
Release/Discharge to Water	Water	Water pollution domestic wastes	• Use of multi-chamber septic tanks • Desludging by accredited service provider	Proponent	Part of Operational costs	ECC conditions and EIS Commitments

Project Phase / Environmental Aspect (Project Activity will likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation* or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee / Financial Arrangements**
Use of limited water resource		Water depletion due to groundwater extraction	• Water conservation measures • Source water from CISC	Proponent and CISC	Part of Operational Costs	Contract with CISC
Emissions to Air	Air	Air pollution from fugitive dusts, equipment and vehicles	• Use/installation of dust collector system • Closed system for transfer and storage • Manual sweeping • Proper maintenance of dust collector including replacement of filter bags • Road water sprinkling • Tree nursery & tree growing	Proponent	Part of Operational Costs	Standard Operating Procedures
	Air	Greenhouse gas emission	• Implementation of a greenhouse gas emission reduction and management program	Proponent		
Noise from equipment and vehicles	People	Increase of ambient noise levels	• Establish and maintain Buffer zone and tree growing • Ensure proper maintenance of equipment and vehicles	Proponent	Part of Operational costs	ECC Condition

Project Phase / Environmental Aspect (Project Activity will likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation* or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee / Financial Arrangements**
			• Provision of earplugs to workers • Maintain OSH prescribed noise criteria • Impose and implement strict policies on hired vehicles			Standard Operating Procedures Contract with Hired Vehicles
Health aspects	People	Increase in health incidence attributable to operation of plant	• Ensure all mitigating measures to control air pollution are in place and operational at all times	Proponent	Part of Operational costs	ECC Condition
Employment and income generation for the people		Increase in livelihood opportunities and community income	• To enhance, give priority to qualified locals • Implement Social Development Program (SDP) and information and Education Campaign (IEC)	Proponent	Part of Operational costs	

Project Phase / Environmental Aspect (Project Activity will likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation* or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee / Financial Arrangements**
Income generation for the Barangay and Calaca Local Government		Increase in local government's income	• Pay appropriate fees and taxes on time and			Compliance to Local Government Code and BIR Regulations
Physical Attributes and Nuisance		Increase in traffic congestion	• Implement Traffic management plan	Proponent		Compliance to CISC Policy and CALACA Ordinance on traffic
IV- ABANDONMENT PHASE						
Demolition of structures	Land	Solid waste pollution/contamination brought about by scraps and debris from demolished structures	• Good housekeeping • Use as filling materials for construction works	Contractor		

Project Phase / Environmental Aspect (Project Activity will likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation* or Enhancement**	**Responsible Entity**	**Cost**	**Guarantee / Financial Arrangements**
		Oil spill	• Conduct of Environmental Site Assessment (ESA) prior to abandonment	Contractor		
	Air	Air pollution because of dusts from demolished structures	• Sprinkling of water	Contractor		
		Noise pollution from structures being demolished	• Limit the activity during daytime	Contractor		
Plant closure or operation stoppage	People	Loss of jobs	• Provide alternative sources of livelihood Pay appropriate separation benefits	Proponent		

SECTION 4. ENVIRONMENTAL RISK ASSESSMENT AND EMERGENCY RESPONSE POLICY AND GUIDELINES

4.1 Introduction

The safety and health of workers as required by the Philippines Occupational Safety & Health (POSH) Program is the major concern of the Environmental Risk Assessment (ERA) as indicated in the PEISS. 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".

Since safety and health of workers are a major concern of Mabuhay Filcement (MFI), this Environmental Risk Assessment (ERA) uwill address the environmental concerns of neighboring community as well as the occupational safety and health (OSH) concerns of workers and employees who will be involved in this proposed project.

MFI has high regard to the environment and 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 Calaca as provided in its missions and goals: (a) advancement of nation building by providing affordable and good quality cement; (b) increase its production capacity to help sustain the increasing demand; (c) providing employment and livelihood to the locals; and (d) generate income to both local and national government.

Annex 2-7e of the RPM provides for the guidelines on the degree of ERA requirements and preparation as provided below:

B. LEVELS OF COVERAGE AND SCOPING REQUIREMENTS

6. The requirement for the conduct of ERA shall be defined at three (3) levels:
   a) Level 2 – for facilities that will use, manufacture, process or store hazardous materials in excess of **Level 2** threshold inventory shall be required to conduct a Quantitative Risk Assessment (QRA) and prepare an Emergency/Contingency Plan based on the results of the QRA.
   b) Level 1 – for facilities that will use, manufacture, process or store hazardous materials in excess of **Level 1** threshold inventory shall be required to prepare an Emergency/Contingency Plan based on the worst case scenario. The Plan shall be based on a Hazard Analysis study.
   c) Risk screening level – specific facilities or the use of certain processes shall require the conduct of a risk screening study even if the projected or estimated inventory does not reach the threshold levels.
7. As stated, projects or undertakings categorized as Level 2 shall be required to conduct a Quantitative Risk Assessment **(QRA)** and prepare an Emergency/Contingency Plan based on the results of the QRA. While projects or undertakings categorized as Level 1 shall be required to prepare an Emergency/Contingency Plan based on the worst case scenario (as a result of a Hazard Analysis study.)

2. Levels 1 and Level 2 Threshold Inventory. The following threshold levels shall be used to determine whether a proposed project or undertaking shall be required to prepare a QRA and/or an emergency/contingency plan:

CATEGORY	LEVEL 1 (tons)	LEVEL 2 (tons)
Explosives	10	50
Flammable substances	5,000	50,000
Highly flammable substances	50	200
Extremely flammable substances	10	50
Oxidizing substances	50	200
Toxic substances (low)	50	200
Toxic substances (medium)	10	50
Toxic substances (high)	5	20
Toxic substances (very high)	0.2	1
Toxic substances (extreme)	0.001	0.1
Unclassified (Type A)	100	500
Unclassified (Type B)	50	200

For this Project Level 2 requirement will not be undertaken.

4.2 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. The information will also provide the basis for further quantitative risk assessment in case will be required in the post EIA stage/process.

a) 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

b) 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.

c) Risk or Hazards Management measures or the general emergency procedures during the worst-case scenario.

4.3. Safety Risks Type:

4.3.1 Fire
Description and assessment of the possible accident scenarios

Probable major fires may not occur at the Plant. As an emergency measure, firefighting facilities, principally fire water lines, fire extinguishers and water hose stations and hoses will be installed at the Plant premises. Alarms will also be installed.

Explosion

The elements for explosion which are the extraordinary/release of energy accompanied by rapid increase in volume of explosive materials are not present in this Project.

Description and assessment of the possible accident scenarios
The possible accident scenarios and the affected population are related to the operation of the major plant equipment and auxiliaries which are not present in this Project.

The instrumentation system of the plant is provided with control, measurements, recording and response mechanism to prevent equipment failures that may result in accidents. Pressure relief valves are installed in sensitive points to cause release of gases away from personnel. Unit or equipment shutdowns are automatically built in the instrumentation system.

Movement of personnel to high structures
Plant operators and maintenance personnel may necessarily climb to high structures as routine part of their functions. Thus, the potential for falling off from these structures exist.

Movement of vehicles
Delivery trucks for materials will necessarily enter the plant premises. Only accredited vehicles and drivers may be allowed to enter the plant, Road signage will be posted conspicuously at strategic places.

4.3.2 Release of Toxic Substances

There are no toxic substances associated with the Project. Even if such is the case, the Proponent will implement health hazard control programs on different levels as follows:

A. Engineering controls:
    1. Design of bag filter system to minimize dust generation;
    2. Regular road watering during dry days to prevent fugitive dust; and

B. Administrative controls:
    1. Workplace and community level monitoring for noise, dust and smoke emissions;
    2. Information, education and training strategies for workers;
    3. Dialogue, information and education of community members on health hazards of concern;
    4. Provision of adequate housing and sanitary facilities for workers;
    5. Personal hygiene facilities for workers; and
    6. Immunization and/or medical prophylaxis for areas where endemic diseases are present.

C. Personal protective equipment (PPE):
    1. Dust mask and other respiratory protection for workers;
    2. Ear protectors (either muffs or plugs) for workers; and
    3. Hard hats and other safety PPE for workers.

D. Proper storage of hazardous waste
    Storage is the holding of waste for a temporary period of time prior to the waste being treated, disposed, or stored elsewhere. Hazardous waste is commonly stored prior to treatment or disposal, and must be stored in containers, tanks, containment buildings, drip pads, waste piles, or surface impoundments that comply with DENR regulations.

    Busted lamps and bulbs and used automotive batteries are among the hazardous wastes that may be generated. These may be stored in containers or any portable device in which a hazardous waste is stored, transported, treated, disposed, or otherwise handled.

E. Disaster management prevention and minimization:
    1. there must be a provision for a medical clinic at the plant site;

2. first aid and emergency plan for plant accidents which needs trained people and detailed steps to include transport facilities and communication with the referral hospitals;
3. disaster plan in case of excessive emissions of pollution, and

Toxic Metals in Air

Under the Philippine Clean Air Act, the emission limits for stationary sources (new facilities) for mercury and lead are: 5 mg/NcM and 10 mg/NcM respectively.

Under the Toxic and Hazardous Wastes Law (R.A. 6969) following are the limits for metallic elements:

Elements	Maximum Concentration
• Mercury & mercury compounds	Includes all wastes with a total Hg concentration > 0.2 mg/; Also include organ mercury compounds
• Lead compounds	Includes all wastes with a total Pb concentration > 5 mg/l

For this Project, no heavy metals will be generated because the project is grinding/finish mill only.

Complete inventory of hazardous wastes, incorporating the inventory in the emergency response plan for hazardous wastes with high risks Or

Table 4.1 List of the Identified Hazardous Substances within the Plant and its Physical and Chemical Properties

Nature of hazardous wastes	Source/Generator	Inventory (Initial estimate only)
Acid and bases for Boiler Feed Water Treatment	Water Treatment System	Variable but small in quantities
Accidental Oil spills	From vehicles and plant	Variable but small in quantities
Spent lighting bulbs	Equipment Lighting for Offices and Plant premises	Variable but small in quantities
Spent computer parts for office use only	Office computers	Small in quantity
Oil Sludges	From Storage Tanks Generated Only during tank cleaning which is undertaken after several year of operation, thus minimal volumes	

4.4. Physical Risks

4.4.1 Breakdown of Pollution Control Facilities

In an event although unlikely that the bag filters fail the instrumentation system described, it will automatically shut-down the plant thus preventing uncontrolled discharge of particulate matters (PM) to the atmosphere.

Bag Filter System Diagram
To address the concerns of Bag Filter failures, the Project will adapt the following standards in the design, installation and operations/maintenance to prevent total failure. This design and O&M philosophy will make total Bag Filter failure improbable.

The bag filter system is installed to address the problem of cement dust emission that comes from operating equipment and silos wherein the cement is stored and extracted. The system comprises of bag filter fan, the discharging equipment which normally a screw conveyor or a rotary airlock, the bag filter casing which the filter media are enclosed, and the ductings (inlet and outlet).

Operation and Maintenance
The design will enable troubleshooting of common cause of field failure while the boiler and other fields are online. The O&M philosophy will be based on United States Environmental Protection Agency (EPA) "Manual for Operation and Maintenance" and "Inspection Procedures for Evaluation of the Control System Performance."

4.4.2 Breakdown or Failure of Equipment and Facilities

Temperature Extremes as Precursor to Accidents
At worst case scenario extreme temperature rise is predicted at 2.4^{0}C for a short-term period of June/July/August in 2050. At the peak ambient temperature at this time of 29.3^{0}C, the effect on operations and maintenance personnel is unlikely.

Indirect adverse effects even if unlikely have to be factored in the design of equipment and safety system, noting that process design take into consideration ambient conditions, e.g., temperature. Failure of systems (e.g. instrumentation) may in theory trigger accidents.

Rainfall Extremes as Precursor to Accidents
Aberrations in predicted rainfalls are seen from the above table, certain months exhibit decrease in rainfalls while in other periods increase is predicted. These predicted increases are however, not expected to trigger accidents in the operation of the plant particularly relating to the transport of coal. Potential effects of heavy rainfalls are flooding. The plant however will be designed for appropriate drainage system.

4.5 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 (geological, hydro-meteorological and* "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, hydro-meteorological or biological.

Floods
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 area is located on a basin which has an elevation ranging from 90 to 100 meters above sea level and falls on low to moderate susceptibility to flooding as delineated by Mines and Geosciences Bureau. The Project site however could experience "localized flooding" if the drainage systems are inadequate and not fully maintained.

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 Iba Fault, Subic Fault, West Valley Fault, Lubang Island/Verde Passage Fault, Philippine Fault and the Manila Trench (Punongbayan, 1989). The site has experienced intensity VII during the July 1990 Luzon Earthquake.

Social

In terms of Social aspect, following are the concerns during abandonment phase:

* Loss of jobs thru loss of income;
* Loss of taxes paid to the government;
* Loss of independent economy dependent on the project;
* Loss of projects by contractors

On top of all of these measures Mabuhay FilCement Inc. has proposed its Emergency Response and Disaster Preparedness Plan (DPP) and Environmental Risk Categorization Plan as provided below:

Ranking of the evaluated risks

Based on the risk values obtained during the risk evaluation phase, risks are sorted and ranked according to their severity.

As part of the risk assessment process, the following risk rating table; RISK RATING TABLE (adapted from Australian/New Zealand Standard 4360:1995 – Risk Management) will be used.

Likelihood or probability of Hazard / Aspect	Severity of Consequence of any injuries or harm to health				
	Insignificant e.g. no injuries	Minor e.g. first aid onsite only	Moderate e.g. medical treatment	Major e.g. extensive injuries	Catastrophic e.g. fatalities
Very likely	Significant	Significant	High	High	High
Likely	Moderate	Significant	Significant	High	High
Moderate	Low	Moderate	Significant	High	High
Unlikely	Low	Low	Moderate	Significant	High
Highly unlikely (rare)	Low	Low	Moderate	Significant	Significant

As shown in the provided list of equipment and Process Diagram the following will take place during production; such as: (1) Raw Materials Hauling involving 200 trucks; (2) Raw Materials Storage; (3) Grinding; (4) Packaging; and (5) Delivery. This excludes however the construction phase which will involve mobilization of workers, materials and equipment that will be used during the period of construction and the maintenance activities that will sustain the quality and the condition of the equipment and the work environment that can be subject to wear and tear as time progresses. In view of this, all activities will be considered in this risk assessment.

During the risk assessment, hazards in its uncontrolled state are considered and that recommended controls are for implementation by FILCEMENT.

The following table presents the risk present in all the activities that are identified and recognized based on the activities and process that are known and identified.

HAZARD / ASPECT	Consequence / Impact (Potential Accident or Incident)	Risk Assessment		Risk Rating	Recommended Controls	Remarks (Applicable Program to be Implemented)
		Likelihood or	Severity of Consequence			

		Probability of Occurrence				
Project Phase - Construction						
Dust	Increase in Respiratory Ailments	Likely	Moderate	Significant	Implementation of dust management system e.g. water sprinkling	
Movement of noise emitting Trucks and MHEs	Noise Pollution	Likely	Insignificant	Moderate	Restrict noise producing activities to daytime hours.	
Accumulation of Residual Waste	Odor nuisance to the community	Unlikely	Insignificant	Low	Implementation of waste segregation (Solid Waste Management); Regular residual waste collection	
Human waste	Ground contamination and Odor nuisance to the community	Very Likely	Insignificant	Significant	Use and regular cleaning of portalet/s	
Hotworks (welding, grinding, cutting, etc.)	Fire	Likely	Moderate	Significant	Implementation of Permit to Work System; Fire extinguishers	
Electrical Lines / Equipment	Electrocution	Likely	Moderate	Significant	Implementation of Permit to Work System; Signage	

HAZARD / ASPECT	Consequence / Impact (Potential Accident or Incident)	Risk Assessment		Risk Rating	Recommended Controls	Remarks (Applicable Program to be Implemented)
		Likelihood or Probability of Occurrence	Severity of Consequence			
Project Phase - Operation						
Dust	Increase in Respiratory Ailments	Likely	Moderate	Significant	Installation of Dust Collection System	

Movement of noise emitting Trucks	Noise Pollution	Likely	Insignificant	Moderate	Restrict noise producing activities to daytime hours.	
Operation of noise emitting machineries and equipment	Noise Pollution	Very Likely	Insignificant	Significant	Installation of equipment housing	
Accumulation of Residual Waste	Odor nuisance to the community	Unlikely	Insignificant	Low	Implementation of waste segregation (Solid Waste Management); Regular residual waste collection	
Accumulation of Hazardous Waste	Ground contamination	Likely	Moderate	Significant	Implementation of Haz Waste Management System; Provision of Hazardous waste facility with secondary containment	
Human waste	Ground contamination and Odor nuisance to the community	Very Likely	Insignificant	Significant	Use of septic vaults and regular siphoning	
Electrical Lines / Equipment	Electrocution	Likely	Moderate	Significant	Implementationof Permit to Work System; Signage	
Hotworks (welding, grinding, cutting, etc.)	Fire	Likely	Moderate	Significant	Implementationof Permit to Work System; Firefighting system; Fire extinguishers	
Breakdown of conveyor system	Injury to community (fishermen)	Unlikely	Moderate	Moderate	Implementation of Preventive maintenance	

HAZARD / ASPECT	Consequence / Impact (Potential Accident or Incident)	Risk Assessment		Risk Rating	Recommended Controls	Remarks (Applicable Program to be Implemented)
		Likelihood or Probability of Occurrence	Severity of Consequence			
Project Phase - Decommissioning/Abandonment						
Dust	Increase in Respiratory Ailments	Likely	Moderate	Significant	Implementation of dust management system e.g. water sprinkling	
Movement of noise emitting Trucks and MHEs	Noise Pollution	Likely	Insignificant	Moderate	Restrict noise producing activities to daytime hours.	
Operation of noise emitting machineries and equipment	Noise Pollution	Very Likely	Insignificant	Significant	Installation of equipment housing	
Accumulation of Residual Waste	Odor nuisance to the community	Unlikely	Insignificant	Low	Implementation of waste segregation (Solid Waste Management); Regular residual waste collection	
Accumulation of Hazardous Waste	Ground contamination	Likely	Moderate	Significant	Conduct of Environmental Site Assessment (ESA) prior to abandonment	
Human waste	Ground contamination and Odor nuisance to the community	Very Likely	Insignificant	Significant	Use and regular cleaning of portalet/s	
Plant Closure	Loss of Job	Unlikely	Insignificant	Low	Provide alternative	

					sources of livelihood; Pay appropriate separation benefits	
Electrical Lines / Equipment	Electrocution	Likely	Moderate	Significant	Implementation of Permit to Work System; Signage	
Hotworks (welding, grinding, cutting, etc.)	Fire	Likely	Moderate	Significant	Implementation of Permit to Work System; Fire extinguishers	

As a result of the Risk Assessment below are the accidents that could occur in FILCEMENT as a consequence of exposures to different OSH hazards. Following are the accidents that could occur at FILCEMENT,

- Exposure to – occurs when workers are exposed to airborne chemicals like dusts (containing silica), fumes, (during welding), etc.
- Contact by – occurs when there are chemicals being handled that can splash
- Struck by – occurs when there are parts that can "fly or take off" striking the eyes.
- Contact with – occurs when workers are working with hot objects and electrical energy (especially during repair and maintenance)
- Struck against – occurs when employees apply force, for example when removing or disengaging a part
- Same level fall – occurs when employees slip and trip over something
- Different level fall – occurs when an employee "work at heights" (example: 2 meters from the surface)
- Overexertion – occurs when an employee lift materials and equipment beyond his threshold
- Caught on – occurs when an object being worn by employees "got caught" on a protruding object on an equipment or on a material in the work environment. Examples are jewelries and loose clothing.
- Caught between – occurs when body parts of employee are caught between two moving parts of equipment
- Trapped in – occurs when employees are trapped inside confined spaces

These accidents present OSH risk like injury and ill health to workers if not proactively controlled and mitigated.

Most of the hazards that constitute to these accidents are related to driving, work environment, use of tools and equipment, chemicals, housekeeping, practices, activities like maintenance (exposure to electrical and mechanical hazards, working at heights), and other activities like welding, confined space work, etc. –

Consequences of the above exposures could be loss of lives, serious injuries, ailment, body pains, impairment, fatigue, etc.

The risk categories using the Risk Assessment Model used are low, moderate, significant and high. The result of which is shown in the in the following table.

RESULT of RISK ASSESSMET	
Risk Category	No of Observation Under Each Risk Category
Low	4
Moderate	10
Significant	115
High	50

Exposures to hazards presenting high and significant risks need to be controlled while exposures to hazards with moderate and low risk must be monitored to ensure that they remain tolerable and under control. NO LONGER INCLUDED IN THE REVISED ERA

4.6 Proposed MFI Emergency Response and Disaster Preparedness Plan

4.6.1 Introduction

The Emergency Response Procedure (ERP) is a consolidated compendium of guidance for management of emergencies in all phases of the project cycle starting from the construction stage to the abandonment phase.

An Emergency Situation is defined as any situation or occurrence of serious nature which may develop suddenly and unexpectedly posing threat to life, property or even the environment that demand immediate action, including but not limited to accidents, fire, explosions, acts of terrorism and sabotage.

The success of this plan depends upon the cooperation of everybody at the site of an emergency and adherence to safety precautions and directives of this plan. The prime concern is everybody's safety which requires unwavering discipline and preparedness.

This plan reflects the Management System that is applied to ensure compliance with MFI standards and other applicable Philippine legal requirements pertaining to cement plant operations.

The scope of this "Plan" is to set the minimum standards required and identifies the persons responsible for applying safe working conditions, procedures and practices including emergency situations potentially arising from plant operations are those involved with coal transport and handling (normally via sea-vessel, fires, and with potential cases of oil spills. Whether natural or man-made the accidents or consequences of hazards will not be societal in scope but most confined to the plant personnel.

Notwithstanding that there are preventive measures to be undertaken, e.g. in the design and construction of major equipment, in the storage and management of coal and of start-up diesel oil, it is prudent for operating companies to develop their internal response plans.

The response and procedure will depend on the nature of the emergency and will include the following generic guidelines:

- Establishment of official detailed responses per type of emergency;

Thus, each plan would be relevant to emergency situations such as fire, earthquake, and even from attacks of criminal elements.

- Contact of necessary and important agencies and offices outside of the plant and facility for assistance depending on the type of emergency;
- Sought after or obtaining the assistance of the Disaster Reduction and Management Coordinating Council;
- Conduct of emergency drills with emergency evacuation as an integral part of the drill;
- Installation or securing of necessary emergency response facilities/equipment, e.g. firefighting system, oil spill containment boom (in an event of accidental oil spill at the jetty), vehicles for use in emergency cases, situations and disasters; and
- Setting up of communication lines, e.g. with barangay, fire department, police department, clinics or hospitals.

During actual emergencies

- Designation of on-site emergency marshal;
  The on-site team leader should be pre-determined. Night shift supervisors are the logical leaders during night time emergencies.
  In case of more serious situations, the on-site team leader may have to call assistance from his supervisor who may be outside the plant premises.
- Communicating with outside parties for help when necessary:
  Contact numbers and means of communications should be well established and be posted in conspicuous places in the plant premises and buildings.
- Execution of emergency procedure; and
  As a basic first step, emergency alarm signals should be set on. The alarms may be coded depending on the type and seriousness of an emergency.
- Evacuation of personnel: Evacuation routes should be well defined and known to the plant personnel.

After emergency

- Audit or investigation of cause of emergency, if man-made such as fire;
- Assistance to injured people

4.6.2 Purpose

The ERP will serve the following general and important purposes:

- Guide and assist the proponent including all its employees, construction contractors' management, and other service provider/suppliers to handle emergency situation;
- Pre-identify responsible parties including their roles and responsibilities in handling emergency situations and cases;
- Achieve Zero Loss Time Injury, Occupational Illness and minimize the rate of incidents
- Comply with the Philippine legal requirement and international standards for handling emergency, health and safety practices and measures; and
- In case of emergency situations/cases and abnormal conditions, prevent contamination to ground water, surface ground stability, destruction of flora and fauna and if they occur take measures to manage them in timely, safely and environmental friendly manner.

4.6.3 Emergency Action Team (EAT)

The Emergency Action Team (EAT) shall be responsible for execution of the ERP. The Team is composed of:

During the Construction Work:

- Chief Marshall – Construction/Project Manager,
- Members – LGUs including the Police Department, Fire Department, National Risk Reduction Committee members and the Health Department.

Under the general supervision of the Project Manager, the EAT will be responsible for providing direction, guidance, and taking appropriate measures in safeguarding life and property. The EAT will also maintain close liaison with the Project Proponent and affected communities/people.

During the Operations Phase:
For serious accidents or emergencies the EAT shall be headed by the most senior personnel of the Proponent who would be at the site of the emergency.

Emergency Action Officer
Emergency Response Procedures shall be under constant close supervision of the Emergency Action Officer (EAO). The EAO shall maintain central control of the execution of the plans. All incidents under emergency situations shall be reported to him. The EAO shall command, coordinate, communicate and direct necessary actions and measures. The mandate of EAO is to establish command and control. However, this does not preclude abstinence of others, especially supervisory employees, from emergency tasks requirements.

In addition to the emergency duties, the EAT shall provide training and/or arrange drills around the year so as to train employees on handling emergency situations.

Threat/Emergency Analysis
When there is an emergency incident e.g. fire or any type of threat or emergency as mentioned below, the first person who sees, hears or recognizes danger should immediately inform the EAO.

Designation of Safe Haven
Safe Haven is a place of safety, shelter, refuge or rest where there is no danger to life. Based on the type of incident, the safe haven shall be determined and designated where the people affected by an emergency situation shall proceed. In case of fire or explosion, the Safe Haven shall be the open space distant from the fire site.

By nature of the project, the site is an open area; the safe haven should be pre-identified and well informed to all the personnel.

Evacuation Policy
In the event of any emergency, an alarm or siren or alternately a sound generating devise shall be blown / activated. The alarm may be coded to signify the intensity and nature of the emergency situation. The EAO shall direct and provide guidance to all persons affected. All affected persons shall be enjoined to strictly follow as instructed.

The evacuation route/roads will be clearly delineated.

4.6.4 Standard Operating Procedures

Fire
All persons near the fire site should be evacuated. Firefighting shall be handled by the EAO in the beginning until assistance from the LGU shall have been obtained.

Acts of Sabotage
Act of sabotage may cause fire, explosion, or damage to life and property. If a threat of sabotage is identified, the Emergency Action Team shall analyze and assess the impact of such sabotage and will determine course(s) of action.

The EAO shall maintain liaison with the concerned government agency (ies) e.g. Bureau of Fire Protection, Police Department, etc. Should a fire or explosion happen due to sabotage, the corresponding procedure specific to the situation shall be followed.

Terrorist Attacks or Kidnappings
The EAT shall analyze, assess and maintain constant but safe contact with the attackers, review all incoming and outgoing communications, designate or task others for action. The EAO

shall ensure compliance of the planned strategy and psychological tactics to counter terrorism and provide guidance for dealing with these incidents. An officer shall be designated to maintain direct or indirect contact with the kidnappers, maintain liaison with the Client and other pertinent Government Agencies, principally the police or the military.

Natural Disasters
Natural disasters such as landslides and earthquakes are beyond human control with respect to occurrences. The EAT shall analyze the situation and take appropriate measures. In the event of earthquake, construction workers shall come out of their workplaces, wear hard hats, and assemble at Safe Haven. Search and Rescue Team shall start search and rescue operations when needed.

As a matter of complete guidelines natural disasters are included although the occurrence of such are deemed remote.

Severe Weather Disturbances
Extreme rainfall and strong typhoon events should be prepared for.

The most effective measure is precautionary action. Constant communications with the PAG ASA and the NDRMC should be made. Warnings which are posted at the websites should be constantly referred to. Work stoppage may be mandated by management when severe weather disturbances may be forthcoming. The movements of vehicles, e.g. during coal haulage should be regulated on account of dangers from slippery roads.

Search and Rescue Team
This team shall work in close cooperation with the LGUs. The primary function of this team is to handle the smooth evacuation of personnel, supplies and personal belongings during the emergency. It is also the duty of this team to rescue personnel trapped or injured in any of the rooms of the building.

Coordination and Communication
One of the most important aspects in any Emergency Response Procedure is efficiency of immediate communications with the parties which will manage an emergency situation.

In an event of fire, explosion or an act of terrorism and sabotage, the EAO shall maintain constant coordination and communication with other senior officers at site or the department heads to locate employees trapped in a work area and take appropriate measures to evacuate them.

Transportation
The EAO shall plan ground transportation of personnel or evacuees for transport to the city, hospital, medical professionals, etc.

Funds and Expenditures
Under the direct supervision of the Project Manager, the EAO shall manage funds for meeting emergency expenditures. This includes, but is not limited to, transportation, medication, expenditures arising out of emergency treatment, hospital and medical expenses, etc.
During the operations phase, the Proponent shall ensure that the emergency response plans are properly supported by funds and resources, the latter involving people and equipment.

Emergency Numbers/Contact Persons
A list of the emergency contact numbers, typical of which is shown in Table 4.2 should be in the possession of all grinding plant personnel.

Table 4.2: Proforma List of Emergency Contact Numbers

Agency Resources/Contact Persons	Telephone No.
LOCAL GOVERNMENT AGENCIES	
Barangay Captains	**+63 915 694 9547**
Fire Station	**(043) 223-5514**

Hospital	**(043) 223-7708**
Police Station	**(043) 223-5048**
Local office of the National Disaster Management Council	
PROPONENT'S PERSONNEL	
Plant Manager	
Safety Engineer	
CONTRACTOR's PERSONNEL	
Project Manager	
Site Engineer	

The emergency numbers/contact persons shall be posted in conspicuous places especially in the construction work temporary offices and in the toll booths, the latter during the operations phase.

Emergency Drills
A protocol will be developed for the conduct of emergency drills at regular schedules.

Administration of first aid especially involving vehicular accidents is among the important drills/training that will be imparted to the EAO for the operations phase.

Trainings and Seminars
The Proponent shall organize and conduct regular trainings and seminars to be conducted by professionals in safety and emergency management. Attendance to these on the part of the personnel shall be compulsory. Members of the LGUs as well as heads of community sectors/sitios/tribes shall be invited as well for their own education.

Among the topics to be discussed during these training programmes are: proper use of Personnel Protective Equipment (PPE), First Aid, Basic Life Support such as Cardiopulmonary Resuscitation; training in the handling of injured persons; training in search and rescue operation and fire-fighting. The assistance of NDRRMC at least from the City level in conducting drills or training for earthquake situations should be explored.

4.6 Institutional Set Up

The MFI Grinding Plant Team will constitute them-selves as the Emergency Response Team. In as much as by its nature the occurrences of emergency situation cannot be reasonably anticipated the most senior personnel at the scene of an emergency situation will be designated as On-Site Emergency Marshall. The supporting personnel will be dependent on the nature/extent of the emergency and the number of persons who may be exposed.

4.7 MFI PROJECT ENVIRONMENTAL RISK CATEGORIZATION PLAN

Environmental risk assessment (ERA) involves the examination of risks resulting from natural events (flooding, extreme weather events, etc.), technology, practices, processes, products, agents and industrial activities that may pose threats to ecosystems, animals and people. Environmental health risk assessment addresses human health concerns and ecological risk assessment addresses environmental media and organisms. ERA is predominantly a scientific activity and involves a critical review of available data for the purpose of identifying and possibly quantifying the risks associated with a potential threat.

Safety risks are characterized by acute consequences, ranging from a minor injury requiring first aid treatment or a more serious lost-time injury through to a permanent disability or a fatality. Health risks may be the result of single or multiple exposures leading to acute or chronic illness or disability. Often those outcomes only materialize over long timeframes and can easily be overlooked in the urgency to manage more immediate concerns.

Social risk addresses both the direct impact and its potential to affect the health and safety of local community. Direct impacts involve the competition on resources such as water, power supply, and the drastic increase of household requirements due to the displacement of population requiring resettlement.

Failure to assess and control those risks can cause substantial or permanent loss of life and significant impacts on the environment and near-mine communities. So, the aim of risk assessment process is to significantly reduce the potential for unplanned or unwanted events and outcomes. It serves as a guideline to prioritize the high level of risk and provide information how to control it.

Risk assessment involves a detailed and systematic examination of any activity, location or operational system to identify hazards. It also systematically enables the ranking of risks such that efforts can be focused to eliminate risks or reduce the risks to an acceptable level. The assessment will consider the relationship between the likelihood and potential consequence of the risk of hazards occurring, and to review the current or planned approaches to controlling the hazards.

By definition:

Hazard is a source of potential harm or a situation with potential to cause harm (AS/NZS 4360 Risk Management).

Risk is defined as the chance of something happening that will have an impact upon objectives (AS/NZS 4360 Risk Management). In other words, risk is the chance of something happening that will have a negative impact on the health or safety of a person. Risks are measured in terms of likelihood and consequence.

Risks are not static, rather they are dynamic and their likelihood and consequences can increase or decrease suddenly depending on various factors. For this reason, risk assessment should be treated as 'living' documents and reviewed regularly.

Risk assessment involves:

1) Risk identification
2) Risk analysis
3) Risk evaluation
4) Risk treatment and discuss how they can be controlled through proper planning and decision-making
5) Monitor and Review

Risk Identification

The aim of the risk identification step is to identify a comprehensive list of risks based on events that might create, enhance, prevent, degrade, accelerate or delay the achievement of MFI objectives.

Risk Analysis

Risk analysis involves consideration of the causes and sources of risk, their positive and negative consequences, and the likelihood that those consequences can occur. Controls represent any process, policy, device, practice or other actions taken by management which reduce the likelihood of a risk

occurring or the potential damage arising from the risk. The risk analysis process involves the assignment of an overall residual risk rating for each risk documented through the following three steps.

(1) Analyze the inherent risk
- assess the likelihood and consequence of a risk event if it were to occur in the absence of controls

(2) Identify and assess controls
- identify the existing controls in place to address the risk, and assess how effective they are in operation

(3) Analyze the residual risk
- reassess the likelihood and consequence of a risk event if it were to occur, taking Into consideration the effectiveness of the control environment as assessed in Step 2

Risk Evaluation

The purpose of risk evaluation is to assist in making decisions based on the outcomes of risk analysis, about the risks that need treatment, and the implementation priority for these treatments.

Risk Treatment

Risk treatment involves selecting one or more options for modifying risks and implementing those options; once implemented, treatments provide or modify the controls. Generally, there are a number of options when treating a risk: avoid the risk; reduce the risk; share the risk; or retain or accept the risk. As a range of options may be available to treat a risk, efficiency of treatment and reduction of the overall cost of the risk is an important consideration. Employees should consider what approaches are available to treat the risk, the cost benefit ratio for each viable treatment, and how such treatments will be implemented.

Monitor and Review

Regularly monitor and report of the progress of treatment implementation to relevant stakeholders for each risk. Where treatments are implemented or a risk profile has changed, the risk's likelihood, consequence, and criticality rating should be re-evaluated.

To support employees in the analysis, assessment and evaluation of risk, MFI has adopted standardized criteria and rating scales to be applied across all risk management activities. These criteria and rating scales and their application to the risk assessment steps outlined above.

Table 1. Qualitative Measures of Consequence

LEVEL	DESCRIPTOR	ENVIRONMENT	HEALTH AND SAFETY	SOCIAL
1	Insignificant	Negligible reversible environmental impact requiring very minor remediation	No injury or illness reported	Low-level social impacts
2	Minor	Minor reversible environmental impact requiring minor remediation	First aid attention needed	Minor social impacts on small number of people.
3	Moderate	Moderate reversible environmental impact with short	Medical attention required-examination	Frequent social issues.

		term effect requiring moderate remediation	at a hospital or medical clinic	
4	Major	Serious environmental impact with medium term effect requiring significant remediation	Long-term illness or severe injury (means hospitalization for more than 24 hours)	A breakdown of social order.
5	Catastrophic	Permanent, severe environmental impact with long term effect requiring major remediation	Death or permanent disability	Complete breakdown of social order

Table 2 Qualitative Measures of Likelihood

LEVEL	DESCRIPTOR	DESCRIPTION	GUIDING FREQUENCY
A	Almost certain	The event is expected to occur in most circumstances.	Will occur in regular basis
B	Likely	There is a strong possibility the event will occur.	Will occur in the next 1-2 years
C	Possible	The event might occur at some time.	Will occur every 2 to 5 years
D	Unlikely	Not expected, but there's a slight possibility it may occur at some time.	Will occur every 5 to 10 years
E	Rare	Highly unlikely, but it may occur in exceptional circumstances. It could happen, but probably never will.	Will occur every 10 years upward

Table 3 Risk Assessment Matrix

LIKELIHOOD	CONSEQUENCES				
	Insignificant (**1**)	Minor (**2**)	Moderate (**3**)	Major (**4**)	Catastrophic (**5**)
(**A**) Almost Certain	**H**	**H**	**E**	**E**	**E**
(**B**) Likely	**M**	**H**	**H**	**E**	**E**
(**C**) Possible	**L**	**M**	**H**	**E**	**E**
(**D**) Unlikely	**L**	**L**	**M**	**H**	**E**
(**E**) Rare	**L**	**L**	**M**	**H**	**H**

E = Extreme Risk **M = Moderate Risk**
H = High Risk **L = Low Risk**

Table 4 presents the Comprehensive Risk Categorization Plan, while **Table 5** shows the Risk Assessment Identification Matrix.

Therefore, when risk management is not undertaken thoroughly it can lead to major impacts on an individual, company and the environment. Thus, sustainability requires that the complex relationships between various risks will be understood specially the potential links between environmental, social, safety and health risks.

SECTION 5. SOCIAL DEVELOPMENT PLAN/FRAMEWORK

AND IEC FRAMEWORK

5.1. Social Development Plan/Framework (SDP)

The Proponent will be undertaking SDPs in consonance with its Corporate Social Responsibility (CSR) mission, which includes but not limited:

- Skills training to prepare the community for employment opportunities during the construction phase of the project;
- Sustainable livelihood training programs;
- Environmental/Climate Mitigation Actions: Reforestation and Carbon Sink Program

The SDP Framework provided in the Table 5.1-1 below shows programs needed by the community based on the perception survey conducted, and the indicated issues and concerns during the Public Scoping and Public Consultation.

Annex 8 is the complete documentation of the Public Scoping.

Table 5.1-1: Preliminary Social Development (SDP) Plan/Framework[1]

CONCERN	Responsible Community Member / Beneficiary	Government Agency/ Non-government Agency & Services	PROPONENT	Indicative Timeline	Source of fund
Livelihood / Employment (Men, Women, Youth & elderly): * Skills training to prepare the community for employment opportunities during the construction phase of the project; * Sustainable livelihood training programs	Qualified Project Affected Men, Women, Youth & Elderly	• Barangay Council of Lumbang Calzada • City Council • TESDA	Community Relations Officer of MFI	-Construction -Operation	LGU–IRA / Proponent
Education and Recreation	Barangay Kagawad for Education • Project-affected Families	• DepEd	Community Relations Officer	-Construction -Operation	LGU–IRA / Proponent
Environment and Sanitation • Reforestation and Carbon-Sink Program • Tree nursery • Climate Change and Disaster preparedness	Barangay Kagawad for Environment • Project Affected Community	• CENRO • Rural Health Unit of Calaca, Batangas • CISC	Community Relations Officer of MFI EHS Manager	-Construction -Operation	LGU–IRA / Proponent
Peace and order	Barangay Kagawad for Peace and order • Project Affected Community	• LGU • PNP	Chief Security Officer	-Construction -Operation	LGU–IRA / Proponent

5.2. Information, Education and Communications (IEC)

The IEC started as early as August 2018, when the Proponent started series of dialogues with the Local Government Unit of Calaca and the Barangay Government Unit of Barangay Lumbang Calzada.

IEC will be a continuing process through the life of the project.

IEC necessarily involves several media and forms such as perception surveys, public consultations or Focus Group Discussions (FGDs) or print media.

The generic IEC Plan/Framework is shown in Table 5.2-1.

The SDP and IEC provided are generic in nature. These may be updated before project implementation thru consultations with stakeholders concerned.

Table 5.2-1: Generic IEC Plan/Framework

Target Sector Identified as Needing Project IEC	Major Topic/s or concern in Relation to Project	IEC Scheme/ Strategy Methods	Information Medium	Indicative Timelines and Frequency	Indicative Cost (in Pesos)
1. Residents of Brgy. Lumbang Calzada	Awareness for the people on the actual impacts & mitigating measures of the Project	Group methods Multi-media	• 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 barangay, i.e. Brgy. Lumbang Calzada		Group methods	• Educational Tour with the four elementary schools of the impact barangays	Once a year	50,000.00
3. Stakeholders meeting		Group methods	• Stakeholder's meeting	Once a year	25,000.00
4. Mabuhay Filcement Inc. employees	Awareness and safety	Group methods	• Annual Safety program • Safety Inspectors Training • First Aid Training • Hazard Identification and Risk Assessment Training	Once a year	Part of company budget for employees

SECTION 6. ENVIRONMENTAL COMPLIANCE MONITORING

6.1. Self-Monitoring Plan

Provided in Table 6.3 is the Self-Monitoring Plan as per Annex 2-20 of RPM for AO 2003-30. Below is the definition of EQPL-Environmental Quality Performance Level:

Table 6.1-1: EQPL Definition

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.

Table 6.1-2. Summary of Environmental Monitoring Plan (Emop) with Environmental Quality Performance Levels (EQPLs)

Key Env'tal Aspect / Phase	**Potential Impacts Per Envit'l Sector**	**Parameter to be Monitored**	**Method**	**Freq.**	**Location**	**Lead**	**Annual Estimated Cost in PhP**	**EQPL MANAGEMENT SCHEME**					
								EQPL RANGE			**MANAGEMENT MEASURE**		
								ALERT	**ACTION**	**LIMIT**	**ALERT**	**ACTION**	**LIMIT**
CONSTRUCTION PHASE													
Aspect #1: Emissions to Air	Increase in Ambient TSP	TSP, (µg/Ncm)	(S) 24 hr High Volume- (A) Gravimetric USEPA 40 CFR, Part 50, Appendix B	quarterly	same as identified in the baseline	PCO	120,000	**75** ug/ncm	**150** ug/ncm	230 u g / n c n	-Check possible sources of increase in levels within the plant site - implement mitigation measures – check possible sources to reduce	-Check possible issues from construction equipment and rectify -mitigate possible source to reduce emission levels -Enhance monitoring	-Check possible source, - shut down equipment source of emission -advise contractor /management
		PM_{10}, (µg/Ncm)	24-hr High Volume with 10 micron particle-size inlet (A) Gravimetric USEPA 40 CFR, Part 50, Appendix J	quarterly	same as identified in the baseline	PCO	Included in the above	40 ug/ncm	80 ug/ncm	150 ug /ncm			

Key Env'tal Aspect / Phase	Potential Impacts Per Envit'l Sector	Parameter to be Monitored	Method	Freq.	Location	Lead	Annual Estimated Cost in PhP	EQPL MANAGEMENT SCHEME					
								EQPL RANGE			MANAGEMENT MEASURE		
								ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
		SO_2, (µg/Ncm)	(S) 24-hr Gas Bubbler (A) Pararosaniline Method	quarterly	same as identified in the baseline	PCO	Included in the above	30 ug/ncm	60 ug/ncm	180 ug/ ncm	emission levels - Continue monitoring		
		NO_2, (µg/Ncm)	(S) 24-hr Gas Bubbler (A) Griess-Saltzman or	quarterly	same as identified in the baseline	PCO	Included in the above	20 ug/ncm	40 ug/ncm	150 ug/ ncm			
		Sound Levels	24 hr sound measurements using hand-held sound meter	daily	same as identified in the baseline	PCO	Included in the above	45 decibels	50 decibels	OSH standa rd			
OPERATION PHASE													

Key Env'tal Aspect / Phase	Potential Impacts Per Envit'l Sector	Parameter to be Monitored	Method	Freq.	Location	Lead	Annual Estimated Cost in PhP	EQPL MANAGEMENT SCHEME					
								EQPL RANGE			MANAGEMENT MEASURE		
								ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
Aspect #1 Emissions to Air	Increase in Ambient TSP	TSP, (µg/Ncm)	(S) 24 hr High Volume- (A) Gravimetric USEPA 40 CFR, Part 50, Appendix B	quarterly	same as identified in the baseline	PCO	120.000	**75** ug/ncm	**150** ug/ncm	230 ug/ ncm	-Check possible sources of increase in levels within the plant site - implement mitigation measures – check possible sources to reduce emission levels - Continue monitoring	-Check possible issues from construction equipment and rectify -mitigate possible source to reduce emission levels -Enhance monitoring	-Check possible source, - shut down equipment source of emission -advise contractor /management
		PM_{10}, (µg/Ncm)	24-hr High Volume with 10 micron particle-size inlet (A) Gravimetric USEPA 40 CFR, Part 50, Appendix J	quarterly	same as identified in the baseline	PCO	Included in the above	40 ug/ncm	80 ug/ncm	150 ug/ ncm			
		SO_2, (µg/Ncm)	(S) 24-hr Gas Bubbler (A) Pararosaniline Method	quarterly	same as identified in the baseline	PCO	Included in the above	30 ug/ncm	60 ug/ncm	180 ug /ncm			

Key Env'tal Aspect / Phase	Potential Impacts Per Envit'l Sector	Parameter to be Monitored	Method	Freq.	Location	Lead	Annual Estimated Cost in PhP	EQPL MANAGEMENT SCHEME					
								EQPL RANGE			MANAGEMENT MEASURE		
								ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
		NO_2, (µg/Ncm)	(S) 24-hr Gas Bubbler (A) Griess-Saltzman or	quarterly	same as identified in the baseline	PCO	Included in the above	20 ug/ncm	40 ug/ncm	150 ug /ncm			
		Sound Levels	24 hr sound measurements using hand-held sound meter	daily	same as identified in the baseline	PCO	Included in the above	45 decibels	50 decibels	OSH standard	Immediately stop/ shutdown the source equipment	Immediately stop/ shutdown the source equipment	Immediately stop/ shutdown the source equipment
Aspect #2 Discharge of Wastewater	Water and Land Pollution due to discharge from Sewage Treatment Plant	PSIC 37000: BOD,	Grab sampling	During entire operations phase	Discharge point of STP	PCO	40,000	30 mg/L	40 mg/L	50 g/L	- Ensure that the STP is enclosed with concrete - -Desludging periodically to avoid discharge		
		Surfactants	- ditto-	ditto-	ditto-	ditto-	Included in the above	5 mg/L	10 mg/L	15 mg/L			

Key Env'tal Aspect / Phase	Potential Impacts Per Envit'l Sector	Parameter to be Monitored	Method	Freq.	Location	Lead	Annual Estimated Cost in PhP	EQPL MANAGEMENT SCHEME					
								EQPL RANGE			MANAGEMENT MEASURE		
								ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
		Oil and Grease	ditto-	ditto-	ditto-	ditto-	Included in the above	2mg/L	3mg/L	5mg/L			
		Fecal Coliform	ditto-	ditto-	ditto-	ditto-	Included in the above	100 MPN/100 ml	200 MPN/100 ml	400 MPN/100 ml			
		Ammonia	ditto-	ditto-	ditto-	ditto-	Included in the above	0.1 mg/L	0.3 mg/L	0.5 mg/L			
		Nitrate	ditto-	ditto-	ditto-	ditto-	Included in the above	5 mg/L	10 mg/L	14 mg/L			
		Phosphate	ditto-	ditto-	ditto-	ditto-	Included in the above	0.2 mg/L	0.5 mg/L	1 mg/L			
ABANDONMENT [PHASE (to be submitted a year before Closure)													

6.2. Multi-Sectoral Monitoring Framework

Provided below is the list of stakeholder-members of the MMT of the proposed project. Annex 3 is the proforma Memorandum of Agreement for the establishment of MMT.

Functions of MMT are as follows:

1. Monitor project compliance with the conditions stipulated in the ECC and the EMP
2. Validate proponent's conduct of self-monitoring
3. Receive complaints, gather relevant information to facilitate determination of validity of complaints or concerns about the project and timely transmit to the proponent and EMB recommended measures to address the complaint
4. Prepare, integrate & disseminate simplified monitoring reports to community stakeholders
5. Make regular and timely submission of MMT Report based on the EMB-prescribed format

6.2.1 Composition of the MFI Cement Grinding and Packing Project MMT

The MMT shall be multi-sectoral and shall have representations from the stakeholders. The identified offices / sector shall officially designate/authorize through a written office order, endorsement letter or similar instruments, a representative to be a member of the MMT who must:

1. Be able to regularly attend meetings, orientations, training, actual monitoring and reporting activities.
2. Be able to read, write and learn the various aspects of monitoring.
3. Be credible to the larger community and without any criminal or administrative cases

(an alternate member for each represented entity may be officially designated if deemed necessary)

The proposed membership for the MFI Project MMT is provided in Table 6.2-1.

Table 6.2-1: Proposed MMT Composition

Stakeholder-Members	
PENRO / CENRO	LGU- Municipality of Calaca
Calaca Industrial Seaport Corporation	BGU- Brgy. Lumbang Calzada
Proponent Mabuhay FilCement, Inc.	Accredited NGO

The roles and functions of the members of MMT are presented as follows:

6.2.2 Functions of the Each MMT Member

As provided in the Template MOA for establishing the MMT, the following are the functions of each member.

MFI as the proponent shall provide necessary budget/funds for the MMT activities, make available to the MMT all project information necessary to determine compliance with the environmental requirements and commitments to the extent that such information is not subject to any restrictions and confidentiality, coordinate with and allow the MMT members to inspect and observe construction and operation activities of the PROJECT including the testing, calibration and operation of pollution control and in-house monitoring equipment.

The Municipal Local Government Unit of Calaca and the Barangay Local Government Unit of Lumbang Calzada's designated representatives shall participate in actual monitoring work, prepare or concur with and sign the MMT monitoring reports, provide the necessary information about local policies, plans and programs affecting MMT monitoring results and standards, advise the MMT of any complaints, information or reports from LGUs concerning the PROJECT.

The Calaca Industrial Seaport Corporation shall monitor/oversee MFI's compliance of the terms and conditions with respect to the sale of CIS zone lot (project site) such as the use of port facility, source of domestic water supply, access roads, etc.

The NGO/PO within the area and its designated representative shall participate in actual monitoring work, prepare or concur with and sign the monitoring reports, provide the necessary information such as update regarding the perceptible impact of the project on the sector/concern being represented.

As may be required from time to time, MMT may request the assistance of DENR – EMB to provide the necessary information about agency/sectoral policies, plans and programs affecting MMT monitoring results and standards and participate in the actual monitoring activity and concur with and sign the monitoring reports.

6.3. Environmental Guarantee and Monitoring Fund Commitments

The establishment of the appropriate EMF and EGF schemes will be in accordance with the prescribed guidelines and procedures of the DENR Administrative Order No. 2003-30 and its procedural manual. The amount of the EGF will be based on the risk and hazards that will be associated with the project's implementation and will be negotiated between Mabuhay FilCement Inc. and the DENR-EMB Central office. The proposed EGF amount is Two Million Pesos (PhP 2,000.000).

The EMF to be established immediately after the Memorandum of Agreement (MOA) on EGF and EMF, based on the activities and programs of the Multi-partite Monitoring Team (MMT), is proposed PhP200,000.00. The EMF can be replenished once the amount of PhP200,000.00 is less than 50%.

SECTION 7. DECOMMISSIONING / ABANDONMENT / REHABILITATION POLICY

Decommissioning refers to the permanent cessation of the operations phase and may be occasioned by (a) Retirement of the facilities after its useful life, estimated of at least 25 years, (b) Non-financial viability, (c) "Force Majeure" scenarios such as maybe due, although unlikely to natural hazards.

Statement of Proponent's Policies and Generic Procedures for Rehabilitation/ Decommissioning/ Abandonment which will be implemented Post-ECC. Corporate Social Responsibility (CSR) which is a major core value of the Proponent adheres to the protection of the environment and people and will be the guiding principle during project decommissioning.

An environmental assessment and audit will necessarily be undertaken prior to abandonment to establish any possible residuals in the resources and thus determine the remedial measures. Since the air resources are constantly monitored no residual impacts on the ambient air is likely. Close out health examinations of personnel workers and of resident near the project site will be undertaken. This will also insulate the Proponent from any legal claims after decommissioning.

The protocol for decommissioning will be submitted to the concerned EMB office for approval before implementation. The MMT will be represented in monitoring the decommissioning activities.

Timeframe

The decommissioning program for submission and approval to the EMB will be submitted at least six (6) months before the schedule or as may be prescribed in the future by the DENR/EMB.

SECTION 8. INSTITUTIONAL PLAN FOR EMP IMPLEMENTATION

Introduction/Rationale

Mabuhay Cement Inc. is guided with the following 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 Mabuhay Filcement, Inc. project implementation (for all phases of the project) and is responsible for overseeing environmental compliance of Mabuhay Filcement, Inc. activities, environmental requirements and regulatory obligations. Figure 8-1.

Core Function of the team/unit includes the following:

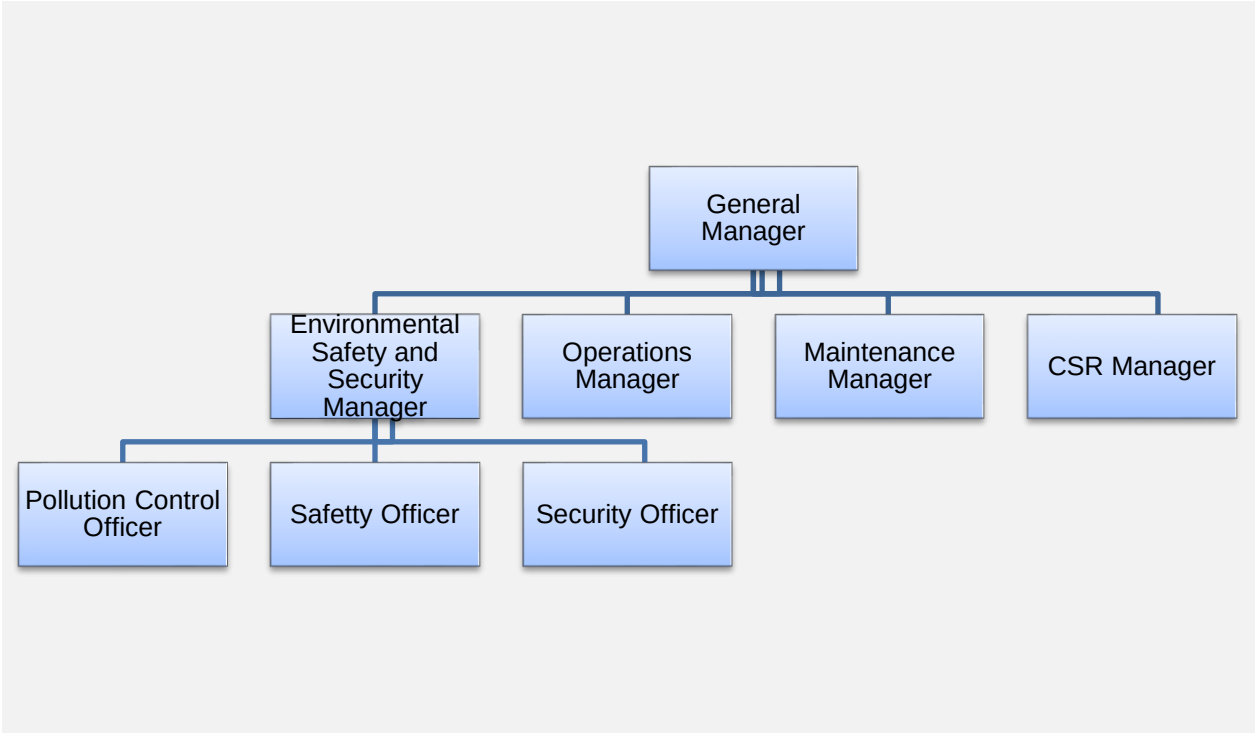
- Systems and Procedures
- Environmental Safeguards and Implementation
- Government Regulatory Compliance
- Environment Health Safety Program and Awareness
- EHS Program Compliance

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. Figure 9.1 illustrate the institutional framework. There are no generally applicable, rigid rules, so many variations are possible depending on the Mabuhay Filcement, Inc.'s personnel capacities and structures.

Presented below is the partial listing of key manpower requirements and the Table of Organization of the Environmental, Health and Safety Unit of MFI.

Figure 8-1 Table of Organization for EMP Implementation



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
EHS Manager	In-charge of implementing the commitments to the EMP, together with the General Manager who is the also the Managing Head per DAO 2014-02
Pollution Control Officer/ maintenance of external agencies	Compliance to environmental regulations & standards; reports that are submitted to internal and
Safety Officer	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

To receive and resolve complaints in a structured way, issues, and concerns, a Grievance Redress Mechanism will be developed by MFI. The grievance mechanism should ensure that complaints are addressed promptly as transparent as possible considering the social and cultural dynamics of the community. Resolution of social and environmental concerns should be able to address the risks or impact associated with the said complaint.

A Grievance Committee will be organized to meet the said objectives with membership to include but not limited to the following: Operations General Manager, Community Relations Manager or Officer, PCO, representative from the Legal Team and a Grievance Coordinator.

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