ENVIRONMENTAL IMPACT STATEMENT

Scrap Recycling Mini Mill Project

Brgy. Telabanca, Concepcion, Tarlac

STEEL ASIA

Prepared by:

Mediatrix Business Consultancy

Table of Contents

Executive Summary 4
Project Fact Sheet / PD Summary 4
Process Documentation of the Conduct of EIA 7
Description of Key EIA Methodologies 12
EIA Summary 19
Concise integrated summary of the main impacts and residual effects after applying mitigation 20
Risks and Uncertainties relating to the findings and implications for decision-making 20
CHAPTER I: PROJECT DESCRIPTION 21
1.1 Project Location and Area 21
1.1.1 Project Location 21
Impact Area Delineation 24
1.1.2 Geographic coordinates of the Project Site 26
1.1.3 Discussion on the Accessibility of the Project Site/Area 26
1.2 Project Rationale 29
1.3 Project Alternatives 29
1.3.1 Criteria Used In Determining Preliminary Options 29
1.3.3 No Project Option 30
1.4 Project Components 31
1.4.1 General lay-out of facilities 31
1.4.2 Map showing the location and boundaries of project area, location and footprint of main and support facilities and proposed buffers 31
1.4.3 Major Components: 33
1.4.4 Ancillary facilities: 33
1.4.5 Pollution Control Devices and Corresponding Facilities Being Served or Connected 35
1.5 Process /Technology 39
1.5.1 Processing/Manufacturing Technology 39
Scrap Yard 39
Melt Shop 42
1.5.2 Pollution Control Devices and Waste Management System 46
1.5.3 Operations and Maintenance of Facility 47
1.6 Project Size 59
1.7 Development Plan, Description of Project Phases and Corresponding Timeframes 59
Pre-Construction 59
Construction 59
Operation 60
1.8 Manpower 60
1.9 Indicative Project Investment Cost 62
CHAPTER II: ASSESSMENT OF ENVIRONMENTAL IMPACTS 63
2.1 LAND 63
2.1.1 Land Use and Classification 63

2.1.2 Geology/Geomorphology 68
2.1.2.1 Change in surface landform/ geomorphology/topography/ terrain/slope 68
2.1.2.2 Change in surface landform/ topography/ terrain/slope 73
2.1.2.3 Hazard Maps and Discussions of Impacts/Effects of Natural Hazards on the Project 75
2.1.3 Pedology 89
2.1.4 Terrestrial Biology 96
2.2 WATER 99
2.2.1 Hydrology 99
2.2.2 Hydrogeology 102
2.2.3 Impact Identification, Prediction and Assessment, and Mitigation 105
2.2.4 Water Quality 106
2.2.4.1 Water Sample Collection 106
2.2.4.2 Water Quality Sampling Stations 106
2.2.4.3 Water Quality Standards 109
2.2.4.4 Results and Analysis 109
2.2.4.4.1 Groundwater 109
2.2.4.4.2 Degradation of Water Quality 110
2.2.4.5 Freshwater Ecology 111
2.2.5 Marine Ecology 134
2.3 AIR 134
2.3.2.1 Ambient Air Quality 147
2.3.2.1.1.2 Degradation of Air Quality during Operation Phase 148
2.3.2.2 Noise Quality 163
Noise Modeling Input Data 166
Noise Modeling Results 167
Noise Modeling Results 170
2.4 PEOPLE 172
Demographic data of impact area 173
2.4.1 Methodology 174
2.4.2 Assessment of key impacts and mitigating measures 177
2.4.2.1 Impacts on land ownership, public access, structures, and livelihood 177
2.4.2.2 In-migration 178
2.4.2.3 Cultural/Lifestyle Change 184
2.4.2.4. Impacts on physical cultural resources 184
2.4.2.5 Threat to delivery of basic services /resource competition 184
2.4.2.6 Threat to public health and safety 185
DISEASES DUE TO CLIMATE CHANGE 186
OCCUPATIONAL HEALTH PLAN AND OCCUPATIONAL HAZARDS 186
2.4.2.8 Traffic congestion 188
CHAPTER III: ENVIRONMENTAL MANAGEMENT PLAN 191

CHAPTER IV: ENVIRONMENT RISK ASSESSMENT AND EMERGENCY RESPONSE POLICY AND GUIDELINES 196
Introduction 196
Scope and Coverage 196
Type of Risks 196
Safety Risks 196
Release of Toxic Substances 197
Physical Risks 198
Breakdown or Failure of Equipment and Facilities 198
Hazard Analysis 199
1. Introduction 199
2. Purpose 200
3. Emergency Action Team (EAT) 200
4. Standard Operating Procedures 201
5. Institutional Set Up 203
CHAPTER V: SOCIAL DEVELOPMENT PLAN (SDP) AND IEC FRAMEWORK 204
5.1 The Social Development Plan (SDP) 204
5.2 The Information, Education and Communications (IEC) Implementation Plan 205
CHAPTER VI: ENVIRONMENTAL COMPLIANCE MONITORING 207
6.1 Self-Monitoring Plan 207
6.2 Multi-Sectoral Monitoring Framework 207
CHAPTER VII: DECOMMISSIONING/ ABANDONMENT/ REHABILITATION POLICY 215
CHAPTER VIII: INSTITUTIONAL PLAN FOR EMP IMPLEMENTATION 216
CHAPTER IX: BIBLIOGRAPHY 220
CHAPTER X: ANNEXES 222

EXECUTIVE SUMMARY

Project Fact Sheet / PD Summary

Project Information	
Name of Project	**Proposed Scrap Recycling Steel Mill (Mini-Mill) Project**
Location	Brgy. Telabanca, Concepcion, Tarlac
Project Proponent	**SteelAsia Manufacturing Corporation (SAMC)**
Principal Office Address	B2 Bldg., Bonifacio High Street, BGC, Taguig, Metro Manila
Contact Person and Details of Proponent's Authorized Representative	**Mr. Roberto Cola** Vice President Contact Details: +639178675921 Email address: RMCola@steelasia.com
Background and Nature of Project	The proposed Scrap Recycling Steel Mill (Mini-mill) Project is a new Project of Steel Asia Manufacturing Corporation (SAMC). It is called mini-mill because it is a facility which produces steel products from recycled scrap metal. Unlike integrated steel mills, which can make new steel from iron ore in a blast furnace, mini-mills melt and refine scrap steel using electric arc furnace (EAF) technology. This Project will be composed of mini-mill using EAF and rolling mill which uses LSFO. SAMC has been manufacturing steel for more than 51 years. The Philippines' largest steel company, SAMC is comprised of steel bar manufacturing companies and 1 melt shop. From 1966 to present, it has built and operated rolling mills across the archipelago. Currently, six SteelAsia Group rolling mills cover the major island groups of Luzon, Visayas and Mindanao with a combined manufacturing capacity of 2.3 million tons per year. SAMC set the standard for modernization in the steel industry by being technologically at par with the best in the world. The SteelAsia Group's operation systems have been internationally certified to: • ISO 9001 Quality Management • ISO 14001 Environmental Management • OHSAS 18001 Occupation Health and Safety • ISO 17025 Testing Laboratory • UK Certification Authority for Reinforcing Steel (UK CARES) British Standard Being a new project, an Environmental Impact Statement (EIS) was required as per Procedural Manual of DENR Administrative Order No. 30 Series of 2003.
Project Description and Location	The Project is a rebar and wire-rod mill with a new generation scrap recycling mini-mill that SteelAsia will construct. The Scrap recycling will produce billets and ultimately, rebars which is an input to countless uses, such as building and construction of houses, infrastructure and different concreted works. SAMC will use "state of the art" technologies for this project because in the long run it will provide the lowest operating cost. The project will be located within the 80 hectares (more or less) project area coverage of SAMC in Barangay Telabanca, Concepcion, Tarlac.

Project Information	
Size and Scale	1,200,000 MTPY rebar and wire rod mill and 1,200,000 MTPY new generation scrap recycling plant to be situated within the approximately 80 hectares project area coverage of SAMC.
Rationale	The steel industry in the Philippines is one of the most significant growth industries. Steel constitutes a basic industry prerequisite in a country's pursuit of development and industrialization. The central role of the industry stems from its linkages with numerous sectors, where its products serve as an essential input to countless uses, such as building and construction, automotive, shipbuilding and repair, electronics, packaging, etc. and it is equally important contributions to employment generation, growth, and promotion of industrial activity, etc. Therefore, ensuring a strong domestic steel and steel-based industry is vital in developing the competitive edge of a country in meeting the challenges of globalization. With the boost in infrastructure industry in the country together with the rehabilitation activities in some parts of the country, there will be a bigger demand for reinforcing steel bars. Some of these infrastructure growth areas are in: • Central Luzon and NCR seen in the coming years • New infrastructure will spur additional growth in housing, retail, tourism and industrial construction • New construction will require more steel products, best supplied by a local/ community steel mill. • Supply of products for industrial use. This project will also provide support to: • Clark Green City • Manila – Clark Rail way • New Clark International Airport Terminal • Building • Central Luzon Link Expressway (CLLEX) • North Luzon Expressway East (NLEE) • San Rafael – Cabanatuan Expressway • Bulacan Bulk water project

Project Components

Provided in tabulated form below is the project's components.

Table ES1: Project Components

Component	Area aloocation in sq. m.
MAJOR COMPONENTS	
Rebar Rolling Mill	95,000
Rebar Meltshop	47,300
Wire Rod Mill	70,300
Wire Rod Meltshop	60,300
SUPPORT FACILITIES	
Finish Goods Warehouse	120,200
Finish Goods Warehouse	64,400
Scrap Yard	126,800
Water Treatment Plant 1	14,670
Water Treatment Plant 2	8,560
Scale & Waste Area	25,900
Greenhouse	7,800
LPG Station	6,100
Reservoir	87,680
Offices	30,000

Truck Parking	25,000
O2, N2 Plant	19,600
Total	809,610

Manpower	During Construction, an estimated manpower of 1,000 workers for the project will be required where 3 are directly hired by SAMC while 997 will be employed by the Contractor. During Scrap Recycling operations, another 1000 workers will be required which will be directly hired by SAMC in coordination with the Public Employment Service Office (PESO) of Concepcion. During decommissioning, work will be outsourced to contractors supervised by the PCO, the Resident Manager and Plant Manager of SAMC. The Company complies with the equal opportunity principle in hiring persons with disability (PWD) as well as women. This means that the Company gives employment opportunities to PWDs and women provided the person is qualified to the position. A qualified employee, whether a woman or with disability is subject to the same terms and conditions of employment and the same compensation, privileges, benefits, incentives and allowances as any qualified employee of the Company. For plantilla-based/regular employees, monthly salaries or wages for services rendered by an employee are timely paid twice a month. Thirteenth month pay is also paid to all qualified employees in compliance with the relevant laws, rules and regulations. Qualified employees also enjoy vacation leaves, sick leaves, overtime pay, health insurance, health plan, separation pay, retirement plan and allowances, as well as safety provisions like Personal Protective Equipment (PPE) and personal emergency kits, contributions and remittances for SSS, Philhealth and PAG-IBIG fund and other welfare benefits. The Human Resources Department of SAMC is open to employees who have concerns or queries on the salaries or benefits they receive or are entitled to. For SAMC contractors or manpower agencies who engage contractual workers, SAMC undertakes an accreditation process wherein contractors are required to submit documents to establish that they are duly registered with the Securities and Exchange Commission or Department of Trade and Industry and with the Bureau of Internal Revenue and that they have substantial capital and/or investments to ensure that they can perform the work to be done and are compliant with relevant laws and regulations, specifically on the prohibition against labor-only contracting. SAMC will not engage the services of the contractor without this accreditation to ensure compliance with all the rights and benefits under labor laws, rules and regulations. SAMC gives priority for all of these manpower requirements, to qualified applicants from the host barangay and Concepcion as a whole. Job vacancies/openings are posted in the barangay and municipal bulletin boards for qualified locals to have an opportunity to work for SAMC.
Duration of Project	The project is expected to operate for a period of at least 40 years.
Project Schedule	Project operation will commence 19 months after securing all necessary permits, licenses and approvals.

Total Project Cost	Estimated at PhP 12,000,000,000.00.

Process Documentation of the Conduct of EIA

The EIA Team

SAMC engaged the services of Mediatrix Business Consultancy to conduct the EIA for the project, prepare the EIS Report and secure the Environmental Compliance Certificate (ECC). The EIA team (Table ES2), composed of professional experts with their respective fields together with the technical experts from the Project Proponent (Table ES2A), was organized based on the project's EIA needs.

Table ES2: EIA Team

NAME	DESIGNATION	EIA Registration No.	EXPERTISE	PARTICIPATION
Matilde Fernando	Project Manager / EIA Team Leader	IPCO-035	Legal Framework, Socio-Economics, Public Participation and Community engagement	Preparation of Study/ Report and consolidation of documents for the whole project study; conduct and facilitation of public participation and community engagement
Ria Caramoan	Assistant Team Leader	IPCO-106	Air and water	Preparation of Project Description and water module
Reynaldo Tejada	Air Quality Expert	IPCO-036	Air and water module	Preparation of Air and water modules including air dispersion and noise attenuation modeling
Alexis Fernando	Researcher	IPCO-034	Research and community engagement	Gathering of secondary information
Juvinal Esteban	Social Worker	IPCO-091	Socio-economics, community engagement and IEC	Preparation of socio module
Benjamin Francisco		IPCO-038	Identification of plankton community structure, presence of fish biota, macro-invertebrates, macro-benthos and fisheries resources	Preparation of Freshwater Ecology Module
Michael Chester Francisco		IPCO-040		
Victor Pantaleon		NA		
Rowena Quimpo		NA		
Jose Rene Villegas		NA		
Hernani Bayani	Geologist	IPCO-58	Geology and Geohazard	Preparation of Geology Module
Allyana Marie Bermudez	Research Assistant	NA	Community engagement	Conduct of perception survey
Patrick Kenneth Fernando	Admin. Assistant	NA	Field Assignments	Gathering of secondary information

Table ES2A: Proponent Representatives assisting the EIA Team

Technical Person from Proponent	Areas of Expertise
Benjamin Magalong	Senior Vice President for Operations
Roberto Cola	Vice President for Industry Affairs
Ronald Magsajo	Project Manager
Eustaquio Alipio, Jr.	Chief Engineer
Reginald Nolido	Legal Counsel
Allan Christopher Agati	Legal
Anna Isabel Galvez	Legal
Janine Marie Soliman	Executive Assistant of the SVP for Operations

EIA Study Period/Schedule

Mediatrix Business Consultancy was engaged by SteelAsia Manufacturing Corporation in July 2017. Coordination with the stakeholders on the proposed project especially with LGUs concerned proceeded including conduct of Information, Education and Communications (IEC) programs and stakeholder profiling. Public Scoping was held in Brgy. San Vicente Covered Court, Brgy. San Vicente, Concepcion, Tarlac on September 22, 2018 while the Technical Scoping was conducted on November 26, 2017. EIA baseline studies and impact assessments were conducted in August and the EIA Report was completed within three months.

Table ES3: EIA Milestone and Schedules

EIA Activity/Stage	Date
EIA Planning, Project and Stakeholder Profiling	July to September 2017
Preliminary IEC and consultation with the officials of Brgy. Telabanca, neighboring barangays and municipal officials	July to September 2017 and May 24
Public Scoping	September 22, 2017
Technical Scoping	November 26, 2017
Baseline studies	August 2017 to November 2017
EIA study, impact assessment and mitigation plan	
EIS Report Preparation	
Report Submission to EMB/Acceptance of EIS	August 8, 2018
1st EIARC Review	September 7, 2018
Public Hearing	
Final Review	
Complete Staff Work	
ECC Issuance	

EIA Study Area

Provided in the succeeding page is Figure 0.1 is the Study Area where the project site is located.

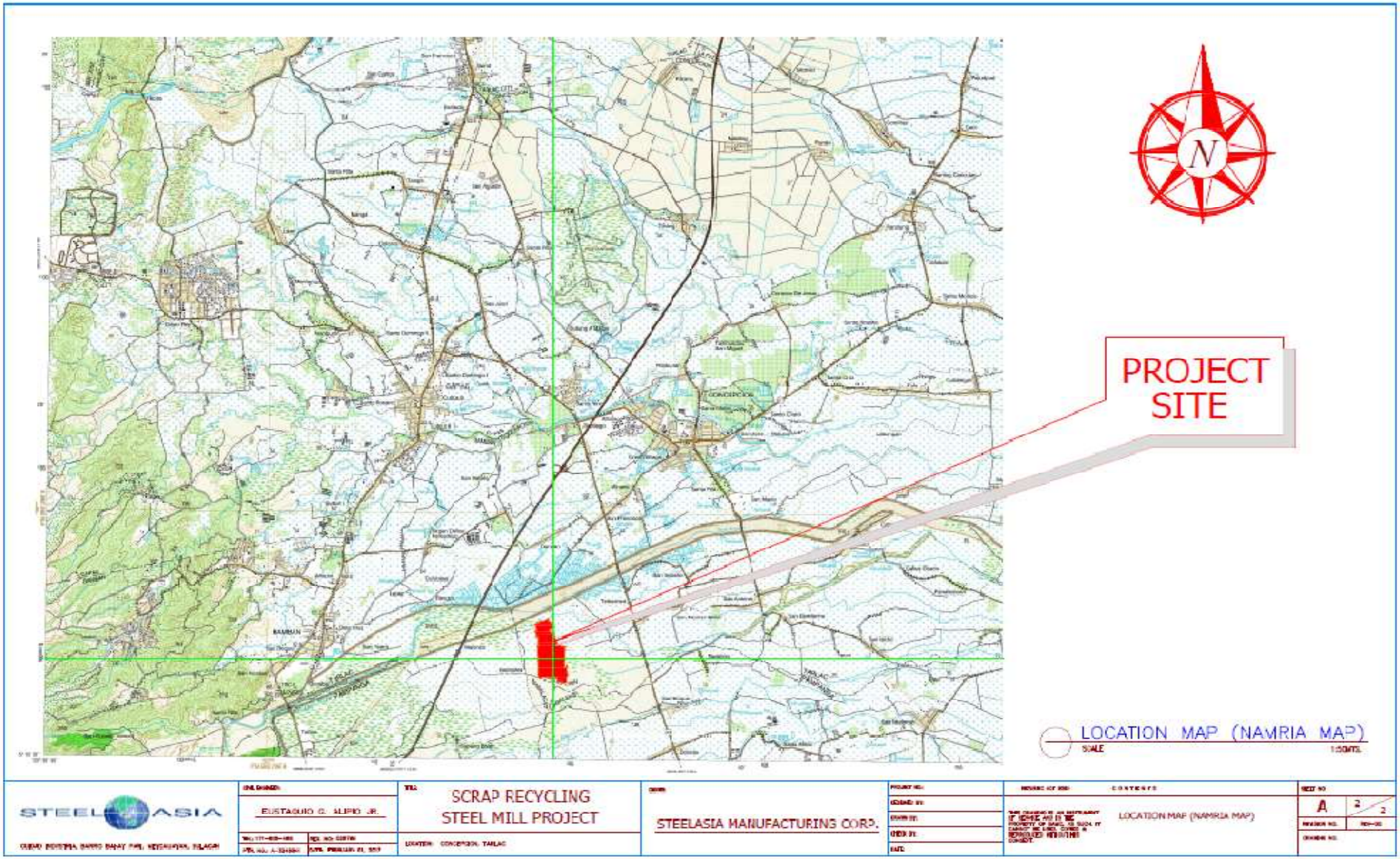


Figure 0.1: Study Area (source: NAMRIA)

EIA Methodology

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

Table ES4: EIA Methodology

EIA Study Module	Parameters/Scope	Baseline Sampling and Methodology
Land		
Geology/ Geomorphology, Pedology, Land Use & Classification	Reconnaissance, land use, land classification assessment, slope, soil types and classification, erosion	Secondary data, soil sampling and testing, review of geological reports and maps, soil site assessment
Terrestrial Biology – Wildlife and Vegetation	Flora and fauna species inventory, species endemicity and conservation status, species abundance, frequency and distribution	Use of secondary data and inventory
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	Primary data were secured through water sampling and laboratory analysis
Freshwater Ecology	Full accounting of all existing benthic habitats, species, composition, density, and diversity of sea grass resources and associated macro benthic algae in front of the project site , commercially-important macro invertebrates in the inter-tidal areas, plankton community	Use of primary and secondary data and interviews
Air		
Air Quality	Ambient air quality	Primary data through 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 Modeling	Worst case scenario identification, use of meteorological data	Use of Aeromod Model
Noise	Noise levels	Ambient noise sampling
Climate Change		
Temperature change	Seasonal Temperature increase (in °C) in 2020 and 2050 under medium range emission scenario in Tarlac Monthly Average Temperature without Climate Change Monthly Average Temperature with Climate Change (2006-2035)	Effects of Temperature Increase
Rainfall change	Seasonal rainfall change (in %) in 2020 and 2050 under medium range emission scenario in Tarlac Monthly Average Rainfall without Climate Change (1980-2010) Monthly Average Rainfall with Climate Change (2006-2035) Monthly Average Rainfall with Climate	Effects of change in rainfall pattern

EIA Study Module	Parameters/Scope	Baseline Sampling and Methodology
	Change (2006-2065)	
Greenhouse as Assessment	GHG Emissions based on IPCC 2006 Guidelines and USEPA Procedure	Bunker oil consumption vs GHG 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, - Population density /growth - gender and age profile, - literacy rate, profile of educational attainment	Interviews with key elected officials of the barangays (from barangay captains to councilors and the social welfare barangay officers/ barangay health workers); analysis of secondary health data; Use of secondary data from RHU and NSO; Interviews with the locals; household-level survey
Socio-economics	Socioeconomic data: Main sources of Income, Employment rate/ profile, sources of livelihood, Poverty incidence, commercial establishments and activities, banking and financial institutions	Perception surveys, Interviews with municipal and barangay officials; analysis of secondary data; analysis of survey results Provision of traffic management flow in a traffic management plan
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

Public participation, scoping and consultation in the conduct of the EIA Study

SAMC in coordination with the stakeholders on the proposed project especially with LGUs concerned proceeded in its consultation with concerned stakeholders including the conduct of Information, Education and Communications (IEC) programs and stakeholder profiling. Public Scoping was held in Brgy. San Vicente Covered Court, Brgy. San Vicente, Concepcion, Tarlac on September 22, 2017 while the Technical Scoping was conducted on November 26, 2017. Additional IEC was conducted on May 24, 2018 to include other barangays and groups not present in the first series of IEC's conducted. Community representations are also involved in the baseline data gathering and conduct of perception survey.

In the consultations conducted, the following attendees were represented:

1. One Concepcion and Kabayan Partylist
2. Members of the Sangguniang Bayan of Concepcion
3. Office of the Mayor and Vice Mayor
4. Barangay Councils and residents of the following barangays:
    a. Telabanca
    b. San Nicolas Balas
    c. San Francisco
    d. San Vicente
    e. Dungan
    f. San Nicolas Telabanca
5. EMB Region 3
6. DEPED

Although absent in the consutations conducted, the following were also invited:

1. Brgy. Alfonso
2. Rep. Noel Villanueva, 3rd Dist. Tarlac

Among the issues raised with the Proponent's responses were the following:

Table ES5: Public Scoping Issues and Concerns

Issues	Proponent's Response
The heat to be generated by the scrap recycling facility may affect the	The heat that will be generated will pass thru the electric arc furnace which is an enclosed facility and compliance

neighboring barangays and climate change	to DENR standards will be strictly imposed.
Air emission	The project will use LSFO for its equipment in the rolling mill; lowest emission will be guaranteed by the high level of technological automation thru the air recuperator embedded in the equipment which is low in fuel consumption and low mechanical maintenance.
Project's similarity with those smelting plants in San Simon, Pampanga	Those projects of other companies are different from the Plants that SteelAsia has constructed and operated and will construct because SteelAsia's Plants are more modern and environmentally-sound.
Comparison with TIPCO operations which alledgedly caused roof melting as allegedly experienced by some neighboring residences	The Project will not use acids which cause corrosion. Electric arc furnace will be used for the project operations.
Water effluent	The project has no effluent or zero effluent because all water will be recycled and reused thru the wastewater treatment facility.
Effects to agricultural lands causing it to be unproductive	Based on existing operations of other SAMC Plants, the project has no adverse effects to farming or agriculture.
Odor	The only odor that may be generated for this kind of operation may come from fuel combustion which is insignificant because the stack is high for proper air dispersion and LSFO will be used.
Employment recommendation	The municipality of Concepcion will be given the priority for employment as what SAMC does in all of its Plants nationwide.

Full details of the IEC and Public Scoping Reports are attached in Annex E.

Description of Key EIA Methodologies

Summary of Baseline Characterization

Information below summarizes the salient findings of the baseline information/data for the land, water, air and people components.

Table ES6: Summary of Findings

Environmental component	Key Findings
Physical Environment—Land	The land classification of the project area as per NAMRIA is Alienable and Disposable (A&D). As per LGU reclassification based on Ordinance No. 003-18, it is now industrial.
Physical Environment—Air	*Climate* The climate at the proposed Project site falls under the category of Type 1 based on the Modified Coronas Climate Classification of Philippine Climate Type I climate is characterized by two (2) pronounced seasons, dry from November to April and wet from May to October with 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. *Temperature Change* The historic average annual ambient air temperature of Tarlac is 26.9°C. The

Environmental component	Key Findings
	data indicate that there is little monthly or seasonal variation in the average temperatures. On a daily time-step, temperatures can vary by 5°C to 8°C on the average during a day, peaking above 30s and dropping to the low 20s overnight. The climate change scenario for the Philippines as published by PAGASA in February 2011 indicates that the province of Tarlac will have an increased temperature. It is projected that the average monthly temperature over the period of 2006–2035 will increase by 1.0°C to 1.1°C while temperatures for the period of 2036-2065 will increase by 1.9°C to 2.2°C.The annual average temperature covering the period of 2006-2035 will rise to 29.7°C while 2036-2065 will rise to 30.8°C. Table 2-3, Figures 2-6 and 2-7present the projected monthly average temperature with climate change (T_{ave} CC) and without climate change (T_{ave} base). The typical effect of temperature increases in the plant operation is the decrease of power output leading to energy inefficiency. This is because an increase in air temperature reduces air density and the mass flow of air intake to the compressor, and creates a similar reduction in heat transfer efficiency of the air cooling system. *Rainfall Change* The historic average annual rainfall of Tarlac is 2,026.8mm. Based from the climate change scenario for the Philippines as published by PAGASA in February 2011, the province of Tarlac will have an increased and decreased rainfall in 2020 and 2050. It is projected that the average monthly rainfall over the period of 2006–2035 will increase by 26% from December to February and it will decrease by 1.6 to 13.7% between March to November; while the rainfall for the period of 2036-2065 will increase by 8.8% from June to August and will decrease by 5.5 to 18.2% between September to February. The annual average rainfall covering the period of 2006-2035 will rise to 43.1 mmin December and will decrease to 30.4mm in May; while the rainfall for the period of 2036-2065 will rise to 467.2mm in August and will decrease to 40.4mm in May. Table 2-5and Figure 2-8present the projected the monthly average rainfall with climate change scenario for 2006-2035; and the monthly average rainfallwith climate change scenario for 2036-2065.
Air and noise quality	An ambient air quality monitoring programme was conducted in five (5) sampling locations within the project site and vicinity. The collected ambient air and noise data from the established stations will be used to represent the baseline data of the project. The ambient TSP, PM_{10}, SO_2, and NO_2 concentrations were measured at the identified sampling points. The selection of the sampling stations was based on the locations of receptors, source, and prevalent wind direction. Methods for sampling and analysis conformed to the methods prescribed in Sec. 1(b) Rule VII Part II of the Clean Air Act IRR. The resulting ambient air concentrations were compared with the National Ambient Air Quality Guidelines Values (NAAQGV), Rule VII, Part II and the National Ambient Air Quality Standards for Source Specific Air Pollutants (NAAQSSSAP) from Industrial Sources/Operations Section 1 Rule XXVI Part VII of the Clean Air Act IRR.
Air dispersion modeling	Based on the overall summary of the predicted concentrations, i.e. maximum modeled concentrations in the air dispersion modeling conducted, the predicted peak 1-hour and 24-hour emissions of TSP, PM_{10}, SO_2, NO_2, and CO are within the CAA limit. The highest ground level concentrations of modeled parameters in the whole modeling domain occurred in an inhabited area of Barangay Sto. Nino, Bamban Tarlac at coordinates 236027.01 m E; 1690535.84 m N. at a distance of about 8,400 meters west of theProject. The highest ground level concentrations predicted were for sulfur dioxide followed by oxides of nitrogen from the proposed sources.

Environmental component	Key Findings
Contribution in Terms of Greenhouse Gas Emissions (or GHG Mitigation Potential)	The total estimated CO_2 emission from the operation of the furnacebased on IPCC 2006 is 42,505 MT/yr. The Philippines Second National Communication (SNC) on Climate Change has projected 100,402,000 MT of CO2 for 2020. Using the projection of SNC, the Project operation is expected to contribute an approximately 0.061% of the total CO_2 emission. Globally, the projected CO_2 emission for 2020 under the United States Environmental Protection Agency (USEPA) Sectoral Trend in Global Energy Use and Greenhouse Gas Emissions, Climate Protection Division, Office of Air and Radiation, the estimated contribution of the Project is 0.000047%. Moreover, the Project will establish a "green buffer zone" to mitigate some of the potential effect of emissions of the proposed Scrap Recycling Steel Mill Project.
Water	*Hydrology* The hydrological characteristics of the area are defined by the Pampanga River Basin which is the fourth largest basin in the Philippines with an aggregate area of 10,434 square kilometer. It is broadly divided into three (3) sub-basins namely: Pampanga Main River basin, Pasac River basin (or alternatively known as the Pasac-Guagua Allied river basin) and the Angat River basin. The headwaters of these three basins originate from different mountain areas with separate river channels draining into the Manila Bay. *Hydrogeology* Based on the 1997 Groundwater Availability Map of the Philippines, the Project Site falls under local and less productive aquifers. This classification is attributed to the low-level wells in the area. The classification is attributed to the scarcity of productive wells in the area. The groundwater occurs under unconfined conditions within the interstices of consolidated pyroclastics and tuffaceuous sedimentary rocks. The water table occurs at the estimated depth range of 6 m near and within valleys and flat areas to 15 m at the lower and middle slopes. The thickness of the aquifer is not known. The aquifer in these segments is tapped by shallow wells which are pumped manually or with the aid of low capacity centrifugal pumps. *Groundwater* The depth of the wells ranges from 7m to 31m. The structures were built as early as 1960 to recent 2017. The usage varies from community drinking water supply and use for cooking, bathing, and watering in residential and commercial garden. As such, drinking water generally comes from the commercial "mineral" water or from the local water utility. Collectively, there is a high 85% conformance of the nine sampling sites with 19 parameters covered by PNSDW and 24 parameters covered by DENR Class C guidelines. Out of 124 measurements, only 19 or 13% cases of varying non-conformance by water sample are attributed to metals. Domestic water is the main uses of water in the project area with ground water as the main source. Domestic water supply in Concepcion Tarlac is provided for by Concepcion Water District. As of December 31, 2016, the District was serving 30 barangays of Concepcion with water delivered to every household 24 hours a day, without interruption. The water supply system of the District is supported by 11 pumping stations, which are strategically located and serving a total of 12,784 active concessionaires classified as residential, domestic, commercial, and industrial. *Water Usage and Water Source.* The project will require about 60 m3/hr make up water system; 576 m3/hr fire protection water system; 1200 m3/hr for indirect cooling water system; and 1700 m3/hr direct cooling water system. A deepwell will be drilled to a depth of 50 to 90 meters and designed not to extract water

Environmental component	Key Findings
	from the shallow aquifers that are utilized by the surrounding communities. A permit from the NWRB will be secured. *Circulating Wastewater Treatment Plant.* The project will invest extensively in the water treatment system that aims to recirculate all process water. Zero wastewater discharge is envisaged. *Water Catchment Pond.* A water catchment pond will be constructed by the project to collect rain water to minimize usage of potable water in the cooling system. The collecting pond has a volume of 35,000 m3. Its main purpose is to provide make up water for the evaporation losses within the plant operation. The storm drainage is connected to the water catchment pond for storing rainwater. Steel Asia is already practicing a water catchment pond system in their existing steel mill plants e.g. Davao Plant. With the use of circulating wastewater treatment plant and water catchment pond, depletion of wastewater resources and competition with its use is not expected as a result of the project.
Freshwater Ecology	River ecology assessment was conducted in three stations in the Sacobia River, the major surface water body nearest to the Steel Asia project site in Barangay Telabanca, Concepcion, Tarlac and a fourth station in a water canal running through Barangay San Francisco on 20 August 2017. The Sacobia River is intensely smothered with lahar from the eruption of Mt. Pinatubo, and movement of lahar and volcanic particulates are still vividly occurring. The Barangay itself was overrun with lahar deposits at the time of the volcano's eruption, and with unproductive lands, most households have left the Barangay ever since. The Sacobia-Bamban River is moderately flowed at 10 cm deep which is heavily affected by mudflow. The river alignment has changed drastically; heavy siltation of lahar is seen along the river. Lahar excavation is still on-going and expected it will last for the next 100 years.
Biological Environment	The project area is a flat area covered with lahar deposits with only few cogon grasses that can be seen at the site.
Socioeconomic and Cultural Environment	Actual visits with residents through household perception survey from 04-08 August 2017. A total of 530 households were randomly interviewed and surveyed for Brgys. Telabanca, Dungan, San Francisco, San Vicente and San Nicolas Balas. Perception survey areas are those in color purple/violet shades. It may be noted that the project area, Brgy. Telabanca is almost a no-people barangay because it has been abandoned since Mt. Pinatubo eruption in 1991.

Impact, Mitigation and Monitoring Summary

Provided below is the Impact, Mitigation and Monitoring Summary.

Table ES7: Impact, Mitigation and Monitoring Summary

Major Activities Description/Details key environmental aspects or activities	Potential Impact, nature and estimate of major emissions	Impact mitigation, built-in management measures and facilities planned
Preconstruction Phase		
Land	Restriction on the land use classification of Project site	The land use is classified as industrial. Provided in Annex C is the LGU of Concepcion Ordinance No. 003-18 reclassification of the area from agricultural to industrial.
Construction Phase		
Generation of	Contamination of	Provision of septic tanks and implementation of

domestic wastewater	water quality	septage management.
Solid waste generation	Accumulation of solid wastes	Provision of Material Recovery Facility (MRF)
Hazardous waste generation	Contamination of land	• Securing of Hazardous Waste Generation ID • Provision of hazardous waste storage area • Treatment and disposal with Certificate of Treatment by DENR-accredited third party treaters
Use of domestic water	Water resource use of competition	Provision of water from water utility
Construction of the steel mill complex	Air emission (TSP, PM10, PM2.5, SOX, NOX) and noise pollution from equipment and vehicles.	• Training on power equipment and vehicle use and speed • Proper maintenance, designation of no idling zone • Good house keeping • Water sprays, use of enclosures, barriers and buffer zones • Implementation of Reforestation and Carbon-sink Program: tree planting within the perimeter
	Potential health and safety hazards for construction workers	• Health and safety policies • Employee safety inspections and toolbox meetings • Regular APE and use of PPEs • First aid training
Operations Phase		
Scrap recycling and Rebar operation	Effect on public health due to dust and emissions brought about by the project	Coordinate with Rural Health office for the implementation of programs related to community health.
	Generation of mill scales	Scales are collected and to be exported for recycling in sinter plants
	Generation of EAF dust and slags	• Slags will be stored and for disposal to 3rd party buyers who use slag as raw material e.g. for cement manufacturing • EAF Dust collection will be undertaken and will be stored and sealed in tonner bags and placed in the hazardous storage facility. • Disposal methods include re-charging in the melt shop for recycling and/or local disposal through DENR-accredited TSD facility and/or being exported for recycling after stabilization
	Water pollution	• Zero effluent • Provision of Rain catchment reservoir • Provision of Water Treatment Facility for process water • Scheduling of excavation activities during dry season will be applied to reduce impact of soil erosion and sedimentation of waterways. • A surface water and effluent quality monitoring will be conducted during construction.
	Air emission and noise pollution	• Training on power equipment and vehicle use and speed • Water sprays, use of enclosures, barriers, and buffer zones. • Proper maintenance, designation of no idling zone • 65 meters stack height • Routine plant maintenance and good house keeping • Use of low sulfur fuel (LSFO) or mixing with Diesel • Training on proper equipment use and speed
	Employment	Preference will be given to qualified Brgy. Telabanca

	generation	and Concepcion residents
	Increase in economic opportunities through associated incomes and taxes	These are predominantly positive effects, no mitigation measures necessary.
	Accumulation of solid wastes due to solid waste generation	Provision of Material Recovery Facility (MRF)
Storage, handling and transport of rebars	Health and safety hazards (e.g. heat and hot liquids)	• Health and safety policies • Installation of proper ventilation • Implementation of safety buffer zones to separate areas where hot materials are handles and stored. • Employee safety inspections and toolbox meetings. • Regular APE for employees • Use of PPEs • First aid training • Provision of 24-Hour Clinic • Provision of Ambulance • Spills containment of fuel
	Traffic and road accidents	• Implementation of Traffic Management Plan • Provision of proper road signages. • Designation of marshalling/holding area offsite • Observe traffic rules and load limit requirement
	CO_2 emissions	• Utilize thermally-efficient heating process equipment • Explore the viability of using inline Electric Induction heating process after the reheating furnace • Engage in carbon sequestration projects such as tree planting and use of electricity from renewable energy sources such as geothermal, etc.
	Noise	• AC motors • Enclosed facility • Tree buffer zone • Insulate structures
	Water collection and operational treatment	• Zero water discharge • Water is recycled and re-circulated within the Water Treatment Facility, which consists of grease/oil skimming, scale inhibitors, filtering and bio/algaecide.
Abandonment Phase		
• Removal of wastes and oil spills if any • Removal of all equipment, • Actual Rehabilitation	• Change in land use • Loss of jobs and community programs	• Turnover of the facilities which can still be used by the new project especially drainage system and rain collection • Adaptation to the industrial land use of the new project • Grading and drainage stabilization works including leveling of sediment trap and settling ponds • Soil conditioning • Planting or reforestation of endemic species • Retrenchment package • Labor support programs

Key Monitoring Plans

Provided below is the matrix of Environmental Monitoring Plan.

Table ES8: Environmental Monitoring Plan

Monitoring Objectives	Potential Impact	Parameters	Limit Level for Compliance	S sampling	
				Station/Location	Frequency
Monitor the water quality and the project's impact to ambient water quality	Surface water quality degradation or pollution	TSS Oil and grease Cr^{+6} Pb Hg T. coliform Fecal coliform DO pH BOD	**DAO 2016-08:** • 80 mg/L • 2 • 0.01 • 0.05 • 0.002 • 5000 • 200 • 5 • 6.5-9.0 • 7	• Surface Water Downstream of Sacobia River • Surface Water Upstream of Sacobia River	Quarterly during construction and operation
	Groundwater quality degradation	TDS Cr^{+6} Oil and grease Pb Hg T. coliform Fecal coliform pH	500 0.01 1 0.01 0.001 0.01 <1.1 6.5-8.5		Quarterly during construction and operation
Monitor the air quality as well as the noise and the impact of the scrap recycling plant and protect the ambient air quality	Possible degradation of the air quality in the areas	TSP / PM_{10} SO_2 NO_2 Sound levels	230 ug/ncm (TSP) /150 ug/ncm (PM10) 180 ug/ncm 150 ug/ncm Daytime: 70 dB (Class C) Morning/ Evening:65 dB (Class C) Nighttime: 60 dB (Class C)	• Stn. 1: In front of Multi-Purpose Hall, Brgy. San Vicente, Concepcion • Stn. 2: Beside the house of Mr. Jun Suizo, Brgy. Dungan Concepcion • Stn. 3: At the back of barangay hall of Brgy. San Nicholas Balas, Concepcion • Stn. 4: Calle Onse, Brgy. San Nicholas Balas, Concepcion • Stn. 4: Highway View Hacienda Subdivision, Brgy. Santo Rosario, Magalang Pampanga	Quarterly
Ensure the safety and health of the workers	Effects on human health and safety	Injury, Accidents, or safety reports statistics and medical records or reports Safety performance	0 fatality	Work areas	Quarterly
Monitor the socio-economic, cultural and Health impact of the project	Increase in economic activities and development, increase in number of employed locals, increase skills and capacity among locals, increase in the average monthly or salary of the households	Household income, Literacy and employment statistics, Number of economic activities, Taxes generated and basic services, Health statistics	Increase by 0.5% or more of the baseline value of some economic indicators in the municipality	Community, Barangay Telabanca	Annually

Environmental Monitoring Fund (EMF) and Environmental Guarantee Fund (EGF) 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 as amended by DAO2017-15. The amount of the EGF will be based on the risk and hazards associated with the project's implementation and will be negotiated between SAMC and the DENR-EMB Central office. The proposed EGF amount will be PhP500,000.00 Trust Fund and PhP500,000.00 Cash Fund which is the current EGF baseline amount for similar SAMC projects.

The EMF to be established immediately after the Memorandum of Agreement (MOA) which is based on the activities and programs of the Multi-partite Monitoring Team (MMT), is around PhP300,000.00 The EMF can be replenished once the amount of PhP300,000.00 is less than 50%.

EIA Summary

Summary of Alternatives Considered in terms of Siting, Technology Selection/Operation Processes and Design

Following were the criteria used:

Technology Selection/Operation Processes
The technology and the processes to be used in the proposed SAMC Scrap Recycling Steel Mill (Mini-Mill) will be the most modern among its other existing plants in the country and in SouthEast Asia. With this criterion, SAMC will use the latest new generation scrap recycling mini-mill technology from the best equipment suppliers in the world.

Resources
In terms of water source, the best option to consider is rainwater collection to avoid resource use competition with the community. For this Project, it can be predicted that there will be enough rainwater for collection because the climate at the proposed Project site falls under the category of Type 1 based on the Modified Coronas Climate Classification of Philippine Climate. Type I climate is characterized by two (2) pronounced seasons, dry from November to April and wet from May to October with 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.

Also, it is projected that the average monthly rainfall over the period of 2006–2035 will increase by 26% from December to February and it will decrease by 1.6 to 13.7% between March to November; while the rainfall for the period of 2036-2065 will increase by 8.8% from June to August and will decrease by 5.5 to 18.2% between September to February**.** The annual average rainfall covering the period of 2006-2035 will rise to 43.1 mm in December and will decrease to 30.4mm in May; while the rainfall for the period of 2036-2065 will rise to 467.2mm in August and will decrease to 40.4mm in May. SAMC may grab this opportunity to use engineering design to capture this excess water to avoid localized flooding, river swelling and overflowing of floodplains.

In terms of power supply, TARELCO II will supply the required power. Standby generator sets with a capacity equivalent to the mill's cranes and critical water pump power requirement will be installed.

Logistics
Steel manufacturing is essentially a transportation business as it requires a lot of moving & handling for its raw materials and finished goods. The plant should be sited near the port, major highways and customers to optimize the logistics cost. The port to be used is Subic Port in Subic Freeport.

Manpower Availability
Scrap Recycling Mini Mill needs around 1,000 direct employees hired thru the local PESO and 5,000 indirect vocational and technical personnel to run and maintain the facilities 24/7. The direct and indirect employees need not be professionals as 80% of the manpower requirement of SteelAsia is vocational and technical personnel who are at least highschool graduates.

Land
The land area must accommodate all the facilities needed in a contiguous manner. In addition it should not require a long time for land conversion and expensive site development. It should have sufficient elevation for flooding.

Carbon footprint
The proponent's policy is to adopt practices to minimize fuel use and use low sulfur fuel oil (LSFO) or mix with diesel. These include optimized trip planning/routing to increase fuel efficiency, reducing the number of kilometers each truck travels daily and minimizing travel time.

The following locations below were evaluated using these criteria.

- Mabalacat, Pampanga
- Magalang, Pampanga
- Concepcion, Tarlac

Environmental Impacts of Each Alternative

In terms of land criteria, the Mabalacat and Magalang sites did not qualify with the Proponent's criteria for land because both areas require a longer time for land reclassification and conversion.

Environmental characteristics of the project site were also considered in the site selection. The proposed location in Concepcion is considerably clear and flat area. Being in a topographically flat area, hazards associated with slope instability, erosion and mass wasting are expected to be nil.

The project's potential impact to people, biodiversity, water (ground water and surface water), air and noise were also considered. In terms of biodiversity, the project site chosen has insignificant impact because only cogon grasses are present in the area. There is no marine environment in or near the project area. Sacobia River may be tapped as resource to supply make-up water.

The proposed location of the project facilities was also evaluated in terms of geohazard susceptibility based on information from government agencies such as the Mines and Geosciences Bureau (MGB) and the Philippine Institute of Volcanology and Seismology (PHIVOLCS). Generally, the project area's susceptibility to earthquake-triggered slope failure and rainfall-triggered slope failure are low. With regard to seismic vulnerability and liquefaction potential, the potential ground-shaking and liquefaction susceptibility of the project site is also low. The impacts are discussed and summarized in the next two chapters.

No Project Option
If the proposed scrap recycling steel mill project will not materialize, employment opportunities and social development such as livelihood projects, skills training, scholarship programs and medical assistance for the residents of Brgy. Telabanca and its neighboring barangays and in the municipality of Concepcion in particular will not be realized. Also, the prospective LGU increase in revenue, multiplier effect of the project such as business opportunities, support to basic services like infrastructure and medical assistance and other opportunities for the community and LGU will likely lose when the project is not pursued.

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

The Project's major impact given in a worst case scenario of drought is water resource use competition. However, when that time comes, the Project will be forced to stop its operations because it will not be feasible to operate in such worst case scenario.

Risks and Uncertainties relating to the findings and implications for decision-making

Among the risks of the project which could be a potential show stopper or could have a material or significant impact on the decision making of the government as well as the project proponent is the uncontrolled release of particulate matters from the dust collectors. To avoid this, a strict contract and monitoring of the Contractors will be undertaken as what are being undertaken in SAMC's other Plants.

CHAPTER I: PROJECT DESCRIPTION

SteelAsia Manufacturing Corporation (SAMC) is the only company that operates modern steel rolling mills in the Philippines. SAMC has been manufacturing rebar for 51 years. It is the largest steel company in the Philippines, the largest job provider and highest taxpayer in the Philippine Steel Industry.

SteelAsia is a provider of rebar solutions. As a manufacturer, it is part of the solution to country growth, expanding to meet the growing needs of the country. SteelAsia has grown as the largest manufacturer of rebar in the Philippines with a total annual production capacity of 2.1 million metric tons per year (MMTPY) and anticipating a multi-decade growth trajectory for the country, has another 2.5 million tons of capacity in its expansion pipeline in several locations. Locating across the archipelago near economic and logistic hubs is solution that makes rebar products accessible, not to mention the significant cost savings from the elimination of sea freight. Production sites in five sites (and three upcoming sites) in all the major island groups is an enabler of country development, and lowers cost for both the large corporate property developer and the small home builder. Investment in technological solutions has enabled SteelAsia to produce the full specification range of rebar products, creating a one-stop-shop service. Technology has also helped the company push the cost of rebar down through its productivity, efficiencies and scale. Downstream added value technologies such as create handling and wastage savings. These advances put SAMC industry and its service capabilities at par with the best in the world.

Copy of the SEC Registration is attached as Annex A.

1.1 Project Location and Area

1.1.1 Project Location

The site is situated at Brgy. Telabanca, Concepcion, Tarlac. Concepcion is a 1st class municipality and one of the largest municipalities in the province of Tarlac, Philippines. It is 7.5 kilometers from the Capas junction along McArthur Highway. It lies on the south-eastern tip of Tarlac, bordered in the south by Magalang, Pampanga, in the east by San Antonio, Nueva Ecija, in the north-east by La Paz, in the north-west by Tarlac City, in the west by Capas, and in the south-west by Bamban. It covers an area of 245.7 km².

Shown in the succeeding pages are the following Figures:

- Figure 1.1.1: Location Map
- Figure 1.1.2: Vicinity Map

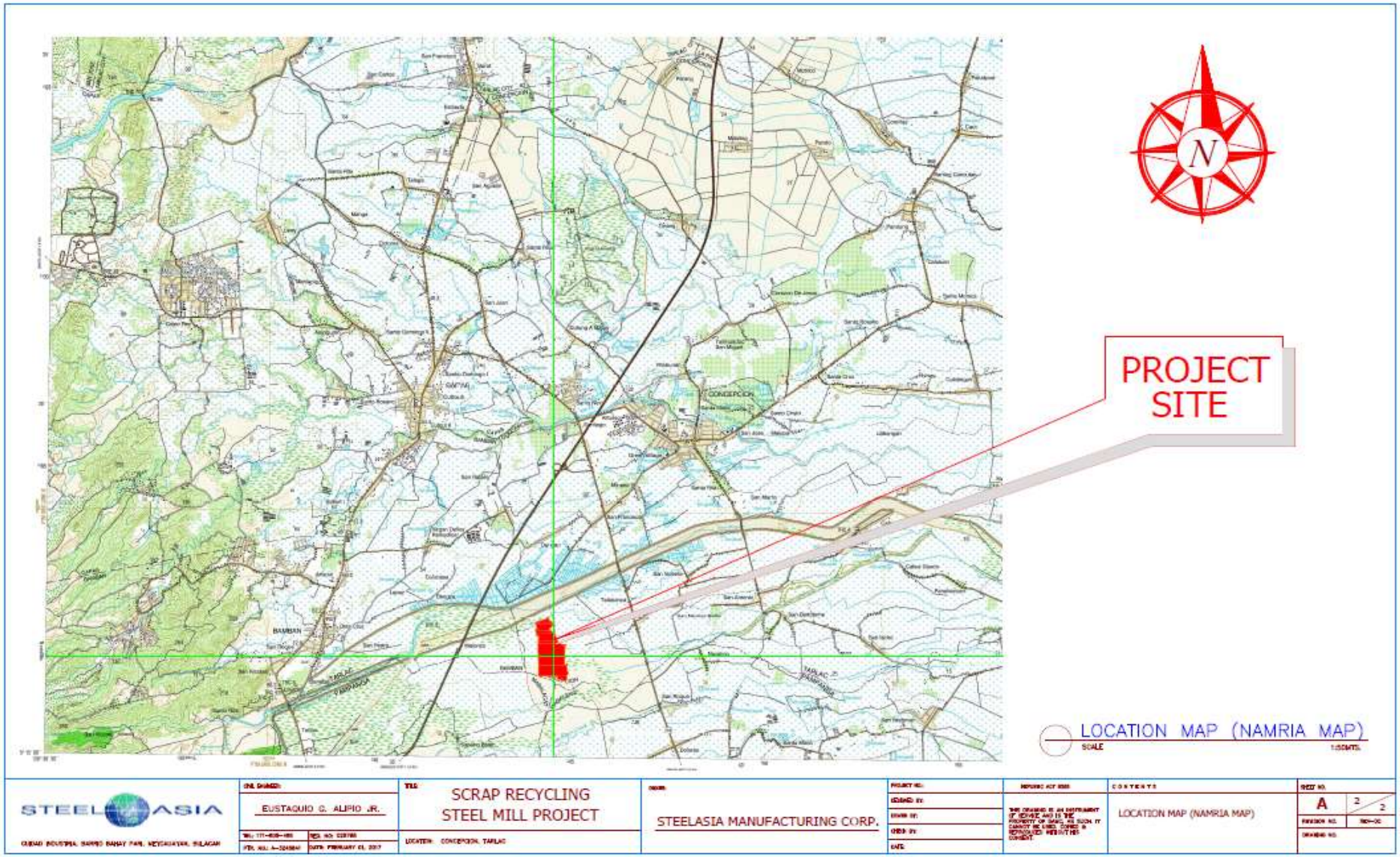


Figure 1.1.1: Location Map in NAMRIA (source: SteelAsia)

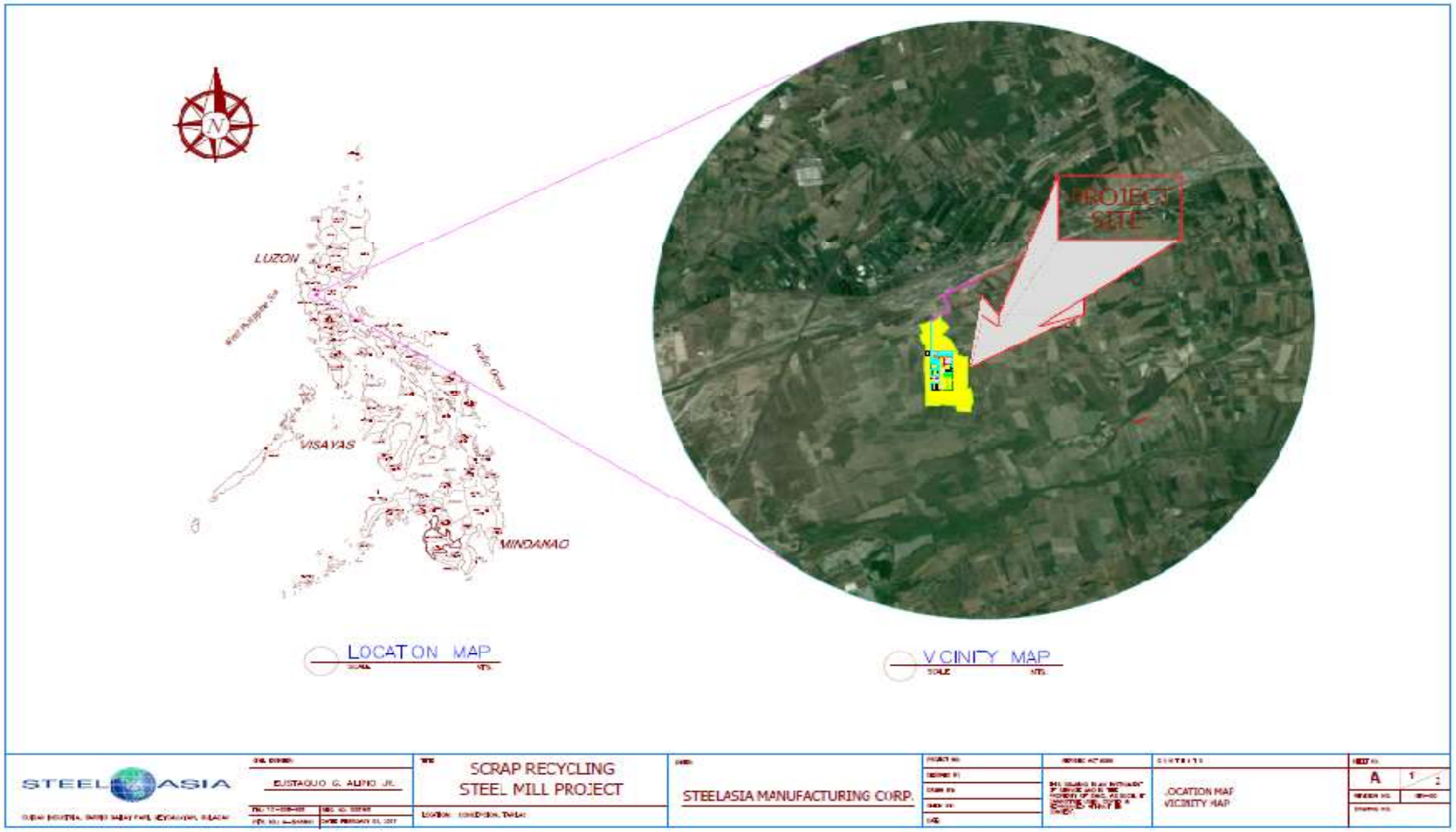


Figure 1.1.2: Vicinity Map superimposed in Google Earth Map (source: SteelAsia)

Impact Area Delineation

Primary & Secondary Impact Areas

The guidelines provided by the Revised Procedural Manual as well as DAO 2017-15 relevant to this project were used for the delineation of the primary or direct impact area (DIA) and secondary or indirect impact area (IIA).

- The primary impact areas of the project are the project including possible environmental, social and economic impact areas are the project site itself, i.e. Brgy. Telabanca and the sensitive receptor areas identified in the air dispersion modeling and where the air sampling stations are located. These are Brgys. San Vicente, Dungan and San Nicolas Balas in Concepcion, Tarlac and Brgy. Santo Rosario, Magalang Pampanga. Sacobia River is also a direct impact area because this may be an alternative water source for the make-up water in the reservoir/rainwater catchment that will be constructed for the Plant's process use.

- The secondary impact areas comprise the haul roads where the trucks will pass through to transport the materials. These secondary impact areas are the Magalang-Concepcion Rd. and the barangay roads where trucks will pass thru. The impact area map is provided below in Figure 1.1.3.

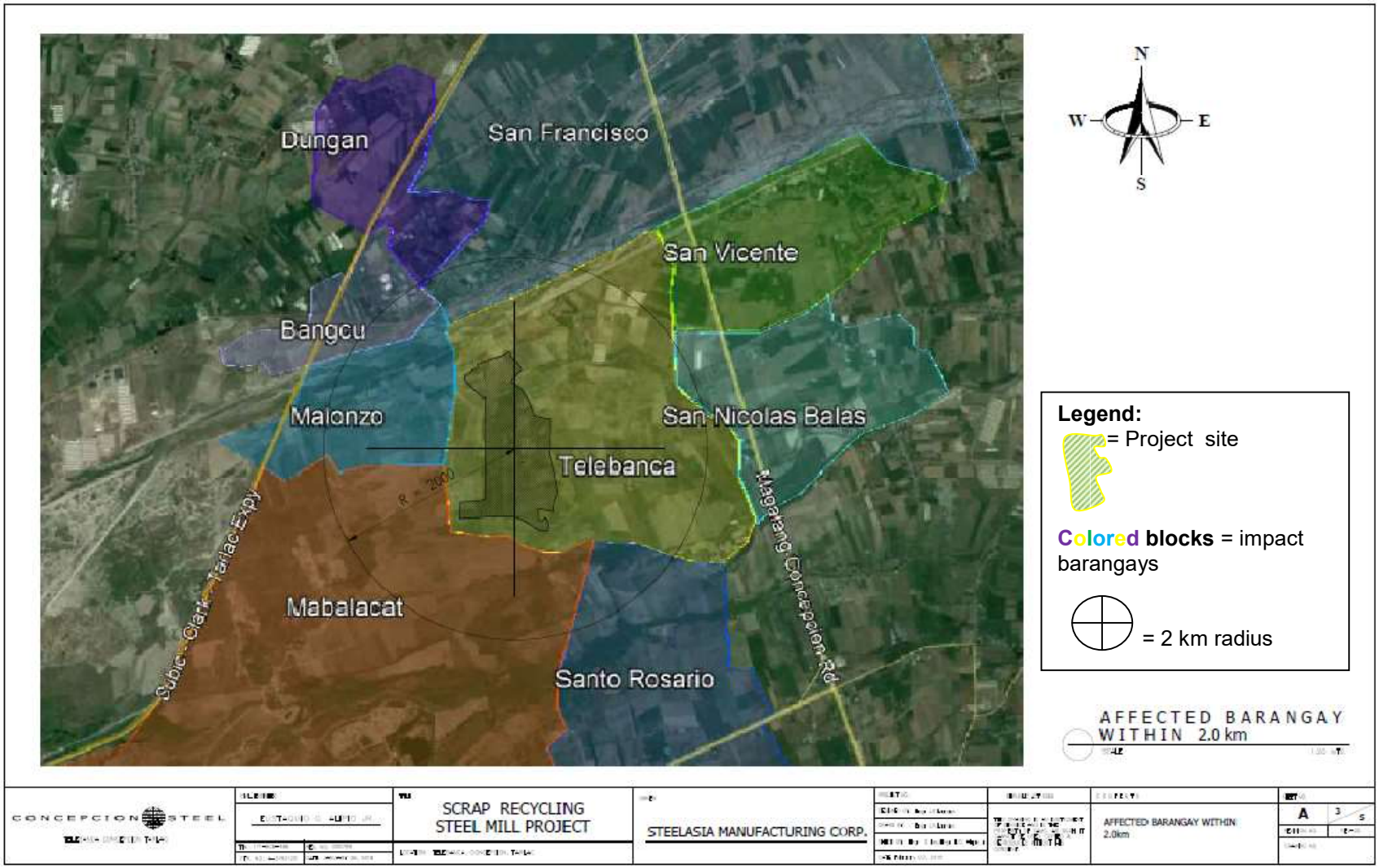


Figure 1.1.3: Impact area Delineation (source: SteelAsia)

1.1.2 Geographic coordinates of the Project Site

Provided below is the geographic coordinates of the project area:

Figure 1.1.2.1: Coordinates of the Project Site (source: Google Earth Map)

1.1.3 Discussion on the Accessibility of the Project Site/Area

The Project Site is located in Barangay Telabanca, Concepcion, Tarlac. The distance from Balintawak North Luzon Expressway (NLEX) Balintawak Toll Gate to Subic-Clark-Tarlac Expressway (SCTEX) Concepcion Exit more than 81 Kms. It is 7.5 kilometers from the Capas junction along McArthur Highway. It lies on the south-eastern tip of Tarlac, bordered in the south by Magalang, Pampanga, in the east by San Antonio, Nueva Ecija, in the north-east by La Paz, in the north-west by Tarlac City, in the west by Capas, and in the south-west by Bamban. It covers an area of 245.7 km². The Project Site may be reached via NLEX-SCTEX through SCTEX Concepcion Exit and take Magalang-Concepcion Road. All forms of land transportation are available in Concepcion such as buses, jeepneys and tricycles. Provided below is a directional map via North Luzon expressway and Subic-Clark-Tarlac Expressway.

Provided below are directional maps from Manila to the project site and from SCTEX/NLEX to the project site.

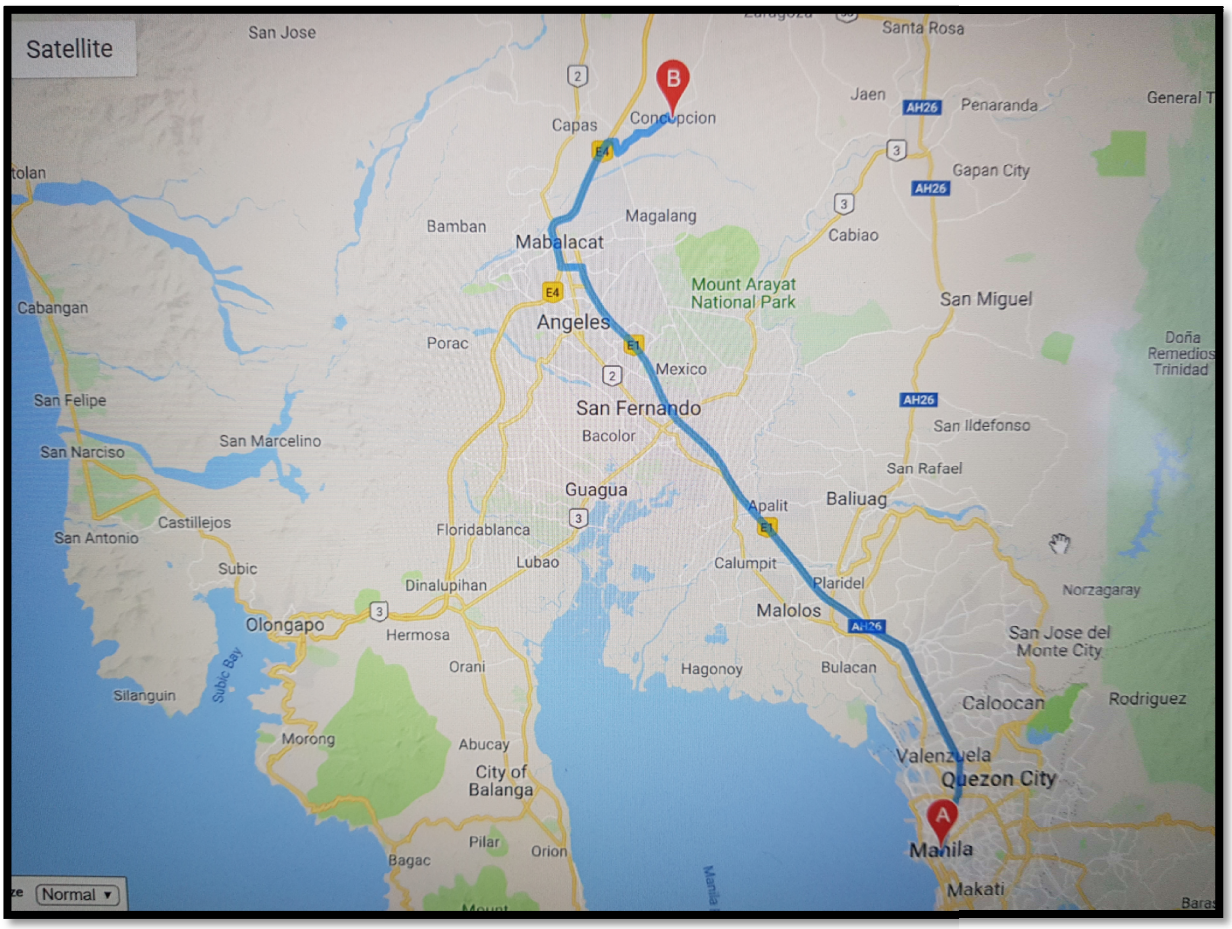


Figure 1.1.3: Directional Map from Manila to Project Site

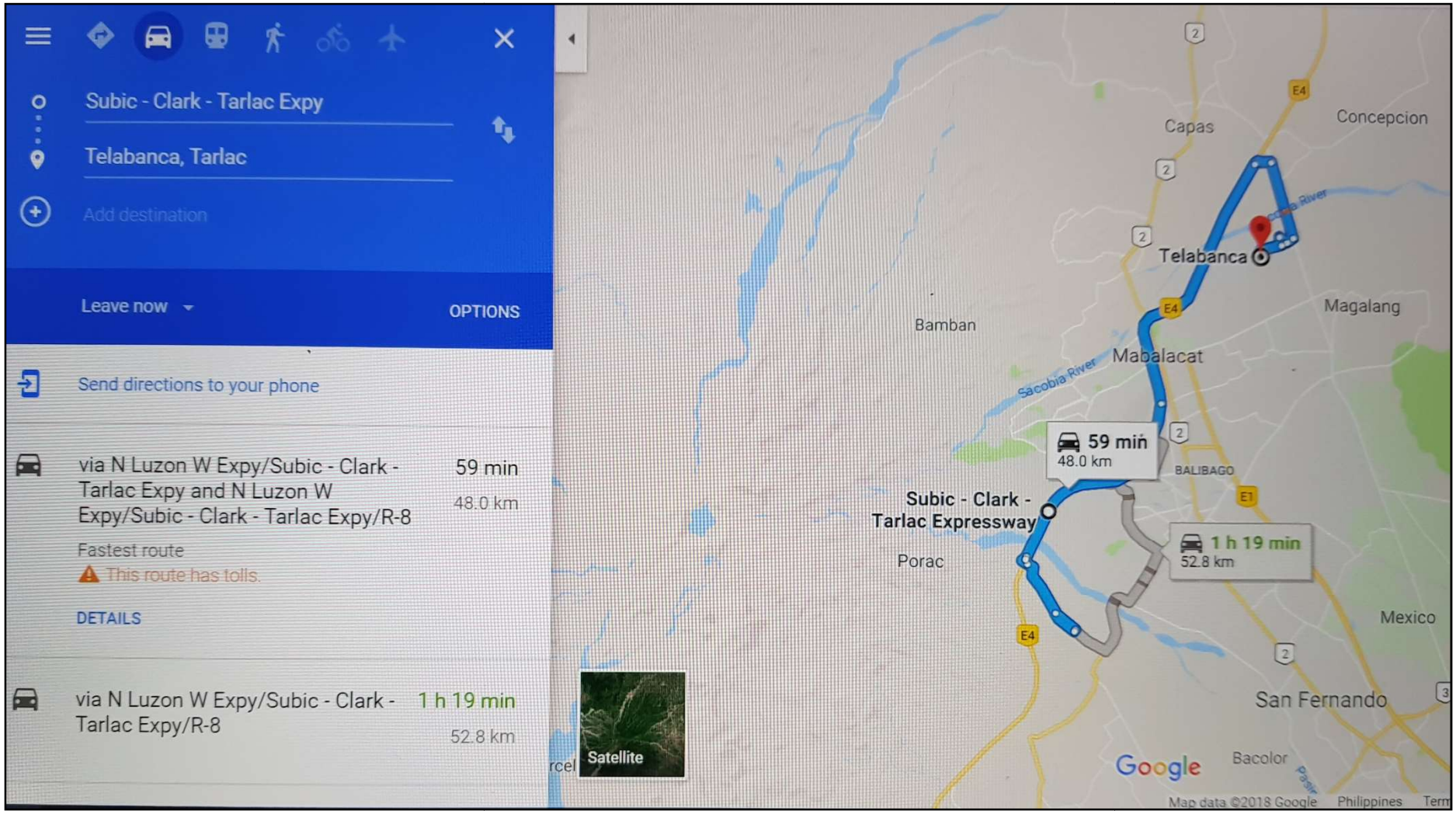


Figure 1.1.4: Directional Map (source: Google Maps)

1.2 Project Rationale

The steel industry in the Philippines is one of the most significant growth industries. Steel constitutes a basic industry prerequisite in a country's pursuit of development and industrialization. The central role of the industry stems from its linkages with numerous sectors, where its products serve as an essential input to countless uses, such as building and construction and it is equally important contributions to employment generation, growth, and promotion of industrial activity, etc. Therefore, ensuring a strong domestic steel and steel-based industry is vital in developing the competitive edge of a country in meeting the challenges of globalization. SteelAsia plays a key role in national development. With the boost in infrastructure industry in the country together with the rehabilitation activities in some parts of the country, there will be a bigger demand for reinforcing steel bars in the future. The proponent is investing for the establishment of a state-of-the-art Scrap Recycling Steel Mill in Brgy. Telabanca, Concepcion, Tarlac. The equipment to be used shall be among the most modern scrap recycling mini-mill in the world featuring new technologies. Its features give the advantage in terms of productivity and efficiency over competitors' facilities.

Around one out every two steel bars installed in construction are manufactured by SteelAsia. More than 80% of the steel bar requirements for land, air, sea, power and communications infrastructure are supplied by SteelAsia. It is the preferred supplier of the largest contractors and property developers in the Philippines. It is has vertically integrated both upstream and downstream, having the largest and most modern steel billet making facility and the largest rebar fabrication plant in the country. Already with 6 plants operating across the archipelago, it is adding additional Plants among the world's largest and most modern steel bar mills, to meet the needs of today's unprecedented economic growth.

Following are the major rationale for the project:

- Infrastructure growth in Central Luzon and NCR
- To support the housing, retail, tourism and industrial construction in the region
- Support the following infrastructure developments in Central and Northern Luzon:
    - Clark Green City
    - Manila - Clark Railway
    - New Clark International Airport Terminal Building
    - Central Luzon Link Expressway (CLLEX)
    - North Luzon Expressway East (NLEX)
    - San Rafael - Cabanatuan Expressway
    - Bulacan Bulk Water Project

In summary, new construction will require more rebars which are best supplied by a local/community steel mill thus the objective to locate the mill near the area where these developments are expected.

1.3 Project Alternatives

1.3.1 Criteria Used In Determining Preliminary Options

Following were the criteria used in determining project options:

Site Selection

The following site locations were evaluated using human settlement, accessibility of the site and legal impediments as significant to the selection:

1. Concepcion, Tarlac
2. Magalang, Pampanga
3. Mabalacat, Pampanga

Technology Selection/Operation Processes

As a member of the Steel Asia group of companies, the technology and the processes to be used in this proposed Scrap Recycling Steel Mill is the most modern mini-mill which will be the most modern in Southeast Asia. SAMC decided to use "state of the art" technologies for this project because in the long run it provides the lowest operating cost.

Resources
In terms of water source, rainwater harvesting will be employed where an reservoir will be the first to be constructed in order to harvest more rainwater and be ready with the water requirement just in time with the Project's operations. For the make-up water because of losses due to evaporation, the best option to consider is the Sacobia River due to its proximity to the project location. Deep well is also not an option since it may affect the supply of those nearby residential communities whose water supply is coming from their own deepwell.

In terms of power supply, Tarlac II Electric Cooperative (TARELCO II) will supply the required power. Standby generator sets with a capacity equivalent to the mill's cranes will be installed.

Logistics
Steel manufacturing is essentially a transportation business as it requires a lot of moving & handling for its raw materials and finished goods. The plant should be sited near the port, major highways and customers to optimize the logistics cost. The nearest port that will be utilized for this Project is the Subic Bay Free Port within the Subic Bay Management Authority (SBMA) in Olongapo.

Manpower Availability
Rebar manufacturing needs around 1,000 direct and 5,000 indirect vocational and technical personnel to run and maintain the facilities 24/7.

Land
The land area must accommodate all the facilities needed in a contiguous manner. In addition it should not require a long time for land conversion and expensive site development. It should have sufficient elevation for flooding.

Carbon footprint
The proponent's policy is to adopt practices to minimize fuel use. These include optimized trip planning/routing to increase fuel efficiency, reducing the number of kilometers each truck travels daily and minimizing travel time.

Social
Social environment was also considered in the project alternatives. The project area was considered because it is already reclassified as industrial by the Sangguniang Bayan of Concepcion, Tarlac. These neighborhoods will be protected through SAMC's commitment to implementation of environmental management and mitigating measures.

Environment
Environmental characteristics of the project site were also considered in the site selection. The proposed location is a clear and flat area. Being in a topographically flat area, hazards associated with slope instability, erosion and mass wasting are nil. The proposed location of the project facilities was also evaluated in terms of geohazard susceptibility based on information from government agencies such as the Mines and Geosciences Bureau (MGB) and the Philippine Institute of Volcanology and Seismology (PHIVOLCS). Generally, the project area's susceptibility to earthquake-triggered slope failure, rainfall-triggered slope failure, and flooding are low. With regard to seismic vulnerability and liquefaction potential, the potential ground-shaking and liquefaction susceptibility of the project site is also low.

Environmental Impacts of Each Alternative
In terms of location, the potential impacts in all locations are the same. However, other areas were not considered because of existing mangrove plantation, lack of sustainable water and power sources and the land classification is not yet industrial. The impacts are discussed and summarized in detail in the next two chapters.

1.3.3 No Project Option
If there will be no proposed scrap recycling steel mill (mini mill) project, the following advantages and benefits for the residents of Brgy. Telabanca and the municipality of Concepcion in particular will not be realized:

- employment opportunities
- social development such as livelihood projects
- skills training
- scholarship programs
- medical assistance
- prospective LGU increase in revenue
- multiplier effect of the project such as business opportunities, support to basic services like infrastructure and medical assistance and other opportunities for the community and LGU

The possibility of expanding and upgrading LGU's basic infrastructure services and facilities and strengthening of LGU's capacity in municipal governance, investment planning, revenue generation and project development and implementation will not also be realized. This may also include possibility of enhancing their capabilities for local leadership because the project may provide technical support and assistance to local leaders to training, seminars and workshops. All of these may be provided by the project thru its tax payments, permits and clearances and Social Development Program.

Another opportunity that the local government and the community may miss if the project will not be realized is the possibility of constructing additional infrastructure projects like roads and bridges, increasing school classrooms and improving school facilities and medical assistance such as provision of medicines, medical supplies and medical missions.

Also, environmental mitigating and management measures may be continuously may be installed and implemented if the project will be implemented because proper drainage system will be constructed so as to abate adverse effects of climate change to the community.

Using all of these considerations as criteria, Brgy. Telabanca in Concepcion, Tarlac was chosen as the best site to be the project's location.

1.4 Project Components

This section provides the project's components.

1.4.1 General lay-out of facilities

Shown in Figure 1.4.1 is the Site Development Plan providing the general lay-out of facilities and proposed buffers.

1.4.2 Map showing the location and boundaries of project area, location and footprint of main and support facilities and proposed buffers

Provided in Figure 1.1.1 and 1.1.2 are the map showing the location, vicinity and boundaries of the project area.

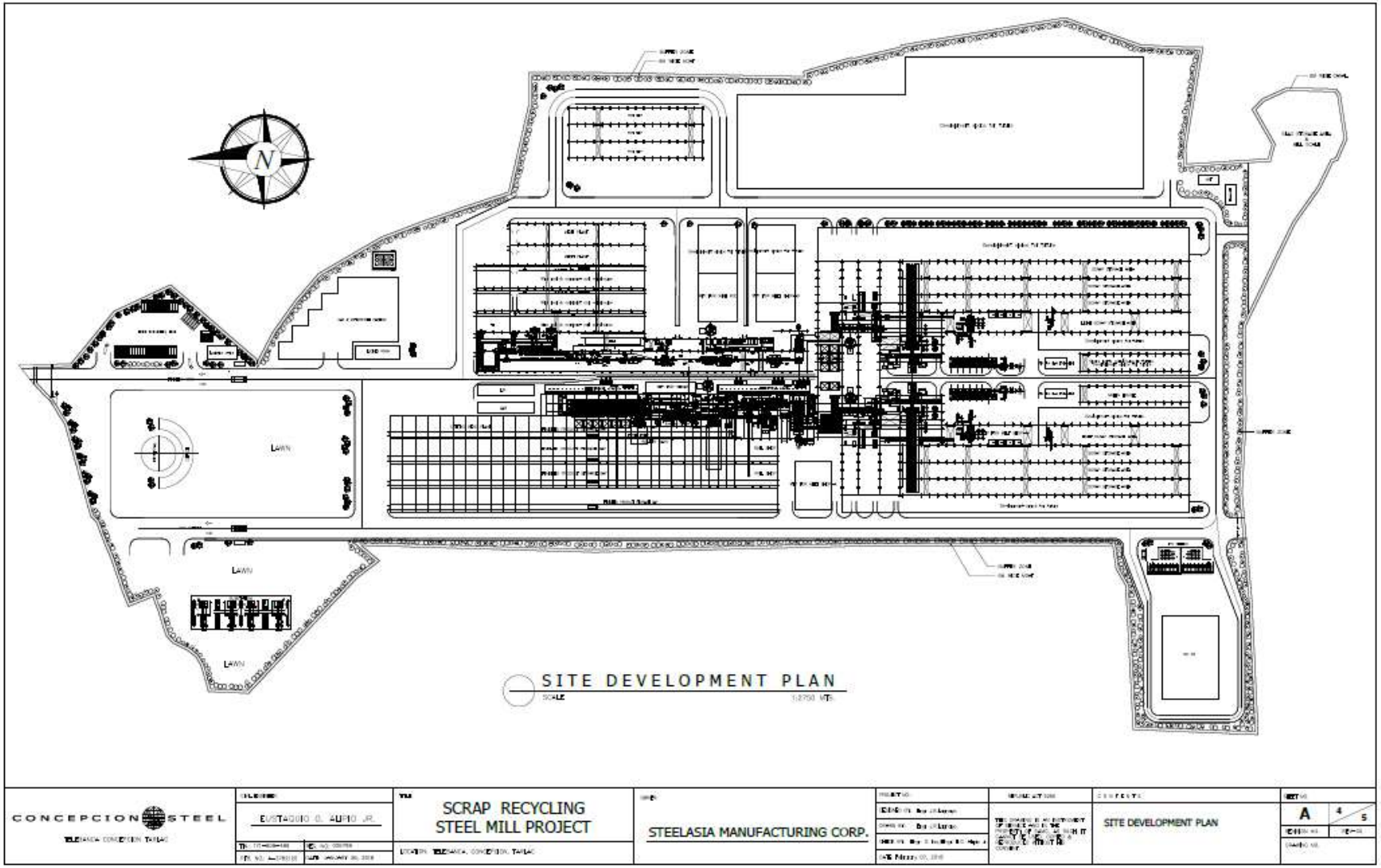


Figure 1.4.1: Site Development Plan

1.4.3 Major Components:

Provided below is project's components.

Table 1.4.3.1: Project Components

EQUIPMENT	DESCRIPTION	AREA ALLOCATION (in sq. m.)
Scrap Yard	Area allocated for scraps that will undergo charging for the melt shop. This is the scrap storage area in the plant with a capacity of 120,000 metric tons.	126,800
Rebar Rolling Mill	The rolling mill, which consists of roughing, intermediate and finishing stands, is composed of 14 rolling stands with 2 convertible stands for flexibility and ease of the rolling process. It has on-board utilities such as air, oil, water, power and hydraulics to minimize downtime during size change.	95,000
Rebar Meltshop		47,300
Wire Rod Mill		70,300
Wire Rod Meltshop		60,300
Finish Goods Warehouse		120,200
Finish Goods Warehouse		64,400
Water Treatment Plant 1	Designed to handle both the direct and indirect cooling water from the Plant operations to cool and recycle 1950 m3/hr of direct cooling water and 2001 m3/hr of indirect cooling water. The recycled water allows the mill to significantly reduce the amount of fresh water required.	14,670
Water Treatment Plant 2		8,560
Scale & Waste Area		25,900
Greenhouse		7,800
LPG Station		6,100
Reservoir	This Water Catchment Pond will collect rainwater which will then pass through the wastewater Treatment Plant (WTP) for recycling and process use. These collecting ponds have a volume of at least 30,000 cu.m, 3,400 cu.m, 26,600 cu.m respectively. They are interconnected with each other and in the WTP. Its main purpose is to provide process and make-up water for the evaporation process that takes place in the rolling mill area.	87,680
Offices		30,000
Truck Parking		25,000
O2, N2 Plant	SteelAsia will install an Oxygen Gas Generator (EOX90), 120,000 liters cryogenic tank (including auxiliary equipment), O2 gas Compressor, Compressed Dry Air (CDA) system and Cooling water system. This new O2 gas generator shall become the primary source of O2 gas and shall be backed up by Liquid O2 vaporization system in case of any failure by the O2 generator.	19,600
Total		809,610

1.4.4 Ancillary facilities:

The following components are ancillary facilities for the Project:

- Rainwater collection reservoir
- Compressed air

- Power substation
- QA laboratory
- Roll shop
- Generator set/Emergency power system
- Cranes
- Fuel Storage
- Oxygen Plant Smoke Stack
- Pumping Station and water pipes from Sacobia River to proposed Project Site
- Quality Assurance laboratory
- Machine shop
- Fire Protection System

- **Rainwater collection reservoir**

The main water source for Plant operations is rainwater. The storm drainage system of SAMC is connected to the Water Catchment Pond to accumulate water which will then pass through the wastewater Treatment Plant (WTP) for recycling and process use. These collecting ponds have a volume of at least 30,000 cu.m, 3,400 cu.m, 26,600 cu.m respectively. They are interconnected with each other and in the WTP. Its main purpose is to provide process and make-up water for the evaporation process that takes place in the rolling mill area.

- **Power substation**

The plant capacity is requiring one package of 69 KV substation to be built in a 2000 square meter area which will consist of a 31.5 MVA power transformer will be installed as the power supply of Rolling Mill and plant auxiliaries. Harmonic filters will also be installed for the rolling mill to be compliant with the Philippine Grid Code on the system power quality such voltage and frequency variations, flicker severity and harmonic distortions. Electric utility company will provide the power requirement of the Plant. They will also provide the tapping point and the distribution line going to the Plant's electric substation.

- **Generator set/Emergency power system**

This will serve as an emergency power of the rolling mill if there is power outage. This plant requires a closed type mobile generator set with a diesel engine and a capacity of 1MVA/800kW standby power to supply all key equipment and facilities such as lighting and power for safety purposes and cranes to ensure all deliveries are in time to make customer satisfied. The generator set is also set with compatible cooling system, noise reduction system, intake and exhaust system, and electronic control system.

- **Compressed Air Station**

Compressed air is being used as atomizer of the fuel for complete combustion in the furnace, also used in pneumatics for instrumentation and controls of equipment. The compressed air station capacity is 5,710 m3/hr at 8 Bars.

- **Cranes**

Cranes will be used in the rolling mill with a mix of Overhead Cranes and Semi- Gantry Cranes with capacity ranging from 10 tons to 25Tons and 6 to 20 tons under magnet. Overhead cranes will be used in the installation, production, and in maintenance, Semi-gantry cranes will be used for lifting the raw material from the truck to the piles of billet then lift to charge the rolling mill. Cranes with magnet will help to store raw materials and finish products faster and safer.

- **Fuel Storage**

Storage area for Low Sulfur Fuel Oil (LSFO) as among the mitigating measures for air pollution

- **Oxygen Gas Generator (EOX)**

SteelAsia will install an Oxygen Gas Generator (EOX90), 120,000 liters cryogenic tank (including auxiliary equipment), O2 gas Compressor, Compressed Dry Air (CDA) system and Cooling water system. The Oxygen gas produced will be delivered via a pipeline and shall be connected to the existing piping on the Meltshop building. This new O2 gas generator shall become the primary source

of O2 gas and shall be backed up by Liquid O2 vaporization system in case of any failure by the O2 generator. The O2 gas is currently being used at the Electric Arc Furnace (EAF) for steel manufacturing. Installing an onsite O2 gas generator is a more efficient and cost effective solution for O2 gas requirement and will therefore make product more competitive.

Oxygen gas is acquired, specifically for this type of plant technology, by an adsorption technology called vacuum swing adsorption, which we shall call EOX. The EOX generator is an On-site oxygen generator that produces oxygen at ambient pressure. The O2 gas produced shall then be compressed to meet the required pressure by the end user. The EOX uses the process of air separation by adsorption. This technology allows producing O2 enriched stream (up to 93%) from air. The basic principle of air separation by adsorption relies on the use of zeolite adsorbents (or molecular sieves), which perform a selective adsorption of nitrogen over oxygen and argon. When feeding air into a vessel filled with zeolite adsorbents, nitrogen is preferentially retained and oxygen and argon go through.

Provided below is the tabulated summary of ancillary facilities of the project.

1.4.5 Pollution Control Devices and Corresponding Facilities Being Served or Connected

The project will use the following pollution control facilities:

a. Wastewater Treatment System
b. Solid Waste Management System
c. Hazardous Waste Management System

Wastewater Treatment Plant (WTP)

The Wastewater Treatment System is designed to handle both the direct and indirect cooling water from the Plant operations. Direct cooling water is the water which is in direct contact with the product, specifically the water used to cool the rolls in the bar mill line. Indirect cooling water on the other hand is the water that does not touch the products and stays inside the pipes and ducts. The WTP is designed to cool and recycle 1950 m3/hr of direct cooling water and 2001 m3/hr of indirect cooling water. The recycled water allows the mill to significantly reduce the amount of fresh water required. The equipment used in this WTP are three cooling towers, sedimentation basins, several filters and pumps (Figure 1.4.5.1). Provided in Figure 1.4.5.1A is the Site Drainage Plan which will is design for storm run-off since the project is zero effluent.

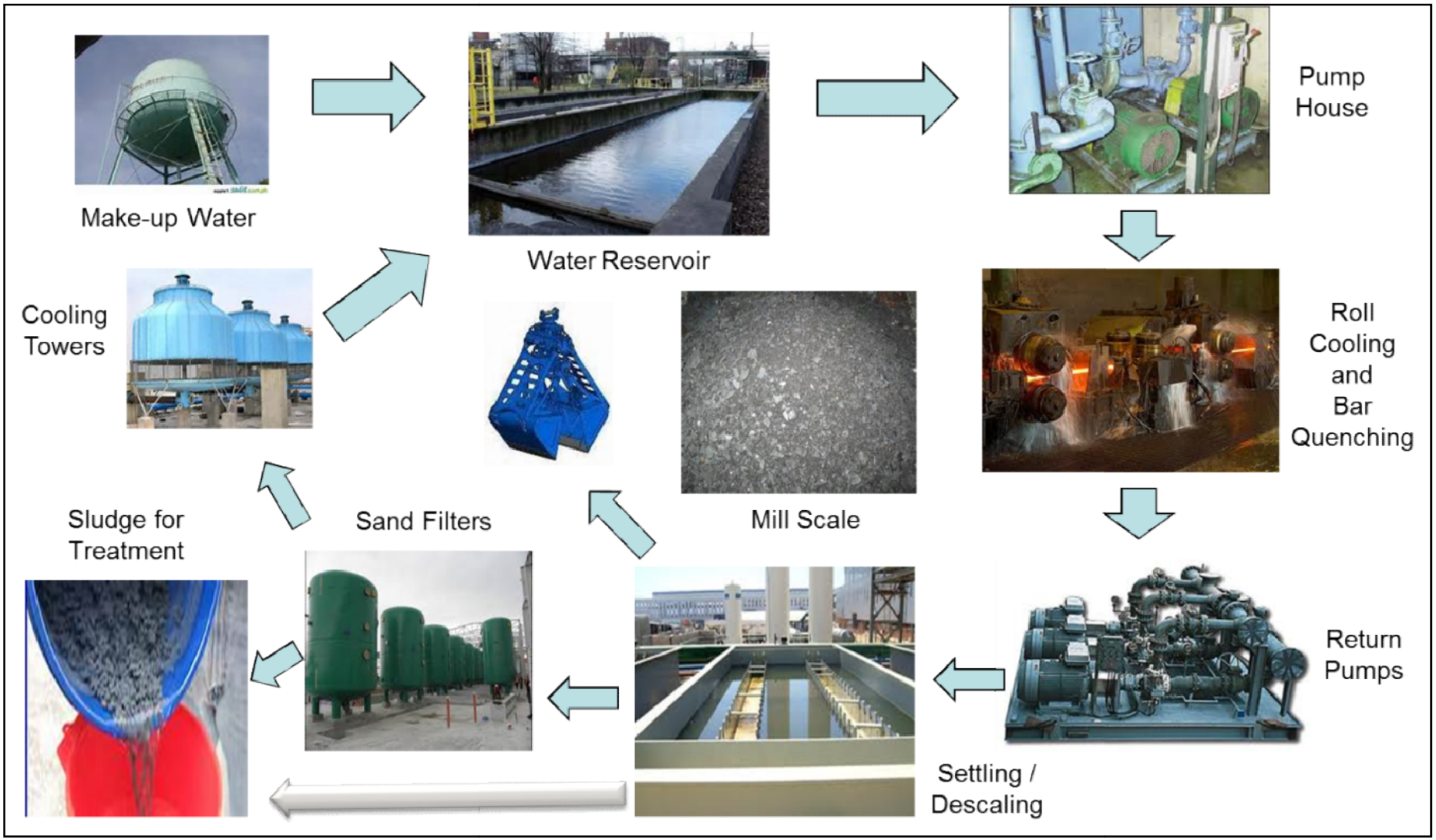


Figure 1.4.5.1: Water Treatment Process Flow

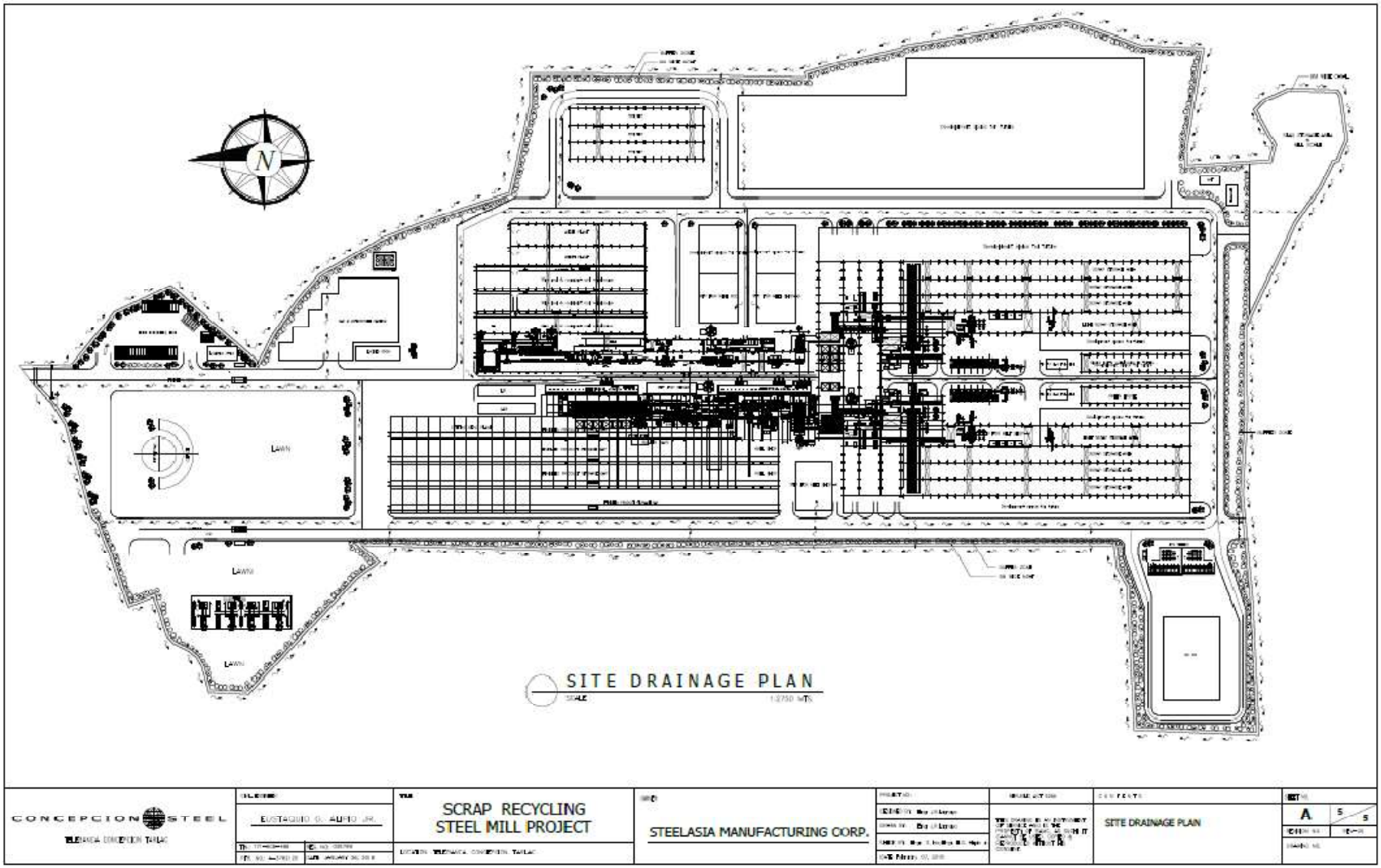


Figure 1.4.5.1A: Site Drainage Plan

Solid Waste Management
Domestic solid waste as well as wrongly-sized rebars will be generated. Material Recovery Facility (MRF) will be provided for domestic solid waste while scrap bars will be hauled to be used as raw material for other plant's meltshop. Solid Wastes will be properly segregated and to be disposed in the Material Recovery Facility. Domestic Waste will be treated through the proposed Sewerage Treatment Plant.

- *Steel Slag*

The slag generated from steelmaking process is estimated to be 7.7% of the total raw material (scrap metal). For the existing production, an estimated amount of 25,410 MT per year is produced as by-product and is being stored in an area of 2500 m^2. With the increase to 500,000 MTPY production, the estimated amount of slag to be generated is around 43,142 MT. In order to avoid problems on storage and handling, there are plans to continuously dispose or utilize the slag as an iron source (recycling back to the EAF), as a clinker material and as road bed/construction material.

Steel slag is considered non-hazardous since it does not meet any one of the waste sub-category classifications and standards listed in Table 1-1 of DENR DAO 04-36. Available analysis of steel slag is shown in Tables 1.4.5.1 and 1.4.5.2.

Table 1.4.5.1: Chemical Analysis of Steel Slag

	Slag Component Sample	Methods/Technique
FeO, % [a]	43.88	Flame AAS
CaO, % [a]	22.95	Flame AAS
SiO_2, %	15.02	Gravimetric
MgO, % [a]	6.92	Flame AAS
Al_2O_3, % [a]	5.01	Flame AAS
MnO, % [a]	0.29	Flame AAS
P_2O_5, %	0.266	Titrimetric

Table 1.4.5.2: Toxicity Characterization of Slag

	Steel Slag Sample	DAO 29 Standard	Method/Technique
Cr^{+6}, mg/L	<0.01	-	Diphenylcarbazide
As, mg/L	0.009	5	Hydride Generation – AAS
Ba, mg/L	6.74	100	Flame AAS
Cd, mg/L	0.004	5	Flame AAS
Pb, mg/L	0.03	5	Flame AAS
Se, mg/L	<0.0002	1	Hydride Generation – AAS
Hg, mg/L	<0.0001	0.2	Cold Vapor - AAS

Flammability	: The sludge did not ignite when subjected to flame test.
Ignitability	: The sample under standard temperature and pressure did not cause fire through friction or absorption of moisture.
Corrosivity	: The 10% sample solution has a pH of 7.77 and can be considered as non-corrosive.
Reactivity	: The sample does not exhibit the characteristics of a reactive substance such as undergoing violent chemical change without detonation, violent reaction with water, forming explosive mixtures with water and generating toxic gases, vapors or fumes.

The slag, as it comes from the process shall be stocked, uncrushed and cooled to ambient temperature by means of water sprays. It shall be collected by a shovel loader and transported by dump trucks to the temporary storage yard. Skulls, which are still rich with iron, shall be recovered by the use of magnet. The skull-free slags are disposed either as a road bed, backfilling or other construction purposes.

Hazardous and Toxic Waste management

- *EAF Dust*

Dust collection starts by funneling the smoke and hot gases emitted by the electric arc furnace through a water-cooled collection duct. The collected hot gaseous emission is passed through a combustion chamber in order to convert remaining combustible gases into carbon dioxide. It is then passed through a long water-cooled pipe until its temperature is lower than 80°C. At this point, ambient air is mixed into the gas stream to further cool it before it is finally passed through a baghouse. Dust are then stored and sealed in tonner bags and placed in the hazardous storage facility. Disposal methods include local disposal through DENR-accredited TSD facility and/or being exported for recycling after chemical stabilization.

Scales is formed on the outer surfaces of plates, sheets or profiles when they are being produced by rolling red hot iron or steel billets in rolling mills. Mill scale is composed of iron oxides mostly ferric and is bluish black in color. It is usually less than 1 mm thick and initially adheres to the steel surface and protects it from atmospheric corrosion. Scales will be collected in containers and will be fed in the melt shop for recycling.

- *Other hazardous wastes*

For other hazardous wastes that will be generated such as busted bulbs and lamps, LED lamps, used oil and used batteries, disposal will be done thru 3rd party DENR-accredited Treaters. Used oil will be collected and put inside sealed drums, stored in a company designated Material Recovery Facility (MRF) inside the plant. It will be transported and treated by a DENR accredited TSD facility.

Busted Fluorescent Bulbs will be put in a container, stored inside the plant MRF in accumulation until there are sufficient inventory for proper disposal through a DENR accredited TSD facility.

Contaminated rags and gloves will also be put in bags, stored inside the plant MRF in accumulation until there is sufficient inventory for proper disposal through a DENR accredited TSD facility.

Used automotive batteries will be traded-in to designated suppliers.

In summary, following are the project's components:

1.5 Process /Technology

1.5.1 Processing/Manufacturing Technology

Provided below is the scrap recycling steel mill process.

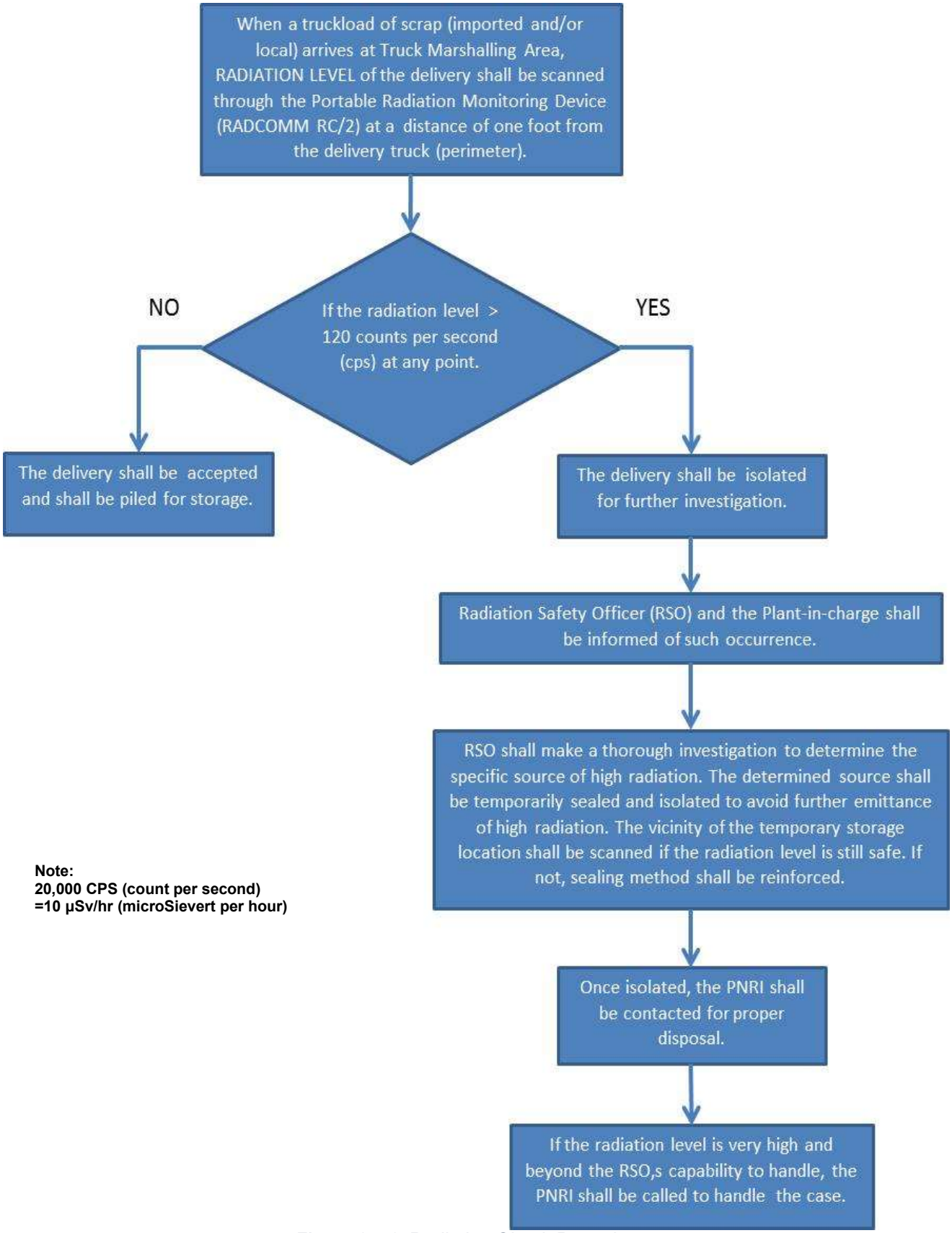
Scrap Yard

All scrap shall be received in the scrap yard and shall be stored directly on piles on the ground. Scrap deliveries shall be checked for radiation level prior to receipt. A high radiation reading could mean a delivery containing explosive or radioactive materials in the form of unspent shells, bombs, munitions among others. Procedural flowchart is shown in Figure 1.5.1.

Scraps are segregated according to its scrap grade designation. A scrap can be classified by its thickness - heavy, medium or light, and by its type - shredded, bundles, tin, can and others. The complete list of scrap grade designation can be found in Scrap Specifications Circular 2007, Institute of Scrap Recycling Industries Inc.

A proper scrap blend shall be observed before charging. Current inventory level, desired chemistry requirement and the density of scrap are some of the considerations on proper scrap blend. Scraps shall be loaded into the scrap buckets located on one of two transfer cars, which are capable of traversing the length of the in-house stockyard to Electric Arc Furnace (EAF) lifting position ready for charging. Scrap bucket loading shall be accomplished by an overhead crane, fitted with electromagnet.

Once a bucket is full, its contents shall be transferred into the EAF through an overhead crane. Scrap charge weight shall be determined by load cells which shall be installed on each scrap bucket transfer car.



Note:
20,000 CPS (count per second)
=10 µSv/hr (microSievert per hour)

Figure 1.5.1: Radiation Check Procedure

Figures 1.5.2 provides the Steel Making Process Flow, 1.5.2A is the Steel making Process followed by the process description while Figure 1.5.3 provides the rebar manufacturing process and process description.

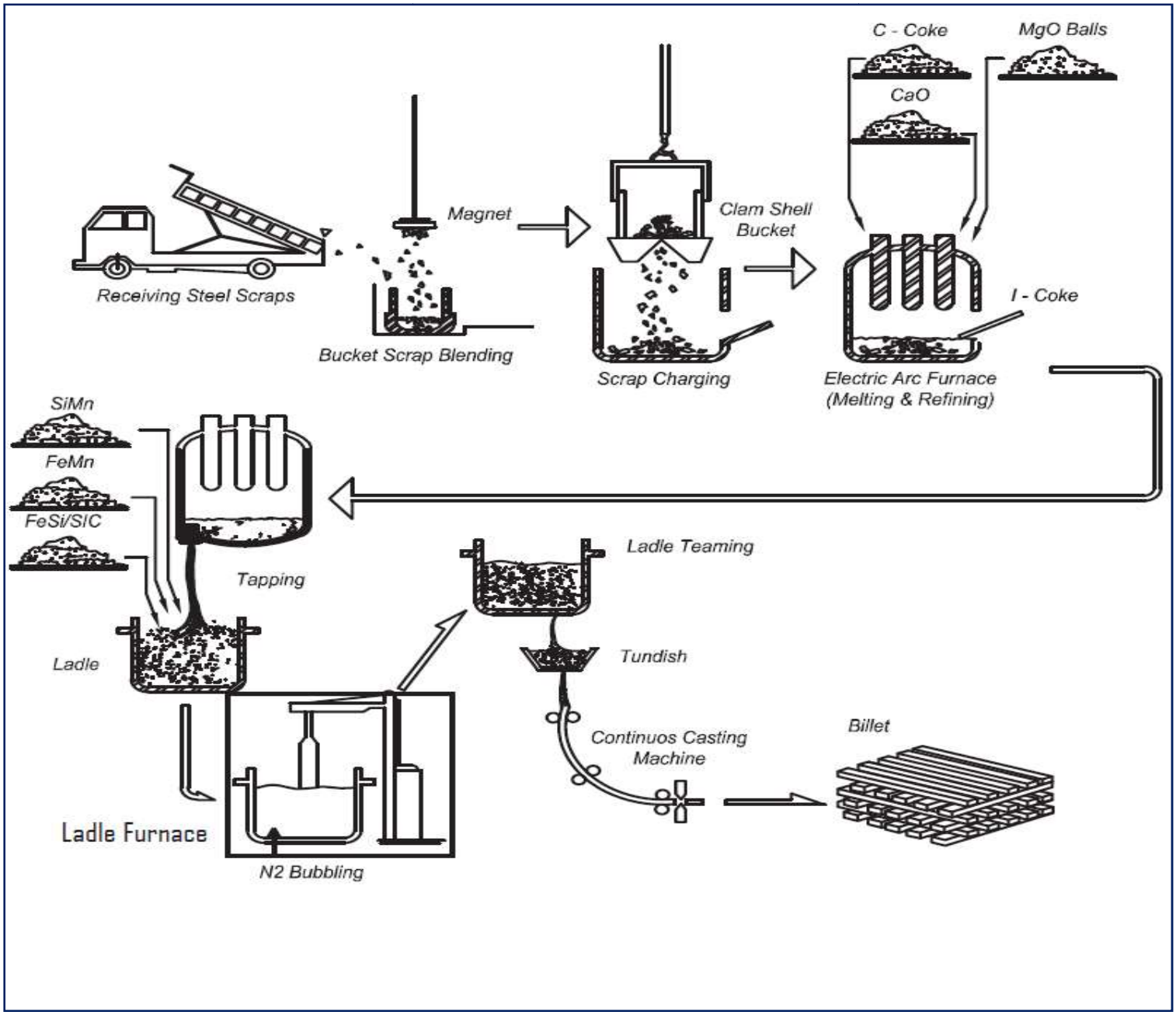


Figure 1.5.2: Steel Making Process Flow

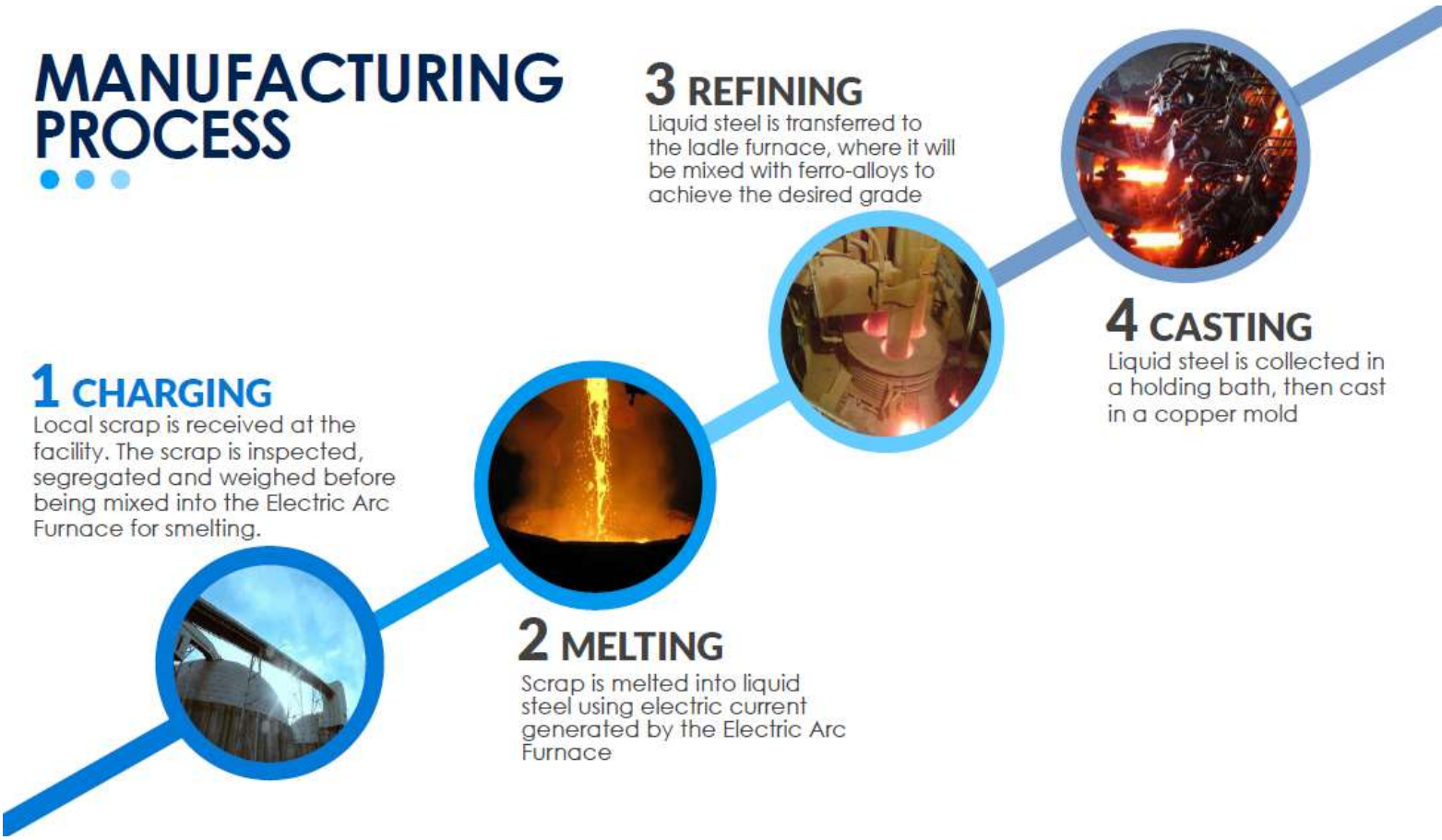


Figure 1.5.2A: Steel Making Process

Melt Shop

The melt shop capacity is 1,200,000 MT per year. Steel scrap and other furnace additives will be melted in an Electric Arc Furnace (EAF). The process is shown in Figure 1.6. Note that as can be seen in Figure 1.5, around 35% imported scrap is being utilized. The chemical composition of the resulting molten steel will be checked, and if necessary, adjusted by the addition of ferro-alloys. With the existing operation, approximately 16MT per year of additives is being used. With the increase in production, it will increase to approximately 26.5 MT per year. The EAF alloying additive system has undergone an automation upgrade for process improvement. The melt is then transferred by means of a tundish to the Continuous Casting Machine (CCM) where it is casted into square-shaped bars called billets. These billets are stockpiled according to grade before being transformed into rebars. Wastages will be reduced due to the reduced generation of intermediate bar lengths.

The meltshop will operate 18 hours with three shifts on weekdays and 24 hours also on three shifts on weekends.

Ladle Furnace

Ladle Furnace (LF) is a secondary metallurgical processor to the Electric Arc Furnace (EAF). Instead of melting and solely refining at EAF, the LF serves as a buffer between EAF and CCM for better sequencing of heats and thoroughly homogenizes the melt in.

The following are the benefits of installing a ladle furnace:

- Power cost savings – lesser power requirement than using EAF alone
- Less refractory consumption – lower cost of consumables
- Less graphite electrode consumption – lower cost of consumables
- Higher productivity – to attain the target productivity

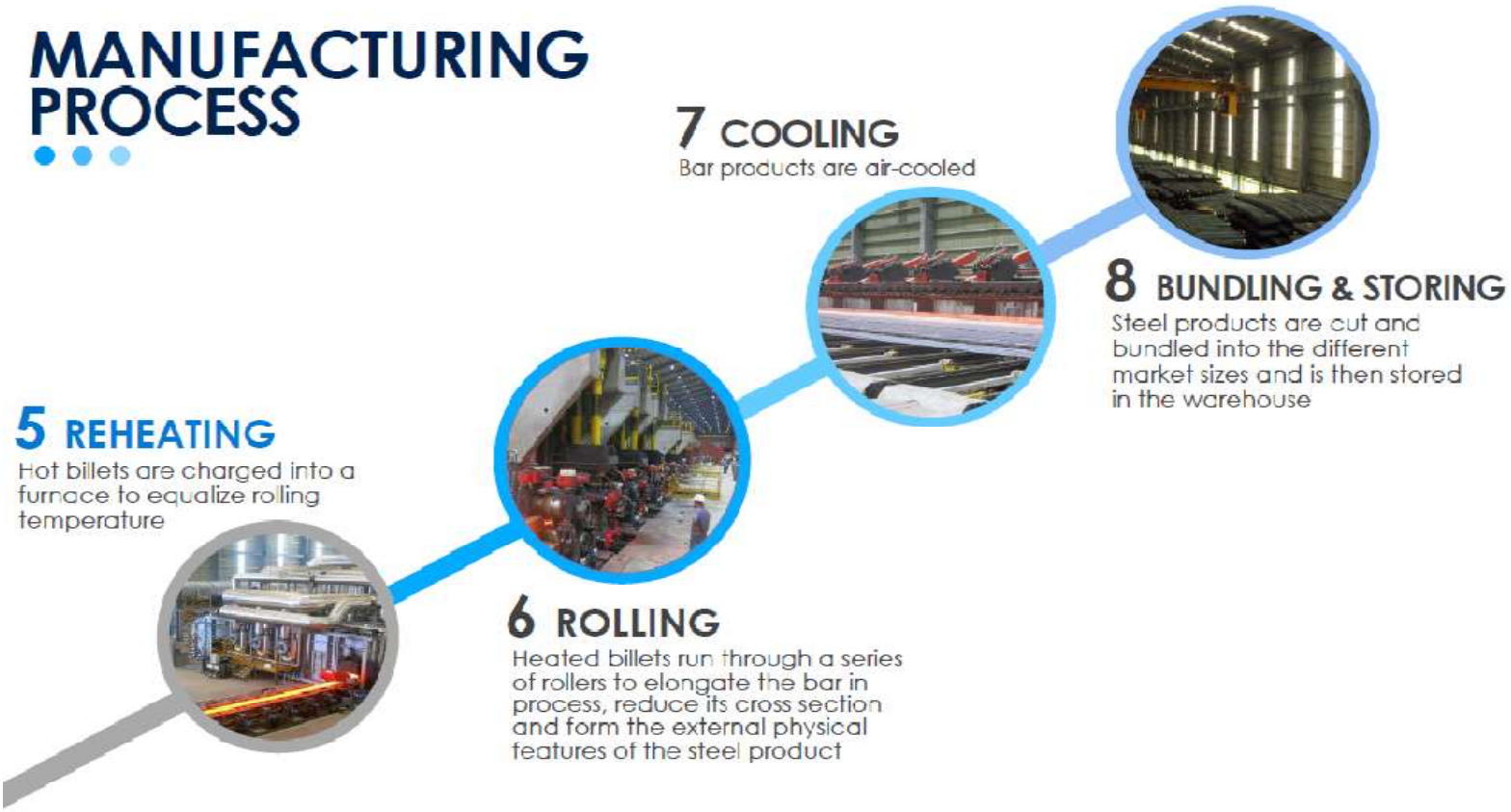


Figure 1.5.3: Rebar Manufacturing Process

Rolling Mill

Billets shall be fed & heated in a reheating furnace then undergo size reduction in a series of rolling mill stands. Then, the rolled steel bars shall pass through a quenching system where it is rapidly cooled. The cooled bars shall then be cut into the desired length, then sorted, bundled and stockpiled prior to delivery. The production capacity of the rolling mill will be 1,200,000 MTPY. Illustration of the process is shown above. Technical details on the subcomponents of the rolling mill are provided as caption for the succeeding illustrations.

Shown below is the rebar operations flow sheet which include waste streams and pollution control/management.

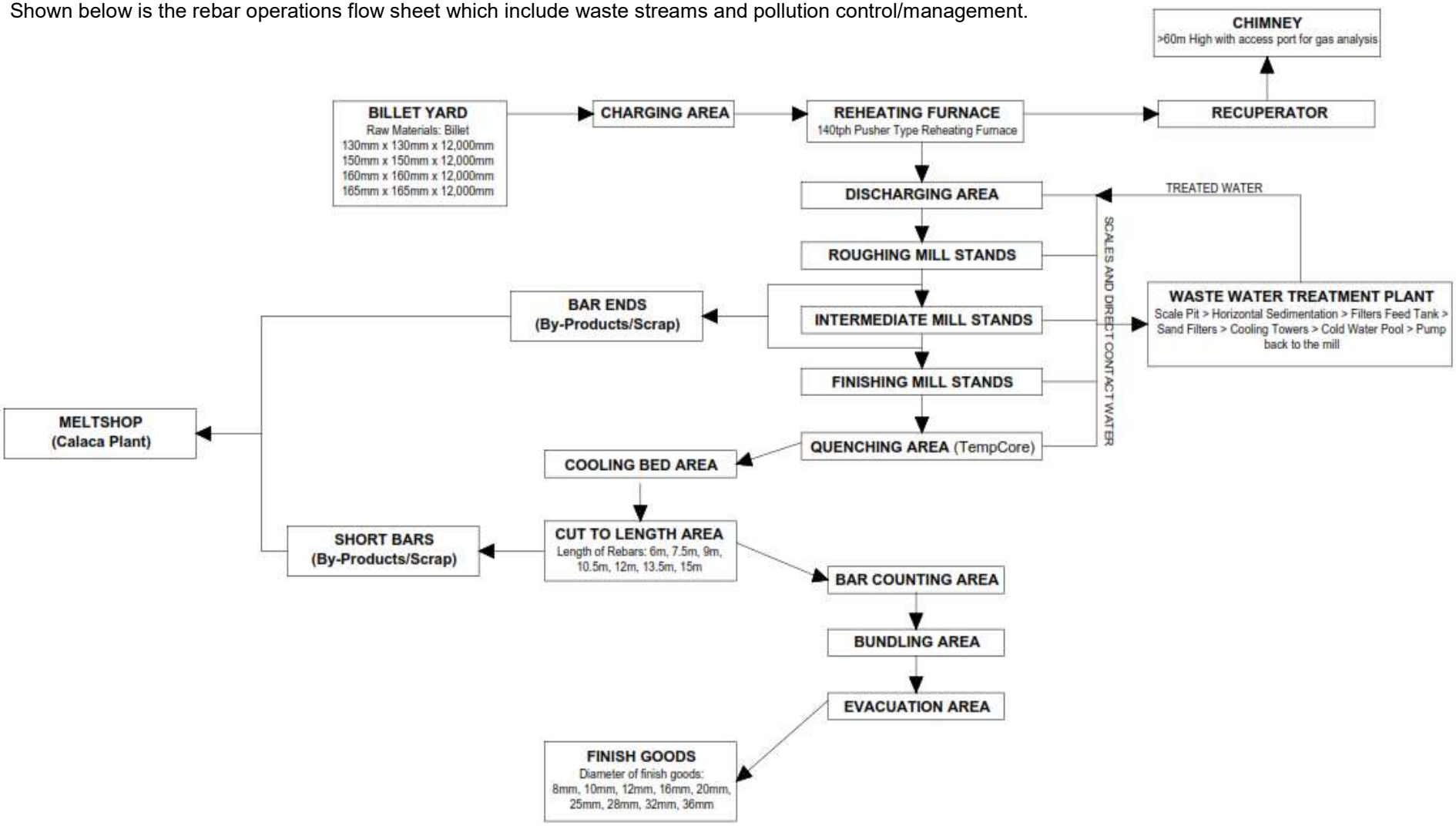


Figure 1.5.4: Process Flow which include waste streams and pollution control/management

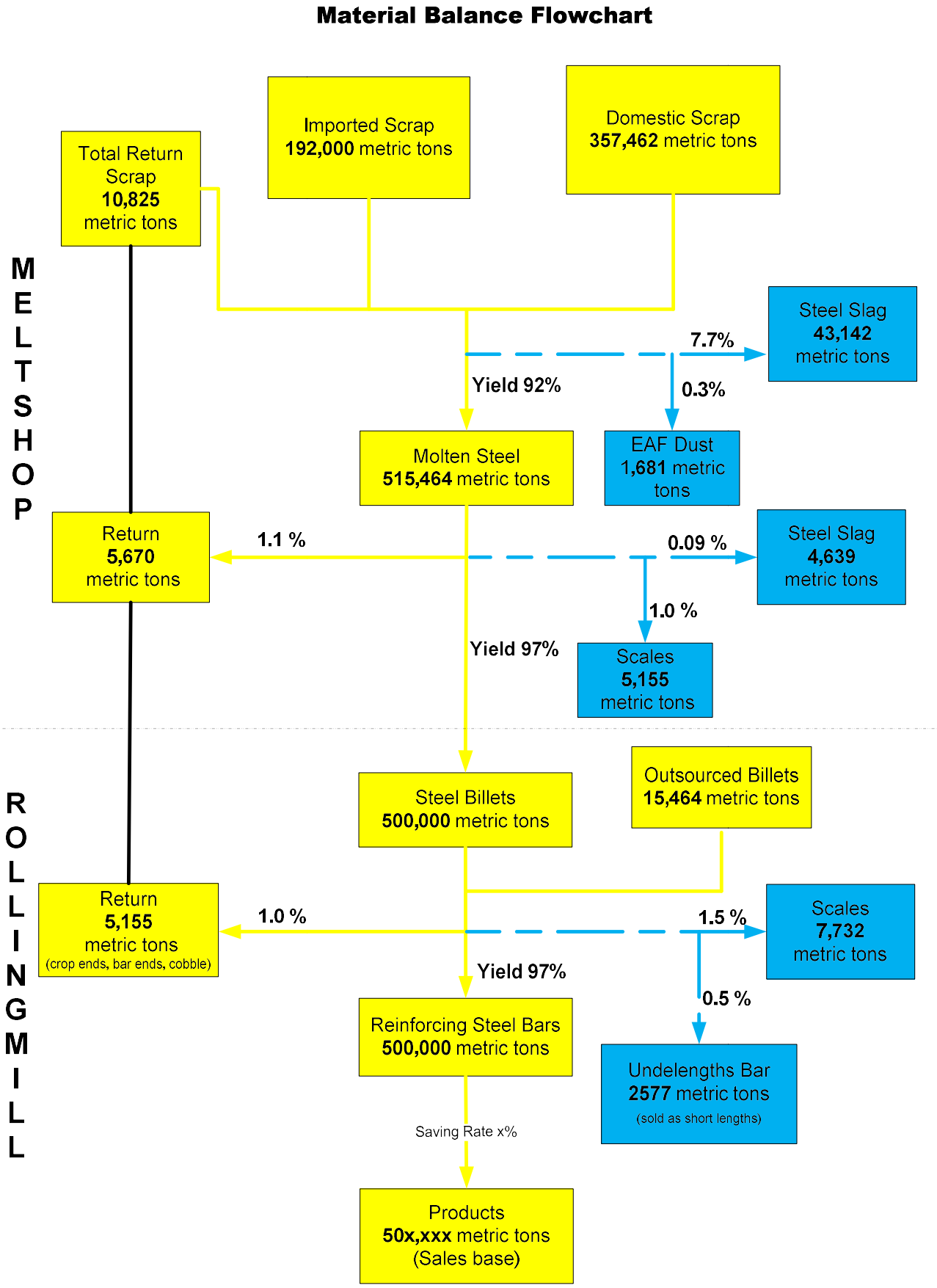


Figure 1.5.5: Material Balance Flowchart for Melt Shop and Rolling Mill

Water Balance
Provided in Table 1.5.1 below is the project's water balance.

Table 1.5.1: Water Balance

Generated Water	Volume, cum/day
Domestic Water Use	123
Water for Washing/Cleaning of Process Equipment	84
Process Wastewater from WTP	975
Evaporation Loss and unaccounted water	2653
Others (drinking, product component, gardening, leaks etc.)	7
TOTAL Volume of Makeup Water	3842

1.5.2 Pollution Control Devices and Waste Management System

The disposal procedures of hazardous, solid and domestic wastes are as follows:

1. Scales is formed on the outer surfaces of plates, sheets or profiles when they are being produced by rolling red hot iron or steel billets in rolling mills. Mill scale is composed of iron oxides mostly ferric and is bluish black in color. It is usually less than 1mm thick and initially adheres to the steel surface and protects it from atmospheric corrosion. Scales will be collected in containers and will be for sale abroad for recycling in sinter plants.
2. EAF dust is collected and re-charged in the melt shop for recycling.
3. Used oil will be collected and put inside sealed drums, stored in a company designated Material Recovery Facility (MRF) inside the plant. It will be transported and treated by a DENR accredited TSD facility.
4. Busted Fluorescent Bulbs will be put in a container, stored inside the plant MRF in accumulation until there are sufficient inventory for proper disposal through a DENR accredited TSD facility.
5. Contaminated rags and gloves will also be put in bags, stored inside the plant MRF in accumulation until there is sufficient inventory for proper disposal through a DENR accredited TSD facility.
6. Used automotive batteries will be traded-in to designated suppliers.
7. Solid Wastes will be properly segregated and to be disposed in the Material Recovery Facility of the LGU of Concepcion
8. Domestic liquid waste will be treated through the WTP.

Following are some of the inherent air pollution control devices (APCDs) which as embedded in the equipment and in the scrap recycling system:

1) Low NOx Burner

Low NOx Burners (LNB) limit NOx formation by controlling the stoichiometric and temperature profiles of the combustion process in each burner zone. The unique design of features of an LNB may create: (i) reduced oxygen level in the combustion zone to limit fuel NOx formation; (ii) a reduced flame temperature that limits thermal NOx formation; and/or (iii) a reduced residence time at peak temperature which also limits thermal NOx formation.

2) Recuperator System

A recuperator is a special purpose counter flow energy recovery heat exchanger positioned within the supply and exhaust air streams of an air handling system in order to recover the waste heat.

Concepcion Steel will have utilized recuperator in order to save energy, fuel and time from their operation. It will also reduce emissions such as CO_2, SO_2 and other gases emissions formed during the combustion of fossil fuel.

3) Emission Monitoring System

The furnace flue stack will be provided with a complete set of emission monitoring system. The basis for the installation of monitoring system will be the DAO 2007-22 "Guidelines on the requirements for continuous emission monitoring systems and other acceptable protocols, thereby modifying and clarifying certain provisions of Section 5, Rule X of DAO 2000-81 and other related provisions".

Provided in Figure 1.5.2.1 is the Water Treatment Process Flow.

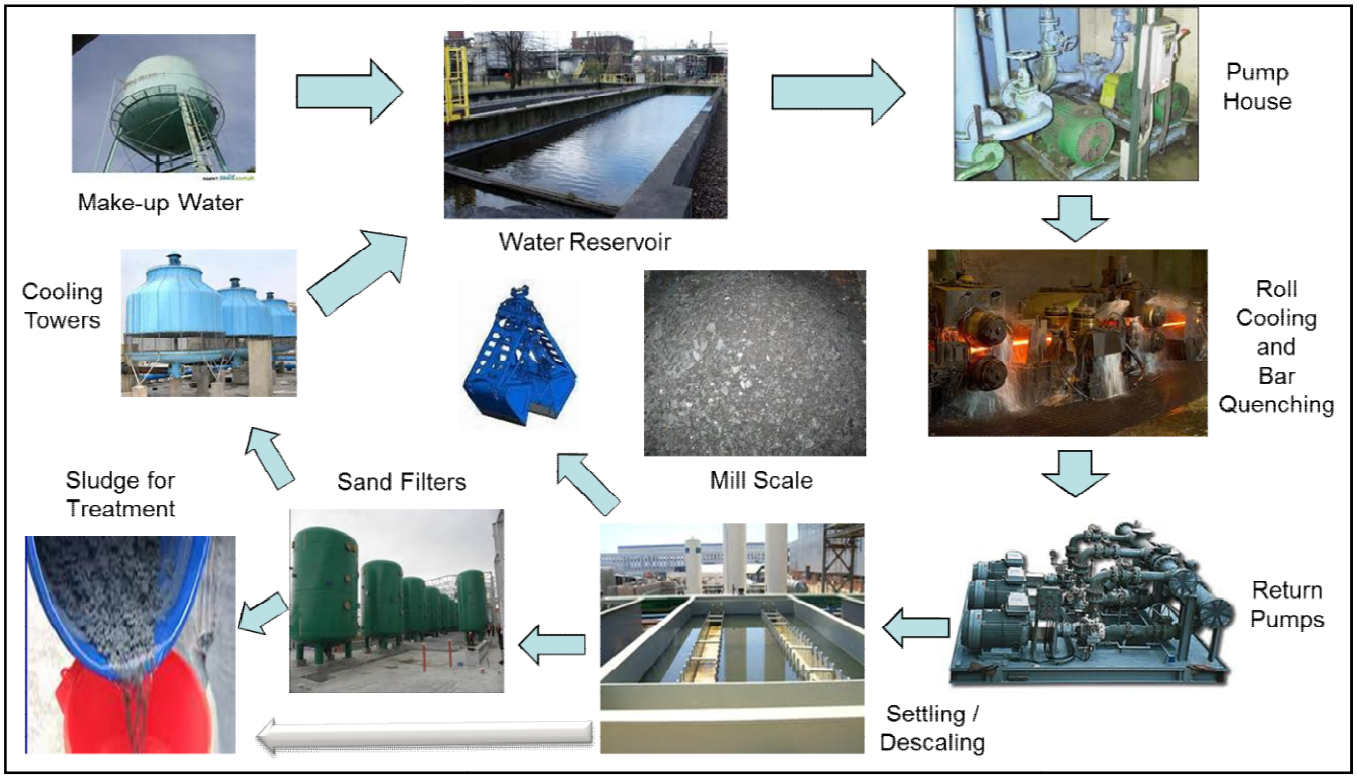


Figure 1.5.2.1: Water Treatment Process Flow

1.5.3 Operations and Maintenance of Facility

Provided below is the maintenance process for all of the operation's process.

Table 1.9: Maintenance for Furnace Section

EQUIPMENT	MAINTENANCE ACTIVITIES	FREQUENCY
Billet Handling (Loading Table)	Monitoring of hydraulic cylinder, solenoid valve, hose, and tube/pipe.	Daily
	Lubricating of wheel, and rotating joints.	Weekly
	Replacement of tilting arm pusher, wheel, and bearing. (Based also on the condition of tilting arm pusher, wheel, and bearing.)	2 Years
	Replacement of hydraulic cylinder, and solenoid valve. (Based also on the condition of hydraulic cylinder.)	2 Years
Roller Table 1 (Charging Billet)	Monitoring of bearing housing temperature, lubrication, gear coupling temperature, rollers, noise, and vibration.	Daily
	Tightening of bolts and lubricating of bearing housing.	Daily
	Replacement of rollers. (Based also on the condition of roller.)	2 Years
	Replacement of bearing. (Based also on the condition of bearing.)	2 Years
	Dismantle of gearbox assembly. Inspection of bearing, gears and shaft condition. Replacement of driveshaft bearings and oil seals. (Note: Depends on the years of service, for less than 5 years, no need to dismantle based on monitoring.)	2 Years
Roller Table 2 (Charging Billet Tilter), Roller Table 3 (Charging Pusher)	Monitoring of bearing housing temperature, lubrication, gear coupling temperature, rollers, noise, and vibration.	Daily
	Inspection of hydraulic cylinder, solenoid valve, hose, and tube/pipe.	Weekly
	Tightening of bolts and lubricating of bearing housing.	Daily
	Replacement of hydraulic cylinder, and solenoid valve. (Based also on the condition of hydraulic cylinder.)	2 Years
	Replacement of rollers. (Based also on the condition of roller.)	2 Years

	Replacement of bearing. (Based also on the condition of bearing.)	2 Years
	Dismantle of gearbox assembly. Inspection of bearing, gears and shaft condition. Replacement of driveshaft bearings and oil seals. (Note: Depends on the years of service, for less than 5 years, no need to dismantle. Base on monitoring.)	2 Years
Disappearing Stopper	Monitoring of hydraulic cylinder, solenoid valve, and hose.	Daily
	Tightening of bolts and lubricating of pin/bushing.	Daily
	Replacement of hydraulic cylinder, and solenoid valve.	Yearly
Charging Pusher	Monitoring of hydraulic cylinder, guide rod, solenoid valve, and hose.	Daily
	Tightening of bolts and lubricating of guide roller, and pin/bushing.	Daily
	Replacement of hydraulic cylinder, and solenoid valve. (Based also on the condition of hydraulic cylinder.)	2 Years
Main Fuel Pump, Zone Pump	Monitoring of pump temperature, noise, and vibration.	Daily
	Tightening of bolts.	Daily
	Replacement of pump. (Based also on the condition of pump.)	2 Years
Combustion Air Fan, Waste Gas Dilution Fan	Monitoring of bearing housing temperature, lubrication, noise, and vibration.	Daily
	Inspection of belt and pulley.	Weekly
	Tightening of bolts and lubricating of bearing and pin/bushing.	Daily
	Replacement of belt.	Yearly
Peel Bar	Monitoring of hydraulic motor, roller, solenoid valve, and hose.	Daily
	Tightening of bolts and lubricating of roller, and pin/bushing.	Daily
	Replacement of roller and bearing. (Based also on the condition of roller and bearing.)	2 Years
	Replacement of hydraulic motor, and solenoid valve. (Based also on the condition of hydraulic cylinder.)	2 Years
Peel Bar Door, Discharging Door	Monitoring of air pressure and lubrication at FRL, pulley, and chain.	Daily
	Inspection of chain, and door.	Weekly
	Tightening of bolts and lubricating of pulley.	Daily
	Replacement of pneumatic cylinder, and solenoid valve.	2 Years
Billet Detector	Monitoring of air pressure and lubrication at FRL, chain, and cooling.	Daily
	Inspection of sprocket, chain, wheel and billet detector rod.	Weekly
	Tightening of bolts and lubricating of roller.	Daily
	Replacement of chain, and sprocket.	2 Years
	Replacement of pneumatic cylinder, and solenoid valve.	2 Years
Pinch Roll 1 (Exit Pinch Roll)	Monitoring of bearing housing temperature, lubrication, gear coupling temperature, roller, cooling, noise, and vibration.	Daily
	Tightening of bolt, lubricating of gear coupling, and bearing housing.	Weekly
	Monitoring of air pressure and lubrication at FRL.	Daily
	Inspection of pneumatic cylinder, solenoid valve, & hose.	Daily
	Replacement of pneumatic cylinder, and solenoid valve.	Yearly
	Replacement of pinch rollers. (Based also on the condition of the roller.)	Yearly
	Dismantle of gearbox assembly. Inspection of bearing, gear, and shaft condition. Replacement of driveshaft bearing and oil seal. (Note: Depends on the years of service, for less than 5 years, no need to dismantle. Base on monitoring.)	2 Years
Roller Table 4 (Exit Roller)	Monitoring of bearing housing temperature, lubrication, gear coupling temperature, rollers, noise, and vibration.	Daily

	Tightening of bolts and lubricating of bearing housing.	Daily
	Replacement of rollers. (Based also on the condition of roller.)	Yearly
	Replacement of bearing. (Based also on the condition of bearing.)	Yearly
	Dismantle of gearbox assembly. Inspection of bearing, gears and shaft condition. Replacement of driveshaft bearings and oil seals. (Note: Depends on the years of service, for less than 5 years, no need to dismantle. Base on monitoring.)	2 Years

Table 1.10: Maintenance for Rolling Mill Section

EQUIPMENT	MAINTENANCE ACTIVITIES	FREQUENCY
Billet Shear	Monitoring of blade.	Daily
	Inspection of hydraulic cylinder, solenoid valve, tube, and hose.	Daily
	Replacement of shear blade. (Note: Depends also on the condition of blade.)	Yearly
Gearbox 0A, 0B, 1 to 14	Monitoring of bearing housing temperature, lubrication pressure and temperature, gear coupling temperature, noise, and vibration.	Daily
	Check and declog gear oil spray nozzles.	Monthly
	Tightening of bolt and lubricating of drive gear coupling.	Weekly
	Dismantle of gearbox assembly. Inspection of bearing, gear and shaft condition. Replacement of driveshaft bearing and oil seal. (Note: Depends on the years of service, for less than 5 years, no need to dismantle. Base on monitoring.)	2 Years
Stand Holder Assembly 0A, 0B, 1 to 14	Monitoring of spindle carrier bearing housing temperature, air/oil lubrication, noise, and vibration.	Daily
	Inspection of gear coupling, spindle, and cross joint.	Daily
	Monitoring of hydraulic oil pressure, temperature, and level.	Daily
	Inspection of hydraulic cylinder, solenoid valve, hose, and tube/pipe.	Weekly
	Replacement of hydraulic cylinder, and solenoid valve.	Yearly
	Lubricating of all spindle carrier bearing.	Daily
	Tightening of bolt, and lubricating of spindle, and cross joint.	Weekly
	Dismantle of spindle carrier assembly. Inspection of bearing, and seal. Replacement of bearing and oil seal. (Note: Depends on the years of service, for less than 5 years, no need to dismantle. Base on monitoring.)	2 Years
Cropping Shear (1 & 2)	Monitoring of blade, bearing housing temperature, lubrication pressure and temperature, gear coupling temperature, noise, and vibration.	Daily
	Check and declog gear oil spray nozzles.	Monthly
	Inspection of brake assembly.	Daily
	Tightening of bolt and lubricating of drive coupling.	Weekly
	Lubricating of pin and bushing at arm and blade assembly.	5 sec / 20 cut
	Lubricating of roller bearing and pin/bushing at channel.	Daily
	Replacement of roller. (Based also on the condition of the roller)	Yearly
	Inspection of cropping shear blade & assembly.	Daily
	Replacement of shear blade. [Note: Depends on the blade life (Tons produce) and also condition of blade. For Shear 1 = 80,000 MT, & for Shear 2 = 50,000 MT]	Blade Life (MT)
	Monitoring of air pressure and lubrication at FRL.	Daily
	Inspection of pneumatic cylinder, solenoid valve, and hose.	Daily

	Replacement of cylinder, and solenoid valve.	Yearly
	Dismantle of gearbox assembly. Inspection of bearing, gears and shaft condition. Replacement of driveshaft bearings and oil seals. (Note: Depends on the years of service, for less than 5 years, no need to dismantle. Base on monitoring.)	2 Years
Looper Expeller 1 to 7 (Horizontal)	Monitoring of air pressure and lubrication at FRL.	Daily
	Inspection of pneumatic cylinder, valve, and hose.	Daily
	Replacement of cylinder, & solenoid valve.	Yearly
Looper Snap Shear 1 to 7 (Horizontal)	Monitoring of blade, air pressure and lubrication at FRL.	Daily
	Inspection of pneumatic cylinder, solenoid valve, and hose.	Daily
	Replacement of cylinder, and solenoid valve.	Yearly
	Inspection of snap shear blade and assembly	Daily
	Replacement of shear blade. (Note: Depends also on the condition of blade.)	Yearly
Pinch Roll 3 - Slitter	Monitoring of bearing housing temperature, lubrication pressure and temperature, gear coupling temperature, noise, and vibration.	Daily
	Check and declog gear oil spray nozzles.	Monthly
	Inspection of gear coupling, spindle, and cross joint.	Daily
	Tightening of bolt, & lubricating of gear coupling, spindle, and cross joint.	Weekly
	Inspection of hydraulic cylinder, solenoid valve, and hose.	Weekly
	Replacement of cylinder, and solenoid valve.	Yearly
	Dismantle of gearbox assembly. Inspection of bearing, gear, and shaft condition. Replacement of driveshaft bearing and oil seal. (Note: Depends on the years of service, for less than 5 years, no need to dismantle. Base on monitoring.)	2 Years

Table 1.11: Maintenance for High Speed Block Section

EQUIPMENT	MAINTENANCE ACTIVITIES	FREQUENCY
Looper 8 (Vertical) - Line A & B	Monitoring of air pressure and lubrication at FRL.	Daily
	Inspection of pneumatic cylinder, valve, and hose.	Daily
	Replacement of cylinder, and solenoid valve.	Yearly
Cropping Shear 3 - Line A & B, Chopping Shear 4 - Line A & B	Monitoring of bearing housing temperature, lubrication pressure temperature, and gear coupling temperature, noise, and vibration.	Daily
	Check and declog gear oil spray nozzles.	Monthly
	Inspection of brake assembly.	Daily
	Tightening of bolt and lubricating of drive coupling.	Weekly
	Lubricating of pin & bushing at arm and blade assembly.	5 sec / 40 cut
	Lubricating of pin/bushing.	Daily
	Inspection of cropping shear blade and assembly.	Daily
	Replacement of shear blade. [Note: Depends on the blade life (Tons wastages at small size run) and condition of blade. Cropping/Chopping shear = 800,000 MT]	Blade Life (MT)
	Monitoring of air pressure and lubrication at FRL.	Daily
	Inspection of pneumatic cylinder, solenoid valve, and hose.	Daily
	Replacement of cylinder, and solenoid valve.	Yearly
	Dismantle of gearbox assembly. Inspection of bearing, gears and shaft condition. Replacement of driveshaft bearings and oil seals. (Note: Depends on the years of service, for less than 5 years, no need to dismantle. Base on monitoring.)	2 Years

Snap Shear 8 - Line A & B	Monitoring of air pressure and lubrication at FRL.	Daily
	Inspection of pneumatic cylinder, solenoid valve, and hose.	Daily
	Replacement of cylinder, and solenoid valve.	Yearly
	Inspection of snap shear blade and assembly	Daily
	Replacement of shear blade. (Note: Depends also in the condition of blade.)	Yearly
MonoBlock Stand 1 to 6 (14 to 20) Line A & B	Monitoring of bearing temperature, lubrication pressure and temperature, gear coupling temperature, noise, vibration, and air/oil lubrication.	Daily
	Check and declog gear oil spray nozzles.	Monthly
	Tightening of bolt and lubricating of drive gear coupling.	Weekly
	Replacement of cylinder, and solenoid valve.	Yearly
	Dismantle of stand assembly. Inspection of bearing, gear and shaft condition. Replacement of driveshaft (mandrel), V seal, bushing (cleveite), and bearing if necessary. (Note: Base also on monitoring.)	Yearly
MonoBlock Gearbox Main, & 1 to 6 (14 to 20) Line A & B	Monitoring of bearing temperature, lubrication pressure and temperature, noise, and vibration.	Daily
	Inspection of air supply, hydraulic supply, safety pin, and spindle.	Weekly
	Tightening of bolt and lubricating of pin/bushing.	Weekly
	Inspection of hydraulic cylinder, solenoid valve, and hose	Weekly
	Replacement of cylinder, and solenoid valve.	Yearly
	Replacement of safety pin. [Note: Depends on the Pin life (Tons produce) and condition of pin. 80,000 MT]	Pin Life (MT)
	Dismantle of spindle carrier assembly. Inspection of bearing, and seal. Replacement of bearing and oil seal. (Note: Depends on the years of service, for less than 5 years, no need to dismantle. Base on monitoring.)	2 Years
QTB (Quenched and Tempered Bar) - Line A, B, & C	Monitoring of water pressure, and opening of valves.	Daily
	Monitoring of entry/exit funnels, coolers, strippers/dryers, and by-pass pipes.	Weekly
	Check and declog water spray nozzles.	Daily
	Inspection and cleaning of entry/exit funnels, coolers, strippers/dryers, and by-pass pipes.	Daily
	Replacement of entry/exit funnels, coolers, strippers/dryers, and by-pass pipes. (Based also on the condition of the entry/exit funnels, coolers, strippers/dryers, and by-pass pipes.)	3 Years
	Inspection of hydraulic cylinder, solenoid valve, and hose.	Weekly
	Replacement of cylinder, and solenoid valve.	Yearly
Dividing Shear 5 - Line A & B, Dividing Shear 6 - Line C	Monitoring of bearing housing temperature, lubrication pressure and temperature, gear coupling temperature, noise, & vibration.	Daily
	Check and declog gear oil spray nozzles.	Monthly
	Inspection of brake assembly.	Daily
	Tightening of bolt and lubricating of drive coupling.	Weekly
	Lubricating of pin and bushing at arm and blade assembly.	5 sec / 40 cut
	Replacement of shear blade. [Note: Depends on the blade life (Tons produce) and condition of blade. Dividing shear = 30,000 MT]	Blade Life (MT)
	Dismantle of gearbox assembly. Inspection of bearing, gears and shaft condition. Replacement of driveshaft bearings and oil seals. (Note: Depends on the years of service, for less than 5 years, no need to dismantle. Base on monitoring.)	2 Years
Pinch Roll (4, 5, & 6) - Line A & B, 7 - Line C	Monitoring of bearing housing temperature, lubrication pressure and temperature, gear coupling temperature.	Daily
	Inspection of gear coupling, spindle, and cross joint.	Daily

	Tightening of bolt, lubricating of gear coupling, spindle, and cross joint.	Weekly
	Lubricating of pin, and bushing.	Daily
	Monitoring of air pressure and lubrication at FRL.	Daily
	Inspection of pneumatic cylinder, solenoid valve, & hose.	Daily
	Replacement of cylinder, and solenoid valve.	Yearly
	Replacement of pinch rollers. (Based also on the condition of the roller.)	Quarterly
	Replacement of pinch roll shaft. (Based also on the condition/eccentricity of shaft)	2 Years
	Dismantle of gearbox assembly. Inspection of bearing, gear, and shaft condition. Replacement of driveshaft bearing and oil seal. (Note: Depends on the years of service, for less than 5 years, no need to dismantle. Base on monitoring.)	2 Years
Diverter - Line A & B	Monitoring of air pressure and lubrication at FRL.	Daily
	Inspection of pneumatic cylinder, solenoid valve, and hose.	Daily
	Tightening of bolts and lubricating of pin/bushing.	Daily
	Replacement of cylinder, and solenoid valve.	Yearly

Table 1.12: For Auxiliary Section

EQUIPMENT	MAINTENANCE ACTIVITIES	FREQUENCY
Roller Table (5 - Exit QTB, & 6 - Exit Dividing Shear) - Line C	Monitoring and Inspection of rollers.	Daily
	Tightening of bolts.	Daily
	Replacement of rollers. (Based also on the condition of roller.)	Monthly
Roller Table 7 (Run in / Sliding Apron) - Line C	Monitoring of pin housing, pin; air pressure and lubrication at FRL and accumulator tank.	Daily
	Inspection of rollers, pins, pneumatic cylinder, regulator, and hose.	Daily
	Tightening of bolts and lubricating of pin/bushing.	Daily
	Replacement of rollers. (Based also on the condition of roller.)	Monthly
	Replacement of hydraulic cylinder, and regulator.	Yearly
	Replacement of pin & bearing.	2 Years
Breaking Pinch Roll (1A, 2A, 1B, 2B)	Monitoring of bearing housing temperature, lubrication pressure and temperature, gear coupling temperature.	Daily
	Check and declog gear oil spray nozzles.	Monthly
	Inspection of gear coupling, spindle, and cross joint.	Daily
	Tightening of bolt, and lubricating of gear coupling, spindle, and cross joint.	Weekly
	Inspection of pneumatic cylinder, solenoid valve, FRL, and hose.	Weekly
	Replacement of pneumatic cylinder, solenoid valve, and FRL	Yearly
	Inspection of hydraulic cylinder, solenoid valve, hose, and tube/pipe.	Weekly
	Replacement of hydraulic cylinder, and solenoid valve.	Yearly
	Replacement of pinch roller. (Based also on the condition of roller.)	2 Days
	Replacement of pinch roll shaft. (Based also on the condition/eccentricity of shaft)	2 Years
	Dismantle of gearbox assembly. Inspection of bearing, gear, & shaft condition. Replacement of driveshaft bearing and oil seal. (Note: Depends on the years of service, for less than 5 years, no need to dismantle. Base on monitoring.)	2 Years
High Speed	Monitoring of bearing housing temperature, lubrication, gear coupling temperature, cooling pressure and temperature,	Daily

Rotating Braking System (1A, 2A, 1B, 2B)	alignment, and torque.	
	Lubricating of all bearing.	Daily
	Tightening of bolt, and lubricating of gear coupling.	Weekly
	Replacement of hose inside the twin channel.	Yearly
	Replacement of bearing inside the twin channel.	3 Years
	Inspection of hydraulic cylinder, solenoid valve, hose, and tube/pipe.	Weekly
	Replacement of hydraulic cylinder, and solenoid valve.	Yearly
	Dismantle of gearbox assembly. Inspection of bearing, & seal. Replacement of bearing & oil seal. (Note: Depends on the years of service, for less than 5 years, no need to dismantle. Base on monitoring.)	2 Years
Rake Section (Fixed & Moving)	Monitoring of bearing housing temperature, lubrication, gear coupling temperature, noise, and vibration.	Daily
	Inspection of brake and rollers assembly.	Daily
	Tightening and lubricating of drive coupling and spindle.	Weekly
	Inspection and tightening of rake.	Daily
	Dismantle of gearbox assembly. Inspection of bearing, gears and shaft condition. Replacement of driveshaft bearings and oil seals. (Note: Depends on the years of service, for less than 5 years, no need to dismantle. Base on monitoring.)	2 Years
Roller Table 8 (Aligning Rollers)	Monitoring of rollers, pillow blocks, chains, and sprockets.	Daily
	Tightening of bolts and lubricating of pillow blocks.	Daily
	Replacement of rollers. (Based also on the condition of roller.)	2 Years
	Replacement of pillow blocks, chain, and sprockets	2 Years
Chain Transfer System, Feeding Chain Conveyor, Storage Chain Conveyor	Monitoring of bearing housing temperature, lubrication, gear coupling temperature, chain, sprocket, noise, and vibration.	Daily
	Tightening and lubricating of drive coupling, sprocket, and shaft.	Weekly
	Tensioning and lubricating of chain.	Daily
	Lubricating of plumber block.	Daily
	Replacement of sprocket and chain. (Based also on the condition of sprocket and chain.)	2 Years
	Replacement of bearing. (Based also on the condition of bearing.)	2 Years
	Dismantle of gearbox assembly. Inspection of bearing, gears and shaft condition. Replacement of driveshaft bearings and oil seals. (Note: Depends on the years of service, for less than 5 years, no need to dismantle. Base on monitoring.)	2 Years
Trolley Transfer System, Dual Section Trolley Transfer System	Monitoring of bearing housing temperature, lubrication, gear coupling temperature, chain, sprocket, noise, and vibration.	Daily
	Inspection of hydraulic cylinder, solenoid valve, hose, and tube/pipe.	Weekly
	Tightening and lubricating of drive coupling, sprocket, and shaft.	Weekly
	Tensioning and lubricating of chain.	Daily
	Lubricating of plumber block and pillow block.	Daily
	Replacement of sprocket and chain. (Based also on the condition of sprocket and chain.)	2 Years
	Replacement of bearing. (Based also on the condition of bearing.)	2 Years
	Replacement of hydraulic cylinder, and solenoid valve.	Yearly
	Dismantle of gearbox assembly. Inspection of bearing, gears and shaft condition. Replacement of driveshaft bearings and oil seals. (Note: Depends on the years of service, for less than 5 years, no	2 Years

	need to dismantle. Base on monitoring.)	
Roller Table 9 (Run out), Roller Table 10 (Exit Shear), Roller Table 11 (Aligning), Roller Table 13 (Tied Bundle Run-out), Roller Table 12 (Loose Bundle Run-out)	Monitoring of bearing housing temperature, lubrication, gear coupling temperature, rollers, noise, and vibration.	Daily
	Lubricating of plumber block.	Daily
	Replacement of rollers. (Based also on the condition of roller.)	2 Years
	Replacement of bearing. (Based also on the condition of bearing.)	2 Years
	Dismantle of gearbox assembly. Inspection of bearing, gears and shaft condition. Replacement of driveshaft bearings and oil seals. (Note: Depends on the years of service, for less than 5 years, no need to dismantle. Base on monitoring.)	2 Years
Cold Shear	Monitoring of bearing housing temperature, lubrication pressure and temperature, gear coupling temperature, noise, and vibration.	Daily
	Check and declog gear oil spray nozzles.	Monthly
	Tightening of bolt and lubricating of drive gear coupling.	Weekly
	Inspection of brake assembly.	Daily
	Lubricating of bearing, pin and bushing.	3 sec / 60 cut
	Replacement of roller. (Based also on the condition of roller)	Yearly
	Inspection of shear blade & assembly.	Daily
	Replacement of shear blade. [Note: Depends on the blade life (Tons produce) and also condition of blade. Shear = 300,000 MT]	Blade Life (MT)
	Monitoring of air pressure and lubrication at FRL.	Daily
	Inspection of pneumatic cylinder, solenoid valve, and hose.	Weekly
	Replacement of pneumatic cylinder, and solenoid valve.	2 Years
	Monitoring of hydraulic oil pressure, temperature, and level.	Daily
	Inspection of hydraulic cylinder, solenoid valve, hose, and tube/pipe.	Weekly
	Replacement of hydraulic cylinder, and solenoid valve.	2 Years
	Dismantle of gearbox assembly. Inspection of bearing, gear and shaft condition. Replacement of driveshaft bearing and oil seal. (Note: Depends on the years of service, for less than 5 years, no need to dismantle. Base on monitoring.)	2 Years
Gauge Stopper, Disappearing Stopper (Intermediate / End), Movable Wall	Monitoring of air pressure and lubrication at FRL.	Daily
	Inspection of pneumatic cylinder, solenoid valve, and hose.	Daily
	Tightening of bolts and lubricating of pin/bushing.	Daily
	Replacement of pneumatic cylinder, and solenoid valve.	Yearly
Buffer Chain Conveyor, Unloading Chain Conveyor	Monitoring of bearing housing temperature, lubrication, gear coupling temperature, chain, sprocket, noise, and vibration.	Daily
	Tightening and lubricating of drive coupling, sprocket, and shaft.	Weekly
	Tensioning and lubricating of chain.	Daily
	Lubricating of plumber block.	Daily
	Inspection of hydraulic cylinder, solenoid valve, hose, and tube/pipe.	Weekly
	Replacement of hydraulic cylinder, and solenoid valve.	Yearly
	Replacement of sprocket and chain. (Based also on the condition of sprocket and chain.)	2 Years
	Replacement of bearing. (Based also on the condition of bearing.)	2 Years
	Dismantle of gearbox assembly. Inspection of bearing, gears and shaft condition. Replacement of driveshaft bearings and oil seals. (Note: Depends on the years of service, for less than 5 years, no	2 Years

	need to dismantle. Base on monitoring.)	
Bar Counting System	Tightening and lubrication of coupling, plumber block, and pillow block.	Weekly
	Inspection of hydraulic cylinder, solenoid valve, hose, and tube/pipe.	Weekly
	Replacement of bearing. (Based also on the condition of bearing.)	2 Years
	Replacement of hydraulic cylinder, and solenoid valve.	Yearly
Collecting Cradles	Tightening and lubrication of coupling, plumber block, and pillow block.	Weekly
	Inspection of hydraulic cylinder, solenoid valve, hose, and tube/pipe.	Weekly
	Replacement of bearing. (Based also on the condition of bearing.)	2 Years
	Replacement of hydraulic cylinder, and solenoid valve.	Yearly
Bundle Transfer Car	Monitoring of bearing housing temperature, lubrication, gear coupling temperature, chain, sprocket, noise, and vibration.	Daily
	Tightening and lubricating of drive coupling, sprocket, and shaft.	Weekly
	Tensioning and lubricating of chain.	Daily
	Lubricating of plumber block and pillow block.	Daily
	Monitoring of air pressure and lubrication at FRL.	Daily
	Inspection of pneumatic cylinder, solenoid valve, & hose.	Daily
	Replacement of pneumatic cylinder, and solenoid valve.	Yearly
	Replacement of sprocket and chain. (Based also on the condition of sprocket and chain.)	2 Years
	Replacement of bearing. (Based also on the condition of bearing.)	2 Years
	Dismantle of gearbox assembly. Inspection of bearing, gears and shaft condition. Replacement of driveshaft bearings and oil seals. (Note: Depends on the years of service, for less than 5 years, no need to dismantle. Base on monitoring.)	2 Years
Tying Machine	Monitoring of hydraulic oil pressure, temperature, and level.	Daily
	Cleaning and lubricating of bearing, pin and bushing.	8 Hours
	Replacement of roller. (Based also on the condition of roller)	2 Years
	Replacement of bearing. (Based also on the condition of bearing)	Yearly
	Inspection of shear blade & assembly.	Daily
	Replacement of shear blade. [Note: Depends on the blade life (Tons produce) and also condition of blade. Shear = 300,000 MT]	Blade Life (MT)
	Inspection of hydraulic cylinder, hydraulic motor, solenoid valve, hose, and tube/pipe.	Weekly
	Replacement of hydraulic filter.	Quarterly
	Replacement of hydraulic cylinder, hydraulic motor, and solenoid valve.	2 Years

Table 1.13: Maintenance for Utilities Section

EQUIPMENT	MAINTENANCE ACTIVITIES	FREQUENCY
Air Compressor & Dryer	See NC-MMRM-REF-007	
Crane	See NC-MMRM-REF-008	
Water Treatment Plant (WTP)	See NC-MMRM-REF-009	
Lubrication Unit (UL1 - Roughing	Monitoring of oil (pressure, temperature, level, and color), cooling temperature, filter, pump temperature, noise, and vibration.	Daily

Mill, UL2 - Intermediate Mill, UL3 - MonoBlock Line A, UL4 - MonoBlock Line B, UL5 - Shear - Pinch Roll, UL6 - Cold Shear - BPR, UL7 - Finishing Mill, UL8 - Air-Oil)	Inspection of pump, filter, hose, and pipe/tube.	Weekly
	Replacement of filter.	2 months
	Replacement of pump, and valves. (Based also on the condition of pump and valve.)	3 Years
	Change oil. (Based also on the monitoring.)	3 Years
Hydraulic Unit (UH1 - Charging Furnace, UH2 - Exit Furnace, UH3 - Mill Stand, UH4 - MonoBlock-QTB, UH5 - Cooling Bed Area, UH6 - Assembly Bed - Evacuation Area, UH7 - Bundling Machine, UH8 - Bucket Crane, UH9 - Roll Assembly)	Monitoring of oil (pressure, temperature, level, and color), cooling temperature, filter, pump temperature, noise, and vibration.	Daily
	Inspection of pump, filter, hose, and pipe/tube.	Weekly
	Replacement of filter.	2 months
	Replacement of pump, and valves. (Based also on the condition of pump and valve.)	3 Years
	Change oil. (Based also on the monitoring.)	3 Years
Hydraulic Valve Stand	Cleaning and servicing (leak removal).	Weekly
Cylinder, Solenoid Valve, Flow Control, FRL	Replacement (Recondition - cleaning and replacement of seal)	Yearly
Air Tank Receiver	Inspection and cleaning of tank and valves.	Yearly

Table 1.14: Maintenance for Compressor/Dryer

EQUIPMENT	MAINTENANCE ACTIVITIES	FREQUENCY
KAESER Compressor 1 - 4 (FSD 571 SFC, ESD 442)	Change Oil.	6,000 running hours
	Replacement of oil filter.	
	Replacement of oil separator.	
	Replacement of air filter.	3,000 running hours
	Inspection of belt/coupling.	
	Inspection of valve.	12,000 running hours
KAESER Compressor 1 - 3 (ESD 442)	Lubrication of bearing.	2,000 running hours
KAESER Compressor 4 (FSD 571 SFC)	Lubrication of bearing.	1,500 running hours
KAESER Compressor 1 - 3 (ESD 442)	Lubrication of motor bearing.	32,000 running hours
	Lubrication of fan bearing.	
KAESER Compressor 4 (FSD 571 SFC)	Lubrication of motor bearing.	36,000 running hours
	Lubrication of fan bearing.	

KAESER Compressor 1 - 4 (FSD 571 SFC, ESD 442)	Inspection of electrical equipment.	9,000 running hours
KAESER Dryer 1 - 4 (TI 901 FE)	Replacement of oil filter.	6,000 running hours
Eco Drain (31, 14, 16)	Cleaning and replacement of wearing parts (seal)	Yearly
KAESER Compressor and Dryer	Cleaning of Compressor and Dryer	Daily

Table 1.15: Maintenance for Overhead Crane and Semi-Gantry Crane

EQUIPMENT	MAINTENANCE ACTIVITIES	FREQUENCY
Wire Rope	Checking by sight for any deformation, wear kinks and element disconnection. Measurement of wire rope diameter. Greasing.	Monthly
Rope Drum	Checking by sight for any deformation, wear, crack and looseness. Measurement of groove.	Monthly
Wheel and bearing	Checking of any deformation, abnormal noise. Measurement of wheel dimension (diameter, width, lip thickness).	Monthly
	Greasing of bearing.	Weekly
Frame	Check for cracks on the running saddle and girder. Inspection of hook using crack detection dye. Tightening of bolt.	Monthly
Bottom block and pulley	Greasing of bearing. Inspection of pulley groove.	Monthly
Crane Hoist	Overhauling. Pull out the hoist and inspect all parts. Replace all wheel, hoist and gearbox bearings.	2 Years

Table 1.16: Maintenance for Water Treatment Plant (WTP)

EQUIPMENT	MAINTENANCE ACTIVITIES	FREQUENCY
Submersible Pumps (KRTK 151-401/506WGH-S. KRTK 100-401/354WGH-S.KRTK 80-251/122UG-S)	Monitor Temperature	Daily
	Visually inspect the lifting chain/rope	Every 4,000 operating hours
	Change the lubricant	Every 10,000 operating hours
	Check the mechanical seal leakage	Every 10,000 operating hours
	Lubricate the bearings	Every 10,000 operating hours
	General Over Haul	Every 5 years
Pumps (Etanorm G 125-200 G10/ Etanorm G 125-315 G10 / Etanorm G 400-315 G10/ Etanorm G 400-315 G10/Etanorm G 080-200 G10	Monitor Temperature	Daily
	Monitor Pressure	Daily
	Inspection for unusual noise, vibration and bearing temperatures. Inspect seal chamber, stuffing box and pipings for leaks	Daily
	Initial Change Oil	After 300 Operating Hours
	Change Oil	Every 3000 Operating Hours
	Check Lubrication for Bearings	Every 12000 Operating Hours
	Check Coupling	Every 6000 Hours
Pumps (CPKN-S2 100-315)	Monitor Temperature	Daily
	Monitor Pressure	Daily

	Inspection for unusual noise, vibration and bearing temperatures. Inspect seal chamber, stuffing box and pipings for leaks	Daily
	Initial Change Oil	After 300 Operating Hours
	Change Oil	Every 3000 Operating Hours
	Check Lubrication for Bearings	Every 12000 Operating Hours
	Check Coupling	Every 6000 Hours
Pumps (A-175N-30/ B-11 *A-175-30/B-11)	Monitor Temperature	Daily
	Monitor Pressure	Daily
	Change Oil	Every 3000 Operating Hours
	Check Lubrication for Bearings	Every 12000 Operating Hours
	Check Coupling	Every 6000 Hours
Hoist (Omis)	General inspection	Daily
	Operating checks	Daily
	Inspection of ropes and hooks	Daily
	Greasing	Every 3 Months
	Check the condition of the main power line	Every Year
	Check pulleys for wear	Every Year
	Change Gear Oil	Every 4 Years
Bucket for Scale Removal (KBL-311-32 i)	Replacement oil filter cartridge	Every 400 operating hours
	Replacing the hydraulic oil and clean the tank	Every 3000 operating hours
	Pins with lubrication pump in possession of such a connection point	Every 65 operating hours
	Filling the tank automatic centralized lubrication.	Every 600 operating hours
	Manual greasing motor bearings	Every 3000 operating hours
Tower (TAG-RN83-S)	Monitor Temperature	Daily
	Monitor Pressure	Daily
	Lubrication	Every 3000 operating hours
	Check the tightening of the bolts.	Every 6 Months
	Check the blades to ensure their structural	Every 6 Months
	Cleaning of blades	Every 6 Months
Indirect Cooling Tower (TAG-NB13)	Monitor Temperature	Daily
	Monitor Pressure	Daily
	Lubrication	Every 3000 operating hours
	Check the tightening of the bolts.	Every 6 Months
	Check the blades to ensure their structural	Every 6 Months
	Cleaning of blades	Every 6 Months
Sand Filter (EC 65 /	Sedimentation	Every 72 operating

2P-RUP80)		hours
	Air Removal	Every 72 operating hours
	Drain	Every 72 operating hours
	Air Backwash	Every 72 operating hours
	Air and Water Backwash	Every 72 operating hours
	Filling	Every 72 operating hours
Oil Skimmer for Scale Pit and Decanter	Cleaning of Skimmer	Every Week
	Lubrication	Every 6 Months

During these maintenance activities for equipment/machine, there will be insignificant increase in waste generation because of contaminated rugs with used oil and lubricants and wastewater contaminated with oil that may be generated. Since these are hazardous wastes, these wastes will be disposed to DENR-accredited third party treaters. There will there be slight increase in water consumption because water will be used during maintenance activities.

1.6 Project Size

1,200,000 MTPY rebar and wire rod mill and 1,200,000 MTPY new generation scrap recycling plant to be situated within the 80 hectares (more or less) property of SteelAsia Manufacturing Corporation.

1.7 Development Plan, Description of Project Phases and Corresponding Timeframes

Provided in Figure 1.4.1 is the Site Development Plan.

Pre-Construction

Prior to the implementation of the project, conduct of significant studies will be done. These include preliminary design, detailed engineering study, impact study to include geohazard identification and environmental impact assessment, securing of necessary permits and clearances such as Environmental Compliance Certificate, Permit to Operate, Building Permits etc.

All the necessary information, plans and designs will be gathered and prepared relative to the requirements and in compliance with the existing laws and regulations applicable to the project. Jurisdiction over the project site, clearances, permits and all other administrative requirements of concerned agencies will also be completed.

Construction

Development phase is comprised mostly of civil works construction. It is estimated that the construction of all the necessary structures will be finished in approximately one and a half year. The major activities are as follows:

- land/site clearing
- land development
- provision of services for the workforce such as temporary housing and toilet facilities
- transport of materials
- mobilization of personnel and equipment
- finishing
- equipment installation

An established guideline for contractors is set by SAMC. During construction, all contractors are required to have their safety officer on site. The DOLE standard for construction (DO 13-98) should also be complied with by all of the contractors.

Operation
This phase involves the processing of desired product. Detailed process is shown in the illustrations in Figures 1.5.2, 1.5.2A and 1.5.3. Target start of the operation will be in 2020 provided all the necessary permits will be secured.

The proposed facility will produce PNS 49 and 211 concrete reinforcing steel bars at an annual capacity of 1,200,000 MTPY rebar and wire rod mill and 1,200,000 MTPY billets from new generation scrap recycling plant.

In this phase, full production of scrap recycling will be undertaken. The finished product shall then be sorted, bundled and stocked prior to delivery.

Abandonment
Considering that the project has a lifespan of at least 40 years, continuous maintenance, enhancement and upgrading will be done to ensure high production efficiency, environmentally compliant and safe facility. Structures and plant equipment will be assessed regularly for the project to continue its operation beyond its lifespan.

However, in case the Plant will cease operations, demolition and decommissioning will be conducted by the Proponent with the contractors which will include all activities and costs for transport of all equipment, materials, disassembly and demolition of facilities (office, stock room, quarters, etc.), removal and disposal of all construction debris and general clean up of construction site. SAMC will also require its contractor to post performance bond together with the 10% retention to take care of any deficiency left behind after demolition and decommissioning.

The formulation of the detailed decommissioning plan will be done by the proponent within the specified timeframe as part of the ECC conditions. It will be submitted for approval to EMB in coordination with the LGU and government agencies concerned on the activities such as Environmental Site Assessment to determine contaminants left by the operation, method and equipment to be used for dismantling of structures, clean-up plan and demobilization scheme before proceeding.

1.8 Manpower
Provided below is the manpower requirement during construction and operations phases of the project.

Pre-Construction/ Construction
Pre-construction manpower will be dedicated to the miscellaneous activities associated with project development, planning and the securing of various governmental permits. Construction requirements for manpower will largely depend on the schedule of workers that will be put up by the Contractor(s) which at this time is identified to be at least 1,000 workers where 3 are directly hired by SAMC while 997 will be employed by the Contractor.. Depending on the construction tasks/jobs that will be undertaken at a given time, the peak manpower complement could reach up to 1,500 personnel.

Operation
A total of 1000 personnel will be hired to fill in the regular job positions for the plant operation. Provided below is the tabulation of manpower requirement which do not discriminate against sex and age as long as the worker is qualified and fit to work. Also, preference will be given to the host barangay and municipality which will be directly hired by SAMC in coordination with the Public Employment Service Office (PESO) of Concepcion.

Table 1.8.1: Manpower Requirements

Manpower requirement during Construction				
Labor Type		**Skill / Designation**	**Employee Type**	**No. of Personnel**
Construction Stage	Safety	Safety Officer / Engineer	Plantilla Position	3
	Project Management	Project Manager / Engineer	Plantilla Position	1
	Civil / Structural Foreman	Civil Engineer	Outsourced	15
	Scaffolder	Certified Scaffolder	Outsourced	75

	Scaffolders Helper	Trained / Experienced Scaffolder	Outsourced	90
	Steel man / Fabricator	Engineering Undergrad / Experienced Fabricator	Outsourced	141
	Steel man / Fabricator Helper	Experience Fabricator	Outsourced	95
	Carpenter	High School Graduate / Experienced Carpenter	Outsourced	50
	Mason	High School Graduate / Experienced Mason	Outsourced	165
	Crane Operator	Certified Crane Operator	Outsourced	15
	Rigger	Certified Crane Rigger	Outsourced	35
	Mechanical Foreman	Mechanical Engineer	Outsourced	20
	Mechanical Fitter	Engineering Undergrad / Experience Mechanical Fitter	Outsourced	35
	Welder	Certified Welder	Outsourced	65
	Mechanical Helper	High School Graduate / Experience Mechanical Fitter	Outsourced	120
	Electrical Foreman	Electrical Engineer	Outsourced	25
	Master Electrician	Certified Master Electrician	Outsourced	15
	Electrical Helper	Undergrad Electrical Technician	Outsourced	35
Total Manpower				**1000**
	Labor Type	**Skill / Designation**	**Employee Type**	**No. of Personnel**
Operations Stage	**Section : Human Resources**			
	Staff 1	Degree in BS/BA Psychology or any related course	Plantilla Position	50
	Supervisor	Degree in BS/BA Psychology or any related course	Plantilla Position	
	Section : Plant Administration			
	Assistant Supervisor	Degree in BS/BA Psychology or any related course	Plantilla Position	275
	Driver 1	Must have a five (5) years experience in driving; with Professional Driver's License	Plantilla Position	
	Health & Safety Officer	College Level	Plantilla Position	
	Building & Grounds Maintenance			
	Building & Facility Engineer	BS Engineering or a BS Engineering or at least Technical course graduate t least Technical course graduate	Plantilla Position	275
	Building & Grounds Maintenance Personnel	BS Engineering or at least Technical course graduate	Plantilla Position	
	Department : Plant Accounting			
	Staff	With a Degree in Bachelor of Science in Accountancy	Plantilla Position	10
	Department : Materials, Planning and Control			
	Staff	With a Degree in Bachelor of Science in Accountancy	Plantilla Position	150
	Store Keeper	With a Degree in Bachelor of Science in Accountancy	Plantilla Position	
	Department : Information Technology			
	Systems Technician	Degree in BS Information Technology or any related course	Plantilla Position	40
	Department : Mechanical Maintenance		Plantilla Position	

	Assistant Supervisor	BS Electrical / Electronic Engineering or BS Mechanical Engineering	Plantilla Position	
	AutoCAD Operator	BS Electrical / Electronic Engineering or BS Mechanical Engineering	Plantilla Position	
	Maintenance Project Specialist	BS Electrical / Electronic Engineering or BS Mechanical Engineering	Plantilla Position	
	Mechanic	At least vocational course on Mechanical Technology	Plantilla Position	
	Senior Supervisor	BS Electrical / Electronic Engineering or BS Mechanical Engineering	Plantilla Position	
	Technician	2-year vocational course on Industrial Electronics or Industrial Electricity	Plantilla Position	
	Department : Electrical Maintenance			
	Assistant Supervisor	BSME Graduate or Any Related Technical Course.	Plantilla Position	200
	Manager	BSME Graduate or Any Related Technical Course.	Plantilla Position	
	Planner	BSME Graduate or Any Related Technical Course.	Plantilla Position	
Total Manpower				**1000**
Abandonment Stage	**During decommissioning, work will be outsourced to contractors supervised by the PCO, the Resident Manager and Plant Manager of SAMC.**			

1.9 Indicative Project Investment Cost

The indicative project investment cost is PhP 12,000,000,000.00.

CHAPTER II: ASSESSMENT OF ENVIRONMENTAL IMPACTS

2.1 LAND

2.1.1 Land Use and Classification

Impact on compatibility with existing land use

The project site is consistent with the land use classification of the municipality which is industrial as per LGU of Concepcion Ordinance No. 003-18 approved on March 14, 2018 (Annex C). However, the land use map of Concepcion (Figure 2.1.1.5) is yet to be revised to conform to this reclassification because based on the existing Land Use Map of the Municipality of Concepcion, the area still lies in an agricultural area.

Provided in Figure 2.1.1.3: Land Classification Map of Concepcion which shows that the project site falls under the classification as alienable and disposable (A&D) while *Figure 2.1.1.4 shows the Land Cover Map showing that the project site is with an area for annual crops.*

Impact on compatibility with classification as an Environmentally Critical Area (ECA)

As provided under DAO 2003-30, provided below is the Summary List of Environmentally Critical Project (ECP) Types and Environmentally Critical Area (ECA) Categories.

Table 2.1.1: Summary List of Environmentally Critical Project (ECP) Types and Environmentally Critical Area (ECA) Categories

	List of ECPs
As declared by Proclamation No. 2146 (1981)	
1.	***Heavy Industries- Non-ferrous Metal Industries, Iron and Steel Mills, Petroleum and Petro-chemical Industries including Oil and Gas, Smelting Plants***
2.	Resource Extractive Industries- Major Mining and Quarrying Projects, Forestry Projects (logging, major wood processing projects, introduction of fauna (exotic animals) in public and private forests, forests occupancy, extraction of mangrove products, grazing), Fishery Projects (dikes for/ and fishpond development projects)
3.	Infrastructure Projects- Major Damns, Major Power Plants (fossil-fueled, nuclear fuelled, hydroelectric or geothermal), Major Reclamation Projects, Major Roads and Bridges
As declared Proclamation No. 803 (1996)	
4.	All golf course projects
A. List of ECA Categories – As declared by Proclamation No. 2146 (1981)	
1.	All areas declared by law as national parks, watershed reserves, wildlife preserves, sanctuaries
2.	Areas set asides as aesthetic potential tourist spots
3.	Areas which constitute the habitat of any endangered or threatened species of Philippines wildlife (flora and fauna)
4.	Areas of unique historic, archaeological, or scientific interests
5.	Areas which are traditionally occupied by cultural communities or tribes
6.	Areas frequently visited and/or hard-hit by natural calamities (geologic hazards , floods, typhoons, volcanic activity, etc.)
7.	Areas with critical slopes
8.	Areas classified as prime agriculture lands
9.	Recharged areas of aquifers
10.	Water bodies characterized by one or any combination of the following conditions: tapped for domestic purposes; within the controlled and/or protected areas declared by appropriate authorities; which support wildlife and fishery activities
11.	Mangrove areas characterized by one or any combination of the following conditions: with primary pristine and dense young growth, adjoining mouth of major river systems: near or adjacent to traditional productive fry or fishing grounds; areas which act as natural buffers against shore erosion, strong wind and storm floods; areas on which people are dependent for their livelihood.
12.	Coral reefs characterized by one or any combination of the following conditions: With 50% and above live coral cover; Spawning and nursery grounds for fish; act as natural breakwater of coastlines.

ECA Determination: Any one (1) confirmed ECA among the 12 categories renders a project location on ECA. However, before a project location is considered in a Non-ECA (NECA), all of the relevant ECA categories (e.g. ECA category of "coral reefs" and "mangrove areas" are not relevant for a project proposed to be located up in the mountains) have to be confirmed by Proponent through the mandated agencies.

The Project is an ECP based on the nature of the Project and its annual production capacity. There is no ECA within the Project site but a part of the nearest ECA of the Pampanga River Basin which is Sacobia-Bamban River is approximately less than 100 meters away from the project boundary. It is located just beside the project site. This renders the Project an ECP in an ECA.

Provided below is a drone shot of the project area showing the location of the project site and the Sacobia-Bamban River.

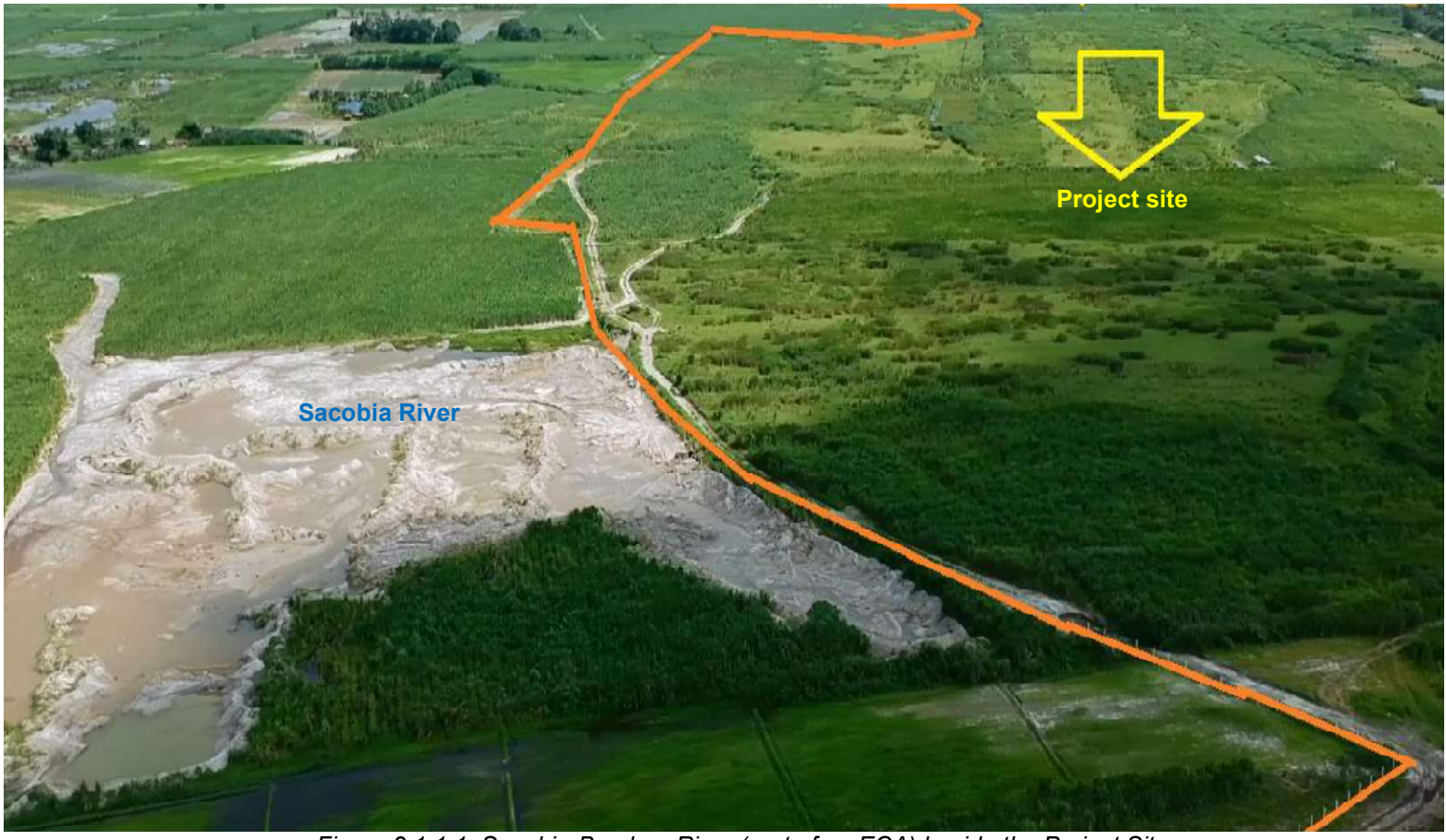


Figure 2.1.1.1: Sacobia-Bamban River (part of an ECA) beside the Project Site

Impact Assessment and Mitigation
Being an ECP in an ECA which is visited by at least 2 per year based on the Typhoon Frequency Map (Figure 2.1.1.2), the site being underlain by lahar deposits is highly susceptible to erosion and scouring. The ground surface must be kept relatively flat or at minimal gradient. All slopes including the road embankments must be protected by riprap, reinforced concrete and well maintained thick vegetation. Good drainage designs must be provided and maintained.

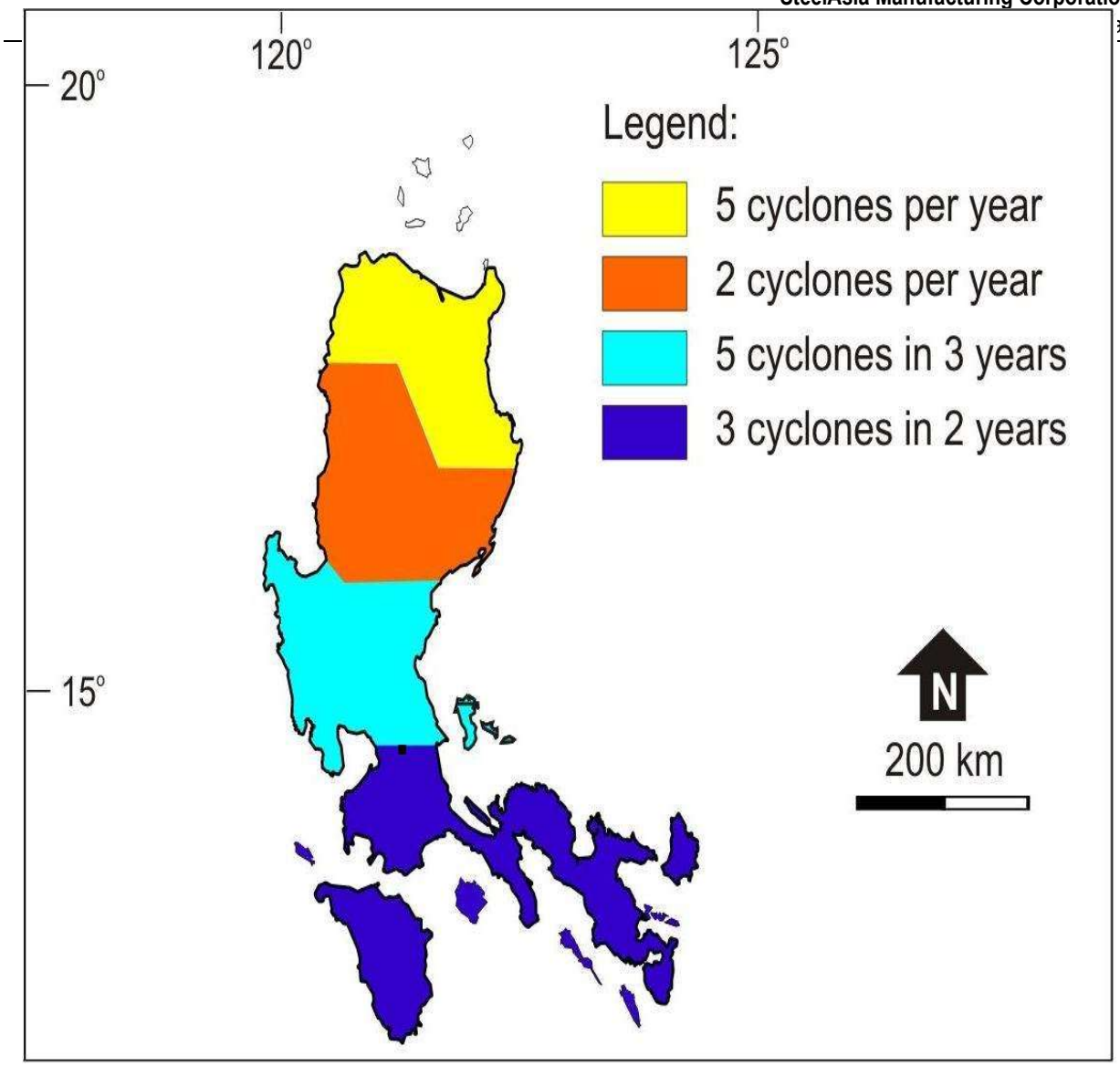


Figure 2.1.1.2: Typhoon Frequency Map

Impact in existing land tenure issue/s

There are no land tenure issues since the project site is already owned by the proponent. The project site is a lahar area where residents have been relocated and resettled in Capas, Tarlac.

Impairment of visual aesthetics

There will be no impairment of visual aesthetics because the project is located in an almost uninhabited area because only 95 residents live in Brgy. Telabanca. Also, the area is now reclassified as industrial area. The Plant site will be designed to suit the aesthetic perspective and improve the project area which was left barren for more than 20 years. Moreover, the Project and the Proponent will cooperate and coordinate with the LGU of Concepcion if there will be plans and programs with respect of the LGU's Industrial and/or Tourism Plan.

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

There will be no devaluation of land value as a result of improper solid waste management and other related impacts because the Project will implement an environmental management plan (EMP). Included in this EMP is the Solid Waste Management Plan which will include an area for Material Recovery Facility and Hazardous Waste area for used oil and batteries and busted bulbs. These facilities will be provided with an area allocation as associated facilities of the Plant.

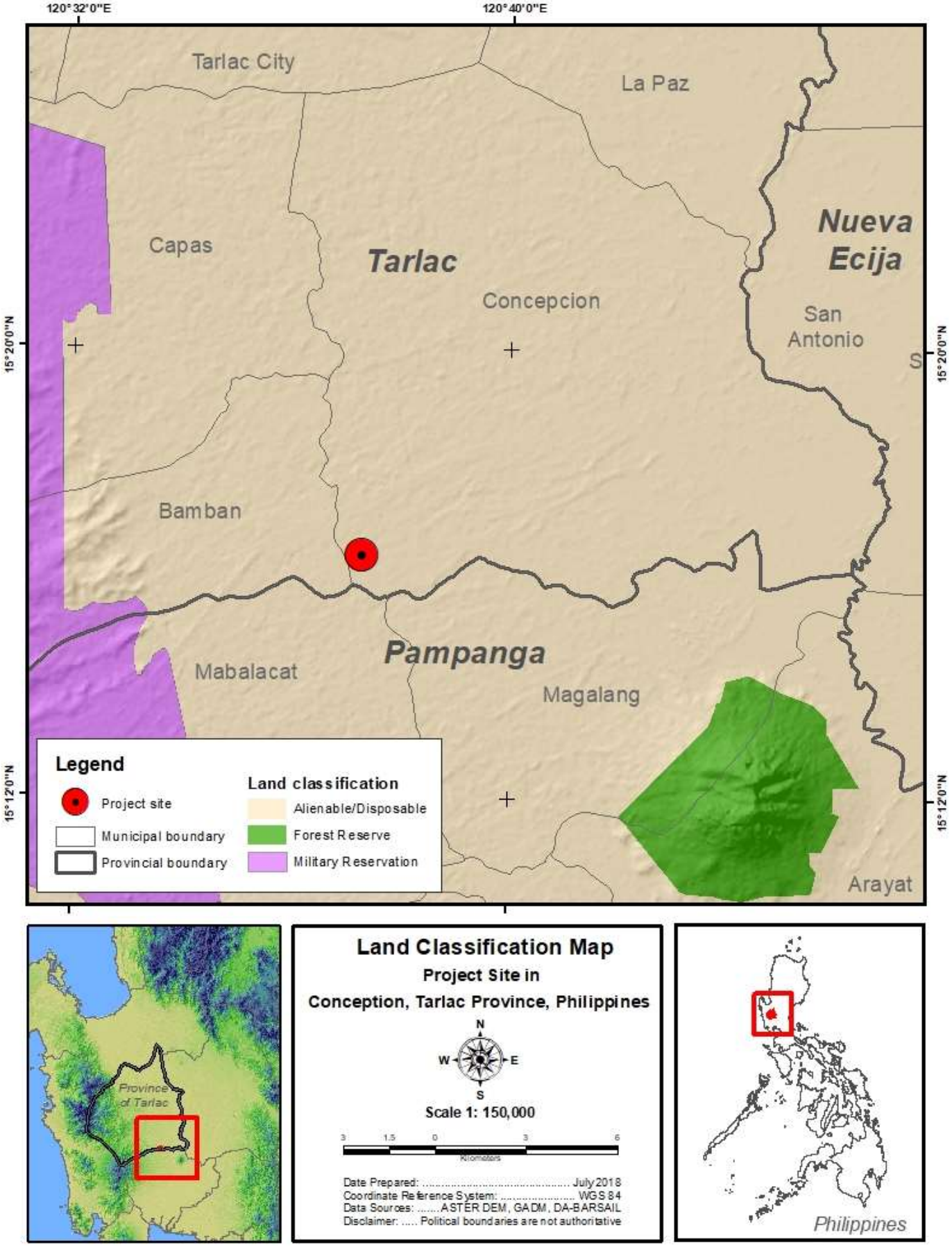


Figure 2.1.1.3: Land Classification Map (source: NAMRIA)

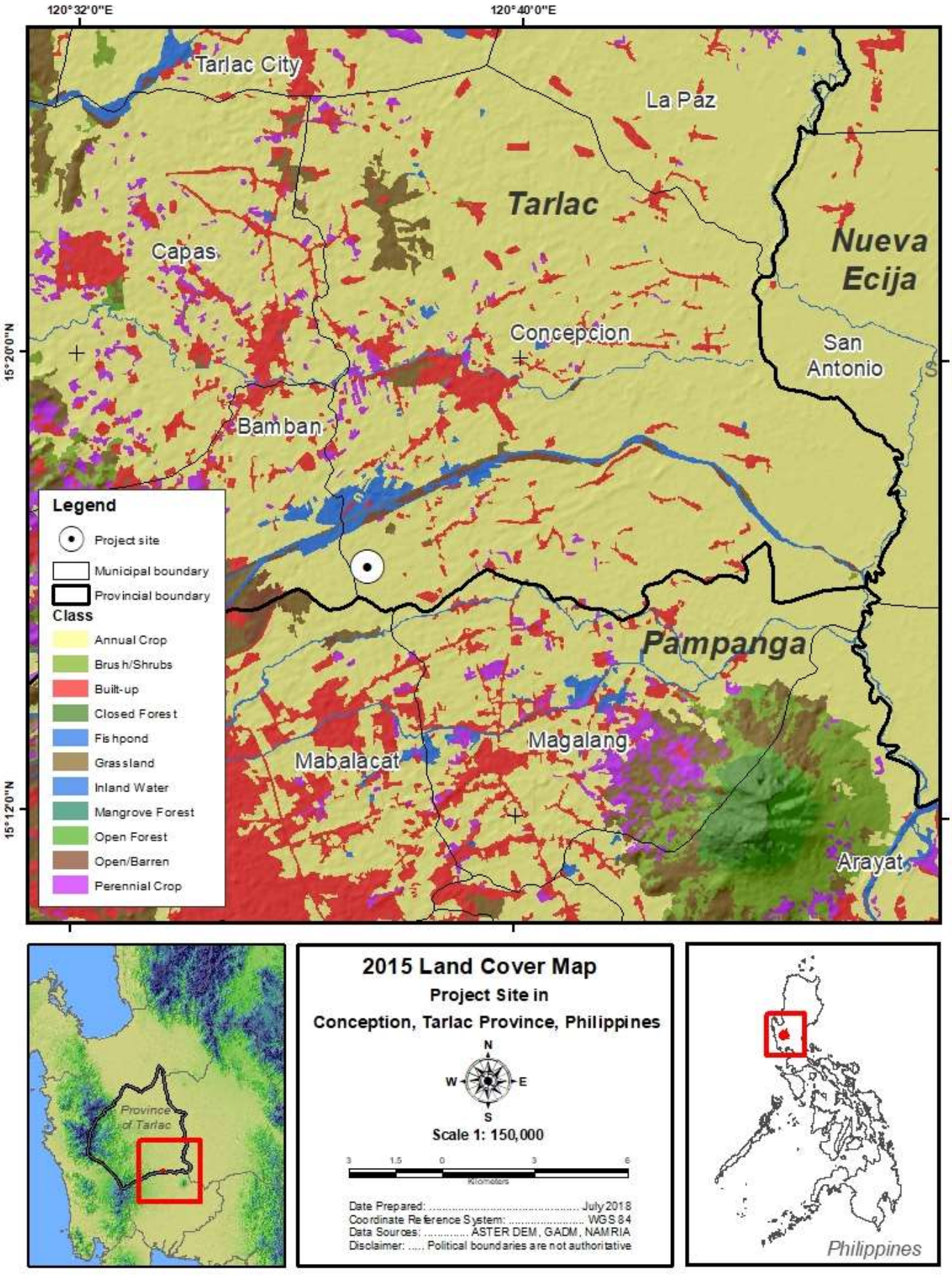


Figure 2.1.1.4: Land Cover Map (source: NAMRIA)

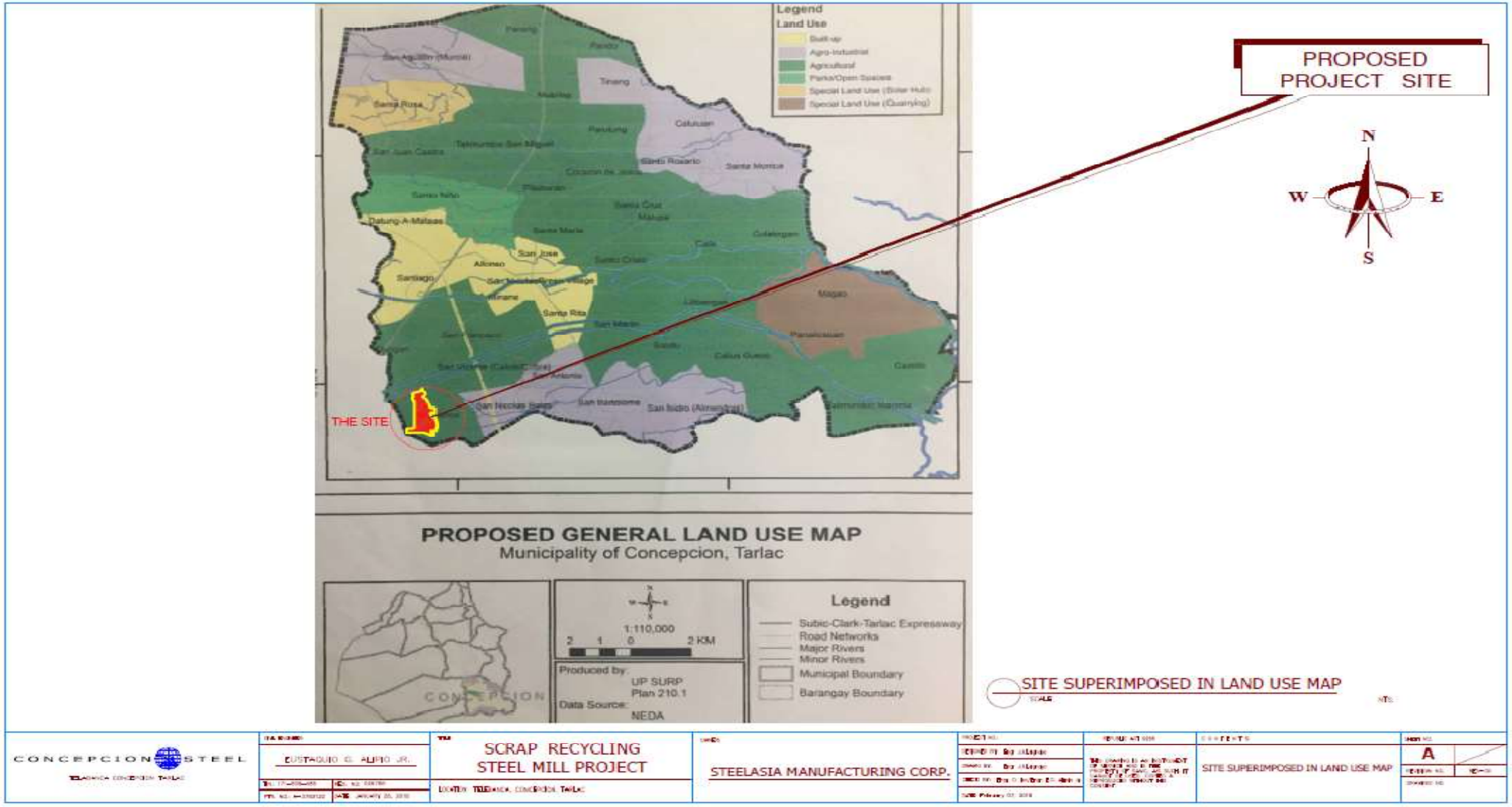


Figure 2.1.1.4: Land Use Map of Concepcion (Source: Concepcion MPDO)

2.1.2 Geology/Geomorphology

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

2.1.2.1.1 General Geology

2.1.2.1.1.1 Tectonic Setting

The proposed Scrap Recycling Mini Mill project is found within a tectonically active region known as the Philippine Mobile Belt (PMB). In Luzon Island, PMB is bounded by two oppositely dipping subduction zones; namely, the Manila Trench on the west and the Philippine Trench-East Luzon Trough on the east. The Manila Trench is the morphological expression of the eastward subduction of the South China Sea marginal basin lithosphere beneath the Philippine Mobile Belt (Barrier et al, 1991). The Philippine Trench-East Luzon Trough, on the other hand, represents the westward oblique subduction of Eocene Philippine Sea Plate (Cardwell *et al*., 1980; Fitch, 1972 and Hamburger et al., 1983 in Aurelio; Sajona et al., 1993). Convergence of the Philippine Mobile Belt and the surrounding blocks is associated with seismicity and formation of volcanic chains in the region (Barrier et al, 1991; Daligdig and Besana, 1993).

The deformation of the Philippine Mobile Belt is further influenced by movement along the Philippine Fault Zone. This fault system, the movement of which is generally considered to be left-lateral, extends more than 1,200 kilometers, transecting the Philippine archipelago from Luzon to Eastern Mindanao (Aurelio, 1996). Its age of initiation is still controversial, although extensive studies (e.g. Barrier et al, 1988 and Aurelio et al, 1990 and Barrier et al., 1991) of the fault in Luzon and Visayas indicate that fault activity began during the Pliocene. The trace of the Philippine fault is defined by young geomorphic features including fault scarps, sinistral stream offsets, fault parallel ridges and narrow, elongated troughs (Barrier et al, 1991).

The province of Tarlac including the project is geologically situated on the Central Luzon Basin bounded by two north-south geanticlines known as the Zambales Range (west) and the Sierra Madre Range (east). Manila Trench, an active east dipping subduction zone is located west of the Zambales Range while the eastern portion of the Sierra Madre Range is the East Luzon Trench (west dipping subduction zone). Truncating the basin on its northeastern portion is the Dingalan-La Union Fault segment of the active Philippine Fault. Major faults occurring in the region include the Subic Bay Fault, the San Antonio Fracture Zone, and the East Zambales Fault *(Figure 2.1.2.1.1.1).*

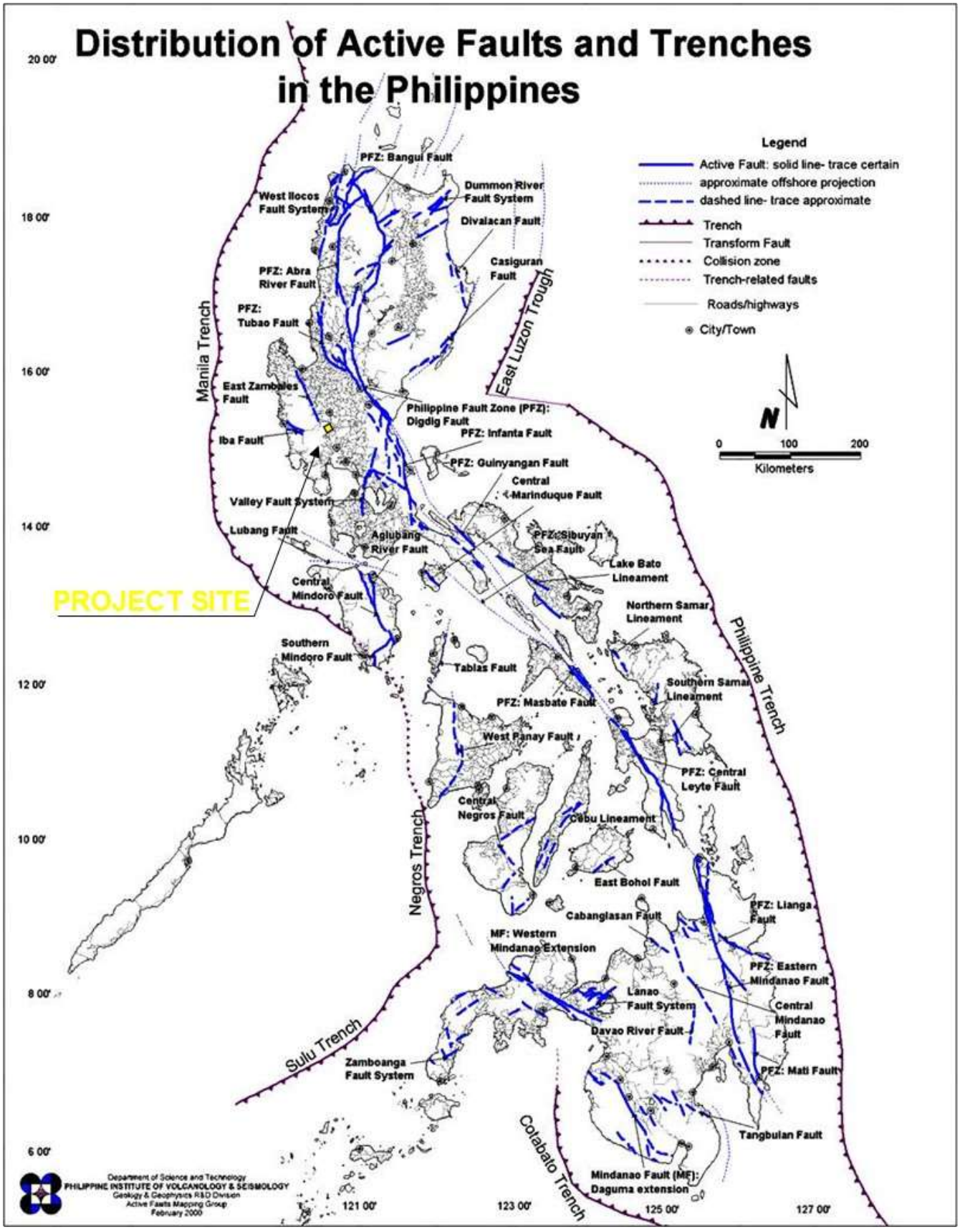


Figure 2.1.2.1.1.1: Tectonic Map of the Philippines (Phivolcs 2000)

2.1.2.1.1.2 Stratigraphy

The stratigraphy of the project was based on Geology of the Central Luzon Basin. Based on the report, Tarlac and its vicinity were covered by Quaternary Alluvium, Quaternary Pyroclastics, Quaternary Plugs and the Bamban Formation (Figure 2.1.2.1.1.2.1).

Quaternary Alluvium (QAl) generally covers the plain including the proposed project site and consists of unconsolidated sand and gravel and lahar deposits.

Bamban Formation (Qbf) is generally interbedded tuffaceous sandstone, conglomerate, and hard, medium to thick bedded lapilli tuff. This occurs west of the project site.

Tarlac Formation (Ntf) consists of interbedded sequence of highly tuffaceous, thinly bedded shale, siltstone, sandstone and massive to thinly bedded and loosely consolidated and poorly sorted lenticular pebble conglomerate.

Malinta Formation (Nmf) interbedded sequence fine to medium grained sandstone, calcareous shale, tuffaceous conglomerate, and fine to coarse lapilli tuff.

2.1.2.1.1.3 Surficial Deposit and Engineering Characteristics

The project, “Scrap Recycling Mini Mill”, located at Barangay Telabanca, Concepcion, Tarlac is generally underlain by thick alluvial deposits and pyroclastic material (volcanic ash/lahars) mostly silty sand. Thickness usually reached more than twenty meters from surface. Water table is shallow encountered at 2.5 meters to 7.50 meters below ground surface.

2.1.2.1.1.4 Geologic Structure

The most prominent geologic structure in the region nearest to the project area is the northwest trending East Zambales Fault approximately located 17.50 kilometers southeast of the site. Philippine Fault is located 82.50 kilometers east of the project. Other active major faults in the region proximal to the project site include the Iba Fault, the Subic Bay Fault, and the San Antonio Fracture Zone.

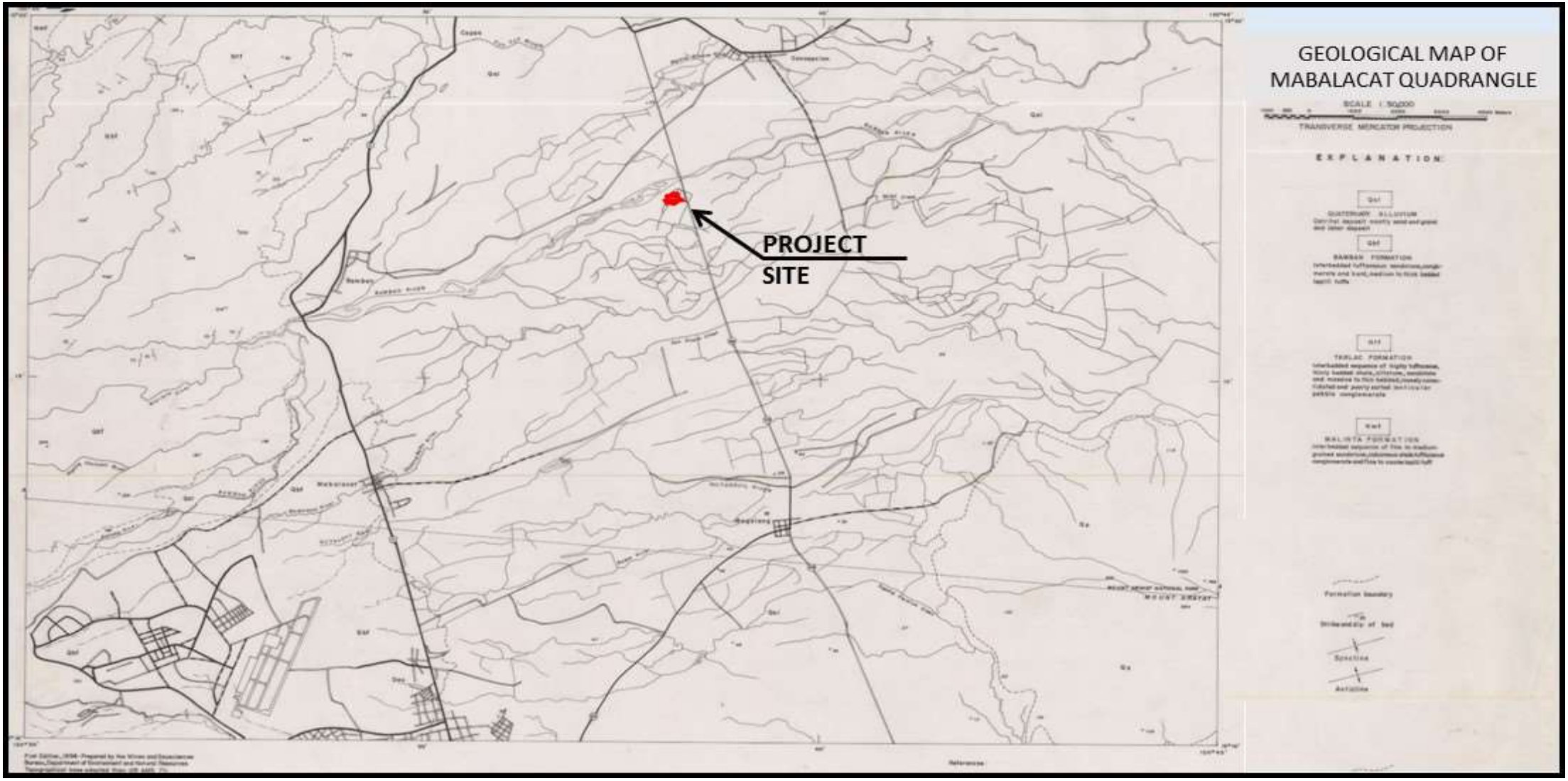


Figure 2.1.2.1.1.2.1: General Geology of Mabalacat Quadrangle (Reprinted MGB 1996)

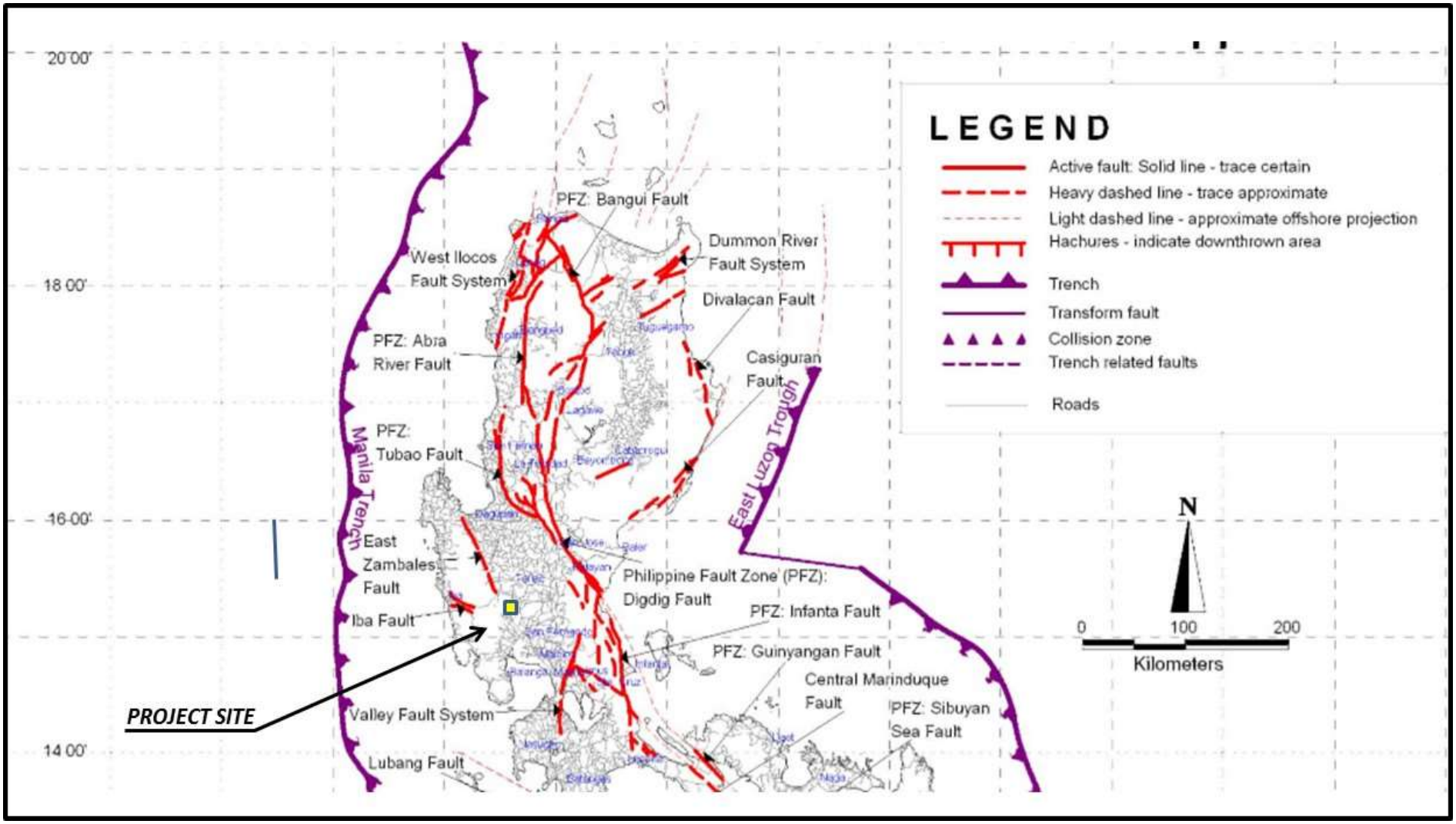
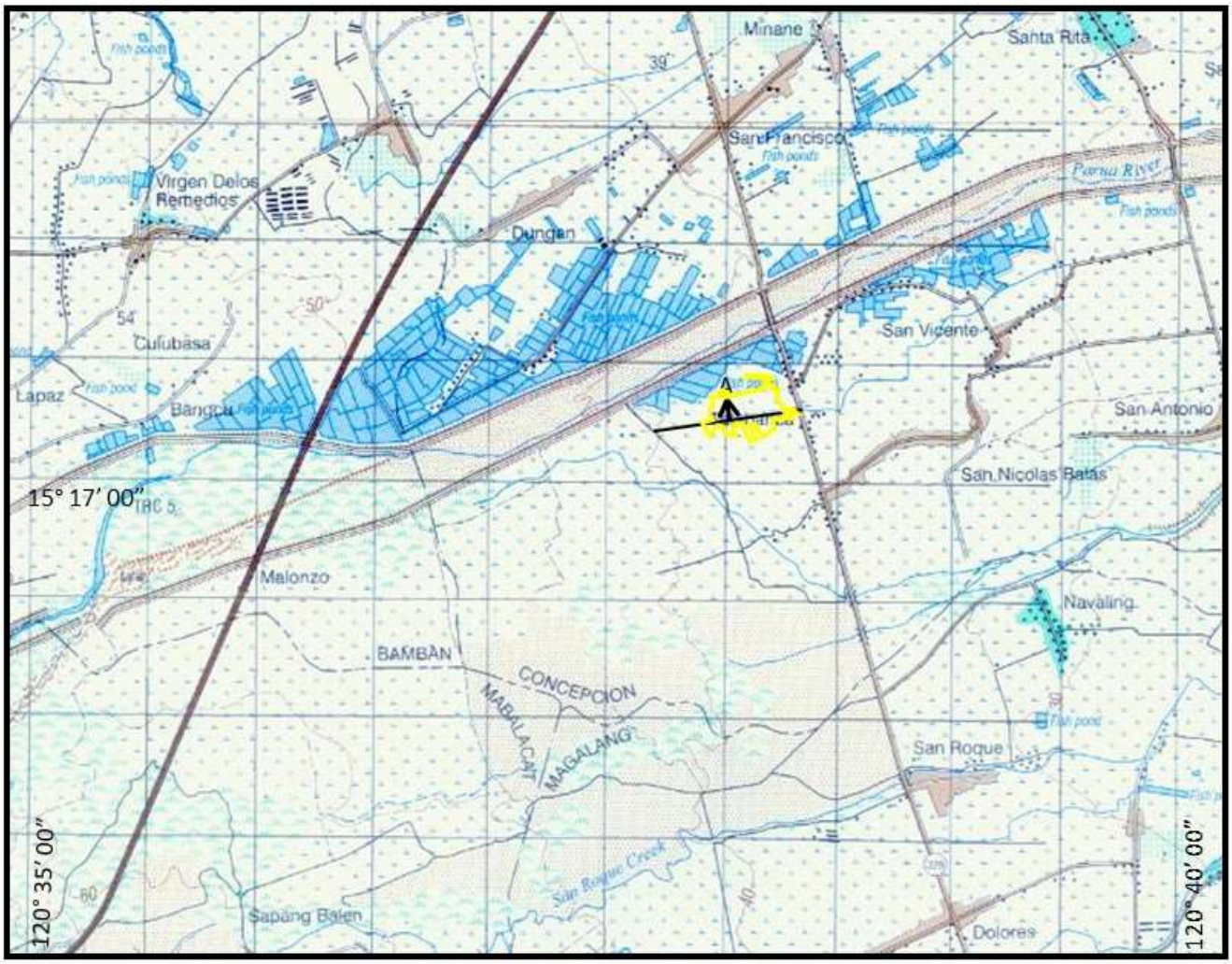


Figure 2.1.2.1.1.2.2: Active Faults and Trenches of Luzon Province (Downloaded from phivolcs.dost.gov.ph 2014)

2.1.2.2 Change in surface landform/ topography/ terrain/slope

Concepcion, Tarlac including the project area, is characterized by generally flat to undulating terrain being located within the Central Luzon Basin, a geosynclines/trough bounded by the Zambales Range and the Caraballo Mountains. It has an elevation ranging from 30 meters to 50 meters above sea level and is drained by Bamban River, joining the Pasig River, which discharges its loads to Manila Bay (Figure 2.1.2.2.1).

The project which is a plant structure is expected to have no effect on the existing landform. Filling to elevate the project site would increase the elevation of the project.



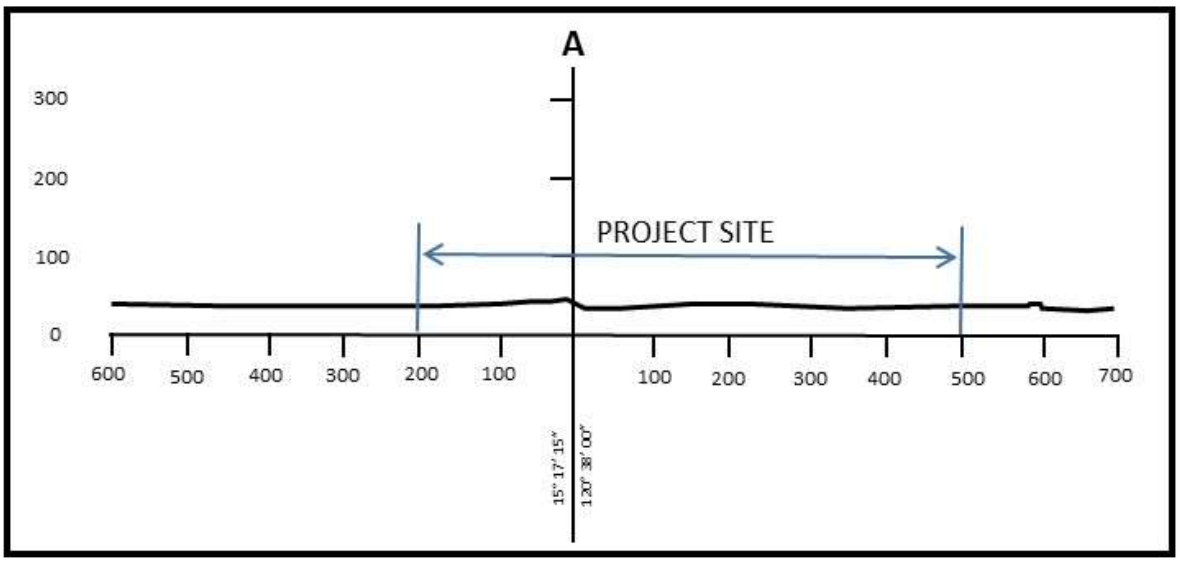


Figure 2.1.2.2.1: Topographic and Cross Section Map Showing the Project Site's Terrain (NAMRIA 1983)

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

"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, hydrometeorological and biological) and/or induced by human processes (environmental degradation and technological hazards)"

2.1.2.4 Geologic Hazard

2.1.2.4.1 Volcanic Hazard

The danger posed by volcanic eruption depends upon the magnitude of its explosion. The types of hazards resulting from volcano eruption are classified as base surge, airfall, lava flow and poisonous gas. The area studied falls under Zone 2 based on the latest existing hazard maps of Mount Pinatubo. Zone 2 includes those areas that are low susceptibility to large scale lahars, moderate to high susceptibility to small magnitude lahars, and high susceptibility to sediments laden (muddy) stream flows or flash floods. The site falls outside the permanent danger zone of Mount Pinatubo and experience of less than 1 centimeter airfall deposits *(Figure 3.2.1.5.1.1, Figure 3.2.1.5.1.1b).*

The project is noted near the Bamban River and is considered to be moderately affected by lahar. Communities must evacuate themselves for safety purposes during imminent lahar threats.

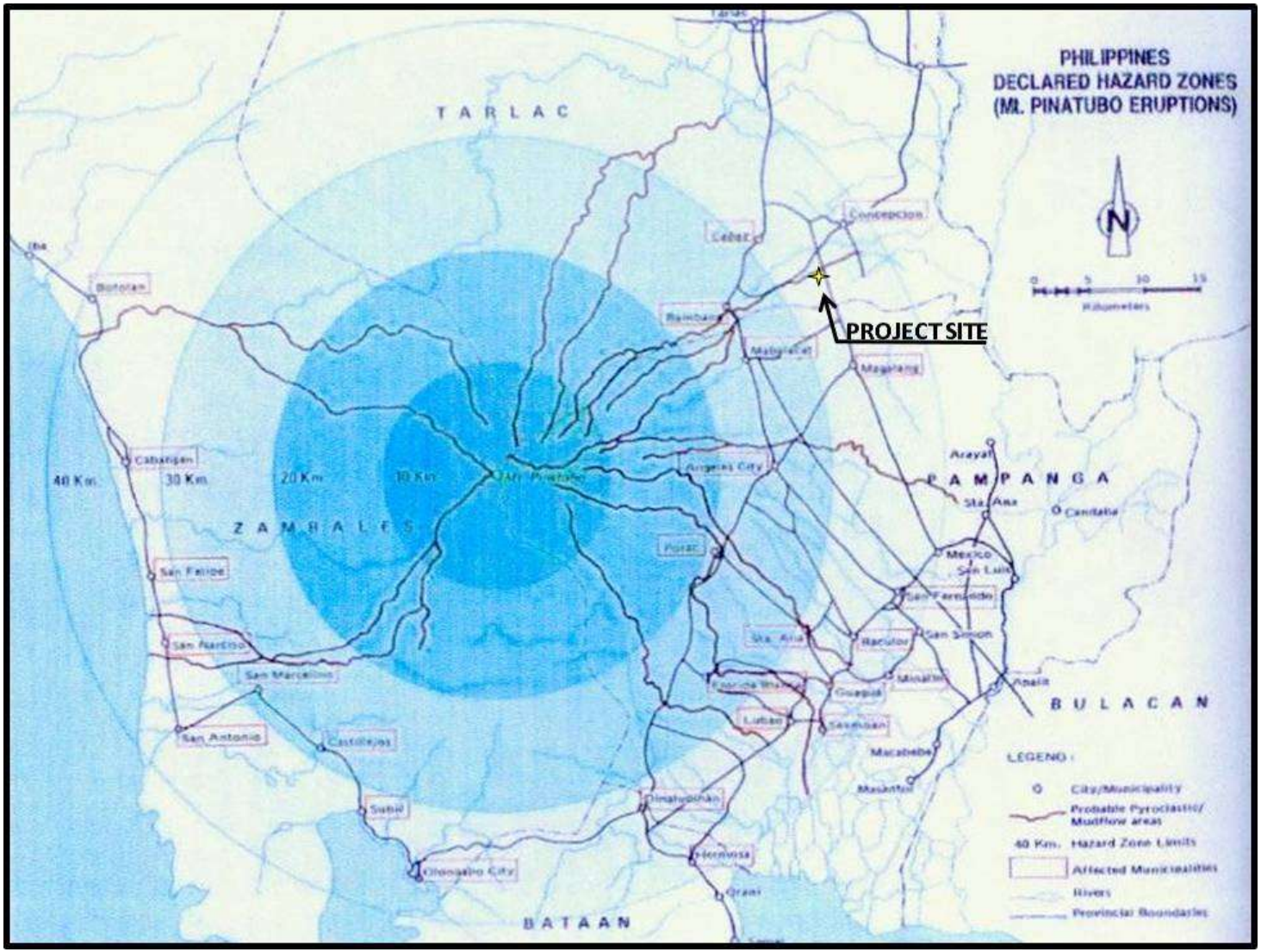


Figure 2.1.2.3: Hazards Zone Map of Mount Pinatubo (Phivolcs 1991)

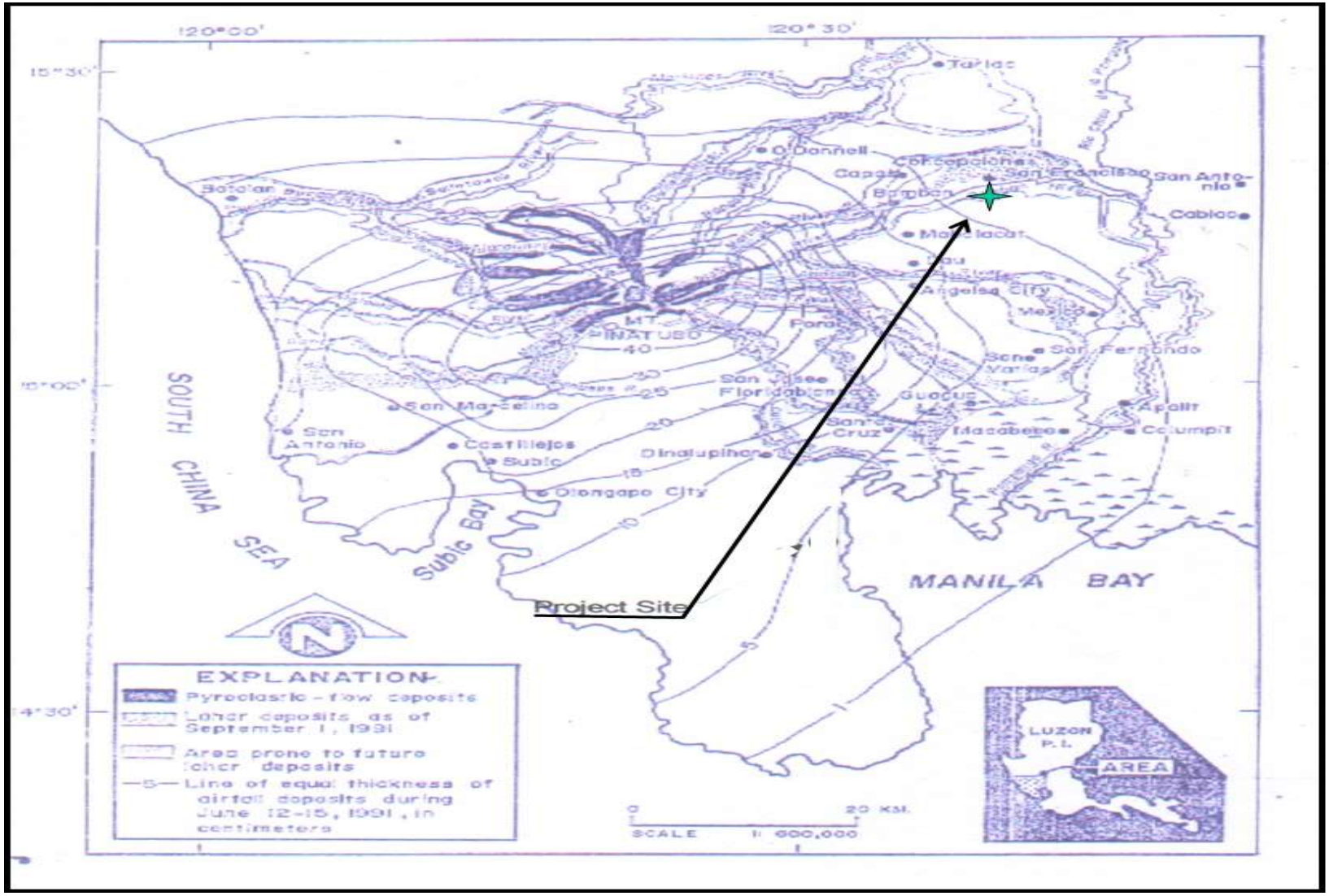


Figure 2.1.2.4.1: *Location of summit caldera, pyroclastic deposits, tephra fall deposit (shown by lines of equal thickness in centimeters), and lahar deposits in Mt. Pinatubo as of September 1, 1991 and area prone to future lahar deposits.*

2.1.2.4.2 Earthquake Hazards

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 ***(Figure 2.1.2.4.2.1).***

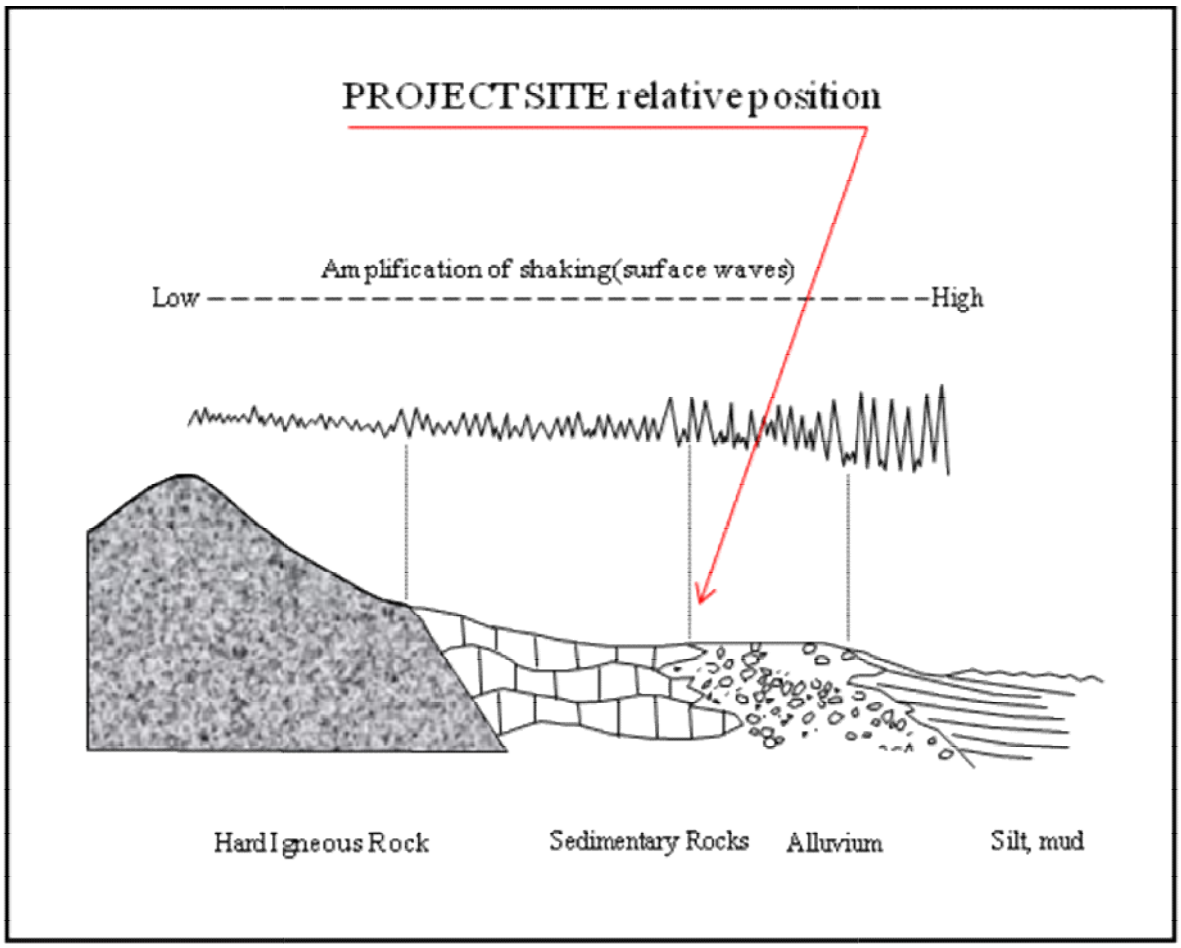


Figure 2.1.2.4.2.1: *Generalized Relationship Between Near Surface Earth Material and Amplification of Shaking During a Seismic Event (Keller E. A. 1985)*

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 East Zambales Fault, 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 (Figure 2.1.2.4.2.2).

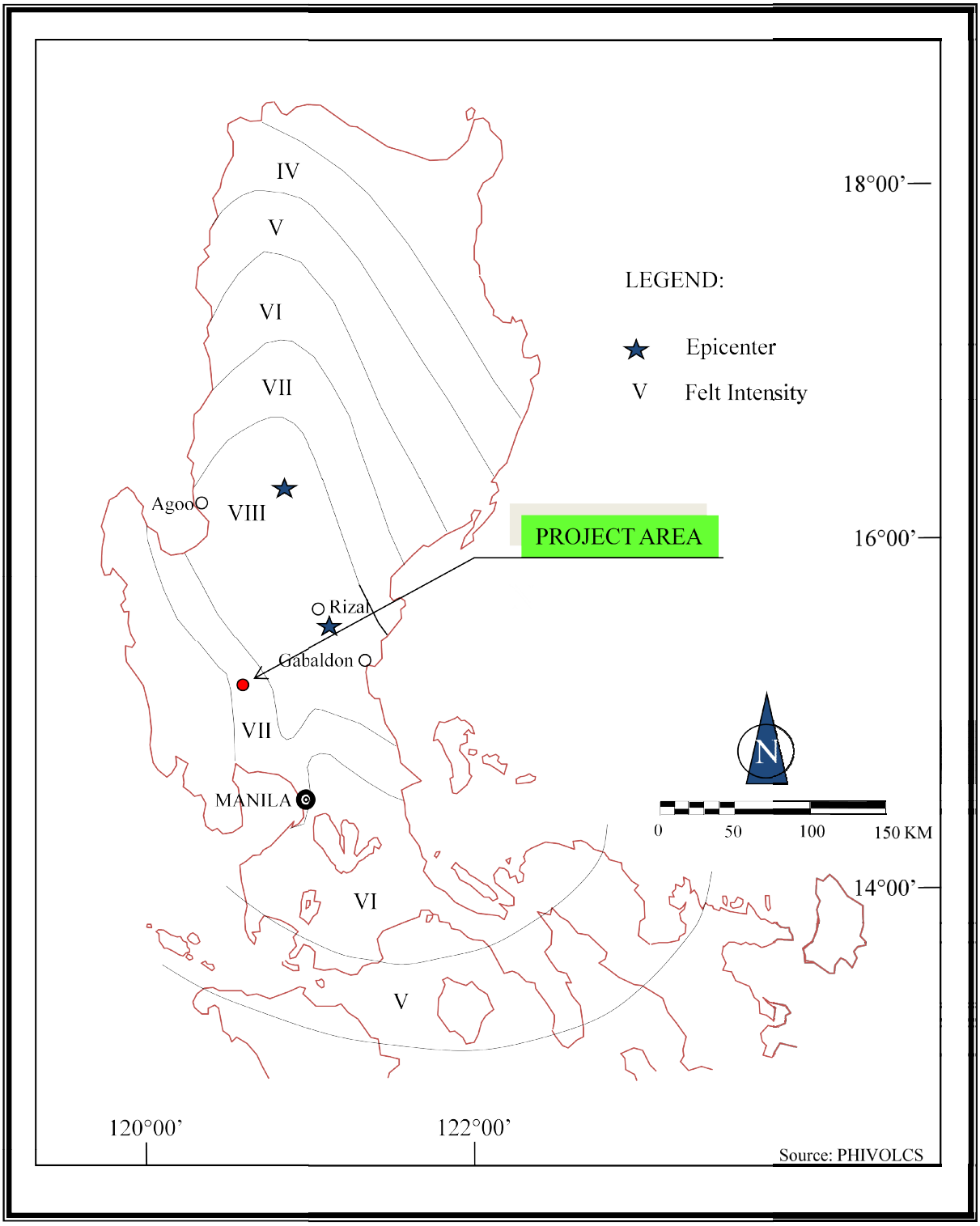


***Figure* 2.1.2.4.2:** *Intensity Map of 16 July 1990 Luzon Earthquake (Phivolcs 1992)*

2.1.2.4.3 Ground Acceleration

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

The project site is underlain mainly by thick alluvial deposits mostly sandy silt being located on the Central Luzon Basin and fall under the .60g as shown in the delineated Acceleration Map for Soft Soil (Figure 3.2.1.5.1.2.1).

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

$$\mathbf{Log_{10}A=0.41M-log_{10}\,(R + 0.032 \times 10^{0.41M}) - 0.0034R = 1.30}$$

Where : A= mean of the peak acceleration from two horizontal components at each site (cm/sec^2)
R= shortest distance between site and fault rupture (km)
M= surface-wave magnitude

Considering an earthquake magnitude of *7.2* and distance of the site of 17.50 kilometers from the East Zambales Fault, the peak ground acceleration (PGA) values will be 0.207g, 0.299g, and 0.478g for bedrock, medium soil and soft soil, respectively. The project falls on the soft soil condition.

2.1.2.4.4 Liquefaction

Liquefaction occurs when a water-saturated cohesionless soil loses its strength and liquefies when subjected to intense and prolonged ground shaking. Reyes et al, of UP-Engineering Research and Development Foundation, Inc., in their soil study of areas that liquefy during the 16th July 1990 Luzon earthquake came out with the following soil conditions for the potential liquefiable layers:

(1) loose soil classification;
(2) upper layers of the surveyed areas;
(3) water table near the ground surface;
(4) N-value of less than 30 using the American Association of State Highway and Transportation Officials (AASHTO) method and less than 35 using the Japan Society of Civil Engineers (JSCE) method; and
(5) 50% passing (D50) of approximately 0.001-1.8mm.

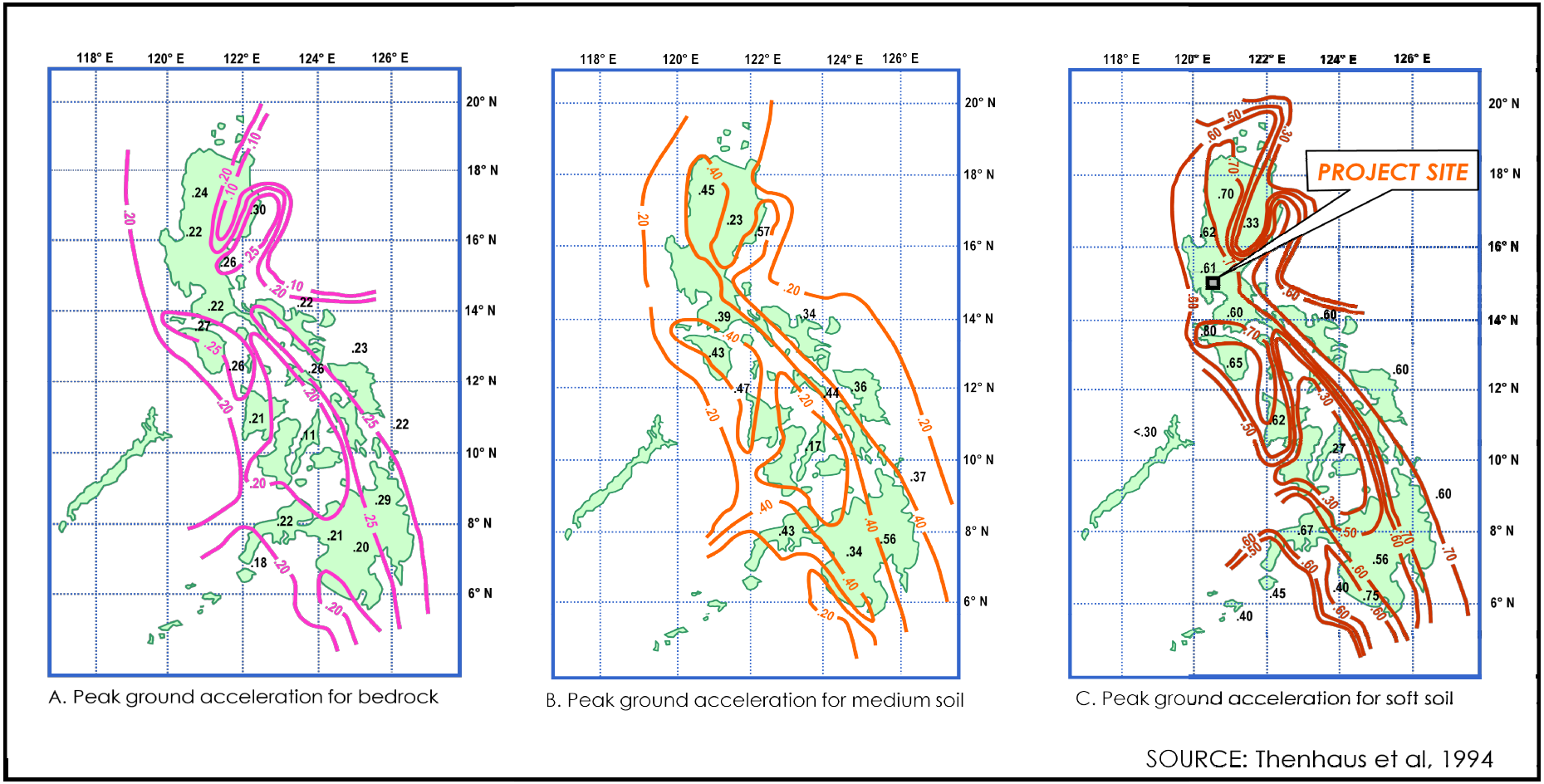


Figure 2.1.2.4.3.1: *Maps Showing Peak Horizontal Acceleration Amplitude on Bedrock, Medium Soil and Soft Soil for the Philippine Region (source: Thenhaus et al, 1994)*

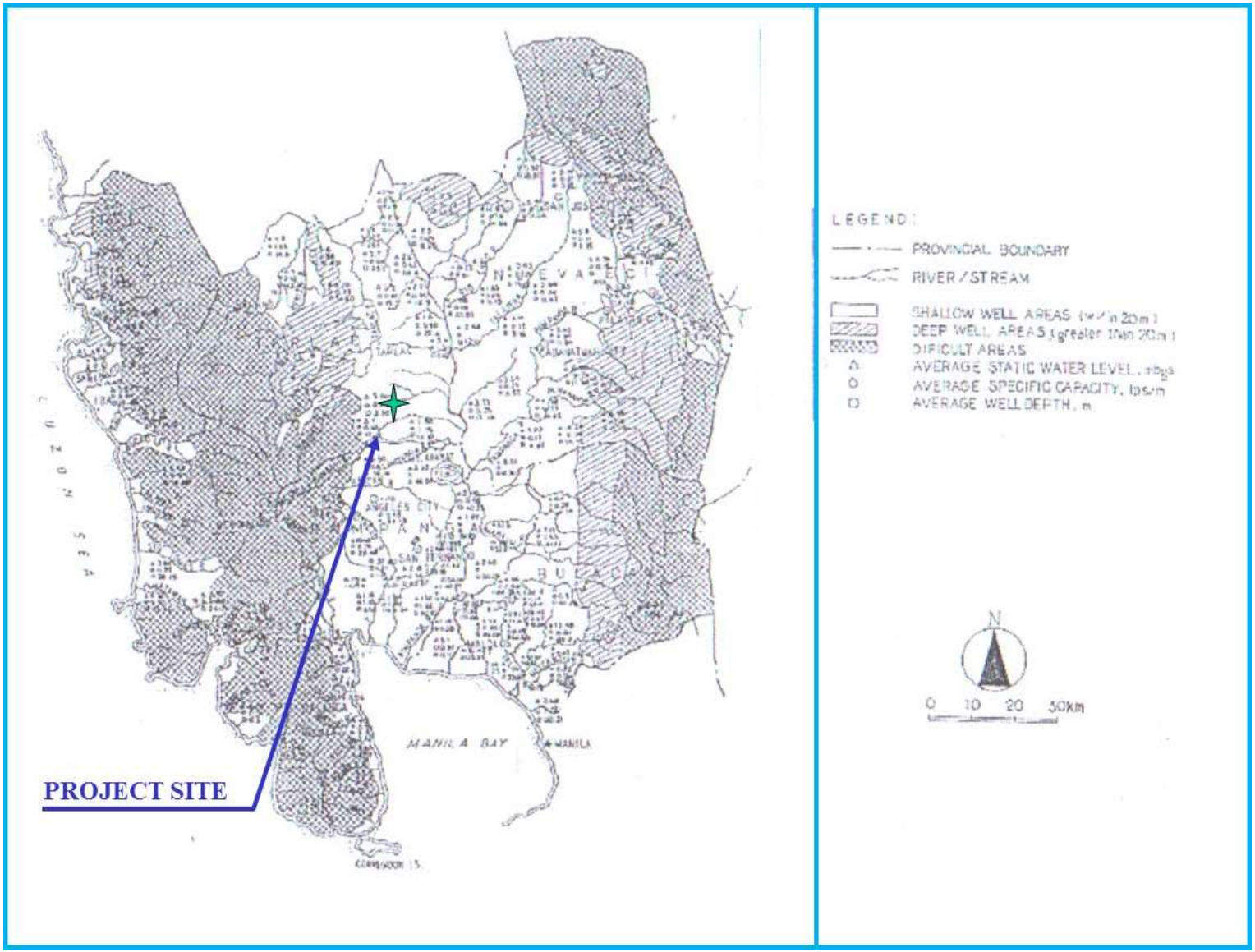


Figure 2.1.2.4.4.1: Maps Showing Depth of Groundwater Based on the Hydrological Studies Conducted by Mines and Geosciences Bureau Region 3

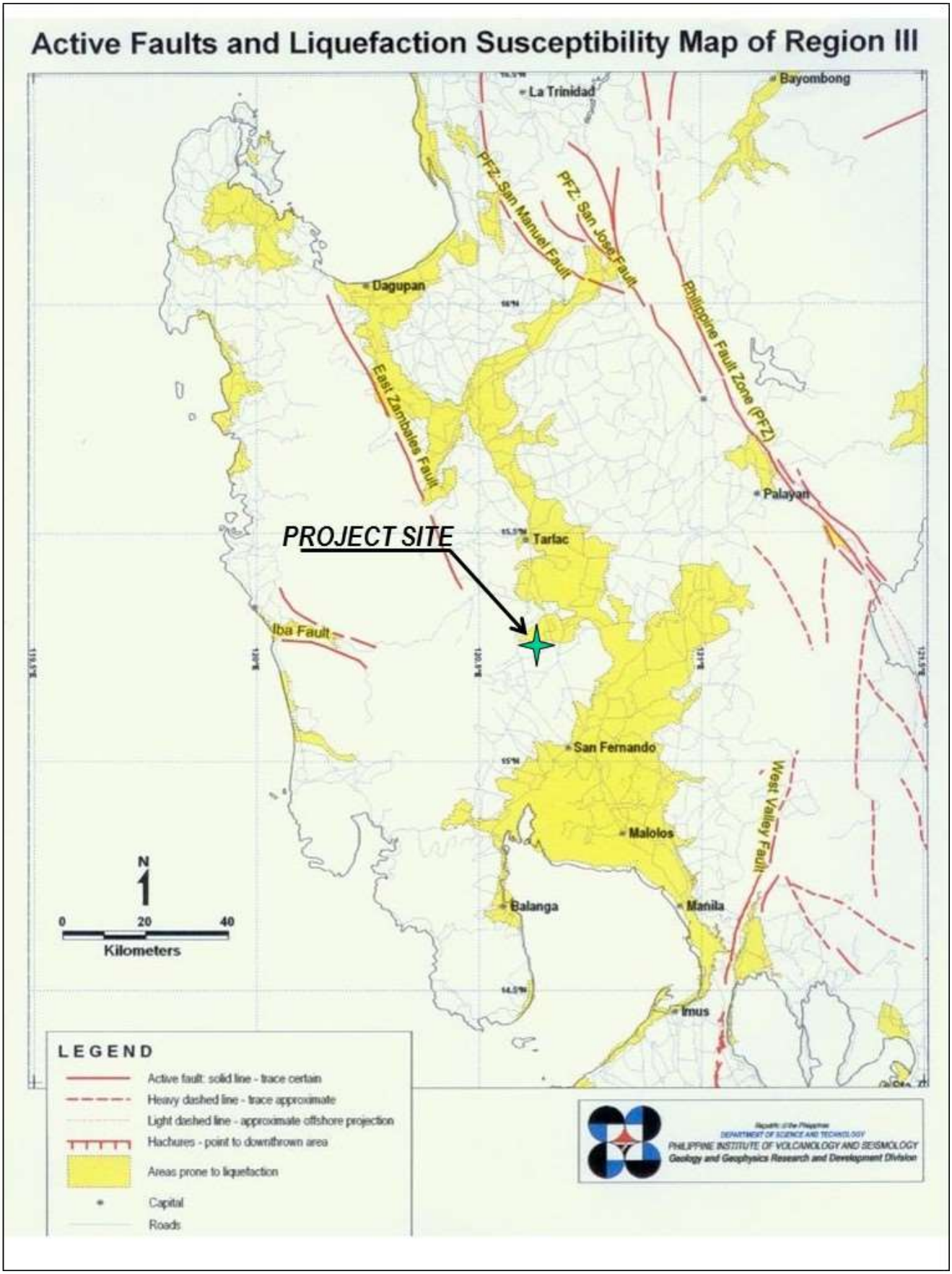


Figure 2.1.2.4.4.1b: *Active Faults and Liquefaction Susceptibility Map of Region 3*

Based on the hydrological study of Mines and Geosciences Bureau, Tarlac province including the project area reveals that the area underlain by thick alluvial deposit falls under the delineated shallow well with water table averaging 1.50 to 5.00 meters below ground. The project site is considered susceptible to liquefaction. It falls inside the delineated liquefaction prone areas by Phivolcs (Figure 2.1.2.4.4.1b).

2.1.2.4.5 Ground Rupture

Ground rupture occurs when a new rupture is created or when renewed movement of old fractures takes place (Punongbayan, 1994). PHIVOLCS is recommending a buffer zone of at least 5 meters on both sides of a fault trace or from the edge of deformation zone. This hazard is seemingly absent in the project area since the nearest active East Zambales Fault is found about 17.50 kilometers northwest of the project site.

2.1.2.4.6 Hydrologic Hazard

2.1.2.4.6.1 Flood Hazard

Floods usually occur during or after heavy rainfall wherein the river channels are saturated with water resulting to river swelling and overflowing of floodplains.

The project area located on a basin has an elevation ranging from 30 to 50 meters above sea level and falls on moderate to high susceptibility to flooding as delineated by Mines and Geosciences Bureau ***(Figure* 2.1.2.4.6.1*)***. The project site could experience “localized flooding” if the drainage systems are inadequate and not fully maintained. The project site must be elevated by at least two meters or level up with the present road elevation to avoid flooding.

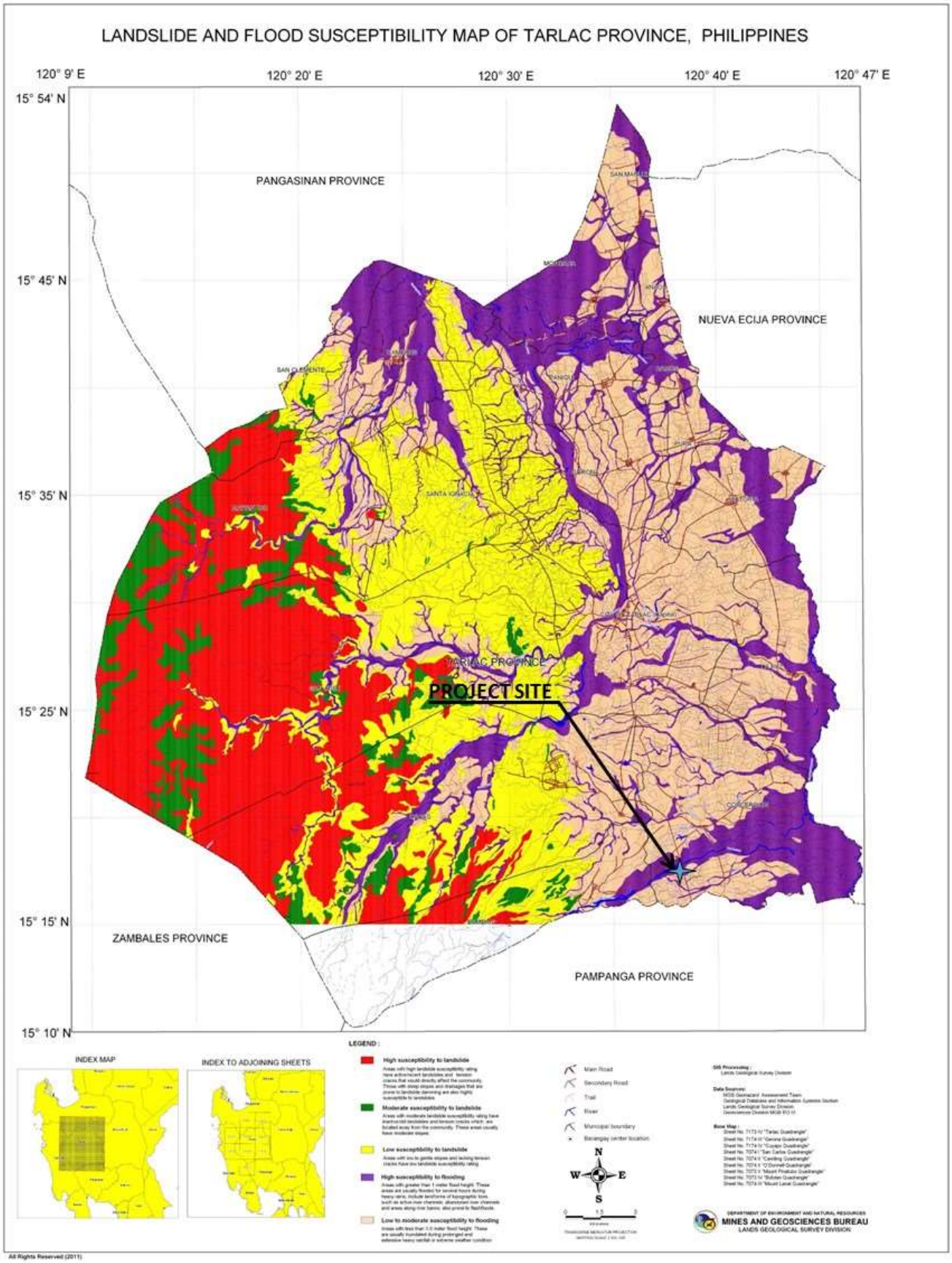


Figure 2.1.2.4.6.1: *Flood Susceptibility Map of Tarlac Province (MGB 2011)*

2.1.2.4.6.2 Scouring

The site being underlain by lahar deposits are highly susceptible to erosion and scouring. The ground surface must be kept relatively flat or at minimal gradient. All slopes including the road embankments must be protected by riprap, reinforced concrete and well maintained thick vegetation. Good drainage designs must be provided and maintained.

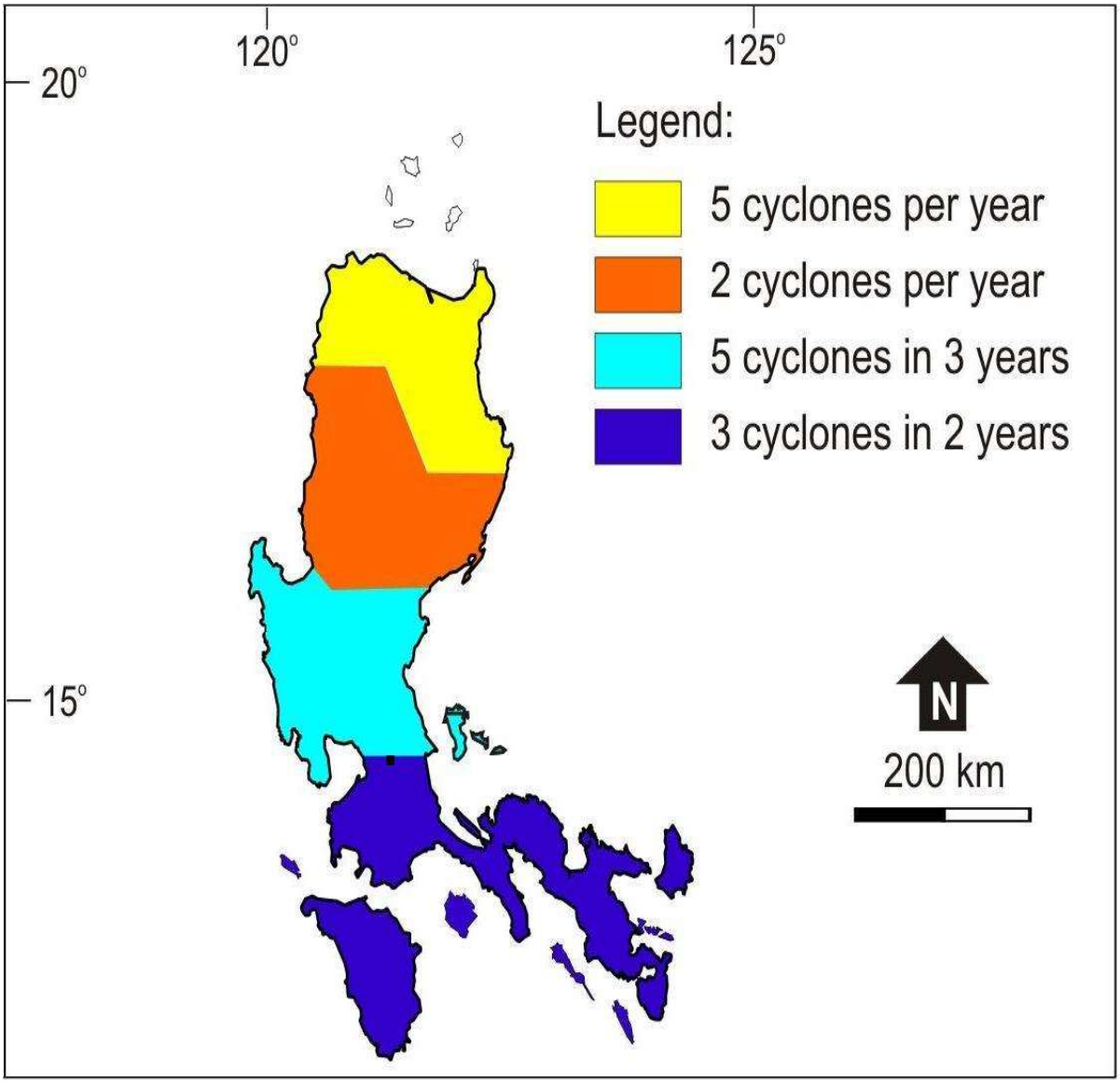


Figure 2.1.2.4.6.2: Typhoon Frequency Map

2.1.2.4.6.3 Typhoons

The relevance of typhoons to the project/project site is reckoned from the following hazards:

- Rain-induced localized floodings
- Risks to personnel

Figure **2.1.2.4.6.3.1** below shows the tropical cyclone frequency map while Figure 3.2.1.5.2.2b shows the normal path of typhoons. From these maps is seen that the project site could experience 2 cyclones per year during the months of November and December.

Table 2.1.2.4.6.3.1: List of Tropical Cyclones which crossed the Philippines in 2017

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

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

NOTE :

** *means Tropical Cyclones with multiple entry in PAR*

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

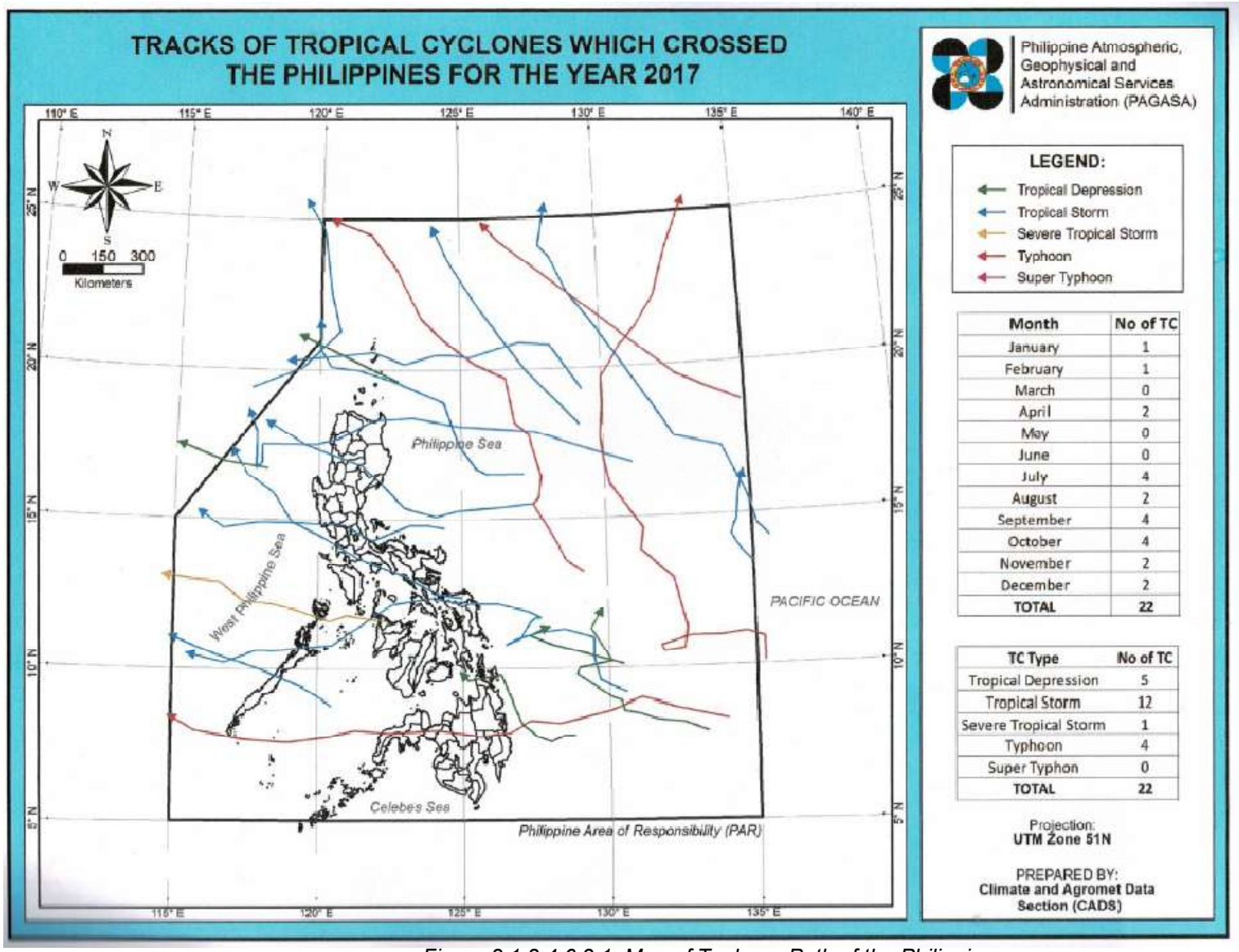


Figure 2.1.2.4.6.3.1: Map of Typhoon Path of the Philippine

2.1.3 Pedology

According to the Philippine Rice Research Institute, Tarlac Series is the soil property of Concepcion. This means that the Surface Soil Type is Sandy clay loam. The Family name is Fine loamy, Kaolinitic (ca.), isohyperhtermic, Oxic Haplustept. This is a fine loamy textured soil with isohyperthermic temperature regime of 22C. It is an inceptisol, the incipient development towards mature soils but has not yet fully developed their diagnostic horizons. This soil has minimum complexity in its soil horizon found in areas with pronounced wet and dry seasons. It is a representative of the great group Haplustepts.

Shown in Figure 2.1.3.1 is the Soil Map of the Province of Tarlac.

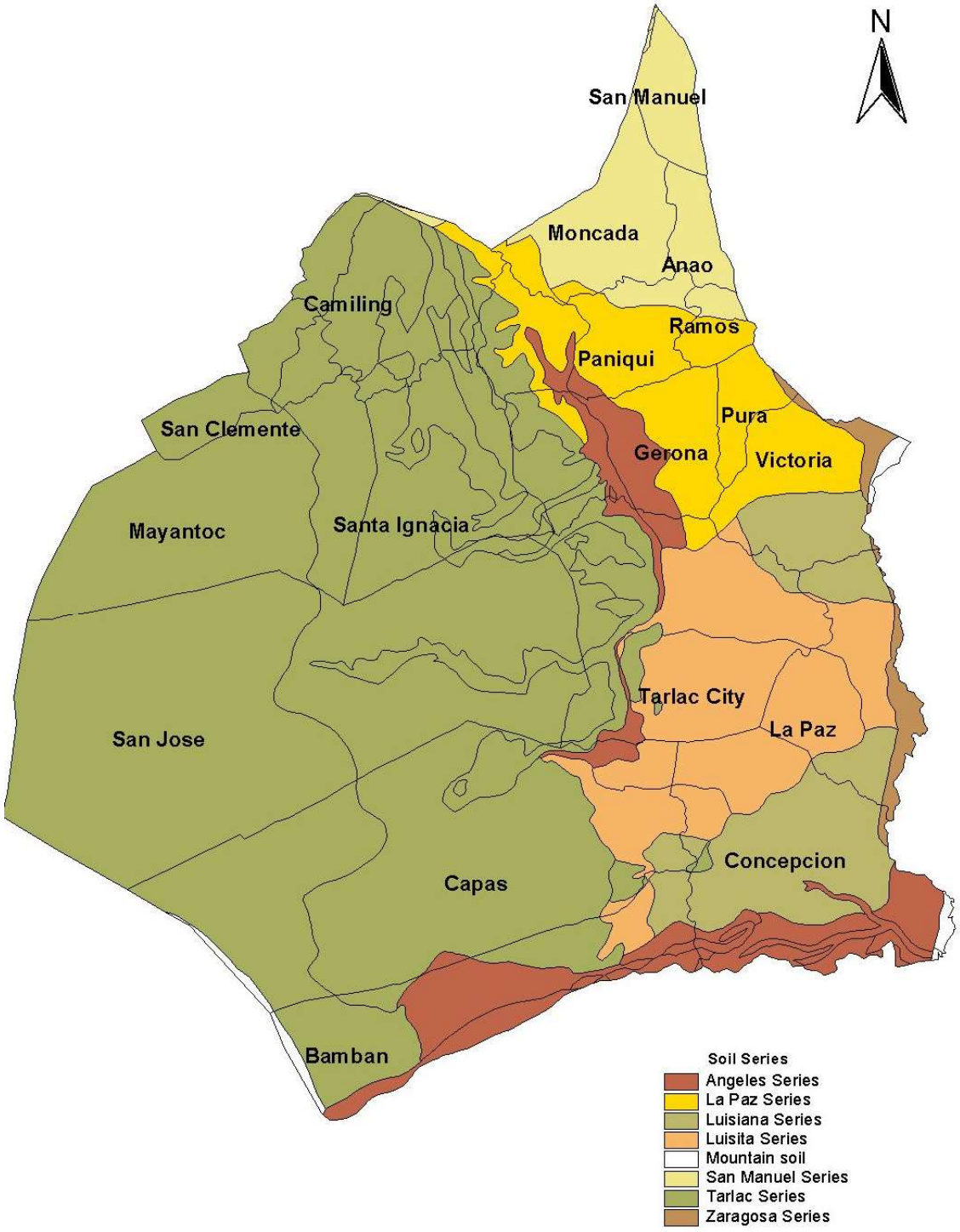


Figure 2.1.3.1: Soil Map of the Province of Tarlac

With the implementation of the project, it is presumed that soil quality will not be significantly affected because the rolling mill process will not involve the use of chemicals which may contaminate the soil. In case of project abandonment, proper soil remediation measures will be implemented in case of soil contamination of used oil will be determined.

Soil Erosion/loss of topsoil/overburden

There will be neither soil erosion nor loss of topsoil/overburden involved in this project because the project involves reheating / rolling mill only and associated facilities. However, during construction since backfilling will be undertake, proper construction methods and procedures will be implemented to avoid soil erosion on site.

Change in soil quality/fertility

Laboratory tests were conducted on the soil and rock samples from the boreholes. The tests carried out on soil samples include: particle size analysis, Atterberg limit test and determination of natural moisture content. Rock samples were analysed for percentage core recovery and rock quality designation (RQD). Intact core samples were subjected to unconfined compression test. The tests were conducted according to the relevant American Society for Testing and Materials (ASTM) standards.

Groundwater level at the site was determined based on measurements made within the boreholes, at least 24 hours after boring completion.

The lahar deposits of Mount Pinatubo affected most of the sugar cane fields in Pampanga and Tarlac. Lahar deposits are predominantly sand (75%) with subordinate silt (18%) and only 3% clay. It has a pH of 4.50. Organic matter content is very low (0.10%) and a total nitrogen content of 0.004%. The phosphorus and potassium contents are 4.3 ppm (Olsen P) and 0.012 me/100g K, respectively. Because of the low nutrient status and low cation exchange capacity (CEC) of only 0.427 me/100g, lahar is considered an inert medium for plant growth and lahar-laden fields have stayed untilled for crop growing. However, several plant species have gradually colonized the areas through the years thus adding organic matter to the fields.

An assessment of the geotechnical conditions of the site and provides recommendations of soil characteristics and strength for the foundation system was conducted on by Mega Tester Center, Inc. in June 2018.

Fourteen boreholes were drilled for the Soil Exploration Program with a depth of 35.0 meters into the ground. During drilling of soil-type material, Standard Penetration Test (SPT) and soil sampling were undertaken at regular intervals of 1.5m. The retrieved soil samples were taken to the soil laboratory for the various laboratory tests.

The boring was accomplished using wash boring. A casing is driven into the ground and the soil inside the casing then is removed by means of a chopping bit that is attached to a drilling rod. Water is forced through the drilling rod, and it goes out at a very high velocity through the holes at the bottom of the chopping bit (Das, 2010).

Standard Penetration Test (SPT) is carried out by using a standard split-spoon sampler, mounted on a drive rod of sufficient strength to prevent whipping from blows delivered by 140 pound (63.5 kg) hammer free-falling from a height of 30 in. (76 cm).

The value of N is reported as the resistance to penetration. It is the number of blows required to drive the tube to the last 300 mm (12 in) of penetration distance.

After the sample and tube are brought to the surface and separated, the sample is removed from the tube and properly preserved and sealed using a moisture tight plastic bag for further testing in the laboratory.

Correlation of SPT data with other soil parameters have been developed for estimates of stiffness of a soil and is a very useful supplementary classification as shown in tables below:

Table 1: Consistency Classification for Fine-Grained Soils

Classification	SPT, N	Undrained Shear Strength, s_u (kPa)
Very soft	< 2	< 12
Soft	2 – 4	12 – 25
Medium	4 – 8	25 – 50
Stiff	8 – 15	50 – 100
Hard	15 – 30	100 – 200
Very hard	> 30	> 200

Source: (Terzaghi, Peck & Mesri, 1996 & U.S. Navy, 1982)

Table 2: Consistency Classification for Coarse-Grained Soils

Classification	SPT, N	Relative Density, D_r (%)
Very loose	< 4	0 – 15
Loose	4 – 10	15 – 35
Medium dense	10 – 17	36 - 65
Dense	17 – 32	65 – 85
Very dense	> 32	85 - 100

Source: (U.S. Navy, 1982 & Lambe and Whitman, 1969)

LABORATORY TESTING PROGRAM
The procedures used in testing the samples for this project conform to the ASTM Standards. All samples were subjected to the following specific tests (as applicable) done at the Laboratory Office of Mega Testing Center, Inc. The test results are presented as attachments to this report, and the procedures are briefly described in this section:

Soil Particle Size Analysis (ASTM D-422, ASTM D-1140/AASHTO T88)
The size and quantity of individual particles found in particular soil is indicative of the performance characteristics of the soil. The percentage by weight of the material passing through each succession sieve is recorded.

The Atterberg Limits (ASTM D-4318/ AASHTO T89, T90)
The liquid Limit and the plastic limit tests define the upper and lower moisture content points at which a particular soil ceases to perform as plastic. The use of this test is constrained to cohesive soils.

Moisture Content of Soils (ASTM 4959/ AASHTO T 265)
This test is based on the weight of the water in the soil. It indicates imperative behavior of different soil types at various levels of moisture. It is the ratio expressed as percentage of the weight of water in a given mass of soil to the weight of solid particles.

Unified Soil Classification System (USCS)(ASTM D-2487/ AASHTO M145)
Based on the results of visual observations and prescribed laboratory tests, a soil is classified according to the basic soil groups, assigned a group symbol(s) and name. This standard classifies

soils from any geographic location into categories representing the results of prescribed laboratory tests to determine the particle-size characteristics, the liquid limit, and the plasticity index

The various groupings of the classification system have been devised to correlate in a general way with the engineering behaviour of soils.

SUBSURFACE AS FOUND
The subsoil at the site is represented by the soil profile derived from the drilled boreholes as shown in the borehole logs attached. As can be seen in the soil profile, the site is generally underlain by a firm and hard overburden (soil) starting from the ground level to 35.0m depth, distinguished by medium dense to very dense poorly graded sand, and dense to very dense clayey gravel. Weak zones of soft fat clay and very loose to loose clayey sand, poorly graded sand, and silt are tabulated below.

The type and condition of the overburden which consists of several materials are idealized into three (3) soil horizons, namely: (a) weak, (b) firm, and (c) hard/over compacted.

(a) Weak Zone – this zone is extremely very soft/loose soils with N-values of less than 10 blows/ft for sandy soils and less than 4 blows/ft for plastic silts and clays. The vertical extent and type of material is tabulated as follows:

Borehole Number	Thickness (meter)	Type and Condition of Materials
BH-4	3.0-4.5	3.0-4.5m; Loose, Clayey Sand, SC
BH-6	3.0-6.0	3.0-6.0m; Soft, Fat Clay, CH
	9.0-10.5	9.0-10.5m; Soft, Fat Clay, CH
BH-7	6.0-7.5	6.0-7.5m; Very Soft, Fat Clay, CH
BH-8	6.0-7.5	6.0-7.5m; Loose, Clayey Sand, SC
BH-11	1.5-6.0	1.5-6.0m; Very Loose to Loose, Clayey Sand, SC
	10.5-12.0	10.5-12.0m; Loose, Poorly Graded Sand, SP
BH-12	0.0-6.0	0.0-6.0m; Very Loose to Loose, Clayey Sand, SC
BH-13	0.0-1.5	0.0-1.5m; Loose, Poorly Graded Sand, SP
	4.5-6.0	4.5-6.0m; Loose, Poorly Graded Sand, SP
BH-14	4.5-7.5	4.5-7.5m; Loose, Silt, ML

(b) Firm Zone – this zone is confined mainly at the upper to middle soil layers with N-values between 10 to 40 blows/ft for sands and between 4 -15 blows/ft for plastic silts and clays. The vertical extent and type of material is tabulated as follows:

Borehole Number	Thickness (meter)	Type and Condition of Materials
BH-1	0.0-15.0	0.0-12.0m; Medium Dense, Poorly Graded Sand, SP
		12.0-15.0m; Dense, Clayey Gravel, GC
	16.5-21.0	16.5-21.0m; Dense, Clayey Gravel, GC
BH-2	0.0-13.5	0.0-9.0m; Medium Dense to Dense, Poorly Graded Sand, SP
		9.0-13.5m; Dense, Clayey Sand, SC
	16.5-19.5	16.5-19.5m; Dense, Clayey Sand, SC
	28.5-31.5	28.5-31.5m; Dense, Clayey Gravel, GC
BH-3	1.5-9.0	1.5-3.0m; Loose, Clayey Sand, SC
		3.0-4.5m; Soft, Fat Clay, CH
		4.5-6.0m; Medium Dense, Clayey Sand, SC
		6.0-9.0m; Medium Dense, Poorly Graded Sand, SP
	15.0-16.5	15.0-16.5m; Dense, Clayey Sand, SC

	19.5-21.0	19.5-21.0m; Dense, Clayey Sand, SC
	25.5-30.0	25.5-30.0m; Dense to Very Dense, Clayey Gravel, GC
BH-4	0.0-3.0	0.0-3.0m; Dense, Poorly Graded Sand, SP
	4.5-9.0	4.5-6.0m; Medium Dense, Clayey Sand, SC
		6.0-9.0m; Dense, Poorly Graded Sand, SP
	15.0-16.5	15.0-16.5m; Dense, Clayey Sand, SC
	19.5-21.0	19.5-21.0m; Dense, Clayey Sand, SC
	25.5-27.0	25.5-27.0m; Dense, Clayey Gravel, GC
BH-5	0.0-7.5	0.0-7.5m; Medium Dense to Dense, Poorly Graded Sand, SP
	9.0-10.5	9.0-10.5m; Dense, Clayey Gravel, GC
	13.5-16.5	13.5-16.5m; Medium Dense to Dense, Poorly Graded Sand, SP
	19.5-21.0	19.5-21.0m; Dense, Clayey Sand, SC
	27.0-30.0	27.0-30.0m; Dense, Clayey Gravel, GC
BH-6	0.0-3.0	0.0-3.0m; Medium Dense, Poorly Graded Sand, SP
	6.0-9.0	6.0-7.5m; Medium Stiff, Fat Clay, CH
		7.5-9.0m; Medium Dense, Poorly Graded Sand, SP
	15.0-16.5	15.0-16.5m; Dense, Clayey Sand, SC
BH-7	0.0-6.0	0.0-1.5m; Medium Dense, Clayey Sand, SC
		1.5-3.0m; Medium Dense, Poorly Graded Sand, SP
		3.0-6.0m; Medium Dense, Clayey Sand, SC
	13.5-15.0	13.5-15.0m; Medium Dense, Clayey Sand, SC
	21.0-24.0	21.0-24.0m; Dense, Clayey Sand, SC
BH-8	0.0-6.0	0.0-6.0m; Medium Dense, Poorly Graded Sand, SP
	10.5-13.5	10.5-13.5m; Dense, Clayey Sand, SC
	15.0-16.5	15.0-16.5m; Dense, Clayey Sand, SC
	18.0-22.5	18.0-22.5m; Dense, Clayey Sand, SC
BH-9	0.0-6.0	0.0-1.5m; Medium Dense, Clayey Sand, SC
		1.5-4.5m; Soft to Medium Stiff, Fat Clay, CH
		4.5-6.0m; Dense, Poorly Graded Sand, SP
	9.0-10.5	9.0-10.5m; Dense, Clayey Sand, SC
	13.5-16.5	13.5-15.0m; Dense, Clayey Sand, SC
		15.0-16.5m; Dense, Poorly Graded Sand, SP
	21.0-22.5	21.0-22.5m; Dense, Clayey Sand, SC
BH-10	0.0-7.5	0.0-6.0m; Loose to Medium Dense, Clayey Sand, SC
		6.0-7.5m; Dense, Poorly Graded Sand, SP
	12.0-15.0	12.0-15.0m; Medium Dense to Dense, Poorly Graded Sand, SP
BH-11	0.0-1.5	0.0-1.5m; Loose, Clayey Sand, SC
	9.0-10.5	9.0-10.5m; Dense, Clayey Sand, SC
	12.0-13.5	12.0-13.5m; Medium Dense, Poorly Graded Sand, SP
	15.0-16.5	15.0-16.5m; Dense, Poorly Graded Sand, SP
	27.0-28.5	27.0-28.5m; Dense, Poorly Graded Sand, SP
BH-12	6.0-9.0	6.0-9.0m; Dense, Poorly Graded Sand, SP
	12.0-13.5	12.0-13.5m; Dense, Poorly Graded Sand, SP
	18.0-19.5	18.0-19.5m; Dense, Poorly Graded Sand, SP
	21.0-22.5	21.0-22.5m; Dense, Poorly Graded Sand, SP
BH-13	1.5-4.5	1.5-4.5m; Medium Dense, Poorly Graded Sand, SP
	6.0-9.0	6.0-9.0m; Dense, Poorly Graded Sand, SP

	12.0-16.5	12.0-15.0m; Medium Dense, Clayey Sand, SC
		15.0-16.5m; Medium Dense, Poorly Graded Sand, SP
BH-14	0.0-4.5	0.0-4.5m; Medium Dense, Clayey Sand, SC
	7.5-9.0	7.5-9.0m; Dense, Poorly Graded Sand, SP
	10.5-15.0	10.5-15.0m; Medium Dense to Dense, Poorly Graded Sand, SP

(c) Hard/Compacted Zone – this zone is located beyond the bottom level of the firm zone. Nvalues fell over 40 blows/ft for sand and 30 blows/ft for silts and clays. No hard zones were observed for the boreholes drilled. The vertical extent and type of material is tabulated as follows:

Borehole Number	Thickness (meter)	Type and Condition of Materials
BH-1	21.0-35.0	21.0-35.0m; Dense to Very Dense, Clayey Gravel, GC
BH-2	13.5-16.5	13.5-16.5m; Very Dense, Clayey Gravel, GC
	19.5-28.5	19.5-28.5m; Dense to Very Dense, Clayey Gravel, GC
	31.5-35.0	31.5-35.0m; Dense to Very Dense, Clayey Gravel, GC
BH-3	0.0-1.5	0.0-1.5m; Dense, Clayey Gravel, GC
	9.0-15.0	9.0-15.0m; Dense to Very Dense, Clayey Gravel, GC
	16.5-19.5	16.5-19.5m; Very Dense, Clayey Gravel, GC
	21.0-25.5	21.0-25.5m; Very Dense, Clayey Gravel, GC
	30.0-35.5	30.0-35.0m; Very Dense, Clayey Gravel, GC
BH-4	9.0-15.0	9.0-15.0m; Dense to Very Dense, Clayey Gravel, GC
	16.5-19.5	16.5-19.5m; Very Dense, Clayey Gravel, GC
	21.0-25.5	21.0-25.5m; Very Dense, Clayey Gravel, GC
	27.0-35.0	27.0-35.0m; Dense to Very Dense, Clayey Gravel, GC
BH-5	7.5-9.0	7.5-9.0m; Dense, Clayey Gravel, GC
	10.5-13.5	10.5-13.5m; Very Dense, Clayey Gravel, GC
	16.5-19.5	16.5-19.5m; Very Dense, Clayey Gravel, GC
	21.0-27.0	21.0-27.0m; Dense to Very Dense, Clayey Gravel, GC
	30.0-35.0	30.0-35.0m; Very Dense, Clayey Gravel, GC
BH-6	10.5-15.0	10.5-15.0m; Dense, Clayey Sand, SC
	16.5-34.5	16.5-34.5m; Dense to Very Dense, Clayey Gravel, GC
BH-7	7.5-13.5	7.5-13.5m; Dense to Very Dense, Clayey Gravel, GC
	15.0-21.0	15.0-21.0m; Dense to Very Dense, Clayey Gravel, GC
	24.0-35.0	24.0-35.0m; Dense to Very Dense, Clayey Gravel, GC
BH-8	7.5-10.5	7.5-10.5m; Very Dense, Clayey Gravel, GC
	13.5-15.0	13.5-15.0m; Dense, Clayey Gravel, GC
	16.5-18.0	16.5-18.0m; Very Dense, Clayey Gravel, GC
	22.5-35.0	22.5-35.0m; Very Dense, Clayey Gravel, GC
BH-9	6.0-9.0	6.0-9.0m; Dense to Very Dense, Clayey Gravel, GC
	10.5-13.5	10.5-13.5m; Dense to Very Dense, Clayey Gravel, GC
	16.5-21.0	16.5-21.0m; Dense to Very Dense, Clayey Gravel, GC
	22.5-35.0	22.5-35.0m; Very Dense, Clayey Gravel, GC
BH-10	7.5-12.0	7.5-12.0m; Dense to Very Dense, Poorly Graded Sand, SP
	15.0-35.0	15.0-35.0m; Very Dense, Poorly Graded Sand, SP
BH-11	6.0-9.0	6.0-9.0m; Dense to Very Dense, Poorly Graded Sand, SP
	13.5-15.0	13.5-15.0m; Dense, Poorly Graded Sand, SP
	16.5-27.0	16.5-27.0m; Very Dense, Poorly Graded Sand, SP

	28.5-35.0	28.5-35.0m; Dense to Very Dense, Poorly Graded Sand, SP
BH-12	9.0-12.0	9.0-12.0m; Very Dense, Poorly Graded Sand, SP
	13.5-18.0	13.5-18.0m; Very Dense, Poorly Graded Sand, SP
	19.5-21.0	19.5-21.0m; Very Dense, Poorly Graded Sand, SP
	22.5-35.0	22.5-35.0m; Very Dense, Poorly Graded Sand, SP
BH-13	9.0-12.0	9.0-12.0m; Dense, Poorly Graded Sand, SP
	16.5-35.0	16.5-35.0m; Dense to Very Dense, Poorly Graded Sand, SP
BH-14	9.0-10.5	9.0-10.5m; Very Dense, Poorly Graded Sand, SP
	15.0-35.0	15.0-35.0m; Very Dense, Poorly Graded Sand, SP

The following figure shows the Standard Penetration Test Index of BH-1 to BH-14.

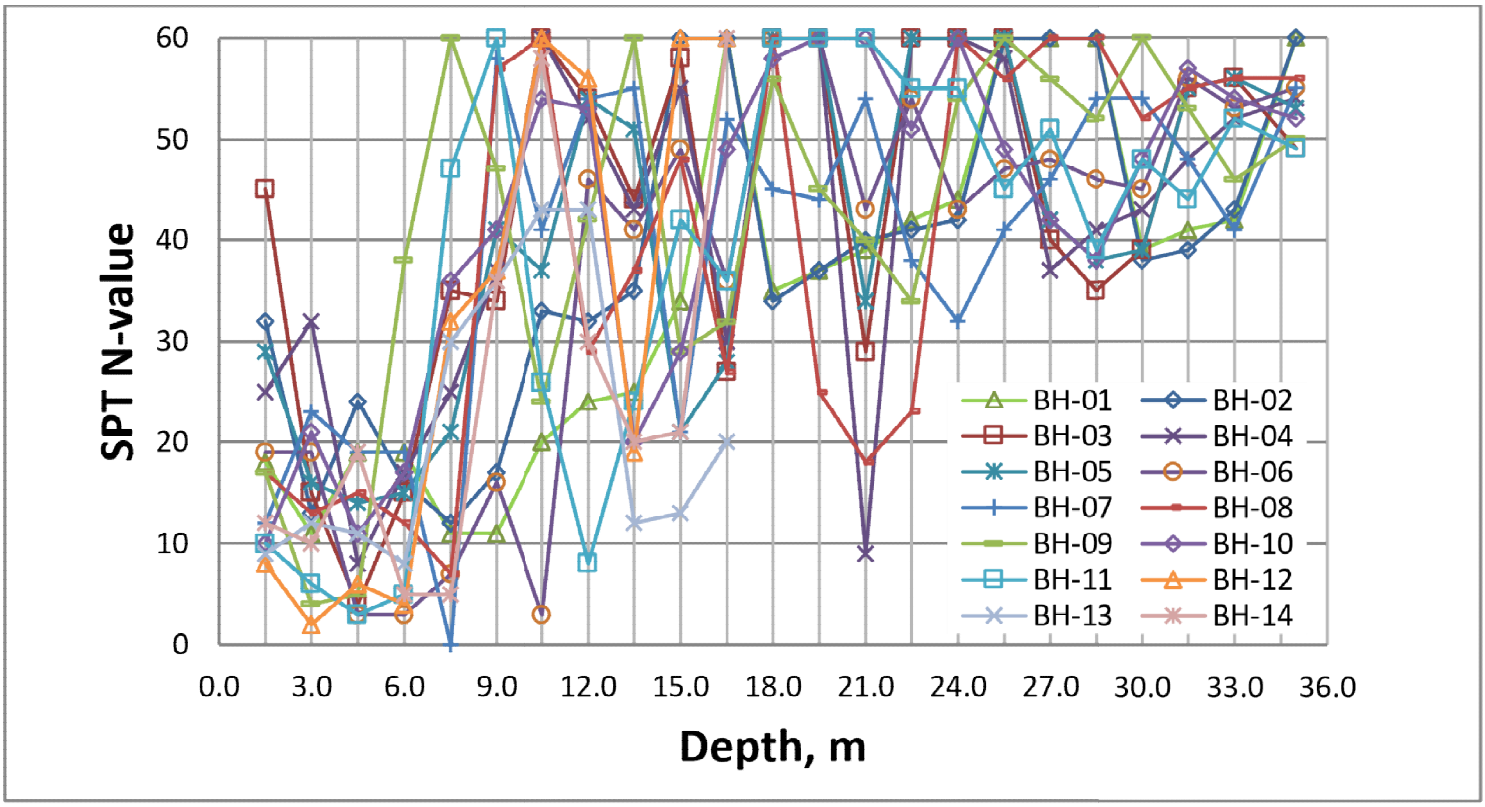


Figure 1: Standard Penetration Test

Static water level has been encountered at an average of -3.36m depth within the area at the time of observation.

The following design properties are correlated based on the soil classification and SPT N-Values.

Borehole Location	Average SPT N-value	USCS	Unit Weight, (KN/m3)	Cohesion, c (kPa)	Angle of Internal Friction	Ground Water Level (m)
BH-1	11	SP	15.40	0	31	4.0
BH-2	13	SP	15.59	0	32	3.9
BH-3	4	CH	17.28	10	17	2.4
BH-4	8	SC	15.21	0	29	3.2
BH-5	14	SP	15.69	0	32	4.0
BH-6	3	CH	15.71	10	17	3.6

BH-7	2	CH	15.71	10	17	2.7
BH-8	7	SC	15.11	0	29	2.5
BH-9	4	CH	17.28	10	17	2.8
BH-10	10	SC	15.4	0	30	3.8
BH-11	3	SC	14.92	0	28	3.7
BH-12	2	SC	14.92	0	28	3.5
BH-13	8	SP	15.21	0	29	3.4
BH-14	5	ML	14.92	0	28	3.6

General Assessment of the Subsoil
Since the results of the subsoil tests give results which rest majority on firm and hard stratum, the proposed foundation system is recommended to be standing on shallow foundations provided that the allowable bearing capacities presented are not exceeded by the actual loads of the proposed structure.

With the ground water table level encountered at an average of 3.36m depth from the ground surface, and with the soil mass having a general firm and hard zone of medium dense to very dense poorly graded sand, and dense to very dense clayey gravel, the project site is generally not susceptible to liquefaction in the event of strong earthquakes except for BH-11, BH-12, and BH-14 area. For these specific zones, ground improvement is recommended to reduce liquefaction potential.

Borehole	Liquefiable Zone (m)	Description
BH-11	0.0-6.0	Very Loose to Loose, Clayey Sand
BH-12	0.0-6.0	Very Loose to Loose, Clayey Sand
BH-14	4.5-7.5	Saturated, Loose, Silt

Settlement analysis is not critical for this site since it is generally not underlain by a significant thickness of soft clay material based on the soil profile, except at BH-6, BH-7, and BH-9 area at the following depths.

Borehole	Soft Clay Zones (m)	Description
BH-6	3.0-6.0	Soft, Fat Clay
BH-7	6.0-7.5	Very Soft, Fat Clay
BH-9	1.5-4.5	Soft, Fat Clay

Deep foundations are recommended to be embedded at the corresponding depth as checked against the required pile capacities.

2.1.4 Terrestrial Biology

The project area is not situated in an ecologically critical area like national parks in Capas, Tarlac (Capas Death March Monument) and Arayat & Magalang, Pampanga (Mt. Arayat). Land use of the entire property is an open/cultivated land. No quadrats sampling was done in the sampling sites for reason that most of the open areas are formerly cultivated areas previously planted with sugarcane and some small portion of the site are still presently planted with sugarcane at the time of the field investigation. Observations conducted in the project sites showed uniform occurrence of plant species.

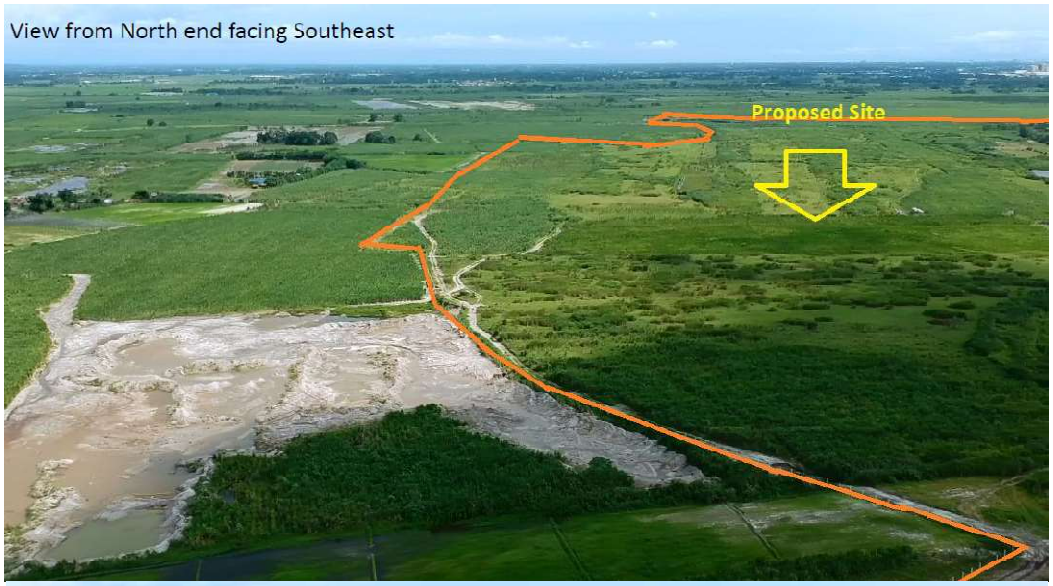
Flora
Based on ocular inspection, sugarcane is the dominant species. The weeds species encountered in the sugarcane plantation are mostly Talahib or *Saccharum spontaneum*, *Imperata cylindrical*, *Themeda* sp., *Paspalum conjugatum*, Carabao grass (*Axonopus compressus*), *Ageratum conyzoides*, *Eleusine indica*, cogon, napier, herbs/ shrubs (such as Hagonoi and Coronitas) and *Datura metel*. Some "pioneering" trees such as Ipil-ipil and Datiles (in solitary distribution) are forming a new

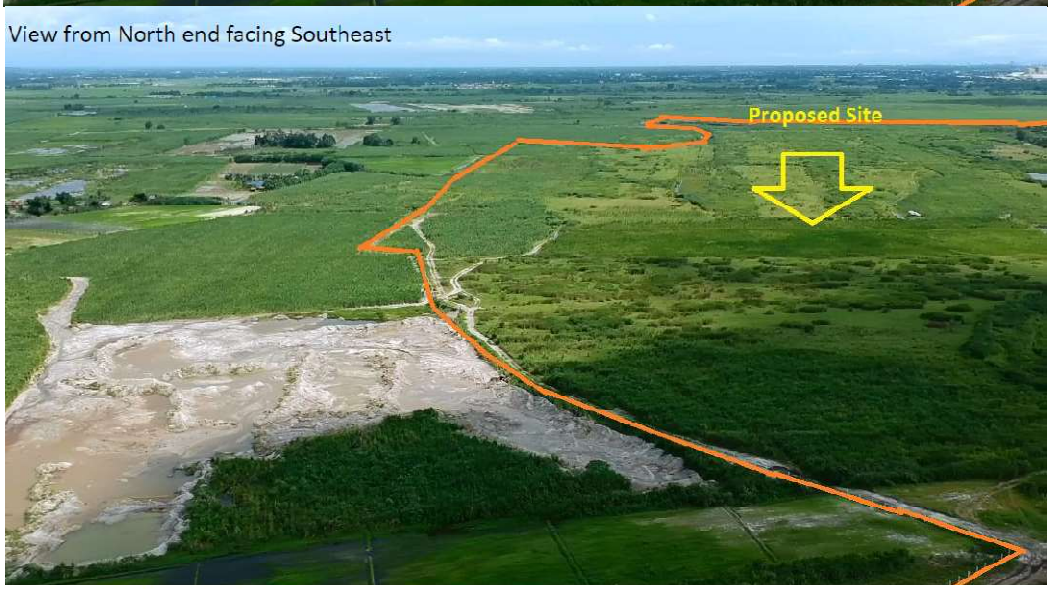
ecological succession in the area. The "without the project scenario" or no physical intervention in the existing environment, such area could form into a new ecosystem in the long term. This can be said a brushland ecosystem dominated with pioneering trees and grasses.

Floral species surveyed inside the sugarcane plantation can also be used as wood materials, food and medicine ingredients and ecological balance. Majority of the observed species are very common and widely distributed in the country. The species take the habit form of trees, shrubs, herbs, and grasses. No rare, endangered and threatened species of flora were observed or recorded in these lahar areas.

Fauna
During the site investigation, a frog (*Bufus marinus*) has been observed. Few small rodents were also seen crossing the fields. Red ants especially *Aphis maydis* were observed colonizing a few broad leaf species found among the open grassy area. No critical species of fauna were found that will be impacted by the proposed project. All are ecologically important but common and widely distributed in the country.

Provided below are the photographs of the project site showing the current environmental condition and setting.





View from North end facing Southwest

Plate 1.4.1: Photographs of the Project Site

2.2 WATER

2.2.1 Hydrology

The hydrological characteristics of the area are defined by the Pampanga River Basin (Figure 3.2.1). The Pampanga River basin system is the fourth largest basin in the Philippines with an aggregate area of 10,434 square kilometer. It is broadly divided into three (3) sub-basins namely: Pampanga Main River basin, Pasac River basin (or alternatively known as the Pasac-Guagua Allied river basin) and the Angat River basin. The headwaters of these three basins originate from different mountain areas with separate river channels draining into the Manila Bay.

Pampanga River

The Pampanga River has a channel length of around 265 km, originating in the Caraballo Mountains north of the basin, and flows into Pantabangan Dam. From the dam it further flows southward meeting with several tributaries until emptying into Manila Bay. The river's main tributaries are the Rio Chico River from the northwest side and the Coronel-Santor and Peñaranda Rivers on the eastern side of the basin.

Pasac-Guagua River

The Pasac-Guagua River system includes various channels draining on the eastern slope of Mt. Pinatubo, such as the Abacan-San Fernando, Pasig-Potrero and Porac-Gumain Rivers, which all flow into Manila Bay. In the lower reaches, the river system is connected with Main Pampanga River by the Bebe-San Esteban Cut-off Channel.

Angat River

The Angat River system originates in the Sierra Madre Mountains and flows into the Angat storage dam. From the dam the river flows westward and finally empties into the Manila Bay through Labangan Floodway. The Angat River joins the Pampanga River at Calumpit, Bulacan via a connecting waterway, the Bagbag River. Southeast of the Pampanga River is the Candaba Swamp, which covers an area of some 250 square kilometers. The Candaba Swamp absorbs most of the flood flows from the western slopes portion of the Sierra Madre and the overflows of the Pampanga River via the Cabiao Floodway. This area is submerged during the rainy season but is relatively dry during summer.

Sacobia-Bamban River

The Sacobia-Bamban River is a major river system of Pampanga whose channels were affected by the deposition of lahar during and after the 1991 eruption of Mt. Pinatubo. The project site is approximately 350 meters south of Sacobia-Bamban River. Sacobia-Bamban River is one of the tributaries that drains to the Pampanga River.

Flooding

Flood is the abnormal rising and overflowing of a body of water. It usually results from high precipitation caused by excessive and continuous downpour brought about by typhoons or monsoon rains. Factors that affect the vulnerability of an area to flooding are surface geology, topography, amount and duration of rainfall, vegetation and land cover.

Figure 3.2-3 presents the Flood Susceptibility Map of Region 3 prepared by the Mines and Geosciences Bureau (MGB) which classifies susceptibility to flooding as follows:

- Areas with Low Susceptibility to Flooding experience floods with heights of less than or equal to 0.5 meter. Areas with Moderate Susceptibility to Flooding attain flood heights from 0.5 to one (1) meter. This condition is attained during prolonged and extensive heavy rainfall or extreme weather occurrences.
- Areas with High Susceptibility to Flooding attain flood heights which exceed one (1) meter. These areas area is usually flooded for several hours during heavy rains. These include topographic lows such as active river channels, abandoned river channels and areas along river banks.

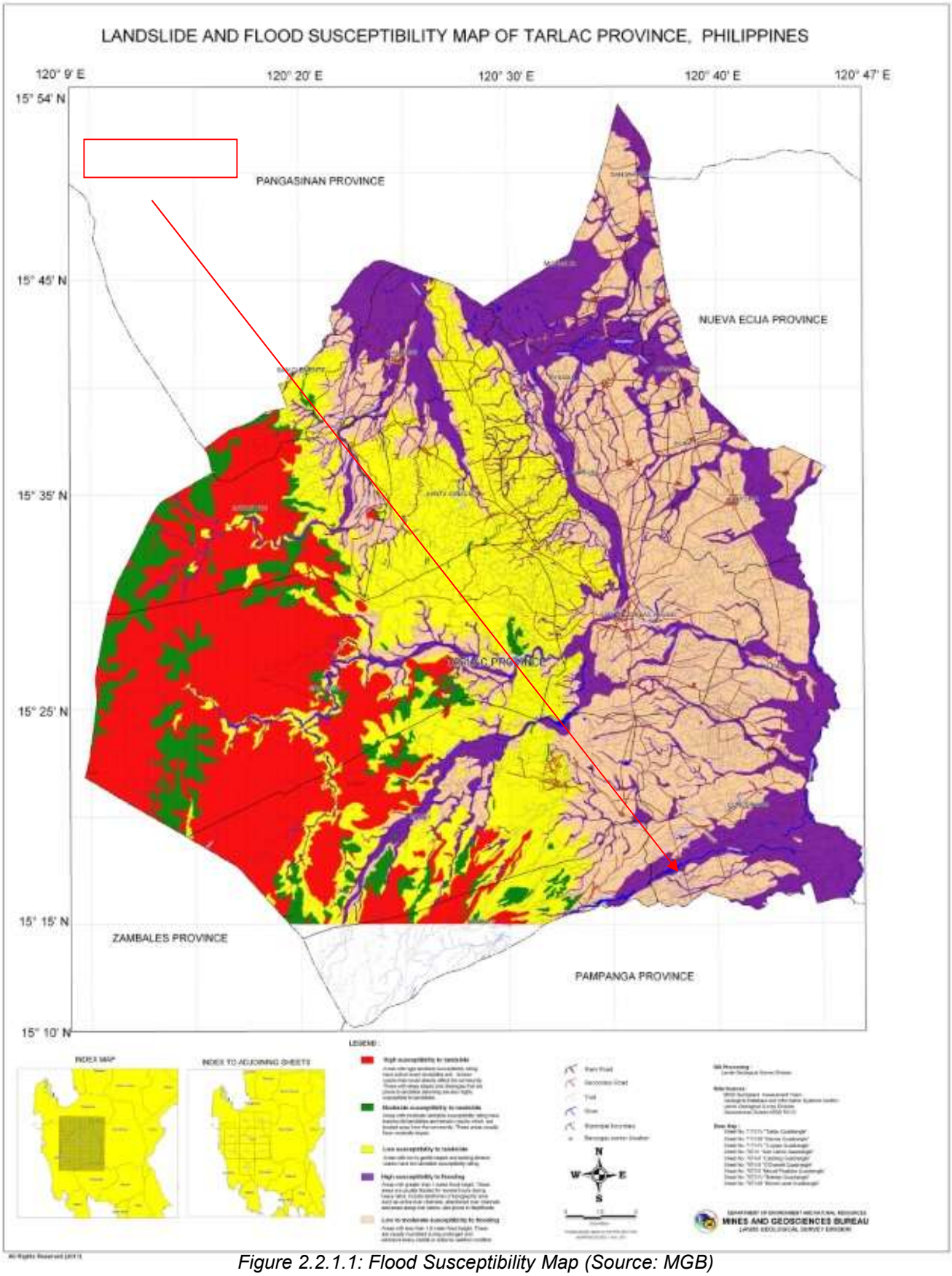


Figure 2.2.1.1: Flood Susceptibility Map (Source: MGB)

The proposed project site is not prone to flooding. The project site is approximately 350 meters south of Sacobia-Bamban River where its elevation is above the said river. Moreover, the Plant has a well-designed drainage system which can accommodate the highest peak of rainfall data. Runoff is confined within plant facility with the runoff directed to the drainage system of the Plant.

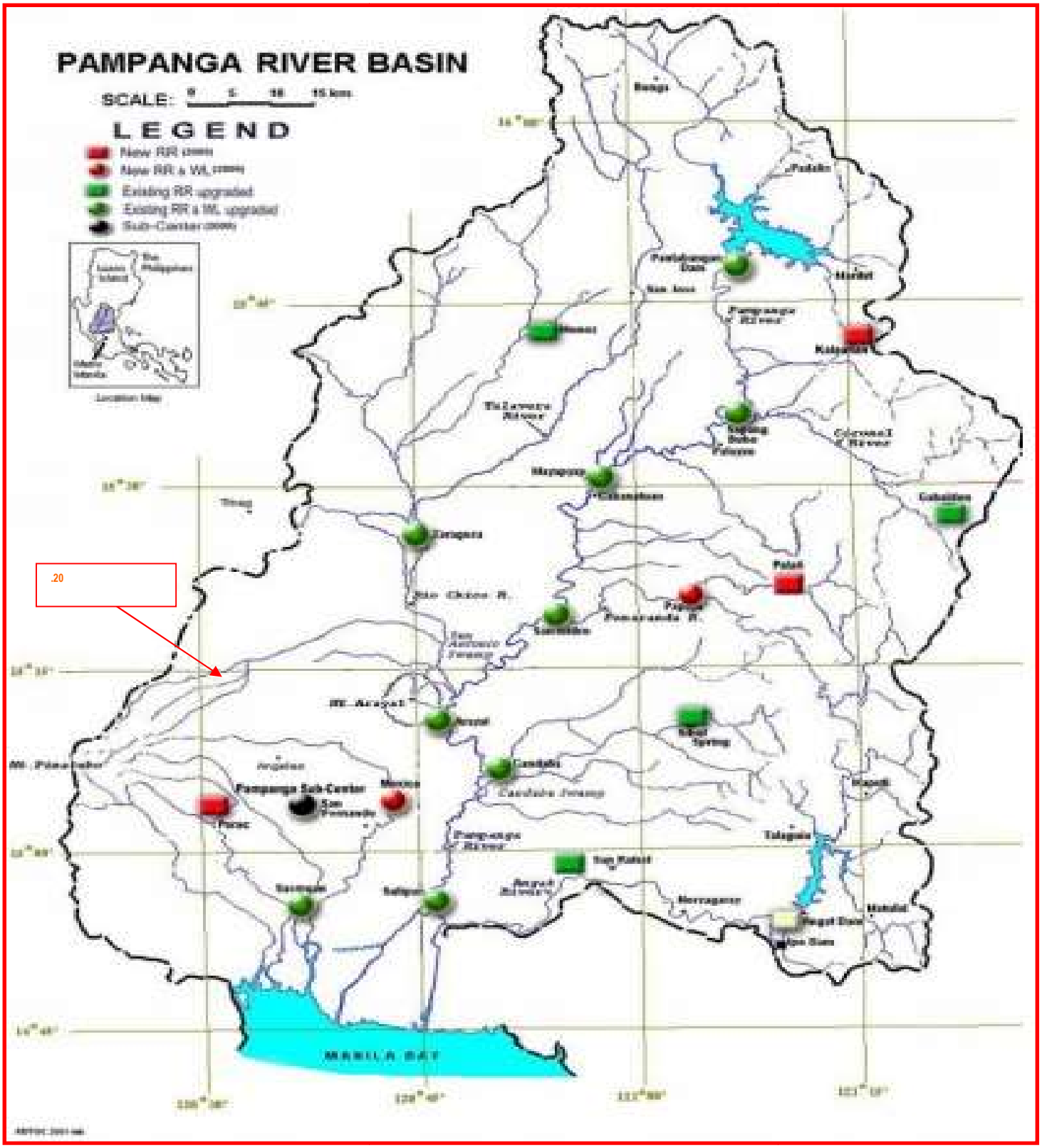


Figure 2.2.1.2: Pampanga River Basin Map (Source: PRFFWC, 2013)

The Sacobia-Bamban River have no historical streamflow records. A basin-factor ratio method was used to estimate the mean monthly flow of the aforementioned river. The Sacobia - Bamban River was estimated using the data from Parua River at San Nicolas, Bamban, Tarlac to determine their mean monthly flow. The highest mean monthly flow computed of Sacobia-Bamban river is 12.75 m3/sec (October).[1] The results of the basin-factor ratio method are shown in Table 2.2.1.1.

Table 2.2.1.1: Sacobia-Bamban River Mean Monthly Flow

Month	Flow (m^3/s)
January	4.79
February	2.68
March	2.97
April	2.89
May	3.82
June	3.86
July	8.30
August	10.35
September	9.70
October	12.75
November	10.80
December	3.58

Source: EIS for Third Sewerage Project, Manila Water Company

2.2.2 Hydrogeology

Based on the Groundwater Map of Tarlac shown in Figure 2.2.2.1, the project site in a shallow well area which is in accordance with the 1997 Groundwater Availability Map of the Philippines showing that the Project Site falls under local and less productive aquifers which are shown in Figure 2.2.2.2. This classification is attributed to the low-level wells in the area. The classification is attributed to the scarcity of productive wells in the area. The groundwater occurs under unconfined conditions within the interstices of consolidated pyroclastics and tuffaceuous sedimentary rocks. The water table occurs at the estimated depth range of 6 m near and within valleys and flat areas to 15 m at the lower and middle slopes. The thickness of the aquifer is not known. The aquifer in these segments is tapped by shallow wells which are pumped manually or with the aid of low capacity centrifugal pumps.

[1] EIS for Third Sewerage Project, Manila Water Company

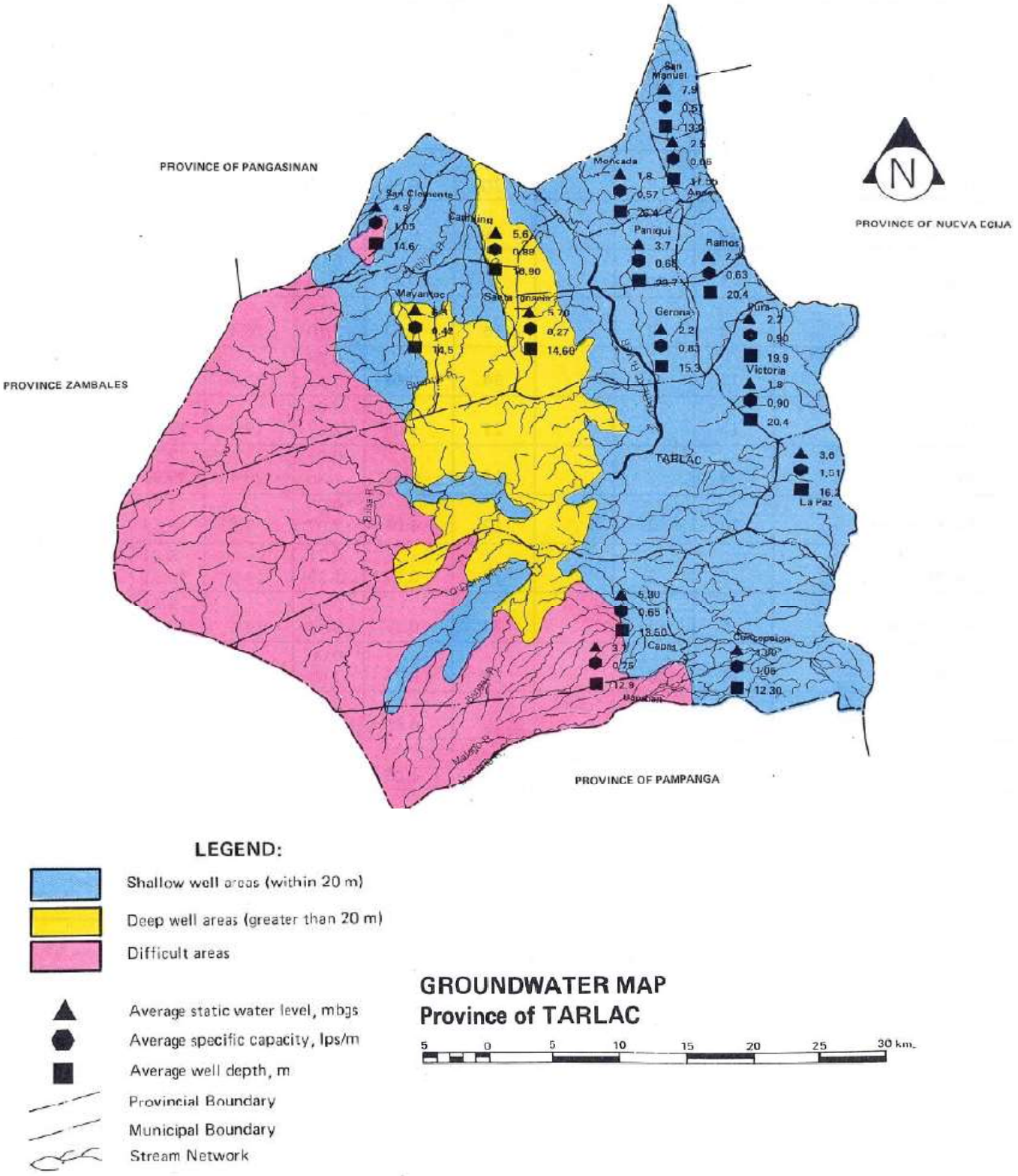


Figure 2.2.2.1: Groundwater Map of Tarlac

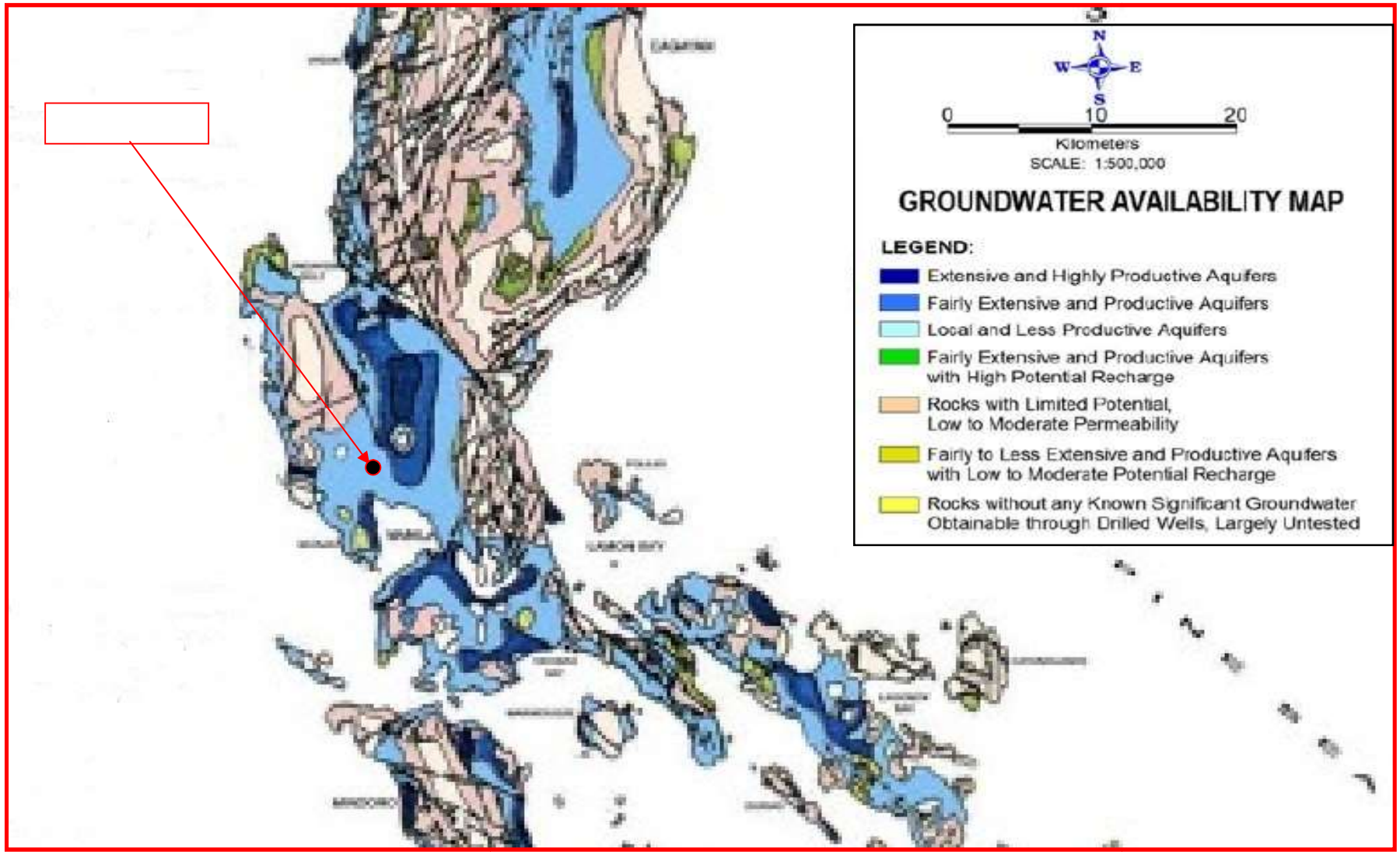


Figure 2.2.2.2: Groundwater Availability Map

2.2.3 Impact Identification, Prediction and Assessment, and Mitigation

2.2.3.1 Change in Drainage Morphology/Inducement of Flooding/Reduction in stream volumetric flow

Pre-Construction and Construction Phase
The construction of the proposed project, specifically during site preparation, land clearing, excavation and earthworks may potentially induced flooding and cause inundation due to sediment run-off, siltation and drainage overflow. The primary culprit will be the improper handling, storage, and hauling of stockpiles of excavated materials/spoils.

A proper drainage system for the project based on the detailed engineering design will be installed in order to address the issue on flooding. Minimizing the removal of vegetation and alternation of topography during construction would alleviate the problem as this would preserve the natural drainage system of the area.

Operation Phase
The frequency of typhoons as well as the slope and drainage characteristics of the areas where the proposed project is to be located is susceptible to flooding and inundation. This will affect the operation activities due to drainage overflows, surface run-off and siltation. This will be eliminated with the proper drainage design though the detailed engineering design study for the project. However, in case of extreme events (strong typhoon, extreme flooding), operation schedules may be affected. The operation of the plant may be disrupted and cancelled. As such, necessary adjustments are to be taken. It is significant that the project will regularly monitor weather bulletins issued by PAGASA and get their advice on necessary actions.

2.2.3.2 Change in Stream, lake water depth

The proposed project will not bring about a change in stream depth during construction and operations phases.

2.2.3.3 Depletion of Water Resources/Competition in Water Use

Pre-Construction and Construction Phase
The major water requirement during construction is the concreting works. Concreting of buildings, roads, and other necessary structures will bring about increase in water consumption. The amount of water will depend on the size of the structure that will require concreting. However, the project concrete requirement will be provided by a batching plant contractor near the area. Therefore, water requirement of the project will be minimal as the water will only be use for cleaning the entire project site during and after concrete pouring domestic water use for the workers.

Operation Phase
Domestic water is the main uses of water in the project area with ground water as the main source. Domestic water supply in Concepcion Tarlac is provided for by Concepcion Water District. As of December 31, 2016, the District was serving 30 barangays of Concepcion with water delivered to every household 24 hours a day, without interruption. The water supply system of the District is supported by 11 pumping stations, which are strategically located and serving a total of 12,784 active concessionaires classified as residential, domestic, commercial, and industrial.

Water Usage and Water Source. The project will require about 60 m3/hr make up water system; 576 m3/hr fire protection water system; 1200 m3/hr for indirect cooling water system; and 1700 m3/hr direct cooling water system. A deepwell will be drilled to a depth of 50 to 90 meters and designed not to extract water from the shallow aquifers that are utilized by the surrounding communities. A permit from the NWRB will be secured.

Circulating Wastewater Treatment Plant. The project will invest extensively in the water treatment system that aims to recirculate all process water. Zero wastewater discharge is envisaged.

Water Catchment Pond. A water catchment pond will be constructed by the project to collect rain water to minimize usage of potable water in the cooling system. The collecting pond has a volume of 35,000 m3. Its main purpose is to provide make up water for the evaporation losses within the plant operation. The storm drainage is connected to the water catchment pond for storing rainwater.

Steel Asia is already practicing a water catchment pond system in their existing steel mill plants e.g. Davao Plant. With the use of circulating wastewater treatment plant and water catchment pond, depletion of wastewater resources and competition with its use is not expected as a result of the project.

2.2.4 Water Quality

2.2.4.1 Water Sample Collection

Primary data gathering was conducted to assess the baseline water quality of the water bodies within the project site. Samples were collected in each sampling station for freshwater water quality and groundwater sampling monitoring. The collected samples were subjected to physical, chemical, microbiological, nutrient and heavy metal analyses. Water samples were preserved in iced boxes prior to transport to the laboratory facility for analysis.

Table 2.2.4.1.1: Water Quality Parameters and Corresponding Methods of Analysis

Parameters	Method of Analysis
pH	Electrometric
Total Suspended Solids (**TSS**)	Gravimetric
Oil & Grease	Petroleum Ether Extraction
Biochemical Oxygen Demand (**BOD_5**)	Azide Modification (Dilution Technique)
Chemical Oxygen Demand (**COD**)	5220 B. Modified Open reflux Dichromate
Dissolved Oxygen (**DO**)	Dissolved Oxygen Meter
Temperature	Alcohol-filled Thermometer
Lead	Flame AAS-EPA Method 7420
Mercury	Flame AAS-EPA Method 7420
Cadmium	Flame AAS-EPA Method 7130
Chromium Hexavalent	Diphenylcarbazide-SM Method 3500CrB
Copper	Flame AAS-EPA Method 7210
Arsenic	Colorimetry- SDDC SM Method 3500
Fecal Coliform	Multiple tube Fermentation – Method 9221B&E
Total Coliform	Multiple tube Fermentation – Method 9221B&E

Source: DAO 12 Series of 2016, Approved Methods of Analysis

2.2.4.2 Water Quality Sampling Stations

Groundwater and freshwater sampling were conducted on October 27, 2017 to assess the physico-chemical property of the water around the project site. Four (4) groundwater and two (2) freshwater sampling stations were established to characterized water quality in the area.

The groundwater samples were collected after sufficient purging of wells. The samples for the analysis of microbes were collected into sterilized small glass bottles and wrapped with aluminum foil. The samples for the analyses of organics were collected into amber glass bottle. The samples for the analysis of other parameters were collected into Polyethylene Terephthalate (PET) bottles. The collected groundwater samples were labeled, stored in ice-chest and submitted to AERONICS, Inc., a DENR recognized laboratory.

The station identification, description and geographical coordinates of the sampling site is provided in the table below is the water quality sampling map.

Table 2.2.4.2.1 Location of Groundwater and Freshwater Sampling Station

Station	Description	UTM Coordinates	
		Easting, (m)	Northing, (m)
GW-1	Hand pump tube well in Barangay San Francisco	244054.09	1691406.32
GW-2	Hand pump tube well in Barangay Telabanca	246276.65	1690546.21
GW-3	Hand pump tube well in Barangay San Nicolas Balas	246972.92	1690820.96
GW-4	Hand pump tube well in Barangay San Vicente	247109.30	1692387.75
SW-1	Surface Water Downstream of Sacobia-Bamban River	246525.76	1692290.17
SW-2	Surface Water Upstream of Sacobia-Bamban River	243088.71	1690699.99

Source: Mediatrix, 2016

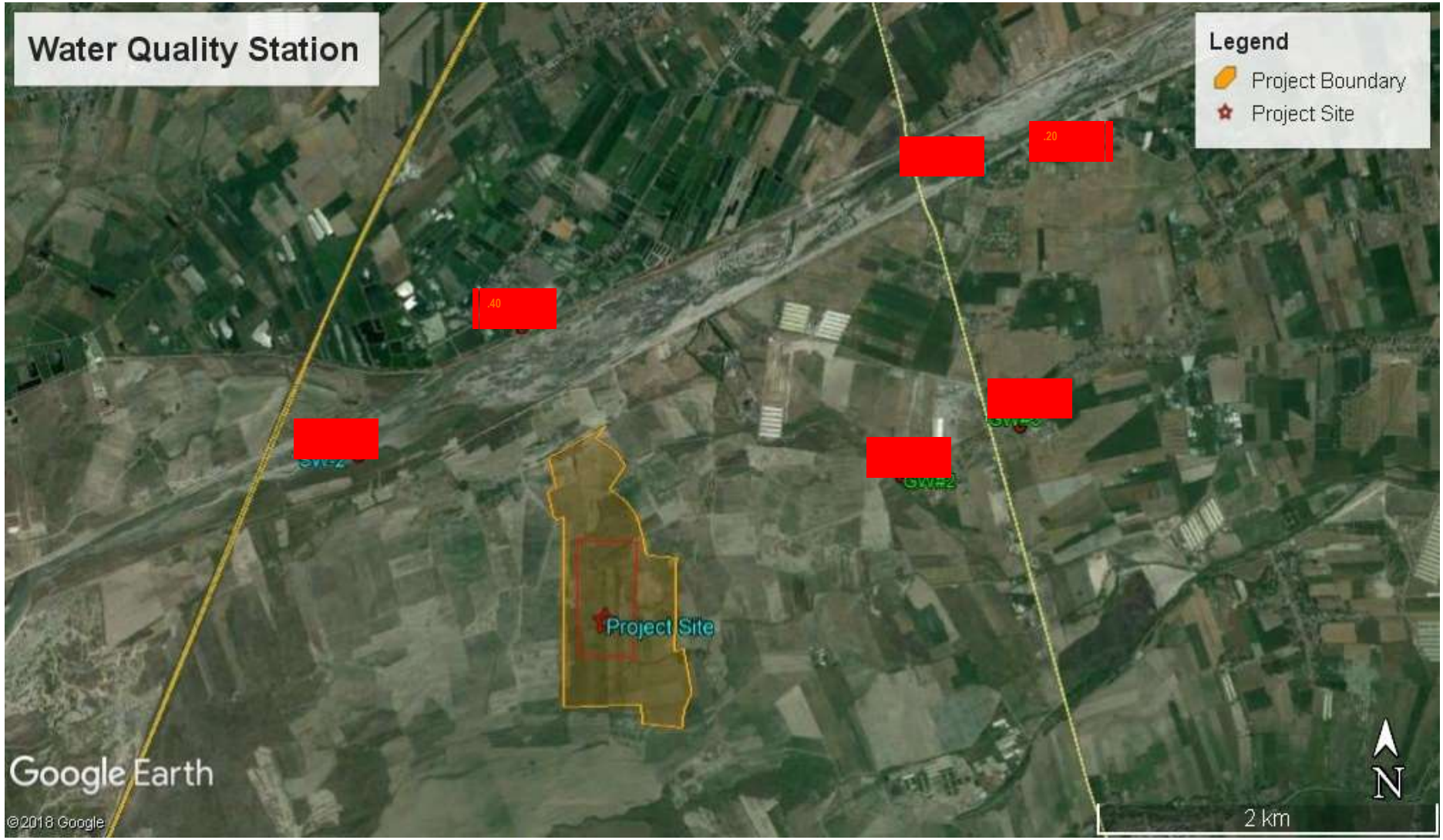


Figure 2.2.4.2.1: Location of Water Quality Monitoring Station

2.2.4.3 Water Quality Standards

The Department of Health (DOH) Administrative Order (DAO) No. 2017-0010 otherwise known as Philippine National Standards for Drinking Water (PNSDW) of 2017 establishes the criteria for drinking water quality was applied for groundwater quality while DAO 2016-08 Water Quality Guidelines (WQG) waters will be used for water sample collected in Sacobia-Bamban river. However, Sacobia-Bamban river is not yet classified, therefore standard use is for Class C water.

2.2.4.4 Results and Analysis

2.2.4.4.1 Groundwater

The depth of the wells ranges from 7m to 31m. The structures were built as early as 1960 to recent 2017. The usage varies from community drinking water supply and use for cooking, bathing, and watering in residential and commercial garden. As such, drinking water generally comes from the commercial "mineral" water or from the local water utility.

Collectively, there is a high 85% conformance of the nine sampling sites with 19 parameters covered by PNSDW and 24 parameters covered by DENR Class C guidelines. Out of 124 measurements, only 19 or 13% cases of varying non-conformance by water sample are attributed to metals. A summary of the results is presented in Table 3.2-4 for groundwater and Table 3.2-5 for surface water.

Table 2.2.4.4.1.1: Result of Groundwater Sampling Analysis

Parameters/Station	GW-1	GW-2	GW-3	GW-4	PNSDW 2017
Date and Time of Sampling	October 27, 2017	October 27, 2017	October 27, 2017	October 27, 2017	
pH	8	7.13	6.97	7.3	6.5-8.5
Chlorides	19.85	24.32	993	17.37	250
Nitrates	0.436	7.469	3.566	0.691	50
Sulfate	195.457	96.737	178.757	203.894	250
Cadmium	<0.003	<0.003	<0.003	<0.003	0.003
Chromium hexa	0.016	0.018	0.018	0.078	0.05
Iron	1.27	<0.004	0.2654	<0.004	1
Lead	0.0805	0.0805	0.0142	0.0805	0.01
Manganese	2.4577	<0.2	1.4967	3.9591	0.4
Mercury	0.009	<0.001	0.02	<0.001	0.001
Nickel	<0.004	0.0083	0.0315	0.017	0.07
Zinc	0.2364	<0.005	0.7017	0.006	5
Barium	<0.04	<0.04	<0.04	<0.04	0.70
Cyanide	0.0216	0.0211	0.0316	0.0296	0.05
Fluoride	0.36	0.20	0.16	0.094	1.5
Benzene	ND	ND	ND	ND	0.01
Toluene	ND	ND	ND	ND	0.7
Ethylbenzene	ND	ND	ND	ND	0.3
Xylene	ND	ND	ND	ND	0.5

Note: ND-below the method detection limit: Red color are the results that exceed the limit.

Table 2.2.4.4.1.2: Result of Surface Water Sampling Analysis

Parameters/Station	SW-1	SW-2	DENR Standard for Class C Waters
Date and Time of Sampling	October 27, 2017	October 27, 2017	
pH	7.6	7.8	6.5-8.5
TSS	35	35	<30 mg/L increase
Oil & Grease	3.74	4.75	2
COD	20	10	-
Chlorides	11.41	8.44	250
Nitrates	1.97	0.895	7
Phosphate	0.369	0.252	0.5

Parameters/Station	SW-1	SW-2	DENR Standard for Class C Waters
Date and Time of Sampling	October 27, 2017	October 27, 2017	
Sulfate	133	139	250
Ammonia	0.03	0.136	0.05
Cadmium	<0.003	<0.003	0.01
Chromium hexa	0.048	0.021	0.01
Iron	0.399	0.1318	1
Lead	0.0308	0.0474	0.01
Manganese	0.1615	<0.2	0.2
Mercury	<0.001	<0.001	0.001
Nickel	0.0604	0.0488	0.02
Zinc	<0.005	0.0164	2
Barium	<0.04	<0.04	0.7
Cyanide	0.0411	0.0415	0.07
Fluoride	0.29	0.20	1
Benzene	ND	ND	0.01
Toluene	ND	ND	0.7
Ethylbenzene	ND	ND	0.3
Xylene	ND	ND	0.5

Note: ND-below the method detection limit: Red color are the results that exceed the limit.

Assessment

The exceedances in heavy metals detected may have been brought about by the fertilizers used by the previous sugarcane plantation and some patches of small plantations in the area and the contamination from the application of septage/sludge in the lahar-affected areas. The analysis in groundwater indicated exceedances in Chromium, Lead, Manganese and Mercury while for surface water, exceedances are in Chromium, Lead, Nickel and oil and grease.

2.2.4.4.2 Degradation of Water Quality

The Project will not aggravate the existing water quality of the area. Wastewater generated during construction phase which include domestic wastewater will be managed through the provision of temporary toilets at the construction site to avoid seepage in groundwater or through freshwater bodies as surface runoff. The Project will provide wastewater management plan and should be strictly implemented. Monthly monitoring of quality of groundwater and fresh water shall be conducted. Storm runoff will be directed through the reservoir as well as the liquid waste from the domestic waste. During operations phase, contaminated rainwater in the maintenance area will be directed to the wastewater treatment plant for reuse in the process water.

2.2.4.5 Freshwater Ecology

River ecology assessment was conducted in three stations in the Sacobia River, the major surface water body nearest to the Steel Asia project site in Barangay Telabanca, Concepcion, and Tarlac and a fourth station in a water canal running through Barangay San Francisco on 20 August 2017. The Sacobia River is intensely smothered with lahar from the eruption of Mt. Pinatubo, and movement of lahar and volcanic particulates are still vividly occurring. The Barangay itself was overrun with lahar deposits at the time of the volcano's eruption, and with unproductive lands, most households have left the Barangay ever since.

Station 1 was positioned approximately downstream of the Sacobia River relative to the geographic position of Barangay Telabanca. Station 2 was located midstream while Station 3, is upstream of the proposed project site. Stations 2 and 3 are located in the southern riverbank while station 1, on the northern side in the opposite side of the river. According to a staff of the local government unit of Concepcion which guided the survey team, there are no other major river systems running contiguous to the impact area of the proposed steel mill in Barangay Telabanca. At the time of the survey, road building and embankment construction activities were being undertaken in all three sampling stations along the Sacobia River, and loose soil and sand from earth moving activities are spilling out into the river. Sampling station 4, considered as a "control station, was located in the Barangay next to Telabanca - San Francisco, in a roadside canal that was fed by fishpond water in Barangay Dungan and domestic wastewater from households along its course (Plate 1). A map of the sampling stations is shown in Figure 1; coordinates of the survey stations are listed in Table 2.2.4.5.1.

Table 2.2.4.5.1: Location of river ecology sampling stations in Barangay Telabanca and San Francisco, Concepcion, Tarlac; 20 August 2017

WP Code	LATITUDE	LONGITUDE	Remarks
RVR1	N 15.292917°	E 120.634000°	Downstream position along Sacobia River with Flow Velocity 0.51m/s ENE, Depth 65cm at sampling point. Turbid grayish water and substrate (lahar and mud). Actual riverbank width at 239m (from Google Earth).
RVR2	N 15.288194°	E 120.627056°	Midstream position along Sacobia River with Flow Velocity 0.96m/s ENE, Depth 46cm at sampling point. Turbid grayish water and substrate (lahar and mud). Actual riverbank width at 275m (from Google Earth).
RVR3	N 15.283425°	E 120.616383°	Upstream position along Sacobia River with Flow Velocity 1.23m/s ENE, Depth 48cm at sampling point. Turbid grayish water and substrate (lahar and mud). Actual riverbank width at 297m (from Google Earth).
RVR4	N 15.302556°	E 120.630194°	Canal proximal to fishponds in Brgy. San Francisco with Flow Velocity 0.80m/s NNE, Depth 95cm at sampling point. Turbid green-brown water and dark gray to black substrate. Actual width at 2.5m (actual measurement)

Plate 2.2.4.5.1: Sampling stations surveyed for river ecology in Barangay Telabanca and San Francisco, Concepcion, Tarlac on 20 August 2017. Upper left to right: stations 1 and 2; lower left to right: stations 3 and 4

Figure 2.2.4.5.1: Map showing location of river ecology sampling stations in Barangay Telabanca, Concepcion, Tarlac

1. Survey Methodology and Station Coordinates

2.1 Physical properties

Parameters describing the basic morphology of the river in four sampling stations were documented *in situ*. Among others, this included riparian width, riverbank vegetation, depth and river flow measurement.

2.2 Aquatic Biota - Plankton

Phytoplankton and zooplankton were collected at the sampling sites by filtering 1 liter samples into a composite sample (Plate 2). Thereafter, phytoplankton samples were filtered through a 20 µm mesh sieve; while zooplankton was filtered through a 33 µm mesh sieve. Phytoplankton samples were then fixed using Lugol's solution; zooplankton samples were fixed with 10% buffered formalin. Mophological characteristics were used as the basis for the identification of the different plankton species. Samples were brought to the UP MSI laboratory for counting and identification. Counting and identification of organisms was conducted using a Sedgwick-Rafter plate. For phytoplankton, a compound light microscope was used, while for zooplankton, a dissecting microscope. Phytoplankton were counted and identified to the lowest taxonomic level (genera) possible while zooplankton were identified to major groups using available references. Phytoplankton and zooplankton densities are presented as number of cells or organisms per liter. The coordinates of the plankton sampling stations is presented in Table 2; map of station locations are presented in Figure 2.

Table 2.2.4.5.2: Sampling stations for plankton community diversity during the freshwater ecology survey in Barangay Telabanca, Concepcion, Tarlac; 20 August 2017.

WP Code	LATITUDE	LONGITUDE	Remarks
PLK1	N 15.292917°	E 120.634000°	Downstream position along Sacobia River with relatively dominant phytoplankton *Chroococcus* sp. at 160 cells/L, while the only zooplankton are from Arcellidae (amoeba) at 32 indiv/L
PLK2	N 15.288194°	E 120.627056°	Midstream position along Sacobia River with relatively dominant phytoplankton *Chroococcus* sp. at 520 cells/L, while the only zooplankton are from Arcellidae (amoeba) at 24 indiv/L
PLK3	N 15.283425°	E 120.616383°	Upstream position along Sacobia River with relatively dominant phytoplankton *Terpsinoë* sp. at 240 cells/L, while relatively dominant zooplankton are from Arcellidae (amoeba) at 40 indiv/L
PLK4	N 15.302556°	E 120.630194°	Canal proximal to fishponds in Brgy. San Francisco with dominant phytoplankton *Arthrospira* sp. at 84,000 cells/L, while relatively dominant zooplankton are Loricate rotifers at 128 indiv/L

2.3 Benthos

Benthic macrobenthos were collected employing the standard kick net (Plate 2). The net is thrust into productive habitats and substrates (*e.g.*, riffle areas, flooded vegetation, submerged root mats and other woody debris) to collect specimens. Macro-benthos were identified up to species level. Identification of other macro-invertebrates, particularly those with significant economic value for food and trade, was supplemented through opportunistic surveys and core sampling along the riverbanks. The four stations for macrobenthos sampling (Table 2) is displayed in (Figure 3).

2.4 Fish

Determination of common species of fish in the Sacobia River was undertaken by using a scoop net in suspected natural fish shelters along shallow and calmer portions of the river (Plate 2). Actual fishing employing a cast net was not possible due to the rapid flow of the river and the extremely turbid condition. There were no actual fishing operations in all of the stations investigated and staff of the local government unit, as well as key informants living near the stations visited, claim that the river is no longer being used for fisheries activities ever since it was overrun by lahar mudflows. Sampling and identification of freshwater fish species was conducted in the same sampling sites for macro-benthos (Figure 3; please see Table 3).

Plate 2: Plankton sampling (left) and fish/benthos gathering through scoop net.

Table 3: Sampling stations for freshwater fish biota and diversity during the freshwater ecology survey in Barangay Telabanca, Concepcion, Tarlac; 20 August 2017.

WP Code	LATITUDE	LONGITUDE	Remarks
FWB1	N 15.292917°	E 120.634000°	Downstream position along Sacobia River with the following biota: Goby = 5 (fry stage), *Macrobrachium*sp. = 17 (juvenile stage and stunted), Tilapia = 3 (juvenile stage)
FWB2	N 15.288194°	E 120.627056°	Midstream position along Sacobia River with the following biota: Goby = 4 (fry stage), *Macrobrachium*sp. = 25 (juvenile stage and stunted), Tilapia = 1 (juvenile stage)
FWB3	N 15.283425°	E 120.616383°	Upstream position along Sacobia River with the following biota: Tilapia = 1 (juvenile stage)
FWB4	N 15.302556°	E 120.630194°	Canal proximal to fishponds in Bgy San Francisco with the following biota: Goby = 1 (fry stage), Shells = 2

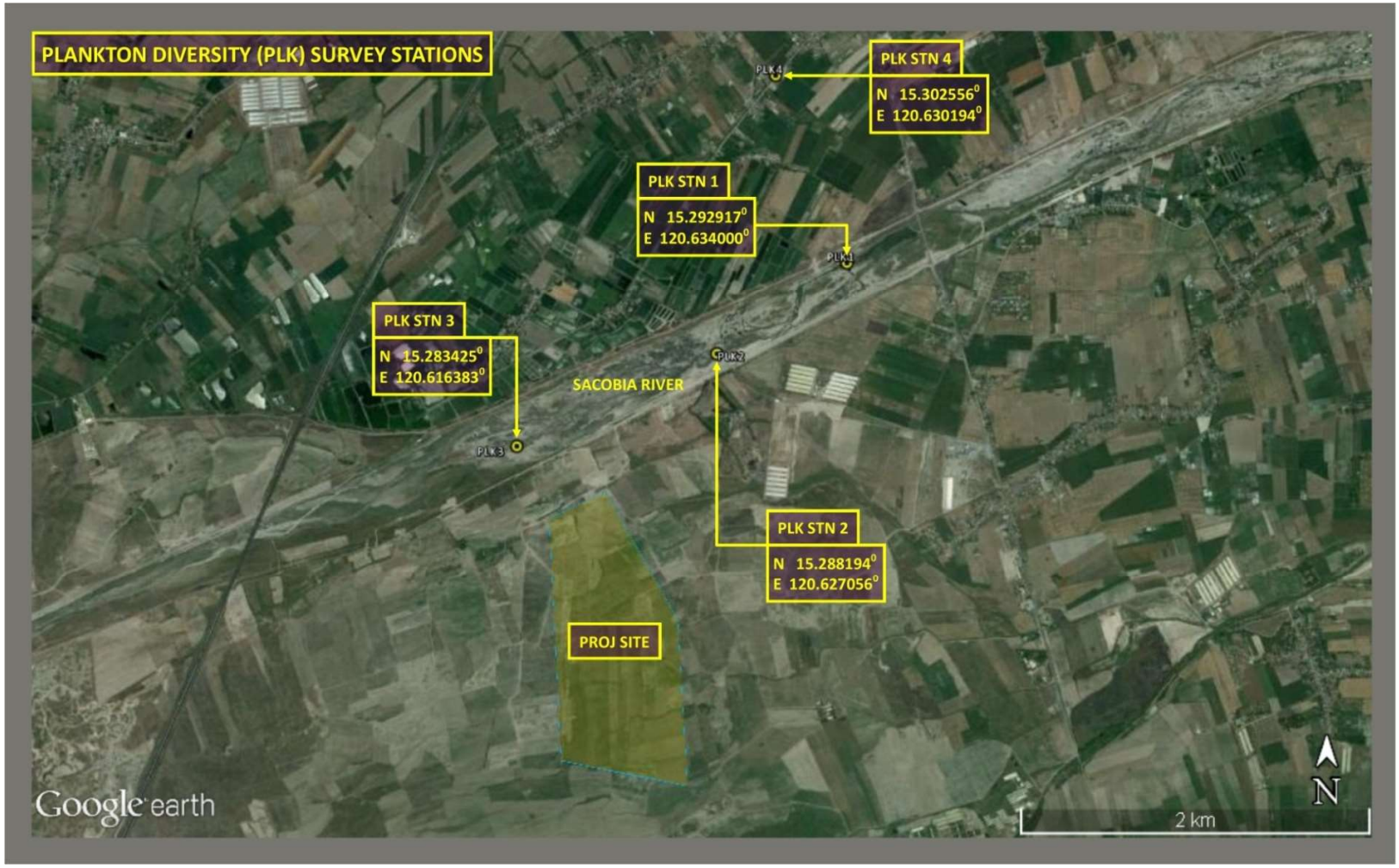


Figure 2.2.4.5.2: Location of plankton community sampling stations in the Sacobia River during the freshwater ecologys baseline assessment conducted in Barangay Telabanca, Concepcion, Tarlac on 20 August 2017.

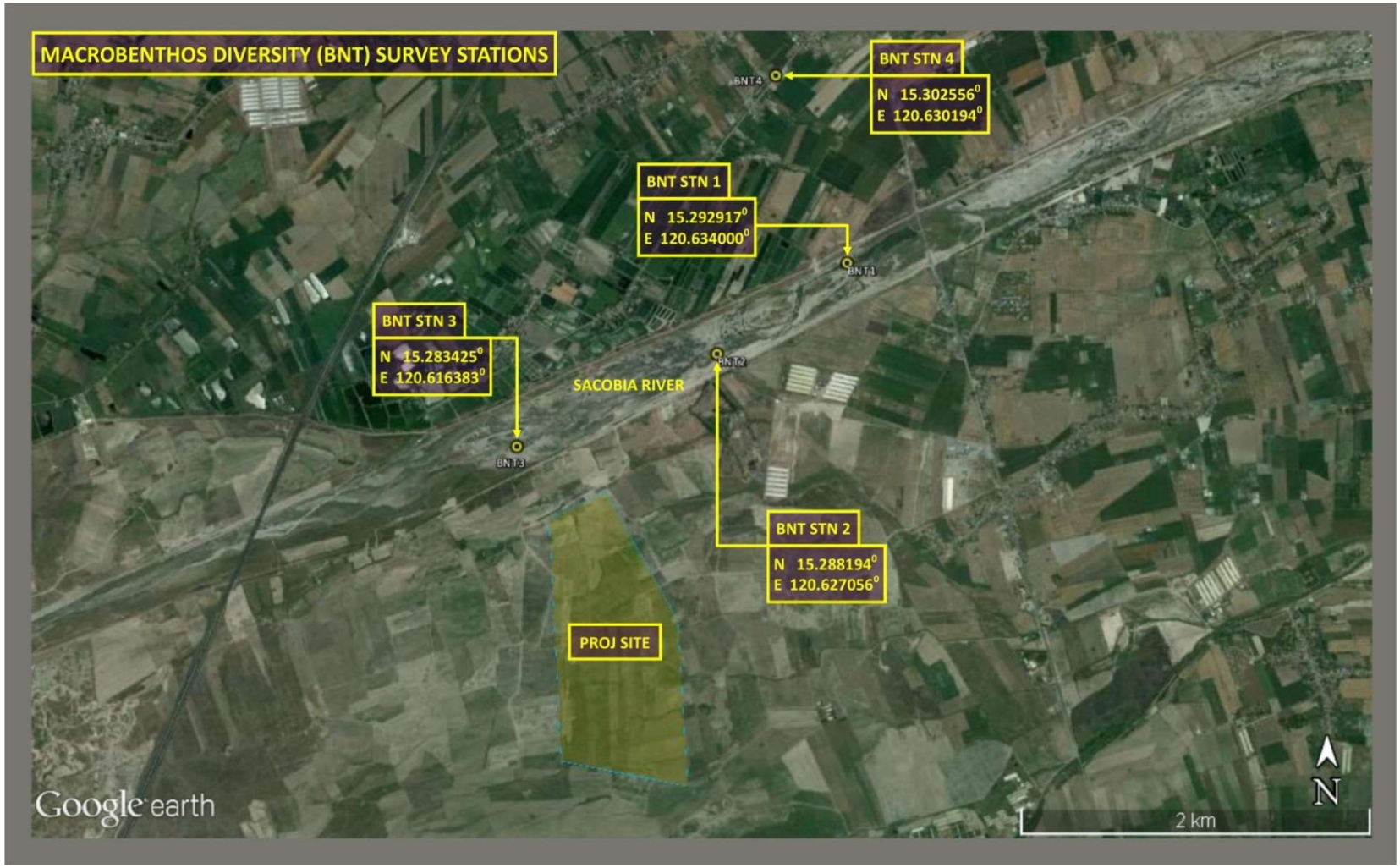


Figure 2.2.4.5.3: Location of macrobenthos and fish species sampling stations in the Sacobia River during the freshwater ecologys baseline assessment conducted in Barangay Telabanca, Concepcion, Tarlac on 20 August 2017.

Objectives and Methodology

The objective of the freshwater ecology baseline study is to catalogue important aquatic biota in the surface freshwater systems in the wider impact area of the proposed steel mill. Moreover, the survey aims to determine the possibility of occurrence of HAB episodes and whether this can be attributable to anthropogenic factors emanating from scrap recycling operations. The resulting baseline data set will serve as the fundamental means for designing appropriate and effective long term mitigating measures to address identified stressors and stressor pathways emanating from project establishment and operations, and will be the principal reference for comparative impact monitoring in the future. The assessment was focused on determining plankton community structure, presence of fish biota, macro-invertebrates, macro-benthos and fisheries resources and practices that can be susceptible to issues and disturbances potentially arising from the operation of the project.

3.1.1River Station Profiles

Station 1 which is located downstream of the Barangay's boundary with the Sacobia River, flows at an east-northeast direction towards the Concepcion bridge at 0.51m/second. The width of the river is about 239 meters but this is interrupted in various points by accretions of lahar and mud which has now been overgrown with gregarious "*Talahib*" (*Saccharum sp) and low relief aquatic plants. River depth was measured at 65 centimeters at near midpoint. There is no significant canopy on both banks of the river station and substrate was completely comprised of lahar sand (Plate 2.2.4.5.3).*

Plate 2.2.4.5.3: Downstream station in Sacobia River with accretions invaded by "talahib"; substrate is completely made up of lahar and mud.

Station 2, midstream of the river survey pathway, is located in an area where heavy equipment and facilities for road construction and riverbank revetment was taking place. At the time of the survey, only a portion of the riverbank have been stabilized with embankments and construction sand were spilling out into the river (Plate 4). River water is extremely turbid, with lahar material mixed with mud clearly muddled up with the river flow. The actual river width is about 297 meters but only about 50 to 60 meters is inundated with very turbid water while the rest of the riverbanks are accumulated lahar colonized with grass and shrubs. River substrate is constantly disturbed and suspended by the strong river current which was measured at 0.96m/second flowing at an east-northeast direction. The sampling station is one of the widest portions of the river in vicinity of Barangay Telabanca and river current has been enhanced by strong precipitation the day before the survey. River depth was measured at 46 cm. With turbid grayish water constantly infused with lahar particulates. No significant vegetation was encountered in both banks. Some free floating aquatics such as *Eichhornia crassipes* or water hyacinth occur in shallow, calmer portions.

Plate 2.2.4.5.4: Station 2 located midstream of the Sacobia River survey site. Sand from road and revetment construction has spilled out into the river (left).

The third sampling station in Sacobia River is located about 1.5 kilometers upstream of station 2, where road construction atop the western flank is still in progress. River flow velocity was measured at 1.23m/s, depth was 48cm at the sampling point. Turbid grayish water with suspended lahar material permeate throughout the length of the river while lahar and muddy substrate has accrued in wide portions of both riverbanks. The riverbank width was estimated at 297m (from Google Earth) but the portion actually with river flow is about 60-65 meters (Plate 5). Riverbank vegetation is unremarkable, dominated by very sparse foliage of "*talahib*", aquatic plants and shrubs.

In the absence of other significant and perrenial river systems in Barangay Telabanca, a fourth station was established in a roadside canal in Barangay San Francisco, approximately 2.5 kilometers from the northern boundary of the project site facing the Sacobia River. The canal, measuring 2.5 meters, features rapdily moving water said to emanate from Tilapia fishpond discharges in Barangay Dungan, as well as from rice fields, springs and domestic wastewater from households along its course (Plate 6). Stream flow vvelocity was measured at 0.80m/s on a north-northeast direction where its turbid green to brown water merges with the main canal along the Concepcion national highway. In the sampling point, depth was measured at 95cm at the center. Substrate was comprised of blackish silt (Plate 2.2.4.5.5)

The river station parameters are summarized in Table 2.2.4.3.

Table 2.2.4.3: Summary of river station physical parameters in four sampling stations in Barangay Telabanca and Barangay San Francisco, Concepcion, Tarlac.

Station No.	River Width	Depth	Stream Flow	Color	Canopy
1	239m	65cm	0.51m/s	Very turbid; dark gray	Sparse foliage; grass
2	275m	46cm	0.96m/s	Very turbid; dark gray	Sparse foliage; grass
3	297m	48cm	1.23m/s	Very turbid; dark gray	Sparse foliage; grass
4	2.5m	95cm	0.80m/s	Turbid green-brown	Sparse foliage; grass and aquatic plants

Plate 2.2.4.5.5: Station 3 in Sacobia River (left) and Station 4 (right) which appears to be a large canal fed by water from fishponds and rice fields in Barangay Dungan and San Francisco, Concepcion, Tarlac.

3.1.2 Plankton

A total of 26 plankton taxa were identified across four stations in two rivers of Concepcion Tarlac during the August 20, 2017 sampling. Basically, the plankton community was comprised of four major groups namely diatoms, green algae, cyanobacteria, euglenoids; and zooplankton (Figure 3.1.2.1). Most of the planktons however, were only found in the control station i.e., the station outside the Sacobia River but still near the project site. The three stations in Sacobia River *were generally very poor in plankton organisms in terms of richness and abundance.* The reason for being a depauperate freshwater body could be attributed to high sedimentation resulting to highly turbid waters that negatively affects growth and survival plankton organisms in the area. The highly turbid water is attributed to the high amount of volcanic debris or "lahar" even up to this day. According to locals, the Sacobia river, at least in the part where the project will be built, is generally turbid even when there is no heavy rain, which actually happened a day before the survey. Overall, cyanobacteria were the most abundant phytoplankton group accounting for almost 84%, followed by green algae with 14%, diatoms with 1%, euglenophyte with 0.73% and zooplankton 0.38% (Figure 5). A total of 114,792 cells(ind)/L organisms were quantified in all the stations combined. During this survey, both cyanobacteria and diatoms were found in all sampling stations but were most abundant in the control station. Among the cyanobacteria, the free-floating, filamentous genus *Arthrospira* comprised the bulk of this group accounting for 73%. This was followed by *Microcystis* (6%), *Merismopedia* (2%), *Chroococcus* (1.46%) and all the remaining taxa constituted for less than 1% each. Cyanobacteria are generally found at high density in highly euthrophic water body. *Scenedesmus* represents the majority of the green algae accounting for 8% (Table 3.1.2.1). There were only two euglenophyte genera observed (*Phacus* sp and *Euglena* sp) but were only few accounting for less than 1%. Zooplankton was also few and were only found in control station and mostly represented by rotifers. Again, the highly turbid water in the Sacobia river is generally known to be fatal to zooplankton which explain their low in richness and abundance. Photomicrographs of common and dominant plankton genera are shown in Plate 3.1.2.1.

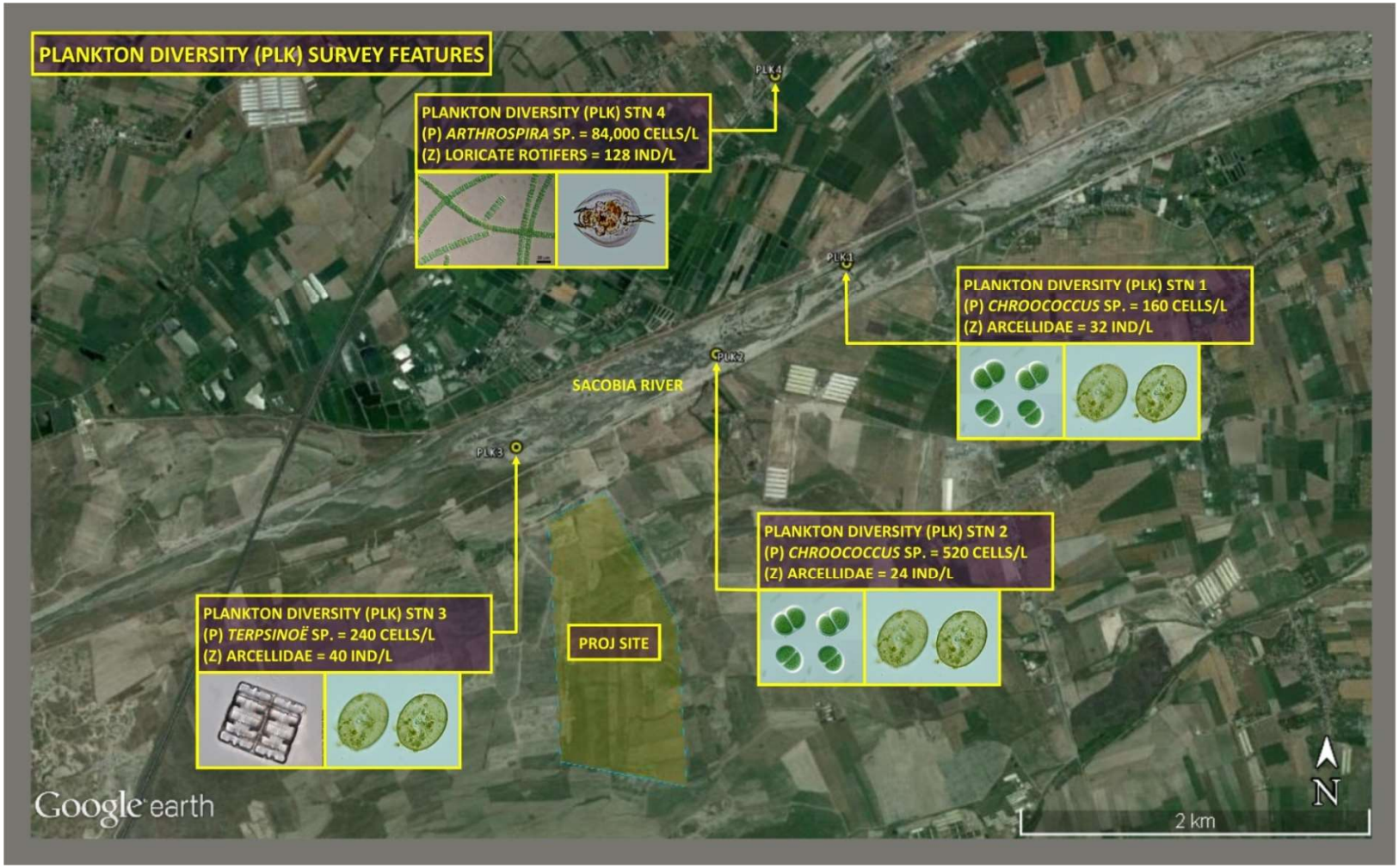


Figure 3.1.2.1: Dominant plankton species catalogued in four sampling stations during the freshwater ecology survey in Barangay Telabanca, Concepcion, Tarlac on 20 August 2017.

The potentially harmful phytoplankton observed in the survey includes *Microcystis,* and *Oscillatoria.* Some species of *Oscillatoria* and *Microcystis* are known to produce toxins e.g., neurotoxins (anatoxins) and hepatotoxins (microcystins). *Oscillatoria* is implicated in irritation of the skin (leading to severe dermatitis) and mucous membranes of people swimming in water containing high *Oscillatoria* concentrations. Microcystin produced by some species of *Microcystis* can be produced in large quantities during algal blooms and pose a major threat to drinking and irrigation water supplies (Paerl and Huisman, 2009). However, these taxa were only observed in the secondary water body not directly affected by the project site but are nevertheless, also an important information of the plankton composition in the area. Generally, results of plankton analysis showed the absence of the known paralytic shellfish poison causative organisms identified in Philippine waters namely*; Pyrodiniumbahamense var. compressum, Gymnodinium catenatum, Alexandrium tamiyavanichii* and *Alexandrium minutum.* During the survey no level of harmful phytoplankton blooms was observed which can cause negative impacts on the present aquatic biota in the surveyed area.

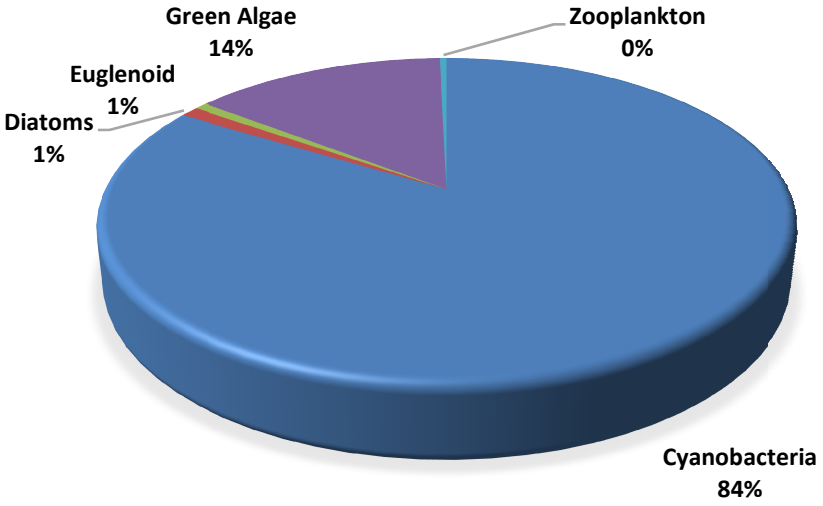


Figure 3.1.2.2: Percentage composition of major phytoplankton groups stations in two rivers of Concepcion, Tarlac during the August 20 sampling.

Table 3.1.2: Phytoplankton composition and abundance (cells or ind/L) in four stations stations in two rivers of Concepcion, Tarlac during the August 20 sampling.

TAXA	Downstream	Midstream	Upstream	Control	Grand Total	Relative Abundance
Cyanobacteria	**280**	**680**	**240**	**94880**	**96080**	**83.70**
Arthrospira				84000	84000	73.18
Chroococcus	160	520		1000	1680	1.46
Merismopoedia				2720	2720	2.37
Microcystis				6720	6720	5.85
Oscillatoria				440	440	0.38

Diatoms	**40**	**320**	**320**	**520**	**1200**	**1.05**
Coscinodiscus		120	200		320	0.28
Navicula				120	120	0.10
Pinnularia				280	280	0.24
Pleurosigma		200			200	0.17
Surirella	40		120	120	280	0.24
Terpsinoe	120	160	240		520	0.45
Euglenoid				**840**	**840**	**0.73**
Euglena				480	480	0.42
Phacus				360	360	0.31
GreenAlgae				**16240**	**16240**	**14.15**
Chlorella				840	840	0.73
Closterium				880	880	0.77
Coelastrum				720	720	0.63
Gleocapsa				720	720	0.63
Pediastrum				1080	1080	0.94
Scenedesmus				9360	9360	8.15
Sphaerocystis				600	600	0.52
Staurastrum				2040	2040	1.78
Zooplankton	**32**	**24**	**56**	**320**	**432**	**0.38**
Arcellidae	32	24	40		96	0.08
Bdelloidrotifer			16	112	128	0.11
Cyclooid				24	24	0.02
Loricaterotifer				128	128	0.11
Rotiferwithwings				56	56	0.05
Grand Total	**352**	**1024**	**616**	**112800**	**114792**	**100**
Mean Abundance	**72**	**208**	**157**	**5127**		
Richness	**4**	**5**	**5**	**22**		
Evenness	**0.86**	**0.80**	**0.82**	**0.36**		
Diversity	**1.19**	**1.29**	**1.32**	**1.12**		

The mean plankton abundance during this sampling reached to 38,147 cells (ind)/L. In terms of spatial distribution, the control station (Station 4) recorded the highest plankton abundance with 112,800 cells (ind) /L (Figure 3.1.2.1.3) and similarly had the most number of plankton observed with 22 species. The lowest plankton abundance was observed in the downstream station at 352 cells (ind)/L. Diversity measurement based on Shannon-Weiner Index was generally low (<2). The highest calculated value was observed in station midstream station with 1.29 while the lowest in control station with 0.36. The computed index of evenness among the three stations in Sacobia river was not so variable ranging from 0.80 to 0.82 while a low value was obtained in control station. The low diversity and evenness values computed in the control station are due to the high abundance of the cyanobacteria *Arthrospira* which accounted for the majority of the plankton community. The Shannon diversity index of all the stations was below (<2) which is categorized overall as low based on the Wilhm criteria (1975) classifying the diversity index <3.0 as low diversity and community stability.

The overall impression from results of the plankton survey in Sacobia River is poor as reflected by low species, richness, abundance and diversity. However narrow is species diversity, the plankton community harbors potentially harmful taxa like O*scillaroria* and *Microscystis*. Threats to plankton community arising from project activities are therefore minimal since the river is already highly sedimented.

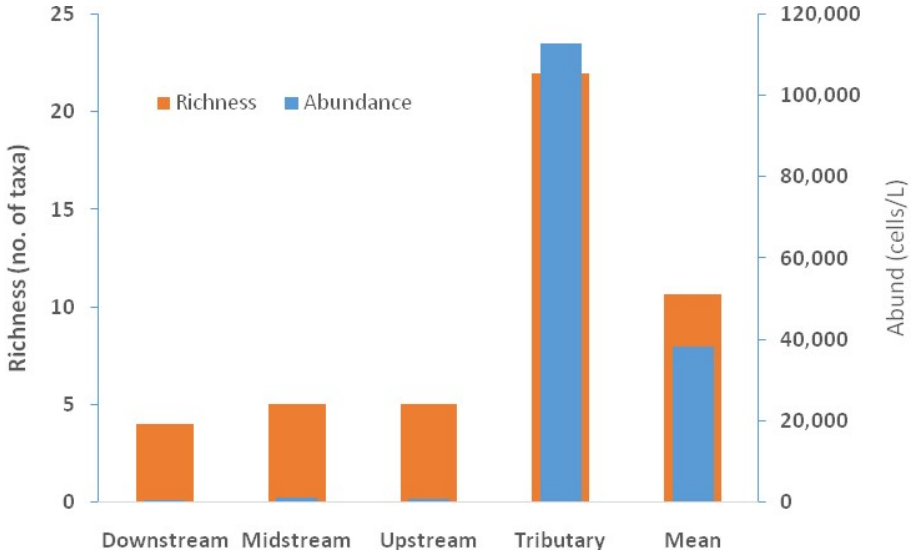


Figure 3.1.2.1.3. Total phytoplankton density and plankton richness in four stations stations in two rivers of Concepcion, Tarlac during the August 20 sampling

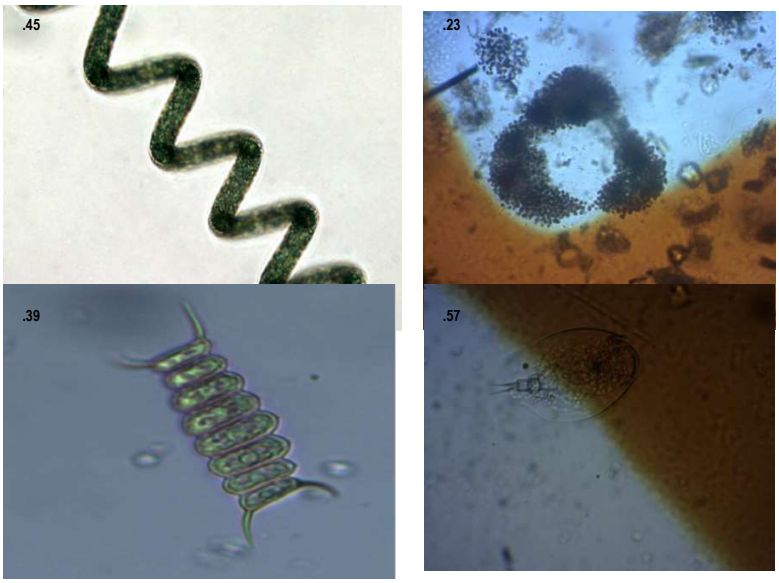


Plate 3.1.2.1: Photomicrograph of common plankton (A) Arthrospira sp. (B) Microscystis sp.(C) Scenedesmus sp. (D) Rotifer.

3.1.3 Macrobenthos

A total of 2,773 individuals belonging to 9 families/orders were quantified across four stations in two rivers of Concepcion Tarlac during the August 20, 2017 sampling (Table 5). In this survey, three stations were sampled in Sacobia River, a water body near the proposed project site covering the upstream, midstream and downstream portion of the river and another station in a water body near the site serving as control station. The macrobenthos recorded in this survey belonged to four major phyla i.e Arthropoda, Annelida, Annelida, Mollusca and Chordata. Among these, the phylum Arthropoda accounted for 47% of the total benthic macrobenthic community, followed by Mollusca with 20% and Annelida with 18% and Chordata 15% (Figure 3.1.3.1 and Figure 3.1.3.2). Among the arthopods, the crustacean belonging to family Paleomindae constituted the bulk of this group accounting for the 31 % of the total macrobenthos counts. The most family rich phyla were Arthropoda with 4 families each recorded for all sampling sites. Among the mollusks, the family planorbiidae contributed significant values to overall count with 11.5%. Images of common macrobenthos are shown in Plate 3.1.3.1.

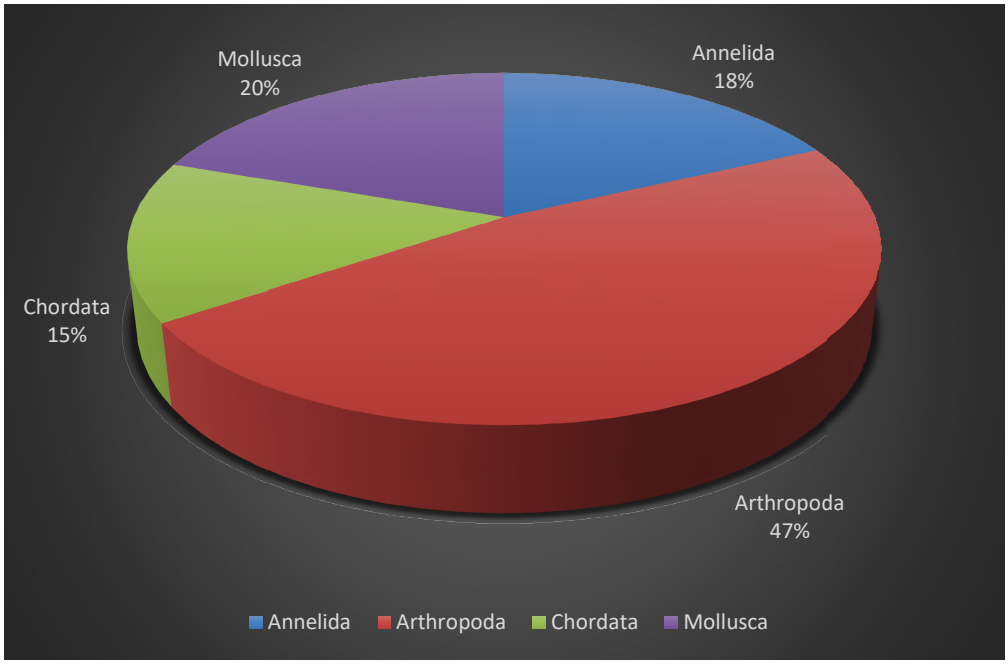


Figure 3.1.3.1: Percent composition of macrobenthos collected across four stations in two rivers of Concepcion Tarlac during the August 20, 2017 sampling.

Benthic and epi-benthic fauna (macro-invertebrates or macrobenthos), serve a number of ecosystem roles at various levels of the food chain, ranging from consumers of plant material to prey for fish. Due to their filter-feeding nature, macro-invertebrates are good indicators of environmental conditions over time and can be used as indicators of water quality and the degradation of the aquatic environment. Benthic or bottom dwelling animals constitute a major part of the diet of many benthic and bottom dwelling fishes and crustaceans. Many of the bivalves in riverine and estuarine systems are also edible invertebrates collected for food and sustenance trade. As indicators of ecosystem health, macroinvertebrates can be grouped based on their tolerance to pollution conditions. Vertebrates like gobiidae were still recorded and categorized among the three categories since they are bioindicator of freshwater ecosystem. Generally, the control station was the most taxa-rich and most populated station of the survey (Figure 3.1.3.2). In contrast, the three sampling stations of Sacobia River at three water elevations were depauperated with macrobenthos. Most of the taxa observed in these stations were *Macrobrachium* and a few gobies primarily in midstream station. The highly silted water of Sacobia river has a huge contribution to low macrobenthos community in the area. Although, sampling was only conducted during the wet season, this

survey provides a poor overall impression of the macrobenthos biodiversity in the area. Very low diversity values (<1) was computed based on Shannon-Weiner Index in the three station of Sacobia river as compared to the control station with 1.47. It is important to note that the diversity value for control is also considered as low which indicates the stressful condition in this water body. Based on Wilhm criteria (1975), this diversity values are poor since this criteria classified the diversity index <3.0 as low and community stability. The control station harbors a lone macro-invertebrate species primarily the mollusk belonging to family Thiaridae. These are mostly pollution-tolerant species that thrives in lower dissolved oxygen, unstable pH and warmer water.

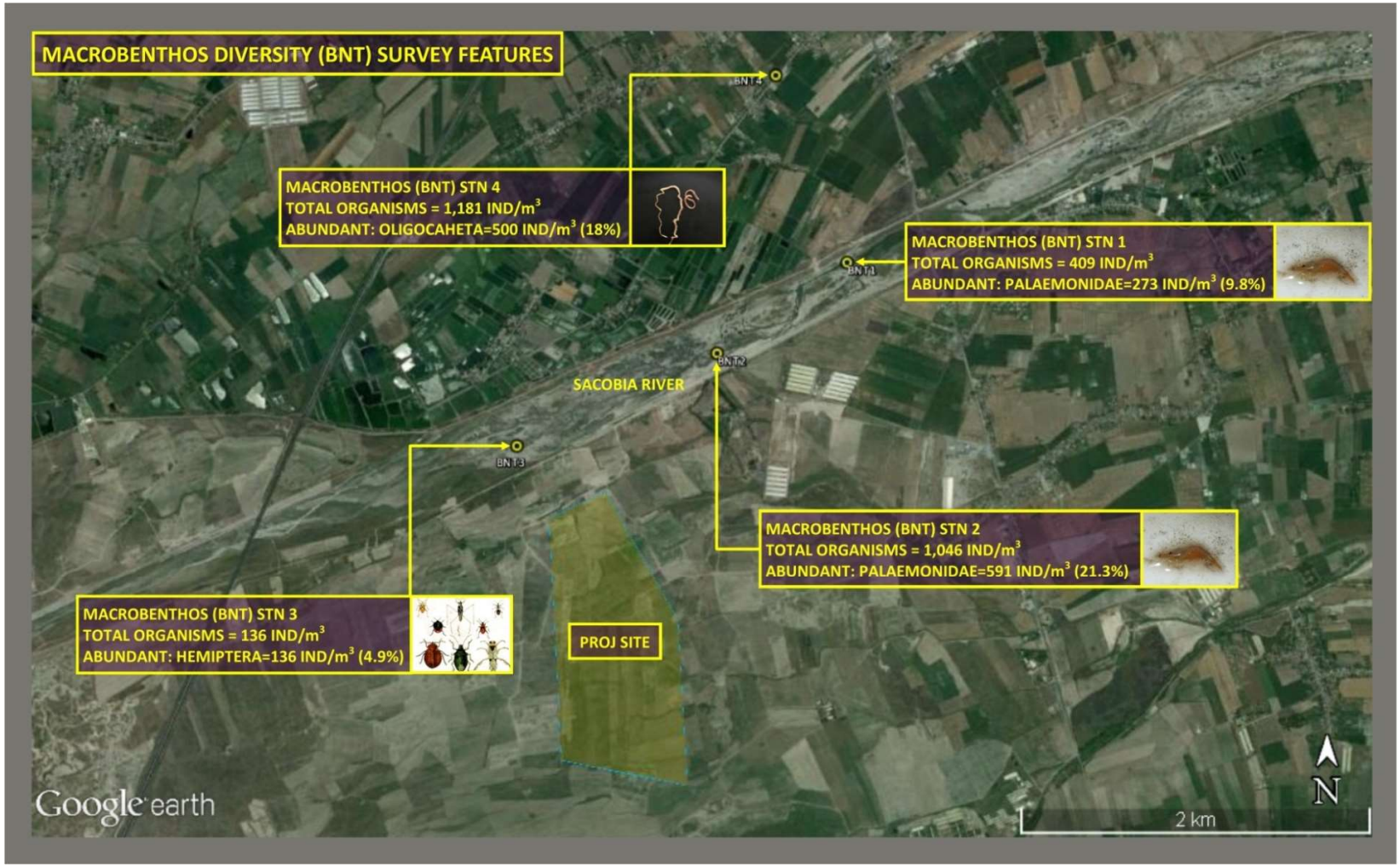


Figure 3.1.3.2: Diversity of macro-invertebrates catalogued in the Sacobia River in Barangay Telabanca, Tarlac, during the freshwater ecology survey on 20 August 2017.

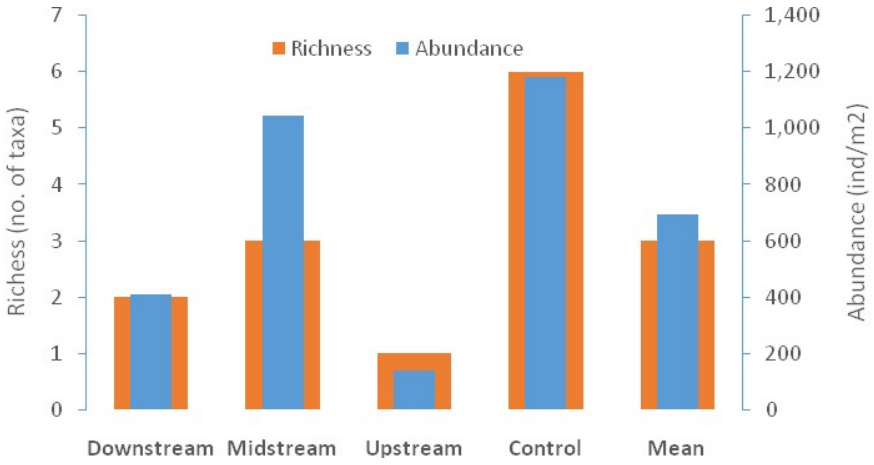


Figure 3.1.3.3: Total macrobenthos abundance and richness in four stations in two rivers of Concepcion, Tarlac during the August 20, 2017 sampling.

The modified Hilsenhoff Family Biotic Index (FBI) was determined for the collected benthic macroinvertebrates in Concepcion Tarlac (Table 5). The computed Hilsenhoff Family Biotic Index was 5.62 which indicates a fair water quality or with fairly significant organic pollution (Table 3.1.3.1). It is important to note that the number of macroinvertebrates observed is relatively low and a monitoring system needs to be established to have a more stable and conclusive data set.

Table 3.1.3.1: Evaluation of water quality using Modified Hilsenhoff Biotic index(Hilsenhoff, 1987)

Biotic Index	Water	Degree of Organic Pollution

TAXA	Downstream	Midstream	Upstream	Control	Grand Total	Relative Abundance	Modified HilsenHoff Biotic Index
Annelida				**500**	**500**	**18.03**	
Oligochaeta				500	500	18.03	5
Arthropoda	**273**	**773**	**136**	**136**	**1,318**	**47.54**	
Coleoptera				91	91	3.28	5
Gerridae		182			182	6.56	
Hemiptera			136	45	182	6.56	3
Palaeominadae	273	591			864	31.15	
Chordata	**136**	**273**			**409**	**14.75**	
Gobiidae	136	273			409	14.75	
Mollusca				**545**	**545**	**19.67**	
Amphullariidae				136	136	4.92	
Planorbiidae				318	318	11.48	7
Thiaridae				91	91	3.28	

Grand Total	**409**	**1,045**	**136**	**1,182**	**2,773**	**100**	**5.62**
Mean Abundance	**205**	**348**	**136**	**197**			
Richness	**2**	**3**	**1**	**6**			
Evenness	**0.92**	**0.89**	**0.00**	**0.08**			
Diversity	**0.64**	**0.98**	**0.00**	**1.47**			

Table 3.1.3.2: Macrobenthos composition, abundance and diversity across four stations in Sacobia River and a canal in Concepcion Tarlac during the August 20, 2017 sampling

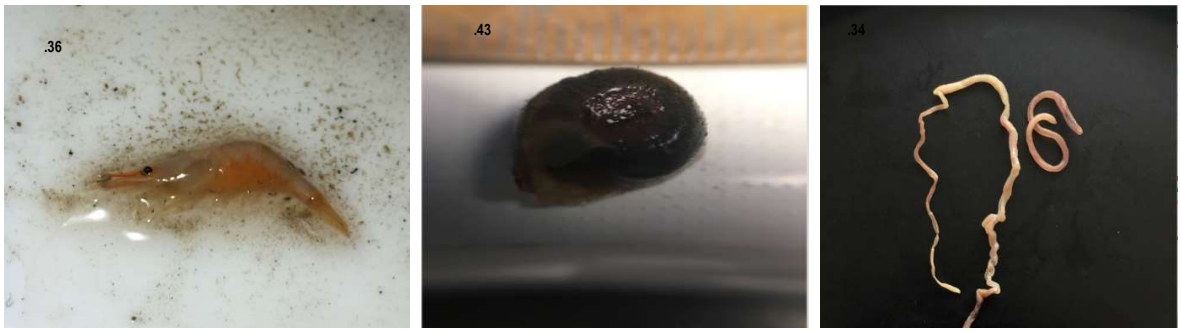


Plate 6. Images of common macrobenthos in in two rivers of Concepcion, Tarlac during the August 20, 2017 sampling (A) Palaeominadae (B) Planorbiidae (D)Oligochaete.

3.1.4 Fish and Fisheries

The presence of species of fish was detected in only three stations(Stations 1, 2 and 3 in the Sacobia River) and species richness and abundance was extremely low (Figure 10). Only one fish species were seen in Station 4 ("control station") even as a significant portion of water flowing into the canal emanates from Tilapia fishponds. No fisher was encountered in the Sacobia River and staff of the local government unit as well as key informants from nearby households declared that the river is no longer used for fisheries or aquaculture since lahar from Mt. Pinatubo overrun the entire stretch of river. The absence of fish in a freshwater system like the Sacobia River – especially hardy species of the *Channidae*and *Clariidae* families (native Dalag and Hito) - is an indication of an extremely unfit habitat exacerbated by constant flooding of lahar sediments.

The fish biota is dominated by juveniles of the freshwater giant prawn *Macrobrachium rosenbergii* which was encountered in two stations with a total of forty-two (42) individuals, or 71% of all the species catalogued in four sampling stations (59 individuals). No adult crustacean was seen. Gobies consisted

of nine (9) individuals in two stations, and juvenile Tilapia consisted of five (5) individuals (Table 3.1.4.1 and Figure 3.1.4.1; also please see Plate 3.1.4.1).

The assessment reveals very poor aquatic biota diversity; obviously brought about by unfavourable conditions for habitation. There are no fishing practices seen in all four stations; neither traps nor stationary weirs were seen. Fishing is evidently not feasible in the river.

Table 3.1.4.1: *Diversity of finfish and crustaceans catalogued in fours freshwater ecology survey stations in the Sacobia River, Barangay Telabanca, Concepcion, Tarlac on 20 August 2017*

Family/Species name	Local Name	Station 1	Station 2	Station 3	Station 4
Gobiidae/ *Glossogobius sp*	Goby/Biya	5	4		1
Palaemonidae/ *Macrobrachium rosenbergii*	Freshwater giant prawn/Ulang	17	25		
Tilapia/ *Oreochromis sp*	Tilapia	3	1	1	
Gastropod/Thiaridae	'Kuhol'				2
Total/per station		**25**	**30**	**1**	**3**

3.1.5 Commercially important macro-invertebrates in the river

No species of macro-invertebrates of commercial importance for food or trade was catalogued in three stations in the Sacobia River. The findings support similar conclusions in the benthos community sampling where very few, pollution-tolerant species of organisms were catalogued.

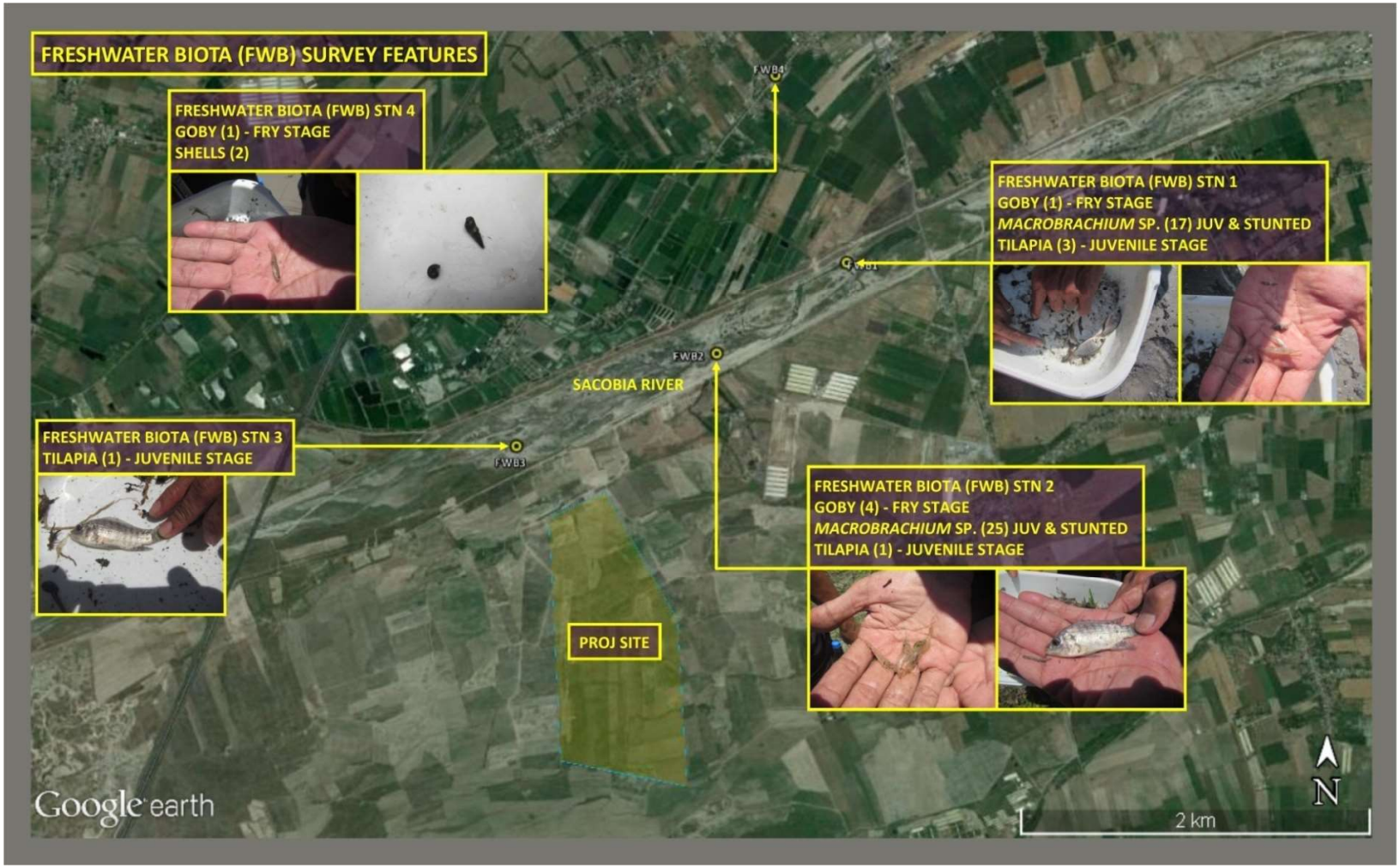


Figure 3.1.4.1: Fish and crustacean species catalogued in four (4) stations investigated during the freshwater ecology assessment in Barangay Telabanca, Concepcion, Tarlac on 20 August 2017.

Plate 3.1.4.1*: Fish biota in three sampling stations in Barangay Telabanca, Concepcion, Tarlac yielded few individuals of Tilapia (left) Goby (middle) and freshwater prawn (right).*

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

Summary of endemicity/conservation status

There are no species of endemic status in the river system surveyed. The absence of significant plankton, foodfish and macro-invertebrate diversity in all the stations surveyed signify a highly deteriorated biological environment and any further threats to the integrity of the said bodies of water is insignificant as there are minimal populations of fish and macro-invertebrates. Nevertheless, prevention of further degradation should be emphasized over the long run in the Sacobia River. The freshwater prawn documented in the sampling site of high conservation value, although they are not reported as endemic, threatened and endangered. In fact, the hatchery of the species is now being successfully practiced in commercial scale. Further enhancement of turbidity in the river is the primary threat to reproduction and growth of the crustacean. Endemic mudfishes and catfishes were not reported to occur in the Sacobia river system.

Abundance of ecologically and economically important species (fishes, benthos, planktons)

The low species density and abundance is indicative of a highly deteriorated habitat condition. The Tilapia and Goby, as well as the species of freshwater prawn existing in the Sacobia River are valuable food fishes but the present population is obviously threatened by lahar sedimentation and increase in abundance is unlikely. Similarly, the low number of plankton species and taxa identified in the plankton surveys is indicative of low diversity and unfavorable environmental conditions.

Threat to benthic organisms

The benthic macrobenthos community in the three stations surveyed in the Sacobia River was very low and were mostly comprised of gobies and macrobrachium. These groups of organisms are dependent on the availability of food in the benthic zone and mainly part of the food chain as well. Some species are tolerant to pollution and can survive by feeding on the organic materials deposited in the bottom part of the aquatic habitat. Macro-benthos can migrate to other area once disturbed; hence, the project is not expected to pose significant impact on this aquatic community.

5. Presence of pollution indicators species

There are no species of fish and shellfish that can be employed as bio-indicators of biotoxin pollution. The potentially harmful phytoplankton observed in the survey includes *Microcystis,* and *Oscillatoria;* the latter species has been implicated in irritation of the skin (leading to severe dermatitis) and mucous membranes of people swimming in water containing high *Oscillatoria* concentrations. The present plankton survey did not reveal indications of bloom proportions of HAB-causing species and overall plankton abundance was catalogued as 'poor'.Similarly, it is important to note that zooplankton community in four sampling stations *is completely absent*. The potential threat/impacts of additional anthropogenic pollution would be insignificant.

Macro-invertebrates are good integrators of environmental conditions over time and can be used as indicators of heavy metal pollution, especially sessile, filter-feeding macro-invertebrates. However, no significant population of bivalves and gastropods were seen in the Sacobia River.

6. Predicted major impacts of project establishment and operation on freshwater ecology.

Potential enhancement of degradation of freshwater quality in the Sacobia River
The Sacobia River – the only major river system that can be influenced by project establishment and operation is already extremely spoiled due to lahar and other substrate infiltration and its current condition is no longer suitable for survival of aquatic biota. The improvement and maintenance of better river water quality can be a long, albeit difficult goal.

The potential additional disturbance that can emanate from the proposed project would be limited to the uncontrolled streams of sediments and loose soil carried down from soil erosion and earth moving due to construction-related activities such as land clearing activities. Poorly-maintained stock piles may erode and end up as runoff to nearby sections of the Sacobia River. While the increment in turbidity may be insignificant compared to the current lahar flows, extreme sediment erosion in freshwater bodies can cause localized mortality of aquatic larval forms of benthic organisms and impair the few remaining nesting grounds of Tilapia and Freshwater prawn.

Pollution due to liquid wastes
During the project's construction phase, poorly-managed waste disposal system can lead to solid and liquid wastewater contamination in the river carried by various waste streams generated during construction. This may further adversely affect water quality and reduce stream flow. Domestic wastewater pollution can lead to hyper-nutrient loading and trigger algal blooms. However, in a fast moving stream like the Sacobia River, localized torpid deposits of organic wastewater is highly unlikely. It is to be noted however, that because sediments serve as a sink for various nutrients, sediment-associated environmental problems is an issue that cannot be attributed to single point source alone but to a broad range of sources, in many instances, domestic wastewater from households, open latrines, fertilized croplands, watersheds and denuded mountain slopes.

Spillage of steel mill wastes
Spillage of waste materials including debris and litter generated from steel milling is highly unlikely due to stringent recovery and recycling measures of the Project. Inadvertent spillage is also highly unlikely because the Project is zero effluent/discharge.

7. Mitigating measures

7.1 Sediment and silt sequestration
The primary mitigation strategy to prevent fugitive sediments and terrigenous material generated during Project establishment from infiltrating water bodies or being carried to the Sacobia River is the establishment of a series of sediment mitigation structures in strategic locations to ensure that silt and sediments will not wantonly pollute waterways or drain into the river. This will include installation of silt traps and screens in project areas where liquid waste and fugitive soil run-off occur, and establishment of settling ponds to contain sediments before they are discharged to the waterways. Stabilization of gullies at desirable distances along and within the existing gullies will be instituted in order to prevent sediment streams from reaching any freshwater river system. In heavy construction areas, loose materials shall be stockpiled in areas away from waterways and where erosion control measures can be easily applied. Construction stockpiles shall be covered and rigidly bundled. As a precautionary approach, the stabilization of areas where earth moving and construction has occurred will be undertaken in appropriate areas through extensive vegetation cover enrichment in order to increase sediment amalgamation capacity and soil compacting.

7.2 Blocking and congestion of stream flow
No part of the river or creek will be blocked and the project will implement zero effluent/discharge.

7.3 Prevention of dust dispersal
Vehicles carrying construction materials shall be covered and speed limits will be imposed. Wet-spraying of soil around construction areas will be undertaken.

7.4 Control and treatment of liquid wastewater

A sound wastewater and solid waste management plan will be implemented and strictly enforced as mitigation to potential waste disturbances, which will include the setting up of a wastewater treatment facility. State-of-the art modern sanitation facilities and wastewater disposal systems will be installed. The use of 3-chambered septic tanks shall be adopted in all project facilities where wastewaters and other effluents are generated both during construction and operations phase. Drainage canals shall be fitted with sediment filters and the recovered water shall be directed to the WTP.

Regular *in-situ* monitoring of water quality and aquatic fauna, particularly for *Macrobrachium* species will be conducted.

7.5 Solid waste management, including prevention of steel mill waste materials

A solid waste management system will be instituted, incorporating waste recovery and re-cycling of steel mill debris and spoils. The Project will consult the local government unit in Barangay Telabanca to formulate and implement measures that will improve solid waste collection, impoundment and dispersal.

2.2.5 Marine Ecology

This is not applicable because this environment will not be used nor impacted because water use is focused on water collection, use of river water for make-up water and local water district for domestic water supply.

2.3 AIR

2.3.1 Climatology and Meteorology

2.3.1.1 Climate Type

The climate at the proposed Project site falls under the category of Type 1 based on the Modified Coronas Climate Classification of Philippine Climate (Figure 2-1). Type I climate is characterized by two (2) pronounced seasons, dry from November to April and wet from May to October with 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.

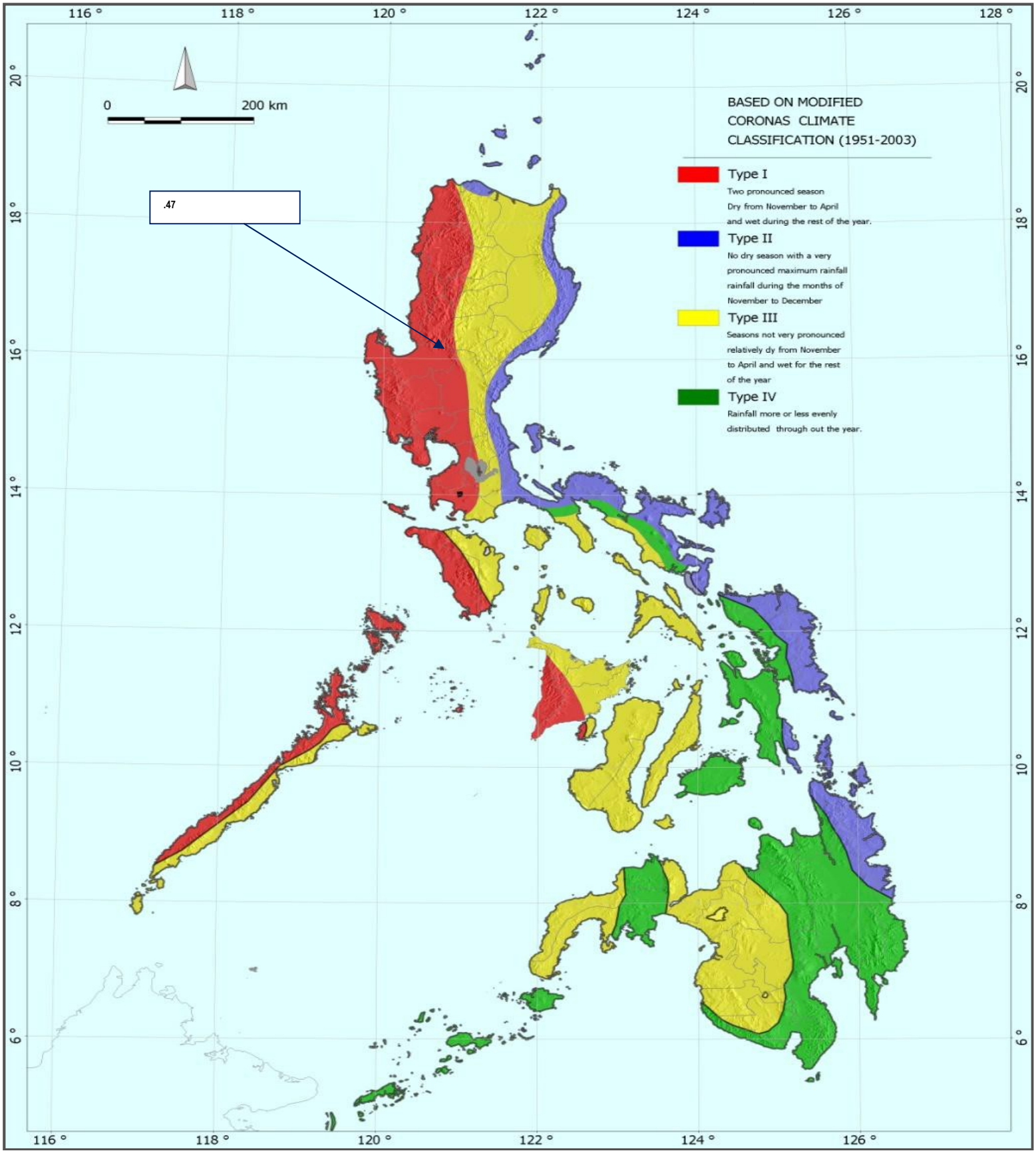


Figure 2.3.1.1: The Philippine Climate Map (Source: PAGASA)

2.3.1.2 Wind Regime

The Clark International Airport Station is the nearest meteorological station of the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) to the proposed Project site. The station is about 12 kilometers southwest of the Project site.

The windrose plot from the station, as shown Figure 2-2, shows that winds prevailing from northwest comprises of about 10% followed by north comprises of about 9%, a significant event produces from the east and westerly comprises of about 8% over the site. Of all hourly wind direction with an average wind speed of 2.39 meter per seconds, few winds exceed 11 meters per seconds and winds less than 0.5 meter per seconds occur from all directions. Calm conditions were observed 0.0% of the time. Strongest winds come from northwest and west-northwest occupying 0.2% of the time.

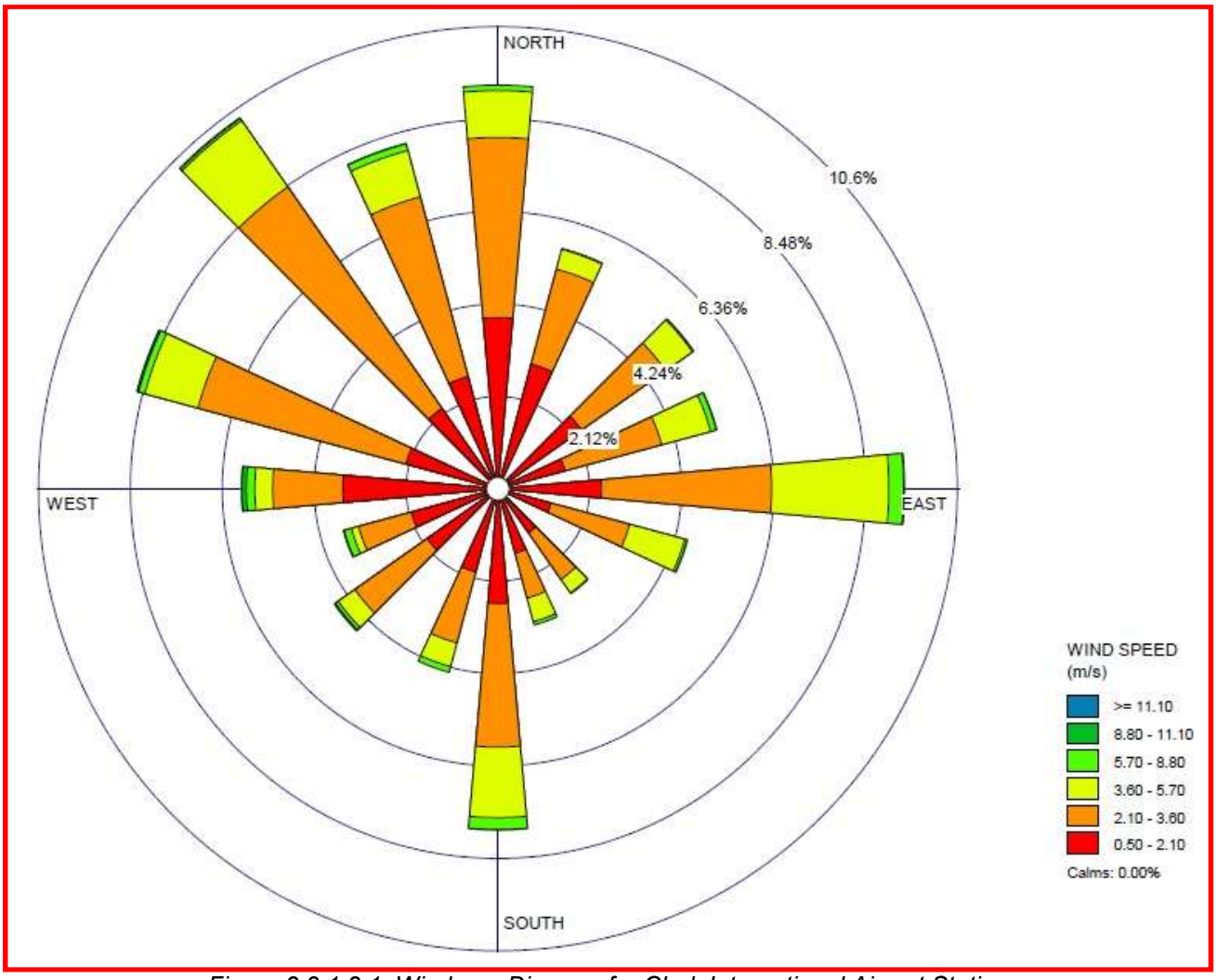


Figure 2.3.1.2.1: Windrose Diagram for Clark International Airport Station (Source: Plotted by WRPLOT View Version 7.0.0 Lakes Environmental)

The tropical condition can be attributed to the location of the project which is between 14 to 16 degrees north of equator. The monsoonal condition, on the other hand, refers to two seasonal wind regimes, the northeasterly winds and the southwesterly winds. From November to May the wind blows on a northeasterly direction with an average wind velocity of 3.08 meters per seconds. From June to October the southwesterly winds prevail with an average wind velocity of 1.96 meters per seconds.

Majority of wind speed in Tarlac occupying 44.5 % of the total wind is 2.10 to 3.6 mps, as shown in Figure 2-3.

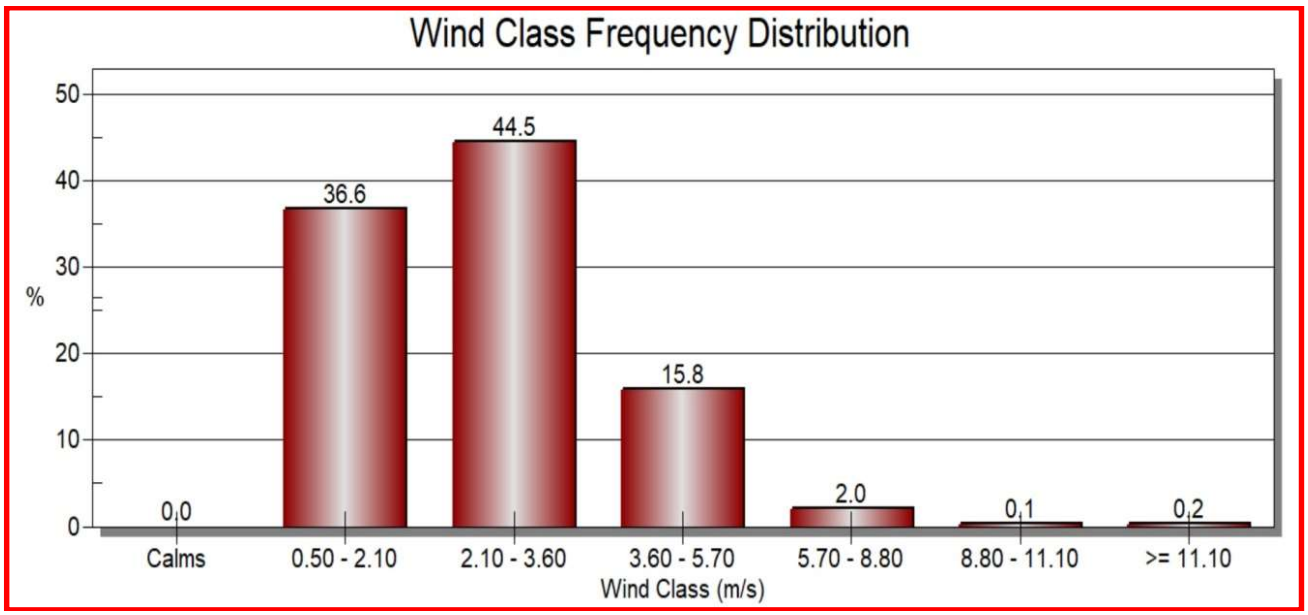


Figure 2.3.1.2.2: Wind Class Frequency Distributions from Clark International Airport Station (Source: WRPLOT View Version 7.0.0)

2.3.1.4 Climatological Normals and Extremes

The annual mean average temperature is 26.9°C with January being the coldest month having an average temperature of 25.3°C while the month of May is the warmest with an average temperature of 28.3°C.

The highest and lowest temperatures occur in the months of April to September and October to February, respectively. The mean maximum and minimum temperatures range from 23.2 to 23.9°C and 20.5 to 21.8°C, respectively.

Rainfall ranges from 17.4 to 429.4 mm, with an annual total of 2,026.8 mm. Least number of rainy days per month occurs in February to April; while the highest number or rainy days per month occurs from December to March.

The mean annual relative humidity recorded at the Clark International Airport Station is 78% with seasonal variation (i.e. mean monthly relative humidity range of 71% to 83% based from 199 - 2010 meteorological data). The months of June to September are the most humid months of the year. Factors affecting humidity are changes in temperature and atmospheric circulation. The air is said to be saturated when it contains the maximum amount of water vapor possible at a given temperature. When the temperature of the air falls below the dew point, some of the water vapor contained in the air condenses, clouds form, and precipitation can result in the form of rain.

Table 2.3.1.4.1: Climatological Normals Recorded at Clark International Airport Station (1997-2010)

Month	Rainfall		Temperature (°C)						RH (%)	No. of Days with	
	Amount (mm)	No. of RD	Max	Min	Mean	Dry Bulb	Wet Bulb	Dew Point		Thunder	Lightning
January	17.4	3	30.1	20.5	25.3	24.8	20.8	19	70	0	0
February	18.6	3	31	20.7	25.9	25.4	21.1	19.2	68	0	0
March	28.4	4	32.6	21.8	27.2	26.8	22	20	66	2	1
April	65	7	34	23.2	28.6	28.2	23.2	21.2	65	5	4
May	221.8	10	32.7	23.9	28.3	27.7	24	22.6	73	14	7
June	241.2	18	31.5	23.6	27.6	27	24.3	23.3	80	14	10
July	422.6	22	30.6	23.5	27	26.3	24.2	23.4	84	16	9
August	429.4	24	30.1	23.5	26.8	26	24.2	23.5	86	13	6
September	293.1	21	30.5	23.2	26.9	26	24	23.2	85	13	7
October	177	12	31.1	23	27	26.5	23.6	22.5	78	6	6
November	78	8	31	22.4	26.7	26.2	22.8	21.5	75	1	3

Month	Rainfall		Temperature (°C)						RH (%)	No. of Days with	
	Amount (mm)	No. of RD	Max	Min	Mean	Dry Bulb	Wet Bulb	Dew Point		Thunder	Lightning
December	34.2	6	30.2	21.3	25.8	25.2	21.5	19.9	72	0	0
Annual	2026.8	143	31.3	22.6	26.9	26.3	23	21.6	75	84	53

Source: PAGASA

Climatological extreme values from the Table are observed the following through Year 2010. The highest recorded temperature was 35 in May 2010.

2.3.1.5 Cyclone Frequency

The most number of cyclones occur during the months of June to December. These tropical cyclones are associated with the occurrence of low pressure areas (LPA) normally originating from the North Western Pacific Ocean of the Philippine Area of Responsibility (PAR) and generally moving northwestward. 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 1948-2015 (period of 67 years) PAGASA determined an annual average of 20 tropical cyclones in the PAR with nine of these passing through the Philippine landmasses. Overall, PAGASA had tracked 25 tropical cyclones that crossed in the province of Bataan where Tarlac is nearby province is shown in Figure 2.3.1.5.1. Figure 2.3.1.5.2 shows that the project site is under medium typhoon risk

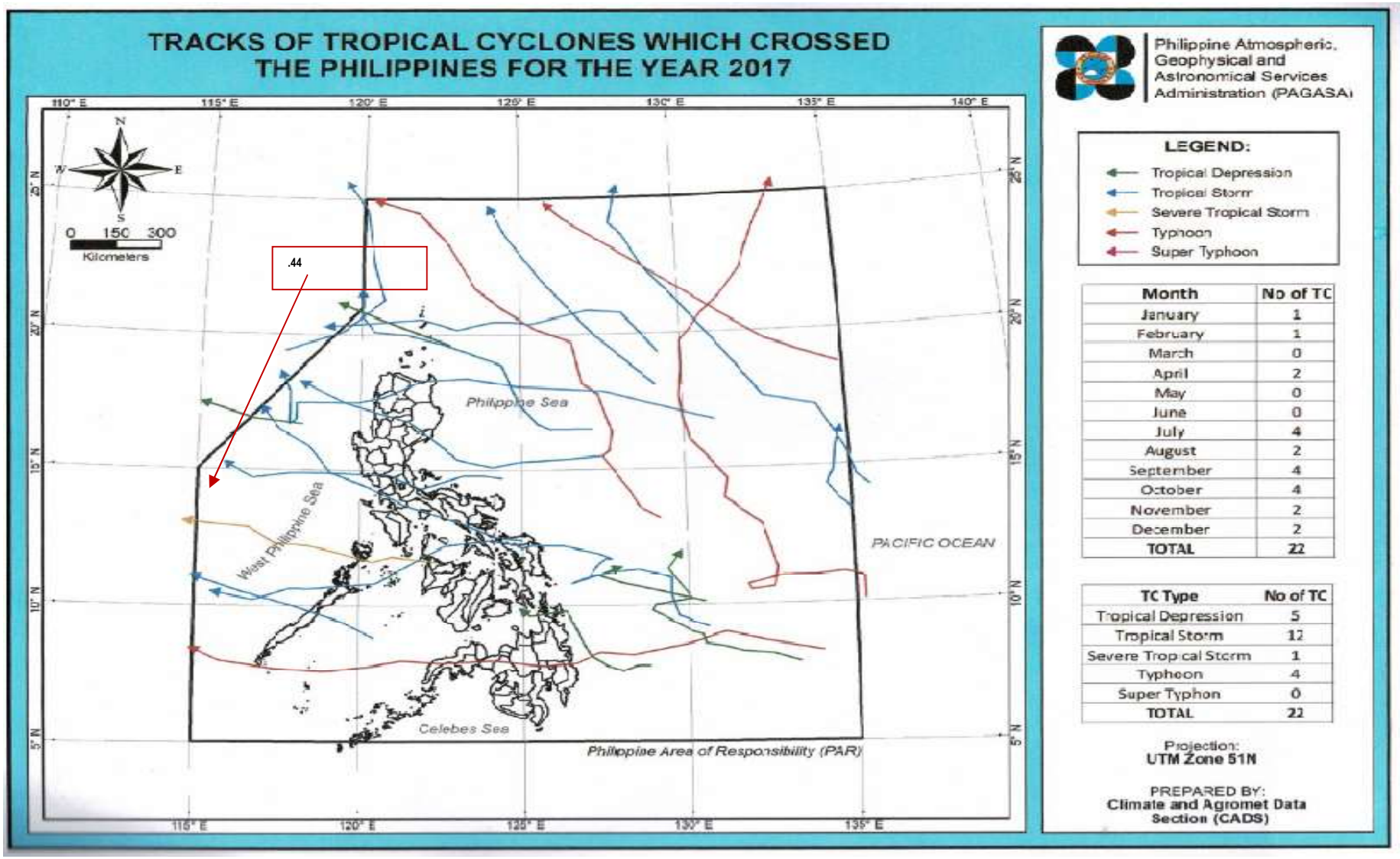


Figure 2.3.1.5.1: Tracks of Tropical Cyclones as of 2017 (Source: PAGASA)

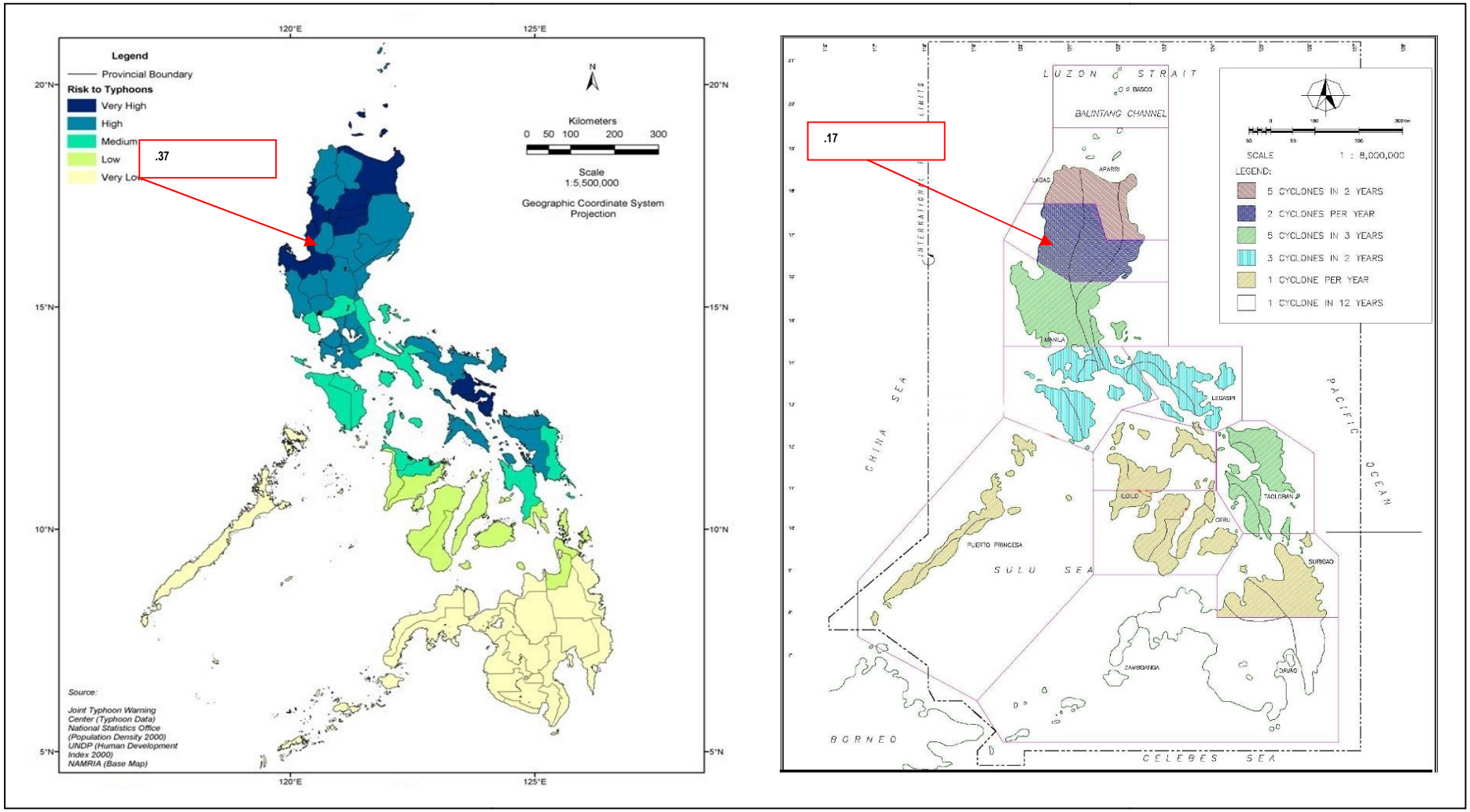


Figure 2.3.1.5.2: Philippine Typhoon Map (source: NSO-NAMRIA)

2.3.1.6 Impact Assessment and Mitigation

2.3.1.6.1 Change in the Local Micro-Climate

Temperature Change

The historic average annual ambient air temperature of Tarlac is 26.9°C. The data indicate that there is little monthly or seasonal variation in the average temperatures. On a daily time-step, temperatures can vary by 5°C to 8°C on the average during a day, peaking above 30s and dropping to the low 20s overnight.

The climate change scenario for the Philippines as published by PAGASA in February 2011 indicates that the province of Tarlac will have an increased temperature (Table 2.3.1.6.1.1).

Table 2.3.1.6.1.1: Seasonal Temperature Increase (in ºC) in 2020 and 2050 under Medium Range Emission Scenario in Tarlac

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
26.1	28.3	27.8	27.3	1.1	1.1	1.0	1.1	2.2	2.2	1.9	2.1

Source: Climate Change in the Philippines, 2011 PAGASA

It is projected that the average monthly temperature over the period of 2006–2035 will increase by 1.0°C to 1.1°C while temperatures for the period of 2036-2065 will increase by 1.9°C to 2.2°C. The annual average temperature covering the period of 2006-2035 will rise to 29.7°C while 2036-2065 will rise to 30.8°C. Table 2.3.1.6.1.2, Figures 2.3.1.6.1.1 and 2.3.1.6.1.2 present the projected monthly average temperature with climate change (Tave CC) and without climate change (Tave base).

Table 2.3.1.6.1.2: Projected Monthly Average Temperature

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Baseline/Without Climate Change Scenario (1981-2010)												
Max	30.1	31	32.6	34	32.7	31.5	30.6	30.1	30.5	31.1	31	30.2
Min	20.5	20.7	21.8	23.2	23.9	23.6	23.5	23.5	23.2	23	22.4	21.3
Ave	25.3	25.9	27.2	28.6	28.3	27.6	27	26.8	26.9	27	26.7	25.8
With Climate Change Scenario (2006-2035)												
Max	31.2	32.1	33.7	35.1	33.8	32.5	31.6	31.1	31.6	32.2	32.1	31.3
Min	21.6	21.8	22.9	24.3	25	24.6	24.5	24.5	24.3	24.1	23.5	22.4
Ave	26.4	27	28.3	29.7	29.4	28.6	27.8	27.8	28	28.1	27.8	26.9
With Climate Change Scenario (2006-2065)												
Max	32.3	33.2	34.8	36.2	34.9	33.4	32.5	32	32.6	33.2	33.1	32.4
Min	22.7	22.9	24	25.4	26.1	25.5	25.4	25.4	25.3	25.1	24.5	23.5
Ave	27.5	28.1	29.4	30.8	30.5	29.5	28.9	28.7	29	29.1	28.8	28

Source: PAGASA

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

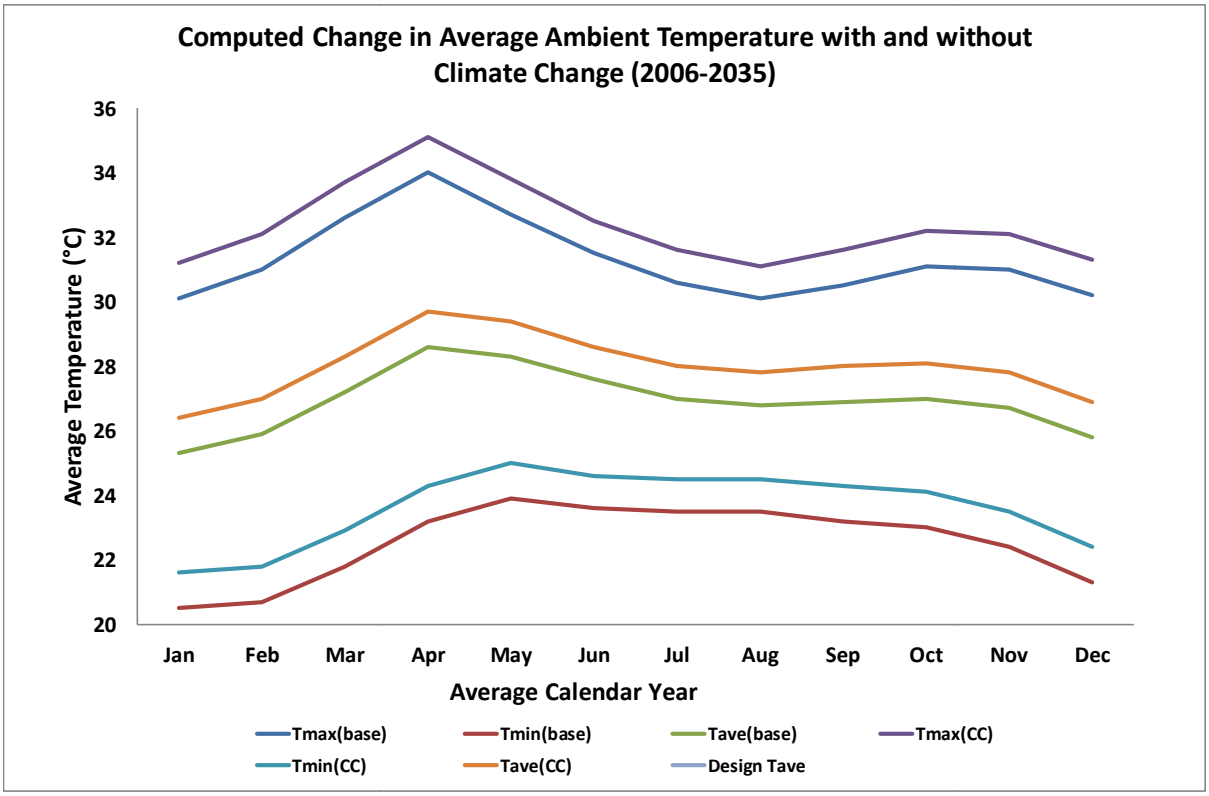


Figure 2.3.1.6.1.1: Change in Monthly Average Temperature for the Period of 2006-2035

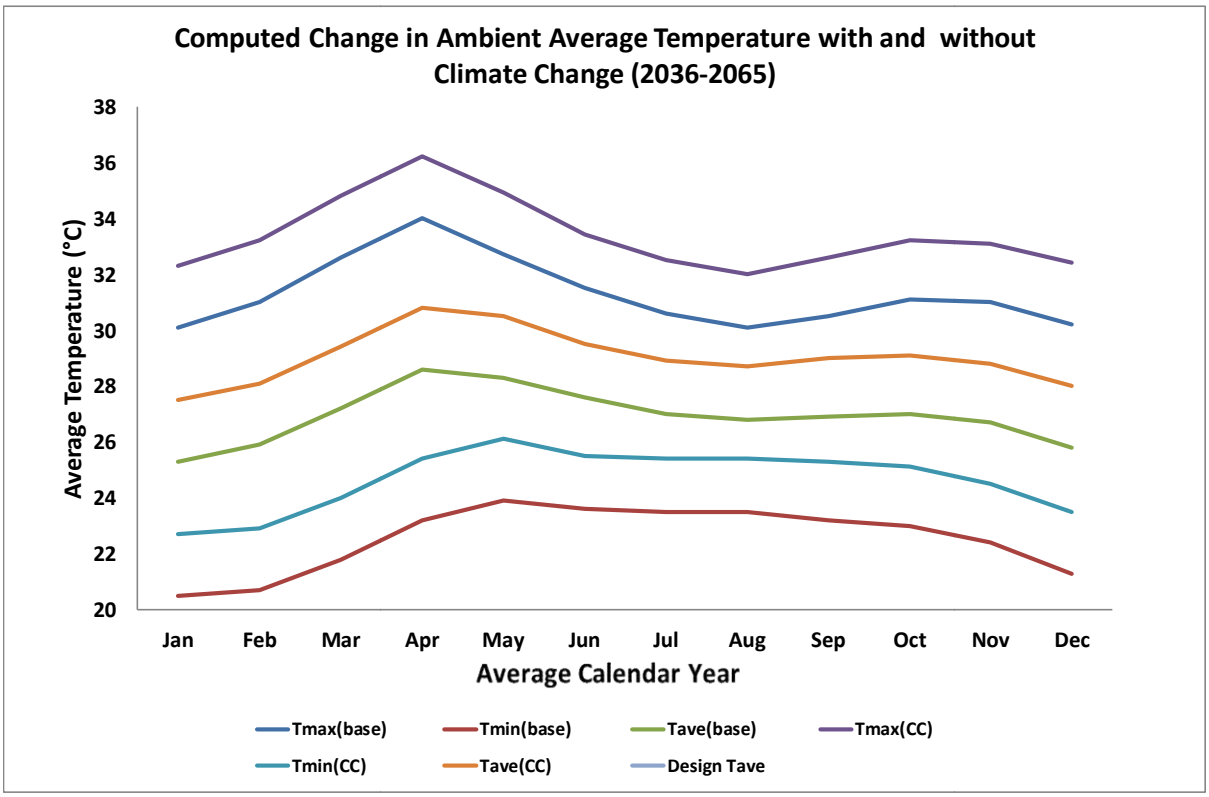


Figure 2.3.1.6.1.2: Change in Monthly Average Temperature for the Period of 2036-2065

The typical effect of temperature increases in the plant operation is the decrease of power output leading to energy inefficiency. This is because an increase in air temperature reduces air density and the mass flow of air intake to the compressor, and creates a similar reduction in heat transfer efficiency of the air cooling system.

Rainfall Change
The historic average annual rainfall of Tarlac is 2,026.8mm. Based from the climate change scenario for the Philippines as published by PAGASA in February 2011, the province of Tarlac will have an increased and decreased rainfall in 2020 and 2050 (Table *2.3.1.6.3*).

Table 2.3.1.6.3: Seasonal Rainfall Change (in %) in 2020 and 2050 under Medium Range Emission Scenario inTarlac

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
43.4	265.4	1193.5	644.3	26	-13.7	-1.6	-9.6	-6.7	-18.2	8.8	-5.5

Source: Climate Change in the Philippines, 2011 PAGASA

It is projected that the average monthly rainfall over the period of 2006–2035 will increase by 26% from December to February and it will decrease by 1.6 to 13.7% between March to November; while the rainfall for the period of 2036-2065 will increase by 8.8% from June to August and will decrease by 5.5 to 18.2% between September to February. The annual average rainfall covering the period of 2006-2035 will rise to 43.1 mm in December and will decrease to 30.4mm in May; while the rainfall for the period of 2036-2065 will rise to 467.2mm in August and will decrease to 40.4mm in May. Table 2.3.1.6.4 and Figure 2.3.1.6.3 present the projected the monthly average rainfall with climate change scenario for 2006-2035; and the monthly average rainfall with climate change scenario for 2036-2065.

Table 2.3.1.6.4: Projected Monthly Average Rainfall

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Baseline/Without Climate Change Scenario (1981-2010)												
Ave	17.4	18.6	28.4	65	221.8	241.2	422.6	429.4	293.1	177	78	34.2
With Climate Change Scenario (2006-2035)												
Ave	21.9	23.4	24.5	56.1	191.4	237.3	415.8	422.5	265	160	70.5	43.1
With Climate Change Scenario (2036-2065)												
Ave	16.2	17.4	28.4	53.2	181.4	262.4	459.8	467.2	277	167.3	73.7	31.9

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

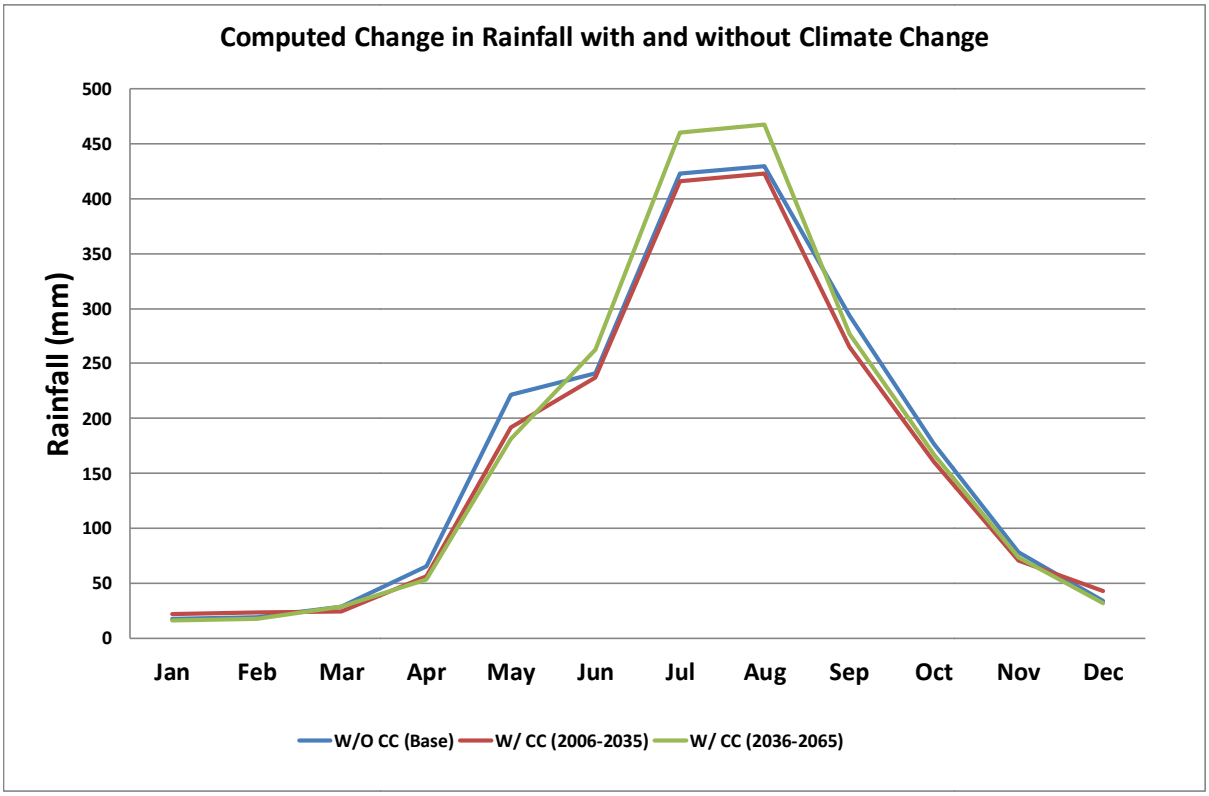


Figure *2.3.1.6.3:* Computed Average Rainfall With and Without Climate Change Scenarios

Frequency of Extreme Events

Based from the climate change scenario for the Philippines as published by PAGASA in February 2011, the province of Tarlac will have 1,855 days with maximum temperature of >35°C during the 2006-2035 period and 3,108 days during the 2036-2050 period; 5,701 dry days during the 2006-2035 period and 5,754 dry days during the 2036-2050 period; and 12 days with rainfall >200mm during the 2006-2035 period and 12 days during the 2036-2050 period, as presented in Table *2.3.1.6.5.*

Table 2.3.1.6.5: Frequency of Extreme Events in 2020 and 2050 under Medium Range Emission Scenario in Clark International Airport

No. of Days w/ Tmax >35ºC			No. of Dry Days			No. of Days w/ Rainfall >200mm		
OBS (1971-2000)	2020	2050	OBS	2020	2050	OBS	2020	2050
355	1855	3108	889	5701	5754	8	12	12

Note: Based from the Frequency of Extreme Events in 2020 and 2050 under Medium Range Emission Scenario in Pampanga, a nearby province of Tarlac
Source: Climate Change in the Philippines, 2011 PAGASA

2.3.1.6.2 Contribution in Terms of Greenhouse Gas Emissions (or GHG Mitigation Potential)

The Greenhouse Gas (GHG) emissions from the proposed Project include carbon dioxide, methane and nitrous oxides. Calculation of these GHG gases employs the Tier 1 Approach of the Intergovernmental Panel on Climate Change (IPCC) 2006 Guidelines using the following equation:

Equation 1:

Emissions GHG, fuel = fuel consumption fuel x emission factor GHG, fuel

Where:

Emissions GHG, fuel = emissions of a given GHG by type of fuel (kg GHG)

Fuel consumption fuel = amount of fuel combusted (TJ)
Emission factorGHG,fuel = default emission factor of a given GHG by type of fuel (kg gas/TJ). For CO2, it includes carbon oxidation factor, assumed to be 1.

Table 2.3.1.6.2 shows the summary of the GHG emissions from the Project. The default emission factor of residual oil no. 6 from Table 2.2 of the IPCC 2006 Guidelines is 77,400 kg of CO2/TJ; 10 kg of CH4/TJ for methane; and 0.6 kg of N2O/TJ for nitrous oxides.

Table 2.3.1.6.2: Summary of GHG Emissions of the Proposed Project

Emission Sources	Fuel Consumption (L/year)	Fuel Heating Value (kcal/kg)	CO2 Emission (MT/year)	CH4 Emission (MT/year)	N2O Emission (MT/year)
Proposed Furnace Stack	14,623,440	10,082	42,499	5.49	0.33

The total estimated CO2 emission from the operation of the furnace based on IPCC 2006 is 42,505 MT/yr. The Philippines Second National Communication (SNC) on Climate Change has projected 100,402,000 MT of CO2 for 2020. Using the projection of SNC, the Project operation is expected to contribute an approximately 0.061% of the total CO2 emission. Globally, the projected CO2 emission for 2020 under the United States Environmental Protection Agency (USEPA) Sectoral Trend in Global Energy Use and Greenhouse Gas Emissions, Climate Protection Division, Office of Air and Radiation, the estimated contribution of the Project is 0.000047%. Moreover, the Project will establish a "green buffer zone" to mitigate some of the potential effect of emissions of the proposed Scrap Recycling Steel Mill Project.

2.3.2 Air Quality and Noise Level

An ambient air quality monitoring programme was conducted in five (5) sampling locations within the project site and vicinity. The collected ambient air and noise data from the established stations will be used to represent the baseline data of the project. Station identification and geographical location are presented in Table 2.3.2.1, while Figure 2.3.2.1 shows the location of the stations.

The ambient TSP, PM10, SO2, and NO2 concentrations were measured at the identified sampling points. The selection of the sampling stations was based on the locations of receptors, source, and prevalent wind direction. Methods for sampling and analysis conformed to the methods prescribed in Sec. 1(b) Rule VII Part II of the Clean Air Act IRR. The resulting ambient air concentrations were compared with the National Ambient Air Quality Guidelines Values (NAAQGV), Rule VII, Part II and the National Ambient Air Quality Standards for Source Specific Air Pollutants (NAAQSSSAP) from Industrial Sources/Operations Section 1 Rule XXVI Part VII of the Clean Air Act IRR.

Table 2.3.2.1: Description of Established Sampling Stations for Ambient Air Quality & Noise Level Monitoring for the Proposed Project

Station	Description	Coordinates		Averaging Period
		Easting, m	Northing, m	
STN-1	In front of Multi-Purpose Hall, Brgy. San Vicente, Concepcion	247138.48	1692325.94	24-hour
STN-2	Beside the house of Mr. Jun Suizo, Brgy. Dungan Concepcion	244083.94	1691405.99	24-hour
STN-3	At the back of barangay hall of Brgy. San Nicholas Balas, Concepcion	247483.95	1691153.68	1-hour
STN-4	Calle Onse, Brgy. San Nicholas Balas, Concepcion	246312.97	1690520.62	1-hour
STN-5	Highway View Hacienda Subdivision, Brgy. Santo Rosario, Magalang Pampanga	245555.58	1686610.46	1-hour

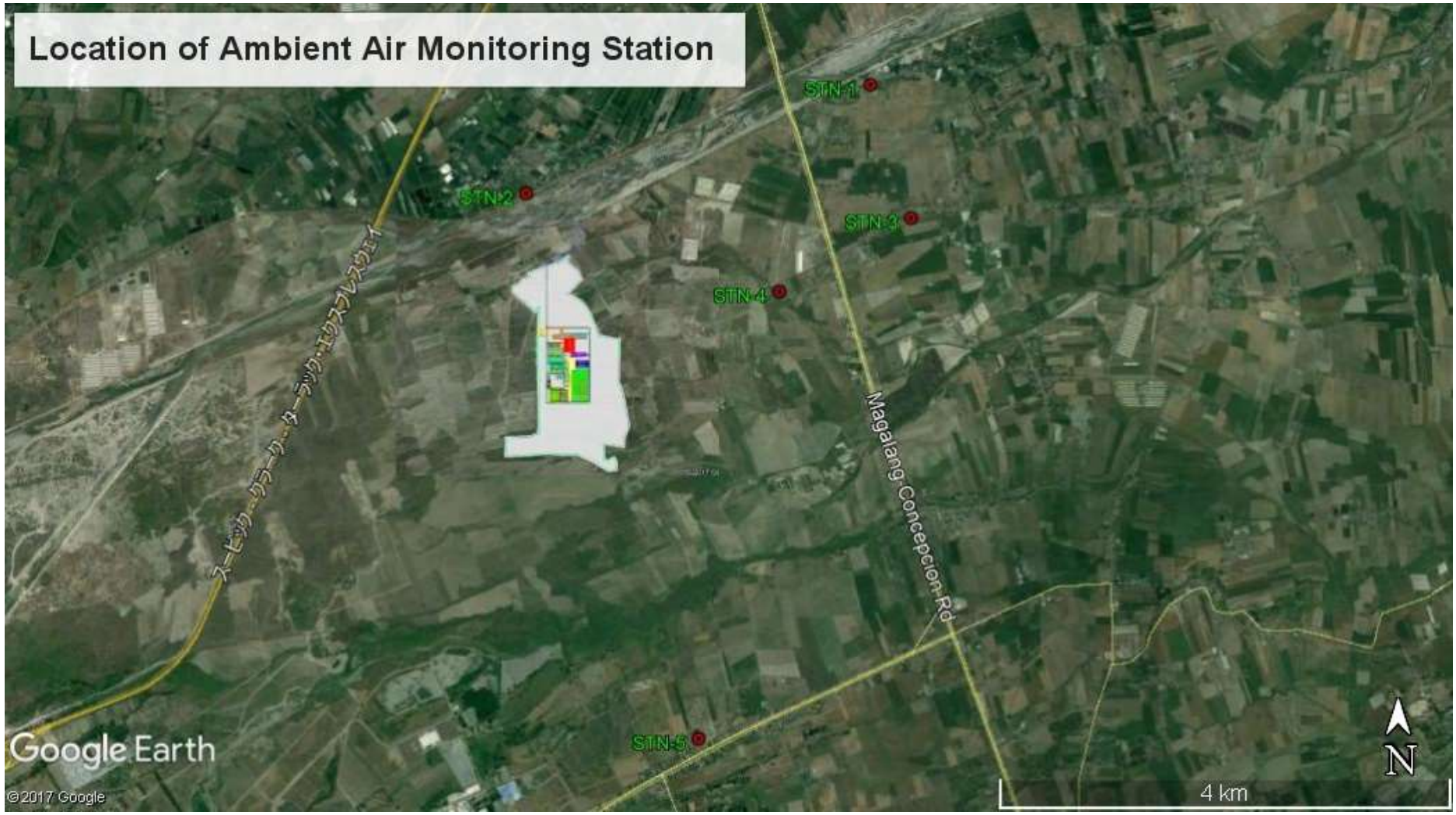


Figure 2.3.2.1: Established Stations for Ambient Air Quality and Noise Level Monitoring for the Proposed Project of Steel Asia

2.3.2.1 Ambient Air Quality

Ambient Air Sampling Result

Tables *2.3.2.1 and 2.3.2.2* present the results of air quality monitoring for 24-hour and hourly averaging time conducted on October 24-26, 2017 at the Project site and its vicinity located in Concepcion Tarlac. The results show the concentrations of particulates (TSP &PM10), SO2, and NO2 for 24-hour averaging period are all below the CAA limit of 230 µg/Ncm for TSP; 150 µg/Ncm for PM10; 150 µg/Ncm for NO2; and 180 µg/Ncm for SO2. 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 PM10, 260 µg/Ncm for NO2, and 340µg/Ncm for SO2.

The highest concentration of TSP is 55 µg/Ncm recorded at Station 2, while the lowest concentration is 34 µg/Ncm recorded at Station 5. For PM10, the highest concentration is 36 µg/Ncm recorded at Station 2 while the lowest concentration is 16 µg/Ncm recorded at Station 5. The highest concentration of SO2 is 36 µg/Ncm recorded at Station 2 while the lowest concentration is 16 µg/Ncm recorded at Station 4. For NO2, the highest concentration is 18 µg/Ncm recorded at Station 3 while the lowest is 9.87 µg/Ncm recorded at Station 2.

For heavy metals (arsenic and cadmium), the concentrations are below the method detection limit in all air sampling stations. The analysis method detection limit for cadmium is 1.0 µg. However, arsenic is detected at Station 2 with a concentration of 0.00010 µg/Ncm.

Table 2.3.2.1.1: Results of 24-hour Ambient Air Quality Monitoring

Items Sampling Station Date of Sampling Time of Sampling	Description/Values		
	STN-1 Oct. 24-25 2017 0950H-0950	STN-2 Oct. 25-26, 2017 1055H-1055H	CAA Limit
TSP, (µg/Ncm)	42	55	230
PM10, (µg/Ncm)	31	36	150
SO2, (µg/Ncm)	33	36	180
NO2, (µg/Ncm)	18	17	150
As, (µg/Ncm)	ND	0.00010	-
Cd, (µg/Ncm)	ND	ND	-
Cr+6, (µg/Ncm)	0.00056	0.00051	-
Pb, (µg/Ncm)	0.00423	0.00537	-
Hg, (µg/Ncm)	0.00001	0.00001	-

Table 2.3.2.1.2: Results of hourly Ambient Air Quality Monitoring

Items Sampling Station Date of Sampling Time of Sampling	Description/Values			
	STN-3 Oct. 26, 2017 1240H-1340H	STN-4 Oct. 26, 2017 1425H-1525H	STN-5 Oct. 26, 2017 1720H-1820H	CAA Limit
TSP, (µg/Ncm)	48	37	34	300
PM10, (µg/Ncm)	28	19	15	200
SO2, (µg/Ncm)	21	16	18	340
NO2, (µg/Ncm)	14	9	12	260

2.3.2.1.1 Impact Assessment and Mitigating Measures

2.3.2.1.1.1 Degradation of Air Quality during Pre-Construction and Construction Phases

Impact Assessment

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

depending on the level of activity, the specific operations, and the prevailing meteorological conditions but these emissions are short-term, local, and minor.

The expected air quality impacts during construction would be mainly from a) fugitive emissions from site clearing and grubbing, and b) vehicular emissions from construction equipment and other vehicles.

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

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

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

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

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

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

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

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

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

2.3.2.1.1.2 Degradation of Air Quality during Operation Phase

Impact Assessment
The proposed Project will utilize oil as its primary fuel. This will be burned in the furnace in turn releases air pollutants which will cause significant impact on the environment. Emissions from oil combustion depend on the fuel composition, size and type of furnace, firing conditions, load, type of control technologies, and level of equipment maintenance. The major pollutants of concern from oil combustions are particulate matter (PM & PM10), nitrogen oxides (NOx), and sulfur dioxide (SO2).

Some unburned combustibles, including carbon monoxide (CO) and other organic compounds are generally emitted even under proper operating conditions.

Air Dispersion Modeling Methodology

The Environmental Management Bureau, Memorandum Circular 2008-03 "Guidelines for Air Dispersion Modeling" uses a tiered approach in assessing air contaminants concentrations against the Clean Air Act (CAA of 1999) air quality guidelines and standard. The tiered approach follows the United States 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.

Modeling Approach for this Study
Air quality 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.

AERMOD model was used in this modeling report to assess and determine air quality impact due to the emissions of PM, SOx, NOx, and CO in the operation of the proposed project. The meteorological data set used is from Clark International Airport Station. The model utilized assessment to determine the level of the proposed development impacts on the surrounding environment, including terrain effects on the discharged plumes for one hour, 8-hours (for CO), 24-hour and annual averaging times, without the need for the use of conversion factors.

The MC 2008-003 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. It 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 9.5.0) was used in this project to simulate the ambient concentration of TSP, PM10, SO2, NO2, and CO at three vertical levels from plant emissions. The modeling with AERMOD was performed using the regulatory default option, which includes stack height adjusted for stack-tip downwash.

Plot Plan
The source subject for this modeling is the furnaceflue stack of the proposed project. Figure 2.3.2.1.1.2.1 is the general plant lay-out of the facility showing the location of the emission source.

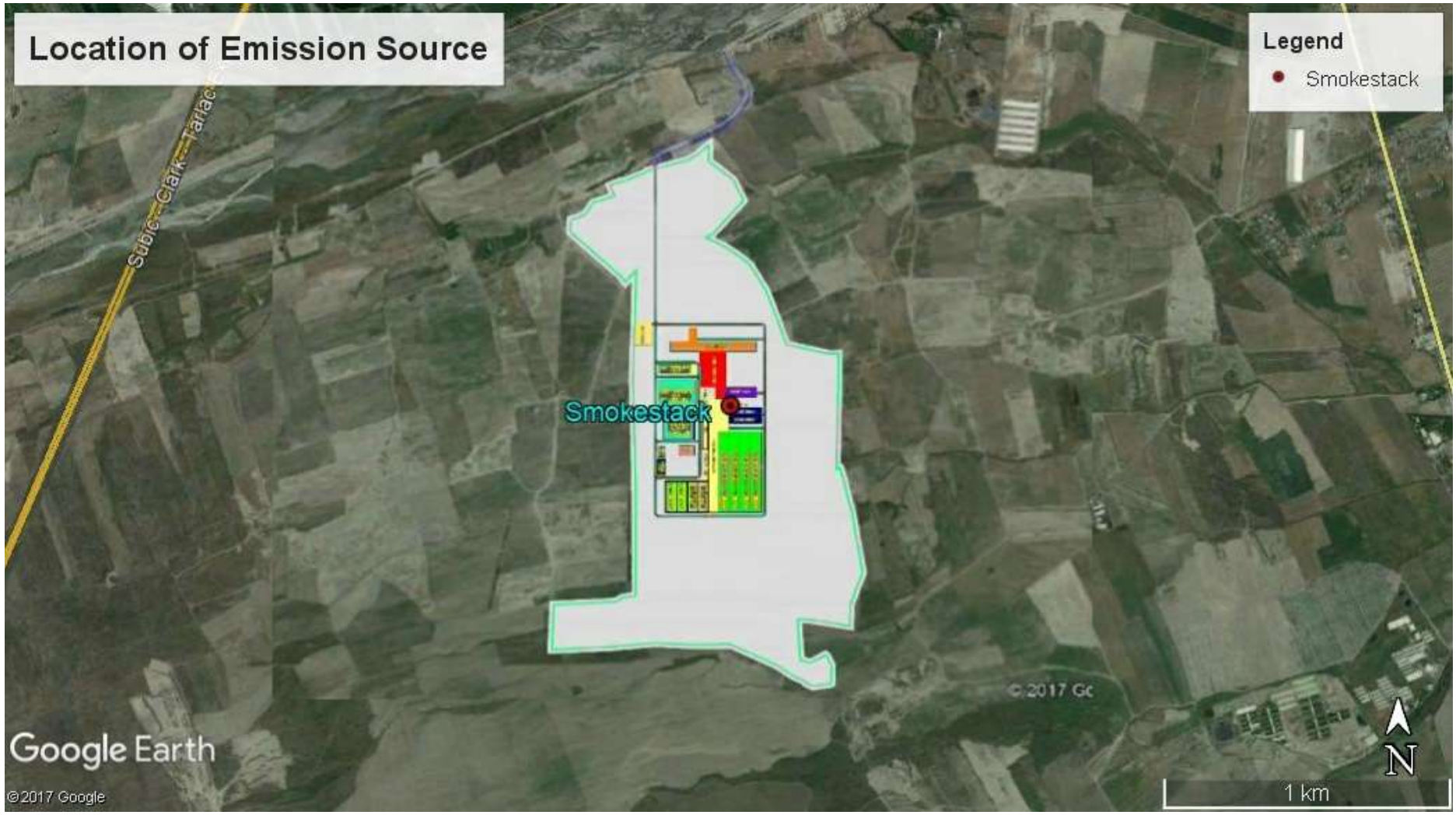


Figure 2.3.2.1.1.2.1: Location of Emission Source

Air Quality Monitoring Data
Modeled ambient air concentrations only reflect the impacts from stationary industrial emission sources. Therefore, "background" concentrations are typically added to the modeled ground-level concentrations. These background concentrations include emissions from industrial emission sources (e.g., area and mobile sources, distant point sources, etc.) and non-industrial emission sources (e.g., vehicles, recreational watercraft, etc.), which are not included in the model.

Emission Load of Each Sources
The modeling scenario considered in this study is the normal operating condition of the furnace. Table below are the summary of the source parameters.

Table 2.3.2.1.1.2.1: Summary of Source Parameters

Parameter	Unit	Proposed Furnace Flue Stack
Coordinates		
Easting (x)	m	244507.66
Northing (y)	m	1689939.14
Elevation (z)	m	55
Fuel consumption	L/yr	14,623,440
Operating hours	h/yr	8220
Flue gas volumetric flow rate	m3/s	17.59
Flue gas velocity	m/s	5.6
Flue gas exit temperature	°C	348.8
Stack height above the ground	m	75
Stack exit diameter	m	2
Pollutant Emission Rate		
SO2	g/s	13.267
NO2	g/s	3.098
CO	g/s	0.282
TSP	g/s	0.563
PM10	g/s	0.450

Modeling Result
Table 2.3.2.1.1.2.2 gives an overall summary of the predicted concentrations, i.e. maximum modeled concentrations. The predicted peak 1-hour and 24-hour emissions of TSP, PM10, SO2, NO2, and CO are within the CAA limit. The highest ground level concentrations of modeled parameters in the whole modeling domain occurred in an inhabited area of Barangay Sto. Nino, Bamban Tarlac at coordinates 236027.01 m E; 1690535.84 m N. at a distance of about 8,400 meters west of the Project. The highest ground level concentrations predicted were for sulfur dioxide followed by oxides of nitrogen from the proposed sources.

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

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

Table 2.3.2.1.1.2.2: Summary of Predicted Maximum Concentration

Receptor ID	Maximum Predicted Ground Level Concentration (µg/m3)									
	COa		NO2		SO2		TSP		PM10	
	1hr	8hr	1hr	24hr	1hr	24hr	1hr	24hr	1hr	24hr
Domain Maximum	0.0035	0.0017	38.58	6.05	165.22	25.90	7.01	1.10	5.60	0.087
ASR-1	0.00015	0.000028	1.69	0.13	7.25	0.57	0.31	0.024	0.25	0.019
ASR-2	0.000089	0.000015	0.98	0.08	4.20	0.33	0.18	0.014	0.14	0.011
ASR-3	0.00025	0.000055	2.74	0.19	11.73	0.81	0.50	0.035	0.40	0.028
ASR-4	0.00018	0.000026	2.01	0.09	8.59	0.40	0.36	0.017	0.29	0.014
ASR-5	0.00019	0.000026	2.12	0.13	9.07	0.55	0.39	0.024	0.31	0.019
ASR-6	0.00025	0.000045	2.73	0.21	11.70	0.92	0.50	0.039	0.40	0.031
ASR-7	0.00011	0.000013	1.18	0.08	5.04	0.36	0.21	0.015	0.17	0.012
ASR-8	0.00019	0.000035	2.08	0.20	8.90	0.84	0.38	0.036	0.30	0.029
ASR-9	0.00026	0.000033	2.82	0.18	12.11	0.77	0.51	0.033	0.41	0.026
ASR-10	0.00026	0.000037	2.84	0.16	12.17	0.68	0.52	0.029	0.41	0.023
ASR-11	0.00021	0.000049	2.35	0.22	10.08	0.95	0.43	0.040	0.34	0.032
ASR-12	0.00032	0.000049	3.49	0.26	14.96	1.12	0.63	0.047	0.51	0.038
ASR-13	0.00019	0.000047	2.10	0.45	8.99	1.93	0.38	0.082	0.30	0.065
ASR-14	0.00019	0.000039	2.10	0.17	8.99	0.71	0.38	0.030	0.31	0.024
ASR-15	0.00025	0.000038	2.78	0.16	11.90	0.69	0.51	0.029	0.40	0.023
ASR-16	0.00013	0.000032	1.42	0.13	6.09	0.54	0.26	0.023	0.21	0.018
ASR-17	0.00025	0.000046	2.75	0.21	11.79	0.92	0.50	0.039	0.40	0.031
ASR-18	0.00024	0.000046	2.64	0.24	11.29	1.01	0.48	0.043	0.38	0.034
ASR-19	0.00023	0.000034	2.49	0.16	10.68	0.67	0.45	0.029	0.36	0.023
ASR-20	0.00015	0.000021	1.62	0.10	6.95	0.42	0.29	0.018	0.24	0.014
ASR-21	0.00010	0.000024	1.12	0.09	4.81	0.38	0.20	0.016	0.16	0.013
ASR-22	0.00015	0.000022	1.65	0.12	7.08	0.53	0.30	0.023	0.24	0.018
ASR-23	0.00014	0.000019	1.36	0.08	5.82	0.33	0.25	0.014	0.20	0.011
ASR-24	0.00018	0.000026	2.02	0.11	8.67	0.48	0.37	0.020	0.29	0.016
ASR-25	0.00017	0.000023	1.84	0.11	7.87	0.47	0.33	0.020	0.27	0.016
NAAQGV:	35	10	-	150	-	180	-	230	-	150
NAAQSSSAP	-	-	260	-	340	-	300	-	200	-

Note: a - mg/m3:

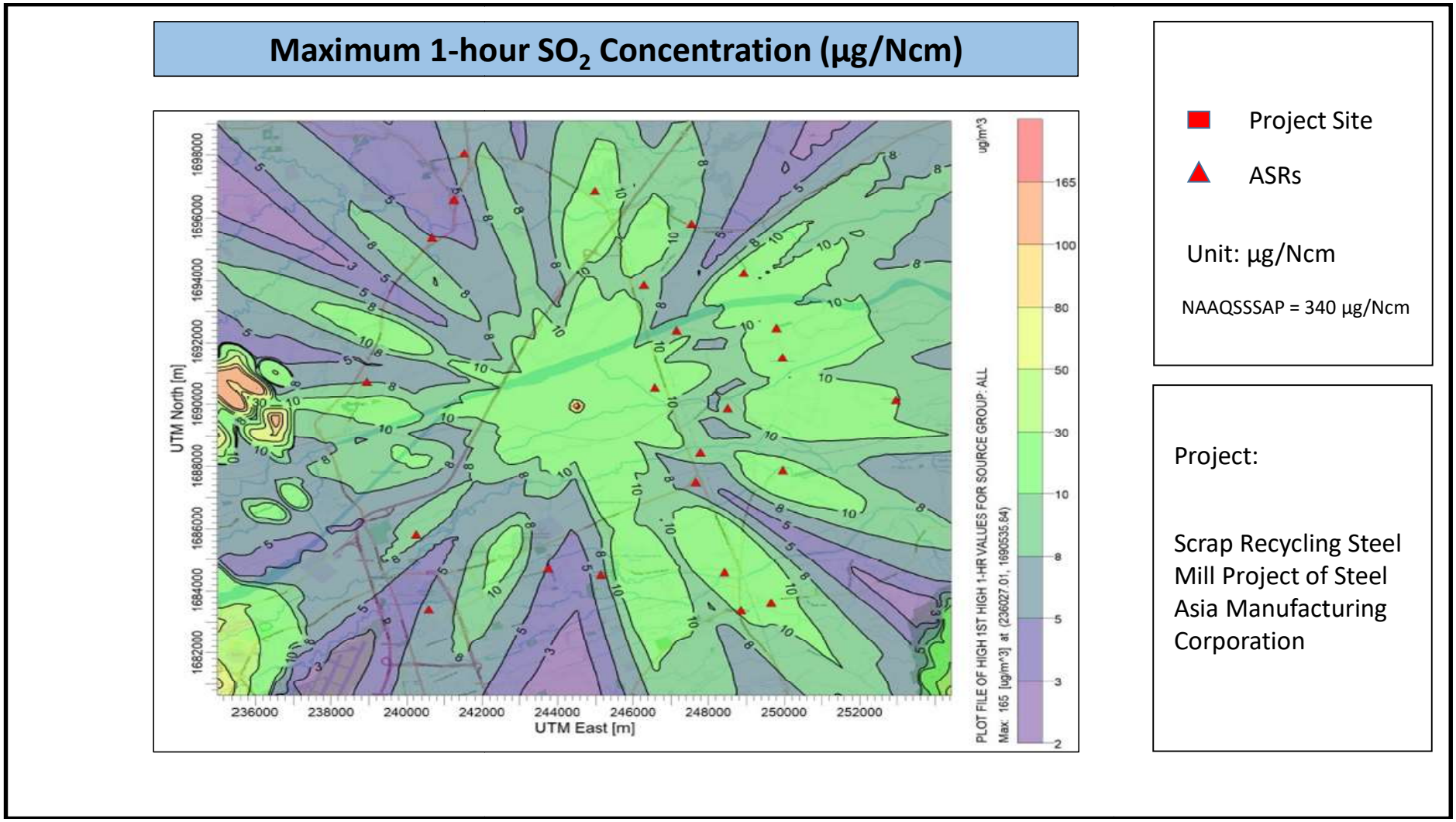


Figure 2.3.2.1.1.2.2: Isopleth of SO2 Concentration 1-hour averaging period

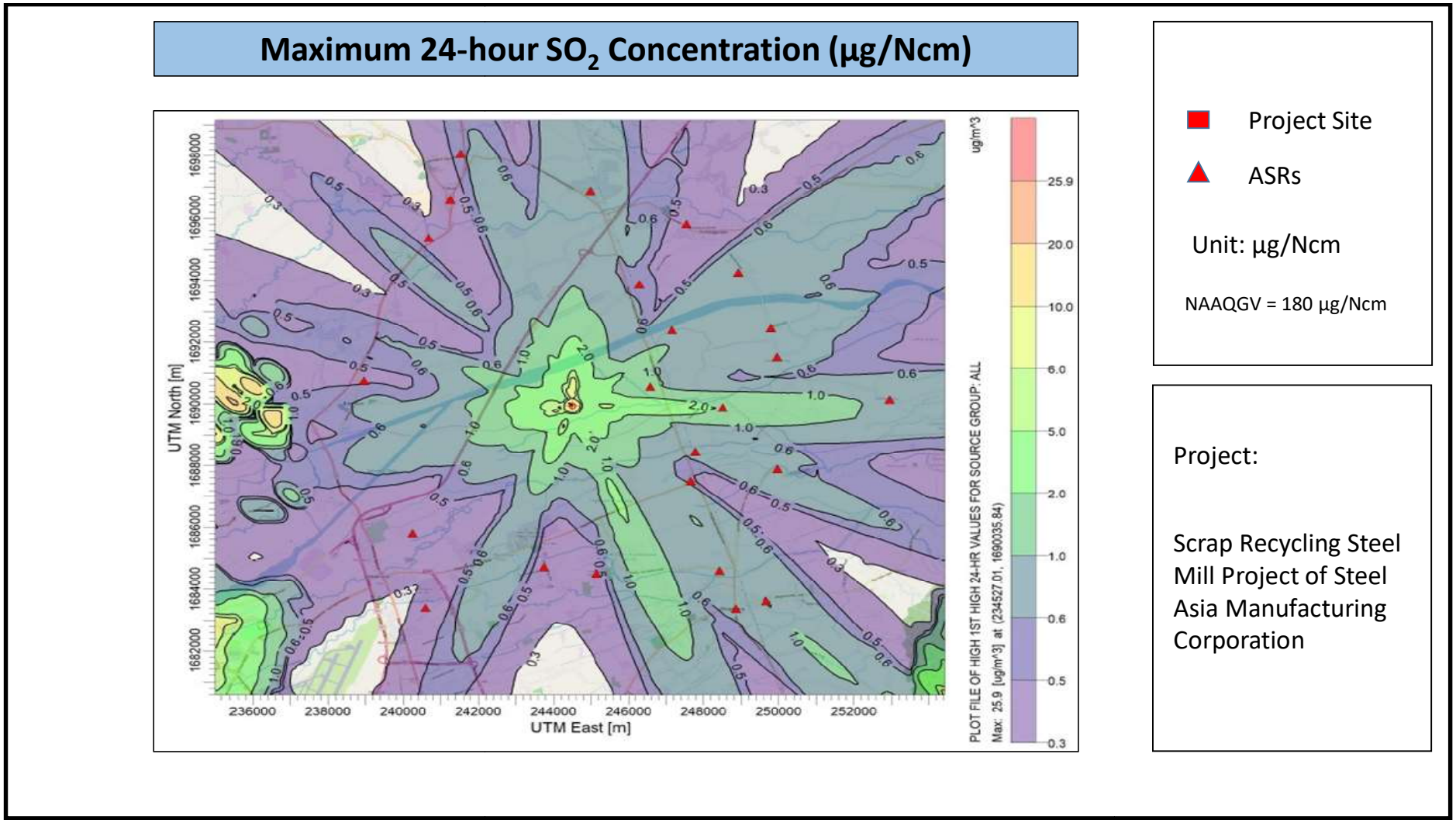


Figure 2.3.2.1.1.2.3: Isopleth of SO2 Concentration 24-hour averaging period

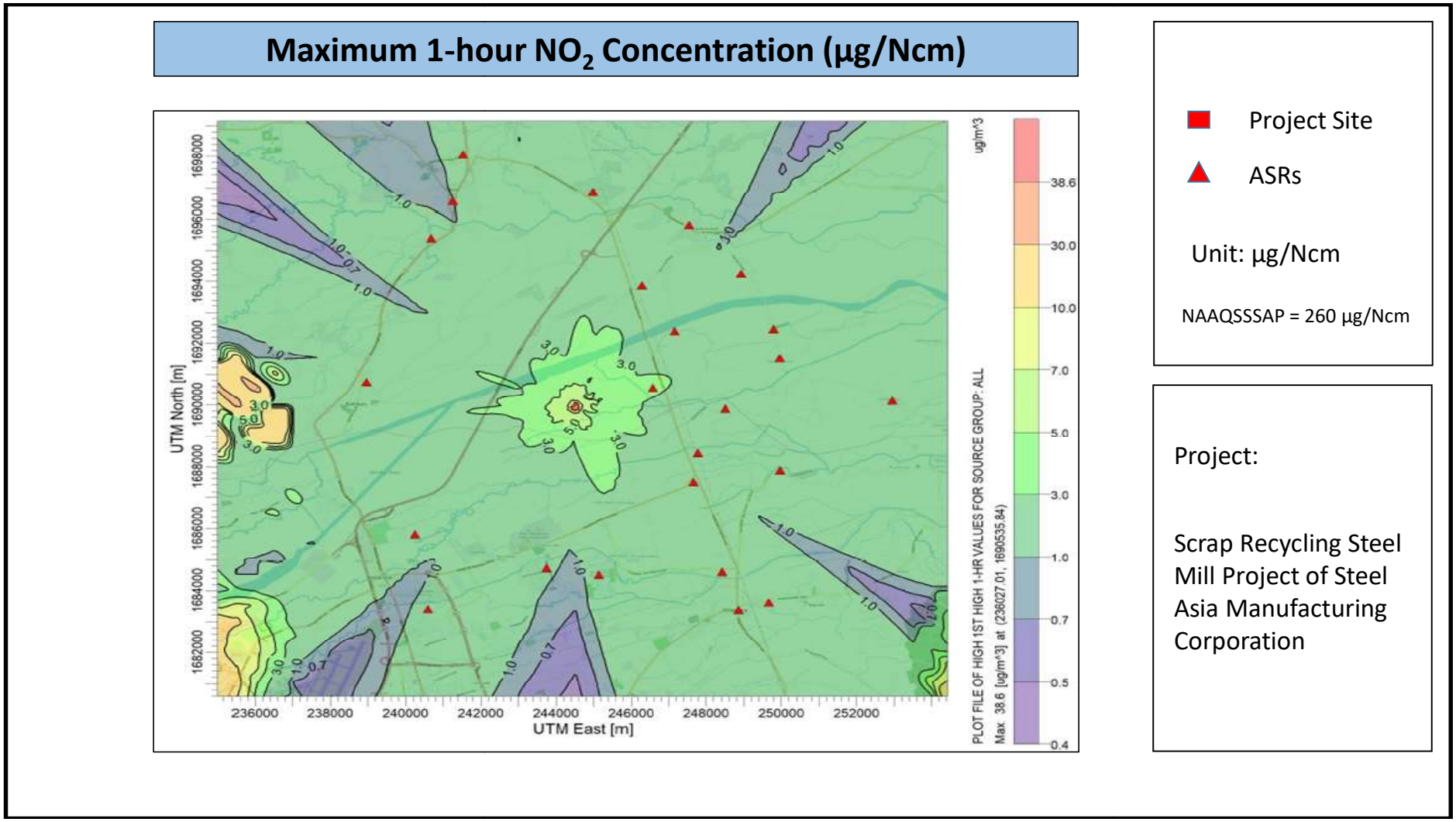


Figure 2.3.2.1.1.2.4: Isopleth of NO2 Concentration 1-hour averaging period

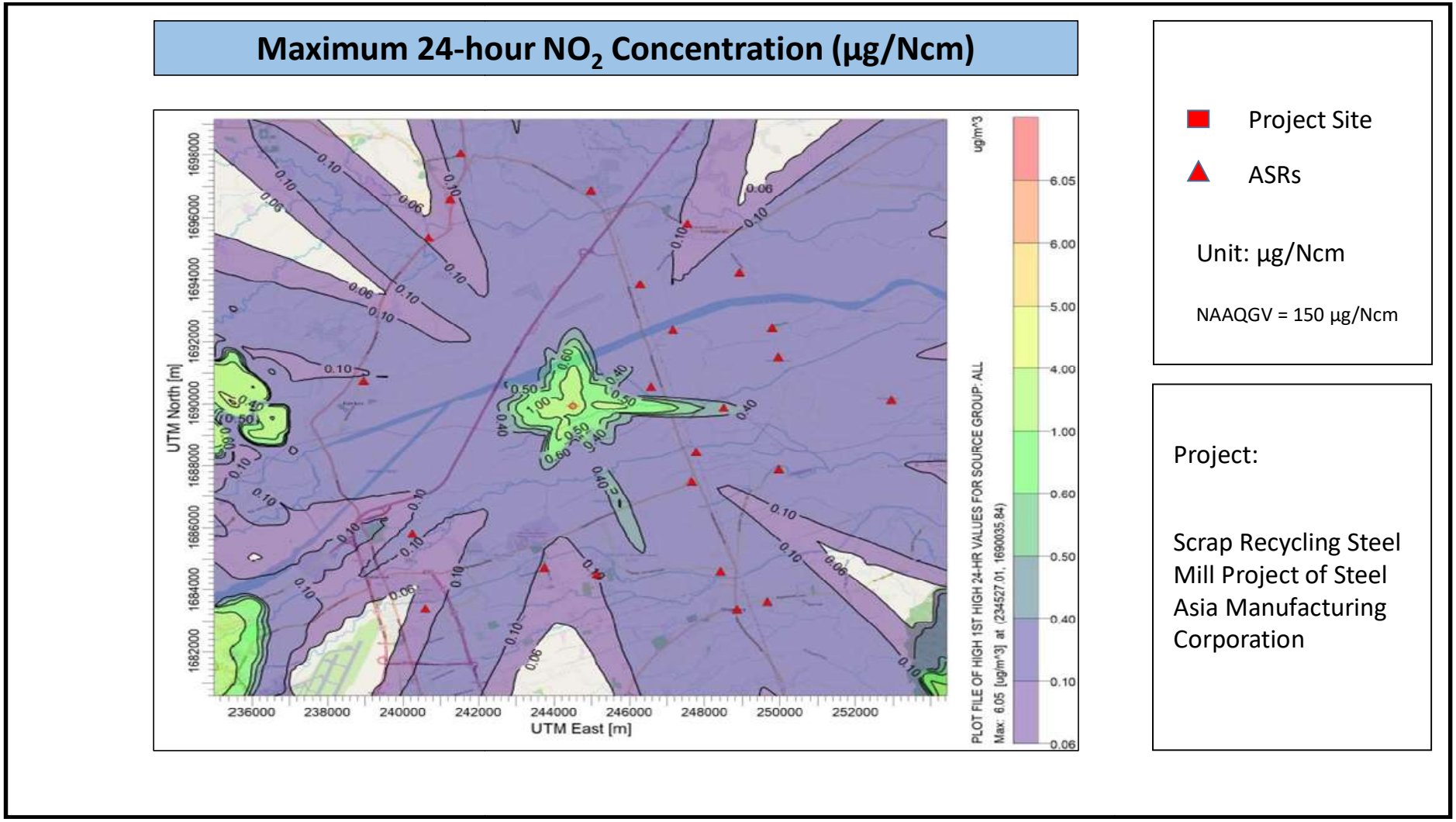


Figure 2.3.2.1.1.2.5: Isopleth of NO2 Concentration 24-hour averaging period

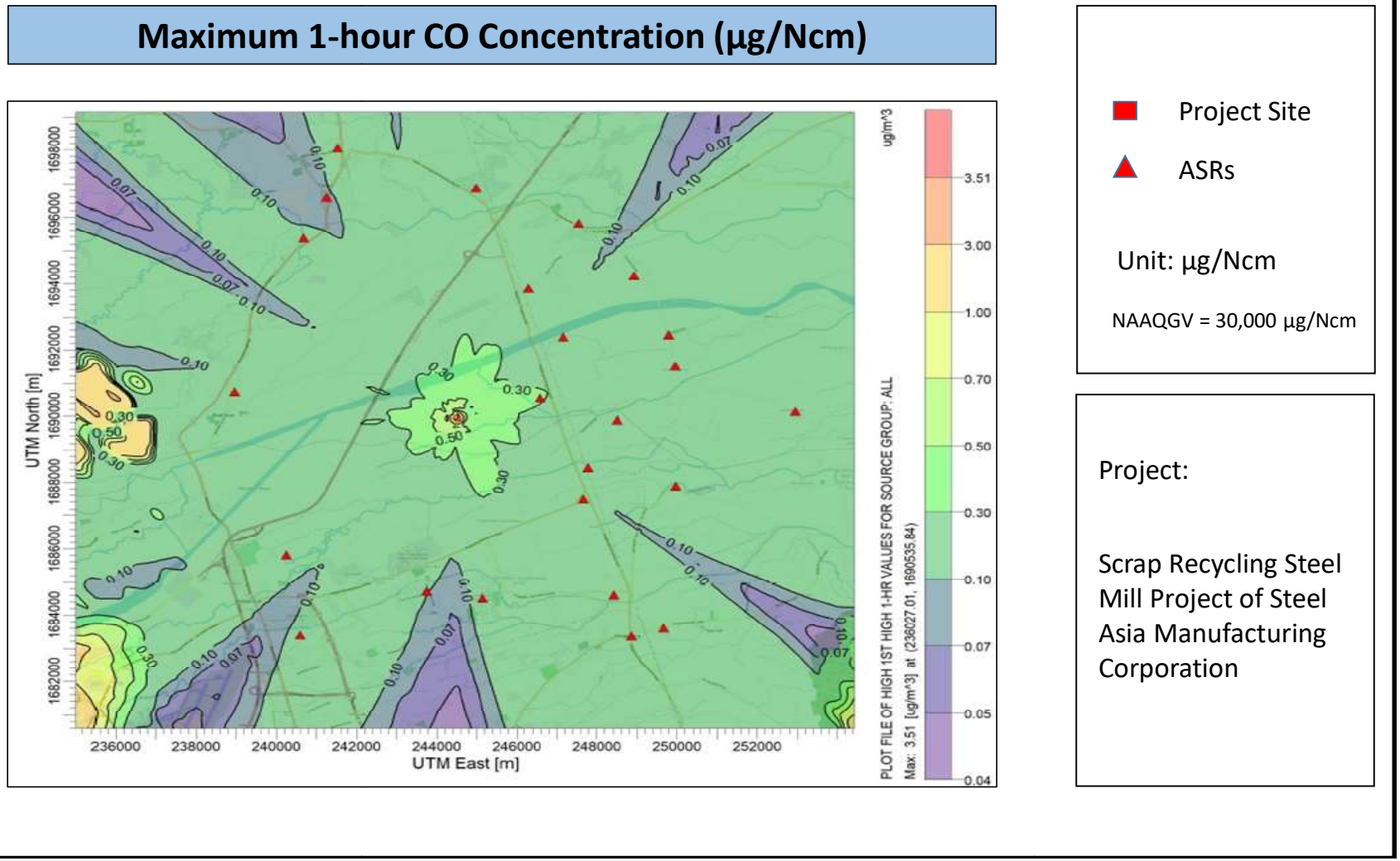


Figure 2.3.2.1.1.2.6: Isopleth of CO Concentration 1-hour averaging period

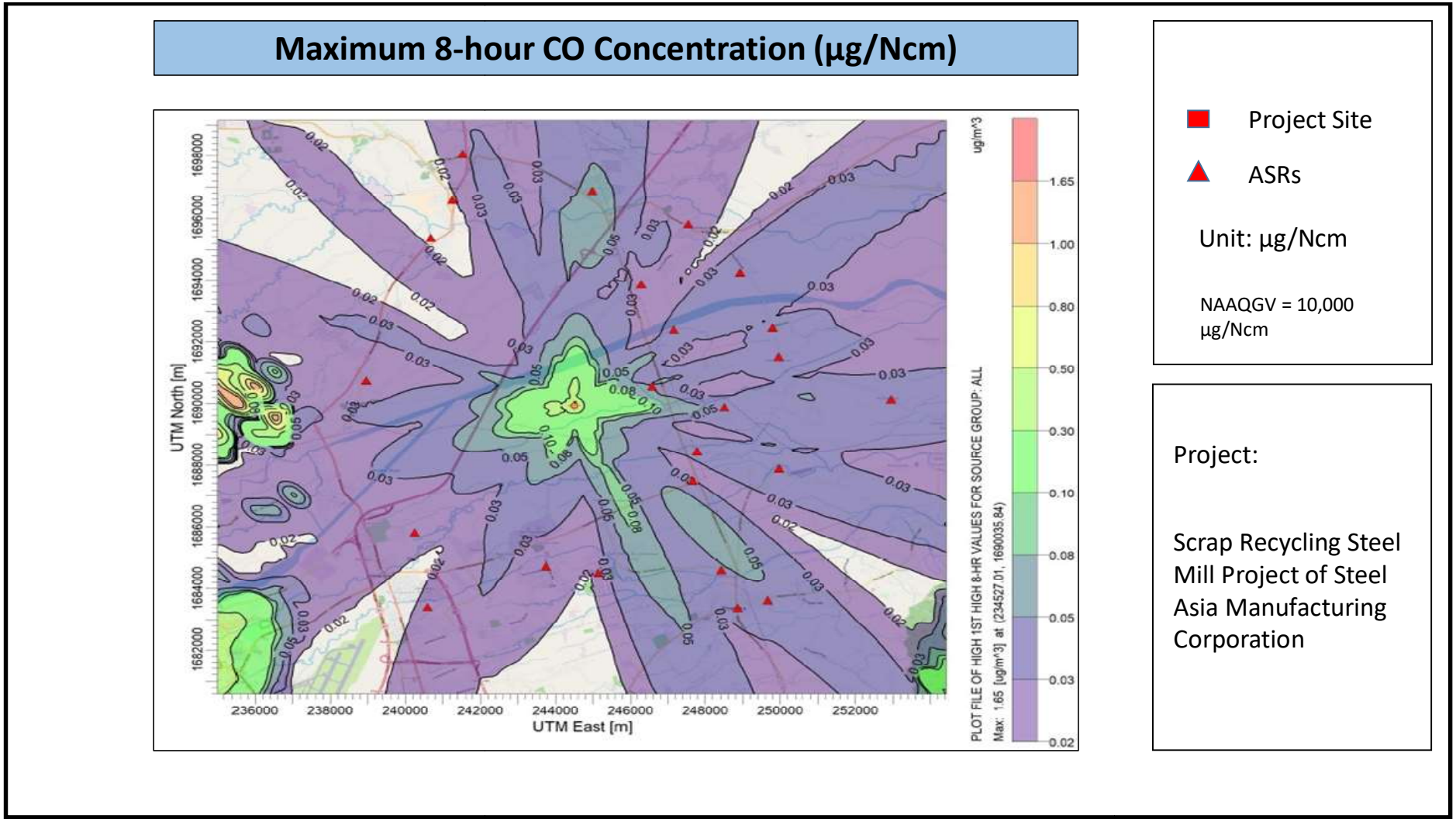


Figure 2.3.2.1.1.2.7: Isopleth of CO Concentration 8-hour averaging period

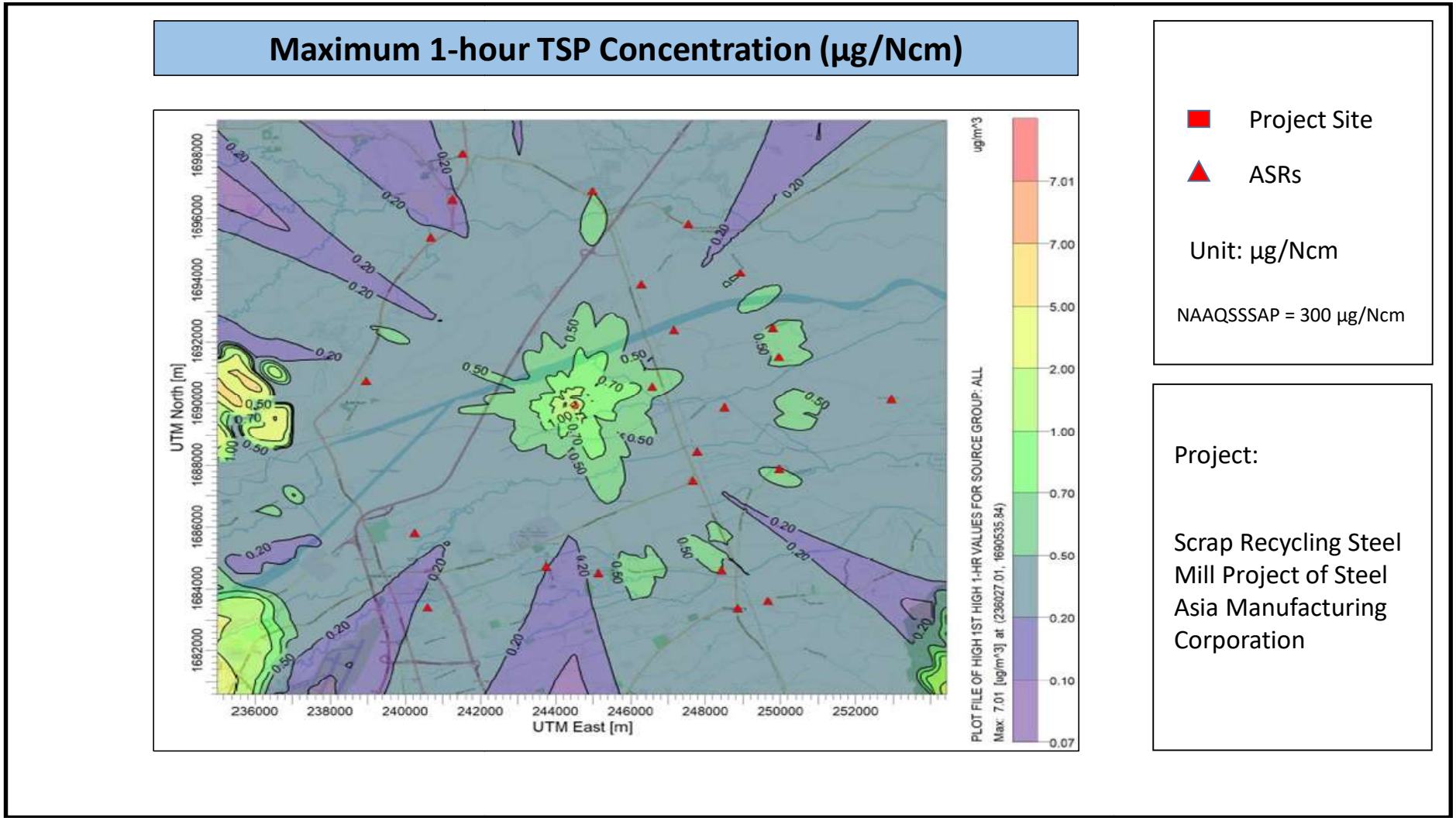


Figure 2.3.2.1.1.2.8: Isopleth of TSP Concentration 1-hour averaging period

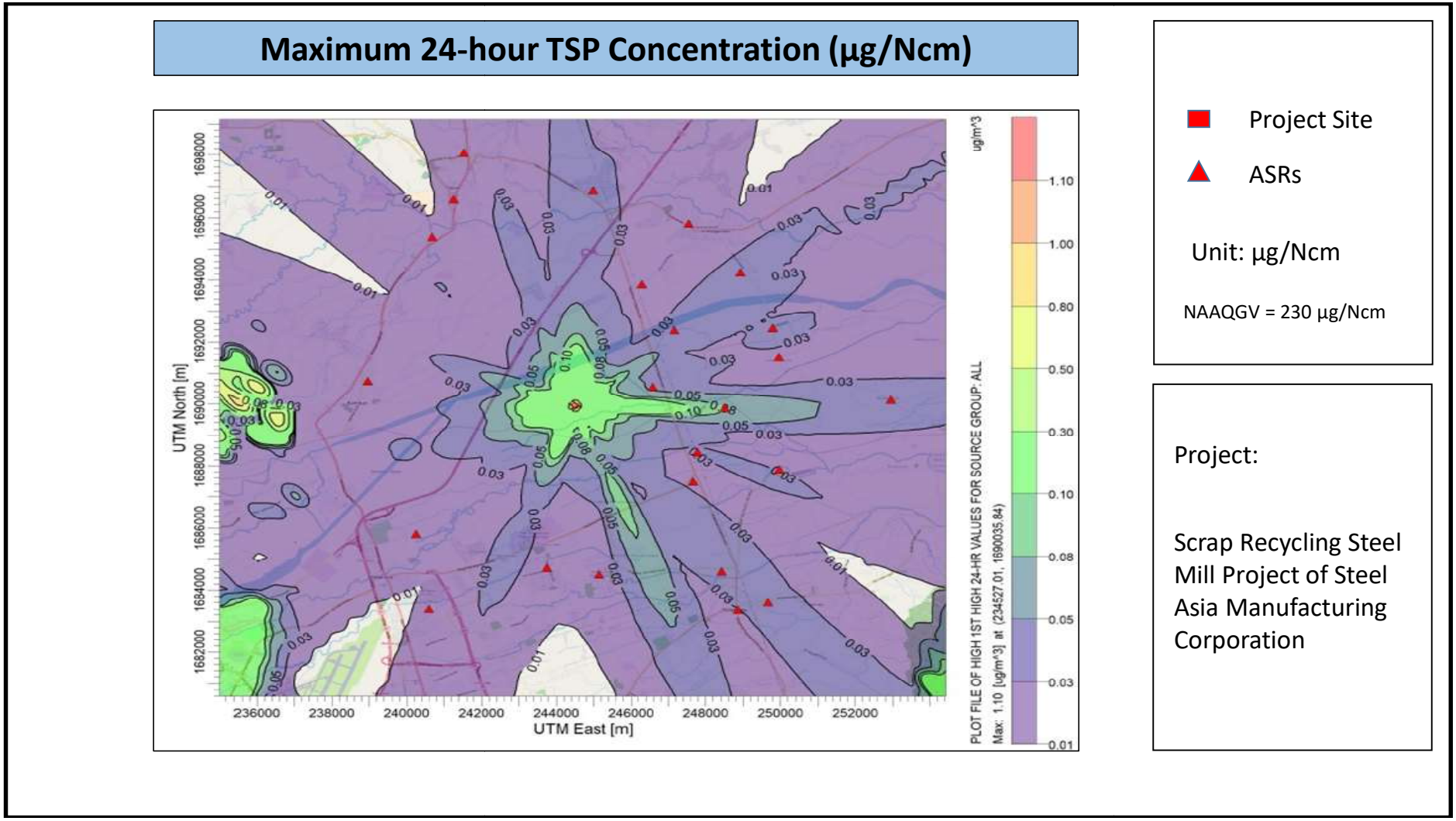


Figure 2.3.2.1.1.2.9: Isopleth of TSP Concentration 24-hour averaging period

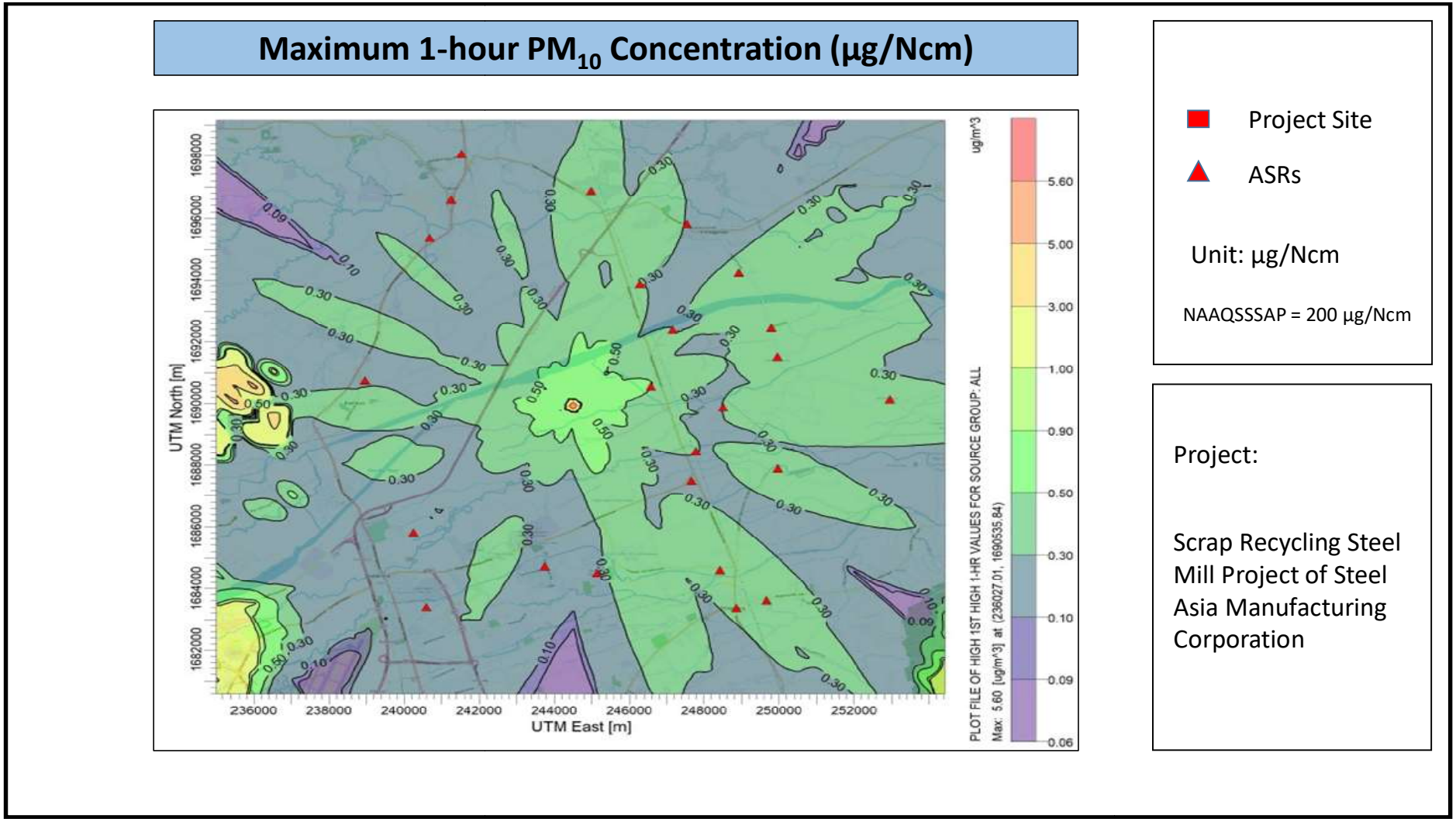


Figure 2.3.2.1.1.2.10: Isopleth of PM10 Concentration 1-hour averaging period

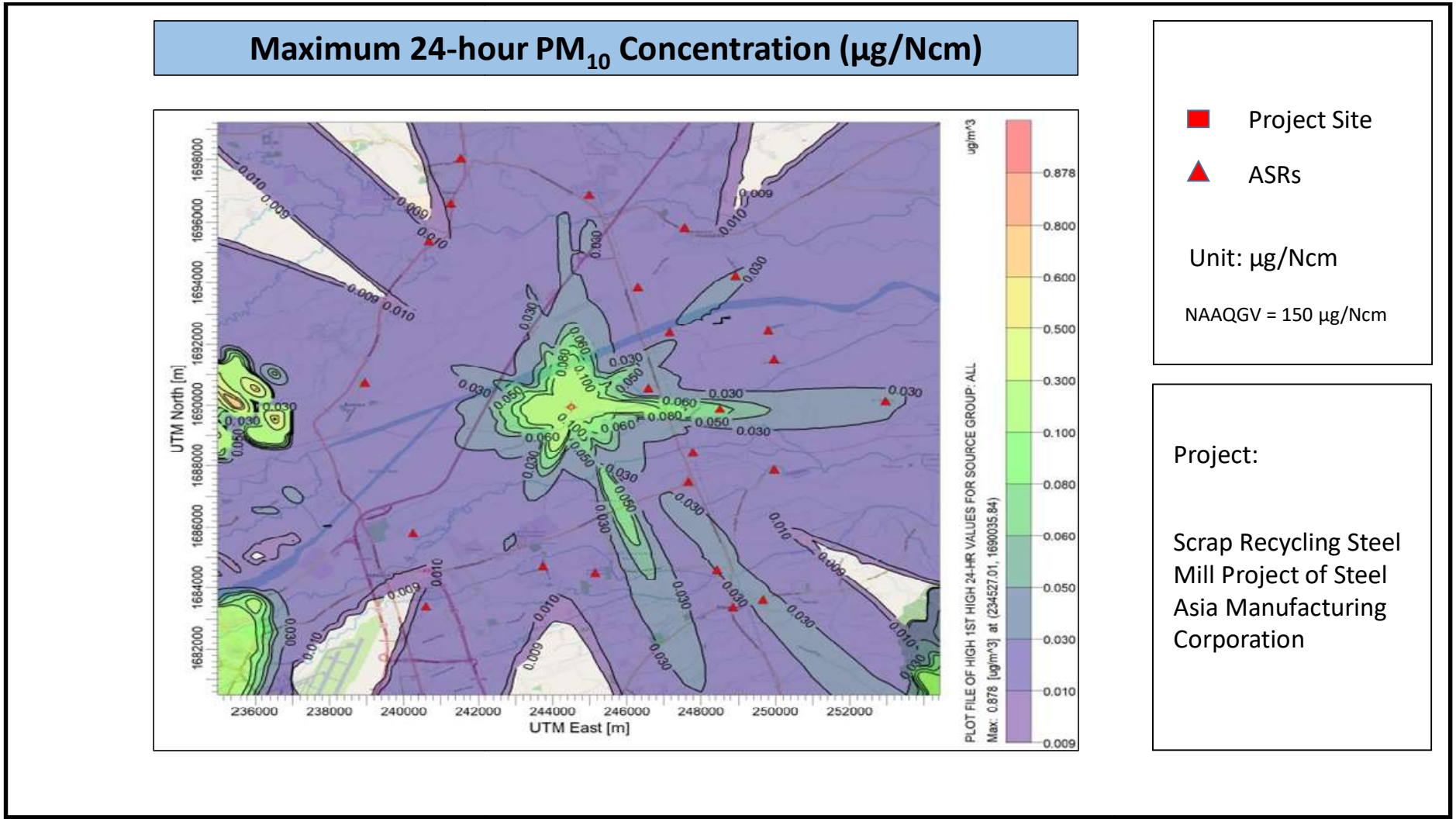


Figure 2.3.2.1.1.2.11: Isopleth of PM10 Concentration 24-hour averaging period

Management and Mitigation Measures
The following mitigation and control measures are presented in detail to establish the capabilities of each equipment to lessen, control and prevent emission of criteria pollutants i.e. particulate matter (PM), NOx (as NO2), and SOx (as SO2) into the receiving environment.

1) Low NOx Burner
Low NOx Burners (LNB) limit NOx formation by controlling the stoichiometric and temperature profiles of the combustion process in each burner zone. The unique design of features of an LNB may create: (i) reduced oxygen level in the combustion zone to limit fuel NOx formation; (ii) a reduced flame temperature that limits thermal NOx formation; and/or (iii) a reduced residence time at peak temperature which also limits thermal NOx formation.

2) Recuperator System
A recuperator is a special purpose counter flow energy recovery heat exchanger positioned within the supply and exhaust air streams of an air handling system in order to recover the waste heat.

SteelAsia Manufacturing Corporation will utilize a recuperator in order to save energy, fuel and time from their operation. It will also reduce emissions such as CO2, SO2 and other gases emissions formed during the combustion of fossil fuel.

3) Emission Monitoring System
The furnace flue stack will be provided with a complete set of emission monitoring system. The basis for the installation of monitoring system will be the DAO 2007-22 “Guidelines on the requirements for continuous emission monitoring systems and other acceptable protocols, thereby modifying and clarifying certain provisions of Section 5, Rule X of DAO 2000-81 and other related provisions”.

Section 3 of DAO 2007-22 states that a) new and modified sources with potential to emit at least 750 tons per year for each applicable pollutant listed in Section 4, Rule IX of DAO 2000-81 must install CEMS for that parameter; b) all sources with potential to emit more than 100 tons per year but less than 750 tons after the air pollution control installation may utilize a PEMS.

In this regard, the plant’s utilization of emission monitoring system either CEMS or PEMS will depend on the results of actual source emission test to be conducted once the plant is in operation. The result of the actual source testing will determine if the plant’s emission rate will have exceeded the 750 tons/year of any regulated pollutants for the installation of CEMS or below the 750 tons/year but more than 100 tons/year of any regulated pollutants for the installation of PEMS.

2.3.2.2 Noise Quality

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

Noise level measurement was conducted in five (5) sampling locations within the project site and its vicinity. 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 Table 2-8 and Figure 2-9 which shows the station identification and the geographical position.

Noise Level Measurement Result
Table 2-13 present the results of noise level monitoring conducted from October 24-26, 2017 at the monitoring stations described in Table 2-8. As shown below, the median noise level in all stations were below the allowable noise standards in Section 78, Table 1 of the 1978 NPCC Rules and Regulations, Environmental Quality Standard for Noise in general areas.

Significant noise was contributed by vehicles plying near the stations which were situated in populated communities, with houses close to each other. Motorcycles and tricycles were main modes

of transportation particularly for communities situated in higher elevations, although there were few cars that pass along these roads.

During sampling, there were also activities that contribute to the noise levels measured, like youths playing basketball 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 2.3.2.2.1: Results of Noise Levels Measurement

Station	Period	Date	Time	Median SPL dB(A)	DENR Noise Standard dB(A)
STN-1	Morning	Oct. 24, 2017	0915H-0930H	42.5	50
	Daytime	Oct. 24, 2017	1430H-1445H	42.8	55
	Evening	Oct. 24, 2017	2040H-2055H	43.0	50
	Nighttime	Oct. 25, 2017	0000H-0015H	42.4	45
STN-2	Morning	Oct. 25, 2017	1040H-1055H	47.4	50
	Daytime	Oct. 25, 2017	1530H-1545H	43.6	55
	Evening	Oct. 25, 2017	2000H-2015H	40.4	50
	Nighttime	Oct. 26, 2017	0005H-0020H	40.8	45
STN-3	Daytime	Oct. 26, 2017	1215H-1230H	41.3	50
STN-4	Daytime	Oct. 26, 2017	1530H-1545H	40.5	50
STN-5	Evening	Oct. 26, 2017	1825H-1840H	47.5	50

Impact Assessment and Mitigation

Construction Phase

Quantitative Analysis
During construction phase, 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. 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 2-83. The equipment listed in the table are 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 DENR-EMB published noise modeling guidelines and procedures, the computation used are based on international technical guidelines and procedures.

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

Table 2.3.2.2.2: 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

Power Mechanical Equipment	PWL, dB(A)
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
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).

The modeling guidelines used is the Technical Memorandum on Noise of Hongkong Environmental Protection Department, Noise Control Authority. Noise levels should be summed in a pairwise fashion and the final total rounded to the nearest whole dB(A), with values of 0.5 or more being rounded up.2

Table *2.3.2.2.3* shows the summation of noise levels. The summed noise assumed to be at the centre of the Project site.

Table 2.3.2.2.3: Summation of Noise Levels

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

Source: Technical Memorandum on Noise, Hongkong Environmental Protection Department

The total power level takes into account assumed maximum numbers of equipment and an assumed 'on-time' for the equipment, that is, period in percentage terms during which the equipment will be operating. Construction activities are predicted to be its worst-case scenario where 24-hour operation is expected. Noise generated from blasting (if there's any) is not included in this modeling because

2 Technical Memorandum on Noise, Hongkong Environmental Protection Department, Noise Control Authority, January 1996

blasting operation is on case to case basis only. CUSTIC software predict a continuous operation, if blasting is included, it simulated continuously for 24- hours.

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.

Noise is simulated to determine the noise impact at the boundary wall of the proposed Project. The identified noise boundary is shown in the figure below.

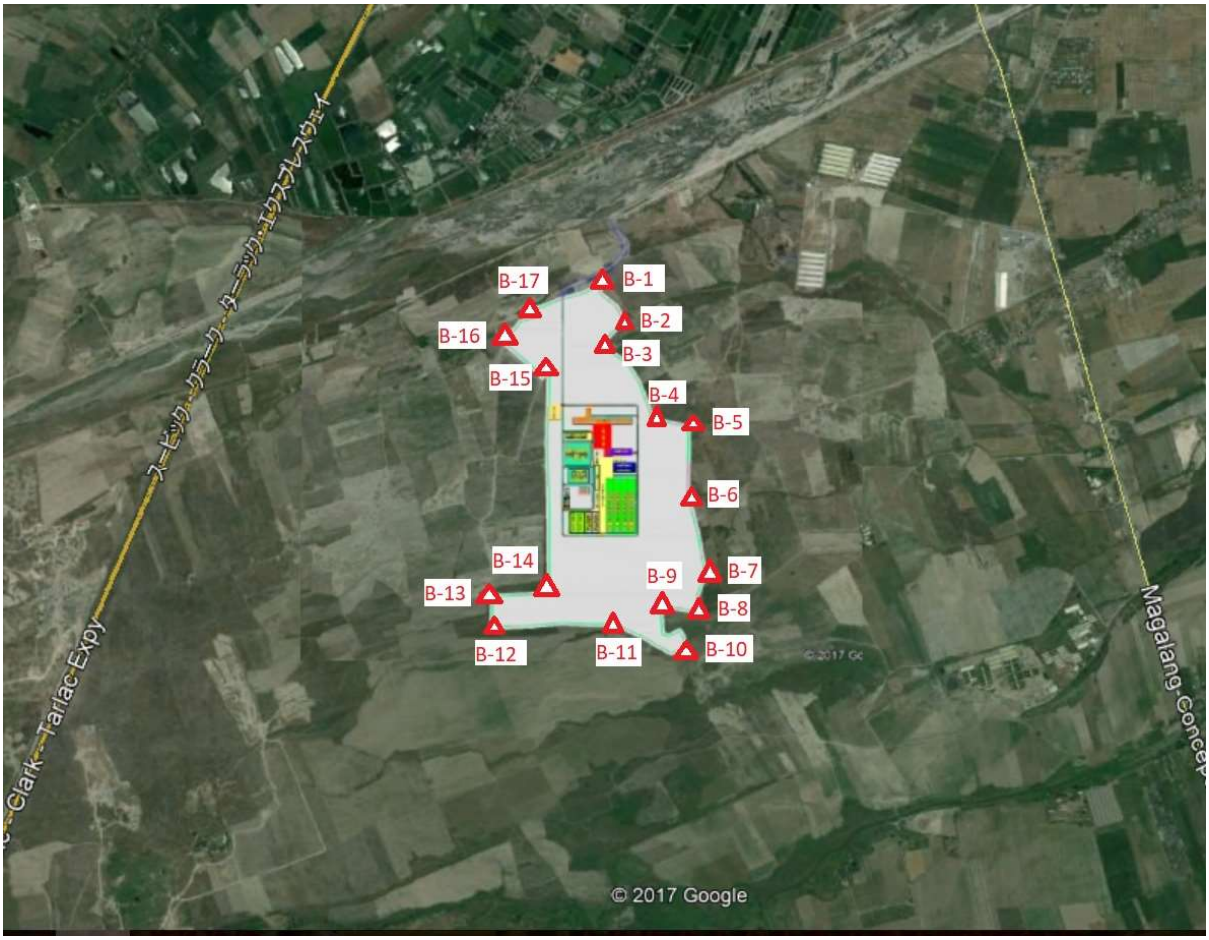


Figure 2.3.2.2.1: Identified Noise at the Plant Boundary

Noise Modeling Input Data

The following input data were used to execute the noise simulation for Construction Phase:

- External source: External means a noise source placed out of a building (for example, a vehicle engine).
- 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 10,000 m x 10,000 m which is a scale view of CUSTIC 2.0. The following assumptions were made to execute the model:

- Ambient Temperature - 25°C
- Relative Humidity – 90%
- Frequency – 500 Hz

Noise Modeling Results

Presented in Table *2.3.2.2.4* is the predicted noise level at the plant boundary wall. The modeling result shows that the allowable noise level is within the standard, therefore noise emission from the construction of the proposed Project is not expected to cause significant impacts to the surrounding environment. The simulation is on 24-hours continuous operation. The predicted noise contour is presented in Figure *2.3.2.2.2.*

Table 2.3.2.2.4: Predicted Noise Level at the Boundary of the Proposed Plant during Construction

Station No	Predicted Noise Level (SPL), dB(A)	Allowable Noise Level, dB(A)		
		Daytime	Morning/ Evening	Nighttime
B-1	30.40	75	70	65
B-2	34.79	75	70	65
B-3	37.63	75	70	65
B-4	44.86	75	70	65
B-5	39.16	75	70	65
B-6	40.23	75	70	65
B-7	35.87	75	70	65
B-8	34.01	75	70	65
B-9	35.42	75	70	65
B-10	31.23	75	70	65
B-11	34.79	75	70	65
B-12	32.13	75	70	65
B-13	34.01	75	70	65
B-14	36.58	75	70	65
B-15	39.16	75	70	65
B-16	32.13	75	70	65
B-17	31.97	75	70	65

Figure 2.3.2.2.2: Predicted Noise Contour during 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;
- 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.

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 plant were based on the given equipment noise data/sizes/dimensions extracted from the existing SteelAsia Steel Mill Plants. The list of power mechanical equipment during operation is presented in Table *2.3.2.2.5*. However, it is advised that the detailed design should be updated to reflect equipment data whenever the design changes.

Table 2.3.2.2.5: Equivalent PWL of Power Mechanical Equipment for Operation Phase

Power Mechanical Equipment	PWL, dB(A)
Reheating Furnace	90
Rolling Mill	90
Twin Finishing Blocks	95

Source: SteelAsia

From the table above, the total estimated sound power level for the operational equipment is 96 dB(A).

The total power level takes into account assumed maximum numbers of equipment and an assumed ‘on-time’ for the equipment, that is, period in percentage terms during which the equipment will be operating. The operational activities are predicted to be its worst-case scenario where 24-hour operation. 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 the plant. Internal source such as furnace, compressors, rolling mills 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 10,000 m x 10,000 m grid which is a scale view of CUSTIC 2.0. The following assumptions were made to execute the model:

- Ambient Temperature - 25°C
- Relative Humidity – 90%
- Frequency – 500 Hz

Noise Modeling Results

The predicted noise levels at the plant boundary for the operation of the proposed Project as exhibited in Table *2.3.2.2.6* are all below the noise condition during daytime, morning/evening and night time. Therefore, 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 2-23.

Table *2.3.2.2.6:* Predicted Noise Level at the Boundary of the Proposed Plant during Operation

Station No	Predicted Noise Level (SPL), dB(A)	Allowable Noise Level, dB(A)		
		Daytime	Morning/ Evening	Nighttime
B-1	16.60	75	70	65
B-2	20.99	75	70	65
B-3	23.83	75	70	65
B-4	31.06	75	70	65
B-5	25.36	75	70	65
B-6	26.43	75	70	65
B-7	22.07	75	70	65
B-8	18.33	75	70	65
B-9	22.78	75	70	65
B-10	17.43	75	70	65
B-11	20.99	75	70	65
B-12	18.33	75	70	65
B-13	20.21	75	70	65
B-14	22.78	75	70	65
B-15	25.36	75	70	65
B-16	20.21	75	70	65
B-17	18.17	75	70	65

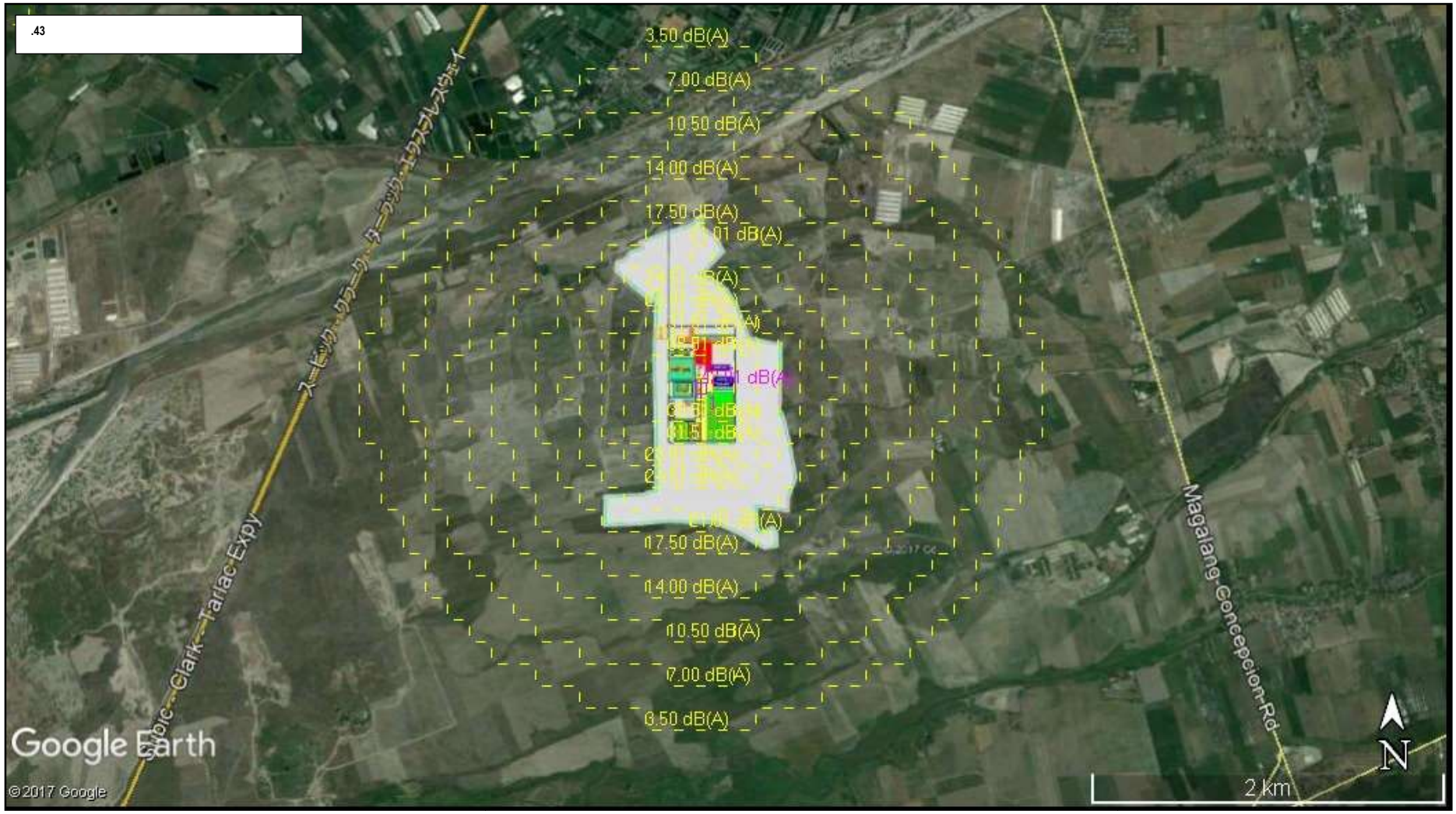


Figure 2.3.2.2.3: Predicted Noise Contour during Operation

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.

Providing the majority of the equipment complies with the relevant equipment noise specifications, noise levels on-plant should meet the 85 dBA limit and noise levels at all boundaries would then be expected to meet the DENR and DOLE requirements.

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 rolling mill to ensure that appropriate limits and noise control measures are incorporated.

Moreover, predicted noise levels are high within the radius of the plant premises which may bring negative impact to workers because of excessive noise. Therefore; it is recommended that personnel protection of workers should be provided and it is necessary to carry out the planned protective measures systematically. The stated measures include (i) controlling the noise level inside the rolling mill and the surrounding inhabited areas; (ii) reducing the noise in individual plants and machines; (iii) applying acoustic protection by setting physical barriers or enclosures and applying personal protection instruments of the employees in the mine.

Protective panels, as physical barriers should be used as an additional measure for protecting the settlement from noise along with the envisaged green belt.

The effect of the panel is momentary reduction of noise emitted towards the settlement until the designed green belt has reached functional age. In terms of protection from emitted noise, the panels as movable structures follow the progression of the activities.

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 PEOPLE

This section provides the key baseline conditions of the site in terms of relevant socioeconomic parameters and the corresponding impacts assessed. Common adverse impacts during the operations phase are as follows:

- In-migration
- Generation of solid waste
- Increase in traffic

- Long-term beneficial impacts are a) generation of employment and livelihood opportunities, b) increase in business opportunities and associated economic activities, and c) increase LGU revenue.

Demographic data of impact area

The total population of Brgy. Telabanca as per the Socio Economic Profile Survey in 2014 by the MPDO of Concepcion is only 95 with 19 households. This small number of population is due to the relocation of the original residents to Capas, Tarlac where relocation site is situated for those affected by the Mount Pinatubo eruption in 1991. Since then, Brgy. Telabanca residents have not returned because of the unproductive area that they left. Brgy. Telabanca's total land area is 573.4545 hectares and the percentage of the total land area is 2.55%.

Table 2.4.1.1: TOTAL NUMBER OF POPULATION AND HOUSEHOLDS PER BARANGAY (source: Concepcion MPDO Socio-Economic Profile Survey, 2014)

NAME OF BARANGAY	TOTAL POPULATION	NUMBER OF HOUSEHOLDS	TOTAL LAND AREA (HECTARES)	PERCENTAGE OF THE TOTAL LAND AREA
• ALFONSO	7,904	1,510	142.295	0.63%
• BALUTU	4,150	794	772.2341	3.44%
• CAFÉ	2,743	535	377.8836	1.68%
• CALIUS GUECO	1,056	240	228.1148	1.01%
• CALULUNAN	4,606	948	305.2494	1.35%
• CASTILLO	3,348	668	1,147.67	5.11%
• CORAZON DE JESUS	2,019	433	313.25	1.40%
• CULATINGAN	3,078	634	895.1	4.00%
• DUNGAN	837	188	320.6602	1.42%
• DUTUNG A MATAS	5,917	1,183	249.5	1.11%
• GREEN VILLAGE	3,063	584	423.055	1.88%
• LILIBANGAN	1,236	241	282.24	1.25%
• MABILOG	2,607	526	760.11	3.38%
• MAGAO	2,444	483	699.92	3.12%
• MALUPA	1,375	289	264.8	1.18%
• MINANE	3,173	658	160.9397	0.72%
• PANALICSICAN	1,219	233	319.0854	1.42%
• PANDO	2,436	485	701.1	3.12%
• PARANG	3,008	582	512.25	2.28%
• PARULONG	1,416	291	246	1.10%
• PITABUNAN	2,599	554	213.983	0.95%
• SAN AGUSTIN	5,845	1,145	1,462.25	6.51%
• SAN ANTONIO	2,791	532	416.3	1.85%
• SAN BARTOLOME	1,976	390	348.12	1.55%
• SAN FRANCISCO	5,163	1,070	705.6258	3.14%
• SAN ISIDRO	2,921	573	746.1	3.32%
• SAN JOSE	9,739	1,948	105.8176	0.47%
• SAN JUAN	4,267	870	284.2742	1.26%
• SAN MARTIN	243	49	545.8065	2.43%
• SAN NICOLAS BALAS	3,869	728	428.9164	1.91%
• SAN NICOLAS POB.	4,985	997	57.1985	0.25%
• SANTIAGO	4,961	864	652.5178	2.91%
• SAN VICENTE	1,917	370	273.1696	1.22%
• STA.CRUZ	4,266	884	642.8	2.86%
• STA.MARIA	1,679	365	215.5682	0.96%
• STA.MONICA	5, 878	1,131	849.7053	3.78%
• STA.RITA	4,958	992	318.1438	1.41%
• STA.ROSA	5,512	1,086	1,164.17	5.20%
• STO.CRISTO	1,156	252	174.3	0.78%
• STO.NINO	3,654	718	978.7879	2.30%
• STO.ROSARIO	1,787	384	291.2719	1.30%

• TAL. MARIMLA	1,730	342	1,280.11	5.71%
• TAL. SAN MIGUEL	2,334	477	469	2.10%
• TELABANCA	95	19	573.4545	2.55%
• TINANG	4,049	841	805.0898	3.27%
T O T A L	**146,009**	**29,087**	**24,570.00**	**100%**

2.4.1 Methodology

Data gathering
Primary data was obtained through socio-economic and perception survey, key informant interviews (KIIs), focus group discussions (FGDs) with stakeholders in Barangays Telabanca, Dungan, San Francisco, San Vicente and San Nicolas Balas and Public Scoping.

Secondary data was collected data from LGU of Concepcion. Other available secondary information was taken from relevant government agency websites.

Socioeconomic and perception survey
Actual visits with residents through household perception survey from 04-08 August 2017. A total of 530 households were randomly interviewed and surveyed for Brgys. Telabanca, Dungan, San Francisco, San Vicente and San Nicolas Balas. Perception survey areas are those in color purple/violet shades. It may be noted that the project area, Brgy. Telabanca is almost a no-people barangay because it has been abandoned since Mt. Pinatubo eruption in 1991.

Questions in the survey covered the following:

- Gender
- Age
- Civil status
- Religious affiliation
- Educational attainment
- Occupation
- Place of work
- Number of years earning income
- Monthly income
- Length of stay in the area
- Intention to out-migrate
- Material component of the dwelling unit
- House ownership
- Home utilities
- Causes of morbidity and mortality
- Health services
- Health facilities
- Type of Toilet
- Source of Drinking Water
- Garbage Disposal
- Perception about the Current Environmental Conditions
- Awareness on the Proposed Project
- Impacts of Proposed Power Project: Positive and Negative
- Perception and attitude towards the Project

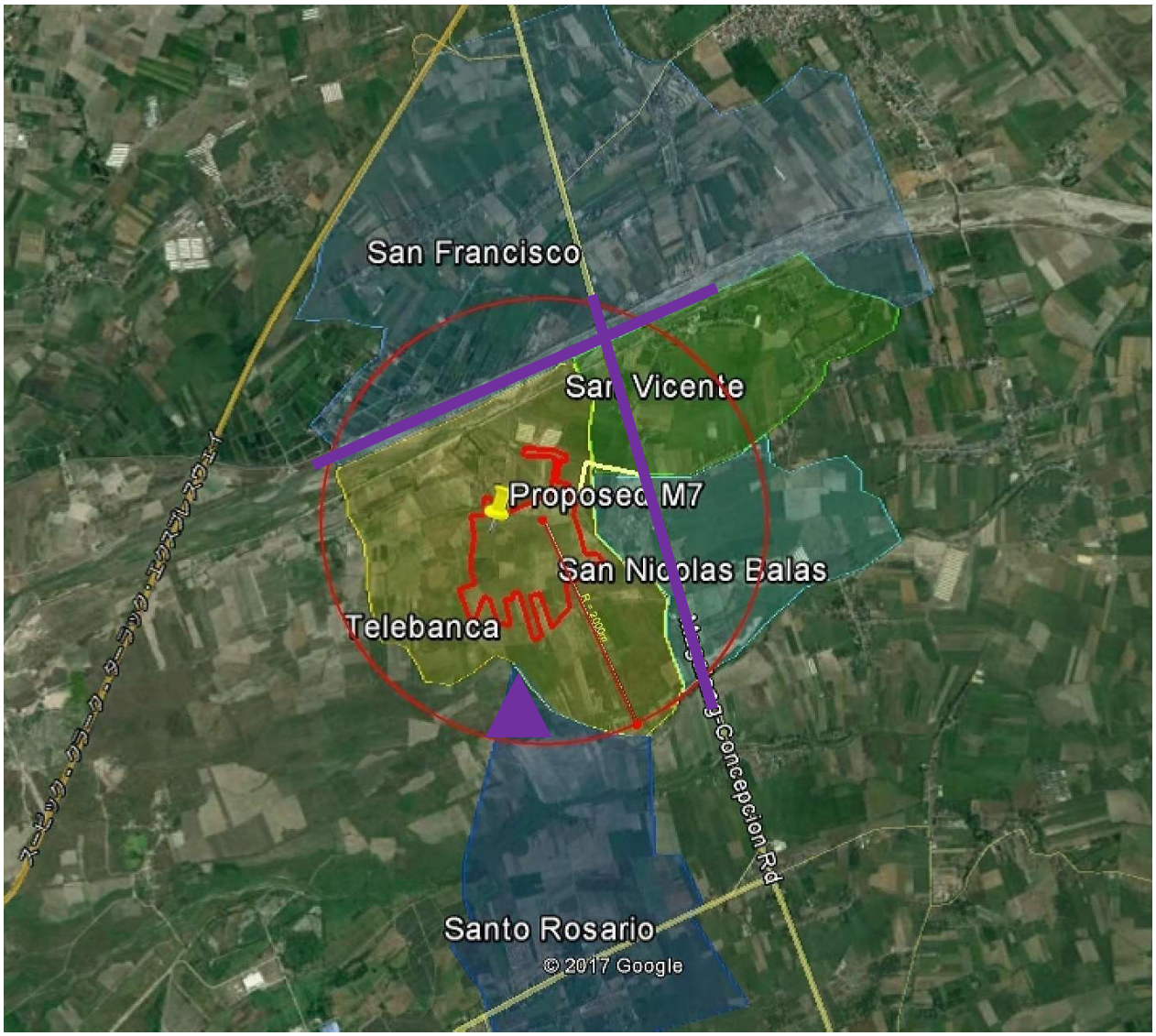


Figure 2.4.1.1: Perception Survey Site Map

Provided below are photographs in connection with the survey.

Plate 1: The Survey Team

Plate 2: The IEC Team

Of the 530 households randomly interviewed and surveyed, 15% of which was from Brgy. Telabanca, 20% from Brgy. Dungan, 4% from Brgy. San Francisco, 7% from Brgy. San Vicente and 54% San Nicolas Balas.

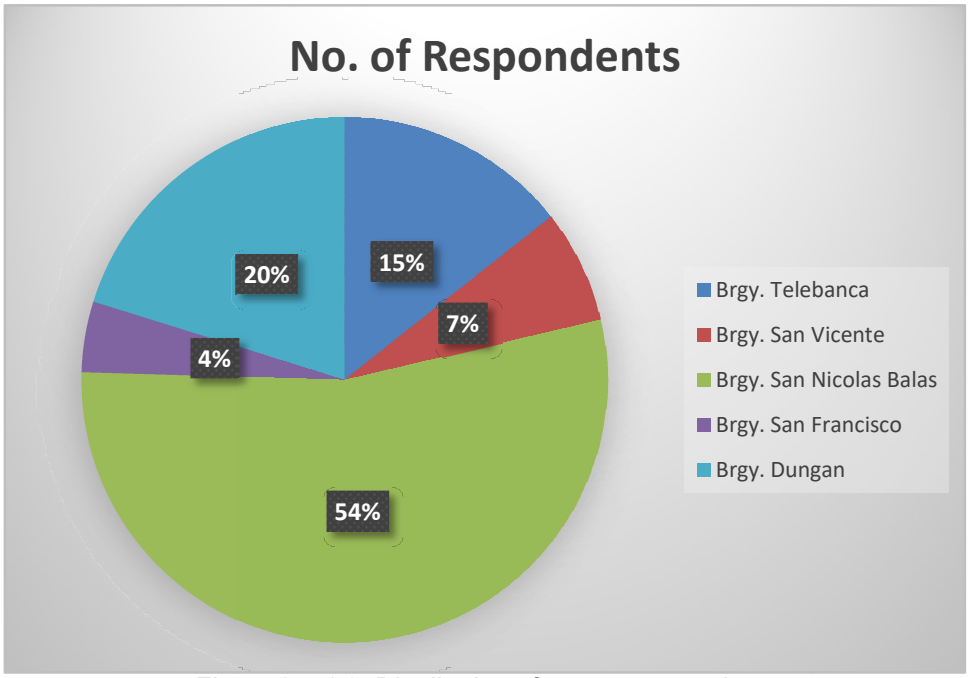


Figure 2.4.1.2: Distribution of survey respondents

Impact assessment and identification of mitigating measures
The results of the perception survey, KII, FGDs and Public Scoping supplemented by secondary data were used to assess the following impacts specified in the Technical Scoping Checklist:
a) Impacts on land ownership, public access, structures, and livelihood
b) In-migration
c) Cultural/Lifestyle changes
d) Impacts on physical cultural resources,
e) Threat to delivery of basic services and resource competition
f) Threat to public health and safety
g) Generation of local benefits from the project, and
h) Traffic congestion. Mitigating measures were recommended to address significant adverse social impacts.

2.4.2 Assessment of key impacts and mitigating measures

2.4.2.1 Impacts on land ownership, public access, structures, and livelihood

Displacement of structures
There were structures identified within the proposed reclamation area that will be physically displaced in addition to settlements that may be affected in areas near or adjacent to the project boundaries.

Displacement of properties and change/conflict in land ownership
There will be no displacement of properties and change/conflict in land ownership because the area is uninhabited and SAMC bought the property/parcels of lands from the rightful land owners.

Impacts on livelihood
The project will not impact on the existing livelihood of the stakeholders because the area is uninhabited and the residents of Brgy. Telabanca were relocated in Capas, Tarlac from the time Mt. Pinatubo erupted in 1991. SAMC will not adversely affect the fishpond operations/industry in Brgy. Dungan because SAMC's operations is zero effluent/discharge.

Conflict in Right of Way
There is no conflict in right of way that may be expected because SAMC will use the existing Concepcion-Magalang and inner roads to transport raw materials and finished products. It will

coordinate with the LGU on the improvement of the roads to conform to their requirement for access when necessary.

Impact on public access
The project will not adversely affect or hinder public access especially for those who have properties near the project site because the road network is shared with the public.

2.4.2.2 In-migration

The proposed project may have insignificant impacts on the existing in-migration pattern in Concepcion because although employment seekers, small-scale businessmen and ambulant vendors may increase during the construction stage, these are expected to be residents of the host barangay and/or from Concepcion. The same will be expected during Operations Phase because more than 80% will be available for vocational and high-school level.

Number of Households and Household Size
Provided below and Figure 2.4.2.2.1 are the household size of the stakeholders gathered from the perception survey conducted:

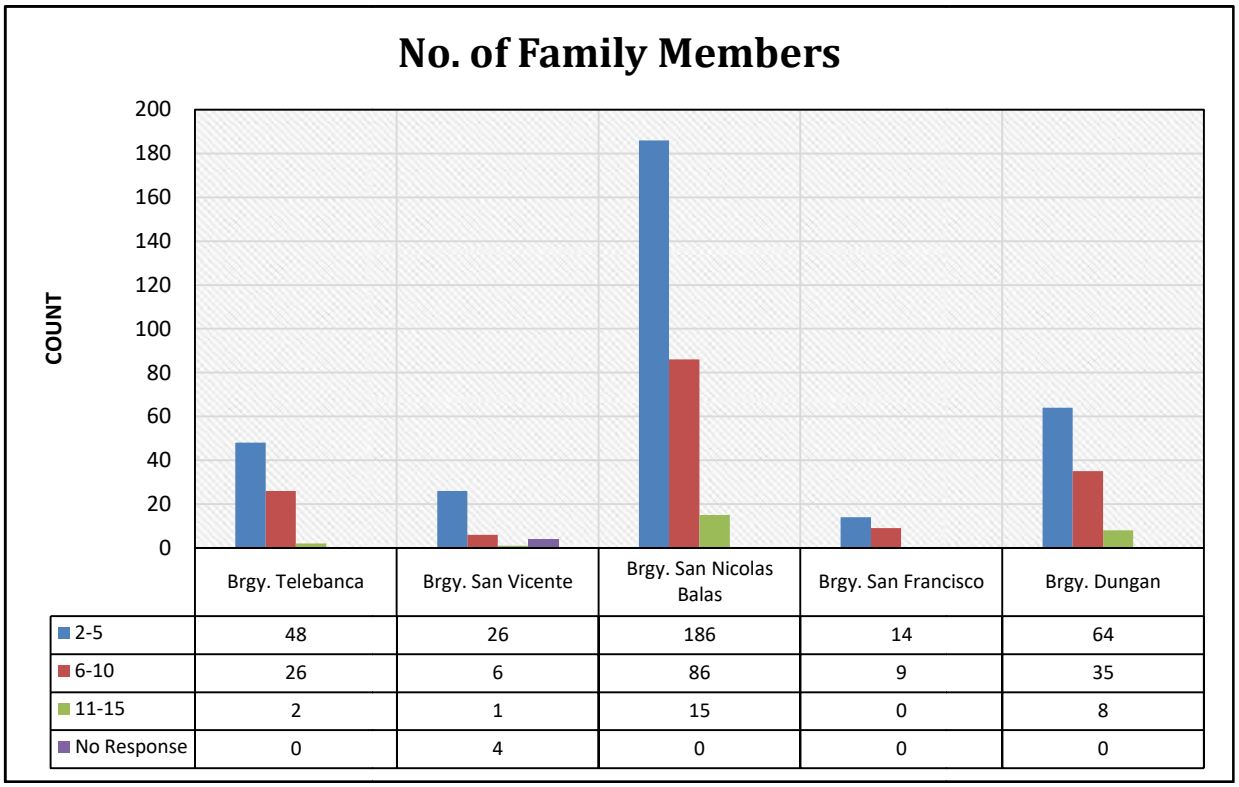
- Brgy.Telabanca: 48 of the respondents have 2-5 members in their family, 26 respondents have 6-10 members in their family and 2 respondents have 11-15 members in their family.

- Brgy.San Vicente: 26 of the respondents have 2-5 members in their family, 6 respondents have 6-10 members in their family 1 respondent have 11-15 members in their family and 4 respondents have no answer.

- Brgy. San Nicolas Balas: 186 of the respondents have 2-5 members in their family, 86 respondents have 6-10 members in their family and 15 respondents have 11-15 members in their family.

- Brgy.San Francisco: 14 of the respondents have 2-5 members in their family and 9 respondents have 6-10 members in their family.

- Brgy.Dungan: 64 of the respondents have 2-5 members in their family, 35 respondents have 6-10 members in their family and 8 respondents have 11-15 members in their family.



	Brgy. Telebanca	Brgy. San Vicente	Brgy. San Nicolas Balas	Brgy. San Francisco	Brgy. Dungan
2-5	48	26	186	14	64
6-10	26	6	86	9	35
11-15	2	1	15	0	8
No Response	0	4	0	0	0

Figure 2.4.2.2.1: Household size of the stakeholders gathered from the perception survey conducted

Land Area

The municipality of Concepcion has a total land area of 245.7 km² subdivided into 45 barangays. The host barangay, Brgy. Telabanca has a land area of 573.4545 hectares.

Population

The official 2015 Philippine Statistics Authority (PSA) population data showed that Concepcion had a total population of 154,188 where Brgy. Telabanca has only 95 because its residents were actually residing resulting from relocation in Capas, Tarlac. Table 2.4.2.2.1 provides the 2015 Population of Concepcion Tarlac and its barangays while Table 2.4.2.2.2 provides the total number of population and households per barangay as per Socio Economic Profile Survey of 2014.

It can be gleaned from these Tables that Barangay Telabanca has the smallest population due to the barangay's relocation in Capas, Tarlac brought about by the Mt. Pinatubo eruption's devastation of the area.

Table 2.4.2.2.1: 2015 Population of Concepcion Tarlac and its barangays

CONCEPCION	**154,188**
Alfonso	8,750
Balutu	3,920
Cafe	2,776
Calius Gueco	1,233
Caluluan	4,694
Castillo	3,457
Corazon de Jesus	2,114
Culatingan	3,237
Dungan	965
Dutung-A-Matas	5,917
Lilibangan	1,276
Mabilog	2,566
Magao	2,219
Malupa	1,547
Minane	3,725
Panalicsian (Panalicsican)	1,207
Pando	2,524
Parang	3,260
Parulung	1,725
Pitabunan	3,107
San Agustin (Murcia)	6,040
San Antonio	3,175
San Bartolome	2,113
San Francisco	7,983
San Isidro (Almendras)	2,950
San Jose (Pob.)	9,739
San Juan (Castro)	4,565
San Martin	408
San Nicolas (Pob.)	4,985
San Nicolas Balas	3,852
Santo Niño	3,971
Santa Cruz	4,948

Santa Maria	1,644
Santa Monica	5,610
Santa Rita	4,958
Santa Rosa	4,846
Santiago	5,391
Santo Cristo	1,463
Santo Rosario (Magunting)	1,819
Talimunduc Marimla	1,801
Talimunduc San Miguel	2,624
Telabanca	95
Tinang	4,547
San Vicente (Caluis/Cobra)	1,882
Green Village	2,560

Table 2.4.2.2.2: TOTAL NUMBER OF POPULATION AND HOUSEHOLDS PER BARANGAY
(Socio Economic Profile Survey 2014)

NAME OF BARANGAY	TOTAL POPULATION	NUMBER OF HOUSEHOLDS	TOTAL LAND AREA (HECTARES)	PERCENTAGE OF THE TOTAL LAND AREA
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• TAL. SAN MIGUEL	2,334	477	469	2.10%
• TELABANCA	95	19	573.4545	2.55%
• TINANG	4,049	841	805.0898	3.27%
T O T A L	**146,009**	**29,087**	**24,570.00**	**100%**

Gender and Age Profile

- Age Profile

Provided below and in Figure 2.4.2.2.2 shows the age distribution of survey respondents.

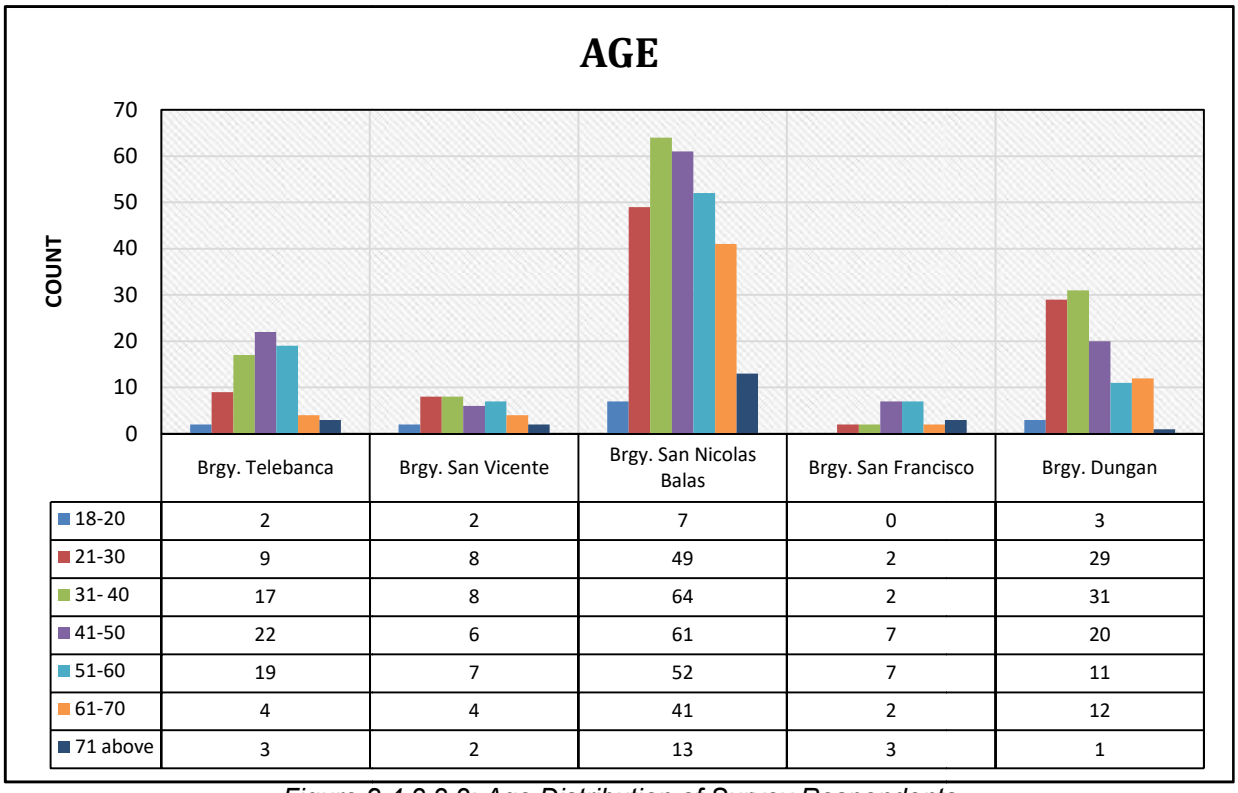
Brgy. Telabanca: 2 respondents are 18-20 years old, 9 respondents are 21 to 30 years old, 17 respondents are 31-40 years old, 22 respondents are 41-50 years old, 19 respondents are between 51-60 years old, 4 respondents fall between 61-70 years old and 3 respondents are 71 and above.

Brgy. San Vicente: 2 respondents are 18-20 years old, 8 respondents are 21-30 years old, 8 respondents are 31-40 years old, 6 respondents are between 41-50 years old, 7 respondents are 51-60 years old, while 4 respondents fall between 61-70 years old and 2 respondents are 71 and above.

Brgy. San Nicolas Balas: 7 respondents are 18-20 years old, 49 respondents are 21-30 years old, 64 respondents are 31-40 years old, 61 respondents are between 41-50 years old, 52 respondents are 51-60 years old, while 41 respondents fall between 61-70 years old and 13 respondents are 71 and above.

Brgy. San Francisco: 2 respondents are 21-30 years old, 2 respondents are 31-40 years old, 7 respondents are between 41-50 years old, 7 respondents are 51-60 years old, while 2 respondents fall between 61-70 years old and 3 respondents are 71 and above.

Brgy. Dungan: 3 respondents are 18-20 years old, 29 respondents are 21-30 years old, 31 respondents are 31-40 years old, 20 respondents are between 41-50 years old, 11 respondents are 51-60 years old, while 12 respondents fall between 61-70 years old and 1 respondent is 71 and above.



	Brgy. Telebanca	Brgy. San Vicente	Brgy. San Nicolas Balas	Brgy. San Francisco	Brgy. Dungan
18-20	2	2	7	0	3
21-30	9	8	49	2	29
31- 40	17	8	64	2	31
41-50	22	6	61	7	20
51-60	19	7	52	7	11
61-70	4	4	41	2	12
71 above	3	2	13	3	1

Figure 2.4.2.2.2: Age Distribution of Survey Respondents

- Gender Profile

Provided below and in Figure 2.4.2.2.3 shows the gender distribution of survey respondents.

Brgy. Telabanca: Majority of the respondents are male with 54 respondents while 22 respondents are female.

Brgy. San Vicente: 19 of the respondents are female while 18 respondents are male.

Brgy. San Nicolas Balas: Majority of the respondents are male with 146 respondents while 141 respondents are female.

Brgy. San Francisco: 11 of the respondents are male while 12 respondents are female.

Brgy. Dungan: Majority of the respondents are female with 75 respondents while 32 respondents are male.

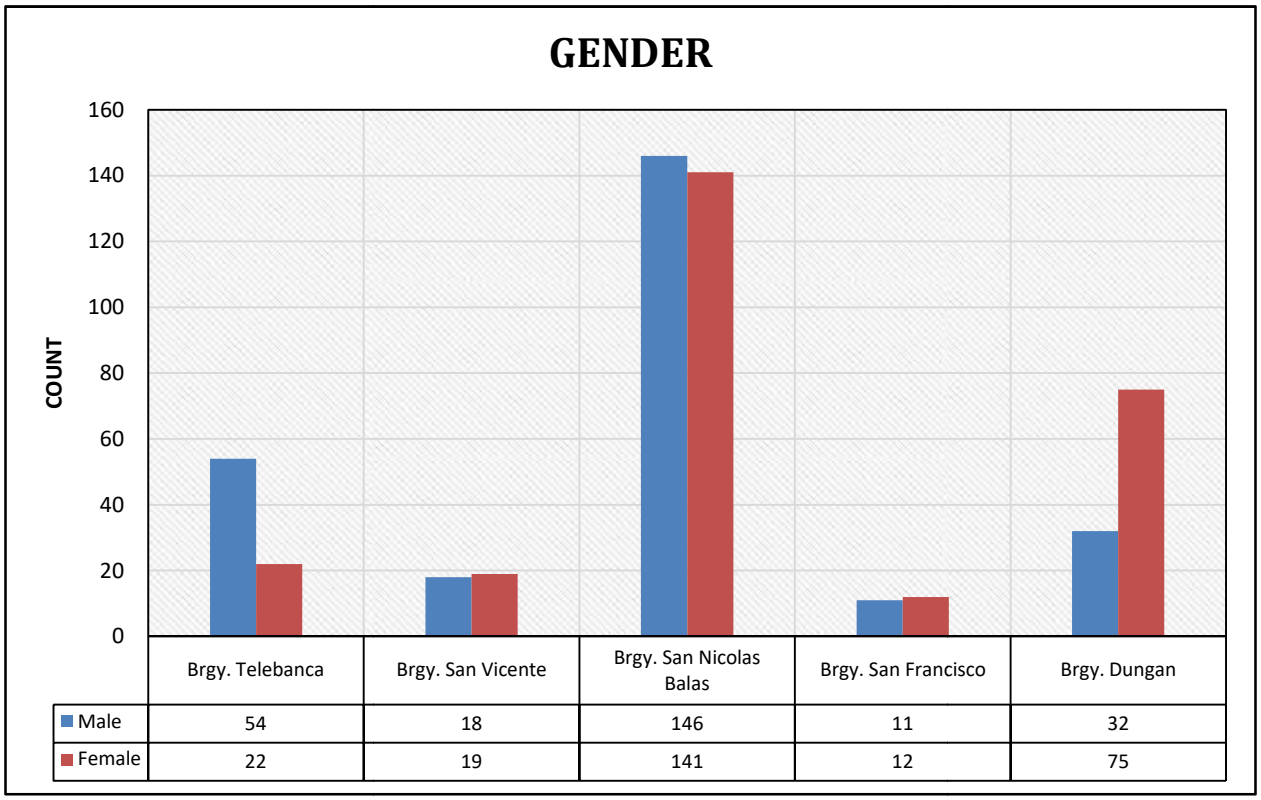


Figure 2.4.2.2.3: Gender Distribution of Survey Respondents

Literacy Rate and Profile of Educational Attainment
Shown below and in Figure 2.4.2.2.4 is the Literacy Rate and Profile of Educational Attainment of Survey Respondents.

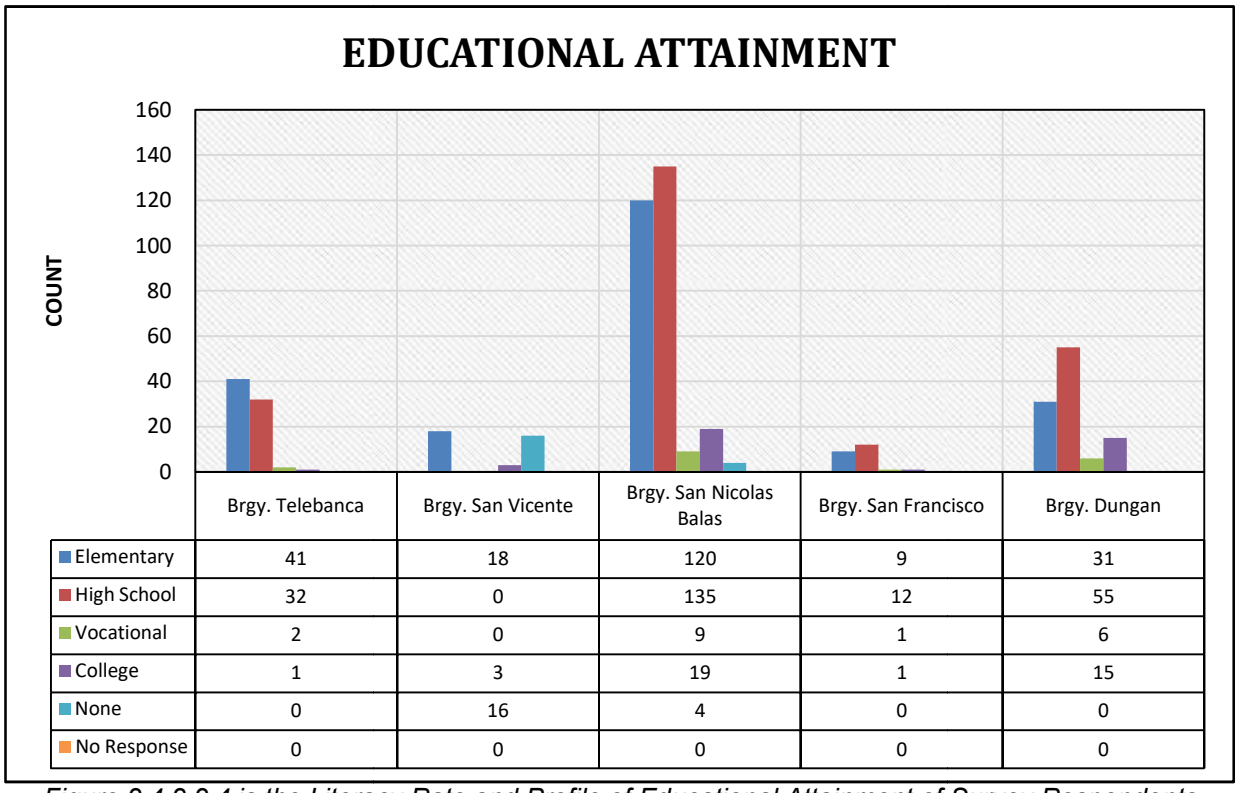
Brgy.Telabanca: 41 of the respondents reached Elementary level, 32 respondents acquired High school education, 2 respondents obtain Vocational Training and 1 respondent reached College level.

Brgy.San Vicente: 18 of the respondents reached Elementary level,3 respondents reached College level and 16 respondents have no Educational attainment.

Brgy.San Nicolas Balas: 120 of the respondents reached Elementary level, 135 respondents acquired High school education, 9 respondents obtain Vocational Training,19 respondents reached College level and 4 respondents have no Edicational Attainment.

Brgy. San Francisco: 9 of the respondents reached Elementary level, 12 respondents acquired High school education, 1 respondent obtain Vocational Training and 1 respondent reached College level.

Brgy.Dungan
31 of the respondents reached Elementary level, 55 respondents acquired High school education, 6 respondents obtain Vocational Training and 15 respondents reached College level.



	Brgy. Telebanca	Brgy. San Vicente	Brgy. San Nicolas Balas	Brgy. San Francisco	Brgy. Dungan
Elementary	41	18	120	9	31
High School	32	0	135	12	55
Vocational	2	0	9	1	6
College	1	3	19	1	15
None	0	16	4	0	0
No Response	0	0	0	0	0

Figure 2.4.2.2.4 is the Literacy Rate and Profile of Educational Attainment of Survey Respondents

2.4.2.3 Cultural/Lifestyle Change

The project is not expected to have impact on social cohesion in the host barangay or their prevailing culture and lifestyle because it will not attract in-migrants into the host barangays, there will be no carriers of new cultural patterns and behavior that may clash with the existing ones. In this case, the project will maintain the existing level of social harmony and cultural homogeneity in the host barangays. These barangays are tightly cohesive communities that evolved through generations to have patterned interactions that changed little through the years. The birthplace of the respondents and their length of stay in their present places of residence indicate this.

2.4.2.4. Impacts on physical cultural resources

There will be no Impacts on physical cultural resources as they are absent in the project site. It will even support and assist the customs and traditions of the community and assist in the improvement of the physical resources through its social development programs.

2.4.2.5 Threat to delivery of basic services /resource competition

The LGU of Concepcion has the following basic services being offered to its constituents:

A. EDUCATION:
Following is Concepcion's Educational Profile.

- PRE-SCHOOL LEVEL: 1,550 Enrollees (Public & Private)
- ELEMENTARY LEVEL:

Public : Composed of 53 schools which are divided into 4 Districts

NORTH DISTRICT 14 Schools
Enrollees – 6,721

SOUTH DISTRICT 10 Schools
Enrollees- 3,552

WEST DISTRICT 17 Schools
Enrollees- 4,196

EAST DISTRICT 12 Schools
Enrollees- 5,262

Private : There are ten (10) private schools in town with a total Elementary enrolment of - 1,044

- SECONDARY LEVEL :

PUBLIC
BENIGNO S. AQUINO NATIONAL HIGHSCHOOL
Total Number of Enrollees: 6,187

BALUTU BARANGAY HIGHSCHOOL
Total Number of Enrollees: 672

CALULUAN NATIONAL HIGHSCHOOL
Total Number of Enrollees: 1,296

PRIVATE B
CONCEPCION CATHOLIC SCHOOL
Total Number of Enrollees: 513
CONCEPCION ECUMENICAL SCHOOL
Total Number of Enrollees: 108
ST.PAUL MONTESSORI (H.S)
Total Number of Enrollees: 93
HOLY CROSS COLLEGE (HS) 141

- COLLEGE LEVEL: There is One (1) College in town with a total enrolment of 253
- VOCATIONAL SCHOOL There is one (1) Vocational School with a Total Enrolment of 123

B. TRANSPORTATION

The following modes of transportation are available in Concepcion:

- PRIVATE VEHICLES: 908
- TRICYCLES: 1,843 (2015 registered)
- JEEPNEYS: 347
- BUSES: 0
- MINI-BUSES 0

C. COMMUNICATIONS

With the new age of communication, the following means of communications are present in Concepcion:

- POST OFFICE: 1
- CABLE STATION: 2
- NEWS PAPERS: All magazines and newspapers reach the town everyday
- T.V, RADIO STATIONS: All station broadcasts reach the town every day.
- TELECOMMUNICATIONS: 1 Landline Service Provider; 14 Cell sites
- TELEGRAPH: 1 provider
- INTERNET: 4 Service providers

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

2.4.2.6 Threat to public health and safety

Concepcion has the following Health and Sanitation Profile:

- CLINICS (including 3 Rural Health Units & 1 Birthing Station) 13
- HOSPITALS: 5
- DOCTORS: (Including 4 Gov't. Doctors) 75
- DENTISTS: 9
- MIDWIVES: 30
- PRACTICING HILOTS: 15
- BARANGAY HEALTH CENTERS: 45
- NO. OF HH WITH TOILETS 24,400
- NO. OF HH WITH POTABLE WATER 25,103

- FAMILY HEALTH: The priority is the welfare of the family and social aspect of health.

- DEGENERATIVE DISEASES: There is an increased incidence of malignant neoplasm probably due to the insecticides used by farmers.
- INFECTIOUS DISEASES: The provincial hospital has a tie up with St. Luke's Medical Center on Japanese Encephalitis. The province is not equipped to handle emerging infections like cases of SARS and AVIAN FLU. No infectious ward.
- LOCAL HEALTH SYSTEM: Devolution a. health managers of devolved hospitals are given the responsibility of delivering quality health service with its accompanying liability but without the full authority in the management of resources. b. difference in the application of COA regulation c. hiring and promotion is tainted with political considerations which affects quality of service and demoralization of work force d. Magna Carta for health is not implemented e. poor working conditions leading to doctors becoming nurses
- HEALTH CARE FINANCING - Problems encountered with PHILHEALTH
  a. Claims are not given right away.
  b. A lot of paper work, duplicate copies have to be done leading to delay in processing.
  c. The professional fee of doctors are not given on time
- RESEARCH "It would be better to have a coordinating body for the region. The workshop would be a good venue to start. The provincial hospital is trying to strengthen its research capability. Tarlac provincial hospital has a lot of materials for research. A collaboration between the provinces of region 3 is recommended to strengthen research and improve health care delivery.
- HEALTHY LIFESTYLE No data on substance abuse

The Project will not pose threat to public health because all management and mitigating measures will be implemented. Also, the company shall be responsible for the regular check-ups of workers and immediate treatment of any work-related sickness incurred by any worker. The company, as it does in all of its plants, will cover employees and its dependents with an HMO plan. Moreover, the company will have medical and dental missions and other health assistance projects for the community.

DISEASES DUE TO CLIMATE CHANGE

According to Dr. Fely Marilyn Lorenzo of the Commission on Higher Education (CHED), climate change exacerbates the conditions that make it more favourable for diseases to set in. For example, in dengue, the vectors can multiply faster and become fiercer. However, even if there is a lot of mosquitoes, if there is no source of infection, there will be very few cases.

The Philippines has been a dengue hotspot in recent years. Dengue cases in 2015 saw a 64.8 percent increase from the previous year, with a Department of Health (DOH) official attributing it to climate change. While the nationwide tally for the first half of 2017 has decreased by 36.8 percent from the year prior, Metro Manila experienced a 24.9 percent increase in dengue victims. This spike is linked to the high population density of areas which is ideal for transmitting diseases. This is especially evident in poor communities, which suffer from poor hygiene and stagnant water occasionally brought by flooding episodes.

Climate-related health issues become more critical in rural areas, which lack infrastructures and services common in urban areas such as water distribution systems. For instance, the spread of cholera and typhoid fever can be worsened by poor water quality, lack of electricity access, and improper sanitation. In shoreline areas, the storm surge due to typhoons may lead to saltwater infiltration of groundwater resource, exposing its inhabitants to water-borne diseases afterwards.

OCCUPATIONAL HEALTH PLAN AND OCCUPATIONAL HAZARDS

Occupational Health is among SAMC's priority as it is committed to implementing a structured approach to workplace health and safety in order to achieve a consistently high standard of safety performance. Occupational Health Plan is included in its Environment, Health and Safety Policies of the Company which is a component of its ISO Certification.

RESPONSIBILITIES

MANAGEMENT

following are the responsibilities that SAMC is committed to:
> ensure the health and safety of its workers and others in its workplace
> ensure the health and safety of other persons is not put at risk from work carried out as part of its operations
> provide and maintain a work environment that is without risks to health and safety
> provide and maintain safe plant and structures

> provide and maintain safe systems of work
> ensure the safe use, handling and storage of plant, structures and substances
> provide adequate facilities for the welfare of workers
> provide information, training, instruction and supervision
> monitor the health of workers and the conditions of our workplaces.

Workers
Workers must take reasonable care for their own health and safety while they are at work, and take reasonable care that their acts or omissions do not adversely affect the health and safety of other persons. They must comply, so far as they are reasonably able, with any reasonable instruction given by the Station Manager, as well as co-operating with any reasonable policy or procedure which relates to workplace health and safety. On a day to day basis, this includes:
> to the extent of the worker's control or influence over working conditions and methods, take reasonable care to work safely
> making sure that the work area safe when leaving it
> make proper use of all appropriate safeguards, safety devices and personal protective equipment
> follow agreed safe working practices and rules
> report all known hazards, accidents and incidents as soon as possible.

It is acknowledged that, in accordance with Labor laws, a worker may cease, or refuse to carry out work if they have a reasonable concern the work would expose the worker to a serious risk to their health or safety. The workers who cease work shall notify the relevant manager that they have ceased unsafe work as soon as practicable after doing so. Workers are also required to remain available to carry out 'suitable alternative work'. This would not however require workers to remain at any place that poses a serious risk to their health or safety.

Contractors
Contractors, sub-contractors and self-employed persons are required to:
> comply with the contractual requirements with SAMC, laws, rules and regulations
> have in place any work health and safety policies and programs required under safety legislation
> consult with about safety matters and comply with policies
> work safely and to include the safety of staff and visitors in their safety plans.

If any staff member believes that a contractor may be engaging in an unsafe work practice, they are required to report this issue to their manager.

Visitors
Visitors and other persons' responsibilities include:
> take reasonable care for their own health and safety and for the health and safety of other persons
> comply with, so far as they are reasonably able, all reasonable safety directions provided by SAMC
> report all safety related incidents to SAMC
> ensure the adequate supervision of any accompanying children
> Do not enter any restricted area without authorisation or escort
> Do not bring or consume alcohol or illegal drugs at workplaces
> Do not wilfully or recklessly interfere with property.

Emergency Procedures is also part of the Occupational Health Plan which is fully discussed in Chapter IV.

Provided below is the Health and Safety Program being implemented in existing and operating SAMC Plants which will also be adopted for this Project.

Table 2.4.2.6.1: Health and Safety Programs

Health Programs	Target Date	Activities
Liver Cancer and Viral Hepatitis Awareness and Prevention Program	January	Lecture on Liver Cancer and Hepatitis.
Locker Room/Restrooms Inspection		Regular inspection of restrooms and lockers together with B&G, San Maritanzion and HR.
Potability Test of Drinking Water		Potability Test of drinking water every two months and Physica/Chemical Test of water source once a year.

STD/AIDS Awareness Program	February	STD/AIDS Awareness Seminar.
Oral Health Program		Lecture on Oral Hygiene and Care (Invite a dentist to talk about the topic).
Cardiovascular Diseases/ Hypertension Prevention Program	March	Lecture on Cardiovascular Diseases/ Hypertension Prevention.
		Case finding. Continuous Blood Pressure Monitoring of high risk employees.
Lecture on Conjunctivitis and Foreign Body in the Eyes		Lecture on conjunctivits (Sore eyes) and Foreign Body in the eyes.
Lecture on Wound Care	April	Lecture on proper wound care and dressing.
Sports Fest - Table Tennis		Table Tennis tournament.
Smoking Cessation Program	May	Seminar on the Ill-effects of smoking.
Motorcycle Safety Program		Seminar on Motorcycle Safety.
Flu Awareness and Prevention Program	June	Flu Awareness Lecture.
		Flu vaccination in partnership with accredited clinics (Sanofi) for interested employees.
National Headache/Migraine Awareness month	June	Headache/Migraine Awareness Lecture
		Case finding / monitoring from previous SL records
Sports Fest - Billiards	June	Billiards Tournament
Dengue Awareness	July	Lecture on Dengue Disease and Prevention.
Gout Arthritis Awareness Lecture	August	Lecture on Gout/Arthritis Disease and Prevention.
Family Planning Program	July	Lecture on Family Planning and Responsible Parenthood.
		One on one counselling to those who are interested with family planning.
Tuberculosis Awareness and Prevention Program	August	Lecture on TB Awareness and Prevention.
		Case finding (APE Result).
Programs on Ergonomics	September	Lecture on Ergonomics.
Food Safety and Nutrition Program	October	Lecture on Safe Food Handling.
Drug Free Workplace Program	November	Re-orientation on Drug Free Workplace Policy.
		Random Drug Testing.
Diabetis Awareness Lecture	December	Lecture on Diabetes
Prepared by:		Noted by:

2.4.2.7 Generation of local benefits from the project

Following are local benefits that may be generated from the project:

Enhancement of Employment and Livelihood Opportunities

- Increased Business Opportunities and Associated Economic Activities
- Increased Revenue of LGUs

2.4.2.8 Traffic congestion

The expected additional transport vehicles in the area will be tricycles, jeepneys, cars and most significantly, cargo and delivery trucks. Since the road is an existing route, traffic density within the site is high and the size of cargo and delivery trucks may be a potential cause of traffic problem. The company will implement a traffic scheme as follows:

- Designate marshalling/holding area (no idling zone) is offsite;
- The provincial road is the main ingress/egress;
- No trucks will be allowed to park outside the mill compound
- Comply with government laws on load limit requirements (13.5 metric tons/axle);
- Comply with existing road traffic and smoke belching laws;
- Assist with company's security personnel the traffic entry to and exit from project site;
- Post proper directional and safety traffic signs in coordination with Concepcion Traffic Management Office
- Alert concerned government agencies regarding the upkeep and maintenance of the roads.

Delivery of scraps

The capacity of 1,200,000 Tons per year requires approximately Tons of scraps to produce input billet. Typically the plant will operate 320 days/yr. This means that several trucks will be plying the routes of Concepcion. SAMC will ensure that a fully loaded truck complies with load limit requirements set by DPWH.

Finished Product
Initially all products will come from the mill to the customers. Ultimately, all product will come from the mill and through the service center. Later when the service center is built, the bulk of 1,200,000 MT will be shipped directly from the service center. The traffic to the mill will be through the main provincial road.

With this all of these impacts, SAMC has formulated its Conceptual Traffic Management Plan as follows:

Traffic Management Plan
The expected additional transport vehicles in the area will be tricycles, jeepneys, cars and most significantly, cargo, scrap and delivery trucks.

During construction, the estimated filling materials needed is around 90,000 cubic meters. A truckload is 20 cubic meters per truck. With estimated land development schedule of 120 days, it is projected that the truck hauling per day will be 90,000 cm / 20 cm / 120 days or 37 trucks per day or 75 trucks per day (multiplied by 2 to consider both in and out traffic). The estimated truck hauling time is 24 hours depending on availability of filling materials and traffic permitting. Thus, the hauling trucks will add an approximate 75 trucks per day or an average of 3 trucks per hour (in and out).

During operations, the Plant will produce finished goods of 800,000 tons per year. Likewise, it will consume raw materials (steel billets) of 1,200,000 tons per year for a total of 2,400,000 tons of steel materials per year.

A truck can load up to 30 tons per trip. With this, the truck hauling per year of 2,400,000 / 30 = 80,000 trucks; which 80,000 / 360 days = 219 trucks per day which is equivalent to 219 / 24 hours = 9 trucks per hour. While, trucks hauling consumables such as fuel, oil and lubricants are estimated to be at 6 trucks per day or 0.25 trucks per hour.

In consideration of all above factors, the Project will have an impact in the traffic situation of the locality. Since the road is an existing route, traffic density within the site may become high and the volume of cargo and delivery trucks that will traverse the route from and to the steel rolling mill project site may contribute to traffic problem.

MANAGEMENT PLAN
The concept of the Management Plan is basically premised on the measures that will be implemented by the Proponent in coordination with and authorization of the LGU of Concepcion and ongoing government infrastructure projects that will contribute to significant reduction of inland traffic and relief in traffic density.

Nevertheless, during the construction and operation stages of the Project, the following mitigating measures will be instituted:

CONSTRUCTION STAGE
During construction, the following mitigating and management measures will be implemented:
1. The provincial road is the main ingress/egress;
2. Proper scheduling of hauling of construction materials in relation to existing truck ban ordinances;
3. No trucks and/or any kind of vehicles, i.e.: cars, motorcycles will be allowed to park outside the mill compound;
4. Assign traffic marshals or officers to control the vehicular movements at the entrance / exit of the Project Site;
5. Coordinate with LGU Concepcion and Brgy. Telabanca for crafting of new and better routing scheme within the affected impact zone area;
6. Posting of the project's own traffic officer to assist and coordinate with Concepcion LGU's Traffic Bureau for orderly flow of vehicle and pedestrian traffic within the identified route of trucks;
7. Institution of mitigating and enhancement measures to avoid the risk of vehicular accidents (e.g. traffic accidents as a result of hauling of construction materials or construction spoils) and to promote safety like putting of safety and directional signages on the identified route of trucks;
8. Assign sufficient number of owned traffic enforcers during rush hours;
9. Comply with government laws on load limit requirements (13.5 metric tons/axle);
10. Comply with existing road traffic and smoke belching laws, and;
11. Conduct free trainings/seminars on Discipline and Traffic Rules and Regulations for all LGU traffic enforcer, Barangay Poblacion officers and tanods as well as other interested motorists and pedestrians.

OPERATION STAGE

During project operation, the company will implement traffic management scheme as follows:

1. The provincial road is the main ingress/egress;
2. Proper scheduling of hauling of raw materials and finished products in relation to existing truck ban ordinances;
3. No trucks and/or any kind of vehicles, i.e.: cars, motorcycles will be allowed to park outside the mill compound;
4. Designate a substantial area inside the plant site for truck marshalling/holding;
5. Address the parking demands/requirements of employees and visitors through proper allocation of parking slots;
6. Assign a traffic marshals or officers to control the vehicular movements at the entrance / exit of the Project Site;
7. Coordinate with LGU Concepcion for crafting of new and better routing scheme within the affected impact zone area;
8. Posting of the project's own traffic enforcers to assist and coordinate with Concepcion LGU's Traffic Bureau for orderly flow of vehicle and pedestrian traffic within the identified route of trucks;
9. Post proper and permanent directional and safety traffic signs in coordination with Concepcion Traffic Management Office;
10. Assign sufficient number of traffic enforcers during rush hours;
11. Alert concerned government agencies regarding the upkeep and maintenance of the roads.
12. Comply with government laws (DPWH load requirement) on load limit requirements (13.5 metric tons/axle);
13. Comply with existing road traffic and smoke belching laws, and;
14. Conduct free trainings/seminars on Discipline and Traffic Rules Education for all LGU traffic enforcer, Barangay Telabanca officers and tanods as well as other interested motorist and pedestrian.

The arrival of trucks shall be coordinated by SAMC with the LGU concerned. Likewise, delivery trucks shall be required to post visible identification and signages for easy recognition. There is a possibility of deterioration of road condition due to regular movement of trucks at site. As a mitigation measure, SAMC shall ensure that regular maintenance shall be done on the road link and the property interior roads. Maintenance and repairs of access roads shall be undertaken at a regular basis. SAMC shall regularly clean the roads to ensure there will be smooth movement of trucks.

CHAPTER III: ENVIRONMENTAL MANAGEMENT PLAN

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

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

Table 3.4.1 summarizes all the potential impacts and options for prevention.

Table 3.4-1: Summary Matrix of the Impact Management Plan

Project Phase / Environmental Aspect (Project Activity Which will likely Impact the Environmental Component)	**Environmental Component Likely to be Affected**	**Potential Impact**	**Options for Prevention or Mitigation* or Enhancement**	**Responsible Entry**	**Estimated Cost in PhP**	**Guarantee / Financial Arrangements**
I- PRE CONSTRUCTION PHASE						
NA	Nil	Nil	Sourcing of equipment and contractors; Securing of ECC	Proponent	Part of Project Cost	
II- CONSTRUCTION PHASE						
Environmental Aspect # 1: Land clearing and demolition of some existing structures	A. The Land	Scraps Construction debris Soil erosion	• Metal scraps if any will be segregated for inclusion in the scraps that will be used as raw material in scrap recycling operations • Good housekeeping • Provision of Material Recovery Facility • Water spraying for dust management • Proper construction methods and procedures and implementation of slope protection	Proponent	10,000 Part of contract	Agreement with contractor
Environmental Aspect # 2	B. The Water	Domestic waste discharges	Use of Portable toilets	Proponent	5,000 depending on septage disposal cost - Part of contract	Agreement with contractor
		River water quality: Further increase in siltation/ sedimentation loading in river increase in turbidity and suspended solids Suffocation of fish and crustacean nesting grounds Further impairment of plankton community	• Provision of drainage canals with silt/sediment traps • Immediate soil compacting in area of earth moving activities • Periodic environmental monitoring, i.e., to comparatively determine fish and crustacean population compared to baseline data.			

		Disruption of fish and benthos larval growth				
		Used oil, used batteries, contaminated rags, busted bulbs and lamps	Provision of a Hazardous Waste Area with proper labeling, segregation and storage of wastes Transport, treatment and disposal by DENR accredited third party contractors	Proponent	No cost because this is being bought by DENR accredited third party contractors	ECC Conditions TSD Permit conditions
Environmental Aspect # 3: Land clearing	The Air	Dust	• Road water sprinkling • Tree nursery and tree planting	Proponent	Part of Contract	ECC Conditions
		Noise	• Proper maintenance of construction equipment and vehicles • The Contractor shall at all times comply with all current statutory environmental legislation.	Proponent	Part of contract	ECC Conditions and DENR Standards on noise
Environmental Aspect # 4: transport of construction materials	D. People	Safety	• Strict implementation of DOLE DO 13-98 • Health and safety policies • Employee safety inspections and toolbox meetings • Regular APE and use of PPEs • First aid training • Provision of ambulance and Clinic • Provision of Fire Fighting System	Proponent	Part of Contract	Contract provisions
		Employment	Employment generation	Proponent	Part of contract	Agreement with Contractor
		Traffic	• Implementation of Traffic management plan • Coordination with local traffic bureau (barangay and municipal)	Proponent	Part of contract	Agreement with Contractor
II- OPERATION PHASE						
Environmental Aspect # 1: Solid waste accumulation	A. The Land	Solid waste pollution due to garbage	• Good housekeeping • Provision of a Material Recovery Facility • Recycle • Sell recyclables • Reuse • Septic Vaults • Disposal thru DENR-accredited 3rd party	Proponent	10,000.00	RA 9003, ECC conditions and EIS commitments
		Generation of sludge from septage	Septic tank management by desludging	Proponent	10,000.00	RA 9275
		Contamination and improper management of hazardous waste	• Provision of Hazardous Waste area with proper labeling, segregation and storage of wastes	Proponent	15,000.00	RA 6969

		materials	• Management of transformer oil to prevent spills. • Transport, treatment and disposal of DENR accredited third party contractors			
		Generation of slags	• Proper stockpiling/storage • Will be used as raw material for other uses	Proponent	No cost	RA 9003
Environmental Aspect # 2: Operation of rolling mill facility	B. Water	Water pollution from run-off and domestic wastes	• Construction of rain water cisterns and collection ponds • Regular ambient and effluent water quality monitoring using DENR standards • Domestic wastewater management by connecting it to the water treatment facility • Zero discharge/effluent	Proponent	Part of Project Cost	ECC conditions and EIS Commitments
		Use of river water for make up water	Address resource use competition; secure water permit	Proponent	Part of Project cost	Water Permit from NWRB ECC conditions and EIS Commitments
		Inadvertent spill of domestic wastewaters that can cause pollution	• Establishment of WTP • Use of 3-chamber septic tanks in all project facilities; • Construction of wastewater canal to divert fugitive liquid waste streams into a containment and treatment area; • Adoption of clean practices by all project operating units and personnel; • Efficient waste retrieval system; • Greening of project's compound.			ECC conditions
		Pollution and blockage of portions of river due to solid wastes	• Implement a rigid solid waste collection and disposal system; • Collaboration with LGU on waste management and recovery.			ECC conditions
		Leachate of steel mill debris and spoils	• Steel litter recovery and recycling • Install weirs to efficiently collect steel mill debris.			ECC conditions
	C. Air	Air pollution from fugitive dusts, equipment and vehicles	• 65 meters stack height • Training on power equipment and vehicle use and speed	Proponent	Part of Project cost	N.A.

			• Proper maintenance, designation of no idling zone • Routine plant maintenance and good house keeping • Use of low sulfur fuel (LSFO or mixing with Diesel) • use of enclosures, barriers and buffer zones • Implementation of reforestation and Carbon-sink Program • Insulate structures • Installation of dust collectors			
		Greenhouse gas emission	Implementation of a reforestation and carbon-sink / greenhouse gas reduction program	Proponent	Part of Project cost	ECC conditions
	D. The People	Noise from equipment and vehicles	• Buffer zone and tree planting • Enclosed facility • Provision of AC motors • Scheduling certain high noise emitting works to more acceptable times of day; • Enclosures for sources of noise • Provide high fence within the plant's perimeter • Provide a buffer zone on the adjoining boundaries • Planting of trees on the buffer zone and plant's perimeter that will serve as noise barrier • It is advisable that electrically-powered equipment 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; • All employees working on site will be provided with PPE	Proponent	Part of Project cost	ECC conditions
		Health and safety hazards	• Health and safety policies • Employee safety	Proponent		

			inspections and toolbox meetings • Regular APE and use of PPEs • First aid training • Provision of ambulance and Clinic • Provision of Fire Fighting System			
II- ABANDONMENT PHASE						
Environmental aspect #1: Demolition of structures	A. The Land	Solid waste pollution/ contamination brought about by scraps and debris from demolished structures	• Good housekeeping • Planting of endemic species or reforestation	Proponent		
		Oil spill	Conduct of Environmental Site Assessment (ESA) prior to abandonment	Proponent		
	B. Water	Water pollution/ contamination	Conduct of Environmental Site Assessment (ESA) prior to abandonment	Proponent		
	C. Air	Air pollution because of dusts from demolished structures	Sprinkling of water	Proponent		
		Noise pollution from structures being demolished	No population center at construction sites	Proponent		
Environment aspect #2: plant closure or operation stoppage	D. The People	Loss of Jobs	• Payment of legal social benefits • Retrenchment package • Labor support programs	Proponent		
		Health data of employees and communities	Recording based on annual physical checkup of employees and data from Rural Health Units for the community	Proponent Proponent		

CHAPTER IV: ENVIRONMENT RISK ASSESSMENT AND EMERGENCY RESPONSE POLICY AND GUIDELINES

Introduction

Human safety is the major concern of the Environmental Risk Assessment (ERA) in the context of 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".

SteelAsia Manufacturing Corporation 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 Brgy. Telabanca.

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

- Level 1: Preparation of an Emergency/Contingency Plan
- Level 2: Preparation of an Emergency/Contingency Plan and ERA Report

Based on the levels of coverage, it was preliminarily determined that Risk screening level is applicable after using the Guideline of DAO 2003-30 as follows:

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. These 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

Type of Risks

Safety Risks

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

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

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 signages will be posted conspicuously at strategic places.

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
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 or 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
1. Mercury & mercury compounds	Includes all wastes with a total Hg concentration > 0.2 mg/ Also include organ mercury compounds

2. Lead compounds — Includes all wastes with a total Pb concentration > 5 mg/l

Complete inventory of hazardous wastes, incorporating the inventory in the emergency response plan for hazardous wastes with high risks
Or
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)
Accidental Oil spills	From vehicles and plant	Variable but small in quantities
Spent lighting bulbs	Equipment Lighting for Offices and Plant premises	To be determined but small in quantity
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 years of operation, thus minimal volumes

Physical Risks

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

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

1. For hazardous wastes that will be generated such as busted bulbs and lamps, LED lamps, used oil and used batteries, disposal will be done thru 3rd party DENR-accredited Treaters. Used oil will be collected and put inside sealed drums, stored in a company designated Material Recovery Facility (MRF) inside the plant. It will be transported and treated by a DENR accredited TSD facility.

2. Busted Fluorescent Bulbs will be put in a container, stored inside the plant MRF in accumulation until there are sufficient inventory for proper disposal through a DENR accredited TSD facility.

3. Contaminated rags and gloves will also be put in bags, stored inside the plant MRF in accumulation until there is sufficient inventory for proper disposal through a DENR accredited TSD facility.

4. Used automotive batteries will be traded-in to designated suppliers.

5. Remedial measures will be undertaken for soil contamination.

Breakdown or Failure of Equipment and Facilities

Temperature Extremes as Precursor to Accidents
At worst case scenario extreme temperature rise is predicted at 2.4^0C for a short term period of June/July/August in 2050. At the peak ambient temperature at this time of 29.3^0C 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. Potential effects of heavy rainfalls are flooding. The plant however will be designed for appropriate drainage system.

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, hydrometeorological 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, hydrometeorological 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 falls in moderate susceptibility to flooding as delineated by Mines and Geosciences Bureau. The project site 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.

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, SteelAsia Manufacturing Corporation has formulated its Emergency Response and Disaster Preparedness Plan (DPP) provided below:

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 SteelAsia Manufacturing Corporation's standards and other applicable Philippine legal requirements pertaining to rolling mill 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. 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 of 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

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.

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 Plant 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. 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 should be regulated on account of dangers 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 list of which to be filled out when the Project is in place is shown in Table 4.1 should be in the possession of all plant personnel.

Table 4.1: Proforma List of Emergency Contact Numbers

Agency Resources/Contact Persons	Telephone No.
LOCAL GOVERNMENT AGENCIES	
Barangay Captains	
Fire Station	
Hospital	
Police Station	
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.

5. Institutional Set Up

The Plant Team will constitute themselves as the Emergency Response Team. Inasmuch 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.

Provided in Annex D is the detailed ERA and ERP of SAMC which are components of its ISO Certiifcation.

CHAPTER V: SOCIAL DEVELOPMENT PLAN (SDP) AND IEC FRAMEWORK

5.1 The Social Development Plan (SDP)

SteelAsia Manufacturing Corporation as part of its Corporate Social Responsibility Program, has agreed to collaborate, by providing funding support and other technical assistance,with the DENR in the latter's endeavor for the environment to:

1. conserve, protect, rehabilitate and develop the remaining mangroveand resources of the country and enhance the replenishment of the denuded areas through natural or artificial means, pursuant to PD 705, as amended, otherwise known as the Revised Forestry Code of the Philippines, and R.A. 7586, otherwise known as the National Integrated Protected Areas System Act;
2. adopt a systematic, comprehensive and ecological solid waste management program under RA 9003 otherwise known as known as the "Ecological Solid Waste Management Act of 2000;
3. protect and advance the right of the people to a balanced and healthful ecology in accord with the rhythm and harmony of nature under RA 8749 otherwise known as the Philippine Clean Air Act of 1999; and
4. pursue a policy of economic growth in a manner consistent with the protection, preservation and revival of the quality of our fresh, brackish and marine waters for sustainable development otherwise known as the "Philippine Clean Water Act of 2004.

With this, STEELASIA is committed to DENR's Sustainable Integrated Area Development (SIAD) Program by establishing SIAD sites which STEELASIA shall help manage for sustainability, ranging from 5 to 10 hectares up to an aggregate of no less than 100 hectares for all the sites, within a period of three (3) to six (6)-year period.

On top of these initiatives, SAMC will be undertaking SDPs which include the following:

- Skills training to prepare the community for employment opportunities during the construction and operations phase of the project through the SteelAsia Academy being conceptualized
- Sustainable livelihood training programs
- Environmental/Climate Mitigation Actions: Reforestation and Carbon Sink Programme

The SDP Framework provided in the Table 5.1 below shows programs needed by the community based on the perception survey conducted and issues and concerns raised during the social preparation and Public Scoping.

Attached in Annex E is the complete documentation of the IEC and Public Scoping.

Table 5.1.1: Preliminary Social Development (SDP) Plan/Framework [1]

CONCERN	Responsible Community Member / Beneficiary	Government Agency/ Non-government Agency and 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 • City Council • TESDA	Community Relations Officer	• Construction • Operation	LGU –IRA/ Proponent
Education and Recreation	Barangay Kagawad for Education • Project-affected Families	• DepEd	Community Relations Officer	• Construction • Operation	Same
Environment and Sanitation • Reforestation and Carbon-Sink Program • Tree nursery • Climate Change and Disaster preparedness	Barangay Kagawad for Environment • Project Affected Community	• CENRO • CHO	Community Relations Officer	• Construction • Operation	Same
Peace and order	Barangay Kagawad for	• LGU	Chief Security	• Construction	Same

	Peace and order • Project Affected Community	• PNP	Officer	• Operation	
Climate Change Adaptation and Disaster Risk Reduction and Management	Barangay and municipal Disaster Risk Reduction and Management Council	LGU NDRRMC	Safety Officer	• Construction • Operation	Same

[1] The SDP of the project shall be derived from and aligned with, the LGU's existing SDP. The project's SDP normally aims to prevent/mitigate and/or enhance a project's adverse and positive impacts, respectively, on people's livelihood, health and environment. The process of formulating the project's SDP shall be actively participated in by Barangay Council, the Municipal Planning and Development Office (MPDO) and/or other Government Agencies whose mandates cover the management of impacts posed by project operations, e.g. DOH who may coordinate with the Proponent on the conduct of health impact studies or conduct of medical mission(s).

5.2 The Information, Education and Communications (IEC) Implementation Plan

IEC will be undertaken using several media and forms such as perception surveys, public consultations or Focus Group Discussions (FGDs), broadcast 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 will 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 of concern in Relation to Project	IEC Scheme / Strategy Methods	Information Medium	Indicative Timelines and Frequency	Indicative Cost
1. Residents of Brgy. Telabanca	Awareness for the people on the actual impacts & mitigating measures of the Project and concerns related to Climate Change Adaptation and Disaster Risk Reduction (CCA-DRR) specifically capacity-building for Barangay and Municipal Disaster Risk Reduction and Management Council	Group methods Multi-media	• Stakeholders' Consultative Planning Session / Community Projects Planning Sessions • Informal discussion/ / meeting with stakeholders • Climate Change Adaptation and Disaster Risk Reduction and Management Seminar and workshop	Annually Monthly	35,000.00
2. Students of elementary schools of impact barangay, i.e. Brgy. Telabanca		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. SteelAsia Manufacturing Corporation employees	Awareness and safety	Group methods	• Annual Safety program • Safety Inspectors Training • First Aid Training • Hazard Identification and Risk Assessment Training • Climate Change Adaptation and	Once a year	Part of company budget for employees

			Disaster Risk Reduction and Management Seminar		

Grievance Redress Mechanism (GRM)

In order to avoid conflict and misunderstanding among employees and the community, SAMC implements the following mechanism:

1. Grievance hotline in different Departments to report any suspected violation in the Code of Ethics or any concerns
2. Regular coordination with barangays thru meetings
3. Provision of Bulletin Boards at the Plant site and in the Barangays
4. Reporting to LGU on any issue or concern to the barangay and/or to the LGU of the Municipal Government of Concepcion
5. Dedicated Resident Manager who also acts as Community Relations Officer

CHAPTER VI: 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 DAO 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.

Provided in Table 6.5-1 is the Environmental Monitoring Plan (EMoP) with ENVIRONMENTAL QUALITY PERFORMANCE LEVELS (EQPLs). The EQPL Criteria/Guidelines above are interim and could be best firmed up with the MMT prior to construction phase.

6.2 Multi-Sectoral Monitoring Framework

As per DAO 2017-15, the vigilance of the public especially stakeholders living or working near the project site shall be used as tool in effectively monitoring and managing environmental impacts of projects.

Provided below is the list of stakeholder-members of the MMT for the project:

Table 6.2-1: MMT Composition

Stakeholder-Members
LGU Representatives
• Municipality of Concepcion / MENRO
• Rural Health Office Chief
• Brgy. Telabanca Captain
LGU-Accredited Local NGO
2 reps from locally-recognized community leaders
3 reps from government agencies with related mandate on the type of project and impacts during operations

6.2.1 Functions of the Multi-Partite Monitoring Team (MMT)

As an independent entity whose membership represents the stakeholders / public, the MMT is expected to add credibility by being open and transparent in monitoring environmental impacts and compliance with the Philippine EIS System requirements.

The MMT shall have the following specific functions:

a.) Conduct quarterly ocular site visit to validate the proponent's compliance with the ECC conditions and the Environmental Management and Monitoring Plan including the requirement to conduct self-monitoring and submit corresponding reports regularly. The MMT may observe sampling activities conducted by the project proponent.
b.) Prepare and submit its reported to EMB-CO and EMB-RO concerned using EMB-prescribed format at least semi-annually not later than July 30 for the first semester report and January 30 for the 2nd semester report
c.) Institute and environmental emergency and complaints receiving and management mechanism which shall include systems for transmitting recommendations for necessary regulatory action to EMB in a timely manner to prevent adverse environmental impacts.

6.2.2 MMT Formation and Operationalization

a. After the issuance of ECC for ECPs, the project proponent shall initiate the formation of the MMT based on the above policy updates in compliance to the relevant ECC condition. A Memorandum Agreement (MOA) between EMB-CO and PROPONENT based on a pro-forma to be provided by

EMB shall be executed with conformity of members of the MMT as identified based on Section 15.3 of this Order. The MOA signed by the proponent and the new members the project proponent shall submitted to EMB CO for final approval within the deadline specified in the ECC.

b. A MMT Manual of Operations (MOO) shall be formulated / updated based on these policy updates. The MOO shall guide the MMT in planning its activities.

c. In the conduct of its quarterly site visit, the MMTs shall implement the usual procedures including a closing meeting where the MMT findings shall be discussed with the representative of the project proponent.

d. MMTs who do not submit the required reports, those who fail to submit its report before the deadlines or submits incomplete reports for one (1) year shall be suspended until such time that such requirements are complied with.

e. Individual MMT Members who violate the code of ethics shall be subject to suspension/ removal/replacement/ by the chairman of MMT or any other disciplinary action as indicated in the MOO.

f. All other existing guidelines consistent with the provisions of this DAO shall still be in effect.

6.3 Environmental Guarantee and Monitoring Fund Commitments

DAO 2017-15 also laid down the guidelines for the fund commitments. For 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 SAMC and the DENR-EMB Central office. The proposed EGF amount will be PhP500,000.00 Trust Fund and PhP500,000.00 Cash Fund which is the current EGF baseline amount for similar steel mill projects.

The EMF to be established immediately after the Memorandum of Agreement (MOA) which is based on the activities and programs of the Multi-partite Monitoring Team (MMT), is around PhP300,000.00 The EMF can be replenished once the amount of PhP300,000.00 is less than 50%.

The proposed funds are still be subject to adjustments together with MMT members especially during the preparation of the Annual Work and Financial Plan once the MMT is established and will also be subject to regular replenishments as needed.

Table 6. 2-1:SUMMARY OF ENVIRONMENTAL MONITORING PLAN (EMoP) with ENVIRONMENTAL QUALITY PERFORMANCE LEVELS (EQPLs)

Key Environmental Aspects per Project Phase	Potential Impacts Per Environmental Sector	Parameter to be Monitored	Method	Frequency	Location	Lead Person	Annual Estimated Cost in PhP	EQPL MANAGEMENT SCHEME					
								EQPL RANGE			MANAGEMENT MEASURE		
								ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
I. PRE-CONSTRUCTION PHASE	NOT APPLICABLE												
II. CONSTRUCTION PHASE													
Environmental Aspect # 1: The Land: Land clearing	Increased sediment deposition	Silts in drainage system	Desilting of canals	Quarterly	Existing stations	Proponent	10,000	Visual observation of silt deposition	Immediate clean-up	Total clean-up	Presence of Complaints	IEC	Regular coordination with stakeholders thru regular IEC
Environmental Aspect # 1: The Land – solid wastes/garbage accumulation	Soil contamination / pollution	Scraps and debris	Observation	Quarterly	Working areas	Proponent	10,000	Uncollected garbage	Coordinate with the garbage hauler immediate collection of garbage	Ensure regular garbage collection	Presence of Complaints	IEC	IEC
III. OPERATIONS PHASE													
Environmental Aspect # 1: The Land - Generation of solid wate	Soil contamination	Heavy metals	TCLP/AAS	Annually	Area near hazwaste storage	PCO	50,000				Presence of Complaints	IEC	Regular coordination with stakeholders thru regular IEC
Environmental Aspect # 1: The Land	Generation of EAF dust	Heavy metals	TCLP/AAS	Annually									
	Generation of slags	Heavy metals	TCLP/AAS	Annually									

Key Environmental Aspects per Project Phase	Potential Impacts Per Environmental Sector	Parameter to be Monitored	Method	Frequency	Location	Lead Person	Annual Estimated Cost in PhP	EQPL MANAGEMENT SCHEME					
								EQPL RANGE			MANAGEMENT MEASURE		
								ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
Environmental Aspect # 2: The Water - Use, Operation and Maintenance of Equipment	Water pollution from used oil	BOD_5	Azide Modification-Dilution Technique (USEPA method 3010)	Quarterly / Per DAO 2003 - 07	Hand pump tube well in Barangay San Francisco Hand pump tube well in Barangay Telabanca Hand pump tube well in Barangay San Nicolas Balas Hand pump tube well in Barangay San Vicente Surface Water Downstream of Sacobia-Bamban River Surface Water Upstream of Sacobia-Bamban River	Project Proponent	7,000	6,000	5,000	7	Review performance	Check WWTF	Regular maintenance of WWTF

Key Environmental Aspects per Project Phase	Potential Impacts Per Environmental Sector	Parameter to be Monitored	Method	Frequency	Location	Lead Person	Annual Estimated Cost in PhP	EQPL MANAGEMENT SCHEME					
								EQPL RANGE			MANAGEMENT MEASURE		
								ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
Environmental Aspect # 3: The Air – plant operation	Ambient air pollution: Increase in dust generation, Increase in exhaust or SOx and NOx emission	TSP	(S)24 hr High Volume (A)Gravimetric USEPA 40 CFR, Part 50	Quarterly	In front of Multi-Purpose Hall, Brgy. San Vicente, Concepcion Beside the house of Mr. Jun Suizo, Brgy. Dungan Concepcion At the back of barangay hall of Brgy. San Nicholas Balas, Concepcion Calle Onse, Brgy. San Nicholas Balas, Concepcion Highway View Hacienda Subdivision, Brgy. Santo Rosario, Magalang Pampanga	Proponent through PCO; MMT	100,000.00	400 ug/Ncm	500 ug/Ncm	600 ug/Ncm		Check APCD	Stop operation
		SO2	(S)24 hr Gas Bubbler (A) Pararosaniline Method (West and Gaeke Method)	Quarterly			Part of Operating Cost	126	144	180		-do-	
		NO2	S)24 hr Gas Bubbler (A) Griess-Saltzman or Chemi luminescence Method	Quarterly			Part of Operating Cost	105	120	150		-do-	
		PM10	Quarterly	Quarterly			Part of Operating Cost	70% of the CAA limit	80% of the CAA limit	90% of the CAA limit	Conduct adjustment of the unit's operation as per operating manual.	Check APCD	Stop operation until the problem has been resolved.

Key Environmental Aspects per Project Phase	Potential Impacts Per Environmental Sector	Parameter to be Monitored	Method	Frequency	Location	Lead Person	Annual Estimated Cost in PhP	EQPL MANAGEMENT SCHEME					
								EQPL RANGE			MANAGEMENT MEASURE		
								ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
Environmental Aspect # 3: The Air – Operation of Rolling Mill	Greenhouse gas emission	CO_2, CH_4, and N_2O Emissions based on IPCC 2006 Guidelines and USEPA Procedure	Implementation of Reforestation and Carbon-Sink / greenhouse gas reduction program		In front of Multi-Purpose Hall, Brgy. San Vicente, Concepcion Beside the house of Mr. Jun Suizo, Brgy. Dungan Concepcion At the back of barangay hall of Brgy. San Nicholas Balas, Concepcion Calle Onse, Brgy. San Nicholas Balas, Concepcion Highway View Hacienda Subdivision, Brgy. Santo Rosario, Magalang Pampanga	Proponent	Part of Operating Cost	Unattended reforestation commitment	80% reforestation	60% reforestation a	Immediate planting of trees and revegetation	Review reforestation and carbon sink program	Further study or revision of the program
Environmental Aspect # 3: The Air – Operation of Melt shop	Generation of EAF dust	Heavy metals	TCLP/AAS	Annually		Proponent					Immediate repair, conduct regular maintenance	Replacement of parts and conduct regular maintenance	Stop operation
Environmental Aspect # 3: The Air – Operation of equipment and vehicles	Increase in sound levels from operation activities	Sound levels	Sound measurements using handheld sound meter	Quarterly		Proponent	To be determined	does not exceed 71.6dB	does not exceed 76.6 dB	does not exceed 81dB	Investigate and identify source of noise	Identification of the source of noise and check buffer zones and noise attenuation measures	Assess performance of the attenuation measures, employ corrective measures and install additional measures if necessary
Environmental Aspect # 4: The People	Traffic congestion	Traffic condition / Road Accessibility	Visual: Number of vehicles per report of Receiving Clerk Representation with the LGU regarding road	Daily	Access Road	Project Proponent	Part of the Proponent's responsibilities	20 minutes traffic	Half hour traffic	1 hour traffic	Deployment of traffic enforcers	Increased deployment of traffic enforcers	Review traffic management program and impact assessment and revise

Key Environmental Aspects per Project Phase	Potential Impacts Per Environmental Sector	Parameter to be Monitored	Method	Frequency	Location	Lead Person	Annual Estimated Cost in PhP	EQPL MANAGEMENT SCHEME					
								EQPL RANGE			MANAGEMENT MEASURE		
								ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
			network and its infrastructure plans Traffic Impact Assessment										
	Accidents	Number and Nature	Records from Clinics Safety Records	Monthly	NA	Health and Safety	No cost	5	10	10	Evaluation of safety procedures		
IV. ABANDONMENT PHASE													
Environmental Aspect # 1: The Land: oil spill	Soil contamination	Heavy metals	TCLP/AAS		Area near hazwaste storage	Proponent	50,000	Apply remedial measures					
Environmental Aspect # 2: The Water	Water pollution/ contamination	• BOD_5 • Total Coliform • Fecal Coliform • Total Suspended Solids (TSS) • pH	Environmental Site Assessment (ESA) that will be conducted prior to abandonment			Proponent thru PCO; MMT	To be determined	Based on ESA recommendations					
Environmental Aspect # 4: The People	Employment	No. of employees	Quarterly	Brgy. Telabanca and LGU of Concepcion	Comrel	150,000.00	70% implementation of employment program	60% implementation of employment program	100% implementation of employment program	Review programs	Revise programs	Enhance program implementation	Employment
	Environmental Aspect # 1: The Land: oil spill	Soil contamination	Contaminated soil TPH (C6-C36) USEPA priority pollutant metals (Sb, As, Be, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag, Tl,Zn VOCs	USEPA 8260C USEPA 8015C USEPA 7470A USEPA 6020A	Once before decommissioning	Hazardous Waste Storage Area	PCO	50,000	80 0.8 1.6	90 0.9 1.8	100 1.0 2.0	Investigate source of contamination and implement corrective measures	Investigate and strengthen implementation of measures

Key Environmental Aspects per Project Phase	Potential Impacts Per Environmental Sector	Parameter to be Monitored	Method	Frequency	Location	Lead Person	Annual Estimated Cost in PhP	EQPL MANAGEMENT SCHEME					
								EQPL RANGE			MANAGEMENT MEASURE		
								ALERT	ACTION	LIMIT	ALERT	ACTION	LIMIT
			SVOCs	USEPA 8260 USEPA 8270					40	45	50		
	Livelihood opportunities for local people and entrepreneurs	No. of Programs implemented	Survey / FGD	Quarterly	Concepcion	Comrel	150,000.00	60% implementation of programs	100% implementation of programs	Review programs	Revise programs	Enhance program implementation	Livelihood opportunities for local people and entrepreneurs
	• Total taxes paid to the national government • Development of small and medium enterprises like transport, construction and utility services, food services and laundry supplies	Total taxes paid	Real Property Tax payments	Quarterly	Concepcion	Comrel		90% availment	70% availment	60% availment services	Review availment and identify issues	Coordinate with LGU to determine if there are revisions/ improvement needed	Revisit policy and implement amendments and enhancements

CHAPTER VII: DECOMMISSIONING/ ABANDONMENT/ REHABILITATION POLICY

The Decommissioning Phase

Decommissioning refers to the permanent stoppage of the plant operations. The relevant aspects, waste generation, issues and built-in measures during this phase will be dependent on the decommissioning plan. The decommissioning / abandonment plan necessarily starts with an Environmental Site Assessment (ESA) taking note in particular of any residual toxic substances especially in the soil.

As a matter of procedure, the Decommissioning shall be subject to submittal of a plan and approval thereof by the Environmental Management Bureau. Third party monitoring of the decommissioning activities for the check and balance may be made by the MMT and the EMB. Unless given clearance after the decommissioning works shall have been completed, the Proponent shall remain legally responsible for any residual impacts on the environmental resources.

On the basis that the economic life of the project is at a minimum of forty (40) years, decommissioning may take place after this period. The protocol for the decommissioning is premature to develop at this early stage but will include among others the following aspects:

In drafting the Decommissioning/Abandonment Plan, following shall be considered:

1. Baseline environmental conditions especially air and water quality.
   Any plan shall be accompanied by definite action plans on how to rehabilitate the environmental resources in order to approximate its pre-project state
2. Result of the monitoring activities
3. Existing rehabilitation program and the cumulative accomplishments of the mitigating measures.
   The accomplishments will be useful in the determination of the performance gaps which must be given more attention and funding if needed. Also, consideration of these efforts shall be given attention to have continuity and not just disregard them
4. Issues and concerns, demands, opinions, wishes and suggestions of the local community, workers and local government which may be extracted thru several means of public consultation
   It is best to consider them they will the ones who will be left behind after the life of the Project
5. Inputs from MMT as an independent third party institution and interaction and relationship between EU and MMT
6. Procedures for decommissioning of the equipment which will consider the following:
   - Potential use of the equipment to be decommissioned; i.e. equipment that can be usable by third parties needs to be decommissioned intact.
   - Transportation of equipment and other materials used
   - Alternatives for the future use of the abandoned area
   - Alternate use of the area which may involve development into business centers including area for housing.
   - Consistency with the long-term zoning and land use development plan
   - Restoration/rehabilitation plan; and
   - Results of the ESA mentioned above.

CHAPTER VIII: INSTITUTIONAL PLAN FOR EMP IMPLEMENTATION

Introduction/Rationale
This section provides the instrument required to establish a proactive institutional requirement to guarantee compliance with environmental regulations and policies and implementation of environmental safeguards and commitments. It is important to set up capable and competent unit/group with properly defined roles in the process of the monitoring and evaluation of post EIA requirements and commitments as well as with other environmental regulations. It is important to identify and provide the group that will implement said requirements for a sustainable project operation.

Function
The Environment Unit/Team is responsible for the environmental performance of the project. It ensures implementation of the environmental safeguards and controls for the project implementation (for all phases of the project) and is responsible for overseeing environmental compliance activities, environmental requirements and regulatory obligations.

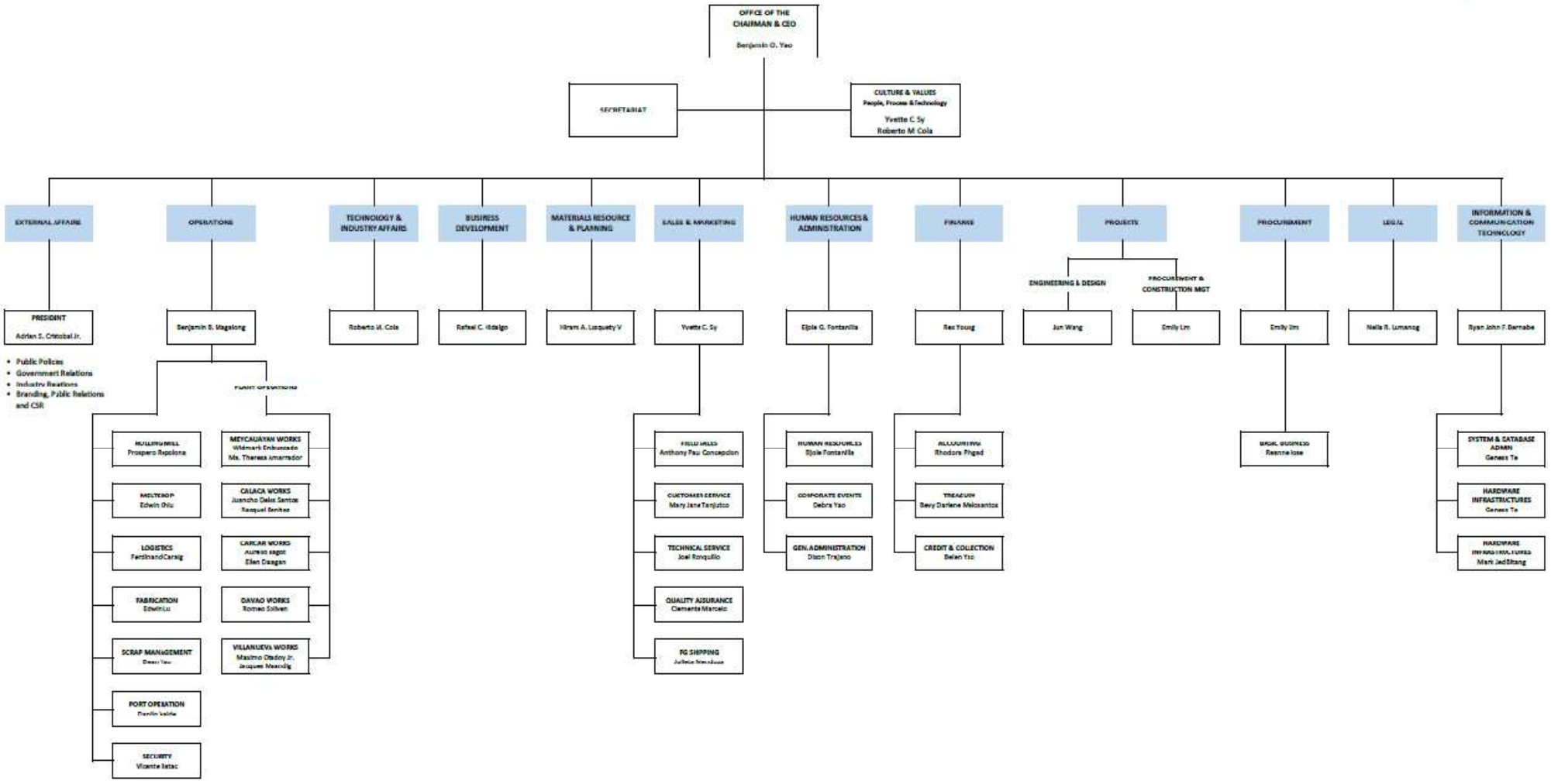
Core Function of the team/unit includes the following:
- Systems and Procedures
- Environmental Safeguards and Implementation
- Government Regulatory Compliance
- Environment Health Safety Program and Awareness
- EHS Program Compliance

Set Up
In many cases, the environmental unit leads the post EIA compliance and implementation process in collaboration with the other technical team/groups to provide technical support. Figure 9.1 illustrate the institutional framework. There are no generally applicable, rigid rules, so many variations are possible depending on the personnel capacities and structures.

The Multipartite Monitoring Team (MMT) is also included as part of the EMP implementation mechanism because it has the primary role of monitoring the project's implementation of the committed EMP.

Presented below is the partial listing of key manpower requirements and the Table of Organization

STEELASIA ORGANIZATIONAL STRUCTURE
AS OF FEBRUARY 2018



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
Pollution Control Officer/ Engineer	Compliance to environmental regulations & standards; maintenance of reports that are submitted to internal and external agencies
Safety Engineer	Responsible for implementation of emergency response procedures, handling of hazardous materials and environmental management systems and requirements of DOLE on occupational safety and health
CSR and SDP personnel	Community relations, design, training and implementation of CSR and SDP programmes

Following are the functions, roles and responsibilities of each department:

A. Operations – The operations department is responsible for acquiring the inputs and devising the best plant operations methods so that value adding occurs in the most efficient and effective way. Thus, the role of operations management (and the operations manager) is to ensure a smooth production process that contributes to the output of goods and services of an organization. In additions, following are inherent responsibilities of the Operations Department:
   - Full Plant operations
   - Safety and Morale of the Department
   - Production / Schedule attainment
   - Continuous Improvement
   - Leadership and Direction, plant wide
   - Customer interface
   - Company policy enforcement
   - Production start-up / launch

B. Maintenance
   This department is in charge for the schedule and regular inspection, maintenance and repair of equipment.

C. Engineering Support
   This Department is in charge of the automation control, optimization, safety and testing of necessary support needed by the plant.

D. Admin. And Finance
   Administrative and Financial Department is a unit to be assigned with various responsibilities concerning personnel, finance, publications, public relations, conferences, sale of documents and similar administrative functions; in particular:
   1. Personnel affairs;
   2. Organization of training of officials and supervision of programs established to that effect;
   3. General services including the general register of the staff and services;
   4. Rendering consultations to other Departments on organizational matters;
   5. Preparation of studies on the administrative organization;
   6. Maintaining and auditing the accounts of the Company;
   7. Supervision of storage and purchasing;
   8. Preparation of the budget;
   9. Organization of administrative services for conferences and meetings;
   10. Maintaining and organization of the library and the archives as well as their use.

Skills and Competency
Selection of competent and effective personnel comprising the environmental unit will be crucial in the institutional or organization building. Qualifications for the members may include the following:

- Understanding of environment management, legal regulatory framework, environmental impact assessment and reporting, and environmental compliance and audit management. Well-versed and familiar with the application of local laws and regulations on Environmental regulatory compliance.

- Experience in integrated environmental assessment
- Good relationship with the environmental regulatory authority
- capacity to dialogue with different stakeholders from both the public and private sector, and ability to build consensus on key environmental issues
- Oral and written communication skills; people skills; project coordination; monitoring and audit; scientific research and development; project planning; policy formulation; and training and facilitation

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CHAPTER X: ANNEXES

ANNEX A: SEC Registration of SteelAsia Manufacturing Corporation

ANNEX B Transfer Certificate of Titles

ANNEX C: LGU of Concepcion Ordinance No. 003-18

ANNEX D: EHS Risk Assessment and Emergency Preparedness and Response

ANNEX E: IEC and Public Scoping Report

ANNEX F: Sampling Results for Air and Water

ANNEX G: Air Dispersion Modeling Inputs

ANNEX H: PEMAPS Questionnaire

ANNEX I: Accountability of Project Proponent

ANNEX J: Accountability of Preparers

ANNEX K: Checklist of Must Requirements