

# ENVIRONMENTAL IMPACT STATEMENT REPORT

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## **Proposed Modular Diesel Power Plant Ancillary Project**

Barangay Libertad, Isabel, Leyte



**Submitted to:**



**ENVIRONMENTAL MANAGEMENT BUREAU**  
**Department of Environment and Natural Resources**  
DENR Compound, Visayas Avenue, Quezon City, Metro Manila

**Submitted by:**

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## Proposed Modular Diesel Power Plant Ancillary Project

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Barangay Libertad, Isabel, Leyte

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## Proposed Modular Diesel Power Plant Ancillary Project

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Annex ES-4 - Public Scoping Documents  
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Annex 6-1 - PEMAPS

### List of Acronyms

|           |   |
|-----------|---|
| CLUP      | Comprehensive Land Use Plan                                   |
| DAO       | Department Administrative Order                               |
| ECC       | Environmental Compliance Certificate                          |
| ECP       | Environmentally Critical Project                              |
| EISR      | Environmental Impact Statement Report                         |
| EMB       | Environmental Management Bureau                               |
| EMP       | Environmental Management Plan                                 |
| EMoP      | Environmental Monitoring Plan                                 |
| GEOSPHERE | GEOSPHERE Technologies, Inc.                                  |
| GO        | Grievance Officer   |
| IASCL     | Isabel Ancillary Services Co. Ltd.                            |
| IEC       | Information, Education and Communication                      |
| LGU       | Local Government Unit   |
| MGB       | Mines and Geosciences Bureau                                  |
| NAMRIA    | National Mapping and Resource Information Authority           |
| NDC       | National Development Corporation                              |
| PAGASA    | Philippine Atmospheric, Geophysical and Astronomical Services |
| PEISS     | Procedural Manual of the Philippine EIS System                |
| PHIVOLCS  | Philippine Institute of Volcanology and Seismology            |



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### EXECUTIVE SUMMARY

#### A. PROJECT FACT SHEET

|   |   |
|---|---|
| <b>Project Name</b>                         | Proposed Modular Diesel Power Plant Ancillary Project   |
| <b>Project Location</b>                     | Leyte Industrial Development Estate, Barangay Libertad, Isabel, Leyte   |
| <b>Project Type</b>                         | Modular Diesel Power Plant  |
| <b>Project Area</b>                         | 1.934 hectares  |
| <b>Project Capacity</b>                     | <ul style="list-style-type: none"><li>40MW regulating reserve with an initial dispatch of 20MW at the start of the interval hour or based on system requirement and/or NGCP's dispatch instruction. Such output will then change if there will be fluctuations of system frequency in the Visayas Grid.</li><li>30MW contingency reserve with an initial dispatch of 1.5MW at the start of the interval hour or based on system requirement and/or NGCP's dispatch instruction. Such output will then change if there will be an outage of a large generator or a loss of transmission line in the system.</li><li>In summary, 70MW plant capacity is available to the grid in cases of emergencies.</li></ul>  |
| <b>Project Technology</b>                   | High Speed Diesel Engines that use Automotive Fuel Oil  |
| <b>Project Components</b>                   | Modular Diesel Generator<br>Air Intake System<br>Exhaust Gas System<br>Fuel Supply System<br>Lubrication System<br>Cooling System<br>Service Water System<br>Instrumentation and Control System<br>Substation<br>Administration Building and other Site Facilities<br>Fire Protection System<br>Smoke Stack<br>Oily Wastewater Treatment System   |
| <b>Project/Investment Cost</b>              | PhP 1,750,000,000.  |
| <b>Profile of the Proponent</b>             |   |
| <b>Name of Proponent</b>                    | Isabel Ancillary Services Co. Ltd. (IASCL)<br><br>IASCL is a subsidiary of Marubeni Corporation (Marubeni), which currently owns over sixty (60) power generating assets in over 24 countries. IASCL is a special purpose company of Marubeni for its proposed Modular Diesel Power Plant Ancillary Project which feasibility and other studies were undertaken through its existing subsidiary company, Axia Power Holdings Philippines Corporation (Axia). Axia is one of the holding companies for Marubeni's power assets/investments in the Philippines which handles projects on its pre-development stage.<br><br>IASCL was granted registration papers by the SEC in May 17, 2018 and is registered as a limited partnership in Taguig City, Metro Manila |
| <b>Proponent's Address</b>                  | Lot 2-A-1-B and Lot 2-A-1-D, Leyte Industrial Development Estate, Libertad, Isabel, Leyte   |
| <b>Authorized Signatory/ Representative</b> | Gen Takahashi<br>Vice President   |
| <b>Contact Details</b>                      | Landline No.: (632) 552 8009  |

# ENVIRONMENTAL IMPACT STATEMENT REPORT

## Proposed Modular Diesel Power Plant Ancillary Project

Isabel Ancillary Services Co. Ltd.

Barangay Libertad, Isabel, Leyte

|                                |  |
|--------------------------------|--|
|                                | Mobile No.: +63 9285511072<br>Fax No.: (632) 553 5716<br>E-mail: gen.takahashi@teamenergy.ph                         |
| <b>Profile of the Preparer</b> |  |
| <b>EIA Preparer</b>            | GEOSPHERE Technologies, Inc.   |
| <b>Consultant's Address</b>    | 19D Eisenhower Tower, Eisenhower St., Greenhills, San Juan City, Metro Manila  |
| <b>Contact Person</b>          | Engr. Leticia T. dela Cruz<br>Managing Director  |
| <b>Contact Details</b>         | Landline: (+632) 724-5665; 724-5667<br>Fax Number: (+632) 723-4250<br>Email Address: gti0722@geospheretechnology.com |

## B. EIA PROCESS DOCUMENTATION

### EIA Team

The EIA Study was conducted by a multidisciplinary team of specialists and consultants of the GEOSPHERE Technologies, Inc. (**GEOSPHERE**), who have strong background in environmental assessments. The composition of the EIA Team are listed in **Table ES-1**.

**Table ES-1 EIA Team Composition**

| <b>Team Member</b>        | <b>Environmental Component/Task</b>             | <b>Reg. No.</b> |
|---------------------------|---|-----------------|
| Leticia T. dela Cruz      | Team Lead                                       | IPCO-287        |
| Marmelou Popes            | Geology and Geohazard                           | -               |
| Enrico Replan             | Terrestrial Ecology                             | -               |
| Reynaldo S. Tejada        | Meteorology and Air Quality                     | IPCO-036        |
| Fritzie Jane Salido       | Water Quality and Environmental Risk Assessment | IPCO-114        |
| Felixberto H. Roquia, Jr. | Socio-Cultural                                  | IPCO-028        |

From Isabel Ancillary Services Co. Ltd. (**IASCL**), the project management was spearheaded by Mr. Gen Takahashi, Vice President, Engr. Gerald Mascardo, Manager of Project Development and Engr. Rodolfo Bernardo, Assistant Vice President of Power Department.

The Accountability Statements of IASCL and GEOSPHERE are presented in **Annex ES-1**.

### EIA Schedule

The major activities undertaken to complete the EIA were listed in **Table ES-2**.

**Table ES-2 EIA Study Schedule**

| <b>Activity</b>  | <b>Date</b>                                       |
|--|---|
| Information, Education and Communication ( <b>IEC</b> ) Activities | September 12 and 19, 2017                         |
| Public Scoping   | November 7, 2017                                  |
| Technical Scoping  | December 13, 2017                                 |
| Primary and Secondary Data Gathering                               |   |
| Pedology   | January 14-16, 2018 – Collection of Soil Samples  |
| Terrestrial Ecology  | January 14-16, 2018 – Terrestrial Flora Survey    |
| Water Quality  | November 20, 2017- Secondary Data from EMB R8     |
| Marine Ecology   | August 17 and 24, 2013- Secondary Data from PASAR |

# ENVIRONMENTAL IMPACT STATEMENT REPORT

## Proposed Modular Diesel Power Plant Ancillary Project

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| Activity                                     | Date  |
|--|---|
| Air Quality and Noise                        | November 6-7, 2017 – Ambient Air Quality and Noise Sampling |
| Socio-economic, Health and Perception Survey | November 7-21, 2017   |
| Preparation of EISR                          | January – July 2018   |

### EIA Study Area

The EIA Study area for the proposed Project covers the area within Leyte Industrial Development Estate (**LIDE**), Municipality of Isabel and Barangays Libertad and Matlang.

### EIA Methodologies

Pursuant to the Department Administrative Order (**DAO**) No. 30 Series of 2003 of the Revised Procedural Manual of the Philippine EIS System (**PEISS**) and EMB Memorandum Circular 005 dated July 7, 2014, the proposed Project is classified under A-1 Category of Environmentally Critical Projects (**ECPs**) which requires an Environmental Impact Statement Report (**EISR**) for an Environmental Compliance Certificate (**ECC**) application.

The EIA for the proposed Project conforms to DAO 2003-30 and DAO 2017-15 in the conduct of the following activities, to wit: (i) IEC and Scoping, (ii) collection of primary and secondary data, (iii) identification/prediction/assessment of environmental impacts, (iv) formulation of Environmental Management Plan (**EMP**) and the (v) development of an Environmental Monitoring Plan (**EMoP**).

The baseline information are mainly primary and secondary data which were obtained from the Local Government Units (**LGUs**) and other government agencies. The data collected were based from the EIA Scoping and Screening Form, which was finalized during the Technical Scoping Meeting, which was conducted at the Environmental Management Bureau of the Department of Environmental and Natural Resources (**EMB-DENR**) Central Office, DENR Compound, Visayas Avenue, Diliman, Quezon City on December 13, 2017. The technical scoping was attended by the EMB Case Handlers, EIA Review Committee (**EIARC**), Isabel Ancillary Services Co. Ltd. (**IASCL**) and GEOSPHERE. The approved EIA Scoping and Screening Form and the attendance sheets during technical scoping are presented in **Annex ES-2**.

Data collected were processed, analyzed and evaluated for impact assessment and formulation of EMP and EMoP. The data and information were written into an EISR and the final version of the EISR was then submitted to the EMB-Central Office for ECC application.

**Table ES-3** shows the pertinent data, sources and methodology used for the proposed Project.

**Table ES-3 The EIA Methodology**

| Environmental Components           | Methodology   |
|------------------------------------|---|
| <b>LAND</b>                        |   |
| <b>Land Use and Classification</b> | <ul style="list-style-type: none"><li>Review of Comprehensive Land Use Plan (<b>CLUP</b>) of Isabel Municipality</li></ul>  |
| <b>Geology</b>                     | <ul style="list-style-type: none"><li>Review of available reports, geologic literature and information from Mines and Geosciences Bureau (<b>MGB</b>), Environmental Management Bureau (<b>EMB</b>), Philippine Institute of Volcanology and Seismology (<b>PHIVOLCS</b>), Philippine Atmospheric, Geophysical and Astronomical Services (<b>PAGASA</b>), and National Mapping and Resource Information Authority (<b>NAMRIA</b>)</li></ul> |
| <b>Pedology</b>                    | <ul style="list-style-type: none"><li>Review of existing literature and maps of the project area.</li><li>Collection and analysis of soil samples</li></ul>   |

# ENVIRONMENTAL IMPACT STATEMENT REPORT

## Proposed Modular Diesel Power Plant Ancillary Project

Isabel Ancillary Services Co. Ltd.

Barangay Libertad, Isabel, Leyte

| Environmental Components               | Methodology   |
|--|---|
| <b>Terrestrial Ecology</b>             | <ul style="list-style-type: none"><li>Conduct field surveys at the proposed Project site.</li></ul>   |
| <b>WATER</b>                           |   |
| <b>Hydrology</b>                       | <ul style="list-style-type: none"><li>Review of CLUP and other secondary data from existing literature and maps of the project area from MGB, EMB and NAMRIA.</li></ul>   |
| <b>Water Quality</b>                   | <ul style="list-style-type: none"><li>Review of water quality data in first to third quarter of 2017 from EMB Region 8</li><li>Review of marine ecology from PASAR EPRMP. The marine ecology was conducted on August 17 and 24, 2013 by PASAR</li></ul>   |
| <b>AIR</b>                             |   |
| <b>Meteorology and Climatology</b>     | <ul style="list-style-type: none"><li>Collection and review of existing literature and maps of the project area from PAGASA Tacloban Airport Station</li></ul>  |
| <b>Air Quality and Noise Level</b>     | <ul style="list-style-type: none"><li>Conduct of ambient air quality monitoring at six (6) established sampling stations to measure the ground level concentrations (GLCs) of NO<sub>2</sub>, SO<sub>2</sub>, TSP, PM<sub>10</sub> and Heavy metals conducted on November 5-7, 2017 in the project area and its vicinity.</li><li>Conduct of Noise level measurement during morning, daytime, evening, and night time using Extech Noise Data Logger at the six (6) established sampling stations conducted on November 5-7, 2018.</li><li>Use of AERMOD version 15181 software to assess and determine air quality impact of TSP, PM<sub>10</sub>, SO<sub>x</sub>, NO<sub>x</sub>, and CO emissions from the operation of the proposed Ancillary Plant Project.</li><li>Noise prediction for construction and operation activities of the proposed Project using CUSTIC 2.0 modeling software.</li></ul> |
| <b>PEOPLE</b>                          |   |
| <b>Socioeconomic and Public Health</b> | <ul style="list-style-type: none"><li>Conduct of IEC for the Barangay and Municipal LGUs</li><li>Conduct of Public Scoping</li><li>Conduct of Socio-economic, Public Health and Perception Survey at Barangay Libertad</li><li>Review of the CLUP of Isabel Municipality</li><li>Review of available secondary data, relevant studies and other information from Philippine Statistics Authority (PSA).</li></ul>   |

### Public Participation Activities

An extensive and comprehensive IEC Activity about the proposed Project and the EIS System was conducted to ensure a meaningful and active participation of well-informed stakeholders – host communities, LGUs, relevant agencies, EMB and the local DENR in the EIA process.

### IEC and Intial Perception Survey

The IEC was conducted to provide updated information about the proposed Project and encourage the concerned stakeholders to participate in the EIA process. The IEC activities were started with a prayer followed by the presentation of the EIA process and the project and its potential associated impacts to the environment. An open forum was held after the presentations in order to solicit the response of the stakeholders regarding the Project and to incorporate the issues that were raised into the EIA Study. The IEC sessions conducted are listed in **Table ES-4**. IEC documents such as attendance, issues raised, and photos taken during the IEC are presented in **Annex ES-3**.

**Table ES-4 IEC Conducted for the EIA Study of the Proposed Project of IASCL  
Barangay Libertad Isabel, Leyte**

| Session         | Date/Time                   | Venue   |
|-----------------|-----------------------------|---|
| Municipal Mayor | September 12, 2017, 9:00 AM | Mayor's Office, Municipal Hall, Isabel, Leyte |



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## Proposed Modular Diesel Power Plant Ancillary Project

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| Session                                 | Date/Time                    | Venue   |
|---|------------------------------|---|
| Barangay Officials and Sectoral Leaders | September 12, 2017, 11:00 AM | Barangay Hall, Barangay Libertad, Isabel, Leyte |
| Sangguniang Bayan                       | September 19, 2017, 9:30 AM  | SB Session Hall, Municipal Hall, Isabel, Leyte  |

The initial Perception Survey was conducted after the IEC in Brgy. Libertad, Isabel, Leyte. Survey questionnaires were distributed to the participants after the IEC sessions. The survey covers the demographic characteristics, source of income, livelihood, health and sanitation, education, employment, their knowledge and attitude towards the proposed Project. The results of perception survey is presented in **Annex ES-3**.

### Public Scoping

The Public Scoping was conducted on November 7, 2017, 9:30 A.M. at the Multi-Purpose Covered Court of Barangay Libertad, Isabel, Leyte to present the EIA Process, the proposed Project and its potential associated impacts and benefits to the public to collect site-specific concerns/inputs and suggestions to be incorporated in the EIA Study.

The main issues and concerns raised during the Public Scoping include the prioritization in hiring of local workers, disposal of used oil, secondary containment for oil tanks, mitigating measures for wastewater discharges and noise levels from the plant operation. The importance of open communication between the host barangay and IASCL throughout the different phases of project implementation was emphasized during the scoping.

The issues/concerns raised, copy of the received invitation letters, attendance sheets and photos taken during Public Scoping are presented in **Annex ES-4**.

## C. EIA SUMMARY

### Summary of Alternatives

#### Siting

There is no other alternative site considered for the proposed Project, except for the 1.934 hectares lot within the LIDE in Barangay Libertad, Isabel, Leyte. Considering that the proposed Project is to be located inside the industrial estate, there will be no sensitive areas such as protected areas, forest, mangroves, critical habitats and endangered species that will be affected. The source of fuel supply is also located approximately two (2) kilometers from the Project site also inside LIDE, which will ease the delivery of fuel to the Project site. Moreover, IASCL identified the 138kV transmission system of NGCP located just above the Project site as the best tapping point.

#### Technology

IASCL will utilize a high-speed modular diesel power plant which is a location-independent complete system with perfectly matched components. In a modular power plant, all the modules are preconfigured for quick installation and are delivered to the installation site prefabricated. This facilitates the installation of the modular power plant on site and shortens set-up times, allowing precision assembly even in locations with limited infrastructure. Other reasons which aid IASCL in choosing a modular diesel power plant are as follows:

- Has simple design and layout of plant
- Occupies less space and is compact
- Can be constructed and operated quickly
- Requires less water for cooling
- No ash handling problem
- Requires Less operating and supervising work

# ENVIRONMENTAL IMPACT STATEMENT REPORT

## Proposed Modular Diesel Power Plant Ancillary Project

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### Summary of Baseline Environmental Condition

| Environmental Component                                 | Description   |
|---|---|
| <b>Land</b>   |   |
| <b>Land Classification</b>                              |   |
| Existing Land Use                                       | <ul style="list-style-type: none"><li>The municipality is composed of built-up areas, forest industrial area, pasture land/grass land and agricultural areas.</li><li>The proposed project site is located in an industrial zoned area inside Leyte Industrial Development Estate (LIDE).</li><li>There is no issue in terms of compatibility with the existing land use.</li></ul>   |
| Environmental Critical Area (ECA)                       | <ul style="list-style-type: none"><li>The proposed project site is to be located in an industrial zoned area inside LIDE and there will be no encroachment of ECAs.</li></ul>   |
| Land Tenure   | <ul style="list-style-type: none"><li>No areas within the proposed Project site is under CARP or with CADC/CADT/CALC.</li></ul>   |
| Visual Aesthetics                                       | <ul style="list-style-type: none"><li>No identified significant landforms or structures within the project area inside LIDE</li></ul>   |
| <b>Geology/Geomorphology</b>                            |   |
| Surface Landform/Geomorphology/Topography/Terrain/Slope | <ul style="list-style-type: none"><li>Barangay Libertad has a slope of greater than 10%.</li><li>It is expected that alteration of the terrain and slope of the proposed Project site will be less significant for the site is already an existing industrial state. Minimal earthworks will be undertaken based on its conceptual bench type design layout</li></ul>   |
| Subsurface Geology/Underground Condition                | <ul style="list-style-type: none"><li>The mainland of Isabel is predominantly composed of alluvium and Hubay formation.</li><li>The basement of Western Leyte is made up of Malitbog Ophiolite, while youngest lithologic units that can be found is the San Isidro Limestone.</li><li>There are no major faults present near the project site for at least 30km from the project area.</li><li>The nearest major fault present near the site is the main branch of the Philippine Fault that traverses Leyte Island striking Northwest to Southeast.</li><li>The Peak Ground Acceleration values for the project site are high.</li><li>The project site is predominantly overlain by limestone as bedrock, it is possible that the area has numerous sinkholes. These sinkholes will then contribute to hazard of land subsidence for the area.</li></ul> |
| <b>Pedology</b>   |   |
| Soil Type   | <ul style="list-style-type: none"><li>The soil in Municipality of Isabel is mostly clay which ranges from Hydrosol Clay to Faraon Clay to Polompon Clay.</li><li>64% of the total area is Faraon Clay, Polompon clay comprises 33% and 3% is Hydrosol Clay</li></ul>  |
| Soil Erodibility  | <ul style="list-style-type: none"><li>The proposed Project is located at the area which is slightly eroded.</li></ul>   |
| Soil Quality and Fertility                              | <ul style="list-style-type: none"><li>Level of pH in Station 1 is favorable, while in other stations (S2 and S3) soils are highly basic.</li><li>Nitrogen range is 1200 mg/kg to 1,600 mg/kg.</li><li>Organic matter is very low.</li><li>Levels of Phosphorous in all sampling stations are adequate or favorable.</li><li>Levels of Potassium in all stations are high from 1655 mg/kg to 2,717 mg/kg.</li></ul>  |

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| Environmental Component    | Description   |
|----------------------------|---|
|                            | <ul style="list-style-type: none"><li>• Levels of Chromium Hexavalent are below the limits in all stations.</li><li>• Levels of Zinc and Arsenic in all sampling station exceeded the Intervention Vale of the Dutch Standard except S3 for Arsenic and in Station 1 for Zinc which are below the Intervention Value but exceeded the Target Value of Dutch Standard.</li><li>• The levels of Iron in all sampling stations exceed the range (3,000-10,000 mg/kg) of Iron in soil</li><li>• Levels of Copper in all sampling stations exceeded the Intervention Value of the Dutch Standard.</li></ul>  |
| <b>Terrestrial Ecology</b> |   |
| Terrestrial Flora          | <ul style="list-style-type: none"><li>• The vegetation in about 2-ha proposed ISACL power plant site is generally a brush land and remnant of mixed land use.</li><li>• The upper portion of the project site is dominated by a dense stand of Ipil-Ipil. There are few unique individual tree species such as Bayok and Bogong located in the upper portion of the area.</li><li>• The inner portion, large diameter trees such as Bogong, Gmelina and Alim dominate the area.</li><li>• There is an existing plant nursery in the area, though located outside the project site.</li><li>• Remnants of agricultural activities can also be observed in the area such that these areas are planted with Banana, Mango, and Avocado.</li><li>• Other species that can be observed in the area include Bangkoto, Malakalumpang, mixed with forest tree species were the wildings/trees of the following species are present, namely Binunga, Alim, Rain tree, Hauili and Niyog-niyogan.</li><li>• In terms of understory species, the area is covered with many colonizers and invasive species such as shrubs, creeping leguminous vines and herbaceous plants from the family Fabaceae, Asteraceae, Verbenaceae, Urticaceae and Poaceae.</li><li>• Only five Philippine endemic plant species were found in the Project site.</li><li>• There were 12 exotic/alien invasive species that were observed in the proposed Project Site. Among the species recorded at the proposed Project site, Molave is the only species listed as Endangered Species under IUCN Red List of Threatened Species and as Vulnerable Species under DAO 2007-01, The National List of Threatened Philippine Plants and their Categories.</li><li>• A total of 542 individuals belonging to 34 species were recorded for intermediate and understory species. The average density is slightly higher than that of trees, at 0.72 individual/m<sup>2</sup> or equivalent to 72 individuals for every 100m<sup>2</sup>.</li></ul> |
| <b>Water</b>               |   |
| Hydrology/Hydrogeology     | <ul style="list-style-type: none"><li>• The Project area is elevated and there are no rivers and creeks within its vicinity. The Flood Susceptibility Map of MGB shows that the project site is not prone to flooding</li></ul>   |



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| Environmental Component     | Description   |
|-----------------------------|---|
| Water Quality               | <ul style="list-style-type: none"> <li>LIDE is bounded by the Dupon Bay at the west and Matlang Bay at the east.</li> <li>These two (2) bays form a peninsula with the Camotes Sea. Based on the DENR Memorandum Circular 2013-03 dated January 17, 2013, the surrounding body of water has been reclassified from Class SD to Class SC.</li> <li>Levels of Temperature, pH, and Dissolved Oxygen (DO) recorded in all sampling stations fall within the DENR Standards for Class SC Waters.</li> <li>The levels of Arsenic, Cadmium, Chromium Hexavalent, Copper, Lead and Mercury in all sampling stations also fall within the DENR Standard except for the level of Arsenic in Station MW6.</li> <li>The levels of Total Suspended Solids (TSS) in all sampling stations monitored in May and June 2017 by the EMB Region 8 are all within the DENR Standard except in Station MW1 during June 2017.</li> <li>Only Stations MW4, MW5 and MW6 had levels of Fecal Coliform that are below the DENR Standard for the whole monitoring period.</li> </ul>  |
| Marine Ecology              | <ul style="list-style-type: none"> <li>The marine ecology within the vicinity of the proposed Project was described using the data from PASAR Corporation.</li> <li>The marine ecology survey was conducted by PASAR Corporation through the Visayas State University Marine Biologist on August 17 and 24, 2013.</li> <li>There were no seagrasses nor seaweeds found in 4 monitoring stations. During the survey, the substrate were observed to be sandy-rocky which were heavily covered with silts.</li> <li>The coral reef was dominantly rock (72%) and sand (21%). Presence of dead corals (6%) indicate that live corals in the area was once growing. Live coral cover comprise 0.73% which indicate poor coral reef condition.</li> <li>Most of the living corals were juveniles (10cm) which indicate poor potential restoration of corals.</li> <li>A total of 15 fish species belonging to eight families were found in which Labridae and Pomacentridae were the most abundant. Ninety-seven percent (97%) of the species found in the area were non-target species.</li> <li>The target species recorded include <i>Scolopsis ciliatus</i>, <i>Epinephelus sp.</i>, and <i>Gymnothorax thyrsoideus</i>.</li> <li>Twenty (20) major taxa of meiofauna were identified at four sampling stations. Most of the meiofauna were found in Station 2.</li> <li>Foramifera had the highest mean density among the meiofaunal groups.</li> </ul> |
| <b>AIR</b>                  |   |
| Climatology and Meteorology | <ul style="list-style-type: none"> <li>The climate at the proposed Project site falls under Type IV category based in the Modified Coronas Climate Classification of Philippine Climate.</li> <li>The nearest meteorological station of the PAGASA to the project site is the Tacloban Airport Station.</li> <li>The annual mean average temperature is 28°C with January being the coldest month having an average temperature of 26.3°C while the month of May is the warmest with an average temperature of 28.8°C.</li> <li>The most number of tropical cyclones that crossed Leyte is during the months of November and December.</li> <li>These tropical cyclones are associated with the occurrence of low pressure areas normally originating from the North Western Pacific</li> </ul>   |





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| Environmental Component                | Description   |
|--|---|
|  | <p>Ocean of the Philippine Area of Responsibility and generally moving northwestward.</p> <ul style="list-style-type: none"> <li>The historic average annual rainfall of Leyte is 2,659.3 mm.</li> </ul>  |
| Air Quality                            | <ul style="list-style-type: none"> <li>The concentrations of particulates (TSP &amp; PM<sub>10</sub>), SO<sub>2</sub> and NO<sub>2</sub> for 24-hour averaging period were all below the CAA limit of 230 µg/Ncm for TSP; 150 µg/Ncm for PM<sub>10</sub>; 150 µg/Ncm for NO<sub>2</sub>; and 180 µg/Ncm for SO<sub>2</sub>.</li> <li>All samples collected for hourly averaging time in all stations were also below the CAA limit.</li> <li>The highest concentration of TSP was 79.42 µg/Ncm recorded at Station 4, while the lowest concentration was 22.26 µg/Ncm recorded at Station 2.</li> </ul>   |
| Noise Level                            | <ul style="list-style-type: none"> <li>Measured noise levels in all of 6 stations were below the allowable noise standard in Section 78, Table 1 of the 1978 NPCC Rules and Regulations, Environmental Quality Standard for Noise in general areas except for STN-2 Daytime. The location of STN-2 is in the parking area of LIDE Clubhouse where noise is expected because the site is full of recreational facilities such as basketball court, swimming pool, gym, etc.</li> </ul>   |
| <b>PEOPLE</b>                          |   |
| Demography                             | <ul style="list-style-type: none"> <li>The August 2015 population census conducted by the Philippine Statistics Authority (PSA) had recorded 46,915 persons in Isabel Municipality. The five (5) most populous barangays are Matlang, Libertad, Santo Niño, Marvel (Pob.) and Bilwang</li> </ul>  |
| Literacy Rate and Education Attainment | <ul style="list-style-type: none"> <li>In 2010, majority (98.27%) of the population over 10 years old in Isabel are literate.</li> </ul>  |
| Peace and Order                        | <ul style="list-style-type: none"> <li>The 2007 Philippine National Police data recorded ten (10) crimes against persons and 3 crimes against property in Isabel Municipality.</li> </ul>   |
| Commercial                             | <ul style="list-style-type: none"> <li>The 435 ha LIDE locates two heavy industries, namely PASAR and PhilPhos. PASAR produces over 172,000 metric tons of copper cathodes every year. LIDE still offers 80 ha for other investors.</li> </ul>  |
| Employment                             | <ul style="list-style-type: none"> <li>In 2010, Leyte has 606, 971 gainful workers where in most (33.79%) of workers were involved in trade and related works.</li> </ul>   |
| <b>Perception Survey</b>               |   |
| Respondent's Profile                   | <ul style="list-style-type: none"> <li>Majority (63%) of the respondents are women while only 36% are men.</li> <li>Most (55%) of the respondents were born in the Barangay.</li> <li>Majority (91%) are Cebuano and some are Waray.</li> <li>54% are within the brackets of 46-65 years old.</li> <li>Most (42%) had finished college, 25% had finished high school, 21% had finished elementary and 11% had finished vocational school.</li> <li>Most (80%) of the respondents are married having 1-3 male (55%) and female (64%) children.</li> <li>Majority (91%) of the respondents are Catholics by religious affiliation.</li> <li>The husbands (64%) are contributing a major portion of income in the family of the respondents. About 52% have an earning of PhP1,000 to PhP9,999 per month and 16% have an earning of less than PhP1,000 per month.</li> <li>Majority (75%) of the respondents source their income from the salary. Though, the Barangay is near the sea, only 8% of the respondents are fishermen.</li> </ul> |

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| Environmental Component   | Description  |
|---------------------------|--|
|                           | <ul style="list-style-type: none"> <li>Most of the respondents (87%) indicated that livelihood or source of income is the main problem in their community followed by solid waste and water conservation.</li> <li>Majority (82%) do not own any land.</li> <li>Majority (80%) of the respondents have water sealed toilet at home, while 20% of the respondent are using the flash toilet.</li> </ul>   |
| Perception Survey Results | <ul style="list-style-type: none"> <li>Majority (84%) of the respondents knew about the proposed Project of IASCL, learning about it from the IEC and Public Scoping (58%). Some (33%) of them knew the proposed Project from the Barangay Officials.</li> <li>About (87%) of the respondents are in favor of the proposed Project.</li> <li>They considered it to have a positive effect, such as provision of job opportunity (64%); source of livelihood (45%); and additional income to the barangay (33%).</li> </ul> |

### Impact Assessment and Environmental Management Plan

Table ES-5 presents the summary of key environmental impacts of the proposed Project and the corresponding management plan and mitigating measures.

**Table ES-5 Environmental Management Plan for the Proposed Project**

| Environmental Component Likely to be Affected | Potential Impact  | Prevention/Mitigation/Enhancement Measures   | Residual Effects |
|---|---|--|------------------|
| <b>CONSTRUCTION PHASE</b>                     |   |  |                  |
| <b>LAND</b>                                   |   |  |                  |
| Land use and Classification                   | <ul style="list-style-type: none"> <li>Change/ Inconsistency in Land Use</li> </ul>   | <ul style="list-style-type: none"> <li>The Project site is an industrial area and consistent with the general land use of Isabel Municipality and therefore there is no issue with the change in land use.</li> </ul>  | None             |
| Geology/ Geomorphology                        | <ul style="list-style-type: none"> <li>Change in surface landform/terrain/ slope</li> <li>Change in sub-surface underground geomorphology</li> <li>Inducement of subsidence, liquefaction, landslides, mud/debris flow</li> </ul> | <ul style="list-style-type: none"> <li>Strict conformance to the recommendations of the geotechnical study</li> <li>Since the area is already developed, the possibility of experiencing landslides and/or mud/debris flow is nil.</li> </ul>                    | None             |
| Pedology                                      | <ul style="list-style-type: none"> <li>Soil erosion</li> </ul>  | <ul style="list-style-type: none"> <li>When necessary, construction of soil erosion control measures either by engineering structure or planting of grasses/trees.</li> <li>Placement of excavated soil materials in appropriate stockpile areas with</li> </ul> | None             |

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| Environmental Component Likely to be Affected | Potential Impact   | Prevention/Mitigation/Enhancement Measures  | Residual Effects   |
|---|--|---|--|
|   |  | avoidance of stockpiling along drainage ways/creeks. <ul style="list-style-type: none"> <li>The soil stockpiles will be covered with plastic sheets/geotextile, or planted with grasses/ small shrubs for erosion control.</li> </ul>   |  |
| Terrestrial Ecology                           | <ul style="list-style-type: none"> <li>Vegetation removal and loss of habitat</li> </ul>                               | <ul style="list-style-type: none"> <li>Since the site is already developed, the construction of the proposed Project will not cause significant loss of habitat.</li> </ul>   | None   |
|   | <ul style="list-style-type: none"> <li>Threat to existence and/or loss of important local species</li> </ul>           | Since the site is already developed, the construction of the proposed Project will not cause significant loss of important local species nor threaten abundance, frequency and distribution   | None   |
|   | <ul style="list-style-type: none"> <li>Threat to abundance, frequency and distribution of important species</li> </ul> |   |  |
|   | <ul style="list-style-type: none"> <li>Hindrance to wildlife access</li> </ul>   | <ul style="list-style-type: none"> <li>No significant wildlife habitats or endangered species were within the project site</li> </ul>   | None   |
| <b>AIR</b>                                    |  |   |  |
| Air Quality and Noise                         | <ul style="list-style-type: none"> <li>Degradation of Air Quality</li> </ul>   | <ul style="list-style-type: none"> <li>Every main haul road shall be paved with concrete, bituminous materials; keep the road clear of dusty materials; spray the road with water so as to maintain the entire road surface wet; and immediately before leaving a construction site, every vehicle shall be washed to remove any dusty materials from its body and wheels;</li> <li>Truck loaded with dusty construction materials shall be covered entirely by clean impervious sheeting to ensure that the dusty materials do not leak;</li> <li>Periodic watering of aggregates storage piles or covering or enclosure if material is especially dusty.</li> <li>Ambient air (TSP) monitoring</li> </ul> | Minimal degradation of air quality, confined only to construction site and away from sensitive receptors |



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| Environmental Component Likely to be Affected | Potential Impact  | Prevention/Mitigation/Enhancement Measures  | Residual Effects   |
|---|---|---|--|
|   | <ul style="list-style-type: none"> <li>Increase in ambient noise level</li> </ul>   | <ul style="list-style-type: none"> <li>Scheduling certain high noise emitting works to more acceptable times of day</li> <li>Use of the most environmentally acceptable equipment which is properly maintained and silenced</li> <li>Proper instruction and supervision of staff</li> <li>Defective equipment/parts with abnormal noise and/or vibration will be either repaired replaced</li> <li>All employees working on site will be provided with proper ear protectors</li> <li>Conduct noise level monitoring</li> </ul> | Minimal increase in ambient noise levels, confined only to construction site and away from sensitive receptors |
| <b>PEOPLE</b>                                 |   |   |  |
| Local residents                               | <ul style="list-style-type: none"> <li>Increase in local employment</li> </ul>  | <ul style="list-style-type: none"> <li>Priority employment for qualified local residents without discrimination to gender and age</li> </ul>  | Increased income of the local residents with consideration to gender equality and vulnerable group             |
| Local community                               | <ul style="list-style-type: none"> <li>Improvement in infrastructures and social services</li> </ul>  | <ul style="list-style-type: none"> <li>Diligent payment of taxes/revenues</li> </ul>  | Increased income of the host LGUs  |
| <b>OPERATION PHASE</b>                        |   |   |  |
| <b>LAND</b>                                   |   |   |  |
| Geology                                       | <ul style="list-style-type: none"> <li>Subsidence and Liquefaction</li> </ul>   | <ul style="list-style-type: none"> <li>Structural monitoring of buildings/facilities especially after each earthquake</li> <li>Formulation of detailed Emergency Preparedness and Response Plan</li> </ul>  | None   |
| Pedology                                      | <ul style="list-style-type: none"> <li>Soil contamination</li> </ul>  | <ul style="list-style-type: none"> <li>Regular monitoring of possible oil spills</li> <li>Implementation of Emergency Preparedness and Response Plan</li> </ul>   | None   |
| Terrestrial Ecology                           | <ul style="list-style-type: none"> <li>Threat to abundance, frequency and distribution of important species because of generation of emissions</li> </ul> | <ul style="list-style-type: none"> <li>IASCL shall plant native species for vegetation, as these would be expected to have good survival rate.</li> </ul>   | Increased number of trees  |





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| Environmental Component Likely to be Affected | Potential Impact  | Prevention/Mitigation/Enhancement Measures   | Residual Effects  |
|---|---|--|---|
| <b>AIR</b>                                    |   |  |   |
| Air Quality                                   | <ul style="list-style-type: none"> <li>Degradation of Air Quality</li> </ul>                                | <ul style="list-style-type: none"> <li>Use of automotive diesel oil, which is a clean fuel</li> <li>Built-in smokestacks for efficient dispersion of plant's emission</li> <li>Conduct ambient air quality monitoring and stack emissions testing</li> </ul>   | Minimal degradation of air quality, since predicted GLCs of all parameters are below CAA limits and away from sensitive receptors     |
| Noise Quality                                 | <ul style="list-style-type: none"> <li>Increase in ambient noise level</li> </ul>                           | <ul style="list-style-type: none"> <li>All generators will be enclosed;</li> <li>Conduct noise level monitoring</li> </ul>   | None  |
| <b>PEOPLE</b>                                 |   |  |   |
| People's health and safety                    | <ul style="list-style-type: none"> <li>Increase in local employment</li> </ul>                              | <ul style="list-style-type: none"> <li>Priority employment for qualified local residents without discrimination to gender and age</li> </ul>   | Increased income of the local residents with consideration to gender equality and vulnerable group                                    |
|   | <ul style="list-style-type: none"> <li>Introduction of disease between migrant and local workers</li> </ul> | <ul style="list-style-type: none"> <li>Clean bill-of-health as a condition for employment per job description</li> <li>Medical missions shall be part of the CSR program of IASCL</li> <li>Provision of potable water, sanitary facilities and garbage bins for workers</li> <li>Provision of a safety officer to monitor safe working conditions</li> <li>Provision of Medical/First Aid kits in all work places</li> </ul> | Accidents may still occur, but the safety and health guidelines in place will significantly lower the exposure of workers to hazards. |
|   | <ul style="list-style-type: none"> <li>Fire hazard</li> </ul>   | <ul style="list-style-type: none"> <li>Provision of fire suppression systems, fire detections systems, fire hose stations and portable fire extinguishers</li> </ul>   |   |

In summary, the proposed Project has no significant adverse impact on land component, as it will be located within LIDE. For the water component, the proposed Project site is approximately 500m from the sea. Additionally, the proposed project will generate minimal wastewater mainly from equipment washings and domestic source. Treated effluent will be discharged through the drainage system of LIDE and there will be no wastewater discharges into the marine environment that can cause significant adverse impact to the marine water quality and ecology.

For the air component, the air emissions are the main impact of the proposed Project. However, IASCL will use automotive diesel oil as fuel, which is cleaner. Moreover, installation of 5.6m stack per unit engine will ensure that emissions will meet DENR air quality standards. Furthermore,

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predicted ground level concentrations (GLCs) from plant emissions are way below the CAA standards.

The residents in the host barangay and municipality will be affected in a beneficial way with employment opportunities, Corporate Social responsibility (CSR), and Social Development Program (SDP) during construction and operation phases of the proposed Project. The LGU will also be positively affected mainly with provision of standby power supply in cases of emergencies, benefits from DOE ER 1-94 and payment of taxes and fees.

### **Risks and Uncertainties relating to the findings and implications for decision making**

There are no major risks and uncertainties identified based on the findings of the EIA.



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### 1.0 PROJECT DESCRIPTION

The Isabel Ancillary Services Co. Ltd. (**IASCL**) proposed to install and operate an ancillary power plant with a total installed capacity of 70MW, named as Modular Diesel Power Plant Ancillary Project, which will be located inside Leyte Industrial Development Estate (**LIDE**) in Barangay Libertad, Isabel, Leyte. The proposed ancillary power plant is aimed to provide support services necessary to sustain transmission capacity and energy essential in maintaining grid power quality, reliability, and security which is consistent to the Ancillary Services Procurement Plan under Energy Regulatory Commission (**ERC**) Case No. 2005-253.

The proposed ancillary power plant of IASCL shall provide two types of Ancillary Services, Regulating Reserve and Contingency Reserve. The Regulating Reserve is the capacity necessary to adjust total system generation over short periods of time to match system load changes. The maximum response time for the change in the generating unit's power output shall be twenty-five (25) seconds and which shall be sustainable for at least 30 minutes. The Contingency Reserve, on the other hand, is intended to take care of sudden and unexpected loss of the large synchronized generating unit or the power import from a single grid interconnection. Ancillary plants are quick enough to maintain system reliability and restore the system to generation/load balance and the system frequency. Contingency Reserve Service shall be sustainable for a period of at least 30 minutes. Continued supply service in excess of 30 minutes shall be provided under the terms of Dispatchable Reserve Service to be sourced from other AS providers. For Generators providing Regulating Reserve operating at Automatic Generation Control mode, the maximum response time is 25 seconds and should be sustainable for at least 30 minutes. For generators on Free-governor mode of operation, the maximum response time is 5 seconds and should be sustainable for 25 seconds.

The proposed ancillary power project of IASCL will have an installed capacity of 70MW allocated as follows: 40MW as regulating reserve and 30MW as contingency reserve. The regulating reserve will be dispatched and have an initial loading of 20MW or 50% of the 40 MW installed capacity at the start of the interval hour or based on system requirement and/or NGCP's dispatch instruction. Such output will then change if there will be fluctuations of system frequency in the Visayas Grid. The contingency reserve will initially require five (5) modular engines to be operated at 300 kW each or a total of 1.5MW initial loading at the start of the interval hour or based on system requirement and/or NGCP's dispatch instruction. Such output will then change if there will be an outage of a large generator or a loss of transmission line in the system. Therefore, the IASCL has committed to the National Grid Corporation of the Philippines (**NGCP**) that the 70MW plant capacity is available to the grid in cases of emergencies.

The proposed Ancillary Power Project of IASCL is classified under A-1 Category of Environmentally Critical Projects (**ECPs**) pursuant to Memorandum Circular 2014-005, the Revised Guidelines for Coverage Screening and Standardized Requirements under the Philippine Environmental Impact Statement System (**PEISS**) of the Department of Environment and Natural Resources (**DENR**) which requires an Environmental Impact Statement Report (**EISR**) for application of an Environmental Compliance Certificate (**ECC**) at the Central Office of the Environmental Management Bureau (**EMB**) of the DENR.

#### Brief Information about the Proponent

Axia Power Holdings Philippines Corporation (AXIA), a holding company owned 100% by Marubeni Corporation (Marubeni), is one of the holding companies for Marubeni's power assets/investments in the Philippines. Thus, for any new project that Marubeni will develop, the originating (or project pre-development) company would regularly be AXIA.

Since all power project companies of Marubeni are single purpose companies, generating income on its own by selling a single product which is electricity, there is the need to establish a Special Purpose Company (SPC) or Special Purpose Vehicle (SPV). In such case, the company will exist and strive to survive and be profitable on its own merits and effort.



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In the case of the Visayas Ancillary Service Diesel Power Plant, which will provide Ancillary Services to the NGCP, the SPV established is the Isabel Ancillary Service Company Limited (IASCL). IASCL was established when the feasibility study of the Project has been nearly completed, which includes the completion of the environmental permit application, securing the project site under land lease with the National Development Company, and the principle agreement of the details of the Ancillary Service Procurement Agreement with the NGCP.

Isabel Ancillary Service Company Limited was granted registration papers by the SEC in May 17, 2018 and is registered as a limited partnership in Taguig City, Metro Manila. **Annex 1-1** presents the SEC Registration Certificate of IASCL.

The proposed Modular Diesel Power Plant Ancillary Project has already been issued an Environmental Compliance Certificate (**ECC**) by the DENR-EMB Region 8 (ECC Reference Code: ECC R08-1840-0016 dated April 30, 2018) under its normal operating capacity of 21.5 MW for providing Regulating and Contingency reserves (**Annex 1-2**). However, based on IASCL's commitment to have the total 70MW plant capacity available to the grid in cases of grid disturbances and/or emergencies, the plant capacity in the ECC has to be upgraded. Thus, this application for an ECC of a 70 MW ancillary plant of IASCL is submitted to DENR - EMB Central Office.

## 1.1 PROJECT LOCATION AND AREA

### 1.1.1 Description of the Project Area

The proposed ancillary power project of IASCL will cover an area of about 1.934 hectares (ha) within the Leyte Industrial Development Estate (**LIDE**) in Barangay Libertad, Isabel, Leyte. Pursuant to the Certification from the National Development Corporation (**NDC**) presented in **Annex 1-3**, NDC has reserved the 1.934 ha Lot 2-A-1-B and Lot 2-A-1 of TCT No. TP 10260 for the proposed Project of IASCL.

The proposed Project site is within an industrial zone and has been stipulated in the approved Comprehensive Land Use Plan (**CLUP**) of the Municipality of Isabel.

The proposed site is accessible from Manila by both air and sea routes. The project site in Brgy. Libertad, Isabel, Leyte is accessible by air via Tacloban City Airport then a 3-hour travel by land to Brgy. Libertad, Isabel, Leyte. Barangay Libertad is approximately 145 km from Tacloban City following the Tacloban-Ormoc-Isabel route. It is also accessible via Cebu International Airport and a 3-hr ferry ride to Ormoc and about 1.5 hr. ride by land going to Brgy. Isabel. **Table 1-1** and **Figure 1-1** present the technical description and the geographical location of the proposed Project, respectively. **Figure 1-2** presents the location of the proposed Project within LIDE.

**Table 1-1 Geographical Coordinates of the Proposed Project Site**

| Points | Latitude      | Longitude      |
|--------|---------------|----------------|
| 1      | 10°53'52.58"N | 124°26'35.87"E |
| 2      | 10°53'52.54"N | 124°26'38.48"E |
| 3      | 10°53'51.36"N | 124°26'38.38"E |
| 4      | 10°53'50.72"N | 124°26'38.67"E |
| 5      | 10°53'50.26"N | 124°26'39.26"E |
| 6      | 10°53'49.21"N | 124°26'40.97"E |
| 7      | 10°53'48.66"N | 124°26'41.61"E |
| 8      | 10°53'47.83"N | 124°26'41.96"E |
| 9      | 10°53'45.38"N | 124°26'42.54"E |
| 10     | 10°53'45.35"N | 124°26'35.47"E |

Source: IASCL



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The adjoining landmarks and structures observed in the vicinity of the proposed project site are listed in **Table 1-2**. **Figure 1-3** shows the vicinity map of the proposed project. **Annex 1-4** presents the design of the final landform of the project footprint.

**Table 1-2 Adjoining landmarks and structures within the vicinity of the proposed Project.**

| Directional Reference | Adjacent landmark or structure                          | Brief Description   | Estimated distance from the proposed project site |
|-----------------------|---|---|---|
| North                 | HK Mining   | HK Mining produces concentrated iron ore which are exported to China from the mineral waste produced by the operation of the Philippine Associated Smelting and Refining Corporation (PASAR).                       | 253 m   |
| South and East        | Gypsum pond of the PHILPHOS                             | The Gypsum pond is owned by PHILPHOS. Gypsum is by product of PHILPHOS.   | 220 m   |
| West                  | Philippine Phosphate Fertilizer (PHILPHOS)              | PHILPHOS produces phosphatic fertilizers which are exported to Vietnam and Southeast Asia. It also produces as by-product 600 to 900 metric tons of gypsum per year.  | 800 m   |
| Southwest             | Philippine Associated Smelting and Refining Corporation | PASAR provides electrolytic copper cathodes, refined copper anodes, dore metals, granulated slag, iron concentrates, selenium powders and sulfuric acid. It produces 172 metric tons of copper cathodes every year. | 1000 km   |

The conceptual design of the final landform of the project footprint is of a bench type landform. It will compose of three layers, EL+22.0m, EL+25.0m, and EL+26.0m as illustrated in **Annex 1-5**. Only the layer of EL+22.0 m on the East part area of the project site will have the soil filling.



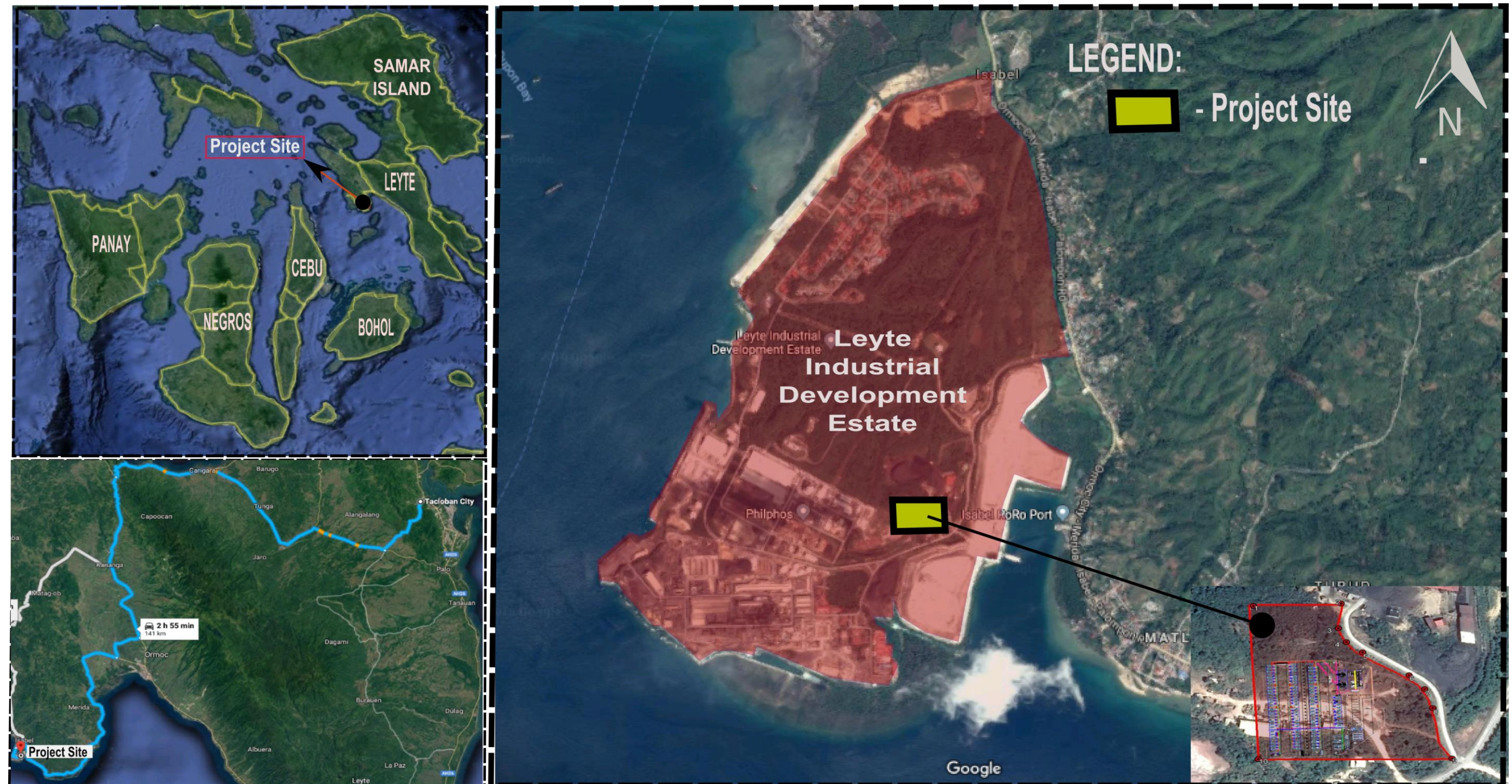




Source: IASCL, modified by GEOSPHERE, 2018

Figure 1-1 Geographical Location of the Proposed Modular Diesel Power Plant Project





Source: Google Earth, modified by GEOSPHERE, 2018

Figure 1-2 Location Map of the Proposed Modular Diesel Power Plant Project





Source: Google Earth, modified by GEOSPHERE, 2018

Figure 1-3 Location Map of the Proposed Modular Diesel Power Plant Project and its nearby industrial plant



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### 1.1.2 Impact Areas

The proposed project site is situated in Brgy. Libertad, Municipality of Isabel, Province of Leyte, Region 8 (Eastern Visayas). Initially, the project impact area are generally consisted of the 1.934 ha lot as the direct impact (**DIA**) and the host barangay. In accordance with the guidelines provided in DAO 2017-15, after completion of the EIA study, the delineation of the direct and indirect impacts area was updated as follows:

For the Land and Water components, the DIA pertains to the areas where the proposed ancillary power plant facilities will be sited, green areas/buffer zone, and other areas around the project site.

For Air component, the DIA covers the 1.934 ha project site which may be exposed to ground level concentrations (**GLCs**) of potential pollutants as well as other parameters above the criteria set by the DENR.

For the people component, In terms of socio economic benefits, the DIA areas include the host local government units (**LGUs**): Barangay Libertad, Isabel Municipality, Province of Leyte and Region 8 which are project beneficiaries for employment, business opportunities, taxes and benefits from Department of Energy (**DOE**) Energy Regulations (**ER**) 1-94 of the Electric Power Industry Reform Act (**EPIRA**) Law as well as reliable power supply that contributes to the economic stability of the Region.

The IIA include the Barangays Poblacion and Matlang as the receptors of the plant's air emissions that comply with the standards based on the air dispersion modeling. The IIA in terms of socio economic benefits will cover the Visayas Area, which will benefit from the stable and reliable power supply which can contribute further to the economic stability of the country.

The DIA and IIA of the proposed Project are presented in **Table 1-2** and **Figure 1-4**.

**Table 1-2 Impact Areas of the Proposed Project**

| Impact Area   | Description   |
|---|---|
| <b>Direct Impact Areas:</b>   |   |
| <b>Land</b>   |   |
| Areas where the proposed Project Facilities will be Sited                                     | <ul style="list-style-type: none"><li>1.934 ha lot area including green areas/buffer zone</li></ul>   |
| Access Road   | <ul style="list-style-type: none"><li>Access road within LIDE</li></ul>   |
| <b>Air and Noise</b>  |   |
| Project Site including buffer zone  | <ul style="list-style-type: none"><li>1.934 ha lot area</li></ul>   |
| <b>Socio-Economic</b>   |   |
| Host Barangay, Municipality, Province and Region  | <ul style="list-style-type: none"><li>Barangay Libertad</li><li>Municipality of Isabel</li><li>Province of Leyte</li><li>Region 8</li></ul> |
| <b>Indirect Areas:</b>  |   |
| Receptors of plant's air emissions with concentrations less than the criteria set by the DENR | <ul style="list-style-type: none"><li>Barangay Poblacion</li><li>Barangay Matlang</li></ul>   |





Source: Google Earth, modified by GEOSPHERE 2018

Figure 1-4 Impact Areas of the Proposed Modular Diesel Power Plant Project



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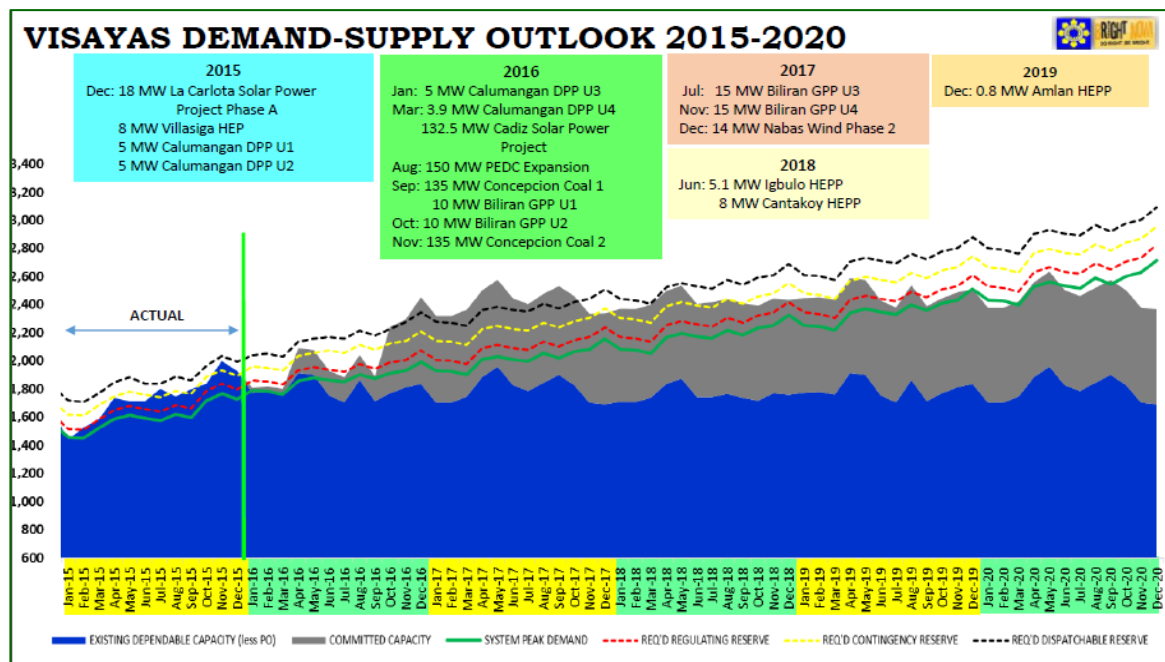
### 1.2 PROJECT RATIONALE

#### 1.2.1 Shortage of Power Supply and Ancillary Services in the Visayas

The DOE Power and Supply-Demand Outlook for 2015-2020 as presented in **Figure 1-5**, shows an increasing power demand in Visayas Grid at an average annual growth rate (AAGR) of 4-5%. Due to growing demand and increasing number of new consumers, the DOE determined the shortfall not only on the baseload power but also on the ancillary or reserve power by 2018. Hence, the IASCL decided to develop the proposed Project to help reinforce the ancillary power capacity of the grid to sustain the power supply reliability and to avoid expensive results of brownouts to industries social inconvenience to the public.

The proposed Project aims to provide ancillary services to the Visayas grid to help sustain the transmission capacity and energy that are essential in maintaining the power quality, reliability, and security of the grid. It will also address both frequency and voltage fluctuations brought about by the intermittent operation of the variable renewable energy power plants such as solar and wind power plants.

The proposed Project will also serve as Back-up Power Plant, which will provide power during times that LIDE and/or Isabel Municipality becomes isolated from the Leyte sub-grid.



Source: DOE PDP, 2015-2020

Figure 1-5. DOE Supply-Demand Outlook in Visayas, 2015-2020

#### 1.2.2 Socio-Economic Benefits

##### DOE ER 1-94 Fund

One centavo for every 1 kWh of electricity sold will go to a fund to be managed by the DOE. The fund will be used for local projects that meet the following categories and respective budget shares:

- Electrification fund (50%),
- Development and livelihood fund (25%), and
- Reforestation, Watershed Management, Health and/or Environmental Enhancement Fund (25%).



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### Increase in Internal Revenue Allocation

The taxes collected from the proposed Project, which include property tax, remittance, and corporate income tax, would be an additional income for Barangay Libertad, Isabel Municipality and Leyte Province through the increased Internal Revenue Allocation (**IRA**). Additionally, there will be incomes from fees for different permits and clearances that the IASCL is required to secure from LGUs. IASCL will also purchase construction supplies and materials from local suppliers in the area.

### Employment Opportunity

The proposed Project will generate additional jobs as it will require manpower during site preparation, project construction and operation phases. IASCL will prioritize hiring of qualified residents of Barangay Libertad and other barangays in Isabel Municipality during project implementation. It is expected that the project will need about 120 workers during construction and 90 regular personnel during operation including 5 security guards and 2 janitorial service personnel. IASCL shall closely coordinate with the Public Employment Services Office (**PESO**) of Isabel Municipality in hiring local personnel for the proposed Project.

### Corporate Social Responsibility

The Isabel Municipality will benefit from the Corporate Social Responsibility (**CSR**) Programs of IASCL, which include programs on community development such as the following:

#### Community Development

- **Tree Planting Program**

IASCL acknowledges the importance of environmental aspect and caring for trees is the social responsibility of every individual. The tree planting program of the municipality in partnership with the local government aims to promote the climate change mitigation strategy as it seeks to enhance the country's forest stock to absorb carbon dioxide, which is largely blamed for global warming. IASCL will join in tree planting program of the Isabel Municipality and/or will donate seedlings for tree planting activities.

- **Relief Assistance and Medical Mission**

Medical Missions will be brought to various areas in Isabel Municipality. Services provided will be free medical consultation, medicine, and basic medical services to the host communities.

## 1.3 PROJECT ALTERNATIVES

### 1.3.1 Site Selection

The site selected for the proposed Project was a result of careful and thorough search to meet all the technical, environmental and land use requirements of the project. Considering that the proposed Project is to be located inside the industrial estate, there will be no sensitive environmental locations such as protected areas, forest, mangroves, critical habitats and endangered species that will be affected.

The source of fuel supply is also located approximately two (2) kilometers from the Project site, which will ease the delivery of fuel to the Project site. Moreover, IASCL identified the 138kV transmission system of NGCP located just above the Project site as the best tapping point.

### 1.3.2 Technology Selection

IASCL will utilize a high-speed modular diesel power plant which is a location-independent complete system with perfectly matched components. In a modular power plant, all the modules are preconfigured for quick installation and are delivered to the installation site prefabricated. This

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facilitates the installation of the modular power plant on site and shortens set-up times, allowing precision assembly even in locations with limited infrastructure. Other reasons which aid IASCL in choosing a modular diesel power plant are as follows:

- Has simple design and layout of plant
- Occupies less space and is compact
- Can be constructed and operated quickly
- Requires less water for cooling
- No ash handling problem
- Requires Less operating and supervising work

### 1.3.3 Resources

For ancillary service purposes, power reserves from solar and wind coupled with high power reserve batteries are expensive to develop while gas (LNG) for gas turbines is still out of sight, the selection of diesel fuel is preferred because it is much cleaner, affordable and suitable for the required quick response mode for both regulating reserve and contingency reserve capacities at a maximum response time for power output of twenty-five (25) seconds.

### 1.3.4 No Project Alternatives

The proposed modular diesel power plant ancillary project of IASCL is in consistent to the requirements of the Ancillary Services Procurement Plan under Energy Regulatory Commission (ERC) Case No. 2005-253. Based on this, the No Project Alternative is not an option. Without the proposed Project, it could result to a worst-case scenario comprising of rotating brownouts and total blackouts, loss of new investments and expansion of industries, work stoppages, increased pollution resulting from the use of small generators with no appropriate pollution controls, reduced economic growth, increased poverty and social inconvenience by 2018. Without the project, opportunity for additional 120 jobs during construction, about 46 permanent jobs during operation and indirect jobs and business opportunities that would be created by the proposed Project would be lost. The substantial increase in local taxes and revenues including the direct and indirect local benefits that are expected to receive would also be foregone.

## 1.4 PROJECT COMPONENTS

**Table 1-3** presents the major component, support facilities, pollution control devices and temporary facilities for the proposed Project of IASCL.

**Table 1-3 Project Components and Specification**

| Component                | Specification/Description   |
|--------------------------|---|
| Modular Diesel Generator | Combination of a diesel engine with an electric generator (often an alternator) to generate electrical energy.  |
| Air Intake System        | Supplies the correct amount of air needed to increase the combustion and the efficiency of an engine  |
| Exhaust Gas System       | The exhaust system consists of the exhaust ducting, exhaust silencer complete with spark arrestor and rain cap assembly. The exhaust gas exits the engine and passes through the exhaust ducting and exhaust out the top of the container through the rain cap assembly. Insulation and heat shields are fitted to the exhaust ducting to prevent operators contact with high temperature surface |
| Fuel Supply System       | The proposed Project will have 10x40,000 litres and 4x20,000 litres fuel tank installed on a bundled plinth. Fuel delivery to the generator sets will be pressurized at 2 bar pressure through 3" main fuel lines and 2" branch line using 2xFuel Pump/Filtration container.  |

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| Component   | Specification/Description  |
|---|--|
|   | The engine fuel system consist of an internal fuel tank, Racor filters, fine fuel filter, fuel pump, injection pump and nozzles. Fuel is pump through the Racor filters to the fine fuel filters and then passed to the injectors and then to the injection nozzles.   |
| Lubrication System                                | The engine oil lubrication system includes pump, strainer and sump all fitted internally within the engine block. Total oil capacity is 177 litres.  |
| Cooling System                                    | Aggreko engine cooling system uses cooling fluid where flow to the radiator is controlled by thermostat.   |
| Service Water System                              | The proposed Project will have a service water system for site facilities containers and washing the equipment at site. Water supply line for equipment washing will be installed in line with the fuel pipeline using PVC pipe material.  |
| Instrumentation and Control System                | The proposed Project will be connected to a central PLC and SCADA system that will automate all equipment controls and protections for plant start/stop, load management, and operations required for meeting regulating and contingency mode protocols. The SCADA will provide trending and data recording functions, as well as user HMO for the PLC and metering, fuel consumption information. The communication platform is Modbus. |
| Substation  | 138kV Gas Insulated Switchgear, 2x60MVA Transformer  |
| Administration Building and other Site Facilities | Administration building and other site facilities are all modular in design such as control rooms (HV/EHV), office container, security/first aid container, kitchen/dinner container, toilet/locker container, workshop container & consumables containers.  |
| Fire Protection System                            | The proposed Project will be provided with manually operated DCP & CO <sub>2</sub> fire extinguishers that will be located on strategic location around the site.  |
| Smoke Stack                                       | The proposed Project will have 70 smoke stacks with a height of 5.6 m from the ground and with a circumference of 40.6cm. Each smoke stack can be access through generator built in ladder and Bi-Line system (fall arrester).   |
| Oily Wastewater Treatment System                  | The system will separate oily wastewater generated during the process of equipment maintenance/washing and preventing the entry of unacceptable level of contamination to the site drainage system.  |

### 1.4.1 Main Plant Components

#### 1.4.1.1 Modular Diesel Generator

The proposed Project will consist of 80 units of 1MW modular diesel generator sets with a maximum output of 70MW. IASCL will utilize the 16-cylinder diesel engine as the prime mover where the fuel burned inside the combustion chambers produces mechanical energy, which is converted in electrical energy as it drives directly couples alternator. All the diesel engines will be enclosed in a 20 ft container with dimensions of 6,058 mm in length, width of 2,438mm and height of 2,591mm. Diesel engines are to be imported, in which available generators would be procured through storehouse of the suppliers. Generator sets will be procured through lease. IASCL selects the Cummins KTA50 engines for its higher combustion efficiency. All the generator sets will be sourced from the storehouse in Dubai and it will take one (1) month shipping going to Cebu port. From Cebu port, it will be shipped to Isabel port for 1 week and another 1 week by land transport to the project site. The modular diesel generator specifications are provided in **Table 1-4**.

**Table 1-4 Modular Diesel Generator Specifications**

| Parameters         | Specifications                        |
|--------------------|---------------------------------------|
| Engine Model       | Cummins KTA50 G12 CPL3947             |
| Model and Type     | 4 Stroke; 60° Vee; 16-Cylinder Diesel |
| Speed              | 1500rpm                               |
| No. of Cylinders   | V16                                   |
| Bore and Stroke    | 159mm, 159mm                          |
| Total Power Output | 60Hz/1097kW/1470HP                    |

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| Parameters                       | Specifications                                      |
|----------------------------------|---|
| Fuel Consumption (max feed rate) | 254 Li/h  |
| Compression ratio                | 13.9:1  |
| Piston Speed                     | 7.9 m/sec   |
| Cylinder Block                   | 16-cylinder,direct injection, 4-cycle diesel engine |

### 1.4.1.2 Air Intake System

The Air Intake System supplies sufficient air to the engine for an effective internal combustion. It consists of pipes for the supply of fresh air to the engine intake manifold. Filters are provided to remove dust particles from air, which are abrasive to the engine cylinders. The intake air is turbocharged and cooled by charge air cooler for best results.

### 1.4.1.3 Exhaust Gas System

The exhaust system consists of the exhaust ducting, exhaust silencer complete with spark arrestor and rain cap assembly. The exhaust gas exits the engine and passes through the exhaust ducting and exhaust out the top of the container through the rain cap assembly. Insulation and heat shields are fitted to the exhaust ducting to prevent operators contact with high temperature surface. A silencer is incorporated in the system to reduce the noise level to within the acceptable limits.

### 1.4.1.4 Fuel Supply System

Diesel oil will be delivered from the depot located approximately two (2) kilometer away from the Project site and will be stored in the 10x40,000 litres and 4x20,000 litres fuel tanks installed on a bunded plinth. Fuel delivery to the generator sets will be pressurized at 2 bar pressure through 3" main fuel lines and 2" branch line using 2xFuel Pump/Filtration container.

The engine fuel system consist of an internal fuel tank, Racor filters, fine fuel filter, fuel pump, injection pump and nozzles. Fuel is pump through the Racor filters to the fine fuel filters and then passed to the injectors and then to the injection nozzles.

The diesel oil should meet the minimum specifications as required by law, acceptable to the engine requirement specifications, as presented in **Table 1-5**.

**Table 1-5. Parameter Limits of Diesel Oil**

| Parameter                               | Limit(s)           |
|---|--------------------|
| Specific gravity @ 60/60°F (ASTM D1298) | 0.8654 max.        |
| °API @ 60 °F (ASTM D 1298)              | 32.00 – 40.00      |
| Density @ 15.5°C (ASTM D 1298)          | 0.8650 kg/L max.   |
| Water Content, Vol.% (ASTM D95)         | 0.20% max.         |
| Heating Value (ASTM D240)               | 19,200 Btu/lb min. |
| Sulfur Content, Wt. % (ASTM 129)        | 1.00% max.         |

### 1.4.1.5 Engine Oil Lubrication System

The lubrication system with a capacity of 177 liters includes lubricating oil tank, oil pump, strainer and sump all fitted internally within the engine block. Lubricating system aims to reduce the wear of the engine moving parts such as piston, shaft, and valves. It also cools the engine.

In the lubrication system, the oil is pumped from the lubricating oil tank through the oil cooler where the oil is cooled by the cold water entering the engine. The hot oil after cooling the moving parts will be pumped to the lubricating oil tank.

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### 1.4.1.6 Cooling System

Aggreko engine cooling system uses cooling fluid where flow to the radiator is controlled by thermostat.

### 1.4.2 Support Facilities

#### 1.4.2.1 Service Water System

The proposed Project will have a service water system for site facilities containers and washing the equipment at site. Water supply line for equipment washing will be installed in line with the fuel pipeline using PVC pipe material. This water requirement of the proposed Project will be supplied by the LMC.

#### 1.4.2.2 Instrumentation and Control System

The proposed Project will be connected to a central PLC and SCADA system that will automate all equipment controls and protections for plant start/stop, load management, and operations required for meeting regulating and contingency mode protocols. The SCADA will provide trending and data recording functions, as well as user HMO for the PLC and metering, fuel consumption information. The communication platform is Modbus.

#### 1.4.2.3 Substation

A switching and metering station (switchyard) will be installed to provide all the necessary technical requirements for interconnection of the switchyard to the grid.

#### 1.4.2.4 Administration Building and Other Site Facilities (Containerized)

Administration building and site facilities are all modular in design and specifically built based on purpose. The proposed Project will include control rooms (HV/EHV), office container, security/first aid container, kitchen/dinner container, toilet/locker container, workshop container and consumables containers.

#### 1.4.2.5 Fire Protection System

To protect the facility in the event of fire or fire risks such as excessive heat or smoke, a fire protection system will be installed, composed of the following components: (i) CO2 fire extinguisher systems; (ii) heat and smoke detector system; (iii) fire hydrants with hose stations; (iv) fire and general services pumps and (v) portable fire extinguishers.

#### 1.4.2.6 Transmission Line

The connection of IASCL power plant to the grid will be done in two (2) schemes. The first will be through PASAR transmission line. At present, PASAR is connected with two separate transmission lines with the NGCP Isabel Substation. This is for redundancy, in case one line fails, PASAR will still have another line to use.

Since IASCL will be connected to the NGCP Isabel substation on a temporary basis only, until after new connection bays are made available at the NGCP Isabel Substation as part of its system upgrading, NGCP suggested that IASCL, will have a temporary 'cut-in' connection to one of the transmission lines of PASAR.

Thus, IASCL, with the concurrence of NGCP, will temporarily connect to Transmission Line No. 2 of PASAR. NGCP and IASCL had already made discussions with PASAR relative to this. Please refer to **Figure 1-6** for the Over-all Single Line Diagram Intermin Scheme.

Later, within one (1) year that the plant has been commissioned and the connection bays become available at the NGCP Isabel Substation, IASCL will exit from the temporary cut in connection with

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PASAR Transmission Line No. 2 and will build its own separate and dedicated transmission line for permanent connection (Figure 1-6).

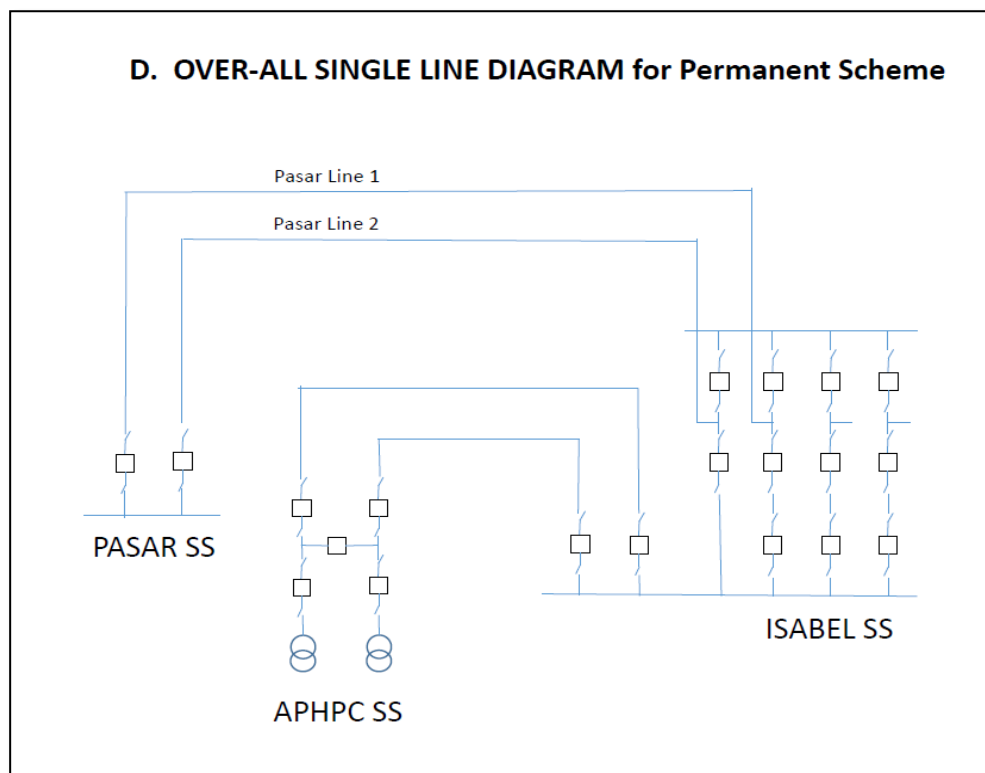
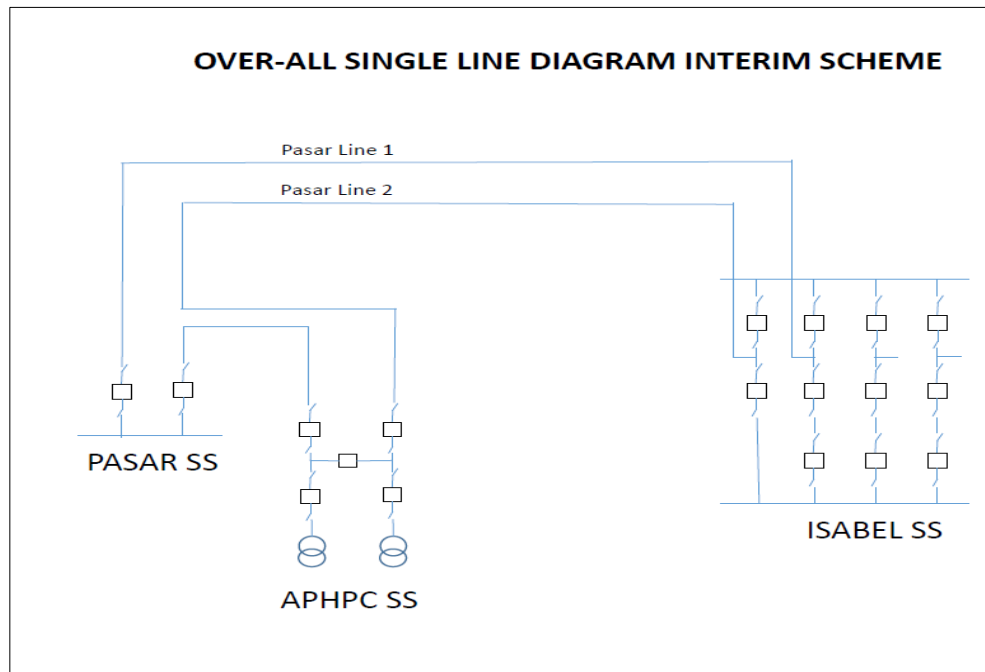


Figure 1-6 for the Over-all Single Line Diagram Intermin Scheme



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### 1.4.3 Pollution Control Devices

#### 1.4.3.1 Air Pollution Control Facilities

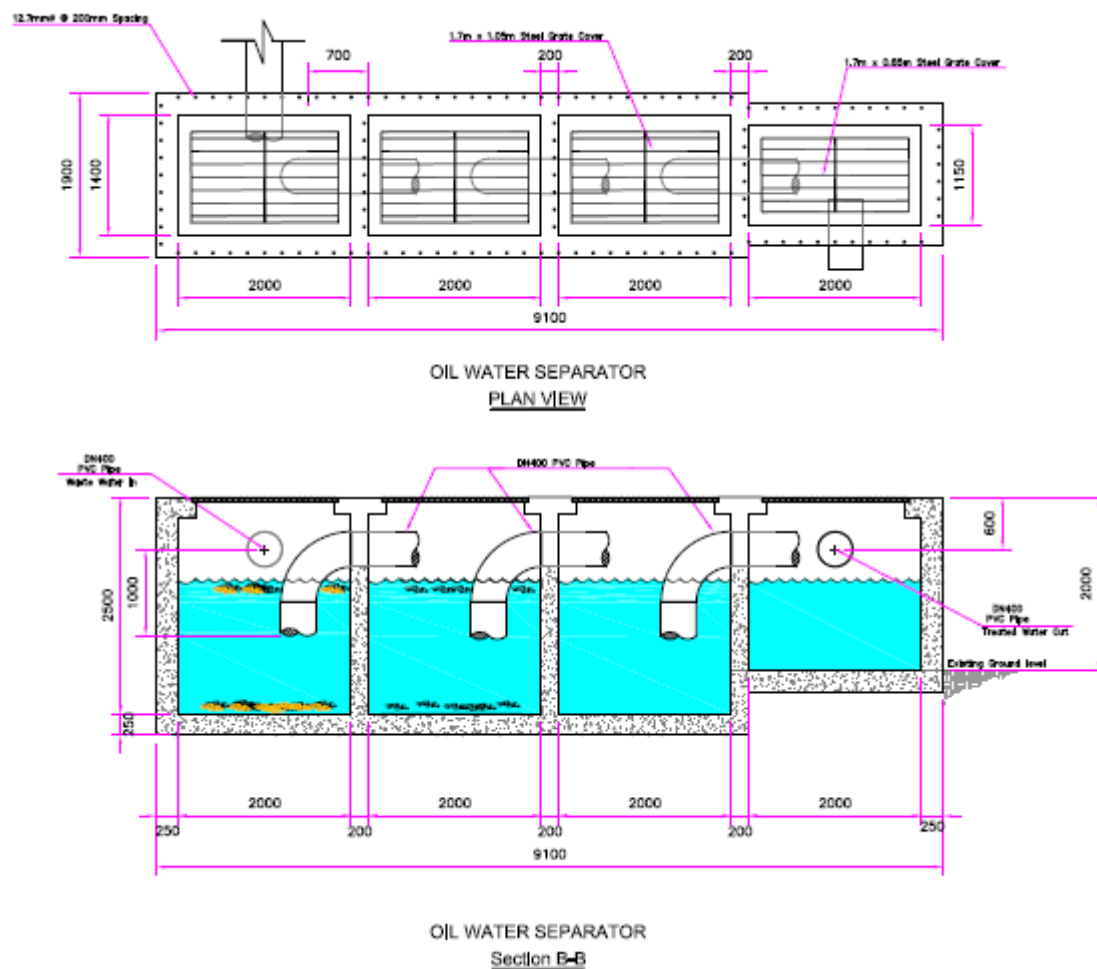
#### 1.4.3.1.1 Exhaust Stack

The proposed Project will have 80 smoke stacks for adequate dispersion of emissions. Each smoke stack can be access through generator built in ladder and Bi-Line system (fall arrester). Exhaust stack has a height of 5.6 m from the ground with a circumference of 40.6cm.

#### 1.4.3.2 Water Pollution Control System

#### 1.4.3.2.1 Oily Wastewater Treatment System

The oily wastewater from the fuel and lube oil centrifuging unit and leakages from lube oil, fuel and water system are collected to the oily wastewater tank, then pumped into the Oil-Water Separator Treatment Plant. The bottom sludge of the oil-water separator will be discharged periodically by the operator for disposal through an accredited treater by the DENR. Oil spill kits will be maintained also on-site in case of emergency oil spill. **Figure 1-7** shows the layout of oil water separator.



### Figure 1-7 Layout of Oil Water Separator

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### 1.4.3.3 Solid Waste Management System

Waste material generated will be classified as hazardous and non-hazardous wastes. Separate receptacles and storage areas will be established for each type of waste identified at the Project site. Non-hazardous solid waste will be classified as compostable, recyclable, and residual. These will then be properly disposed of, based on their classification. IASCL shall comply with disposal regulations stipulated in the Ecological Solid Waste Management Act of 2000 or Republic Act 9003. Hazardous waste will be classified based on Republic Act 6969 or the Toxic Substances and Nuclear Wastes Control Act 1990. It will be handled, stored and transported according to Philippine standards and treated through DENR-accredited hazardous waste treaters. The following are the solid wastes generated from the proposed Project:

- Domestic waste consisting of compostable waste materials from food and recyclable or residual materials such as plastics, wrappers, crates or boxes for food supply of workers and/or employees.
- Debris and other materials removed from construction activities such as spoils or excavated materials
- Industrial solid wastes, such as damaged vehicle and equipment parts, etc.
- Hazardous wastes such as fuel/lube oil sludge, and bulbs.

The estimated waste generation of the proposed Project during operation is presented below.

| Approx. Waste generation per month |                 |                  |  |
|------------------------------------|-----------------|------------------|--|
| Load                               | Oil Waste (Lts) | Solid Waste (Kg) | Industrial waste/used Air Filters (Kg) |
| 25%                                | 13500           | 2000             | 1000                                   |
| 50%                                | 27000           | 4000             | 2000                                   |
| 75%                                | 40500           | 6000             | 3000                                   |
| 100%                               | 54000           | 8000             | 4000                                   |

A Solid Waste Management Plan for the Project will be also developed.

### 1.4.4 Temporary Facilities

#### Construction Offices

Temporary facilities shall be constructed to house the offices of IASCL, contractor and its subcontractor. The offices shall be equipped with appropriate utilities such as power supply, water supply, sanitary facilities, communication/internet connection and road network.

### 1.4.5 General Layout Facilities

**Table 1-6** shows the major components and the corresponding estimated footprints of the proposed Project. The Site Development Map of the proposed Project is shown in **Figure 1-8 and Annex 1-6**.

**Table 1-6 Estimated Footprint of the Proposed Project**

| Components  | Area (m <sup>2</sup> ) |
|---|------------------------|
| Power Plant<br>Modular Diesel Generator, Air Intake System, Exhaust Gas System, Cooling System, Smoke Stack, Fire Protection System, Instrumentation and Control System | 2,679                  |
| Fuel Supply System  | 516                    |
| Lubrication System  | 72                     |

# ENVIRONMENTAL IMPACT STATEMENT REPORT

## Proposed Modular Diesel Power Plant Ancillary Project

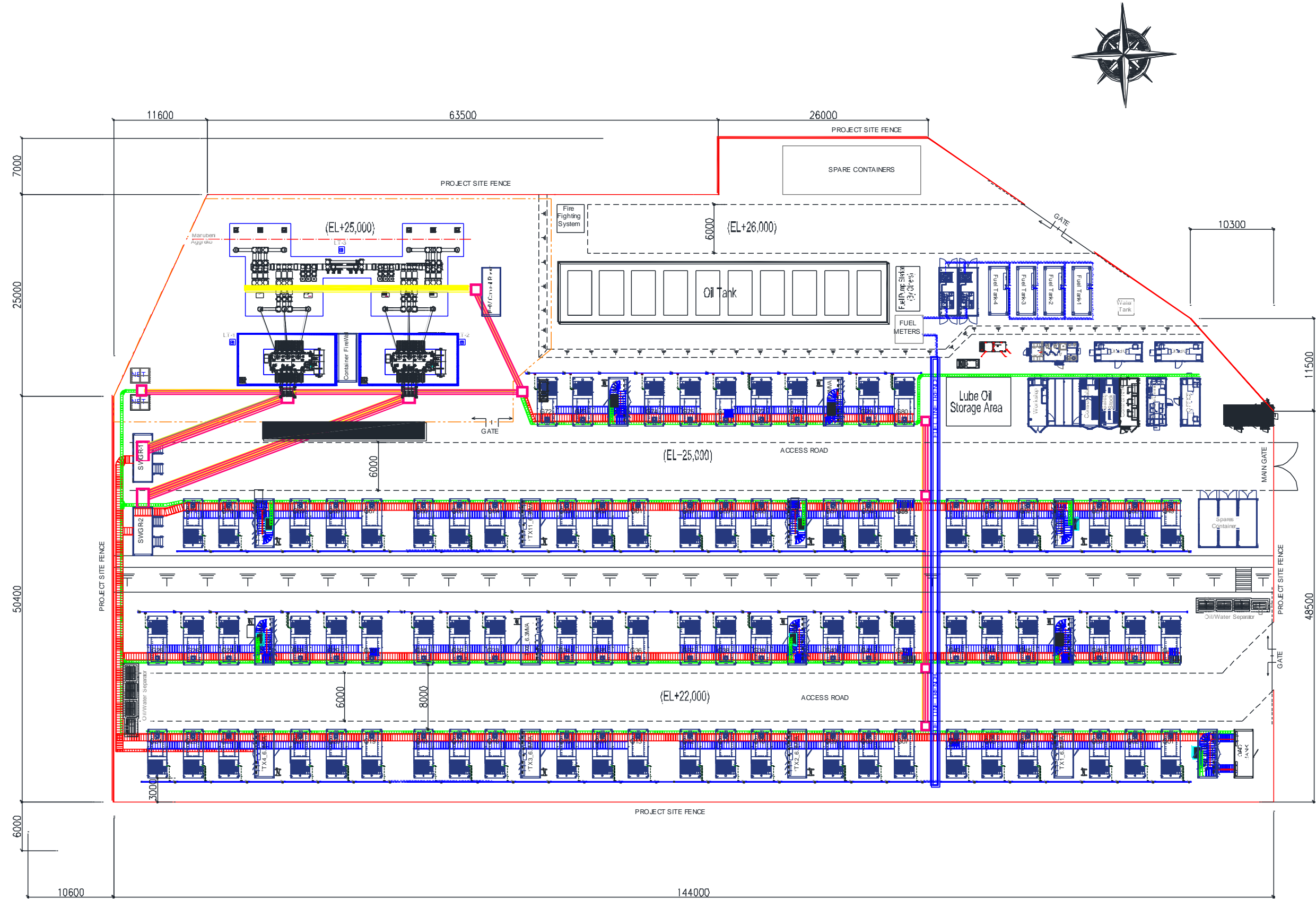
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| Components  | Area (m <sup>2</sup> ) |
|---|------------------------|
| Substation  | 1,415                  |
| Administration Building and other Site Facilities | 270                    |
| Service Water System                              | 36                     |
| Oily Wastewater Treatment System                  |                        |
| Open space and buffer zones                       | 14,352                 |
| <b>Total</b>                                      | <b>19,340</b>          |

Note: IASCL is permitted by NDC and LMC for the use of the existing access road





Source: IASCL

**Figure 1-8 Layout and Site Development Plan of the Proposed Modular Diesel Power Plant Ancillary Project**

# ENVIRONMENTAL IMPACT STATEMENT REPORT

## Proposed Modular Diesel Power Plant Ancillary Project

Isabel Ancillary Services Co. Ltd.

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### 1.5 PROCESS/TECHNOLOGY

IASCL will utilize a modular diesel power plant, which is a location-independent complete system with perfectly matched components. All the modules are preconfigured for quick installation and are delivered to the installation site prefabricated. This facilitates the installation of the modular cogeneration power plant on site and shortens set-up times, allowing precision assembly even in locations with limited infrastructure. **Figure 1-9** shows an illustrative sample of a modular diesel power plant.

IASCL will utilize a modular High Speed Diesel Engines that use Automotive Fuel Oil, a 4-stroke diesel engine technology. These four (4) strokes are the intake, compression, power and exhaust (**Figure 1-10**). During the intake, fresh air is sucked in or forced into the power cylinder. The compression stroke compresses the air to produce hot gas. As fuel is introduced and burnt with the hot gas, the power stroke happens. The last stroke is to eject the burnt gas to the atmosphere where exhaust stroke happens. The process diagram is described in **Figure 1-11**.



Figure 1-9. Modular Diesel Power Plant

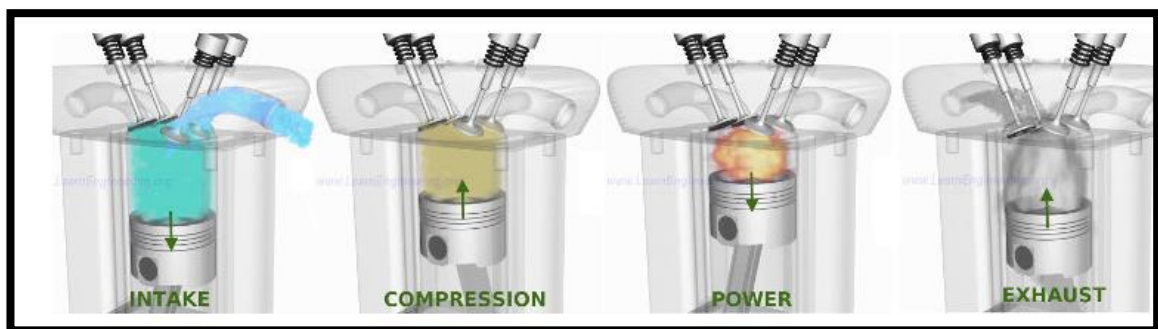


Figure 1-10. 4-Stroke Diesel Engine Technology

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The proposed Project will be designed mainly to provide ancillary services, regulating reserve and contingency reserve to the NGCP. The ancillary services is support services necessary to sustain the transmission capacity an energy that are essential in maintaining the power quality, reliability and security of the grid. It also addresses both frequency and voltage fluctuations brought about by intermittent operation of variable renewable energy power plants. The 70MW capacity shall be subdivided based on the two (2) types of ancillary services. The 40MW capacity shall be allocated for Regulating Reserve and the remaining 30MW capacity shall be for Contingency Reserve. This contractual arrangement is consistent to the rules, terms and condition of the Ancillary Services Procurement Plan under Energy Regulatory Commission (**ERC**) Case No. 2005-253.

The Regulating Reserve is the capacity necessary to adjust total system generation over short periods of time to match system load changes. The maximum response time for the change in the generating unit's power output shall be twenty-five (25) seconds and which shall be sustainable for at least 30 minutes. The Contingency Reserve, on the other hand, is intended to take care of sudden and unexpected loss of the large synchronized generating unit or the power import from a single grid interconnection. Ancillary plants are quick enough to maintain system reliability and restore the system to generation/load balance and the system frequency. Contingency Reserve Service shall be sustainable for a period of at least 30 minutes. Continued supply service in excess of 30 minutes shall be provided under the terms of Dispatchable Reserve Service to be sourced from other AS providers.

The regulating reserve will be dispatched and have an initial loading of 20MW or 50% of the 40MW installed capacity at the start of the interval hour or based on system requirement and/or NGCP's dispatch instruction. Such output will then change if there will be fluctuations of system frequency in the Visayas Grid. The contingency reserve will initially require five (5) modular diesel engines to be operated at 300kW each or a total of 1.5MW initial loading at the start of the interval hour or based on system requirement and/or NGCP's dispatch instruction. Such output will then change if there will be an outage of a large generator or a loss of transmission line in the system. Therefore, the IASCL has committed to the National Grid Corporation of the Philippines (**NGCP**) that the 70MW plant capacity is available to the grid in cases of emergencies.





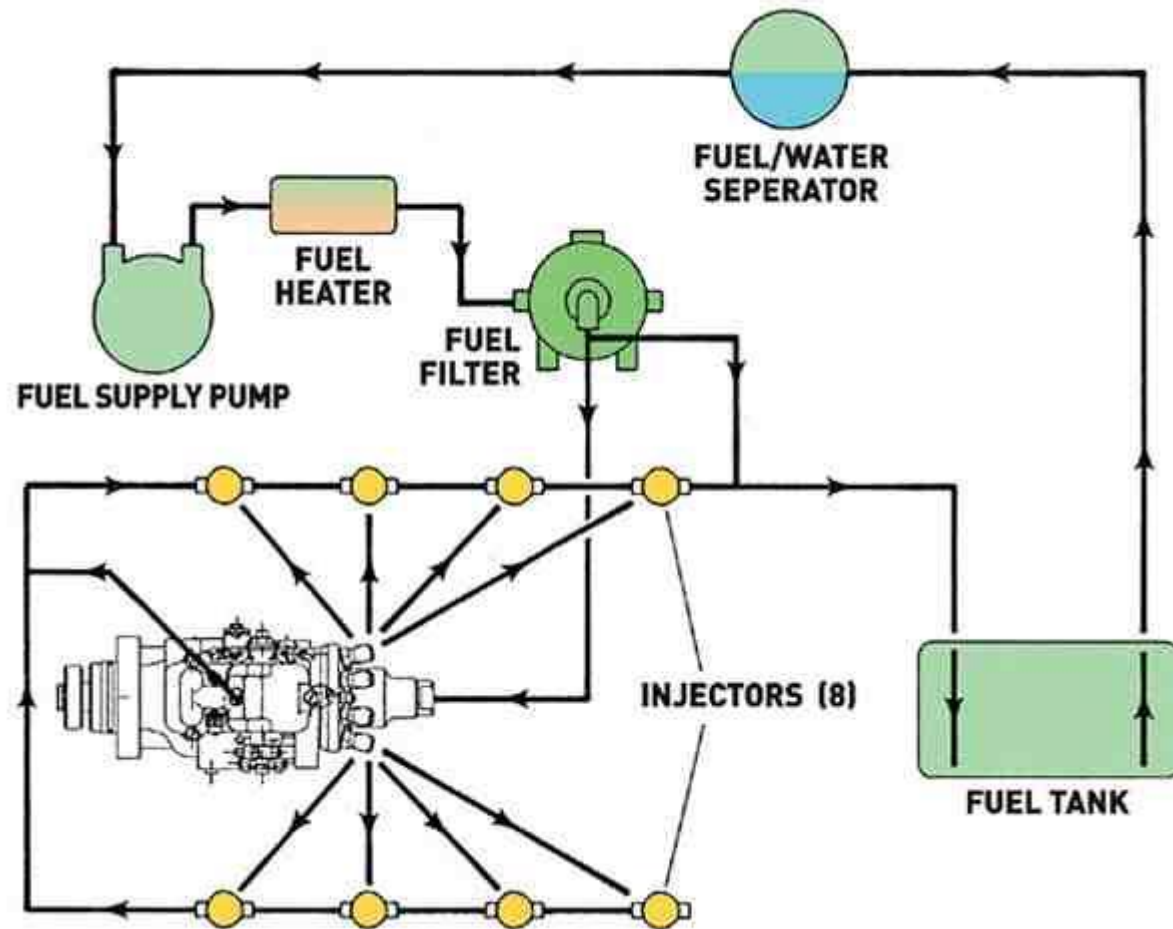


Figure 1-11. Proposed Project Process

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## Proposed Modular Diesel Power Plant Ancillary Project

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### 1.5.1 Utility Requirements

#### 1.5.1.1 Automotive Diesel Oil

The proposed Project will require about 150,000 liters/day of Automotive Diesel Oil. The Automotive Diesel Oil will be sourced from the existing Petron depot located approximately 2km from the proposed Project site via dedicated fuel delivery trucks for the proposed Project owned by Petron. The delivery of diesel to the Project Site will be through delivery trucks. **Table 1-7** presents the specifications of the automotive diesel oil to be used for the proposed Project.

**Table 1-7 Automotive Diesel Oil Specifications**

| Properties            | Specification                |
|-----------------------|------------------------------|
| Specific Gravity,     | 0.854 to                     |
| Density               | 0.816-0.876 kg/L             |
| Kinetic Viscosity     | 1.3 – 4.5 mm <sup>2</sup> /s |
| Sulfur, % wt          | Max 0.5                      |
| Calorific Value (HHV) | Min 19,600                   |
| Calorific Value (LHV) | Min 18,400                   |

#### 1.5.1.2 Water Use

The proposed Project will be using water for the operation and maintenance of the proposed power plant which will be sourced from the potable water supply system of LMC. The water requirement will be primarily used as service water, potable water, and other necessary water consumptions. About 50 m<sup>3</sup>/month will be allocated for domestic use during construction and operation phases of the project as presented in **Table 1-8**.

**Table 1-8 Breakdown of the Water Requirement**

| Usage                     | m <sup>3</sup> /month |
|---------------------------|-----------------------|
| <b>Construction Phase</b> |                       |
| Domestic                  | 35                    |
| Service Water             | 25                    |
| <b>Operation Phase</b>    |                       |
| Domestic                  | 15                    |
| <b>Total</b>              | <b>75</b>             |

#### 1.5.1.3 Electricity

During its operation, the plant's generator will produce 440 volts AC. A step-up transformer will increase the voltage to 12,000 volts or 12 kV before it is supplied to the Visayas Grid via the 138kV substation. The parasitic load per unit of the proposed Project is less than 1 MW. These will come from their generated power.

### 1.5.2 Waste Generation and Built-in Management Measures

#### 1.5.2.1 Air Emissions

Fuel oil combustion will generate particulate matter (PM), sulfur oxides (SO<sub>x</sub>) and nitrogen oxides (NO<sub>x</sub>) emissions. Based on the fuel consumption and specifications, the proposed Project is expected to produce the emission characteristics, which will meet or better the standards set by the Philippine Government. The proposed power plant will have an anticipated emission rates well below the DENR standards of 150 mg/Ncm for PM, 700 mg/Ncm for SO<sub>x</sub>, and 2000mg/Ncm for NO<sub>x</sub>.



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These emissions will be directed to 70 smoke stacks with a height of 5.6 m from the ground and with a circumference of 40.6cm. The exhaust stack will provide an elevated point of discharge of flue gas emissions to promote air dispersion.

The green areas surrounding the proposed Project will be enhanced and will serve as a control measures to decrease the emissions that may reach the Area Sensitive Receptors (**ASRs**).

### 1.5.2.2 Noise

The generators for the proposed Project will be designed and arranged as such to prevent resonant vibration and will comply with the noise standards set by DENR for industrial areas. At the plant's property line, the noise standards are 75 dB(A) during daytime, 70 dB(A) during morning and evening, and 65 dB(A) during nighttime.

The green areas surrounding the proposed Project will be enhanced and will also serve as a control measures to decrease the noise that may reach the Nearest Sensitive Receivers (**NSRs**).

### 1.5.2.3 Wastewater

Operation of the proposed Project requires low volume of water. Oily water from the equipment area drains and the secondary containment areas of the transformers and fuel oil tanks will be treated in the Oily Water Treatment System. IASCL shall ensure that wastewater is properly treated to meet DENR effluent standards prior to discharge to the main drainage facility of LIDE. **Annex 1-7** shows the drainage plan of the proposed Project.

### 1.5.2.4 Spill Containment

Provision of spill containment will be incorporated in the project in compliance to all national, provincial and local regulations and requirements. Spill containment will be provided for potential risk of leak/spill in the area. The fuel oil storage tanks will be furnished with bund plinths to house the fuel storage tanks. The bund shall be constructed of reinforced concrete and capable of containing a spill of at least 10,000 gallons (US), plus 10% of the aggregate storage capacity.

All materials harmful to the environment, including coolant, cooling fluids, acids, solvents will be stored within a secondary containment to prevent accidental release during delivery and operation. All fuel systems will be formally inspected at least monthly to ensure they are not damaged in any way and to check for any leaks. **Figure 1-12** shows a sample of the different secondary spill containment. Any leak in a fuel system must receive immediate attention. The leak will be contained immediately and then repaired.



Figure 1-12. Spill containment

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### 1.5.2.5 Solid Wastes

#### 1.5.2.5.1 Industrial Solid Wastes

The industrial solid wastes include slag, oily sludge from vehicles, equipment and oil and water separators, spent lubricants and other chemicals.

#### 1.5.2.5.2 Domestic Solid Wastes

The amount of domestic solid waste will not be significant. Waste per capita, calculated on an average income basis, in a developing country is 0.5 kg/day. With an estimated workforce of 120 during construction, the domestic waste will amount to 60 kg/day. With a workforce of 46 during operation, the domestic waste generated amounts to 23 kg/day/shift. Domestic solid waste will include paper, cartons, plastic, bottles, tin cans, rubber, food left-over, etc. These will be temporarily collected and stored in waste bins properly sorted out into recyclables and non-recyclables before collection and disposal by the local government. Some hazardous solid waste will include busted fluorescent lamps, spent industrial and car batteries, spent chemical cartridges and containers and expired chemicals. Within six (6) months from generation, these hazardous wastes will be removed, transported and disposed according to acceptable practices. IASCL will ensure that the hazardous waste will be properly treated and disposed of, by the DENR accredited transporter and treater.

### 1.5.3 Operations and Maintenance of Facilities

The proposed Project will operate 24 hours a day, 7 days a week and 52 weeks a year. The maintenance is conducted per diesel engine. As such, there is no maintenance outage to be considered.

## 1.6 PROJECT SIZE

### 1.6.1 Plant Capacity

The proposed Project has a net capacity of 70 MW. It will have a projected output of up to 188,340,000 kilowatt-hours of electricity annually for a period of at least five (5) years.

### 1.6.2 Project Area

The total land area allocated for the proposed Project, which includes major components, support facilities, access road and green areas is 1.934 ha.

## 1.7 DEVELOPMENT PLAN, DESCRIPTION OF PROJECT PHASES AND CORRESPONDING TIMEFRAMES

### 1.7.1 Project Phases

#### 1.7.1.1 Pre-Construction Phase

**Permit Acquisition.** During the Pre-Construction Phase, the design and detailed engineering of the project components will be prepared and finalized. Preparatory works involves the procurement of the supplies and equipment planning for setting-up the physical characteristics, permit acquisition, and resource requirements allocation and provision.

#### 1.7.1.2 Construction Phase

**Site Clearing.** The area where the project components will be installed shall be cleared of all structures and obstructions. All trees, shrubs, vegetation and other landscape features designated for preservation shall be carefully protected from damage during site preparation and equipment installation. Holes remaining after removal of all obstruction, objectionable materials, trees, stumps,

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shall be backfilled with approved material, compacted and restored to approximately its original contours by bulldozing or by other method.

**Site Grading.** This shall cover the removal of top soil, cutting, grading, filling, rough contouring and compacting materials as required to established 1-2 % slope sub-grade elevation of the site. Removal of top soil will depend on the extent available or required as directed by a Civil Engineer. When the natural grade of the proposed site is essentially flat, it may be necessary to bring fill material to improve the drainage condition of the lay down area. The fill material shall consist of a satisfactory soil free from sods, stump, roots, large rocks or other perishable matters. The amount of fill material shall vary from 300mm to 600mm thickness or as necessary to meet the desired sub-grade elevation. Adequate compaction during placement of the fill is necessary to develop the required soil bearing capacity. All fill areas shall be compacted in 200mm (8 inch) layers to 95 percent Maximum Dry Density.

**Gravel Layer Finish.** Prior on applying gravel layer finish, it is ideal that all equipment is already in place to provide a level and stable positioning of plastic block platforms and container stands. Gravel surfacing material shall be of 20mm to 25mm grade sprinkled evenly over the entire yard and extending 1 meter beyond perimeter fence. Layer thickness shall not be less than 75mm.

**Site Drainage System.** Site drainage system shall be surface runoff type whereby ground elevation gently sloping 1% to 2% gradient to the edge of the yard or shallow ditches within the yard. Site slope elevation shall be coordinated with the location of the cable trenches and roads within the site. Careful consideration of the quantity, quality, and particularly the location of the discharge water from the yard has to be emphasized prior to site preparation. Small interceptor ditches strategically located within the site will prevent erosion of slopes or embankments.

**Mobilization of Construction Equipment and Materials.** Construction equipment and raw construction materials will be transported to the dedicated temporary laydown area. Machineries, equipment, and construction materials shall be transported by truck or by boat to the Project site. The existing jetty within the LIDE will be used to transport large and heavy components.

**Hiring of Workers.** Approximately 120 workers will be employed during the construction period. The majority of the workers will be coming from the host and nearby barangays of Isabel while the highly skilled workers who will be coming from outside of the Isabel will be billeted in the surrounding communities in order to enhance the economic activity of these areas.

**Installation of Modular Diesel Generators and Facilities.** The construction activities will commence starting from the access and internal roads, installation of permanent drainage systems and installation of project components. The construction period is approximately three (3) months.

### 1.7.1.3 Post Construction Phase

During the Post-Construction phase, all temporary structures/facilities will be demolished and construction debris will be removed. Construction machinery and equipment will be decommissioned and removed from the site. Clean-up activities will be undertaken.

Construction/demolition wastes will be segregated into recyclable and non-recyclable wastes. Where recyclable and reusable items are available and desired by the communities near the site, the IASCL will be willing to make these available to them. Open spaces and buffer zones will be revegetated/landscaped with appropriate indigenous species. In all aspects, IASCL will endeavor to minimize the visual impact of the site consistent with its purpose as an industrial facility.

### 1.7.1.4 Operation Phase

**Electricity Generation.** The proposed Project will operate 24 hours a day, 7 days a week and 52 weeks a year to provide Regulating Reserve and Contingency Reserve. The 40MW capacity shall be allocated for Regulating Reserve and the remaining 30MW capacity shall be for Contingency Reserve. This contractual arrangement is consistent to the rules, terms and condition of the Ancillary Services Procurement Plan under Energy Regulatory Commission (**ERC**) Case No. 2005-253. Based on the required operation of NGCP for provision of ancillary services, only half of the 40MW



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capacity for Regulating Reserve shall be initially dispatched. This means that only 40 modular diesel engines will operate at 50% loading, having a total of 20MW output capacity. Such output capacity will then change if there will be fluctuations of system frequency in the Visayas grid.

On the other hand, for the provision of 30MW Contingency Reserve, NGCP initially will require five (5) modular diesel engines to be operated at 300kW each, a total of 1.5MW. The remaining 25 modular diesel engines will serve as standby units and shall only be dispatched by NGCP should there be an outage of a large generator or loss of transmission line in the system which has caused the system frequency to drop below 59.85Hz. Such frequency drop shall trigger the modular diesel engines to start automatically and produce the full 30MW output in less than 10 minutes. Once the system frequency comes back to its nominal value of 60Hz, then the modular diesel engines shut down automatically as well.

**Environmental Pollution Control and Monitoring.** Part of the operations of the proposed Project is to ensure that all pollution control devices will be installed and properly working in order to assure compliance with the DENR standards.

### 1.7.1.5 Abandonment Phase

The contract lifespan of IASCL with NGCP for the proposed Project is five (5) years. However, if the plant is still needed, it may be extended as agreed upon by both parties. In the unlikely event that the operation of the project is no longer deemed feasible to operate and maintain, a decommissioning or abandonment plan will be prepared by the proponent. The abandonment plan will specify the proposed studies to be conducted (e.g., site assessment) and what equipment can be recovered, relocated, or sold, and the area will be developed based on the next industrial use of the site. If soil contamination is present, the subject area will be decontaminated through the appropriate measures. The green buffer zone will have to be retained.

### 1.7.2 Project Schedule

The proposed Project is targeted to begin construction in October 2018 and completion in March 2019. Following the accreditation test conducted by NGCP, it is expected to commercially operate in June 2019.

## 1.8 MANPOWER

The manpower requirements during construction of the proposed Project will be composed of local skilled workers to be hired based on formal qualifications, experience and good moral character. Priority employment will be afforded to the local residents in the host barangay, surrounding barangays and Isabel Municipality, provided they possess the necessary qualifications. Furthermore, IASCL will comply with the relevant provisions of the DOE Act (RA 7368) regarding local employment. The proposed Project is expected to employ approximately 120 workers during the construction period. During the operation phase, it is estimated that 90 regular personnel including 5 security guards and 2 janitorial service personnel will be employed.

## 1.9 INDICATIVE PROJECT INVESTMENT COST

The proposed Project and its components are estimated to cost at **One Billion Seven Hundred Fifty Million (PhP 1,750,000,000.00) Pesos** only.





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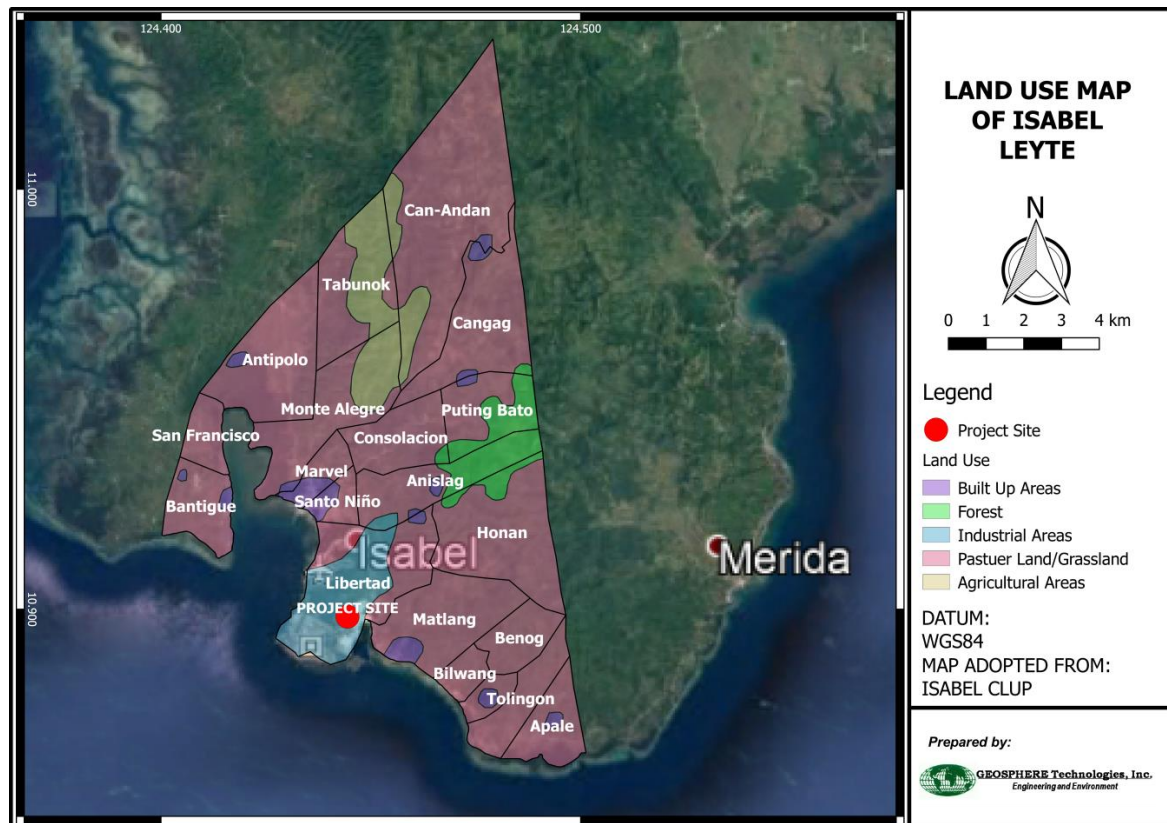
## 2.0 ANALYSIS OF KEY ENVIRONMENTAL IMPACTS

### 2.1 LAND

#### 2.1.1 Land Use Classification

##### 2.1.1.1 Impact in Terms of Compatibility with the Existing Land Use

Isabel Municipality is composed of built-up areas, forest, industrial areas, pasture land/grass land and agricultural areas. Majority of the land in Isabel are grassland. The land use of the area where the proposed Project is located is designated as an industrial area as this is located inside LIDE (Figure 2-1). Therefore, there is no issue in terms of compatibility with the existing land use.



Source: CLUP of Isabel Municipality, modified by GEOSPHERE 2018

Figure 2-1. General Land Use Map of Isabel, Leyte

##### 2.1.1.2 Impact on Compatibility with Classification as an Environmentally Critical Areas

Environmentally Critical Areas (**ECAs**) are environmentally sensitive areas declared under Presidential Proclamation No. 2146 of 1982 where significant environmental impacts are expected if certain types/thresholds of proposed Project are located, developed or implemented in it. Since the proposed Project is to be located inside the LIDE, which is an industrial area, there will be no encroachment of ECAs.

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### 2.1.1.3 Impact in Existing Land Tenure Issue/s

The proposed Project site is to be located inside the LIDE, which is an industrial area. No areas within the proposed Project site is under CARP or with CADC/CADT/ CALC. Thus, there is no possible tenurial or land issue within the proposed Project site. 2.1.1.4 Impairment of Visual Aesthetics

There are no identified significant landforms or structures within the proposed Project site. Project Area is inside the LIDE, which is an industrial site which houses two of the country's major industries, the Philippine Associated Smelting and Refining Corporation (**PASAR**), and the Philippine Phosphate Fertilizer Corporation (**PhilPhos**).

### 2.1.1.4 Devaluation of Land Value as a Result of Improper Solid Waste Management and Other Related Impacts

Generation of waste and improper waste disposal may affect the soil quality in the area. The proposed Project will generate 60 kg/day of domestic wastes during construction phase and 23 kg/day/shift of domestic waste during operation phase. Domestic solid waste will include paper, cartons, plastic, bottles, tin cans, rubber, food leftover, etc. Some hazardous solid waste that will be generated by the proposed Project include busted fluorescent lamps and spent industrial and car batteries.

A Solid Waste Management Plan will be implemented in the power plant facility, which includes minimization of waste generation and segregation. All domestic wastes will be temporarily collected and stored in waste bins properly sorted out into recyclables and non-recyclables before collection and disposal by the local government. Within six (6) months from generation, the hazardous wastes will be removed, transported and disposed according to acceptable practices. IASCL shall ensure that the hazardous waste will be properly treated and disposed of, by the DENR accredited transporter and treater.

### 2.1.2 Geology/Geomorphology

#### 2.1.2.1 Change in Surface Landform/Geomorphology/Topography/Terrain/Slope

The general terrain morphology of Isabel, Leyte is generally moderately sloping as most of the land area has a slope of greater than 10%. Barangay Libertad has a slope of greater than 10% (**Figure 2-2**).

It is expected that the alteration of the terrain and slope of the proposed Project site will be less significant for the site is already an existing industrial estate. However, the permanent alteration due to cut and fill activities to achieve the planned grade level is unavoidable, but will be lessened by proper planning of earthwork with respect to the proposed bench type layout design. The strength of the fill materials shall be taken into account as well for the computation of the stable slope. For the slope protection of the filling area in the project site, it will be enforced with a sturdy concrete retaining wall after the soil filling activities. Other areas of the project site which will involve soil cutting will be enforced by grouted rock wall riprap for protection.

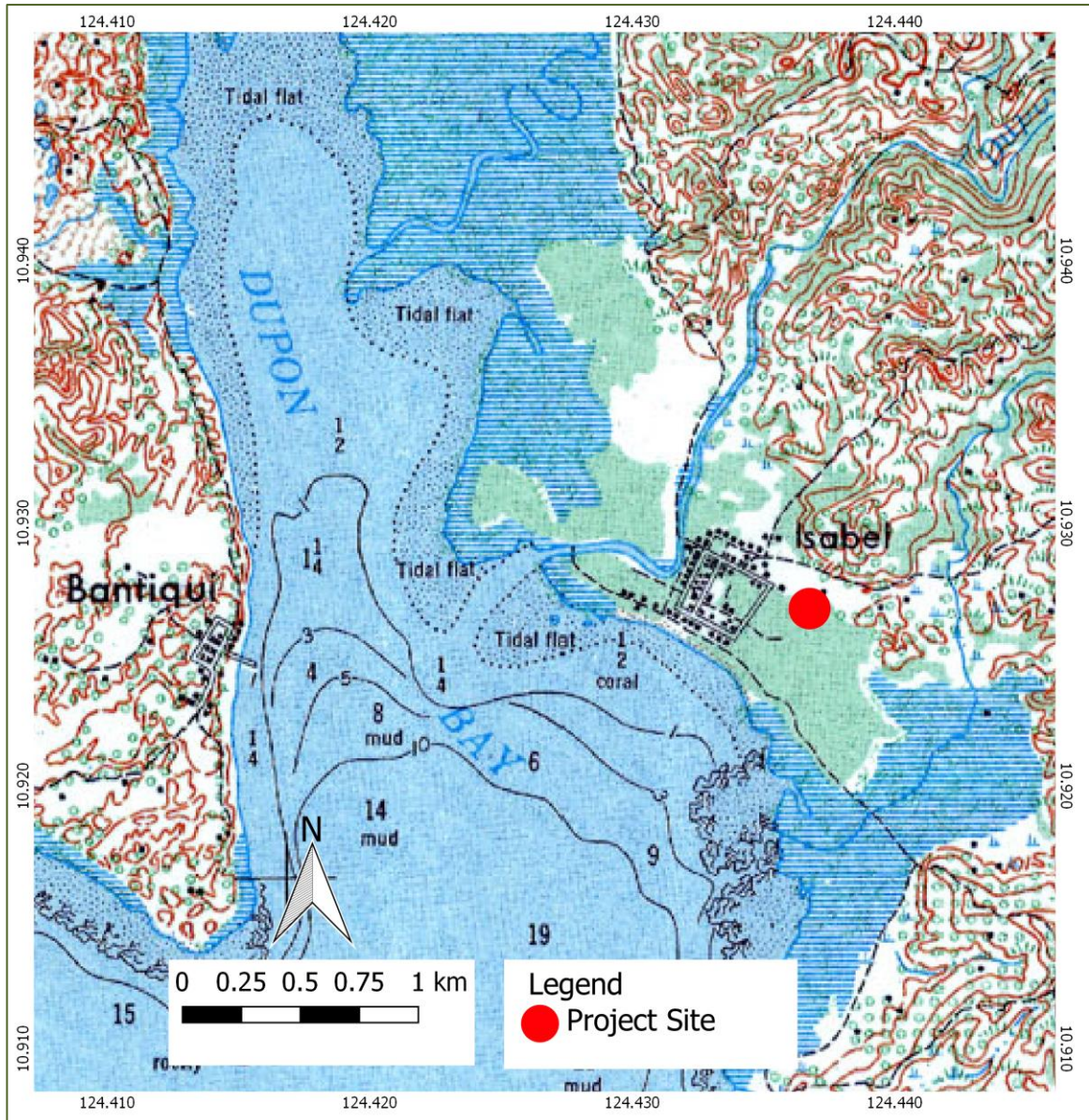


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Source: NAMRIA

Figure 2-2. Topographic Map of the Project Area

### 2.1.2.2 Change in Sub-surface Geology/Underground Condition

**Bedrock Lithology and Subsurface Geomorphology.** The geology of the mainland area is relatively young and ranges in age between Tertiary and Quarternary (**Figure 2-3**). The area is predominantly underlain by coralline limestone and calcarenites with varying thickness of overburden. The mainland of Isabel is predominantly composed of alluvium and Hubay formation. The northern portion of Isabel is underlain by quarternary alluvium that is composed of lenticular clayey, sandy, gravelly, river sheet talus and coastal and partly unconsolidated coral deposits. Clayey deposits dominate over valleys underlain by the sedimentary rocks. The Hubay formation is very evident at the western side of Dupon Bay and the eastern sides of both bays, characterized as Pliocene to Pleistocene coralline limestone underlain by minor sandstone, shale and conglomerate. Since the area is predominantly covered with the Hubay Limestone, the underlying geology of the area might be karst. Possible speleogenesis might be present in the area.

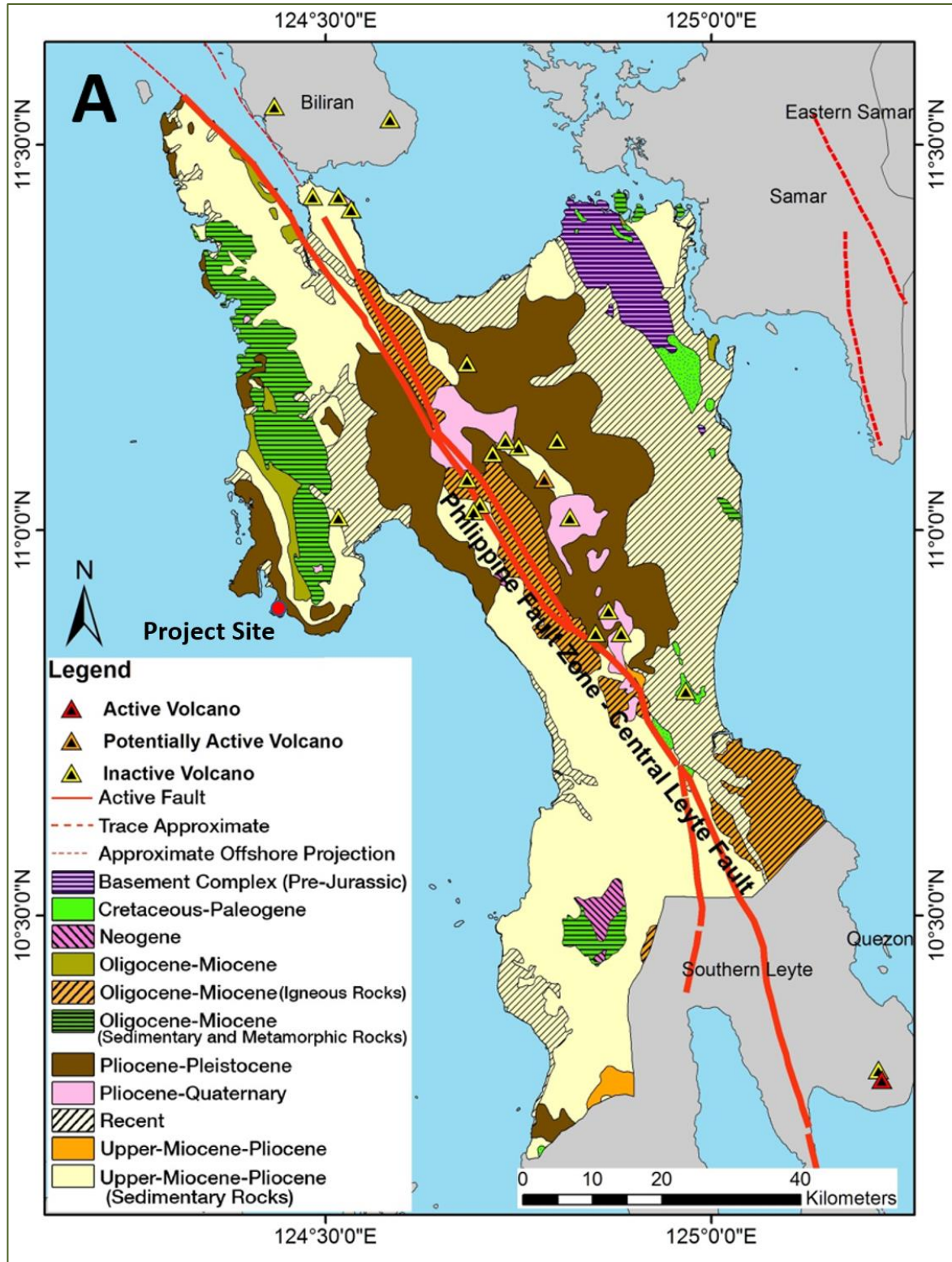


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Source: Eco et al. in 2014

Figure 2-3. Geologic Map of Leyte

**Stratigraphy.** The basement of Western Leyte is made up of the Malitbog Ophiolite, while the youngest lithologic units that can be found on this portion of Leyte is the San Isidro Limestone which is dated to Middle to Late Pleistocene (Figure 2-4).

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| PERIOD              | EPOCH       | Ma        | WESTERN LEYTE/CAMOTES ISLAND |                    |
|---------------------|-------------|-----------|------------------------------|--------------------|
| NEOGENE             | HOLOCENE    | 0.0117    |                              |                    |
|                     | PLEISTOCENE |           | San Isidro Limestone         |                    |
|                     |             |           | Tuktuk Limestone             |                    |
|                     | PLIOCENE    | 2.59      | Inopacan Formation           |                    |
|                     | MIOCENE     | 5.33      | Hubay Limestone              |                    |
|                     |             |           | Cadlum Conglomerate          | Bata Formation     |
|                     |             |           | Calubian Limestone           | Tagnocot Formation |
|                     |             |           | Laboon Conglomerate          |                    |
|                     |             |           | Taog Formation               |                    |
| Kantaring Limestone |             |           | Batang Formation             |                    |
| PALEOGENE           | OLIGOCENE   | 23.03     |                              |                    |
|                     | EOCENE      | 33.9      | Gilonon Formation            |                    |
|                     |             | PALEOCENE | 55.8                         | Amontay Sandstone  |
|                     |             |           |                              |                    |
|                     | CRETACEOUS  | UPPER     | 65.5                         | Malitbog Ophiolite |
| LOWER               |             | 99.6      |                              |                    |
| JURASSIC            |             | 145.5     |                              |                    |

Source: Peña (2010)

**Figure 2-4. Stratigraphic Column for Western Leyte/Camotes Island**

There will be no significant disturbance of the subsurface/underground geomorphology of the proposed Project site. Although, excavations shall cause permanent impact, the level of disturbance is considered low. The area of disturbance would include the footprint of the proposed Project facilities, which includes its appurtenant facilities.

### 2.1.2.3 Inducement of Subsidence, Liquefaction, Landslides, Mud/Debris Flow, etc.

**Seismic Hazards.** The main hazard associated with earthquakes is intense ground shaking accompanied with ground rupture, tsunami and landslides occur as collateral hazards. The degree and extent by which the area is affected by these seismic hazards will depend on the magnitude of the earthquake, proximity to the earthquake source and the site's geological conditions.

There are no major faults present near the project site for at least 30km from the project area as indicated by **Figure 2-5**. The nearest major fault present near the site is the main branch of the Philippine Fault that traverses Leyte Island striking Northwest to Southeast. The presence of the Philippine Fault in the areas produces numerous earthquake events in the island (**Figure 2-6**). Other earthquake generating structures that can affect the area are the Philippine Trench, Cebu Fault System: Central Segment and East Bohol Fault.

The Philippine Trench is produced by the subducting Philippine Plate to the Philippine Mobile Belt. It is deeply subducting in the northern portions and shallows towards the south. This structure has

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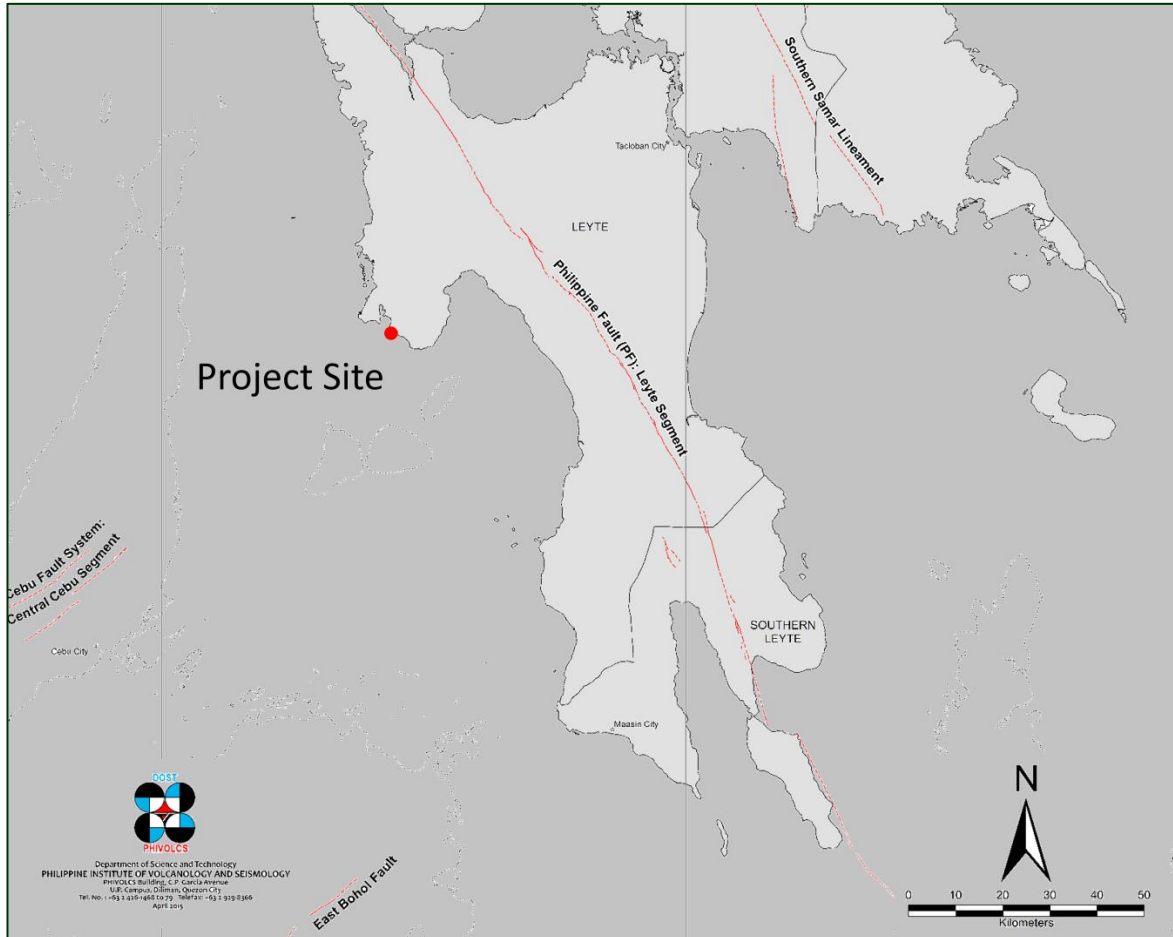
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produced many earthquakes on the eastern margins of the Philippine Archipelago. The Cebu Fault System together with the East and North Bohol Faults are major faults that have contributed to the majority of the earthquake events in Central Visayas.

Although these structures can affect the area due to their distance from the project site, their overall impact to the seismic hazard in the project site is quite minimal.



Source: PHIVOLCS

**Figure 2-5. Fault Map of the Project Site showing the Philippine Fault, Cebu Fault System, and the East Bohol Fault**

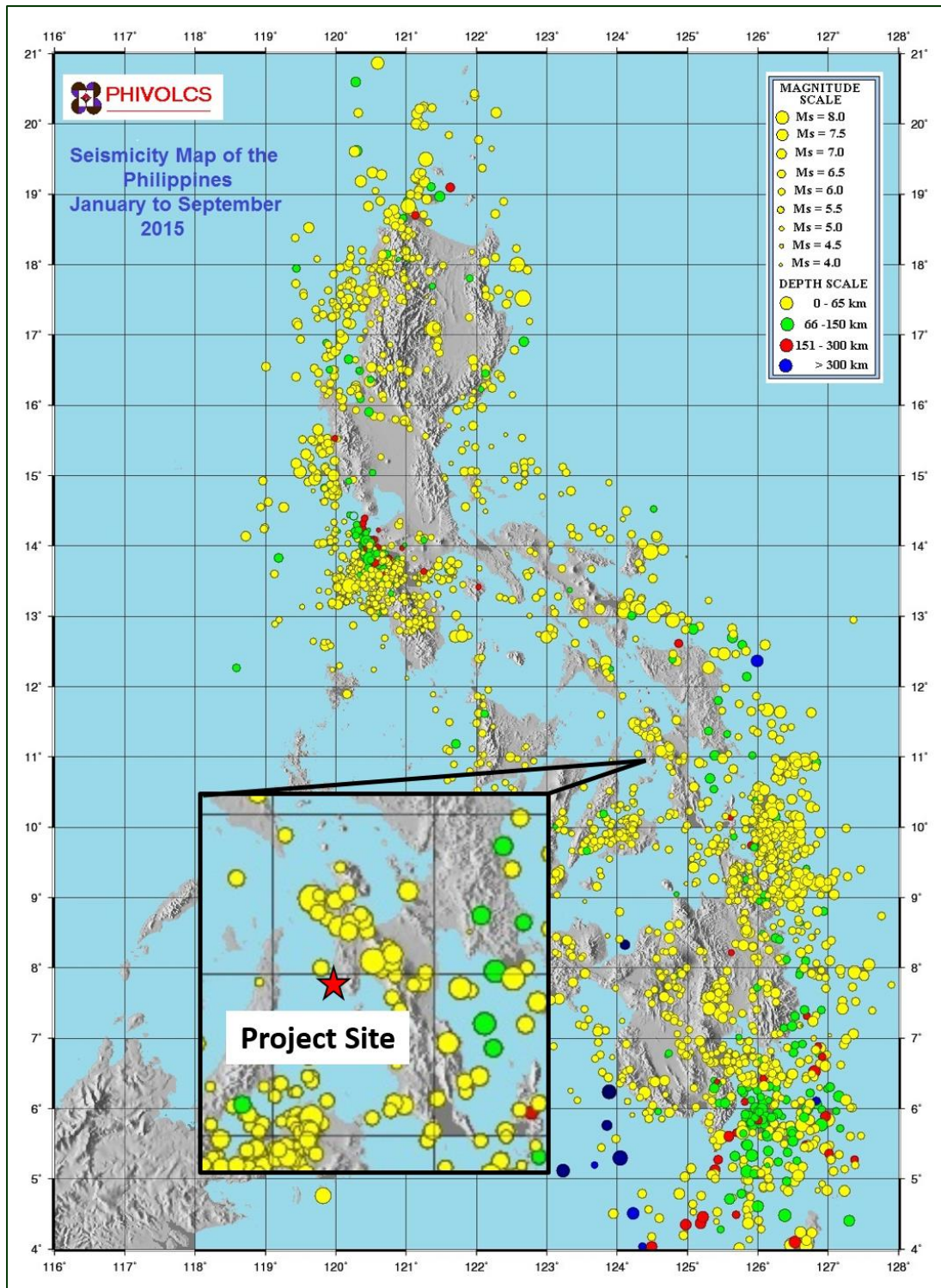


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Source: PHIVOLCS

Figure 2-6. Earthquake Map of the Philippines for the Year 2015

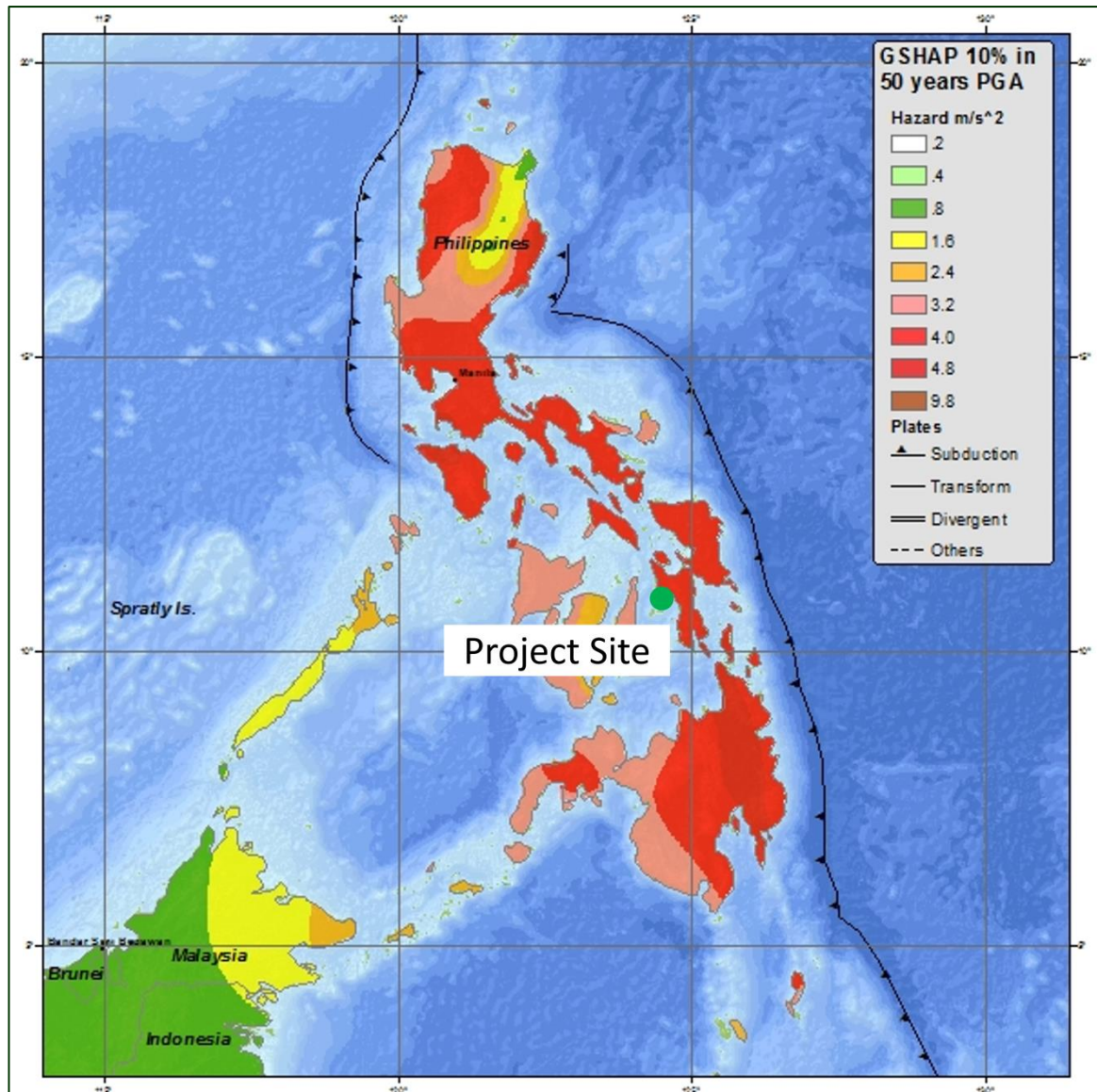
**Ground Acceleration.** Ground shaking is a well-recognized geologic hazard in the Philippines considering that the country is located in a tectonically active region where seismic activities such as earthquakes normally occur. The Peak Ground Acceleration values for the project site are high as presented in **Figure 2-7**. This is due to the fact that the main branch of the Philippine Fault directly traverses the island of Leyte.

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Source: USGS

Figure 2-7. Peak Ground Acceleration Map

Although the island of Leyte experiences a lot of earthquakes, the risk induced by earthquakes in the project site is low (**Figure 2-8**). This might be due to the underlying lithology in the areas and the fact that the project site is far from the main branch of the Philippine Fault. The portion of the Philippine Fault where the project is located is part of the creeping segment which produces low energy but frequent earthquakes.

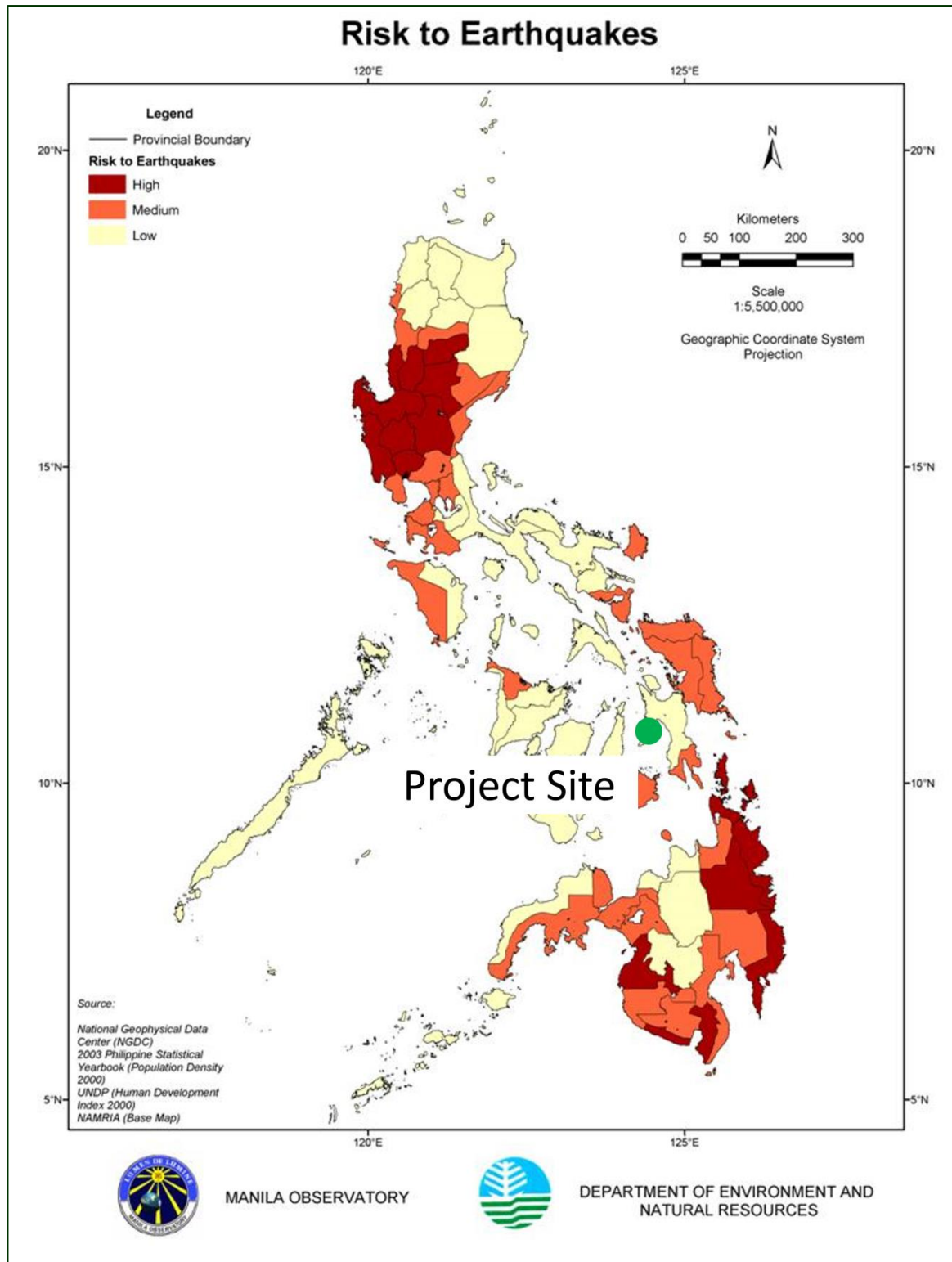


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Source: DENR and Manila Observatory

**Figure 2-8. Risk to Earthquakes Map of the Philippines**

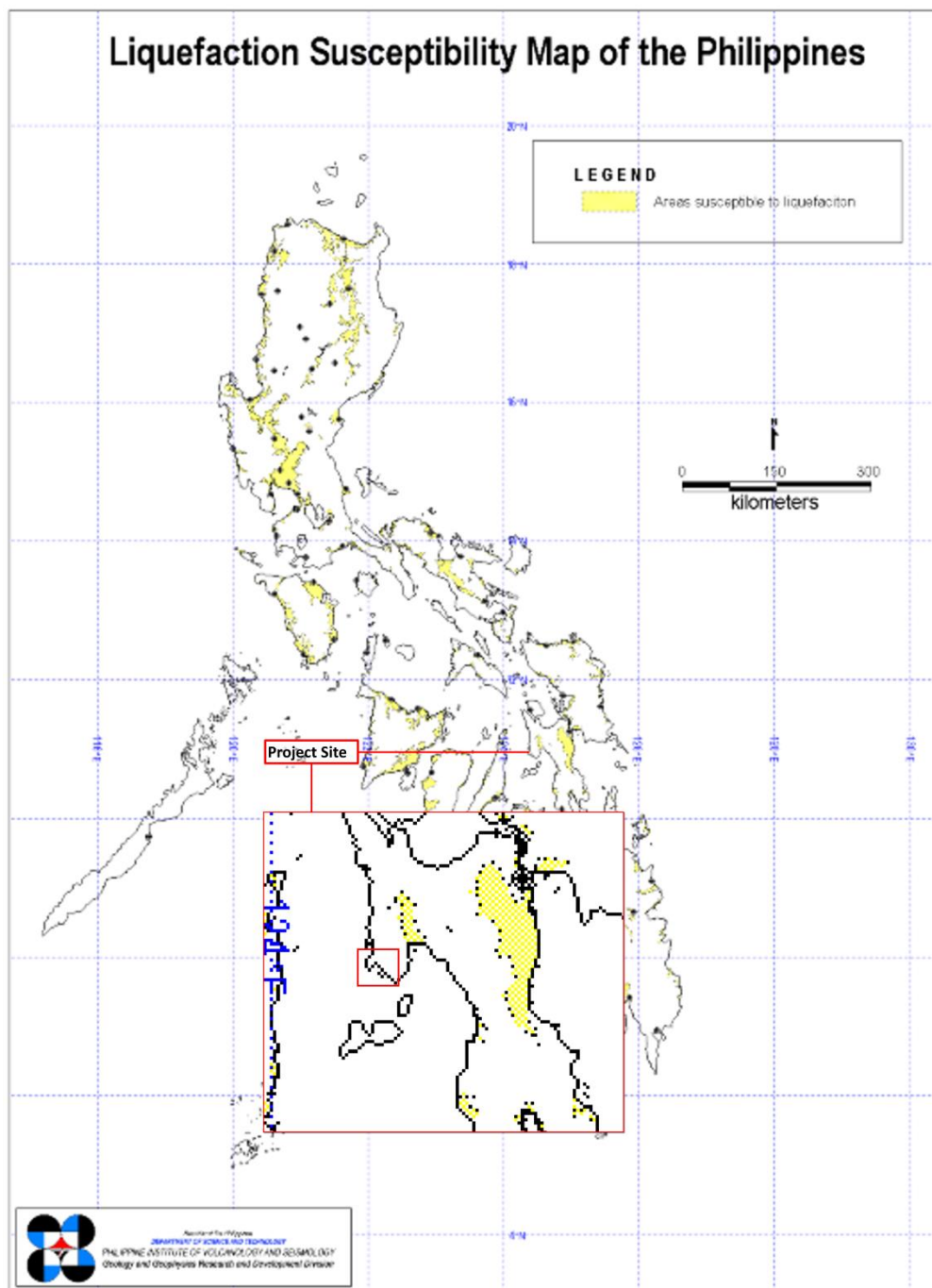
**Liquefaction.** Since Leyte is tectonically active because of the presence of the main branch on the Philippine Fault traversing the island, parts of the island may be subjected to liquefaction during earth movement. **Figure 2-9** shows that Project area is not susceptible to liquefaction.

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Source: PHIVOLCS, modified by GEOSPHERE

**Figure 2-9. Liquefaction Susceptibility Map of the Philippines**

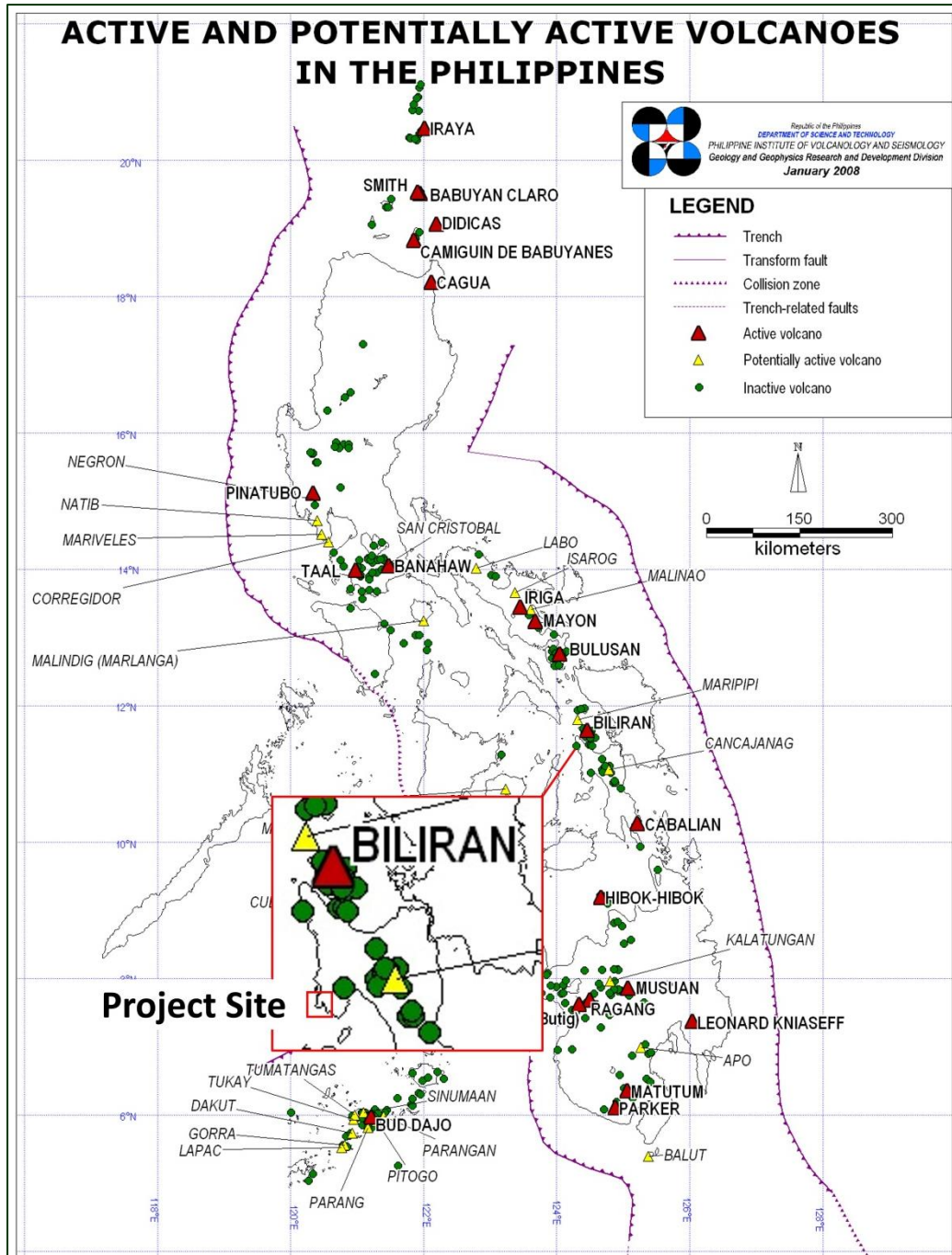
**Volcanic Hazards.** Leyte being host to a huge geothermal area in the Philippines is also hosts to few active and potentially active volcanoes (**Figure 2-10**). Mt. Biliran is a stratovolcano that is basaltic to andesitic in nature. It can erupt both lava and ash. However, the project site is far from Mt. Biliran to be directly affected by lava flow or pyroclastic flow. Tephra or ashfall may reach the project site especially during large volcanic eruptions. The size of the materials expected to reach the site will not exceed a few millimeters in diameter. The worst treat for the project site is the ashfall which can be readily mobilized by the subsequent rainfall.

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Source: PHIVOLCS

Figure 2-10. Distribution of Volcanoes in the Philippines

**Land Subsidence.** Land subsidence is the lowering of ground in elevation. There are many factors that can affect the subsidence of ground. It can be that the area experienced earthquake, presence of pseudokarst, or other reasons. Since the project site is predominantly overlain by limestone as bedrock, it is possible that the area has numerous sinkholes. This sinkholes will then contribute to the hazard of land subsidence for the area. It is recommended that a geotechnical survey of the project site must be conducted in order to check for the presence of sinkholes in the area.

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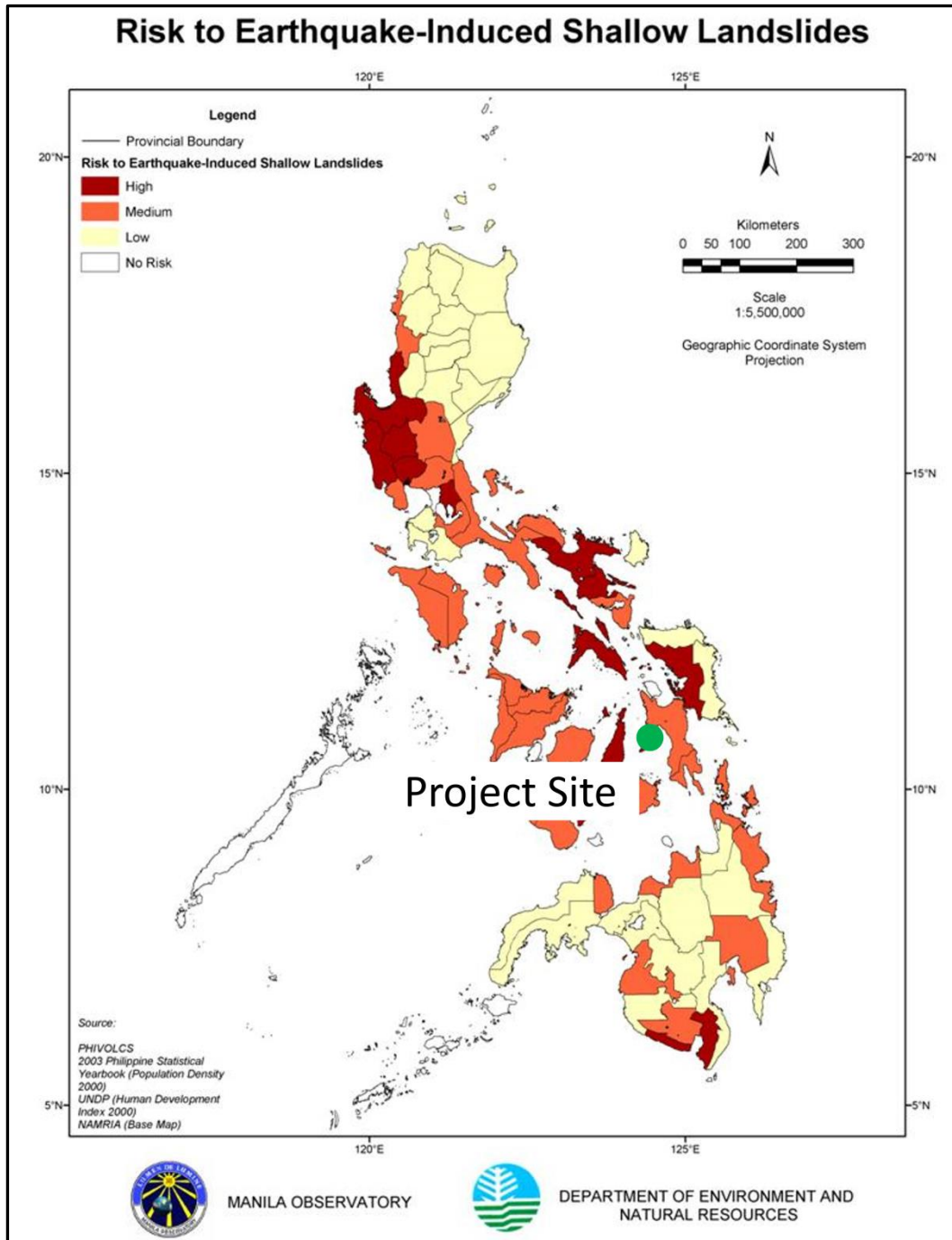
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Moreover, since the project site is located inside the LIDE, the ground where the power plant will erect would have been already compacted and other possible causes of land subsidence would have been eliminated already.

**Landslide.** Considering the earthquake induced shallow-landslides, the project site is moderately at risk (**Figure 2-11**). Since the project site is dominantly covered by limestone, the weathering of the underlying geology is much faster compared to volcanic rocks. Considering that limestone is also a brittle rock, the risk to earthquake-induced landslides can be common.



Source: DENR and Manila Observatory

Figure 2-11. Risk to Earthquake-Induced Shallow Landslides Map of the Philippines





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**Tsunami and Storm Surge.** Tsunamis are high amplitude ocean waves generated by earthquakes, volcanic eruptions or other underwater explosions. Sudden displacements in the ocean floor caused by fault movements generate these large waves, which can travel over long distances.

Tsunami and storm surge are among the coastal hazards in the Philippines. Tsunamis are giant sea waves that are produced by a massive displacement of land under water, usually due to vertical displacement during dip slip faulting. Coastal zones are particularly vulnerable to tsunami and storm surge.

Most of the historically prone areas of tsunami in the Philippines are near high-energy earthquake producers. As shown in in **Figure 2-12**, the project site is considered to be an area where locally generated earthquakes can affect the area and produce tsunami. It is considered as such because lines the margins of the island. However, there are no historically accounts on occurrences of previous tsunamis in the area.

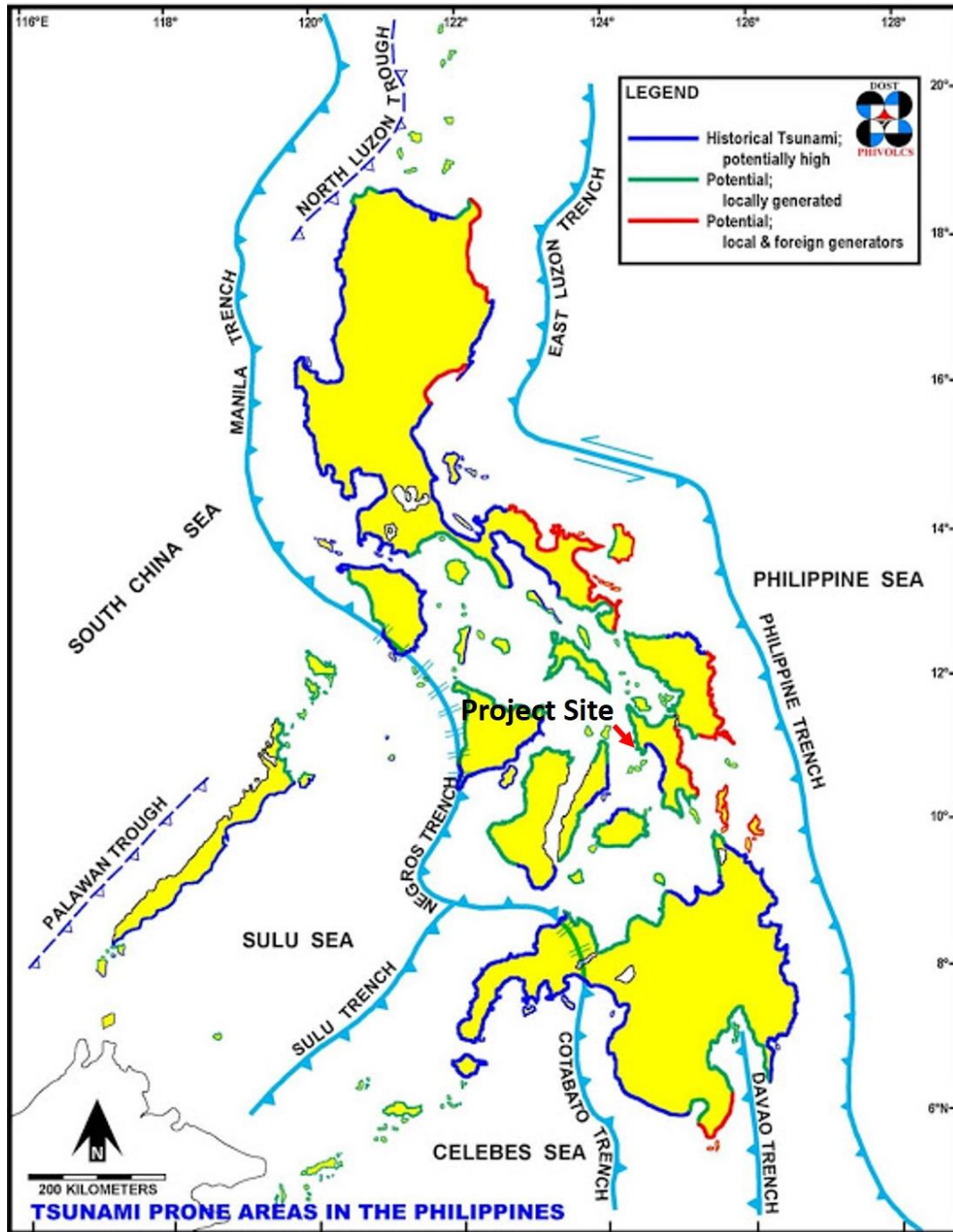


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Source: PHIVOLCS

**Figure 2-12. Tsunami Prone Areas in the Philippines**

Attention shall be directed to designing the proposed Project to withstand repetitive shaking over long period of time. The stability of the foundation of the project facilities shall also be considered. If soft soil materials are encountered in areas where heavy structures will be constructed or where heavy equipment will be installed, the soft materials shall be excavated and replaced by engineered fill. The founding level of all structures must be on competent soil or rock, depending on the results of the soil investigation.

Moreover, IASCL shall prepare an Emergency Preparedness and Response Plan, which includes evacuation point, alternative transport routes and communication lines, to ensure preparedness of the personnel in the event of natural hazards such as typhoon, earthquake, etc.

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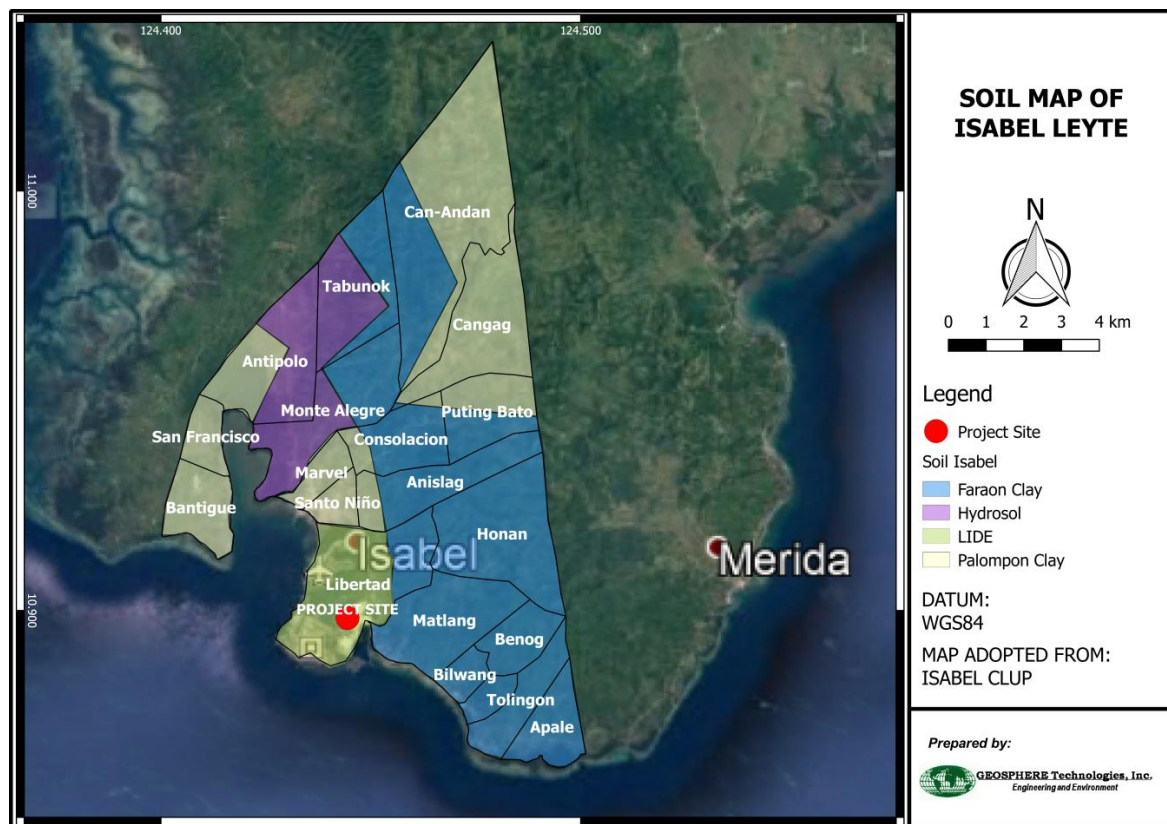
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### 2.1.3 Pedology

#### 2.1.3.1 Soil Erosion/Loss of Topsoil/Overburden

The soils in Isabel Municipality is mostly clay which ranges from Hydrosol Clay to Faraon Clay to Palompon Clay. Significant part of the total area which is 64% is the Faraon Clay. It is fairly granular clay that becomes sticky when wet and hard upon drying. The Palompon Clay comprises 33% of the total area. This kind of clay has a light to brown clay, with good granular structure and slightly sticky when wet but friable when dry.

Only 3% of the total area is Hydrosol Clay, which is a poorly drained flat lowland, located near the coastal and swampy areas. Depending upon the tide, these areas are covered with seawater or saturated with brackish water throughout the year. **Figure 2-13** presents the soil map of Isabel Municipality.



Source: CLUP of Isabel Municipality

**Figure 2-13. Soil Map of Isabel Municipality**

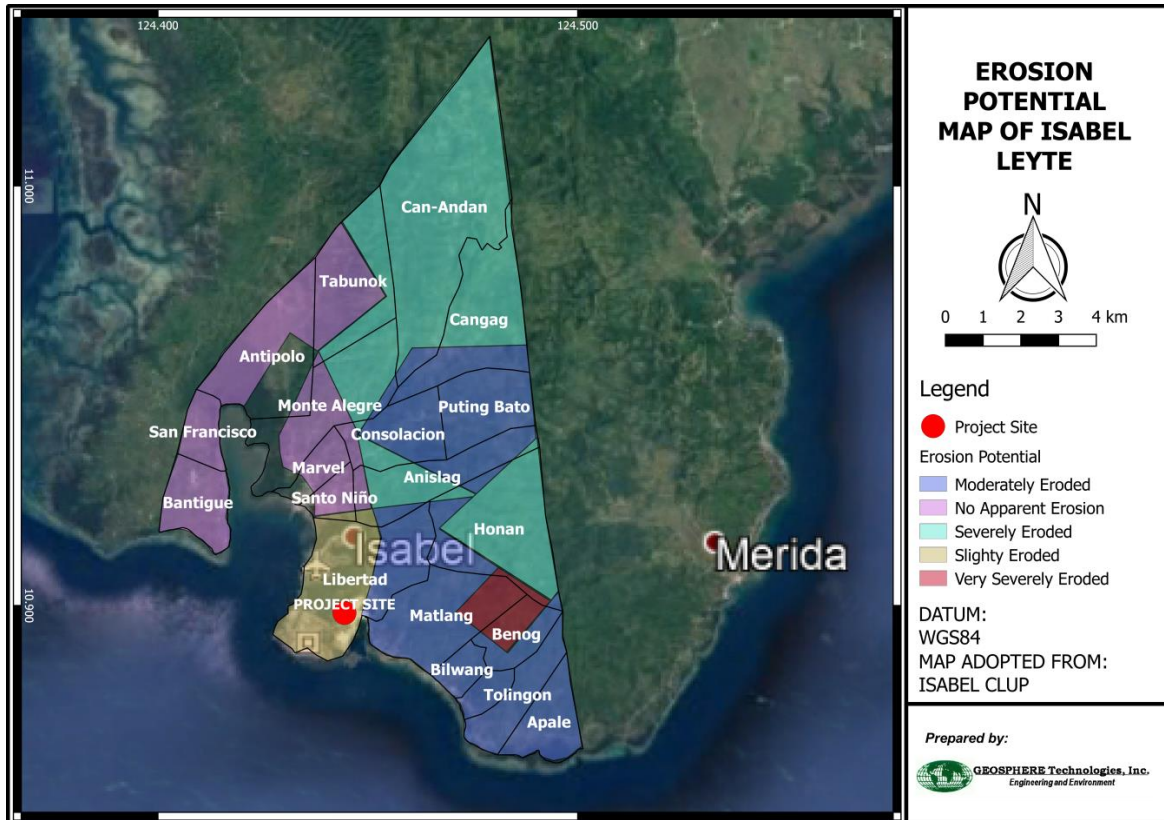
Based on the Soil Erosion Map presented in **Figure 2-14**, about 19.2% of the total land area is very severely eroded; significant 36.6% is severely eroded; 28.1% is moderately eroded and 2.4% is slightly eroded. Only 13.7% of the total areas has no erosion potential. The proposed Project is located at the area which is slightly eroded.

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Source: CLUP of Isabel Municipality

**Figure 2-14 Erosion Susceptibility Map of the Proposed Project Site**

Earthworks during construction phase will disturb the soil and may lead to soil erosion. Cut and fill activities can generate significant volume of sediments that may be carried off by surface runoff. Soil erosion and sedimentation could be considerable during rainfall events, especially during the wet season but could be minimal during the dry season. However, erosion, downslope processes and siltation are expected to return to their natural rates as soon as excavation activities stop when construction phase ended. Operation-related impacts of the proposed Project on soil would be of minor magnitude, short-term duration, and small extent, and have a possible likelihood of occurring. Soils are anticipated to be completely stabilized upon commencement of plant operations.

To avoid considerable soil erosion during rainfall events, an erosion protection program will be implemented. This program shall contain specific engineering, protective construction and planting rules, as well as requirements in the terms of reference of construction companies.

Earthworks during the construction phase shall be scheduled during dry season. Soil erosion control measures such as engineering structures, silt traps and vegetative cover shall be installed prior to grading of the site. Areas which are most vulnerable to soil erosion by water will be covered with geo-textile liners.

The ground surface on which fill is to be laid will be prepared by removing some of the vegetation, non-complying fill, topsoil, and other unsuitable materials. The exposed material will be scarified to provide bond with the new fill. It is absolutely necessary that the fill slopes be keyed in into the natural sub-grade to prevent the formation of a weak interface which could trigger a block slide particularly when the interface is saturated with water. Detrimental amounts of organic materials will not be permitted on fills. All fills will be compacted to a minimum 95% of maximum dry density based on ASTM D-698 using an adequate size compactor. Irreducible material with a maximum dimension of greater than 300 mm will not be buried or placed on fills. The quality and adequacy of the compaction works will be verified using ASTM D-1556 Procedures. Vibratory rollers such as tamper



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foot of smooth drum are suited for granular materials. Such vibratory rollers will have a minimum static weight of ten (10) metric tons and vibrating frequency of 30 cps and will have a maximum travel speed of two (2) KPH when compacting granular materials. For soils exhibiting cohesiveness or plasticity, a smooth drum static roller or sheep foot roller will become necessary. Earthworks contractor will perform compaction trials to determine the most suitable compaction procedure.

### 2.1.3.2 Change in Soil Quality and Fertility

Soil testing was conducted at three (3) established sampling stations on January 14-16, 2018 (**Table 2-1** and **Figure 2-15**) to determine the physico-chemical properties of the soils with the proposed Project site and its vicinity.

**Table 2-1. Sampling Stations for Soil Quality Testing**

| Station | Coordinates                      | Vegetation Profile   | Photos   |
|---------|----------------------------------|--|--|
| S1      | N 10°53'49.96"<br>E124°26'37.27" | Upper portion of the project site, with dense stand of Ipil-Ipil ( <i>Leucaena leucocephala</i> ) and mixed understorey layer species of Ganoi ( <i>C. odorata</i> ) and Kulot ( <i>Triumfetta rhomboidea</i> ).<br><br>Mixed species of banana and herbaceous layer.    |   |
| S2      | N 10°53'47.50"<br>E124°26'41.30" | Tree species of Ipil-Ipil ( <i>Leucaena leucocephala</i> ) and mixed understorey layer of Sablot ( <i>Listea glutinosa</i> ) and Leea philippinensis, <i>Mucuna pruriens</i> , <i>Mimosa pudica</i> L., and <i>Callicarpa formosana</i> Rolfe.<br><br>Thin litter layer. |  |
| S3      | N 10°53'44.38"<br>E124°26'36.53" | Near a small creek with small patch of dense tree and shrub vegetation.<br><br>Tree species: <i>Ficus variegata</i> , <i>Trema orientalis</i> (L.) Blume, <i>Macaranga tanarius</i> (L.) Muell.-Arg. <i>Morinda citrifolia</i> L., <i>Ficus septica</i> Burm. f          |  |

Source: Google Earth, modified by GEOSPHERE, 2018

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Source: Google Earth, Modified by GEOSPHERE, 2018

**Figure 2-15 Location Map of Soil Quality Sampling Stations**

As presented in **Table 2-2**, the level of pH in Station S1 is favorable, however the soil reactions in Stations S2 and S3 are highly basic. Nitrogen range is high from 1,200mg/kg to 1,600 mg/kg. Organic matter is very low. The levels of Phosphorous in all sampling stations are adequate. The levels of Potassium in all sampling stations are also high.

**Table 2-2. Results of Surface Soil Analysis Pertaining to Soil Fertility Rating, January 14-16, 2018**

| Parameters                     | Sampling Stations |       |       | Soil Fertility Rating Guidelines <sup>a</sup> |                                   |                         |
|--------------------------------|-------------------|-------|-------|---|-----------------------------------|-------------------------|
|                                | S1                | S2    | S3    | Adequate (Favorable)                          | Moderate (Moderately Unfavorable) | Deficient (Unfavorable) |
| pH                             | 6.4               | 9.2   | 9.3   | 5.5-8.5                                       | 5.0-5.5                           | <5.0/>8.5               |
| Total Kjeldahl Nitrogen, mg/kg | 1,500             | 1,200 | 1,600 | -   | -                                 | -                       |
| Phosphorus, mg/kg              | 5,801             | 112   | 878   | >10   | 6-10                              | <6                      |
| Potassium, mg/kg               | 1,655             | 2,717 | 1,982 | -   | -                                 | -                       |
| Organic Matter, %              | 1.36              | 0.94  | 0.94  | >3  | 2-3                               | <2                      |

The limits used for assessment of heavy metals are the Target and Intervention Values of Dutch Standards. USEPA 2010 Standard and Leeper, 1978 were used as reference for the assessment of parameters that are not found in the Dutch Standards. The Dutch Standards are environmental pollutant reference values used in environmental remediation, investigation and clean-up.

**Table 2-3** shows that the levels of Chromium Hexavalent in all samplings stations are below the detectable limits of the analysis. The levels of Zinc and Arsenic in all sampling stations exceeds the the Intervention Value of the Dutch Standard except in Station S3 for Arsenic and in Station 1 for Zinc which are below the Intervention Value but exceeds the Target Value of the Dutch Standard. The levels of Cadmium, Lead and Mercury in all sampling stations exceeds the Target Value but way below the Intervention Value of the Dutch Standard. The levels of Copper in all sampling stations exceed the Intervention Value of the Dutch Standard. The levels of Fe in all sampling stations exceed the standard range (3,000-10,000mg/kg) of Fe in soil. Manganese and Oil and grease are also present in all sampling stations.



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Table 2-3. Results of Surface Soil Analysis for Heavy Metals, January 14-16, 2018

| Parameters                 | Sampling Stations |         |         | Dutch Standard          |                    |
|----------------------------|-------------------|---------|---------|-------------------------|--------------------|
|                            | S1                | S2      | S3      | Target Value            | Intervention Value |
| Copper, mg/kg              | 1,165             | 4,192   | 6,996   | 36                      | 190                |
| Manganese, mg/kg           | 558               | 162     | 89.4    | -                       | -                  |
| Lead, mg/kg                | 97.3              | 106     | 59.9    | 85                      | 530                |
| Zinc, mg/kg                | 1,127             | 2,363   | 547     | 140                     | 720                |
| Mercury, mg/kg             | 0.58              | 0.4     | 0.5     | 0.3                     | 10                 |
| Iron, mg/kg                | 20,635            | 560,234 | 430,100 | 3,000 – 10,000 (Leeper) |                    |
| Cadmium, mg/kg             | 9.04              | 5.94    | 5.16    | 0.8                     | 12                 |
| Arsenic, mg/kg             | 46.60             | 163     | 172     | 29                      | 55                 |
| Chromium Hexavalent, mg/kg | <0.2              | <0.2    | <0.2    | -                       | 2 (USEPA)          |
| Oil and Grease, mg/kg      | 425               | 104     | 112     | -                       | -                  |

Note: Target Values of Dutch Standard (2000) – indicates the level at which there is a sustainable soil quality; Intervention Values of Dutch Standard (2000) – representative of the level of contamination above which there is a serious case of soil contamination;

Range of Iron in Soil = 3,000 – 10,000 mg/kg (Leeper, 1978);

Chromium hexavalent = 2mg/kg (USEPA, 2010)

Construction of the proposed Project involves the use of heavy equipment, which has risk of an accidental fuel or chemical spill and potential contamination of soils. The operation of the proposed Project could hypothetically result in localized contaminant loading into the soil due fuel leakage and spill and improper disposal of wastes. Accidental fuel and oil spill may occur in storage area, and tank truck unloading area.

The following procedures for the handling and storage of fuel shall be implemented to reduce the potential soil contamination within the vicinity of the proposed Project:

- (i) Fueling and lubrication of equipment shall be in designated and approved locations.
- (ii) Washing, servicing and fueling of mobile equipment shall not be allowed within thirty (30) meters of drainage
- (iii) Storage of waste oils and lubricants shall be in a tank or closed container
- (iv) Storage of greasy or oily rags or materials shall be in an appropriate and approved designated area that are not prone to spontaneous combustion
- (v) Prohibition on dumping of any contaminating material product to the environment, including waste oils
- (vi) Formulation of Spill Prevention Procedures and a Spill Contingency Plan, a detailed response system to deal with accidents such as the release of petroleum, oils, or lubricants. Make available on-site all equipment and materials necessary to execute a clean-up
- (vii) Collection and storage of all wastes recovered during clean-up operations in labeled and secured containers for subsequent disposal by an accredited treatment facility
- (viii) Training and awareness programs shall be conducted for all personnel

During operation phase, the fuel storage area will be provided with a secondary containment in the form of a bund containment wall. The bund containment wall will surround the fuel storage tank and will be sized to accommodate the volume for a full capacity spillage of the tank.

The tank truck unloading area shall be installed with a berm, sized with sufficient capacity to contain 110% of the largest tank truck capacity and the volume displaced by the truck in the unloading area. The fuel oil spill containment area will be provided with a level transmitter for level monitoring and alarm in the digital control system.

All routine handling or transfer of chemicals will take place within bermed areas to ensure that spills or leaks will be contained. Chemical feed skids, pot feeders, portable storage tanks, or drums will be installed or staged in bermed areas. Bermed areas for storing at least one spare portable tank or

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drum for each in service will be provided.

Possibility of soil contamination will be assessed through a soil-testing program, especially in the vicinity of storage areas. If positive for contamination, then the area will be subjected to remediation or decontamination. Any toxic or hazardous materials remaining in the site will be collected along with the contaminated soil for appropriate disposal. An accredited treater/ transporter will be contracted to undertake the required treatment and proper disposal.

### 2.1.4 Terrestrial Ecology

#### 2.1.4.1 Vegetation Removal and Loss of Habitat

The terrestrial flora survey was conducted at ten (10) sampling plots within the proposed Project site and its vicinity on January 14-16, 2018. Nested quadrat method using 20m x 20m (400m<sup>2</sup>) plots was used to assess and characterize the structure and species composition of the different plant communities within the sampling plots (**Figure 2-16**). Individual trees inside the quadrat, with a diameter at breast height (DBH) of  $\geq 10$  cm, were geo-tagged and the merchantable height (MH), and total height (TH) were measured. The diameter of trees was measured at 1.3m above ground or 10 cm above the tallest buttress/prop roots if taller than 1.3m. For tree forks below 1.3 m from the ground, all stems with  $\geq 5$  cm DBH were measured separately.

Associated species of trees  $< 10$  cm and other plant forms such as palm, vine, shrubs, weeds, lianas, ferns, bamboos, and grasses identified were recorded. Frequency of shrubs, poles, and saplings inside the 5m x 5m quadrat was counted to account for the intermediate species, while percentage cover of understorey species such as grasses and other plants below 1m in height inside the 1m x 1m quadrat was determined. Opportunistic sampling survey was also conducted in other sections of the study area particularly in the peripheral sections near roads and excavation area. This was done to account other plant species and vegetation extent of the area using a more comprehensive and systematic approach.

Identification of all species inside the transect plots was made. Specimens that were not identified in the field were collected and voucher specimens were prepared for later identification. Species and family names followed the latest Angiosperm Phylogeny Group classification (APG 3, version 13) while the common names adapted that of Rojo (2001). Local names provided by the community guides were also incorporated.

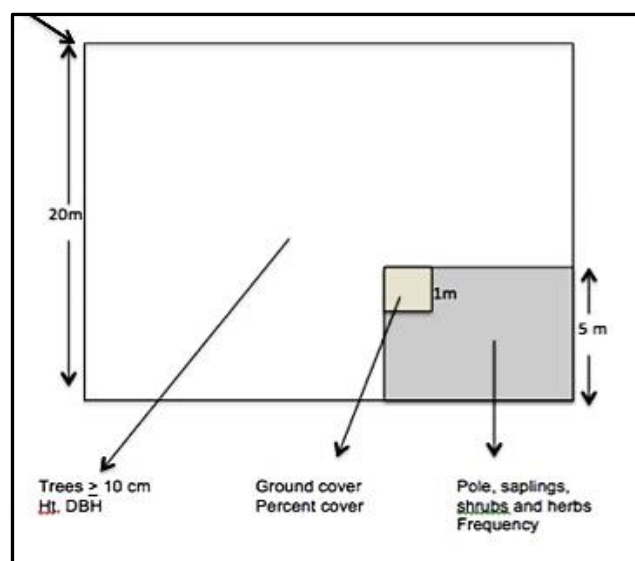


Figure 2-16. The nested plot technique employed in the plant diversity survey.

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The ecological or biodiversity value of an area is always measured in terms of species richness and in the number of endemic and threatened species present. In addition, the presence of indigenous and endemic species are also contributing factors to the total biodiversity of the area.

### Importance Values

The relative density, relative dominance and relative frequency values for each plant and tree species in all the monitoring plots were determined to obtain their Importance Value (IV), a standard measure in ecology that determines the rank relationships of species. High Importance values of species indicate a composite score for high relative species dominance, density and frequency. IV is often correlated with both ecological and economic importance. Species importance value (SIV) as a parameter, covers all of these parameters together for the determination of distribution and frequency patterns of species as well as judgments about ecological conditions that have more significance

### Conservation Status

The conservation status of species is based on the most recent recommendations of the Philippine Plant Conservation Committee (PPCC) officially issued as DENR Administrative Order No. 2007-01 better known as "The National List of Threatened Philippine Plants and their Categories". The listing of protected species of CITES and threatened species of the IUCN red list were also used as reference. Based from these listings, a number of conservation categories were describe pertaining to the threatened ecological community (TEC), which is found to fit into one of the following categories; Critically Endangered (CR), Endangered (EN) or Vulnerable (VU). Possible threatened ecological communities that do not meet survey criteria are added to 'Other threatened species' (OTS). Lists under Priorities 1, 2 and 3 (referred to as P1, P2, P3). Ecological Communities that are adequately known, are rare but not threatened, or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4 (P4). These ecological communities require regular monitoring.

Based from the land cover map with focus on the different land uses in the Island of Leyte in 2000-2001, the Municipality of Isabel was categorized as having mixed-land use involving forestry and agricultural uses such as pasture areas, firewood production, etc.

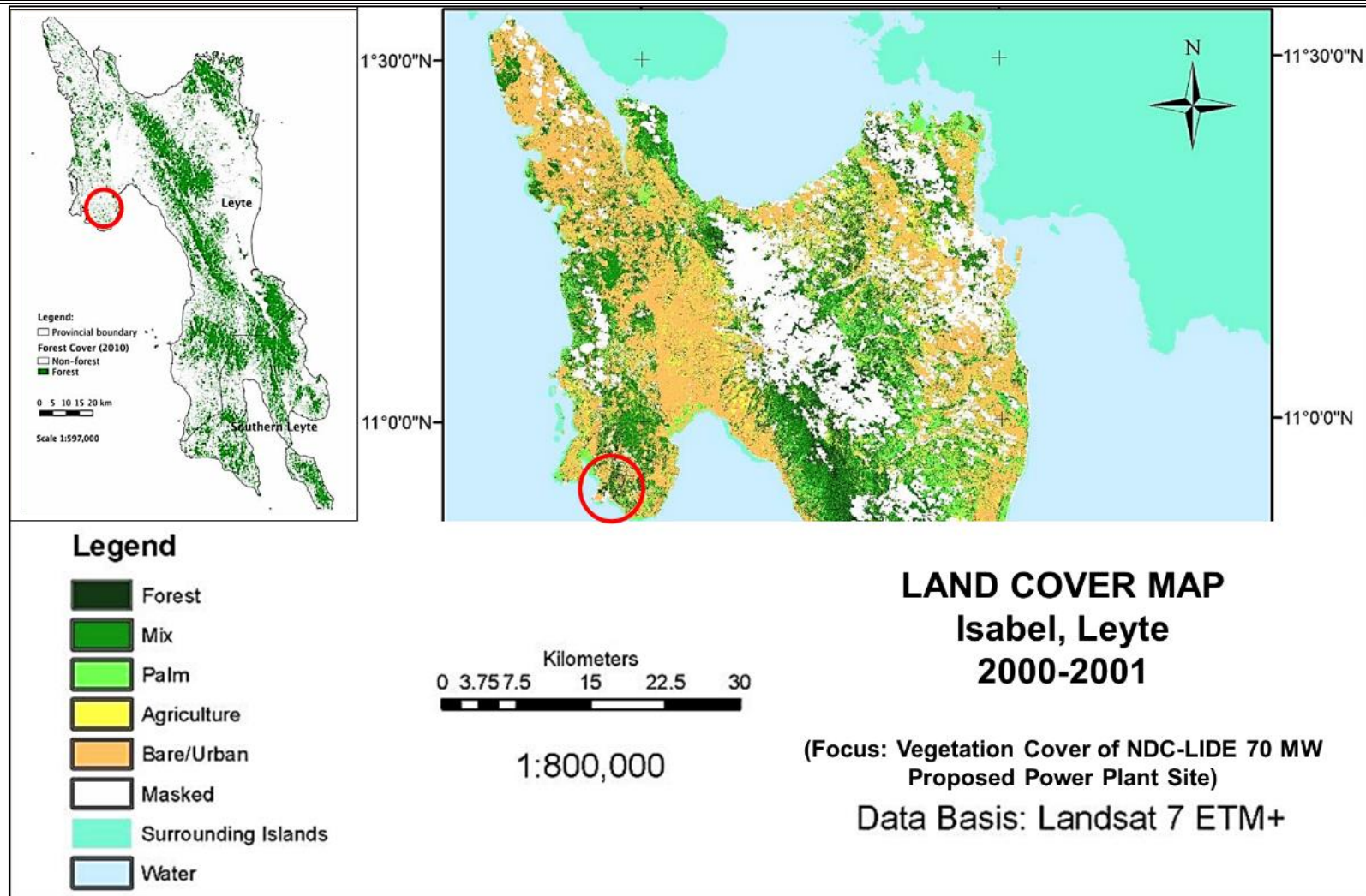
**Figure 2-17** shows the 2002-2001 land cover map.

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Source: NAMRIA, 2002

Figure 2-17 Land Cover Map of Leyte



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The vegetation inside the about 2-ha proposed power plant site is generally a brush land and remnant of mixed-land use vegetation where in pioneer tree species dominates the area after a long history series of agricultural activities such as pasture, firewood production and etc. as shown in **Figure 2-18**.



**Figure 2-18** Satellite image of the proposed project site which is currently being temporarily utilized by the contractor of the adjacent facility

Based from the reconnaissance survey, the upper portion of the proposed site was dominated by a dense stand of Ipil-Ipil (*Leucaena leucocephala*). However, there are few unique individual tree species such as Bayok (*Pterospermum diversifolium*) and Bogong (*Garuga floribunda*) located in the upper portion of the area that is fortunately quite far from the proposed project site. Furthermore, some of the tree and plant species were confined and growing well in sites where soil are stacked for a long period of time. These species are represented by either exotic or native species in various plant forms such as shrubs, woody vines and trees. Exposed areas are smothered by opportunistic and shade tolerant species such as the exotic species Gonoi (*Chromolaena odorata*) and Coronitas (*Lantana camara*). These species are regarded as illegal recruits since they grow in many kinds of soils and can be easily adapted to extreme environments and conditions. They are observable all throughout the proposed plant site and even in adjacent areas.

### ***Associated Vegetation/Landscape***

Associated vegetation or landscapes are important in assessing terrestrial ecology since these areas can serve as either viable alternative shelter or entrance site for new plant or animal species recruits in the main ecosystems or an area affected by any development or disturbance.

During the survey, it was observed that the study area has no associated vegetation as it was already surrounded by heavy industrial facilities and infrastructures. Aside from the remaining dense vegetation with some tall trees and shaded portions, there could still be some areas that can serve as viable habitat for birds and other wildlife species in the area. These areas includes the upper portion of the site near transmission tower and vegetated sections with native tree species.

**Figure 2-19** presents the photos during floral survey.

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Note: a) Dense vegetation of Ipil-Ipil, Alim, Binunga, and some individuals of Molave in the upper portions near Transmission tower; (b) East sections of the project site along the stretch of the road going to the existing plant nursery

**Figure 2-19 Site Photos during Floral Survey**

On the other parts within the middle section of the project site, the vegetation actually includes some remaining patches of grasses transition to the dense vegetation in the upper section. These includes species of Hakati (*Paspalum* sp.), Talahib (*Saccharum spontaneum*) and Cogon (*Imperata cylindrica*), etc. Other documented species present in the area are Gono (Chromolaena odorata), Kamot-kabag (*Caesalpinia latisiliquum*), and species of clumping grasses such as Cogon (*Imperata cylindrica*) and a leguminous species *Alysicarpus* sp. The vegetation in the area supports immediate cover which also became shelter for some bird species in the area.

At the inner portion, large diameter trees such as Bogo (*Garuga floribunda*), Gmelina (*Gmelina arborea*) and Alim (*M. multiglandulosa*) dominate the area. These trees are typically pioneer species that tend to dominate open areas and are light tolerant species. The remaining patch of vegetation is very significant in terms of cover in the area as these would serve as buffer zone to nearby facilities that don't operate heavily (e.g. in the case of a power plant) and as well as to adjacent communities near the proposed project site. There is an existing plant nursery in the area, though located outside the project site. The nursery is actually located in the upper portion of the site where in a large area of gypsum by-products (black sand) are being piled. Remnants of agricultural activities can also be observed in the area such that these areas are planted with Banana (*Musa* sp.), Mangga (*Mangifera indica*) and Avocado (*Persea americana*). Other species that can be observed in the area are Bangkoro (*Morinda citrifolia*), Malakalumpang (*Sterculia ceramica*), mixed with forest tree species were the wildlings/trees of the following species are present, namely, Binunga (*Macaranga tanarius*), Alim (*Melanolepis multiglandulosa*), Rain tree (*Samanea saman*), Hauili (*Ficus septica*) and Niyog-niyogan (*Ficus pseudopalma*).

Aside from the tree vegetation in the proposed power plant site, there are other vegetation with notable tree species that can be observed from other parts of the whole study area. These sites should be covered as monitoring zones or conserved area such as the forest vegetation in the upper elevations near the gypsum pile/stock area. A rapid listing and enumeration of plant and tree species were also done to account other species that are present in these areas.

**Table 2-4** and **Figure 2-20** present the location and general vegetation condition of the different plots from the 10 sampling plots established in the site.

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Table 2-4. Description of the Terrestrial Flora Sampling Stations

| Plot No. | Coordinates                      | Elevation (masl) | Profile/Dominant Species**   |
|----------|----------------------------------|------------------|--|
| 1        | N 10°53'50.29"<br>E124°26'32.86" | 41               | <p><b>Shrub species:</b> <i>Lantana camara</i> L., <i>Urena lobata</i>, <i>Chromolaena odorata</i> and <i>Pipturus arborescens</i>.</p> <p><b>Tree species:</b> <i>Leucaena leucocephala</i>, <i>Trema orientalis</i> (L.) Blume, <i>Macaranga tanarius</i> (L.) Muell.-Arg. <i>Morinda citrifolia</i> L., <i>Ficus septica</i> Burm. f. <i>Melanolepis multiglandulosa</i>,</p> <p><b>Herbaceous layer:</b> <i>Mimosa pudica</i> L., <i>Stachytarpetta jamaicensis</i>, <i>Mikania cordata</i> (Burm. f.) B.L. Rob., <i>Caesalpinia latisiliquum</i>, <i>Tridax procumbens</i></p>  |
| 2        | N 10°53'50.51"<br>E124°26'34.26" | 43               | <p><b>Herbaceous layer:</b> <i>Xanthosoma violaceum</i>, <i>Stachytarpetta jamaicensis</i>, <i>Mikania cordata</i> (Burm. f.) B.L. Rob., <i>Caesalpinia latisiliquum</i>, <i>Musa acuminata</i></p> <p><b>Shrub species:</b> <i>Tristellateia australasiae</i> A. Rich., <i>Callicarpa formosana</i> Rolfe, <i>Lantana camara</i> L.</p> <p><b>Tree species:</b> <i>Artocarpus blancoi</i>, <i>Trema orientalis</i> (L.) Blume, <i>Macaranga tanarius</i> (L.) Muell.-Arg. <i>Garuga floribunda</i>, <i>Ficus septica</i> Burm. f., <i>Gmelina arborea</i>, <i>Litsea glutinosa</i></p>  |
| 3        | N 10°53'50.59"<br>E124°26'35.68" | 43               | <p><b>Shrub species:</b> <i>Lantana camara</i> L., <i>Tristellateia australasiae</i> A. Rich. <i>Mimosa pudica</i> L.,</p> <p><b>Tree species:</b> <i>Leucaena leucocephala</i>, <i>Garuga floribunda</i>, <i>Trema orientalis</i> (L.) Blume, <i>Macaranga tanarius</i> (L.) Muell.-Arg. <i>Morinda citrifolia</i> L., <i>Ficus septica</i> Burm. f., <i>M. multiglandulosa</i>, <i>Munitigia calabura</i>, <i>Artocarpus blancoi</i></p> <p><b>Herbaceous layer:</b> <i>Alysicarpus</i> sp., <i>Mimosa pudica</i> L., <i>Stachytarpetta jamaicensis</i>, <i>Mikania cordata</i> (Burm. f.) B.L. Rob., <i>Caesalpinia latisiliquum</i>, <i>Tridax procumbens</i>, <i>Imperata cylindrica</i>.</p>   |
| 4        | N 10°53'49.96"<br>E124°26'37.27" | 40               | <p><b>Shrub species:</b> <i>Lantana camara</i> L., <i>Tristellateia australasiae</i> A. Rich., <i>Triumfetta rhomboidea</i>, <i>Callicarpa formosana</i> Rolfe, <i>Leea philippinensis</i></p> <p><b>Tree species:</b> <i>Leucaena leucocephala</i>, <i>Garuga floribunda</i>, <i>Trema orientalis</i> (L.) Blume, <i>Macaranga tanarius</i> (L.) Muell.-Arg. <i>Morinda citrifolia</i> L., <i>Molave</i> (<i>Vitex parviflora</i> Juss.), <i>Melanolepis multiglandulosa</i></p> <p><b>Herbaceous layer:</b> <i>Xanthosoma violaceum</i>, <i>Caesalpinia latisiliquum</i>, <i>Stachytarpetta jamaicensis</i>, <i>Mikania cordata</i> (Burm. f.) B.L. Rob., <i>Mimosa pudica</i>, <i>Centrosema pubescens</i>, <i>Imperata cylindrica</i>.</p> |

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| Plot No. | Coordinates                       | Elevation (masl) | Profile/Dominant Species**  |
|----------|-----------------------------------|------------------|---|
| 5        | N 10°53'47.50"<br>E124°26'41.30"  | 25               | <p><b>Shrub species:</b> <i>Leea philippinensis.</i>, <i>Solanum torvum.</i>, <i>Cocos nucifera</i> L., <i>Mimosa pudica</i> L., <i>Callicarpa formosana</i> Rolfe</p> <p><b>Tree species:</b> <i>Leucaena leucocephala</i>, <i>Samanea saman</i>, <i>Artocarpus blancoi</i>, <i>Trema orientalis</i> (L.) Blume, <i>Macaranga tanarius</i> (L.) Muell.-Arg. <i>Garuga floribunda</i>, <i>Ficus septica</i> Burm. f., <i>Gmelina arborea</i>, <i>Sterculia ceramica</i>, <i>Litsea glutinosa</i></p> <p><b>Herbaceous layer:</b> <i>Centrosema pubescens</i>, <i>Alysicarpus sp.</i>, <i>Mimosa pudica</i> L., <i>Phyllanthus debilis</i>, <i>Mikania cordata</i> (Burm. f.) B.L. Rob., <i>Caesalpinia latisiliquum</i>, <i>Tridax procumbens</i></p> |
| 6        | N 10°53'45.60"<br>E124°26'41.11"  | 17               | <p><b>Shrub species:</b> <i>Solanum torvum.</i>, <i>Cocos nucifera</i> L., <i>Callicarpa formosana</i> Rolfe</p> <p><b>Tree species:</b> <i>Gmelina arborea</i>, <i>Trema orientalis</i> (L.) Blume, <i>Macaranga tanarius</i> (L.) Muell.-Arg. <i>Morinda citrifolia</i> L., <i>Ficus septica</i> Burm. f. <i>Melanolepis multiglandulosa</i></p> <p><b>Herbaceous layer:</b> <i>Centrosema pubescens</i>, <i>Alysicarpus sp.</i>, <i>Mimosa pudica</i> L., <i>Imperata cylindrica</i>, <i>Mikania cordata</i> (Burm. f.) B.L. Rob., <i>Caesalpinia latisiliquum</i>, <i>Tridax procumbens</i></p>   |
| 7        | N 10° 53'45.82"<br>E124°26'38.65" | 20               | <p><b>Shrub species:</b> <i>Leea philippinensis.</i>, <i>Solanum torvum.</i>, <i>Cocos nucifera</i> L., <i>Mimosa pudica</i> L., <i>Callicarpa formosana</i> Rolfe</p> <p><b>Tree species:</b> <i>Sweitenia macrophylla</i>, <i>Trema orientalis</i> (L.) Blume, <i>Macaranga tanarius</i> (L.) Muell.-Arg. <i>Morinda citrifolia</i> L., <i>Ficus septica</i> Burm. f. Some planted seedlings of Molave (<i>Vitex parviflora</i> Juss).</p> <p><b>Herbaceous layer:</b> <i>Centrosema pubescens</i>, <i>Alysicarpus sp.</i>, <i>Mimosa pudica</i> L., <i>Phyllanthus debilis</i>, <i>Mikania cordata</i> (Burm. f.) B.L. Rob., <i>Caesalpinia latisiliquum</i>, <i>Tridax procumbens</i></p>   |
| 8        | N 10°53'44.38"<br>E124°26'36.53"  | 15               | <p><b>Shrub species:</b> <i>Leea philippinensis.</i>, <i>Solanum torvum.</i>, <i>Cocos nucifera</i> L., <i>Mimosa pudica</i> L., <i>Callicarpa formosana</i> Rolfe</p> <p><b>Tree species:</b> <i>Sweitenia macrophylla</i>, <i>Trema orientalis</i> (L.) Blume, <i>Macaranga tanarius</i> (L.) Muell.-Arg. <i>Morinda citrifolia</i> L., <i>Ficus septica</i> Burm. f. Some planted seedlings of Molave (<i>Vitex parviflora</i> Juss).</p> <p><b>Herbaceous layer:</b> <i>Centrosema pubescens</i>, <i>Alysicarpus sp.</i>, <i>Mimosa pudica</i> L., <i>Phyllanthus debilis</i>, <i>Mikania cordata</i> (Burm. f.) B.L. Rob., <i>Caesalpinia latisiliquum</i>, <i>Tridax procumbens</i></p>   |





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| Plot No. | Coordinates                      | Elevation (masl) | Profile/Dominant Species**  |
|----------|----------------------------------|------------------|---|
| 9        | N 10°53'46.13"<br>E124°26'34.78" | 22               | <p><b>Shrub species:</b> <i>Leea philippinensis.</i>, <i>Solanum torvum.</i>, <i>Cocos nucifera</i> L., <i>Mimosa pudica</i> L., <i>Callicarpa formosana</i> Rolfe</p> <p><b>Tree species:</b> <i>Sweitenia macrophylla</i>, <i>Trema orientalis</i> (L.) Blume, <i>Macaranga tanarius</i> (L.) Muell.-Arg. <i>Morinda citrifolia</i> L., <i>Ficus septica</i> Burm. f. Some planted seedlings of Molave (<i>Vitex parviflora</i> Juss).</p> <p><b>Herbaceous layer:</b> <i>Centrosema pubescens</i>, <i>Alysicarpus</i> sp., <i>Mimosa pudica</i> L., <i>Phyllanthus debilis</i>, <i>Mikania cordata</i> (Burm. f.) B.L. Rob., <i>Caesalpinia latisiliquum</i>, <i>Tridax procumbens</i></p> |
| 10       | N 10°53'47.03"<br>E124°26'32.73" | 26               | <p><b>Shrub species:</b> <i>Leea philippinensis.</i>, <i>Solanum torvum.</i>, <i>Cocos nucifera</i> L., <i>Mimosa pudica</i> L., <i>Callicarpa formosana</i> Rolf</p> <p><b>Tree species:</b> <i>Sweitenia macrophylla</i>, <i>Trema orientalis</i> (L.) Blume, <i>Macaranga tanarius</i> (L.) Muell.-Arg. <i>Morinda citrifolia</i> L., <i>Ficus septica</i> Burm. f. Some planted seedlings of Molave (<i>Vitex parviflora</i> Juss).</p> <p><b>Herbaceous layer:</b> <i>Centrosema pubescens</i>, <i>Alysicarpus</i> sp., <i>Mimosa pudica</i> L., <i>Phyllanthus debilis</i>, <i>Mikania cordata</i> (Burm. f.) B.L. Rob., <i>Caesalpinia latisiliquum</i>, <i>Tridax procumbens</i></p>  |

\*\* Profile/Information regarding the plant/vegetation composition of each plots.

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**Figure 2-20. Location of different sampling plots for the plant diversity assessment**

Information gathered in the field were tabulated and analyzed to characterize floral composition within the study area. The relative density, relative dominance and relative frequency values for each tree species were determined to obtain their Importance Value (IV), which is the standard measurement in forest ecology to determine the rank relationships of species. Also, the relative frequency, relative density and relative dominance indicate different aspects of the species importance in a community. Importance values were determined using the following formula:

|                    |   |  |
|--------------------|---|--|
| Density            | = | $\frac{\text{number of individuals}}{\text{area sampled}}$                                       |
| Relative Density   | = | $\frac{\text{density for a species}}{\text{total density for all species}} \times 100$           |
| Frequency          | = | $\frac{\text{number of plots in which species occur}}{\text{total number of plots sampled}}$     |
| Relative Frequency | = | $\frac{\text{frequency value for a species}}{\text{total frequency for all species}} \times 100$ |
| Dominance          | = | $\frac{\text{basal area or volume for a species}}{\text{area sampled}}$                          |
| Relative Dominance | = | $\frac{\text{dominance for a species}}{\text{total dominance for all species}} \times 100$       |
| Importance Value   | = | Relative Density + Relative Frequency + Relative Dominance                                       |

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Diversity indices (Shannon, Simpson's and Evenness) for each sampling quadrats were generated using Paleontological Statistical software package for education and data analysis (PAST version 3.12). Moreover, endemism and ecological status of the different species were assessed to determine the ecological importance of the vegetation in the area. Plant classification followed the latest Angiosperm Phylogeny Group classification (APG IV, 2016) while the common names adapted that of Rojo (1998).

The proposed Project site is generally a remnant of secondary growth vegetation. It comprises a dense vegetation from small patch of grassland to tree and shrub vegetation representing different stages of recovery from the previous and present human disturbances. Moreover, some sections of the area is predominantly a second growth vegetation with a less proportion (5%) being a forest while the remaining vegetation are man-made from a long history of reforestation activities.

The vegetation area in the proposed Project site can be classified as distributed brush land vegetation. There are no significant residual secondary forest growths in the area, although several tree species (both naturally grown and planted) proliferate throughout. The dense vegetation inside the proposed Project site were actually dominated by the species of Ipil-Ipil (*L. leucocephala*) which is small fast-growing mimosoid tree native to southern Mexico and northern Central America (Belize and Guatemala) and is now naturalized throughout the tropics. Vegetation on the site is generally low in species richness and plant cover because of the dominance of Ipil-Ipil as dense tree cover in almost all sections in the area. However, in terms of understorey species, the area is covered with many colonizers and invasive species such as shrubs, creeping leguminous vines and herbaceous plants from the family Fabaceae, Asteraceae, Verbenaceae, Urticaceae and Poaceae (**Plate 2-1**). Many of these species are early colonizers which begin soil stabilization. Seed production is typically high as the majority of these species are dispersed by prolific seeds, rhizomes or stolons. Though undocumented, seed dispersal is primarily by wind and soil transport (piling and stacking due to earthwork activities).

In terms of ground cover, majority of the species are represented by the family of Asteraceae such as *Tridax procumbens*, *Mikania cordata*, *Chromolaena odorata* and some individuals of *Wedelia trilobata*. Other leguminous ground cover species include *Caesalpinia latisiliquum*, *Mimosa pudica*, *Centrosema pubescens* and *Mucuna pruriens*. Ground cover is dense in open areas especially in areas where soil are piled due to excavation and left undisturbed for a long period of time.



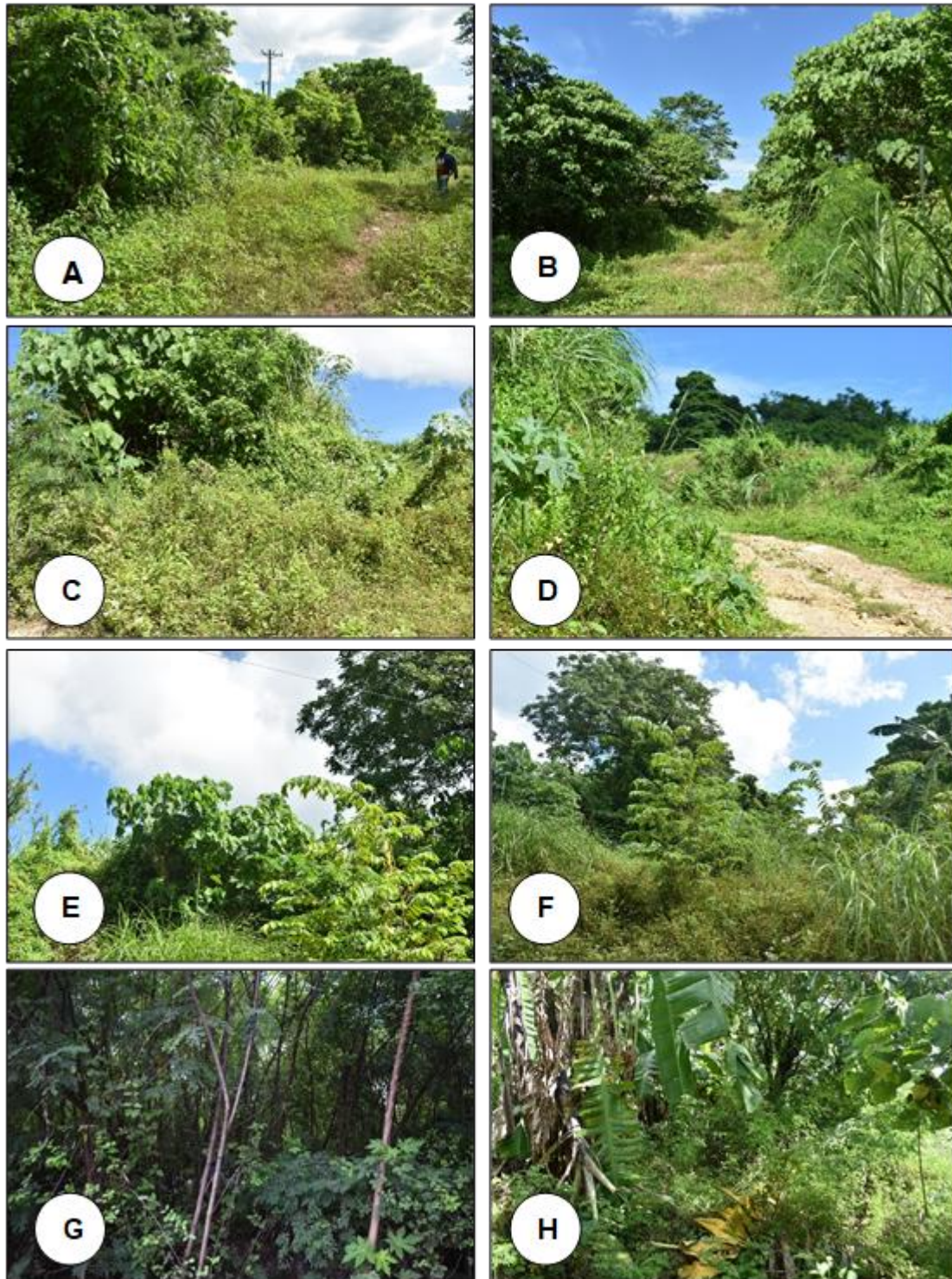


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Note: (a) Plot 5 with dominant species *Euphorbia atoto* and *Mimosa pudica* for ground cover; (b) Vegetation near the entrance of the site; (c) Dense vegetation of *C. odorata*; (d) *Ricinus communis* shrub species along roadside; (e) Dominant trees of Anabiong (*T. orientalis*) in P4; (f) Talahib (*Sacharrum spontaenum*) dominated (P6); (g) Dense stand of young saplings of Ipil-Ipil (*L. leucocephala*); (h) *Musa sp.* dominated plot 3 in the upper section of the site.

**Plate 2-1. Dense Vegetation Inside the Proposed Project Site**



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A total of 71 morpho-species from 64 genera belonging to 31 families were recorded from the ten (10) sampling plots (including the opportunistic sampling) surveyed. The study area was dominated by Fabaceae, Malvaceae, Cannabaceae, Asteraceae, Burseraceae, Lamiaceae and Euphorbiaceae. The most frequently occurring species were *Leucaena leucocephala*, *Macaranga tanarius*, *Melanolepis multiglandulosa*, *Gmelina arborea*, *Garuga floribunda* and *Trema orientalis*. The aforementioned species were present in all transects except for the *Sterculia ceramica* R.Br. from the family Malvaceae and Molave (*Vitex parviflora* Juss) of the family Lamiaceae.



**Plate 2-2 Photos of the Proposed Project Site Showing the Dense Stands of Ipil-Ipil, Anabiong and Binunga Tree and Grass Patches.**

The dominance of pioneer tree species in the area is due to the degradation and exposure of the environment to extreme sunlight. These triggers opportunistic and light demanding species to grow faster than neighboring plant species. The high presence of these pioneer species is a bit unexpected but can be explained by the high environmental heterogeneity of the site compared in other sections of the study area in early successional stages. Some individual trees of *Gmelina* (*G. arborea*) sprouts from mature trunks, while strong disturbances (like clearing and site preparation) allow light demanding pioneer species to recruit and establish, thus increasing the number of species as observed in the area. With ongoing succession, some of the original vegetation remnants are disappearing, in part due to environmental stress and to losing out in light competition with early succession species, which causes a decline in species diversity. At the same time, the light demanding pioneer species are already establishing cover in disturbed sections of the study area.

Other plant and tree species documented in the area are closed from young to mature stage and been able to regenerate quickly after disturbance, by maximizing the coexistence of fast growing pioneers and more competitive ground cover species. However, the disturbance intensity of site preparation in relation to habitat fragmentation and loss use may be too high for fast regeneration dynamics. The re-establishment of the vegetation species is a slow process, which demands longer time periods.

The construction of the proposed Project will not cause more biodiversity losses as these have already been developed.

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However, unavoidable impacts on the surrounding flora and fauna due to dust generation will be expected during preconstruction and construction phase of the proposed Project. Dust will be generated as delivery vehicles transport the construction materials into the site. The dust will cover the leaves of vegetation and may stress the plants thus, affecting the photosynthetic activity of the plants.

In order to minimize the generation of dust during construction phase, delivery trucks carrying loose materials such as sand and gravel as well as filling materials will be covered. The speed of vehicles shall be reduced and watering of road network during dry periods shall be undertaken.

IASCL is also committed to establish a buffer zone to reduce air pollution that may be emitted within the Project site. In line with the National Greening Program of DENR and to partially offset carbon emission, IASCL shall carry out a reforestation program in coordination with the LGUs. Additionally, native species shall be used for revegetation, as these would be expected to have good survival rate.

### 2.1.4.2 Threat to Existence and/or Loss of Important Local Species

Only five (5) Philippine endemic plant species were found in the proposed Project site (**Table 2-5**). Eighty four percent (84%) of the total number of species are indigenous to the Philippines and exhibit different economic and ecological importance. These species are represented by different general plant forms such as trees, vines, herbs and shrubs.

There were 12 exotic/alien invasive species that were observed in the proposed Project site. These species have negative effects in terms of maintaining local biodiversity in the area as they can grow individually in clump or as dense thickets, crowding out more desirable species. Coronitas (*L. camara*) and Gono (i.e. *C. odorata*) have allelopathic qualities that can reduce vigor of nearby plant species and reduce their productivity (GISD, 2006). **Plate 2-3** presents the photos of some exotic species observed in the proposed Project site.

**Table 2-5. List of Flora Species and Endemicity**

| Family Name       | Species  | Local Name    | Endemicity/<br>Indigenous/<br>Exotic |
|-------------------|--|---------------|--------------------------------------|
| 1. ANACARDIACEAE  | 1. <i>Buchanania arborescens</i> (Blume) Blume                     | Balinghasai   | Indigenous                           |
|                   | 2. <i>*Mangifera indica</i> L.                                     | Mangga        | Exotic                               |
|                   | 3. <i>Semecarpus cuneiformis</i> Blanco                            | Ligas         | Indigenous                           |
| 2. APOCYNACEAE    | 4. <i>Voacanga globosa</i> (Blanco) Merr.                          | Bayag Usa     | Indigenous                           |
| 3. ARACEAE        | 5. <i>Rhapidophora pinnata</i> (L.) Schott                         | Tibatib       | Indigenous                           |
|                   | 6. <i>Xanthosoma violaceum</i> Schott                              | Yautia        | Indigenous                           |
| 4. ARECACEAE      | 7. <i>Caryota rumphiana</i> Mart. var. <i>philippinensis</i> Becc. | Takipan       | Indigenous/<br>Endemic               |
|                   | 8. <i>Cocos nucifera</i> L.  | Niyog         |                                      |
| 5. ASTERACEAE     | 9. <i>*Chromolaena odorata</i> (L.) R.M. King & H. Rob.            | Gono/ Hagonoy | Exotic                               |
|                   | 10. <i>Mikania cordata</i> (Burm. f.) B.L. Rob.                    | Uoko          |                                      |
|                   | 11. <i>Tridax procumbens</i>                                       |               |                                      |
| 6. BURSERACEAE    | 12. <i>Canarium ovatum</i> Engl.                                   | Pili          | Indigenous/<br>Endemic               |
|                   | 13. <i>Garuga floribunda</i> Decne                                 | Bogo          | Indigenous                           |
| 7. CANNABACEAE    | 14. <i>Trema orientalis</i> (L.) Blume                             | Anabiong      | Indigenous                           |
| 8. CARICACEAE     | 15. <i>Carica papaya</i>   | Papaya        |                                      |
| 9. CONVULVULACEAE | 16. <i>Merremia vitifolia</i> (Burm. f.) Hall. f.                  | Kalalaknit    | Indigenous                           |

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| Family Name          | Species   | Local Name       | Endemicity/<br>Indigenous/<br>Exotic |
|----------------------|---|------------------|--------------------------------------|
| 10. CORNACEAE        | 17. <i>Alangium javanicum</i> (Blume) Wangerin                              | Putian           | Indigenous                           |
| 11. CUCURBITACEAE    | 18. <i>Momordica sp.</i>  | Ampalayang ligaw |                                      |
| 12. DIOSCOREACEAE    | 19. <i>Dioscorea sp.</i>  |                  |                                      |
| 13. EUPHORBIACEAE    | 20. <i>Melanolepis multiglandulosa</i> (Reinw. Ex Blume) Reichb. f. & Zoll. | Alim             | Indigenous                           |
|                      | 21. <i>Euphorbia atoto</i> G. Forst.  | Lamingo          | Indigenous                           |
|                      | 22. <i>Euphorbia heterophylla</i> (L.)                                      | Pintado          | Indigenous                           |
|                      | 23. <i>Euphorbia hirta</i>  | Tawa-Tawa        |                                      |
|                      | 24. <i>Macaranga tanarius</i> (L.) Muell.-Arg.                              | Binunga          | Indigenous                           |
|                      | 25. <i>Ricinus communis</i>   | Tangan-tangan    | Indigenous                           |
|                      | 26. <i>Mallotus philippensis</i> (Lamk) Muell.-Arg.                         | Banato           | Indigenous                           |
| 14. FABACEAE         | 27. <i>Alysicarpus sp.</i>  |                  |                                      |
|                      | 28. <i>Caesalpinia latisiliquum</i> (Cav.) Hattink                          | Kamot-kabag      | Indigenous                           |
|                      | 29. <i>Caesalpinia nuga</i> (L.) Ait.                                       | Sapinit          | Indigenous                           |
|                      | 30. * <i>Centrosema pubescens</i> Benth.                                    | Dilang butiki    | Exotic                               |
|                      | 31. * <i>Gliricidia sepium</i> (Jacq.) Kunth ex Walp                        | Kakaute          | Exotic                               |
|                      | 32. * <i>Mimosa pudica</i> L.   | Makahiya         | Exotic                               |
|                      | 33. <i>Mucuna pruriens</i> (L.) DC  | Anipay           | Indigenous                           |
|                      | 34. <i>Leucaena leucocephala</i> (Lam.) de Wit                              | Ipil-Ipil        | Indigenous                           |
|                      | 35. * <i>Samanea saman</i> (Jacq.) Merr.                                    | Rain tree        | Exotic                               |
| 15. FLAGELLARIACEAE  | 36. <i>Flagellaria indica</i> L.  | Baling-uai       | Indigenous                           |
| 16. LAMIACEAE        | 37. <i>Callicarpa formosana</i> Rolfe                                       | Tambabasi        | Indigenous                           |
|                      | 38. * <i>Gmelina arborea</i> Roxb.  | Gmelina          | Exotic                               |
|                      | 39. <i>Vitex parviflora</i> Juss.   | Molave           | Indigenous                           |
| 17. LAURACEAE        | 40. <i>Litsea glutinosa</i> (Lour.) C.B. Rob.                               | Sablot           | Indigenous                           |
|                      | 41. * <i>Persea gratissima</i> Gaertn.                                      | Avocado          | Exotic                               |
| 18. LOMARIOPSIDACEAE | 42. <i>Nephrolepis biserrata</i> (Sw.) Schott                               | Pakong Kalabaw   | Indigenous                           |
| 19. MALVACEAE        | 43. <i>Abutilon theophrasti</i> Medik.                                      |                  |                                      |
|                      | 44. <i>Hibiscus spp.</i>  |                  |                                      |
|                      | 45. <i>Pterospermum diversifolium</i> Blume                                 | Bayok            | Indigenous                           |
|                      | 46. <i>Sterculia ceramica</i> R.Br.   | Malakalumpang    | Indigenous                           |
|                      | 47. <i>Triumfetta rhombioides</i> Jacq.                                     | Kulot-kulotan    |                                      |
|                      | 48. <i>Urena lobata</i> L.  | Kulot-Kulot      |                                      |
| 20. MELIACEAE        | 49. <i>Dysoxylum gaudichaudianum</i> (A. Juss.) Miq.                        | Igyo             | Indigenous                           |
|                      | 50. <i>Sandoricum koetjape</i> (Burm. f.) Merr.                             | Santol           | Indigenous                           |
| 21. MORACEAE         | 51. <i>Artocarpus Blancoi</i> (Elmer) Merr.                                 | Antipolo         | Indigenous/<br>Endemic               |
|                      | 52. <i>Ficus ampelas</i> Burm. f.   | Upling gubat     | Indigenous                           |
|                      | 53. <i>Ficus pseudopalma</i> Blanco   | Niyog-Niyogan    | Indigenous/<br>Endemic               |





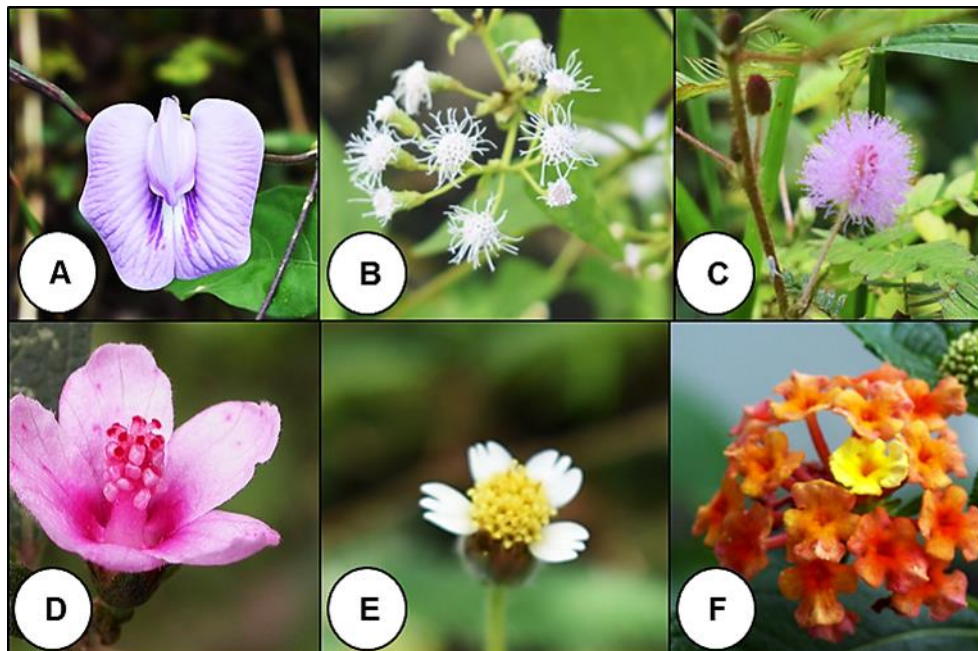
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| Family Name        | Species  | Local Name        | Endemicity/<br>Indigenous/<br>Exotic |
|--------------------|--|-------------------|--------------------------------------|
|                    | 54. <i>Ficus septica</i> Burm. f.                        | Hauili            | Indigenous                           |
|                    | 55. <i>Ficus variegata</i> Blume                         | Tangisang-bayawak | Indigenous                           |
|                    | 56. <i>Ficus subcordata</i> Blume                        | Marabotum         | Indigenous                           |
| 22. MUNTIGIACEAE   | 57. * <i>Muntigia calabura</i> L.                        | Datiles           | Exotic                               |
| 23. MUSACEAE       | 58. <i>Musa acuminata</i> Colla                          | Saging matsing    | Indigenous                           |
| 24. MYRTACEAE      | 59. * <i>Psidium guajava</i> L.                          | Guava             | Exotic                               |
| 25. PASSIFLORACEAE | 60. * <i>Passiflora foetida</i> L.                       | Karunggut         | Exotic                               |
| 26. PHYLLANTACEAE  | 61. <i>Breynia vitis-idaea</i>                           | Matanghipon       | Indigenous                           |
|                    | 62. <i>Phyllanthus debilis</i> Klein ex Willd            | Sampa-sampalukan  | Indigenous                           |
| 27. POACEAE        | 63. <i>Bambusa vulgaris</i> Schrad.                      | Kawayan kiling    | Indigenous                           |
|                    | 64. <i>Imperata cylindrica</i> (L.) Beauv.               | Cogon             |                                      |
| 28. RUBIACEAE      | 65. <i>Morinda citrifolia</i> L.                         | Bangkoro          | Indigenous                           |
| 29. RUTACEAE       | 66. <i>Micromelum minutum</i> (J.G. Forster) Wight & Arn | Tulibas tilos     | Indigenous                           |
| 30. SOLANACEAE     | 67. <i>Solanum torvum</i> Sw.                            | Talong-talungan   |                                      |
| 31. URTICACEAE     | 68. <i>Pipturus arborescens</i> (Link) C.B. Rob.         | Dalunot           | Indigenous                           |
| 32. VERBENACEAE    | 69. * <i>Lantana camara</i> L.                           | Coronitas         | Exotic                               |
|                    | 70. <i>Stachytarpetta jamaicensis</i>                    | Kandilaan         |                                      |
| 33. VITACEAE       | 71. <i>Leea philippinensis</i> Merr.                     | Kaliantan         | Indigenous/<br>Endemic               |



Note: a) Dilang butiki (*Centrosema pubescens* Benth); (b) Hagonoy (*Chromolaena odorata* (L.) R.M. King & H. Rob.); (c) Makahiya (*Mimosa pudica* L.); (d) Kulot-Kulot (*Urena lobata* L.); (e) *Tridax procumbens*; (f) Coronitas (*Lantana camara* L.)

**Plate 2-3. Photographs of Some Exotic Species at the Proposed Project Site**



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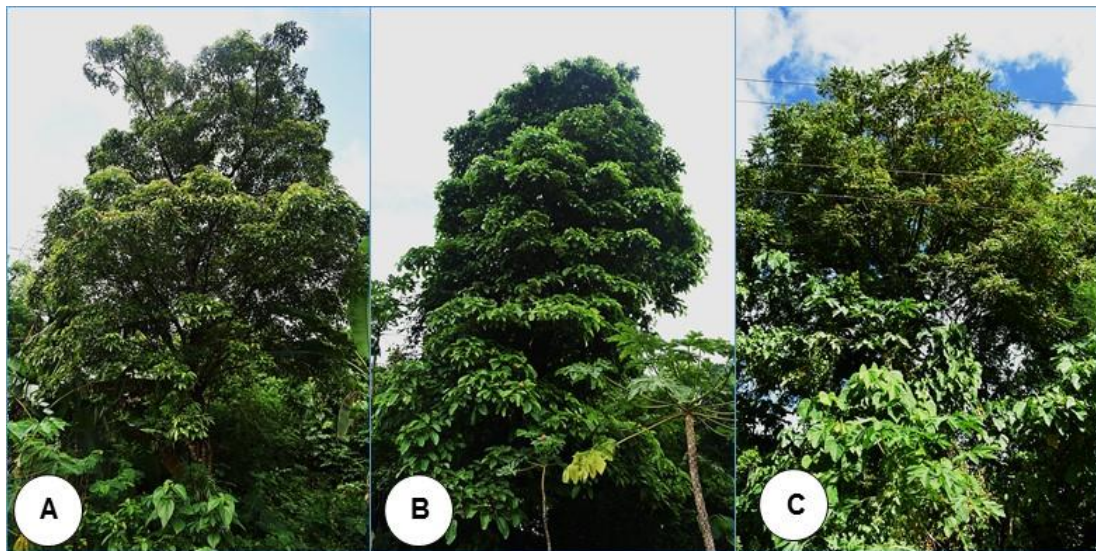
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Among the species recorded at the proposed Project site, Molave is the only species listed as Endangered Species (**EN**) under IUCN Red List of Threatened Species (IUCN 2015-3) and as Vulnerable Species (**VU**) under DAO 2007-01, The National List of Threatened Philippine Plants and their Categories.

### 2.1.4.3 Threat to Abundance, Frequency and Distribution of Important Species

A total of 23 tree species with 178 individuals were recorded to have a dbh of more than 10 cm (**Plate 2-4**). The average number of trees per quadrat (20m x 20m) is about six (6) individuals or an average density of 0.015 tree/m<sup>2</sup> (1 tree for every 100 m<sup>2</sup>). This is very low than the normal average stocking density of a second growth vegetation which is .05 tree/m<sup>2</sup> (5 tree for every 100m<sup>2</sup>). The lower tree density of the quadrats can be attributed to the disturbance and land use of the area. Most sections surveyed are in the early advanced stage of vegetation succession characterized by the dominance of medium-sized trees. The trees with the largest diameter are Rain tree (*Samanea saman*), Molave (*Vitex parviflora*), Gmelina (*Gmelina arborea*), Bogo (*Garuga floribunda*), Alim (*Melanolepis multiglandulosa*), Ipil-Ipil (*Leucaena leucocephala*), Binunga (*Macaranga tanarius*), and Anabiong (*Trema orientalis*).



Note: (a) Molave (*Vitex parviflora* Juss) LAMIACEAE; (b) Malakalumpang (*Sterculia ceramica* R.Br.) MALVACEAE; (c) Bogo (*Garuga floribunda* Decne) BURSERACEAE

**Plate 2-4. Some of the Notable and Important Tree Species Recorded at the Study Area**

The average diameter size of all tree species with greater than 10 cm is 17.06 cm which indicates that the area is in the early stage of vegetation succession. These trees are located along constructed roads and within the dense vegetation inside the study area. Some trees were observed to be coppicing such as Gmelina (*Gmelina arborea*) and Datiles (*Muntigia calabura*) as a result of partial cutting due to road construction and other site preparation activities.

The relative density, relative dominance and relative frequency values for each tree species in all the quadrats were determined to obtain their Importance Value (IV), a standard measure in ecology that determines the rank relationships of species. High Importance values of species indicate a composite score for high relative species dominance, density and frequency. Based on the computed IV (Table 2), the three most important species (with the highest IV) are Bogo (52.312), Gmelina (20.136), and Molave (18.509). It is interesting to note that one of the tree species such as Molave is listed as threatened species yet it is one of the dominating native tree species in the project site. This imply a conservation value of the tree species as well as other notable tree species in the study area.

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Table 2-6. Top 10 Species with the Highest Importance Value

| Scientific Name   | Common Name | Family Name   | IV     |
|---|-------------|---------------|--------|
| <i>Garuga floribunda</i> Decne  | Bogo        | BURSERACEAE   | 52.312 |
| <i>Gmelina arborea</i> Roxb.  | Gmelina     | LAMIACEAE     | 20.136 |
| <i>Vitex parviflora</i> Juss.   | Molave      | LAMIACEAE     | 18.509 |
| <i>Trema orientalis</i> (L.) Blume                                      | Anabiong    | CANNABACEAE   | 11.322 |
| <i>Melanolepis multiglandulosa</i> (Reinw. Ex Blume) Reichb. f. & Zoll. | Alim        | EUPHORBIACEAE | 7.959  |
| <i>Leucaena leucocephala</i> (Lam.) de Wit                              | Ipil-Ipil   | FABACEAE      | 7.214  |
| <i>Macaranga tanarius</i> (L.) Muell.-Arg.                              | Binunga     | EUPHORBIACEAE | 6.049  |
| <i>Samanea saman</i> (Jacq.) Merr.                                      | Rain tree   | FABACEAE      | 6.000  |
| <i>Artocarpus blancoi</i> (Elmer) Merr.                                 | Antipolo    | MORACEAE      | 5.176  |
| <i>Muntigia calabura</i> L.   | Datiles     | MUNTINGIACEAE | 5.121  |

\*\*Note: RF – Relative frequency; RDen – Relative density; RDom – Relative dominance

\* IV – Importance Value

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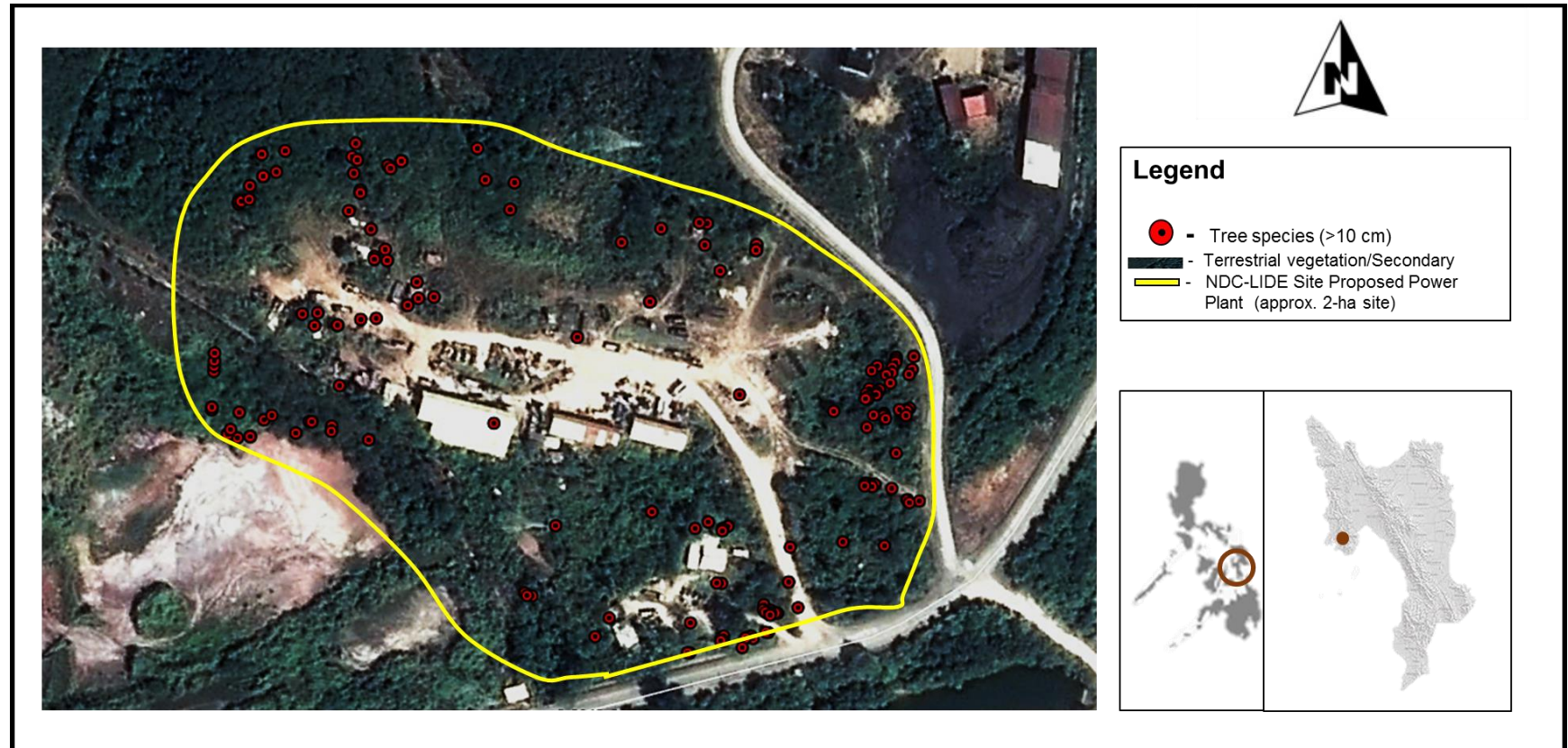


Figure 2-21. Map of the geo-tagged trees with dbh > 10 cm in the proposed Project



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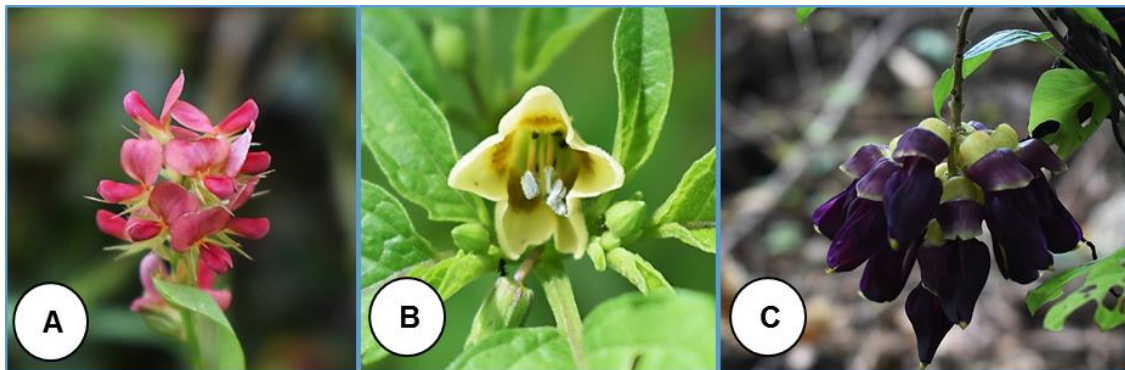
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A total of 542 individuals belonging to 34 species were recorded for intermediate and understorey species. The average density is slightly higher than that of trees, at 0.72 individual/m<sup>2</sup> or equivalent to 72 individuals for every 100m<sup>2</sup>. The two most abundant understorey species are Ipil-Ipil (*L. leucocephala*) with 41 individuals and Binunga (*Macaranga tanarius*) with 34. Both species are native species which confirm attention for conservation of trees in the area for ecosystem services. Table 3 shows the top understorey species in terms of abundance.

Table 2-7. Top 10 most abundant understorey species

| Scientific Name   | Common Name  | Family Name   | Total Count |
|---|--------------|---------------|-------------|
| <i>Leucaena leucocephala</i> (Lam.) de Wit                              | Ipil-Ipil    | FABACEAE      | 41          |
| <i>Macaranga tanarius</i> (L.) Muell.-Arg.                              | Binunga      | EUPHORBIACEAE | 34          |
| <i>Pipturus arborescens</i> (Link) C.B. Rob.                            | Dalunot      | URTICACEAE    | 22          |
| <i>Lantana camara</i> L.  | Coronitas    | VERBENACEAE   | 14          |
| <i>Gmelina arborea</i> Roxb.  | Gmelina      | LAMIACEAE     | 13          |
| <i>Melanolepis multiglandulosa</i> (Reinw. Ex Blume) Reichb. f. & Zoll. | Alim         | EUPHORBIACEAE | 13          |
| <i>Litsea glutinosa</i> (Lour.)C.B. Rob.                                | Sablot       | LAURACEAE     | 11          |
| <i>Muntigia calabura</i> L.   | Datiles      | MUNTIGIACEAE  | 11          |
| <i>Semecarpus cuneiformis</i> Blanco                                    | Ligas        | ANACARDIACEAE | 11          |
| <i>Breynia vitis-idaea</i>  | Matang-hipon | PHYLLANTACEAE | 10          |

There are 10 ground cover species recorded from the thirty 1m x 1m quadrats. It must be noted that the ground cover species referred in this survey are all species (crawling or erect) inside the 1m x 1m quadrat with height of less than 1 meter. Hence, seedlings of different tree species are included as ground cover. This treatment gives us better understanding of the stand structure of the vegetation from the ground to the canopy. Based on the survey, forest litter occupies less than 32% of the vegetation floor leaving more growing spaces for the ground cover species, hence, low species diversity. The most dominant species that occupy the highest relative cover are Dilang butiki (*Centrosema pubescens*) (24.12%), Hagonoi (*Chromolaena odorata*) (23.25%), *Alysicarpus* sp.(23.22%) , Kamot-kabag (*Caesalpinia latisiliquum*) (23.21%), Ipil-Ipil (*Leucaena leucocephala*) (15.47%), and Lamingo (*Euphorbia atoto*) (4.86%).



Note: (a) *Alysicarpus* sp., FABACEAE; (b) Solanaceae species; (c) Anipay (*Mucuna pruriens*) FABACEAE, with flowers in bloom.

#### Plate 2-5. Other notable ground cover species present in the area with few individuals.

All ground cover species were identified into species level except for 1 species of Fabaceae which is identified to genus level (*Alysicarpus* sp.). Ground cover species are dominated with the families of Fabaceae, Verbenaceae, Poaceae and Asteraceae. These families are typical for ground cover plants that inhabit certain open spaces and degraded conditions. They are most favorable and can survive in dry areas. Dilang butiki (*Centrosema pubescens* Benth.), Hagonoy (*Chromolaena odorata*)



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(L.) R.M. King & H. Rob.) and Kamot kabag (*Caesalpinia latisiliquum* (Cav.) Hattink) are some of the dominant ground cover species in the project site. They are present in the whole study area especially in exposed soils along road sides and grass covered area.

**Table 2-8. Top 10 most dominant ground cover species.**

| Scientific Name                                     | Common Name       | Family Name   | Relative % Cover |
|---|-------------------|---------------|------------------|
| <i>Centrosema pubescens</i> Benth.                  | Dilang butiki     | FABACEAE      | 24.12            |
| <i>Chromolaena odorata</i> (L.) R.M. King & H. Rob. | Hagonoy/<br>Gonoi | ASTERACEAE    | 23.25            |
| <i>Alysicarpus</i> sp.                              |                   | FABACEAE      | 23.22            |
| <i>Caesalpinia latisiliquum</i> (Cav.) Hattink      | Kamot-kabag       | FABACEAE      | 23.21            |
| <i>Leucaena leucocephala</i> (Lam.) de Wit          | Ipil-Ipil         | FABACEAE      | 15.47            |
| <i>Euphorbia atoto</i> G. Forst.                    | Lamingo           | EUPHORBIACEAE | 14.86            |
| <i>Tridax procumbens</i>                            |                   | ASTERACEAE    | 13.65            |
| <i>Lantana camara</i> L.                            | Coronitas         | VERBENACEAE   | 3.65             |
| <i>Imperata cylindrica</i> (L.) Beauv.              | Cogon             | POACEAE       | 3.34             |
| <i>Mucuna pruriens</i>                              | Anipay            | FABACEAE      | 2.73             |

The diversity index of the area ranged from low to moderately low, while evenness indices varied from very low to low. Diversity indices were highest in the understorey and herbaceous layer. The vegetation in some of the sampling plots (P2, P3, P5) is considered as young secondary growth/early succession/pioneer vegetation where trees are not that dominant, which provides a more favorable environment for the growth of the intermediate and understorey layers including opportunistic species. Evenness index was low in the tree layer.

**Table 2-9** shows the species diversity per plot established in the whole project area which suggest introduction, disturbance and invasion. Consequently, the number of species per plot recorded in the survey coincide with the general trend that the disturbed areas are dominated with more understorey and ground cover species which are mostly opportunistic and light tolerant species.

**Table 2-9. Species diversity, dominant families and abundance per sampling plot**

| Sampling Plot | Number of Species (S) | Number of Individuals (N) | Dominant Plant Families   |
|---------------|-----------------------|---------------------------|---|
| P1            | 9                     | 64                        | Asteraceae, Fabaceae, Verbenaceae, Lamiaceae, Malvaceae, Euphorbiaceae, Meliaceae, Moraceae, Cannabaceae    |
| P2            | 9                     | 66                        | Poaceae, Fabaceae, Verbenaceae, Lamiaceae, Malvaceae, Euphorbiaceae, Meliaceae, Moraceae, Cannabaceae       |
| P3            | 7                     | 82                        | Moraceae, Verbenaceae, Lamiaceae, Euphorbiaceae, Muntigiaceae, Asteraceae, Cannabaceae                      |
| P4            | 8                     | 56                        | Fabaceae, Verbenaceae, Lamiaceae, Malvaceae, Euphorbiaceae, Meliaceae, Arecaceae, Poaceae, Asteraceae       |
| P5            | 10                    | 72                        | Euphorbiaceae, Asteraceae, Fabaceae, Verbenaceae, Lamiaceae, Malvaceae, Burseraceae, Cannabaceae, Arecaceae |
| *P6           | 7                     | 55                        | Euphorbiaceae, Muntigiaceae, Moraceae, Fabaceae, Lamiaceae, Araceae, Musaceae, Asteraceae, Cannabaceae      |

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| Sampling Plot | Number of Species (S) | Number of Individuals (N) | Dominant Plant Families   |
|---------------|-----------------------|---------------------------|---|
| *P7           | 7                     | 56                        | Euphorbiaceae, Muntingiaceae, Moraceae, Lamiaceae, Araceae, Musaceae, Asteraceae, Cannabaceae           |
| *P8           | 3                     | 61                        | Muntingiaceae, Moraceae, Fabaceae, Lamiaceae, Araceae, Musaceae, Asteraceae, Cannabaceae, Euphorbiaceae |
| *P9           | 2                     | 57                        | Fabaceae, Moraceae, Verbenaceae, Lamiaceae, Euphorbiaceae, Muntingiaceae, Asteraceae, Cannabaceae       |
| *P10          | 9                     | 59                        | Fabaceae, Poaceae, Cannabaceae, Euphorbiaceae and Lamiaceae   |
| <b>Total</b>  | <b>71</b>             | <b>628</b>                |   |

\*\* Inner and Outer areas of the project site

Based on the diversity classification range developed by Fernando *et al.* (1996), most of the sampling plots has low diversity (**Table 2-10**). The low diversity for a 20m x 20m quadrat is expected in any disturbed environment or vegetation per se due to disruption of the biological as well as physical environment such as exposed soils, extreme heat and land use conversion. Sampling plot 1, 2, 3 and 4 are considered to be low in diversity. Transect plot 5 obtained the highest value (0.579) while plot 8 and 9 with a single species got the lowest Shannon index of zero (0). The number of species present in each quadrat was primarily the reason for very low/low value of Shannon index.

Ten (10) species were recorded in plot 5 and only three (3) species was recorded in plot 8. Similarly, plot 9 had the lowest value of Simpson index. Transect plot 8 and 9, a dense vegetation of *Ipil-ipil* and *Datiles* along with other plant and tree species composed of *M. multiglandulosa* obtained the second lowest value of Shannon and Simpson index. Plot 5 obtained the highest value of Simpson index instead of plot 1. The over dominance of *M. tanarius* and *L. leucocephala* in plot 2 and 1 lowered its Simpson index. In terms of Evenness index, plot 5 had the highest value of 1.00 understandably because it contains a relatively more species.

**Table 2-10. Diversity indices and number of species and individuals for each plot**

| Sampling Plot No. | No. of species | No. of Individuals | Diversity Indices |       |       |
|-------------------|----------------|--------------------|-------------------|-------|-------|
|                   |                |                    | H'                | D'    | J'    |
| 1                 | 9              | 64                 | 0.323             | 0.680 | 0.890 |
| 2                 | 9              | 66                 | 0.304             | 0.130 | 0.432 |
| 3                 | 7              | 82                 | 0.197             | 0.670 | 0.645 |
| 4                 | 8              | 56                 | 0.344             | 0.671 | 0.832 |
| 5                 | 10             | 72                 | 0.579             | 0.010 | 1.001 |
| 6                 | 7              | 55                 | 0.196             | 0.361 | 0.543 |
| 7                 | 7              | 56                 | 0.159             | 0.456 | 0.623 |
| 8                 | 3              | 61                 | 0.091             | 0.332 | 0.734 |
| 9                 | 2              | 57                 | 0.128             | 0.609 | 0.532 |
| 10                | 9              | 59                 | 0.120             | 0.504 | 0.322 |

Note: H' – Shannon index; D = Simpson's index; J – Evenness index

**Diversity Index:** vh – very high (3.50 above), h – high (3.00 – 3.49), m – moderate (2.50 – 2.99), l – low (2.00 – 2.49), vl – very low (1.99 – below); **Evenness Index:** vh – very high (0.75 – 1.00), h – high (0.50 – 0.74), m – moderate (0.25 – 0.49), l – low (0.15 – 0.24), vl – very low (0.05 – 0.14).

The dense vegetation of *L. leucocephala* in general are represented by young saplings in the area. Such species has a diameter of less than 5 cm and with height of 3-4 meters which can be regarded as young stands. Figure 14 shows the dense young vegetation of *Ipil-ipil* (*Leucaena leucocephala*).

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**Plate 2-6. Dense vegetation of young Ipil-Ipil (*L. leucocephala*) stands in the upper section of the project site all throughout going to the nursery**

Based on the computed IV (**Table 2-11**), the three most important species (with the highest IV) are Bogo (*Garuga floribunda*), Anabiong (*Trema orientalis*), and Gmelina (*Gmelina arborea*). *G. floribunda* obtained more than 30% of the total importance values for all the species. It is number one in all the 3 values – relative frequency, relative density, and relative dominance.

**Table 2-11. Importance value of plant and tree species surveyed in the whole project area.**

| Species   | RF     | RD     | RDom   | IV     |
|---|--------|--------|--------|--------|
| <i>Garuga floribunda</i> Decne  | 11.966 | 18.980 | 30.881 | 61.827 |
| <i>Trema orientalis</i> (L.) Blume                                      | 7.692  | 12.606 | 17.307 | 37.606 |
| <i>Gmelina arborea</i> Roxb.  | 8.547  | 7.365  | 12.897 | 28.809 |
| <i>Vitex parviflora</i> Juss.   | 8.547  | 9.632  | 6.081  | 24.259 |
| <i>Leucaena leucocephala</i> (Lam.) de Wit                              | 6.838  | 6.374  | 11.037 | 24.249 |
| <i>Melanolepis multiglandulosa</i> (Reinw. Ex Blume) Reichb. f. & Zoll. | 9.402  | 6.374  | 5.770  | 21.545 |
| <i>Artocarpus blancoi</i> (Elmer) Merr.                                 | 6.838  | 5.949  | 7.211  | 19.998 |
| <i>Muntigia calabura</i> L.   | 8.547  | 5.099  | 0.780  | 14.427 |
| <i>Chromolaena odorata</i> (L.) R.M. King & H. Rob.                     | 2.564  | 6.374  | 4.350  | 13.288 |
| <i>Pipturus arborescens</i> (Link) C.B. Rob.                            | 5.128  | 4.533  | 0.982  | 10.643 |
| <i>Centrosema pubescens</i> Benth.                                      | 4.274  | 3.966  | 0.817  | 9.056  |
| <i>Caesalpinia latisiliquum</i> (Cav.) Hattink                          | 4.274  | 2.550  | 0.323  | 7.146  |
| <i>Imperata cylindrica</i> (L.) Beauv.                                  | 0.855  | 0.142  | 0.001  | 0.997  |

Note: RF – Relative frequency, RD – Relative density, RDom – Relative dominance

### 2.1.4.4 Threat to Vegetation in terms of the Conservation Status

The project site is within the LIDE, which is an industrial area. Therefore, there will be no threat to vegetation in terms of the conservation.

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## 2.1.4.5 Hindrance to Wildlife Access

There are no significant wildlife habitats or endangered species within the project site, except for some common domestic animals. The only natural habitat that could be considered significant to fauna is the brush land at the back of the study area.





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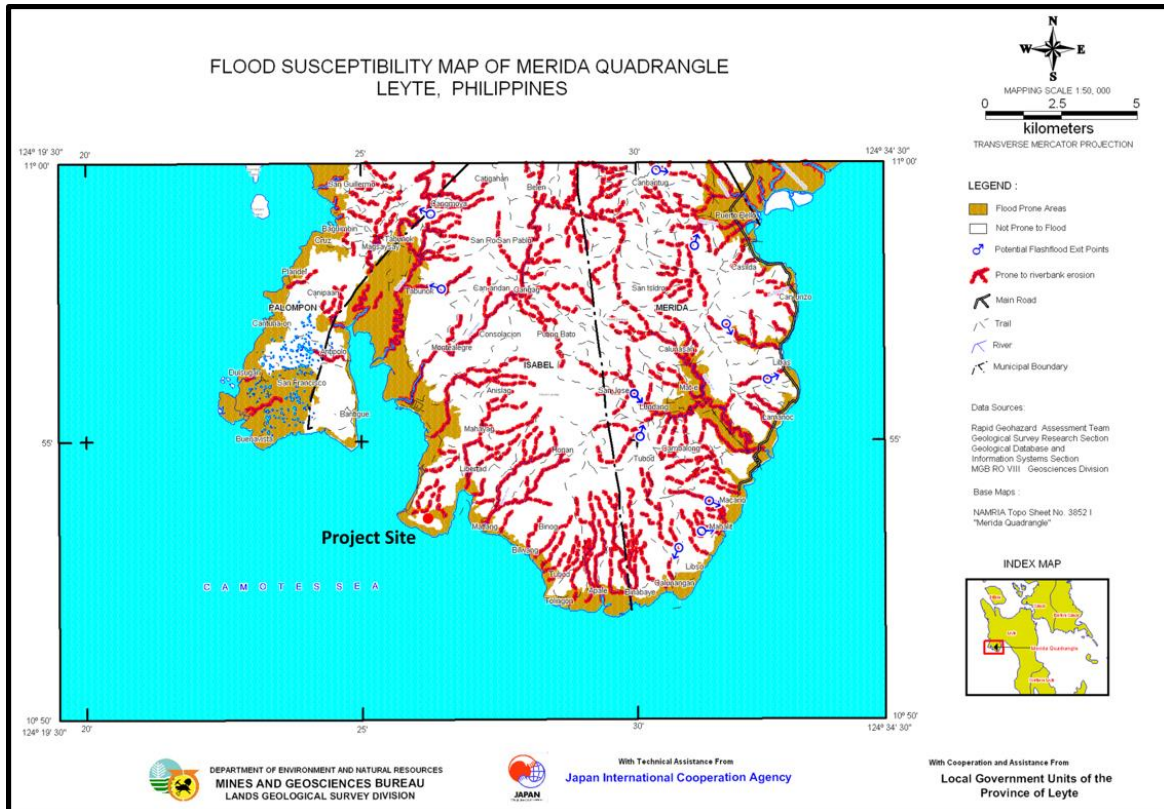
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### 2.2 WATER

#### 2.2.1 Hydrology/Hydrogeology

##### 2.2.1.1 Change in Drainage Morphology/Inducement of Flooding/Reduction in Stream Volumetric Flow

The Project Area is elevated and there are no rivers and creeks within its vicinity. Rainwater runoff from the proposed Project site drain into the sea. Thus, the project will not cause or contribute to flooding to neighboring areas. Moreover, the Flood Susceptibility Map of MGB shows that the project site is not prone to flooding (**Figure 2-22**).



Source: MGB

**Figure 2-22. Flood Susceptibility Map of the Merida Quadrangle**

##### 2.2.1.2 Change in Stream/Lake/Water Depth

The Project Area is elevated and there are no streams and lakes within its vicinity.

##### 2.2.1.3 Depletion of Water Resources/Competition in Water Use

Based on the 1997 Groundwater Availability Map of the Philippines presented in **Figure 2-23**, the area where the proposed Project is to be located fall under the classification "Fairly to Less Extensive and Productive Aquifers with Low to Moderate Potential Recharge".

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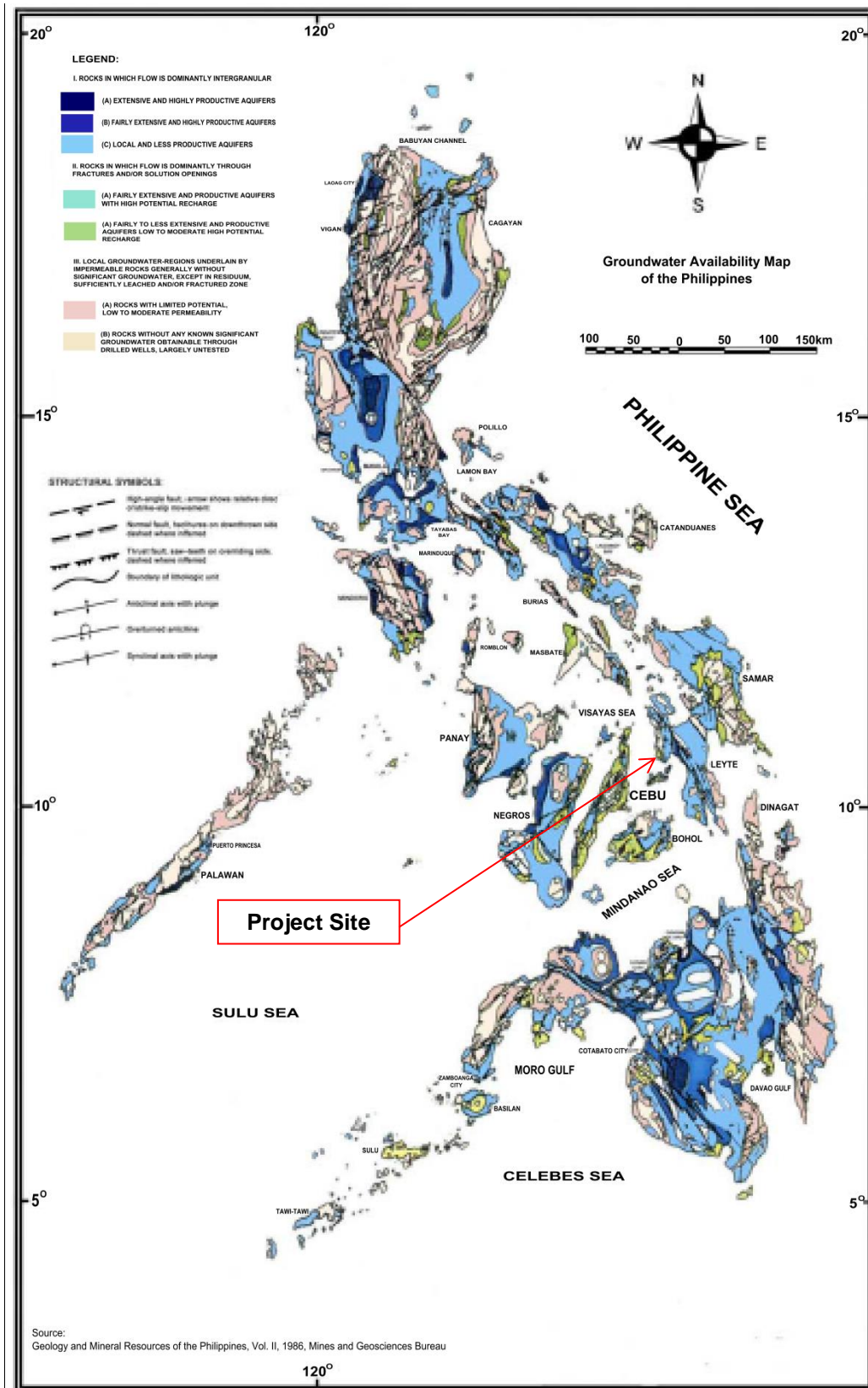


Figure 2-23. Groundwater Availability Map of the Philippines



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There will be no extraction of groundwater at the proposed Project site. The water requirement for the proposed Project will be sourced from the LMC Pumping Station located in Barangay Salvacion, Ormoc City. The facility consists of eight (8) deep well pumps with a capacity of 5,600m<sup>3</sup>/day per pump. There are two (2) back-up pumping stations at Tabunok and Matlang with a capacity of 4,300 m<sup>3</sup>/day and 3,700 m<sup>3</sup>/day, respectively. These pumping stations are reserved sources in case the Ormoc pumping station is not operational. LIDE has a 15,000m<sup>3</sup> storage tank capacity which is kept full for emergency purposes. IASCL shall implement necessary measures to conserve water and reduce water usage.

### 2.2.2 Water Quality

#### 2.2.2.1 Degradation of Coastal/Marine Water Quality

LIDE is bounded by the Dupon Bay at the west and Matlang Bay at the east. These two (2) bays form a peninsula with the Camotes Sea. Based on the DENR Memorandum Circular 2013-03 dated January 17, 2013, the surrounding body of water has been reclassified from Class SD to Class SC.

The marine water quality at the LIDE was described using the monitoring data from EMB-Region 8. The EMB-Region 8 monitored the marine water quality at ten (10) sampling stations presented in **Figure 2-24**.



Note: MW – Marine Water

Source: Google Earth modified by Geosphere, 2016

**Figure 2-24. Marine Water Quality Monitoring Stations**

The results of the analyses of marine water samples were described with reference to the standards for Class SC Waters set in DAO No. 2016-08. **Tables 2-12 to 2-17** show that the levels of Temperature, pH, and Dissolved Oxygen (**DO**) recorded in all sampling stations fall within the DENR Standards for Class SC Waters. The levels of Arsenic, Cadmium, Chromium Hexavalent, Copper, Lead and Mercury in all sampling stations also fall within the DENR Standard except for the level of Arsenic in Station MW6. The levels of Total Suspended Substance (**TSS**) in all sampling stations monitored in May and June 2017 are all within the DENR Standard except in Station MW1 during June 2017. Only Stations MW4, MW5 and MW6 have the levels of Fecal Coliform that are below the DENR Standard for the whole monitoring period.



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Due to the distance of the project site to the sea, the proposed Project is not expected to cause adverse impact the marine water.

**Table 2-12. Results of Temperature Monitoring by EMB Region 8 for Marine Water Quality**

| Station                  | Temperature (°C) |       |       |       |      |        |           |
|--------------------------|------------------|-------|-------|-------|------|--------|-----------|
|                          | February         | March | April | May   | June | August | September |
| MW1                      | 28.67            | 28.08 | 26.95 | 31.10 | 31.2 | 31.0   | 30.3      |
| MW2                      | 28.75            | 27.47 | 27.14 | 30.80 | 31.4 | 31.1   | 30.5      |
| MW3                      | 28.86            | 27.23 | 26.48 | 30.40 | 31.2 | 30.8   | 30.5      |
| MW4                      | 28.62            | 27.48 | 27.05 | 30.50 | 31.3 | 30.5   | 30.5      |
| MW5                      | 29.67            | 27.47 | 28.17 | 31.00 | 31.5 | 31.4   | 30.5      |
| MW6                      | 33.37            | 27.52 | 27.43 | 31.0  | 32.4 | 30.7   | 30.6      |
| MW7                      | 28.30            | 27.81 | 28.54 | 31.40 | 31.7 | 30.7   | 30.9      |
| MW8                      | 27.14            | 27.79 | 27.49 | 31.60 | 30.8 | 30.7   | 31.1      |
| MW9                      | 28.33            | 27.79 | 27.25 | 30.70 | 31.1 | 30.9   | 30.8      |
| MW10                     | 28.08            | 27.73 | 26.96 | 31.30 | 30.6 | 31.1   | 30.7      |
| DENR Standard (Class SC) | 25-31            |       |       |       |      |        |           |

Source: EMB Region 8

**Table 2-13. Results of pH Monitoring by EMB Region 8 for Marine Water Quality**

| Station                  | pH       |       |       |      |      |        |           |
|--------------------------|----------|-------|-------|------|------|--------|-----------|
|                          | February | March | April | May  | June | August | September |
| MW1                      | 7.66     | 8.26  | 7.96  | 8.03 | 8.09 | 8.25   | 8.26      |
| MW2                      | 7.67     | 8.12  | 7.99  | 8.03 | 8.09 | 8.30   | 8.26      |
| MW3                      | 7.69     | 8.13  | 7.86  | 8.05 | 8.09 | 8.33   | 8.34      |
| MW4                      | 7.70     | 8.25  | 7.98  | 8.05 | 8.10 | 8.34   | 8.33      |
| MW5                      | 7.72     | 8.26  | 8.01  | 8.05 | 8.09 | 8.36   | 8.38      |
| MW6                      | 7.68     | 8.26  | 8.02  | 8.05 | 8.05 | 8.37   | 8.39      |
| MW7                      | 7.72     | 8.16  | 7.00  | 8.06 | 7.59 | 7.76   | 8.38      |
| MW8                      | 7.23     | 8.18  | 7.82  | 8.04 | 8.02 | 7.89   | 8.34      |
| MW9                      | 7.58     | 8.16  | 7.89  | 8.04 | 8.06 | 8.27   | 8.37      |
| MW10                     | 7.71     | 8.12  | 7.98  | 7.98 | 8.02 | 8.35   | 8.39      |
| DENR Standard (Class SC) | 6.5-8.5  |       |       |      |      |        |           |

Source: EMB Region 8

**Table 2-14. Results of DO Monitoring by EMB Region 8 for Marine Water Quality**

| Station                  | DO (mg/L) |       |       |       |      |        |           |
|--------------------------|-----------|-------|-------|-------|------|--------|-----------|
|                          | February  | March | April | May   | June | August | September |
| MW1                      | 9.10      | 7.82  | 11.22 | 10.32 | 9.49 | 5.07   | 5.8       |
| MW2                      | 11.87     | 7.72  | 10.58 | 8.65  | 9.3  | 5.88   | 5.55      |
| MW3                      | 12.04     | 8.43  | 9.48  | 8.29  | 8.93 | 6.4    | 5.76      |
| MW4                      | 10.26     | 7.08  | 9.01  | 9.05  | 9.08 | 8.34   | 5.73      |
| MW5                      | 6.56      | 7.85  | 10.33 | 8.87  | 9.65 | 5.73   | 5.94      |
| MW6                      | 6.34      | 6.34  | 9.55  | 8.65  | 8.73 | 6.28   | 5.47      |
| MW7                      | 9.30      | 7.49  | 8.11  | 9.24  | 7.96 | 5.5    | 5.54      |
| MW8                      | 6.32      | 9.17  | 7.89  | 8.92  | 8.5  | 5.63   | 5.29      |
| MW9                      | 5.18      | 8.58  | 8.01  | 8.84  | 8.17 | 5.85   | 5.87      |
| MW10                     | 5.22      | 8.96  | 8.18  | 10.81 | 8.14 | 5.97   | 5.45      |
| DENR Standard (Class SC) | 5         |       |       |       |      |        |           |

Source: EMB Region 8



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**Table 2-15. Results of TSS Monitoring by EMB Region 8 for Marine Water Quality**

| Station                   | TSS (mg/L) |       |       |     |      |        |           |
|---------------------------|------------|-------|-------|-----|------|--------|-----------|
|                           | February   | March | April | May | June | August | September |
| MW1                       | 70         | 121   | 14    | 32  | 86   | 106    | 92        |
| MW2                       | 83         | 102   | 113   | 10  | 23   | 104    | 111       |
| MW3                       | 99         | 91    | 17    | 35  | 37   | 104    | 119       |
| MW4                       | 104        | 95    | 41    | 60  | 21   | 107    | 118       |
| MW5                       | 82         | 97    | 103   | 45  | 48   | 140    | 124       |
| MW6                       | 88         | 95    | 121   | 33  | 47   | 130    | 140       |
| MW7                       | 109        | 103   | 118   | 46  | 54   | 137    | 143       |
| MW8                       | 81         | 94    | 95    | 51  | 57   | 136    | 136       |
| MW9                       | 67         | 148   | 90    | 37  | 52   | 132    | 153       |
| MW10                      | 127        | 113   | 106   | 44  | 32   | 137    | 134       |
| DENR Standards (Class SC) | 80         |       |       |     |      |        |           |

Source: EMB Region 8

**Table 2-16. Results of Fecal Coliform Monitoring by EMB Region 8 for Marine Water Quality**

| Station                  | Fecal Coliform (mg/L) |       |       |     |      |        |           |
|--------------------------|-----------------------|-------|-------|-----|------|--------|-----------|
|                          | February              | March | April | May | June | August | September |
| MW1                      | 2600                  | 130   | 4900  | 39  | 2    | 17     | 4900      |
| MW2                      | 1300                  | 9.3   | 330   | 39  | <1.8 | 1.8    | 70        |
| MW3                      | <1.8                  | 130   | 790   | 27  | <1.8 | <1.8   | 7.8       |
| MW4                      | 7                     | 4.5   | 49    | 32  | <1.8 | <1.8   | 2         |
| MW5                      | 4.5                   | <1.8  | <1.8  | 39  | <1.8 | <1.8   | 1.8       |
| MW6                      | 23                    | <1.8  | 70    | 34  | <1.8 | <1.8   | 1.8       |
| MW7                      | 490                   | 2     | 790   | 33  | 330  | 460    | 2100      |
| MW8                      | 7900                  | 7.8   | 1300  | 39  | 7900 | 1700   | 2         |
| MW9                      | 79                    | 2     | 7900  | 70  | 490  | 3100   | 330       |
| MW10                     | 1100                  | 2     | 1100  | 46  | 7900 | 7.8    | 4         |
| DENR Standard (Class SC) | 200                   |       |       |     |      |        |           |

Source: EMB Region 8

**Table 2-17. Results of Heavy Metals Monitoring by EMB Region 8 for Marine Water Quality**

| Station                   | First Semester 2017 |         |                     |        |       |         |
|---------------------------|---------------------|---------|---------------------|--------|-------|---------|
|                           | Arsenic             | Cadmium | Chromium Hexavalent | Copper | Lead  | Mercury |
| MW1                       | 0.0013              | <0.002  | <0.01               | <0.01  | <0.01 | <0.0001 |
| MW2                       | 0.0019              | <0.002  | <0.01               | <0.01  | <0.01 | <0.0001 |
| MW3                       | 0.0017              | <0.002  | <0.01               | <0.01  | <0.01 | <0.0001 |
| MW4                       | 0.0027              | <0.002  | <0.01               | <0.01  | <0.01 | <0.0001 |
| MW5                       | 0.0197              | <0.002  | <0.01               | <0.01  | <0.01 | <0.0001 |
| MW6                       | 0.0221              | <0.002  | <0.01               | <0.01  | <0.01 | <0.0001 |
| MW7                       | <0.0001             | <0.002  | <0.01               | <0.01  | <0.01 | <0.0001 |
| MW8                       | <0.0001             | <0.002  | <0.01               | <0.01  | <0.01 | <0.0001 |
| MW9                       | 0.0005              | <0.002  | <0.01               | <0.01  | <0.01 | <0.0001 |
| MW10                      | <0.0001             | <0.002  | <0.01               | <0.01  | <0.01 | <0.0001 |
| DENR Standards (Class SC) | 0.02                | 0.005   | 0.05                | -      | 0.05  | 0.002   |

Source: EMB Region 8

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### 2.2.3 Marine Ecology

The marine ecology near the vicinity of the proposed Project was described using the data from PASAR Corporation. The marine ecology survey was conducted by PASAR Corporation through the Visayas State University Marine Biologist on August 17 and 24, 2013. The survey was conducted at four (4) monitoring stations established within the vicinity of PARAR Corporation, as described in **Table 2-18** and **Figure 2-25**.

**Table 2-18. Monitoring Stations of PASAR Corporation for Marine Ecology Survey**

| Station   | Description  | Coordinates |              |
|-----------|--|-------------|--------------|
|           |  | Latitude    | Longitude    |
| Station 1 | Fronting the mangroves along the Old Filipino-Japanese Bunkhouse | 10°53.22'N  | 124°26.428'E |
| Station 2 | Near the outfall of Settling Pond                                | 10°53.19'N  | 124°26.182'E |
| Station 3 | Inside the Fish Sanctuary  | 10°53.41'N  | 124°25.259'E |
| Station 4 | Near the Sludge Out-Loading Facility                             | 10°53.57'N  | 124°25.693'E |

Source: EPRMP, PASAR Corporation



**Figure 2-25. Marine Ecology Monitoring Stations of PASAR Corporation**

#### 2.2.3.1 Seagrass/Seaweeds

There were no seagrasses nor seaweeds found in the four (4) monitoring stations. During the survey, the substrate were observed to be sandy-rocky which were heavily covered with silts. The silts made the water column very turbid that could inhibit the growth of the macro-flora and macro-algae. Associated marine invertebrates were also rarely found in the sites being surveyed.

#### 2.2.3.2 Coral Reefs

The different lifeforms of microbenthic organisms, inclusive of corals and abiotic substrate components encountered along the transect line, were identified and their corresponding transition cover was recorded (**Table 2-19**). The percent cover of the different lifeforms and substrate were computed for the quantitative description of the community structure of the reef.

The coral reef was dominantly rock (72%) and sand (21%). Presence of dead corals (6%) indicate that live corals in the area was once growing. Live coral cover comprise 0.73% which indicate poor

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coral reef condition. Most of the living corals were juveniles (10cm) which indicate poor the potential restoration of corals.

**Table 2-19. Percent Cover of Corals and Other Resources in the Reefs**

| Station        | Dead Coral  | Live Coral  | Sand         | Rock         | Mud         |
|----------------|-------------|-------------|--------------|--------------|-------------|
| Station 1      | 350         | 70          | 1,730        | 2,850        | -           |
| Station 2      | 415         | 28          | 995          | 2,760        | -           |
| Station 3      | -           | -           | 110          | 4,090        | 20          |
| Station 4      | -           | -           | 40           | 10           | -           |
| <b>Total</b>   | <b>765</b>  | <b>98</b>   | <b>2,875</b> | <b>9,710</b> | <b>20</b>   |
| <b>% Cover</b> | <b>5.68</b> | <b>0.73</b> | <b>21.35</b> | <b>72.10</b> | <b>0.15</b> |

Source: EPRMP, PASAR Corporation



Source: EPRMP, PASAR Corporation

**Plate 2-7. Juveniles (10cm) of Massive (Porites) and Encrusting Growth Forms**

### 2.2.3.3 Fisheries

A total of 15 fish species belonging to eight families were found in which Labridae and Pomacentridae were the most abundant. Ninety-seven percent (97%) of all the species found in the area were non-target species (*i.e.*, not commercially important). The target species recorded include *Scolopsis ciliatus*, *Epinephelus* sp., and *Gymnothorax thyrsoideus*. Based on the study, PASAR coastal waters has an estimated average of 865 fishes per hectare. **Table 2-20** present the fish species found in the vicinity of the Pasar marine waters.

**Table 2-20. Fish Species Found in the Vicinity of the PASAR Marine Waters**

| Family     | Species                     | Local Name | Station |    |   |   |
|------------|-----------------------------|------------|---------|----|---|---|
|            |                             |            | 1       | 2  | 3 | 4 |
| Apogonidae | <i>Apogon</i> sp. 1         | moong      | 4       | 0  | 0 | 0 |
|            | <i>Apogon</i> sp. 2         | moong      | 20      | 0  | 0 | 0 |
| Blenniidae | <i>Blenniidae</i> sp. 1     | -          | 0       | 1  | 0 | 0 |
| Labridae   | <i>Halichoeres pictus</i>   | labayan    | 5       | 8  | 0 | 0 |
|            | <i>Halichoeres</i> sp.      | labayan    | 4       | 26 | 2 | 0 |
|            | Labridae sp. 1              | labayan    | 0       | 1  | 3 | 0 |
|            | <i>Labroides dimidiatus</i> | labayan    | 1       | 2  | 3 | 0 |

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| Family                      | Species                        | Local Name  | Station   |           |           |          |
|-----------------------------|--------------------------------|-------------|-----------|-----------|-----------|----------|
|                             |                                |             | 1         | 2         | 3         | 4        |
|                             | <i>Thalassoma lunare</i>       | labayan     | 6         | 12        | 18        | 0        |
| Muraenidae                  | <i>Gymnothorax thyrsoideus</i> | ubod        | 0         | 0         | 1         | 0        |
| Nemipteridae                | <i>Scolopsis ciliates</i>      | silay       | 0         | 2         | 0         | 0        |
| Pinguipedidae               | <i>Parapercis clathrate</i>    | -           | 0         | 1         | 0         | 0        |
| Labridae                    | <i>Halichoeres pictus</i>      | labayan     | 5         | 8         | 0         | 0        |
| Labridae                    | <i>Halichoeres sp.*</i>        | labayan     | 4         | 26        | 2         | 0        |
| Labridae                    | <i>Labridae sp. 1</i>          | labayan     | 0         | 1         | 3         | 0        |
| Labridae                    | <i>Labroides dimidiatus*</i>   | labayan     | 1         | 2         | 3         | 0        |
| Labridae                    | <i>Thasalloma lunare*</i>      | labayan     | 6         | 12        | 18        | 0        |
| Muraenidae                  | <i>Gymnothorax thyrsoideus</i> | ubod        | 0         | 0         | 1         | 0        |
| Nemipteridae                | <i>Scolopsis ciliates</i>      | ubod        | 0         | 0         | 1         | 0        |
| Pinguipedidae               | <i>Parapercis clathrata</i>    | -           | 0         | 1         | 0         | 0        |
| Pomacentridae               | <i>Abudedefduf saxitilis*</i>  | pata        | 1         | 6         | 2         | 0        |
| Pomacentridae               | <i>Chrysiptera parasema</i>    | "pata"      | 0         | 4         | 2         | 0        |
| Pomacentridae               | <i>Neoglyphidodon oxyodon*</i> | "pata"      | 20        | 10        | 6         | 0        |
| Serranidae                  | <i>Epinephelus sp.</i>         | "lapu-lapu" | 0         | 0         | 2         | 0        |
| <b>Total Counts</b>         |                                |             | <b>61</b> | <b>73</b> | <b>39</b> | <b>0</b> |
| <b>Total No. of Species</b> |                                |             | <b>8</b>  | <b>11</b> | <b>9</b>  | <b>0</b> |

Source: EPRMP, PASAR Corporation

Of the eight families, Labridae and Pomacentridae were the most abundant. Species from these families also dominated in each sampling station. Five (5) species occurred in all stations (i.e., Stations 1 to 3): *Thasalloma lunare*, *Halichoeres sp.*, *Labroides dimidiatus* (Labridae); *Abudedefduf saxitilis* and *Neoglyphidodon oxyodon* (Pomacentridae). There were no fish found in the SOF area. Ninety-seven (97%) of all the species found in the area were non-target species (i.e., not commercially important). Target species found were *Scolopsis ciliatus*, *Epinephelus sp.*, and *Gymnothorax thyrsoideus*. From the present study, there is an estimated average of 865 fishes-ha (fish per hectare) in the PASAR coastal waters is presented in **Table 2-21**.

**Table 2-21. Estimated fish abundance in the PASAR Coastal Area**

| Family        | Station 1   | Station 2   | Station 3  | Station 4 | Average    |
|---------------|-------------|-------------|------------|-----------|------------|
| Apogonidae    | 480         | 0           | 0          | 0         | 120        |
| Blennidae     | 0           | 20          | 0          | 0         | 5          |
| Labridae      | 320         | 980         | 520        | 0         | 455        |
| Muraenidae    | 0           | 0           | 20         | 0         | 5          |
| Nemipteridae  | 0           | 40          | 0          | 0         | 10         |
| Pinguipedidae | 0           | 20          | 0          | 0         | 5          |
| Serranidae    | 0           | 0           | 40         | 0         | 10         |
| <b>Total</b>  | <b>1220</b> | <b>1460</b> | <b>780</b> | <b>0</b>  | <b>865</b> |

Note: values are in fish per hectare

Source: EPRMP, PASAR Corporation

Twenty (20) major taxa of meiofauna were identified at the four sampling stations. Most of the meiofauna were found in Station 2. Foraminifera had the highest mean density among the meiofaunal groups. It is known to tolerate a wide range of unfavorable conditions, and its sensitivity are useful indicators of environmental changes. Nematodes, copepods, and ostracods were also abundant in all stations. These serve also as indicators to environmental stressors based on their density. Generally, the abundance of meiofauna in the coastal area was very low (0-10 individuals per cm<sup>3</sup>; safe concentration should be a little more than 100 individuals per cm<sup>3</sup>. Their density depends on the nutrient input from the land.

*Nitzschia longgisima*, a phytoplankton, was abundant in Stations 2, 3, and 4. It is known to produce neurotoxin called domoic acid, a toxin which is responsible for the human illness called amnesic



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shellfish poisoning. It is very sensitive to nutrient inputs which cause algal bloom when nutrient input from the land is abundant.

Generally, the coastal area has poor biological resources. However, the presence of juvenile corals indicates that the reef has improved better compared to the last survey (BFAR 2006) wherein no live corals were found. Mangrove and associated organisms are growing well which can be enhanced by reducing the iron granulated slag that settles at the mangrove area and transplanting of mangrove seedlings.

### 2.2.3.4 Threat to abundance, frequency and distribution

Due to the distance of the project site to the sea and there will be no wastewater discharges into the sea, the proposed IASCL ancillary project is not expected to cause threat to abundance, frequency and distribution of the marine community.

## 2.3 AIR

### 2.3.1 Climatology and Meteorology

#### 2.3.1.1 Climate Type

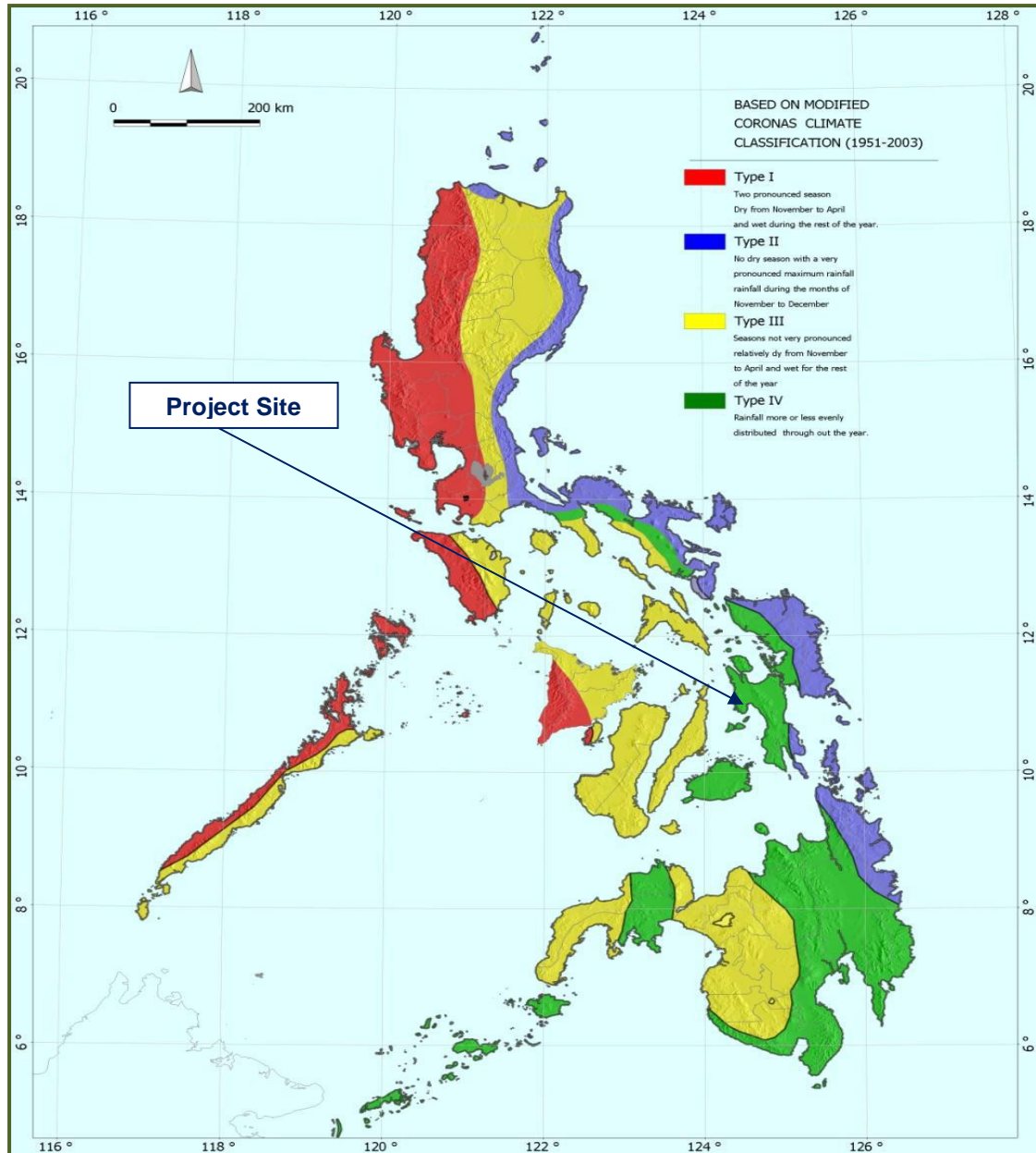
The climate at the proposed Project site falls under Type IV category based on the Modified Coronas Climate Classification of Philippine Climate (**Figure 2-26**). Type IV climate is characterized by having a rainfall of more or less evenly distributed throughout the year.

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Source: PAGASA, modified by GEOSPHERE 2018

Figure 2-26. The Philippine Climate Map

### 2.3.1.2 Wind Regime

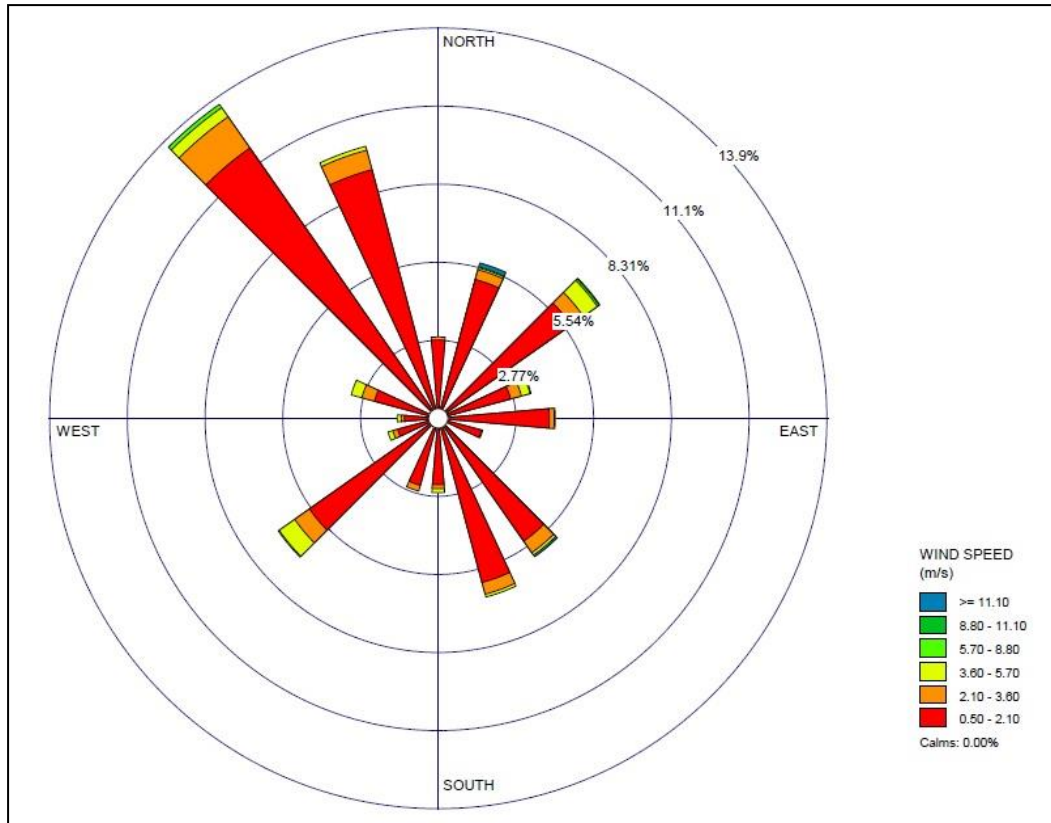
The nearest meteorological station of the Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) to the proposed Project site is the Tacloban Airport Station. The meteorological data of Tacloban Station from January 1 to December 31, 2012 was plotted and the windrose diagram is shown **Figure 2-27**. Prevailing winds were from northwest which comprised of about 13.5% over the site followed by north-northwest covering 10% over the site. The average wind speed was 1.78 meters per second, few winds exceeded 11.1 meters per second and winds of less than 2.10 meter per second occurred from all directions. Calm conditions were 0.0% of the time. Strongest wind came from north-northeast followed by northeast which occupied about 0.2% of the time.

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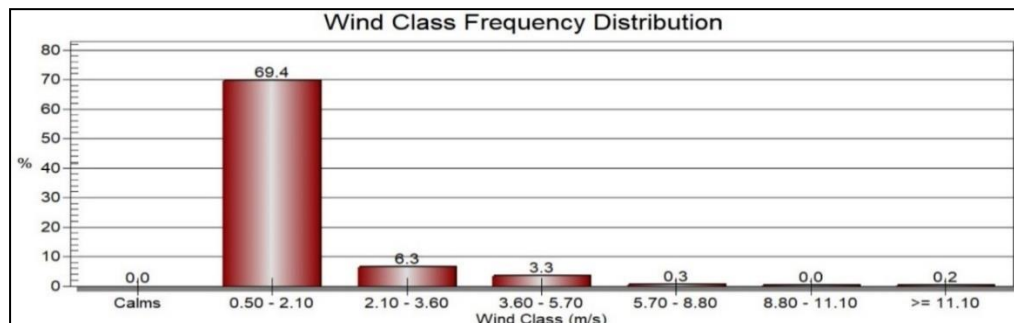


Source: AERMET View Version 9.5.0 Lakes Environmental; weather underground

**Figure 2-27. Windrose Diagram for Tacloban Station of PAGASA from January 1 to December 31, 2012**

The tropical condition can be attributed to the location of the project which is between 10 to 11 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 September to March the wind blows on a northwesterly direction with an average wind speed of 1.84 meters per second. From April to August the southwesterly winds prevail with an average wind speed of 1.64 meters per second.

Majority of wind speeds in the Project site occupying 69.4% of the total wind is 0.50 to 2.10 mps, as shown in **Figure 2-28**.



Source: AERMET View Version 9.5.0; weather underground

**Figure 2-28. Wind Class Frequency Distributions for the Tacloban Station January 1 to December 31, 2012**

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### 2.3.1.3 Climatological Normals and Extremes

The annual mean average temperature is 28°C with January being the coldest month having an average temperature of 26.3°C while the month of May is the warmest with an average temperature of 28.8°C (**Table 2-22**).

The highest and lowest temperatures occurred in the months of May and March, respectively. The mean maximum and minimum temperatures range from 28 to 28.8°C and 23.4 to 26.6°C, respectively.

Rainfall ranges from 115.2 to 386 mm, with an annual total of 2,659.3 mm. Least number of rainy days per month occurred in February to April; while the highest number of rainy days per month occurred in December to March.

The mean annual relative humidity recorded at PAGASA Tacloban Station was 85% with seasonal variation (i.e. mean monthly relative humidity range of 82% to 88% based from 1981 - 2010 meteorological data). The months of November to January were 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 vapors contained in the air condense, clouds form, and precipitation can result in the form of rain.

**Table 2-22. Climatological Normals Recorded at PAGASA Tacloban Station (1981-2010)**

| 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       | 323.9         | 22         | 29.2             | 23.4        | 26.3        | 25.7        | 24          | 23.4        | 87        | 2                | 1          |
| February      | 238.4         | 17         | 29.9             | 23.4        | 26.6        | 26          | 24          | 23.2        | 85        | 1                | 0          |
| March         | 184.4         | 17         | 30.7             | 23.8        | 27.3        | 25.7        | 24.5        | 23.7        | 83        | 3                | 1          |
| April         | 115.2         | 14         | 31.8             | 24.7        | 28.3        | 27.9        | 25.5        | 24.7        | 82        | 7                | 4          |
| May           | 144.1         | 10         | 32.3             | 25.3        | 28.8        | 28.4        | 26          | 25.2        | 83        | 15               | 12         |
| June          | 184.6         | 17         | 32               | 25.2        | 28.6        | 28.1        | 25.9        | 25.2        | 84        | 16               | 14         |
| July          | 186           | 17         | 31.6             | 24.8        | 28.2        | 27.7        | 25.5        | 24.7        | 84        | 17               | 15         |
| August        | 160.9         | 15         | 32               | 24.9        | 28.4        | 27.9        | 25.6        | 24.8        | 83        | 15               | 13         |
| September     | 173.7         | 16         | 31.8             | 24.7        | 28.2        | 27.6        | 25.5        | 24.8        | 84        | 18               | 16         |
| October       | 243.9         | 20         | 31.4             | 24.6        | 28          | 27.3        | 25.4        | 24.7        | 86        | 18               | 15         |
| November      | 318.2         | 22         | 30.7             | 24.4        | 27.5        | 26.9        | 25.1        | 24.5        | 86        | 12               | 8          |
| December      | 386           | 23         | 29.7             | 23.9        | 26.8        | 26.1        | 24.5        | 23.9        | 88        | 5                | 3          |
| <b>Annual</b> | <b>2659.3</b> | <b>214</b> | <b>31.1</b>      | <b>24.4</b> | <b>27.8</b> | <b>27.2</b> | <b>25.1</b> | <b>24.4</b> | <b>85</b> | <b>129</b>       | <b>102</b> |

Source: PAGASA

Climatological extreme values from the 30-year monthly and annual summaries of temperature, rainfall, and wind speed are presented in **Table 2-23**. The recorded annual extreme high temperature was 38.0°C which occurred on April 6, 1924 and August 18, 1924, while the extreme low was 17.5°C which was recorded on December 3, 1904. The amount of annual average extreme greatest rainfall was 325.9 mm which occurred on May 2, 1959 while the annual average extreme highest wind of 62 meters per second southwesterly direction occurred on November 23, 1968.



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Table 2-23. Climatological Extreme Recorded at Tacloban Station as of 2016

| Month            | Temperature (°C) |            |      |            | Greatest Daily RF (mm) |            | Strongest Winds (m/s) |     |            |
|------------------|------------------|------------|------|------------|------------------------|------------|-----------------------|-----|------------|
|                  | High             | Date       | Low  | Date       | Amount                 | Date       | Speed                 | Dir | Date       |
| Jan              | 34.7             | 01-28-1924 | 18.8 | 01-30-1905 | 246.7                  | 01-14-1916 | 29                    | NNW | 01-07-1972 |
| Feb              | 34.8             | 02-22-1998 | 17.6 | 02-24-1905 | 160.3                  | 02-17-2001 | 20                    | SE  | 02-18-2001 |
| Mar              | 35.9             | 03-31-1924 | 18.0 | 03-04-1905 | 397.4                  | 03-16-2011 | 27                    | NW  | 03-16-2006 |
| Apr              | 38.0             | 04-06-1924 | 20.2 | 04-23-1911 | 135.4                  | 04-20-1978 | 53                    | NNW | 04-15-1979 |
| May              | 37.9             | 05-02-1924 | 20.5 | 05-01-1985 | 325.9                  | 05-02-1959 | 55                    | SW  | 05-15-1966 |
| Jun              | 36.5             | 06-03-1987 | 20.9 | 06-23-1975 | 244.0                  | 06-02-1923 | 35                    | W   | 06-20-2008 |
| Jul              | 37.8             | 07-24-1920 | 21.0 | 07-10-1991 | 244.3                  | 07-14-1913 | 30                    | WSW | 07-14-1971 |
| Aug              | 38.0             | 08-18-1924 | 20.6 | 08-01-1920 | 118.0                  | 08-12-2008 | 22                    | WSW | 08-08-1968 |
| Sep              | 37.2             | 09-10-1924 | 21.0 | 09-14-1982 | 156.4                  | 09-29-1995 | 20                    | NNW | 09-04-1999 |
| Oct              | 36.0             | 10-08-1947 | 19.8 | 10-30-1920 | 167.9                  | 10-23-1988 | 32                    | W   | 10-26-1952 |
| Nov              | 35.2             | 11-01-1924 | 19.4 | 11-17-1968 | 206.5                  | 11-11-1928 | 62                    | WSW | 11-04-1984 |
| Dec              | 35.0             | 12-02-1998 | 17.5 | 12-03-1904 | 314.8                  | 12-29-2014 | 42                    | ESE | 12-21-1994 |
| Annual           | 38.0             | 04-06-1924 | 17.5 | 12-03-1904 | 325.9                  | 05-02-1959 | 62                    | SW  | 11-23-1968 |
|                  | 38.0             | 08-18-1924 |      |            |                        |            |                       |     |            |
| Period of Record | 1903-2016        |            |      |            | 1903-2016              |            | 1951-2016             |     |            |

Source: PAGASA Climatological Extremes as of 2016

### 2.3.1.4 Cyclone Frequency

The most number of tropical cyclones that crossed Leyte is during the months November and 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.

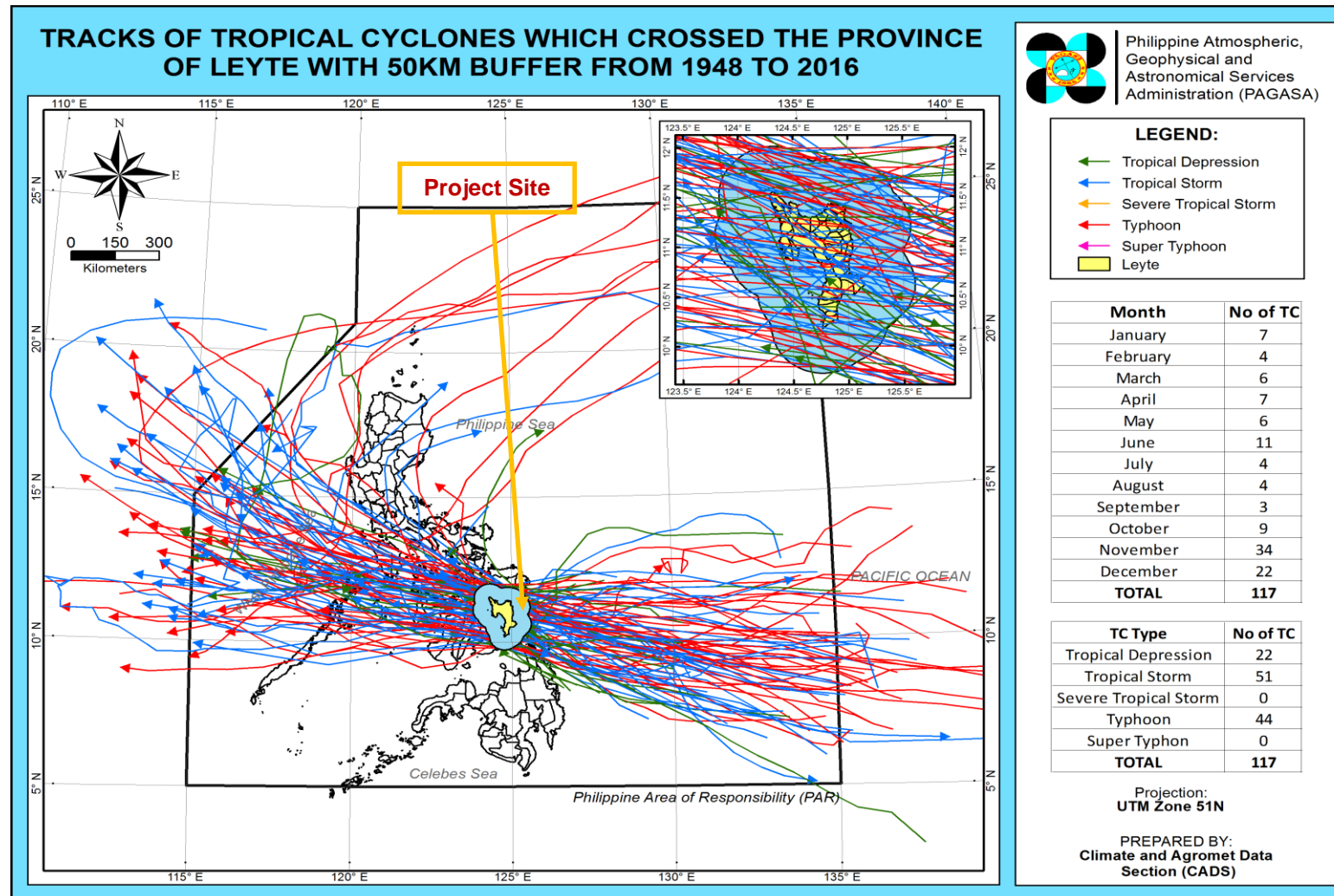
From 1948-2016 (period of 68 years) PAGASA determined an annual average of 20 tropical cyclones in the PAR with nine of these passing through the Philippine landmasses. Overall, PAGASA had tracked 117 tropical cyclones that crossed in the province of Leyte as shown in **Figure 2-29**. Moreover, in **Figure 2-30**, the map shows that the project site is under medium typhoon risk.

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Source: PAGASA

Figure 2-29. Tracks of Tropical Cyclones that Crossed the Province of Leyte, 1948-2016

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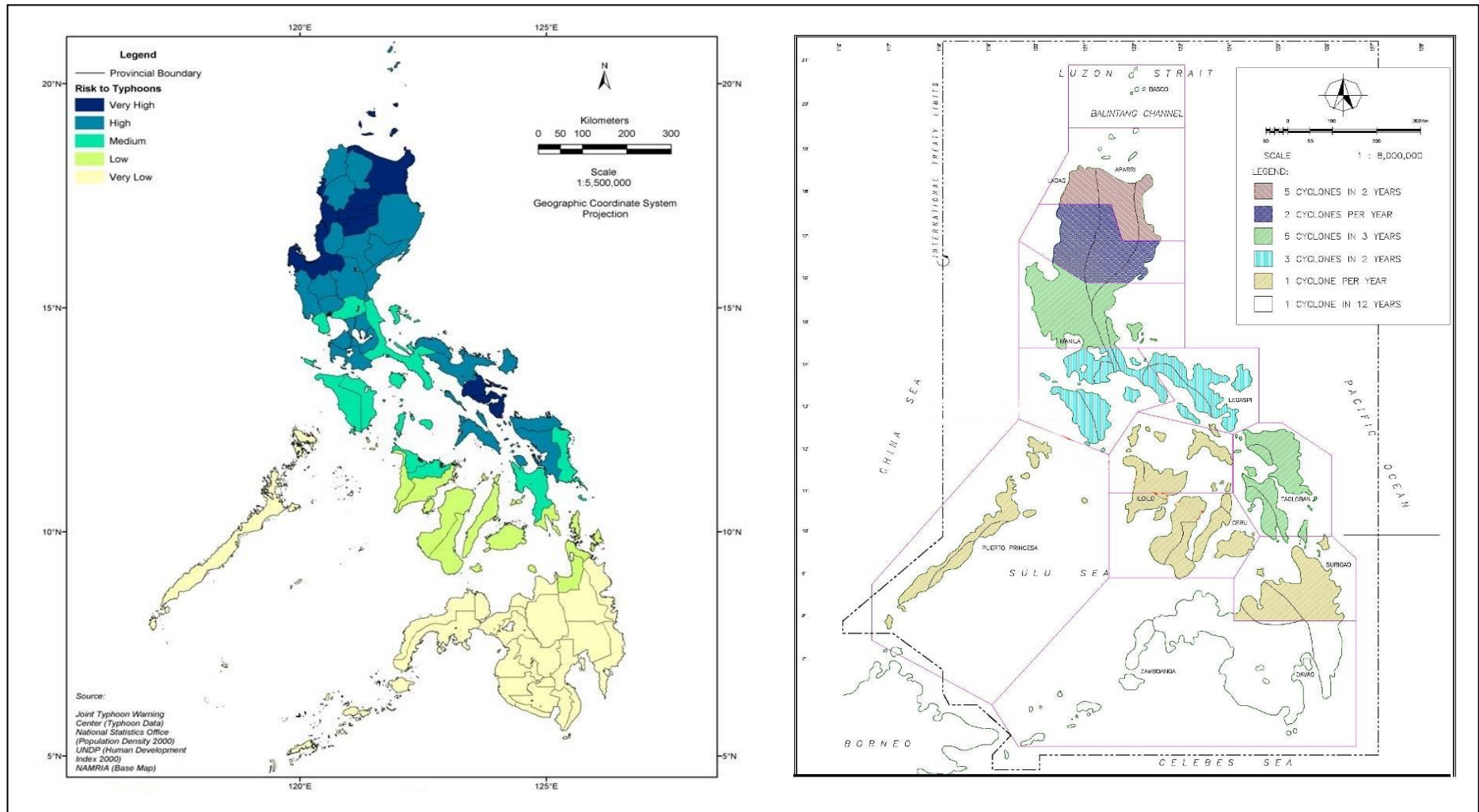


Figure 2-30. Philippine Typhoon Map

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### 2.3.1.5 Change in the Local Micro-Climate

#### Temperature Change

The historic average annual ambient air temperature of Leyte is 27.8°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 Leyte will have an increased temperature (**Table 2-24**).

**Table 2-24. Seasonal Temperature Increase (in °C) in 2020 and 2050 under Medium Range Emission Scenario in Leyte**

| Observed baseline<br>(1971-2000) |      |     |      | Change in 2020<br>(2006-2035) |     |     |     | Change in 2050<br>(2036-2065) |     |     |     |
|----------------------------------|------|-----|------|-------------------------------|-----|-----|-----|-------------------------------|-----|-----|-----|
| DJF                              | MAM  | JJA | SON  | DJF                           | MAM | JJA | SON | DJF                           | MAM | JJA | SON |
| 26.4                             | 27.8 | 28  | 27.7 | 0.9                           | 1.2 | 1.1 | 1.0 | 1.8                           | 2.3 | 2.2 | 1.9 |

Source: Climate Change in the Philippines, 2011 PAGASA

The PAGASA projection revealed that the average monthly temperature over the period of 2006–2035 will increase by 0.9°C to 1.2°C while temperatures for the period of 2036-2065 will increase by 1.8°C to 2.3°C. The annual average temperature covering the period of 2006-2035 will rise to 29°C while 2036-2065 will rise to 30.1°C. **Table 2-21, Figures 2-31 and 2-32** present the projected monthly average temperature with climate change ( $T_{ave\ CC}$ ) and without climate change ( $T_{ave\ base}$ ).

**Table 2-25. Projected Monthly Average Temperature**

|   | Jan  | Feb  | Mar  | Apr  | May  | Jun  | Jul  | Aug  | Sep  | Oct  | Nov  | Dec  |
|---|------|------|------|------|------|------|------|------|------|------|------|------|
| <b>Baseline/Without Climate Change Scenario (1981-2010)</b> |      |      |      |      |      |      |      |      |      |      |      |      |
| <b>Max</b>  | 29.2 | 29.9 | 30.7 | 31.8 | 32.3 | 32   | 31.6 | 32   | 31.8 | 31.4 | 30.7 | 29.7 |
| <b>Min</b>  | 23.4 | 23.4 | 23.8 | 24.7 | 25.3 | 25.2 | 24.8 | 24.9 | 24.7 | 24.6 | 24.4 | 23.9 |
| <b>Ave</b>  | 26.3 | 26.6 | 27.3 | 28.3 | 28.8 | 28.6 | 28.2 | 28.4 | 28.2 | 28   | 27.5 | 26.8 |
| <b>With Climate Change Scenario (2006-2035)</b>             |      |      |      |      |      |      |      |      |      |      |      |      |
| <b>Max</b>  | 30.1 | 30.8 | 31.9 | 33   | 33.5 | 33.1 | 32.7 | 33.1 | 32.8 | 32.4 | 31.7 | 30.6 |
| <b>Min</b>  | 24.3 | 24.3 | 25   | 25.9 | 26.5 | 26.3 | 25.9 | 26   | 25.7 | 25.6 | 25.4 | 24.8 |
| <b>Ave</b>  | 27.2 | 27.5 | 28.5 | 29.5 | 30   | 29.7 | 29.3 | 29.5 | 29.2 | 29   | 28.5 | 27.7 |
| <b>With Climate Change Scenario (2006-2065)</b>             |      |      |      |      |      |      |      |      |      |      |      |      |
| <b>Max</b>  | 31   | 31.7 | 33   | 34.1 | 34.6 | 34.2 | 33.8 | 34.2 | 33.7 | 33.3 | 32.6 | 31.5 |
| <b>Min</b>  | 25.2 | 25.2 | 26.1 | 27   | 27.6 | 27.4 | 27   | 27.1 | 26.6 | 26.5 | 26.3 | 25.7 |
| <b>Ave</b>  | 28.1 | 28.4 | 29.6 | 30.6 | 31.1 | 30.8 | 30.4 | 30.6 | 30.1 | 29.9 | 29.4 | 28.6 |

Source: PAGASA

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





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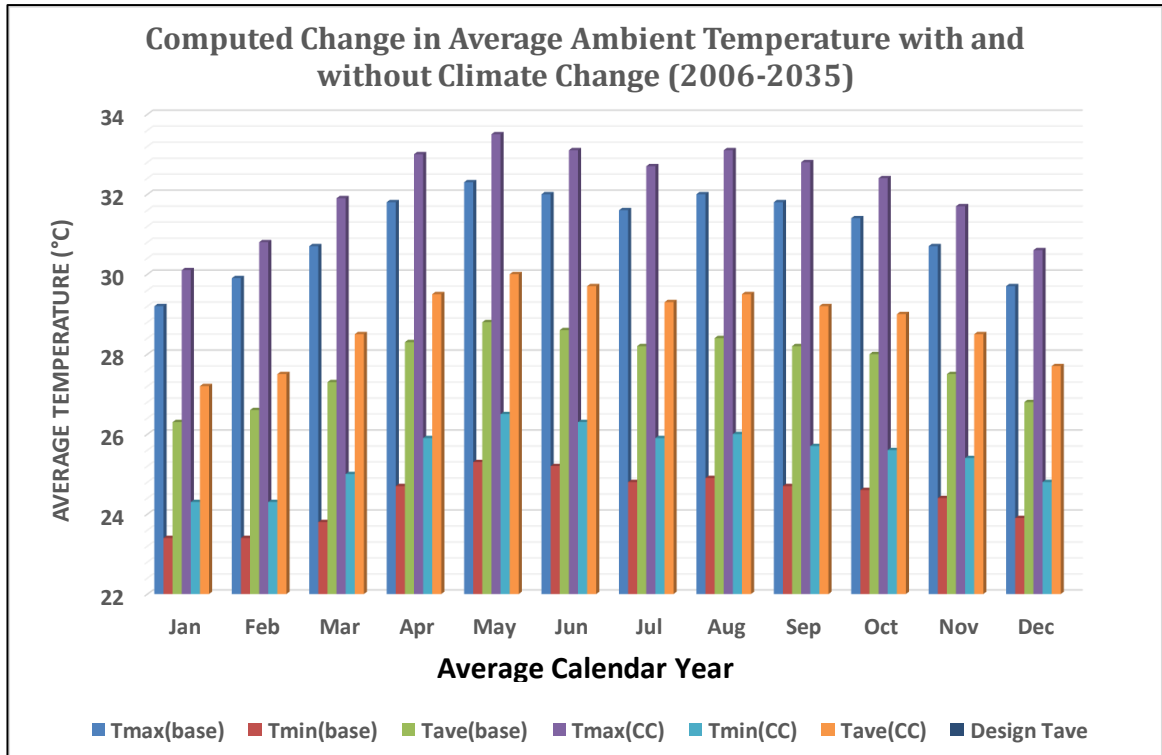


Figure 2-31 Change in Monthly Average Temperature for the Period of 2006-2035

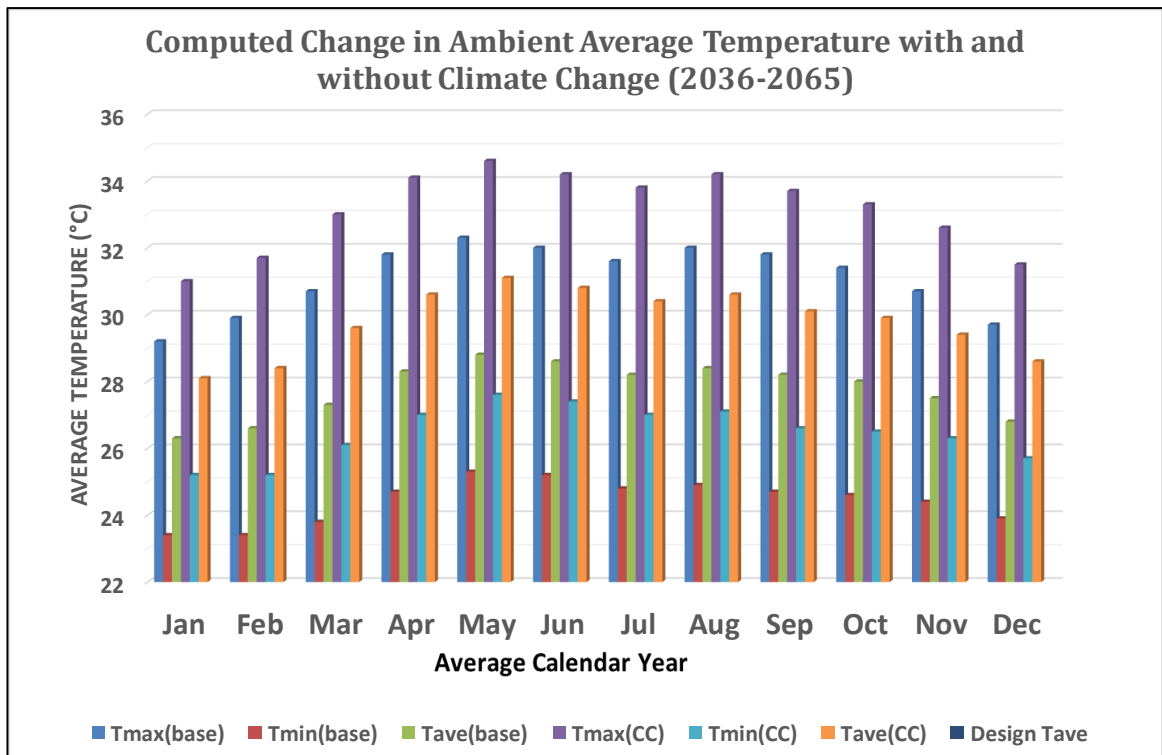


Figure 2-32 Change in Monthly Average Temperature for the Period of 2036-2065

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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.

For plant operations, the variability in daily temperatures together with the longer-term monthly averages defines the design air temperature. IASCL considers the temperature increase for 2020 and 2050 in their plant design. The selection of the design temperature reflects an optimization of plant productivity, operational and capital costs based on historical conditions.

### Rainfall Change

The historic average annual rainfall of Leyte is 2,659.3 mm. Based from the climate change scenario for the Philippines as published by PAGASA in February 2011, the province of Leyte will have an increased and decreased rainfall in 2020 and 2050 (**Table 2-26**).

**Table 2-26. Seasonal Rainfall Change (in %) in 2020 and 2050 under Medium Range Emission Scenario in Leyte**

| Observed baseline<br>(1971-2000) |       |        |       | Change in 2020<br>(2006-2035) |      |     |     | Change in 2050<br>(2036-2065) |       |      |      |
|----------------------------------|-------|--------|-------|-------------------------------|------|-----|-----|-------------------------------|-------|------|------|
| DJF                              | MAM   | JJA    | SON   | DJF                           | MAM  | JJA | SON | DJF                           | MAM   | JJA  | SON  |
| 43.4                             | 265.4 | 1193.5 | 644.3 | 3.0                           | -8.9 | 9.5 | 7.4 | 9.4                           | -18.9 | 19.6 | 19.5 |

Source: *Climate Change in the Philippines, 2011 PAGASA*

The PAGASA projection reveal that the average monthly rainfall over the period of 2006–2035 will increase by 3 to 9.5% from July to February and it will decrease by 8.9% between March to May; while the rainfall for the period of 2036-2065 will increase by 9.4 to 19.6% from June to February and will decrease by 18.9% between March to May. The annual average rainfall covering the period of 2006-2035 will rise to 23.55 mm in November and will decrease to 16.4mm in March; while the rainfall for the period of 2036-2065 will rise to 36.3mm in December and will decrease to 34.9mm in March. **Table 2-27** and **Figure 2-33** present the projected monthly average rainfall with climate change scenario for 2006-2035; and the monthly average rainfall with climate change scenario for 2036-2065.

**Table 2-27. Projected Monthly Average Rainfall**

|   | Jan   | Feb   | Mar   | Apr   | May   | Jun   | Jul   | Aug   | Sept  | Oct   | Nov   | Dec   |
|---|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>Baseline/Without Climate Change Scenario (1981-2010)</b> |       |       |       |       |       |       |       |       |       |       |       |       |
| <b>Ave</b>  | 323.9 | 238.4 | 184.4 | 115.2 | 144.1 | 184.6 | 186   | 160.9 | 173.7 | 243.9 | 318.2 | 386   |
| <b>With Climate Change Scenario (2006-2035)</b>             |       |       |       |       |       |       |       |       |       |       |       |       |
| <b>Ave</b>  | 333.6 | 245.6 | 168   | 104.9 | 131.3 | 202.1 | 203.7 | 176.2 | 186.6 | 261.9 | 341.7 | 397.6 |
| <b>With Climate Change Scenario (2036-2065)</b>             |       |       |       |       |       |       |       |       |       |       |       |       |
| <b>Ave</b>  | 354.3 | 260.8 | 149.5 | 93.4  | 116.9 | 220.8 | 222.5 | 192.4 | 207.6 | 291.5 | 380.2 | 422.3 |

Source: PAGASA

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

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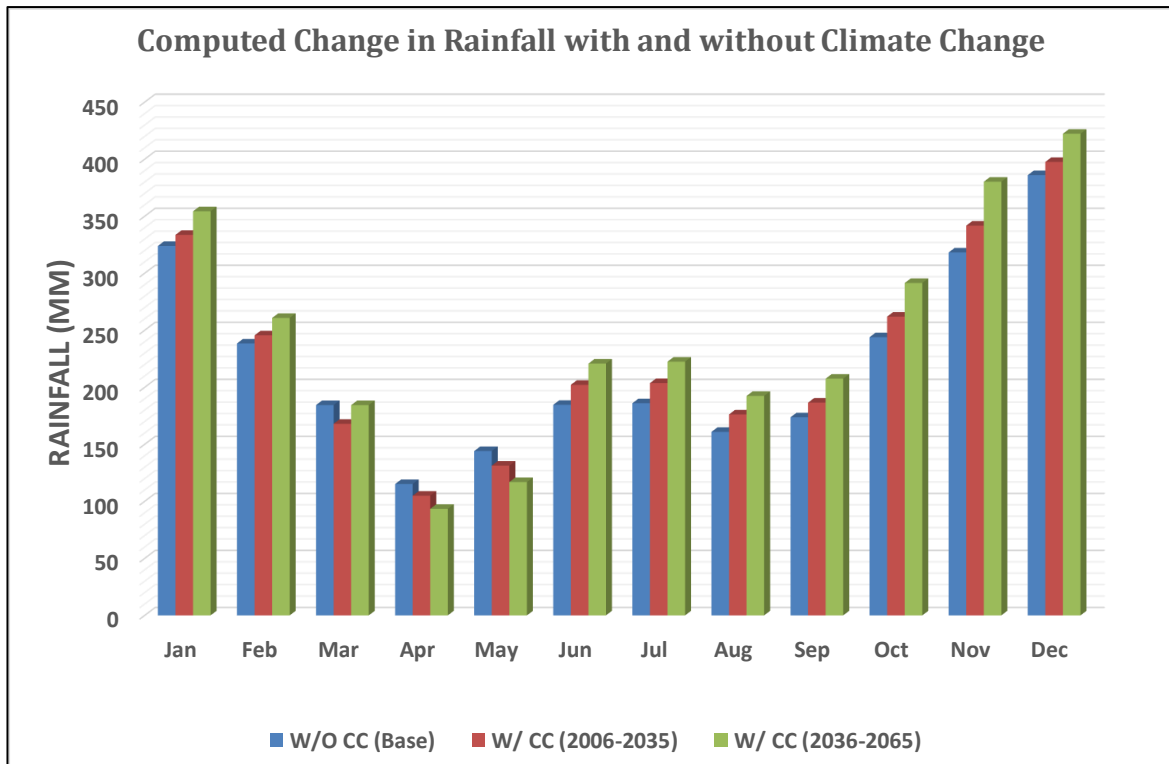


Figure 2-33 Computed Average Rainfall With and Without Climate Change Scenarios

## Frequency of Extreme Events

Based from the climate change scenario for the Philippines as published by PAGASA in February 2011, the province of Leyte will have 1,398 days with maximum temperature of  $>35^{\circ}\text{C}$  during the 2006-2035 period and 2,495 days during the 2036-2050 period; 5,199 dry days during the 2006-2035 period and 5,475 dry days during the 2036-2050 period; and 10 days with rainfall  $>200\text{mm}$  during the 2006-2035 period and 15 days during the 2036-2050 period, as presented in **Table 2-28**.

**Table 2-28 Frequency of Extreme Events in 2020 and 2050 under Medium Range Emission Scenario in Leyte**

| No. of Days w/ $T_{\text{max}} > 35^{\circ}\text{C}$ |      |      | No. of Dry Days |      |      | No. of Days w/ Rainfall $> 200\text{mm}$ |      |      |
|--|------|------|-----------------|------|------|--|------|------|
| OBS (1971-2000)                                      | 2020 | 2050 | OBS             | 2020 | 2050 | OBS                                      | 2020 | 2050 |
| 52   | 1398 | 2495 | 6874            | 5199 | 5475 | 1  | 10   | 15   |

Note: Based from the Frequency of Extreme Events in 2020 and 2050 under Medium Range Emission Scenario in the province of Leyte

Source: Climate Change in the Philippines, 2011 PAGASA

### 2.3.1.6 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:

$$\text{Emissions}_{\text{GHG}, \text{fuel}} = \text{fuel consumption}_{\text{fuel}} \times \text{emission factor}_{\text{GHG}, \text{fuel}}$$



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Where:

- Emissions<sub>GHG,fuel</sub> = emissions of a given GHG by type of fuel (kg GHG)
- Fuel consumption<sub>fuel</sub> = amount of fuel combusted (TJ)
- Emission factor<sub>GHG,fuel</sub> = default emission factor of a given GHG by type of fuel (kg gas/TJ). For CO<sub>2</sub>, it includes carbon oxidation factor, assumed to be 1.

**Table 2-29** 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 74,100 kg of CO<sub>2</sub>/TJ; 3 kg of CH<sub>4</sub>/TJ for methane; and 0.6 kg of N<sub>2</sub>O/TJ for nitrous oxides.

**Table 2-29. Summary of GHG Emissions of the Proposed Project**

| Emission Sources              | Fuel Consumption (L/hr) | Fuel Heating Value (kcal/kg) | CO <sub>2</sub> Emission (MT/year) | CH <sub>4</sub> Emission (MT/year) | N <sub>2</sub> O Emission (MT/year) |
|-------------------------------|-------------------------|------------------------------|------------------------------------|------------------------------------|-------------------------------------|
| Proposed Generator Set Stacks | 254                     | 10,755.3                     | 121,679                            | 5                                  | 1                                   |

The total estimated CO<sub>2</sub> emission from the operation of the furnace based on IPCC 2006 is 121,685 MT/yr. The Philippines Second National Communication (SNC) on Climate Change has projected 100,402,000 MT of CO<sub>2</sub> for 2020. Using the projection of SNC, the Project operation is expected to contribute an approximately 0.12% of the total CO<sub>2</sub> emission. Under the operation phase, Scope 2 GHG estimates is not applicable because the electricity that will be using by the Project will come from their generated power. Moreover, AISCL will establish a “green buffer zone” to mitigate some of the potential effects of emissions of its proposed Power Plant Project.

### 2.3.2 Air Quality and Noise Level

An ambient air quality monitoring programme was conducted in six (6) 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 2-30**, while **Figure 2-34** shows the location of the stations.

The ambient TSP, PM<sub>10</sub>, SO<sub>2</sub>, and NO<sub>2</sub> 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 (NAAQSSAP) from Industrial Sources/Operations Section 1 Rule XXVI Part VII of the Clean Air Act IRR.

**Table 2-30. 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   | Inside of the Proposed Project Site, Brgy. Libertad, Isabel                      | 657784.53   | 1204913.88  | 24-hour          |
| STN-2   | Inside the Clubhouse parking lot of LIDE Staff House, Brgy. Mahayag, Isabel      | 657523.53   | 1206277.22  | 24-hour          |
| STN-3   | About 40 meters away from the shore of Kinatumyan Beach, Brgy. San Roque, Isabel | 656802.84   | 1205859.03  | 1-hour           |





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| Station | Description   | Coordinates |             | Averaging Period |
|---------|---|-------------|-------------|------------------|
|         |   | Easting, m  | Northing, m |                  |
| STN-4   | About 26 meters away from PHILPHOS Gate No. 2, Brgy. San Roque, Isabel  | 656706.03   | 1205142.71  | 1-hour           |
| STN-5   | Inside the compound of Isabel Roro Port, Brgy. Matlang, Isabel          | 658517.12   | 1204868.68  | 1-hour           |
| STN-6   | About 53 meters away from the main gate of LIDE, Brgy. Libertad, Isabel | 658530.77   | 1205824.25  | 1-hour           |



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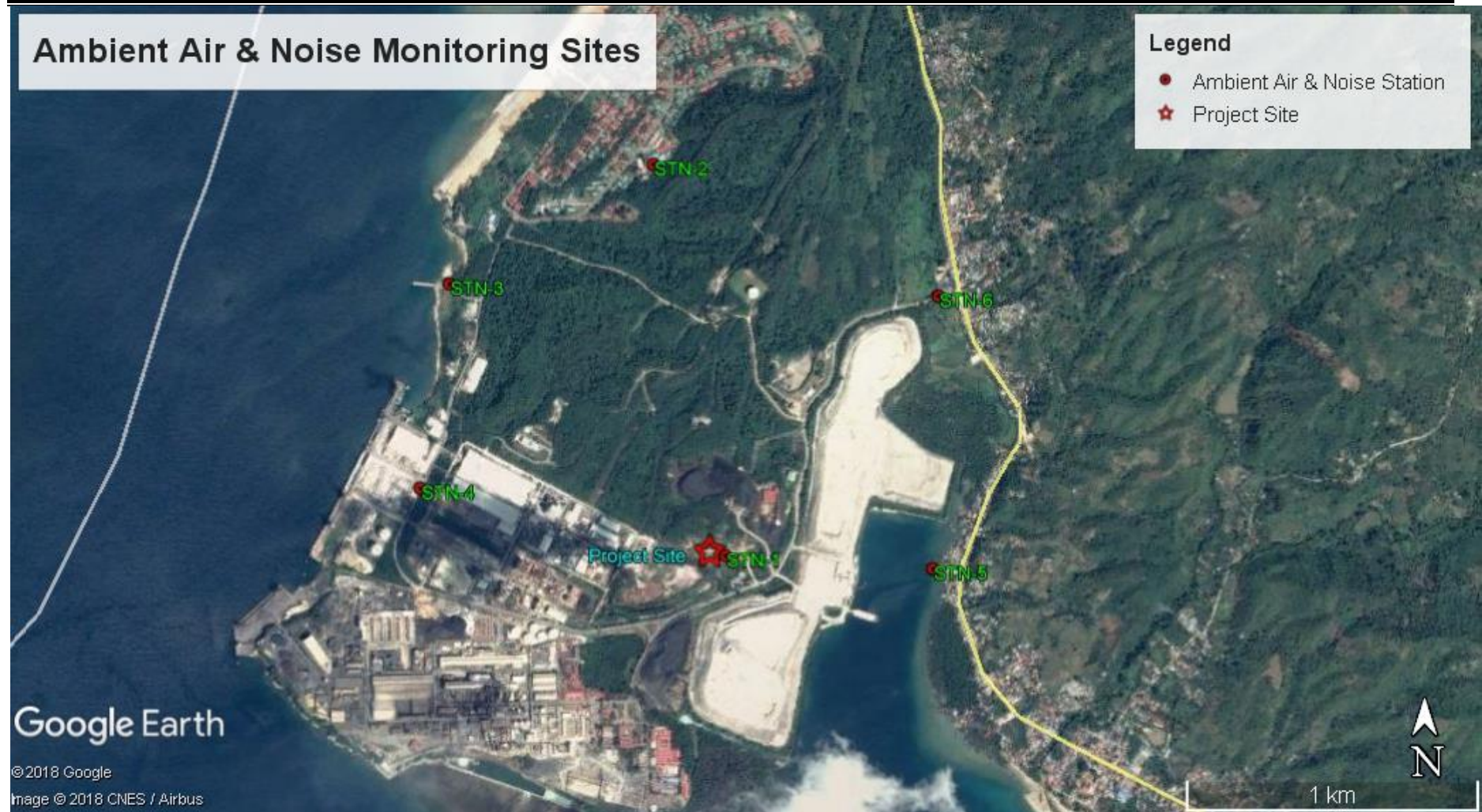


Figure 2-34. Established Stations for Ambient Air Quality and Noise Level Monitoring for the Proposed Project

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### 2.3.2.1 Ambient Air Quality

Tables 2-31 and 2-32 present the results of air quality monitoring for 24-hour and hourly averaging periods conducted on November 5-7, 2017 at the Project site and its vicinity located in Isabel Leyte. The results showed that the concentrations of particulates (TSP & PM<sub>10</sub>), SO<sub>2</sub>, and NO<sub>2</sub> for 24-hour averaging period were all below the CAA limit of 230 µg/Ncm for TSP; 150 µg/Ncm for PM<sub>10</sub>; 150 µg/Ncm for NO<sub>2</sub>; and 180 µg/Ncm for SO<sub>2</sub>. All samples collected for hourly averaging time in all stations were also below the CAA limit of 300 µg/Ncm for TSP, 200 µg/Ncm for PM<sub>10</sub>, 260 µg/Ncm for NO<sub>2</sub>, and 340 µg/Ncm for SO<sub>2</sub>.

The highest concentration of TSP was 79.42 µg/Ncm recorded at Station 4, while the lowest concentration is 22.26 µg/Ncm recorded at Station 2. For PM<sub>10</sub>, the highest concentration is 27.56 µg/Ncm recorded at Station 6 while the lowest concentration is 12.25 µg/Ncm recorded at Station 5. The highest concentration of SO<sub>2</sub> is 83.25 µg/Ncm recorded at Station 5 while the lowest concentration is 47.11 µg/Ncm recorded at Station 2. For NO<sub>2</sub>, the highest concentration is 1.17 µg/Ncm recorded at Station 6 while the lowest is 0.26 µg/Ncm recorded at Station 2.

Table 2-31. Results of 24-hour Ambient Air Quality Monitoring

| Items<br>Sampling Station<br>Date of Sampling<br>Time of Sampling | Description/Values                     |  |           |
|---|--|--|-----------|
|   | STN-1<br>Nov. 5-6, 2017<br>1300H-1300H | STN-2<br>Nov. 6-7, 2017<br>1345H-1345H | CAA Limit |
| TSP, (µg/Ncm)   | 54.95                                  | 22.66                                  | 230       |
| PM <sub>10</sub> , (µg/Ncm)                                       | 23.56                                  | 13.51                                  | 150       |
| SO <sub>2</sub> , (µg/Ncm)  | 47.54                                  | 47.11                                  | 180       |
| NO <sub>2</sub> , (µg/Ncm)  | 0.66                                   | 0.26                                   | 150       |

Table 2-32. Results of hourly Ambient Air Quality Monitoring

| Items<br>Sampling Station<br>Date of Sampling<br>Time of Sampling | Description/Values                   |                                       |                                      |                                      |           |
|---|--------------------------------------|---------------------------------------|--------------------------------------|--------------------------------------|-----------|
|   | STN-3<br>Nov. 7, 2017<br>1500H-1600H | STN-4<br>Nov. 7, 2017<br>16300H-1730H | STN-5<br>Nov. 7, 2017<br>1819H-1919H | STN-6<br>Nov. 7, 2017<br>2000H-2100H | CAA Limit |
| TSP, (µg/Ncm)   | 44.71                                | 79.42                                 | 25.06                                | 51.74                                | 300       |
| PM <sub>10</sub> , (µg/Ncm)                                       | 19.99                                | 31.18                                 | 12.25                                | 27.56                                | 200       |
| SO <sub>2</sub> , (µg/Ncm)  | 57.01                                | 63.04                                 | 47.77                                | 83.25                                | 340       |
| NO <sub>2</sub> , (µg/Ncm)  | 1.01                                 | 1.01                                  | 1                                    | 1.17                                 | 260       |

### 2.3.2.2 Degradation of Air Quality during Pre-Construction and Construction Phases

Construction activities are the significant sources of dust emissions that may have a substantial temporary impact on local air quality. The expected air quality impacts during construction would be mainly from a) fugitive emissions from site clearing and site grading, and b) vehicular emissions from construction equipment and other vehicles. 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.

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 PM<sub>10</sub> that will lead to health hazard for workers. All construction related emissions would be temporary and vary from day to day depending on the type of work being done.

The following measures shall be considered to minimize fugitive dust emission from construction activities:

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### 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

Trucks loaded with dusty construction dusty materials shall be covered entirely by clean impervious sheeting to ensure that the dusty materials do not leak.

### Site Clearing and Site Grading

The working area of any site clearing and site grading shall be sprayed with water immediately before, during and immediately after the activities so as to maintain the entire surface wet.

### 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.

#### 2.3.2.3 Degradation of Air Quality considering the Existing Sources

The baseline ambient air monitoring was conducted to assess and characterized the present ambient air concentration of regulated parameters such as particulates (TSP & PM<sub>10</sub>) and gaseous compounds (SO<sub>2</sub> & NO<sub>2</sub>).

The results show that the ground level concentrations (GLCs) of particulates and gaseous compounds are within the allowable limit set forth under PCAA of 1999. These GLCs include all existing emission sources within the project vicinity e.g emissions from existing industrial plant (PASAR and PHILPHOS), vehicular and others.

In assessing the emission impact of the proposed IASCL Ancillary Power Plant project, an air dispersion modelling was conducted to stimulate and predict the concentrations of particulates and gaseous emissions into the ambient air. The results of the modeling show that the emissions of particulates and gaseous compounds are within the allowable limit of the PCAA of 1999. **Table 2-33** below shows the current GLCs based on ambient air monitoring and the predicted GLCs from the proposed IASCL ancillary power plant through air dispersion modeling at each monitoring stations.

**Table 2-33 Current Emissions considering the existing sources and the proposed Project emission contribution**

| Station No. | Parameters  |                 |       |                  |   |                 |         |                  |
|-------------|---|-----------------|-------|------------------|---|-----------------|---------|------------------|
|             | Current Ground Level Concentrations (GLCs), ug/m <sup>3</sup> |                 |       |                  | Predicted GLCs from the proposed IASCL Power Plant emissions, ug/m <sup>3</sup> |                 |         |                  |
|             | NO <sub>2</sub>   | SO <sub>2</sub> | TSP   | PM <sub>10</sub> | NO <sub>2</sub>   | SO <sub>2</sub> | TSP     | PM <sub>10</sub> |
| 1           | 0.66  | 47.54           | 54.95 | 23.56            | 0.10591   | 0.00687         | 0.00745 | 0.00640          |
| 2           | 0.26  | 47.11           | 22.66 | 13.51            | 0.01245   | 0.00081         | 0.00088 | 0.00075          |
| 3           | 1.01  | 57.01           | 44.71 | 19.99            | 0.01210   | 0.00079         | 0.00085 | 0.00073          |



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|                |      |       |       |       |         |         |         |         |
|----------------|------|-------|-------|-------|---------|---------|---------|---------|
| 4              | 1.01 | 63.04 | 79.92 | 31.18 | 0.42065 | 0.0273  | 0.02957 | 0.02543 |
| 5              | 1    | 47.77 | 25.06 | 12.25 | 0.02820 | 0.00183 | 0.00198 | 0.00170 |
| 6              | 1.17 | 83.25 | 51.74 | 27.56 | 0.01451 | 0.00094 | 0.00102 | 0.00088 |
| PCAA Standards | 260  | 340   | 300   | 200   |         |         |         |         |

As shown in Table 2-33, the contribution of the proposed IASCL Power Plant operation to current GLCs is very minimal at less than 0.04% of the current GLCs for SO<sub>2</sub> and TSP, less than 8% and 16% of current GLCs for PM<sub>10</sub> and NO<sub>2</sub> respectively. The results show that the predicted increments on the existing GLC's from the proposed IASCL Power Plant are minimal and less significant.

### 2.3.2.4 Degradation of Air Quality during Operation Phase

The proposed Project will utilize automotive diesel oil as fuel. This will be burned in the generator set 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, firing conditions, load, type of control technologies, and level of equipment maintenance. The major pollutants of concern from oil combustions are particulate matter (PM & PM<sub>10</sub>), nitrogen oxides (NO<sub>x</sub>), and sulfur dioxide (SO<sub>2</sub>). 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.

American Meteorological Society/Environmental Protection Agency Regulatory Model (**AERMOD**) model (Version 9.5.0) was used in this modeling report to assess and determine air quality impact due to the emissions of TSP, PM<sub>10</sub>, SO<sub>x</sub>, NO<sub>x</sub>, and CO in the operation of the proposed project. The meteorological data set used is 2016 MM5 AERMET derived meteorological data. 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 under Tier 4 adopted the use of 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 ( $\sigma_y$  and  $\sigma_z$ ).



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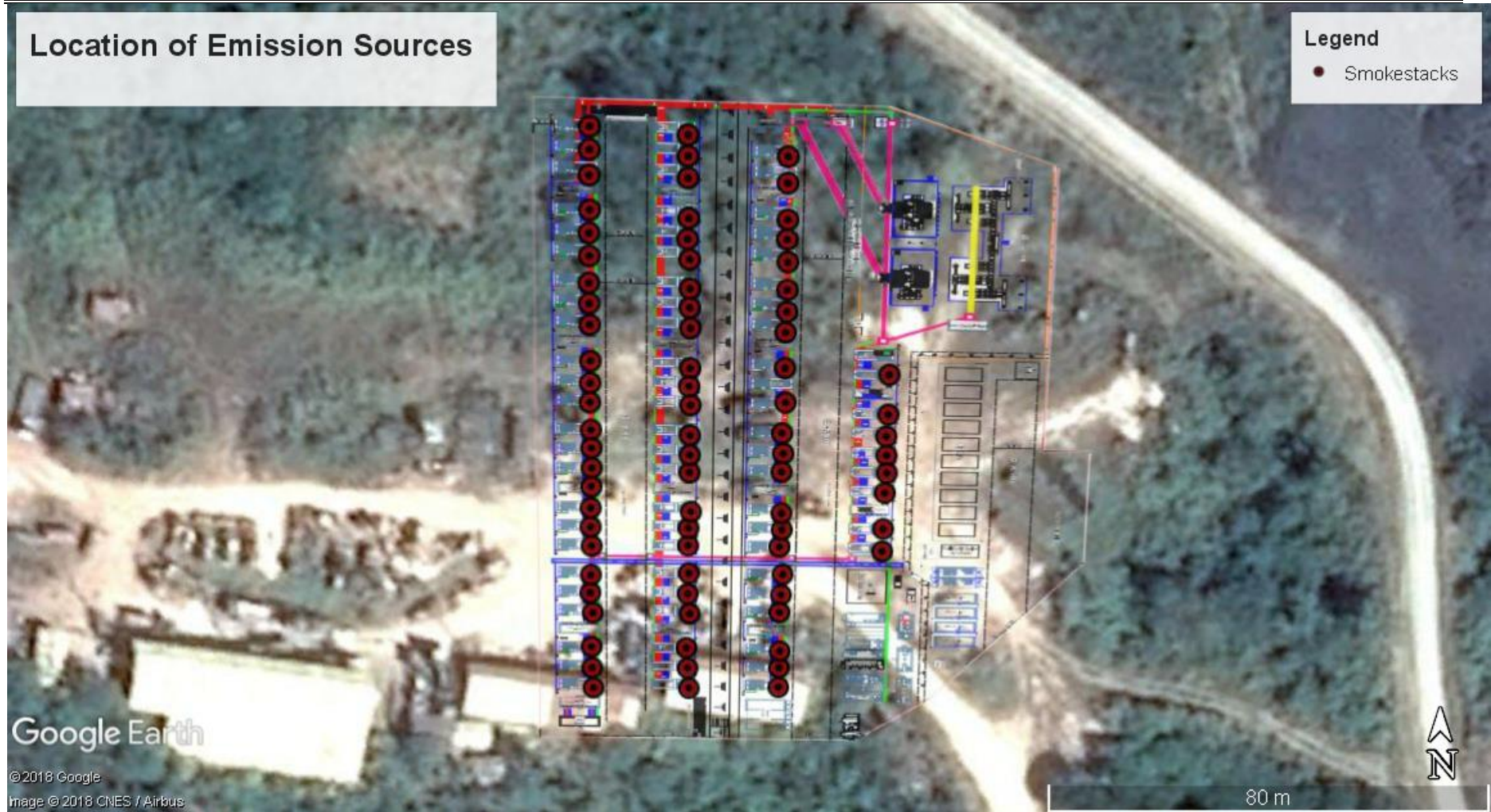
The modeling with AERMOD was performed using the regulatory default option, which includes stack height adjusted for stack-tip downwash.

### **Plot Plan**

The source subject for this modeling are the generator sets flue` stack from the proposed project. **Figure 2-35** is the general plant lay-out of the facility showing the location of the emission sources.



**Location of Emission Sources**



**Figure 2-35. Location of Emission Sources**

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### Area Sensitive Receptors (ASRs)

There are 11 area sensitive receptors identified within the modeling domain. The description, distance from the source, and geographical coordinates of these receptors are listed in **Table 2-34**. **Figure 2-36** shows the relative location of the area sensitive receptors.

**Table 2-34. Description, Distance, Direction, and Coordinates of the ASRs**

| Station | Description  | Distance from the source (m) | Direction | Coordinates |              |
|---------|--|------------------------------|-----------|-------------|--------------|
|         |  |                              |           | Easting (m) | Northing (m) |
| ASR-1   | LIDE Staff Housing Compound, Brgy. Mahayag, Isabel           | 1,463                        | N         | 657513.37   | 1206355.56   |
| ASR-2   | Central School of Isabel, Brgy. Marvel, Isabel               | 3,620                        | N         | 657002.04   | 1208428.12   |
| ASR-3   | Isabel Adventist Elementary Schoolm Brgy. Santo Nino, Isabel | 3,058                        | N         | 657124.45   | 1207888.09   |
| ASR-4   | Residential Area, Brgy. Santo Nino, Isabel                   | 3,160                        | N         | 657521.75   | 1208041.40   |
| ASR-5   | Residential Area, Brgy. Anislag, Isabel                      | 2,352                        | NNE       | 658650.30   | 1207122.57   |
| ASR-6   | Libertad Elementary School, Brgy. Libertad, Isabel           | 1,554                        | NE        | 658713.86   | 1206192.82   |
| ASR-7   | Residential Area, Brgy. Matlang, Isabel                      | 867                          | E         | 658672.70   | 1204803.10   |
| ASR-8   | Matlang National High School, Brgy. Matlang, Isabel          | 1,627                        | ESE       | 659302.94   | 1204279.05   |
| ASR-9   | Bilwang Central School, Brgy. Bilwang, Isabel                | 2,675                        | SE        | 660136.98   | 1203626.42   |
| ASR-10  | Relocation Site, Brgy. Binog, Isabel                         | 3,297                        | SE        | 660904.44   | 1203711.99   |
| ASR-11  | Residential Area, Brgy. Tubod, Isabel                        | 3,908                        | SE        | 661139.59   | 1202870.23   |





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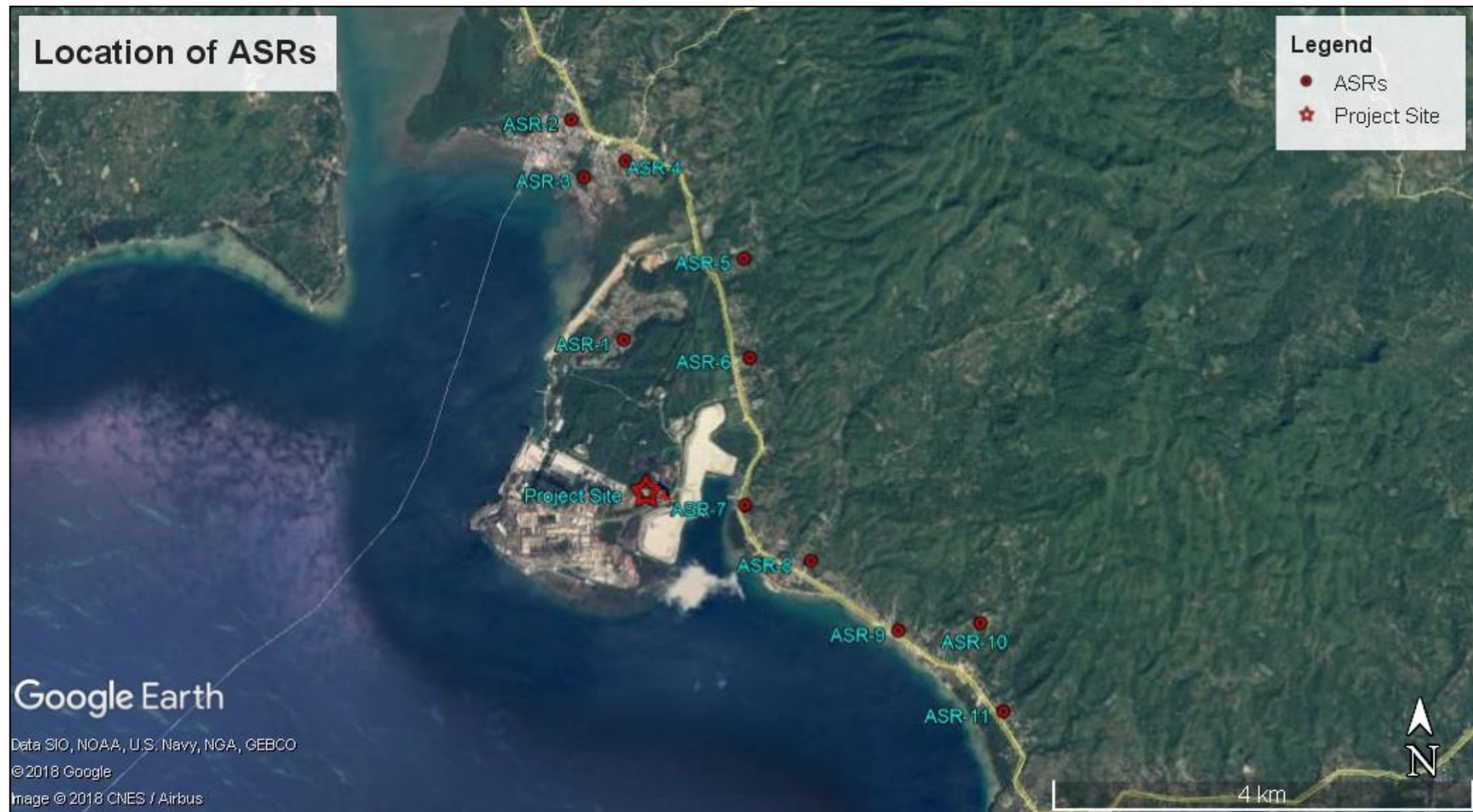


Figure 2-36. Location of Area Sensitive Receptors

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### Modeling Meteorological Data

The nearest meteorological station of the Philippine Atmospheric Geophysical and Astronomical Services Administration (**PAGASA**) to the proposed Project site is the Tacloban Airport Station. However, said station is too far to the Project site to use in the modeling, therefore the meteorological data set to be used is from The Fifth-Generation Penn State University / National Center for Atmospheric Research mesoscale model (commonly referred to as MM5) purchased at Lakes Environmental. The table below shows the details of the purchased Surface & Upper Air Met Data for AERMET preprocessed from MM5.

|                         |  |
|-------------------------|--|
| Met Number              | MET1711208                             |
| Met Data Type:          | AERMET-Ready (Surface & Upper Air Data |
| Start-End Date:         | January 1 to December 31, 2016         |
| Latitude:               | 10.896561 N                            |
| Longitude:              | 124.443547 E                           |
| Datum:                  | WGS 84                                 |
| Site Time Zone:         | UTC/GMT UTC + 8 hour(s)                |
| Anemometer Height:      | 15 m                                   |
| Station Base Elevation: | 2 m                                    |
| Upper Air Adjustment:   | -8 hour(s)                             |
| Closest City:           | Ormoc City                             |
| Country:                | Philippines                            |

The format of the Hourly Surface Met Data is SAMSON (surface met data for preprocessing by AERMET (\*.sam)) while the format for upper air data is TD-6201 – Fixed Length (upper air met data for preprocessing by AERMET (\*.ua)).

The MM5 is a frequently-used global meteorological model for historical episodes. It is a limited-area, non-hydrostatic, terrain-following sigma-coordinate model designed to simulate or predict mesoscale and regional-scale atmospheric circulations.

The annual wind rose from the 2016 MM5-AERMET derived meteorological data for the Project site is provided in **Figure 2-37**. Prevailing winds are coming from the east and east-southeast occupying an approximately 8.88% percent of the time. There are lighter winds from the south (sea breeze) while the strongest wind is from the southwest occupying approximately 0.7% of the time. The average wind speed is 3.81 m/s and calm condition is 1.293% of the time.

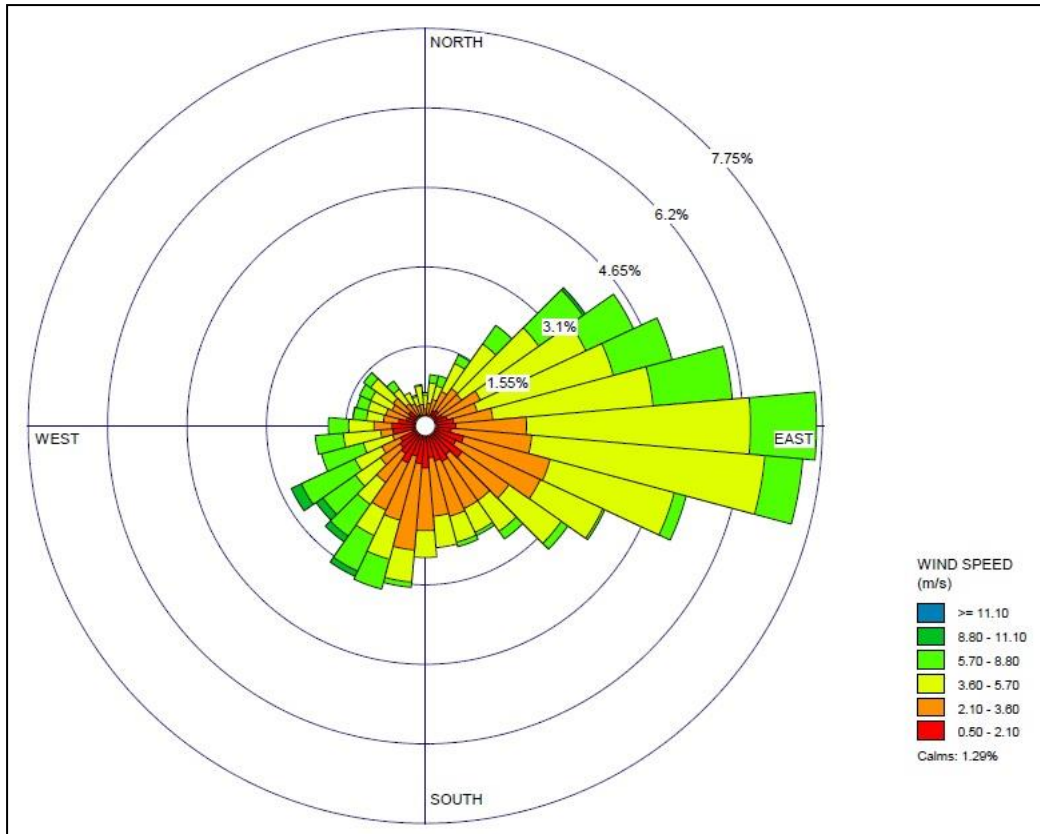


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Source: AERMET View Version 9.5.0 Lakes Environmental

**Figure 2-37. Windrose Diagram for the MM5-AERMET Derived Meteorological Data**

### Emission Load of Each Sources

IASCL proposes to install 80 units power generator sets with 1MW capacity each with a maximum output of 70 MW (10 units will serve as a spare unit) and designed mainly to provide ancillary services to the NGCP. The 70MW capacity shall be subdivided based on the two (2) types of ancillary services: the 40MW shall be for Regulating Reserve; and the 30MW shall be Contingency Reserve.

Accordingly, based on the required operation of NGCP for provisional of Ancillary Services, only half of the 40MW capacity for Regulating Reserve shall be initially dispatched. This means that only 40 modular diesel engines will operate at 50% loading, having a total initial dispatch of 20MW. Such output will then change if there will be fluctuations of system frequency in the Visayas Grid.

On the other hand, for the provision of 30MW Contingency Reserve, NGCP initially will require five (5) modular diesel engines to be operated at 300KW each, a total initial dispatch of 1.5MW. The remaining 25 modular diesel engines will serve as standby units and shall only be dispatched should there be an outage of a large generator loss of transmission line in the system.

The modeling scenarios considered in this study are the worst-case condition wherein the emission sources are modeled at its maximum output. The sources subject for this air modeling are the 40MW Regulating Reserve and the 30MW Contingency Reserve. The modeling scenario considered are the following:

- Scenario 1: Normal operating condition (Regulating Reserve); consisting of 40 operating modular diesel engines; and

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- Scenario 2: Maximum operating condition (Regulating + Contingency Reserves); consisting of 70 operating modular diesel engines.

Emission data used in the modeling are from the source emission testing report of the 1.3MW Generator Set of DMCI Masbate Power Corporation conducted by GEOSPHERE Technologies, Inc.

The average of the results for PM, SO<sub>2</sub>, NO<sub>2</sub>, and CO together with the source parameters of the stacks, such as stack height, stack inside diameter; flue gas exit velocity and temperature are summarized in **Tables 2-35 to 2-41**. **Annex 2-3** presents the Source Emission Report of DMCI-Masbate.





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Table 2-35. Summary of Source Parameters

| Parameter                     | Unit   | Generator Set #1 | Generator Set #2 | Generator Set #3 | Generator Set #4 | Generator Set #5 | Generator Set #6 | Generator Set #7 | Generator Set #8 | Generator Set #9 | Generator Set #10 |
|-------------------------------|--------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|-------------------|
| <b>Coordinates</b>            |        |                  |                  |                  |                  |                  |                  |                  |                  |                  |                   |
| Easting                       | m      | 657753.83        | 657753.65        | 657753.53        | 657753.37        | 657753.56        | 657753.45        | 657753.30        | 657753.48        | 657753.66        | 657753.74         |
| Northing                      | m      | 1204989.06       | 1204983.00       | 1204976.91       | 1204964.25       | 1204958.45       | 1204952.08       | 1204943.16       | 1204936.98       | 1204930.78       | 1204918.27        |
| Rated Capacity                | MW     | 1                | 1                | 1                | 1                | 1                | 1                | 1                | 1                | 1                | 1                 |
| Operating hours               | hrs/yr | 8,760            | 8,760            | 8,760            | 8,760            | 8,760            | 8,760            | 8,760            | 8,760            | 8,760            | 8,760             |
| Flue gas velocity             | m/s    | 34.8             | 34.8             | 34.8             | 34.8             | 34.8             | 34.8             | 34.8             | 34.8             | 34.8             | 34.8              |
| Flue gas exit temperature     | °C     | 341.19           | 341.19           | 341.19           | 341.19           | 341.19           | 341.19           | 341.19           | 341.19           | 341.19           | 341.19            |
| Stack height above the ground | m      | 5.6              | 5.6              | 5.6              | 5.6              | 5.6              | 5.6              | 5.6              | 5.6              | 5.6              | 5.6               |
| Stack exit diameter           | m      | 0.41             | 0.41             | 0.41             | 0.41             | 0.41             | 0.41             | 0.41             | 0.41             | 0.41             | 0.41              |
| <b>Emission rate</b>          |        |                  |                  |                  |                  |                  |                  |                  |                  |                  |                   |
| CO                            | g/s    | 0.00812          | 0.00812          | 0.00812          | 0.00812          | 0.00812          | 0.00812          | 0.00812          | 0.00812          | 0.00812          | 0.00812           |
| SO <sub>2</sub>               | g/s    | 0.00561          | 0.00561          | 0.00561          | 0.00561          | 0.00561          | 0.00561          | 0.00561          | 0.00561          | 0.00561          | 0.00561           |
| NO <sub>2</sub>               | g/s    | 0.00896          | 0.00896          | 0.00896          | 0.00896          | 0.00896          | 0.00896          | 0.00896          | 0.00896          | 0.00896          | 0.00896           |
| PM                            | g/s    | 0.01736          | 0.01736          | 0.01736          | 0.01736          | 0.01736          | 0.01736          | 0.01736          | 0.01736          | 0.01736          | 0.01736           |
| PM <sub>10</sub>              | g/s    | 0.01493          | 0.01493          | 0.01493          | 0.01493          | 0.01493          | 0.01493          | 0.01493          | 0.01493          | 0.01493          | 0.01493           |

Note: 1. Emission data are extracted from the Source Emission Testing Report of the 1.23MW Generator Set of DMCI Masbate Power Corporation conducted by

GEOSPHERE Technologies, Inc. dated July 12-14, 2017.

2. The Report has no PM<sub>10</sub> result; therefore, PM<sub>10</sub> is assumed to be 80% of PM.

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Table 2-36. Summary of Source Parameters

| Parameter                     | Unit   | Generator Set #11 | Generator Set #12 | Generator Set #13 | Generator Set #14 | Generator Set #15 | Generator Set #16 | Generator Set #17 | Generator Set #18 | Generator Set #19 | Generator Set #20 |
|-------------------------------|--------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| <b>Coordinates</b>            |        |                   |                   |                   |                   |                   |                   |                   |                   |                   |                   |
| Easting                       | m      | 657753.63         | 657753.81         | 657753.68         | 657753.69         | 657753.69         | 657753.65         | 657753.62         | 657753.60         | 657769.68         | 657769.40         |
| Northing                      | m      | 1204911.97        | 1204905.64        | 1204897.23        | 1204890.56        | 1204884.76        | 1204872.80        | 1204866.08        | 1204859.93        | 1204860.20        | 1204866.36        |
| Rated Capacity                | MW     | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 |
| Operating hours               | hrs/yr | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             |
| Flue gas velocity             | m/s    | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              |
| Flue gas exit temperature     | °C     | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            |
| Stack height above the ground | m      | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               |
| Stack exit diameter           | m      | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              |
| <b>Emission rate</b>          |        |                   |                   |                   |                   |                   |                   |                   |                   |                   |                   |
| CO                            | g/s    | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           |
| SO <sub>2</sub>               | g/s    | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           |
| NO <sub>2</sub>               | g/s    | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           |
| PM                            | g/s    | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           |
| PM <sub>10</sub>              | g/s    | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           |

Note: 1. Emission data are extracted from the Source Emission Testing Report of the 1.23MW Generator Set of DMCI Masbate Power Corporation conducted by

GEOSPHERE Technologies, Inc. dated July 12-14, 2017.

2. The Report has no PM<sub>10</sub> result; therefore, PM<sub>10</sub> is assumed to be 80% of PM.

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Table 2-37. Summary of Source Parameters

| Parameter                     | Unit   | Generator Set #21 | Generator Set #22 | Generator Set #23 | Generator Set #24 | Generator Set #25 | Generator Set #26 | Generator Set #27 | Generator Set #28 | Generator Set #29 | Generator Set #30 |
|-------------------------------|--------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| <b>Coordinates</b>            |        |                   |                   |                   |                   |                   |                   |                   |                   |                   |                   |
| Easting                       | m      | 657769.41         | 657769.42         | 657769.43         | 657769.43         | 657769.52         | 657769.29         | 657769.35         | 657769.48         | 657769.26         | 657769.04         |
| Northing                      | m      | 1204872.52        | 1204884.79        | 1204891.20        | 1204896.72        | 1204906.29        | 1204912.34        | 1204918.36        | 1204930.89        | 1204936.82        | 1204943.28        |
| Rated Capacity                | MW     | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 |
| Operating hours               | hrs/yr | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             |
| Flue gas velocity             | m/s    | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              |
| Flue gas exit temperature     | °C     | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            |
| Stack height above the ground | m      | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               |
| Stack exit diameter           | m      | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              |
| <b>Emission rate</b>          |        |                   |                   |                   |                   |                   |                   |                   |                   |                   |                   |
| CO                            | g/s    | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           |
| SO <sub>2</sub>               | g/s    | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           |
| NO <sub>2</sub>               | g/s    | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           |
| PM                            | g/s    | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           |
| PM <sub>10</sub>              | g/s    | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           |

Note: 1. Emission data are extracted from the Source Emission Testing Report of the 1.23MW Generator Set of DMCI Masbate Power Corporation conducted by

GEOSPHERE Technologies, Inc. dated July 12-14, 2017.

2. The Report has no PM<sub>10</sub> result; therefore, PM<sub>10</sub> is assumed to be 80% of PM.

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Table 2-38. Summary of Source Parameters

| Parameter                     | Unit   | Generator Set #31 | Generator Set #32 | Generator Set #33 | Generator Set #34 | Generator Set #35 | Generator Set #36 | Generator Set #37 | Generator Set #38 | Generator Set #39 | Generator Set #40 |
|-------------------------------|--------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| <b>Coordinates</b>            |        |                   |                   |                   |                   |                   |                   |                   |                   |                   |                   |
| Easting                       | m      | 657769.42         | 657769.48         | 657769.27         | 657769.28         | 657769.27         | 657768.98         | 657794.41         | 657794.46         | 657794.51         | 657794.33         |
| Northing                      | m      | 1204951.94        | 1204958.32        | 1204964.38        | 1204976.46        | 1204982.80        | 1204988.85        | 1204988.92        | 1204982.89        | 1204976.84        | 1204964.71        |
| Rated Capacity                | MW     | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 |
| Operating hours               | hrs/yr | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             |
| Flue gas velocity             | m/s    | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              |
| Flue gas exit temperature     | °C     | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            |
| Stack height above the ground | m      | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               |
| Stack exit diameter           | m      | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              |
| <b>Emission rate</b>          |        |                   |                   |                   |                   |                   |                   |                   |                   |                   |                   |
| CO                            | g/s    | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           |
| SO <sub>2</sub>               | g/s    | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           |
| NO <sub>2</sub>               | g/s    | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           |
| PM                            | g/s    | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           |
| PM <sub>10</sub>              | g/s    | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           |

Note: 1. Emission data are extracted from the Source Emission Testing Report of the 1.23MW Generator Set of DMCI Masbate Power Corporation conducted by

GEOSPHERE Technologies, Inc. dated July 12-14, 2017.

2. The Report has no PM<sub>10</sub> result; therefore, PM<sub>10</sub> is assumed to be 80% of PM.



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Table 2-39. Summary of Source Parameters

| Parameter                     | Unit   | Generator Set #41 | Generator Set #42 | Generator Set #43 | Generator Set #44 | Generator Set #45 | Generator Set #46 | Generator Set #47 | Generator Set #48 | Generator Set #49 | Generator Set #50 |
|-------------------------------|--------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| <b>Coordinates</b>            |        |                   |                   |                   |                   |                   |                   |                   |                   |                   |                   |
| Easting                       | m      | 657794.68         | 657794.45         | 657794.53         | 657794.59         | 657794.65         | 657794.76         | 657794.81         | 657794.86         | 657794.94         | 657794.98         |
| Northing                      | m      | 1204958.61        | 1204952.20        | 1204943.22        | 1204936.73        | 1204930.77        | 1204918.76        | 1204912.43        | 1204906.64        | 1204897.34        | 1204891.51        |
| Rated Capacity                | MW     | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 |
| Operating hours               | hrs/yr | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             |
| Flue gas velocity             | m/s    | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              |
| Flue gas exit temperature     | °C     | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            |
| Stack height above the ground | m      | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               |
| Stack exit diameter           | m      | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              |
| <b>Emission rate</b>          |        |                   |                   |                   |                   |                   |                   |                   |                   |                   |                   |
| CO                            | g/s    | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           |
| SO <sub>2</sub>               | g/s    | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           |
| NO <sub>2</sub>               | g/s    | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           |
| PM                            | g/s    | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           |
| PM <sub>10</sub>              | g/s    | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           |

Note: 1. Emission data are extracted from the Source Emission Testing Report of the 1.23MW Generator Set of DMCI Masbate Power Corporation conducted by

GEOSPHERE Technologies, Inc. dated July 12-14, 2017.

2. The Report has no PM<sub>10</sub> result; therefore, PM<sub>10</sub> is assumed to be 80% of PM.

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Table 2-40. Summary of Source Parameters

| Parameter                     | Unit   | Generator Set #51 | Generator Set #52 | Generator Set #53 | Generator Set #54 | Generator Set #55 | Generator Set #56 | Generator Set #57 | Generator Set #58 | Generator Set #59 | Generator Set #60 |
|-------------------------------|--------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| <b>Coordinates</b>            |        |                   |                   |                   |                   |                   |                   |                   |                   |                   |                   |
| Easting                       | m      | 657794.73         | 657795.10         | 657795.14         | 657794.89         | 657815.87         | 657815.52         | 657815.47         | 657815.35         | 657815.29         | 657815.53         |
| Northing                      | m      | 1204885.09        | 1204872.80        | 1204866.63        | 1204860.46        | 1204860.48        | 1204866.36        | 1204872.82        | 1204885.14        | 1204891.28        | 1204897.12        |
| Rated Capacity                | MW     | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 |
| Operating hours               | hrs/yr | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             |
| Flue gas velocity             | m/s    | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              |
| Flue gas exit temperature     | °C     | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            |
| Stack height above the ground | m      | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               |
| Stack exit diameter           | m      | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              |
| <b>Emission rate</b>          |        |                   |                   |                   |                   |                   |                   |                   |                   |                   |                   |
| CO                            | g/s    | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           |
| SO <sub>2</sub>               | g/s    | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           |
| NO <sub>2</sub>               | g/s    | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           |
| PM                            | g/s    | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           |
| PM <sub>10</sub>              | g/s    | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           |

Note: 1. Emission data are extracted from the Source Emission Testing Report of the 1.23MW Generator Set of DMCI Masbate Power Corporation conducted by

GEOSPHERE Technologies, Inc. dated July 12-14, 2017.

2. The Report has no PM<sub>10</sub> result; therefore, PM<sub>10</sub> is assumed to be 80% of PM.

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Table 2-41. Summary of Source Parameters

| Parameter                     | Unit   | Generator Set #61 | Generator Set #62 | Generator Set #63 | Generator Set #64 | Generator Set #65 | Generator Set #66 | Generator Set #67 | Generator Set #68 | Generator Set #69 | Generator Set #70 |
|-------------------------------|--------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| <b>Coordinates</b>            |        |                   |                   |                   |                   |                   |                   |                   |                   |                   |                   |
| Easting                       | m      | 657815.38         | 657815.28         | 657815.18         | 657815.28         | 657815.17         | 657815.36         | 657815.21         | 657815.10         | 657814.99         | 657815.07         |
| Northing                      | m      | 1204906.15        | 1204912.53        | 1204918.59        | 1204930.92        | 1204937.18        | 1204943.42        | 1204952.43        | 1204958.58        | 1204964.70        | 1204976.87        |
| Rated Capacity                | MW     | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 | 1                 |
| Operating hours               | hrs/yr | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             | 8,760             |
| Flue gas velocity             | m/s    | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              | 34.8              |
| Flue gas exit temperature     | °C     | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            | 341.19            |
| Stack height above the ground | m      | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               | 5.6               |
| Stack exit diameter           | m      | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              | 0.41              |
| <b>Emission rate</b>          |        |                   |                   |                   |                   |                   |                   |                   |                   |                   |                   |
| CO                            | g/s    | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           | 0.00812           |
| SO <sub>2</sub>               | g/s    | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           | 0.00561           |
| NO <sub>2</sub>               | g/s    | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           | 0.00896           |
| PM                            | g/s    | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           | 0.01736           |
| PM <sub>10</sub>              | g/s    | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           | 0.01493           |

Note: 1. Emission data are extracted from the Source Emission Testing Report of the 1.23MW Generator Set of DMCI Masbate Power Corporation conducted by

GEOSPHERE Technologies, Inc. dated July 12-14, 2017.

2. The Report has no PM<sub>10</sub> result; therefore, PM<sub>10</sub> is assumed to be 80% of PM.

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### Modeling Results

**Tables 2-42** and **2-43** give an overall summary of the predicted concentrations, i.e. maximum modeled concentrations for Scenarios 1 and 2, respectively. The predicted peak 1-hour and 24-hour emissions of TSP, PM<sub>10</sub>, SO<sub>2</sub>, NO<sub>2</sub>, and CO are within the CAA limit for the whole modeling domain and at any air sensitive receptors. The highest ground level concentrations of modeled parameters in the whole modeling domain occurred in an uninhabited area of Barangay Libertad, Isabel extending from a distance 50 to 300 meters north-northwest of the Project site boundary. The highest ground level concentrations predicted were for particulates followed by SO<sub>2</sub> and NO<sub>2</sub> of the proposed sources.

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





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Table 2-42. Summary of Predicted Maximum Concentration under Scenario 1

| Receptor ID     | Maximum Predicted Ground Level Concentration ( $\mu\text{g}/\text{m}^3$ ) |           |                 |            |                 |            |            |            |                  |            |
|-----------------|---|-----------|-----------------|------------|-----------------|------------|------------|------------|------------------|------------|
|                 | CO <sup>a</sup>   |           | NO <sub>2</sub> |            | SO <sub>2</sub> |            | TSP        |            | PM <sub>10</sub> |            |
|                 | 1hr   | 8hr       | 1hr             | 24hr       | 1hr             | 24hr       | 1hr        | 24hr       | 1hr              | 24hr       |
| Domain Maximum  | 0.6580  | 0.2586    | 72.61           | 16.49      | 91.26           | 19.58      | 140.69     | 31.96      | 121.0            | 27.48      |
| ASR-1           | 0.0319  | 0.0047    | 3.52            | 0.232      | 4.17            | 0.279      | 6.83       | 0.449      | 5.87             | 0.386      |
| ASR-2           | 0.0153  | 0.0020    | 1.69            | 0.101      | 2.16            | 0.124      | 3.28       | 0.196      | 2.82             | 0.169      |
| ASR-3           | 0.0170  | 0.0024    | 1.88            | 0.119      | 2.27            | 0.146      | 3.64       | 0.231      | 3.13             | 0.199      |
| ASR-4           | 0.0213  | 0.0028    | 2.35            | 0.116      | 2.99            | 0.147      | 4.56       | 0.225      | 3.92             | 0.194      |
| ASR-5           | 0.2248  | 0.0350    | 24.81           | 1.35       | 29.74           | 1.638      | 48.07      | 2.61       | 41.34            | 2.25       |
| ASR-6           | 0.0430  | 0.0195    | 4.75            | 0.943      | 5.98            | 1.174      | 9.20       | 1.83       | 7.91             | 1.57       |
| ASR-7           | 0.0323  | 0.0200    | 3.57            | 1.50       | 4.46            | 1.878      | 6.91       | 2.91       | 5.94             | 2.50       |
| ASR-8           | 0.0217  | 0.0114    | 2.39            | 0.588      | 2.98            | 0.739      | 4.64       | 1.14       | 3.99             | 0.979      |
| ASR-9           | 0.0164  | 0.0069    | 1.81            | 0.406      | 2.26            | 0.509      | 3.51       | 0.787      | 3.02             | 0.677      |
| ASR-10          | 0.1318  | 0.0166    | 14.54           | 0.616      | 18.01           | 0.763      | 28.18      | 1.19       | 24.23            | 1.03       |
| ASR-11          | 0.0158  | 0.0045    | 1.74            | 0.241      | 2.18            | 0.301      | 3.37       | 0.467      | 2.90             | 0.402      |
| <b>NAAQGV:</b>  | <b>35</b>   | <b>10</b> | <b>-</b>        | <b>150</b> | <b>-</b>        | <b>180</b> | <b>-</b>   | <b>230</b> | <b>-</b>         | <b>150</b> |
| <b>NAAQSSAP</b> | <b>-</b>  | <b>-</b>  | <b>260</b>      | <b>-</b>   | <b>340</b>      | <b>-</b>   | <b>300</b> | <b>-</b>   | <b>200</b>       | <b>-</b>   |

Note: a - mg/m<sup>3</sup>:

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Table 2-43. Summary of Predicted Maximum Concentration under Scenario 2

| Receptor ID     | Maximum Predicted Ground Level Concentration ( $\mu\text{g}/\text{m}^3$ ) |           |                 |            |                 |            |            |            |                  |            |
|-----------------|---|-----------|-----------------|------------|-----------------|------------|------------|------------|------------------|------------|
|                 | CO <sup>a</sup>   |           | NO <sub>2</sub> |            | SO <sub>2</sub> |            | TSP        |            | PM <sub>10</sub> |            |
|                 | 1hr   | 8hr       | 1hr             | 24hr       | 1hr             | 24hr       | 1hr        | 24hr       | 1hr              | 24hr       |
| Domain Maximum  | 1.69  | 0.711     | 168.92          | 26.96      | 95.03           | 14.39      | 218.19     | 34.82      | 187.65           | 29.95      |
| ASR-1           | 0.071   | 0.011     | 7.07            | 0.570      | 7.06            | 0.42       | 9.14       | 0.737      | 7.86             | 0.634      |
| ASR-2           | 0.048   | 0.0061    | 4.82            | 0.239      | 3.97            | 0.21       | 6.23       | 0.309      | 5.36             | 0.266      |
| ASR-3           | 0.045   | 0.0060    | 4.53            | 0.278      | 4.14            | 0.18       | 5.85       | 0.360      | 5.03             | 0.310      |
| ASR-4           | 0.066   | 0.0087    | 6.61            | 0.323      | 4.57            | 0.25       | 8.54       | 0.417      | 7.34             | 0.359      |
| ASR-5           | 0.617   | 0.106     | 61.65           | 3.79       | 28.86           | 1.47       | 79.63      | 4.90       | 68.48            | 4.21       |
| ASR-6           | 0.122   | 0.056     | 12.20           | 2.38       | 7.82            | 1.39       | 15.76      | 3.07       | 13.56            | 2.64       |
| ASR-7           | 0.099   | 0.061     | 9.91            | 4.12       | 5.79            | 2.11       | 12.80      | 5.33       | 11.01            | 4.58       |
| ASR-8           | 0.064   | 0.034     | 6.40            | 1.59       | 4.08            | 0.79       | 8.27       | 2.05       | 7.11             | 1.77       |
| ASR-9           | 0.048   | 0.020     | 4.83            | 1.09       | 3.05            | 0.52       | 6.23       | 1.41       | 5.36             | 1.21       |
| ASR-10          | 0.380   | 0.048     | 38.03           | 1.61       | 13.88           | 0.59       | 49.12      | 2.08       | 42.25            | 1.79       |
| ASR-11          | 0.047   | 0.013     | 4.69            | 0.642      | 2.76            | 0.29       | 6.05       | 0.829      | 5.21             | 0.713      |
| <b>NAAQGV:</b>  | <b>35</b>   | <b>10</b> | <b>-</b>        | <b>150</b> | <b>-</b>        | <b>180</b> | <b>-</b>   | <b>230</b> | <b>-</b>         | <b>150</b> |
| <b>NAAQSSAP</b> | <b>-</b>  | <b>-</b>  | <b>260</b>      | <b>-</b>   | <b>340</b>      | <b>-</b>   | <b>300</b> | <b>-</b>   | <b>200</b>       | <b>-</b>   |

Note: a -  $\text{mg}/\text{m}^3$ .

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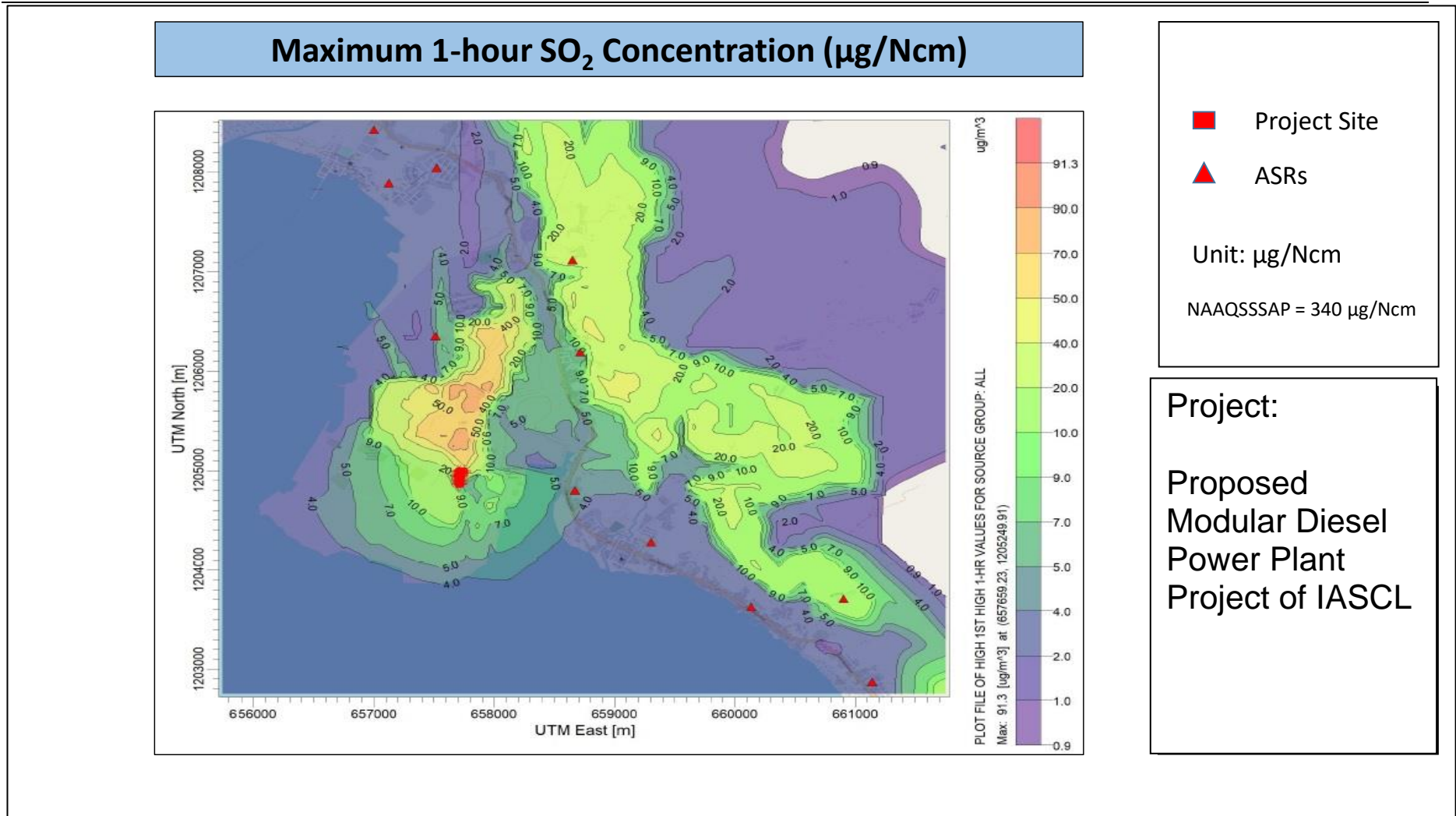


Figure 2-38. Isopleth of SO<sub>2</sub> Concentration 1-hour averaging period Scenario 1

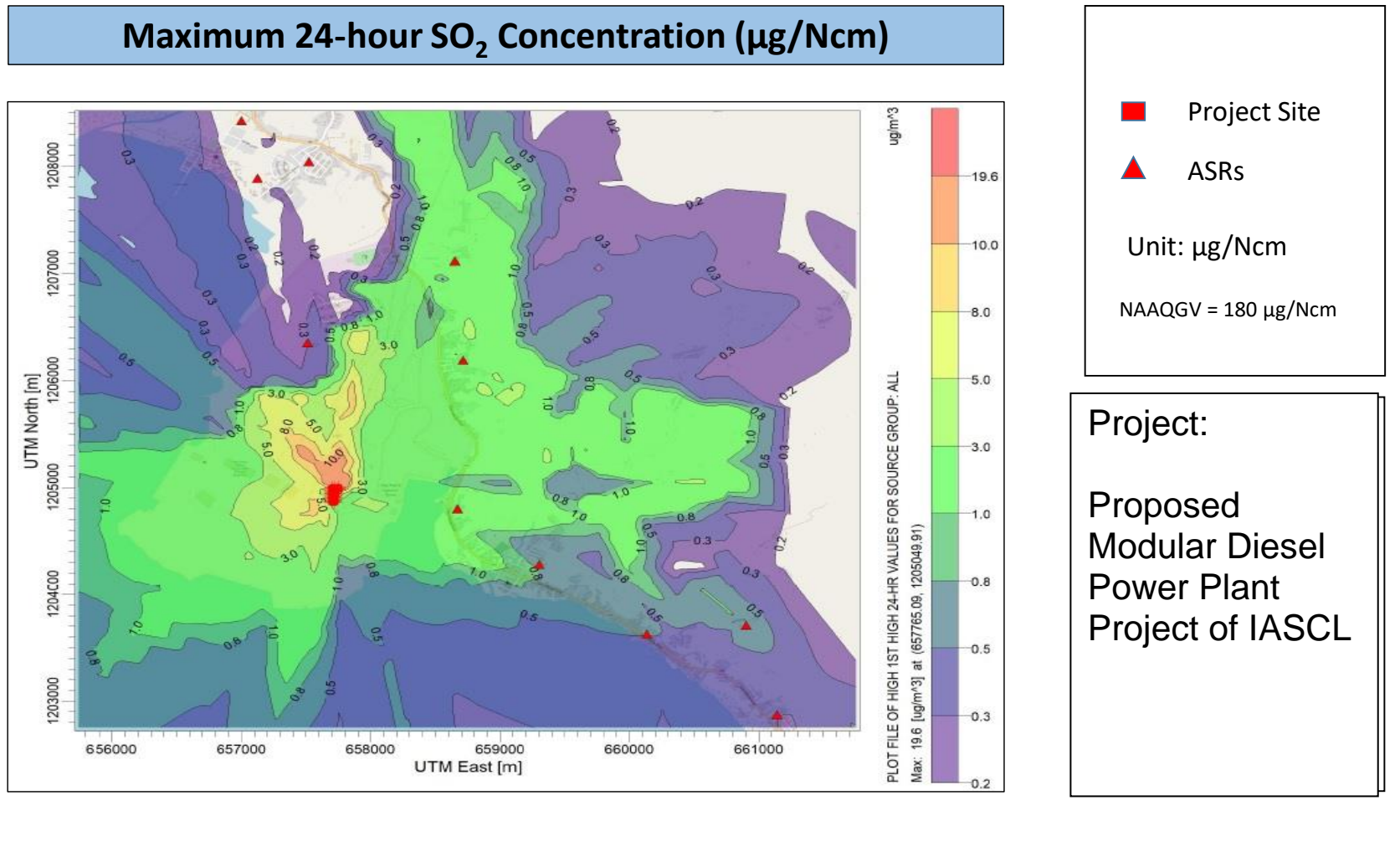


Figure 2-39. Isopleth of SO<sub>2</sub> Concentration 24-hour averaging period Scenario 1



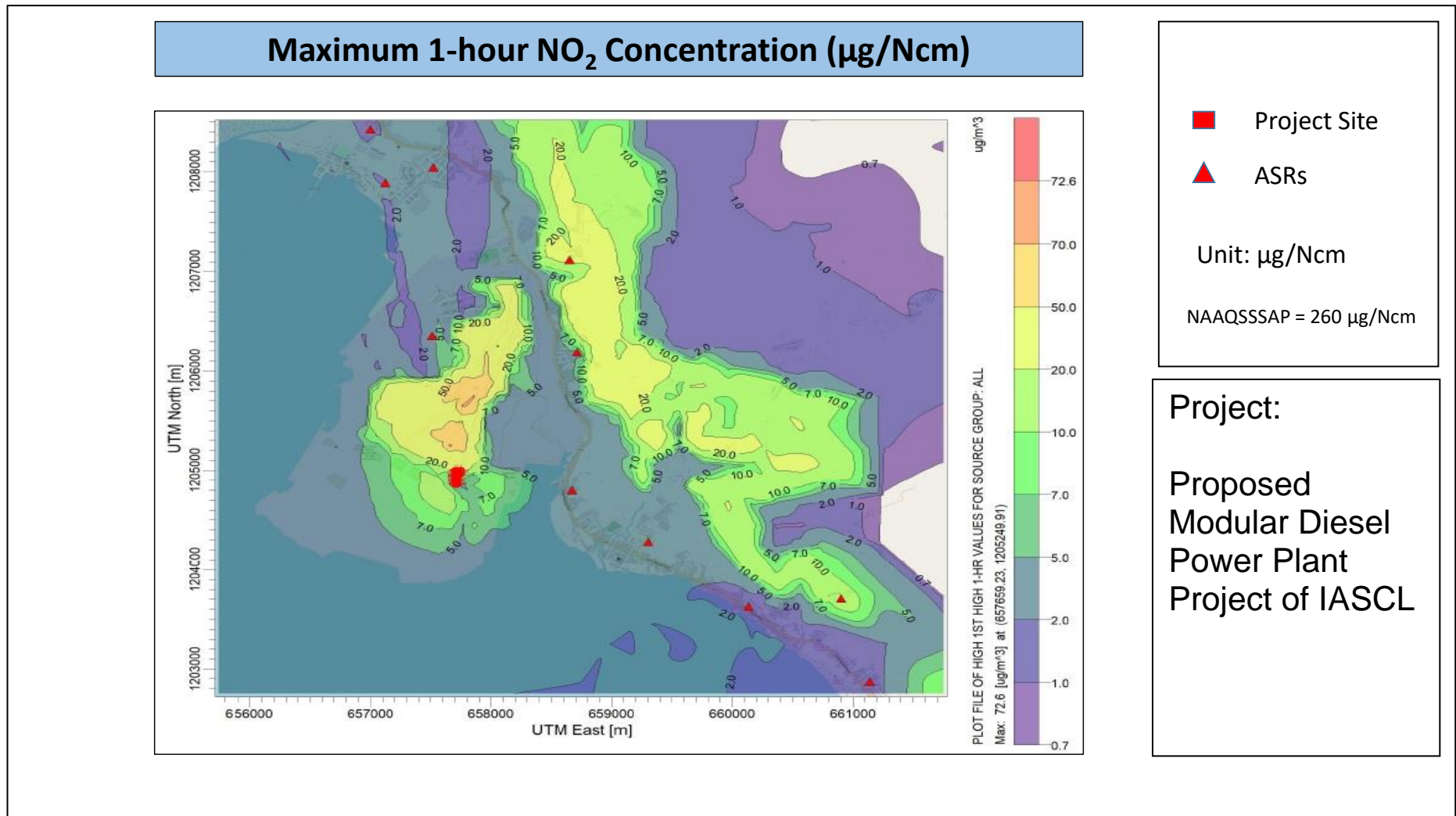


Figure 2-40. Isopleth of NO<sub>2</sub> Concentration 1-hour averaging period Scenario 1

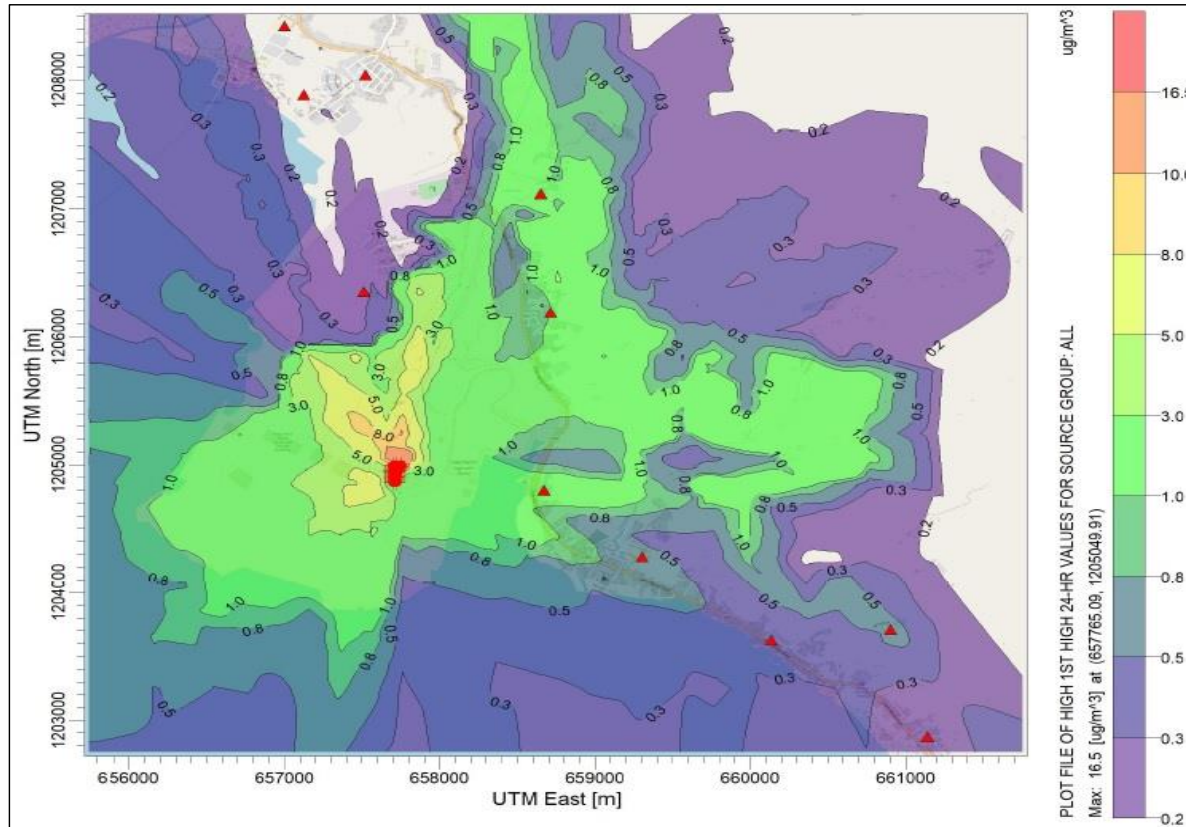
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### Maximum 24-hour NO<sub>2</sub> Concentration (µg/Ncm)



■ Project Site

▲ ASRs

Unit: µg/Ncm

NAAQGV = 150 µg/Ncm

Project:

Proposed  
Modular Diesel  
Power Plant  
Project of IASCL

Figure 2-41. Isopleth of NO<sub>2</sub> Concentration 24-hour averaging period Scenario 1

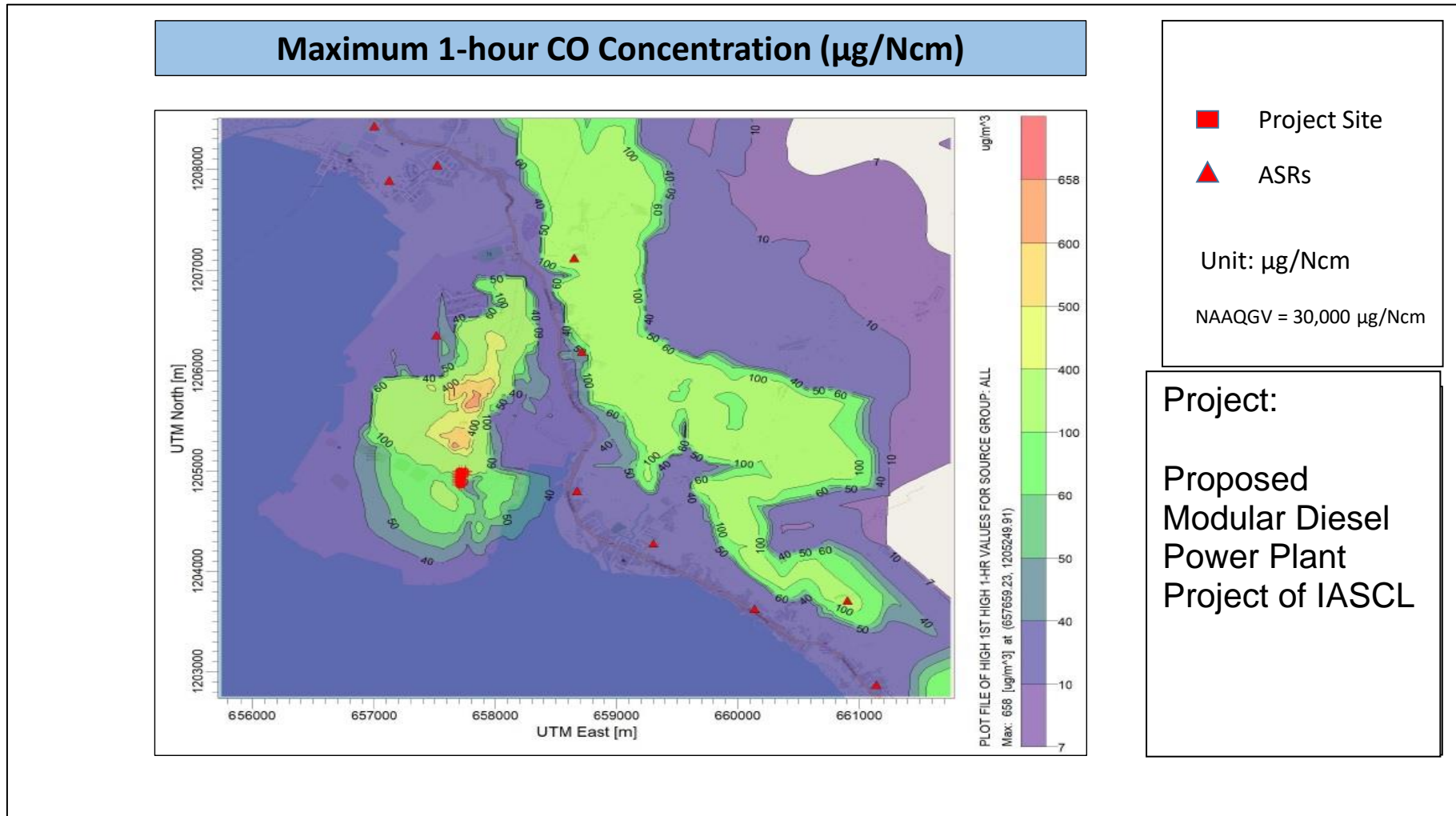


Figure 2-42. Isopleth of CO Concentration 1-hour averaging period Scenario 1

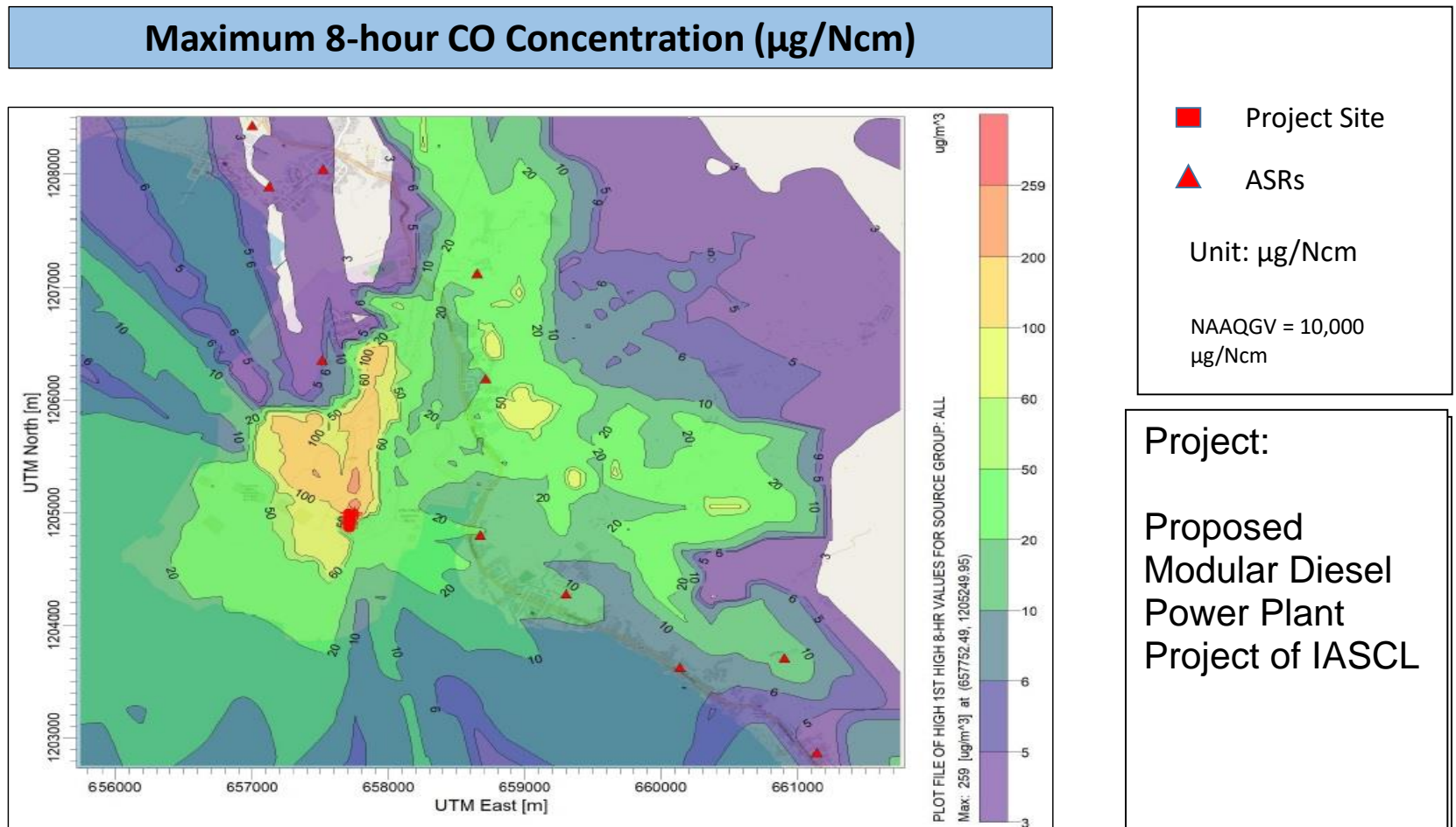


Figure 2-43. Isopleth of CO Concentration 8-hour averaging period Scenario 1



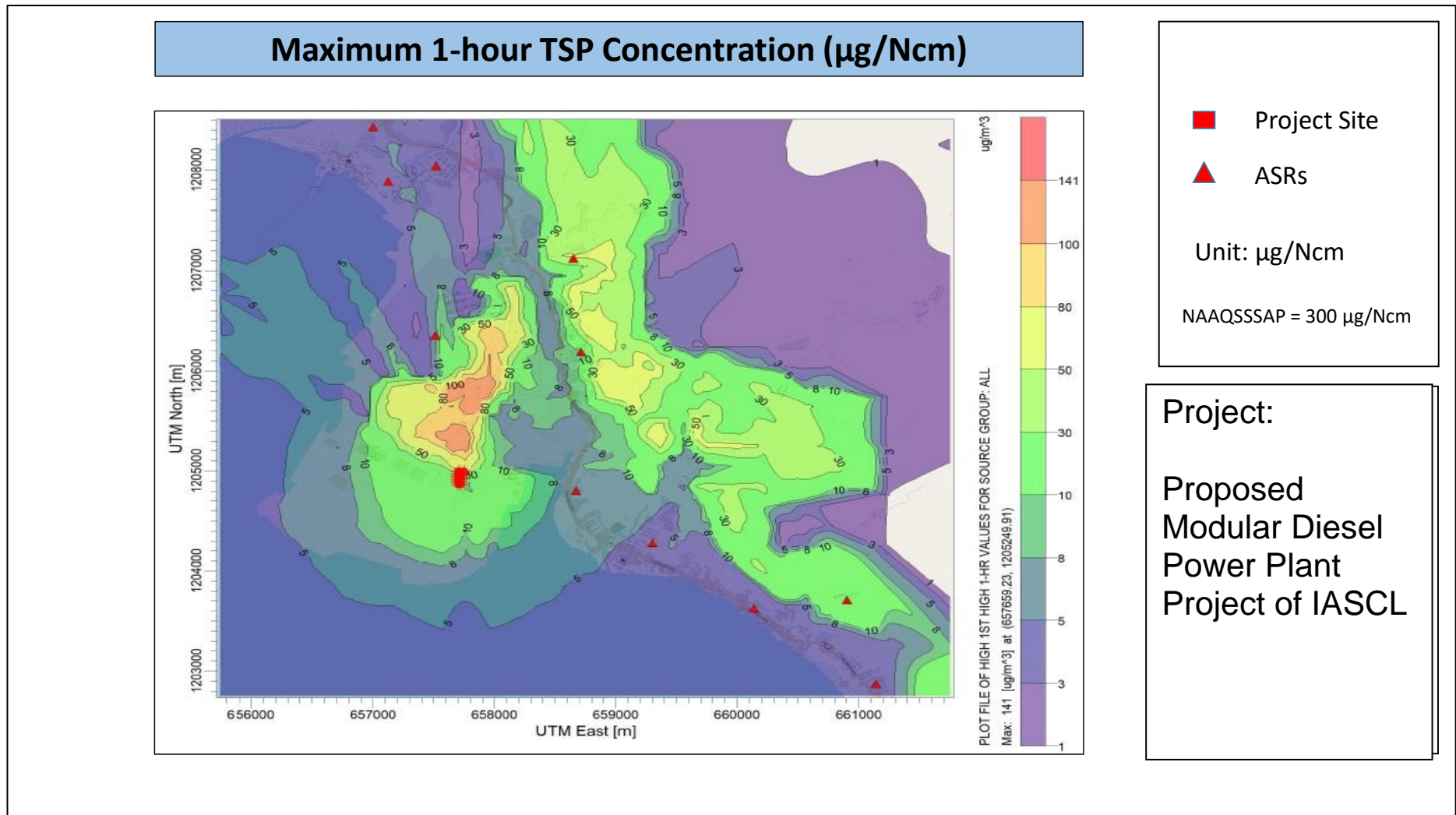
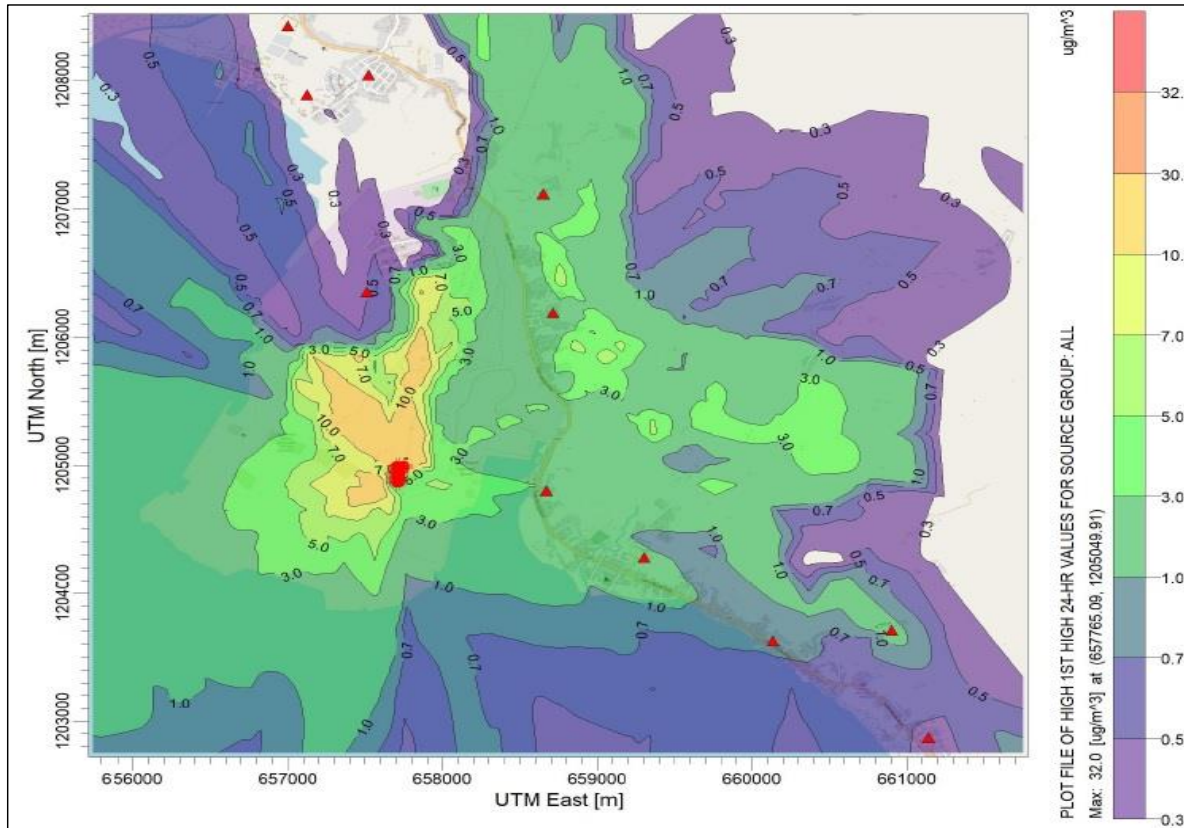


Figure 2-44. Isopleth of TSP Concentration 1-hour averaging period Scenario 1

### Maximum 24-hour TSP Concentration ( $\mu\text{g}/\text{Ncm}$ )



■ Project Site

▲ ASRs

Unit:  $\mu\text{g}/\text{Ncm}$

NAAQGV = 230  $\mu\text{g}/\text{Ncm}$

Project:

Proposed  
Modular Diesel  
Power Plant  
Project of IASCL

Figure 2-45. Isopleth of TSP Concentration 24-hour averaging period Scenario 1

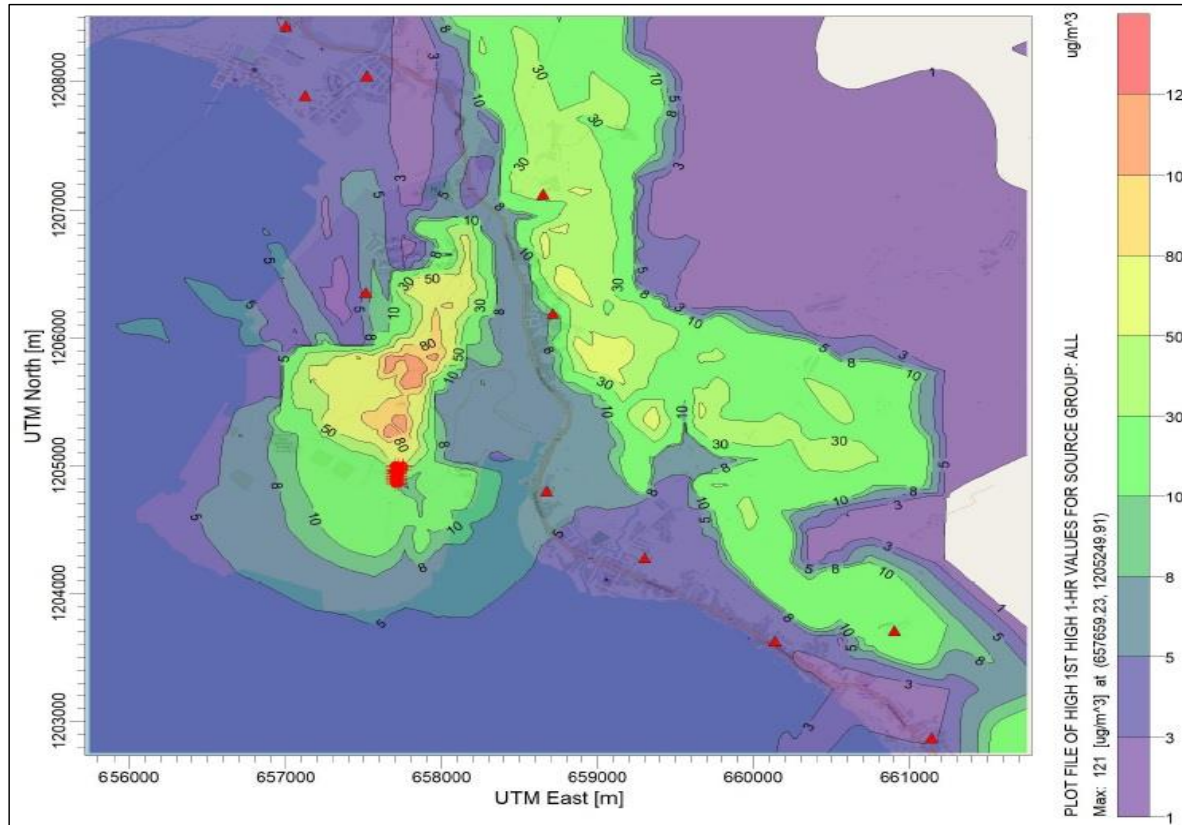
## ENVIRONMENTAL IMPACT STATEMENT REPORT

Proposed Modular Diesel Power Plant Ancillary Project

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Isabel Ancillary Services Co. Ltd.

### Maximum 1-hour PM<sub>10</sub> Concentration (µg/Ncm)



Project Site

ASRs

Unit: µg/Ncm

NAAQSSAP = 200 µg/Ncm

Project:

Proposed  
Modular Diesel  
Power Plant  
Project of IASCL

Figure 2-46. Isopleth of PM<sub>10</sub> Concentration 1-hour averaging period Scenario 1

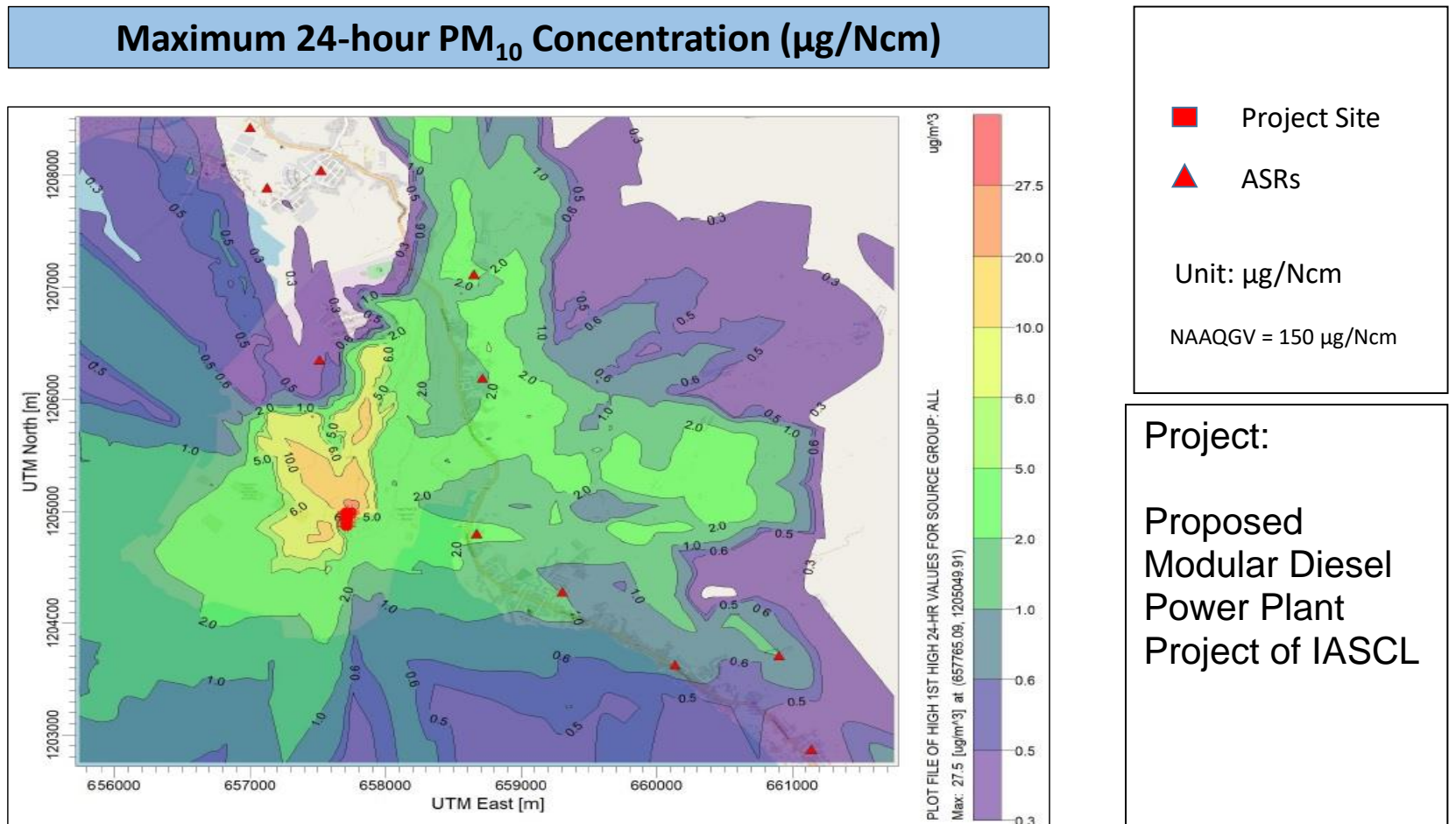


Figure 2-47. Isopleth of PM<sub>10</sub> Concentration 24-hour averaging period Scenario 1



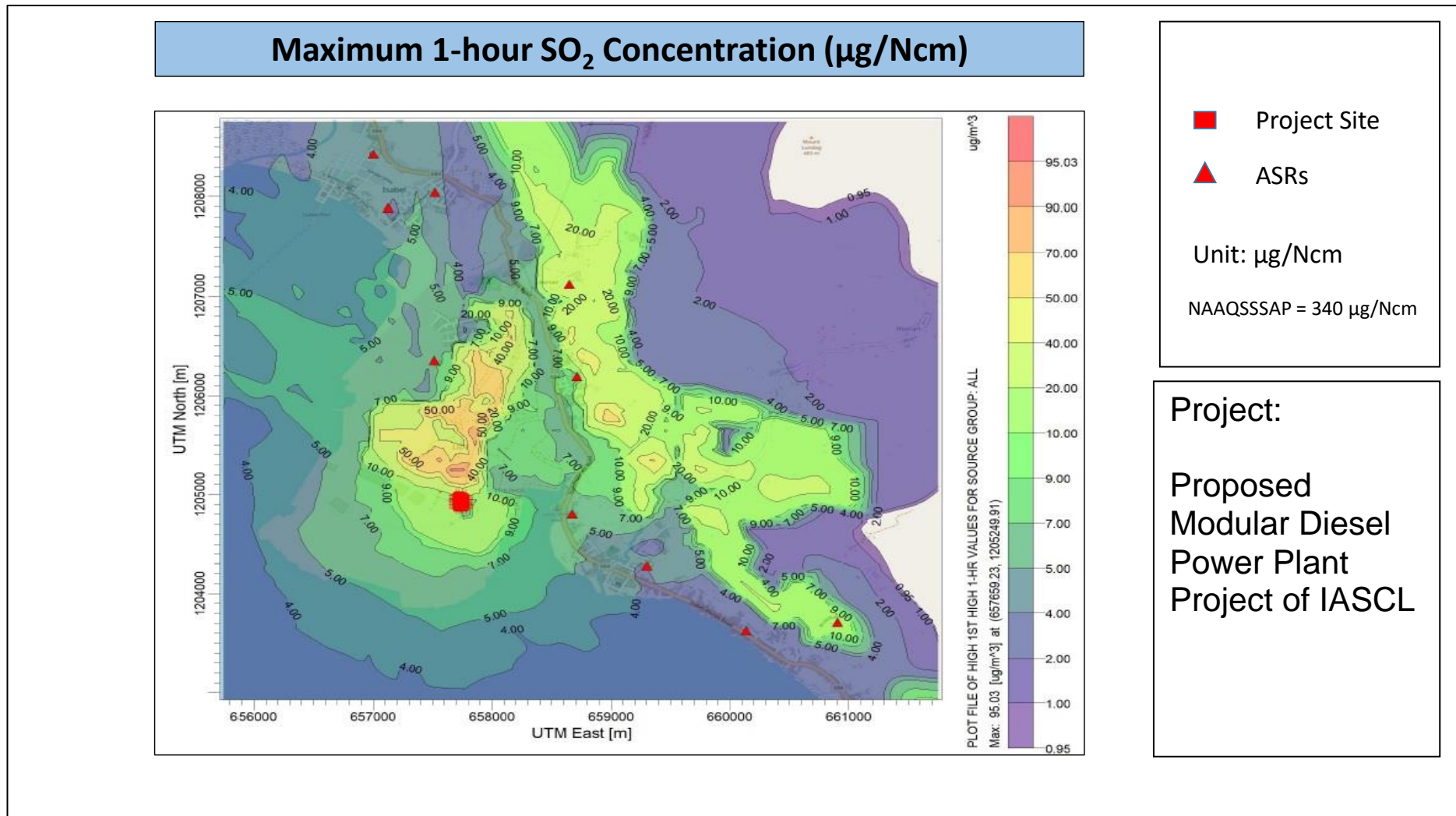
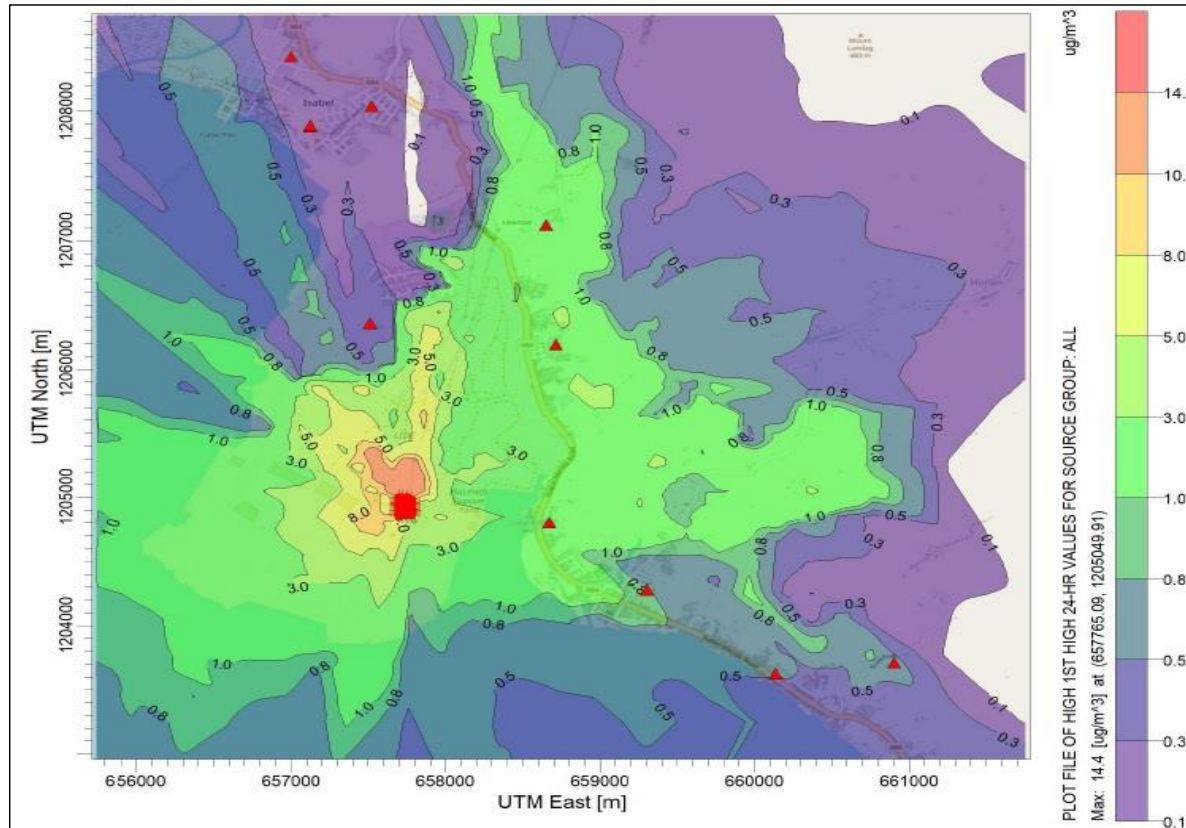


Figure 2-48. Isopleth of SO<sub>2</sub> Concentration 1-hour averaging period Scenario 2

### Maximum 24-hour SO<sub>2</sub> Concentration (µg/Ncm)



■ Project Site

▲ ASRs

Unit: µg/Ncm

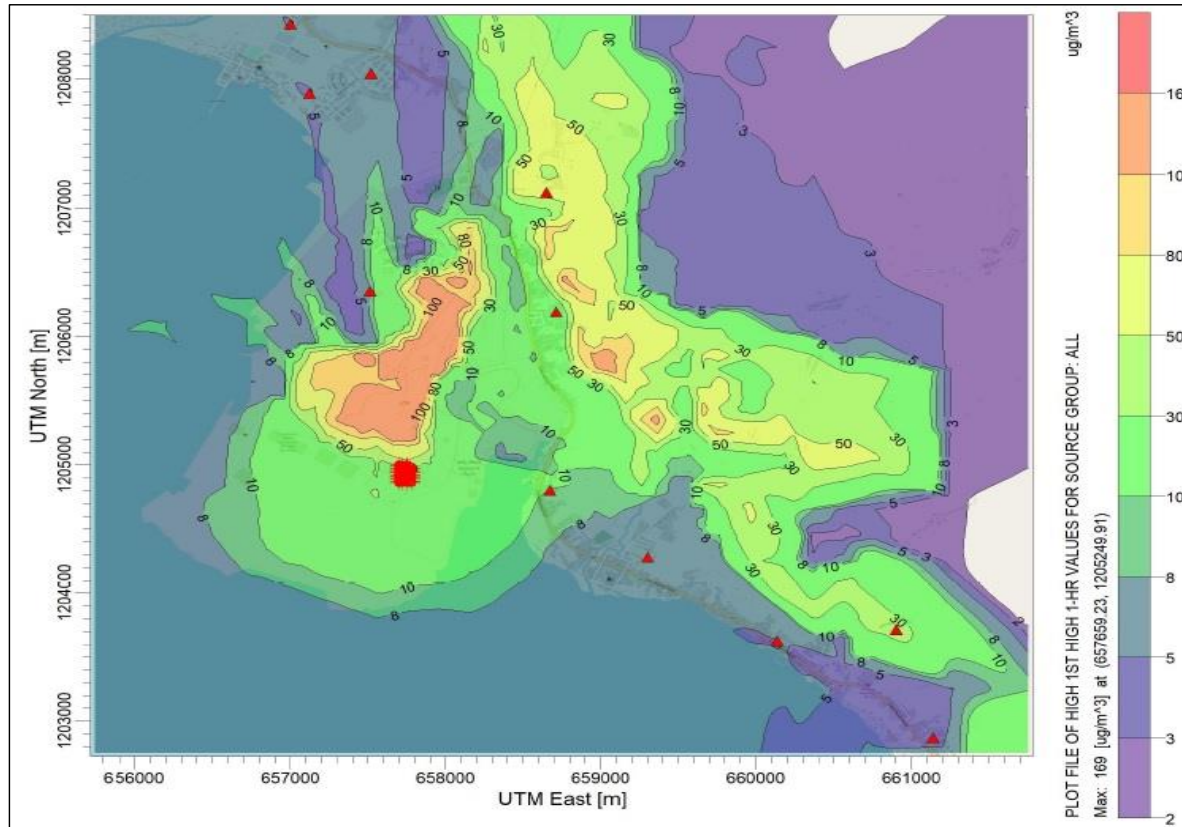
NAAQGV = 180 µg/Ncm

Project:

Proposed  
Modular Diesel  
Power Plant  
Project of IASCL

Figure 2-49. Isopleth of SO<sub>2</sub> Concentration 24-hour averaging period Scenario 2

### Maximum 1-hour NO<sub>2</sub> Concentration (µg/Ncm)



■ Project Site

▲ ASRs

Unit: µg/Ncm

NAAQSSAP = 260 µg/Ncm

Project:

Proposed  
Modular Diesel  
Power Plant  
Project of IASCL

Figure 2-50. Isopleth of NO<sub>2</sub> Concentration 1-hour averaging period Scenario 2

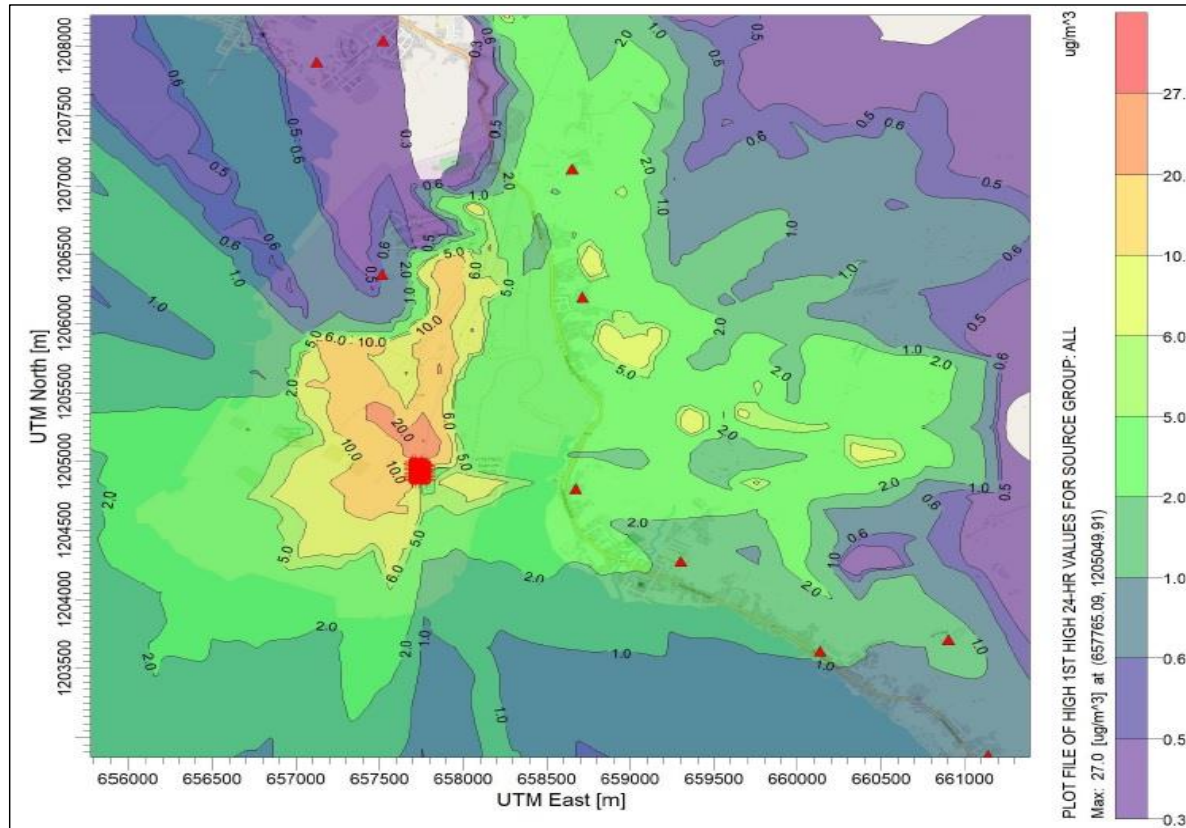
## ENVIRONMENTAL IMPACT STATEMENT REPORT

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Isabel Ancillary Services Co. Ltd.

### Maximum 24-hour NO<sub>2</sub> Concentration (µg/Ncm)



Project:

Proposed  
Modular Diesel  
Power Plant  
Project of IASCL

Figure 2-51. Isopleth of NO<sub>2</sub> Concentration 24-hour averaging period Scenario 2



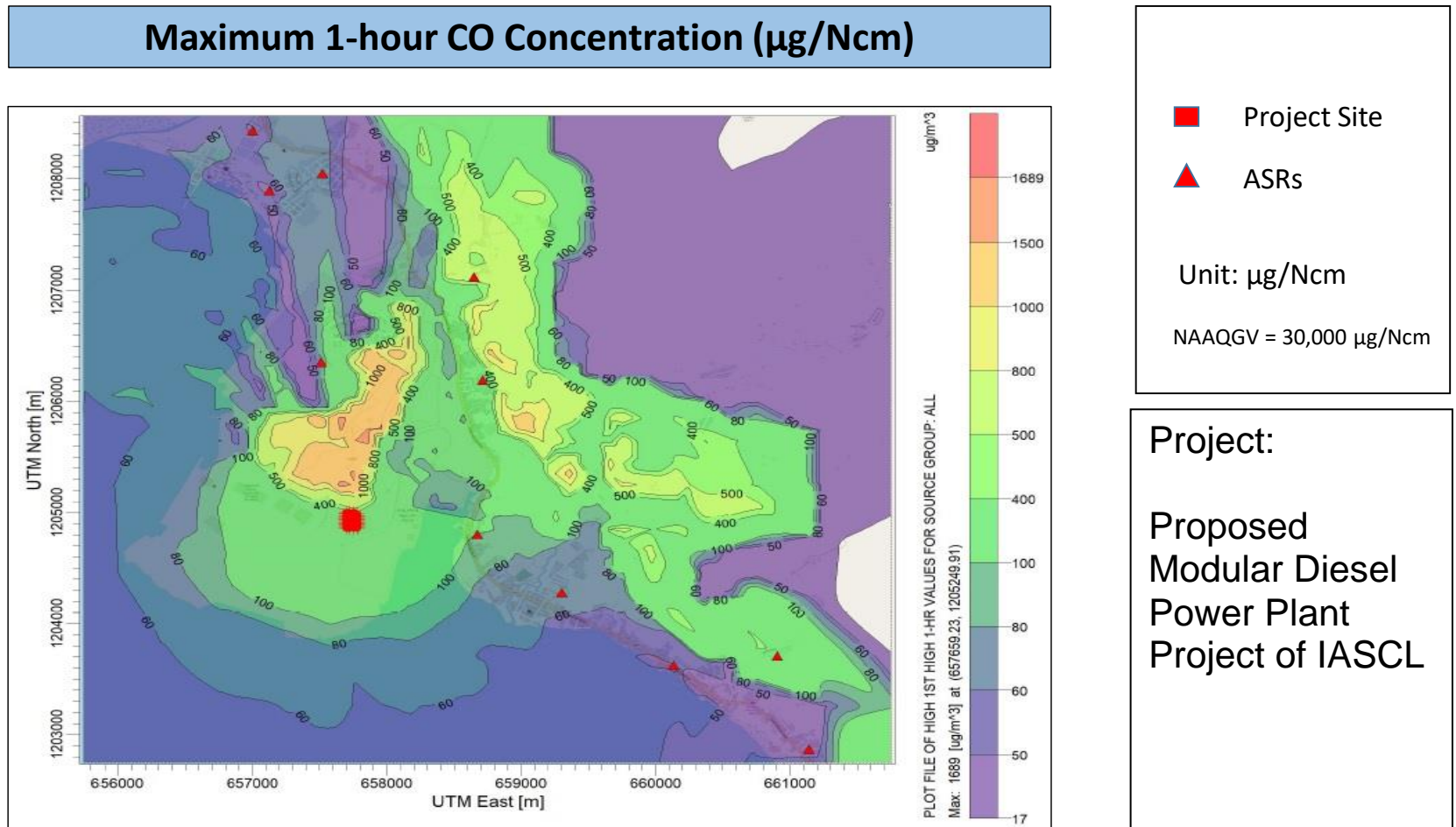


Figure 2-52. Isopleth of CO Concentration 1-hour averaging period Scenario 2

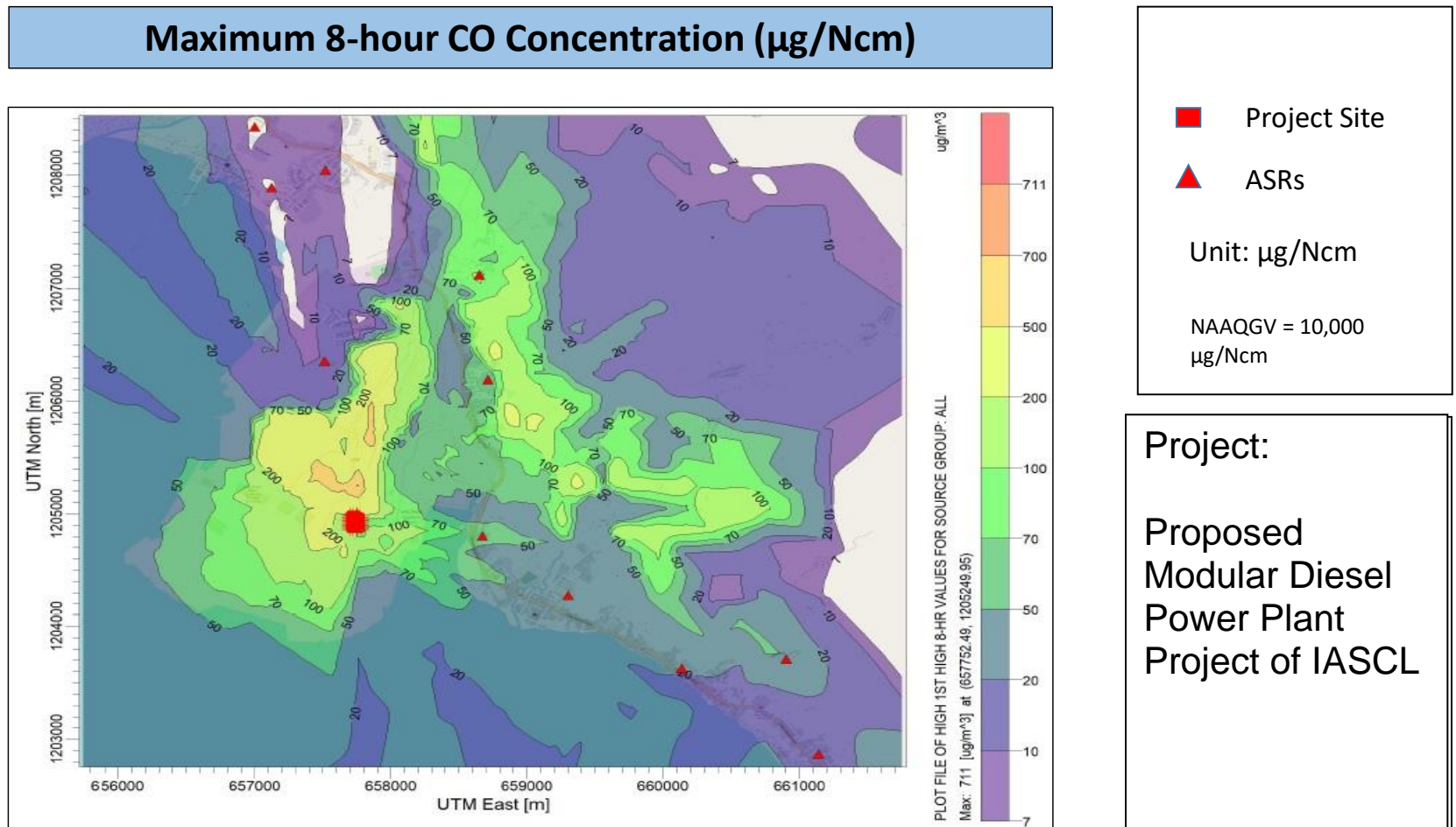


Figure 2-53. Isopleth of CO Concentration 8-hour averaging period Scenario 2

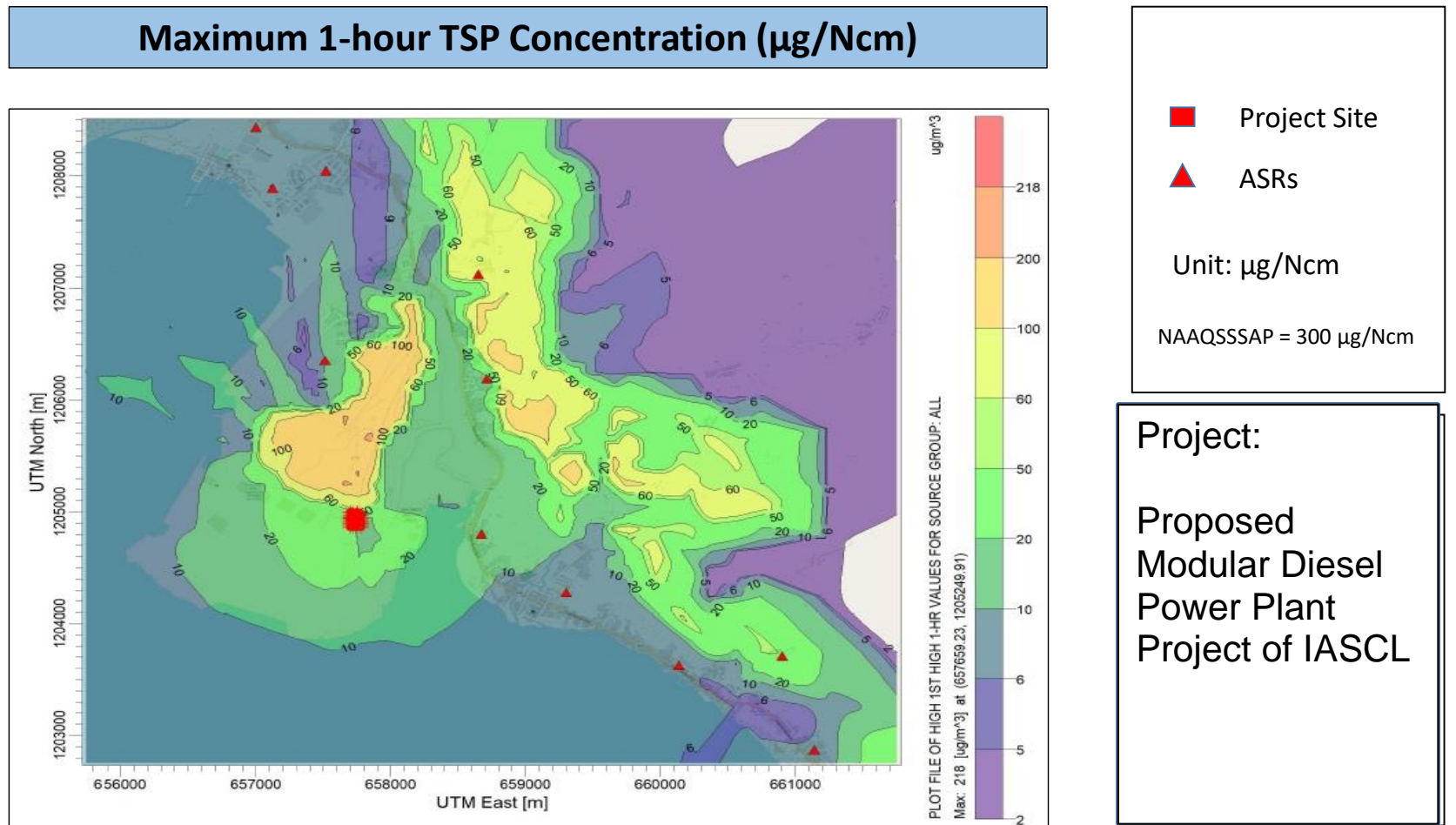
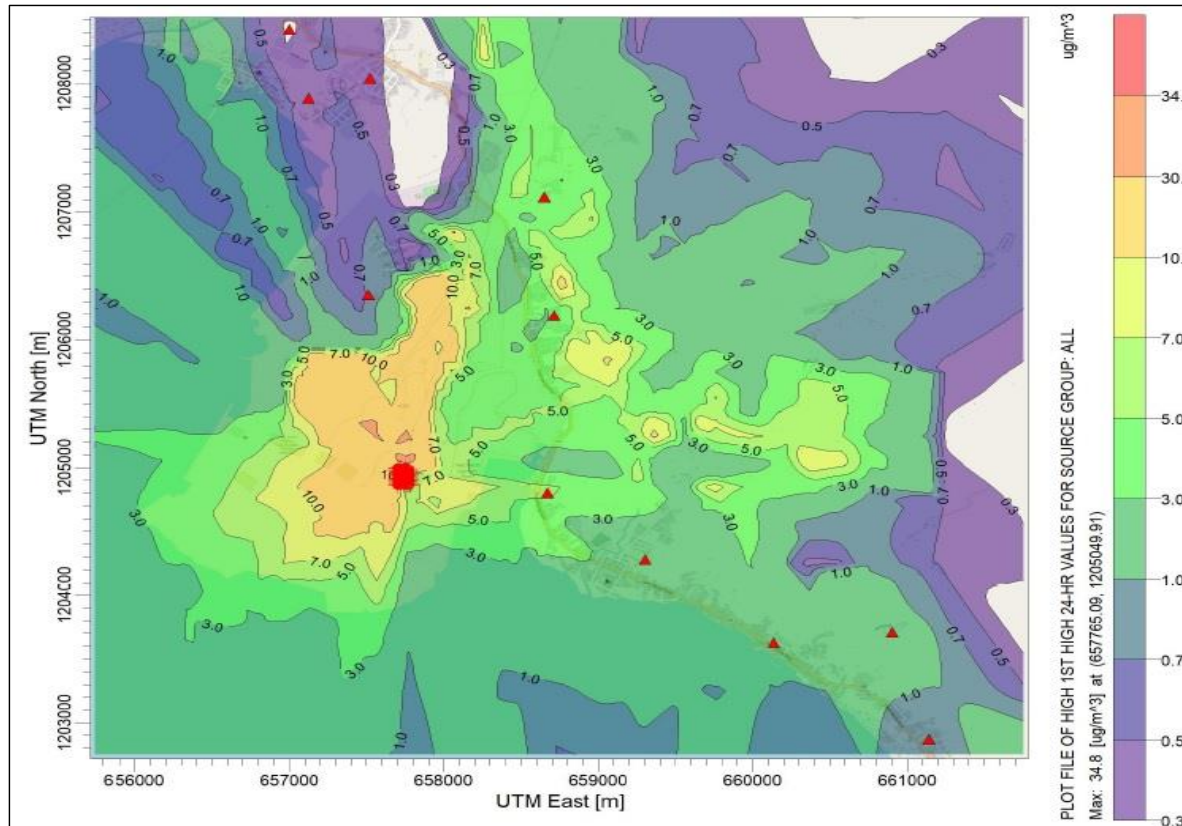


Figure 2-54. Isopleth of TSP Concentration 1-hour averaging period Scenario 2

### Maximum 24-hour TSP Concentration ( $\mu\text{g}/\text{Ncm}$ )



■ Project Site

▲ ASRs

Unit:  $\mu\text{g}/\text{Ncm}$

NAAQGV = 230  $\mu\text{g}/\text{Ncm}$

Project:

Proposed  
Modular Diesel  
Power Plant  
Project of IASCL

Figure 2-55. Isopleth of TSP Concentration 24-hour averaging period Scenario 2



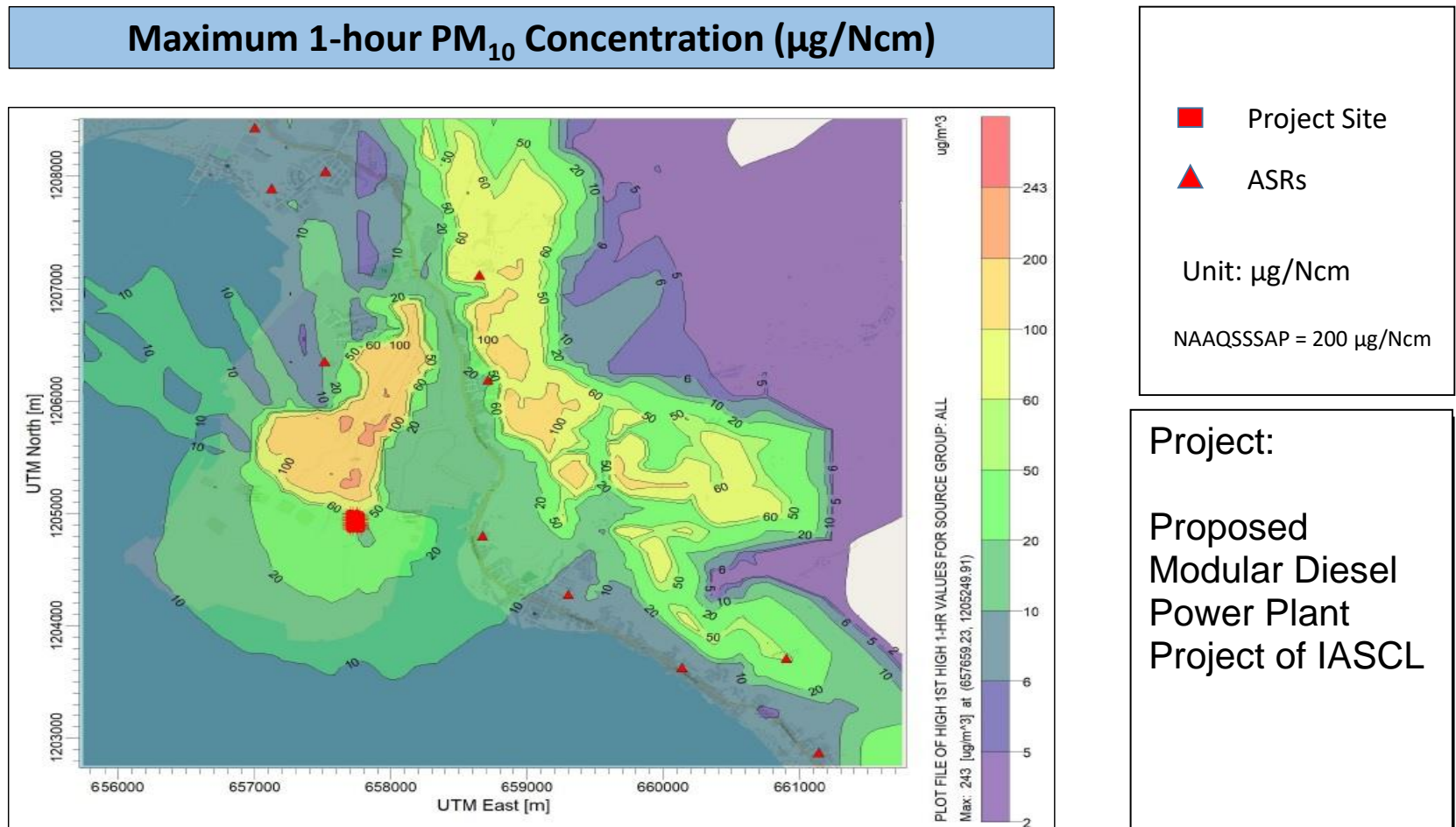


Figure 2-56. Isopleth of PM<sub>10</sub> Concentration 1-hour averaging period Scenario 2

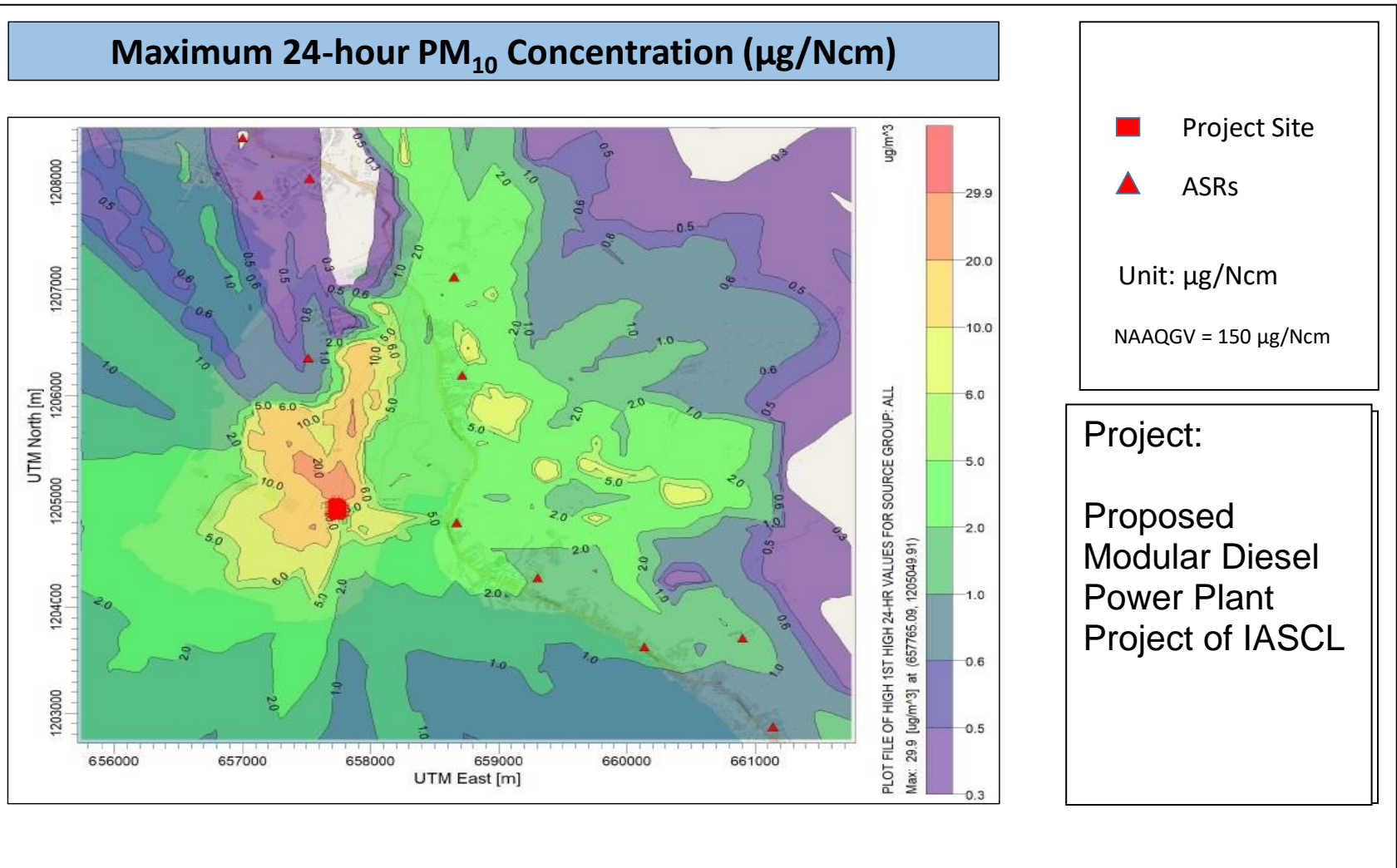


Figure 2-57. Isopleth of PM<sub>10</sub> Concentration 24-hour averaging period Scenario 2

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To lessen, control and prevent emission of NO<sub>x</sub> (as NO<sub>2</sub>) into the receiving environment, Low NO<sub>x</sub> Burners (**LNB**) shall be installed. LNB limit NO<sub>x</sub> 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 NO<sub>x</sub> formation; (ii) a reduced flame temperature that limits thermal NO<sub>x</sub> formation; and/or (iii) a reduced residence time at peak temperature which also limits thermal NO<sub>x</sub> formation.

Based on the isopleth plot of the air dispersion modelling, windrose and terrain pattern of the project site, the recommended monitoring stations for ambient air and noise measurement are presented in **Table 2-44**.

**Table 2-44. Recommended Monitoring Stations for Ambient Air Quality**

| Station | Description   | Coordinates |             |
|---------|---|-------------|-------------|
|         |   | Easting, m  | Northing, m |
| 1       | Approximately 1.30 Km northwest of the Project, 40 meters from the shore of Kinatumyan Beach, Brgy. San Roque, Isabel | 656802.84   | 1205859.03  |
| 2       | Clubhouse of LIDE Staff House, Brgy. Mahayag, Isabel  | 657523.53   | 1206277.22  |
| 3       | Libertad Elementary School, Brgy. Libertad, Isabel  | 658713.86   | 1206192.82  |
| 4       | Residential Area, Brgy. Libertad  | 658843.87   | 1205496.25  |
| 5       | Residential Area, Brgy. Matlang, Isabel   | 658672.70   | 1204803.10  |

The IASCL will also secure a Permit to Operate (PTO) for the generator sets from EMB Regional Office in compliance to DAO 2004-26 of the DENR. Part of the requirements of the PTO issuance is the emission testing to ensure compliance of emissions to DENR standards. The emission testing requirements for the generator set and other point source of emissions is implemented through DENR MC 2007-003.

### 2.3.2.5 Noise Quality

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 six (6) 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. **Table 2-45** presents the results of noise level monitoring conducted from November 5-7, 2017 at the ambient air quality monitoring stations. As shown in **Table 2-45**, 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 except for STN-2 Daytime. The location of STN-2 is in the parking area of LIDE Clubhouse where noise is expected because the site is full of recreational facilities such as basketball court, swimming pool, gym, etc.

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 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 2-45. Results of Noise Levels Measurement**



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| Station | Period    | Date         | Time        | Median SPL<br>dB(A) | DENR Noise<br>Standard dB(A) |
|---------|-----------|--------------|-------------|---------------------|------------------------------|
| STN-1   | Morning   | Nov. 6, 2017 | 0642H-0652H | 46.7                | 70                           |
|         | Daytime   | Nov. 5, 2017 | 1732H-1742H | 56.0                | 75                           |
|         | Evening   | Nov. 5, 2017 | 2019H-2029H | 51.1                | 70                           |
|         | Nighttime | Nov. 5, 2017 | 2234H-2244H | 51.2                | 65                           |
| STN-2   | Morning   | Nov. 7, 2017 | 0533H-0543H | 47.8                | 50                           |
|         | Daytime   | Nov. 6, 2017 | 1703H-1713H | 56.8                | 55                           |
|         | Evening   | Nov. 6, 2017 | 1943H-1953H | 53.5                | 50                           |
|         | Nighttime | Nov. 6, 2017 | 2251H-2301H | 47.3                | 45                           |
| STN-3   | Daytime   | Nov. 7, 2017 | 1518H-1528H | 50.4                | 65                           |
| STN-4   | Daytime   | Nov. 7, 2017 | 1645H-1655H | 55.4                | 75                           |
| STN-5   | Evening   | Nov. 7, 2017 | 1829H-1839H | 53.4                | 60                           |
| STN-6   | Evening   | Nov. 7, 2017 | 2024H-2034H | 54.6                | 70                           |

### 2.3.2.6 Impact in Noise Quality during 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 2-46**. 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 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 2-46. Equivalent PWL of Power Mechanical Equipment during Construction Phase**

| Power Mechanical Equipment | PWL, dB(A) |
|----------------------------|------------|
| Jackhammer                 | 104        |
| Chipping gun               | 93         |
| Air compressor             | 96         |
| Bulldozer                  | 89         |
| Lejeune gun                | 89         |
| Backhoe                    | 86         |
| Forklift                   | 85         |
| Hand hammer                | 85         |
| Welding torch              | 84         |
| Chopsaw                    | 80         |
| Truck                      | 78         |
| Heavy-duty bulldozer       | 99         |





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| Power Mechanical Equipment                | PWL, dB(A) |
|---|------------|
| 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.<sup>1</sup>

**Table 2-47** shows the summation of noise levels. The summed noise assumed to be at the centre of the Project site.

**Table 2-47. 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 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

<sup>1</sup> Technical Memorandum on Noise, Hongkong Environmental Protection Department, Noise Control Authority, January 1996

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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 Sensitive Receivers

Noise sensitive receiver can be defining as those locations or areas where dwelling units or other fixed, developed sites frequent human use occur (**FHWA**). The identified NSRs are the same as ASRs in the air dispersion modeling. Noise is simulated to determine the noise impact at the NSRs from the proposed Project.

### 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 20,000 m x 20,000 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 – 80%
- Frequency – 500 Hz

### Noise Modeling Results

Presented in **Table 2-48** 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 2-58**.

**Table 2-48. Predicted Noise Level at NSRs during Construction**

| Station No | Description  | Predicted Noise Level (SPL), dB(A) | Allowable Noise Level, dB(A) |                  |           |
|------------|--|------------------------------------|------------------------------|------------------|-----------|
|            |  |                                    | Daytime                      | Morning/ Evening | Nighttime |
| NSR-1      | LIDE Staff Housing Compound, Brgy. Mahayag, Isabel           | 21.93                              | 55                           | 50               | 45        |
| NSR-2      | Central School of Isabel, Brgy. Marvel, Isabel               | 0.0                                | 55                           | 50               | 45        |
| NSR-3      | Isabel Adventist Elementary Schoolm Brgy. Santo Nino, Isabel | 2.09                               | 55                           | 50               | 45        |
| NSR-4      | Residential Area, Brgy. Santo Nino, Isabel                   | 3.04                               | 55                           | 50               | 45        |
| NSR-5      | Residential Area, Brgy. Anislag, Isabel                      | 10.66                              | 55                           | 50               | 45        |
| NSR-6      | Libertad Elementary School, Brgy. Libertad, Isabel           | 22.84                              | 55                           | 50               | 45        |
| NSR-7      | Residential Area, Brgy. Matlang, Isabel                      | 33.96                              | 55                           | 50               | 45        |
| NSR-8      | Matlang National High School, Brgy. Matlang, Isabel          | 19.72                              | 55                           | 50               | 45        |
| NSR-9      | Bilwang Central School, Brgy. Bilwang, Isabel                | 8.20                               | 55                           | 50               | 45        |



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| Station No | Description                           | Predicted Noise Level (SPL), dB(A) | Allowable Noise Level, dB(A) |                  |           |
|------------|---------------------------------------|------------------------------------|------------------------------|------------------|-----------|
|            |                                       |                                    | Daytime                      | Morning/ Evening | Nighttime |
| NSR-10     | Relocation Site, Brgy. Binog, Isabel  | 0.29                               | 55                           | 50               | 45        |
| NSR-11     | Residential Area, Brgy. Tubod, Isabel | 0.0                                | 55                           | 50               | 45        |



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Isabel Ancillary Services Co. Ltd.

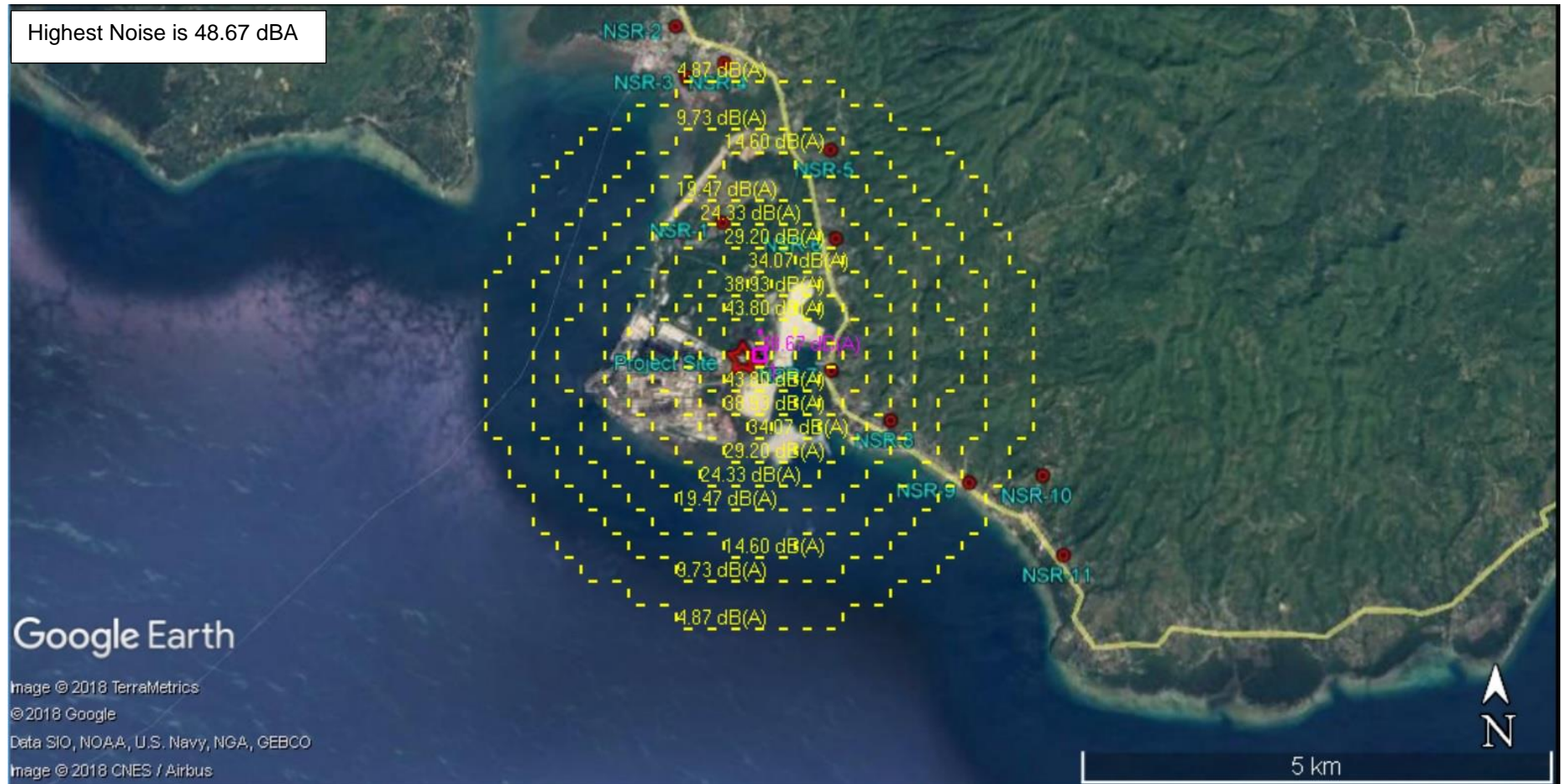


Figure 2-58. Predicted Noise Contour during Construction



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The following measures shall 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 shall be applied for the protection of employees working on site as well as the nearest sensitive receptor:

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

### 2.3.2.7 Impact in Noise Quality during Construction 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 power plant were based on the given equipment noise data, sizes, and dimensions. The list of power mechanical equipment during operation is presented in **Table 2-49**. However, it is advised that the detailed design should be updated to reflect equipment data whenever the design changes.

**Table 2-49. Equivalent PWL of Power Mechanical Equipment for Operation Phase**

| Power Mechanical Equipment | PWL, dB(A) |
|----------------------------|------------|
| Engine                     | 121        |
| Engine exhaust             | 120        |
| Cooling Fan                | 105        |
| Alternator                 | 90         |
| Induction                  | 90         |

Source: Technical Information from Cummins Power Generation, 2007

From the table above, the total estimated sound power level for the operational equipment is 123 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



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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 power plant:

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

The scale use for the model is 20,000 m x 20,000 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 – 80%
- 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 2-48** 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 2-59**.

**Table 2-50. Predicted Noise Level at the Boundary of the Proposed Plant during Operation**

| Station No | Description  | Predicted Noise Level (SPL), dB(A) | Allowable Noise Level, dB(A) |                  |           |
|------------|--|------------------------------------|------------------------------|------------------|-----------|
|            |  |                                    | Daytime                      | Morning/ Evening | Nighttime |
| NSR-1      | LIDE Staff Housing Compound, Brgy. Mahayag, Isabel           | 34.26                              | 55                           | 50               | 45        |
| NSR-2      | Central School of Isabel, Brgy. Marvel, Isabel               | 9.78                               | 55                           | 50               | 45        |
| NSR-3      | Isabel Adventist Elementary Schoolm Brgy. Santo Nino, Isabel | 15.29                              | 55                           | 50               | 45        |
| NSR-4      | Residential Area, Brgy. Santo Nino, Isabel                   | 16.24                              | 55                           | 50               | 45        |
| NSR-5      | Residential Area, Brgy. Anislag, Isabel                      | 23.86                              | 55                           | 50               | 45        |
| NSR-6      | Libertad Elementary School, Brgy. Libertad, Isabel           | 36.04                              | 55                           | 50               | 45        |
| NSR-7      | Residential Area, Brgy. Matlang, Isabel                      | 43.16                              | 55                           | 50               | 45        |
| NSR-8      | Matlang National High School, Brgy. Matlang, Isabel          | 36.04                              | 55                           | 50               | 45        |
| NSR-9      | Bilwang Central School, Brgy. Bilwang, Isabel                | 21.40                              | 55                           | 50               | 45        |
| NSR-10     | Relocation Site, Brgy. Binog, Isabel                         | 13.49                              | 55                           | 50               | 45        |
| NSR-11     | Residential Area, Brgy. Tubod, Isabel                        | 7.17                               | 55                           | 50               | 45        |



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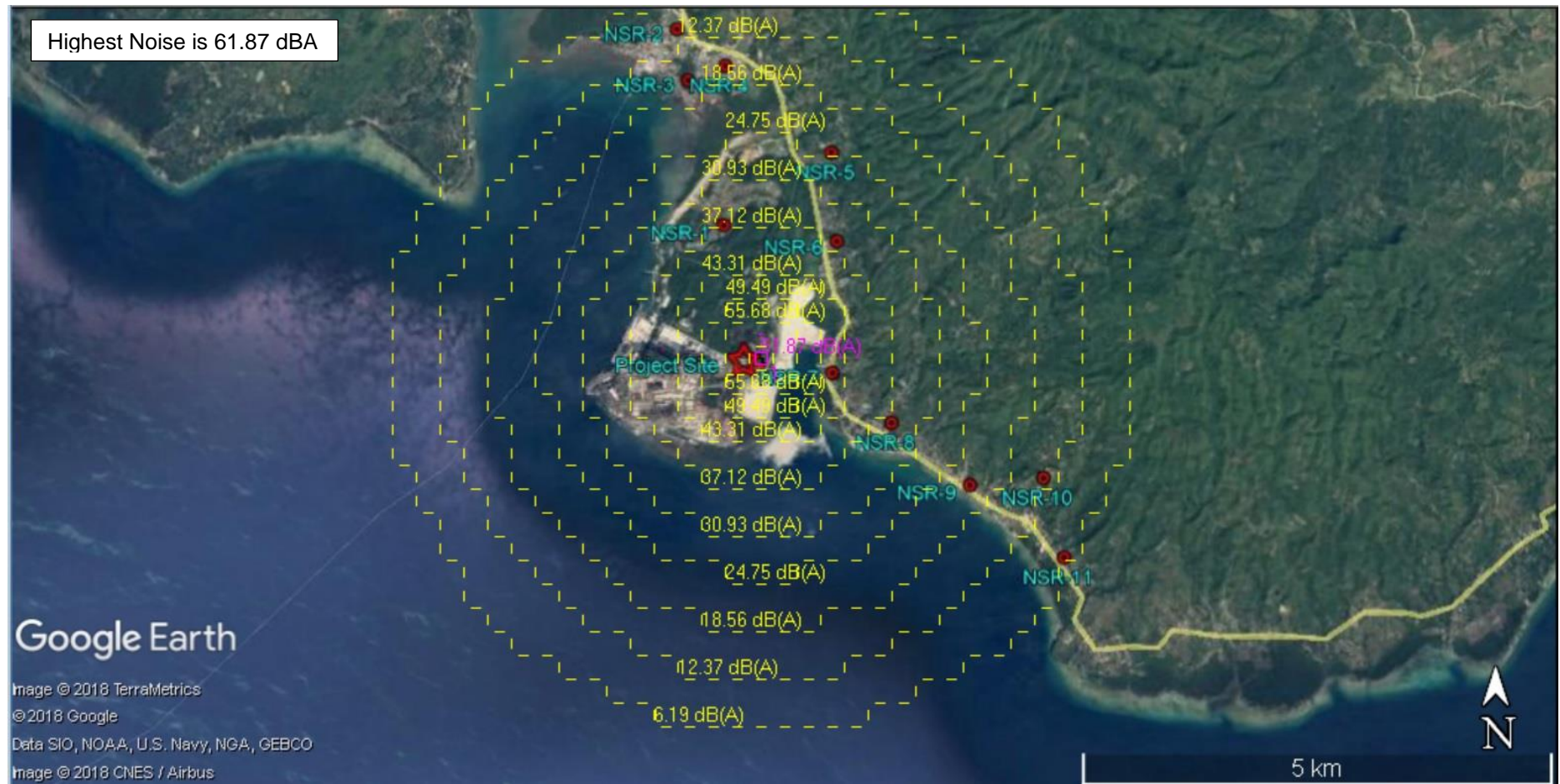


Figure 2-59. Predicted Noise Contour during Operation

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It is clearly important to limit the noise emission of all major noise sources in the plant 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 power plant 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 plant 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 inside the plant.

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 areas 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;
- 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; and
- Defective equipment/parts with abnormal noise and/or vibration will be either repaired or replaced.

## 2.4 PEOPLE

### 2.4.1 Displacement of Settlers

The proposed project will not cause displacement of settlers and disturbance of properties for it will be located within an existing industrial estate in Isabel, Leyte.

**Land Area, Population, Population Density and Growth Rate.** Isabel Municipality has a total of 24 barangays covering an area of 5,717.92 ha. Barangay Libertad, the host barangay of the proposed Project, covers 190.13 hectares or 3.33% of the municipality's total land area. The August 2015 population census conducted by the Philippine Statistics Authority (**PSA**) had recorded 46,915 persons in Isabel Municipality. The five (5) most populous barangays are Matlang, Libertad, Santo Niño, Marvel (Pob.) and Bilwang. **Table 2-49** presents the land area and 2015 population per barangay of Isabel.





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Table 2-49. Land Area and Population per Barangay of Isabel

| Barangay            | Land Area       |                | Population    |           |               |           |
|---------------------|-----------------|----------------|---------------|-----------|---------------|-----------|
|                     | Area (ha)       | Classification | Number, 2010  | Density   | Number, 2015  | Density   |
| Anislag             | 218.10          | Rural          | 562           | 2         | 738           | 3         |
| Antipolo            | 85.39           | Rural          | 550           | 6         | 611           | 7         |
| Apale               | 220.88          | Rural          | 1,697         | 7         | 1,836         | 8         |
| Bantigue            | 244.94          | Rural          | 2,085         | 8         | 2,339         | 10        |
| Benog               | 304.66          | Rural          | 607           | 1         | 664           | 2         |
| Bilwang             | 107.19          | Rural          | 2,878         | 26        | 3,062         | 29        |
| Can-andan           | 141.18          | Rural          | 373           | 2         | 410           | 3         |
| Cangag              | 450.55          | Rural          | 601           | 1         | 674           | 1         |
| Consolacion         | 295.21          | Rural          | 443           | 1         | 566           | 2         |
| Honan               | 443.67          | Rural          | 1,053         | 2         | 1,096         | 2         |
| <b>Libertad</b>     | <b>190.13</b>   | <b>Rural</b>   | <b>4,870</b>  | <b>25</b> | <b>5,332</b>  | <b>28</b> |
| Mahayag             | 194.89          | Rural          | 1,959         | 10        | 2,269         | 12        |
| Marvel (Pob.)       | 174.58          | Urban          | 3,568         | 20        | 4,093         | 23        |
| Matlang             | 441.63          | Rural          | 5,841         | 13        | 5,972         | 14        |
| Monte Alegre        | 281.07          | Rural          | 649           | 2         | 799           | 3         |
| Putting Bato        | 844.75          | Rural          | 659           | 0.78      | 779           | 1         |
| San Francisco       | 143.97          | Rural          | 859           | 5         | 973           | 7         |
| San Roque           | 6.61            | Urban          | 1,614         | 244       | 1,625         | 246       |
| Santa Cruz          | 5.77            | Urban          | 1,680         | 321       | 1,687         | 292       |
| Santo Niño          | 264.36          | Urban          | 5,151         | 19        | 5,293         | 20        |
| Santo Rosario       | 3.05            | Urban          | 839           | 275       | 962           | 315       |
| Tabunok             | 312.61          | Rural          | 1,912         | 6         | 1,885         | 6         |
| Toligon             | 225.87          | Rural          | 1,723         | 7         | 1,829         | 8         |
| Tubod               | 116.86          | Rural          | 1,340         | 11        | 1,421         | 12        |
| <b>Total Isabel</b> | <b>5,717.92</b> |                | <b>43,593</b> | <b>8</b>  | <b>46,915</b> | <b>9</b>  |

Note: Urban-rural barangay classification - barangay should have at least 1,000 inhabitants, the occupation is predominantly non-farming or fishing and/or meet the following: population density of at least 500 persons/sq.km or regardless of population with street pattern or network of streets, at least 6 establishments, at least 3 of the following: town hall, church, public plaza, park or cemetery, market place, school hospital or health center

Source: 2015 Census and Housing Population; 2015 Philippine Statistics Authority, Total Population by Province, City, Municipality and Barangay as of August 1, 2015

The population of Isabel, Leyte has increased by 1.56% from 43,513 in 2010 to 46,915 in 2015. On the other hand, the population of the host Barangay Libertad increased by 1.90% from 4,870 in 2010 to 5,332 in 2015. **Table 2-50** presents the population history and annual growth rate per barangay of Isabel from 2010-2015.

Table 2-50. Annual Growth Rates per Barangay of Isabel Municipality

| Barangay    | Total Population |       | Annual Growth Rate (%) |
|-------------|------------------|-------|------------------------|
|             | 2010             | 2015  |                        |
| Anislag     | 562              | 738   | 6.26                   |
| Antipolo    | 550              | 611   | 2.22                   |
| Apale       | 1,697            | 1,836 | 1.64                   |
| Bantigue    | 2,085            | 2,339 | 2.44                   |
| Benog       | 607              | 664   | 1.88                   |
| Bilwang     | 2,878            | 3,062 | 1.28                   |
| Can-andan   | 373              | 410   | 1.98                   |
| Cangag      | 601              | 674   | 2.43                   |
| Consolacion | 443              | 566   | 5.55                   |

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| Barangay            | Total Population |               | Annual Growth Rate (%) |
|---------------------|------------------|---------------|------------------------|
|                     | 2010             | 2015          |                        |
| Honan               | 1,053            | 1,096         | 0.82                   |
| <b>Libertad</b>     | <b>4,870</b>     | <b>5,332</b>  | <b>1.90</b>            |
| Mahayag             | 1,959            | 2,269         | 3.16                   |
| Marvel (Pob.)       | 3,568            | 4,093         | 2.94                   |
| Matlang             | 5,841            | 5,972         | 0.45                   |
| Monte Alegre        | 649              | 799           | 4.62                   |
| Putting Bato        | 659              | 779           | 3.64                   |
| San Francisco       | 859              | 973           | 2.65                   |
| San Roque           | 1,614            | 1,625         | 0.14                   |
| Santa Cruz          | 1,680            | 1,687         | 0.08                   |
| Santo Niño          | 5,151            | 5,293         | 0.55                   |
| Santo Rosario       | 839              | 962           | 2.93                   |
| Tabunok             | 1,912            | 1,885         | -0.28                  |
| Tolingon            | 1,723            | 1,829         | 1.23                   |
| Tubod               | 1,340            | 1,421         | 1.21                   |
| <b>Total Isabel</b> | <b>43,513</b>    | <b>46,915</b> | <b>1.56</b>            |

Source: PSA

**Household Size and Gender and Age Profile.** In 2010, PSA had recorded a total of 43,524 households in Isabel. The recorded data also shows that Isabel had more males than females. The proportion of the population aged 0 to 14 was 31.52%. The productive aged 15 to 64 years comprised 64.03% of the total population while only 4.45% of the populations were 65 years old and above. **Table 2-51** and **Figure 2-61** present the Percent Distribution of Household Population by Age and Sex of Isabel.

**Table 2-51. Total Household Population on Isabel by Five-Year Age Group, Sex, 2010**

| Five-Year Age Group | Number of Household |               |               |
|---------------------|---------------------|---------------|---------------|
|                     | Total               | Male          | Female        |
| 0-4                 | 4,717               | 2,467         | 2,250         |
| 5-9                 | 4,448               | 2,318         | 2,130         |
| 10-14               | 4,555               | 2,377         | 2,178         |
| 15-19               | 4,682               | 2,410         | 2,272         |
| 20-24               | 4,197               | 2,201         | 1,996         |
| 25-29               | 3,352               | 1,749         | 1,603         |
| 30-34               | 2,944               | 1,477         | 1,467         |
| 35-39               | 2,679               | 1,315         | 1,364         |
| 40-44               | 2,518               | 1,269         | 1,249         |
| 45-49               | 2,544               | 1,321         | 1,223         |
| 50-54               | 2,232               | 1,207         | 1,025         |
| 55-59               | 1,578               | 819           | 759           |
| 60-64               | 1,141               | 570           | 571           |
| 65 and over         | 1,937               | 863           | 1,074         |
| <b>Total</b>        | <b>43,524</b>       | <b>22,363</b> | <b>21,161</b> |

Note: Figures are based on 20% sample households.

Details may not add up to total due to rounding off.

Source: 2010 Census of Population and Housing, PSA

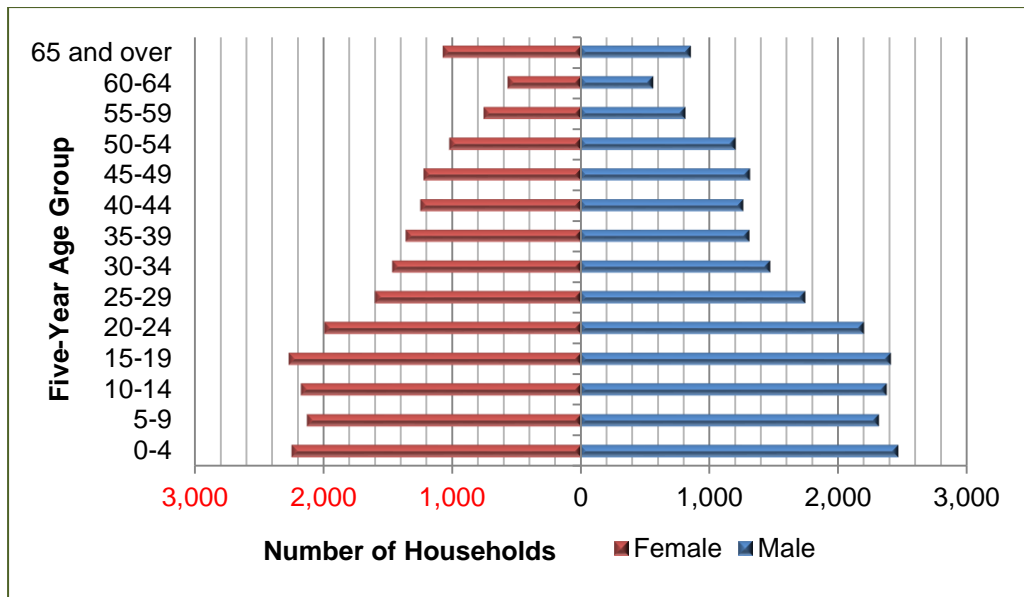


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Source: 2010 Census of Population and Housing, PSA

Figure 2-61. Age-Sex Distribution Pyramid

There will be no settlers and properties that will be displaced, land ownership transfer, right-of-way conflict and land use conversion for the proposed Project will be cited in the LIDE of LMC.

Table 2-52. Literacy Rate of Population 5 years Old and Over by Sex, 2010

|                              | Male   |       | Female |       | Both Sexes |        |
|------------------------------|--------|-------|--------|-------|------------|--------|
|                              | No.    | %     | No.    | %     | No.        | %      |
| Population 10 years old over | 17,578 | 51.16 | 16,781 | 48.84 | 34,359     | 100.00 |
| Literate                     | 17,246 | 51.08 | 16,520 | 48.92 | 33,766     | 98.27  |
| Illiterate                   | 332    | 72.85 | 161    | 27.15 | 593        | 1.73   |

Note: Figures are based on 20% sample households. Details may not add up to total due to rounding off.

Source: 2010 Census of Population and Housing, PSA

### 2.4.2 In-migration

**Migration.** Most of the households (99.45%) in Isabel are non-movers, as presented in Table 2-52.

Table 2-53. Households Reporting Intention to Reside in Isabel of Residence Five Years from 2010

| Total Number of Households | Residence Five Years from 2010           |   |  |                              |              |
|----------------------------|--|---|--|------------------------------|--------------|
|                            | Same Province/ Municipality (Non-movers) | Same Province Different Municipality (Domestic Short Distance Movers) | Different Province (Domestic Long Distance Movers) | Foreign Country (Immigrants) | Not Reported |
| 10,075                     | 10,020                                   | 20  | 15   | 10                           | 10           |

Note: Figures are based on 20% sample households. Details may not add up to total due to rounding off.

Source: 2010 Census of Population and Housing, PSA

Influx of migrant workers during the construction and operation phases of the proposed Project will intensify the competition for jobs of locals. Locals who are qualified shall be given the opportunities and priority to seek employment from the proposed Project. IASCL and its Contractors shall maximize the use of local labor as possible.

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### 2.4.3 Cultural/Lifestyle Change

There are no ethnic groups or cultural minorities known to exist in Isabel Municipality. Semi-urban lifestyle prevails in the municipality. The population is predominantly Roman Catholic. However, surge of various religious affiliations recently has been very noticeable.

In terms of lifestyle, there is not much change projected since there is already an existing industries within the LIDE. Migrant workers may bring in cultures and views not acceptable to the locals. Sometimes, the presence of foreign labor in the area is associated with increased crime rate and other social ills.

Locals who are qualified shall be given the opportunities and priority to seek employment from the proposed Project. Some residents may have to increase the pace of their lifestyle to keep up with the increased demands of employment and livelihood opportunities.

### 2.4.4 Impacts on Physical Cultural Resources

The Isabel Municipality has some tourist spots such as the Candonicot Cave in Barangay Bantigue, the Bentoraray Cave in Barangay Tolingon, Hombayon Spring in Barangay Tabunok and Apale Falls in Barangay Apale. Candonicot Cave is 8km away from Poblacion. Bentoraray Cave is 20 min ride from Poblacion and is located along the coast of Barangay Tolingon. Honbayon Spring can be reach by means of tricycle or multi-cabs within 10 min. Apale falls is about 4km walk from Barangay Apale proper. These places are still in their pristine state and tourist can enjoy their natural beauty.

The proposed Project site is to be located within LIDE and is classified industrial area. Moreover, there will be no direct impact on the identified tourist spots and other physical cultural resources and landscapes that have historical or cultural significance since they are relatively distant from the project site.

Since the Project involves earthmoving activities, possible unearthing of artifacts and archeological remains is inevitable. In the event that an archaeological asset is discovered during the course of construction period, the following procedure shall be implemented:

1. IASCL must preserve the potential archaeological finds and report it immediately to the National Museum.
2. Closely coordinate with the National Museum on the appropriate course of action in protecting the archaeological finds.
3. Cease immediately all construction activities in the vicinity of the find/feature/site;
4. Hire an archaeological professional, recognized by the National Museum, to ensure the following are carried out:
  - Delineate the discovered find/feature/site;
  - Record the coordinates of the find location, and all remains are to be left in place;
  - Secure the area to prevent any damage or loss of removable objects;
  - Assess, record and photograph the find/feature/site;
  - Undertake the inspection process in accordance with all project health and safety protocols under direction of the Health and Safety Officer;
  - Conduct all investigation of archaeological soils by hand;
  - Keep all finds, osteological remains and samples and submit to the National Museum as required;
  - In the event that any artefacts need to be conserved, secure approval from the National Museum;
  - Provide an on-site office and finds storage area to allow storage of any artefacts or other archaeological material recovered during the monitoring process;
  - In the case of human remains, in addition to the above, contact the National Museum and adhere to the guidelines for the treatment of human remains; and
  - If skeletal remains are identified, tap an osteo-archaeological to examine the remains





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5. Implement the following process for conservation:

- Hire a conservator, if required
- The consulting archaeologist completes a report on the findings and submits to the National Museum
- National Museum reviews the report and informs when works can resume

### 2.4.5 Threat to Delivery of Basic Services/Resource Competition

In view of the entry of migrant workers and increase of economic activities due to the proposed Project, there could be overburdening of public social services in the area and possible resource competition in terms of food, water supply, electricity and medical supply.

To prevent competition for public basic services, the IASCL will provide temporary housing/construction camp for non-resident workers. The water requirement for the proposed Project will be sourced from the LMC Pumping Station located in Barangay Salvacion, Ormoc City. The facility consists of eight (8) deep well pumps with a capacity of 5,600m<sup>3</sup>/day per pump. There are two (2) back-up pumping stations at Tabunok and Matlang with a capacity of 4,300 m<sup>3</sup>/day and 3,700 m<sup>3</sup>/day, respectively. These pumping stations are reserved sources in case the Ormoc pumping station is not operational. LIDE has a 15,000m<sup>3</sup> storage tank capacity which is kept full for emergency purposes. IASCL shall implement necessary measures to conserve water and reduce water usage. Power supply will be source from the power plant itself.

### 2.4.6 Threat to Public Health and Safety

The health service in Isabel Municipality is being delivered by the Department of Health (DOH) through its Rural Health Unit (RHU). The RHU is composed of a municipal health officer, public health nurse, rural health midwife, dentist, medical technician and rural sanitary inspector. The RHU building is located at Simangan, Barangay Sto. Niño along the national road.

In order to be able to effectively serve the needs of the populace, there are five (5) barangay health stations (BHS) located in Barangays Bantigue, Matlang, Monte-alegre, Cangag and Tolingon. These stations serve adjacent barangays within a range of 3-8km. They are manned by one (1) rural health midwife each.

The RHU and BHS personnel render Maternal and Child Health care services such as Expanded Program on Immunization, Nutrition Program, Control of Diarrheal Diseases, Under Five Clinics, Maternal Care and Family Planning. They also render health education, immunization, internal medicine, eye, ear, nose, throat clinic, emergency/first aid, simple laboratory examinations (urinalysis/blood typing), dental health service, and ambulance services. They implement the National Tuberculosis Program, Sexually Transmitted Diseases Control and the National Leprosy Control Program.

Aside from the health centers, the services of private practitioners consisting of medical doctors and dentists are also available to the residents of the municipality. There is one (1) pediatrician and one (1) general medicine practitioner in the poblacion. The Canora Clinic and Laboratory in poblacion also offers medical services to the residents of Isabel. PhiloPhos and PASAR Hospital located inside the LIDE serve the medical and dental needs of its employees and dependents. They also admit patients in emergency cases. Isabel Municipality has only one private dental clinic situated in the poblacion.

The health data of Isabel from 2008 to 2012 showed that the leading caused of morbidity in the municipality is the Uppert Respiratory Tract Infection, with an average cases of 3,517 cases. **Table 2-53** presents the ten (10) leading causes of morbidity in Isabel Municipality, while **Table 2-54** presents the ten (10) leading causes of mortality.

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**Table 2-54. Leading Causes of Morbidity from 2008-2012**

| Causes                               | Number of Cases (Average) |
|--------------------------------------|---------------------------|
| 1. Upper Respiratory Tract Infection | 3,517                     |
| 2. Bronchitis                        | 1,549                     |
| 3. Urinary Tract Infection           | 1,023                     |
| 4. Wounds (All Kinds)                | 619                       |
| 5. Skin Diseases (All Kinds)         | 525                       |
| 6. Acute Gastritis                   | 243                       |
| 7. Acute Gastroenteritis             | 224                       |
| 8. Musculo-Eskeletal Diseases        | 193                       |
| 9. Vitamin Deficiency                | 181                       |
| 10. Asthma                           | 100                       |

Source: RHU of Isabel Municipality, PASAR EPRMP

**Table 2-55. Leading Causes of Mortality from 2008-2012**

| Causes                                    | Number of Cases (Average) |
|---|---------------------------|
| 1. Cardio Vascular Disease                | 84                        |
| 2. Cancer (All Forms)                     | 31                        |
| 3. Pneumonia                              | 12                        |
| 4. Renal Diseases                         | 9                         |
| 5. Diabetes Mellitus                      | 8                         |
| 6. Bleeding Peptic Ulcer Disease          | 7                         |
| 7. Status Ashmaticus                      | 6                         |
| 8. Chronic Obstructive Lung               | 4                         |
| 9. Liver Cirrhosis                        | 4                         |
| 10. Hemorrhage Sec. to Stab/Gunshot Wound | 3                         |

Source: RHU of Isabel Municipality, PASAR EPRMP

Isabel Municipality has a dump site located at Sition Can-esco, Barangay Tabunok, with an area of 1ha. A total of 984 households or 11.85% of the total number of households availed the services of the garbage truck. About 33.01% of the households dumped their garbage in individual pits; 3.5% resorted to burning their garbage and 12.37% used the compost method which is to be used later on as fertilizer.

The potential air pollutants generated during the various phases of the project may have adverse impacts on the health of operation workers and residents of nearby communities, specifically those along the property boundaries. This impact to the health of the residents may be worsen by increased temperature and frequent rainfall events brought about by climate change.

Workers, particularly those on field, may be exposed to ergonomic stress and increased levels of noise, dust and heat. They may also be exposed to physical hazards associated with heavy lifting, moving heavy equipment, etc.

Infectious diseases among workers caused by viruses and bacteria (i.e. fungus and parasites) may spread to the residents if the workers live and mingle with the community.

An IEC plan shall be formulated and implemented to inform the local communities of the project, the project activities, the duration, the person/company responsible for the operation and the management of the project. It shall also contain information on safety aspects like portions of operation areas and equipment that shall be avoided.

Medical check-up will be part of the CSR Program of IASCL to monitor the occurrence of unusual health problems that can be associated with the proposed Project. IASCL shall coordinate with the



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barangay health unit to create a barangay health database from the medical check-ups. Vaccines shall be provided to protect workers from different kinds of infectious and non-infectious diseases.

IASCL will provide safe working environment for workers. Workers shall be given orientation on occupational health and safety. Appropriate personal protection equipment (**PPEs**) shall be provided to each worker. Ample potable water and clean toilet shall be provided in the plant site. Medical clinic shall be provided and a safety officer shall be designated to monitor safe working conditions. Medical/First Aid kits shall be available at all times in all work places that can be used in case of emergency especially in areas, which are of distance to the medical clinic.

All workers shall undergo medical examinations, and be certified to be physically fit by a licensed physician prior to hiring. IASCL shall implement a continuous annual health examination of workers. All occupational injuries and diseases shall be recorded, analyzed and submitted to DOLE annually.

### 2.4.7 Generation of Local Benefits from the Project

**Literacy Rate/Profile of Educational Attainment.** The municipality has one (1) tertiary school, seven (7) secondary schools and 26 elementary schools. There are also five (5) private pre-elementary schools. In 2010, majority (98.27%) of the population over ten (10) years old in Isabel are literate.

**Peace and Order/Crime.** The 2007 Philippine National Police data recorded ten (10) crimes against persons and three (3) crimes against property in Isabel Municipality. The crime rate against persons is 2.5 per 10,000 population, while the crime rate against property is 0.8 per 10,000 population.

**Industries, Commercial Establishments and Activities.** The 435-hectare LIDE houses two heavy industries, namely PASAR and PhilPhos. PASAR produces over 172,000 metric tons of copper cathodes every year. These are being shipped to international and domestic markets together with its by-products namely: dore metal, sulfuric acid and selenium powder. Among its major importers are Japan, Taiwan, South Korea, China and Southeast Asia. PhilPhos, on the other hand, produces phosphatic fertilizers which are also exported to countries like Vietnam and Southeast Asia. It also produces, as by-product 600 to 900 metric tons of gypsum per year. LIDE still offers 80 hectares for other investors.

LIDE maintains one of the most modern ports in the country having a total berth length of 670 meters and a handling capacity of 3.4 million tons of cargo per year.

LIDE has spurred economic activities in Isabel. In 2001, the municipality registered a total of 553 commercial establishments. The bulk or 77.6% were engaged in retail trading, 20.8% in business, recreational and personal services, and 1.6% in finance and other industries. Also, with the influx of workers coming from the different parts of the country, the municipality now has three subdivision sites as follows: Pleasantville Subdivision located in Brgy. Tolingon; Don Ciriaco Sotero Subdivision in Brgy. Bilwang; and Isabel Development and Realty Corporation Subdivision situated at Sitio Alipasa, Mahayag.

With the big income derived from these two industries, Isabel is now classified as first class municipality. In 1988, the municipality belonged to fourth class municipalities.

**Employment Profile.** In 2010, Leyte has 606,971 gainful workers where in most (33.79%) of workers are involve in trade and related works (**Table 2-56**).

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Table 2-56. Gainful Workers in Province of Leyte, 2010

| Major Occupation Group   | Gainful Workers, 15 Years Old and Over | Age Group     |               |               |               |               |               |               |               |               |               |               |
|--|--|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
|  |  | 15-19         | 20-24         | 25-29         | 30-34         | 35-39         | 40-44         | 45-49         | 50-54         | 55-59         | 60-64         | 65 and over   |
| Government Officials and Special Interest Organizations, Corporate Executives, Managers, Managing Proprietors, and Supervisors | 47,742                                 | 441           | 1,575         | 3,587         | 4,836         | 5,407         | 6,045         | 6,139         | 5,737         | 4,333         | 3,822         | 5,819         |
| Professionals  | 24,818                                 | 11            | 2,755         | 4,400         | 3,922         | 3,365         | 2,756         | 2,559         | 2,152         | 1,666         | 994           | 238           |
| Technicians and Associate Professionals  | 13,343                                 | 167           | 1,437         | 1,884         | 1,895         | 1,635         | 1,756         | 1,403         | 1,328         | 829           | 441           | 568           |
| Clerks   | 24,372                                 | 528           | 3,588         | 4,626         | 3,778         | 2,654         | 2,395         | 2,498         | 2,084         | 1,400         | 530           | 291           |
| Services Workers and Shop and Market Sales Workers   | 51,464                                 | 4,022         | 8,877         | 8,280         | 7,153         | 6,242         | 4,909         | 4,294         | 3,058         | 2,244         | 1,181         | 1,205         |
| Farmers, Forestry Workers and Fishermen  | 144,297                                | 3,122         | 7,701         | 11,839        | 13,659        | 15,238        | 16,105        | 16,388        | 15,951        | 13,822        | 11,056        | 19,417        |
| Trade and Related Workers  | 46,219                                 | 1,303         | 3,619         | 4,926         | 5,875         | 6,490         | 5,871         | 5,304         | 4,446         | 3,292         | 2,296         | 2,798         |
| Plant and Machine Operators and Assemblers   | 42,545                                 | 701           | 3,741         | 6,310         | 7,505         | 6,754         | 6,096         | 4,458         | 3,344         | 2,035         | 1,008         | 594           |
| Laborers and Unskilled Workers   | 205,096                                | 23,622        | 28,533        | 26,105        | 23,948        | 21,417        | 20,448        | 18,146        | 14,786        | 11,267        | 7,402         | 9,421         |
| Armed Forces   | 114                                    | -             | 5             | 20            | 10            | 25            | 15            | 20            | 10            | -             | 10            | -             |
| Other Occupation   | 10                                     | -             | 5             | -             | -             | 5             | -             | -             | -             | -             | -             | -             |
| Not Reported   | 6,952                                  | 45            | 359           | 962           | 1,023         | 811           | 945           | 900           | 816           | 600           | 308           | 183           |
| <b>Total</b>   | <b>606,971</b>                         | <b>33,961</b> | <b>62,195</b> | <b>72,939</b> | <b>73,603</b> | <b>70,043</b> | <b>67,340</b> | <b>62,110</b> | <b>53,710</b> | <b>41,488</b> | <b>29,049</b> | <b>40,534</b> |

Note: Figures are based on 20% sample households. Details may not add up to total due to rounding off.

Source: 2010 Census of Population and Housing, PSA



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The direct benefits resulting from this Project include the creation of employment for local residents and non-local manpower in the area. During construction of the proposed Project, IASCL would provide temporary about 120 employment to local residents. During operation, 46 new positions will be required. Potential positive effects of the manpower influx will include demand for retail and other services, which may increase economic activities and benefits for some local businesses, including food suppliers and other retailers. It is expected also to increase business opportunities in terms of the project needs for construction materials, supplies, concrete aggregates and social services.

Aside from the generation of job opportunities for the direct and indirect impact barangays, opportunities for business establishments is also expected to be created by the proposed Project. Another benefit is under DOE ER 1-94 which provides a percentage share to LGUs for every kW-hr sale of electricity. The fund that will be accessed by the concerned LGUs from the DOE will be used for electrification, development and livelihood fund and reforestation/watershed management. Another benefit is the generation of revenues from taxes, permits and other dues for the local government units.

To enhance the employment opportunities brought by the proposed Project, IASCL shall regularly coordinate with the LGU of Isabel, specifically at the barangay level regarding the hiring of temporary workers during construction phase and regular workers during operation phase to ensure that the workers being considered are legitimate residents in the area. Moreover, by hiring local residents, some of the social conflicts associated with uncontrolled in-migration can be minimized.

The respective contractor shall be responsible to provide accommodation for their workers and equipped with the necessary social infrastructure. Workers and professional personnel from outside the area will stay in temporary accommodation. Increased traffic in the project area during construction will be controlled on and off site to minimize traffic hazards to road users.

### 2.4.8 Traffic Congestion

Leyte can be accessed by air through the only one (1) commercial airport located in Tacloban City. Isabel Municipality, which is 145km from Tacloban City can be reach by any transportation within 2.5h to 3.5h.

Isabel Municipality can also be reach by inter-island transport. Philtranco, which has a bus stop in Tacloban and Ormoc, operates a route from Manila-Maharlika highway, passing through Allen, Northern Samar in Samar Island from Matnog, Sorsogon in Bicol region.

Major ports are also located in Ormoc City in the south and Tacloban City in the north. Small ports are also located in Palompon, Hilongos, Isabel, and Baybay City.

Isabel Municipality has a total road length of approximately 57.5 kilometers, which is broken down into national roads (33.7km), municipal streets (4.8km) and barangay roads (19 km). About 34.18km or 59.45% of the total road length are concrete, 14.4km are gravel filled and 8.92km are earth road. All municipal streets are concrete/paved. The national road traverses Barangays Sto. Niño, Marvel, Mahayag, Libertad, Matlang, Bilwag, Tubod, Tulingon, Apale, Tabunok, the Consolacion–Puttingbato and the Sto. Niño–Consolacion sections. The municipal streets are traverses Poblacion which is composed of Barangays Marvel and Sto. Niño. The barangay roads are situated in the rural areas.

The national roads and municipal streets are six (6) meters wide except the national road at Barangay Tabunok which is only four (4) meters wide. The width of the barangay roads vary from 1.5m to 6m with the narrowest at the Barangay Bilwang Road which is only an earth road. Some portion of Barangay Bilwang Road and the Matlang-Honan Road are 3m width and the Antipolo-San Francisco Road and the Mahayag-Anislag Road have 4m width. The rest are 5-6m wide.

The national roads and municipal street are in good condition. The barangay roads which are either gravel-filled or earth roads are also passable.

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### Construction Phase

An increase in vehicular traffic will be expected during construction phase of the proposed project due to the movement of construction equipment; the delivery of construction materials by haulers and trucks; and the additional commuters—the construction workforce during rush hours in the morning and the afternoon. The entry and exit of the construction equipment and delivery of raw materials such as fuel, lubrications and cooling fluids into and out of the project site will increase the volume of vehicles passing the access roads.

Employee traffic is anticipated during rush hours in the morning and late in the afternoon. Additional traffic can also be expected at the beginning and end of weekly work cycles, when migrant workers report for work on a Monday and go home for the weekend.

It must be noted also that the traffic impact during construction will be temporary and short in duration for the construction phase will only take about four (4) months. Management measures to alleviate overland traffic impacts during construction are the following:

- (i) Delivery of construction materials during off peak hours;
- (ii) Detailed truck scheduling;
- (iii) Conduct IEC with the host Barangay Libertad and Isabel Municipality in coordination with LIDE
- (iv) Provision of adequate parking areas; and
- (v) Posting of appropriate traffic sign and warning.

### Operation Phase

During operation, employee traffic will persist although this will be lesser in magnitude compared to during construction, since less personnel will be required for operation than during construction. This impact will be long-term but confined only during morning and afternoon and weekends.

Traffic will be disrupted during delivery of fuel by trucks, coming from the nearby Petron depot. Based on the 150,000 L/day fuel consumption and total fuel storage capacity of 480,000 liters, delivery will be made every 3 days. The impact will be confined to the 2-km distance between the depot and the project site, and only during the delivery hours.

Impact may be mitigated by proper timing of delivery during non-rush hours.

### 2.4.9 Socio-Economic, Perception and Health Survey

The perception survey was conducted to the host Barangay Libertad. The survey covers the demographic characteristics, the source of income, the knowledge about the new structures and their attitude towards the proposed Project. **Table 2-57** presents the number of respondents surveyed in Barangay Libertad.

**Table 2-57. Number of Respondents of Socio-Economic and Perception Survey**

| Male | Female | Total Number of Respondents |
|------|--------|-----------------------------|
| 27   | 48     | 76                          |

### Demographic Characteristic

Majority (63%) of the respondents are women while only 36% are men. Most (55%) of the respondents were born in the Barangay. Majority (91%) of the respondents are Ceburano and some are Waray. Majority (54%) of the respondents are within the bracket of 46-65 year old. Most (42%) had finished college, 25% had finished high school, 21% had finished elementary and 11% had finished vocational school. Most (80%) of the respondents are married having 1-3 male (55%) and female (64%) children. Majority (91%) of the respondents are Catholics by religious affiliation.

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### Migration/Settlement History

Most of the respondents (54%) have stayed in the Barangay for 21-40 years and 33% of the respondents have stayed in the Barangay for 51-60 years. If they were given a chance to live in other places, 93% of them would still chose to live in their Barangay.

### Income and Employment

The husband (64%) is contributing a major portion of income in the family of the respondents. About 52% have an earning of PhP1,000 to PhP9,999 per month and 16% have an earning of less than PhP1,000 per month. Majority (75) of the respondents source their income from the salary. Though, the Barangay is near the sea, only 8% of the respondent are fishermen.

### Community & Land Resource

Most of the respondents (87%) indicated that livelihood or source of income is the main problem in their community followed by solid waste and water conservation. Majority (82%) do not own any land.

### Perception

Majority (83%) of the respondents knew about the proposed Project of IASCL, learning about it from the IEC and Public Scoping (58%). Some (33%) of them knew the proposed Project from the Barangay Officials. About 87% of the respondents are in favor of the proposed Project. They considered it to have a positive effect, such as provision of job opportunities (64%); source of livelihood (45%); and additional income to the barangay (33%). On the other hand, degradation of air quality is the main negative impact raised by the respondents.

### Smoking and Drinking Habits

Twenty percent (12%) of the respondents smoke cigarites and 33% drink liquors. Majority of the smokers smoke for more than 31 years. Chronic obstructive pulmonary disorder (**COPD**) is the disease predisposed by smoking one pack of cigarette for ten years and above. It is manifested by chronic cough, wheezing and progressive difficulty of breathing in the 50-year old smoker. Moreover, excessive and prolonged liquor drinking can result to alcoholic hepatitis and cirrhosis. Majority of the respondents who drinks liquor are drinking only during occasions.

### Site of Medical Consultation

The respondents consult the private clinic (30%) and the Municipal Health Unit (22%) for their health problems. Some of them consult the Barangay Health Unit, Hospital and herbalist.

### Causes of Diseases

The most common causes of diseases encountered by the respondents are cough, hypertension and diabetes (**Table 2-58**).

**Table 2-58. Causes of Diseases**

| Diseases     | Respondents |
|--------------|-------------|
| Cough        | 9%          |
| Hypertension | 7%          |
| Diabetes     | 7%          |
| Fever        | 5%          |
| Asthma       | 5%          |
| UTI          | 4%          |
| Arthritis    | 4%          |

Source: GEOSPHERE 2017



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### Medicines Taken by Respondents

The medicines usually taken by the respondents are the medicine for fever (Paracetamol). The list of medicine usually taken by the respondents are listed in **Table 2-59**.

**Table 2-59. Medicines Taken by the Respondents**

| Medicine    | Respondents |
|-------------|-------------|
| Paracetamol | 30%         |
| Aspirin     | 8%          |
| Neozep      | 5%          |
| Salbutamol  | 5%          |
| Antibiotic  | 4%          |

Source: GEOSPHERE 2017

### Sources of Medicines

Most of the respondents source their medicines from the pharmacy and Hospital, as shown in **Table 2-60**.

**Table 2-60. Sources of Medicines**

| Source   | Respondents |
|----------|-------------|
| Pharmacy | 71%         |
| Hospital | 4%          |
| MHU/RHU  | 3%          |
| BHU      | 4%          |

Source: GEOSPHERE 2017

### Toilet Facility

Majority (71%) of the respondents have water sealed toilet at home, while 20% of the respondent are using flash toilet.

### Water Sources

Majority (80%) of the respondents source their water supply from water system. Some sources their water from spring and deep well.





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### 3.0 ENVIRONMENTAL MANAGEMENT PLAN

The IASCL is committed to minimize any adverse impacts, which could arise from the construction, operation and abandonment of the proposed Project. It will do so by formulating an Environmental Management Program (**EMP**) to manage the Project's impacts, adopt the best available proven control technologies and procedures, undergo a continuing process of review and positive action in the light of available monitoring results and continuing consultation with the local communities.

Basically, the EMP will aim to achieve an exemplary environmental performance in the construction and operation of a power plant. In order to meet this goal, the following activities/measures/programs will have to be implemented:

- Environmental Policy;
- Application of Mitigation/Management Measures;
- Environmental Monitoring Program;
- Social Development Program;
- Emergency and Contingency Plan;
- Information, Education and Communication Plan;
- Reforestation Program for Buffer Zone;
- Construction Contractor's Program; and
- Institutional Plan and Hiring of an Environmental/Safety Officer.

### 3.1 ENVIRONMENTAL POLICY

The Environmental Policy of the IASCL can be summarized in three (3) statements, as follows:

- To produce electricity using high-efficiency, state-of-the-art technology and practices with the minimum possible impact on the environment and surrounding community;
- To design and operate the plant safely and in an environmentally-responsible manner according to world class standards and in full compliance with all applicable laws and regulations; and
- To conduct continuous dialogue with the affected community as well as all stakeholders to ensure protection and enhancement of the quality of the environment and to contribute to the sustainable development of the country.

To carry out this Environmental Policy, the IASCL commits to regularly evaluate the environmental impacts of the proposed Project, its facilities all throughout the construction and operation phases; and maintain good communication/relations with the local communities.

Furthermore, the IASCL Management shall issue work instructions/controls for defining the manner of conducting an activity and inspection procedure to ensure application of the mitigation measures. Documentation of the supervision and monitoring results for the Project shall be done to test the effectiveness of mitigation measures and impact controls.

The IASCL Management will inform the community and the local government about its environmental policies and program through its IEC Program.

### 3.2 MANAGEMENT AND MITIGATION

The main emphasis of environmental management of the proposed Project will be on air quality and safety factor of the plant.

The mitigation measures are formulated to reduce the adverse environmental impacts that have been identified and enhance the beneficial impacts as a result of the proposed Project. The mitigation measures have been discussed in **Chapter 2** of this EISR after the assessment of each



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impact. The EMP outlines the predicted impacts of the proposed Project as well as its prevention/mitigation and enhancement measures.

### 3.3 ENVIRONMENTAL MANAGEMENT PROGRAMS

The following are the EMPs that will be implemented for the proposed Project:

- **Air Quality, Water Quality and Ambient Noise Monitoring Program.** Environmental quality monitoring shall be undertaken at recommended monitoring stations to ensure compliance to DENR relevant standards for water, air and noise during construction and operation phases of the project.
- **Solid Wastes Management System.** The proposed Project operation mainly generates industrial solid wastes which include slag, oily sludge from vehicles, equipment and oil and water separators, spent lubricants and other chemicals.
- **Stormwater Management and Drainage Plan.** IASCL shall install a storm drainage system especially along the access/maintenance roads and stormwater detention/retention pond.
- **Emergency Preparedness and Response Plan.** Emergency response/procedures will be developed for accidents due to equipment/machinery failure or malfunction, accidental spills of chemicals and other hazardous materials and calamity from a major seismic event or earthquake. Evacuation maps shall be posted at different areas of the Project site. Evacuation drills shall be conducted to assess the applicability of the plan.
- **Fire Protection system.** A comprehensive fire detection, alarm system and fire protection system is designed for the facility to provide a high degree of protection for plant buildings and other auxiliary facilities. The Fire Protection System shall consist of fire suppression systems, independent fire detection systems, standpipe, fire hose stations, fire loop system, and portable fire extinguishers to protect the asset, buildings and facilities. Fire drill shall be undertaken regularly to ensure preparedness of the personnel in the event of fire or fire risks.
- **Social Development and IEC Program.** The indicative sustainable social development plan that was formulated is based on the government requirement R.A 7279/DAO 2003-30 revised and the mandated corporate responsibility of IASCL aligning the programs to the mandated development programs as required by the Department of Interior and Local Government (**DILG**) in the Internal Revenue Allotments (**IRA**).
- **Health and Safety Plan.** The Health and Safety Plan for the community especially the identified impact area involves the following: a) A Medical and Dental Program; and b) Emergency Disaster Health Program. Health and Safety plan for the workers will be also implemented.
- **Reforestation Program for Buffer Zones.** The need for a buffer zone is clearly stressed in the light of neutralizing the noise level at the property line, creating a habitat for displaced vegetation, and improving the aesthetics of the Project site.
- **Construction Contractors Program.** The contract between IASCL and the respective contractors shall incorporate rules, regulations and conditions to ensure that the mitigating, management and enhancement measures in the EISR and the conditions stipulated in the ECC are strictly followed.

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Table 3-1 Impact Management Plan for the Proposed Project

| Environmental Aspect  | Environmental Component Likely to be Affected | Potential Impact                                  | Prevention/Mitigation/Enhancement Measures  | Responsible Institution | Estimated Cost (Php) | Guarantee/ Financial Arrangement |
|---|---|---|---|-------------------------|----------------------|----------------------------------|
| <b>PRE-CONSTRUCTION PHASE</b>   |   |   |   |                         |                      |                                  |
| Pre-construction phase covers activities like planning, feasibility study, drawing of plans and permit procurement. |   |   |   |                         |                      |                                  |
| <b>CONSTRUCTION PHASE</b>   |   |   |   |                         |                      |                                  |
|   | <b>LAND</b>                                   |   |   |                         |                      |                                  |
| Cut and fill activities<br><br>Construction of the proposed Project   | Land use and Classification                   | • Change/Inconsistency in Land Use                | • The Project site is an industrial land and consistent with the general land use of Isabel Municipality and therefore there is no issue with the change in land use.   | IASCL and Contractor    | NA                   | NA                               |
|   |   | • Encroachment to ECA                             | • The Project site has not encroached in an ECA.  | IASCL and Contractor    | NA                   | NA                               |
|   | Geology/ Geomorphology                        | • Change in surface landform/terrain/slope        | • Strict conformance to the recommendations of the geotechnical study<br>• Since the area is already developed, the possibility of experiencing landslides and/or mud/debris flow is nil.   | IASCL and Contractor    |                      | Part of EPC contract cost        |
|   |   | • Change in sub-surface underground geomorphology |   |                         |                      |                                  |
| Site Preparation, and Earthwork   | Pedology                                      | • Soil erosion                                    | • When necessary, construction of soil erosion control measures either by engineering structure or planting of grasses/trees.<br>• Placement of excavated soil materials in appropriate stockpile areas with avoidance of stockpiling along drainage ways/creeks. | IASCL and Contractor    | 150,000.00           | Part of EPC contract cost        |
|   |   |   |   |                         |                      |                                  |

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| Environmental Aspect         | Environmental Component Likely to be Affected                                | Potential Impact  | Prevention/Mitigation/Enhancement Measures  | Responsible Institution | Estimated Cost (PhP)              | Guarantee/ Financial Arrangement |
|------------------------------|--|---|---|-------------------------|-----------------------------------|----------------------------------|
| Presence of Heavy equipment  |  |   | <ul style="list-style-type: none"><li>The soil stockpiles will be covered with plastic sheets/geotextile, or planted with grasses/ small shrubs for erosion control.</li><li>Slope protection to prevent soil siltation such as sturdy concrete wall, grouted rock wall and riprap for the bench type conceptual design layout.</li></ul> |                         |                                   |                                  |
|                              |  | <ul style="list-style-type: none"><li>Soil Contamination</li></ul>  | <ul style="list-style-type: none"><li>Regular site inspection and monitoring</li><li>Soil Sampling (if necessary)</li></ul>   | IASCL and Contractor    | Included in the construction cost | NA                               |
|                              | Terrestrial Ecology  | <ul style="list-style-type: none"><li>Vegetation removal and loss of habitat</li></ul>  | <ul style="list-style-type: none"><li>Since the site is already developed, the construction of the proposed Project will not cause significant loss of habitat.</li></ul>   | IASCL and Contractor    | NA                                | NA                               |
|                              |  | <ul style="list-style-type: none"><li>Threat to existence and/or loss of important local species</li></ul>                          | <ul style="list-style-type: none"><li>Not applicable since there will be no significant flora and fauna that will be affected in the project site</li></ul>   | IASCL and Contractor    |                                   |                                  |
|                              |  | <ul style="list-style-type: none"><li>Threat to abundance, frequency and distribution of important species</li></ul>                |   |                         |                                   |                                  |
|                              | <ul style="list-style-type: none"><li>Hindrance to wildlife access</li></ul> | <ul style="list-style-type: none"><li>No significant wildlife habitat or endangered species were within the project site.</li></ul> |   |                         |                                   |                                  |
|                              | AIR  |   |   |                         |                                   |                                  |
|                              | Meteorology/ climatology   | <ul style="list-style-type: none"><li>Change in local climate and local temperature</li></ul>                                       | <ul style="list-style-type: none"><li>IASCL shall plant native tree species for vegetation, as these would be expected to have good survival rate.</li></ul>  |                         |                                   |                                  |
| Mobilization of Construction | Air Quality and Noise  | <ul style="list-style-type: none"><li>Degradation of Air Quality</li></ul>  | <ul style="list-style-type: none"><li>Every main haul road shall be paved with concrete, bituminous</li></ul>   | IASCL and Contractor    | Included in the                   | Part of EPC contract cost        |



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| Environmental Aspect    | Environmental Component Likely to be Affected | Potential Impact | Prevention/Mitigation/Enhancement Measures  | Responsible Institution | Estimated Cost (Php) | Guarantee/ Financial Arrangement |
|-------------------------|---|------------------|---|-------------------------|----------------------|----------------------------------|
| Equipment and Materials |   |                  | <p>materials; keep the road clear of dusty materials; spray the road with water so as to maintain the entire road surface wet; and immediately before leaving a construction site, every vehicle shall be washed to remove any dusty materials from its body and wheels;</p> <ul style="list-style-type: none"><li>• Truck loaded with dusty construction materials shall be covered entirely by clean impervious sheeting to ensure that the dusty materials do not leak;</li><li>• Periodic watering of aggregates storage piles or covering or enclosure if material is especially dusty.</li><li>• Ambient air (TSP) monitoring</li></ul> |                         | construction cost    |                                  |

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| Environmental Aspect                  | Environmental Component Likely to be Affected | Potential Impact   | Prevention/Mitigation/Enhancement Measures   | Responsible Institution                              | Estimated Cost (PhP) | Guarantee/ Financial Arrangement |
|---------------------------------------|---|--|--|--|----------------------|----------------------------------|
|                                       |   | <ul style="list-style-type: none"><li>Increase in ambient noise level</li></ul>                                | <ul style="list-style-type: none"><li>Scheduling certain high noise emitting works to more acceptable times of day</li><li>Use of the most environmentally acceptable equipment which is properly maintained and silenced</li><li>Proper instruction and supervision of staff</li><li>Defective equipment/parts with abnormal noise and/or vibration will be either repaired replaced</li><li>All employees working on site will be provided with proper ear protectors</li><li>Conduct noise level monitoring</li></ul> |  |                      |                                  |
|                                       | PEOPLE  |  |  |  |                      |                                  |
| Implementation of livelihood projects | Local residents                               | <ul style="list-style-type: none"><li>Increase income for residents</li></ul>                                  | <ul style="list-style-type: none"><li>Positive Impact</li></ul>  | IASCL  | 100,000.00           | Part of EPC contract cost        |
| Hiring of workers                     | Local residents                               | <ul style="list-style-type: none"><li>Increase in local employment</li></ul>                                   | <ul style="list-style-type: none"><li>Priority employment for qualified local residents without discrimination to gender and age</li></ul>   | IASCL, Contractor in coordination with host barangay |                      | Part of EPC contract cost        |
| Increase in taxes and revenues        | Local community                               | <ul style="list-style-type: none"><li>Improvement in infrastructures and social services</li></ul>             | <ul style="list-style-type: none"><li>Diligent payment of taxes/revenues</li></ul>   | IASCL  |                      | Part of EPC contact cost         |
| Accidents                             | Local and migrant workers                     | <ul style="list-style-type: none"><li>Construction-related hazards</li><li>Safety Hazards on workers</li></ul> | <ul style="list-style-type: none"><li>Environment, health and safety training prior to construction</li><li>Conduct Safety training</li></ul>  | IASCL, Contractor                                    |                      | Part of EPC contract cost        |
| OPERATION PHASE                       |   |  |  |  |                      |                                  |

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| Environmental Aspect         | Environmental Component Likely to be Affected | Potential Impact   | Prevention/Mitigation/Enhancement Measures   | Responsible Institution | Estimated Cost (PhP) | Guarantee/ Financial Arrangement |
|------------------------------|---|--|--|-------------------------|----------------------|----------------------------------|
|                              | <b>LAND</b>                                   |  |  |                         |                      |                                  |
| Foundation Stability         | Geology                                       | <ul style="list-style-type: none"> <li>Subsidence and Liquefaction</li> </ul>  | <ul style="list-style-type: none"> <li>Structural monitoring of buildings/facilities especially after each earthquake</li> <li>Formulation of detailed Emergency Preparedness and Response Plan</li> </ul>   | IASCL, EMB              | 200,000.00           | Part of Operation cost           |
| Operation of the power plant | Pedology                                      | <ul style="list-style-type: none"> <li>Soil contamination</li> </ul>   | <ul style="list-style-type: none"> <li>Regular monitoring of possible oil spills</li> </ul>  | IASCL, EMB              | 60,000.00            | Part of Operation cost           |
| Emissions from power plant   | Terrestrial Ecology                           | <ul style="list-style-type: none"> <li>Threat to abundance, frequency and distribution of important species</li> </ul> | <ul style="list-style-type: none"> <li>IASCL shall plant native species for vegetation to act as emission filters, as these would be expected to have good survival rate.</li> </ul>                         | IASCL                   | 100,000              | Part of Operation cost           |
|                              | <b>AIR</b>                                    |  |  |                         |                      |                                  |
| Operation of the power plant | Air Quality                                   | <ul style="list-style-type: none"> <li>Degradation of Air Quality</li> </ul>   | <ul style="list-style-type: none"> <li>Built-in smokestacks for efficient dispersion of plant's emission</li> <li>Conduct ambient air quality monitoring and stack emissions testing</li> </ul>              | IASCL, EMB              | 1,000,000.00         | Part of Operation cost           |
|                              | Noise Quality                                 | <ul style="list-style-type: none"> <li>Increase in ambient noise level</li> </ul>                                      | <ul style="list-style-type: none"> <li>All generators will be enclosed;</li> <li>Conduct noise level monitoring</li> </ul>   | IASCL                   | 150,000.00           | Part of Operation cost           |
|                              | <b>PEOPLE</b>                                 |  |  |                         |                      |                                  |
| Operation of the power plant | Waste Management                              | <ul style="list-style-type: none"> <li>Generation of sewage/solid waste</li> </ul>                                     | <ul style="list-style-type: none"> <li>Provision, portalets and latrines, no litter signs, waste bins</li> <li>Applying the hierarchy of measures: Reduce, Segregate, Re-use, Recycle and Dispose</li> </ul> | IASCL                   | 100,000.00           | Part of Operation cost           |

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| Environmental Aspect         | Environmental Component Likely to be Affected | Potential Impact  | Prevention/Mitigation/Enhancement Measures   | Responsible Institution | Estimated Cost (PhP) | Guarantee/ Financial Arrangement |
|------------------------------|---|---|--|-------------------------|----------------------|----------------------------------|
|                              |   |   | <ul style="list-style-type: none"> <li>Proper disposal of non-recyclable wastes through an accredited contractor</li> </ul>  |                         |                      |                                  |
|                              | Traffic Congestion                            | <ul style="list-style-type: none"> <li>Increase in Traffic</li> </ul>   | <ul style="list-style-type: none"> <li>Proper Scheduling of delivery for the construction and other materials</li> </ul>   | IASCL                   | 30,000               | Part of Operation cost           |
| Hiring of workers            | Population                                    | <ul style="list-style-type: none"> <li>Change in population (size, distribution)</li> <li>In-migration</li> </ul> | <ul style="list-style-type: none"> <li>Priority hiring of qualified local residents in coordination with the Municipal Gov't and host barangay</li> </ul>  | IASCL, LGU              | 300,000.00           | Part of Operation cost           |
|                              | Social services                               | <ul style="list-style-type: none"> <li>Overburdening of public social services</li> </ul>                         | <ul style="list-style-type: none"> <li>Priority hiring of qualified local residents</li> <li>On-site safety officer/first aider</li> </ul>   | IASCL                   | 300,000.00           | Part of Operation cost           |
|                              | Health  | <ul style="list-style-type: none"> <li>Introduction of disease between migrant and local workers</li> </ul>       | <ul style="list-style-type: none"> <li>Clean bill-of-health as a condition for employment</li> <li>Medical missions shall be part of the CSR program of IASCL</li> <li>Provision of potable water, sanitary facilities and garbage bins for workers</li> <li>Provision of a safety officer to monitor safe working conditions</li> <li>Provision of Medical/First Aid kits in all work places</li> </ul> | IASCL                   | 200,000.00           | Part of Operation cost           |
| Operation of the power plant | Local residents                               | <ul style="list-style-type: none"> <li>Increased social and economic financial activity</li> </ul>                | <ul style="list-style-type: none"> <li>Positive impact, no mitigation required</li> </ul>  | IASCL                   | NA                   | NA                               |
|                              | Local properties                              | <ul style="list-style-type: none"> <li>Fire hazard</li> </ul>   | <ul style="list-style-type: none"> <li>Provision of fire suppression systems, fire detections systems, fire hose stations and portable fire extinguishers</li> </ul>   | IASCL                   | 100,000.00           | Part of Operation cost           |
| <b>ABANDONMENT PHASE</b>     |   |   |  |                         |                      |                                  |



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| Environmental Aspect  | Environmental Component Likely to be Affected | Potential Impact  | Prevention/Mitigation/Enhancement Measures  | Responsible Institution | Estimated Cost (PhP) | Guarantee/ Financial Arrangement |
|---|---|---|---|-------------------------|----------------------|----------------------------------|
|   | <b>LAND</b>                                   |   |   |                         |                      |                                  |
| Decommissioning   | Pedology                                      | <ul style="list-style-type: none"> <li>Soil contamination with heavy metals</li> </ul>  | <ul style="list-style-type: none"> <li>The Abandonment Rehabilitation Plan shall be followed strictly with emphasis on the strategy of sustaining erosion/ sedimentation control within and adjacent vicinity of the power plant and rendering the Project area free of soil contamination from oil spills</li> </ul> | IASCL, EMB              | 50,000.00            | Part of Abandonment cost         |
|   | Terrestrial Ecology                           | <ul style="list-style-type: none"> <li>Increase biodiversity due to retention of planted native trees</li> </ul>  | <ul style="list-style-type: none"> <li>Positive impact, no mitigation needed</li> </ul>   | IASCL                   | NA                   | NA                               |
|   | <b>AIR</b>                                    |   |   |                         |                      |                                  |
|   | Air Quality and Noise                         | <ul style="list-style-type: none"> <li>Generation of noise,</li> <li>Generation of dusts which affects workers and vegetation</li> </ul>  | <ul style="list-style-type: none"> <li>Watering during dismantling to minimize dusts</li> <li>Proper maintenance of vehicles</li> <li>Use of noise suppressors/mufflers</li> <li>Limiting noisy activities during daytime</li> <li>Conduct noise level monitoring</li> </ul>  | IASCL, EMB              | 50,000.00            | Part of Abandonment cost         |
|   | <b>PEOPLE</b>                                 |   |   |                         |                      |                                  |
| Hiring of workers for demolition and abandonment activities | Local residents                               | <ul style="list-style-type: none"> <li>Increase in local employment during abandonment</li> <li>New skills developed for decommissioning may be marketable elsewhere</li> </ul> | <ul style="list-style-type: none"> <li>Priority for qualified local residents</li> </ul>  | IASCL                   | NA                   | NA                               |
| Loss of jobs/ employment                                    |   | <ul style="list-style-type: none"> <li>Reduction in employment opportunities to include the staff of local</li> </ul>   | <ul style="list-style-type: none"> <li>Six (6)-month notice prior to termination of contract to give ample time to look for next employment</li> </ul>  | IASCL                   | NA                   | NA                               |

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Isabel Ancillary Services Co. Ltd.

| Environmental Aspect | Environmental Component Likely to be Affected | Potential Impact   | Prevention/Mitigation/Enhancement Measures   | Responsible Institution | Estimated Cost (PhP) | Guarantee/ Financial Arrangement |
|----------------------|---|--|--|-------------------------|----------------------|----------------------------------|
|                      |   | contractors with long-standing service contracts with the project, for example, maintenance services, site transport services and franchised catering companies. | <ul style="list-style-type: none"><li>• Effective management via consultation, planning and communications with affected workers</li><li>• Financial support within a human resources plan</li></ul> |                         |                      |                                  |
|                      | Demographic                                   | <ul style="list-style-type: none"><li>• Out migration of affected project personnel to seek work elsewhere</li></ul>   |  |                         |                      |                                  |

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### 4.0 ENVIRONMENTAL RISK ASSESSMENT (ERA) & EMERGENCY RESPONSE POLICY AND GUIDELINES

The Environmental Risk Assessment (ERA) was conducted as part of the EIA Study requirement for the proposed Project in Barangay Libertad, Isabel, Leyte. This ERA report is in accordance with the prescribed format stipulated in the RPM of DAO 2003-30, Implementing Rules and Regulations of PD 1586, establishing the PEISS. The primary objective of this ERA is to perform a preliminary qualitative risk assessment/ screening to identify, describe and evaluate the possible impacts arising from the development and operation of the proposed Project on the communities and the environment. The general objective of this report shall be as follows:

- To identify and characterize the hazardous substances that will be handled, used, and stored at the proposed Project;
- To identify the requirements or the degree of ERA preparation based on the results of the inventory as compared with Threshold levels prescribed in Annex 2-7e of the RPM DAO 2003-30.
- To present the physical and chemical properties of these substances;
- Discussion of the hazards associated with the use and storage of these substances; and
- To establish mitigation measures to prevent harmful consequences to human health and possible damage to the environment.

#### 4.1 HAZARD IDENTIFICATION

IASCL will store and utilize diesel fuel oil for the operation of the proposed Project. The categorization of diesel fuel oil shall be mainly based on the nature and the quantity that will be stored on-site. If diesel fuel oil falls in any category definitions of Annex 2-7e, it is considered hazardous and will be included in this study. The results are summarized in **Table 4-1**.

**Table 4-1 Categorization of Hazardous Substances**

| Category                | Applicable Criteria  | Evaluation   | Criteria Met? |
|-------------------------|--|--|---------------|
| <b>Diesel Fuel Oil</b>  |  |  |               |
| Explosives              | Substances or preparations which create risk of an explosion by shock, friction, fire, or other sources of ignition.               | Not explosive in normal form (liquid).   | No            |
| Flammable Substance     | Substances and preparations having a flash point range of 21°C to 55°C and capable of supporting combustion.                       | Flash point 50°C.  | Yes           |
| Oxidizing Substances    | Substances which give rise to highly exothermic reaction when in contact with other substances, particularly flammable substances. | Diesel oil belongs to aliphatic saturated hydrocarbons which are mostly unreactive. They are not affected by aqueous solutions of acids, alkalis, most oxidizing agents, and most reducing agents. ( <a href="http://cameochemicals.noaa.gov/c/hemical/11452#section2">http://cameochemicals.noaa.gov/c/hemical/11452#section2</a> ) | No            |
| Toxic Substances        | Low, medium, high, very high and extreme toxicity of substances or preparations.   | Value of <i>a</i> based on LC <sub>50</sub> = 6<br>Value of <i>b</i> based on Vapor Pressure = 1<br>Toxicity Class ( <i>a</i> + <i>b</i> ) = 7 (Medium Toxicity based on Table 1 in Annex 2-7e of RPM)   | Yes           |
| Unclassified Substances | Substances or preparations that react violently with water (Type A), and substances or   | Insoluble in water. No known hazardous reaction. ( <a href="http://cameochemicals.noaa.gov/r">http://cameochemicals.noaa.gov/r</a>   | No            |

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| Category                | Applicable Criteria   | Evaluation   | Criteria Met? |
|-------------------------|---|--|---------------|
|                         | preparations which release or liberate toxic gas in contact with water (Type B).  | eactivity/documentation/RG29-RG100)  |               |
| <b>Lube Oil</b>         |   |  |               |
| Explosives              | Substances or preparations which create risk of an explosion by shock, friction, fire, or other sources of ignition.  | Not explosive in normal form (liquid).   | No            |
| Flammable Substance     | Substances and preparations having a flash point range of 21°C to 55°C and capable of supporting combustion.  | Flash point 230°C.   | No            |
| Oxidizing Substances    | Substances which give rise to highly exothermic reaction when in contact with other substances, particularly flammable substances.                                      | Lube oil belongs to aliphatic saturated hydrocarbons which are mostly unreactive. They may be incompatible with strong oxidizing agents like nitric acid. Not affected by aqueous solutions of acids,alkalis, most oxidizing agents and most reducing agents.<br><a href="https://cameochemicals.noaa.gov/chemical/12193">https://cameochemicals.noaa.gov/chemical/12193</a> | No            |
| Toxic Substances        | Low, medium, high, very high and extreme toxicity of substances or preparations.  | Value of <i>a</i> based on LC <sub>50</sub> = 6<br>Value of <i>b</i> based on Vapor Pressure = 1<br>Toxicity Class ( <i>a</i> + <i>b</i> ) = 7 (Medium Toxicity based on Table 1 in Annex 2-7e of RPM)   | Yes           |
| Unclassified Substances | Substances or preparations that react violently with water (Type A), and substances or preparations which release or liberate toxic gas in contact with water (Type B). | Insoluble in water.<br><a href="https://cameochemicals.noaa.gov/chemical/12193">https://cameochemicals.noaa.gov/chemical/12193</a>   | No            |

Using the data in **Table 4-1**, the result of the categorization and classification of the quantity of substance to be stored on site shows that diesel fuel oil is not categorized as Level 1 or Level 2 (**Table 4-2**).

**Table 4-2 Threshold Inventory Level for Hazardous Substances Identified**

| Hazardous Substance   | Total Storage Capacity | Category            | Threshold Inventory |         | Remarks |
|-----------------------|------------------------|---------------------|---------------------|---------|---------|
|                       |                        |                     | Level 1             | Level 2 |         |
| Automotive Diesel Oil | 480 tons               | Flammable Substance | 5,000               | 50,000  | Level 1 |
| Lube Oil              | 14                     | Toxic Substances    | 50                  | 200     | Level 1 |

Submission of risk screening study will be prepared by IASCL prior to operation. A risk screening level exercise refer to specific facilities or the use of certain processes that has the potential to pose significant risk to people and its surrounding environment. The proposed Project is covered by the risk screening level exercise, as indicated in **Table 4-3**.



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Table 4-3 Risk Screening Matrix

| Activities requiring risk screening exercise*  | ERA applicability to the project? |
|--|-----------------------------------|
| 1. Facilities for the production or processing of organic or inorganic chemicals using: <ul style="list-style-type: none"><li>• Alkylation</li><li>• Amination by ammonolysis</li><li>• Carbonylation</li><li>• Condensation</li><li>• Dehydrogenation</li><li>• Esterification</li><li>• Halogenation</li><li>• Hydrogenation</li><li>• Hydrolysis</li><li>• Oxidation</li><li>• Polymerization</li><li>• Sulphonation</li><li>• Desulphurization, manufacture and transformation of Sulphur-containing compounds</li><li>• Nitration and manufacture of nitrogen-containing compound</li><li>• Manufacture of Phosphorous-containing compounds</li><li>• Distillation</li><li>• Extraction</li><li>• Solvation</li></ul> | No                                |
| 2. Installation for distillation, refining and other processing of petroleum   | No                                |
| 3. Installations for the total or partial disposal of solid or liquid substances by incineration or chemical decomposition   | No                                |
| 4. Installations for the production or processing of energy gases, for example, LPG, LNG, SMG.   | No                                |
| 5. Installations for the dry distillation of coal or lignite   | No                                |
| 6. Installations for the production of metals and non-metals by wet process or electrical energy   | No                                |
| 7. Installations for the loading and unloading of hazardous materials as defined by RA 6969 (or DAO 1992-29)   | Yes                               |

\*Based on Annex 2-7e of DAO 2003-30, Revised Procedural Manual

## 4.2 EMERGENCY RESPONSE POLICY AND GENERIC GUIDELINES

IASCL shall have necessary emergency preparedness and response plan (**EPRP**) in case of emergency while doing the proper monitoring and preventive maintenance to avoid any cases of fire.

Earthquake and strong typhoons are natural calamities that may affect the environment and safety of the people although these are quite remote to occur. The proposed Project will be built in accordance with the prescribed processes, mechanical, electrical, and civil structural engineering designs, with each phase featuring the necessary safety requirements.

Moreover, IASCL shall establish an EPRP to define response protocol for any possible crisis/disaster that the proposed Project may encounter in the future such as Fire, Earthquakes, Typhoon, Flood, Enemy Attack, Bomb Threat and Oil Spill. The EPRP shall be consistent with the relevant

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government agencies' guidelines, specially procedures and protocols followed by Isabel Municipality and LMC.

### 4.2.1 General Requirements

#### 4.2.1.1 Facilities, Equipment and Supplies

IASCL shall ensure that the proposed Project has complete facilities, equipment and supplies for communication, firefighting, medical and security. The following equipment shall be made readily available at or near the office:

- Siren System
- Walkie-talkies (if available)
- Portable Loud Speakers
- Portable Fire Extinguishers
- First Aid Kit
- Stretchers
- Van and Driver

A manually activated emergency siren will be situated at one or more locations to allow full coverage of the project and shall be loud enough to be distinguished above other noise.

Fire protection system shall be in place throughout the plant as per the recommendation of Bureau of Fire Protection (**BFP**) according to the Fire Code of the Philippines, Safety Regulations set forth by Department of Labor and Employment (**DOLE**) and National Fire Protection Association (**NFPA**). The Fire Protection System shall consist of the following equipment:

- Fire suppression systems;
- Independent fire detection systems;
- Standpipe and fire hose stations;
- Fire loop system; and
- Portable fire extinguishers.

Fire protection equipment shall be installed in strategic areas in the event of fire or fire risks such as excessive heat or smoke. Portable fire extinguishers shall be provided at all fire hose stations in addition to other key locations to ensure that adequate fire protection is distributed strategically. Fire alarm signals shall be installed from various facility areas of the power plant.

#### 4.2.1.2 Emergency Communication System

An emergency communication system shall be established between the person(s) that discovers the emergency, HSE Office, Project Manager, Employer's Emergency Control Center, LMC, fire station, hospital, etc. Notification of this emergency communication system shall be posted in prominent locations at project site.

The Plant Communications System shall facilitate communication among personnel at the facility. The Plant Communications System shall consist of a multichannel party line and one page line system, with page or party line selection being available from all handsets located throughout the facility. Paging speakers will be located throughout the facility such that pages can be heard from any locations. Consideration shall be given to the environment where handsets and speakers are located. Where possible, handsets and speakers shall be located in non-hazardous areas. Handsets and speakers located outdoors or in hazardous areas will have intrinsic ratings suitable for the area in which the device is located.

The Plant Paging System will consist of cable, raceway, handsets, and speakers. Handsets, amplifiers or speakers shall be finalized during detail design to achieve adequate coverage for the entire finished facility.

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### 4.2.1.3 Emergency Evacuation Muster Areas

The position of muster areas shall be defined as the Project develops. Muster areas on site will normally located outside of the operation and office areas. HSE Officers will be responsible for the assembly area locations as well as signages. The evacuation routes and assembly location, and emergency communication network shall be prominently displayed at key points around the project site and main office and gates.

### 4.2.1.4 Emergency Response Training and Drills

Emergency Response Training and Drills for Fire Fighting, Rescue and Evacuation shall be conducted at least twice a year for all personnel in the project site.

## 4.2.2 Response Procedures

### 4.2.2.1 Fire and Explosion Emergency Response Procedure

- At the first sign of fire or explosion, sound the fire alarm located at the nearest site of the fire or explosion. A fire alarm shall be characterized by continuous sound.
- This alarm will trigger the security guard to call the following:
  - Fire Department
  - Plant Manager
- The main power supply to the affected area (if possible) shall be switched off by the designated power cut-off personnel if it can be done safely. Always put into consideration the power supply to the man lift as somebody might be trapped. The fire pump tender shall start the fire pump at the pump house.
- The nozzle man with the assistance of the hose man shall attempt to extinguish the fire if applicable. If the fire is too big to handle, they shall abandon their posts and assemble at the Emergency Evacuation Muster Areas.
- All the remaining personnel shall congregate at the muster areas and do the following:
  - The Office Coordinator/Sweeper shall ensure that all staffs, visitors and office personnel are evacuated to the assembly area.
  - The Sweeper shall scout their respective areas and guide other personnel into the muster areas.
  - The First Aid Coordinator shall provide emergency first aid to any injured personnel.
  - The Point Man shall advise the Head Count Personnel in charge of his presence and immediately go to the main gate and wait for the fireman's arrival. Upon their arrival, he will inform him the details regarding the fire/explosion and inform them of the hydrant's connection point.
  - The Head Count Personnel shall see to it that all personnel are accounted for including those that has asked permission and performed their other functions.
  - The Security Officer shall advise the Head Count Personnel of his presence and then advise the driver to proceed to the parking area.
  - Fire Pump Tender shall advise the head count of his presence, then proceed to the pump-house and start the operation of the fire pumps.
  - The Power Cut-Off personnel shall advise the head count of his presence and proceed to cut-off the main power supply.



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- Upon arrival of the emergency responding unit, Point Man shall be the one who will assist the group towards the fire scene and give them the details. The fire officials shall have the jurisdiction over all emergency operations.
- All communications with the media personnel shall be handled by the Media Representative.

### 4.2.2.2 Bomb Threat/Suspected Bomb Package Emergency Procedure

- At the first sign of a bomb threat or whenever somebody discovers an unidentified package or box inside the facility, advise the Plant Supervisor. Either one of them shall call the Police Department and give them the following information:

#### For Bomb Threat

- Caller name
- Time call was made
- Location of the bomb
- Any other information related to the threat

#### For Suspected Bomb Package

- Description of the box
  - Location of box
  - Other information related to the box
- The Plant Supervisor shall advise the following personnel to evacuate outside of the plant to the muster area.
    - The Office Coordinator shall ensure that all staffs, visitors and office personnel are evacuated to the assembly area. The Sweeper shall scour the plant area and guide other personnel into the assembly area.
    - The First Aid Coordinator shall provide emergency first aid to any injured personnel.
    - The Point Man shall advise the Head Count Personnel in charge of his presence and immediately go to the main gate for the rescue unit's arrival. Upon their arrival, he will inform him of the details regarding the threat.
    - The Security Officer shall see to it that all personnel are accounted for including those that seek his permission and performed their other functions.
    - The Security Officer shall advise the driver to proceed to the muster area. The driver shall stay on the cars and wait for instructions.
  - Upon arrival of the bomb disposal unit, the Point Man shall assist the police and fire officials of the location of the box and shall have jurisdiction over all emergency operations.
  - All communication with the media personnel shall be handled by the Plant Manager only (media representative).
  - All telephone calls shall be handled at the guardhouse.
  - Back to work order shall be cleared by the bomb disposal unit officials with the approval of the Plant Manager.

### 4.2.2.3 Storm and Flood Emergency Response Procedure

- In the absence of any announcement from the government or as the need arises, the Plant Manager shall be responsible for any announcement regarding the operation of the plant.
- Operators shall shutdown their equipment in the normal procedure.



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- All personnel shall congregate in the following areas:
  - The Office Coordinator shall advise all staffs, visitors and office personnel to congregate at the assembly area for any special instructions. They shall get a hand held radio for better communication.
  - The Security Officer shall advise the drivers and helpers to stay put at the parking area and wait for any special instruction. All other personnel shall proceed inside the plant warehouse premises and wait for instructions. Being the Security-In-Charge, inform the Plant Manager of any other abnormal condition within the plant.
  - The Head Count Personnel shall assemble plant personnel at the assembly area and ensure the head count for all production and other personnel (Admin/Country Office, contractors, visitors) are complete.
- The Head Count Personnel, with coordination with the Plant Manager, shall relay either of the following information to the plant personnel and also the Office Coordinator:
  - Order to go Home- if personnel feel safer in the comfort of their homes or they may stay within the plant if they feel unsafe to travel.
  - Order to stay- if floodwater has already elevated to an unsafe level. If ever anybody insists on going home, he may be allowed to leave at his own risk. In addition, plant personnel might be requested to stay and secure the plant.

### Additional Reminders:

- Home sketches must be available especially for those living in lower lying areas, in case they need to be evacuated to the plant.
- Employee communication (e.g. cell phone numbers) must be done to ensure all employees are accounted for.
- Floaters must be available (e.g. empty plastic drums, banana husk) for use mini-boats in case of floods.
- Advanced notification must be communicated to employees as to “go home”, “stay at the plant”, or “do not report” advice (for those who are still at home or on the way to work).
- Put electronic appliances (e.g. computers, servers) to higher areas to prevent them from being washed away by floodwaters.

#### 4.2.2.4 Earthquake Emergency Response Procedure

- In the event that an earthquake is detected, the detecting personnel shall advise the Central Control Room Operator to activate the Earthquake alarm). Listed below are the steps to be followed in this emergency:
  - During the earthquake, do not panic. Stay under a rigid table to prevent falling objects from hitting you if the earthquake is too strong.
  - Carefully move out of the building after the earthquake. The Plant Supervisor or the Plant Manager at day shall advise personnel to evacuate and congregate at the Gazebo.
  - The Power Cut-Off Personnel shall cut all source of energy like electricity, and close all source of fuel.
  - The Office Coordinator shall ensure that all staffs, visitors and other office personnel are evacuated to the assembly area.
  - The Sweeper shall scout plant area and guide other personnel into the assembly area. He shall confirm that nobody is trapped or left.
  - The Head Count Personnel shall ensure the headcount for all production and other personnel (administration office, staffs and visitors) are complete.
  - The First Aid Coordinator shall provide emergency first aid to any injured personnel.
- After the earthquake, the plant manager shall check if the condition is already safe for the personnel to move back to work or instruct them to go home if necessary.

**4.2.2.5 Liquid Spill/Fuel Oil/Lubricating Oil Spill Control Procedures**

- In case of oil spillage, the detecting personnel shall immediately notify his supervisor. In turn, the Plant Supervisor shall notify the Plant Manager all the information and the steps to clean up the spill.
- The Supervisor shall immediately instruct the following:
  - The Mechanic shall immediately isolate the affected tank enclosure valves.
  - The Plant Technician, with the assistance of plant personnel, shall layout the spill blanket (if applicable) and prepare for clean-up.
- The Plant Supervisor shall directly supervise the clean-up
- The Plant Supervisor shall prepare the Spill Reporting Plan.

**4.2.2.6 Physical Injury or Illness Emergency Response Procedure**

- Notify the Plant Manager or Plant Supervisor in case of personal emergency:
- In case of extreme emergency (life threatening) the supervisors shall do the following:
  - Advise plant management of the situation as soon as possible so that they can notify the victim's relatives.
  - Daytime – the Plant Supervisor shall drive the victim to the hospital and accompany the patient until he is stabilized.
  - Nightshift- the Plant Supervisor shall drive the victim to the hospital and accompany the patient until he is stabilized.
- In case of minor injury or immovable injuries (orthopedic cases), the Plant Supervisor shall do the following:
  - Call the hospital for assistance and stay on the phone until all information is relayed.
  - Assign at least one person to stay with the victim and to assure him that help is on the way.
  - If applicable, basic first aid will be administered as necessary by qualified personnel.
  - Assign personnel who will guide the emergency crew to the victim
  - Notify the victim's relatives.

*NOTE: There must be an available vehicle and a qualify driver all the time*

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### 5.0 SOCIAL DEVELOPMENT PLAN/Framework AND IEC FRAMEWORK

#### 5.1 Social Development Plan/Framework

The Social Development Plan (**SDP**) was prepared based on the data/information collected from the CLUP of Isabel Municipality. The results of perception survey were also incorporated in the SDP to address the perceived fears of environmental degradation due to pollution on land, water, air and health risks.

The SDP aims to enhance the identified programs and design the appropriate development programs that would be the basis for the preparation of the DOE required five-year Social Development and Management Plan (**SDMP**) upon the continued operation of the proposed Project. Various programs identified are in the areas of health and safety; education; peace and order; environment and sanitation; and spiritual. Multi-sectoral representatives are the Inter-agency Government Offices (MSWD, MAO, MPDO/ENRO, MHO, PNP) from the youth, senior citizens, church/religious organizations and the LGUs. The recommended SDP will be presented to the Inter-agency representatives in consideration of their mandate to deliver services in coordination with the LGU and IASCL. This includes the municipality and barangay IRAs to maximize the resources with IASCL's socio-economic commitments as mandated by law. For sustainability, the Social Development Technical Working Group sits as Ad hoc Committee in coordination with IASCL CSR Team to oversee the implementation of the SDMP.

IASCL has indicated its commitment to support the SDP in partnership with the LGUs, NGOs, POs and other concerned government agencies. It is expected that in the long term, the economic benefits from tax revenues, the funds from the mandated services of the inter-agencies and the socio-economic benefits from DOE ER No. 1-94 will be the contributing sources of funds together with the IRA of the host barangay to sustain the implementation of the SDP.

**Table 5-1** presents the SDP for the proposed Project of IASCL.

#### 5.2 Information, Education and Communication

Information materials such as brochures, videos, slide, pamphlets and posters will be prepared and distributed by IASCL. These materials will provide information about the project details such as benefits and risks that will result from its implementation. As well, focus group discussions and community open forum will be carried out to disseminate important information to affected residents. The IEC program will be implemented in close coordination with concerned LGUs, NGOs, and stakeholders. **Table 5-2** presents the proposed IEC Framework.

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Table 5-1 Indicative SDP for the Proposed Project

| Concern   | Responsible Community Member/Beneficiary  | Government Agency/ Non-government Agency and Services  | PROPONENT  | Indicative Timeline       | Source of fund              |
|---|---|--|--|---------------------------|-----------------------------|
| <b>Gender Responsive Livelihood/and Credit Facilities</b><br>(Men, Women, Youth, Elderly and PWD)   | <ul style="list-style-type: none"> <li>Barangay Chairman</li> <li>Barangay Chair for Women</li> <li>Qualified Project Affected Men, Women, Youth, Elderly and PWD</li> </ul>  | <b>LGU, Municipal Planning Office</b><br><br><b>MSWD, TESDA, DA</b> <ul style="list-style-type: none"> <li>Development Community Micro-finance Facilities</li> <li>Product and Marketing Information System Development:</li> <li>Cooperative Development</li> </ul> <b>TESDA/TLRC</b> <ul style="list-style-type: none"> <li>Technician/electrician/mechanics/driving</li> </ul>  | <b>IASCL Community Relations Officer (ComRel)</b> <ul style="list-style-type: none"> <li>Create opportunities for the barangay to address their most basic asset in growth and development – land and resources.</li> <li>Equity among the men and women in the access and control of economic opportunities.</li> </ul> | Construction<br>Operation | LGU-IRA, ER 1-94, IASCL CSR |
| <b>Health and Safety</b> <ul style="list-style-type: none"> <li>Climate Change</li> <li>Environment Health Risk from the construction and operation of the proposed Project</li> <li>Contagious Diseases</li> <li>Malnourished Babies and Children</li> <li>Problems of Potable Water and Sanitation</li> <li>Lack of Health Facilities and Development Program</li> <li>Expensive quality drugs</li> <li>Proliferation of unhealthy lifestyle</li> </ul> | <ul style="list-style-type: none"> <li>Barangay Kagawad for Health</li> <li>Barangay Kagawad for Senior Citizen</li> <li>Barangay Health Workers</li> <li>Barangay Nutrition Scholars</li> <li>Barangay Disaster Risk Reduction Coordinating Council</li> </ul> | <b>MHO/MSWD/MDRRMC</b> <ul style="list-style-type: none"> <li>Community Health Awareness Project</li> <li>Upgrading of Facilities and Equipment</li> <li>Supply and Medicines</li> </ul> <b>Regular Programs</b> <ul style="list-style-type: none"> <li>Nutrition and Food for Growth Program               <ul style="list-style-type: none"> <li>Malnutrition</li> <li>Supplemental feeding</li> </ul> </li> <li>Health Facilities Development Program</li> <li>Water and Sanitation Program</li> <li>Provide potable water system</li> <li>Improvement of Access to Low Cost Quality Drugs through the Botika ng Barangay</li> <li>Advocacy on Healthy Lifestyle</li> <li>Provide assistance to Senior Citizens and Persons with Disability</li> <li>Barangay Disaster Management Training</li> </ul> | <b>IASCL ComRel</b> <ul style="list-style-type: none"> <li>Organize medical missions and provision of medicines to the host barangay</li> </ul>  | Construction<br>Operation | LGU-IRA, ER 1-94, IASCL CSR |



# ENVIRONMENTAL IMPACT STATEMENT REPORT

## Proposed Modular Diesel Power Plant Ancillary Project

Barangay Libertad, Isabel, Leyte

Isabel Ancillary Services Co. Ltd.

| Concern  | Responsible Community Member/Beneficiary   | Government Agency/ Non-government Agency and Services   | PROPONENT  | Indicative Timeline       | Source of fund              |
|--|--|---|--|---------------------------|-----------------------------|
| <ul style="list-style-type: none"> <li>Neglect of Senior Citizen and PWD</li> <li>Enhancement of Senior Citizen's benefits</li> </ul>  |  |   |  |                           |                             |
| <b>Education and Recreation</b> <ul style="list-style-type: none"> <li>Community/School children lack training for disaster preparedness</li> <li>Lack of knowledge about the construction and operation of a modular diesel power plant</li> <li>Lack of school rooms</li> <li>Lack of teachers</li> <li>Scholarship for qualified students</li> <li>Alternative education for adults who lack literacy and numeracy skills</li> <li>Maintenance of Culture and Sports school activities</li> </ul> | <ul style="list-style-type: none"> <li>Barangay Kagawad for Education</li> <li>Barangay School Head Teacher/Principal</li> </ul> | <b>DepEd/MHO/ME/MDRRC</b> <ul style="list-style-type: none"> <li>Production of IEC Materials including Climate Change &amp; Disaster Management in relation to the operation of the proposed Project</li> <li>Include in the school curriculum the operation of a modular diesel power plant</li> <li>Disaster Preparedness and Response Program</li> <li>Construction/Rehabilitation of additional School Buildings</li> <li>Provision/Hiring of additional teachers</li> <li>Construction of school fences</li> <li>Upgrading of parks &amp; playground</li> <li>Teachers orientation &amp; skills training</li> <li>Basic Literacy and Numeracy/<i>Sulong Dunong</i> Program</li> <li>Technical Education and Skills Development Program</li> <li>Setting-up of scholarship program for qualified students</li> <li>Literacy Programs &amp; Alternative Education</li> <li>Opening of Technical/Vocational Courses</li> </ul> <b>Sports</b> <ul style="list-style-type: none"> <li>Purchase of Sports Equipment</li> <li>Establishment of Sports Program (i.e. scholarship, etc.)</li> </ul> | <b>IASCL ComRel</b> <ul style="list-style-type: none"> <li>Provision of Technical Education Scholarship               <ul style="list-style-type: none"> <li>Skills training based on the technical needs of the proposed Project</li> <li>Includes TESDA training fee and meal allowance</li> </ul> </li> </ul> | Construction<br>Operation | LGU-IRA, ER 1-94, IASCL CSR |

# ENVIRONMENTAL IMPACT STATEMENT REPORT

Proposed Modular Diesel Power Plant Ancillary Project

Barangay Libertad, Isabel, Leyte

Isabel Ancillary Services Co. Ltd.

| Concern   | Responsible Community Member/Beneficiary  | Government Agency/ Non-government Agency and Services   | PROPONENT  | Indicative Timeline       | Source of fund              |
|---|---|---|--|---------------------------|-----------------------------|
| <b>Environment and Sanitation</b> <ul style="list-style-type: none"> <li>Indiscriminate disposal of waste</li> <li>No proper toilets and sewage system</li> </ul> | <ul style="list-style-type: none"> <li>Barangay Kagawad for Environment</li> </ul>  | <b>MPDO/MENRO/MHO/BFAR (Climate Change Programs)</b> <ul style="list-style-type: none"> <li>Enforcement/Implementation of Ecological Solid Waste Management Ordinance and Integrated Solid Waste Management Plan</li> <li>Establishment of Recycling Industry</li> <li>Establishment of Garbage Collection and Transport System</li> <li>Provide water sealed toilets</li> <li>Monitor water quality for consumption</li> <li>Development of MRF and Solid Waste Management System</li> <li>Prevention/Control of Land, Water, Air and Noise Pollution</li> <li>Control of Soil Erosion and Siltation</li> <li>Construction of STP</li> </ul> | <b>IASCL ComRel</b> <ul style="list-style-type: none"> <li>Training and capacity building</li> </ul> | Construction<br>Operation | LGU-IRA, ER 1-94, IASCL CSR |
| <b>Infrastructure</b> <ul style="list-style-type: none"> <li>Improvement and rehabilitation of barangay roads</li> </ul>  | <ul style="list-style-type: none"> <li>Barangay Chairman</li> <li>Barangay Kagawad for Infrastructure</li> </ul>              | <b>MPDO/ME/ DPWH</b> <ul style="list-style-type: none"> <li>Road Rehabilitation</li> </ul>  | <b>IASCL ComRel</b>  | Construction<br>Operation | LGU-IRA, ER 1-94, IASCL CSR |
| <b>Peace and order</b> <ul style="list-style-type: none"> <li>Maintenance of peace &amp; order</li> </ul>   | <ul style="list-style-type: none"> <li>Barangay Kagawad for Peace and Order</li> <li>Barangay Tanod</li> </ul>                | <b>LGU/PNP</b> <ul style="list-style-type: none"> <li>Capacitate and Strengthen Barangay Tanods in peace keeping</li> </ul>   | <b>IASCL Chief Security Officer</b>  | Construction<br>Operation | LGU-IRA, ER 1-94, IASCL CSR |
| <b>Spiritual</b>  | <ul style="list-style-type: none"> <li>Barangay Assigned Catholic Priest</li> <li>Pastor of different denomination</li> </ul> | <b>Parish Priest/Pastor</b>   | <b>IASCL ComRel</b>  | Construction<br>Operation | LGU-IRA, ER 1-94, IASCL CSR |

## Barangay Libertad, Isabel, Leyte

### Table 5-2 Proposed IEC Framework

| Needs  | Implementation  | Community Implementation Plan (Strategies)  | Government/<br>Non-Government<br>Agency Services  | Proponent  | Cost<br>Estimate<br>(Php) |
|--|---|---|---|--|---------------------------|
| <ul style="list-style-type: none"> <li>Province of Leyte</li> <li>Municipality of Isabel</li> <li>Barangay Libertad:</li> </ul> <p>Full Information about:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> The EIA process</li> <li><input type="checkbox"/> The nature and operation of the modular diesel power plant</li> <li><input type="checkbox"/> The consequential impacts on the residents of the community and their mitigation measures</li> <li><input type="checkbox"/> The benefits of the Project on their Socio-cultural/ economic and bio-physical environment of the affected residents as they address the major issues of air pollution using IEC</li> <li><input type="checkbox"/> Full information on the decommissioning plan of the project.</li> </ul> | <p>Before project implementation</p> <p>During project operations</p> | <p><b>1. Primer/Brochure (print media)</b></p> <p>This strategy is effective in explaining in detail the subject matter, done in a simplified manner and in the language of the people. This strategy, likewise, uses illustrations to further clarify the processes that are to be done.</p> <p>It is a good vehicle for IEC to provide updates and relevant issues of the proposed Project during construction and operation.</p> <p>A. The EIA process must be illustrated and simplified in the language of the affected community written in English &amp; Tagalog/Visayan.</p> <p>B. The Modular Diesel Power Plant</p> <p>This shall contain:</p> <ul style="list-style-type: none"> <li>- the project description, project time frame, project facilities, management of social and environmental impacts, potential project benefits, graphic illustration about the process and operation of modular diesel power plant, process of EIA, roles and responsibilities of the stakeholders</li> <li>- Philippine Clean Water Act of 2004</li> <li>- R.A. No. 8749 (Philippine Clean Air Act of 1999);</li> <li>- R.A. 9003 Ecological Solid Waste Management</li> </ul> <p>C. Benefits</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> The Social Development and Management Plan           <ul style="list-style-type: none"> <li>- Gender Responsive Livelihood and Credit Facilities</li> <li>- Education and Recreation</li> <li>- Health and Safety</li> <li>- Environment and Sanitation R.A.9003</li> </ul> </li> </ul> | <ol style="list-style-type: none"> <li>1. Municipality &amp; Barangay Information Officers</li> <li>2. Elementary and High School Students</li> <li>3. Barangay Committee on Education and Culture</li> <li>4. Barangay Gabay sa Mamamayan Action Center</li> </ol> | <ul style="list-style-type: none"> <li>• IASCL ComRel</li> </ul> | 50,000.00                 |

# ENVIRONMENTAL IMPACT STATEMENT REPORT

Proposed Modular Diesel Power Plant Ancillary Project

Barangay Libertad, Isabel, Leyte

Isabel Ancillary Services Co. Ltd.

| Needs | Implementation | Community Implementation Plan (Strategies)  | Government/<br>Non-Government<br>Agency Services | Proponent | Cost<br>Estimate<br>(PhP) |
|-------|----------------|---|--|-----------|---------------------------|
|       |                | <ul style="list-style-type: none"> <li>- Peace and order</li> <li>- Spiritual</li> </ul> <p>D. Grievance</p> <p>On the residents who will be affected by the proposed Project activities showing their right to complain for violations of ECC conditions</p> <p><b>2. Consultations</b></p> <p>These are face to face encounters where participants and facilitators of knowledge and skills develop strategies to respond to the needs of the communities in the context of what is appropriate for their capabilities and resources</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Using the interpersonal approach, the Community Relations Officer shall maintain regular consultations with the barangay for an open dialogue on the issues, problems and concerns related to the implementation and sustainability of the project.</li> <li><input type="checkbox"/> Group discussion of the sectoral groups which will be affected in the project activities, the legal processes with the application of priority job placement, and other benefits</li> <li><input type="checkbox"/> Workshops on Solid Waste Management and Preparation of IEC materials</li> <li><input type="checkbox"/> Workshop on community Disaster and Risk Management</li> </ul> <p><b>3. Posters and Wall Comics</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> A graphic illustration of information on "What is a Modular Diesel Power Plant?" and the rationale of the project in the context of their life-ways based on DOE ER 1-94.</li> <li><input type="checkbox"/> Community-Based Solid Waste Management and information about R.A.9003 and DAO 2004-1</li> </ul> |  |           |                           |



## ENVIRONMENTAL IMPACT STATEMENT REPORT

Proposed Modular Diesel Power Plant Ancillary Project

Barangay Libertad, Isabel, Leyte

Isabel Ancillary Services Co. Ltd.

| Needs | Implementation | Community Implementation Plan (Strategies)  | Government/<br>Non-Government<br>Agency Services | Proponent | Cost<br>Estimate<br>(PhP) |
|-------|----------------|---|--|-----------|---------------------------|
|       |                | <ul style="list-style-type: none"><li>❑ Community-Based Climate Change Management/ Disaster Risk Management.</li></ul> <p><b>4. Cell phone Patch Consultation</b></p> <ul style="list-style-type: none"><li>❑ Using the Cell Phone feed-back mechanism through the Barangay Counsel in project affected barangay.</li></ul> <p><b>5. Barangay Forum and Phone Patch Up</b></p> <ul style="list-style-type: none"><li>❑ This strategy enables the IASCL to discuss the progress of the proposed Project with key-persons of the company/resource persons weekly. This also encourages multi-sectoral interest groups to ask questions through phone patches.</li></ul> |  |           |                           |

# ENVIRONMENTAL IMPACT STATEMENT REPORT

## Proposed Modular Diesel Power Plant Ancillary Project

Isabel Ancillary Services Co. Ltd.

Barangay Libertad, Isabel, Leyte

### 6.0 ENVIRONMENTAL COMPLIANCE MONITORING

The Environmental Compliance Monitoring presents the IASCL's commitment to conduct a self-monitoring activity wherein various measures are proposed in order to ensure that the impacts which will be caused by the proposed project are minimized and properly managed.

#### 6.1 SELF-MONITORING PLAN

IASCL will conduct self-monitoring activity of its environmental operations, and will regularly submit its Self-Monitoring Report (**SMR**) to the DENR. An initial Environmental Monitoring Plan (**EMoP**) is presented in **Table 6-1** that will be implemented by the Proponent during the different phases of the proposed Project. This EMoP follows Annex 2-20 of the DAO 2003-30. The plan is largely indicative and will be refined during project implementation.

For sampling and analysis of air quality, the IASCL will refer to DAO 2000-81, "Implementing Rules and Regulations of the Philippine Clean Air Act of 1999". Results of ambient air quality monitoring will be compared with the National Ambient Air Quality Guideline Values (NAAQGV) and National Emission Standards for Source Specific Air Pollutants (NESSAP) of the CAA.

Environmental monitoring involves all project phases; namely, construction, commissioning, operations and abandonment to determine and find explanation on any changes in the baseline data. For ambient air quality and noise level, the recommended monitoring stations are presented in **Figure 6-1**. The prescribed sampling points for emission sources are presented in **Figure 6-2**. This includes inventory of opened up areas, removal of structures and vegetation, volume of spoils, spaces opened up, built up structures, influx of workers, water consumption, waste generation, disposal of hazardous wastes, operating and maintenance of equipment, fuel and chemical storage and dismantling and removal of facilities and removal and disposal of demolition wastes. IASCL will monitor its compliance through regular submission of Self-Monitoring Report (SMR) and Compliance Monitoring Report (CMR) to the DENR-EMB.

#### 6.2 MULTI-SECTORAL MONITORING FRAMEWORK

The Monitoring Framework, as stated in Annexes 3-2 and 3-3 of the RPM for DAO 2017-15, present a proposed program wherein the proposed Project's environmental compliance will be verified and reported to concerned stakeholders.

The MMT will be consistent to the requirements of DAO 2017-15 of the DENR. The proponent shall provide appropriate funding for the MMT activities based on the Annual Work and Financial Plan approved by the EMB. DENR-EMB must provide oversight guidance to the MMT and consider its reports and recommendation in its impacts and compliance evaluation.

# ENVIRONMENTAL IMPACT STATEMENT REPORT

Proposed Modular Diesel Power Plant Ancillary Project

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Isabel Ancillary Services Co. Ltd.

Table 6-1 Environmental Monitoring Plan for the Proposed Project

| Key Environmental Aspects  | Environmental Component | Potential Impacts   | Sampling & Measurement Plan   |   |   |   | Lead Entity           | Estimated Cost (PhP)              | EQPL Management Scheme                                |   |   |   |  |  |
|--|-------------------------|---|---|---|---|---|-----------------------|-----------------------------------|---|---|---|---|--|--|
|  |                         |   | Parameter   | Method  | Frequency   | Location  |                       |                                   | EQPL Range  |   |   | Management Measures   |  |  |
|  |                         |   |   |   |   |   |                       |                                   | Alert   | Action  | Limit   | Alert   | Action   | Limit  |
| CONSTRUCTION PHASE   |                         |   |   |   |   |   |                       |                                   |   |   |   |   |  |  |
|  | LAND                    |   |   |   |   |   |                       |                                   |   |   |   |   |  |  |
| • Mobilization of construction equipment and materials   | Pedology                | Soil contamination due to fuel spills/ leakage                                  | • Volume of leak<br>• Occurrence of accidental spills<br>• Condition of equipment and machinery | • Visual inspection<br>• Regular Reporting, meeting   | • Upon report, stoppage of spills<br>• Monthly reporting, meeting | Area of Construction  | IASCL, Contractor EMB | NA                                | Spill Vol.: <1L<br><br>Visible oil spill in the site. | Spill Vol.: 1L to <100L<br><br>Visible oil spill in the site. | Spill Vol.: >100L<br><br>Visible oil spill in the site. | Conduct investigation regarding the reason of the leak.<br><br>Visual check of the oil tanks. | Conduct of leak test in the tank.<br><br>Inspection of the tanks for the area where leakage occur. | Conduct of leak test.<br><br>Do not use the tank unless the damage is fixed.<br><br>Report the incident to the EMB Region 8. |
| • Construction of power plant and other support facilities<br>• Generation of domestic waste                             |                         | Soil Pollution and accidental spills of hazardous waste (i.e. oil, grease, etc) | • Quantity<br>• Occurrence of accidental spills   | • Ocular Inspection<br>• Regular reporting and documentation<br>• Meeting<br>• Soil Sampling (if necessary) | • Daily visual inspection, Monthly reporting                      | Area of construction and temporary facilities   | IASCL, Contractor EMB | Included in the engineering cost  | Spill Vol.: <1L<br><br>Visible oil spill in the site. | Spill Vol.: 1L to <100L<br><br>Visible oil spill in the site. | Spill Vol.: >100L<br><br>Visible oil spill in the site. | Conduct investigation regarding the reason of the leak.<br><br>Visual check of the oil tanks  | Conduct of leak test in the tank.<br><br>Inspection of the tanks for the area where leakage occur  | Conduct of leak test.<br><br>Do not use the tank unless the damage is fixed.<br><br>Report the incident to the EMB Region 8. |
| CONSTRUCTION PHASE   |                         |   |   |   |   |   |                       |                                   |   |   |   |   |  |  |
|  | AIR                     |   |   |   |   |   |                       |                                   |   |   |   |   |  |  |
| • Mobilization of construction equipment and materials<br><br>• Construction of power plant and other support facilities | Air Quality             | Degradation of ambient air quality  | TSP, µg/Ncm   | Grab Sampling   | Quarterly Reporting to DENR                                       | 1-Hour Averaging Time:<br><br>Station 1 – 1.30 km Northwest of the Project, 40 meters |                       | Included in the Construction Cost | 240   | 270   | 300   | Check weather condition during sampling and if  | Check weather condition during sampling and if location is downwind                                | Hire a 3 <sup>rd</sup> party DENR accredited sampling firm to confirm results and conduct investigation.                     |
|  |                         |   | PM <sub>10</sub> , µg/Ncm   |   |   |   |                       |                                   | 160   | 180   | 200   |   |  |  |
|  |                         |   | NO <sub>2</sub> , µg/Ncm  |   |   |   |                       |                                   | 208   | 234   | 260   |   |  |  |
|  |                         |   | SO <sub>2</sub> , µg/Ncm  |   |   |   |                       |                                   | 272   | 306   | 340   |   |  |  |
|  |                         |   |   |   |   |   |                       |                                   |   |   |   |   |  |  |

# ENVIRONMENTAL IMPACT STATEMENT REPORT

## Proposed Modular Diesel Power Plant Ancillary Project

Barangay Libertad, Isabel, Leyte

Isabel Ancillary Services Co. Ltd.

| Key Environmental Aspects      | Environmental Component | Potential Impacts       | Sampling & Measurement Plan |                            |   |  | Lead Entity             | Estimated Cost (PhP) | EQPL Management Scheme                                   |  |  |   |   |   |
|--------------------------------|-------------------------|-------------------------|-----------------------------|----------------------------|---|--|-------------------------|----------------------|--|--|--|---|---|---|
|                                |                         |                         | Parameter                   | Method                     | Frequency   | Location   |                         |                      | EQPL Range   |  |  | Management Measures   |   |   |
|                                |                         |                         |                             |                            |   |  |                         |                      | Alert  | Action   | Limit  | Alert   | Action  | Limit   |
| • Generation of domestic waste |                         |                         |                             |                            |   | from the shore of Kinatumyan<br><br>Station 2 – Clubhouse of LIDE Staff House, Brgy. Mahayag<br><br>Station 3 – Libertad Elementary School, Brgy. Libertad<br><br>Station 4 – Residential Area, Brgy. Libertad<br><br>Station 5 – Residential, Brgy. Matlang |                         |                      |  |  | location is down wind of the area.<br><br>Conduct site visit at said sampling stations and hire a 3 <sup>rd</sup> party DENR accredited sampling firm to confirm.<br><br>If the source is not from the Project, coordinate it with LGU and EMB for appropriate action. | Temporarily stop certain aspects of the activities unless the problem has been resolved.<br><br>If the source is not from the Project, coordinate it with LGU and EMB for appropriate action. |   |   |
|                                | Noise level             | Increase in noise level | Noise Level (dBA)           | Portable Noise Level Meter | Once a month (morning, daytime, evening and nighttime)<br><br>Quarterly Reporting to DENR | Stations 1 to 2 (Class D)<br><br>Station 3 (Class AA)  | IASCL, Contractor & EMB |                      | Daytime-65<br><br>Morning/Evening-60<br><br>Nighttime-55 | Daytime-70<br><br>Morning/Evening-65<br><br>Nighttime-60 | Daytime-75<br><br>Morning/Evening-70<br><br>Nighttime-65   | Conduct survey at sampling stations to verify complaints.<br><br>Check the sound level using  | Conduct retesting to validate the complaint/ If source of noise is from the Project, inform the Unit head in-charge to provide noise mitigation measures. | Conduct noise sampling with the presence of the DENR or a 3 <sup>rd</sup> party environmental firm.<br><br>Inform the operations or the area owner to stop activity unless noise mitigation measures have |



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## Proposed Modular Diesel Power Plant Ancillary Project

Barangay Libertad, Isabel, Leyte

Isabel Ancillary Services Co. Ltd.

| Key Environmental Aspects | Environmental Component | Potential Impacts   | Sampling & Measurement Plan |  |                                       |                        | Lead Entity            | Estimated Cost (PhP)          | EQPL Management Scheme  |   |  |  |   |   |
|---------------------------|-------------------------|---|-----------------------------|--|---------------------------------------|------------------------|------------------------|-------------------------------|---|---|--|--|---|---|
|                           |                         |   | Parameter                   | Method   | Frequency                             | Location               |                        |                               | EQPL Range  |   |  | Management Measures  |   |   |
|                           |                         |   |                             |  |                                       |                        |                        |                               | Alert   | Action  | Limit  | Alert  | Action  | Limit   |
|                           |                         |   |                             |  |                                       | Stations 4-5 (Class A) |                        |                               | me-30   | -35   | -40  | sound meter.   | Conduct noise monitoring to verify the limits are already within limits.  | been installed or the source of noise has been corrected. |
|                           |                         |   |                             |  |                                       |                        |                        |                               | Daytime-45  | Daytime-50  | Daytime-55   |  |   |   |
|                           |                         |   |                             |  |                                       |                        |                        |                               | Morning/Evening-40  | Morning/Evening-45  | Morning/Evening-50   |  |   |   |
|                           |                         |   |                             |  |                                       |                        |                        |                               | Nighttime-35  | Nighttime-40  | Nighttime-45   |  |   |   |
|                           |                         |   |                             |  |                                       |                        |                        |                               |   |   |  | If source of noise is not from the Project, inform the EMB regarding possible source of noise for the group's investigation and coordination with LGU. | Upon installation of noise mitigation measures, conduct noise monitoring to verify if the noise level is already within limits. |   |
| CONSTRUCTION PHASE        |                         |   |                             |  |                                       |                        |                        |                               |   |   |  |  |   |   |
|                           | PEOPLE                  |   |                             |  |                                       |                        |                        |                               |   |   |  |  |   |   |
| Hiring of workers         | Local residents         | Increase in local employment<br><br>Increase income for residents | Composition of workforce    |  | Semi-annually                         | NA                     | IASCL, Contractor, LGU | NA                            | 50% of the employees are local residents (based on the skills and capacity) | 55% of the employees are local residents (based on the skills and capacity) | 60 % of the employees are local residents (based on the skills and capacity) | Increase employability of local residents by undertaking construction skills training prior to job hiring  | Investigation of the reasons for not meeting the % local resident employment  | Review employment memos, etc.                             |
| Construction Activities   | Costruction Workers     | Threat to Health and safety of workers                            | Number of accidents         | • Survey Occurrence of accidents<br>• Interview of | • Regular Monitoring during construct | Project Site           | IASCL, Contractor, LGU | Included in construction cost | NA  | NA  | NA   | Complaints   | Resolve complaints based on GRM   | Implement corrective actions as necessary                 |

# ENVIRONMENTAL IMPACT STATEMENT REPORT

## Proposed Modular Diesel Power Plant Ancillary Project

Barangay Libertad, Isabel, Leyte

Isabel Ancillary Services Co. Ltd.

| Key Environmental Aspects   | Environmental Component | Potential Impacts                              | Sampling & Measurement Plan |  |  |   | Lead Entity           | Estimated Cost (PhP)                           | EQPL Management Scheme                                |   |   |   |  |  |
|---|-------------------------|--|-----------------------------|--|--|---|-----------------------|--|---|---|---|---|--|--|
|   |                         |  |                             |  |  |   |                       |  | EQPL Range  |   |   | Management Measures   |  |  |
|   |                         |  | Parameter                   | Method   | Frequency  | Location  |                       |  | Alert   | Action  | Limit   | Alert   | Action   | Limit  |
|   |                         |  |                             | affected communities                             | ion phase<br>• In case of emergency, immediately |   |                       |  |   |   |   |   |  |  |
| OPERATION PHASE   |                         |  |                             |  |  |   |                       |  |   |   |   |   |  |  |
| • Operation of power plant and other support facilities<br>• Generation of domestic waste | LAND                    |  |                             |  |  |   |                       |  |   |   |   |   |  |  |
|   | Pedology                | Soil Contamination due to fuel spills/ leakage | Volume of leak              | Visual inspection                                | Upon report, stoppage of spills                  | Project site and off-site   | IASCL Contractor EMB  | NA   | Spill Vol.: <1L<br><br>Visible oil spill in the site. | Spill Vol.: 1L to <100L<br><br>Visible oil spill in the site. | Spill Vol.: >100L<br><br>Visible oil spill in the site. | Conduct investigation regarding the reason of the leak.<br><br>Visual check of the oil tanks.   | Conduct of leak test in the tank.<br><br>Inspection of the tanks for the area where leakage occur.   | Conduct of leak test.<br><br>Do not use the tank unless the damage is fixed.<br><br>Report the incident to EMB Region 8.   |
| OPERATION PHASE   |                         |  |                             |  |  |   |                       |  |   |   |   |   |  |  |
| • Operation of power plant  | AIR                     |  |                             |  |  |   |                       |  |   |   |   |   |  |  |
|   | Air Quality             | Decrease in Ambient air quality                | TSP, µg/Ncm                 | Using High volume-gravimetric method of analysis | Quarterly  | 1-Hour Averaging Time:<br><br>Station 1- 1.30 km Northwest of the Project, 40 meters from the shore of Kinatumyan<br><br>Station 2 – Clubhouse of LIDE Staff House, Brgy. | IASCL, Contractor EMB | Included in the operation and maintenance cost | 240   | 270   | 300   | Check weather condition during sampling and if location is downwind of the area.<br><br>Check possible sources of pollution including | Check weather condition during sampling and if location is downwind of the area.<br><br>Conduct site visit at said sampling stations and hire a 3 <sup>rd</sup> party DENR accredited sampling | Hire a 3 <sup>rd</sup> party DENR accredited sampling firm to confirm and conduct investigation.<br><br>Check emission of smoke stacks using CEMS.<br><br>Conduct adjustments of the unit's operation as per operating manual. |
|   |                         |  | PM <sub>10</sub> , µg/Ncm   |  |  |   |                       |  |   |   |   |   |  |  |
|   |                         |  | NO <sub>2</sub> , µg/Ncm    |  |  |   |                       |  |   |   |   |   |  |  |
|   |                         |  | SO <sub>2</sub> , µg/Ncm    |  |  |   |                       |  |   |   |   |   |  |  |
|   |                         |  |                             |  |  |   |                       | 208  | 234   | 260   |   |   |  |  |
|   |                         |  |                             |  |  |   |                       | 272  | 306   | 340   |   |   |  |  |

# ENVIRONMENTAL IMPACT STATEMENT REPORT

Proposed Modular Diesel Power Plant Ancillary Project

Barangay Libertad, Isabel, Leyte

Isabel Ancillary Services Co. Ltd.

| Key Environmental Aspects | Environmental Component | Potential Impacts                               | Sampling & Measurement Plan |  |   |   | Lead Entity             | Estimated Cost (PhP)                           | EQPL Management Scheme |        |   |  |   |   |
|---------------------------|-------------------------|---|-----------------------------|--|---|---|-------------------------|--|------------------------|--------|---|--|---|---|
|                           |                         |   | Parameter                   | Method   | Frequency   | Location  |                         |  | EQPL Range             |        |   | Management Measures  |   |   |
|                           |                         |   |                             |  |   |   |                         |  | Alert                  | Action | Limit   | Alert  | Action  | Limit   |
|                           |                         |   |                             |  |   | Mahayag<br><br>Station 3 – Libertad Elementary School, Brgy. Libertad<br><br>Station 4 – Residential Area, Brgy. Libertad<br><br>Station 5 – Residential, Brgy. Matlang |                         |  |                        |        | g external factors.<br><br>Check status of generators for any upset or off-operating parameters and have it adjusted accordingly as needed. | firm to confirm.<br><br>Check emission of smoke stacks using CEMS.<br><br>Conduct adjustments of the unit's operation as per operating manual.<br><br>If the source is not from the proposed Project, coordinate it with LGU, DENR and the EMB for appropriate action. | Temporarily stop certain aspects of the operations unless the problem has been resolved.<br><br>If the source is not from the Project, coordinate it with LGU, DENR and the EMB for appropriate action. |   |
|                           |                         | Decrease in air quality due to source emissions | PM, mg/Ncm                  | Using USEPA Methods 1 to 5                           | Continuous with manual stack testing Twice a year | Stack   | IASCL Contractor<br>EMB | Included in the operation and maintenance cost | 120                    | 135    | 150   | Coordinate with operations and verify the status of generator for any upset or off-operating parameters  | Hire a 3rd party DENR accredited sampling firm to confirm and conduct investigation.<br><br>Check emission of smoke stacks using CEMS.  | Hire a 3 <sup>rd</sup> party DENR accredited sampling firm to confirm and conduct investigation.<br><br>Check emission of smoke stacks using CEMS.<br><br>Conduct adjustments of the unit's |
|                           |                         |   | SO <sub>x</sub> , mg/Ncm    | Using USEPA Methods 1 to 4 and 6 or 8 as appropriate |   |   |                         |  | 500                    | 600    | 700   |  |   |   |
|                           |                         |   | NO <sub>x</sub> , mg/Ncm    | Using USEPA Methods 1 to 4 and Method 7              |   |   |                         |  | 700                    | 850    | 1000  |  |   |   |
|                           |                         |   | CO, mg/Ncm                  |  |   |   |                         |  | 300                    | 400    | 500   |  |   |   |

# ENVIRONMENTAL IMPACT STATEMENT REPORT

## Proposed Modular Diesel Power Plant Ancillary Project

Barangay Libertad, Isabel, Leyte

Isabel Ancillary Services Co. Ltd.

| Key Environmental Aspects    | Environmental Component | Potential Impacts       | Sampling & Measurement Plan |                            |             |                           | Lead Entity             | Estimated Cost (Php)                           | EQPL Management Scheme |                    |  |  |  |  |
|------------------------------|-------------------------|-------------------------|-----------------------------|----------------------------|-------------|---------------------------|-------------------------|--|------------------------|--------------------|--|--|--|--|
|                              |                         |                         | Parameter                   | Method                     | Frequency   | Location                  |                         |  | EQPL Range             |                    |  | Management Measures  |  |  |
| Alert                        | Action                  | Limit                   |                             |                            |             |                           | Alert                   | Action   | Limit                  |                    |  |  |  |  |
|                              |                         |                         |                             |                            |             |                           |                         |  |                        |                    |  | ers and have it adjusted accordingly as needed.  | Conduct adjustments of the unit's operation as per operating manual.   | operation as per operating manual.<br><br>Temporarily stop certain aspects of the operations unless the problem has been resolved. |
| Operation of the power plant | Noise level             | Increase in noise level | Noise Level (dBA)           | Portable Noise Level Meter | Quarterly   | Stations 1 to 2 (Class D) | IASCL, Contractor & EMB | Included in the operation and maintenance cost | Daytime-65             | Daytime-70         | Daytime-75   | Conduct survey at sampling stations to verify complaints as per IASCL Guideline on Noise Level Monitoring and Measurement                              | If source of noise is from the proposed Project, inform the Plant Manager to provide noise mitigation measures.  | Conduct noise sampling in the presence of the DENR or a 3 <sup>rd</sup> party environmental firm.                                  |
|                              |                         |                         |                             |                            |             | Station 3 (Class AA)      |                         |  | Nighttime-55           | Nighttime-60       | Nighttime-65   | Conduct noise monitoring to verify if the level is already within limits.  | Inform the Operations or the area owner to stop activity unless noise mitigation measures have been installed or the source of noise has been corrected. |  |
|                              |                         |                         |                             |                            |             |                           |                         |  | Daytime-40             | Daytime-45         | Daytime-50   |  |  |  |
|                              |                         |                         |                             |                            |             |                           |                         |  | Morning/Evening-35     | Morning/Evening-40 | Morning/Evening-45   |  |  |  |
|                              |                         |                         |                             |                            |             | Nighttime-30              |                         |  | Nighttime-35           | Nighttime-40       | Procedure. Check the sound level using sound meter. Determine possible causes. | If source of noise is not from the Project, inform the EMB regarding possible source of noise for the group's investigation and coordination with LGU. | Upon installation of noise mitigation measures, conduct noise monitoring to verify if the noise level is already within limits.                          |  |
|                              |                         |                         |                             |                            |             | Daytime-45                |                         |  | Daytime-50             | Daytime-55         |  |  |  |  |
|                              |                         |                         |                             |                            |             | Morning/Evening-40        |                         |  | Morning/Evening-45     | Morning/Evening-50 |  |  |  |  |
|                              |                         |                         |                             |                            |             | Nighttime-35              |                         |  | Nighttime-40           | Nighttime-45       |  |  |  |  |
|                              |                         |                         |                             |                            |             | OPERATION PHASE           |                         |  |                        |                    |  |  |  |  |
|                              | PEOPLE                  |                         |                             |                            |             |                           |                         |  |                        |                    |  |  |  |  |
|                              | Local residents         | Increase in local       | Composition of workforce    |                            | Semi-annual | NA                        | IASCL                   | NA   | 60% of the             | 50% of the         | 40 % of the  | Increase employa   | Investigation of the   | Review employment  |



# ENVIRONMENTAL IMPACT STATEMENT REPORT

## Proposed Modular Diesel Power Plant Ancillary Project

Barangay Libertad, Isabel, Leyte

Isabel Ancillary Services Co. Ltd.

| Key Environmental Aspects | Environmental Component | Potential Impacts                        | Sampling & Measurement Plan |  |                |              | Lead Entity | Estimated Cost (Php) | EQPL Management Scheme   |  |  |  |  |   |
|---------------------------|-------------------------|--|-----------------------------|--|----------------|--------------|-------------|----------------------|--|--|--|--|--|---|
|                           |                         |  | Parameter                   | Method   | Frequency      | Location     |             |                      | EQPL Range   |  |  | Management Measures  |  |   |
|                           |                         |  |                             |  |                |              |             |                      | Alert  | Action   | Limit  | Alert  | Action   | Limit   |
|                           |                         | employment                               |                             |  |                |              |             |                      | employees are local residents (based on the skills and capacity) | employees are local residents (based on the skills and capacity) | employees are local residents (based on the skills and capacity) | bility of local residents by undertaking construction skills training prior to job hiring  | reasons for not meeting the % local resident employment  | memos, etc.   |
|                           |                         | Develop Local residents' Skills Training | Training completion rate    |  | Semi-annual    | NA           | IASCL       | NA                   | 50% of trainees did not complete the skills training             | 60% of trainees did not complete the skills training             | 70% of trainees did not complete the skills training             | Conduct investigation regarding the turnout of the training activity   | Conduct perception survey and do research of what is the preferred skills training of the stakeholders | Hire 3rd party experts to conduct investigation and do some assessment regarding the effective skills training for a certain group of people.<br><br>Intensify the IEC. |
|                           |                         | Health risks and safety of workers       | Safety Risk                 | Medical Check-up   | Regular        | Project Site | IASCL, EMB  | NA                   | No safety training of workforce                                  | No sustained training for workforce                              | Zero accident  | Conduct safety training for workers  | Sustained safety training for workers<br><br>Implement wearing of PPE among workers                    | Implement Phil. OSH Std./NIOSH Std.   |
|                           |                         |  |                             | Incident reporting, surveys, included in the Health and Safety Plan of IASCL | Monthly report |              |             |                      | Zero accident  |  |  | Conduct re-training of the workers on health safety rules and regulation<br><br>Conduct investigation. Inspect the area wherein most accidents happen.<br><br>Conduct monitoring. Hire a 3 <sup>rd</sup> party safety practitioner to conduct safety audit in the plant site.<br><br>Strictly adhere to occupational health and safety standards |  |   |

# ENVIRONMENTAL IMPACT STATEMENT REPORT

## Proposed Modular Diesel Power Plant Ancillary Project

Barangay Libertad, Isabel, Leyte

Isabel Ancillary Services Co. Ltd.

| Key Environmental Aspects  | Environmental Component | Potential Impacts                                       | Sampling & Measurement Plan |   |                                 |                                    | Lead Entity           | Estimated Cost (PhP)             | EQPL Management Scheme                                |   |   |   |  |  |
|--|-------------------------|---|-----------------------------|---|---------------------------------|------------------------------------|-----------------------|----------------------------------|---|---|---|---|--|--|
|  |                         |   | Parameter                   | Method  | Frequency                       | Location                           |                       |                                  | EQPL Range  |   |   | Management Measures   |  |  |
|  |                         |   |                             |   |                                 |                                    |                       |                                  | Alert   | Action  | Limit   | Alert   | Action   | Limit  |
|  |                         | Increased social acceptability for the proposed Project | Project Related complaints  | Listing of valid complaints                               | Monthly                         | Municipality and affected barangay | IASCL, EMB            | NA                               | One (1) valid complaint in a month                    | Three (3) valid complaint in a month                          | Five (5) valid complaint in a month                     | Talk with the complainant<br><br>Conduct investigation  | Talk with complainants and conduct immediate investigation<br><br>Intensify monitoring of usual complaints of stakeholders | Participation of EMB in the resolution of complints  |
| ABANDONMENT PHASE  |                         |   |                             |   |                                 |                                    |                       |                                  |   |   |   |   |  |  |
|  | LAND                    |   |                             |   |                                 |                                    |                       |                                  |   |   |   |   |  |  |
| <ul style="list-style-type: none"><li>• Mobilization of Decommissioning equipment</li><li>• Decommissioning of the power plant and other support facilities</li><li>• Generation of domestic waste</li></ul> | Pedology                | Soil Contamination due to fuel spills/ leakage          | Volume of leak              | Visual inspection   | Upon report, stoppage of spills | Project site and off-site          | IASCL, Contractor EMB | NA                               | Spill Vol.: <1L<br><br>Visible oil spill in the site. | Spill Vol.: 1L to <100L<br><br>Visible oil spill in the site. | Spill Vol.: >100L<br><br>Visible oil spill in the site. | Conduct investigation regarding the reason of the leak.<br><br>Visual check of the oil tanks. | Conduct of leak test in the tank.<br><br>Inspection of the tanks for the area where leakage occur.                         | Conduct of leak test.<br><br>Do not use the tank unless the damage is fixed.<br><br>Report the incident to EMB Region 8. |
| ABANDONMENT PHASE  |                         |   |                             |   |                                 |                                    |                       |                                  |   |   |   |   |  |  |
|  | AIR                     |   |                             |   |                                 |                                    |                       |                                  |   |   |   |   |  |  |
| <ul style="list-style-type: none"><li>• Mobilization of Decommissioning equipment</li><li>• Decommissioning of the power plant and other support facilities</li></ul>  | Air Quality             | Decrease in Ambient Air Quality                         | TSP, µg/Ncm                 | Using High volume sampling-gravimetric method of analysis | Quarterly                       |                                    | IASCL Contractor EMB  | Included in the abandonment cost |   |   |   |   |  |  |
|  |                         |   | PM <sub>10</sub> , µg/Ncm   |   |                                 | 1-Hour Averaging Time:             |                       |                                  | 240   | 270   | 300   | Check whether the area wherein exceedances occur is upwind or downwind of the Project site.   | Conduct retesting of the parameters to validate results.   | Hire a 3 <sup>rd</sup> party DENR accredited firm to check validate results in the area.                                 |
|  |                         |   | NO <sub>2</sub> , µg/Ncm    |   |                                 |                                    |                       |                                  | 160   | 180   | 200   |   |  |  |
|  |                         |   | SO <sub>2</sub> , µg/Ncm    |   |                                 |                                    |                       |                                  | 208   | 234   | 260   |   |  |  |
|  |                         |   |                             |   |                                 |                                    |                       |                                  | 272   | 306   | 340   |   |  |  |

# ENVIRONMENTAL IMPACT STATEMENT REPORT

## Proposed Modular Diesel Power Plant Ancillary Project

Barangay Libertad, Isabel, Leyte

Isabel Ancillary Services Co. Ltd.

| Key Environmental Aspects   | Environmental Component | Potential Impacts       | Sampling & Measurement Plan |                            |   |   | Lead Entity          | Estimated Cost (PhP)             | EQPL Management Scheme   |  |  |  |  |   |
|---|-------------------------|-------------------------|-----------------------------|----------------------------|---|---|----------------------|----------------------------------|--|--|--|--|--|---|
|   |                         |                         | Parameter                   | Method                     | Frequency   | Location  |                      |                                  | EQPL Range   |  |  | Management Measures  |  |   |
|   |                         |                         |                             |                            |   |   |                      |                                  | Alert  | Action   | Limit  | Alert  | Action   | Limit   |
|   |                         |                         |                             |                            |   | shore of Kinatumyan<br><br>Station 2 – Clubhouse of LIDE Staff House, Brgy. Mahayag<br><br>Station 3 – Libertad Elementary School, Brgy. Libertad<br><br>Station 4 – Residential Area, Brgy. Libertad<br><br>Station 5 – Residential, Brgy. Matlang |                      |                                  |  |  |  | Conduct investigation regarding the source of the pollutants in the area including external sources.   | Report the incident to the DENR Region 8.  |   |
| <ul style="list-style-type: none"><li>• Mobilization of Decommissioning equipment</li><li>• Decommissioning of the power plant and other support facilities</li></ul> | Noise level             | Increase in noise level | Noise Level (dBA)           | Portable Noise Level Meter | Once a month (morning, daytime, evening and nighttime)<br><br>Quarterly Reporting to DENR | Stations 1 to 2 (Class D)<br><br>Station 3 (Class AA)   | IASCL Contractor EMB | Included in the abandonment cost | Daytime-65<br><br>Morning/Evening-60<br><br>Nighttime-55<br><br>Daytime-40<br><br>Morning/Evening-35<br><br>Nighttime-30 | Daytime-70<br><br>Morning/Evening-65<br><br>Nighttime-60<br><br>Daytime-45<br><br>Morning/Evening-40<br><br>Nighttime-35 | Daytime-75<br><br>Morning/Evening-70<br><br>Nighttime-65<br><br>Daytime-50<br><br>Morning/Evening-45<br><br>Nighttime-40 | Conduct survey at sampling stations to verify complaints as per IASCL Guideline on Noise Level Monitoring and Measurement Procedure. Check the sound | If source of noise is from IASCL, inform the Plant Manager to provide noise mitigation measures.<br><br>Conduct noise monitoring to verify if the level is already within limits.<br><br>If source of noise is not | Conduct noise sampling in the presence of the DENR or a 3 <sup>rd</sup> party environmental firm.<br><br>Inform the Operations or the area owner to stop activity unless noise mitigation measures have been installed or the source of noise has been corrected. |

# ENVIRONMENTAL IMPACT STATEMENT REPORT

Proposed Modular Diesel Power Plant Ancillary Project

Barangay Libertad, Isabel, Leyte

Isabel Ancillary Services Co. Ltd.

| Key Environmental Aspects | Environmental Component | Potential Impacts | Sampling & Measurement Plan |        |           |                        | Lead Entity | Estimated Cost (Php)                                     | EQPL Management Scheme                                   |  |       |  |  |   |
|---------------------------|-------------------------|-------------------|-----------------------------|--------|-----------|------------------------|-------------|--|--|--|-------|--|--|---|
|                           |                         |                   | Parameter                   | Method | Frequency | Location               |             |  | EQPL Range   |  |       | Management Measures  |  |   |
|                           |                         |                   |                             |        |           |                        |             |  | Alert  | Action   | Limit | Alert  | Action   | Limit   |
|                           |                         |                   |                             |        |           |                        |             |  |  |  |       | level using sound meter.<br><br>Determine possible causes. | from the Project, inform the EMB regarding possible source of noise for the group's investigation and coordination with LGU. | Upon installation of noise mitigation measures, conduct noise monitoring to verify if the noise level is already within limits. |
|                           |                         |                   |                             |        |           | Stations 4-5 (Class A) |             | Daytime-45<br><br>Morning/Evening-40<br><br>Nighttime-35 | Daytime-50<br><br>Morning/Evening-45<br><br>Nighttime-40 | Daytime-55<br><br>Morning/Evening-50<br><br>Nighttime-45 |       |  |  |   |

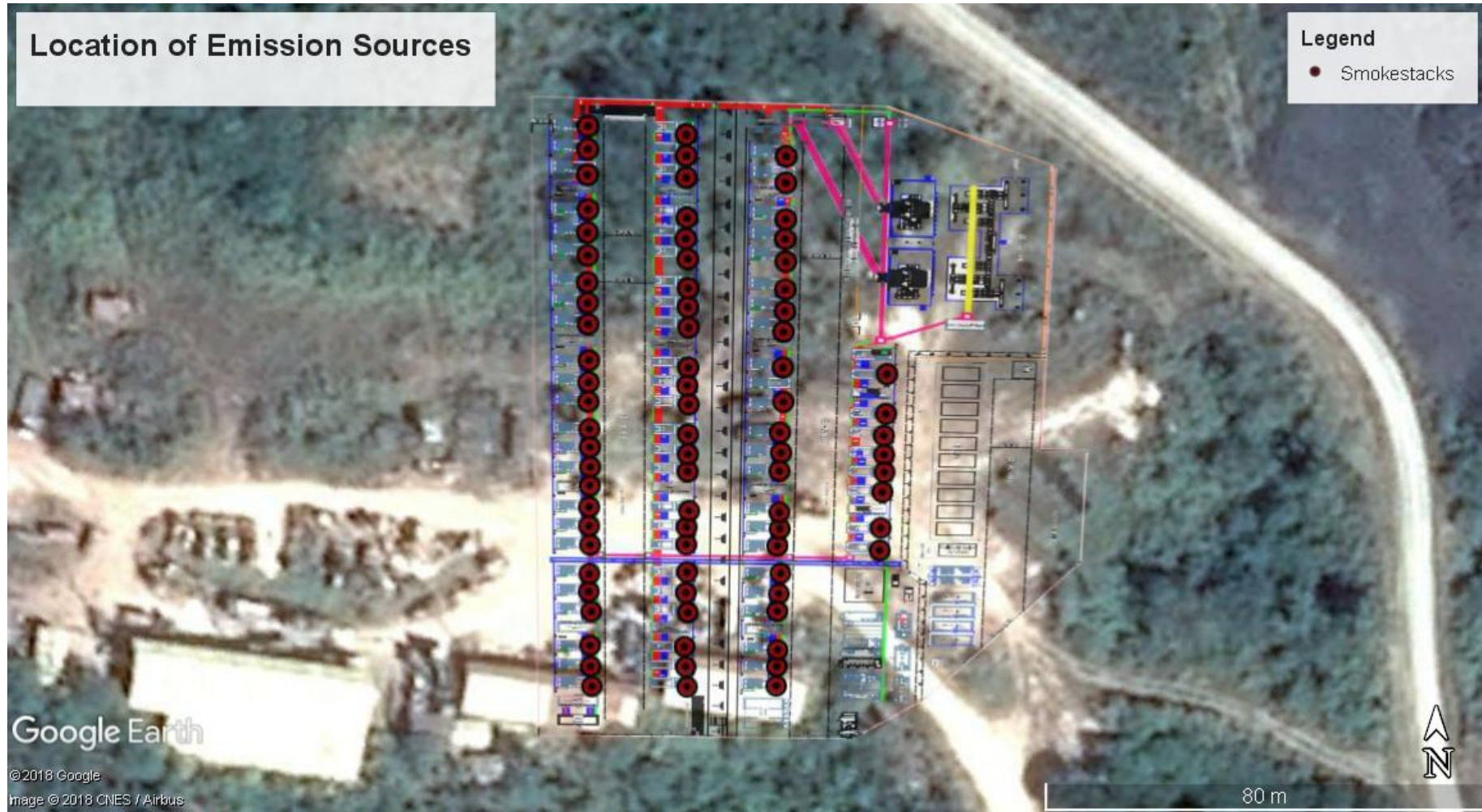




Sources: Google Earth, modified by GEOSPHERE 2018

Figure 6-1 Prescribed Sampling Points for Monitoring of Ambient Air and Noise Level Quality





Sources: Google Earth, modified by GEOSPHERE 2018

**Figure 6-2 Prescribed Sampling Points for Monitoring of Emission Sources**

# ENVIRONMENTAL IMPACT STATEMENT REPORT

## Proposed Modular Diesel Power Plant Ancillary Project

Isabel Ancillary Services Co. Ltd.

Barangay Libertad, Isabel, Leyte

### 6.3 IMPLEMENTATION OF THE EGF COMMITMENTS

The IASCL commits to establish an Environmental Guarantee Fund (**EGF**). The EGF shall be used exclusively for the following purposes:

- Immediate rehabilitation of areas affected by damages to the environment and the resulting deterioration of environmental quality as a direct consequence of the proposed Modular Diesel Power Plant Ancillary Project construction, operation and abandonment;
- Just compensation of parties and communities affected by the negative impacts of the proposed Modular Diesel Power Plant Ancillary Project;
- Conduct of scientific or research studies related to the proposed Project that will aid in the prevention or rehabilitation of accidents and/or environmental damages; and
- For contingency and clean-up activities, environmental enhancement measures, damage prevention programs and social equity measures including the necessary IEC and capability building activities related to the Modular Diesel Power Plant Ancillary Project.

The EGF Trust Fund and EGF Cash Fund shall be replenished to its original amount annually or whenever the amount goes below 50% of the original amount. The EGF Trust Fund shall be renewed upon every expiration. **Table 6-2** shows the EGF Trust Fund and EGF Cash Fund for the proposed Project.

**Table 6-2 EGF Trust Fund and EGF Cash Fund for the Proposed Project**

| Type of Fund         | Amount (PhP) |
|----------------------|--------------|
| EGF Trust Fund (PhP) | 250,000.00   |
| EGF Cash Fund (PhP)  | 250,000.00   |

The EGF will be used during the event of accidents involving spills and in supporting rehabilitation efforts of the community after calamities such as typhoons.

# ENVIRONMENTAL IMPACT STATEMENT REPORT

## Proposed Modular Diesel Power Plant Ancillary Project

Isabel Ancillary Services Co. Ltd.

Barangay Libertad, Isabel, Leyte

### 7.0 ABANDONMENT/DECOMMISSIONING/REHABILITATION POLICIES AND GENERIC GUIDELINES

In the unlikely event that the proposed Project becomes uneconomically viable or if by *force majeure* or acts of God, the Project will have to be terminated. A detailed abandonment plan shall be developed prior to the closure of the facilities and within the timeframe that will be specified in the ECC. The Abandonment and Decommissioning Plan will be prepared in accordance to DENR requirements and shall address the following:

- Proposed abandonment/decommissioning measures for the power plant and all auxiliary facilities constructed as part of the project.
- Removal of the existing hazardous and non-hazardous waste, if any
- Site restoration
- Cost associated with the proposed abandonment/decommissioning activities and source of funds for the implementation of the activities
- Conformance to the requirements of the company, the local government, the DENR and other relevant agencies.

The plan will be submitted to the DENR for review and approval prior to the commencement of abandonment/decommissioning activities. IASCL Staff/Workers will be informed six (6) months prior to abandonment of the Project.





# ENVIRONMENTAL IMPACT STATEMENT REPORT

## Proposed Modular Diesel Power Plant Ancillary Project

Isabel Ancillary Services Co. Ltd.

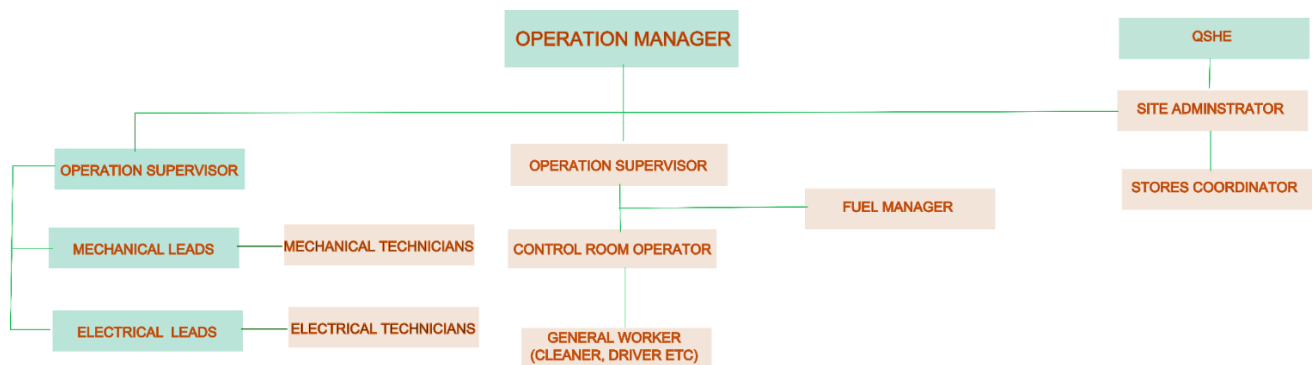
Barangay Libertad, Isabel, Leyte

### 8.0 INSTITUTIONAL PLAN FOR EMP IMPLEMENTATION

The institutional organization of IASCL for the proposed Modular Diesel Power Plant Ancillary Project who are responsible for the implementation of the EMP, EMoP, SDP, management of complaints, grievances and the ECC Conditions is presented in **Figure 8-1**. The organization is formed to achieve the following:

- Economical and safety operations and maintenance of the proposed power plant components;
- Implementation of the IASCL policies;
- Environmental compliance;
- Awareness of the proposed project and increase of the acceptability of the proposed project

The institutional organization will involve IASCL's top level management, who is responsible to provide the policies of the company to the contractors and disseminate to the power plant department heads and operation managers for the implementation of the company personnels.



**Figure 8-1 Organizational Structure for the Proposed Project**

# ENVIRONMENTAL IMPACT STATEMENT REPORT

## Proposed Modular Diesel Power Plant Ancillary Project

Isabel Ancillary Services Co. Ltd.

Barangay Libertad, Isabel, Leyte

### 9.0 GRIEVANCE REDRESS MECHANISM

#### 9.1 OBJECTIVES OF GRIEVANCE REDRESS MECHANISM

The Grievance Redress Mechanism (GRM) is an effective tool for early identification, assessment, and resolution of complaints on projects. GRM will serve as a venue for receiving aggrieved stakeholders' concerns and acting on the concerns but it does not hinder them from their right to judicial action if the decision is unacceptable. The IASCL will establish a GRM for following objectives:

- Receive and facilitate the resolution of project stakeholders' concerns and grievances about environment related project impacts which cannot be settled during public consultations, paying particular attention to the impacts on vulnerable groups;
- Measure to the risks and adverse impacts of the project; and
- Address project stakeholders' concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to the country's judicial or administrative remedies.

#### 9.2 INFORMATION DISSEMINATION

During the construction and operation phase, the grievance officer (GO) of IASCL will set-up a helpdesk to initially handle complaints. GRM will be established during the construction stage. IASCL-QSHE will consult the affected people through their representative and make necessary revision in this GRM to make this more effective. This will ensure the stakeholders are aware of the existence of this GRM. The consultation includes providing the contact information of the IASCL-QSHE (hotlines, email, etc.).

#### 9.3 LEVELS OF GRIEVANCE REDRESS MECHANISM

The GRM is composed of four (4) levels as presented in **Table 7-1**. The Grievance officer of IASCL will be the contact point for receiving the grievances/complaints from the stakeholders.

**Table 7-1 Levels of Grievance Redress Mechanism**

|               | Environment Issue          | Health and Safety Issue | Timeline |
|---------------|----------------------------|-------------------------|----------|
| Contact Point | Grievance Officer of IASCL |                         | Same day |
| 1st Level     | QSHE                       |                         | 3 days   |
| 2nd Level     | Operation Manager          |                         | 10 days  |
| 3rd Level     | IASCL Management Level     |                         | 15 days  |
| 4th Level     | DENR EMB                   | Court of Justice        |          |

As part of the basic policies for the GRM, a grievance will be resolved in a timely manner at the lowest level possible. However, (a) if not settled at the lowest level, (b) if the aggrieved stakeholders are not satisfied with the action taken, or (c) the case is not acted upon after 15 days, the issue or concern will be taken to the next level.

The DENR and the Court of Justice will be the final decision maker for the complaint and grievance. All cases elevated to the 4th level will be outside the jurisdiction and control of this GRM.

# ENVIRONMENTAL IMPACT STATEMENT REPORT

## Proposed Modular Diesel Power Plant Ancillary Project

Isabel Ancillary Services Co. Ltd.

Barangay Libertad, Isabel, Leyte

### 9.4 ROLES AND RESPONSIBILITIES

#### 9.4.1 The Grievance Officer of IASCL

The Grievance Officer will be appointed as a complaint contact point of IASCL to receive all project-related complaints. The IASCL will prepare a procedural manual / operation manual on the GRM to include, but not limited to, the nature of complaints which should be handled by the QHSE, IASCL, Management Level. The manual will also include a GRM Frequently Asked Questions Sheet to be available in the project site. The Grievance Officers will be provided with sufficient training prior to deployment.

The following are the roles and responsibilities of the Grievance Officer of IASCL:

- Screening of complaint if it is project-related or not. If the complaint is project-related (health, safety, environment issue), forward the complain to QSHE. If the complaint is not project-related, assist the aggrieved stakeholder by forwarding the complaint to the appropriate agency or LGUs who will act on the complaint;
- Receiving the written, verbal or electronically forwarded complaint from the aggrieved stakeholder and explaining the grievance redress process. Acknowledge receipt (and entering it into the grievance registry of the IASCL-Record Management System) of the complaint and provide copy of the complaint including contact details where the complaint will be forwarded and who will act on it within the day of receipt;
- Constant communication with the aggrieved stakeholder to the whereabouts and status of his/her concerns;
- Following up with QSHE on their action on the complaint;
- Providing feedback on the status of complaint and subsequent action/decision of QSHE; and
- Maintaining a database for all complaints and the corresponding actions and decisions on the complaints received. Prepare Quarterly Report on Grievance Redress to include accomplishments and status of unresolved grievance to the higher level and IASCL.

#### 9.4.2. 1<sup>st</sup> Level: Quality, Health and Environment Officer

The QSHE of IASCL will be responsible to receive, assess, assess/evaluate and provide findings/recommendation on all complaints forwarded by the Grievance Officer of IASCL.

- Act and decide within three (3) working days on the complaint forwarded by the GO of IASCL
- Provide feedback to the aggrieved stakeholder on the status and/or the decision on the complaint through the GO.
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#### 9.4.3. 2<sup>nd</sup> Level: Operation Manager

The operation manager, will be responsible to receive all complaints forwarded by the Grievance Officer. The following are the roles and responsibilities of the operation manager:

- Discuss forwarded grievances on the regular weekly meeting;
- Act and decide within 10 working days on the complaint received from the Grievance Officer; and
- Provide feedback to the aggrieved stakeholder on the status and/or the decision on the complaint through the Grievance Officer.
- Hold public consultation within the area of complaint to consult the community.

#### 9.4.4. 3<sup>rd</sup> Level: IASCL Management Level

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The IASCL Management will be responsible for handling environmental issues whereas health and safety related issues and initiate inform all the stakeholders. Its roles and responsibilities relative to grievances are the following:

- Convene immediately once a complaint forwarded by the Grievance Officer has not been resolved in the 1<sup>st</sup> and 2<sup>nd</sup> level;
- Act and decide within 15 working days on the complaint filed by aggrieved stakeholder who is not satisfied with the action or decision of QSHE; and
- Inform the aggrieved stakeholder of the actions and decisions regarding the filed complaints through the Grievance Officer of IASCL
- Conduct monthly meetings to discuss complaints and grievances; and

### 9.4.5 4<sup>th</sup> Level: DENR

Issues related to environment, not addressed in the third level will be elevated to EMB-DENR.

### 9.4.6 GRIEVANCE ACTION FORM

At all levels, a grievance registry will be maintained to keep track and document the number and type of complaints and grievances that will be raised, as well as their status and action/s taken. The GAF will, as a minimum, contain the following:

- Basic information of the aggrieved stakeholder (Name, Address, Contact Number);
- Date of last disclosure meeting;
- Category of grievance filed (environment related issue or not); and
- Type of action taken (resolved at the HSEC level or referred to higher authorities).

### 9.4.7 MONITORING REPORTS ON GRIEVANCE REDRESS

The IASL-General Manager will prepare Quarterly Reports on Grievance Redress which include the accomplishments and status of unresolved grievance of each agency to the higher level and IASCL. This report will be a part of internal and external monitoring.



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