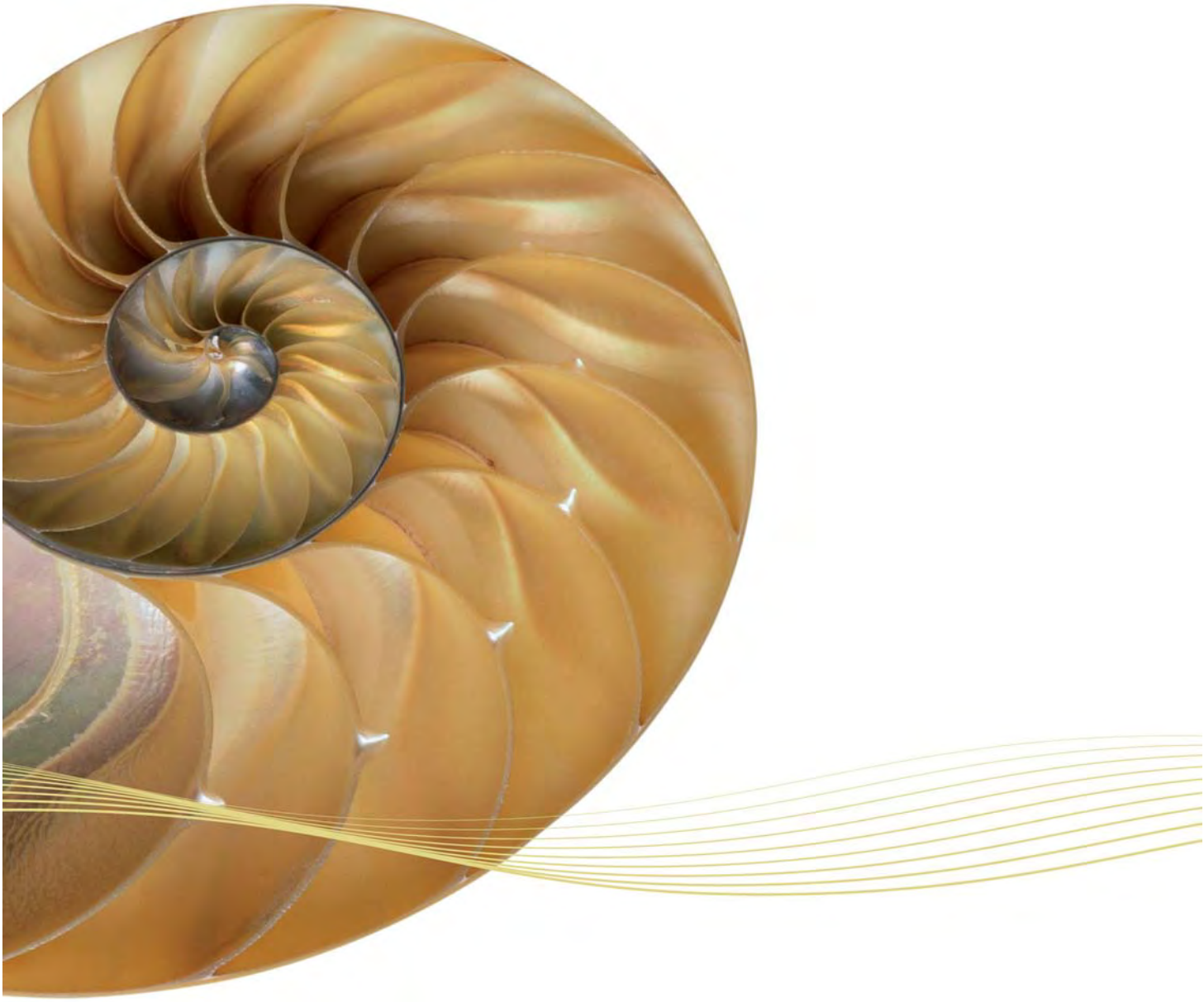

Environmental Impact Assessment for the Hmawbi Agricultural Inputs Complex (HAIC) for Myanma Awba Group

Final ESIA Report

14th February 2018

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Environmental Impact Assessment for the Hmawbi Agricultural Inputs Complex (HAIC)

Final ESIA Report

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APPENDIX B IMPACT ASSESSMENT METHODOLOGY

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APPENDIX D INFORMATION ON WORKPLACE SAFETY SYSTEMS

EXECUTIVE SUMMARY

In June 2016, the **International Finance Corporation** (IFC) extended a financing facility of US$10 million to **Myanma Awba** (Awba) for the expansion of Awba's core business. This includes the construction and operation of a new agro-chemical formulation complex, Hmawbi Agriculture Input Complex (HAIC), in the Hmawbi Township of Yangon Region ("the Project"). The location of the Project is shown in *Figure 1.1*.

An Environmental Impact Assessment (EIA) Report for this specific Project was prepared prior to the implementation of the Myanmar EIA Procedure and National Environmental Quality (Emission) Guidelines (NEQs), both enacted in December 2015. The locally prepared EIA Study, however, has been submitted to the Ministry of Natural Resources and Environmental Conservation (MONREC) for the application of an Environmental Compliance Certificate (ECC) or the Project. Awba participated in the EIA Review Team meeting with MONREC on the local EIA in August 2017, and provided an updated EIA Report in response to comments received by MONREC. At the time of writing this ESIA Report (February 2018), Awba are awaiting the Ministry's final decision on whether another Review Team meeting is required or if the ECC will be issued.

Awba have been conducting technical feasibility studies since 2015 on the Project. The land was owned by the Ministry of Industry in 1982 and transferred to Ministry of Agriculture. The Ministry of Agriculture has provided Awba this land under a Built-Operate-Transfer (BOT) system. No record of the site selection for this Industrial Park is available and no environmental and social impacts assessment and/or strategic environmental assessment have been carried out by the government to date.

The IFC has reviewed the local EIA and considers that it does not fulfil the requirements of the IFC Performance Standards (PSs). As such, **Environmental Resources Management** (ERM) have been commissioned by Awba to undertake a supplemental Environmental and Social Impact Assessment (ESIA). The ESIA addresses gaps with respect to the IFC PSs and other relevant international requirements such as the World Bank Group (WBG) Environmental Health and Safety (EHS) Guidelines for Pesticide Manufacturing, Formulation, and Packaging (2007) and the WBG EHS General Guidelines (2007).

PURPOSE AND OBJECTIVES OF THE ESIA STUDY

The ESIA aims to produce a fit-for-purpose identification, assessment, and management of potential risks and impacts from the Project, and to gain material useful to inform other aspects of the Project planning.

Specifically, the objectives of the ESIA are:

- To review the proposed Project activities with respect to their potential to interact with environmental and social receptors and resources;

- To identify the potentially vulnerable environmental and social components of the baseline within the Study Area;

- To identify and evaluate potential environmental and social impacts from the Project; and

- To recommend mitigation or enhancement measures to avoid, reduce or compensate potential adverse impacts.

PROJECT DESCRIPTION

The Project involves the construction and operation of the HAIC, which is located in the Hmawbi Township of Yangon Region. The HAIC will formulate a variety of pesticides, herbicides, fungicides, and foliar fertilizers. The plant will be designed for both solid and liquid products, and is expected to have an initial capacity of 16 million litres/kilos per annum of agrochemical products in the first phase (2017). This will eventually grow up to a capacity of 30 million litres/kilos per annum in 2020 with growing demand from Myanmar's agriculture industry.

In addition to the production and formulation facilities, there will laboratory, utility, workshop, warehouse, office, and security facilities, carpark, staff accommodation, canteen, testing farm and greenhouse supporting the operations. Onsite incinerator and wastewater treatment facilities will be constructed to treat the wastes generated from the HAIC.

The HAIC will be constructed in three phases. It was observed during the site visit in May 2017 that construction had commenced for Phase 1. Construction of the Project is expected to be completed before 2020.

BASELINE ENVIRONMENTAL CONDITIONS

For the purposes of this non-technical summary, the description of the baseline environmental conditions is limited to those aspects that are directly relevant to the proposed Project and anticipated impacts, i.e. ambient air quality, noise, water quality, soil and biodiversity etc. Baseline surveys were undertaken in June to July 2017 for these aspects in order to provide baseline information for the purpose of conducting an informed ESIA of the Project.

Baseline river and well water quality data was collected in June and July. At all river sampling locations, the level of total suspended solids (sediment and soil in the water) exceeded the WBG *General EHS Guidelines* (2007) for treated sanitary sewage discharge and WHO Drinking Water Standards. These exceedances are due to the turbid nature of the surface waters. Villagers use sieve / filtering systems when using the water for drinking purposes. In addition, high levels of faecal matter were recorded. Other measurements were generally within the WHO and WBG EHS Guidelines with no specific concern / pollution identified. Well water quality parameters measured include in-situ measurement of pH and temperature as well as laboratory analysis of pH, Total Suspended Solid (TSS), Total Cyanide, Ammonia, Nitrite, Nitrate, Reactive Phosphorus, Oil & Grease, Chemical Oxygen

Demand (COD), Biochemical Oxygen Demand (BOD), Phenols, Arsenic, Cadmium, Chromium, Copper, Mercury, and Faecal Coliforms. Only one exceedance of WHO Drinking Water quality standards – PH levels in water in Yae Tar Shey well. This is not an indication of pollution on its own, as heavy metal concentrations identified did not exceed the WHO standards.

Noise measurements showed exceedance of both the noise limits set out in NEQ and WBG General EHS guideline values during daytime (except at one location) and night-time periods, the baseline levels of other aspects generally indicated compliance with relevant environmental standards with occasional isolated exceedances.

For biodiversity, the survey results indicated presence of a modified habitat with generally low biodiversity value in the vicinity of the proposal HAIC.

STAKEHOLDER CONSULTATION

As a part of the ESIA process, consultation was carried out with the indirectly and directly affected population within the Project's Area of Influence (AOI). The consultation served the dual purpose of informing the public about the potential impacts of the Project and seeking community views on issues.

A summary of the stakeholder consultation activities for the ESIA Study is provide in *Table 1.1.*

Table 1.1 Engagement Undertaken

Date	Location	Venue	Attendees
Scoping Phase			
21/6/2017	Hmawbi	GAD office	Government (8)
21//2017	Wah Net Chaung	Village monastery	Government (19), Local Community (37)
22/6/2017	Tha Pyay Kone	Village monastery	Government (4), Local Community (35)
22/6/2017	Yae Tar Shey	Village monastery	Government (9), Local Community (41)
23/6/2017	Nyaung Kone	Village monastery	Government (4), Local Community (35)
ESIA Phase			
16/8/2017	War Net Chaung	Village monastery	Government (5), Local Community (43)
16/8/2017	Nyaung Kone	Village monastery	Local Community (33)
17/8/2017	Yae Tar Shey	Village monastery	Government (1), Local Community (55)
17/8/2017	Tha Pyay Kone	Village monastery	Local Community (33)

Key findings of consultation are presented below and summarised in *Table 1.2*

Table 1.2 Summary of Comments Received during Engagement

Key Comments Received and Response	Consideration for Supplementary ESIA
Consultation & Information Disclosure One of the key comments received related to the availability of information and transparency in the process. Stakeholders wanted to emphasise that it is important to ensure the community can understand the information provided. Some stakeholder in War Net Chaung noted that Pa Ywet Sate Kone, Kyi Ni San, Poe Dana Kone, and Shan Kone villages are located within 5 km of the Project (upstream) and should be included in the assessment.	The Regulatory EIA Report will have a Myanmar language executive summary to ensure information is easily available to local communities. Awba will undertake further disclosure and consultation in Pa Ywet Sate Kone, Kyi Ni San, Poe Dana Kone, and Shan Kone villages.
Public Health & Safety The key concern related to public health and safety impacts specifically from air and wastewater emissions. These also included concerns related to unplanned events. The four villages consulted are downstream of the Project Site and use the river/creek water for domestic and drinking purposes.	This Supplementary ESIA will assess the impact on Public Health and Safety from air and noise emissions. The baseline survey results from air, noise, soil, water and biodiversity will be disclosed to the community.
Monitoring and Auditing Transparency of the monitoring and auditing process during operation was of key importance to the stakeholders.	The grievance mechanism and future disclosure will be provided to all PAPs in the area.
Use of Existing Infrastructure The quality of the access road was commented on during the public consultation. Some community members mentioned that Awba vehicle use had damaged the road into the Project Site.	Awba will investigate this grievance via their community grievance mechanism and will restore the road to its existing condition after the rainy season.
Current Activities / Historic Activities Some people in Nyaung Kone reported a smell coming from the current operations or store at the Project Site. Also, one main concern was historic contamination from the existing industrial park and factories.	Awba will investigate the odour complaint through their community grievance mechanism. Awba have undertaken a baseline assessment and will disclose the results of the baseline to the local communities. Awba will also undertake regular monitoring as outlined in this supplementary ESIA and will disclose monitoring results to the local community.
Land Permitting This village raised concerns with the permitting of the land from the ministry / government and the site selection process.	Awba were given permission from the Ministry of Agriculture, Livestock and Irrigation to construct the Project within this existing Industrial Zone.
Corporate Social Responsibility and Social Benefits	Awba will undertake a CSR program once operational and will consider these

Key Comments Received and Response	Consideration for Supplementary ESIA
All villages mentioned potential social investment opportunities in the village. The two key concerns on inadequacies of services related to road condition and electricity. These were mentioned as potential opportunities for social investment. In Nyaung Kone, it was noted that villagers spend a lot of money on pesticides and Awba could provide a subsidized store for the local community for their products.	suggestions in the planning of any social investment.

In addition to questions raised during the ESIA engagement, a number of grievances were collected as part of the Community Grievance Procedure, this are provided in *Table 1.3* with considerations for this Supplementary ESIA.

Table 1.3 Community Grievance Log

Category	Summary of Query	Action for ESIA
Corporate Social Responsibility (CSR)	To conduct the Community Development activities transparently and affectively. Awba should contribute to the local hospital and provide discount pesticide shop for local.	All engagement activities will be conducted transparently. CSR is not part of the ESIA. Awba will consider CSR separately.
ESIA	Who will take responsibility to inspect and monitor following the impact assessment. ERM to involve respective community members for the ESIA survey. Provide communities the result of the ESIA as well as provide guarantee on their result and collect from tube wells.	Monitoring, including roles and responsibilities, will be included in the ESIA Report. Community members will be invited to the baseline surveys. Water will be collected from tube wells and the results will be provided to the community during future engagement.
Accidental events	Information needed on the emergency plan and the potential impact to villagers.	Accidental events (including impact to communities) will be assessed in the ESIA.
Job opportunities	Provide job opportunities to youth and local community members.	The provision of jobs and potential beneficial impact will be assessed in the ESIA.
Land Issue	The road connecting Phoe Dana Kone village to Nyaung Kone village has been reduced from 13 ft. to 6.5 ft. by the Project fencing.	This is based on the Land Lease Agreement between Awba and the Ministry of Agriculture.
Pollution	Will gas emissions damage crops or agricultural land? There have been historic examples of sickness in the community when the MPI factory produced gas (and/or) smoke.	Emissions and their impact on local communities and the surrounding environment will be assessed in the ESIA. A cumulative assessment of impacts from the Industrial Park will also be undertaken.

Category	Summary of Query	Action for ESIA
Relocation	The Project is located near villagers, why was this land selected? Is it possible to relocate?	This is based on the Land Lease Agreement between Awba and the Ministry of Agriculture.
Road damage	The factory trucks are damaging the roads of the villages. Awba should repair the road.	Awba should repair the road to the Site.
Village Information	The village list shared is not correct. Public consultation should be conducted in all the villages surrounding project area and involved in the ESIA survey.	Consultation locations were selected to include all the village tracts within 3.5 km. The second round of engagement will invite villagers from villages in which the meetings are not held during the scoping engagement.
Waste Management	Concerned that waste produced by the factory would impact local water courses, local crops and local communities. Provide an explanation of the waste management system to the villagers.	The potential impact of waste on environmental and social receptors will be considered in the ESIA.

In parallel to the stakeholder consultation, a total of 72 useable household surveys, and 8 group discussions for socio-economic systems were completed with the Project's AOI with particular focus on the livelihoods of community. The information obtained is used to inform the impact assessment and mitigation measures derivation.

KEY POTENTIAL IMPACTS AND PRELIMINARY MITIGATION MEASURES

During the impact assessment, potential impacts have firstly been identified through a systematic scoping process whereby the activities (both planned and unplanned) associated with the Project have been considered with respect to their potential to interact with environmental resources or receivers. Interactions which may generate potentially significant environmental impacts ranging from those associated with the construction phase, operation phase as well as accidental events (e.g. spillage) of the Project.

The potentially significant environmental impacts are further assessed in the ESIA Study, with appropriate mitigation and enhancement measures recommended for alleviating potential negative impacts or enhancing potential positive impacts from the Project. It is concluded in the ESIA Study that with proper implementation of the recommended mitigation measures, the residual environmental and social impacts causing by the construction and operation of the Project would be of no larger than **moderate** significance. A summary of the residual impacts (after mitigation) are provided in *Table A*.

Table A ***Summary of Impact Assessment Results***

Impact	Summary of Mitigation	Residual Impact Significance
Impacts to Air Quality	– Implement monitoring system. – Apply intensive dust suppression methods. – Emissions in line with Myanmar Standards (NEQ Guidelines) and international guidelines.	**Minor**
Impacts from Noise	– Only well-maintained equipment should be operated on-site. – Emissions in line with Myanmar Standards (NEQ Guidelines) and international guidelines.	**Negligible**
Impact to Water Quality	– Implement monitoring system to continuously monitor / disclose wastewater discharge quality. – Discharges in line with Myanmar Standards (NEQ Guidelines) and international guidelines.	**Minor**
Impacts to Soil Quality	– As per water quality impacts above.	**Negligible**
Community Health and Safety	– A Workforce Code of Conduct. – A Contractor EHS Management Plan. – During consultation, it was mentioned that an access road was damaged by Project vehicles and it is recommended that Awba restore the road to its original condition. – Community Grievance Mechanism	**Minor**
Economy and Livelihoods	– None recommended.	**Positive**
Occupational health and safety	Ventilation systems, and life and fire safety systems in the buildings	**Minor**

Impact	Summary of Mitigation	Residual Impact Significance
Impacts to Biodiversity	– Limit clearance of land and re-establish vegetation where possible. – Potential re-instatement of vegetation on site.	**Minor**
Infrastructure services	– Traffic Management Plan. – Community Grievance Mechanism.	**Minor**
Accidental Events	– Waste Management Plans and Emergency Response Plans. – Project will adopt good practices for chemical storage. – Drainage design to limit spread of spills.	**Moderate**

SUMMARY AND CONCLUSIONS

The Project covers the construction and operation of a new agro-chemical formulation complex, HAIC, in the Hmawbi Township of Yangon Region by Awba. The Project is funded by IFC through extending a financing facility of US$10 million to Awba with specific use of proceeds for the expansion of Awba's core business.

An ESIA Study has been conducted for Project in accordance with the local Myanmar requirements and in conformance with relevant environmental and social guidelines of the international benchmark (i.e. IFC PS and WBG EHS Guidelines) with an overall objective to ensure acceptable environmental and social performance of the Project. During the ESIA Study, potential impacts have firstly been identified through a systematic scoping process whereby the activities (both planned and unplanned) associated with the Project have been considered with respect to their potential to interact with environmental and social resources or receptors. Interactions, which may generate potentially significant environmental and social impacts, have been further assessed in the ESIA Study, with appropriate mitigation and enhancement measures recommended for alleviating potential negative impacts or enhancing potential positive impacts from the Project.

A local ESIA has been prepared for MONREC requirements and is currently being reviewed by MONREC. It is recommended that Awba wait for the approval of this report prior to commencing operations.

Consultation outcomes have been incorporated into the design of mitigation measures for Project and are contained in this ESIA Report. These include:

- Routine air and water monitoring at the Project Site and in communities closest to the Project Site.

- The access road to the Project Site has been damaged by Project vehicles and it is recommended that Awba restore the road to its original condition.

- Development of a formal grievance procedure for use by local residents.

- Undertake consultation and information disclosure in Pa Ywet Sate Kone, Kyi Ni San, Poe Dana Kone, and Shan Kone villages.

It is concluded in the ESIA Study that with proper implementation of the recommended mitigation measures, the residual environmental and social impacts causing by the construction and operation of the Project would be of no larger than **moderate** significance.

To ensure proper delivery of the committed mitigation measures identified in the ESIA Study, an Environmental and Social Management Plan has been prepared for the Project, which provides the procedures and processes to be applied to the Project activities in order to check and monitor compliance and effectiveness of the mitigation measures during the construction and operation of the Project. In addition, this ESMP will be used to ensure compliance with statutory requirements and corporate safety and environmental policies. Overall, it is expected that the Project will be constructed and operated with acceptable environmental and social performance under proper implementation of the ESMP.

The Project will also have a Construction Phase and Operational Phase Monitoring Plan will be required for the Project, which will include air quality, noise, and water quality impacts. It is important to undertake monitoring to track the effectiveness of these mitigation measures and manage any necessary changes accordingly.

1 INTRODUCTION

1.1 PROJECT OVERVIEW

Established in 1995, **Myanmar Awba Group's** (Awba) core business involves the importation, manufacturing, formulation, reformulation, blending and distribution of Crop Protection Products (CPP or agrochemicals, such as pesticides, fungicides and herbicides), fertilizers (urea and compound fertilizers – Nitrate, Phosphate, Potassium - NPK) and seeds.

In June 2016, the International Finance Corporation (IFC) extended a financing facility of US$10 million to Awba with specific use of proceeds for the expansion of Awba's core business. This includes the construction and operation of a new agro-chemical formulation complex, the Hmawbi Agriculture Input Complex (HAIC), in the Hmawbi Township of Yangon Region ("the Project"). The location of the Project Site is shown in *Figure 1.1*.

1.2 BACKGROUND TO THE ESIA

An Environmental Impact Assessment (EIA) Report for the Project was prepared prior to the implementation of the Myanmar EIA Procedure and National Environmental Quality (Emission) Guidelines (NEQ Guidelines), both enacted in December 2015. The EIA has been submitted to the Ministry of Natural Resources and Environmental Conservation (MONREC) for the application of an Environmental Compliance Certificate (ECC) for the Project. At the time of this report, the results of this application were still pending.

The local EIA does not fulfil the requirements of the International Finance Corporation's Performance Standards on Environmental and Social Sustainability, 2012 (IFC PSs). As such, **Environmental Resources Management** (ERM) have been commissioned by Awba to undertake a Supplemental Environmental and Social Impact Assessment (ESIA) to address gaps with respect to the IFC PSs and other relevant international requirements such as the World Bank Group Environmental, Health, and Safety (WBG EHS) Guidelines for Pesticide Manufacturing, Formulation, and Packaging (2007).

1.3 OBJECTIVES OF THE ESIA STUDY

The ESIA aims to produce a fit-for-purpose identification, assessment, and management of potential risks and impacts from the Project, and to gain material useful to inform other aspects of the Project planning.

Specifically, the objectives of the ESIA are:

- To review the proposed Project activities with respect to their potential to interact with environmental and social receptors and resources;

- To identify the potentially vulnerable environmental and social components of the baseline within the Study Area;
- To identify and evaluate potential environmental and social impacts from the Project; and
- To recommend mitigation or enhancement measures to avoid, reduce or compensate potential adverse impacts.

1.4 STUDY LIMITATIONS

This EIA is based on data and information obtained from Myanmar Awba Group at the time of the study. Any future changes to the Project Description, as presented in *Chapter 3*, upon which this report is based or additional relevant information revealed as Project design, equipment, and service procurement proceed may affect the analysis, assessment, and conclusions contained in this report. Should such changes occur, they should be the subject of further study to verify that the conclusions of this EIA do not change and to determine whether any additional mitigation, management, or monitoring measures are warranted.

1.5 STRUCTURE OF THIS ESIA REPORT

This supplementary ESIA Report is structured as follows:

- Chapter 1 – Introduction;
- Chapter 2 – Project Description;
- Chapter 3 – Policy, Legal and Institutional Framework
- Chapter 4 – Impact Assessment Methodology;
- Chapter 5 – Environmental Baseline;
- Chapter 6 – Socio-Economic Baseline;
- Chapter 7 – Stakeholder Engagement;
- Chapter 8 – Construction Phase Impact Assessment;
- Chapter 9 – Operational Phase Impact Assessment;
- Chapter 10 – Environmental and Social Management Plan; and
- Chapter 11 – Summary and Conclusion.

Figure 1.1 Project Site Location

2 PROJECT DESCRIPTION

2.1 PROJECT LOCATION

The Hmawbi Agriculture Input Complex is located in the Hmawbi Township of the Yangon Region (*Figure 1.1*). The size of the HAIC is 126 acres. Next to the HAIC is the existing Hmawbi pesticide factory, which was established in 1986 and is under a Joint Venture (JV) agreement between Awba and the Myanmar Government. The nearest community is Yae Tar Shey Village, approximately 1 km away from the Project Site.

2.2 LAND USE

The overall land size is approximately 130 acres and only some portions of it will be utilized for the construction of a new plant. The land is generally flat with small and gradual contours in the west while the eastern side is hilly and has rubber plantations on it. There is an existing pesticide formulation plant somewhere near the middle (slightly closer to the eastern side). Most of the plot is vacant save for the existing pesticide factory and the old worker housing. The new factory is to be constructed on an empty land, which is at the immediate west of the existing pesticide plant. The project is expected to be built in three phases and the land utilization for each phase is as stated in *Table 2.1*.

Table 2.1 Project Phases and Land Use

Phase	Year	Land Usage
Phase 1	2016	16 Acres
Phase 2	2017	16+4=20 Acres
Phase 3	2019	20+9=29 Acres

2.3 INDUSTRIAL PARK BACKGROUND

The land of HAIC was owned by the Ministry of Industry in 1982 and transferred to Ministry of Agriculture. The Ministry of Agriculture has provided Awba this land under a Built-Operate-Transfer (BOT) system. The Ministry of Agriculture rented 126.13 acres within 137.28 acres of Industrial Park that located near Wah Net Chaung village, Hmawbi Township, Yangon Region to Awba. According to the BOT, contract terms are from the contract signing date (23 September 2015) until initial 10 years. If the contract terms will be extended, that will be five years in one term and up to 2 terms can be extended (totally will be 20 years). No record of the site selection for this Industrial Park is available and no environmental and social impacts assessment and/or strategic environmental assessment have been carried out by the government to date.

The neighbouring MPI Site will not be decommissioned as it is leased under a similar BOT contract to the HAIC. Instead, Awba will investigate two options, the final decision of which will be made at a later date:

1) Transfer of the Site back to the Ministry of Agriculture; or
2) Transfer of the Site to another Company.

2.4 CONSTRUCTION PHASE

It was observed during the site visit in May 2017 that construction of an office building and warehouses had already commenced from January 2017 and is due to be completed before 2020.

The Project Site is accessed by an unpaved road from the main road connecting to War Net Chaung Village. An estimated five vehicles access the Site daily. During consultation, it was mentioned that this access road was damaged by Project vehicles and it is recommended that Awba restore the road to its original condition. This was noted by the local community as a grievance during the consultation.

During construction, there is currently around 50-100 workers on site. Water is supplied by potable bottled sources and power is provided by generators. Clearance and excavation works have already been conducted in the Phase 1 area.

Figure 2.1 shows some representative photos taken during the site visit at the Project Site and its vicinity.

Figure 2.1 Representative Photos taken at the Project Site and its vicinity during the Site Visit in May 2017

2.5 *OPERATIONAL PHASE*

The layout of the Project facilities is shown in *Figure 2.2*. The HAIC will have the capabilities to formulate a variety of pesticides, herbicides, fungicides, and foliar fertilizers. The plant will be designed for both solid and liquid products formulation, and is expected to have an initial capacity of 16 million litres/kilos per annum of agrochemical products in the first phase in 2017. This will eventually grow to a capacity of 30 million litres/kilos per annum in 2020 to meet the growing demand from Myanmar's progressive agriculture industry. It is expected that the plant will have a capacity to manufacture 50% of Myanmar's domestic crop protection demand.

In addition to the production facilities, there will laboratory, utility, workshop, warehouse, office and security facilities, carpark, staff accommodation, canteen, testing farm and greenhouses supporting the operations. Incinerator and wastewater treatment facilities will be constructed to treat the solid/hazardous and liquid wastes generated from the HAIC.

The following sections provide an overview of the facilities within the HAIC.

2.5.1 *Office Building*

There will be a two-story office building able to hold up to 100 people (*Figure 2.3)*. The building will be 40 m x 13 m x 7 m (11,800 square feet) and will feature a fire protection system, sprinkler and alarm system, CCTV system, and an indoor public address (PA) system.

Figure 2.2 Layout of Hmawbi Agriculture Input Complex

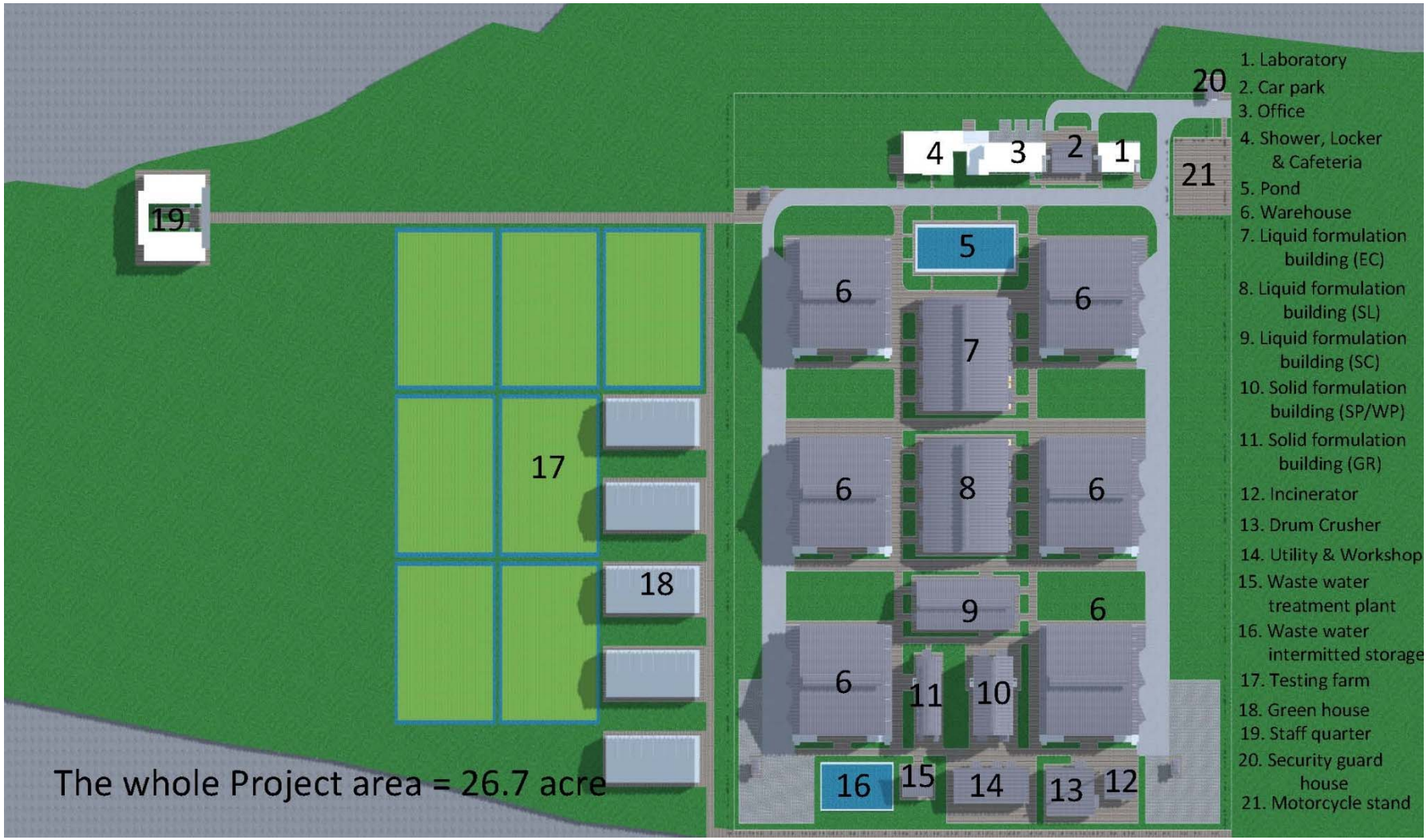


Figure 2.3 Office Building

2.5.2 *Laboratory Building*

The laboratory is a one-story building, and will be suitable for 7 to 10 people. The building will be 28 m x 13 m x 4 m (3,900 square feet) and will provide state-of-the art quality testing equipment such as UCFL, GCMS, and separate storage system for flammable and non-flammable chemicals. A mechanical ventilation system will be installed in every room, scrubber system, liquid waste drainage system and black water drainage and solid waste storage area. The lab has a fire protection system, sprinkler and alarm system, CCTV system and indoor PA. Information on the fire system is provided in **Appendix D**.

2.5.3 *Worker Facilities*

The worker facilities are a one-story building with security camera and PA system (*Figure 2.4*). The facilities include cafeteria, shower room, and locker room for up to 350 people. The facility is 50.5 m x 19.5 m x 3.5 m (85,000 square feet). The canteen can serve 100 people in a time. The facilities also include a clinic, convenient store, and food distribution area.

Figure 2.4 Worker Facilities

2.5.4 *Warehouse*

The warehouse (*Figure 2.5*) consists of the following: high-density warehouse system, flood prevention system, firefighting system, lightening protection system, and good ventilation and is 54 m x 17.5 m x10.5 m (35,000 square feet). A good storage practice will apply for forklift operations, a 5 layer of racking system, and plastic pellets.

Figure 2.5 Warehouse

2.5.5 *Pesticide Formulation Facilities*

The following sections provided an overview of the facilities involved in formulation of the pesticide Project during operation.

Emulsifiable Concentrates (EC) Building

The Emulsifiable Concentrates (EC) building will be 14,424 square feet and will have a fire alarm system, ex-proof formulation line, processing equipment, packaging equipment, dust collector system, scrubber system, black water drainage system, and natural ventilation system. The building is shown in *Figure 2.6*. The EC process that will be conducted on site is shown in *Figure 2.7* and the packaging process in *Figure 2.8*.

Figure 2.6 EC Building

Figure 2.7 EC Process

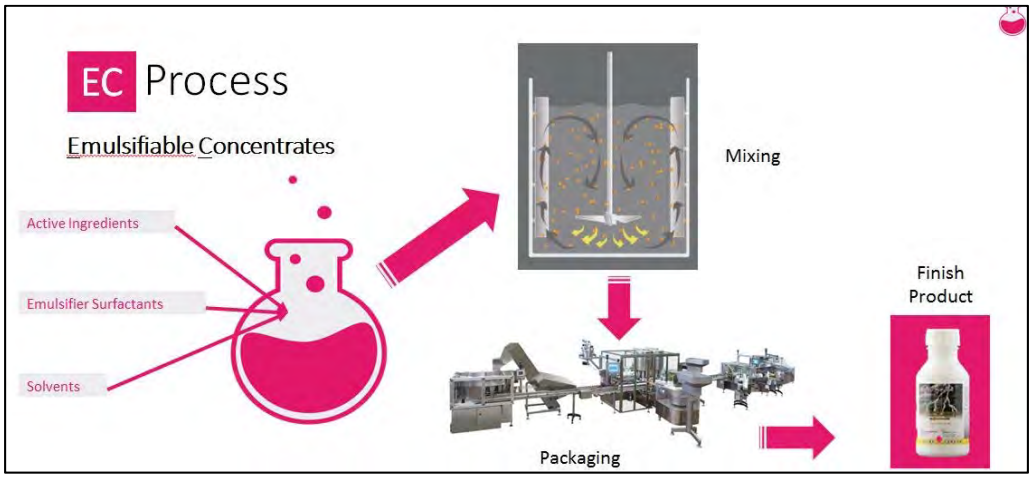
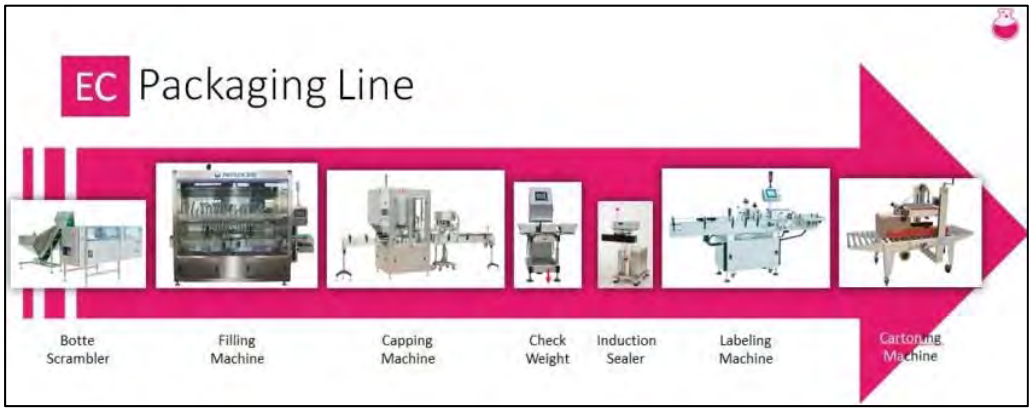


Figure 2.8 EC Packaging line



Soluble Liquid (SL) Building

The Soluble Liquid (SL) building will have an installed fire alarm system, processing equipment, packaging equipment, dust collector system, scrubber system, black water drainage system, and natural ventilation system. The building size is 14,424 square feet (*Figure 2.9*). The SL process that will be

conducted on site is shown in *Figure 2.10* and the packaging process in *Figure 2.11*.

Figure 2.9 SL Building

Figure 2.10 SL Formulation

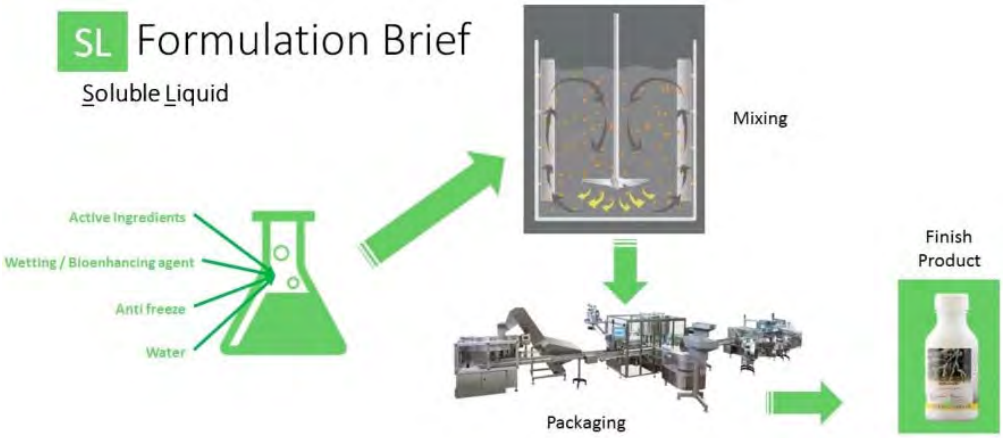
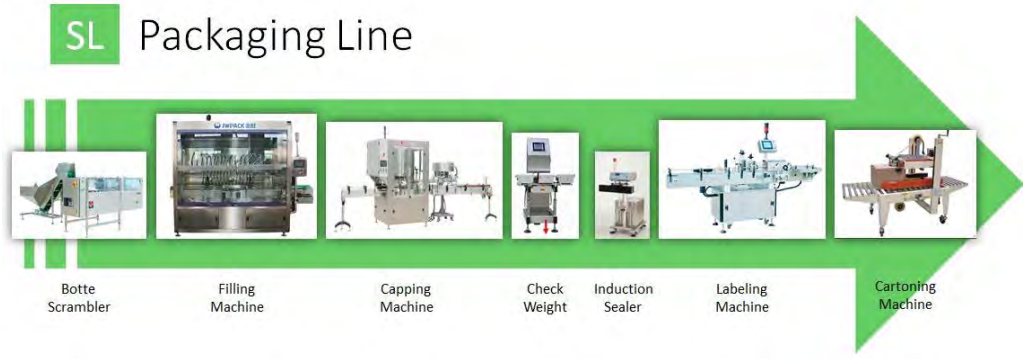


Figure 2.11 SL Packaging Line



Wettable Powder (WP) and Soluble Power (SP) Building

The wettable powder (WP) and soluble power (SP) building is 43.5 m x 24m x 14 m (10,120 square feet) and will have an installed fire alarm system,

processing equipment, packaging equipment, dust collector system, scrubber system, black water drainage system, and natural ventilation system (*Figure 2.12*). The WP and SP process that will be conducted on site is shown in *Figure 2.13* and the packaging process in *Figure 2.14*.

Figure 2.12 WP and SP Building

Figure 2.13 WP and SP Formulation

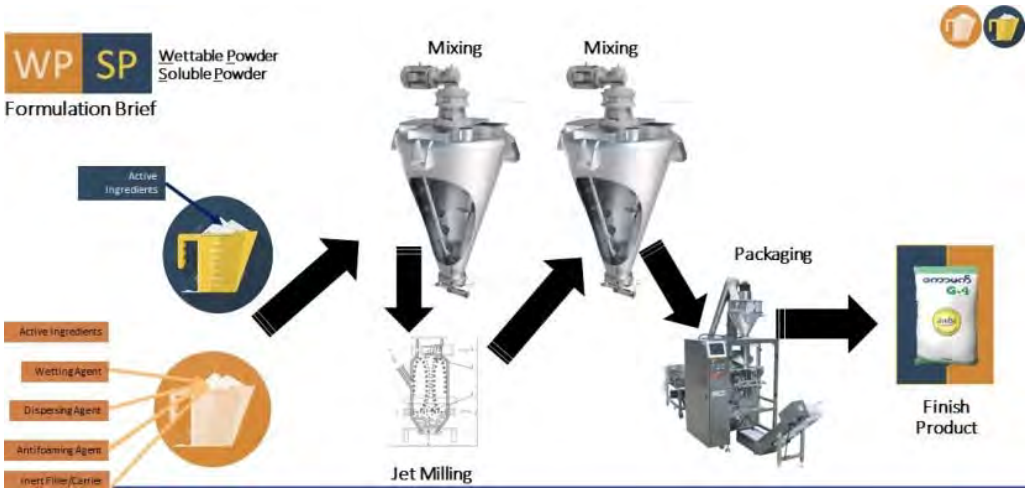


Figure 2.14 WP and SP Packaging

Suspension Concentrates (SC) Building

The SC building is 43 m x 21 m x 9 m (7,100 square feet) and has an installed fire alarm system, processing equipment, packaging equipment, dust collector system, scrubber system, black water drainage system, and natural ventilation system. The SC process that will be conducted on site is shown in *Figure 2.15* and the packaging process in *Figure 2.16*.

Figure 2.15 SC Formation Line

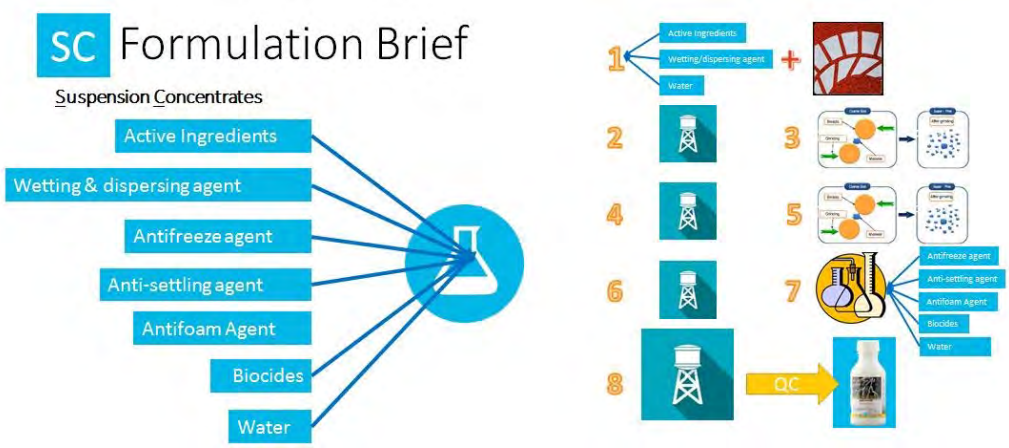
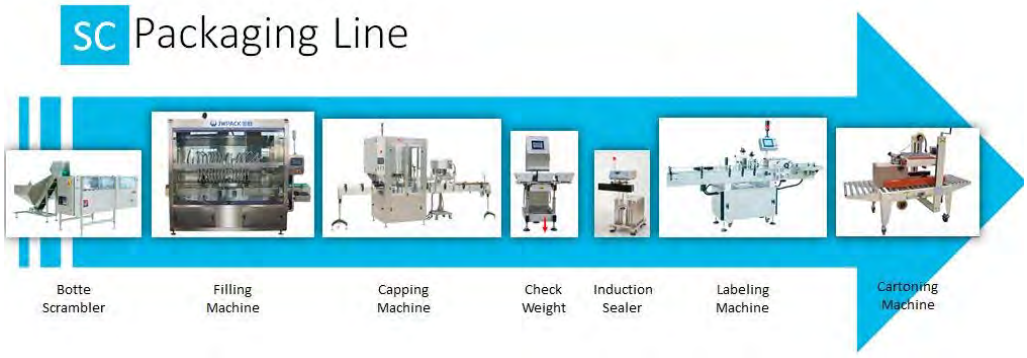


Figure 2.16 SC Packaging Process



2.5.6 Utility Building

Utility Building size is 448x22.5x 6 m (5537 square feet). It features the compressor systems, workshop, restrooms; spare parts store room, fire alarm system in place, security camera, PA, IP PBX system and natural ventilation system.

2.5.7 Drum Crusher Building

The drum crusher building is 30 m x 20 m x 8.8 m (7,108 square feet) and features the drum crushing machine, drum washing machine, temporary waste storage, fire alarm system, security camera, PA, IP PBX system, and natural ventilation system.

2.5.8 *Waste Water Treatment System Building*

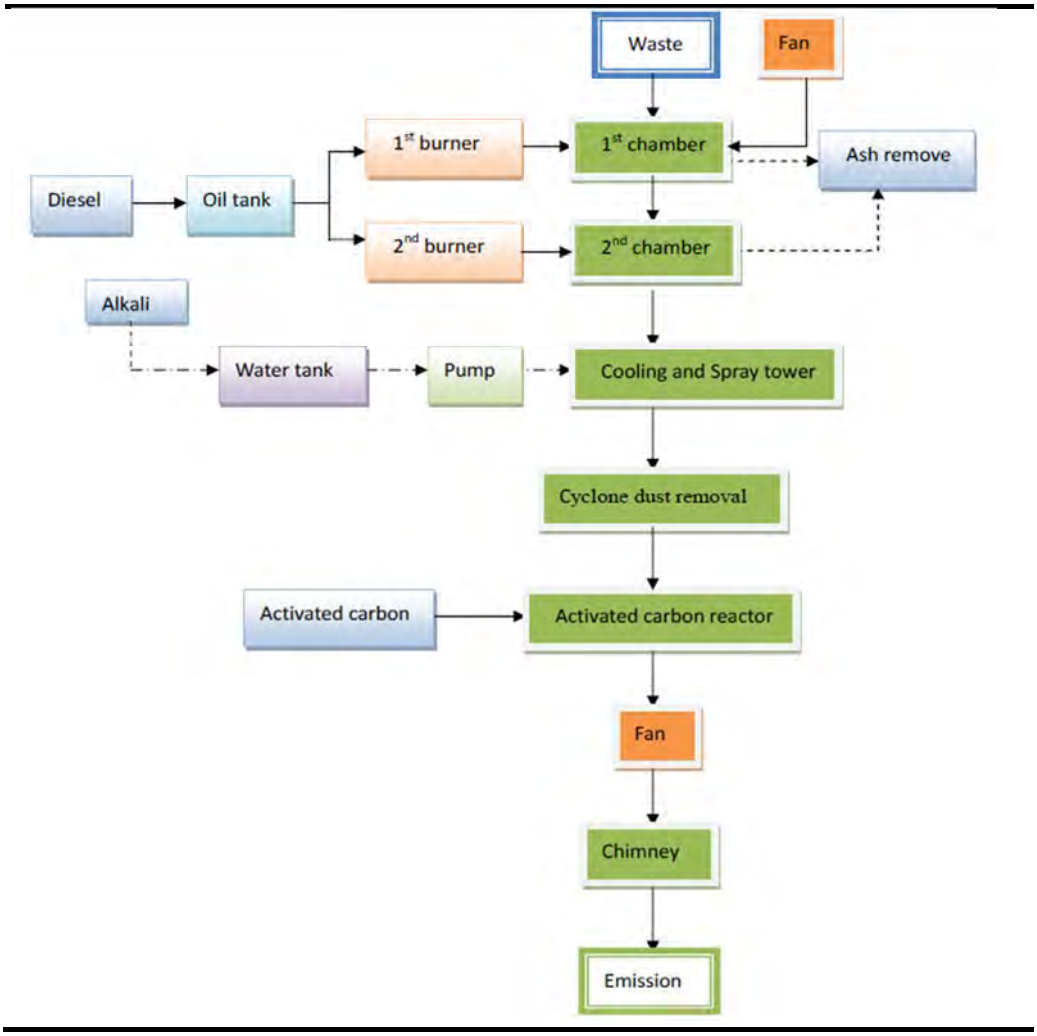
Waste Water Treatment System Building size is 23x16x10m (8,024 square feet). It features the collecting basing, equalization tank, reaction tanks, Flocculation, Sedimentation tanks, aeration tank, effluent tank, slug dehydrator, and control panel.

2.6 *WASTE MANAGEMENT*

2.6.1 *Solid Waste Management*

Incineration will be used to burn disposable personal protective equipment (PPE) which is expected to be generated at a rate of 3 kg / day, and contaminated containers and packaging, which is expected to be generated at a rate of 200-500 kg / day from HAIC. The incinerator will be designed on a basis to treat a solid waste volume of 1,000 kg/day from HAIC as well as from other Awba operations, e.g. Piti Paye. *Figure 2.17* illustrates the incineration process.

Figure 2.17 ***Flow Chart of the Incineration Process***



The waste will be fed manually into the incinerator. The incinerator comprises a primary and secondary combustion chambers in which diesel will be used as fuel for the combustion process. After incineration in the first chamber, subsequent incineration is to be carried out at above 1,100°C in the second chamber to burn off leftover hazardous substances. Air blowers will be used to supply the oxygen required for combustion in the chambers and the combustion can be controlled by adjusting the volume of air flow rate inside the furnace. The flue gas from the second chamber is then passed into the cooling tower where the temperature of the gas is brought down to between 160 and 350°C by scrubbing with alkaline and at the same time acidic gas content is reduced. Afterwards, the flue gas will pass through the cyclone dust removal system where fly ash is forced to out of the system Eventually, gas will enter the activated carbon filter where the metal content in the flue gas is reduced before being discharged through the chimney into the atmosphere.

It is noted that the incinerator will be designed to comply with the Air Emission Standards for Municipal Solid Waste (MSW) and Hazardous Waste Incinerators of the European Union (EU) as specified in the World Bank Group Environmental, Health and Safety (EHS) Guidelines for Waste Management Facilities (2007) (*Table 3.5*). These air emission standards for MSW and Hazardous Waste Incinerators specified in the WBG EHS Guidelines for Waste Management Facilities (2007) are noted to be the same as those specified for the same types of incinerator in the Myanmar NEQ Guidelines (2015).

The emission inventory from the incinerator is presented in *Table 2.2*. During operation, air emissions from the incinerator should be monitored to track compliance with the applicable WBG and NEQ standards.

Table 2.2 Project Emission Inventory

Stack Parameter[1]	**Unit**	**Value**
Stack location	Lat / Long	17° 9'59.99"N 96° 4'41.98"E
Actual Stack Conditions [2]		
Stack height	m	25
Stack diameter	m	0.4
Emission velocity	m/s	10
Exit temperature	C	120
Oxygen content (wet gas)	%	9
Moisture content (wet gas)	%	20
Actual volume flow rate	Am^3/s	1.26
Normalised Conditions [3]		
Exit temperature	C	0
Oxygen content (dry gas)	%	7
Moisture content (dry gas)	%	0
Normalised volume flow rate [4][5]	Nm^3/s	0.598
Normalised Emission Concentrations [3][6]		
NO_x	mg/Nm^3	400
SO_2	mg/Nm^3	50

Stack Parameter[1]	Unit	Value
PM[7]	mg/Nm^3	10
HCl	mg/Nm^3	10
Dioxins and Furans	ng TEQ/m^3	0.1
Cd	mg/Nm^3	0.1
CO	mg/Nm^3	150
Pb	mg/Nm^3	1
Hg	mg/Nm^3	0.1
HF	mg/Nm^3	1
Normalised Emission Rates		
NO_x	g/s	0.239
SO_2	g/s	0.0299
$PM_{2.5}$	g/s	5.98×10^{-3}
PM_{10}	g/s	5.98×10^{-3}
HCl	g/s	5.98×10^{-3}
Dioxins and Furans	g/s	5.98×10^{-10}
Cd	g/s	5.98×10^{-5}
CO	g/s	0.0896
Pb	g/s	5.98×10^{-4}
Hg	g/s	5.98×10^{-5}
HF	g/s	5.98×10^{-4}

(1) Incinerator stack
(2) Actual stack data provided and confirmed by Awba
(3) International Finance Corporation (IFC) (2008) Environmental, Health and Safety Guidelines for Waste Management facilities [Online] Available at: http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines [Accessed 08 August 2017]
(4) Environment Agency (2013) Pollution Inventory Reporting – Combustion Activities Guidance Note [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/296994/LIT_7825_e97f48.pdf [Accessed 08 August 2017]
(5) Normalised flow rate at 7% oxygen, dry gas, 273K and a pressure of 101.3 kPa.
(6) Myanmar *National Environmental Quality (Emission) Guidelines* (2015)
(7) The PM concentration is used to conservatively estimate emissions of both $PM_{2.5}$ and PM_{10}.

Residual ashes from the incinerator will be disposed of properly according to the Ash Disposal Management Plan to be developed for the Project before commencement of operation.

General refuse is expected to be generated at a rate of 25 kg / day, which will be taken off-site for disposal by Yangon City Development Committee (YCDC).

2.6.2 *Wastewater Management*

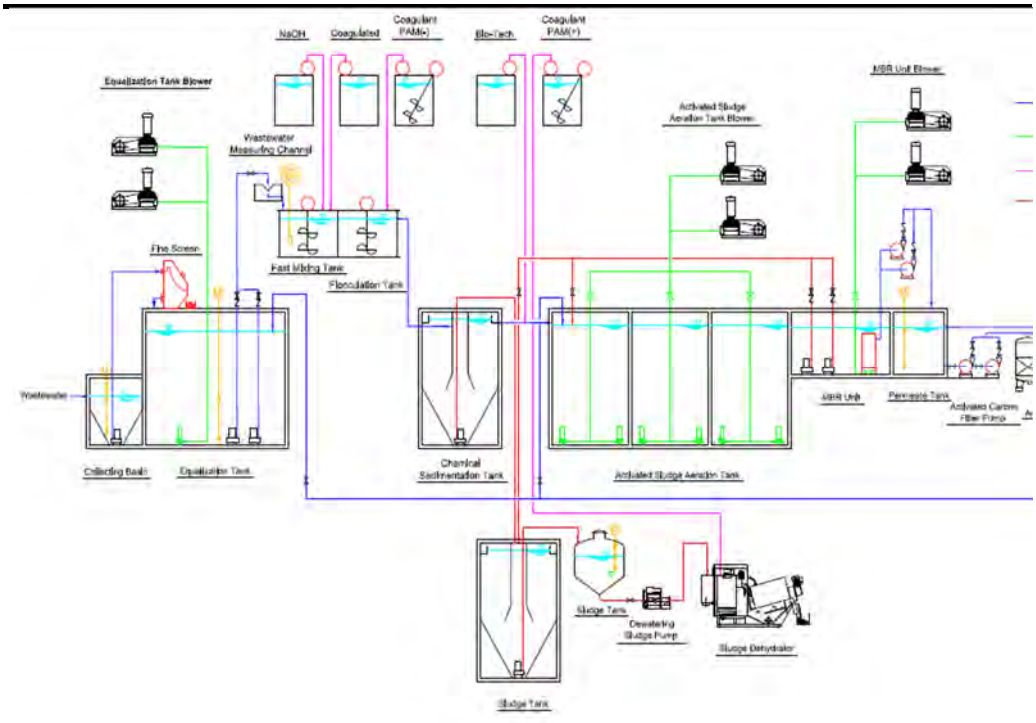
Wastewater generated from washing of formulation lines (~20 m^3 / day), laundry (~1m^3 / day) and cleaning of process area (~3 m^3 / day) in the HAIC will be treated by an on-site wastewater treatment plant. *Table 2.3* shows the design basis of the influent characteristics for the on-site wastewater treatment plant.

Table 2.3 ***Design Basis of the Influent Characteristics for the On-site Wastewater Treatment Plant***

Parameters	Unit	Value
Flow Rate	m^3/hr	1
pH	S.U.	3-9
BOD_5	mg/L	8,750
COD	mg/L	10,000
TSS	mg/L	3,000

Figure 2.5 indicates the flowchart of the proposed wastewater treatment plant. Wastewater will firstly be collected in the collection basin and then passed into the fine screen where large solids and trashes are screened out before entering the equalization tank. In the equalization tank, air diffusers are used for even mixing of the wastewater. The water is subsequently transferred via submersible pumps into the fast mixing tank where pH adjustment and chemical coagulation will be conducted. The sludge formed will be settled in the chemical sludge sedimentation tank while water will pass as overflow into the activated sludge aeration tank. In this tank, aerobic bacteria are used to digest organic matters to reduce the biological oxygen demand (BOD) with the aid of oxygen supplied through air diffusers. Next, the overflow will be passed into the second sedimentation tank where the sludge will be settled and transferred into the sludge tank while the water is forced through the membrane filter. Thereafter, the water will be passed through activated carbon filters to remove odour and colour and then temporarily stored in the effluent tank where water samples will be taken and analysed before being discharged into the pond next to the treatment facility.

Figure 2.5 ***Flow Chart of the Wastewater Treatment Process***



There will be two types of pond in this area. The first pond will be able to hold seven (7) days of treated effluent from the waste water treatment system and it will be water proof concrete pond. The second pond will be more natural which will have enough capacity to hold over one and half years of effluent. This pond will be developed to include natural flora and fauna (e.g., fishes and lotus flowers). There will be over flow in each pond and the final discharge will be via the factory main drainage system, which will lead to the nearest stream. In case the treated wastewater content is unsuitable to be discharged into the pond, water will be directed into the emergency storage tank and then recirculated back to the equalization pond for re-treatment.

It is expected that the effluent will meet the effluent guidelines as specified in WBG EHS Guidelines for Pesticide Manufacturing, Formulation and Packaging (2007) (*Table 3.3*). Sludge from the wastewater treatment is expected to be cleared regularly for incineration by the on-site incinerator.

Sewage from the operation workforce is expected to be generated at a rate of 10 m^3 / day, which will be treated on-site by a septic tank and seepage field.

3 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

This section sets out the relevant international and national standards that the Project will follow, including:

- Myanmar National Environmental Quality (emissions) (NEQ) Guidelines (2015);
- IFC Performance Standards (IFC PS) (2012);
- World Bank Group (WBG) Environmental Health and Safety (EHS) General Guidelines (2007); and
- WBG EHS Guidelines for Pesticide Manufacturing, Formulation and Packaging (2007).

The local Myanmar requirements on emissions from the Project (for pesticide manufacturing, formulation and packaging) are specified in the NEQ Guidelines which are noted to be the same as those recommended by the relevant WBG EHS Guidelines. As such, local emissions requirements are not presented separately.

3.1 INTERNATIONAL FINANCE CORPORATION PERFORMANCE STANDARDS

The IFC PS represent the 'policy and performance-based framework' and requirements for the ESIA and sustainable social and environmental management for the Project(1). **W**hereas the World Bank Group's EHS Guidelines provide guidance on general and industry best practice as well as recommended numerical limits for air emissions to the atmosphere, noise, liquid and solid wastes, hazardous wastes, occupational health and safety, and other aspects of industrial facilities and other types of development projects. The IFC PS includes:

- PS1 - Assessment and Management of Environmental and Social Risks and Impacts
- PS 2 - Labour and Working Conditions
- PS 3 - Resource Efficiency and Pollution Prevention
- PS 4 - Community Health, Safety and Security
- PS 5 - Land Acquisition and Involuntary Resettlement
- PS 6 - Biodiversity Conservation and Sustainable Management of Natural Resources

(1) IFC Performance Standards on Environmental and Social Sustainability, January 2012, International Finance Corporation, World Bank Group

- PS 7 - Indigenous Peoples
- P8 8 - Cultural Heritage

According to information presented on IFC Environmental and Social Review Summary (ESRS) [1], for the investment in Awba issues related to PS5: Land Acquisition and Involuntary Resettlement, PS6: Biodiversity Conservation and Sustainable Natural Resources Management, PS7: Indigenous Peoples and PS8: Cultural Heritage are not expected for the following reasons

- All the land related transactions within the context of this investment are/will be based on a willing seller: willing buyer and/or willing lessor: willing lessee and are expected to be located within industrial areas.
- During IFC appraisal, IFC obtained copies of all land lease agreements in Myanmar, which were all valid.
- Awba is not directly involved in agricultural primary production and its operating facilities are or will be developed in urban industrial sites.
- There was no presence of Indigenous Peoples or known cultural artefacts within the company's operational footprint.

As such in the current ESIA Study, it is expected that there will be no potentially significant issues related to PS5, PS6, PS7, and PS8. However, if such issues arise for the proposed HAIC, these will be addressed as appropriate by Awba in the appropriate manner.

3.2 *WORLD BANK GROUP EHS GUIDELINES*

The WBG EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). The EHS Guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology at reasonable costs.

Levels of noise, air emissions, and effluent recommended by the relevant WBG Guidelines are summarised in *Tables 3.1-3.5*. The Project should achieve compliance with these recommended levels.

[1] https://disclosures.ifc.org/#/projectDetail/ESRS/35880

Table 3.1 Noise Level Guidelines outside the Project Site Boundary

Receptor	One Hour LAeq (dBA)[a]	
	Daytime 07:00 – 2:00 (10:00 – 22:00 for Public holidays)	Night-time 22:00 -07:00 (22:00 – 10:00 for Public holidays)
Residential, institutional, educational	55	45
Industrial, commercial	70	70

Source: WBG EHS General Guidelines (2007)

[a] Equivalent continuous sound level in decibels

Table 3.2 Air Emission Levels for Pesticides

Pollutants	Units	Guideline Value
Particulate Matter	mg/Nm^3	20
Total Organic Carbon	mg/Nm^3	50
Volatile organic compounds	mg/Nm^3	20
Chloride	mg/Nm^3	5
Bromines (as HBr), Cyanides (as HCN), Fluorines (as HF), Hydrogen Sulfide	mg/Nm^3	3
Chlorine	mg/Nm^3	3
Ammonia, Gaseous Inorganic Chlorine Compounds (as HCl)	mg/Nm^3	30

Source: WBG EHS Guidelines for Pesticide Manufacturing, Formulation and Packaging (2007

Table 3.3 Effluent Levels for Pesticides

Pollutants		Unit	IFC Guideline
pH		S.U.	6-9
BOD_5		mg/L	30
COD		mg/L	150
TSS		mg/L	10-20
Oil and Grease		mg/L	10
AOX		mg/L	1
Phenol		mg/L	0.5
Arsenic		mg/L	0.1
Chromium total		mg/L	0.5
Chromium		mg/L	0.1
Copper		mg/L	0.5
Chlorinated organics		mg/L	0.05
Nitrorganics		mg/L	0.05
Mercury		mg/L	0.01
Zinc		mg/L	2
Active Ingredient (each)		mg/L	0.05
Bioassays Toxicity	Toxicity to:	TU	
	Fish		2
	Daphnia		8
	Algae		16
	Bacteria		8
Ammonia		mg/L	10

Pollutants	Unit	IFC Guideline
Total Phosphorus	°C	2

Source: WBG EHS Guidelines for Pesticide Manufacturing, Formulation and Packaging (2007)

Table 3.4 Guideline Values for Treated Sanitary Sewage Discharge and Site Runoff

Parameter	Unit	Maximum Concentration
Biological oxygen demand	mg/L	30
Chemical oxygen demand	mg/L	125
Oil and grease	mg/L	10
pH	S.U.	6-9
Total coliform bacteria	MPN/100 ml	400
Total nitrogen	mg/L	10
Total phosphorus	mg/L	2
Total suspended solids	mg/L	50

Source: Environmental Health and Safety (EHS) General Guidelines (2007) and Myanmar National Environmental Quality (Emissions) Guidelines

Table 3.5 Guideline Values for Air Emission Standards for MSW and Hazardous Waste Incinerators

Parameter	Unit	Maximum Concentration
Total Suspended Particulars	mg/m^3	10
Sulfur Dioxide	mg/m^3	50
Oxides of Nitrogen	mg/m^3	200 – 400
Hydrochloric Acid	mg/m^3	10
Dioxins and Furans	ng TEQ/m^3	0.1
Cadmium	mg/m^3	0.05 – 0.1
Carbon Monoxide	mg/m^3	50 – 150
Lead	mg/m^3	0.5 – 1
Mercury	mg/m^3	0.05 – 0.1
Total Metals	mg/m^3	0.5 – 1
Hydrogen fluoride	mg/m^3	1

Source: Environmental Health and Safety (EHS) General Guidelines (2007)

3.3 RELEVANT STANDARDS FOR THE AIR QUALITY IMPACT ASSESSMENT

For ambient air quality standards, the WBG EHS General Guidelines (2007) states that:

> *…Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines, or other internationally recognized sources*

Myanmar has established air quality standards published in the NEQ Guidelines (2015), which are noted to be the same as those specified under the WBG EHS General Guidelines (2007). Therefore, for the air quality impact assessment, where air quality standards for specific substances assessed are not specified under the WBG EHS General Guidelines (2007), the World Health Organization (WHO) or other internationally recognised sources have been referred to.

In terms of potential impacts to ecology and agriculture, local assessment criteria do not exist and the WBG do not set standards or guidelines for

protection of vegetation, however, guidelines and standards from the WHO [1] existed and are referred.

3.3.1 *Human Health*

A summary of the air quality standards that are relevant to the air quality impact assessment of the Project are shown in *Table 3.6*. These guidelines provide the basis for regulation and control of air emissions from the Project in order to prevent pollution and protect the environment and public health. These standards will be used for comparison of baseline data and predicted impacts in this air quality impact assessment unless otherwise stated.

Table 3.6 Air Quality Standards and Guidelines

Parameter	Averaging Period	Air Quality Standard (µg/m³)	Source
Nitrogen dioxide (NO_2)	Annual	40	WBG [1]
	1-hour	200	WBG
Ozone (O_3)	8-hour daily maximum	100	WBG
Particulate matter (PM_{10}) [a]	Annual	20	WBG
	24-hour	50	WBG
Particulate matter ($PM_{2.5}$) [b]	Annual	10	WBG
	24-hour	25	WBG
Sulphur dioxide (SO_2)	24-hour	20	WBG
	10-minute	500	WBG
Hydrogen Chloride (HCl)	24-hour	600	WHO [2]
Hydrogen Fluoride (HF)	1-hour	600	WHO
Cadmium (Cd)	Annual	0.005	WHO
Carbon monoxide (CO)	Annual	100,000	WHO
	8-hour	30000	WHO
	1-hour	10000	WHO
Lead (Pb)	Annual	0.5	WHO
Mercury (Hg)	Annual	1	WHO
Dioxins and Furans	24-hour	1.00×10^{-7}	Ontario [3]

1. WBG EHS General Guidelines (2007)
2. World Health Organisation (WHO) Air Quality Guidelines for Europe, 2nd edition (2000)
3. Ontario's Ambient Air Quality Criteria (2012)

3.3.2 *Ecology and Agriculture*

Air quality critical levels for the protection of sensitive ecological areas and agriculture adopted in this air quality impact assessment are presented below in *Table 3.7*. The critical level is the concentration in the atmosphere above which direct adverse effects on ecological receptors, such as plants or ecosystems may occur. These standards will be used for comparison of baseline data and predicted impacts in this air quality impact assessment unless otherwise stated.

[1] World Health Organisation (WHO) (2000) Air Quality Guidelines for Europe, 2nd Edition [Online] Available at: http://www.euro.who.int/__data/assets/pdf_file/0005/74732/E71922.pdf [Accessed 3 August 2017]

Table 3.7 Air Quality Critical Levels used for the Assessment of Impacts on Sensitive Ecological and Agricultural Receptors

Pollutant	Averaging Period and Statistic	Assessment Criteria (µg/m³) (1)
Nitrogen Oxides (NO_x)	Annual mean	30
Sulphur dioxide (SO_2)	Annual Mean	20

1. World Health Organisation (WHO) Air Quality Guidelines for Europe, 2nd edition (2000)

3.3.3 Nuisance Effects

Dust emissions from the Project site may result in nuisance issues when depositing onto surfaces, for example, property, vehicles, and washing. In addition, dust deposition can affect vegetation and agriculture due to the soiling of leaves hindering photosynthesis and the blockage of leaf pores. There is very little information available on the sensitivity of specific plants to dust soiling, however, the information that is available suggests that the guidelines for identifying the deposition rate at which nuisance at human sensitive receptors may occur is also appropriate for use as a metric for assessing the point at which significant impacts on plants may arise (1).

Dust *per se* does not pose a specific risk to human health and as such, the WBG and WHO guidelines do not include guidelines for nuisance dust. A number of organisations have set guidelines for dust deposition and these are set out in *Table 3.8*.

Table3.8 Dust Deposition Nuisance Thresholds

Potential for complaint	Measure of soiling	Data source
National Guidelines		
Nuisance: mass deposition measurements (mg/m²/day)		
Possible Nuisance	350 (monthly mean)	German Technical Instructions on Air Quality Control (TA-Luft)
Very Likely Nuisance	650	
First Loss of Amenity	133 (monthly mean)	West Australia Nuisance Standard
Unacceptable reduction in air quality	333	
Serious nuisance	200 (annual mean)	UK recommended nuisance dust deposition rate
Nuisance dust deposition	133	Malaysia air quality standard
Nuisance: soil rate measurements		
Upper limit of acceptability through soiling	20 – 25 soiling units/week	UK glass slide guideline

Where relevant these standards will be used for comparison of baseline data and predicted impacts in this air quality impact assessment unless otherwise stated.

(1) Farmer, A, M. (1993). The Effects of Dust on Vegetation – A Review. Environmental Pollution. 79, 63-75.

4 IMPACT ASSESSMENT METHODOLOGY

4.1 INTRODUCTION

This section of the ESIA Report presents the methodology used to conduct the impact assessment. This methodology has been developed by ERM and is based on international good practice. The first section summarises the scoping results from the scoping study.

4.2 SCOPING RESULTS

Scoping has been undertaken to identify the potential Area of Influence (AOI) for the Project (and thus the appropriate Study Area), to identify interactions between the Project and resources/receptors in the AOI and the impacts that could result from these interactions, and to prioritize these impacts in terms of potential significance.

This phase is intended to ensure that the IA focuses on those issues that are most important for design, decision-making, and stakeholder interest.

Scoping also has the benefit of identifying those impacts, which are not likely to be significant and hence which warrant little or no further consideration or associated data gathering.

ESIA Scoping followed a systematic process that involved the following activities:

- Gathering of information on Project activities during each phase of the Project through desktop review of information provided by Awba;
- A site visit to the Project Site and its vicinity in April 2017 to obtain preliminary information on existing site conditions as well as environmental and socio-economic receptors and/or resources;
- Identifying environmental and socio-economic receptors and/or resources identified in the AOI;
- Identifying potential interactions between Project activities and resources/receptors based on information obtained above;
- Prioritising potential interactions in terms of their likelihood to lead to significant impacts; taking into consideration the extent and nature of Project activities, and the existing condition/ sensitivities of the resources;
- Developing the ESIA ToR, which detailed the methodology and requirements of the subsequent IA Phase to address potentially significant impacts that are most likely to affect Project planning, decision-making and which are of stakeholder interest.

Potential impacts, which were not likely to be significant, and hence will need little further consideration or associated data gathering during the IA Phase, were "scoped-out" of the ESIA at this stage.

For scoping, Project activities are divided into the following phases:

- Construction Phase (including accidental events); and
- Operational Phase (including accidental events).

A Scoping Matrix displays Project activities against resources/receptors, and supports a methodical identification of the potential interactions each Project activity may have on the range of resources/receptors within the Area of Influence for the Project. Entries in the matrix cells are coloured to indicate whether:

- An interaction is not reasonably expected (white);
- An interaction is reasonably possible but none of the resulting impacts are likely to lead to significant effects (grey); or
- The interaction is reasonably possible and at least one of the resulting impacts is likely to lead to an effect that is significant (black).

All potential interactions, regardless of probability of occurrence, were considered at this stage.

A scoping exercise was undertaken as part of ESIA Study of the Project. Scoping matrix of the Project is presented in *Table 4.1*. The scoping of impacts indicates that the majority of identified potential impacts are not expected to be significant (i.e. those scoped out above). For activities predicted to have no significant impact (i.e. those in white in the Matrix), no detailed quantification, or further assessment will be conducted in this ESIA Report. For activities where possible significant effects could occur, these interactions will be assessed in more detail in *Sections 8-9* of this ESIA Report

Table 4.1 Scoping Matrix for Construction and Operation of HAIC

Project Activities	Physical Environmental							Biological Environment				Human Environment				
	Ambient Air Quality and Climate Change	Ambient Noise & Vibration	Groundwater and Surface Water Quality	Hydrology & Hydrogeology	Soil and Topography	Landscape and Visual Character	Use of Natural Resources	Terrestrial Flora	Terrestrial Fauna	Aquatic Habitat (freshwater)	Aquatic Flora & Fauna(freshwater)	Community Health and Safety	Demographic Pattern, Economy and Livelihoods	Occupational Health and Safety	Infrastructure Services	Cultural Heritage
Construction Phase																
Labour, equipment and services supply												■	■	■	■	
Transportation of equipment, materials, waste and workforce	■	■										■		■	■	
Site preparation, excavation and foundation works	■											■		■		
Use of PME for construction (e.g. generator)	■	■						■	■	■	■	■		■		
Solid waste management (non-hazardous and hazardous)			■		■	■						■		■		
Wastewater management			■				■	■	■	■	■	■		■		
Machinery maintenance / vehicle refueling			■		■		■					■		■		
Accidental Events			■		■		■	■	■	■	■	■		■		
Operational Phase																
Incineration	■											■		■		
Presence of the structures				■		■										
Labour, equipment and services supply												■	■	■	■	
Transportation of equipment, materials, waste and workforce	■	■										■		■	■	
Use of PME for plant operation (e.g. Drum Crusher)	■	■						■	■	■	■	■		■		
Solid waste management (non-hazardous and hazardous)			■		■	■						■		■		
Wastewater management			■		■		■	■	■	■	■	■		■		
Machinery maintenance / vehicle refueling			■		■		■					■		■		

Project Activities	Physical Environmental							Biological Environment				Human Environment				
	Ambient Air Quality and Climate Change	Ambient Noise & Vibration	Groundwater and Surface Water Quality	Hydrology & Hydrogeology	Soil and Topography	Landscape and Visual Character	Use of Natural Resources	Terrestrial Flora	Terrestrial Fauna	Aquatic Habitat (freshwater)	Aquatic Flora & Fauna(freshwater)	Community Health and Safety	Demographic Pattern, Economy and Livelihoods	Occupational Health and Safety	Infrastructure Services	Cultural Heritage
Accidental Events																

A summary of the impacts that were scoped out during the Scoping Phase and are not considered in this ESIA Report is provided in *Table 4.2*.

Table 4.2 Scoped Out Impacts and Rationale

Impact	Rationale for scoping out of assessment
Construction Phase	
Impacts on terrestrial and aquatic biodiversity due to construction activities	The Project will be developed within a brownfield industrial zone. As such, terrestrial and aquatic biodiversity are expected to be of negligible value with no potentially significant impacts from the development.
Impacts on air quality due to the use of PMEs	During construction of the Project, potential short-term, localized impacts to air quality may arise from gaseous emissions from equipment and vehicles. Pollutants emitted during the construction phase are likely to include NOx and NO_2, SO_2 and particulate matter (PM_{10} and $PM_{2.5}$) and remain mostly localised. Due to the nature of the construction process, emissions will not be constant and will fluctuate according to the operating periods for each activity and the equipment being used. In addition, it is expected that emissions could be managed and reduced by implementing good industry practices such as provision of site hoarding along the Project Site and proper maintenance of machinery, etc.
Operation Phase	
Impacts on terrestrial and aquatic biodiversity due to operation activities	The Project will be developed on an industrial zone and is surrounded by other industrial development. As such, terrestrial and aquatic biodiversity are expected to be of negligible value with no potentially significant impacts from the Project.

Impact	Rationale for scoping out of assessment
Impacts on hydrology, hydrogeology and landscape and visual character due to presence of the structure	Potentially significant impact to hydrology and hydrogeology is not expected since drainage channel will be constructed around the Project Site to divert the run-off. Potentially significant impact to landscape and visual character is not expected due to the Project structure since the surrounding area is planned and already been used for industrial purposes.
Impacts on air quality due to the use of PMEs	During operation of the Project, potential localized impacts to air quality may arise from gaseous emissions from equipment and vehicles. Pollutants emitted during the operation phase are likely to include NOx and NO_2, SO_2 and particulate matter (PM_{10} and $PM_{2.5}$). It is expected that emissions could be managed and reduced by implementing good industry practices such as provision of site hoarding along the Project Site and proper maintenance of machinery etc.

Findings of the Scoping Phase are presented in the Scoping Report of the Project under a separate cover (1). The ESIA ToR is extracted from the Scoping Report and appended in *Annex A*.

As presented in the ESIA ToR, potential significant impacts to air quality, noise, surface water quality, waste management, biodiversity and ecosystems, traffic management and socio-economic conditions are expected from the construction and operation of the Project. Baseline data collection, stakeholder consultation, impact assessment and the preparation of management plans been undertaken, with findings presented in *Sections 4-10* of this ESIA Report.

Priority impacts of the Project identified during the Scoping Phase, for which particular attention was paid during the current IA Phase are discussed in detail below.

4.2.1 Potential Impacts on Ambient Air Quality

Based on the nearest settlements within proximity to the Project Site, representative ASRs were identified and shown in *Figure 4.3*. Potential impacts to these ASRs are further discussed below.

Construction Phase

During the scoping site visit, it was observed that the Project Site was muddy with exposed earth works and stockpile materials. These areas associated with site preparation, excavation and foundation works together with transportation were observed to be sources of fugitive dust. Impact to air

(1) Scoping Report - Supplementary ESIA for STC Cement Plant & Associated Facilities in Myanmar, ERM, 2016.

quality from these areas and activities is considered as potentially significant given the existing unmanaged road condition at the Project Site.

Operational Phase

It is noted that an incinerator will be used for incineration of solid/hazardous waste. Point source air emission from the incinerator is considered as a potentially significant impact to the nearby ASRs and has not been assessed during local EIA study. It would be necessary to confirmed during the ESIA Study on whether the incinerator will be designed and used for incineration of both MSW and hazardous wastes, given the information provided by Awba shows that it is currently designed for MSW but both MSW and hazardous wastes are planned to be incinerated.

In addition, if not properly managed as observed during the site visit in May 2017, transportation on unpaved road may be a potentially significant impact to air quality during operation of the HAIC.

4.2.2 *Potential Impact on Ambient Noise*

Based on the nearest settlements within proximity to the Project Site, representative ASRs were identified and shown in *Figure 4.3*. Potential impacts to these NSRs are further discussed below.

Construction Phase

Noise will be generated by the plant and machinery used on site to construct the HAIC. This will include PME such as generator, cranes, backhoe etc. Noise will also be generated by vehicles transporting the materials and workforce to and from the Project Site. Noise generated during the construction phase is a nuisance to nearby NSRs (*Figure 4.3*) and is thus considered as potentially significant impact.

Operational Phase

During operation, noise will be generated from transportation related to the Project as well as use of PME for plant operation (e.g. drum crusher). Given that the plant is expected to manufacture 50% of domestic crop protection demand, the transportation volume to and from the Project Site as well as the operation may lead to potentially significant noise impacts on nearby NSRs (*Figure 4.3*).

4.2.3 *Potential Impacts on Groundwater and Surface Water Quality as well as Use of Natural Resources*

As presented in *Section 4.3*, there is a stream at the north-west corner of the Project Site. This stream is on the lowest point of the Project Site and is subjected to wastewater run-off from the Project. The stream flows to the northwest and into the villages of Nyaung Kone and Wah Net Chaung where stream water is then used for domestic purposes (washing, cleaning). Potential impacts to groundwater and surface water quality and use of these

water resources by the communities are therefore important issues to be considered in the ESIA Report.

Construction Phase

Typical construction activities (such as site preparation, excavation and foundation work etc.) can cause impacts to surface water quality through run off of unconsolidated sediments, for example, from stockpile areas. As observed during the site visits in May 2017, there appeared to be no run-off management at the Project Site and sediment-laden run-off was observed flowing to the stream at the north-west corner of the Project Site. The generation of sediment-laden run off could be transferred to the nearby Ayeyarwaddy River. In addition, poor sanitation facilities in the worker camps may lead to surface water contamination through improper sewage handling. Improper solid waste management, which was observed during the site visit, could also be a potentially significant issue to surface water quality.

No secondary containment was observed at the Project Site at the storage area of hazardous materials. Leakage from the storage area as well as from maintenance and refuelling area may result in surface water and groundwater contamination and this can have long-term deleterious effects on human and environmental health.

Operational Phase

During operation, it is expected that the same water quality issues as presented for the construction phase above may occur. In addition, treated wastewater discharge from the wastewater treatment facilities could be a potential issue if not designed properly. However, the distance between the wastewater treatment plant and the nearest stream is 1 km.

4.2.4 Potential Impacts on Soil and Topography

Improper solid waste management was observed during the site visit in May 2017, which is considered as a potentially significant issue to soil quality. In addition, there was no secondary containment at the Project Site at the storage area of hazardous materials. Leakage from the storage area as well as from maintenance and refuelling area may result in soil contamination and this can have long-term deleterious effects on human and environmental health. These impacts may occur during both the construction and operation phases and will require proper management measures.

4.2.5 Potential Impacts on Community Health and Safety

Potential impacts on community health and safety may be caused by environmental impacts to air quality, noise, surface and ground water quality as well as natural resources as discussed above.

Contractors will be engaged for supply of labour, equipment or services. Contractors' activities could be a nuisance to the local community if not

properly managed, for example, occupancy of public area for storage of construction wastes, staging areas or nuisance from workers' camps if sited near the communities.

There is also the increased risk of vehicle collisions with local residents due to increased traffic traveling to and from the Project Site during both the construction and operation phases.

4.2.6 Potential Impacts on Economy and Livelihoods

Construction Phase

The Project is expected to create the following livelihood opportunities (positive impacts) during construction:

- Contractual employment in construction phase activities, including in the supply chain; and
- Increase in business of local shops and markets, establishment of small shops etc. due to the influx of construction personnel.

Operational Phase

During operation, the Project is expected to create the following livelihood opportunities:

- Increase in business of local shops and markets, establishment of small shops etc. due to the influx of operational personnel.
- Regular employment in the operations phase, based on the requirement and skill level of the community.

4.2.7 Potential Impacts on Occupational Health and Safety

Construction Phase

In terms of occupational health and safety, issues include exposure to dust, noise and hazardous materials /wastes and physical hazards associated with the use of heavy equipment. In addition, the construction camp was observed to be not up to international standards during the site visit in May 2017, which may be a potentially significant health and safety issue to the construction workers such as not meeting the IFC PS2 guidelines on minimum living areas, provision of potable drinking water (meeting WHO parameters), electricity, and latrine services.

Operational Phase

The impacts during the operational phase will be similar to those discussed during construction of the Project.

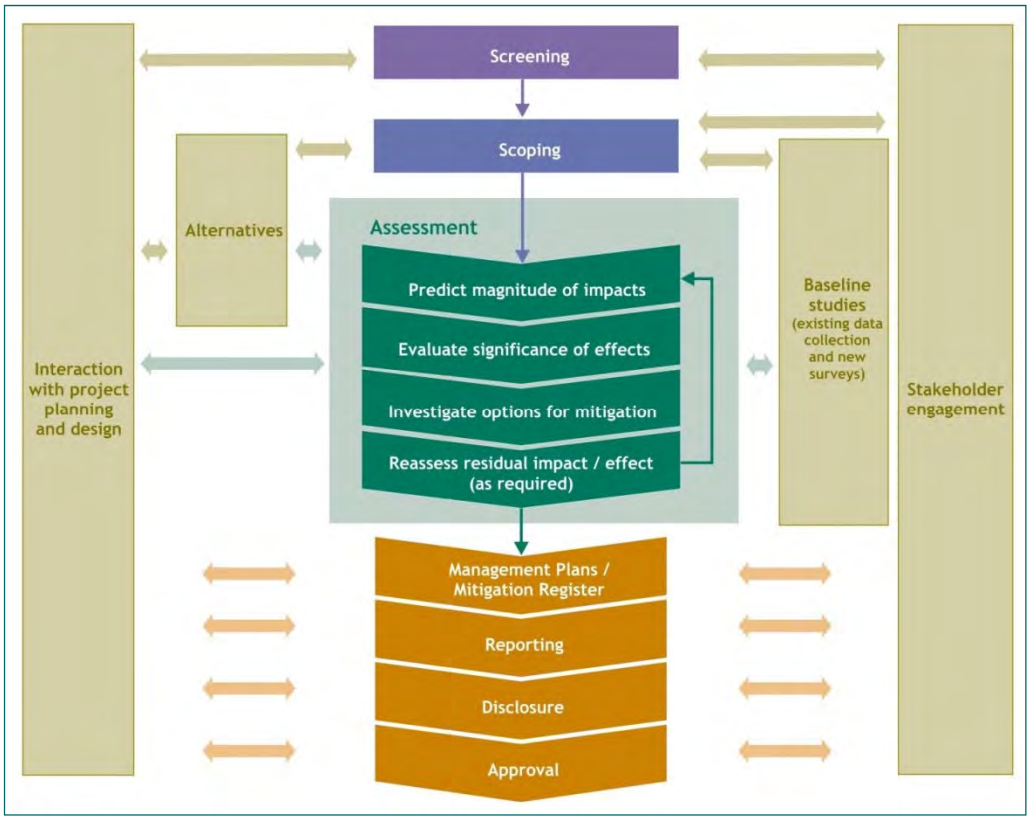
4.2.8 *Potential Impacts on Infrastructure Services*

The impacts on the road infrastructure from the Project are likely to result from the movement of equipment, material and workforce during construction. In addition, presence of workers and in-migration may place pressure on the already limited social infrastructure e.g. schools, health facilities, village roads and water supply. These impacts are expected to occur during the construction and operation phases.

4.3 *IMPACT ASSESSMENT METHODOLOGY*

The impact assessment (IA) methodology follows the overall approach illustrated in *Figure 4.1.* The IA has been undertaken following a systematic process that predicts and evaluates the impacts the Project could have on aspects of the physical, biological, and social/ socio-economic environment, and identifies measures that the Project will take to avoid, minimise/reduce, mitigate, offset, or compensate for adverse impacts; and to enhance positive impacts where practicable. The stages of the IA process are described below and further explained in the subsequent sections.

Figure 4.1 ***Impact Assessment Process***



4.3.1 *Impact Assessment*

Impact identification and assessment starts with scoping and continues through the remainder of the IA Process. The principal IA steps are summarised in *Figure 4.2* and comprise:

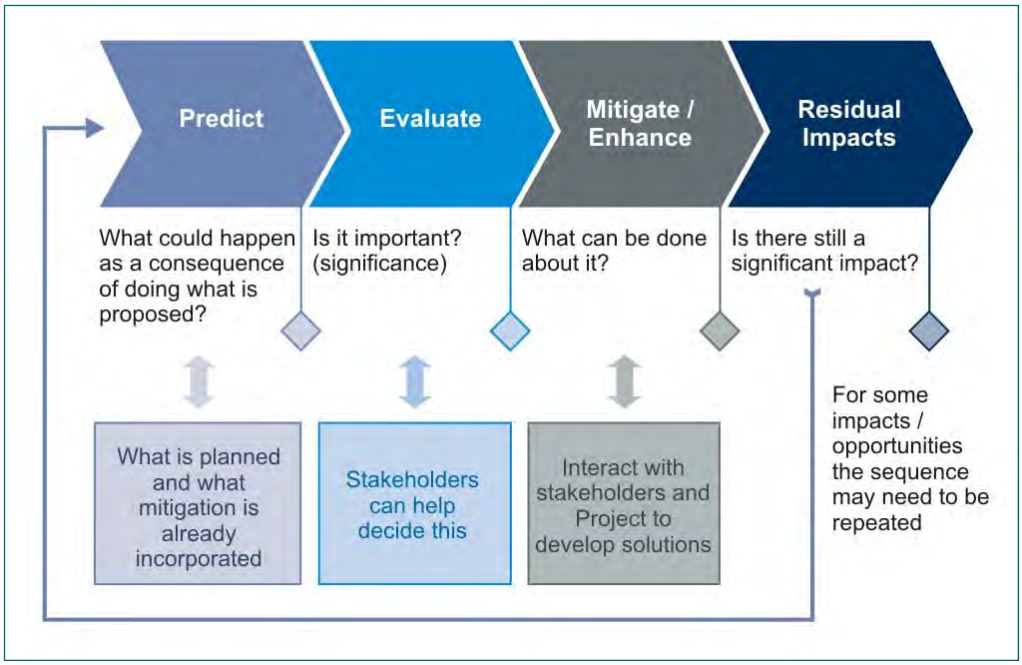
- Impact prediction: to determine what could potentially happen to resources/receptors as a consequence of the Project and its associated activities.

- Impact evaluation: to evaluate the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resource/receptor.

- Mitigation and enhancement: to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts.

- Residual impact evaluation: to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.

Figure 4.4.1 Impact Assessment Process



Prediction of Impacts

Prediction of impacts is essentially an objective exercise to determine what could potentially happen to the environment as a consequence of the Project and its associated activities. This is essentially a repeat of the process undertaken in scoping, whereby the potential interactions between the Project and the baseline environment are identified. In the impact assessment stage, these potential interactions are updated based on additional Project and baseline information. From these potential interactions, the potential impacts to the various resources/receptors are identified, and are elaborated to the extent possible. The diverse range of potential impacts considered in the IA process typically results in a wide range of prediction methods being used including quantitative, semi-quantitative and qualitative techniques.

Once the prediction of impacts is complete, each impact is described in terms of its various relevant characteristics (e.g., type, scale, duration, frequency, extent). The terminology used to describe impact characteristics is shown in *Table 4.3*.

Table 4.3 Impact Characteristic Terminology

Characteristic	Definition	Designations
Type	A descriptor indicating the relationship of the impact to the Project (in terms of cause and effect).	Direct Indirect Induced
Extent	The "reach" of the impact (e.g., confined to a small area around the Project Footprint, projected for several kilometres, etc.).	Local Regional International
Duration	The time over which a resource / receptor is affected.	Temporary Short-term Long-term Permanent
Scale	The size of the impact (e.g., the size of the area damaged or impacted, the fraction of a resource that is lost or affected, etc.)	[no fixed designations; intended to be a numerical value]
Frequency	A measure of the constancy or periodicity of the impact.	[no fixed designations; intended to be a numerical value]

The definitions for the *type* designations are shown in *Table 4.4*. Definitions for the other designations are resource/receptor-specific, and are discussed in the resource/receptor-specific sections.

Table 4.4 Impact Type Definitions

Designations (Type)	Definition
Direct	Impacts that result from a direct interaction between the Project and a resource/receptor (e.g., between occupation of a plot of land and the habitats which are affected).
Indirect	Impacts that follow on from the direct interactions between the Project and its environment as a result of subsequent interactions within the environment (e.g., viability of a species population resulting from loss of part of a habitat as a result of the Project occupying a plot of land).
Induced	Impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project (e.g., influx of camp followers resulting from the importation of a large Project workforce).

The above characteristics and definitions apply to planned and unplanned events. An additional characteristic that pertains only to unplanned events is *likelihood*. The *likelihood* of an unplanned event occurring is designated using a qualitative scale, as described in *Table 4.5*.

Table 4.5 Definitions for Likelihood Designations

Likelihood	Definition
Unlikely	The event is unlikely but may occur at some time during normal operating conditions.
Possible	The event is likely to occur at some time during normal operating conditions.
Likely	The event will occur during normal operating conditions (i.e., it is essentially inevitable).

Impact Magnitude, Receptor/Resource Sensitivity and Impact Significance

Once an impact's characteristics are defined, the next step in the impact assessment phase is to assign each impact a 'magnitude'. Magnitude is a function of some combination (depending on the resource/receptor in question) of the following impact characteristics:

- Extent
- Duration
- Scale
- Frequency

Additionally, for unplanned events only, magnitude incorporates the 'likelihood' factor discussed above.

Magnitude essentially describes the intensity of the change that is predicted to occur in the resource/receptor as a result of the impact. As discussed above, the magnitude designations themselves are universally consistent, but the definitions for these designations vary on a resource/receptor-by-resource/receptor basis, as further discussed in each of the resource/receptor-specific sections. The universal magnitude designations are:

- Positive
- Negligible
- Small
- Medium
- Large

In the case of a *positive* impact, no magnitude designation (aside from 'positive') is assigned. It is considered sufficient for the purpose of the IA to indicate that the Project is expected to result in a *positive* impact, without characterising the exact degree of positive change likely to occur.

In the case of impacts resulting from unplanned events, the same resource/receptor-specific approach to concluding a magnitude designation is utilised,

but the 'likelihood' factor is considered, together with the other impact characteristics, when assigning a magnitude designation.

The definitions for these designations vary on a resource/ receptor basis. The impact magnitude for the ley receptors are provided in *Table 4.6-4.10*.

Table 4.6 Impact Magnitude for Terrestrial Species

	Extent / Duration / Scale / Frequency
Large	May affect an entire population or species in sufficient magnitude to cause a decline in abundance and/ or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would not return that population or species, or any population or species dependent upon it, to its former level within several generations.
Medium	May affect a portion of a population and may bring about a change in abundance and/ or distribution over one or more generations, but does not threaten the integrity of that population or any population dependent on it.
Small	May affect specific group of localised individuals within a population over a short time period (one generation or less), but does not affect other trophic levels or the population itself.
Negligible	Immeasurable, undetectable or within the range of normal natural variation.

Table 4.7 Impact Magnitude for Terrestrial Habitats

	Extent / Duration / Scale / Frequency
Large	May affect the integrity of an area or region, by substantially changing, in the long term, its ecological features, structures and functions, across its whole area, that enable it to sustain the habitat, complex of habitats and/or population levels of species that makes it important.
Medium	May affect some, if not all, of the area's ecological features, structures and functions in the short or medium term. The area or region may be able to recover through natural regeneration and restoration.
Small	May cause some minor impacts of limited extent, or to some elements of the area, are evident but easy to recover through natural regeneration.
Negligible	Immeasurable, undetectable or within the range of normal natural variation.

Table 4.8 Impact Magnitude for Water Quality

	Extent / Duration / Scale / Frequency
Large	Change in water quality over a large area that lasts over the course of several months with quality likely to cause secondary impacts on marine ecology; and/or Routine exceedance of benchmark effluent discharge limits.
Medium	Temporary or localised change in water quality with water quality returning to background levels thereafter and/or occasional exceedance of benchmark effluent discharge limits.
Small	Slight change in water quality expected over a limited area with water quality returning to background levels within a few metres and/or discharges are well within benchmark effluent discharge limits.
Negligible	Immeasurable, undetectable or within the range of normal natural variation.

Table 4.9 Impact Magnitude for Local Communities

	Extent / Duration / Scale / Frequency
Large	Change dominates over baseline conditions. Affects the majority of the area or population in the area of influence and/or persists over many years. The impact may be experienced over a regional or national area.

	Extent / Duration / Scale / Frequency
Medium	Clearly evident difference from baseline conditions. Tendency is that impact affects a substantial area or number of people and/or is of medium duration. Frequency may be occasional and impact may potentially be regional in scale.
Small	Perceptible difference from baseline conditions. Tendency is that impact is local, rare and affects a small proportion of receptors and is of a short duration.
Negligible	Change remains within the range commonly experienced within the household or community.

Table 4.10 Impact Magnitude for Air Pollutants

Magnitude of impact	Non-degraded airshed (i.e. baseline < AQS)	Degraded airshed (i.e. baseline > AQS)
Negligible	PC <25% of AQS	PC <10% of AQS
Small	PC between 25% and 50% of AQS and PEC <100% of AQS	PC between 10% and 30% of AQS
Medium	PC between 50% and 100% of AQS, and PEC <100% AQS; or PC between 25% and 50% of AQS, and PEC >100% of AQS	PC between 30% and 50% of AQS
Large	PC > 100% of AQS; or PC > 50% of AQS, and PEC >100% of AQS	PC > 50% of AQS

PC: Process Contribution
PEC: Predicted Environmental Concentration
AQS: Air Quality Standard

The other principal impact evaluation step is definition of the sensitivity (including vulnerability and importance) of the impacted resource/receptor. Other factors may also be considered, such as legal protection, government policy, stakeholder views, and economic value.

As in the case of magnitude, the sensitivity designations themselves are universally consistent, however, the definitions for these designations vary on a resource/receptor basis. The universal sensitivity/ vulnerability/ importance designations are: Low; Medium; and High.

The receptor sensitivities for key receptors are provided in *Table 4.11-4.15*.

Table 4.11 Receptor Sensitivity for Terrestrial Habitat

Category	Designation / Importance / Vulnerability
High	A habitat that has designated conservation status at an international scale (e.g. IUCN). Areas of particular biodiversity importance that may support populations of restricted range, endemic or endangered species, or is in itself unique or threatened.
Medium	A habitat that has designated conservation status at a national or regional scale. Areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition.
Low	A habitat not protected by law.

Category	Designation / Importance / Vulnerability
	Areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition.

Table 4.12 Receptor Sensitivity for Terrestrial Species

Category	Designation / Importance / Vulnerability
High	A species population that has designated conservation status at an international scale (e.g. IUCN). A species that is globally rare. A keystone species fundamental to the functioning of the ecosystem.
Medium	A species population that has designated conservation status at a national or regional scale. A species common globally but rare locally. Important to ecosystem functions or under threat or population in decline.
Low	A species not protected by law. Not critical to other ecosystem functions (e.g. as prey to other species or as predator to potential pest species) or common / abundant locally.

Table 4.13 Receptor Sensitivity for Water Quality

Category	Designation / Importance / Vulnerability
High	Existing water quality is already under stress and/ or the ecological resources it supports are very sensitive to change (secondary ecological or health impacts are likely).
Medium	Existing water quality already shows some signs of stress and/ or supports ecological resources that could be sensitive to change in water quality.
Low	Existing water quality is good and the ecological resources that it supports are not sensitive to a change in water quality.

Table 4.14 Receptor Sensitivity for Local Communities

Category	
High	Profound or multiple levels of vulnerability that undermine the ability to adapt to changes brought by the Project.
Medium	Some but few areas of vulnerability; but still retaining an ability to at least in part adapt to change brought by the Project.
Low	Minimal vulnerability; consequently with a high ability to adapt to changes brought by the Project and opportunities associated with it.

Table 4.15 Receptor Sensitivity for Air Pollutants

Receptor Sensitivity	Human Health	Ecology
High	Hospitals	Internationally Designated Sites
Medium	General Population	Nationally Designated Sites
Low	n/a	· Locally Designated Sites (Areas of specific ecological interest not subject to statutory protection) · Agriculture

Once magnitude of impact and sensitivity/vulnerability/importance of resource/receptor have been characterised, the significance can be assigned

for each impact. Impact significance is designated using the matrix shown in *Figure 4.3*.

Figure 4.3 Impact Significances

		Sensitivity/Vulnerability/Importance of Resource/Receptor		
		Low	Medium	High
Magnitude of Impact	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

The matrix applies universally to all resources/receptors, and all impacts to these resources/receptors, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity/vulnerability/ importance designations that enter into the matrix.

Box 4.1 provides a context for what the various impact significance ratings signify.

It is important to note that impact prediction and evaluation take into account any embedded controls (i.e., physical or procedural controls that are already planned as part of the Project design, regardless of the results of the IA Process). An example of an embedded control is a standard acoustic enclosure that is designed to be installed around a piece of major equipment. The avoids the situation where an impact is assigned a magnitude based on a hypothetical version of the Project that considers none of the embedded controls.

Identification of Mitigation and Enhancement Measures

Once the significance of an impact has been characterised, the next step is to evaluate what mitigation and enhancement measures are warranted. For the purposes of this IA, ERM has adopted the following Mitigation Hierarchy:

- **Avoid at Source; Reduce at Source**: avoiding or reducing at source through the design of the Project (e.g., avoiding by siting or re-routing activity away from sensitive areas or reducing by restricting the working area or changing the time of the activity).
- **Abate on Site**: add something to the design to abate the impact (e.g., pollution control equipment, traffic controls, perimeter screening, and landscaping).
- **Abate at Receptor**: if an impact cannot be abated on-site then control measures can be implemented off-site (e.g., noise barriers to reduce noise impact at a nearby residence or fencing to prevent animals straying onto the site).
- **Repair or Remedy**: some impacts involve unavoidable damage to a resource (e.g. agricultural land and forestry due to creating access,

work camps or materials storage areas) and these impacts can be addressed through repair, restoration or reinstatement measures.

- **Compensate in Kind; Compensate Through Other Means**: where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g., planting to replace damaged vegetation, financial compensation for damaged crops or providing community facilities for loss of fisheries access, recreation and amenity space).

The priority in mitigation is to first apply mitigation measures to the source of the impact (i.e., to avoid or reduce the magnitude of the impact from the associated Project activity). Then to address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (i.e., to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

Box 4.1 Context of Impact Significances

An impact of **negligible** significance is one where a resource/receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.

An impact of **minor** significance is one where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small (with or without mitigation) and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards.

An impact of **moderate** significance has an impact magnitude that is within applicable standards, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.

An impact of **major** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of IA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

Residual Impact Evaluation

Once mitigation and enhancement measures are declared, the next step in the IA Process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the

assumed implementation of the additional declared mitigation and enhancement measures.

Management and Monitoring

The final stage in the IA Process is definition of the management and monitoring measures that are needed to identify whether: a) impacts or their associated Project components remain in conformance with applicable standards; and b) mitigation measures are effectively addressing impacts and compensatory measures and offsets are reducing effects to the extent predicted.

An ESMP, which contains a summary of all actions which the Project Proponents have committed to executing with respect to environmental/social/health performance for the Project, is also included as part of the ESIA Report. The ESMP includes mitigation measures, compensatory measures and offsets, and management and monitoring activities.

5 ENVIRONMENTAL BASELINE

This Section is structured to provide information on the environmental baseline characteristics and conditions in the Project Site and its Area of Influence (AOI). The discussion is limited to the factors and environmental components that could have a direct impact on the Project, or which may be impacted by the Project.

Baseline information has been collated from a range of sources including publicly available information, primary data collection and through consultation. Primary data collection was undertaken through a scoping site visit in May 2017 as well as the baseline surveys of air quality, airborne noise, surface water quality and soil quality in June to July 2017 (2017 baseline surveys).

5.1 AREA OF INFLUENCE

The Area of Influence (AOI) of the Project encompasses:

- Primary Project Site including the proposed HAIC; and
- Areas potentially affected by the cumulative impacts from other developments as well as induced activities of the Project.

It should be noted that the AOI for a particular resource/ receptor may vary depending on the nature of the change caused by the Project activities and the type of effect being considered, but in each case it is defined to include all the area within which it is likely that potentially significant impacts could result. For example, a 600 m AOI may be considered sufficient for noise given the localised nature of noise impacts while the AOI for water quality impacts due to uncontrolled runoff from the Project Site may be considered sufficient from the stream in the north-west corner of the Project Site to the War Net Chaung village 3 km downstream. As such, for a specific resource / receptor / impact, the AOI will be discussed and refined as appropriate.

5.2 AIR QUALITY

5.2.1 Overview

Taking into account the nature of activities during the construction and operation phases of the Project and the relative locations of sensitive receptors, an AOI of 500 m and 5 km around the Project Site has been established for the construction and operational phases, respectively, for the Air Quality Impact Assessment. The AOIs have been determined so that all potentially impacted sensitive receptors closest to the Project activities during both construction and operation phase have been identified.

Sensitive receptors are split into two categories, which are identified within the Project AOI as described below.

- Human – these are locations of human settlement, schools, hospitals, clinics and government offices. The relevant pollutants of interest for sensitive human receptors are particulate matter as dust, PM_{10} and $PM_{2.5,}$ NO_2, NO_x and SO_2.

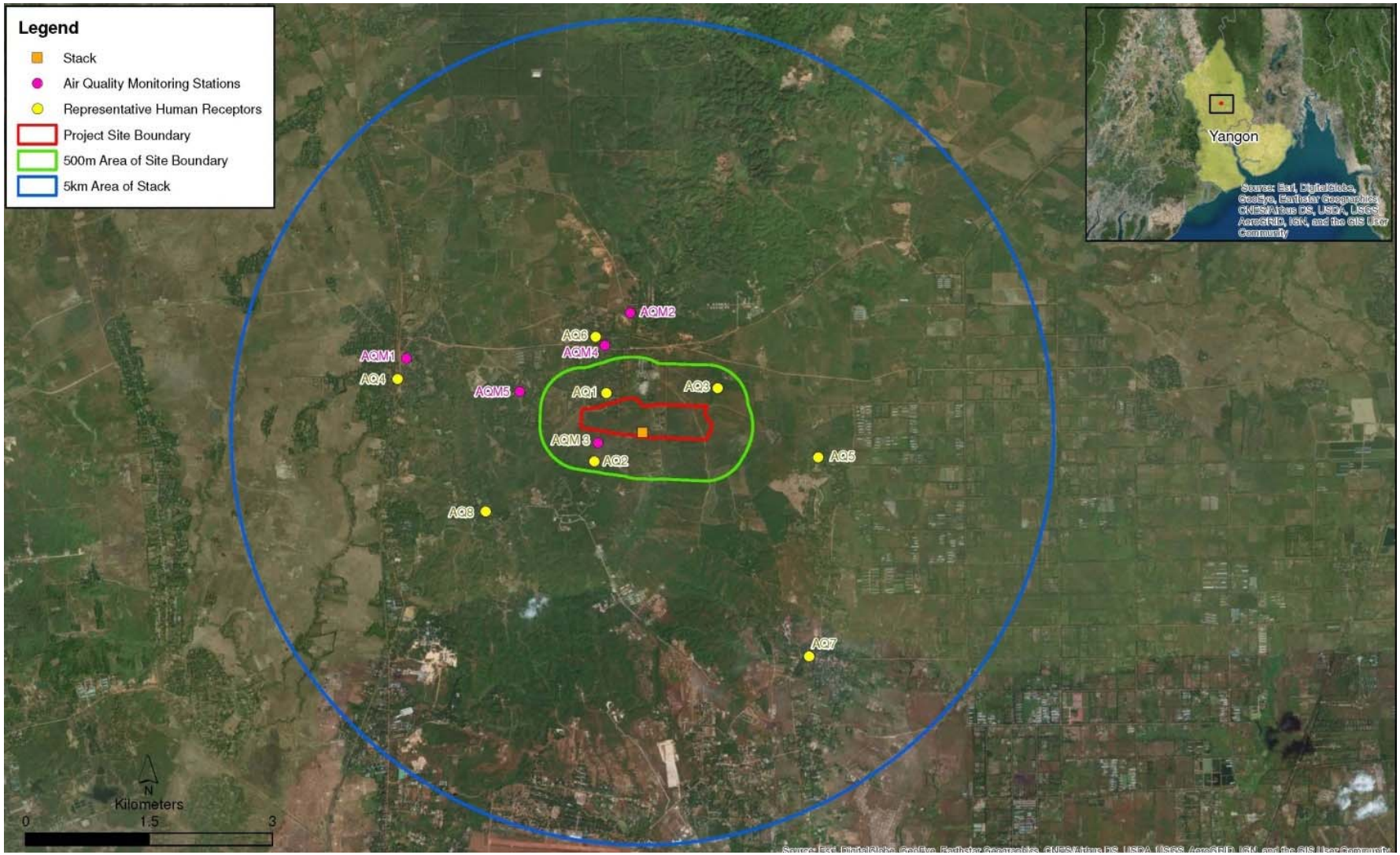
- Agricultural - these are locations where there are crop growing activities, as crop growth may be detrimentally affected and crops soiled as a result of project activities. The relevant pollutants of interest for sensitive agricultural receptors are particulate matter as dust, SO_2 and NO_x.

A number of representative human sensitive receptors and agricultural areas were identified in the vicinity of the Project Site as presented in *Table 5.1* and *Figure 5.1*. For the operational air quality impact assessment, a select number of representative human receptors spatially distributed around the incinerator stack location have been identified. Detailed information on these is presented in *Table 5.1*.

Table 5.1 Representative Human Receptors

Receptor ID	Type of Receptor	Location		Approximate Distance to Stack (km)
		Latitude	Longitude	
AQ1	Human	17°10'15.25"N	96° 4'26.86"E	<0.7
AQ2	Human	17° 9'48.27"N	96° 4'22.35"E	<0.7
AQ3	Human	17°10'17.89"N	96° 5'12.54"E	<1.1
AQ4	Human	17°10'19.59"N	96° 3'1.04"E	<3.1
AQ5	Human	17° 9'51.22"N	96° 5'54.35"E	<2.2
AQ6	Human	17°10'37.35"N	96° 4'22.09"E	<1.3
AQ7	Human	17° 8'32.74"N	96° 5'51.75"E	<3.4
AQ8	Human	17° 9'27.86"N	96° 3'37.90"E	<2.2

Figure 5.1 Representative Air Sensitive Receptors around the Project Site



In accordance with WBG guidelines [1], measurement of existing air quality is required for emissions associated with the Project processes over time that have potential to impact the surrounding land use.

Ambient concentrations of NO_2 and SO_2 were measured by means of a diffusion tube survey undertaken by ERM in June to July 2017. Ambient concentrations of $PM_{2.5}$ and PM_{10} were measured using the Haz-Scanner Environmental Perimeter Air Station (EPAS) [2] operated by a specialist subcontractor under the supervision of ERM.

The findings from both surveys are presented in the following section.

5.2.2 Monitoring Methodology

Ambient air quality monitoring was undertaken between 30 June and 17 July 2017 to provide an indication of current concentrations of PM_{10}, $PM_{2.5}$, NO_x, NO_2, and SO_2 in ambient air and to inform the air quality impact assessment.

Air quality monitoring (AQM) locations (see *Figure 5.1*) were selected by identifying potentially affected communities, with consideration given to the prevailing wind conditions and Project activities. There is limited local monitoring of meteorology and therefore the Weather Research and Forecasting Model (WRF) data [3] was used to generate meteorological data for the purpose of reviewing climatic conditions, review regional air quality and identify representative sensitive receptors. The final decision on AQM locations was made while in the field to determine the most suitable and representative locations for monitoring equipment to be deployed.

A total of five (5) air quality monitoring sites were established at locations in the vicinity of the Project (*Figure 5.1*). Information regarding the monitoring locations and period of monitoring are presented in *Table 5.2*. In most cases, monasteries were identified as monitoring locations due to their accessibility and security. At each monitoring location, measurements of NO_x, NO_2 and SO_2 were undertaken using Palmes type diffusion tubes and measurements of PM_{10} and $PM_{2.5}$ were undertaken using the EPAS.

Representative photos taken at the AQM stations are shown in *Figures 5.2-6*.

(1) International Finance Corporation (IFC) (2007) Environmental, Health and Safety Guideline: Air Emissions and Ambient Air Quality

(2) Haz-Scanner Environmental Perimeter Air Station (EPAS). Specifications available online at: http://www.skcinc.com/catalog/pdf/instructions/1801.pdf [Accessed 03 August 2017]

(3) Skamarock, W. C., J. B. Klemp, J. Dudhia, D. O. Gill, D. M. Barker, M. G Duda, X.-Y. Huang, W. Wang, and J. G. Powers, 2008: A Description of the Advanced Research WRF Version 3. NCAR Tech. Note NCAR/TN-475+STR, 113 pp.

Table 5.2 Air Quality Monitoring Summary

Site	Land-use	Location		Monitoring	Period	Duration (hours)
		Latitude	Longitude			
AQM1	Monastery	17°10'27.70"	96° 3'4.36"	NO_2, SO_2	30/06/2017 – 17/07/2017	406
				$PM_{2.5}$, PM_{10}	30/06/2017 – 01/07/2017	24
AQM2	Primary School	17°10'46.97"	96° 4'36.16"	NO_2, SO_2	30/06/2017 – 17/07/2017	404
				$PM_{2.5}$, PM_{10}	01/07/2017 – 02/07/2017	24
AQM3	Monastery	17° 9'55.55"	96° 4'23.67"	NO_2, SO_2	30/06/2017 – 17/07/2017	405
				$PM_{2.5}$, PM_{10}	02/07/2017 – 03/07/2017	24
AQM4	Monastery	17°10'34.00"	96° 4'25.95"	NO_2, SO_2	30/06/2017 – 17/07/2017	404
				$PM_{2.5}$, PM_{10}	03/07/2017 – 04/07/2017	24
AQM5	Monastery	17°10'15.30"	96° 3'51.27"	NO_x, NO_2, SO_2	30/06/2017 – 17/07/2017	403
				$PM_{2.5}$, PM_{10}	04/07/2017 – 05/07/2017	24

Figure 5.2 Air Quality Monitoring Station at AQM1: War Net Chaung Village

Figure 5.3 Air Quality Monitoring Station at AQM2: Tha Pyay Kone Village

Figure 5.4 Air Quality Monitoring Station at AQM3: Monastery near the Project Site

Figure 5.5 Air Quality Monitoring Station at AQM4: Yae Tar Shae Village

Figure 5.6 Air Quality Monitoring Station at AQM5: Nyaung Kone Village

Diffusion tubes are passive samplers that consist of small plastic tubes, which contain a chemical reagent to absorb the pollutant to be measured directly from the air. The preparation and analysis of the diffusion tubes is undertaken to British Standard (BS) EN 13528. The technique is widely recognised internationally, including by the IFC, US EPA, and UK

Environment Agency. There is best practice guidance, adopted by this assessment, available from the US EPA [1] and from the UK Department for the Environment, Food and Rural Affairs (DEFRA) [2] on the siting and deployment of tubes. The analysis of the exposed tubes is completed through Ion Chromatography (United Kingdom Accreditation Service (UKAS) Accredited Method ISO/IEC 17025:2005).

The EPAS is a portable real time continuous air quality monitor capable of simultaneously monitoring both $PM_{2.5}$ and PM_{10} in ambient air using 90° infrared light scattering technology.

5.2.3 *Baseline Results and Summary – NO_x, NO_2 and SO_2*

The monitoring data from the air quality survey undertaken between 30 June and 17 July 2017 for NO_x, NO_2, and SO_2 are presented below in *Table 5.3*.

The diffusion tube data have conservatively been used to represent indicative annual background concentrations of NO_x, NO_2, and SO_2. A review of the baseline data collected concludes that the baseline concentrations are consistently below the relevant annual air quality standards. Baseline concentrations of SO_2 were found to be low and below the limit of detection at all monitoring sites.

Table 5.3 Derived Long Term NO_x, NO_2 and SO_2 Background Concentrations

Site	Land-use	Tube No.	NO_x	NO_2	SO_2[1]
				µg/m³	
AQM1	Residential	1	-	4.70	<1.63
		2	-	<0.93	<1.63
		3	-	4.18	<1.63
AQM2	Residential	1	-	4.08	<1.64
		2	-	3.43	<1.64
		3	-	4.66	<1.64
AQM3	Residential	1	-	3.53	<1.64
		2	-	4.34	<1.64
		3	-	4.49	<1.64
AQM4	Residential	1	-	5.28	<1.64
		2	-	4.69	<1.64
		3	-	4.31	<1.64
AQM5	Residential	1	12.2	4.61	<1.64
		2	-	4.92	<1.64
		3	-	4.66	<1.64
Average			12.2	4.42	1.64[2]
WHO Annual Mean Air Quality Standard (Human Health)			*n/a*	40	*n/a*
WHO Annual Mean Air Quality Standard (Agriculture)			30	*n/a*	20

(1) United States Environmental Protection Agency (USEPA) Ambient Monitoring Technology Information Centre [Online] Available at: https://www3.epa.gov/ttn/amtic/ [Accessed 08 August 2017]

(2) AEA Energy and Environment on behalf of the Department for Environment, Food and Rural Affairs (Defra) and the Devolved Administrations (2008) Diffusion Tubes for Ambient NO_2 Monitoring: Practical Guidance for Laboratories and Users [Online] Available at: https://laqm.defra.gov.uk/documents/0802141004_NO2_WG_PracticalGuidance_Issue1a.pdf [Accessed 08 August 2017]

Site	Land-use	Tube No.	NO_x	NO_2	SO_2[1]
				µg/m³	
Status of airshed in Study Area[3]			Non-degraded	Non-degraded	Non-degraded

(1) Results reported as <0.03µgS on tube are below the detection limit.
(2) The detection limit will be used as indicative of the long term background as a conservative approach.
(3) Status of airshed based on the average concentration across all five monitoring sites.

The baseline also needs to be interpreted for short term periods to compare against the short term air quality standards where relevant. DEFRA (1) recommends that the short term baseline is derived by multiplying the long term by a factor of two. Furthermore, DEFRA sets out conversion factors for converting between the one hour and 24 hour periods. To compare against the SO_2 10-minute averaging period, the power law (2) has been applied to the derived hourly SO_2 baseline data.

These conversions have been undertaken to provide baseline concentrations for comparison against the short term air quality standards presented in *Table 3.6*. The results from applying this methodology are presented below in *Table 5.4*. The results at each monitoring site are based on the median value from the triplicate diffusion tube data set presented in *Table 5.3* to remove outlying values.

Table 5.4 Derived Short Term NO_x, NO_2 and SO_2 Background Concentrations

Site	NO_2	SO_2	
	1-hour	10-minute	24-hour
AQM1	8.36	4.69	1.94
AQM2	8.16	4.69	1.94
AQM3	8.68	4.69	1.94
AQM4	9.38	4.69	1.94
AQM5	9.32	4.69	1.94
Average[1]	8.78	4.69	1.94
Air Quality Standard (Human Health)	200	500	20
Status of airshed in study area[2]	Non-degraded	Non-degraded	Non-degraded

(1) Average across all five sites
(2) Based on the average concentration.

The results from the monitoring conducted in the AOI indicated that ambient concentrations of NO_x, NO_2 and SO_2 are likely to be below the relevant air quality standards. The receiving airshed in the area can therefore be classified as 'non-degraded' with regard to the aforementioned pollutants. The magnitude of the impact to air quality is defined based on this finding.

5.2.4 Baseline Results and Summary – $PM_{2.5}$ and PM_{10}

The monitoring data from the air quality survey undertaken between 30 June and 5 July 2017 for $PM_{2.5}$ and PM_{10} are presented below in *Table 5.5*.

(1) Department for Environment, Food and Rural Affairs (DEFRA) (2016) Air emissions risk assessment for your environmental permit [Online] Available from: https://www.gov.uk/guidance/air-emissions-risk-assessment-for-your-environmental-permit [Accessed 03 August 2017]

(2) Environmental Protection Agency (EPA) (1970) Workbook of Atmospheric Dispersion Estimates [Online] Available at: http://www.dot.ca.gov/newtech/researchreports/1969-1970/70-07.pdf [Accessed 03 August 2017]

The data was collected continuously over a 24-hour period at each location and are used as an indication of average daily background concentrations in the AOI. A review of the information collected indicates that the ambient concentration of $PM_{2.5}$ exceeds the air quality standard at AQM1 and AQM3 and is below at all other monitoring locations. On average across the AOI, the $PM_{2.5}$ concentration is below the relevant air quality standard and the airshed can therefore be classified as non-degraded on this basis. With regard to PM_{10}, the monitoring results indicated that ambient concentrations over the 24-hour period are below the relevant air quality standard at all monitoring locations and thus the airshed can be classified as non-degraded on this basis.

Table 5.5 $PM_{2.5}$ and PM_{10} Background Concentrations (24-hour Average)

Site	Land-use	$PM_{2.5}$	PM_{10}
		µg/m³	
AQM1	Residential	**29**	39
AQM2	Residential	17	30
AQM3	Residential	**26**	41
AQM4	Residential	21	24
AQM5	Residential	20	34
Average(1)		**23**	**34**
WHO 24-hour Mean Air Quality Standard (Human Health)		25	50
Status of airshed in study area(2)		Non-degraded	Non-degraded

(1) Average across all five sites

(2) Based on the average concentration across all five monitoring sites.
Note; values exceeding the standard limits are shown in red

The baseline also needs to be interpreted for long term periods. By applying the DEFRA approach, the long term baseline is derived by dividing the short term by a factor of two.

These conversions have been undertaken to provide baseline concentrations for comparison against the long term air quality standards for $PM_{2.5}$ and PM_{10} as presented in *Table 3.6*. The results from applying this methodology are presented below in *Table 5.6*.

Table 5.6 Derived Long Term $PM_{2.5}$ and PM_{10} Background Concentrations

Site	Land-use	$PM_{2.5}$	PM_{10}
		µg/m³	
AQM1	Residential	**14.5**	19.5
AQM2	Residential	8.5	15
AQM3	Residential	**13**	20.5
AQM4	Residential	**10.5**	12
AQM5	Residential	10	17
Average(1)		**11.3**	16.8
WHO Annual Mean Air Quality Standard (Human Health)		10	20
Status of airshed in study area(2)		Degraded	Non-Degraded

(1) Average across all five sites

(2) Based on the average concentration.
Note; values exceeding the standard limits are shown in red

The results from the monitoring conducted in the AOI indicated that long term ambient concentrations of $PM_{2.5}$ exceed the relevant air quality standard at four (4) out of five (5) monitoring stations and the combined average is also in exceedance. The results from the monitoring conducted in the study area indicate that the long term ambient concentrations of PM2.5 exceed the WHO standard specified at four out of five monitoring stations. The combined average across all monitoring sites is also found to exceed the Myanmar National Environmental (Emissions) Quality Standards. Concentrations of PM_{10} exceed the relevant standard at only one (1) of five (5) stations and the combined average is below the air quality standard. The airshed in the AOI with regard to long term air quality has therefore been classified as degraded and non-degraded for $PM_{2.5}$ and PM_{10}, respectively.

5.3 CLIMATE AND METEOROLOGY

In order to define the baseline meteorology and climate, hourly sequential meteorological data are required for:

- Wind speed;
- Wind direction;
- Precipitation;
- Relative humidity;
- Temperature; and
- Cloud cover.

Following IFC recommendations, data is required for five (5) years in order to capture year on year variability. These data are also used in the air quality impact assessment.

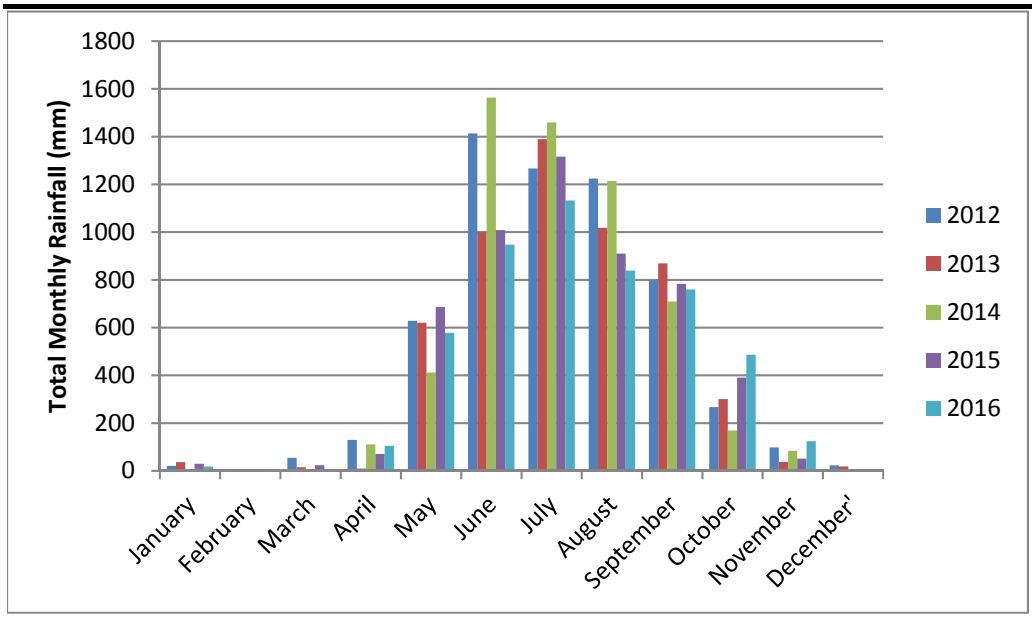
There are no meteorological stations in the vicinity of the Project Site that capture all these parameters or have sufficient data availability. Therefore five years of meteorological data were modelled using a 12 km x 12 km grid resolution using the Weather Research and Forecasting Model (WRF) [1]. The WRF model is a next-generation mesoscale numerical weather prediction system designed for both atmospheric research and operational forecasting needs. The model is extensively validated using actual observations to ensure the best possible accuracy and precision.

Figures 5.7-11 illustrate the monthly meteorological characteristics at the Project Site for a five year period from 2012 to 2016 inclusive. The figures have been created using the WRF data discussed previously. The data show that the climate of the AOI is characterised by a dry season that occurs

[1] Skamarock, W. C., J. B. Klemp, J. Dudhia, D. O. Gill, D. M. Barker, M. G Duda, X.-Y. Huang, W. Wang, and J. G. Powers, 2008: A Description of the Advanced Research WRF Version 3. NCAR Tech. Note NCAR/TN-475+STR, 113 pp.

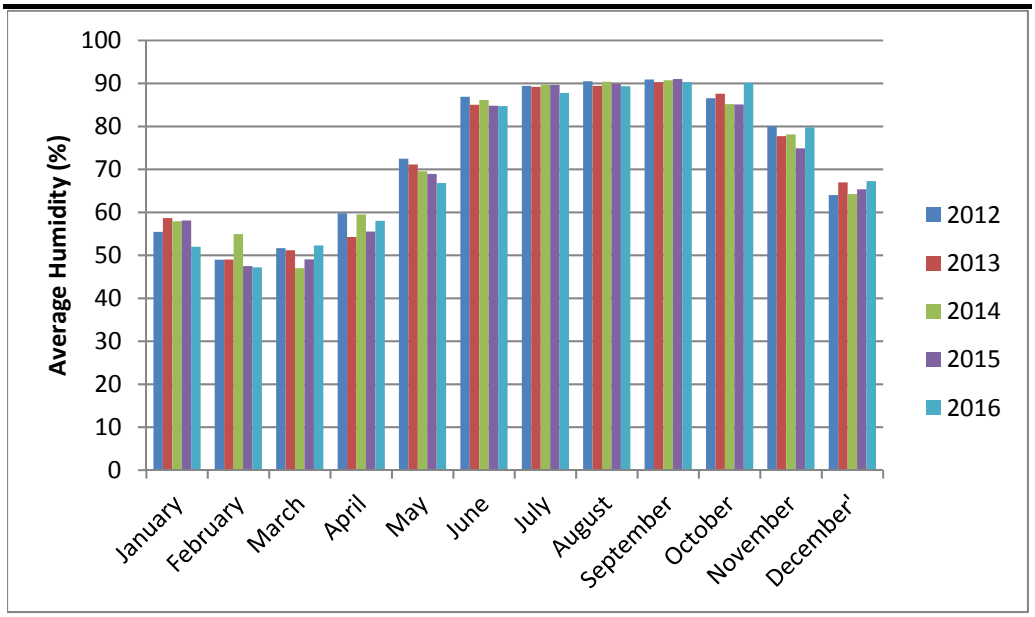
between December and April and prevailing winds that blow from the south west.

Figure 5.7 ***Total Monthly Rainfall***



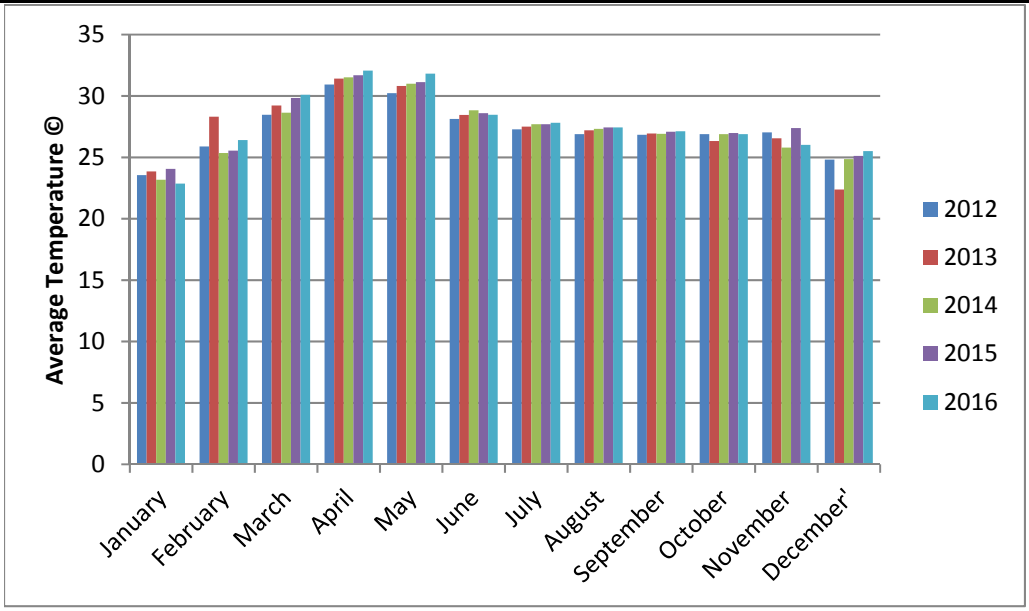
Modelled using the Weather Research and Forecasting Model (WRF)

Figure 5.8 ***Relative Humidity***



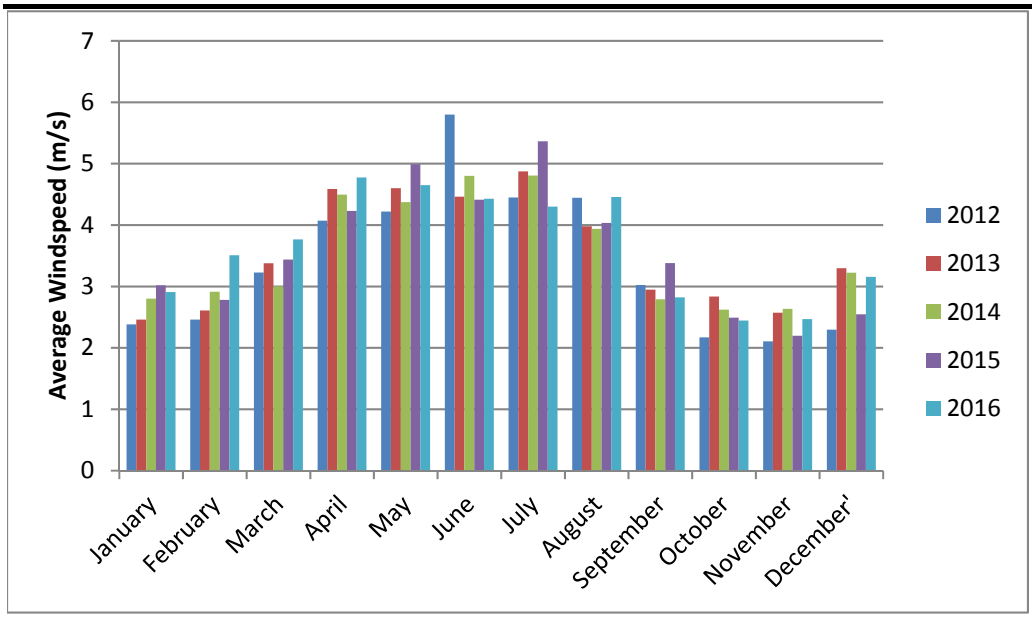
Modelled using the Weather Research and Forecasting Model (WRF)

Figure 5.9 Mean Monthly Temperature



Modelled using the Weather Research and Forecasting Model (WRF)

Figure 5.10 Mean Wind Speed



Modelled using the Weather Research and Forecasting Model (WRF)

Figure 5.11 Wind Rose 2012 - 2016

Figure 5.7 indicates that most rainfall is received at the Project Site from May to October, with June, July and August being the most consistently wet months in comparison to the rest of the year.

Relative humidity is presented in *Figure 5.8.* The modelled data show that humidity in the area is highest from July through to September with February and March recorded as the least humid. The average temperatures presented in *Figure 5.9* correlate with average humidity with the highest average temperatures recorded during periods of low relative humidity.

Mean wind speeds are presented in *Figure 5.10.* Higher wind speeds are more pronounced from April through to August, with lowest mean wind speeds generally found in October and November.

A wind roses based on the WRF data is shown in *Figure 5.11.* The figure shows that south west winds dominate. Wind speeds average 3.54 m/s, with a maximum one hour average of 12.5 m/s. Wind direction and wind speed are both important factors when considering air pollution dispersion. Prevailing winds mean receptors downwind are more likely to be exposed to increased concentrations with higher wind speeds leading to increased dispersion.

5.4 AMBIENT NOISE

Existing noise sensitive receivers (NSR) located near the Project site have been identified that may be potentially affected by the Project during construction and operation phases. Baseline noise monitoring was conducted at representative NSRs to establish the background noise levels in these areas. The location of baseline monitoring station is summarised in *Table 5.7* and is presented in *Figure 5.12*. Representative photos of the NSRs are presented in *Figures 5.13-17*.

Table 5.7 Location of Baseline Noise Monitoring Station

Station ID	Description	GPS Coordinates	
NSR1	War Net Chaung Village	17°10'27.70"N	96°3'4.36"E
NSR2	Tha Pyay Kone Village	17°10'46.97"N	96°4'36.16"E
NSR3	Monastery near the factory	17°9'55.55"N	96°4'23.67"E
NSR4	Yae Tar Shay Village	17°10'34.00"N	96°4'25.95"E
NSR5	Nyaung Kone Village	17°10'15.30"N	96°3'51.27"E

Baseline noise monitoring was conducted in June and July 2017. Hourly A-weighted equivalent continuous sound pressure levels ($L_{Aeq, 1\ hour}$) were recorded continuously for 24 hours. Daytime and night-time noise levels in L_{Aeq} were calculated by averaging the hourly sound pressure levels measured during the 24-hour period between 0700 and 2200 hours and between 2200 to 0700 hours, respectively.

Noise levels (L_{Aeq}) were recorded using a Type II sound level meter at about 1.5 m above ground with no reflecting surface nearby in accordance with the Myanmar NEQ and IFC guidelines. Sampling frequency was at 0.2-second interval for 24 hours continuously. Sound level meter employed for the baseline noise monitoring and the measurement parameter are summarised in *Table 5.8* with the detailed monitoring schedule shown in *Table 5.9*.

Table 5.8 Equipment Used for Baseline Noise Monitoring and Measurement Parameters

Sound Level Meter	Measurement Parameters
Lutron SL-0423SD	Sound Pressure Level, $L_{Aeq, 0.2s}$, dB(A)

Table 5.9 Monitoring Schedule

Station ID	Description	Measurement Schedule
NSR1	War Net Chaung Village	30 June – 1 July 2017
NSR2	Tha Pyay Kone Village	1 – 2 July 2017
NSR3	Monastery near the factory	2 – 3 July 2017
NSR4	Yae Tar Shay Village	3 – 4 July 2017
NSR5	Nyaung Kone Village	4 – 5 July 2017

Figure 5.12 Location of Baseline Noise Monitoring Station

Figure 5.13 Noise Monitoring Station at NSR1

Figure 5.14 Noise Monitoring Station at NSR2

Figure 5.15 Noise Monitoring Station at NSR3

Figure 5.16 Noise Monitoring Station at NSR4

Figure 5.17 Noise Monitoring Station at NSR5

The dominant sources of noise were from the traffic along access roads and community activities around the monitoring stations. Results of the baseline noise monitoring are summarised in *Table 5.10*.

Table 5.10 Summary of Baseline Noise Monitoring and Noise Criteria

NSR	Type of Uses	Averaged Background Noise Levels, dB(A)		NEQ and WBG Noise Level Guidelines, dB(A)	
		Daytime	Night-time	Daytime	Night-time
NSR1	Residential	66	64	55	45
NSR2	Residential	59	62	55	45
NSR3	Place of Worship	61	62	55	45
NSR4	Residential	50	53	55	45
NSR5	Residential	67	68	55	45

Notes:

(a) Daytime refers to the hours from 0700 hrs to 2200 hrs while night-time refers to the hours from 2200 hrs to 0700 hrs.

(b) Noise levels are averaged from the data obtained for daytime and night-time periods, respectively, and without inclusion of highly intrusive noises.

Note; values exceeding the standard limits are shown in red

The background noise levels at all NSRs exceeded both the noise limits set out in NEQ and WBG General EHS guideline values during daytime (except NSR4) and night-time periods. In accordance with the NEQ and IFC Guidelines, noise impacts from the Project should then not result in a maximum increase in background noise levels of 3 dB(A) at the nearest receptor which is taken as the basis for the impact assessment.

5.5 SURFACE WATER QUALITY

Baseline water quality survey was conducted in June and July 2017 and was conducted at five (5) locations within (2) km of the proposed Project. One of the sampling locations was at a stream located within approximately 100 m of the Awba HAIC factory compound and other four sites were along this stream which is flowing down across four (4) villages including War Net Chaung, Tha Pyay Kone, Nyaung Kone and Yae Tar Shay. The locations of monitoring sites are presented in *Table 5.11*. *Figure 5.18* illustrates the locations of the sampling station with photos shown in *Figures 5.19-5.23*.

Table 5.11 Water Sampling Locations

ID	Date	Coordinates	
		Northern	Eastern
SW-1	30.6.2017	17°01' 12.01"	96°04' 31.87"
SW-2	1.7.2017	17°10' 06.98"	96°02' 57.37"
SW-3	1.7.2017	17°10' 10.44"	96°03' 02.33"
SW-4	2.7.2017	17°10' 06.23"	96°03' 58.59"
SW-5	3.7.2017	17°10' 25.28"	96°04' 25.51"

During the baseline survey in June and July 2017, three water samples were taken at each sampling location using sampling bottles provided by a laboratory certified under the Hong Kong Laboratory ALS Technichem (HK) Pty Ltd. These samples were stored at chilled condition and sent to the laboratory for analysis. Water quality parameters measured include *in-situ* measurement of pH and temperature as well as laboratory analysis of pH, Total Suspended Solid (TSS), Total Cyanide, Ammonia, Nitrite, Nitrate, Reactive Phosphorus, Oil & Grease, Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), Phenols, Arsenic, Cadmium, Chromium, Copper, Mercury, Faecal Coliforms. These parameters have been selected to align with the relevant WBG EHS and Myanmar National Environmental Quality (Emission) Standards for monitoring.

For construction of the Project, it is noted that the Myanmar National Environmental Quality (Emissions) Guidelines specify the guidance levels for site runoff and wastewater discharges, which are the same as those specified for treated sanitary sewage discharge by WBG *General EHS Guidelines* (2007). As the water in the streams is also used for drinking purposes, the *WHO Drinking Water Standards* are used for comparison.

The baseline water quality data collected in June and July 2017 are presented in *Table 5.12*. At all stations, the level of TSS exceeded the WBG *General EHS Guidelines* (2007) for treated sanitary sewage discharge and WHO Drinking Water Standards. These exceedances are due to the turbid nature of the surface waters. Villagers use rudimentary sieve / filtering systems when using the water for drinking purposes. Other measurements were generally within the WHO and WBG EHS Guidelines with no specific concern identified.

Figure 5.18 Surface Water Sampling Locations Stations

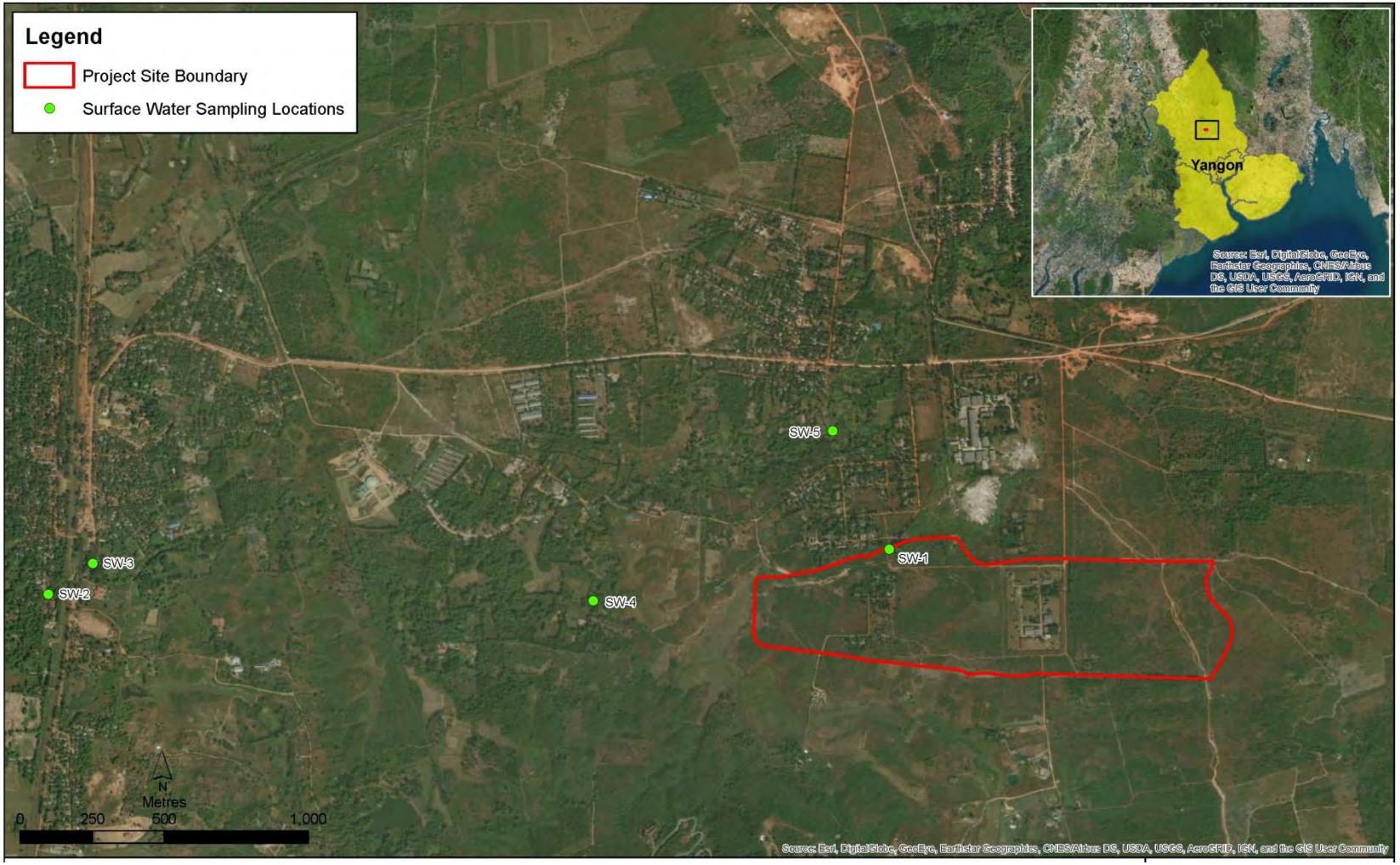


Figure 5.19 Surface Water Quality Sampling Station at SW1

Figure 5.20 Surface Water Quality Sampling Station at SW2

Figure 5.21 Surface Water Quality Sampling Station at SW3

Figure 5.22 Surface Water Quality Sampling Station at SW4

Figure 5.23 Surface Water Quality Sampling Station at SW5

Table 5.12 Baseline Surface Water Quality Data, June and July 2017

Parameter	Unit	SW1	SW2	SW3	SW4	SW5	WHO Drinking Water Standard	WBG EHS Treated Sanitary Water / NEQ Guidelines
pH	pH Unit	7.1	6.8	6.8	6.7	6.7	6.5-8.5	6-9
Total Suspended Solid	mg/L	271.3	54.33	59.67	122.67	48.67	Not available	20
Total Cyanide	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.07	N/A
Ammonia as N	mg/L	0.06	0.02	0.03	0.07	0.01	Not available	10
Nitrite as N	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.5	N/A
Nitrate as N	mg/L	0.34	0.13	0.12	0.17	0.12	<10	N/A
Reactive Phosphorus as P	mg/L	<0.01	<0.01	<0.01	<0.03	<0.01	Not available	2
Oil & Grease	mg/L	<5	<5	<5	<5	<5	10	10
Chemical Oxygen Demand	mg/L	23	11.33	12.33	14.67	9.33	250	150
Biochemical Oxygen Demand	mg/L	2.33	<2	<2	2	<2	<3	30
Phenols (Total)	mg/L	<0.2	<0.2	<0.2	<0.3	0.57	4	0.5
Arsenic	µg/L	<10	<10	<10	<10	<10	<10	100

Parameter	Unit	SW1	SW2	SW3	SW4	SW5	WHO Drinking Water Standard	WBG EHS Treated Sanitary Water / NEQ Guidelines
Cadmium	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<5	N/A
Chromium	µg/L	20.33	4	4	5.67	2.33	Not available	500
Copper	µg/L	7	2.67	2	4.33	2	Not available	500
Mercury	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	Not available	10
Faecal Coliforms	CFU/100mL	6,566.67	4,833.33	5,066.67	10,066.67	2,233.33	Not available	N/A

Notes:
(1) LOR = Limit of Reporting
(2) N.D. = not detected

To determine the average level at a station with one of the three samples reported to be below detection limit, value below detection limit is halved for the calculation.

5.6 GROUND WATER QUALITY

Baseline ground water sampling was conducted at two (2) locations (dug well and tube well) within (2) km of the proposed project site. In each location, three (3) replicates sampling were carried out at approximately the same time to identify the variability in all sampling and analysis system.

The locations of monitoring sites are presented in *Table 5.13*. *Figure 5.24* illustrates the locations of the sampling station with photos shown in *Figures 5.25-5.26*.

Table 5.13 Ground Water Monitoring Locations

ID	Date	Coordinates	
		Northern	Eastern
GW-1	1.8.2017	17˚10' 52.10"	96˚04' 43.97"
GW-2	1.8.2017	17˚10' 46.93"	96˚04' 22.86"

Figure 5.24 Ground Water Sampling Locations Stations

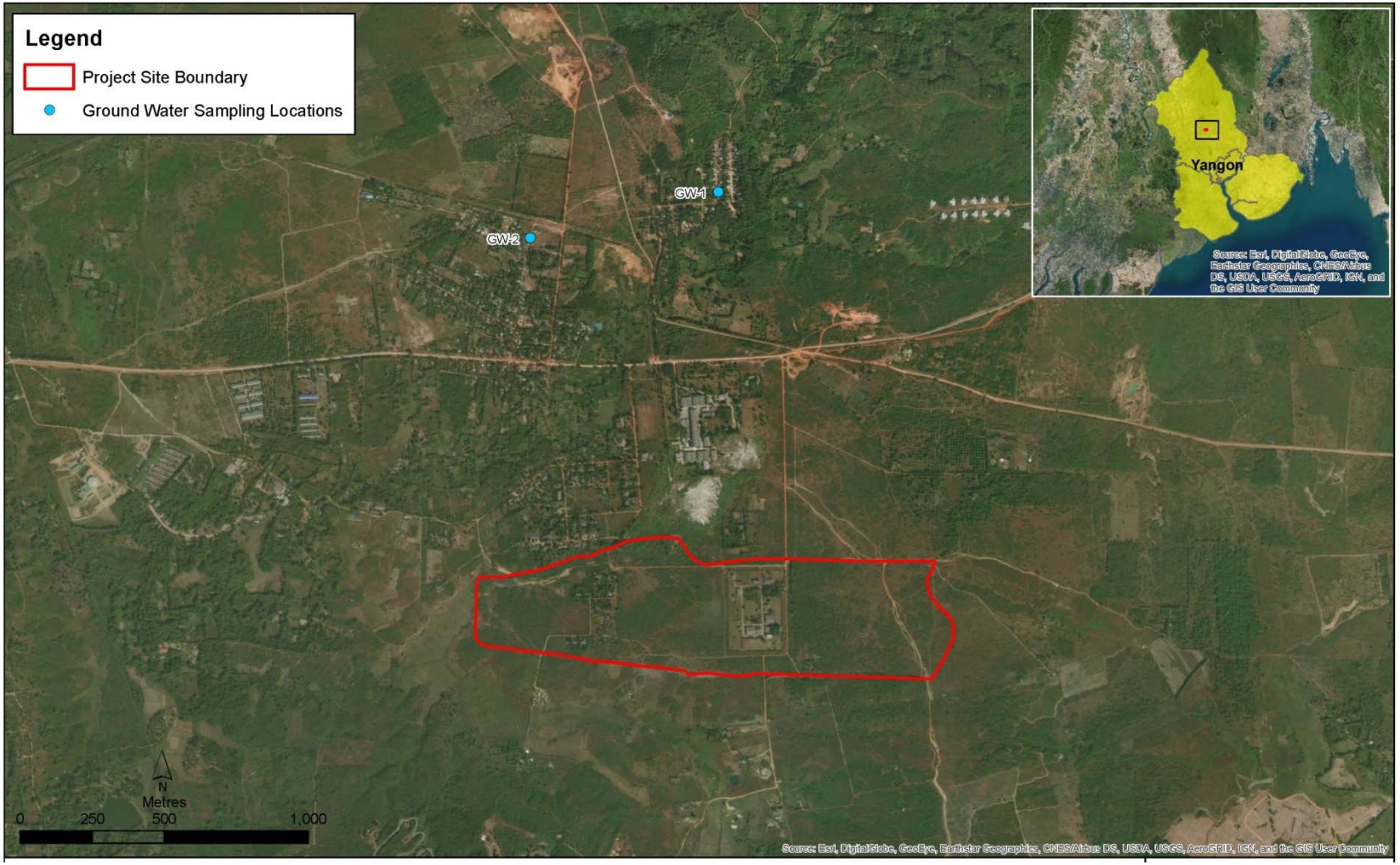


Figure 5.25 Ground Water Quality Sampling Station at GW1

Figure 5.26 Ground Water Quality Sampling Station at GW2

During the baseline survey in June and July 2017, three water samples were taken at each sampling location using sampling bottles provided by a laboratory certified under the Hong Kong Laboratory ALS Technichem (HK)

Pty Ltd. These samples were stored at chilled condition and sent to the laboratory for analysis. Water quality parameters measured include in-situ measurement of pH and temperature as well as laboratory analysis of pH, Total Suspended Solid (TSS), Total Cyanide, Ammonia, Nitrite, Nitrate, Reactive Phosphorus, Oil & Grease, Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), Phenols, Arsenic, Cadmium, Chromium, Copper, Mercury, Faecal Coliforms. These parameters have been selected to align with the relevant WBG EHS and Myanmar National Environmental Quality (Emission) Standards for monitoring.

Only one exceedance of WHO Drinking Water quality standards – PH levels in water in Yae Tar Shey well. The baseline water quality data collected in June and July 2017 are presented in *Table 5.17*.

Table 5.14 Baseline Ground Water Quality Data, June and July 2017

Test Parameter	Unit	WHO Drinking Water Standard	GW1	GW2
pH	pH Unit	6.5-8.5	6.5	4.9
Total Suspended Solid	mg/L	NG	43	15
Total Cyanide	mg/L	<0.07	<0.01	<0.01
Ammonia as N	mg/L	NG	0.03	0.06
Nitrite as N	mg/L	<0.5	<0.01	<0.01
Nitrate as N	mg/L	<10	0.91	1.05
Reactive Phosphorus as P	mg/L	NG	<0.01	<0.01
Oil & Grease	mg/L	10	<5	<5
Chemical Oxygen Demand	mg/L	250	<1	<2
Biochemical Oxygen Demand	mg/L	<3	<2	<2
Phenols (Total)	mg/L	4	<0.2	<0.2
Arsenic	µg/L	<10	<10	<10
Cadmium	µg/L	<5	<0.2	<0.2
Chromium	µg/L	NG	<1	<1
Copper	µg/L	NG	<1	<1
Mercury	µg/L	NG	<0.5	<0.5
Faecal Coliforms	CFU/100mL	NG	10,977.67	3,861.67

To determine the average level at a station with one of the three samples reported to be below detection limit, value below detection limit is halved for the calculation.

5.7 SOIL

Soil baseline sampling with the Project Site was undertaken. The locations for soil sampling are provided in *Figure 5.28*.

Collecting soil sample photos from five locations within the proposed project area are shown in *Figure 5.29*. Soil quality monitoring results for laboratory analysed parameters are shown in *Table 5.15*.

During the baseline survey in June and July 2017, two soil samples were taken at each sampling location using sampling bottles provided by a laboratory

certified under the Hong Kong Laboratory ALS Technichem (HK) Pty Ltd. These samples were stored at chilled condition and sent to the laboratory for analysis. Water quality parameters measured laboratory analysis of pH level, Moisture Content, Cadmium, Copper, Lead, Zinc, and Iron. These parameters have been selected to align with the relevant WBG EHS and Myanmar National Environmental Quality (Emission) Standards for monitoring.

Figure 5.28 Locations for Soil Sampling within the Project Area

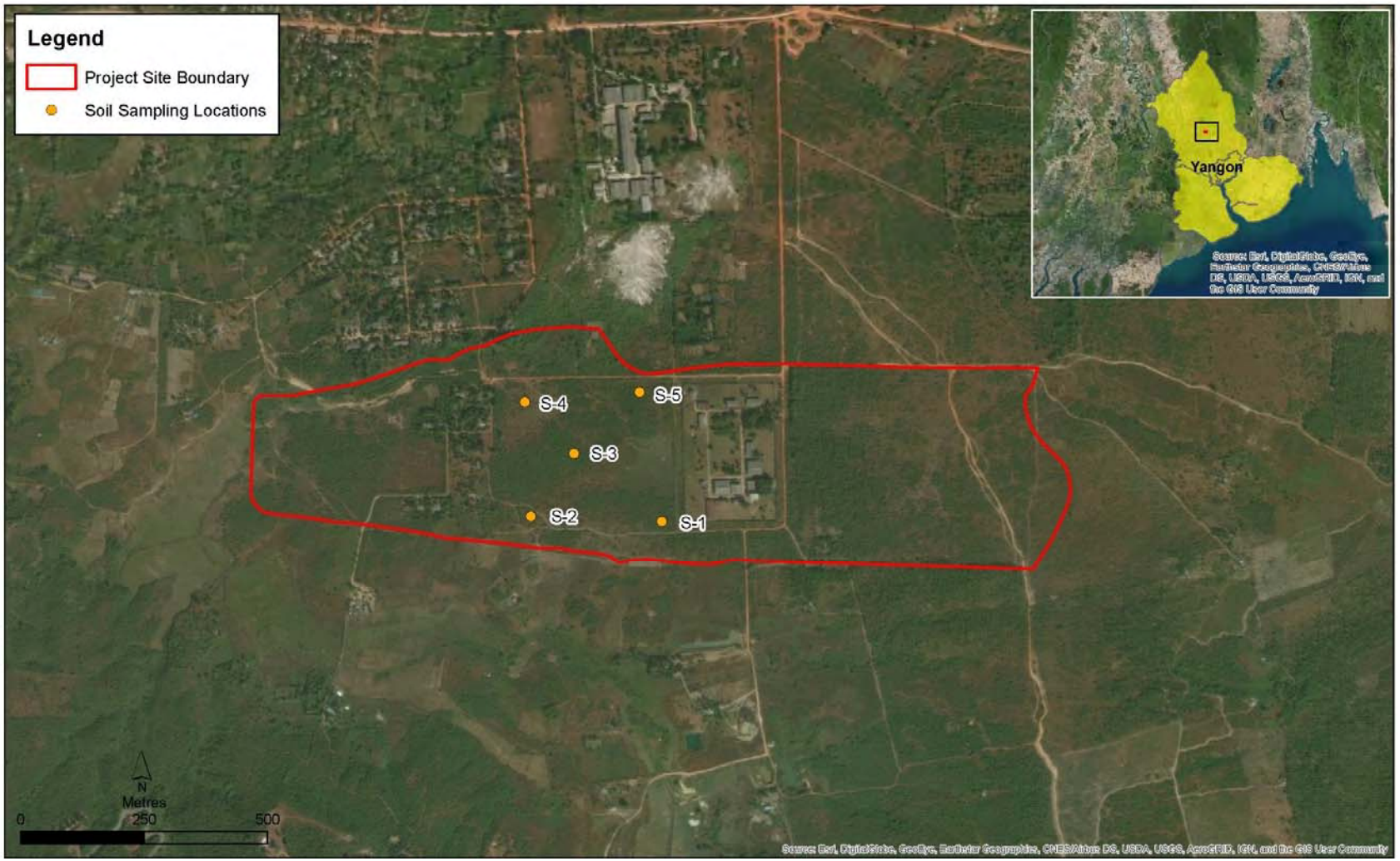


Table 5.15 Soil Quality Monitoring Results for Laboratory Analysed Parameters

Test Parameter	Unit	LOR	S1	S2	S3	S4	S5	FAO Soil Bulletin 65 & Dutch Standards
			Result	Result	Result	Result	Result	
pH Value	pH Unit	0.1	4.45	5	4.75	5.3	4.9	-
Moisture Content (dried @ 103°C)	%	0.1	14	20.35	15.35	15.35	19.35	-
Cadmium	mg/kg	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.8
Copper	mg/kg	1	3.5	10	6.5	4.5	7	20-300
Lead	mg/kg	1	7	10	11	10.5	10.5	85
Zinc	mg/kg	1	7.5	19	13	13.5	14	15-150
Iron	mg/kg	2	3480	12800	6040	7120	5280	-

5.8 PROTECTED AREAS AND KEY BIODIVERSITY AREAS

There are a total of 39 Protected Areas in Myanmar covering an area of 38,906 km^2. Based on Myanmar's NBSAP for 2015 to 2020, there are plans to establish 9 more Protected Areas in three phases from 2020 to 2021. With the addition of these 9 proposed areas, the total area under protection in Myanmar will be 52,932 km^2, representing a coverage of 7.82% of the country's total land area (1).

National Protected Wildlife Park within a 20 km buffer of project sites is Hlawga National Park (*Figure 5.29*) and the locations in relation to project site are shown *Table 5.16*.

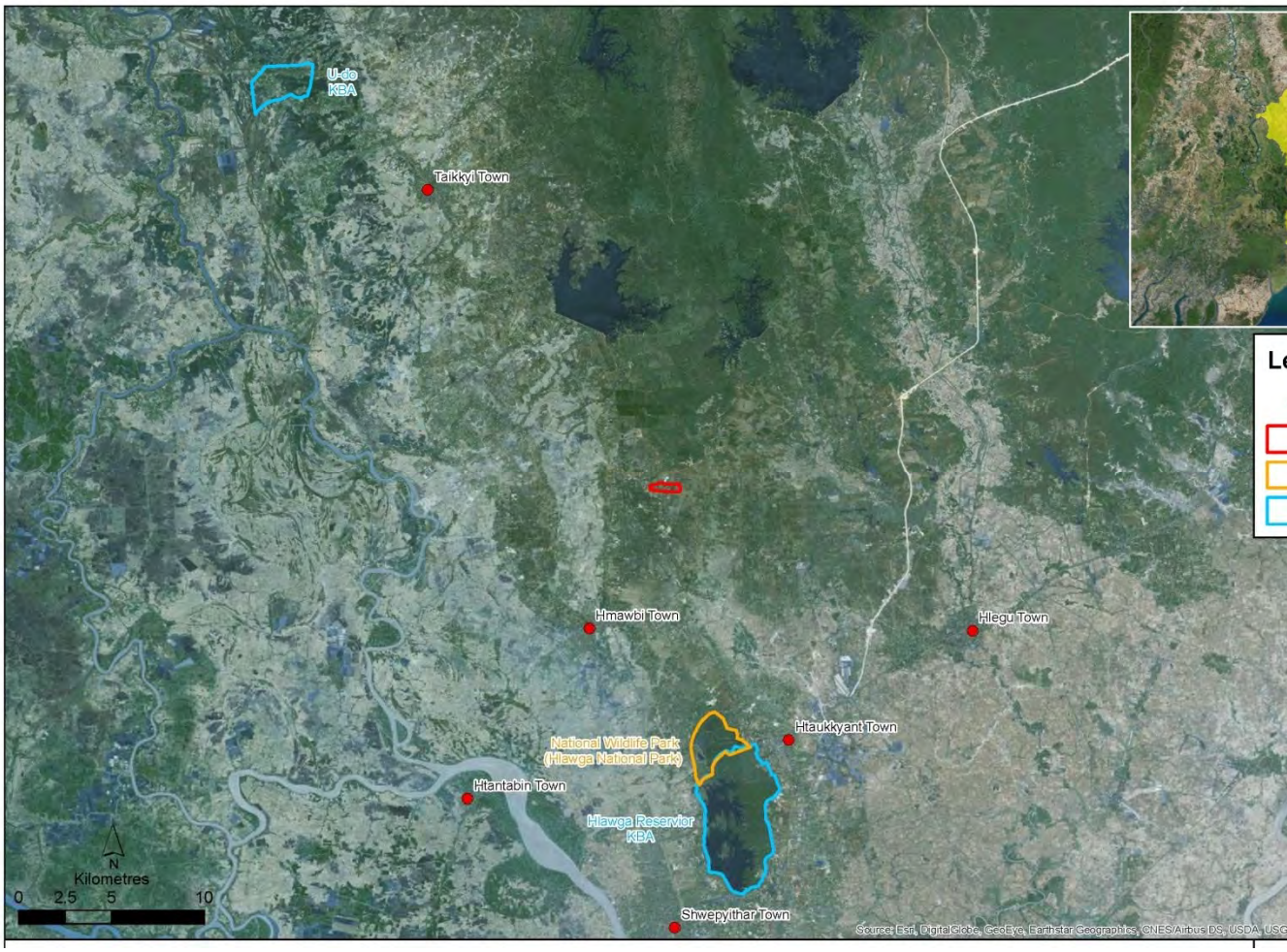
Hlawga National Park is a national park located in Mingaladon Township, Yangon Region, Myanmar, 22 miles (35 km) north of Yangon. The park was established in 1982 with joint-funding by the UNDP and the Burmese government. The 1,540-acre (623-hectare) park includes an 818-acre (313 hectare) wildlife park, a 62-acre (25-hectare) mini-zoo and a 660-acre (267-hectare) buffer zone. First established as an environmental education centre in 1982, the national park is a popular day-trip destination with Yangonites and Eco-tourists.

Table 5.16 Protected Areas within 20 km of Project Sites

Protected Area	**Properties**	**Details**
Hlawga National Wildlife Park (25 km south)	• Size • KBA year • Key Species	• 6 km^2 • 2012 • Pale-capped Pigeon (VU) (CO)
Key Biodiversity Area	**Properties**	**Details**
Hlawga Reservoir	• Size • KBA year • Key Species	• 23 km^2 • 2012 • *Dalbergia cultrata* (EN)(CO), *Dipterocarpus alatus* (EN)(CO), *Hopea odorata* (VU)(CO), *Holarrhena pubescens* (EX)(CO)
U-do Terrestrial KBA (25 km south)	• Size • KBA year • Key Species	• 5 km^2 • 2012 • Sarus Crane (VU) (CO), Congregatory waterbirds (CO)

(1) Republic of the Union of Myanmar, National Biodiversity Strategy and Action Plan 2015-2020 (Oct, 2015) Retrieved from https://www.cbd.int/doc/world/mm/mm-nbsap-v2-en.pdf

Figure 5.29 Protected Areas and Key Biodiversity Areas Closest to the Project Site



5.9 BIODIVERSITY

The biodiversity survey was undertaken in the wet season between 24 and 27 June, 2017. The survey was conducted in the Project Site and within habitats types within 500 m of the Project Site. The study covered terrestrial fauna, especially as major groups are vertebrate (birds, reptiles, lizards and amphibians especially visual observation for the birds) and invertebrate (butterflies, and dragonflies). A total of 73 fauna species were recorded; 25 avian species, 10 reptilian species, 22 species of butterfly, and 14 species of Dragonfly. The survey also covered the assessment of the species diversity of flora groups such as trees, small trees, shrubs, herbs and climbers. It was calculated for trees and small trees species by quantitative method. A total of 47 flora species were recorded.

5.9.1 *Avifauna*

25 species of avian fauna belonging to 7 order and 18 families were recorded including insectivores, omnivores, carnivorous and Fruit-eating species (Table 4.20). Among them, the Asian Palm Swift *Cypsiurus balasinensis* was most abundant at the Project Site. Two bird species were recorded that are completely protected under Myanmar Law (Protection of Wildlife, Wild Plants and Conservation of Natural Areas Act 15(A)); White Throated Babbler *Turdoides gularis*, and Watercock *Gallicrex cinerea*. No species recorded were listed as species of conservation concern on the IUCN Red List. Avian fauna species occurrences of various types of habitats in Study Area are presented in *Table 5.17*. Photos of some species observed are shown in *Figure 5.31*.

Table 5.17 Bird species recorded during the survey period in Hmawbi Agriculture Input Complex

No.	Order/Family	Scientific Name	Common Name	IUCN Red List Status
I	**Passeriformes**			
1	Muscicapidae	*Copsychus saularis*	Oriental Magpie Robin	LC
2	Muscicapidae	*Saxicola caprata*	Pied Bushchat	LC
3	Covidae	*Dicrurus macrocercus*	Black Drongo	LC
4	Covidae	*Aegithina tiphia*	Common Iora	LC
5	Leiothrichidae	*Heterophasia melanoleuca*	Dark-Backed Sibia	LC
6	Passeridae	*Passer domesticus*	House Sparrow	LC
7	Passeridae	*Passer montanus*	Eurasian Tree Sparrow	LC
8	Passeridae	*Anthus rufulus*	Paddy field Pipit	LC

No.	Order/Family	Scientific Name	Common Name	IUCN Red List Status
9	Ploceidae	*Lonchua punctulata*	Scaly-Breasted Munia	LC
10	Sturnidae	*Acridotheres tristis*	Common Myna	LC
11	Columbidae	*Streptopelia chinensis*	Spotted Dove	LC
12	Columbidae	*Columba livia*	Rock Pigen	LC
13	Pycnonotidae	*Pycnonotus blanfordi*	Streak Eared Bulbul	LC
14	Pycnonotidae	*Pycnonotus cafer*	Red-vented Bulbul	LC
15	Cisticolidae	*Prinia inornata*	Plain Prinia	LC
16	Cisticolidae	*Prinia hodgsonii*	Grey-Breasted Prinia	LC
17	Laniidae	*Lanius cristatus*	Brown Shrike	LC
18	Sylviidae	*Turdoides gularis*	White Throated Babbler	LC
19	Sylviidae	*Chrysomma sinense*	Yellow-Eyed Babbler	LC
II	**Apodiformes**			
20	Apodidae	*Cypsiurus balasiensis*	Asian Palm Swift	LC
III	**Coraciiformes**			
21	Meropidae	*Merops orientalis*	Green Bee-Eater	LC
IV	Piciformes			
22	Megalaimidae	*Megalaima haemacephala*	Coppersmith Barbet	LC
V	Charadriiformes			
23	Turnicidae	*Turnix suscitator*	Barred buttonquail	LC
VI	**Gruiformes**			
24	Rallidae	*Grallicrex cinerea*	Watercock	LC
VII	**Cuculiformes**			
25	Centropodidae	*Centropus sinensis*	Greater Coucal	LC

LC= Least Concern

Figure 5.31 Photos of Bird Species in the Study Area

Watercock *Grallicrex cinerea*

White-Throated Babbler *Turdoides gularis*

5.9.2 Herpetofauna

Interviews and transect walks were conducted across the Study Area and noted 10 reptile species belonging to one order and 6 families. This consisted of three lizard and six snake species. The water snake *Xenochrophis flavipunctatus* is occasionally seen in this area. Two species of amphibian fauna belonging to one order and one family were recorded with different population abundance and different categorize aquatic species. The list of species found within the Project Site and its surroundings is presented in *Table 5.18*. Photos of some of the species observed are provided in *Figure 5.32*.

No species recorded were listed as species of conservation concern on the IUCN Red List or as "completely protected" under Myanmar Law (Protection of Wildlife, Wild Plants and Conservation of Natural Areas Act 15(A)).

Table 5.18 Reptile species recorded during the survey period in Awba Pesticide Plant Project Area

No.	Order/Family	Species	Common Name	IUCN Red List Status	Type of evidence
I	**Squamata (Lizard)**				
1	Agamidae	*Caltoes versicolor*	Garden Fence Lizard	LC	Observed
2	Agamidae	*Calotes mystaceus*	Blue Crested Lizard	LC	Observed
3	Agamidae	*Calotes jerdoni*	Jerdon's Forest Lizard	NE	Observed
4	Scincidae	*Mabuya multifasciata*	East Indian Brown Mabuya	LC	Observed
II	**Squamata (Snake)**				
5	Viperidae	*Trimeresurus gramineus*	Common Green Pit Viper	LC	Observed
6	Viperidae	*Daboia russelii*	Russell's viper	LC	Interviewed
7	Colubridae	*Dendrelaphis pictus*	Painted Bronzeback Tree Snake	LC	Observed
8	Colubridae	*Oligodon spp*	kukri snakes	LC	Interviewed
9	Colubridae	*Xenochrophis flavipunctatus*	Water snake	LC	Interviewed
10	Elapidae	*Bungarus fasciatus*	Banded Krait	LC	Interviewed
III	**Anura**				
1	Dicroglossidae	*Fejervarya limnocharis*	Paddy frog	LC	Observed
2	Dicroglossidae	*Euphlyctis cyanophylyctis*	Skittering frog	LC	Observed

LC= Least Concern, Not Evaluated =NE

Figure 5.32 Photos of Herpetofauna Observed in the Study Area

Paddy frog *Fejervarya limnocharis*

Painted Bronzeback Tree Snake *Dendrelaphis pictus*

Blue Crested Lizard *Calotes mystaceus*

Garden Fence Lizard *Caltoes versicolor*

Jerdon's Forest Lizard *Calotes jerdoni*

East Indian Brown Mabuya *Mabuya multifasciata*

5.9.3 *Butterflies and Dragonflies*

Biodiversity surveys observed 20 species of Butterfly belonging to 8 families and 14 species of Dragonfly species belonging to one family (Libellulidae) (*Table 5.19*).

Table 5.19 Butterfly species recorded during the survey period in Awba Pesticide Plant Project Construction Area

Sr.	Order/Family	Species	Common Name	IUCN Red List
	Lepidoptera			
1	Papilionidae	*Papilio polytes*	Common Mormon	NE
2	Papilionidae	*Papilio demoleus*	Lime butterfly	NE
3	Pieridae	*Catopsilia pomona*	Common Emigrant	NE
4	Pieridae	*Catopsilia crocale*	Common Emigrant	NE
5	Pieridae	*Catopsilia pyranthe*	Mottled Emigrant	NE
6	Pieridae	*Eurema hecabe*	Common grass yellow	NE
7	Danaidae	*Euploea core*	Common Crow	LC
8	Danaidae	*Danaus genutia*	Striped- Tiger	NE
9	Danaidae	*Danaus limniace*	Blue Tiger	NE
10	Nymphalidae	*Hypolimnas bolina (Male)*	Great Eggfly	NE
11	Nymphalidae	*Athyma perius*	Common Sergeant	NE
12	Nymphalidae	*Acraea violae*	Tawny Coster	NE
13	Nymphalidae	*Junonia hierta (Male)*	Yellow Pansy	LC
14	Nymphalidae	*Junonia atlites (Male)*	Gray Pansy	NE
15	Satyridae	*Ypthima baldus*	Common Five ring	NE
16	Lycaenidae	*Chilades pandava (Male)*	plains Cupid	NE
17	Lycaenidae	*Chilades pandava (Female)*	plains Cupid	NE
18	Lycaenidae	*Loxura atymnus*	Yamfly	NE
19	Riodinidae	*Abisara abnormis*	-	NE
20	Hesperiidae	*Caltoris sp.*	Swift	-
I	**Odonata (Dragonfly)**			

Sr.	Order/Family	Species	Common Name	IUCN Red List
1	Libellulidae	*Orthetrum sabina*	Slender Skimmer/ Green Marsh Hawk	LC
2	Libellulidae	*Brachythemis contaminate*	Ditch Jewel (Male)	LC
3	Libellulidae	*Rhyothemis phyllis*	Yellow-striped Flutterer	VU
4	Libellulidae	*Potamarcha congener*	Yellow-Tailed Ashy Skimmer	LC
5	Libellulidae	*Neurothemis tullia (Female)*	Pied Paddy Skimmer	LC
6	Libellulidae	*Brachythemis fuscopalliata*	Dark-winged Groundling	LC
7	Libellulidae	*Crocothemis erythraea*	Carmine Darter	LC
8	Libellulidae	*Diplacodes trivialis (Male & Female)*	Ground Skimmer/Chalky Percher	LC
9	Libellulidae	*Diplacodes pumila (Male)*	Dwarf Percher	LC
10	Libellulidae	*Orthetrum pruinosum (Male)*	Crimson-tailed Mash Hawk	LC
11	Libellulidae	*Lathrecista asiatica (Male & Female)*	Asiatic Blood Tail	LC
12	Libellulidae	*Pantala flavescens*	Wandering Glider	LC
13	Libellulidae	*Crocothemis servilia*	Scarlet Skimmer/Ruddy Marsh Skimmer	LC
14	Libellulidae	*Trithemis pallidinervis*	Long-legged Marsh Glider	LC

LC= Least Concern, NE = Not Evaluated

Some examples of butterfly and dragonfly species observed are provided in *Figure 5.33*. No species recorded were listed as "completely protected" under Myanmar Law (Protection of Wildlife, Wild Plants and Conservation of Natural Areas Act 15(A)). However, one species, *Rhyothemis Phyllis*, Yellow-striped Flutterer is listed as Vulnerable on the species of conservation concern on the IUCN Red List.

Figure 5.33 Photos of Butterfly and Dragonfly Species in Study Area

	
Common Crow *Euploea core*	Yellow Pansy *Junonia hierta* (Male)
	
Yellow-striped Flutterer *Rhyothemis phyllis*	Ditch Jewel (Male) *Brachythemis contaminate*

5.9.4 Flora

The Project Site is classified as terrestrial swamp land with no forest areas nearby. A total of 47 species were recorded during the study period, of which 5 species were herbs, 15 shrubs, 10 climbers and 17 trees. Among them 17 species belonging to 17 genera of tree and small tree species representative of 11 sample plots were calculated for density index. Among the sample plots tree and small tree species density per plot was varied and the highest density was observed *Glochidion assamicum*, *Psidium acidum*, *Cratoxylum ligustrinum* and *Microcos paniculata*. The result shows that these four species are abundant in surrounding area.

Relative frequency is the frequency of one species compared to the total frequency of all the species. According to the results *Glochidion assamicum* and *Microcos paniculata* have high relative frequency value (11%) followed by, *Psidium acidumis* (10%). Some examples of flora species observed are provided in *Figure 5.34*.

Figure 5.34 Photos of Flora Species in Study Area

	
Ampelocissus Latifolia	*Convolvulus arvensis*
	
Lagerstroemia macrocarpa	*Semecarpus subpanduriformis*

6 SOCIO-ECONOMIC BASELINE

The socio-economic baseline is derived from engagement with village leaders, groups of farmers and women and a survey of 72 households from 6 villages and one ward in the vicinity of the Project sites.

6.1 SOCIAL AREA OF INFLUENCE

A preliminary Area of Influence (AOI) of the project for the purpose of social environment has been defined and this will be revisited and refined as an outcome of the scoping stage of the ESIA process. The criteria used to demarcate the AOI at this stage are:

- The Project Area;
- The major village tracts around the Project Area: the Township is Hmawbi and the closest village tract is War Net Chaung; and
- Location of decision making centres and location of the key government agencies (Yangon, and Naypyidaw).

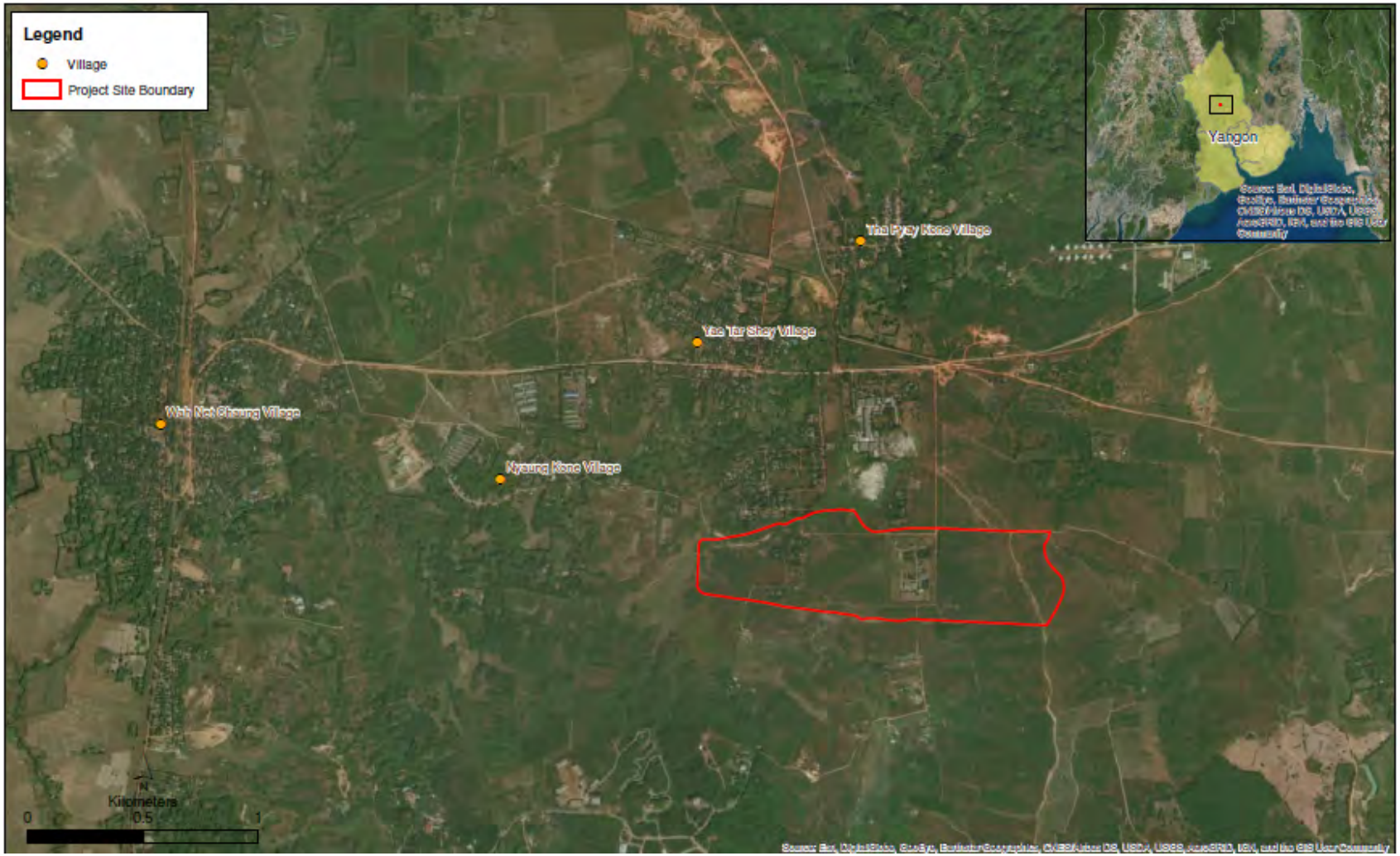
The administrative area falling within Awba's AOI is shown in *Table 6.1*.

Table 6.1 Local setting in the Project Area of Influence

Administrative levels	Area	Features
Regional	Yangon	Business capital of Myanmar.
District / Township	Hmawbi	Home for Myaung Dagar Industrial Zone and well known for supplying vegetables and fruits for commercial market

The AOI is shown in *Figure 6.1*. This is defined by a radius of 3.5 km around the Project Area. The villages are located to the north, and west of the Project. To the south and east are industrial and army land and no residences.

Figure 6.1 Social Area of Influence



The villages in the AOI and the number of households in each are presented in *Table 6.2*.

Table 6.2 Villages in the Project AOI

No.	Community	Number of Household (HH)
1.	War Net Chaung	1,447 HH
2.	Nyaung Gone	58 HH
3.	Yae Tar Shey	449 HH
4.	Tha Pyay Kone	96 HH
5.	Zaw Ti Kone	82 HH
6.	War Phyu Taw	122 HH

Detailed information was collected from focus group discussions and household surveys with villagers, farmers, village tract leaders, village elders, and women in these villages and is presented in the following sections. There was no public consultation meeting in Zaw Ti Kone and War Phyu Taw villages. However, the villagers were invited to attend the meeting in War Net Chaung village and household socio economic survey was done in those villages.

6.2 POPULATION AND DEMOGRAPHIC

Table 6.3 provides an understanding of the population and demographic profile of the village tracts consulted from during focus group discussions and household socio economic survey with villagers, village leaders and village tract leaders. The smallest village is Nyaung Kone with 58 households and the largest is War Net Chaung village tract with 1,447 households. The villages consulted were:

- War Net Chaung village, War Net Chaung Village Tract, Hmawbi Township, Yangon Region
- Tha Pyay Kone village, Let Pa Dan Village Tract, Hmawbi Township, Yangon Region
- Nyaung Kone village, War Net Chaung Village Tract, Hmawbi Township, Yangon Region
- Yae Tar Shey village, War Net Chaung Village Tract, Hmawbi Township, Yangon Region
- Zaw Ti Kone village, War Net Chaung Village Tract, Hmawbi Township, Yangon Region

- War Phyu Taw village, War Net Chaung Village Tract, Hmawbi Township, Yangon Region.

Data on demography, population and livelihoods from the Myanmar Census (2015) is presented in *Table 6.4* and *Table 6.5*.

Table 6.3 Primary data on Population Statistics from the Townships and Villages in the Study Area

Township / Village	Male	Female	Total	No. of households	Ethnicity	Distance from Project Area
Hmawbi	***120,931***	***123,676***	***244,607***	***231,073***		
War Net Chaung	3172	3412	6584	1651	90 % Burma, 5 % of Shan, 3 % of Kayin, 1 % of Mon, 1 % of other	2.6 km
Tha Pyay Kone	-	-	364	96	70 % of Shan, 20 % of Burma, 10 % of Kayin	1.3 km
Nyaung Kone	145	126	271	58	70 % of Shan, 30 % of Burma	1.4 km
Yae Tar Shey	868	910	1778	449	50 % of Shan, 50 % of Burma	0.9 km
War Phyu Taw	247	242	489	122	100% of Burma	3 km
Zaw Ti Kone	193	161	354	82	60% of Burma, 40% of Shan	3.6 km

Table 6.4 Population in Yangon and Hmawbi Township (Myanmar Census, 2015)

	Total population				Population in conventional households			Population in institutions		
	Both sexes	Male	Female	Sex ratio	Both sexes	Male	Female	Both sexes	Male	Female
Yangon	7,360,703	3,516,403	3,844,300	91.5	6,949,440	3,258,469	3,690,971	411,263	257,934	153,329
- Yangon Urban	5,160,512	2,441,229	2,719,283	89.8	4,855,682	2,252,076	2,603,606	304,830	189,153	115,677
- Yangon Rural	2,200,191	1,075,174	1,125,017	95.6	2,093,758	1,006,393	1,087,365	106,433	68,781	37,652
- North Yangon	2,606,670	1,253,082	1,353,588	92.6	2,456,529	1,159,498	1,297,031	150,141	93,584	56,557
Hmawbi	**244,607**	**120,931**	**123,676**	**97.8**	**231,073**	**110,580**	**120,493**	**13,534**	**10,351**	**3,183**

Table 6.5 Livelihoods in Hmawbi Township (Myanmar Census, 2015)

		Usual activity status											
	Total	Employee (government)	Employee (private)	Employer	Own account worker	Unpaid family worker	Sought work	Did not seek work	Full time student	Household worker	Pensioner, retired, elderly	Disabled	Other
Hmawbi													
Total	202,679	11,927	50,276	2,764	32,559	8,545	4,069	831	29,364	39,589	11,474	1,431	9,850
Male	99,729	8,518	32,777	2,021	20,586	3,484	2,630	573	14,814	1,141	5,469	782	6,934
Female	102,950	3,409	17,499	743	11,973	5,061	1,439	258	14,550	38,448	6,005	649	2,916

6.3 LIVELIHOOD AND ECONOMY

6.3.1 Livelihood Sources

The main livelihood source is cultivation of seasonal vegetables, flowers, rice and some fruits and others businesses related to agriculture. Some villagers are employed in the private sector or with the government particularly in War Net Chaung and Yae Tar Shey. People from smaller villages such as Nyaung Kone and Tha Phay Kone focus more on agriculture based business. Agriculture is the major economic source for Tha Pyay Kone and Nyaung Kone villages with 70% and 90 % of households, respectively, engaged in agriculture related business. 30% of villagers from War Net Chaung and Yae Tar Shey villages also engaged in agricultural based business. Growing flowers and vegetables to sell and working as labourers in gardens are the main source of agriculture related income. The main crops grown include:

- Seasonal vegetables such as eggplant, beans, gourd, cucumber, betel leave and Roselle;
- Flowers mainly jasmine and golden and silver ginger lily;
- Fruits such as bananas, guavas and other citrus fruit; and
- Rice and other cash crops like rubber.

Employment as part-time or full-time labourers in the industrial zone (in which the Project is situated) and around Hmawbi is another source of income particularly for War Net Chaung villages where this accounts for around 30% of households. In Tha Pyay Kone and Yae Tar Shey the employment in industrial zones is around 10%. Less than 15% of households work in government jobs. Yae Tar Shey village has significant numbers (50%) of the population engaged in private companies while the other villages have less than 15%. Households in the villages consulted have small numbers of livestock for domestic use and some small scale farm for commercial purposes. There is a private poultry commercial farm in Nyaung Kone. The animals they raise include chickens, ducks, goats, and pigs and a small number of buffalos and cattle in War Net Chaung village a reared to assist with cultivation. *Figure 6.2* shows examples of cultivation in the Study Area.

The main crops and cooking fuel sources per village are presented in *Table 6.6* and livelihood sources per village are provided in *Table 6.7*.

Figure 6.2 Photos of Cultivation in Tha Pyay Kone

Table 6.6 Main Crops and Cooking Fuels in Village Tracts

Village	Village Tract	Main Crops/ Vegetable	Cooking Fuel
War Net Chaung	War Net Chaung	1) Egg Plant 2) Gourd 3) Paddy 4) Rubber 5) Roselle 6) Cucumber 7) Green beans 8) Betel leave 9) Banana 10) Lime	45 % of households (HHs) use firewood and charcoal, and 50 % use electricity and 5 % use gas.
Tha Pyay Kone	Let Pa Dan	1) Flower 2) Jasmine 3) Monsoon Paddy 4) Sugar Cane	-

Village	Village Tract	Main Crops/ Vegetable	Cooking Fuel
		5) Bean 6) Vegetables	
Nyaung Kone	War Net Chaung	1) Egg Plant 2) Jasmine 3) Flower 4) Vegetables 5) Gourd 6) Cucumber 7) Green beans	Most of households (HHs) use firewood.
Yae Thar Shey	War Net Chaung	1) Egg Plant 2) Groundnut 3) Bean 4) Cucumber 5) Vegetables 6) Flower	All households (HHs) use firewood, charcoal and electricity.

Table 6.7 Livelihood Sources per Village (% of households in each Village)

Type of Livelihood	War Net Chaung	Tha Pyay Kone	Nyaung Kone	Yae Thar Shey
Cultivator	30 %	70 %	90 %	30 %
Agricultural labourer				-
Fishing	-	-	-	-
Business (Small/Medium Enterprise, shop, trading etc.)	5 %	5 %	1 %	5 %
Livestock rearing	5 %	-	-	
Casual Labourer/ temporary work	30 %	10 %	-	10 %
Government service	15 %	5 %	3 %	5 %
Private companies	15 %	5 %	5 %	50 %
Other	-	5 %	1 %	-

6.3.2 Household Income and Credit

The monthly income of the villages consulted varies depending on the size of village. 70% of the average monthly income in Nyaung Kone village is between 100,000 – 200,000 Kyats while 40% of people from War Net Chaung village earn more than 300,000 Kyats. This may be due to the fact that there are more people employed in private companies or government than in other villages. The details of monthly income from different village can be seen in *Table 6.8*.

Table 6.8 Average Monthly Income and Expenses Distribution per Village

Monthly Income	War Net Chaung	Tha Pyay Kone	Nyaung Kone	Yae Thar Shey
100,000 - 200,000 Kyats	20 %	50 %	70 %	50 %
200,000 - 300,000 Kyats	40 %	30 %	20 %	40 %
More than 300,000 Kyats	40 %	20 %	10 %	

The average monthly income of the village ranges from approximately 195,000 to 385,000 Kyats. War Phyu Taw village has the highest monthly income and Nyaung Kone village has the lowest. Nyaung Kone and War Net Chaung villages have the same expenditure and Tha Pyay Kone village has the lowest expenditure. The details of average monthly income and expenditure can be seen in *Table 6.9*.

Table 6.9 Income and Expenditure in the AOI

Village Name	Average Monthly Income (Kyat)	Average Monthly Expenditure (Kyat)
War Net Chaung	231,103	176,666
Tha Pyay Kone	233,333	155,833
Nyaung Kone	195,000	176,067
Yae Tar Shey	382,667	178,384
War Phyu Taw	379,000	238,000
Zaw Ti Kone	243,000	178,385

There are different sources for loans in the villages consulted. Women in Yae Tar Shey mentioned PACT's microfinance system with the interest rate of 2.5% per month. However the facility does not go to other villages consulted. Villagers take loans from small loan services with the interest rate of 15% per year and can get a maximum 2 lakhs (1 lakh = 100,000) Kyats per year. In War Net Chaung, there is a licensed saving and loan group who take 2% interest rate per month and allow people to borrow up to 12 lakhs Kyats.

6.3.3 Average Land Holding

The average agricultural land holding size for consulted villages is approximately 0.5 acre to 2 acre. Villagers mentioned that selling and buying land among villagers is not common but some villagers sell the land to people from other areas for higher prices. Villagers mostly inherited the land from their ancestors and village leaders and land administration officers normally make the decisions on land purchase in the community.

In War Net Chuang village, only 5% of household own the land they cultivate while Tha Pyay Kone and Nyaung Kone all own the land they cultivate. 50% of households in Yae Tar Shey village own the land they cultivate. The reason for this pattern is not known.

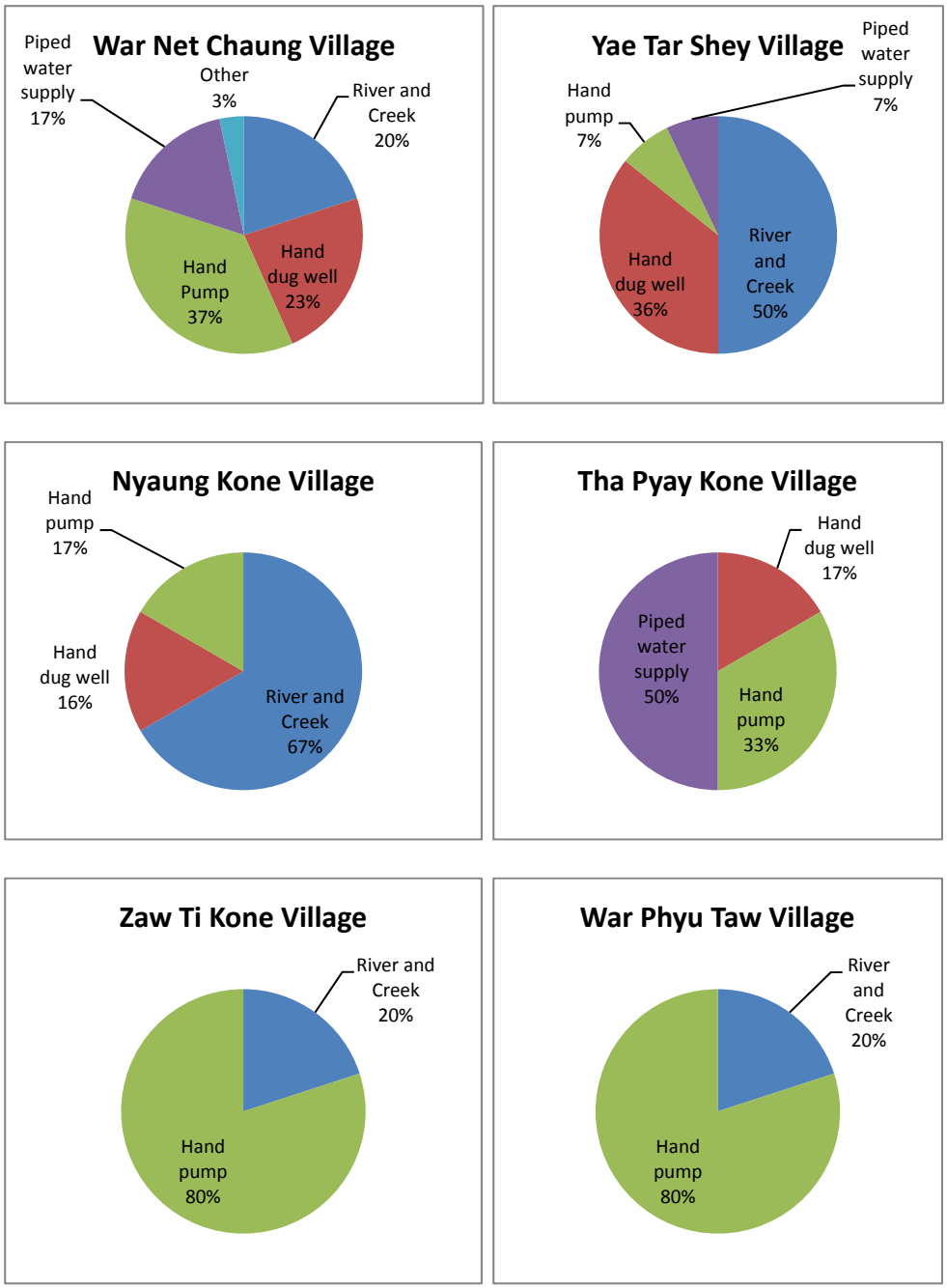
6.3.4 Utilities and Infrastructure

The villages consulted are well connected with average to good condition roads to Hmawbi Township. The main infrastructure and facilities are found in War Net Chaung village as it is the biggest populated area and village tract. War Net Chaung has a hospital, high school and train station. There are primary schools in Yae Tar Shey and Tha Pyay Kone villages but there are no schools in Nyaung Kone village. All villages except Nyaung Kone Village have access to government facility electricity schemes. In Nyaung Kone solar panels are used for electricity.

Villagers receive drinking water from different sources such as from river and creek, hand dug well, hand pump, piped water supply. Some village use purified water for drinking but not all villages. Most of the villagers in the area have access to drinking water on perennial basic, only few of them have problem during summer time. They received water from in the village level and see the quality as good.

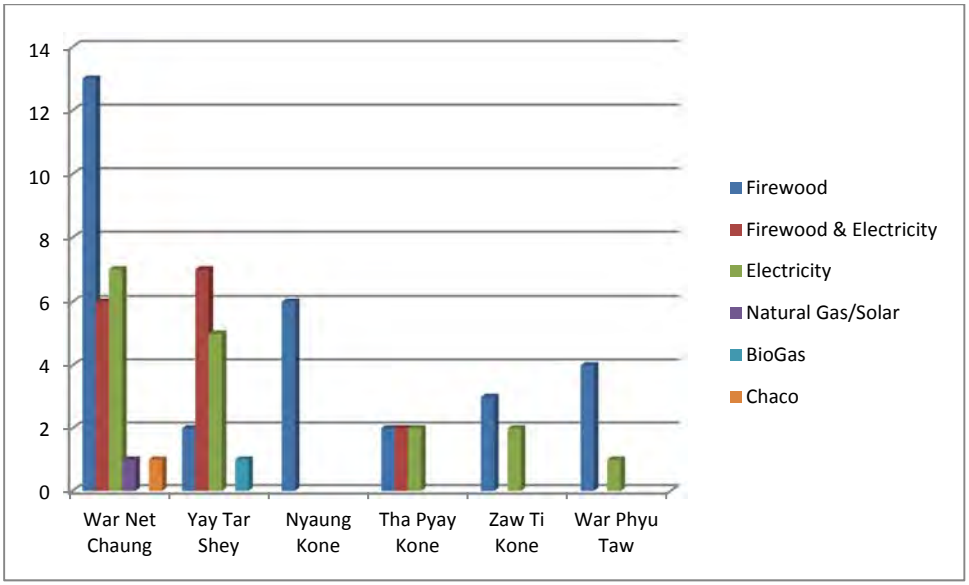
Many households from War Net Chaung receive from hand pump well (37%), 23% from hand dug wells, 20% from river and creek, 17% from piped water supply and 3% from other sources (such as bottled). For Yae Tar Shey and Nyaung Kone village over 50% of household received drinking water from rivers and creeks. Tha Pyay Kone village received from piped water supply as there is a spring water storage tank in the village. The detailed sources of drinking water in each village are shown in *Figure 6.3.*

Figure 6.3 Source of Drinking Water in Villages



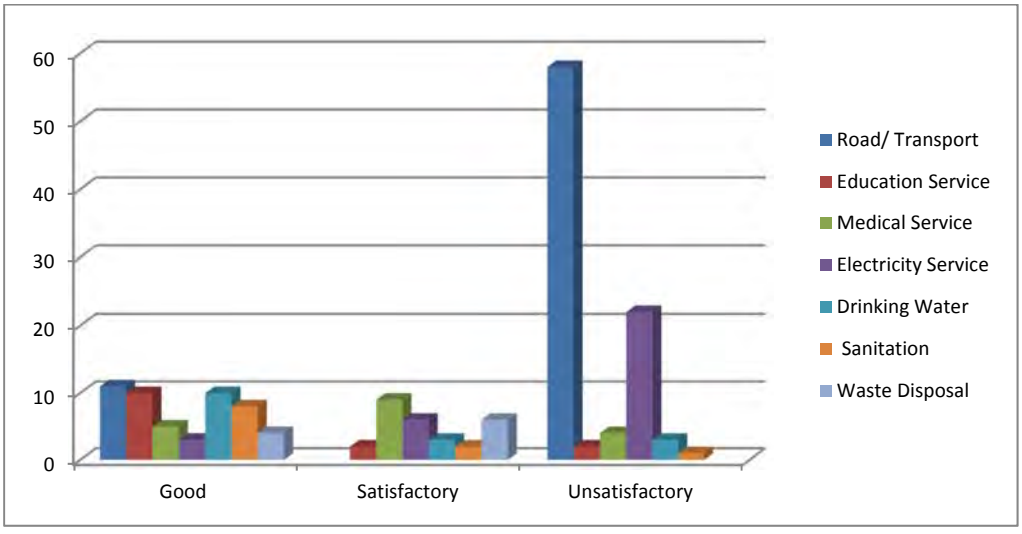
Most households in the area use firewood or charcoal for cooking as this is easily available from the local forest although villages also have access to use electric and gas stove. Villagers from most villages use both firewood and electricity as main source of cooking. Nyaung Kone is the only village which has no access to electricity of the villages consulted. As a result firewood is the only source of cooking. The detail sources of cooking fuel kinds are shown in *Figure 6.4*. More than 50% of firewood is collected from the forest, 20% is purchased from the market, and 20 % are collected from household land and within the village.

Figure 6.4 *Sources of Cooking Fuel*



The adequacy of services in the area was recorded by the villages in terms of good, satisfactory and unsatisfactory. The majority of people stated that roads are unsatisfactory with electricity connection as the second most common unsatisfactory issue. An overview of the adequacy of the services in the community is shown in *Figure 6.5* (the number of households is recorded against the adequacy of the service).

Figure 6.5 *Adequacy of Services in the Community*



6.3.5 *Health*

Villagers from War Net Chaung and Yae Tar Shey village rely on both public and private health care services. Tha Pyay Kone and War Phyu Taw villagers rely on Public than Private while Nyaung Kone villgers go to public facility. Zaw Ti Kone village rely equally on both public and private.

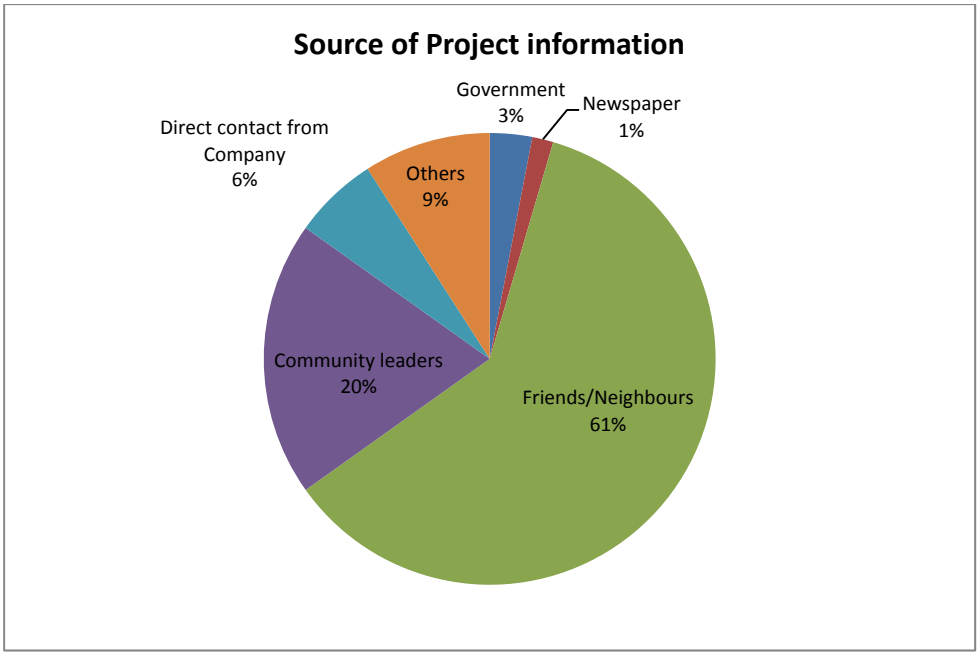
81% of people in the AOI spend 1,500 to 5,000 Kyats per month for health service and 19 % of them spend above 5,000 Kyats per month. The main

illnesses are common fever, hyptension, kidney problems, and stomach aches. The main hospital in the AOI is in War Net Chaung village.

6.3.6 *Knowledge and Information about the Project*

The household surveys considered knowledge of the Project and it was found that the community mainly received project information from friends and neighbours (61%). 20% of information is shared by community leaders and 6% from directly from the company (*Figure 6.5*).

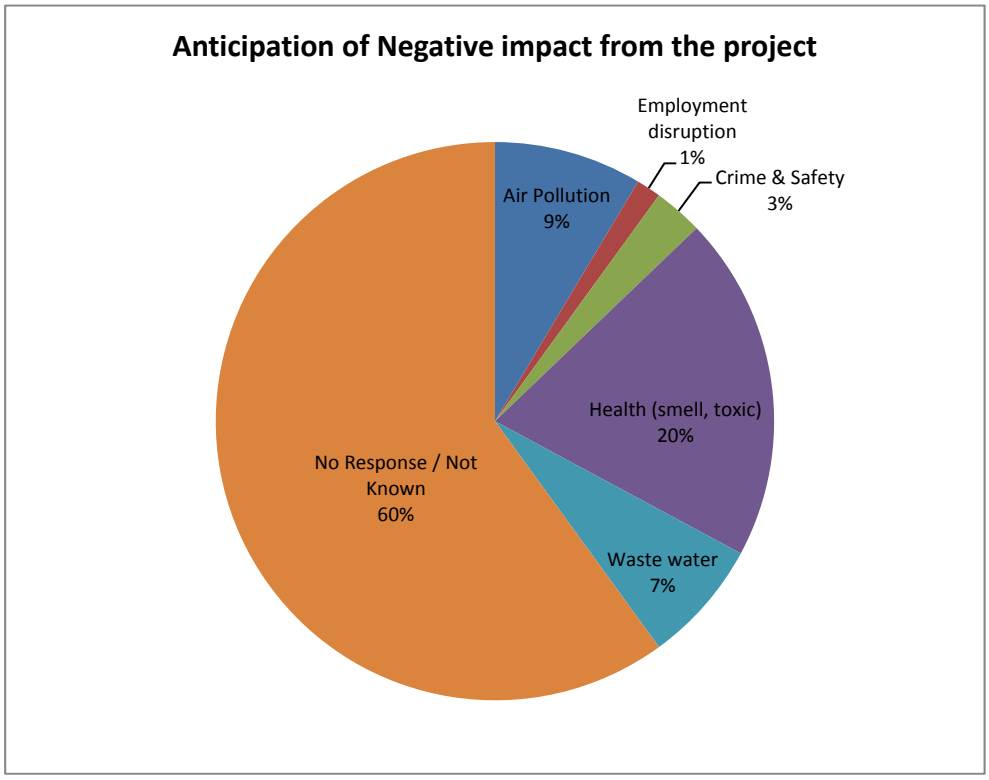
Figure 6.5 Source of Project Information



21% of households consulted mentioned that the project may bring positive impact for their livelihoods while 43% of villagers anticipated that the project will generate impacts. 43% of respondent do not give any answer.

The most common issue rasied was from potential health impact related to smell and toxins (20% of respondents) with 9% concerned for air pollution, and 7% for wastewater. 60% of villages did not respond or did not know what the potential impacts / benefits may be (*Figure 6.6*).

Figure 6.6 Community Views and Anticipation of the Project



6.3.7 *Village Profiles*

A number of focus group discussions (FGDs) were held with attendees in order to gather data on the Potentially Affected Communities. These FGDs were targeted at village heads (for population and demographic data), farmers (for livelihood data) and where present, women's groups were also conducted. Information collected during these FGDs is summarised in the following sections.

Tha Pyay Kone Village

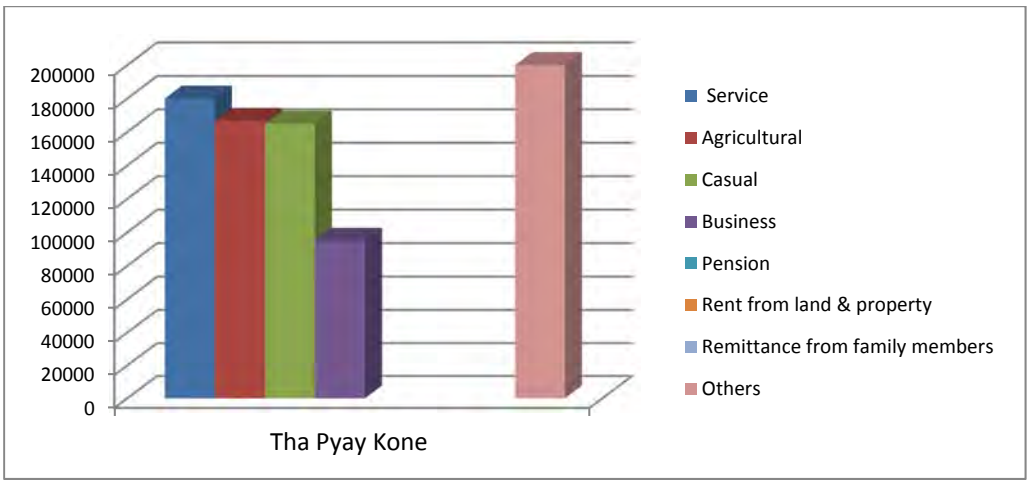
Background

Tha Pyay Kone village is located in Hmawbi Township, Northern District of Yangon Region. This village is located approximately 1.2 km north of Project site. The village was established over 100 years ago and is located near the Sa-Par-Kye Creek which flows into Hmawbi River. There are 96 households in the village with a population of 364 people (3.8 members per household on average) and most are engaged in agriculture. Vegetable plantation such as, green beans, cucumbers, and aubergine, and fruit plantation, such as pomelo, mango, and guava are common in the village. 70% of the population are Shan, 20% are Bamar and 10% are Karen.

Livelihood and Income

Half of the households in the village earn between 100,000 and 200,000 Kyats per month. The detailed source of income information is provided in *Figure 6.7.*

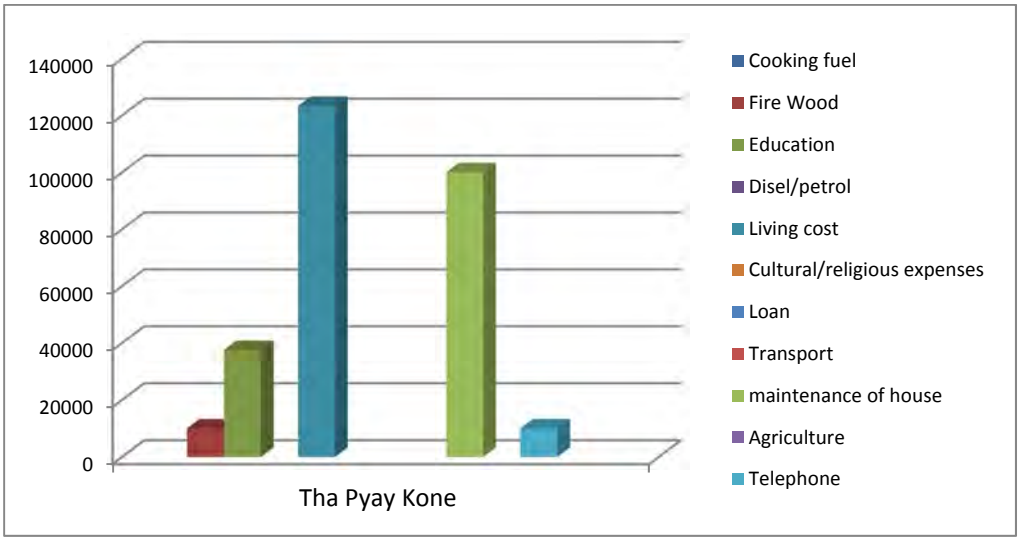
Figure 6.7 ***Different Source of Income in Tha Pyay Kone Village***



Note: casual = casual labourer

Most of the house expenditure goes to living costs (food, domestic use, etc.); some of them go to education, firewood and telephone. Only one respondent recorded a high expense for house maintenance, therefore the graph for maintenance shows this as high when it is low for the majority of households (*Figure 6.8*). There is no expense allocated for healthcare, transportation, loan repayment and agriculture input investment.

Figure 6.8 ***Household Expenditures in Tha Pyay Kone village***



Infrastructure and Utilities

The village has average road access to other villages but access is limited during the rainy season as it is made of laterite [1]. The village also has its own transformer for electricity and a collective storage water tank. Water supply is from a single manual pump well installed in the majority of

[1] A reddish clayey material, hard when dry, forming a topsoil in some tropical or subtropical regions and sometimes used for building

households and streams. There is also a primary school in the village. Photos of the village are provided in *Figur*e 6.9.

Figure 6.9 Photos Taken from Tha Pyay Kone Village

Houses

Monastery

Yae Tar Shey Village

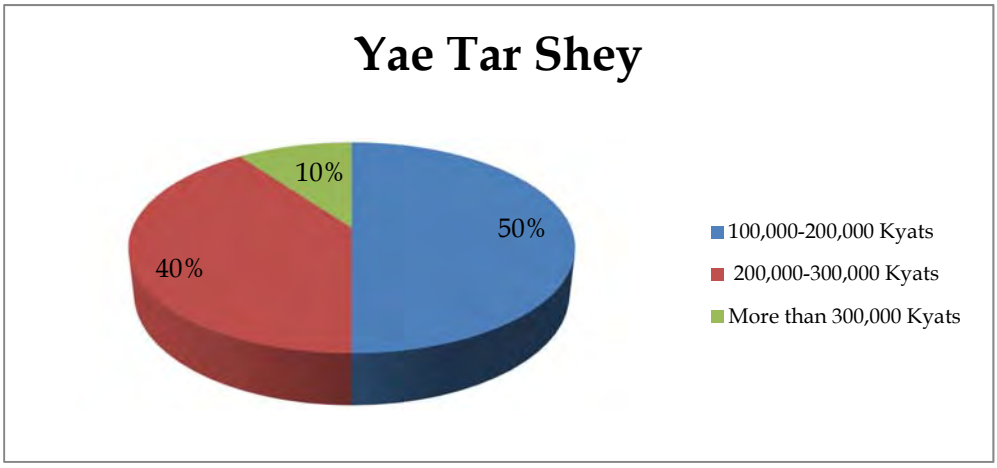
Background

Yae Tar Shey village is located in Hmawbi Township, Northern District of Yangon Region. This village is located 1 km north-west of the Project and is made up of around 449 households. The village was established over 60 years ago as is located near Sa-Par-Kye Creek which flows into Hmawbi River (around 10 miles from the village). Of the population, 50% are Shan and 50% are Bamar. Yae Tar Shey Village is home to population of 1,778 (4 members per household on average).

Livelihood and Income

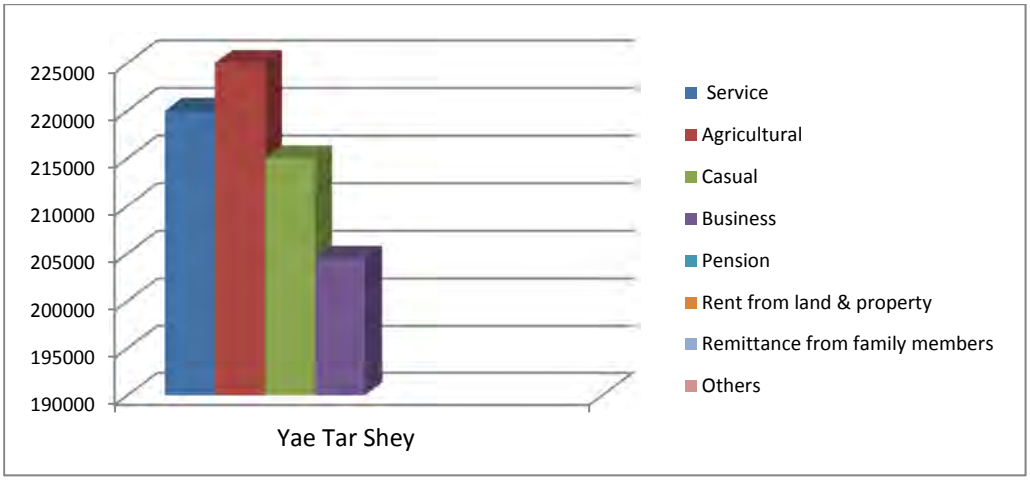
The main source of income in the past was making cook stoves. The majority of young people now work in garment and fertilizer factories located in Hmawbi Township. The senior generation are engaged in agriculture related business and grow golden and silver ginger lily and seasonal vegetable such as cucumber and eggplants. Only small numbers of households are engaged in other businesses such as trading, and government service. 50% of the households in this village earn between 100,000 and 200,000 Kyats per month *(Figure 6.10).*

Figure 6.10 Monthly Income of Household



In Yae Tar Shey village, most of the income is from agricultural, casual labour, and business. There is no income from pension, rent, remittance from family members and others (*Figure 6.11*).

Figure 6.11 Different Source of Income in Yae Tar Shey village



Income in Kyats shown on the Y Axis

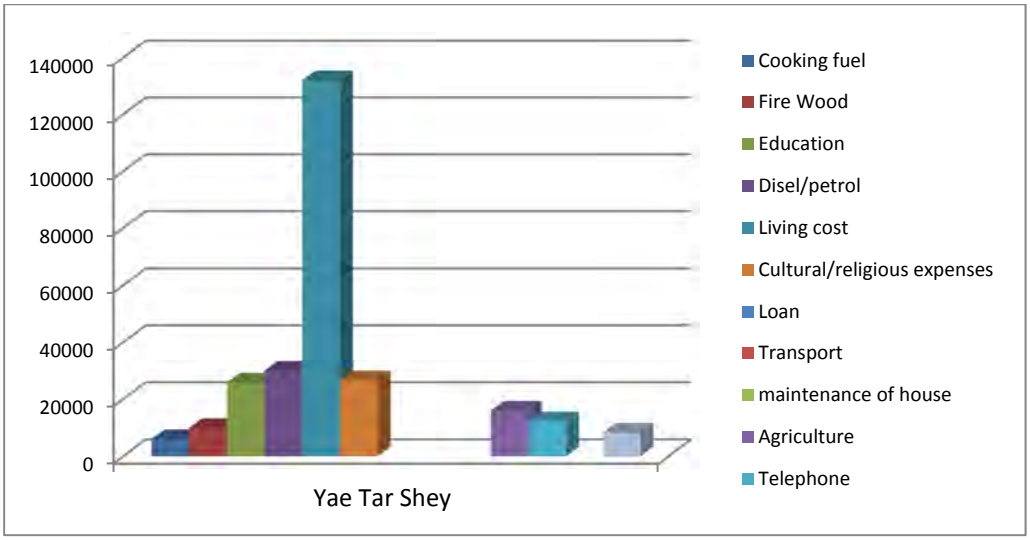
In this village, 90% of agricultural land is irrigated using water pumps. Generally all family members are involved in farming however sometimes additional labourers are hired from neighbouring villages. The wages paid per day are provided in *Table 6.9*. There are also poultry and pig farms for domestic and commercial purposes in this village.

Table 6.9 Expenditure on Agriculture

Expenditure on Agriculture	Amount
Wage paid per male labour per day	6,000 kyats
Wage per women labour per day	4,000 kyats

The main expense is for living costs. It is the only village in the AOI where some money was allocated to cultural and religious affairs. The detail of household expenditure Yae Tar Shey village is provided in *Figure 6.12*.

Figure 6.12 Household Expenditure in Yae Tar Shey village



Infrastructure and Utilities

The village is located along the main road to Hmawbi with good road access year round. There is a government owned Asbestos factory located between the village and the HAIC which is no longer functional. A secondary school is located in the village and 70% of the village has access to electricity from the national grid whilst the remainder use solar energy. For drinking water, villagers mostly take from the hand dug well. Photos of the village are provided in *Figure 6.13.*

Figure 6.13 Photo Taken from Yae Tar Shey Village

War Net Chaung Village

Background

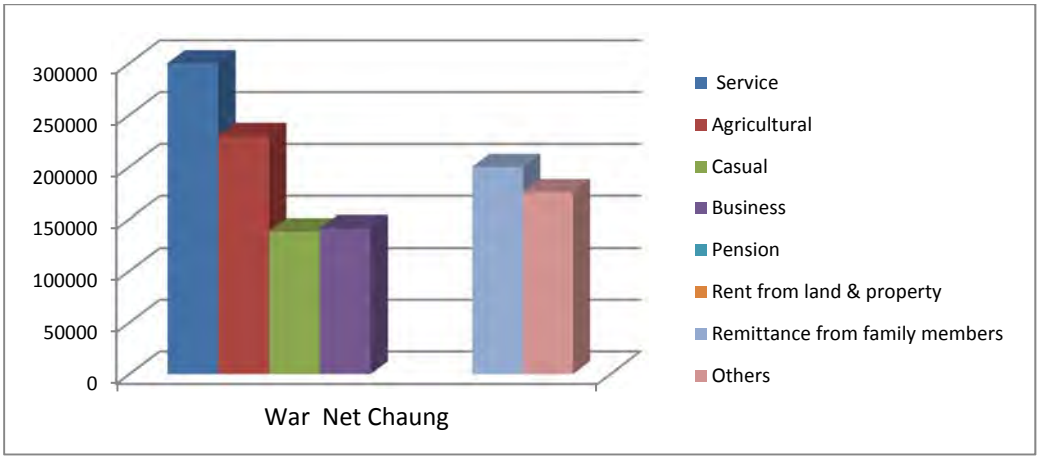
War Net Chaung village is located in Hmawbi Township, Northern District of Yangon Region. This village is located 2.6 km north-west of the Project and is made up of about 1,651 households. This is the main village tract in the area where HAIC has situated. The village was established over 100 years ago and is located near the Sa-Par-Kye Creek which flows into the Htan Ta Pin River (9 miles from the village).

Livelihood and Income

The majority of livelihood sources are casual labourer and agriculture. There are higher numbers of government employees residing in this village compared to other three villages. Small scale businesses such as grocery and other shops can be found along the main road. Livestock rearing is also undertaken as a source of livelihood in War Net Chaung.

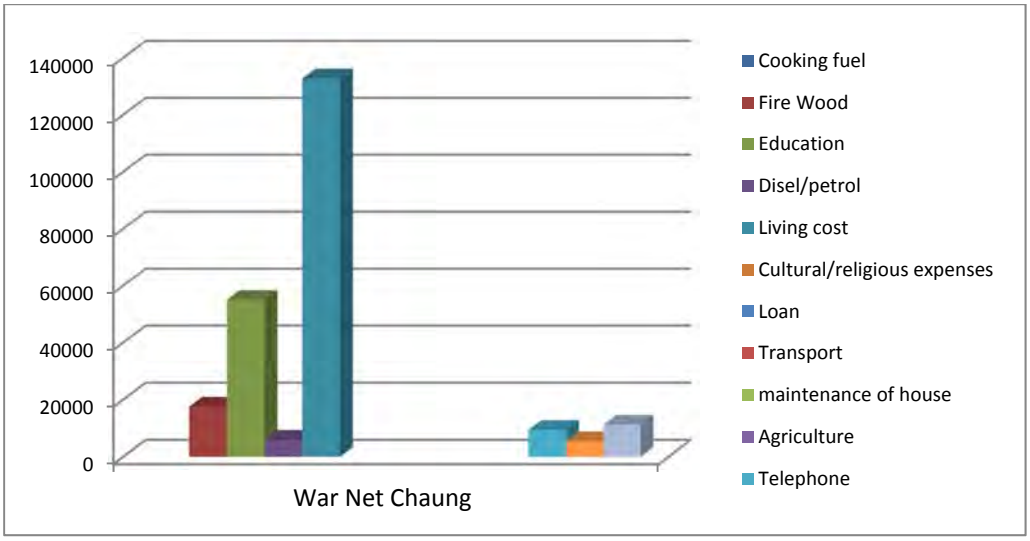
In War Net Chaung village, the higher amount of income comes from the source of general service and agriculture. Causal labourer work, remittance from family members and others also provided for family income. The detail sources of household income are provided in the *Figure 6.14.*

Figure 6.14 Different Source of Income in War Net Chaung Village



Average monthly income in War Net Chaung is slightly higher than in other villages with around 40% earning between 200,000 and 300,000 Kyat and 40% earning over 300,000 Kyat per month. Most expenses go to cost of living, as with other villages, the detailed household expenditure is provided in the *Figure 6.15.*

Figure 6.15 Household Expenditure in War Net Chaung Village



Infrastructure and Utilities

War Net Chaung village is located in the main road to Hmawbi Township and can be accessed year round. There is a train station, sub-township hospital, one Government High School and one monastic education school. The area is well known for supplying fruits and vegetables to the markets around the country. The main transportation is by motorbike.

80% of houses in War Net Chaung village have electricity provided by the government and others use solar power. Streams and ground water wells are the sources of water. Firewood is predominately used for cooking though electric and gas stove are available. Photos from the village are provided in *Figure 6.16.*

Figure 6.16 Photo Taken from War Net Chaung Village

Nyaung Kone Village

Background

Nyaung Kone village is located in Hmawbi Township, the Northern District of Yangon Region. The village is located 1.4 km west of the HAIC and has 58 households. The village was established over 100 years ago and it located near Sa Par Kye Creek which flows into Hmawbi River. This village is the

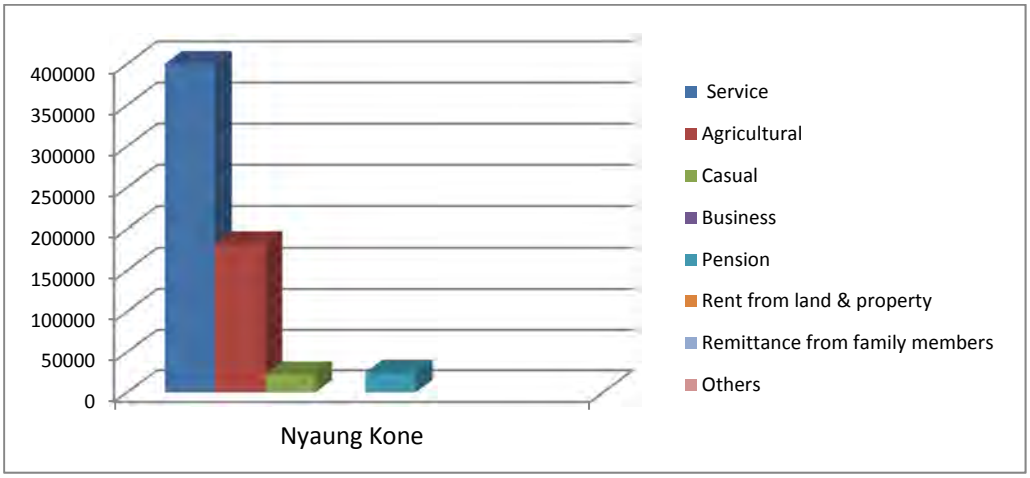
smallest of the villages consulted. Nyaung Kone village is home to some 58 households for a population of 271 (4.7 members per household on average).

Livelihood and Income

90% of households depend on agriculture and related business such as labouring. Growing seasonal vegetables, such as eggplant, beans, cucumbers, and jasmine flowers are the main source of income. Only small numbers of households are employed by the government and private sectors.

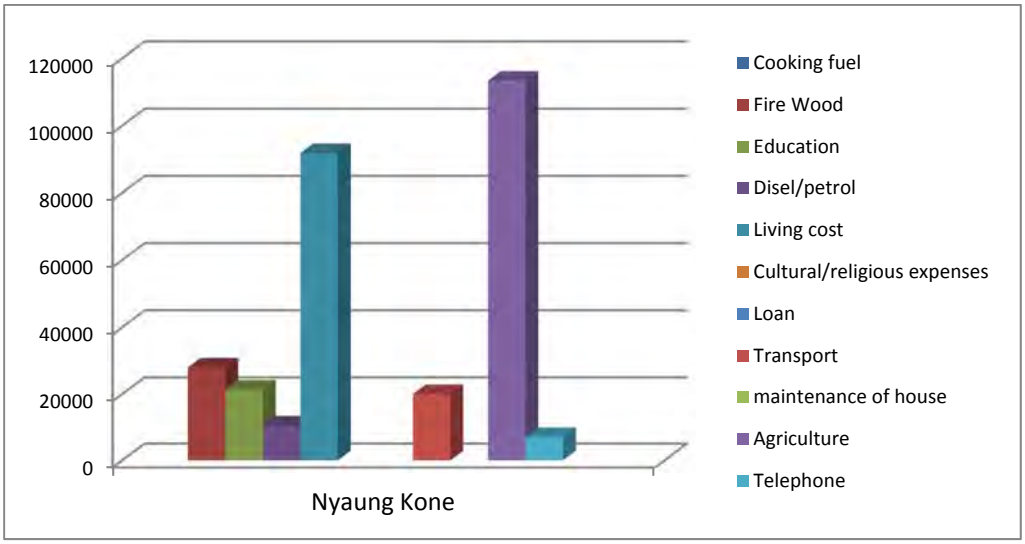
In Nyaung Kone village, most of the income comes from services and agriculture. It is the only village which has income from pension compared to other villages. Information on income sources is provided in the *Figure 6.17*.

Figure 6.17 Different Source of Income in Nyaung Kone Village



*V*illagers spend much more money in agriculture input than other villages and are the only village where living cost is lower than the agriculture expense. There is small amount of expenses on firewood, education, diesel and transport. Information on income sources is shown in *Figure 6.18*.

Figure 6.18 Household Expenditure in Nyaung Kone village



Agriculture and Livestock

Farmers mentioned that they use water pumps to irrigate their fields and each household owns about an acre of agriculture land. They stated that productivity has reduced compared to 20 years ago. In the past, farmers stated that they did not need to use fertilizer, as production was good. Nowadays farmers use different types of fertilizers and pesticides in order to meet the same productivity of the past. The younger generation are employed in factories with a small number working in agriculture related businesses.

Households in this village raise some animals such as chicken and pigs for domestic use. A private poultry farm owned by people from Yangon was seen around the entrance of the village. Photos of Kyaung Kone Village are provided in *Figure 6.19*.

Figure 6.19 Photo Taken from Nyaung Kone Village

7 STAKEHOLDER ENGAGEMENT

As a part of the ESIA process, consultation was carried out with the indirectly and directly affected population in four villages within the Project's Area of Influence (AOI). This included interviews with Village Leaders in each of the five villages in the AOI.

The consultation served the dual purpose of informing the public about the potential impacts of the Project and seeking community views on issues.

7.1 OBJECTIVES OF THE STAKEHOLDER ENGAGEMENT

The objectives of stakeholder engagement during the ESIA were to:

- Identify stakeholders and communities potentially affected by Project activities;
- Update stakeholders about the expansion Project; and
- Engage with potentially affected groups and individuals to understand their views, concerns and perceptions in order to inform the ESIA

7.2 STAKEHOLDER IDENTIFICATION

For this Project, local communities within 3.5 km of the Project Area were identified from a site visit in May, 2017. In addition to local communities, other stakeholder groups were identified such as governmental departments, non-governmental organisations (NGOs), civil society organisations (CSOs) and local businesses. These stakeholder groups are shown in *Table 7.1*.

Table 7.1 Stakeholder Mapping

Group	Key Stakeholders	Relevance
Potentially Affected Communities	- Wah Net Chaung Village - Tha Pyay Kone Village - Nyaung Kone Village - Yae Tar Shey Village	These communities live within 3.5 km of the Project and could be potentially impacted by the Project activities and should be consulted.
Government	- Village leaders - MONREC (Yangon) - Hmawbi GAD - Other relevant departments	GAD and local government should be consulted for data gathering and to inform the wider community of the Project.
NGOs / CSOs	- Green Network - Myanmar Centre for Responsible Business - Others, as appropriate	Some local CSO groups have voiced opposition to the Project in the past and should be consulted.
Businesses	- Asbestos Plant Workers - Others, as appropriate	Cumulative impacts from the Project should be considered and other businesses consulted.

7.3 OVERVIEW OF ENGAGEMENT UNDERTAKEN

Consultation in relation to environmental and social issues has been undertaken as part of the local EIA Study prepared for regulatory submission in Myanmar.

The following consultation was undertaken for the Supplementary ESIA:

- Consultation with Hmawbi Township GAD during Scoping in June 2017.
- Consultation with Village Tract Leaders and villagers from four villages during Scoping in June 2017.
- Focus Group Discussions with women and gardeners in four villages in June 2017.
- 72 Household surveys in six villages and one ward within the AOI in August 2017.

To inform this supplementary ESIA Report, engagement was undertaken in four areas covering the 5 villages (Kyade Taung Su was included in Wah Net Chaung); *Table 7.2*. Representative photos taken during the consultation are shown in *Figure 7.1*.

Table 7.2 Engagement Undertaken

Date	Location	Venue	Attendees
Scoping Phase			
21/6/2017	Hmawbi	GAD office	Government (8)
21//2017	Wah Net Chaung	Village monastery	Government (19), Local Community (37)
22/6/2017	Tha Pyay Kone	Village monastery	Government (4), Local Community (35)
22/6/2017	Yae Tar Shey	Village monastery	Government (9), Local Community (41)
23/6/2017	Nyaung Kone	Village monastery	Government (4), Local Community (35)
ESIA Phase			
16/8/2017	War Net Chaung	Village monastery	Government (5), Local Community (43)
16/8/2017	Nyaung Kone	Village monastery	Local Community (33)
17/8/2017	Yae Tar Shey	Village monastery	Government (1), Local Community (55)
17/8/2017	Tha Pyay Kone	Village monastery	Local Community (33)

7.4 *HOUSEHOLD SURVEYS*

Household (HH) survey questionnaires were used to gather data and solicit views about the Project from the communities around the project area to inform the ESIA. The data is relevant to understanding current socio-economic conditions in the Area of Influence of the Project, historical impacts associated with the construction of the project as well as potential issues associated with the operation of the Project.

Prior to conducting HH surveys, an introductory meeting was convened in the host community to introduce the purpose of the consultation. Each community consultation event consisted of an update of the project by Awba.

The information collected is reflected in the Socio-economic Baseline in ***Section 6*** of this supplementary ESIA.

7.5 *DATA COLLECTION*

Data was collected through community meetings, household surveys and face to face discussions with stakeholders. Special attention was given to potentially vulnerable groups such as women who have traditionally faced issues with land tenure (although not for this Project).

Community meetings were arranged by Awba and ERM in collaboration with the Village tract leaders and Village leaders. These meetings provided an opportunity to update stakeholders on the Project as well as gather feedback.

A total of 72 useable household surveys, and 8 group discussions for socio-economic systems were completed across all 6 villages with particular focus on the livelihoods of community. (*Figure 7.4*)

Table 7.3 Focus Group Discussions and Questionnaires in each Village

Date	Village	Village Tract	No. of HH Consulted by Village Tract
21.6.2017			Meeting with Hmawbi GAD officers and other related departments
21.6.2018	War Net Chaung	War Net Chaung	Public Consultation Meeting, Community Questionnaire: 1, Farmer Questionnaire:1
22.6.2017	Tha Pyay Kone	Let Pa Dan	Public Consultation Meeting, Community Questionnaire: 1, Farmer Questionnaire:1
22.6.2017	Yae Thar Shey	War Net Chaung	Public Consultation Meeting, Community Questionnaire: 1, Farmer Questionnaire:1 , Woman Group Discussion:1
23.6.2017	Naung Kone	War Net Chaung	Public Consultation Meeting, Community Questionnaire: 1, Farmer Questionnaire:1
16.8.2017	War Net Chaung	War Net Chaung	Public Consultation Meeting
16.8.2017	Nyaung Kone	Let Pa Dan	Public Consultation Meeting
17.8.2017	Yae Thar Shey	War Net Chaung	Public Consultation Meeting
17.8.2017	Tha Pyay Kone	War Net Chaung	Public Consultation Meeting
17.8.2017	Nyaung Kone	Let Pa Dan	6 HH Surveys
17.8.2017	Yae Thar Shey	War Net Chaung	15 HH Surveys
18.8.2017	War Net Chaung	War Net Chaung	30 HH Surveys
18.8.2017	Kyauk Taung Su Ward	War Net Chaung	5 HH Surveys
21.8.2017	Tha Pyay Kone	War Net Chaung	6 HH Surveys
21.8.2018	Wa Phyu Taw	War Net Chaung	5 HH Surveys
21.8.2019	Zaw Ti Kone	War Net Chaung	5 HH Surveys
Total Surveys			**72 HH Surveys, Public Consultation Meeting : 8, Community Questionnaire: 4, Farmer Questionnaire: 4, Women Group Discussion: 1**

7.6 KEY FINDINGS FROM CONSULTATION WITH AFFECTED COMMUNITIES

Key findings of consultation are presented below and summarised in *Table 7.4*.

Table 7.4 Summary of comments received

Key Comments Received and Response	Consideration for Supplementary ESIA
Consultation & Information Disclosure One of the key comments received related to the availability of information and transparency in the process. Stakeholders wanted to emphasise that it is important to ensure the community can understand the information provided. Some stakeholder in War Net Chaung noted that Pa Ywet Sate Kone, Kyi Ni San, Poe Dana Kone, and Shan Kone villages are located within 5 km of the Project (upstream) and should be included in the assessment.	The Regulatory EIA Report will have a Myanmar language executive summary to ensure information is easily available to local communities. Awba will undertake further disclosure and consultation in Pa Ywet Sate Kone, Kyi Ni San, Poe Dana Kone, and Shan Kone villages.
Public Health & Safety The key concern related to public health and safety impacts specifically from air and wastewater emissions. These also included concerns related to unplanned events. The four villages consulted are downstream of the Project Site and use the river/creek water for domestic and drinking purposes.	This Supplementary ESIA will assess the impact on Public Health and Safety from air and noise emissions. The baseline survey results from air, noise, soil, water and biodiversity will be disclosed to the community.
Monitoring and Auditing Transparency of the monitoring and auditing process during operation was of key importance to the stakeholders.	The grievance mechanism and future disclosure will be provided to all PAPs in the area.
Use of Existing Infrastructure The quality of the access road was commented on during the public consultation. Some community members mentioned that Awba vehicle use had damaged the road into the Project Site.	Awba will investigate this grievance via their community grievance mechanism and will restore the road to its existing condition after the rainy season.
Current Activities / Historic Activities Some people in Nyaung Kone reported a smell coming from the current operations or store at the Project Site. Also, one main concern was historic contamination from the existing industrial park and factories.	Awba will investigate the odour complaint through their community grievance mechanism. Awba have undertaken a baseline assessment and will disclose the results of the baseline to the local communities. Awba will also undertake regular monitoring as outlined in this supplementary ESIA and will disclose monitoring results to the local community.

Key Comments Received and Response	Consideration for Supplementary ESIA
Land Permitting This village raised concerns with the permitting of the land from the ministry / government and the site selection process.	Awba were given permission from the Ministry of Agriculture, Livestock and Irrigation to construct the Project within this existing Industrial Zone.
Corporate Social Responsibility and Social Benefits All villages mentioned potential social investment opportunities in the village. The two key concerns on inadequacies of services related to road condition and electricity. These were mentioned as potential opportunities for social investment. In Nyaung Kone, it was noted that villagers spend a lot of money on pesticides and Awba could provide a subsidized store for the local community for their products.	Awba will undertake a CSR program once operational and will consider these suggestions in the planning of any social investment.

In addition to questions raised during the ESIA engagement, a number of grievances were collected as part of the Community Grievance Procedure, this are provided in *Table 7.5* with considerations for this Supplementary ESIA.

Table 7.5 Community Grievance Log

Category	Summary of Query	Action for ESIA
Corporate Social Responsibility (CSR)	To conduct the Community Development activities transparently and affectively. Awba should contribute to the local hospital and provide discount pesticide shop for local.	All engagement activities will be conducted transparently. CSR is not part of the ESIA, Awba will consider CSR separately.
ESIA	Who will take responsibility to inspect and monitor following the impact assessment. ERM to involve respective community members for the ESIA survey. Provide communities the result of the ESIA as well as provide guarantee on their result and collect from tube wells.	Monitoring, including roles and responsibilities, will be included in the ESIA Report. Community members will be invited to the baseline surveys. Water will be collected from tube wells and the results will be provided to the community during future engagement.
Accidental events	Information needed on the emergency plan and the potential impacts to villagers.	Accidental events (including impact to communities) will be assessed in the ESIA.
Job opportunities	Provide job opportunities to youth and local community members.	The provision of jobs and potential beneficial impact will be assessed in the ESIA.
Land Issue	The road connecting Phoe Dana Kone village to Nyaung Kone village has been reduced from 13 ft. to 6.5 ft. by the Project fencing.	This is based on the Land Lease Agreement between Awba and the Ministry of Agriculture.
Pollution	Will gas emissions damage crops or agricultural land? There have been historic examples of sickness in the community when the MPI factory produced gas (and/or) smoke.	Emissions and their impact on local communities and the surrounding environment will be assessed in the ESIA. A cumulative assessment of impacts from the Industrial Park will also be undertaken.
Relocation	The Project is located near villagers, why was this land selected? Is it possible to relocate?	This is based on the Land Lease Agreement between Awba and the Ministry of Agriculture.

Category	Summary of Query	Action for ESIA
Road damage	The factory trucks are damaging the roads of the villages. Awba should repair the road.	Awba should repair the road to the Site.
Village Information	The village list shared is not correct. Public consultation should be conducted in all the villages surrounding project area and involved in the ESIA survey.	Consultation locations were selected to include all the village tracts within 3.5 km. The second round of engagement will invite villagers from villages in which the meetings are not held during the scoping engagement.
Waste Management	Concerned that waste produced by the factory would impact local water courses, local crops and local communities. Provide an explanation of the waste management system to the villagers.	The potential impact of waste on environmental and social receptors will be considered in the ESIA.

Figure 7.1 Consultation Photos

Wah Net Chaung

Nyaung Kone

Yae Tar Shey

Tha Pyay Kone

7.7 *NEXT STEPS*

Consultation outcomes have been incorporated into the design of mitigation measures for Project and are contained in this ESIA Report. These include:

- Routine air and water monitoring at the Project Site and in communities closest to the Project Site.
- The access road to the Project Site has been damaged by Project vehicles and it is recommended that Awba restore the road to its original condition.
- Development of a formal grievance procedure for use by local residents.
- Undertake consultation and information disclosure in Pa Ywet Sate Kone, Kyi Ni San, Poe Dana Kone, and Shan Kone villages.

During the ESIA disclosure period, Awba has committed to briefing those communities consulted as part of the ESIA process to provide feedback on how the concerns raised are being addressed.

7.7.1 Grievance Mechanism

Awba have engaged Conyat Create to prepare a Community Grievance Mechanism for the Project. The proposed Grievance Mechanism is provided in *Figure 7.1*. The roles and responsibilities of the Grievance Mechanism are provided in *Table 7.6*.

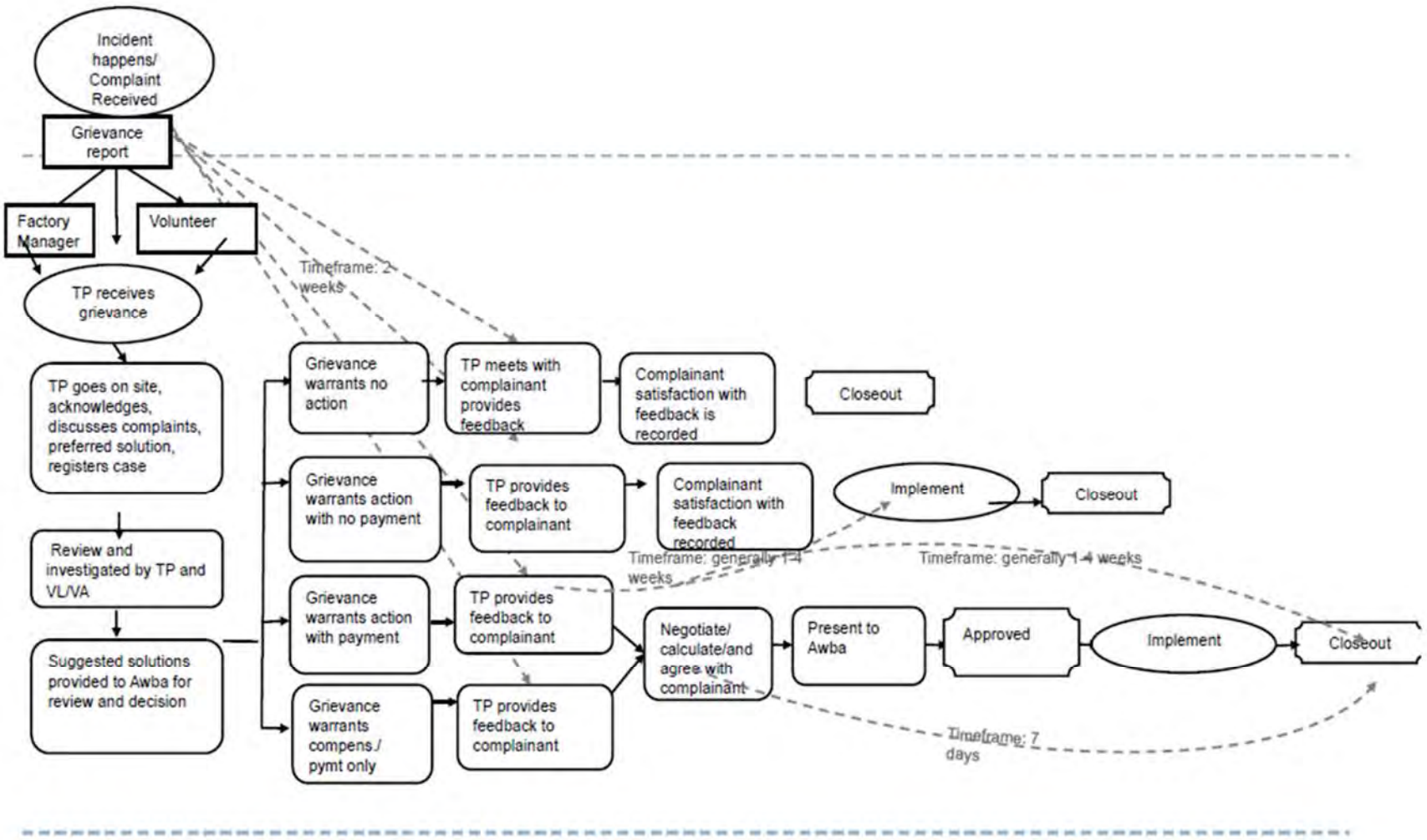
Table 7.6 Roles and Responsibilities of Grievance Mechanism

Role	Responsibility
3rd Party Conyat Create	• Implement the mechanism during a three-month pilot phase and provide training to key community stakeholders and volunteers • Manage the grievance mechanism • Coordinate with communities and complainants • Collect, record, and monitor grievances • Coordinate with the Awba Grievance Mechanism Committee and provide suggestions for remedy • Close out cases and negotiate on behalf of Awba • Communicate progress
Community Volunteer	• Collect complaints and/or concerns • Collaborate with the 3rd Party to communicate and promote instructions, progress, and operation activities • Communicate progress • Coordinate with the 3rd Party once a week
Awba Grievance Mechanism Committee	• Review grievance log and suggested solution provided by 3rd Party • Disclose grievance results and progress on corporate website on a quarterly basis • Attend quarterly progress workshop with communities

7.7.2 Further Engagement

Continual engagement is an important part of the Project. Awba will disclose this ESIA Report to local communities. Engagement should also be undertaken periodically with local communities to ensure that they are informed on the Project and to present the results of the grievance mechanism.

Figure 7.1 Community Grievance Mechanism



8 CONSTRUCTION PHASE IMPACT ASSESSMENT

As presented in the ESIA ToR (**Appendix A**), potential significant impacts to air quality, noise, surface water quality, soil quality, community health and safety, economy and livelihoods, occupational health and safety, and infrastructure are expected from the construction and operation of the Project. These priority impacts of the Project identified during the Scoping Phase are included in the impact assessment provided below.

The Project's Environmental and Social Action Plan (ESAP) is included in **Appendix C**.

8.1 AIR QUALITY

8.1.1 Source of Impacts

The construction of the Project has the potential to generate dust as a result of ground excavation, material transfer, stockpiles of material and use of construction vehicles on unmade roads.

Fugitive dust has the potential to cause impacts on sensitive receptors in the vicinity of construction activities if not managed accordingly. Dust emissions can vary substantially from day to day and will depend on the level of activity, the specific operations being undertaken and the meteorological conditions.

The proposed Project activities identified as having a potential impact on air quality during the construction period include:

- Vehicle movements over unpaved access roads and within construction areas;
- Site clearance, site formation and levelling involving excavation and material transfer; and
- Construction of the main Project infrastructure.

The Institute of Air Quality Management (IAQM) [1] provide guidance for defining the significance arising from construction sites based on the magnitude of the change and the sensitivity of the receptors identified. The risk of dust emissions is defined using a number of variables including, but not limited to the activities being undertaken, the duration of activities, the size of the site and the meteorological conditions. The guidance further provides screening criteria of 350 m and 50 m from the construction site and access road, respectively, beyond which impacts are not considered likely. The premise of the guidance is that with the implementation of effective site specific mitigation measures, the environmental effect will not be significant in most cases. However, as the guidance is primarily developed for use in

[1] Institute of Air Quality Management (IAQM) (2014) Guidance on the Assessment of Dust from Demolition and Construction [Online] Available at: http://iaqm.co.uk/guidance/ {Accessed 07 August 2017}

the UK, consideration is given to its applicability in Myanmar due to the dissimilar climate and differing construction working practices. On this basis, further evidence has been explored such as that specified by the USEPA [1] [2] which states that:

"The potential drift distance of particles is governed by the initial injection height of the particle, the terminal settling velocity of the particle, and the degree of atmospheric turbulence. Theoretical drift distance, as a function of particle diameter and mean wind speed, has been computed for fugitive dust emissions. Results indicate that, for a typical mean wind speed of 16 km/hr (10 mph), particles larger than about 100 µm are likely to settle out within 6 to 9 meters (20 to 30 feet [ft]) from the edge of the road or other point of emission. Particles that are 30 to 100 µm in diameter are likely to undergo impeded settling. These particles, depending upon the extent of atmospheric turbulence, are likely to settle within a few hundred feet from the road. Smaller particles, particularly PM-15, PM-10, and PM-2.5, have much slower gravitational settling velocities and are much more likely to have their settling rate retarded by atmospheric turbulence."

And:

"Entrainment of dust particles by the action of turbulent air currents, such as wind erosion, are likely to occur from open exposed surfaces (such as stripped ground and stock piles) at wind speeds greater than 19 kilometres per hour(5.3 m/s)."

And:

"However, all roads are subject to some natural mitigation because of rainfall and other precipitation and emission factors can be extrapolated to annual average uncontrolled conditions (but including natural mitigation) under the simplifying assumption that annual average emissions are inversely proportional to the number of days with measurable (more than 0.254 mm [0.01 inch]) precipitation."

8.1.2 *Existing / In-Place Controls*

There are no in place controls for air quality.

8.1.3 *Impact Significance*

The evidence presented suggests that particulate matter generated by the Project can remain airborne and can travel several hundred feet from the source, and emissions and subsequent impacts to air quality associated with the construction activities will depend a lot upon the nature of the activities occurring at any one time or location and local meteorological conditions at the time of release. Given that during construction, emission source locations and volumes of materials being moved, for example, are constantly changing both spatially and temporally, impacts have not been separately quantified for separate Project related construction sites or activities. Instead, the impact

[1] United States Environmental Protection Agency (USEPA) (1995) AP-42 Section 13.2 Fugitive Dust Sources [Online] Available at: https://www3.epa.gov/ttnchie1/ap42/ch13/ [Accessed 03 August 2017]

[2] United States Environmental Protection Agency (1995) AP-42 Section 13.2 Fugitive Dust Sources [Online] Available at: https://www3.epa.gov/ttnchie1/ap42/ch13/ [Accessed 03 August 2017]

from construction dust is said to have a major adverse impact if unmitigated and uncontrolled at receptors within a conservative distance of 500 m of construction activities and access roads. The significance of impacts pre-mitigation is presented below in *Table 8.1.*

Table 8.1 Assessment of Impact Related to Construction Dust during Construction

Impact	Adverse impact to human health and agriculture, as well as nuisance issues from dust emitted from construction related activities including vehicles moving over un-paved road surfaces.				
Impact Nature	Negative	Positive	Neutral		
	Elevated ambient concentrations of dust from construction related activities will have a **negative** impact on human health and agriculture as well create nuisance issues.				
Impact Type	Direct	Indirect	Induced		
	Elevated ambient concentrations of dust from construction related activities will have a **direct** impact on human health and agriculture as well create nuisance issues.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Potential impacts to air quality will occur throughout the construction phase only and can therefore be described as **short term** in nature.				
Impact Extent	Local	Regional	International		
	Construction activities at the site have the potential to result in significant emissions of dust up to 500 m from the construction site boundary and can therefore be described as **local.**				
Impact Scale	The scale of the impact is likely to be up to 500m from the construction site boundary.				
Frequency	Impacts will be **intermittent** and **spatially variable** during the construction phase.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	The impact magnitude before mitigation is expected to be **large.**				
Receptor Sensitivity	Low	Medium	High		
	All sensitive human and agricultural receptors in the study area are defined as 'medium' sensitivity with regard to impacts from dust emissions.				
Impact Significance	Negligible	Minor	Moderate	Major	
	The impact magnitude before mitigation is expected to be **major.**				

8.1.4 Additional Mitigation and / or Management Measures

Effective site management is critical to the successful implementation of dust suppression procedures and any air quality complaints during the construction phase of the Project should be investigated, the cause determined and actions taken to reduce those emissions in a timely manner.

For the construction activities, several best practice mitigation and management measures are advised:

- A dust management plan (DMP) should be produced and adhered to. The DMP will include measures to be adopted by Awba during the dry season to avoid dust impacts such as the use of localised dampening and activity specific dampening should be used to reduce localised emissions of dust;
- Water suppression or surface binding agents should be used on exposed open earthworks where rainfall is less than 0.25 mm in a 24 hour period and wind speeds are forecast to be more than 19 kph (5.3m/s) (i.e., during the dry season from December to March;
- Where unpaved roads are utilised by vehicles, water suppression at a rate of 2 litres/m^2/hr should be used where rainfall of less than 2 mm in the last hour has occurred or surface binding agents should be used to more permanently reduce dust generation;
- On-site meteorological monitoring should be undertaken to inform the use of mitigation on site during construction period. This will be included in the Construction Phase Monitoring Plan;
- Wheel washing should be used prior to entry onto a sealed road section to avoid tracking dirt onto sealed roads and generating dust;
- Vehicles transporting dusty materials should be covered;
- Stockpiling of material, for example, rocks, sand and soils should be minimised;
- Stockpiles should be located as far away from receptors as possible;
- The design of stockpiles should be optimised to retain a low profile with no sharp changes in shape;
- Vegetation of stockpiles should be used where a stockpile is not to be used for a month to stabilize the surface and prevent dust generation;
- Drop heights of material should be minimised;
- Wind breaks should be erected around the key construction activities and in the vicinity of potentially dusty works;
- Qualitative monitoring surveys should be implemented to include site inspections for visible dust emissions in the vicinity of the site boundary (both internal and external); and
- Visual monitoring of dust deposition onto surfaces on and off-site should be undertaken regularly.

Management procedures, such as those outlined above, should be outlined within the dust management plan so that impacts to air quality are reduced.

It should be noted that dust during the construction phase, dust emissions will be naturally attenuated during periods of increased precipitation i.e. during

the wet season (see *Figure 5.7*). Mitigation measures should be carefully considered relative to meteorological conditions and amended accordingly. For example, the use of additional water suppression and localised dampening should be managed during periods of increased rainfall as additional suppression techniques may not be necessary.

A Construction Phase Monitoring Plan will be required for the Project which will include air quality. During construction, emissions of particulates PM10, PM2.5, NO_2, and SO_2 will be monitored monthly at the ASRs as shown in *Figure 5.1*. NO_2 and SO_2 measured by means of a diffusion tube. Others will be monitored by HAZ-SCANNER (EPAS) Environmental Perimeter Air Monitoring System.

8.1.5 Significance of Residual Impact

When correctly applying and actively managing the mitigating controls outlined in *Section 8.1.2*, it is reasonable to conclude that receptors located within 500 m downwind of any construction activity are likely to experience **minor impacts** to air quality. It is important to undertake monitoring to track the effectiveness of these mitigation measures and manage any necessary changes accordingly. The monitoring plan is set out in *Table 10.3*.

8.2 NOISE

8.2.1 Source of Impacts

The construction noise impact assessment was conducted with reference to relevant international guidelines and local legislation, regulations, standards where available. Noise level guidelines given in Myanmar Environmental Quality Guideline (EQG) and IFC General EHS Guidelines are 55 dB(A) LAeq,1 hour for daytime and 45 dB(A) LAeq, 1 hour for night-time, or a maximum increase in background levels of not more than 3 dB(A) at the nearest receptor location off-site. Since baseline monitoring was conducted, noise criterion of a maximum increase in background levels of not more than 3 dB(A) was adopted as the assessment criterion.

Baseline noise monitoring was conducted on 30 June to 5 July 2017 at five selected noise sensitive receivers (NSRs) located near the Project Site to establish the background levels (*Figure 5.12*). Based on the findings, the average noise levels (both day and night time) at the Baseline Noise Monitoring locations are in general above the EQG and IFC EHS General Guidelines (2007). These baseline levels were mainly captured from vehicles (motorcycles, cars), people activities, rain and loud speakers.

The methodology adopted for the construction noise impact assessments is based on standard acoustics principles. The procedures of the assessment are summarised as follows:

- locate representative noise sensitive receiver (NSR) that may be affected by the works;

- assign Sound Power Level (SWL) to each plant item proposed and calculate the overall SWL associated with the proposed plant inventory;
- determine the distance between the approximate geographical centre of the Project work site and the NSR;
- apply correction factors on the distance and façade reflection, in accordance with BS5228: Part 1: 2009(1); and
- predict the construction noise levels at NSRs on the basis of the plant activity and an in built design controls, if any.
- Identification of Noise Sensitive Receivers
- The nearest representative NSRs that may potentially experience noise impacts from the construction works of the Project are identified with locations shown in *Figure 4.3*:

Noise will be generated by the plant and machinery used on site to construct the HAIC. This will include plant and machinery such as generator, cranes, backhoe etc. Noise generated during the construction phase is a nuisance to nearby NSRs and is thus considered as potentially significant impact.

The indicative construction plant inventory for the construction activities during daytime period of the Project is summarised in *Table 8.4*. It is assumed that the construction works will be carried out during daytime period only.

Table 8.4 Indicative Construction Plant Inventory (Daytime)

Plant Item	Quantity during peak hour	Unit SWL, dB(A)	Sub-Total SWL, dB(A)	Overall SWL, dB(A) (b) (c)
Excavator	5	100	107	123
Dozer	5	107	114	
Mobile crane	5	108	115	
Concrete pump (stationery)	3	103	108	
Concrete pump (Boom)	3	108	113	
Roller compactor	5	103	110	
Jack hammer	5	113	120	

Notes:
(a) SWL is calculated from the Sound pressure level at 10m provided by the Client.
(b) The figures are rounded up to a whole number.
(c) The overall SWL represents the maximum potential noise impact during construction phase.

The results of the predicted construction noise levels at the representative NSRs are presented in *Table 8.5*.

(1) Noise and Vibration Control on Construction and Open Sites, Part 1. Code of Practice for Basic Information and Procedures for Noise and Vibration control. British Standard, BS5228: Part 1: 2009

Table 8.5 Predicted Construction Noise Levels at Representative NSRs

NSR	Distance between the approximate Geometric Centre of the Works Area and NSR (D), m	Predicted Noise Level[b] [c], dB(A)
NSR1	3,000	45
NSR2	1,307	47
NSR3	615	55
NSR4	1,026	50
NSR5	1,564	45

Notes:
(a) The SWL from *Table 8.4* has been adopted in the calculation.
(b) Predicted noise level = overall SWL + distance correction + façade reflection
= 123 – (25 x log D + 1) + 3
(c) The figures are rounded-up to a whole number.

Potential Consequence

With the indicative plant inventory presented in *Table 8.4*, the predicted construction noise levels at the representative NSRs are in the range of 45 - 55 dB(A). Cumulative noise impact is presented in *Table 8.6*.

Table 8.6 Predicted Construction Noise Levels at Representative NSRs

NSR	Predicted Noise Level (A), dB(A)	Daytime Averaged Background Noise Level (B), dB(A)	Cumulative Noise Level , dB(A) [a]	Increase in Background Noise, dB(A) [b]	Compliance (Yes/No)
NSR1	45	66	66	0	Yes
NSR2	47	59	59	0	Yes
NSR3	55	61	62	1	Yes
NSR4	50	50	53	3	Yes
NSR5	45	67	67	0	Yes

Notes:
(a) Cumulative Noise Level (C) = 10 x log ($10^{(A/10)}$+ $10^{(B/10)}$)
(b) With reference to assessment noise criterion of a maximum increase in background levels of not more than 3 dB(A).

The predicted noise levels at all NSRs during daytime period due to construction activities comply with the EQG and IFC General EHS Guidelines. Noise mitigation measures are considered unnecessary.

8.2.2 Existing in-place controls

There are currently no existing / in-place controls for noise.

8.2.3 Impact Significance

The nearby NSRs are residential in nature and their sensitivity is considered medium. Given in *Table 8.6* that the predicted noise levels due to construction of the Project comply with noise criteria, construction noise impact is not anticipated. As such, the magnitude of impact is considered high and the impact significance is considered **negligible** (see *Table 8.7*)**.**

Table 8.7 Noise Impact Assessment - General Construction Phase

Impact	Noise impact from the construction works during construction phase.				
Impact Nature	Negative	Positive	Neutral		
	Noise impact from the construction activities is **negative**.				
Impact Type	Direct	Indirect	Induced		
	Noise impact from the construction activities is **direct**.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Noise impact from the construction activities is **temporary**.				
Impact Extent	Local	Regional	International		
	Noise impact from the construction equipment and activities is **local**.				
Impact Scale	Project area.				
Frequency	Throughout the construction period.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	Considering the predicted noise levels comply with both the noise criteria. The magnitude of the noise impact is **Negligible**.				
Receptor Sensitivity	Low	Medium	High		
	The identified NSR are residential, the sensitivity of the receptor is considered as **medium.**				
Impact Significance	Negligible	Minor	Moderate	Major	
	As the impact magnitude is negligible and the receptor sensitivity is medium, the impact significance is considered as **Negligible**.				

8.2.4 Good Site Practices

The following good site practices are recommended during construction phase of the Project:

- Well-maintained equipment to be operated on-site;
- Regular maintenance of equipment such as lubricating moving parts, tightening loose parts and replacing worn out components;
- Shut down or throttled down between work periods for machines and construction plant items (e.g. trucks) that may be in intermittent use;
- Reduce the number of equipment operating simultaneously as far as practicable;
- Orientate equipment known to emit noise strongly in one direction so that the noise is directed away from receptors as far as practicable;
- Locate noisy plant as far away from receptors as practicable;
- Avoid transportation of materials on- and off-site through existing community areas; and
- Use material stockpiles and other structures, where practicable, to screen noise sensitive receptors from on-site construction activities.

8.2.5 Significance of Residual Impact

Residual noise impact due to the construction of the Project is expected to be of **negligible significance**. Noise monitoring during construction is considered not necessary.

8.3 WATER QUALITY

8.3.1 Source of Impacts

As presented in *Section 5.5*, there is a stream at the north-west corner of the Project Site. This stream is on the lowest point of the Project Site and is subjected to wastewater run-off from the Project. The stream flows to the northwest and into the villages of Nyaung Kone and Wah Net Chaung where stream water is then used for drinking, washing and cleaning. Potential impacts to surface water quality and use of these water resources by the communities are therefore important issues to be considered.

Typical construction activities (such as site preparation, excavation and foundation work etc.) can cause impacts to surface water quality through run off of unconsolidated sediments, for example, from stockpile areas. As observed during the site visits in May 2017, there appeared to be no run-off management at the Project Site and sediment laden run-off was observed flowing to the stream at the north-west corner of the Project Site. The generation of sediment laden run off could be transferred to the nearby rivers and creeks. In addition, poor sanitation facilities in the worker camps may lead to surface water contamination through improper sewage handling. Improper solid waste management, which was observed during the site visit, could also be a potentially significant issue to surface water quality.

No secondary containment was observed at the Project Site at the storage area of hazardous materials. Spill from the storage area as well as from maintenance and refuelling area may result in surface water contamination and this can have long-term deleterious effects on human and environmental health.

Results of the baseline water quality surveys conducted in June to July 2017 indicated there where high levels of TSS in the surface water and total coliform bacteria at all stations.

8.3.2 Existing / In-place Controls

There are no existing / in-place controls.

8.3.3 Impact Significance

The receptor sensitivity to surface water quality impact is high given that the streams and rivers downstream of the Project Site are used as a drinking water supply. The potential impact magnitude is considered to be large given the existing in-place control is considered inadequate. The overall impact significance is therefore **major**.

Table 8.3 Water Quality Impact Assessment

Impact	Deterioration of surface water quality in nearby watercourses from uncontrolled runoff, improper wastewater, solid waste and hazardous material management at the site.				
Impact Nature	Negative	Positive	Neutral		
	Pollutants entering surface water courses would create a negative impact.				
Impact Type	Direct	Indirect	Induced		
	The impact would be directly upon surface water resources and on the residents of nearby villages that depend on water supplied from the watercourses.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	If not managed, the impact would occur during the construction phase of the Project.				
Impact Extent	Local	Regional	International		
	The extent of the impact would be limited to the watercourses adjacent to the site.				
Impact Scale	Moderate				
Frequency	Runoff from the construction site will occur frequently during the construction phase. Contamination due to improper wastewater, solid waste and hazardous material management are expected to be infrequent during the construction phase.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	The impact magnitude is **Large**.				
Receptor Sensitivity	Low	Medium	High		
	The receptor sensitivity is **High**, given the year round dependence by residents on water from the watercourses for drinking, washing and cleaning.				
Impact Significance	Negligible	Minor	Moderate	Major	
	The impact magnitude before mitigation is expected to be **major.**				

8.3.4 Additional Mitigation/Management Measures

Construction Site Run-off and Drainage

Good site practices should be developed in order to minimise surface runoff, and also to retain and reduce any suspended solids prior to discharge. These practices include the follows:

- Exposed soil surfaces should be protected by paving or fill material as soon as possible to reduce the potential of soil erosion.

- Open stockpiles of construction materials or construction wastes on-site should be covered with tarpaulin or similar fabric during rainstorms.

- Design drainage pipes and culverts for the controlled release of storm flows.

- Regularly, and particularly following rainstorms, inspect and maintain drainage systems and erosion control and silt removal facilities to ensure proper and efficient operation at all times.

- Provide measures to reduce the ingress of site drainage into excavations. If trenches have to be excavated during the wet season, excavate and backfill them in short sections wherever practicable. Discharge any water pumped out from trenches or foundation excavations into storm drains via silt removal facilities.

- Mulch to stabilise exposed areas, where practicable and appropriate.

- Re-vegetate areas promptly, where practicable and appropriate.

- Provide measures to prevent the washing away of construction materials, soil, silt or debris into any drainage system of open stockpiles of construction materials.

- Construct wells/ sediment basins for the separation of oil in the wash water and stormwater drains.

- Oil water separators and grease traps will be installed and maintained as appropriate at refueling facilities, workshops, parking areas, fuel storage and containment areas.

- Discharges of runoff should be monitored monthly for compliance with Myanmar National Environmental Quality (Emissions) Guidelines for site runoff and wastewater discharges (construction phase).

Sewage Generated from On-site Workforce

- Where no public sewage treatment system is available (e.g. during construction), sanitary waste water will be treated by domestic waste water unit (ref. septic tank). The contractor will provide the domestic waste water unit which is designed and installed to treat all domestic wash and wastewater and sewage during construction. All effluents shall comply with legal guidelines for emissions into the environment, as appropriate.

- Sewage from toilets, kitchens and similar facilities should be discharged into a foul sewer or appropriate receiving facility. Wastewater collected from canteen kitchens, including that from basins, sinks and floor drains, should be discharged into foul sewers via grease traps. The foul sewer should then lead to the temporary sewage treatment plant prior to discharge or reuse as greywater.

- Discharges of treated sewage should be monitored monthly for compliance with Myanmar National Environmental Quality (Emissions) Guidelines for site runoff and wastewater discharges (construction phase).

Hazardous Material Management

- Oils, fuels and chemicals should only be used and stored in designated areas which have pollution prevention facilities and constructed on bund hardstand. The bund should be drained of rainwater after a rain event.

- Proper guidelines and procedures should be developed and included in a Spill Response Plan (SPR) for immediate clean-up actions following any spillages of oil, fuel or chemicals.

- Surface run-off from bunded areas should pass through oil water separators and grease traps prior to discharge to the storm water system.

Solid Waste Management

- A waste management plan (WMP) for the Project should be developed that sets out plans and actions for construction waste as follows.

- Good housekeeping practices for waste storage and handling referencing GIIP;

- The WMP should include a waste inventory developed in the planning stage, in discussion with the engineers, to establish the types of wastes expected from the construction and to identify appropriate disposal routes;

- Construction materials will be managed in a way to avoid over-ordering, poor storage and maintenance, mishandling as well as improper operation procedures;

- Construction wastes will be separated into reusable items and materials to be disposed of or recycled whenever possible;

- Waste suitable for reuse will be stored on site and reintroduced to the construction process as and when required;

- The WMP will identify disposal routes (including transport options and disposal sites) for all wastes generated during the construction phase;

- A hazardous waste management system covering waste classification, separation, collection, storage, transfer and disposal should be set up and operated. The waste management system will comply with applicable regulation of the government, if any, or in its absence, GIIP;

- Hazardous waste will be stored in such a way as to prevent and control accidental release to the environment (e.g. secondary containment, sealed containers);

- Waste will be collected regularly by reputable waste collectors;

- Recyclables such as scrap steel, metals, plastics, and paper items will be collected for recycling wherever possible;
- Disposal of construction waste in or off the construction site should be prohibited;
- Chain of custody documents should be used for construction waste to monitor disposal; and
- Waste segregation should be practiced at the workers camps with an emphasis placed on reducing, reusing and recycling of waste streams as appropriate.

A Construction Phase Monitoring Plan will be required for the Project which will include surface water quality. During construction, surface water quality monitoring will include pH, DO, COD, BOD5, oil and grease, TN, TP, TSS and total coliform. This will be conducted monthly at the water sampling locations shown in *Figure 5.18* and one upstream station located 100m upstream of the Project Site.

8.3.5 Significance of Residual Impact

With proper implementation of the recommended mitigation measures, the residual impacts to surface water quality are expected to be of **minor significance**. It is important to undertake monitoring to track the effectiveness of these mitigation measures and manage any necessary changes accordingly. The monitoring plan is set out in *Table 10.3*.

8.4 SOIL QUALITY

8.4.1 Source of Impacts

Improper solid waste management was observed during the site visit in May 2017 which is considered as a potentially significant issue to soil quality. In addition, there was no secondary containment at the Project Site at the storage area of hazardous materials. Spills from the storage area as well as from maintenance and refuelling area may result in soil contamination and this can have long-term deleterious effects on human and environmental health. These impacts may occur during both the construction and operation phases and will require proper management measures.

8.4.2 Existing / in-place controls

There are no existing / in place controls.

8.4.3 Impact Significance

Results of the baseline soil quality surveys conducted in June to July 2017 indicated the soil quality parameters generally complied with the FAO Soil Bulletin 65 & Dutch Standards and sols are of good quality with limited contamination.

For potential soil quality impact, the receptor sensitivity is considered low given that impacts caused by improper solid waste and hazardous material management are likely to be contained within the Project Site for industrial use only. The potential impact magnitude is considered to be large given the existing in-place control is considered inadequate. The overall impact significance is therefore **moderate**.

Table 8.4 Soil Quality Impact Assessment

Impact	Deterioration of soil quality due to improper solid waste and hazardous material management at the site.				
Impact Nature	Negative	Positive	Neutral		
	Pollutants entering soil would create a negative impact.				
Impact Type	Direct	Indirect	Induced		
	The impact would be direct on soil quality.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	If not managed, the impact would occur during the construction phase of the Project.				
Impact Extent	Local	Regional	International		
	The extent of the impact would be limited to mainly within the Project Site.				
Impact Scale	Small				
Frequency	Contamination due to improper solid waste and hazardous material management are expected to be infrequent during the construction phase.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	The impact magnitude is **Large**.				
Receptor Sensitivity	Low	Medium	High		
	The receptor sensitivity is **Low**, given that the Project Site where potential impact is more likely to occur is for industrial use.				
Impact Significance	Negligible	Minor	Moderate	Major	
	The impact magnitude before mitigation is expected to be **moderate.**				

8.4.4 Additional Mitigation/Management Measures

To mitigate potential impacts on soil quality, mitigation measures developed for management of impacts to water quality as presented in *Section 8.3.4* above should be followed.

8.4.5 *Significance of Residual Impact*

With proper implementation of the recommended mitigation measures, the residual impacts to soil quality are expected to be of **negligible significance**.

8.5 *COMMUNITY HEALTH AND SAFETY*

8.5.1 *Potential Impacts*

Potential impacts on community health and safety may be caused by environmental impacts to air quality, noise, surface water quality and soil quality as discussed in *Section 8.1-4* above. Public health and safety in relation to air quality and wastewater was a key concern of the villagers.

The Project is employing employ around 50-100 staff during the construction Phase. Some of these staff are sourced from local villages. Contractors will be engaged for supply of labour, equipment or services. Contractors' activities could be a nuisance to the local community if not properly managed, for example occupancy of public area for storage of construction wastes, staging areas or nuisance from workers' camps if sited near the communities.

There is also the increased risk of vehicle collisions with local residents due to increased traffic traveling to and from the Project Site during both the construction and operation phases. Currently up to 5 vehicles per day access the site using the one access road. This road is not paved for the majority of its length.

8.5.2 *Existing/In-place Controls*

There are currently no existing and/or in-place controls for the above impacts.

8.5.3 *Impact Significance*

Traffic accidents represent the greatest risk for local communities in the vicinity of the Project area. The sensitivity is considered high given that both livestock and local residents will not be accustomed to increased traffic during the construction phase. The magnitude of the impact is likely to be medium. This impact is assessed as of **major** significance.

Table 8.6 Assessment of Impacts on Community Health and Safety

Impact	Impact on community health and safety during construction		
Impact Nature	Negative	Positive	Neutral
	Potential injury or death to humans or livestock would be a negative occurrence.		
Impact Type	Direct	Indirect	Induced
	The impact could directly affect local residents and/or livestock.		

Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Impact is expected to be most significant during the construction phase.				
Impact Extent	Local	Regional	Global		
	Impact is limited to communities near the construction site.				
Impact Scale	N/A				
Impact Frequency	Construction equipment and vehicles will be operational almost continuously over the construction period.				
Likelihood	Unlikely but certainly possible given that residents and livestock will be unaccustomed to construction equipment and vehicles in the area.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	The impact magnitude is potentially **Medium.**				
Receptor Sensitivity	Low	Medium	High		
	The receptor sensitivity is considered **High.**				
Significance	Negligible	Minor	Moderate	Major	
	The significance is likely to be **Major.**				

8.5.4 Additional Mitigation and/or Management Measure

- Impacts on community health and safety can be mitigated through good practices and close cooperation between the Project managers, contractors and local authorities, as below:
- A Workforce Code of Conduct for all Project personnel could be developed.
- A Contractor EHS Management Plan will be developed to reduce potential impacts of contractors' activities to nearby communities.
- During consultation, it was mentioned that this access road was damaged by Project vehicles and it is recommended that Awba restore the road to its original condition. This was noted by the local community as a grievance during the consultation.
- Awba will prepare and implement a Community Grievance Mechanism (as per Myanmar/Awba (#35880) – Environmental and Social Action Plan (ESAP) No. 1).
- A Traffic Management Plan should be developed to indicate the traffic routes to be followed and speed limit to be complied with in order to reduce risk to the local communities.
- Awba will develop a Safe Vehicle Policy and Training Safety Procedure for its own transport fleet, including provisions for safe agro-chemical and hazardous waste transport, and will include such requirements in transport contractual agreements, including barge third-party contractors (as per Myanmar/Awba (#35880) – Environmental and Social Action Plan (ESAP) No. 7).

- Enforcement of a speed limit for vehicles related to construction activities of the Project. During the construction phase, a speed limit of 40km/h shall be enforced.

- Establishment of a security team to monitor entrance to the construction site.

8.5.5 Significance of Residual Impacts

The enforcement of speed limits for Project vehicles and other measures as presented above should reduce the likelihood of vehicle strikes and of health and safety issues to local communities such that the residual impact is of **minor significance**. It is important to undertake monitoring to track the effectiveness of these mitigation measures and manage any necessary changes accordingly. The monitoring plan is set out in *Table 10.3*.

8.6 ECONOMY AND LIVELIHOODS

8.6.1 Source of Impact

The Project is expected to create the following livelihood opportunities (positive impacts) during construction:

- Contractual employment in construction phase activities, including in the supply chain; and

- Increase in business of local shops and markets, establishment of small shops etc. due to the influx of construction personnel.

8.6.2 Significance of Impact

The local economy is expected to grow as a result of the project. This positive impact will be felt during the construction phase and will continue throughout the lifespan of the Project. Both technical and basic products procured for the port operations will likely be characterised by short-term, high value expenditures. It is likely that there might be some businesses in local area can satisfy the demand for basic goods and services required by the project (such as provision of basic supplies, the supply of food, plastic footwear, clothing, soap, powder, *etc*).

8.6.3 Enhancement Measures

For positive impacts, it will not be further discussed in the ESIA Study. Awba should explore further enhancement of these impacts as well as practicable during the Project's construction and operation.

8.7 OCCUPATIONAL HEALTH AND SAFETY

8.7.1 Source of Impact

In terms of occupational health and safety, issues include exposure to dust, noise and hazardous materials /wastes and physical hazards associated with the use of heavy equipment. In addition, the construction camp was observed to be not up to international standards during the site visit in May 2017, such as not meeting the IFC PS2 guidelines on minimum living areas, provision of potable drinking water (meeting WHO parameters), electricity, and latrine services. This will be a potentially significant health and safety issue to the construction workers.

8.7.2 Existing / In-place Controls

There are ventilation systems, and life and fire safety systems in the buildings as outlined in the Project Description. Information on these systems are provided in **Appendix C**. There are also a number of existing controls under the air, noise, and water impact assessments (*Section 8.1 to 8.3*) that are also applicable to reduce impact on workers.

8.7.3 Impact Significance

Provided the impacts will be temporary and limited to workers of the Project, the magnitude of the impact is likely to be medium. The sensitivity of workforce is considered medium. This impact is assessed as of **moderate significance**.

Table 8.7 Assessment of Impacts on Occupational Health and Safety

Impact	Impact on occupational health and safety during construction				
Impact Nature	Negative	Positive	Neutral		
	Potential negative impacts to workers due to health and safety issues.				
Impact Type	Direct	Indirect	Induced		
	The impact could directly affect the workers.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Impact is expected to be most significant during the construction phase.				
Impact Extent	Local	Regional	Global		
	Impact is limited to workers of the construction site.				
Impact Scale	N/A				
Impact Frequency	Construction workers are working and some staying in the construction camp during the construction period.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	The impact magnitude is potentially **Medium.**				

Receptor Sensitivity	Low	Medium	High	
	The receptor sensitivity is considered **High**			
Significance	Negligible	Minor	Moderate	Major
	The significance is likely to be **Moderate.**			

8.7.4 Additional Mitigation and/or Management Measure

Measures adopted for air, noise, and water are also applicable here (*Section 8.1* to *8.3*). The following mitigation measures will also be adopted for occupational health and safety impacts:

- The Project will design an occupational health and safety management plan, which will be a subset of the overall ESMP, tailored to the needs of the Project. This plan will set standards that will be met by all contractors and subcontractors.
- The Project will abide by Myanmar laws and regulations, and International Labour Organisation (ILO) conventions when gaps are identified between national legislation and international standards.
- Use equipment wash-down waters as makeup solutions for subsequent batches.
- Use dedicated dust collectors to recycle recovered materials.
- Workers will have contracts, which clearly state the terms and conditions of their employment and their legal rights. The Project and all contractors will be able to access a worker grievance mechanism managed by Awba.
- Workers accommodation will comply with the requirements of IFC PS2 guidelines regarding minimum living areas, provision of potable drinking water (meeting WHO parameters), electricity, and latrine services
- Awba will develop and implement a corporate Human Resource Policy and Manual of Procedures in compliance with applicable national labour laws and regulations and IFC's Performance Standard 2 requirements, including the following actions issues (as per Myanmar/Awba (#35880) – Environmental and Social Action Plan (ESAP) No. 2).
    - Corporate HR policies applicable to all operations;
    - HR Manual of Procedures and Staff HR Handbook;
    - Development of a multi-year HR awareness program;
    - Worker's grievance mechanism for its permanent and casual workers, as well as for construction workers, to enable anonymous complaints and tracking and analysis of systemic
- Awba will develop and implement OHS management system – consistent with OHSAS 18001 – commensurate with the level of risks and impacts,

applying to all its new operations, including the following actions issues (as per Myanmar/Awba (#35880) – Environmental and Social Action Plan (ESAP) No. 3).

- Corporate OHS policy applicable to all operations;
- OHS Manual of Procedures (SOPs), including ambient air quality monitoring procedure;
- Development of a multi-year OHS training plan for its staff, including centres of responsibilities, budgetary allocations, and schedule of delivery;
- Definition of OHS KPIs for monitoring and reporting;
- External and internal OHS audits and implementation of Corrective Action Plan (CAP), if required;
- Training manuals for end-customers (e.g. farmers);
- Consolidated annual OHS performance reports

- Awba will develop a management procedure to ensure contractor labour and safe working conditions (inclusive of OHS) comply with PS2 requirements. This procedure will be developed based on standards of contract work in Myanmar and approved by the relevant Department / Ministry of Labour. This procedure will identify Awba's roles and responsibilities for monitoring contractor performance and will apply to all new/existing facilities included within this investment issues (as per Myanmar/Awba (#35880) – Environmental and Social Action Plan (ESAP) No. 4).
  - Submission of the procedure and supporting OHS documentation (e.g. safety plan, procedures, work instructions);
  - Inclusion of contractual provisions for casual workers and contractors to comply with Performance Standard 2 for all facilities identified within the scope of IFC's investment,

8.7.5 Significance of Residual Impacts

The residual impact is considered of **minor significance**.

8.8 INFRASTRUCTURE SERVICES

8.8.1 Source of Impact

The impacts on the road infrastructure from the Project are likely to result from the movement of equipment, material, and workforce during construction. In addition, presence of workers and in-migration may place pressure on the already limited social infrastructure e.g. schools, health

facilities, village roads and water supply. These impacts are expected to occur during the construction and operation phases. There is a non-paved access road leading to the Project Site. During consultation, the damage experienced to this road was a key concern of the local communities. This road has already been damaged by traffic to and from the Project Site during the current activities.

8.8.2 Existing / In-place Controls

There are currently no existing and/or in-place controls for the above impacts and the existing social infrastructures are considered limited. The magnitude of the impact is likely to be medium given the impacts would be local in extent. The sensitivity of the community is considered medium. This impact is assessed as of **moderate significance**.

Table 8.8 Assessment of Impacts on Infrastructure Services

Impact	Impact on occupational health and safety during construction				
Impact Nature	Negative	Positive	Neutral		
	Potential impacts are considered negative.				
Impact Type	Direct	Indirect	Induced		
	The impact could directly affect the community use of infrastructure.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Impact is expected to be most significant during the construction phase.				
Impact Extent	Local	Regional	Global		
	Impact is limited to the communities in the vicinity.				
Impact Scale	N/A				
Impact Frequency	Construction activities are continuous during the construction period.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	The impact magnitude is potentially **Medium.**				
Receptor Sensitivity	Low	Medium	High		
	The receptor sensitivity is considered **High.**				
Significance	Negligible	Minor	Moderate	Major	
	The significance is likely to be **Moderate.**				

8.8.3 Additional Mitigation and/or Management Measure

A number of mitigation measures could be adopted to reduce impact on infrastructure services. These include:

- Camps for construction and operational workforces should be properly sited and designed to reduce demand on local infrastructure services.

- A Traffic Management Plan should be developed to indicate the traffic routes to be followed, speed limit to be complied with as well as restriction of traffic hours (e.g. avoid rush hour) in order to reduce pressure on road infrastructure.

- Stakeholder engagement should be undertaken, including implementing its grievance mechanism to address stakeholder concerns and issues related to infrastructure services in a timely manner.

- Awba will prepare and implement a Community Grievance Mechanism (as per Myanmar/Awba (#35880) – Environmental and Social Action Plan (ESAP) No. 1).

8.8.4 Residual Impact

The residual impact is considered of **minor** significance.

8.9 UNPLANNED SPILLS

8.9.1 Source of Impacts

No secondary containment was observed at the Project Site at the storage area of hazardous materials during the site visit in May 2017. As presented in *Section 5.5*, there is a stream at the north-west corner of the Project Site. This stream is on the lowest point of the Project Site and is subjected to wastewater run-off from the Project. The stream flows to the northwest and into the villages of Nyaung Kone and Wah Net Chaung where stream water is then used for domestic purposes (washing, cleaning). As such, leakage from the storage area as well as from maintenance and refuelling area could easily run off into the nearby water courses. This may result in surface water and groundwater contamination which can have long-term deleterious effects on human health and the environment.

8.9.2 Existing/In-place Controls

There are currently no existing and/or in-place controls for the above impacts.

8.9.3 Impact Significance

The receptor sensitivity to surface water quality impact is high given that the streams and rivers downstream of the Project Site are used as a drinking water supply. Although spill is unlikely to occur in general with good practice on site, the potential impact magnitude is considered to be large given there is no existing in-place control. The overall impact significance is therefore **major**.

Table 8.9 Assessment of Impacts from Unplanned Spills

Impact	Deterioration of surface water quality in nearby watercourses from unplanned spills from the site.		
Impact Nature	Negative	Positive	Neutral

	Pollutants entering surface water courses would create a negative impact.				
Impact Type	Direct	Indirect	Induced		
	The impact would be directly upon surface water resources and on the residents of nearby villages that depend on water supplied from the watercourses.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	If not managed, the impact would occur during the construction phase of the Project and may lead to long-term impacts to the environment and human health.				
Impact Extent	Local	Regional	International		
	The extent of the impact would be limited to the watercourses adjacent to the site or extend to further downstream, depending on scale of spill.				
Impact Scale	Large				
Frequency	Potentially occur during construction phase.				
Likelihood	Unlikely in general with good practice on site.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	The impact magnitude is **Large**.				
Receptor Sensitivity	Low	Medium	High		
	The receptor sensitivity is **High**, given the year round dependence by residents on water from the watercourses for drinking, washing and cleaning.				
Impact Significance	Negligible	Minor	Moderate	Major	
	The impact magnitude before mitigation is expected to be **major.**				

8.9.4 Additional Mitigation/Management Measures

- Development of an Emergency Preparedness and Response Plan, including for transport and sale depots (as per Myanmar/Awba (#35880) – Environmental and Social Action Plan (ESAP) No. 1).

- Fuel tanks and chemical storage areas should be provided with locks and be sited on sealed areas. Establishment of secondary containment for fuel storage and hazardous materials (as per Myanmar/Awba (#35880) – Environmental and Social Action Plan (ESAP) No. 5).

- Oils, fuels and chemicals should only be used and stored in designated areas which have pollution prevention facilities. The bund should be drained of rainwater after a rain event.

- Surface run off from bunded areas should pass through oil/gas traps prior to discharge to the storm water system.

- On site oil-water separators and holding facilities should be installed to accommodate unanticipated releases of oily water.

- The oil contaminated water will be collected and handled by local licensed waste water sub-contractors (if available, to be determined at the later stage).

- Guidelines and procedures should be established for immediate clean up actions following any spillages of oil, fuel or chemicals.

8.9.5 Significance of Residual Impact

With proper implementation of the recommended mitigation measures, the residual impacts to surface water quality are expected to be of **moderate significance**.

9 OPERATIONAL PHASE IMPACT ASSESSMENT

As presented in the ESIA ToR (**Appendix A**), potential significant impacts to air quality, noise, surface water quality, soil quality, community health and safety, economy and livelihoods, occupational health and safety, and infrastructure are expected from the construction and operation of the Project. These priority impacts of the Project identified during the Scoping Phase are included in the impact assessment provided below.

9.1 AIR QUALITY

9.1.1 Source of Impacts

The main source of atmospheric emission from the Project during the operation phase includes stack emissions from the onsite incineration of process waste. The Project emission inventory is presented in *Table 9.1.*

Potential impacts to air quality during this phase of the Project were quantified using detailed dispersion modelling, the USEPA AERMOD dispersion model version 9.4.0. AERMOD is a state of the art detailed dispersion model that can be used to represent complex multiple emission sources and predict air quality at receptor locations taking into account meteorology. The model is widely recognised for use in this type of application, including by the IFC, US EPA, UK Environment Agency and Australian EPA. Detailed modelling methodology is presented in *Annex A*.

Table 9.1 Project Emission Inventory

Stack Parameter[1]	Unit	Value
Stack location	Lat / Long	17° 9'59.99"N 96° 4'41.98"E
Actual Stack Conditions [2]		
Stack height	m	25
Stack diameter	m	0.400
Emission velocity	m/s	10
Exit temperature	C	120
Oxygen content (wet gas)	%	9
Moisture content (wet gas)	%	20
Actual volume flow rate	Am^3/s	1.26
Normalised Conditions [3]		
Exit temperature	C	0
Oxygen content (dry gas)	%	7
Moisture content (dry gas)	%	0
Normalised volume flow rate [4][5]	Nm^3/s	0.598
Normalised Emission Concentrations [3][6]		
NO_x	mg/Nm^3	400
SO_2	mg/Nm^3	50
PM[7]	mg/Nm^3	10
HCl	mg/Nm^3	10
Dioxins and Furans	ng TEQ/m^3	0.1
Cd	mg/Nm^3	0.1
CO	mg/Nm^3	150

Stack Parameter[1]	Unit	Value
Pb	mg/Nm^3	1
Hg	mg/Nm^3	0.1
HF	mg/Nm^3	1
Normalised Emission Rates		
NO_x	g/s	0.239
SO_2	g/s	0.0299
$PM_{2.5}$	g/s	5.98×10^{-3}
PM_{10}	g/s	5.98×10^{-3}
HCl	g/s	5.98×10^{-3}
Dioxins and Furans	g/s	5.98×10^{-10}
Cd	g/s	5.98×10^{-5}
CO	g/s	0.0896
Pb	g/s	5.98×10^{-4}
Hg	g/s	5.98×10^{-5}
HF	g/s	5.98×10^{-4}

(8) Incinerator stack

(9) Actual stack data provided and confirmed by Awba

(10) International Finance Corporation (IFC) (2008) Environmental, Health and Safety Guidelines for Waste Management facilities [Online] Available at: http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines [Accessed 08 August 2017]

(11) Environment Agency (2013) Pollution Inventory Reporting – Combustion Activities Guidance Note [online] Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/296994/LIT_7825_e97f48.pdf [Accessed 08 August 2017]

(12) Normalised flow rate at 7% oxygen, dry gas, 273K and a pressure of 101.3 kPa.

(13) Myanmar National Environmental Quality (Emission) Guidelines (NEQEG) (2015)

(14) The PM concentration is used to conservatively estimate emissions of both $PM_{2.5}$ and PM_{10}.

9.1.2 *Existing / In-place Controls*

The incinerator will be designed to comply with the Air Emission Standards for Municipal Solid Waste (MSW) and Hazardous Waste Incinerators of the European Union (EU) as specified in the World Bank Group Environmental, Health and Safety (EHS) Guidelines for Waste Management Facilities (2007) (*Table 3.5*).

9.1.3 *Impact Significance*

The modelling results based on the emissions inventory detailed in *Table 9.1* and the methodology detailed in **Appendix B** are presented below in *Tables 9.2-20.* The results of the assessment comprise the maximum process contribution predicted over a period of five years from 2012 to 2016 on the receptor grid. At each of the representative human air sensitive receptor (see *Figure 5.1*) the maximum process contribution and the predicted environmental concentration for each substance of interest is presented and the significance of the impact defined using the approach outlined in the modelling methodology in *Annex B*. In addition, the maximum process contribution and predicted environmental concentration at any point on the receptor grid has been identified and the significance defined.

Overall, the assessment defines the potential impacts on air quality as **negligible** (*Table 9.21*).

Table 9.2 Nitrogen Dioxide (NO_2) 1-hour Average

Site	Baseline(µg/m³)	AQS[1] (µg/m³)	PC[2] (µg/m³)	PC/AQS (%)	PEC[3]	PEC/AQS (%)	Impact Significance
Maximum	8.78	200	41.1	21%	49.9	24.9%	Negligible
AQ1			4.72	2%	13.5	6.7%	Negligible
AQ2			6.62	3%	15.4	7.7%	Negligible
AQ3			5.45	3%	14.2	7.1%	Negligible
AQ4			2.33	1%	11.1	5.6%	Negligible
AQ5			2.27	1%	11.0	5.5%	Negligible
AQ6			3.67	2%	12.4	6.2%	Negligible
AQ7			1.66	1%	10.4	5.2%	Negligible
AQ8			2.47	1%	11.3	5.6%	Negligible

(1) Air Quality Standard
(2) Process Contribution
(3) Predicted Environmental Contribution

Table 9.3 Nitrogen Dioxide (NO_2) Annual Average

Site	Baseline(µg/m³)	AQS[1] (µg/m³)	PC[2] (µg/m³)	PC/AQS (%)	PEC[3]	PEC/AQS (%)	Impact Significance
Maximum	4.19	40	0.428	1.1%	4.62	11.5%	Negligible
AQ1			0.0510	<1%	4.24	10.6%	Negligible
AQ2			0.0435	<1%	4.23	10.6%	Negligible

Site	Baseline(µg/m³)	AQS[1] (µg/m³)	PC[2] (µg/m³)	PC/AQS (%)	PEC[3]	PEC/AQS (%)	Impact Significance
AQ3			0.0662	<1%	4.25	10.6%	Negligible
AQ4			0.0116	<1%	4.20	10.5%	Negligible
AQ5			0.0311	<1%	4.22	10.5%	Negligible
AQ6			0.0234	<1%	4.21	10.5%	Negligible
AQ7			0.0122	<1%	4.20	10.5%	Negligible
AQ8			0.0123	<1%	4.20	10.5%	Negligible

(1) Air Quality Standard
(2) Process Contribution
(3) Predicted Environmental Contribution

Table 9.4 Sulphur Dioxide (SO_2) 10-minute Average

Site	Baseline(µg/m³)	AQS[1] (µg/m³)	PC[2] (µg/m³)	PC/AQS (%)	PEC[3]	PEC/AQS (%)	Impact Significance
Maximum	4.69	500	9.18	1.8%	13.9	2.8%	Negligible
AQ1			1.05	<1%	5.75	1.1%	Negligible
AQ2			1.48	<1%	6.17	1.2%	Negligible
AQ3			1.22	<1%	5.91	1.2%	Negligible
AQ4			0.521	<1%	5.21	1.0%	Negligible
AQ5			0.507	<1%	5.20	1.0%	Negligible
AQ6			0.820	<1%	5.51	1.1%	Negligible
AQ7			0.372	<1%	5.07	1.0%	Negligible

Site	Baseline(µg/m³)	AQS[1] (µg/m³)	PC[2] (µg/m³)	PC/AQS (%)	PEC[3]	PEC/AQS (%)	Impact Significance
AQ8			0.553	<1%	5.25	1.0%	Negligible

(1) Air Quality Standard
(2) Process Contribution
(3) Predicted Environmental Contribution

Table 9.5 Sulphur Dioxide (SO_2) 24-hour Average

Site	Baseline(µg/m³)	AQS[1] (µg/m³)	PC[2] (µg/m³)	PC/AQS (%)	PEC[3]	PEC/AQS (%)	Impact Significance
Maximum	1.94	20	0.478	2.4%	2.41	12.1%	Negligible
AQ1			0.151	<1%	2.09	10.4%	Negligible
AQ2			0.0930	<1%	2.03	10.1%	Negligible
AQ3			0.111	<1%	2.05	10.2%	Negligible
AQ4			0.0417	<1%	1.98	9.9%	Negligible
AQ5			0.0473	<1%	1.98	9.9%	Negligible
AQ6			0.0827	<1%	2.02	10.1%	Negligible
AQ7			0.0484	<1%	1.98	9.9%	Negligible
AQ8			0.0468	<1%	1.98	9.9%	Negligible

(1) Air Quality Standard
(2) Process Contribution
(3) Predicted Environmental Contribution

Table 9.6 Particulate Matter ($PM_{2.5}$) 24-hour Average

Site	Baseline(µg/m³)	AQS[1] (µg/m³)	PC[2] (µg/m³)	PC/AQS (%)	PEC[3]	PEC/AQS (%)	Impact Significance
Maximum	22.6	25	0.0957	<1%	22.7	91%	Negligible
AQ1			0.0303	<1%	22.6	91%	Negligible
AQ2			0.0186	<1%	22.6	90%	Negligible
AQ3			0.0222	<1%	22.6	90%	Negligible
AQ4			$8.34x10^{-3}$	<1%	22.6	90%	Negligible
AQ5			$9.46 x10^{-3}$	<1%	22.6	90%	Negligible
AQ6			0.0165	<1%	22.6	90%	Negligible
AQ7			$9.68 x10^{-3}$	<1%	22.6	90%	Negligible
AQ8			$9.37 x10^{-3}$	<1%	22.6	90%	Negligible

(1) Air Quality Standard
(2) Process Contribution
(3) Predicted Environmental Contribution

Table 9.7 Particulate Matter ($PM_{2.5}$) Annual Average

Site	Baseline(µg/m³)	AQS[1] (µg/m³)	PC[2] (µg/m³)	PC/AQS (%)	PEC[3]	PEC/AQS (%)	Impact Significance
Maximum	11.3	10	0.01426	<1%	11.3	113%	Negligible
AQ1			$1.70 x10^{-3}$	<1%	11.3	113%	Negligible
AQ2			$1.45 x10^{-3}$	<1%	11.3	113%	Negligible
AQ3			$2.21 x10^{-3}$	<1%	11.3	113%	Negligible

Site	Baseline(µg/m³)	AQS[1] (µg/m³)	PC[2] (µg/m³)	PC/AQS (%)	PEC[3]	PEC/AQS (%)	Impact Significance
AQ4			3.90×10^{-4}	<1%	11.3	113%	Negligible
AQ5			1.04×10^{-3}	<1%	11.3	113%	Negligible
AQ6			7.80×10^{-4}	<1%	11.3	113%	Negligible
AQ7			4.10×10^{-4}	<1%	11.3	113%	Negligible
AQ8			4.10×10^{-4}	<1%	11.3	113%	Negligible

(1) Air Quality Standard
(2) Process Contribution
(3) Predicted Environmental Contribution

Table 9.8 Particulate Matter (PM_{10}) 24-hour Average

Site	Baseline(µg/m³)	AQS[1] (µg/m³)	PC[2] (µg/m³)	PC/AQS (%)	PEC[3]	PEC/AQS (%)	Impact Significance
Maximum	33.6	50	0.0957	<1%	33.7	67.4%	Negligible
AQ1			0.0303	<1%	33.6	67.3%	Negligible
AQ2			0.0186	<1%	33.6	67.2%	Negligible
AQ3			0.0222	<1%	33.6	67.2%	Negligible
AQ4			$8.34x10^{-3}$	<1%	33.6	67.2%	Negligible
AQ5			$9.46 x10^{-3}$	<1%	33.6	67.2%	Negligible
AQ6			0.0165	<1%	33.6	67.2%	Negligible
AQ7			$9.68 x10^{-3}$	<1%	33.6	67.2%	Negligible
AQ8			$9.37 x10^{-3}$	<1%	33.6	67.2%	Negligible

(1) Air Quality Standard
(2) Process Contribution
(3) Predicted Environmental Contribution

Table 9.9 Particulate Matter (PM_{10}) Annual Average

Site	Baseline(µg/m³)	AQS[1] (µg/m³)	PC[2] (µg/m³)	PC/AQS (%)	PEC[3]	PEC/AQS (%)	Impact Significance
Maximum	16.8	20	0.01426	<1%	16.8	84%	Negligible
AQ1			$1.70 x10^{-3}$	<1%	16.8	84%	Negligible
AQ2			$1.45 x10^{-3}$	<1%	16.8	84%	Negligible
AQ3			$2.21 x10^{-3}$	<1%	16.8	84%	Negligible

Site	Baseline(µg/m³)	AQS[1] (µg/m³)	PC[2] (µg/m³)	PC/AQS (%)	PEC[3]	PEC/AQS (%)	Impact Significance
AQ4			3.90×10^{-4}	<1%	16.8	84%	Negligible
AQ5			1.04×10^{-3}	<1%	16.8	84%	Negligible
AQ6			7.80×10^{-4}	<1%	16.8	84%	Negligible
AQ7			4.10×10^{-4}	<1%	16.8	84%	Negligible
AQ8			4.10×10^{-4}	<1%	16.8	84%	Negligible

(1) Air Quality Standard
(2) Process Contribution
(3) Predicted Environmental Contribution

Table 9.10 Hydrogen Fluoride (HF) 1-hour Average

Site	Baseline(µg/m³)	AQS(1) (µg/m³)	PC(2) (µg/m³)	PC/AQS (%)	PEC(3)	PEC/AQS (%)	Impact Significance
Maximum	n/a	600	0.128	<1%	0.128	<1%	Negligible
AQ1			0.0147	<1%	0.0147	<1%	Negligible
AQ2			0.0207	<1%	0.0207	<1%	Negligible
AQ3			0.0170	<1%	0.0170	<1%	Negligible
AQ4			$7.29x10^{-3}$	<1%	$7.29x10^{-3}$	<1%	Negligible
AQ5			$7.09 x10^{-3}$	<1%	$7.09 x10^{-3}$	<1%	Negligible
AQ6			0.0115	<1%	0.0115	<1%	Negligible
AQ7			$5.20 x10^{-3}$	<1%	$5.20 x10^{-3}$	<1%	Negligible
AQ8			$7.73 x10^{-3}$	<1%	$7.73 x10^{-3}$	<1%	Negligible

(1) Air Quality Standard
(2) Process Contribution
(3) Predicted Environmental Contribution

Table 9.11 Mercury (Hg) Annual Average

Site	Baseline(µg/m³)	AQS(1) (µg/m³)	PC(2) (µg/m³)	PC/AQS (%)	PEC(3)	PEC/AQS (%)	Impact Significance
Maximum	n/a	1	$1.40x10^{-4}$	<1%	$1.40x10^{-4}$	<1%	Negligible
AQ1			$1.00 x10^{-5}$	<1%	$1.00 x10^{-5}$	<1%	Negligible
AQ2			$1.00 x10^{-5}$	<1%	$1.00 x10^{-5}$	<1%	Negligible
AQ3			$2.00 x10^{-5}$	<1%	$2.00 x10^{-5}$	<1%	Negligible

Site	Baseline(µg/m³)	AQS[1] (µg/m³)	PC[2] (µg/m³)	PC/AQS (%)	PEC[3]	PEC/AQS (%)	Impact Significance
AQ4			0.00	0%	0.00	0%	Negligible
AQ5			1.00 x10^{-5}	<1%	1.00 x10^{-5}	<1%	Negligible
AQ6			1.00 x10^{-5}	<1%	1.00 x10^{-5}	<1%	Negligible
AQ7			0.00	0%	0.00	0%	Negligible
AQ8			0.00	0%	0.00	0%	Negligible

(1) Air Quality Standard
(2) Process Contribution
(3) Predicted Environmental Contribution

Table 9.12 Lead (Pb) Annual Average

Site	Baseline(µg/m³)	AQS(1) (µg/m³)	PC(2) (µg/m³)	PC/AQS (%)	PEC(3)	PEC/AQS (%)	Impact Significance
Maximum	n/a	0.5	$1.43x10^{-3}$	<1%	$1.43x10^{-3}$	<1%	Negligible
AQ1			$1.10 x10^{-4}$	<1%	$1.10 x10^{-4}$	<1%	Negligible
AQ2			$1.30 x10^{-4}$	<1%	$1.30 x10^{-4}$	<1%	Negligible
AQ3			$2.20 x10^{-4}$	<1%	$2.20 x10^{-4}$	<1%	Negligible
AQ4			$3.00 x10^{-5}$	<1%	$3.00 x10^{-5}$	<1%	Negligible
AQ5			$1.00 x10^{-4}$	<1%	$1.00 x10^{-4}$	<1%	Negligible
AQ6			$6.00 x10^{-5}$	<1%	$6.00 x10^{-5}$	<1%	Negligible
AQ7			$4.00 x10^{-5}$	<1%	$4.00 x10^{-5}$	<1%	Negligible
AQ8			$4.00 x10^{-5}$	<1%	$4.00 x10^{-5}$	<1%	Negligible

(1) Air Quality Standard
(2) Process Contribution
(3) Predicted Environmental Contribution

Table 9.13 Carbon monoxide (CO) 15-minute Average

Site	Baseline(µg/m³)	AQS(1) (µg/m³)	PC(2) (µg/m³)	PC/AQS (%)	PEC(3)	PEC/AQS (%)	Impact Significance
Maximum	n/a	100,000	89.7	<1%	89.7	<1%	Negligible
AQ1			2.92	<1%	2.92	<1%	Negligible
AQ2			4.09	<1%	4.09	<1%	Negligible
AQ3			3.37	<1%	3.37	<1%	Negligible

Site	Baseline(µg/m³)	AQS[1] (µg/m³)	PC[2] (µg/m³)	PC/AQS (%)	PEC[3]	PEC/AQS (%)	Impact Significance
AQ4			1.44	<1%	1.44	<1%	Negligible
AQ5			1.40	<1%	1.40	<1%	Negligible
AQ6			2.27	<1%	2.27	<1%	Negligible
AQ7			1.03	<1%	1.03	<1%	Negligible
AQ8			1.53	<1%	1.53	<1%	Negligible

(1) Air Quality Standard
(2) Process Contribution
(3) Predicted Environmental Contribution

Table 9.14 Carbon monoxide (CO) 1-hour Average

Site	Baseline(µg/m³)	AQS[1] (µg/m³)	PC[2] (µg/m³)	PC/AQS (%)	PEC[3]	PEC/AQS (%)	Impact Significance
Maximum	n/a	30,000	19.3	<1%	19.3	<1%	Negligible
AQ1			2.21	<1%	2.21	<1%	Negligible
AQ2			3.10	<1%	3.10	<1%	Negligible
AQ3			2.55	<1%	2.55	<1%	Negligible
AQ4			1.09	<1%	1.09	<1%	Negligible
AQ5			1.06	<1%	1.06	<1%	Negligible
AQ6			1.72	<1%	1.72	<1%	Negligible
AQ7			0.780	<1%	0.780	<1%	Negligible
AQ8			1.16	<1%	1.16	<1%	Negligible

(1) Air Quality Standard
(2) Process Contribution
(3) Predicted Environmental Contribution

Table 9.15 Carbon monoxide (CO) 8-hour Average

Site	Baseline(µg/m³)	AQS[1] (µg/m³)	PC[2] (µg/m³)	PC/AQS (%)	PEC[3]	PEC/AQS (%)	Impact Significance
Maximum	n/a	10,000	4.30	<1%	4.30	<1%	Negligible
AQ1			0.888	<1%	0.888	<1%	Negligible
AQ2			0.799	<1%	0.799	<1%	Negligible
AQ3			0.842	<1%	0.842	<1%	Negligible

Site	Baseline(µg/m³)	AQS[1] (µg/m³)	PC[2] (µg/m³)	PC/AQS (%)	PEC[3]	PEC/AQS (%)	Impact Significance
AQ4			0.281	<1%	0.281	<1%	Negligible
AQ5			0.404	<1%	0.404	<1%	Negligible
AQ6			0.668	<1%	0.668	<1%	Negligible
AQ7			0.337	<1%	0.337	<1%	Negligible
AQ8			0.349	<1%	0.349	<1%	Negligible

(1) Air Quality Standard
(2) Process Contribution
(3) Predicted Environmental Contribution

Table 9.16 Cadmium (Cd) Annual Average

Site	Baseline(µg/m³)	AQS[1] (µg/m³)	PC[2] (µg/m³)	PC/AQS (%)	PEC[3]	PEC/AQS (%)	Impact Significance
Maximum	n/a	0.005	1.40×10^{-4}	<1%	1.40×10^{-4}	<1%	Negligible
AQ1			2.00×10^{-5}	<1%	2.00×10^{-5}	<1%	Negligible
AQ2			1.00×10^{-5}	<1%	1.00×10^{-5}	<1%	Negligible
AQ3			2.00×10^{-5}	<1%	2.00×10^{-5}	<1%	Negligible
AQ4			0.00	0%	0.00	0%	Negligible
AQ5			1.00×10^{-5}	<1%	1.00×10^{-5}	<1%	Negligible
AQ6			1.00×10^{-5}	<1%	1.00×10^{-5}	<1%	Negligible
AQ7			0.00	0%	0.00	0%	Negligible
AQ8			0.00	0%	0.00	0%	Negligible

(1) Air Quality Standard
(2) Process Contribution
(3) Predicted Environmental Contribution

Table 9.17 Hydrochloric Acid (HCl) 24-hour Average

Site	Baseline(µg/m³)	AQS[1] (µg/m³)	PC[2] (µg/m³)	PC/AQS (%)	PEC[3]	PEC/AQS (%)	Impact Significance
Maximum	n/a	600	0.0957	<1%	0.0957	<1%	Negligible
AQ1			0.0303	<1%	0.0303	<1%	Negligible
AQ2			0.0186	<1%	0.0186	<1%	Negligible
AQ3			0.0222	<1%	0.0222	<1%	Negligible

Site	Baseline(µg/m³)	AQS[1] (µg/m³)	PC[2] (µg/m³)	PC/AQS (%)	PEC[3]	PEC/AQS (%)	Impact Significance
AQ4			$8.34x10^{-3}$	<1%	$8.34x10^{-3}$	<1%	Negligible
AQ5			$9.46 x10^{-3}$	<1%	$9.46 x10^{-3}$	<1%	Negligible
AQ6			0.0165	<1%	0.0165	<1%	Negligible
AQ7			$9.68 x10^{-3}$	<1%	$9.68 x10^{-3}$	<1%	Negligible
AQ8			$9.37 x10^{-3}$	<1%	$9.37 x10^{-3}$	<1%	Negligible

(1) Air Quality Standard
(2) Process Contribution
(3) Predicted Environmental Contribution

Table 9.18 Dioxins and Furans 24-hour Average

Site	Baseline(µg/m³)	AQS(1) (µg/m³)	PC(2) (µg/m³)	PC/AQS (%)	PEC(3)	PEC/AQS (%)	Impact Significance
Maximum	n/a	$1x10^{-7}$	0.00	0%	0.00	0%	Negligible
AQ1			0.00	0%	0.00	0%	Negligible
AQ2			0.00	0%	0.00	0%	Negligible
AQ3			0.00	0%	0.00	0%	Negligible
AQ4			0.00	0%	0.00	0%	Negligible
AQ5			0.00	0%	0.00	0%	Negligible
AQ6			0.00	0%	0.00	0%	Negligible
AQ7			0.00	0%	0.00	0%	Negligible
AQ8			0.00	0%	0.00	0%	Negligible

(1) Air Quality Standard
(2) Process Contribution
(3) Predicted Environmental Contribution

Table 9.19 NO_x – Maximum Annual Average (Agriculture)

Receptor	Baseline(µg/m³)	AQS (1)	PC(2)	PC / AQS (%)	PEC(3)	PEC/AQS (%)	Impact Significance
Maximum on grid	12.2	30	0.570	1.9%	12.7	42%	Negligible

(1) Air Quality Standard
(2) Process Contribution
(3) Predicted Environmental Contribution

Table 9.20 SO_2 – Maximum Annual Average (Agriculture)

Receptor	Baseline(µg/m³)	AQS (1)	PC(2)	PC / AQS (%)	PEC(3)	PEC/AQS (%)	Impact Significance
Maximum on grid	1.64	20	0.0713	<1%	1.66	8.3%	Negligible

(1) Air Quality Standard
(2) Process Contribution
(3) Predicted Environmental Contribution

Table 9.21 Assessment of Impact Related to Incinerator Emissions during Operation

Impact	Adverse impact to human health and agriculture from stack emissions.				
Impact Nature	Negative	Positive	Neutral		
	Elevated ambient concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$, HF, Hg, Pb, CO, Cd, HCl and Dioxins and Furans will have a **negative** impact on human health and NO_x and SO_2 will have a **negative** impact on agriculture.				
Impact Type	Direct	Indirect	Induced		
	Elevated ambient concentrations of NO_2, SO_2, PM_{10}, $PM_{2.5}$, HF, Hg, Pb, CO, Cd, HCl and Dioxins and Furans will have a **direct** impact on human health and NO_x and SO_2 will have a **direct** impact on agriculture.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Potential impacts to air quality will occur throughout the operation phase and can therefore be described as **long term** in nature.				
Impact Extent	Local	Regional	International		
	Emissions from the Project may cause adverse impacts up to 5 km from the point of release and are therefore **local** in their extent.				
Impact Scale	The scale of the impacts is likely to be within 5 km from the point of release and is therefore considered **medium** scale.				
Frequency	Impacts will arise **continuously** throughout the operation period.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	The impact magnitude before mitigation is expected to be **negligible** for all substances of interest.				
Receptor Sensitivity	Low	Medium	High		
	When considering impacts to human health due to inhalation of airborne pollutants, all sensitive human receptors are defined as **'medium'** sensitivity. This represents general populations and areas of habitation. Agricultural areas are defined as **'low'** sensitivity.				
Impact Significance	Negligible	Minor	Moderate	Major	
	The impact significance before mitigation is expected to be **negligible** for all substances of interest at both human and agricultural receptors.				

9.1.4 Additional Mitigation/Management Measures

The Project should ensure that emission concentrations from the incinerator do not exceed the concentrations outlined in the WBG EHS Guidelines for

Waste Management Facilities [1] and presented in *Table 9.1*. The WBG EHS Guidelines for Waste Management Facilities also provides following good practice measures to prevent, minimise and control air emissions from incineration facilities:

- Segregate waste to avoid the incineration of waste that contains metals and metalloids that may volatize during combustion and be difficult to control through air emission technology;
- Adhere to applicable national requirements and internationally recognized standards for incinerator design and operating conditions;
- Introduce wastes only after the optimum temperature is reached in the final combustion chamber of the incinerator and avoid operating conditions in excess of those that are required for the efficient combustion of waste;
- Interlock the charging system with the temperature monitoring and control system to prevent further addition of waste if the operating temperature falls below the required limits;
- Minimise planned and unplanned shutdowns by implementing and managing a robust maintenances program;
- Optimise furnace and boiler geometry, combustion air injection, NOx control devices (if used), combustion temperature and level of distribution, and the control of raw gas residence time;
- Use auxiliary burner(s) for start-up and shut-down and for maintaining the required operational combustion temperatures at all times when unburned waste is in the combustion chamber; and
- Use flue gas treatment system for control of acid gases, particulate matter, and other air pollutants such as NOX control measures and/or selective catalytic reduction (SCR) or selective noncatalytic reduction (SNCR) systems.

An Operational Phase Monitoring Plan will be required for the Project which will include air quality. During construction, emissions of particulates PM10, PM2.5, NO_2, and SO_2 will be monitored monthly at the ASRs as shown in *Figure 5.1*. NO_2 and SO_2 measured by means of a diffusion tube. Others will be monitored by HAZ-SCANNER (EPAS) Environmental Perimeter Air Monitoring System. Stacked emissions from incinerator will be continuously monitored including waste feed rate, total hydrocarbons, temperature (measured at the end of the residence zone), and CO and oxygen (measured at the stack.

[1] International Finance Corporation (IFC) (2007) Environmental, Health and Safety Guidelines for Waste Management Facilities [Online] Available at: http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines [Accessed 01 August 2017]

9.1.5 Residual Impact

The residual impact on air quality from waste incineration during the normal operation of the Project is considered negligible. It is important to undertake monitoring to track the effectiveness of these mitigation measures and manage any necessary changes accordingly. The monitoring plan is set out in *Table 10.3*.

9.2 AMBIENT NOISE

9.2.1 Source of Impacts

During operation, noise will be generated from transportation related to the Project as well as use of PME for plant operation (e.g. drum crusher). Given that the plant is expected to manufacture 50% of domestic crop protection demand, the transportation volume to and from the Project Site as well as the operation may lead to potentially significant noise impacts on nearby NSRs (*Figure 5.12*).

Baseline noise monitoring was conducted on 30 June to 5 July 2017 at five selected noise sensitive receivers (NSRs) located near the Project Site to establish the background levels (*Figure 5.12*). Based on the findings, the average noise levels (both day and night time) at the Baseline Noise Monitoring locations did not meet the WBG EHS General Guidelines (2007). These baseline levels were mainly captured from vehicles (motorcycles, cars) and people activities, raining and loud speaker.

9.2.2 Existing / In-place Controls

There are no existing / in place controls.

9.2.3 Impact Significance

A final plant inventory for operational activities is not available for quantitative assessment of noise. As such, the following is based on qualitative assessment.

The nearby NSRs are residential in nature and their sensitivity is considered medium. Given that the existing baseline noise level exceeded the WBG EHS General Guidelines (2007), any additional noise impact from the Project may lead to significant cumulative impact to the community. As such, the magnitude of impact is considered high and the impact significance is considered **major.**

Table 9.2 Noise Impact Assessment – Operation Phase

Impact	Noise impact from the operation of fixed plant and machinery during operational phase.				
Impact Nature	Negative	Positive	Neutral		
	Noise impact from the construction activities is **negative**.				
Impact Type	Direct	Indirect	Induced		
	Noise impact from the construction activities is **direct**.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	Noise impact from the construction activities is **long-term**..				
Impact Extent	Local	Regional	International		
	Noise impact from the operation activities is **local**.				
Impact Scale	Project area				
Frequency	Throughout the operation period.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	The magnitude of the noise impact is **negligible**.				
Receptor Sensitivity	Low	Medium	High		
	The identified NSR are residential, the sensitivity of the receptor is considered as **medium.**				
Impact Significance	Negligible	Minor	Moderate	Major	
	As the impact magnitude is large and the receptor sensitivity is medium, the impact significance is considered as **Major**.				

9.2.4 Mitigation/Management Measures

The following mitigation measures are recommended to mitigate the noise impact during operation phase of the Project:

- Select equipment with lower SWL from the BS5228: Part 1: 2009.
- Install silencers, mufflers or acoustic enclosures to reduce sound power level of noisy equipment at all times.
- Re-locate noise sources to less sensitive areas to take advantage of distance and shielding.
- Site permanent facilities away from community areas if possible.
- Take advantage of the natural topography as a noise buffer during facility design; Vehicles should be regularly maintained.
- Transportation of materials during night time should be avoided to minimize disturbance to communities.

An Operational Phase Monitoring Plan will be required for the Project which will include noise emissions. During operation, ambient noise levels in Leq, Leq day, Leq night and hourly Leq will be measures monthly at the NSRs within 500 m from the Project boundary as shown in *Figure 5.12*.These will be measured for 24-hours.

9.2.5 *Residual Impact*

Through the implementation of the above mitigation measures, operational noise would be expected to be of moderate significance. It is important to undertake monitoring to track the effectiveness of these mitigation measures and manage any necessary changes accordingly. The monitoring plan is set out in *Table 10.3*.

9.3 *SURFACE WATER QUALITY*

9.3.1 *Source of Impacts*

During operation, it is expected that the same surface water quality issues as presented for the construction phase in the previous *Section 8.3.1* above may occur. In addition, wastewater generated from washing of formulation lines (~20 m^3 / day), laundry (~1m^3 / day) and cleaning of process area (~3 m^3 / day) in the HAIC may be a potential issue if they are not being managed properly.

According to Project information provided by Awba as presented in *Section 2.1.2*, wastewater generated from washing of formulation lines, laundry and cleaning of process area will be treated by an on-site wastewater treatment plant. In addition, sewage from the operation workforce will be treated on-site by a septic tank and seepage field. Solid wastes generated during operation will be incinerated on site. No specific mitigation measures are currently proposed to manage potential surface water quality impacts from site runoff and hazardous material management.

9.3.2 *Existing/In-place Controls*

Awba will have a solid and liquid waste water treatment facility as detailed in *Section 2.4.2*.

9.3.3 *Impact Significance*

Considering the above, the potential impact magnitude is considered to be small while receptor sensitivity is high given that the streams and rivers downstream of the Project Site are used as a drinking water supply. The overall impact significance is therefore **moderate**.

Table 9.23 Surface Water Quality Impact Assessment

Impact	Deterioration of surface water quality in nearby watercourses from uncontrolled runoff, improper wastewater, solid waste and hazardous material management at the site.		
Impact Nature	Negative	Positive	Neutral
	Pollutants entering surface water courses would create a negative impact.		
Impact Type	Direct	Indirect	Induced

	The impact would be directly upon surface water resources and on the residents of nearby villages that depend on water supplied from the watercourses.			
Impact Duration	Temporary	Short-term	Long-term	Permanent
	If not managed, the impact would occur during the operation phase of the Project.			
Impact Extent	Local	Regional	International	
	The extent of the impact would be limited to the watercourses adjacent to the site.			
Impact Scale	Moderate			
Frequency	Runoff from the Project site will occur frequently during the operation phase. Contamination due to improper wastewater, solid waste and hazardous material management are expected to be infrequent during the operation phase.			
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	The impact magnitude is **Small**.			
Receptor Sensitivity	Low	Medium	High	
	The receptor sensitivity is **High**, given the year round dependence by residents on water from the watercourses for drinking, washing and cleaning.			
Impact Significance	Negligible	Minor	Moderate	Major
	The impact magnitude before mitigation is expected to be **Moderate.**			

9.3.4 Additional Mitigation/Management Measures

To mitigate potential impacts on surface water quality during the operation phase, mitigation measures developed for the construction phase as presented in *Section 8.3.2* above should be followed given the similar issues expected. In addition to the above:

- Discharges from the production process should be treated and monitored monthly for compliance with effluent levels specified in WBG EHS Guidelines for Pesticide Manufacturing, Formulation and Packaging (2007).

- Sewage from the operation workforce should be treated on-site by a septic tank and seepage field properly designed and maintained according to WBG Genera EHS Standards (2007) as follows:

    - Installed in areas with sufficient soil percolation for the design wastewater loading rate;
    - Installed in areas of stable soils that are nearly level, well drained, and permeable, with enough separation between the drain field and the groundwater table or other receiving waters;

- Grease trap should be installed at sources where oily water is expected (e.g. kitchen); and
- Residual sludge should be collected and disposed of properly.

- Should treated wastewater to be reused as spray water, they should be monitored monthly for compliance with Myanmar National Environmental Quality (Emissions) Guidelines for site runoff and wastewater discharges (for TSS, oil and grease, pH).

- For Class II (moderately hazardous) pesticides, Awba will provide the appropriate controls in relation to the manufacture, procurement, or distribution and/or use of these chemicals (as per Myanmar/Awba (#35880) – Environmental and Social Action Plan (ESAP) No. 6).

An Operational Phase Monitoring Plan will be required for the Project which will include surface water quality. During construction, surface water quality monitoring will include pH, DO, COD, BOD5, oil and grease, TN, TP, TSS and total coliform. This will be conducted monthly at the water sampling locations shown in *Figure 5.18* and one upstream station located 100m upstream of the Project Site.

9.3.5 Significance of Residual Impact

With proper implementation of the recommended mitigation measures, the residual impacts to surface water quality are expected to be of minor significance. A Construction Phase Monitoring Plan will be required for the Project which will include surface water quality. During construction, surface water quality monitoring will include pH, DO, COD, BOD5, oil and grease, TN, TP, TSS and total coliform. This will be conducted monthly at the water sampling locations shown in *Figure 5.18* and one upstream station located 100 m upstream of the Project Site.

9.4 SOIL QUALITY

Potential impacts to soil quality from the Project are expected to be similar during the construction and operation phase of the Project. Please refer to the previous *Section 8.4* for the impact assessment and recommended mitigation measures.

9.5 COMMUNITY HEALTH AND SAFETY

Potential impacts on community health and safety are expected to be similar to those during construction phase. Please refer to *Section 8.5* as well as *Sections 9.1-4* for the relevant assessment and mitigation measures recommended.

9.6 ECONOMY AND LIVELIHOODS

Potential impacts on economy and livelihoods are expected to be similar to those during construction phase. Please refer to *Section 8.6* for the relevant assessment and mitigation measures recommended.

9.7 OCCUPATIONAL HEALTH AND SAFETY

Potential impacts on occupational health and safety are expected to be similar to those during construction phase. Please refer to *Section 8.7* for the relevant assessment and mitigation measures recommended.

During operation, there is also the potential for fugitive emissions from the pesticide formulation. Accidental spills are assessed under Section 9.9. Adequate PPE and suction hoods will be used to collect vapours and other fugitive emissions. The impact significance is expected the same as during the Construction Phase.

9.8 INFRASTRUCTURE SERVICES

Potential impacts on infrastructures are expected to be similar to those during construction phase. Please refer to *Section 8.8* for the relevant assessment and mitigation measures recommended.

9.9 UNPLANNED EVENTS

9.9.1 Source of Impact

During operation, there is the potential for hazardous materials (pesticide ingredients, oils, lubes, etc.) to spill or leak into the surrounding environment which can lead to pollution of water courses and potential impacts to human health. Potential impacts from unplanned spills are expected to be similar to those during construction phase. Please refer to *Section 8.9* for the relevant assessment and mitigation measures recommended.

Unplanned fire during the pesticide formulation process is a potential unplanned event of the Project which may cause potential impacts to workers and local communities.

9.9.2 Existing / In-place Controls

As presented in *Section 2.5,* fire protection / fighting system will be installed at the office building, laboratory building, warehouse, EC Building, SL Building, WP Building, SP Building, SC Building, Utility Building, Drum Crusher Building to mitigate fire risk during operation of the Project.

9.9.3 Impact Significance

Fire event due to the Project is more likely to occur within the Project Site at which the pesticide formulation process occurs. As presented in *Section 9.9.2*

above, existing / in-place controls are planned at the Project Site to reduce likelihood and potential impact of a fire event. Provided that these measures are implemented properly, fire outbreaks have been evaluated to result in impacts of up to **Moderate** significance.

Table 9.24 Assessment of Impacts on Community and Occupational Health and Safety from Unplanned Fire Event

Impact	Impacts from fire to workers and local communities.				
Impact Nature	Negative	Positive	Neutral		
	Unplanned fire event is a health and safety risk to workers and local communities				
Impact Type	Direct	Indirect	Induced		
	Direct impacts to health and safety in case of fire.				
Impact Duration	Temporary	Short-term	Long-term	Permanent	
	If not managed, the impact would occur and may lead to long-term impacts to workers / communities.				
Impact Extent	Local	Regional	International		
	The extent of the impact likely to be limited to the Project Site.				
Impact Scale	Large				
Frequency	Potentially occur during operation phase.				
Likelihood	Unlikely in general with good practice on site.				
Impact Magnitude	Positive	Negligible	Small	Medium	Large
	The impact magnitude is **Small**.				
Receptor Sensitivity	Low	Medium	High		
	The receptor sensitivity is **High**.				
Impact Significance	Negligible	Minor	Moderate	Major	
	The impact magnitude before mitigation is expected to be **moderate.**				

9.9.4 Additional Mitigation, Management and Monitoring

- As administered under the Emergency Preparedness Plan, a Fire Risk Management Plan will be developed including communications protocols and measures to control any fires that do arise.
- Induction training for personnel is recommended to include a mandatory segment on fire safety and actions in the event of a fire.
- Conduct fire training and response drills.

9.9.5 Significance of Residual Impacts

With measures to manage fire risk, it is considered the residual risk can be reduced to **Minor to Moderate**.

10 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

Through a systematic assessment, the ESIA has identified a number of significant environmental and social impacts which may potentially result from the construction and operation of the Project. In order to manage and mitigate these impacts, a range of measures have been developed to reduce the overall residual impacts to acceptable levels and as low as reasonably practicable. Implementing and tracking the effect of these management and mitigation measures is an essential element to ensuring that the assessed residual impact levels are confirmed.

10.1 OBJECTIVES

The key objectives of this Environmental and Social Management Plan (ESMP) are to:

- Collate the various mitigation and management measures developed throughout the ESIA into a single point;
- Identify all of the detailed management plans which will need to be developed for implementation throughout the construction and operation phases of the Project;
- Define monitoring requirements to determine the efficiency of all mitigation and management measures; and
- Provide clarity to all stakeholders as to what impacts have been identified, how they will be mitigated and managed, and through what means.

10.2 SCOPE OF THIS ESMP

The scope of this ESMP covers both construction and operation phases of the Project, which have the potential to affect, positively or negatively, the environment and communities in which the Project will operate.

As required by this ESMP, a range of detailed management plans will be developed and implemented for each specific phase of the Project. The responsibility for the implementation of these plans will lay variously with the Awba, contractors and sub-contractors. It is noted that this is only a framework ESMP into which the full range of management and monitoring activities will eventually fit into.

In addition, the ESMP for the Project should align with the HSE Policy of the Project which will be developed by Awba.

10.3 SUMMARY OF IMPACTS AND MITIGATION MANAGEMENT MEASURES

A summary of mitigation measures identified for the construction and operation phases of the Project is presented in *Table 10.1*. This also identifies lead responsibility for implementing the mitigation measures and sources of

funds for such implementation. Awba will be responsible for ensuring that the mitigation measures in the ESMP are implemented throughout the life span of the Project.

In addition, Awba will implement the IFC Environmental and Social Action Plan (ESAP) which is provided in *Annex E*.

10.4 DETAILED MANAGEMENT PLANS

Based upon the outcomes of the ESIA, detailed management plans are required to guide Awba and its contractors in the implementation of all mitigation and management measures. This is essential to ensure that the key outcomes of the impact assessment process are put in place throughout the life of the Project, and their overall efficacy tracked. These detailed management plans will be leveraged by the contractors in developing their own management plans.

As identified with the summary of impacts and mitigation and management measures, the following detailed management plans are considered necessary to effectively implement the outcomes of the ESIA throughout the life of the Project (*Table 10.2*).

Table 10. 2 Management Plans Required by the Project

Management Plans	Key Objectives and Content
Dust Management Plan (for construction phase only)	The Dust Management Plan should demonstrate how appropriate management techniques will reduce the potential for any dust-related adverse effect to public health or the environment, and describe the measures that will be undertaken to control dust generated by the operation. This could include dust produced by bulk materials handling, storage activities, earth-moving, construction, or vehicular movements.
Spill Response Plan	A Spill Response Plan aims to identify the course of action that is necessary to achieve a successful response to any spills on Site. The primary objectives of tactical response plans are to: • Allow response personnel to prepare for and safely respond to spill incidents • Identify potential equipment, manpower, and other resources necessary to implement a spill response • Outline response procedures and techniques for combating the spill at a specific location
Waste Management Plan	Waste management plans are guides for reducing, handling, and disposing of waste during construction, renovation, or land-clearing projects. Detailing all types of waste and their origins, the steps taken to lower the level of waste, and plans for removing and eliminating waste, these plans are often given to contractors or subcontractors and provide guidelines for keeping waste at a minimum.

Management Plans	Key Objectives and Content
Wastewater Management Plan	A Wastewater Management Plan outlines wastewater management (treatment and associated infrastructure and services), and identifies plans for the future development, expansion or upgrade of wastewater systems to accommodate changing needs.
Emergency Response Plan	The purpose of an Emergency Response Plan (ERP) is to serve as both a framework and guideline, to establishing an organized approach in the delivery and implementation of effective decision-making, communication and overall coordination during an emergency.
Traffic Management Plan	A Traffic Management Plan is the management of occupational safety and site performance risks associated with work activities undertaken in a traffic environment including managing traffic to and from the Site.
Project communication Plan	A communication plan facilitates effective and efficient communications with the various stakeholders. It describes how project communications will occur. A good communication plan generally includes the following elements: • Communication objectives • Target audiences • Key content for the communications • Communication method and frequency
Workforce Code of Conduct	A Workforce Code of Conduct sets out clear ground-rules for the professional behaviour and conduct that is expected in your workplace.
Contractor EHS Management Plan	A Contractor EHS Management Plan links to the Projects EMP and ensures that all contractors are aware of the requirements to mitigate and manage the environmental, health and safety risks and impacts associated with the Project.
Occupational Health and Safety Management Plan	An Occupational Health and Safety Plan demonstrates an organisation's commitment to health and safety in the workplace by providing a clearly written statement of intent and plan of action for the prevention of accidents and occupational illness and injury.
Environmental and Social Monitoring Plan	An Environmental and Social Monitoring Plan describes the comprehensive program that a Project Proponent has established to monitor its performance in relation the full range of voluntary or regulation-based environmental and social management requirements.
Ash Disposal Management Plan	Residual ashes from the incinerator will be disposed of properly according to the Ash Disposal Management Plan to be developed for the Project before commencement of operation.

It is intended that these documents will be prepared to cover the construction phase of the Project. Prior to operation commencing further documents should be developed to cover the operation phase.

Specific plans will be disclosed to stakeholders at the appropriate time, which should be determined within the individual plans.

Table 10.1 Environmental and Social Management Plan of the Project

Item No.	Project Stage/Affected Aspect	Project Activity and affected area	Potential Impacts	Mitigation Measures	Implementation Schedule	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements
Construction Phase								
8.1	Air Quality	Vehicle movements over unpaved access roads and within construction areas. Site clearance, site formation and levelling involving excavation and material transfer. Construction of the main Project infrastructure.	Dust	• A dust management plan should be produced and adhered to; • Water suppression or surface binding agents should be used on exposed open earthworks where rainfall is less than 0.25 mm in a 24 hour period and wind speeds are forecast to be more than 19 kph (5.3m/s); • Where unpaved roads are utilised by vehicles, water suppression at a rate of 2 litres/m^2/hr should be used where rainfall of less than 2 mm in the last hour has occurred or surface binding agents should be used to more permanently reduce dust generation; • On-site meteorological monitoring should be undertaken to inform the use of mitigation on site during construction period; • Use of localised dampening and activity specific dampening should be used to reduce localised emissions of dust; • Wheel washing should be used prior to entry onto a sealed road section to avoid tracking dirt onto sealed roads and generating dust; • Vehicles transporting dusty materials should be covered; • Stockpiling of material, for example, rocks, sand and soils should be minimised; • Stockpiles should be located as far away from receptors as possible; • The design of stockpiles should be optimised to retain a low profile with no sharp changes in shape; • Vegetation of stockpiles should be used where a stockpile is not to be used for a month to stabilize the surface and prevent dust generation; • Drop heights of material should be minimised; • Wind breaks should be erected around the key construction activities and in the vicinity of potentially dusty works; • Qualitative monitoring surveys should be implemented to include site inspections for visible dust emissions in the vicinity of the site boundary (both internal and external); and • Visual monitoring of dust deposition onto surfaces on and off-site should be undertaken regularly. • Mitigation measures should be carefully considered relative to meteorological conditions and amended accordingly. For example, the use of additional water suppression and localised dampening should be managed during periods of increased rainfall as additional suppression techniques may not be necessary. • A Construction Phase Monitoring Plan will be required for the Project which will include air quality. During construction, emissions of particulates PM10, $PM_{2.5}$, NO_2, and SO_2 will be monitored monthly at the ASRs as shown in *Figure 5.1*. NO_2 and SO_2 measured by means of a diffusion tube. Others will be monitored by HAZ-SCANNER (EPAS) Environmental Perimeter Air Monitoring System.	Construction Phase	Appointed Contractor	On site Project Management team and designated EHS team	Monthly report to the Awba
8.2	Noise	Overall construction activities including heavy machinery operations for construction works.	Increase in ambient noise levels	• Well-maintained equipment to be operated on-site; • Regular maintenance of equipment such as lubricating moving parts, tightening loose parts and replacing worn out components; • Shut down or throttled down between work periods for machines and construction plant items (e.g. trucks) that may be in intermittent use; • Reduce the number of equipment operating simultaneously as far as practicable; • Orientate equipment known to emit noise strongly in one direction so that the noise is directed away from receptors as far as practicable;	Construction Phase	Appointed Contractor	On site Project Management team and designated EHS team	Monthly report to the Awba

Item No.	Project Stage/Affected Aspect	Project Activity and affected area	Potential Impacts	Mitigation Measures	Implementation Schedule	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements
				• Locate noisy plant as far away from receptors as practicable; • Avoid transportation of materials on- and off-site through existing community areas; and • Use material stockpiles and other structures, where practicable, to screen noise sensitive receptors from on-site construction activities. • A Construction Phase Monitoring Plan will be required for the Project which will include noise emissions. During construction, ambient noise levels in Leq, Leq day, Leq night and hourly Leq will be measures monthly at the NSRs within 500 m from the Project boundary as shown in *Figure 5.12*. These will be measured for 24-hours.				
8.3	Surface Water Quality	Uncontrolled runoff, improper wastewater, solid waste and hazardous material management at the site, affecting surface water quality of watercourse.	Impact to surface water quality	Construction Site Run-off and Drainage • Exposed soil surfaces should be protected by paving or fill material as soon as possible to reduce the potential of soil erosion. • Open stockpiles of construction materials or construction wastes on-site should be covered with tarpaulin or similar fabric during rainstorms. • Design drainage pipes and culverts for the controlled release of storm flows. • Regularly, and particularly following rainstorms, inspect and maintain drainage systems and erosion control and silt removal facilities to ensure proper and efficient operation at all times. • Provide measures to reduce the ingress of site drainage into excavations. If trenches have to be excavated during the wet season, excavate and backfill them in short sections wherever practicable. Discharge any water pumped out from trenches or foundation excavations into storm drains via silt removal facilities. • Mulch to stabilise exposed areas, where practicable and appropriate. • Re-vegetate areas promptly, where practicable and appropriate. • Provide measures to prevent the washing away of construction materials, soil, silt or debris into any drainage system of open stockpiles of construction materials. • Construct wells/ sediment basins for the separation of oil in the wash water and stormwater drains. • Oil water separators and grease traps will be installed and maintained as appropriate at refueling facilities, workshops, parking areas, fuel storage and containment areas. • Discharges of runoff should be monitored monthly for compliance with Myanmar National Environmental Quality (Emissions) Guidelines for site runoff and wastewater discharges (construction phase). • A Construction Phase Monitoring Plan will be required for the Project which will include surface water quality. During construction, surface water quality monitoring will include pH, DO, COD, BOD5, oil and grease, TN, TP, TSS and total coliform. This will be conducted monthly at the water sampling locations shown in *Figure 5.18* and one upstream station located 100m upstream of the Project Site.	Construction Phase	Appointed Contractor for mitigation measures implementation 3rd Party Environmental Consultant for monitoring & audit	On site Project Management team and designated EHS team	Monthly report to the Awba
				Sewage Generated from On-site Workforce • Where no public sewage treatment system is available (e.g. during construction), sanitary waste water will be treated by domestic waste water unit (ref. septic tank). The contractor will provide the domestic waste water unit which is designed and installed to treat all domestic wash and wastewater and sewage during construction. All effluents shall comply with legal guidelines for emissions into the environment, as appropriate. • Sewage from toilets, kitchens and similar facilities should be discharged into a foul sewer or appropriate receiving facility. Wastewater collected from canteen kitchens, including that from basins, sinks and floor drains, should be discharged into foul sewers				

Item No.	Project Stage/Affected Aspect	Project Activity and affected area	Potential Impacts	Mitigation Measures	Implementation Schedule	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements
				via grease traps. The foul sewer should then lead to the temporary sewage treatment plant prior to discharge or reuse as greywater. • Discharges of treated sewage should be monitored monthly for compliance with Myanmar National Environmental Quality (Emissions) Guidelines for site runoff and wastewater discharges (construction phase).				
				Hazardous Material Management • Oils, fuels and chemicals should only be used and stored in designated areas which have pollution prevention facilities and constructed on bund hardstand. The bund should be drained of rainwater after a rain event. • Proper guidelines and procedures should be developed and included in a Spill Response Plan (SPR) for immediate clean-up actions following any spillages of oil, fuel or chemicals. • Surface run-off from bunded areas should pass through oil water separators and grease traps prior to discharge to the storm water system.				
				Solid Waste Management • A waste management plan (WMP) for the Project should be developed that sets out plans and actions for construction waste as follows. • Good housekeeping practices for waste storage and handling referencing GIIP; • The WMP should include a waste inventory developed in the planning stage, in discussion with the engineers, to establish the types of wastes expected from the construction and to identify appropriate disposal routes; • Construction materials will be managed in a way to avoid over-ordering, poor storage and maintenance, mishandling as well as improper operation procedures; • Construction wastes will be separated into reusable items and materials to be disposed of or recycled whenever possible; • Waste suitable for reuse will be stored on site and reintroduced to the construction process as and when required; • The WMP will identify disposal routes (including transport options and disposal sites) for all wastes generated during the construction phase; • A hazardous waste management system covering waste classification, separation, collection, storage, transfer and disposal should be set up and operated. The waste management system will comply with applicable regulation of the government, if any, or in its absence, good international practise. • Hazardous waste will be stored in such a way as to prevent and control accidental release to the environment (e.g. secondary containment, sealed containers); • Waste will be collected regularly by reputable waste collectors; • Recyclables such as scrap steel, metals, plastics, and paper items will be collected for recycling wherever possible; • Disposal of construction waste in or off the construction site should be prohibited; • Chain of custody documents should be used for construction waste to monitor disposal; and • Waste segregation should be practiced at the workers camps with an emphasis placed on reducing, reusing and recycling of waste streams as appropriate.				
8.4	Soil Quality	Improper solid waste and hazardous material management at the site	Impacts to soil quality	To mitigate potential impacts on soil quality, mitigation measures developed for management of hazardous material and solid waste as presented in Item 8.3 above should be followed.	Construction Phase	Appointed Contractor	On site Project Management team and designated EHS team	Monthly report to the Awba

Item No.	Project Stage/Affected Aspect	Project Activity and affected area	Potential Impacts	Mitigation Measures	Implementation Schedule	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements
8.5	Landscape and Visual	Improper solid waste management outside the Project Site	Impacts to landscape and visual characters	Mitigation measures developed for management of solid waste as presented in Item 8.3 above should be followed. In addition: • The extent of the construction areas should be limited; and • Construct site hoarding around the construction site. The colour of the hoarding should blend in with the surrounding environment.	Construction Phase	Appointed Contractor	On site Project Management team and designated EHS team	Monthly report to the Awba
8.6	Community Health and Safety	Contractor's activities, increased traffic activity as well as environmental impacts to air quality, noise, surface water quality and soil quality from the Project.	Impacts to community health and safety.	• A Workforce Code of Conduct for all Project personnel could be developed. • A Contractor EHS Management Plan will be developed to reduce potential impacts of contractors' activities to nearby communities. • During consultation, it was mentioned that this access road was damaged by Project vehicles and it is recommended that Awba restore the road to its original condition. This was noted by the local community as a grievance during the consultation. • Awba will prepare and implement a Community Grievance Mechanism (as per Myanmar/Awba (#35880) – Environmental and Social Action Plan (ESAP) No. 1). • A Traffic Management Plan should be developed to indicate the traffic routes to be followed and speed limit to be complied with in order to reduce risk to the local communities. • Awba will develop a Safe Vehicle Policy and Training Safety Procedure for its own transport fleet, including provisions for safe agro-chemical and hazardous waste transport, and will include such requirements in transport contractual agreements, including barge third-party contractors (as per Myanmar/Awba (#35880) – Environmental and Social Action Plan (ESAP) No. 7). • Enforcement of a speed limit for vehicles related to construction activities of the Project. During the construction phase, a speed limit of 40km/h shall be enforced; • Establishment of a security team to monitor entrance to the construction site.	Construction Phase	Appointed Contractor	On site Project Management team and designated CSR team	Monthly report to the Awba
8.8	Occupational Health and Safety	Construction activities as well as construction camp.	Impacts to occupational health and safety.	• The Project will design an occupational health and safety management plan which will be a subset of the overall ESMP, tailored to the needs of the Project. This plan will set standards that will be met by all contractors and subcontractors. • Use dedicated dust collectors to recycle recovered materials. • Workers will have contracts which clearly state the terms and conditions of their employment and their legal rights. The Project and all contractors will be able to access a worker grievance mechanism managed by Awba. • Workers accommodation will comply with the requirements of IFC PS2 guidelines regarding minimum living areas, provision of potable drinking water (meeting WHO parameters), electricity, and latrine services • Awba will develop and implement a corporate Human Resource Policy and Manual of Procedures in compliance with applicable national labour laws and regulations and IFC's Performance Standard 2 requirements, including the following actions issues (as per Myanmar/Awba (#35880) – Environmental and Social Action Plan (ESAP) No. 2). - Corporate HR policies applicable to all operations; - HR Manual of Procedures and Staff HR Handbook; - Development of a multi-year HR awareness program; - Worker's grievance mechanism for its permanent and casual workers, as well as for construction workers, to enable anonymous complaints and tracking and analysis of systemic • Awba will develop and implement OHS management system – consistent with OHSAS 18001 – commensurate with the level of risks and impacts, applying to all its new	Construction Phase	Appointed Contractor	On site Project Management team and designated EHS and CSR teams	Monthly report to the Awba

Item No.	Project Stage/Affected Aspect	Project Activity and affected area	Potential Impacts	Mitigation Measures	Implementation Schedule	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements
				operations, including the following actions issues (as per Myanmar/Awba (#35880) – Environmental and Social Action Plan (ESAP) No. 3). - Corporate OHS policy applicable to all operations; - OHS Manual of Procedures (SOPs), including ambient air quality monitoring procedure; - Development of a multi-year OHS training plan for its staff, including centres of responsibilities, budgetary allocations, and schedule of delivery; - Definition of OHS KPIs for monitoring and reporting; - External and internal OHS audits and implementation of Corrective Action Plan (CAP), if required; - Training manuals for end-customers (e.g. farmers); - Consolidated annual OHS performance reports • Awba will develop a management procedure to ensure contractor labour and safe working conditions (inclusive of OHS) comply with PS2 requirements. This procedure will be developed based on standards of contract work in Myanmar and approved by the relevant Department / Ministry of Labour. This procedure will identify Awba's roles and responsibilities for monitoring contractor performance and will apply to all new/existing facilities included within this investment issues (as per Myanmar/Awba (#35880) – Environmental and Social Action Plan (ESAP) No. 4). - Submission of the procedure and supporting OHS documentation (e.g. safety plan, procedures, work instructions); - Inclusion of contractual provisions for casual workers and contractors to comply with Performance Standard 2 for all facilities identified within the scope of IFC's investment. • The Project will abide by Myanmar laws and regulations and International Labour Organisation (ILO) conventions when gaps are identified between national legislation and international standards. • Workers will have contracts which clearly state the terms and conditions of their employment and their legal rights. The Project and all contractors will be able to access a worker grievance mechanism managed by Awba.				
8.9	Infrastructure Services	Project traffic and in-migration of workers.	Completion of infrastructures with local communities..	• Camps for construction and operational workforces should be properly sited and designed to reduce demand on local infrastructure services. • A Traffic Management Plan should be developed to indicate the traffic routes to be followed, speed limit to be complied with as well as restriction of traffic hours (e.g. avoid rush hour) in order to reduce pressure on road infrastructure. • Stakeholder engagement should be undertaken, including implementing its grievance mechanism to address stakeholder concerns and issues related to infrastructure services in a timely manner.	Construction Phase	Appointed Contractor	On site Project Management team and designated EHS and CSR teams	Monthly report to the Awba
8.10	Accidental Events – Leaks and Spills	Unplanned Spills	Contamination to water course and impact to human health	• Development of an Emergency Preparedness and Response Plan, including for transport and sale depots (as per Myanmar/Awba (#35880) – Environmental and Social Action Plan (ESAP) No. 1). • Fuel tanks and chemical storage areas should be provided with locks and be sited on sealed areas. Establishment of secondary containment for fuel storage and hazardous materials (as per Myanmar/Awba (#35880) – Environmental and Social Action Plan (ESAP) No. 5). • Oils, fuels and chemicals should only be used and stored in designated areas which have pollution prevention facilities. The bund should be drained of rainwater after a rain event. • Surface run off from bunded areas should pass through oil/gas traps prior to discharge to the storm water system.	Construction Phase	Appointed Contractor	On site Project Management team and designated EHS and CSR teams	Monthly report to the Awba

Item No.	Project Stage/Affected Aspect	Project Activity and affected area	Potential Impacts	Mitigation Measures	Implementation Schedule	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements
				• On site oil-water separators and holding facilities should be installed to accommodate unanticipated releases of oily water. • The oil contaminated water will be collected and handled by local licensed waste water sub-contractors (if available, to be determined at the later stage). • Guidelines and procedures should be established for immediate clean up actions following any spillages of oil, fuel or chemicals.				
Operation Phase								
9.1	Air Quality	Stack emissions from the onsite incineration of process waste	Impact on ambient air quality	• The Project should ensure that emission concentrations from the incinerator do not exceed the concentrations outlined in the WBG EHS Guidelines for Waste Management Facilities [1]. • Segregate waste to avoid the incineration of waste that contains metals and metalloids that may volatize during combustion and be difficult to control through air emission technology; • Adhere to applicable national requirements and internationally recognized standards for incinerator design and operating conditions; • Introduce wastes only after the optimum temperature is reached in the final combustion chamber of the incinerator and avoid operating conditions in excess of those that are required for the efficient combustion of waste; • Interlock the charging system with the temperature monitoring and control system to prevent further addition of waste if the operating temperature falls below the required limits; • Minimise planned and unplanned shutdowns by implementing and managing a robust maintenances program; • Optimise furnace and boiler geometry, combustion air injection, NOx control devices (if used), combustion temperature and level of distribution, and the control of raw gas residence time; • Use auxiliary burner(s) for start-up and shut-down and for maintaining the required operational combustion temperatures at all times when unburned waste is in the combustion chamber; and • Use flue gas treatment system for control of acid gases, particulate matter, and other air pollutants such as NOX control measures and/or selective catalytic reduction (SCR) or selective noncatalytic reduction (SNCR) systems. • An Operational Phase Monitoring Plan will be required for the Project which will include air quality. During construction, emissions of particulates PM10, $PM_{2.5}$, NO_2, and SO_2 will be monitored monthly at the ASRs as shown in *Figure 5.1*. NO_2 and SO_2 measured by means of a diffusion tube. Others will be monitored by HAZ-SCANNER (EPAS) Environmental Perimeter Air Monitoring System. Stacked emissions from incinerator will be continuously monitored including waste feed rate, total hydrocarbons, temperature (measured at the end of the residence zone), and CO and oxygen (measured at the stack.	Design and Operation Phase	Appointed Operations team for mitigation measures implementation 3rd Party Environmental Consultant for monitoring & audit	On site Project Management team and designated EHS team	Monthly report to the Awba
9.2	Noise	Operation of fixed plant and machinery during operational phase	Increase in ambient noise levels	• Select equipment with lower SWL from the BS5228: Part 1 : 2009; • Install silencers, mufflers or acoustic enclosures to reduce sound power level of noisy equipment at all times; • Re-locate noise sources to less sensitive areas to take advantage of distance and shielding; • Site permanent facilities away from community areas if possible;	Operation Phase	Appointed Operations team	On site Project Management team and designated EHS team	Monthly report to the Awba

[1] International Finance Corporation (IFC) (2007) Environmental, Health and Safety Guidelines for Waste Management Facilities [Online] Available at: http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines [Accessed 01 August 2017]

Item No.	Project Stage/Affected Aspect	Project Activity and affected area	Potential Impacts	Mitigation Measures	Implementation Schedule	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements
				• Take advantage of the natural topography as a noise buffer during facility design; Vehicles should be regularly maintained. • Transportation of materials during night time should be avoided to minimize disturbance to communities. • An Operational Phase Monitoring Plan will be required for the Project which will include noise emissions. During construction, ambient noise levels in Leq, Leq day, Leq night and hourly Leq will be measures monthly at the NSRs within 500 m from the Project boundary as shown in *Figure 5.12*. These will be measured for 24-hours.				
9.3	Surface and Ground Water Quality	Uncontrolled runoff, improper wastewater, solid waste and hazardous material management at the site, affecting surface water quality of watercourse.	Impact to surface water quality	To mitigate potential impacts on surface water quality during the operation phase, mitigation measures developed for the construction phase as presented in Item 8.3 above should be followed given the similar issues expected. In addition to the above: • Discharges from the production process should be treated and monitored monthly for compliance with effluent levels specified in WBG EHS Guidelines for Pesticide Manufacturing, Formulation and Packaging (2007). • Sewage from the operation workforce should be treated on-site by a septic tank and seepage field properly designed and maintained according to WBG Genera EHS Standards (2007) as follows: ▪ Installed in areas with sufficient soil percolation for the design wastewater loading rate; ▪ Installed in areas of stable soils that are nearly level, well drained, and permeable, with enough separation between the drain field and the groundwater table or other receiving waters; ▪ Grease trap should be installed at sources where oily water is expected (e.g. kitchen); and ▪ Residual sludge should be collected and disposed of properly. • Should treated wastewater to be reused as spray water, they should be monitored monthly for compliance with Myanmar National Environmental Quality (Emissions) Guidelines for site runoff and wastewater discharges (for TSS, oil and grease, pH). • An Operational Phase Monitoring Plan will be required for the Project which will include surface water quality. During construction, surface water quality monitoring will include pH, DO, COD, BOD5, oil and grease, TN, TP, TSS and total coliform. This will be conducted monthly at the water sampling locations shown in Figure 5.18 and one upstream station located 100m upstream of the Project Site. • For Class II (moderately hazardous) pesticides, Awba will provide the appropriate controls taken in relation to the manufacture, procurement, or distribution and/or use of these chemicals (as per Myanmar/Awba (#35880) – Environmental and Social Action Plan (ESAP) No. 6). • All wastewater from Project Site will be fully collected and treated to comply with applicable standards at the proposed wastewater treatment plant. • Implement monitoring system to continuously monitor / disclose waste water discharge quality.	Operation Phase	Appointed Operations team for mitigation measures implementation 3rd Party Environmental Consultant for monitoring & audit	On site Project Management team and designated EHS team	Monthly report to the Awba
9.4	Soil Quality	Improper solid waste and hazardous material management at the site	Impacts to soil quality	To mitigate potential impacts on soil quality, mitigation measures developed for management of hazardous material and solid waste as presented in Item 8.3 above should be followed. • Debris and refuse generated on-site should be collected, handled and disposed of properly. • Oils, fuels and chemicals should only be used and stored in designated areas which have pollution prevention facilities.	Operation Phase	Appointed Operations team	On site Project Management team and designated EHS team	Monthly report to the Awba

Item No.	Project Stage/Affected Aspect	Project Activity and affected area	Potential Impacts	Mitigation Measures	Implementation Schedule	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements
9.5	Landscape and Visual	Improper solid waste management outside the Project Site	Impacts to landscape and visual characters	Mitigation measures developed for management of solid waste as presented in Item 8.3 above should be followed. In addition, it is recommended for the operation that that landscaped area should be developed along the Project Site boundary.	Operation Phase	Appointed Operations team	On site Project Management team and designated EHS team	Monthly report to the Awba
9.6	Community Health and Safety	Project activities, increased traffic activity as well as environmental impacts to air quality, noise, surface water quality and soil quality from the Project.	Impacts to community health and safety.	Please refer to Item 8.6 above for mitigation measures recommended. A number of mitigation measures could be adopted to reduce impact on community health and safety, these measures may include the following: • Awba will prepare and implement a Community Grievance Mechanism (as per Myanmar/Awba (#35880) – Environmental and Social Action Plan (ESAP) No. 1). • Awba will develop a Safe Vehicle Policy and Training Safety Procedure for its own transport fleet, including provisions for safe agro-chemical and hazardous waste transport, and will include such requirements in transport contractual agreements, including barge third-party contractors (as per Myanmar/Awba (#35880) – Environmental and Social Action Plan (ESAP) No. 7).	Operation Phase	Appointed Operations team	On site Project Management team and designated CSR team	Monthly report to the Awba
9.8	Occupational Health and Safety	Operational activities as well as workers camp.	Impacts to occupational health and safety.	Please refer to Item 8.6 above for mitigation measures recommended. A number of measures should be adopted to reduce impacts to occupational health and safety: • Ventilation systems and life and fire safety systems in all buildings. • Adequate PPE and suction hoods will be used to collect vapours and other fugitive emissions. • The Project will develop and implement a worker's grievance mechanism for its permanent and casual workers, as well as for construction workers, to enable anonymous complaints and tracking and analysis of systemic issues (as per Myanmar/Awba (#35880) – Environmental and Social Action Plan (ESAP) No. 2).	Operation Phase	Appointed Operations team	On site Project Management team and designated EHS and CSR teams	Monthly report to the Awba
9.9	Infrastructure Services	Project traffic and in-migration of workers.	Completion of infrastructures with local communities.	Please refer to Item 8.6 above for mitigation measures recommended.	Operation Phase	Appointed Operations team	On site Project Management team and designated EHS and CSR teams	Monthly report to the Awba
9.10	Accidental Events – Leaks and Spills	Unplanned Spills	Contamination to water course and impact to human health	• Development of an Emergency Preparedness and Response Plan, including for transport and sale depots (as per Myanmar/Awba (#35880) – Environmental and Social Action Plan (ESAP) No. 1). • Fuel tanks and chemical storage areas should be provided with locks and be sited on sealed areas. Establishment of secondary containment for fuel storage and hazardous materials (as per Myanmar/Awba (#35880) – Environmental and Social Action Plan (ESAP) No. 5). • Oils, fuels and chemicals should only be used and stored in designated areas which have pollution prevention facilities. The bund should be drained of rainwater after a rain event. • Surface run off from bunded areas should pass through oil/gas traps prior to discharge to the storm water system. • On site oil-water separators and holding facilities should be installed to accommodate unanticipated releases of oily water. • The oil contaminated water will be collected and handled by local licensed waste water sub-contractors (if available, to be determined at the later stage).	Operation Phase	Appointed Operations team	On site Project Management team and designated EHS team	Monthly report to the Awba

Item No.	Project Stage/Affected Aspect	Project Activity and affected area	Potential Impacts	Mitigation Measures	Implementation Schedule	Responsibility for Mitigation Implementation	Responsibility for supervision of mitigation implementation	Reporting Requirements
				• Guidelines and procedures should be established for immediate clean up actions following any spillages of oil, fuel or chemicals.				
9.11	Accidental Events –Fire	Accidental Events – Fire	Health and safety risk to workers and local community.	• Fire protection / fighting system will be installed at the office building, laboratory building, warehouse, EC Building, SL Building, WP Building, SP Building, SC Building, Utility Building, Drum Crusher Building to mitigate fire risk during operation of the Project. • As administered under the Emergency Preparedness Plan, a Fire Risk Management Plan will be developed including communications protocols and measures to control any fires that do arise. • Induction training for personnel is recommended to include a mandatory segment on fire safety and actions in the event of a fire. • Conduct fire training and response drills.	Operation Phase	Appointed Operations team	On site Project Management team and designated EHS team	Monthly report to the Awba

10.5 ENVIRONMENTAL AND SOCIAL MONITORING PROGRAMME

Monitoring is a means verifying overall effectiveness of the management and mitigation measures contained within the management plans listed above. Key objectives of the monitoring process are to:

- Confirm effectiveness of management and mitigation measures;
- Ensure compliance with Applicable Standards (i.e. IFC Performance Standards and WBG EHS Guidelines);
- Monitoring the status of, and impacts on, identified sensitive receptors;
- Provide an early warning that any of the control measures or practices are failing to achieve their desired performance and ensure changes can be implemented to remedy these practices;
- Determine whether environmental and social changes are attributable to Project activities, or as a result of other activities or natural variation; and
- Provide a basis for continual review and improvements to Project design and execution.

An Environmental Monitoring and Audit (EM&A) Manual will be required of the Project. The purpose of the Manual is to provide information, guidance and instruction to personnel charged with environmental duties and those responsible for undertaking EM&A work during the construction and operation of the HAIC. It will provide systematic procedures for monitoring and auditing of potential environmental impacts that may arise from the works.

The objectives of the EM&A will be:

- To monitor and report on the environmental impacts of the construction and operational activities;
- To design and continually review the operation and monitoring programme;
- To make recommendations for changes to the operation that will rectify any unacceptable environmental impacts;
- To make recommendations for changes to the monitoring programme that will improve the ability to cost effectively detect environmental changes caused by the Project activities;
- To establish numerical decision criteria for defining impacts for each monitoring component; and

- To provide supervision on the field works and laboratory works to be carried out by contractors/laboratories.

10.5.1 Performance Indicators and Monitoring Schedule

Physical, biological and social environmental management components of particular significance have been identified as performance indicators. A comprehensive monitoring plan for each performance indicator has been prepared for all phases of the Project and is presented in *Table 10.2*.

This includes the tentative parameters to be measured, methods to be utilised, sampling locations, frequency of measurements, detection limits and responsibilities for implementation and supervision.

It is to be noted that the detailed and specific monitoring measures will be developed and included within the Environmental Monitoring Plan. The monitoring components will be refined and finalised during plan development.

Impact monitoring will be undertaken during the life of the Project to verify the predicted levels of residual impacts from the Project and the effectiveness of the various management plans and mitigation measures.

10.5.2 Reporting Mechanism for Environmental and Social Monitoring Programme

A robust reporting system will provide the Project with the necessary feedback mechanisms to ensure quality and timely implementation of the works. The reporting system will provide a mechanism to ensure that the measures proposed in the Project's ESMP are implemented.

Prior to the commencement of the construction and operation activities, Awba will finalise the format and frequency for reporting on the status and progress of environmental and social monitoring.

The format will be designed to meet all the compliance conditions associated with the local and international requirements. The contractor will be required to submit the duly filled up reporting form on the agreed frequency to Awba.

Table 10.3 Environmental and Social Monitoring Programme (Construction and Operation Phase)

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Estimated Budget (USD)
General	Inspection of mitigation compliance	General compliance with mitigation measures presented in the ESMP.	Project activity areas	Visual inspection of all active work areas and inspection of records	Weekly	EHS Team of Appointed Contractor / Operations team and On site EHS team of Awba	Within EHS Advisor responsibilities
Construction Phase							
Air	Increase in emissions of dust and particulates	PM_{10}, $PM_{2.5}$, NO_2, and SO_2	ASRs as shown in *Figure 5.1*.	NO_2 and SO_2 measured by means of a diffusion tube. Others by HAZ-SCANNER (EPAS) Environmental Perimeter Air Monitoring System	Monthly until completion of construction and operation	3rd Party Environmental Consultant	Air monitoring will be 2,500-5,000 USD monthly A monitoring machine costs 20,000-30,000 USD
Noise	Increase in ambient noise levels	Noise levels in Leq, Leq day, Leq night and hourly Leq	Identified NSRs within 500 m from the Project boundary as shown in *Figure 5.12*.	24-hour	Monthly until completion of construction and operation	3rd Party Environmental Consultant	Noise monitoring will be 2,500-5,000 USD monthly

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Estimated Budget (USD)
							A monitoring machine costs 20,000-30,000 USD
Surface Water	Contamination of surface water	pH, DO, COD, BOD_5, oil and grease, TN, TP, TSS and total coliform	Water sampling points as shown in *Figure 5.18* and one upstream station located 100m upstream of the Project Site.	Standard analytical methods	Monthly until completion of construction and operation	3rd Party Environmental Consultant	Water monitoring will cost 3,000 USD monthly (including laboratory fees)
Operational Phase							
Air	Increase in emissions of dust and particulates	PM_{10}, $PM_{2.5}$, NO_2, and SO_2	ASRs as shown in *Figure 5.1*.	NO_2 and SO_2 measured by means of a diffusion tube. Others by HAZ-SCANNER (EPAS) Environmental Perimeter Air Monitoring System	Monthly until completion of construction and operation	3rd Party Environmental Consultant	As above.
Air	Stacked emissions from incinerator	Continuously monitor incinerator parameters including waste feed rate, total hydrocarbons, temperature (measured at the end of the residence zone), and CO and oxygen (measured at the stack).				EHS Team of Operations team	As above

Project Stage/ Affected Component	Potential Impact	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Estimated Budget (USD)
Noise	Increase in ambient noise levels	Noise levels in Leq, Leq day, Leq night and hourly Leq	Identified NSRs within 500 m from the Project boundary as shown in *Figure 5.12*.	24-hour	Monthly until completion of construction and operation	3rd Party Environmental Consultant	As above
Surface Water	Contamination of surface water	pH, DO, COD, BOD_5, oil and grease, TN, TP, TSS and total coliform	Water sampling points as shown in *Figure 5.18* and one upstream station located 100m upstream of the Project Site.	Standard analytical methods	Monthly until completion of construction and operation	3rd Party Environmental Consultant	As above

10.6 INSTITUTIONAL SETTING AND IMPLEMENTATION ARRANGEMENTS

10.6.1 Construction Phase

The ESMP will be included in the construction contract and the contractor will be responsible for implementation of the measures associated with design and construction. Awba's staff, specifically the EHS Officer and Site Engineer of the Project Management team, will monitor the implementation of these mitigation measures by the contractors at the site.

The roles and responsibilities of Awba and the Contractor for implementation and monitoring have been outlined in *Table 10.3*.

Table 10.3 Roles and Responsibilities of AWBA and Contractor

Awba – EHS Officer and Site Engineer	Contractor
Obtaining statutory clearances required during pre-construction stage of the Project	Obtaining permits required during the construction stage
Overall Project co-ordination and management through Contractor and supported by the third party environmental consultants	Joint verification with Awba and Third Party Environmental Consultant for review of ESMP implementation
Interaction and reporting to IFC	Filling of reporting formats as per the reporting schedule and submission to IFC via Awba
Effective implementation of ESMP and monitoring of ESMP implementation	Environmental monitoring through Third Party Environmental Consultant
Carryout verification/supervision exercises during the construction phase of the Project for implementation of ESMP	Preparation of various plans for effective implementation of ESMP
Overall supervision of ESMP implementation	Management of labour camp and to provide drinking water, sanitation facility
Approval of plans prepared by the Contractor	
Addressing grievances of local community and information dissemination	
Environmental monitoring through Third Party Environmental Consultant	

While the contractor or a particular party is responsible for physical implementation of the mitigating measures, the whole implementation process requires supervision, checking, documentation and verification so that problems are identified and properly addressed before they get out of hand. In order to ensure proper execution of the ESMP, implementation reviews will be conducted by the EHS Officer / Site Engineer by various means including weekly construction meetings, review of construction log book, monthly and other construction reports etc. Records of these minutes of the weekly meeting, monthly reports and special reports on implementation of the mitigating measures will also be maintained and available for review by the Project management. It is suggested to identify documents and records that require templates and accordingly suitable templates should be developed, which should include but not limited to policies, procedures and work instructions, meeting minutes, monitoring results, training attendance records, emergency contract lists, action plans etc. Further, all these templates should be communicated to all potential users. All these records will be archived at the Project office and will be maintained by the EHS officer. All documents and records shall be archived with a unique identifier so that they can be distinguished from any other material and can be easily retrieved.

10.6.2 Operation Phase

The ESMP will be included in the operation contract if contractor is engaged for plant operation and the contractor's operations team will be responsible for implementation of the associated mitigation measures. Awba's staff, specifically the EHS Officer and Site Engineer, will monitor the implementation of these mitigation measures by the operations team at the site.

10.7 TRAINING

10.7.1 Construction Phase

Prior to commencement of major civil works at site, a suitably qualified in-house/external expert will be appointed by the contractor in consultation with the Awba to develop and deliver a training program on implementation of the ESMP, monitoring and reporting will be conducted in line with the applicable reference framework for the Project. The training will include the following topics:

- Environment, Health and Safety Policy of the contractor;
- Environment and fundamentals of environmental pollution in relation to the Project;
- EHS management plans prepared by the Contractor;
- Do's and Don'ts for the construction workers;
- Safety procedures and guidelines; and

- Internal reporting and response system.

In addition, specific training will be provided to the team involved in environmental and social monitoring and reporting, which will include:

- Applicable environmental and social guidelines and standards;
- Sampling site selection guidelines in line with environmental monitoring plan;
- Sample collection, storage, transportation and analysis procedures;
- Quality assurance and quality control; and
- Environmental monitoring report preparation.

The training will help in capacity building and implementation of the ESMP during the construction phase of the Project. It will also help in ensuring internal and external monitoring and verification of the environmental and social performance of the Project. The timeframe for reporting and verification during the construction phase will be agreed between the Awba, the contractor and the IFC.

10.7.2 Operation Phase

Prior to the commencement of the Project operation, a suitably qualified in-house/external environmental expert will be engaged by the Awba to develop and deliver a training program on operation phase environmental and social monitoring and reporting. The topics will be mostly same as that during the construction phase.

The training will help in capacity building and implementation of the ESMP during the operation phase of the Project. It will also help in ensuring internal and external monitoring and verification of the environmental and social performance of the Project. The timeframe for reporting and verification during the operation phase will be agreed between the Awba, the contractor and the IFC.

10.8 BUDGET

The Contractor and Awba will allocate separate budget for environmental and social management plan implementation, training, environmental monitoring, analysis and reporting, verification monitoring and capacity building. The budget is estimated to be **US$ 1,000,000.** It should be noted that costs for many in-built mitigation measures, such as, acoustic enclosures for noise control, water and wastewater treatment, are already included in the contract cost estimate and/or operating cost estimates. In addition, separate budget will be allocated for CSR activities, which will be conducted by the Awba for community development.

10.9 UPDATE OF THE ESMP

This ESMP will be updated, revised and reviewed internally on a regular basis to ensure its effectiveness in monitoring the environmental and social performance of the Project. The ESMP of the Project will be reviewed on a half yearly basis in conjunction with the EM&A.

Furthermore, in the event of an unanticipated impact and design change with respect to the Project standards (including Myanmar Government and IFC requirements); the ESMP would be updated as necessary.

11 CUMULATIVE IMPACT ASSESSMENT

Within the Industrial Park area there are two other facilities that could be operational at the same time as the HAIC:

1. Marlarmyaing Company Limited; and

2. Myanmar Pesticide Industry (MPI).

Both of these facilities are pesticide formulation and packaging industries like the HAIC and therefore potential impacts are expected to be similar. There is no publically available information on the operations of the Marlarmyaing facility. It is also unconfirmed whether the MPI facility will continue its operation after the end of the BOT contract between the Awba and the Government of Myanmar. On the basis of this, a quantitative cumulative impact assessment of the HAIC with the two facilities is not possible; however, the following presents a qualitative approach.

Under the ESIA of the HAIC project, baseline surveys for air quality, noise, surface water quality, groundwater quality and soil quality were undertaken in June to July 2017. Except for noise which showed exceedance of both the noise limits set out in NEQ and WBG General EHS guideline values during daytime (except NSR4) and night-time periods, the baseline levels of other aspects generally indicated compliance with relevant environmental standards as presented in *Sections 5.1-7* with occasional isolated exceedances. These baseline levels are considered to reflected environmental conditions at the sensitive receiver under normal operation of the surrounding facilities (i.e. Marlarmyaing and MPI), and were taken into account during the operational impact assessment of the Project in *Section 9*.

It is concluded in the ESIA Study that with proper implementation of the recommended mitigation measures, the residual environmental and social impacts causing by the operation of the Project could be expected to be of no larger than **moderate** significance. If the operations of the surrounding facilities remain the same as when the baseline surveys were undertaken in June to July 2017, it is expected that the cumulative impact of the HAIC Project and the Marlarmyaing and MPI facilities will also be no larger than moderate significance.

The Project covers the construction and operation of a new agro-chemical formulation complex, HAIC, in the Hmawbi Township of Yangon Region by Awba. The Project is funded by IFC through extending a financing facility of US$10 million to Awba with specific use of proceeds for the expansion of Awba's core business.

An ESIA Study has been conducted for Project in accordance with the local Myanmar requirements and in conformance with relevant environmental and social guidelines of the international benchmark (i.e. IFC PS and WBG EHS Guidelines) with an overall objective to ensure acceptable environmental and social performance of the Project. During the ESIA Study, potential impacts have firstly been identified through a systematic scoping process whereby the activities (both planned and unplanned) associated with the Project have been considered with respect to their potential to interact with environmental and social resources or receptors. Interactions, which may generate potentially significant environmental and social impacts, have been further assessed in the ESIA Study, with appropriate mitigation and enhancement measures recommended for alleviating potential negative impacts or enhancing potential positive impacts from the Project.

A local ESIA has been prepared for MONREC requirements and is currently being reviewed by MONREC. It is recommended that Awba wait for the approval of this report prior to commencing operations.

Consultation outcomes have been incorporated into the design of mitigation measures for Project and are contained in this ESIA Report. These include:

- Routine air and water monitoring at the Project Site and in communities closest to the Project Site.
- The access road to the Project Site has been damaged by Project vehicles and it is recommended that Awba restore the road to its original condition.
- Development of a formal grievance procedure for use by local residents.
- Undertake consultation and information disclosure in Pa Ywet Sate Kone, Kyi Ni San, Poe Dana Kone, and Shan Kone villages.

It is concluded in the ESIA Study that with proper implementation of the recommended mitigation measures, the residual environmental and social impacts causing by the construction and operation of the Project would be of no larger than **moderate** significance.

To ensure proper delivery of the committed mitigation measures identified in the ESIA Study, an Environmental and Social Management Plan has been prepared for the Project, which provides the procedures and processes to be applied to the Project activities in order to check and monitor compliance and effectiveness of the mitigation measures during the construction and

operation of the Project. In addition, this ESMP will be used to ensure compliance with statutory requirements and corporate safety and environmental policies. Overall, it is expected that the Project will be constructed and operated with acceptable environmental and social performance under proper implementation of the ESMP.

The Project will also have a Construction Phase and Operational Phase Monitoring Plan will be required for the Project, which will include air quality, noise, and water quality impacts. It is important to undertake monitoring to track the effectiveness of these mitigation measures and manage any necessary changes accordingly.

Appendix A

Terms of Reference for the ESIA

1 TERMS OF REFERENCE FOR THE ESIA

1.1 INTRODUCTION

A key outcome of the Scoping Study includes the creation of the Terms of Reference (ToR) for the Supplementary ESIA Study of the Project. The ESIA Study will then be carried out according to the ToR.

This section serves as the ToR which sets out the following:

- ESIA Study objectives;
- Overview of activities to complete the ESIA process;
- Baseline surveys and stakeholder engagement; and
- Impact assessment approach.

1.2 ESIA OBJECTIVES

The purpose of the ESIA is to assess the potential impacts of the Project and Project-related activities on the environment (including biological, physical and socio-economic resources), and where applicable to design mitigation or enhancement measures to remove, reduce or avoid negative impacts.

1.3 ESIA STEPS

Following on from the Scoping stage of the Project, ERM will:

- Update and finalize the technical Project description as further details become available, working closely with the Awba to confirm details such as the layout of the facilities, production design as well as construction and operation plans;
- Conduct additional stakeholder consultation as necessary;
- Collect additional baseline data through desktop research and baseline surveys to complete a comprehensive description of the environmental and social conditions;
- Develop mitigation and enhancement measures and outline an ESMP including an approach for monitoring; and
- Report findings in a comprehensive ESIA Report and presented the mitigation and enhancement measures as well as the monitoring plan in the ESMP (including timeline, cost and center of responsibility).

1.4 BASELINE SURVEYS

The following baseline surveys and stakeholder engagement will be undertaken to fill the data gaps identified which will be necessary to inform the impact assessment.

1.4.1 Baseline Surveys for Air

Overview

It is understood that the Project will operate a solid/hazardous waste incinerator on site. ERM propose to undertake a baseline survey to a) inform the ESIA; b) provide evidence in the event of future complaints regarding operations of the incinerator; and c) provide a basis for the setting of monitoring levels. The potentially significant substances of interest from a waste incinerator include particulate matter ($PM_{2.5}$ and PM_{10}) nitrogen oxides (NO_x), sulphur dioxide (SO_2), carbon monoxide (CO), metals and unburned hydrocarbons.

Methodology

Parameter Selection

The survey will capture existing air quality at sensitive receptors in the vicinity of the Project. The parameters which are monitored should be decided based on a) an understanding of the potentially significant substances of interest released from the Project; and b) an understanding of the substances which may already be elevated in the ambient environment. Further to a review of the process and a preliminary understanding of the existing environment, the parameters which will be included in the baseline assessment include $PM_{2.5}$, PM_{10}, NO_x, NO_2 and SO_2.

Monitoring Method

Monitoring will be undertaken at five (5) sites around the Project to provide sufficient spatial coverage and to provide a robust and informative data set. NO_x, NO_2 and SO_2 will be monitored using five (5) sets of diffusion tubes, noting that NO_x is only required at agricultural areas and sensitive ecological habitats. The tubes will be deployed at each site for four (4) weeks continuously and then collected and sent back to the laboratory for analysis.

$PM_{2.5}$ and PM_{10} will be monitored using one (1) active sampler on rotation between the identified monitoring locations.

Monitoring Locations

Whilst the general locations of the monitoring stations can be understood from desk based studies of local mapping performed by ERM, the exact locations of monitoring equipment deployment will be confirmed during the site visit performed by an ERM air quality specialist. The approximate

monitoring locations are presented n *Figure 4.3* which will cover the five (5) ASRs.

Monitoring Duration

Diffusion tubes will be installed on site for four weeks continuously. Automatic sampling of $PM_{2.5}$ and PM_{10} will be undertaken at each site for 48 hours continuously.

1.4.2 Baseline Surveys for Noise

Potential impacts to NSRs are expected due to the Project construction and operation. Baseline surveys for noise will thus be undertaken in accordance with IFC Standards at two of the five locations for baseline air quality monitoring since the ASRs are at the same time NSRs. Exact sampling locations will be determined during the baseline survey.

During baseline noise monitoring, hourly A-weighted equivalent continuous sound pressure levels (LAeq, 1 hour) will be recorded continuously over 24 hours at each location during both weekday and weekend. At each location, daytime and night-time LAeq will be calculated by averaging the hourly sound pressure levels measured between 0700 and 2200 hours and between 2200 to 0700 hours, respectively.

Noise levels (L_{Aeq}) will be recorded using a type II sound level meter at about 1.5 m above ground with no reflecting surface nearby in accordance with IFC guidelines. Sampling frequency will be at 10-minute interval for 24 hours continuously.

1.4.3 Baseline Surveys for Soil and Groundwater

Potential impacts to surface water and groundwater quality are expected due to issues related to solid water management, wastewater management and accidental spills etc. from the Project. Baseline surface water quality monitoring will be undertaken at three locations, including the stream at the northwest of the Project Site, water collection point by the local communities downstream of the Project Site as well as a location approximately 500 m upstream of the Project Site. Soil samples will be taken at five (5) locations within the Project Site. During the baseline survey, two water samples will be taken at each sampling location using sampling bottles provided by a laboratory certified under the Hong Kong Laboratory Accreditation Scheme (HOKLAS). These samples will be stored at chilled condition and sent to the laboratory for analysis. Water quality parameters measured will include *in-situ* measurement of pH and temperature as well as laboratory analysis of BOD_5, COD, TSS, Oil and Grease, Phenol, Arsenic, Chromium total, Chromium, Copper, Chlorinated organics, Nitrorganics, Mercury, Zinc, Ammonia, Total Phosphorus, Total Nitrogen and Total Coliform. These parameters are pollutants of concern specified in the WBG EHS Guidelines for Pesticide Manufacturing, Formulation and Packaging (2007) (*Table 3.3*) and WBG General EHS Guidelines (2007) for treated sanitary sewage discharge

during operation of the Project (*Table 3.4*). For construction of the Project, it is noted that the Myanmar National Environmental Quality (Emissions) Guidelines specified the guidance levels for site runoff and wastewater discharges, which are the same as those specified for treated sanitary sewage discharge by WBG General EHS Guidelines (2007).

1.4.4 Baseline Surveys for Biodiversity

The purpose of biodiversity field surveys is to obtain further information on existing biodiversity values in the Project's AOI.

- Using the information obtained in the desktop review, a list of all the known or potentially occurring global, national and/or local biodiversity values in the project study area will be identified. This will include consideration of any additional assessment of invasive species, if required. This information will be used to:

  (i) develop a prioritized list of terrestrial areas for field biodiversity surveys; and

  (ii) make recommendations based on recognized good international practice on focus, seasonality, timing, required expertise and design of survey efforts.

- Using information obtained in the desktop review, a prioritized list of habitat types/areas where additional field biodiversity survey will be developed.

1.4.5 Socio-economic Baseline Survey and Data Collection

The ERM team will undertake household surveys and/or focus group discussions in Wah Net Chaung, Tha Pyay Kone, Yae Tar Shey and Nyaung Kone Village which are all within 3.5 km of the Project.

Up to 50 interviews or surveys over a period of up to one week will be conducted to gather information on livelihoods, economy, demographics, infrastructure, utilities, agriculture, education and health care. The household surveys will be used both as a means of consultation and to gather baseline socio-economic data for the ESIA. The household survey questionnaire is attached in *Annex A*. Surveys will include those working at the Awba facility.

1.5 APPROACH TO ASSESSMENT OF POTENTIAL IMPACTS

Potential Project risks and impacts should be assessed in accordance with the requirements and standards set out in IFC Performance Standards, WBG guidelines and other relevant guidelines. The assessment will cover all potentially risks and impacts using recognised methods as applicable, but should focus on the potentially significant impacts. Impacts should be identified in the context of the Project's AOI, covering: the Project footprint and other areas likely to be directly affected by Project activities; indirect

impacts from unplanned but predictable activities; and cumulative impacts. Impact avoidance and mitigation measures should be designed for the Project to enable the Project to achieve compliance with national legislation, IFC PSs and WBG EHS Guidelines, whichever is more stringent. These measures shall be incorporated into Project design, construction and operation.

Impact assessment should take into account the views and concerns of key stakeholders, including project affected peoples, representatives of affected communities, relevant authorities and NGOs. Impacts should be described in terms of: being adverse or beneficial, direct / indirect, cumulative, localised/ regional / cross-border / global, duration, and permanent / temporary / reversible. Wherever possible impacts shall be objectively described (quantified) rather than simply subjectively described.

Quantitative modelling will be undertaken for air quality assessment. An emissions inventory for the overall Project will be developed. All characteristics of the emission sources would be defined either from plant specific data or from publically available default values used in the development of emission factors (for example USEPA AP-42 or Australian NPi). Once the emission inventory has been acknowledged and agreed with Awba, detailed air dispersion modelling using the USEPA regulatory model AERMOD will be undertaken, as this is internationally recognised as being suitable for this type of near field study in areas of simple terrain and locations away from the coast. The modelling will take into account local meteorological data, terrain data, sensitive receptor locations and the identified potential sources of emissions.

The main assumptions for air quality modelling are as follows:

- The assessment will be undertaken for the worst case operating scenario.
- One single stack height(s) and one emission profile will be assessed. In the event that the base design is not compliant, further modelling scenarios would be required. No further modelling scenarios will be performed prior to discussion and variation approvals from Awba.
- All facility design/layout required for the modelling are to be provided by Awba.
- Known emissions data required for modelling will be provided by Awba.
- The conversion factor for NO_x to NO_2 is a critical factor in the assessment of NO_2 impacts. It is proposed that the current USEPA conversion factors are used.

1.6 STRUCTURE OF THE ESIA REPORT

An outline of the proposed contents of the main volume of the ESIA report is provided in *Table 1.1*.

Table 1.1 Proposed ESIA Report Structure

Chapter Number	Contents Heading	Explanatory Note
Cover page	-	Title page, acknowledgments, table of contents (including list of figures, tables and maps)
Executive Summary	-	Executive Summary of entire ESIA Report in non-technical language, including inclusion of the E&S Management Plan
1	Introduction and Overview of the Project	This *Chapter* will outline the development and structure of the ESIA report including the background, terms of reference, objectives, scope and declaration. The Project Rationale.
2	Project Description	This *Chapter* will provide a concise description of the project and its geographical and temporal context. It will include a site description, an overview of the Facility Project design and details of project inputs and outputs. Specific points to discuss include: • Description of Project facilities, components and activities • Embedded Controls included in the Project design to control impacts and technical specifications • Construction activities • Operational activities • Project schedule
3	Project Alternatives and Project Justification	This *Chapter* will include discussion of the Project background, objectives, need for the Project, value of the Project, envisioned sustainability, alternatives considered (including no project alternative), development options considered and site selection.
4	Policy, Legal and Administrative Framework	The policy, legal and institutional framework within which the ESIA has been conducted will be discussed in this *Chapter*. National regulations, if available, will be summarised along with relevant international agreements and conventions to which Myanmar is party, as well as applicable international best practice guidelines and project standards.
5	Assessment Methodology	This Chapter presents the methodology to conduct the Impact Assessment. The systematic approach that predicts and evaluates the impacts the Project and associated facilities could have on aspects of the physical, biological and socio economic and cultural environment shall be outlined in this Chapter. Reference should be made to the initial scoping activities to set the context for the ESIA. Impact assessment terminology, sensitivity and evaluation criteria should be included within this Chapter for specific parameters assessed.
6	Baseline Environment	This *Chapter* will summarise the available baseline data on the environmental receptors within the Project AOI. These include results of the additional baseline studies recommended in the above. It will be based on both

Chapter Number	Contents Heading	Explanatory Note
		primary and secondary data sources and will consider changes in the baseline condition without the development in place. It will focus on the description of the biological and physical environment.
7	Socio-economic Baseline and Stakeholder Consultation and Disclosure	This *Chapter* will present the results of consultation and baseline socio-economic survey undertaken as part of the ESIA, plus plans for future consultation. It will identify key Project stakeholders and present their feedback on the Project.
8	Impact Prediction and Evaluation	This *Chapter* will summarise the predicted positive and negative impacts of the Project. Cumulative impacts will be assessed based on additional agro-formulations plants being under design and construction in the vicinity of the Hawmbi plant. This *Chapter* will also include a summary of the current socio-economic status and the identification of potential negative and positive impacts.
9	Environmental and Social Management Plan (ESMP)	The ESMP will draw together the possible mitigation measures; group them logically into components with common themes; define the specific actions required and timetable for implementation; identify training needs, institutional roles and responsibilities for implementation; develop a monitoring program and estimate the costs of the measures.
10	Conclusion and Recommendations	This *Chapter* will summarise conclusions that are made based on the assessment as well as outline any further recommendations.
Annexes		These will include all technical annexes with details of specific technical surveys

Appendix B

Impact Assessment Methodology

1 IMPACT ASSESSMENT METHODOLOGY

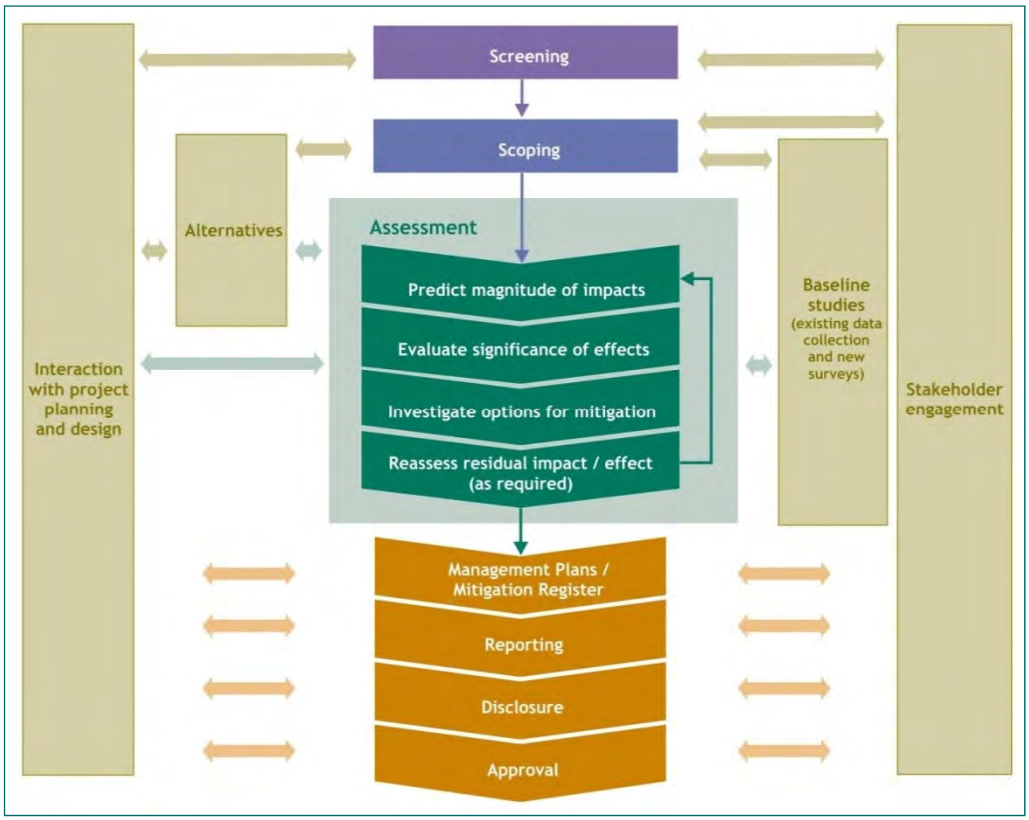
1.1 INTRODUCTION

This section of the EIA presents the methodology used to conduct the impact assessment. This methodology has been developed by ERM and is based on international best practice. The following approach is considered applicable to meet both Myanmar national and IFC requirements on environmental and social performance of the Project.

1.2 IMPACT ASSESSMENT METHODOLOGY

The impact assessment (IA) methodology follows the overall approach illustrated in *Figure B1*. The IA has been undertaken following a systematic process that predicts and evaluates the impacts the Project could have on aspects of the physical, biological, and social/ socio-economic environment, and identifies measures that the Project will take to avoid, minimise/reduce, mitigate, offset or compensate for adverse impacts; and to enhance positive impacts where practicable. The stages of the IA process are described below and further explained in the subsequent sections.

Figure B1 Impact Assessment Process



1.2.1 Scoping

Scoping has been undertaken to identify the potential Area of Influence (AOI) for the Project (and thus the appropriate Study Area), to identify interactions between the Project and resources/receptors in the AOI and the impacts that could result from these interactions, and to prioritize these impacts in terms of potential significance.

This phase is intended to ensure that the IA focuses on those issues that are most important for design, decision-making and stakeholder interest.

Scoping also has the benefit of identifying those impacts which are not likely to be significant and hence which warrant little or no further consideration or associated data gathering.

A scoping exercise was undertaken as part of EIA of the Project and the results are presented in *Section 4* of the EIA Report. The scoping of impacts indicates that the majority of identified potential impacts are not expected to be significant (i.e. those scoped out above). For activities predicted to have no significant impact (i.e. those in white in the Matrix), no detailed quantification or further assessment will be conducted in this EIA Report. For activities where possible significant effects could occur, these interactions will be assessed in more detail in *Sections 8-9* of this EIA Report

1.2.2 Project Description

The Project Description sets out the scope of the Project features and activities, with particular reference to the aspects which can impact on the environment. Details of the Project facilities' design characteristics, as well as Project activities, are provided in *Section 2* of this EIA Report.

1.2.3 Stakeholder Engagement

An effective IA Process requires engagement with relevant stakeholders throughout the key stages. This assists in informing stakeholders about the Project, understanding stakeholder views on the Project and in identifying issues that should be taken into account in the prediction and evaluation of impacts.

Details of the stakeholder engagement activities undertaken for this Project are presented in *Section 7* of this EIA report

1.2.4 Baseline Environment

To provide a context within which the impacts of the Project can be assessed, a description of physical, biological and social/socio-economic conditions that would be expected to prevail in the absence of the Project is characterized. The baseline includes information on all resources/receptors that were identified during scoping as having the potential to be affected by the Project.

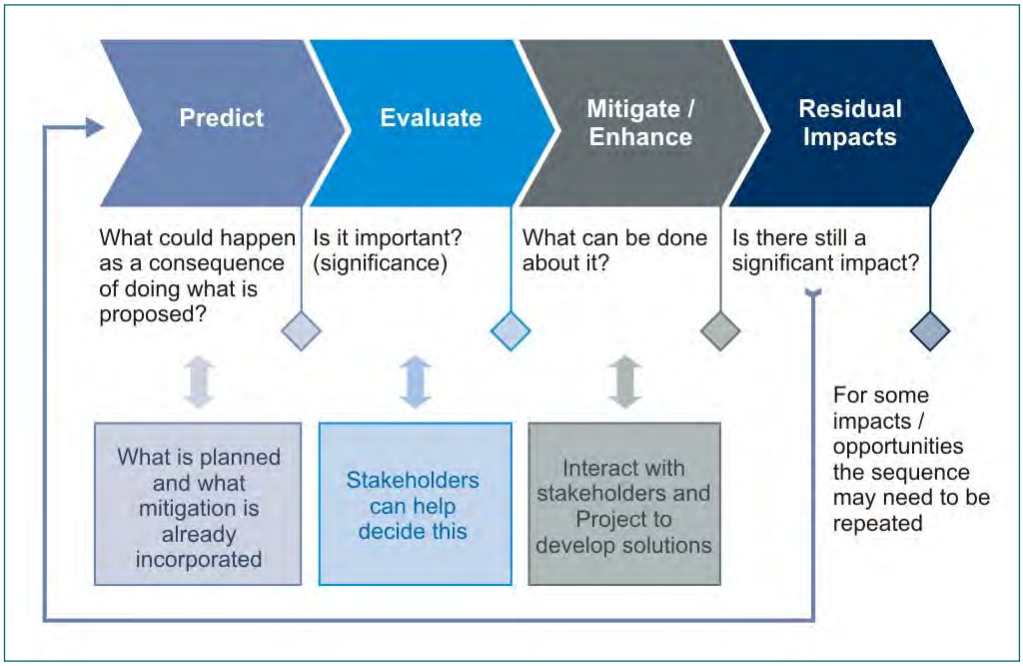
The baseline environment characterization is reported in *Sections 5-6* of this EIA Report.

1.2.5 Impact Assessment

Impact identification and assessment starts with scoping and continues through the remainder of the IA Process. The principal IA steps are summarized in *Figure B2* and comprise:

- Impact prediction: to determine what could potentially happen to resources/receptors as a consequence of the Project and its associated activities.
- Impact evaluation: to evaluate the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resource/receptor.
- Mitigation and enhancement: to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts.
- Residual impact evaluation: to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.

Figure B2 Impact Assessment Workflow



Prediction of Impacts

Prediction of impacts is essentially an objective exercise to determine what could potentially happen to the environment as a consequence of the Project

and its associated activities. This is essentially a repeat of the process undertaken in scoping, whereby the potential interactions between the Project and the baseline environment are identified. In the impact assessment stage, these potential interactions are updated based on additional Project and baseline information. From these potential interactions, the potential impacts to the various resources/receptors are identified, and are elaborated to the extent possible. The diverse range of potential impacts considered in the IA process typically results in a wide range of prediction methods being used including quantitative, semi-quantitative and qualitative techniques.

Evaluation of Impacts

Once the prediction of impacts is complete, each impact is described in terms of its various relevant characteristics (e.g., type, scale, duration, frequency, extent). The terminology used to describe impact characteristics is shown in *Table B1.*

Table B1 Impact Characteristic Terminology

Characteristic	Definition	Designations
Type	A descriptor indicating the relationship of the impact to the Project (in terms of cause and effect).	Direct Indirect Induced
Extent	The "reach" of the impact (e.g., confined to a small area around the Project Footprint, projected for several kilometres, etc).	Local Regional International
Duration	The time period over which a resource / receptor is affected.	Temporary Short-term Long-term Permanent
Scale	The size of the impact (e.g., the size of the area damaged or impacted, the fraction of a resource that is lost or affected, etc)	[no fixed designations; intended to be a numerical value]
Frequency	A measure of the constancy or periodicity of the impact.	[no fixed designations; intended to be a numerical value]

The definitions for the *type* designations are shown in *Table B2*. Definitions for the other designations are resource/receptor-specific, and are discussed in the resource/receptor-specific sections.

Table B2 Impact Type Definitions

Designations (Type)	Definition
Direct	Impacts that result from a direct interaction between the Project and a resource/receptor (e.g., between occupation of a plot of land and the habitats which are affected).
Indirect	Impacts that follow on from the direct interactions between the Project and its environment as a result of subsequent interactions within the environment (e.g., viability of a species population resulting from loss of part of a habitat as a result of the Project occupying a plot of land).

Induced	Impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project (e.g., influx of camp followers resulting from the importation of a large Project workforce).

The above characteristics and definitions apply to planned and unplanned events. An additional characteristic that pertains only to unplanned events is *likelihood*. The *likelihood* of an unplanned event occurring is designated using a qualitative scale, as described in *Table B3*.

Table B3 Definitions for Likelihood Designations

Likelihood	Definition
Unlikely	The event is unlikely but may occur at some time during normal operating conditions.
Possible	The event is likely to occur at some time during normal operating conditions.
Likely	The event will occur during normal operating conditions (i.e., it is essentially inevitable).

Once an impact's characteristics are defined, the next step in the impact assessment phase is to assign each impact a 'magnitude'. Magnitude is a function of some combination (depending on the resource/receptor in question) of the following impact characteristics:

- Extent
- Duration
- Scale
- Frequency

Additionally, for unplanned events only, magnitude incorporates the 'likelihood' factor discussed above.

Magnitude essentially describes the intensity of the change that is predicted to occur in the resource/receptor as a result of the impact. As discussed above, the magnitude designations themselves are universally consistent, but the definitions for these designations vary on a resource/receptor-by-resource/receptor basis, as further discussed in each of the resource/receptor-specific sections. The universal magnitude designations are:

- Positive
- Negligible
- Small
- Medium
- Large

In the case of a *positive* impact, no magnitude designation (aside from 'positive') is assigned. It is considered sufficient for the purpose of the IA to indicate that the Project is expected to result in a *positive* impact, without characterising the exact degree of positive change likely to occur.

In the case of impacts resulting from unplanned events, the same resource/receptor-specific approach to concluding a magnitude designation is utilised,

but the 'likelihood' factor is considered, together with the other impact characteristics, when assigning a magnitude designation.

In addition to characterising the magnitude of impact, the other principal impact evaluation step is definition of the sensitivity / vulnerability / importance of the impacted resource/receptor. There are a range of factors to be taken into account when defining the sensitivity / vulnerability / importance of the resource/receptor, which may be physical, biological, cultural or human. Other factors may also be considered when characterising sensitivity/vulnerability/importance, such as legal protection, government policy, stakeholder views and economic value.

As in the case of magnitude, the sensitivity/vulnerability/importance designations themselves are universally consistent, but the definitions for these designations vary on a resource/receptor basis. The universal sensitivity/vulnerability/importance designations are:

- Low
- Medium
- High

Once magnitude of impact and sensitivity/vulnerability/importance of resource/receptor have been characterised, the significance can be assigned for each impact. Impact significance is designated using the matrix shown in *Figure B3.*

Figure B3 ***Impact Significances***

		Sensitivity/Vulnerability/Importance of Resource/Receptor		
		Low	**Medium**	**High**
Magnitude of Impact	**Negligible**	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Critical

The matrix applies universally to all resources/receptors, and all impacts to these resources/receptors, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity/vulnerability/ importance designations that enter into the matrix.

Box B1 provides a context for what the various impact significance ratings signify.

It is important to note that impact prediction and evaluation take into account any embedded controls (i.e., physical or procedural controls that are already planned as part of the Project design, regardless of the results of the IA Process). An example of an embedded control is a standard acoustic enclosure that is designed to be installed around a piece of major equipment. This avoids the situation where an impact is assigned a magnitude based on a hypothetical version of the Project that considers none of the embedded controls.

Identification of Mitigation and Enhancement Measures

Once the significance of an impact has been characterised, the next step is to evaluate what mitigation and enhancement measures are warranted. For the purposes of this IA, ERM has adopted the following Mitigation Hierarchy:

- **Avoid at Source; Reduce at Source**: avoiding or reducing at source through the design of the Project (e.g., avoiding by siting or re-routing activity away from sensitive areas or reducing by restricting the working area or changing the time of the activity).

- **Abate on Site**: add something to the design to abate the impact (e.g., pollution control equipment, traffic controls, perimeter screening and landscaping).

- **Abate at Receptor**: if an impact cannot be abated on-site then control measures can be implemented off-site (e.g., noise barriers to reduce noise impact at a nearby residence or fencing to prevent animals straying onto the site).

- **Repair or Remedy**: some impacts involve unavoidable damage to a resource (e.g. agricultural land and forestry due to creating access, work camps or materials storage areas) and these impacts can be addressed through repair, restoration or reinstatement measures.

- **Compensate in Kind; Compensate Through Other Means**: where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g., planting to replace damaged vegetation, financial compensation for damaged crops or providing community facilities for loss of fisheries access, recreation and amenity space).

The priority in mitigation is to first apply mitigation measures to the source of the impact (i.e., to avoid or reduce the magnitude of the impact from the associated Project activity), and then to address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (i.e., to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

Box B1 Context of Impact Significances

An impact of **negligible** significance is one where a resource/receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.

An impact of **minor** significance is one where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small (with or without mitigation) and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards.

An impact of **moderate** significance has an impact magnitude that is within applicable standards, but falls somewhere in the range from a threshold below which the impact is

minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.

An impact of **major** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of IA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

Residual Impact Evaluation

Once mitigation and enhancement measures are declared, the next step in the IA Process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional declared mitigation and enhancement measures.

Management and Monitoring

The final stage in the IA Process is definition of the management and monitoring measures that are needed to identify whether: a) impacts or their associated Project components remain in conformance with applicable standards; and b) mitigation measures are effectively addressing impacts and compensatory measures and offsets are reducing effects to the extent predicted.

An ESMP, which contains a summary of all actions which the Project Proponents have committed to executing with respect to environmental/social/health performance for the Project, is also included as part of the EIA Report. The ESMP includes mitigation measures, compensatory measures and offsets and management and monitoring activities.

Appendix C

Environmental and Social Action Plan

Myanmar/Awba (#35880) – Environmental and Social Action Plan (ESAP)

	Description of the Action Item
	Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts
1	Awba will develop and implement a Quality, Environmental and Social Management System (QEHS) in accordance with PS1 requirements – and consistent with ISO9001 and ISO14001 – commensurate with the level of risks and impacts, applying to all its existing and new operations, including the following actions: - Corporate QEHS policies applicable to all operations; - EHS Risk Assessment Studies for existing and all new operations; - Standard Operating Procedures (SOPs) and QEHS management program; - Development of a multi-year QEHS training plan; - Development of an Emergency Preparedness and Response Plan, including for transport and sale depots; - Definition of QEHS KPIs for monitoring and reporting; - Community Grievance Mechanism
	Performance Standard 2: Labor and Working Conditions
2	Awba will develop and implement a corporate Human Resource Policy and Manual of Procedures in compliance with applicable national labor laws and regulations and IFC's Performance Standard 2 requirements, including the following actions: - Corporate HR policies applicable to all operations; - HR Manual of Procedures and Staff HR Handbook; - Development of a multi-year HR awareness program; - Worker's grievance mechanism for its permanent and casual workers, as well as for construction workers, to enable anonymous complaints and tracking and analysis of systemic issues
3	Awba will develop and implement OHS management system – consistent with OHSAS 18001 – commensurate with the level of risks and impacts, applying to all its new operations, including the following actions: - Corporate OHS policy applicable to all operations; - OHS Manual of Procedures (SOPs), including ambient air quality monitoring procedure; - Development of a multi-year OHS training plan for its staff, including centers of responsibilities, budgetary allocations, and schedule of delivery; - Definition of OHS KPIs for monitoring and reporting; - External and internal OHS audits and implementation of Corrective Action Plan (CAP), if required; - Training manuals for end-customers (e.g. farmers); - Consolidated annual OHS performance reports
4	Awba will develop a management procedure to ensure contractor labor and safe working conditions (inclusive of OHS) comply with PS2 requirements. This procedure will be developed based on standards of contract work in Myanmar and approved by the relevant Department / Ministry of Labor. This procedure will identify Awba's roles and responsibilities for monitoring contractor performance and will apply to all new/existing facilities included within this investment. - Submission of the procedure and supporting OHS documentation (e.g. safety plan, procedures, work instructions);

	- Inclusion of contractual provisions for casual workers and contractors to comply with Performance Standard 2 for all facilities identified within the scope of IFC's investment
	Performance Standard 3: Resource Efficiency and Pollution Prevention
5	Awba will achieve compliance of all its plants with the applicable country legal and regulatory framework and PS3 requirements as well as WBG's generic EHS Guidelines, including establishment of point source's air emissions measurements and establishment of secondary containment for fuel storage. - Compliance report of all plants against PS3 requirements and WBG Guidelines
6	Awba will provide: - A phase-out strategy for agro-chemical product (ref. carbofuran) that falls in WHO Recommended Classification of Pesticides by Hazard Class Ia (extremely hazardous) and Ib (highly hazardous); - For Class II (moderately hazardous) pesticides, Awba will provide the appropriate controls taken in relation to the manufacture, procurement, or distribution and/or use of these chemicals; - Awba will provide a Technical Academy Program to strengthen competency-based technical development programs for its agronomists; - Awba will provide the structured Field Farmer training curriculum and Implementation Delivery Program.
	Performance Standard 4: Community Health, Safety and Security
7	Awba will develop a Safe Vehicle Policy and Training Safety Procedure for its own transport fleet, including provisions for safe agro-chemical and hazardous waste transport, and will include such requirements in transport contractual agreements, including barge third-party contractors.

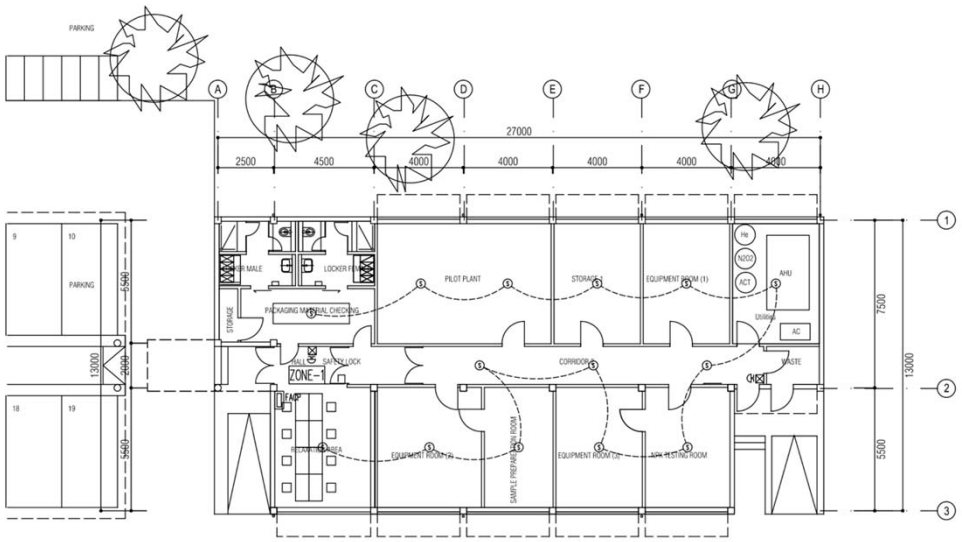
Appendix D

Information on Workplace Safety Systems

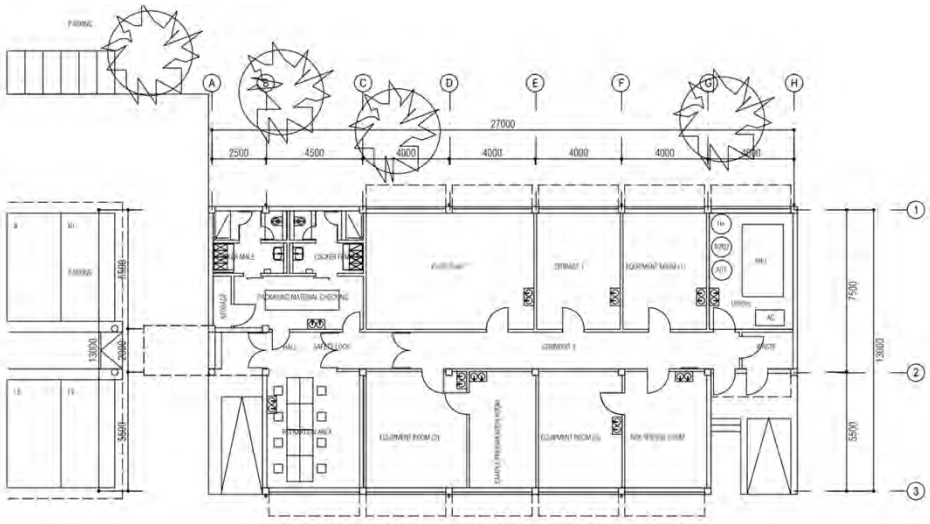
Lab Building

- One story building
- Size: 27.5x13x3.5m
- Square feet: 3,900
- Dedicate for 7~10 people
- State of the art quality testing equipment such as
  - UCFL
  - GCMS
  - Separate storage system for Flammable and Non Flammable chemical.
- Special system such as
  - Mechanical Ventilation system in every room
  - Scrubber system
  - Liquid waste drainage system (Black water drainage)
  - Dedicated solid waste storage area
- Compete with Fire Protection system (Hydrant and alarm)
- Indoor PA, CCTV system

Lab Building Fire Protection System



Fire Alarm and Hose Reel system

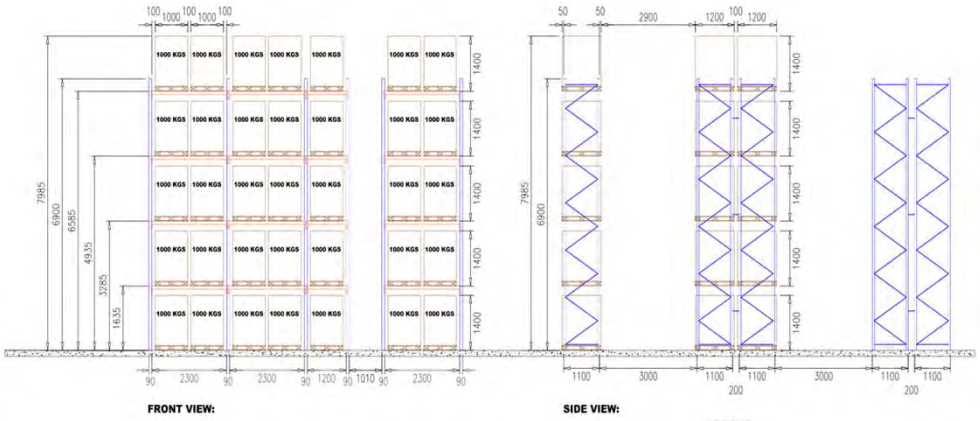


Fire Extinguisher Locations

Warehouse

- Warehouse size: 35,000 sq-ft
- Size: 54x17.5x10.5 m
- Total number of pallets: 2530 pcs
- High density warehouse system
- Good Storage Practice
  - Battery Forkflit system
  - 5 layer of racking system
  - Plastic Pellets
- Flood Prevention system
- Fire Protection system
- Lightening protection sytem
- Good ventilation with >16 air change rate

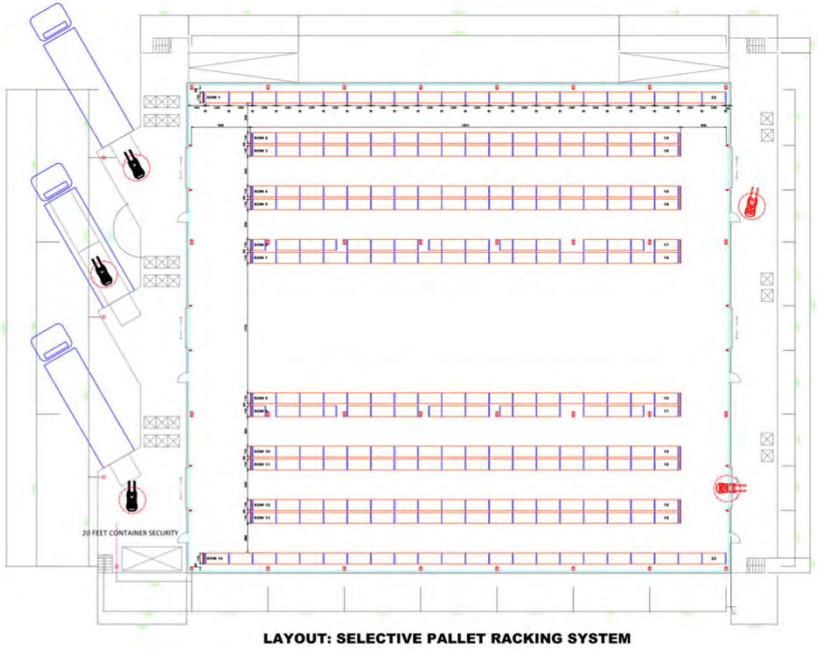
Good Storage Practice



5 pallets (High density storage)

Plastic Pallets

Battery Forklift

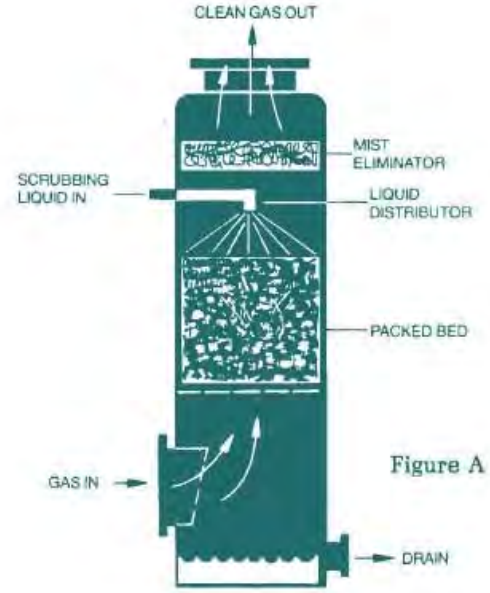


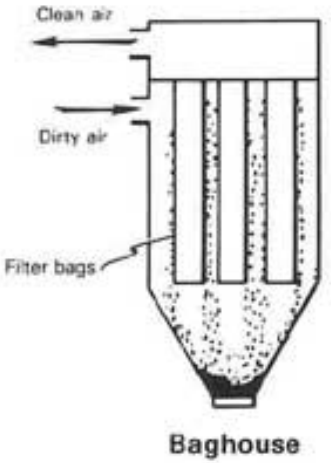
Properly designed racking and empty space

EC Building

- Building size: 14,424 sq-ft
- Formulation type: EC
- System in place
  - Fire Alarm system
  - Ex-proof formulation line
  - Processing equipment
  - Dust collector system
  - Scrubber system
- Black Water drainage system
- Natural Ventilation system with 6 air change rate

Operational Safety for Environment





Bag Dump

Scrubber

Dust Collector

SL Building

- Building size: 14,424 sq-ft
- Formulation type: SL
- System in place
  - Fire Alarm system
  - Processing equipment
  - Dust collector system
  - Scrubber system
- Black Water drainage system
- Natural Ventilation system with 6 air change rate

Operational Safety for Environment

Bag Dump

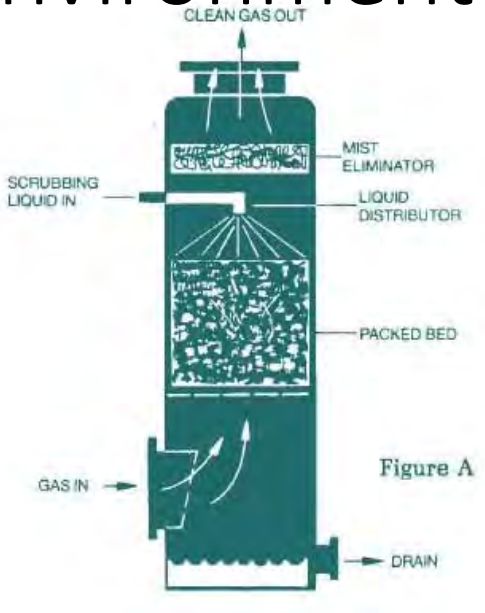


Figure A

Scrubber

WP SP Building

- Building size: 10,120sq-ft
- Size: 43.5x24x14* m
- Formulation type: WP, SP
- System in place
  - Fire Alarm system
  - Processing equipment
  - Dust collector system
  - Scrubber system
- Black Water drainage system
- Natural Ventilation system with 6 air change rate

Operational Safety for Environment

Bag Dump

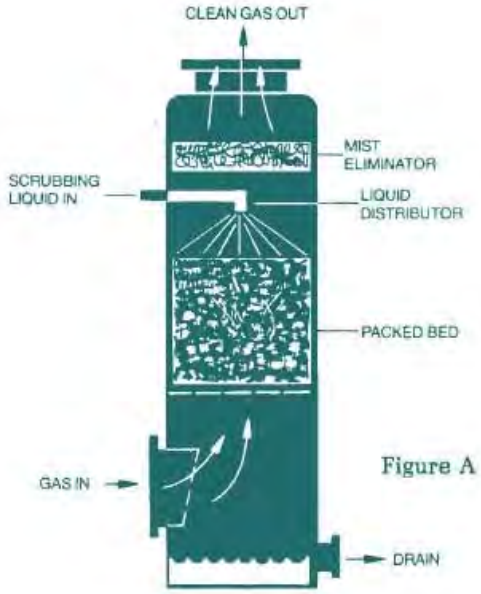
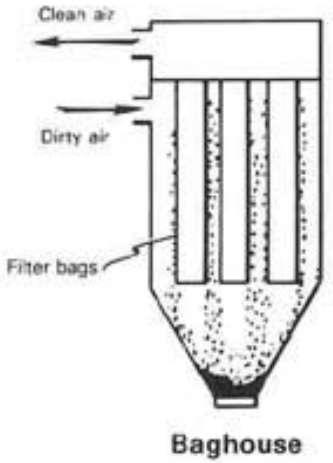


Figure A

Scrubber



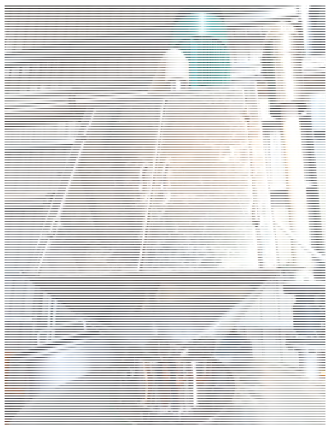
Dust Collector

SC Building

- Building size: 7,100sq-ft
- Size: 31x21x9* m
- Formulation type: SC
- System in place
  - Fire Alarm system
  - Processing equipment
  - Dust collector system
  - Scrubber system
- Black Water drainage system
- Natural Ventilation system with 6 air change rate

Operational Safety for Environment

Non Return
Isolation Valve



Bag Dump

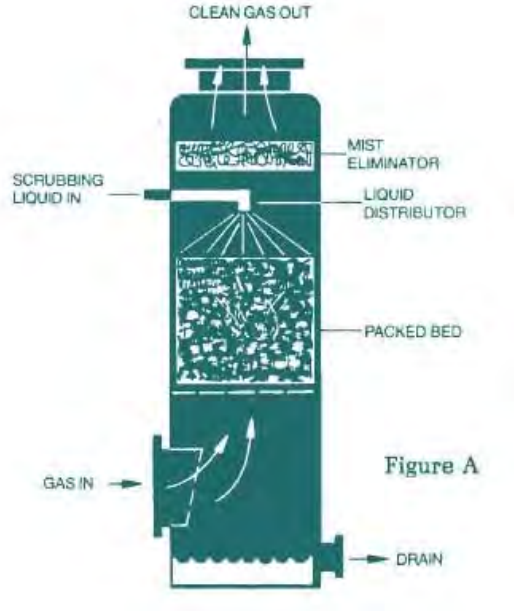
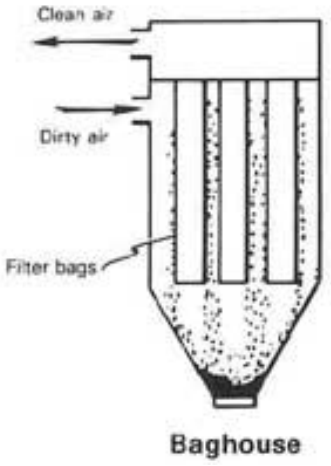


Figure A

Scrubber



Dust Collector

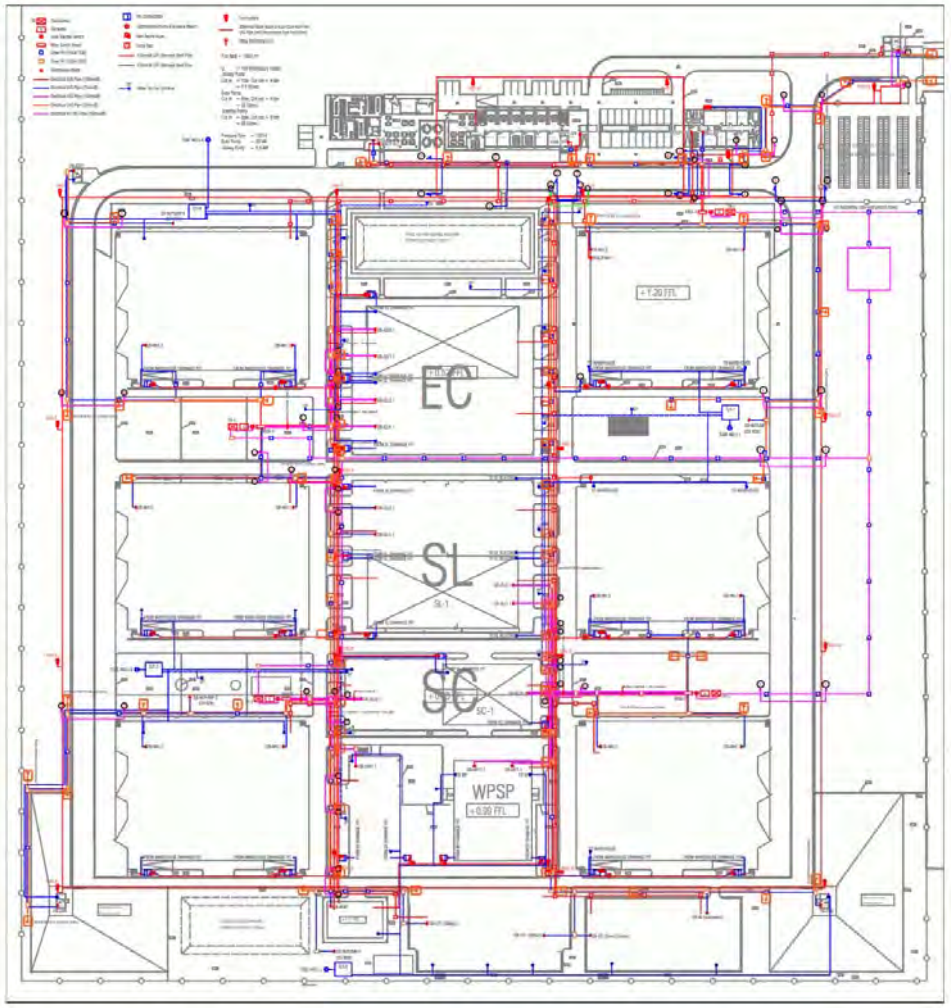
Utility Building

- Building size: 5,537sq-ft
- Size: 48x22.5x 6 m
- Functions in place
  - Compressor systems
  - Workshop
  - Restrooms
  - Spare parts store room
  - Fire alarm system in place
  - Security camera, PA, IP PBX system in place
- Natural Ventilation system with 6 air change rate

Sub Store Building

- Building size: 7,108sq-ft
- Size: 30x20x8.8 m
- Functions in place
  - Temporary storage
  - Fire alarm system in place
  - Security camera, PA, IP PBX system in place
- Natural Ventilation system with 6 air change rate

Infrastructure: All Services



TR Transformer
G Generator
Auto Transfer Switch
Main Switch Board
Draw Pit (1200x1200)
Draw Pit (1200x1800)
Distribution Board
Electrical U/G Pipe (100mmØ)
Electrical U/G Pipe (75mmØ)
Electrical U/G Pipe (150mmØ)
Electrical U/G Pipe (50mmØ)
Electrical HT U/G Pipe (150mmØ)

Pit (2500x2000)
Submersible Pump (For Black Water)
Non Return Valve
G Gully Trap
100mmØ U/G Stainless Steel Pipe
100mmØ U/G Stainless Steel Pipe

SP Water Tap For Sprinkler

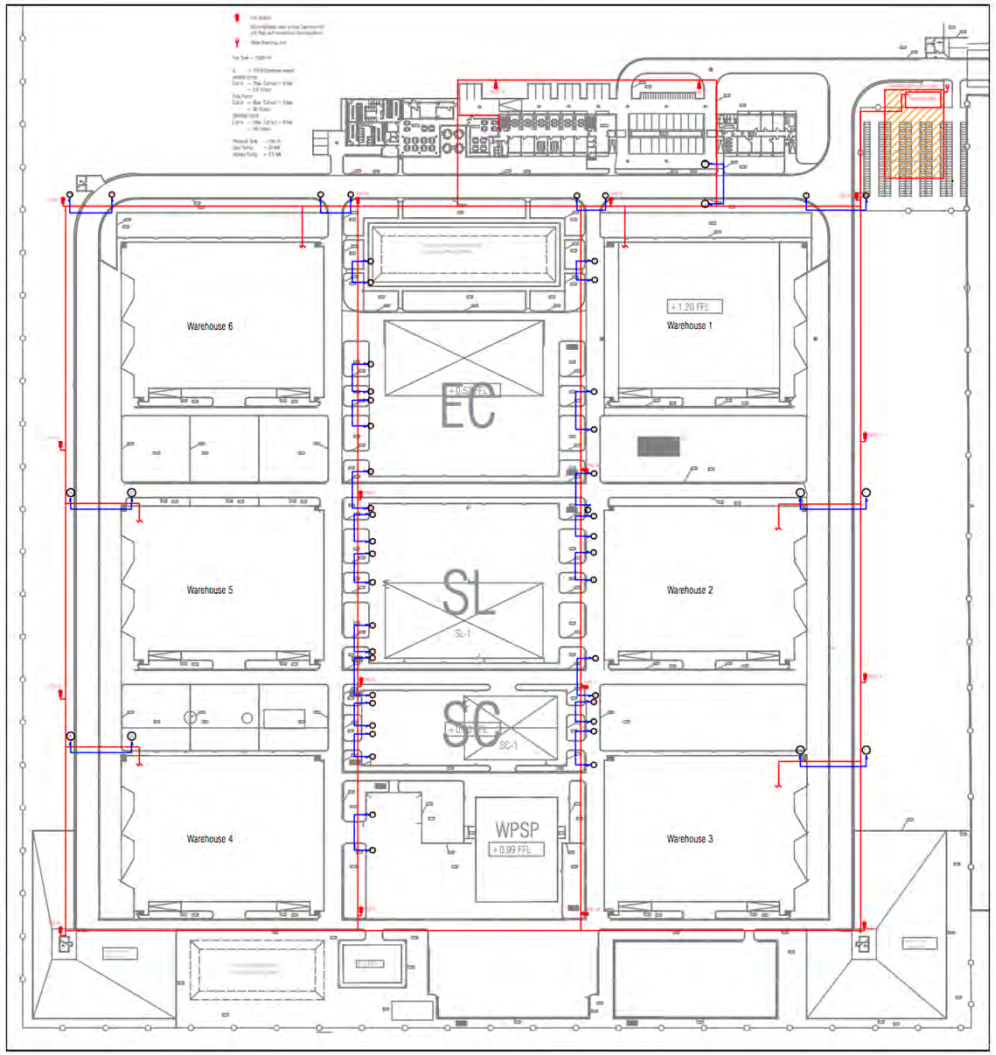
Fire Hydrant
200mmØ Black Steel or Gray Cast Iron FHD U/G Pipe (with Incorrosive Tape Insulation)
2Way Breeching Inlet

Fire Tank = 1500 m³

Q = 150 lit/pressure vessel
Jockey Pump
Cut in = 7bar, Cut out = 8 bar
= 5.6 lit/sec
Duty Pump
Cut in = 6bar, Cut out = 8 bar
= 56 lit/sec
Standby Pump
Cut in = 5bar, Cut out = 8 bar
= 56 lit/sec

Pressure Tank = 150 lit
Duty Pump = 55 kW
Jockey Pump = 5.5 kW

Infrastructure: Fire Protection System



Fire Hydrant

200mmØ Black Steel or Gray Cast Iron FHD U/G Pipe (with Incorrosive Tape Insulation)

2Way Breeching Inlet

Fire Tank = 140,000 Gal

Q = 150 lit/pressure vessel

Jockey Pump

Cut in = 7bar, Cut out = 8 bar
= 5.6 lit/sec

Duty Pump

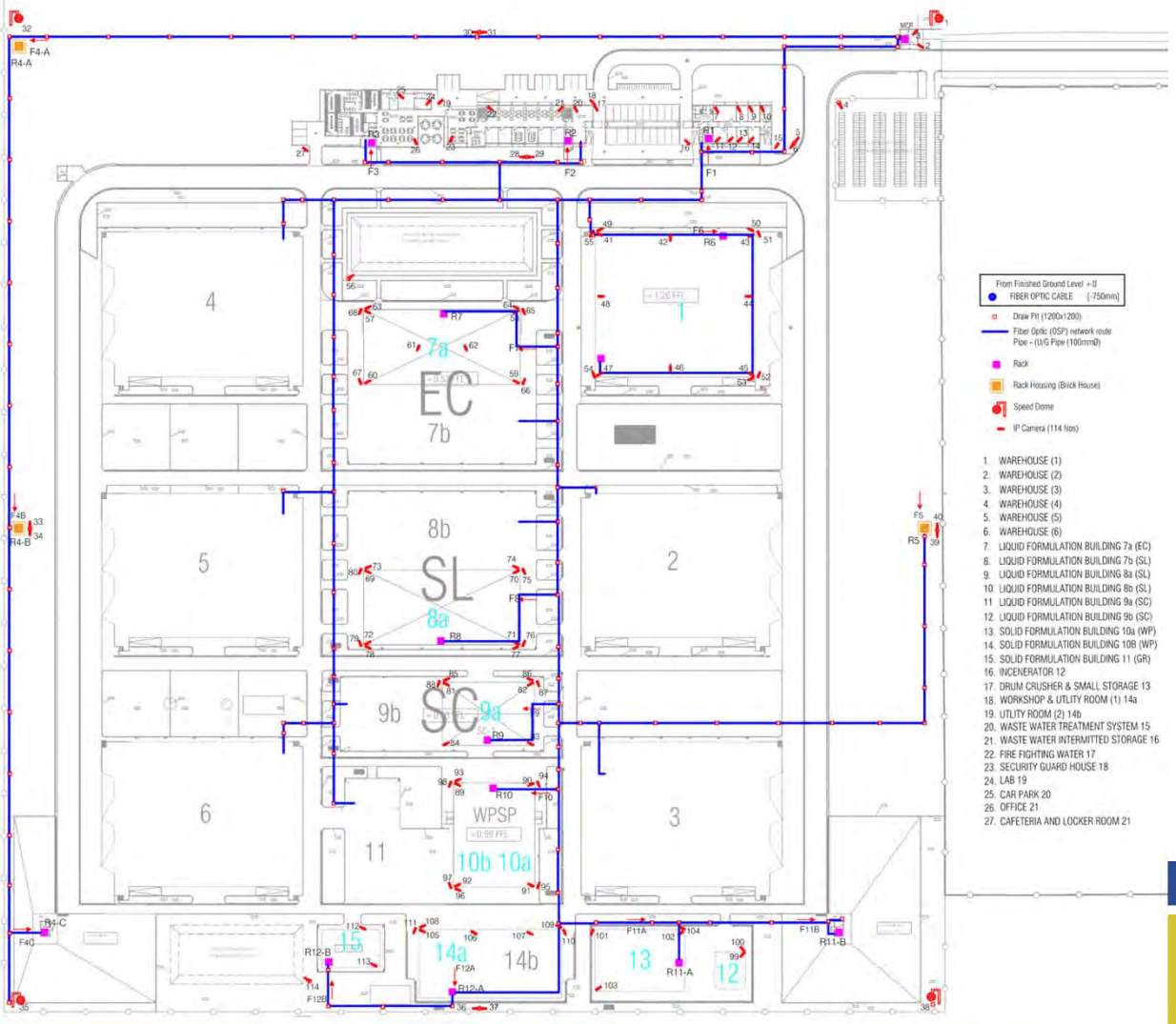
Cut in = 6bar, Cut out = 8 bar
= 56 lit/sec

Standby Pump

Cut in = 5bar, Cut out = 8 bar
= 56 lit/sec

Pressure Tank = 150 lit
Duty Pump = 55 kW
Jockey Pump = 5.5 kW

Infrastructure: Security Camera System



From Finished Ground Level +0

FIBER OPTIC CABLE [-750mm]

Draw Pit (1200x1200)

Fiber Optic (OSP) network route
Pipe - (U/G Pipe (100mmØ)

Rack

Rack Housing (Brick House)

Speed Dome

IP Camera (114 Nos)

PPE

Protective Measures

Signs


No Camera
No Smoking
No Naked Flame


No Cell Phone
No Car Entry
No Smoking
Use Recycle
No Naked Flame


Wear Hat
Wear Glass
Wear Mask
Wear Gloves
No Naked Flame
No Smoking
No Food & Drink


No Smoking
No Naked Flame
Don't Touch
No Food & Drink
Wear Glass
Wear Mask
Wear Gloves
Wear Hat
Wear Boots