



# Development of New Yangon City Phase 1

SEA Report

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## Strategic Environmental Assessment (SEA) for the Development of New Yangon City Phase 1 Masterplan

**SEA Report** 

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#### **Acronyms and Abbreviations**

Name	Description
Aol	Area of Influence
AZE	Alliance for Zero Extinction
CBD	Central Business District
CHS	Community Health and Safety
CSO	Civil Society Organisations
CSR	Corporate Social Responsibility
DUHD	Department of Urban and Housing Development
DWIR	Directorate of Water Resources and Improvement of River Systems
EBA	Endemic Bird Areas
ECC	Environmental Compliance Certificate
ECD	Environmental Conservation Department
EHS	Environmental, Health, and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPAS	Electronic Perimeter Air Station
EQEG	Environmental Quality (Emissions) Guidelines
EQM	Environmental Quality Management
ERI	Earth Rights International
ERM	Environmental Resources Management
ERP	Emergency Response Plan
ESMF	Environmental and Social Management Framework
ESMS	Environmental and Social Management System
FAO	Food and Agriculture Organisation of the United Nations
FFI	Fauna and Flora International
FGD	Focus Group Discussion
GAD	General Administrative Department
GFA	Gross Floor Area
GIIP	Good International Industry Practice
GPS	Global Positioning System
НН	Household
H&S	Health and Safety
IBA	Important Bird Area
ICJ	International Commission of Jurists
ICT	Information and Communications Technology
IEE	Initial Environmental Examination
IFC	International Finance Corporation
iNGO	International Non-Governmental Organizations

Name	Description
IPP	Independent Power Producer
IUCN	International Union for Conservation of Nature
JICA	Japan International Cooperation Agency
KBA	Key Biodiversity Area
kph	Kilometres per hour
KPIs	Key Performance Indicators
kV	Kilovolt
MATA	Myanmar Alliance for Transparency and Accountability
MCRB	Myanmar Centre for Responsible Business
MERN	Myanmar Environmental Rehabilitation-conservation Network
MGN	Myanmar Green Network
MIC	Myanmar Investment Commission
MNBC	Myanmar National Building Code
MOALI	Ministry of Agriculture, Livestock, and Irrigation
MOC	Ministry of Construction
MOEE	Ministry of Electricity and Energy
MOI	Ministry of Industry
MONREC	Ministry of Natural Resources and Environmental Conservation
MOPF	Ministry of Planning, Finance and Industry
МОТС	Ministry of Transport and Communications
MP	Management Plan
MPA	Myanmar Port Authority
MRT	Mass Rapid Transit
MSDP	Myanmar Sustainable Development Plan
NGOs	Non-Governmental Organisations
NUP	National Urban Policy
NYDC	New Yangon Development Company Ltd.
OHS	Occupational Health and Safety
PAP	Project Affected Peoples
PIC	Planning Implementation Committee
PM	Particulate Matter
PME	Powered Mechanical Equipment
PPE	Personal Protective Equipment
REM	Resource and Environment Myanmar
ROW	Right of Way
RS	Richter Scale
SDGs	Sustainable Development Goals
SEA	Strategic Environmental Assessment
	·

Name	Description
SEP	Stakeholder Engagement Plan
SEZ	Special Economic Zone
SFRA	Strategic Flood Risk Assessment
Sq.km	Square kilometre
sqm	Square metre
SUDP	Strategic Urban Development Plan
TDM	Transportation Demand Management
ToR	Terms of Reference
TSP	TOTAL Suspended Particles
TTS	Traffic and Transport Study
UKAS	United Kingdom Accreditation Service
UK DEFRA	United Kingdom Department for the Environment, Food and Rural Affairs
UNESCO	United Nations Educational, Scientific and Cultural Organization
UN Habitat	United Nations Habitat
UPD	Urban Planning Division
URDP	Urban and Regional Development Planning
US EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WCS	Wildlife Conservation Society
WWF	World Wildlife Fund
WHO	World Health Organization
WRTC	Water, Research, and Training Centre
YCDC	Yangon City Development Committee
YRG	Yangon Region Government

## 1. EXECUTIVE SUMMARY

In 2013, the Yangon City Development Committee (YCDC) working alongside the Japanese International Cooperation Agency (JICA) developed the 2040 Strategic Urban Development Plan for Yangon Region and proposed the locations for new developments and infrastructure. The location selected for the New Yangon City (the Project) is one of the 2040 JICA allocations, and the Yangon Regional Government chose the current Project Area according to that plan.

In 2018, the New Yangon Development Company (NYDC) (the Project proponent) commissioned AECOM to conduct Master Planning for the Project. This process selected locations of the various facilities within the New Yangon City. This Strategic Environmental Assessment (SEA) Report was voluntarily commissioned to ERM Myanmar Company Limited in order to review the New Yangon City Phase 1 Master Plan and various other studies including the traffic and transport study, the socio-economic master plan, and the flood risk assessment for the New Yangon City.

This SEA Report is an overarching document to inform sustainable development of the New Yangon City Phase 1 project components. The main objective of this SEA is to propose an environmental and social management framework (ESMF) that will be used to manage potential environmental and social impacts arising from the development of all future Phase 1 projects. For this SEA, the ESMF has been produced to align with the Myanmar Sustainable Development Plan (MSDP) and the United Nations Sustainable Development Goals (UNSDGs). The SEA also includes proposed sustainability objectives and performance indicators for the administrator of the New Yangon City Phase 1 to assess progress made to achieve the sustainability objectives.

SEAs have been the subject of various academic research, international good practice recommendations (including by the International Finance Corporation (IFC) and Work Bank Group (WBG) and on-the-ground uses and tests. SEAs are expected to be designed for a specific purpose and as such will be tailored to fit whatever purpose is sought for, in this case designing a new city to align with the MSDP/UNSDGs. The main aspect in the SEA methodology is to cater for high-level discussions around how to organize the parts in a sustainable manner for all.

It is important to note that this SEA is not, nor should be taken as, an EIA of any future facilities within the New Yangon City. Rather, the SEA will help provide the framework for sustainable development to be considered as part of future EIAs and gives guidance on where and when to employ such. It is fully expected that, where legislation requires it, or through the individual choice of developers, separate EIAs will be prepared for each and every applicable development within the New Yangon City. This SEA thereby provides the core backbone to ensuring that New Yangon City will be both environmentally and socially acceptable development governed by the highest standards within Myanmar as they presently stand.

#### 1.1 Introduction

The **New Yangon Development Company, Ltd.** (NYDC), incorporated under the Yangon Regional Government (YRG), plans to develop the New Yangon City. The New Yangon City is located in a semi-urban to rural area in Seikgyi Kanaungto, Twantay, Hlaing Tharyar and Kyee Myin Daing Townships to the West of Yangon.

The development of the overall project is proposed to consist of Phases (Phases 1 and 2).

- The overall Phase 1 Project Area would be 88.3 sq.km. The masterplan includes residential areas of 30.93 sq.km, commercial areas of 6.41 sq.km, industrial areas of 22.37 sq.km, transport and logistics of 1.51 sq.km, green spaces of 12.01 sq.km, villages of 11.97 sq.km, civic amenities of 2.33 sq.km, and utilities (physical infrastructure) of 0.77 sq.km. Further development of the Phase 1 has been aligned with the JICA 2040 Master Plan (2018) and other Master Plans issued by Myanmar authorities.
- Phase 2 is located south of Phase 1 and will cover an area approximately 600 km<sup>2</sup> and is not covered under either the Master Plan or this SEA.

Phase 1 is being developed by NYDC with the support of different consultants (Phase 1 Development). Such consultants have undertaken a socio-economic study for the target economic and industrial sectors, prepared the strategic plan for the area, assessed strategic flood risk, proposed transportation planning and assessed the management of potential environmental and social impacts associated with the development of Phase 1 through a Strategic Environmental Assessment (SEA) and five Environmental Impact Assessments (EIAs) and one Initial Environmental Examination (IEE), each dedicated to various Project components.

The scope of this SEA includes the following key aspects:

- Designing and undertaking a Stakeholder Engagement Plan common to the SEA and the IEEs/EIAs of the main project components of the New Yangon City Phase 1;
- Developing sustainable development goals for the New Yangon City Phase 1 in reference to the Myanmar Sustainable Development Plan (MSDP) (2018-2030) and the United Nations Sustainable Development Goals (UNSDGs). These are proposed as the 'SEA Framework Objectives';
- Developing impact assessment criteria to be used as key metrics in evaluating the proposed New Yangon City as it develops further. These are proposed as the 'SEA Framework Performance Indicators'; and
- Designing an Environmental and Social Management Framework (ESMF) to guide environmental and social management practices to be employed by the various developers and operators of sub-projects within the New Yangon City; such implementation is expected to support the protection of the environment and of the people potentially impacted by the Phase 1 development, and is thus expected to contribute to the SEA Framework Objectives.

The development of the SEA has also included:

- A scoping exercise, that included desk-based studies, field visits, primary data collection, and consultation and engagement activities,
- Regular and documented engagement activities with key parties on the contents of the proposed SEA deliverables (i.e. scoping report, presentations, report),
- The inclusion of the environmental and social baseline description of the Project Area based on an up-to-date description of the technical Master Plan and of the environmental and social conditions of the Project,
- A high-level assessment of potential environmental and social impacts that may be triggered by the development of the New Yangon City, and
- An overview of the relevant administrative framework.

This SEA Report documents the SEA process is undertaken for the Phase 1 Development and provides the proposed guidance for the six IEEs/EIAs' respective scopes of work and for any future IEEs/EIAs required under further development of the Phase 1. This guidance takes the form of:

- A proposed ESMF to manage potential environmental and social arising from the development of the Phase 1 targeted at both individual sub-project developers/ operators as well as the Administrator<sup>1</sup> of the New Yangon City Phase 1;
- Proposed Sustainability Objectives for the Administrator of the New Yangon City Phase 1 to drive the development of the New Yangon City Phase 1 (SEA Framework Objectives); and

<sup>&</sup>lt;sup>1</sup> The development of the New Yangon City Phase 1 is managed by an Administrator which is, currently, NYDC. NYDC is 100% Yangon Regional Government owned. The objective of NYDC is to create economic growth, homes and jobs. The development of New Yangon City will be primarily based on Public-Private Partnership Models with the private sector playing a major role with equity investments. NYDC (or any other administrative body as decided by the government) will remain under the leadership of Yangon Regional Government and will therefore perform an administration role for the government.

Proposed Sustainability Performance Indicators to be monitored and communicated on by the Administrator of the New Yangon City Phase 1 to assess progress made to achieve the sustainability objectives set for the New Yangon City Phase 1.

The purpose of the SEA process and Report is to inform the sustainable development of the Master Plan's various project components. The ESMF aims to guide the various sub-projects' developers/ operators in integrating environmental and social considerations when implementing their individual projects. The ESMF and the SEA Framework Objectives and Indicators proposed in this SEA aim to guide the Administrator of the Phase 1 Development in monitoring and reporting on the various activities being implemented in the New Yangon City Phase 1 at any one time.

This SEA Report sets out:

- The context and description of the Phase 1 Development;
- An overview of the administrative framework relevant to the proposed Phase 1 Development and its SEA;
- A description of the Phase 1 Development;
- A description of the Phase 1 Development's surrounding environment, incorporating environmental and social aspects;
- A high-level environmental and social impact assessment of the development of the Phase 1, including cumulative impacts;
- An Environmental and Social Management Framework (ESMF) to inform project developers/ operators on the environmental and social expectations of the New Yangon City, including the anticipated governance to manage the sub-projects to be implemented in the Project Area;
- A brief on the Stakeholder Engagement process to date and how it has been undertaken for both this SEA and the individual IEEs/EIAs covering different Phase 1 activities; and
- A presentation of proposed assessment benchmarks for sustainable development objectives of the Master Plan (SEA Framework Objectives) and impact assessment indicators (SEA Framework Indicators) of the activities pertaining to the development of the Phase 1.

#### 1.2 Policy and Regulatory Framework

The main individual components of the Phase 1 Development are subject to individual IEEs/EIAs, in accordance with the EIA Procedure (2015) and good international practices. A Stakeholder Engagement Plan (SEP) is undertaken in parallel to this SEA, which is common to all Phase 1 Stage 1 individual IEEs/EIAs and the SEA.

There is no regulation covering SEA in Myanmar, however, some SEAs have recently been conducted with the support of MONREC, as recommended by good international practices and relevant academic and professional research. Examples of SEAs conducted in Myanmar include an SEA undertaken to inform the energy policy covering the development of hydropower generation in the country<sup>2</sup> as well as an SEA to inform the development programme of the Thilawa Special Economic Zone (SEZ).

In the absence of specific SEA regulatory framework in Myanmar, the regulatory requirements applicable to EIA in Myanmar and international regulations, conventions, and guidelines relevant to the Phase 1 Development's projects are proposed to be used to guide this SEA.

Ultimately, the SEA has been prepared to provide a high-level assessment of the environmental and social risks and impacts from the Phase 1 Development, and the recommended mitigation measures

<sup>&</sup>lt;sup>2</sup> SEA of the hydropower sector in Myanmar – resource page accessed from the IFC website at

https://www.ifc.org/wps/wcm/connect/industry\_ext\_content/ifc\_external\_corporate\_site/hydro+advisory/resources/sea+of+the+h ydropower+sector+in+myanmar+resources+page

and indicators of sustainable development goals to integrate into the considerations for the New Yangon City components.

#### **1.3 Project Description**

The development of the New Yangon City Phase 1 is part of a wider planned development of an area allocated to the west of Yangon City, as illustrated in Figure 1.1 and Figure 1.2.

The development of the New Yangon City Phase 1 is captured under a Master Plan development by AECOM on behalf of NYDC and with the support of other specialist consultants.



Source: NYDC, 2018

Figure 1.1 Phases 1 and 2 of New Yangon City





DEVELOPMENT OF NEW YANGON CITY PHASE 1 SEA Report

## 1.3.1 Project Components

Figure 1.3 shows the various main components of the Phase 1 Development, including existing villages, planned resettlement areas, existing main roads, planned new and expanded main roads, planned new green areas and water grid, and planned new infrastructure projects.



Figure 1.3 Master Plan for New Yangon City Phase 1

The Project Area is planned to be 88.3 sq.km, consisting of residential areas of 30.93 sq.km, commercial areas of 6.41 sq.km, industrial areas of 22.37 sq.km, transport and logistics of 1.51 sq.km, green spaces of 12.01 sq.km, villages of 11.97 sq.km, civic amenities of 2.33 sq.km, and utilities (physical infrastructure) of 0.77 sq.km. The Project Area will consist of:

- Existing villages to be retained;
- Five new resettlement areas, with residential, commercial, office buildings, and supporting public and social infrastructure (administrative, schools, sports, healthcare, etc.), etc.;
- New green urban areas;
- New / rechannelled surface water reserves (ponds, creaks, etc.);
- Underlying transport (railways, tramways, footpaths, cycle paths, etc.) and connectivity infrastructure (inter-modal hubs, telecommunications network, etc.);
- Administrative areas (including fire stations, police stations and government administrative quarter); and
- Connectivity to outside existing utility systems and infrastructure, and to goods, services and people.

The Phase 1 Development is also composed of various Project main components that are being progressed as dedicated IEEs/EIAs:

Bridges:

- Bridge 1: connecting Kyee Myin Daing Township (near Bagaya Road and Kyee Myin Daing Kanner Junction) to the Project Area, and;

- Bridge 2: connecting Hlaing Tharyar Township to the Project Area;
- Roads:

- Permanent Auxiliary Support Infrastructure: Road 1, Road 2, Road 3, Sub-arterial roads, Collector roads, and

- Stormwater network;
- Water:
  - Water treatment plant;
  - Raw water pipeline;
  - Treated water distribution lines; and
  - Water intake point;
- Wastewater:
  - Wastewater pumping stations;
  - Wastewater pipe network;
  - Sewage water tanks; and
  - Wastewater treatment plant and its associated subsidiary facilities;
- Power:
  - Transformer substation (one 230 kV, two 66 kV) and switching station (one 33 kV);
  - Main Transmission lines (from National Grid / Independent Power Producer (IPP) to 230 kV substation); and
  - Distribution lines (internal transmission lines) including 66 kV, 33 kV and 11 kV lines;

- Industrial Zone:
  - Area for industrial facilities covering approximately 13 sq.km.

Any other future development may require to be assessed under an IEE or EIA in accordance with Myanmar's EIA Procedure (2015). As part of these future assessments, the principles and objectives laid out in the SEA ESMF are expected to be considered.

#### 1.3.2 Land Acquisition

The land acquisition process for the Phase 1 Development is being managed by the Yangon Regional Government (YRG). The land acquisition process will trigger both economic displacement (from farmers and other land users) and physical displacement of a limited number of households and businesses (specifically for Phase 1 Stage 1, only in the area required for Bridge 1 in Kyee Myin Daing Township).

The policy currently adopted by the government mandates returning 20% of original land holding as net serviced and developable land. "Resettlement Areas" will be identified in New Yangon City and will be sub-divided based on plot ownership. The net plot requirement will be grossed up to include additional land required for a functioning township such as roads, community facilities / small scale commercial and green area. NYDC will assist YRG in this process. More information on resettlement is provided in **Appendix B**.

#### **1.4 Description of the Environment**

The information on the environment is based on primary data collected for the Project in February and March 2019 as well as a review of published information provided by NYDC and from ERM's in-house library.

The purpose of reviewing the baseline conditions is to present an understanding of the potential environmental and social sensitivities of the Study Area, which is defined as a 2 km buffer around the whole New Yangon City Phase 1 Development. The full baseline section is included in **Appendix C** and a summary is provided below.

#### 1.4.1 Setting the Study Limits

The **Project Area** is defined as the Phase 1 Master Plan, located in a semi-urban to rural area in Seikgyi Kanaungto, Twantay, Hlaing Tharyar and Kyee Myin Daing Townships to the West of Yangon.

The **Study Area** is defined as the wider area in which the environmental and social conditions are evaluated with the sources of impact, in order to determine interactions and the magnitude and significance of potential impacts resulting from the Project.

For this Project, the **Study Area** is defined as a 2 km buffer around the whole New Yangon City Phase 1 Development. **Area of Influence** (AOI) is defined as the village tracts, wards and townships within or neighbouring the Project Area.

#### 1.4.2 Physical and Environmental Baseline

The primary baseline survey was designed to cover the whole of the Phase 1 Development and includes surveys for air, noise, soil, ground water, surface water, as well as terrestrial and aquatic biodiversity. The details on survey locations and environmental survey results are provided in **Appendix D**.

#### 1.4.2.1 Climate

The weather and climate of Myanmar are primarily influenced by the northeast and the southwest monsoons, and the short transitional periods between them. The southwest monsoon (June to September) is characterised by extensive cloud cover, light rain almost daily, interspersed with

rainsqualls or thunderstorms. The northeast monsoon (December to April) brings less cloud, scant rainfall, mild temperatures and lower humidity during winter (Suwannathatsa, et al, 2012).

Yangon, as with Myanmar in general, has less rainfall in summer. The average maximum temperature is 29°C while the average annual rainfall is 2,378 mm. The driest month is January, with 3 mm of rainfall and June is the wettest month with an average of 516 mm. The warmest month is April, with an average temperature of 30°C. January has the lowest average temperature of the year; 25 °C. During the year, the average temperatures vary by 5.5 °C (Climate Data Website, 2018).

## 1.4.2.2 Ambient Air Quality

 $NO_2$  and  $SO_2$  were sampled in 27 locations, and  $PM_{2.5}$  and  $PM_{10}$  were sampled in 18 locations in the Study Area at sensitive receptors, such as households. For ambient air quality, none of the values for  $NO_2$  exceeded the World Health Organisation (WHO) guidelines for human health.  $SO_2$  exceeded the WHO guideline for agriculture in one location, a monastery near Lay Eain Village, Twantay Township. The rest of the locations are within the standards of WHO/EU Annual Mean Air Quality Critical Level (Agriculture). For  $PM_{2.5}$  and  $PM_{10}$ , the data were compared to the WHO standards for Human Health. There were exceedances of both  $PM_{2.5}$  and  $PM_{10}$  in all of the Townships surveyed except six out of the 18 locations. The results show that there are increased particulates in the air, which is most likely caused by climatic conditions at the time of the survey (the end of the dry season usually means increases in dust). Many of the surveyed locations were at houses close to a main road where vehicle use can also cause elevation of dust on the dry roads.

#### 1.4.2.3 Ambient Noise

Noise levels were sampled in 27 locations in the Study Area at sensitive receptors, such as households. The survey indicated that ambient noise levels at many locations exceeded the IFC noise level guidelines (for residents). Ten out of 27 locations for day time and 15 out of 27 locations for night time exceeded the standard value by over 5db, whilst, only five out of 27 locations during day time did not exceed the standard. Based on these results, half of the surveyed area is over the acceptable noise level. It is likely that this noise was generated from private generators, loudspeakers, automatic farm machinery, and activities from vehicles or motorbikes and residential houses.

### 1.4.2.4 Soil Quality

Out of 24 sampling locations, one location (Seik Kan Thar Park, in between Kyee Myin Daing Strand Road and Yangon River, in Kyee Myin Daing Township) exceeded the Food and Agriculture Organization of the United Nations (FAO) Soil Bulletin 65 and the Dutch Standard, for Sulphide only.

#### 1.4.2.5 Water Resources

Groundwater quality was sampled at 24 locations in the Study Area (i.e., wells in local villages). The results analysis were compared to the WHO Drinking Water Standards and Myanmar National Drinking Water Quality Standards (DWQS).

The groundwater samples met the WHO Drinking Water Standards, except for five locations for which the pH values were outside the recommended range (i.e., Obo ward, Kyee Myin Daing Township, Ah Lat Chaung village, Kyee Mying Daing Township, Kone village, Twantay Township, Wa Yon Seik village, Twantay Township, and Kan Gon village, Twantay Township) and one occurrence where arsenic level exceeds both WHO and National (DWQS) at Ka Lauk Ka Lu village, Twantay Township.

The majority of the sampling points exceeded the National DWQS for ammonia (as N) and chloride, while more than half of the sampling points exceed the standard for sulphide (as S2). Despite the exceedances, ammonia (as N) and chloride are not of health concern for drinking water (WHO, 2017). The elevated levels of sulphide (as S2) only slightly exceeded the standards.

Surface water was sampled in 24 locations in rivers, creeks, streams and ponds within the Study Area. The results analysis were compared to the WHO Drinking Water and Myanmar National Drinking Water Quality Standards (DWQS).

None of the surface water sampling points exceeded the WHO standard; however, most of the sampling points exceed the National DWQS's chloride levels. Despite the exceedances, chloride is not of health concern for drinking water (WHO, 2017).

#### 1.4.2.6 Natural Hazards

Myanmar is exposed to multiple natural hazards including cyclones, earthquakes, and flooding. These are discussed in the following sub-sections.

#### Storms and Cyclones

Gale force winds (17.2 ms<sup>-1</sup> or over) are mainly associated with local rainsqualls and with severe tropical storms or cyclones. The central region receives the worst buffeting during the summer monsoon. The threat of cyclones with winds above 32.7 ms<sup>-1</sup> affects different areas at different times of the year affecting all areas, though the major tracks do not pass over the Andaman Sea (OCHA, 2011). Cyclones are most frequent from mid-May to early December.

#### Flooding

Areas within the New Yangon City are prone to flooding due to the low elevation relative to its surroundings. Pluvial flood can occur due to runoff to low lying areas with limited drainage capacity. Fluvial flooding can occur when the surroundings are lower than the water in the surrounding rivers or canals (Royal Haskoning DHV, 2019).

The average tidal range of the Yangon River is about 6 m at spring tide and 3 m at neap tide. Modelling of the discharge of Yangon River indicates discharges ranging from <500 m<sup>3</sup>/s in April to approximately 7,000 m<sup>3</sup>/s in August, with tidal water level variations of around 1 to 6 m based on water level measurements at Monkey Point located downstream of the Study Area (De Koning and Janssen, 2015). In the Ayeyarwady Delta, which includes the Yangon River, drainage, salt intrusion, and flood protection are key concerns (EO Earth Website, 2016).

Two main forces dominate the Yangon River system that can result in fluvial floods (Royal Haskoning DHV, 2019):

- Increased water levels from the sea: there is a strong tide from the Gulf of Martaban. The spring tide range is approximately 5.4 m in the Hlaing River, and the neap tide range is approximately 2 m. In addition, storm surges can increase offshore water levels.
- Increased discharges during the monsoon period: the Irrawaddy River feeds the Yangon River with rainfall from the Irrawaddy River Basin and water levels increase by approximately 0.7 m during the monsoon period.

As part of the Phase 1 Development, NYDC initiated a Strategic Flood Risk Assessment (SFRA) to ensure that the proposed development takes account of flood risk. Royal Haskoning DHV was selected as the consultant to provide professional services to contribute to the development of New Yangon City's flood risk assessment services for Phase 1. The following are some of the main conclusions from the Strategic Flood Risk Assessment.

- The New Yangon City is prone to flooding due to the following three flood sources: tide and storm surge (coastal), river discharge (fluvial), and rainfall (pluvial). Among the three flood sources, coastal floods (in terms of days) are usually shorter in duration than fluvial floods (in terms of weeks).
- The flood risk profile for New Yangon City shows that the existing flood risk without flood protection is fairly high. Sea level rise will strongly impact the flood risk profile of New Yangon

City in terms of economic risk as well as loss of life. Implementation of flood risk reduction measures is recommended (Royal Haskoning DHV, 2019).

#### Seismic Activity

A review of available literature has shown that Myanmar is seismologically unstable and vulnerable to earthquakes due to its location in the active Alpide seism tectonic belt and the young Alpine Himalayan-Sumatran orogenic belt (Willige et al., 2009). Historic records show that at least 15 major earthquakes with magnitudes M≥7.0 Richter scale (RS) have occurred in Myanmar in the last hundred years. These earthquakes occurred within Myanmar in the last century, in Yangon Region, these include on 27 March, 16 May, and 21 May 1931 and in 1970.

#### 1.4.3 Biodiversity Baseline

Field surveys were conducted by local specialists during February and March 2019. The field surveys include fauna, and habitat mapping and flora, covering the whole of the Phase 1 Development area. The details on Integrated Biodiversity Assessment Tool (IBAT) are provided in **Appendix E**.

#### 1.4.3.1 Fauna

The survey covered a range of fauna species, including mammals, birds, fish, reptiles and amphibians, butterflies, and dragonflies. The fauna survey was conducted via direct observation in the field, observation of tracks and signs such as footprints and feeding signs in their natural habitats, and interview surveys with local communities.

The four mammal species recorded were all classified as Least Concern on the International Union for Conservation of Nature (IUCN) red list.

A total of 80 bird species were recorded during the survey, with one (1) species classified as Near Threatened, 78 as Least Concern, and one (1) Not Yet Assessed on the IUCN red list. The near threatened species recorded is the Black-headed lbis.

For fish, the surveys identified three (3) Near Threatened species, 42 Least Concern species, one (1) Data Deficient species, and five (5) Not Yet Assessed on the IUCN Red List. According to FishBase (2019), a global species database of fish species, 26 out of 51 species reported are classified as migratory. Four (4) species recorded are endemic species (i.e., native and restricted to a certain place) (Living International Treasure, 2019).

For reptiles and amphibians, the surveys identified no species of conservation concern (as per IUCN Red List) and no endemic / range-restricted species, in total 10 species were reported.

During the survey, 28 butterflies species and 10 dragonflies were identified, of which none are classified as species of conservation concern according to the IUCN Red List (IUCN, 2019).

#### 1.4.3.2 Habitat Mapping

Satellite imagery was used to map the land classes identified within the Project Area. These land classes were verified during the field investigations. The land classes include intensive agriculture, woodland, residential area, and water bodies. The majority of land in the Project Area is agricultural land.

#### 1.4.3.3 Flora

Of the 164 floral species identified during the surveys, one (1) species is Endangered (i.e., Htan or Palmyrah Palm (*Borassus flabellifer*)), one (1) is Vulnerable (i.e., Mahogany -*Swietenia macrophylla*-), 21 species are classified as Least Concern, two (2) as Data Deficient and 139 as Not Yet Assessed on the IUCN Red List. Endemic/ restricted range floral species (Living International Treasures, 2019) were not observed during field survey.

### 1.4.4 Social Baseline

The primary social baseline survey was designed to cover the whole of the Phase 1 Development and the Study Area that is defined as a 2 km buffer around the whole New Yangon City Phase 1 Development. Social baseline data was collected from 392 households, with a random sample of 21 village tracts / wards in Twantay, Seikgyi Kanaungto, Kyee Myin Daing, Hlaing Tharyar, Ahlone, and Dala Townships in March 2019. For details on methodology, please refer to **Appendix C**.

The population in the Study Area is mostly urban whereas in the Project Area, the population is mostly rural. Population density is high (more than 1,000 inhabitants per / km<sup>2</sup>) in four of the six townships. Five of the six townships exhibit population growth, which is typical in urban areas in Myanmar.

In all townships of the Study Area, there are slightly more women than men and almost a third of the population of Twantay, Seikgyi Kanaungto and Dala is less than 15 years old. Over 70% of the population of Kyee Myin Daing, Hlaing Tharyar and Ahlone are between 15 to 65 years. In all townships of the Study Area, the elderly (over 65 years old) represent less than 8% of the population.

The survey also indicated that there has been a decrease in births over the last 20 years. More than one third (36%) of the Study Area's population is concentrated in the age group between 15 to 30 years old.

There are approximately 475 education facilities in the Study Area and 45% are located in Twantay Township. All the townships within the Study Area have a higher literacy rate than the Union level average of 90%.

There are approximately 329 healthcare facilities within the Study Area. Hlaing Tharyar has the largest number of healthcare facilities (42%) and the highest ratio of health professional-to-patient in the Study Area (one doctor per every 37,665 inhabitants).

Electricity is the main source for lighting in four out of six townships. Whereas, Seikgyi Kanaungto Township and Twantay Township, most inhabitants use others source of energy such as battery, candle, kerosene, and generators.

Three out of six townships (Ahlone, Kyee Myin Daing and Hlaing Tharyar) in the Study Area use bottled/purified water as a main source of drinking water. The remaining three townships (Seikgyi Kanaungto, Twantay and Dala) mainly use pond/lake and tube well/borehole. Tap /piped water as a source for domestic water use represents less than 20% in all townships of the Study Area. In general, the main sources for domestic water is from tube well/borehole, pond/lake, and river/stream.

The most common method of transport to Yangon City from the Project Area is via boat, which only takes 15 minutes compared to the road journey of over an hour.

The main economic activities in the Study Area are small and medium businesses. Other activities include agriculture, river transportation, and casual labour (i.e. services according to fluctuating demands). In addition, there are small-scale fishing and dredging activities. Although there are slightly more working age women (15-65) than men in the Study Area, the labour force participation rate for men is significantly higher than for women (up to 47%).

The major concern about the Project among the population of the Study Area is noise impacts (58% of the total concerns of negative impacts). In rural areas, loss of land is also the biggest concern. Other concerns are related to the influx of foreign workers, air pollution, traffic, waste generation, and crime.

#### 1.5 High-Level Impact Assessment

IEEs and EIAs are being undertaken for the initial main components of the New Yangon City Phase 1. This SEA gathers in one document the main impacts each of the main components are expected to generate. In addition to these main components, the New Yangon City Phase 1 also covers the residential, commercial, civic amenities areas, and green spaces. At the time of writing (March 2020),

the definitive and comprehensive construction and operation details of these were not yet confirmed. All components of the New Yangon City Phase 1 are expected to be subject to EIAs / IEEs in accordance with the requirements of the EIA Procedure (2015) whenever they are being developed.

Risks were identified for both planned (routine and non-routine) and unplanned (accidents/incidents) activities of the Project main components of the Phase 1 Development. Potential impacts were then determined based on the physical activity or hazard type e.g. light and noise.

Table 1.1 groups the potential impacts for all components of the New Yangon City Phase 1 and gathers the main identified impacts on the physical, biological, and social environments for anticipated activities for the construction phase, operation phase, and for unplanned events. If an interaction is considered likely, it is coloured in black in Table 1.1. Recommended mitigation and management actions to minimise the overall significance of impacts potentially generated by the projects that will be undertaken for the Phase 1 Development are provided under the ESMF.

An assessment of the Project main components undertaken concurrently is presented along with the anticipated requirements in terms of additional number of workers in the Study Area, additional number of vehicles, and additional demand of domestic wastewater treatment facilities. For these aspects, at least, the individual impacts evaluated in the respective IEEs / EIAs of the project components will be cumulative on the environment and other receptors.

Impacts from Phase 1 Development Activities	Physical Environment				Biological Human Environr Environment				ment					
	Ambient Air Quality	Ambient Noise and Vibration	Surface Water and Groundwater Quality	Hydrology and Hydrogeology	Soil Quality and Topography	Landscape and Visual Character	Terrestrial Flora	Terrestrial Fauna	Aquatic Flora and Fauna	Community Health and Safety	Demographic Pattern, Economy and Iivelihood	Occupational Health and Safety	Infrastructure Services	Cultural Heritage
Construction Phase		÷						·			· · ·			
Site preparation, excavation and filling works;														
Pilling and metal structure works (bridges)														
Pavement, marking and signing works (roads)														
Worker influx and worker camps														
Transportation of equipment, supplies and workforce														
Machinery maintenance / vehicle refuelling														
Waste storage and disposal														
Wastewater management														
Right of way clearance and access roads														
Labour, equipment and services supply														

## Table 1.1 Scoping Matrix for the Phase 1 Development

Impacts from Phase 1 Development Activities	Physical Environment			Biological Environment			Human Environment							
	Ambient Air Quality	Ambient Noise and Vibration	Surface Water and Groundwater Quality	Hydrology and Hydrogeology	Soil Quality and Topography	Landscape and Visual Character	Terrestrial Flora	Terrestrial Fauna	Aquatic Flora and Fauna	Community Health and Safety	Demographic Pattern, Economy and livelihood	Occupational Health and Safety	Infrastructure Services	Cultural Heritage
Use of Powered Mechanical Equipment (PME)														
Construction of substations (power)														
Erection of transmission towers and stringing (power)														
Water pipeline installation works (water)														
Pre-commissioning and commissioning (water)														
Facilities construction (industrial zone)														
Operational phase														
Maintenance works														
Labour, equipment and services supply														
Transportation of equipment, cargo, and workforce														
Operation and maintenance of plants, intakes, pipelines (water, wastewater)														

Impacts from Phase 1 Development Activities	Physical Environment				Biological Environment			Human Environment						
	Ambient Air Quality	Ambient Noise and Vibration	Surface Water and Groundwater Quality	Hydrology and Hydrogeology	Soil Quality and Topography	Landscape and Visual Character	Terrestrial Flora	Terrestrial Fauna	Aquatic Flora and Fauna	Community Health and Safety	Demographic Pattern, Economy and Iivelihood	Occupational Health and Safety	Infrastructure Services	Cultural Heritage
Operation of transmission lines (power)														
Operation of substations (power)														
Operation of facilities (industrial zone)														
Operation of bridges														
Operation of roads														
Maintenance / vehicle refuelling														
Waste management														
Accidental events														
Spills and leaks														
Fire and explosion														
Vehicle collision														

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#### Keys

An interaction is not reasonably expected
An interaction is reasonably possible but none of the resulting impacts is likely to lead to significant effects
The interaction is reasonably possible and at least one of the resulting impacts is likely to lead to an effect that is significantly negative
The interaction is reasonably possible and at least one of the resulting impacts is likely to lead to an effect that is significantly positive

#### **1.6 Public Consultation and Disclosure**

A stakeholder engagement process was conducted across administrative levels, subject to permissions of responsible authorities. Engagement, as specified in the Myanmar EIA Procedure, was undertaken in two phases in January- February 2019 and in April 2019. A consultation team consisting of ERM and NYDC representatives conducted meetings and consultations at the different administrative levels and the village tract level. Requests were made to the relevant Township General Administration Department (GAD) offices and village tract leaders to invite the relevant community members and interested organisations from the potentially impacted villages to be present to such meetings and consultations to ensure appropriate representative samples from the relevant villages.

Consultation involved face-to-face meetings, during both the scoping and the assessment phases of the IEEs/EIAs and the SEA, with a range of stakeholders including a representative for the Chief Minister of Yangon, Regional level ECD and GAD, Members of Yangon Region Hluttaw, Member of Pyithu Hluttaw, Director from Department of Social Welfare and Township GADs from the Project Area. The date, time, location, stakeholder and purpose of each meeting are provided in Table 1.2 and Table 1.3.

Key questions raised during the public consultation activities are included in Table 1.4.

Date, time, location	Stakeholder	Purpose of Engagement
Wednesday 23 <sup>rd</sup> January, 2019	Chief Minister Office Meeting	<ul> <li>Present information on the Project;</li> <li>Get approval for township/ward and village level meetings; and</li> <li>Gather concerns and suggestions from stakeholders.</li> </ul>
Wednesday 30 <sup>th</sup> January, 2019	Twantay Township GAD Office, Seikgyi Kanaungto Township GAD office and Kyee Myin Daing Township GAD Office	<ul> <li>Meeting arrangements and approvals.</li> </ul>
Thursday 31 <sup>st</sup> January, 2019	Ahlone Township GAD office and Hlaing Tharyar Township GAD Office	<ul> <li>Meeting arrangements and approvals.</li> </ul>
Friday 1 <sup>st</sup> February, 2019	Ahlone Township	<ul> <li>Present Project information to local government, ward administrators, local communities and other interested parties;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake socio-baseline data collection; and</li> <li>Interview with Ward Administrators.</li> </ul>
Saturday 2 <sup>nd</sup> February, 2019	Twantay Township	<ul> <li>Present Project information to local government, ward administrators, local communities and other interested parties;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake socio-baseline data collection; and</li> <li>Interview with Ward Administrators.</li> </ul>
Saturday 2 <sup>nd</sup> February, 2019	Kyee Myin Daing Township	<ul> <li>Present Project information to local government, ward administrators, local communities and other interested parties;</li> <li>Gather concerns and suggestions from stakeholders;</li> </ul>

#### Table 1.2 Consultation Activities Undertaken during Scoping Phase

Date, time, location	Stakeholder	Purpose of Engagement
		<ul> <li>Undertake socio-baseline data collection; and</li> <li>Interview with Ward Administrators.</li> </ul>
Sunday 3 <sup>rd</sup> February, 2019	Seikgyi Kanaungto Township	<ul> <li>Present Project information to local government, ward administrators, local communities and other interested parties;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake socio-baseline data collection; and</li> <li>Interview with Ward Administrators.</li> </ul>
Sunday 3 <sup>rd</sup> February, 2019	Hlaing Tharyar Township	<ul> <li>Present Project information to local government, ward administrators, local communities and other interested parties;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake socio-baseline data collection; and</li> <li>Interview with Ward Administrators.</li> </ul>
Tuesday 19 <sup>th</sup> March, 2019	Myanmar Centre for Responsible Business	<ul> <li>Present Project information; and</li> <li>Gather concerns, suggestions and list of recommended stakeholders.</li> </ul>

Date, time, location	Stakeholder	Purpose of Engagement
1 April 2019, 10 AM – 12 PM Ahlone Township	Meeting with Township level Authorities, Parliamentary representatives, Project Related Persons, CSOs, NGOs, Ward Leaders and local communities from Ahlone, Landmadaw, Sanchaung, Hlaing and Kamayut Townships	<ul> <li>Present Project information to Township level authorities, parliamentary representatives, project related persons, CSOs, NGOs, Ward leaders and local communities from Ahlone, Landmadaw, Sanchaung, Hlaing and Kamayut Townships;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake FGDs with women.</li> </ul>
2 April 2019, 10 AM – 12 PM Kyee Myin Daing Township (East)	Meeting with Ward Leaders, Related government officials, CSOs, NGOs, Project Related Persons and Communities from Wa Yone Seik Aye Ywar (West) Ward, Aye Ywar Ba Lote Nyunt Sat Ka Lay Ward	<ul> <li>Present Project information to Ward leaders, related government officials, CSOs, NGOs, project related persons and communities from Wa Yone Seik Aye Ywar (West) Ward, Aye Ywar Ba Lote Nyunt Sat Ka Lay Ward;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake FGDs with Ward leaders, farmers and women.</li> </ul>
2 April 2019, 2 PM – 4 PM Kyee Myin Daing Township (West)	Meeting with Ward Leaders, Related government officials, CSOs, NGOs, Project Related Persons and communities from Sat San Auk Yone A Latt Chaung Ward, Seik Kyee U Mya Ngar Zin Ward	<ul> <li>Present Project information to Ward leaders, related government officials, CSOs, NGOs, project related persons and communities from Sat San Auk Yone A Latt Chaung Ward and Seik Kyee U Mya Ngar Zin Ward;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake FGDs with Ward leaders, women and ferrymen.</li> </ul>
3 April 2019, 10 AM-12 PM Seikgyi Kanaungto Township	Township level Authorities, Parliamentary representatives, Project Related Persons, CSOs, NGOs, Ward Leaders and local communities from Seikgyi Kanaungto Township, Tha Khin Ba Thaung Ward	<ul> <li>Present Project information to Township level authorities, parliamentary representatives, project related persons, CSOs, NGOs, Ward leaders and local communities from Seikgyi Kanaungto Township and Tha Khin Ba Thaung Ward;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake FGDs with farmers and women.</li> </ul>
3 April 2019, 2 PM – 4 PM Twantay Township	Township level Authorities, Parliamentary representatives, Project Related Persons, CSOs, NGOs, Ward Leaders and local communities from Twantay Township	<ul> <li>Present project information to Township level authorities, parliamentary representatives, project related persons, CSOs, NGOs, Ward leaders and local communities from Twantay Township;</li> <li>Gather concerns and suggestions from stakeholders.</li> </ul>

## Table 1.3 Consultation Activities Undertaken during EIA Assessment Phase

Date, time, location	Stakeholder	Purpose of Engagement
4 April 2019, 10 AM - 12 PM Ta Mar Ta Kaw Village Tract, Twantay Township	<ul> <li>Meeting with Ward Leaders, Related government officials, CSOs, NGOs, Project Related Persons and communities from the Project Area, including:</li> <li>Kyun Ka Lay Village Tract,</li> <li>Pa Tan Yae Kyaw Village Tract,</li> <li>Kha Lauk Chaik Village Tract,</li> <li>Ta Man Gyi Village Tract,</li> <li>Ta Mar Ta Kaw Village Tract,</li> <li>Gyaung Waing Village Tract, and</li> <li>Ma Ngay (Middle) Village Tract.</li> </ul>	<ul> <li>Present Project information to Ward leaders, related government officials, CSOs, NGOs, project related persons and communities from the Project Area;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake FGDs with women and farmers.</li> </ul>
4 April 2019, 2 PM – 4 PM Ku Lar Tan Thone Eain Village Tract, Twantay Township	<ul> <li>Meeting with Ward Leaders, Related government officials, CSOs, NGOs, Project Related Persons and communities from the Project Area, including:</li> <li>Ku Lar Tan Thone Eain Village Tract, Kan Ywar Village Tract,</li> <li>Byauk Yoe Village Tract,</li> <li>Lat Pan Gwa Village Tract,</li> <li>Pyawbwe Lay Village Tract,</li> <li>Peik Swei Village Tract,</li> <li>Yangon Pauk Village Tract,</li> <li>Hpa Yar Ngoke To (North) Village Tract, Hpa Yar Ngoke To (South) Village Tract, and</li> <li>Ka Li Htaw Village Tract.</li> </ul>	<ul> <li>Present Project information to Ward leaders, related government officials, CSOs, NGOs, project related persons and communities from the Project Area;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake FGDs with women and farmers.</li> </ul>
5 April 2019, 10 AM – 12 PM Hlaing Tharyar Township	Township level Authorities, Parliamentary representatives, Project Related Person, CSOs, NGOs, Ward Leaders and local communities from Hlaing Tharyar Township.	<ul> <li>Present project information to Township level authorities, parliamentary representatives, Project related person, CSOs, NGOs, Ward leaders and local communities from Hlaing Tharyar Township;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake FGDs with women.</li> </ul>
5 April 2019, 2 PM – 4 PM Ah Pyin Pa Dan Village Tract, Hlaing Tharyar Township	<ul> <li>Meeting with Ward Leaders, Related government officials, CSOs, NGOs, Project Related Persons and Communities from the Project Area, including:</li> <li>Ah Pyin Pa Dan village Tract,</li> <li>Ah Twnin Pa Dan village Tract,</li> <li>Oke Kan Taung Kyar village tract, and</li> <li>Nyaung village tract.</li> </ul>	<ul> <li>Present project information to Ward leaders, related government officials, CSOs, NGOs, Project related persons and communities from the Project Area;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake FGDs with women and farmers.</li> </ul>
8 April 2019, 10 PM – 12 PM Dala Township	Meeting with Township level Authorities, Parliamentary representatives, Project Related Person, CSOs, NGOs, Ward Leaders	<ul> <li>Present project information to Township level authorities, parliamentary representatives, Project related person, CSOs, NGOs, Ward leaders and local communities from Dala Township;</li> </ul>

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Date, time, location	Stakeholder	Purpose of Engagement
	and local communities from Dala Township.	<ul> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake FGDs with women.</li> </ul>
8 April 2019, 2 PM – 4 PM Kyee Myin Daing Township	Meeting with Township level Authorities, Parliamentary representatives, Project Related Persons, CSOs, NGOs, Ward Leaders and local communities from Kyee Myin Daing (East) Township.	<ul> <li>Present project information to Township level authorities, parliamentary representatives, Project related persons, CSOs, NGOs, Ward leaders and local communities from Kyee Myin Daing (East) Township;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake FGDs with local communities.</li> </ul>

Questions	Responses	SEA/EIA/IEE Consideration
Land Compensation		
How will the company deal with land compensation?	A 20/80 compensation scheme was agreed with the Security, Peace, Stability and Rule of Law Working Committee. The previous government set 15/85 land compensation scheme, however, a 20/80 scheme is fairer.	The IEEs/EIAs will provide a high-level review of the resettlement / compensation process relevant to their project area.
What is the development plan for farmland compensation?	The compensated lands will be upgraded to residential (urban) land from farming land.	
What will be the compensation plan for farmers?	There is a difference between farmland and urban land. Urban land is more priceworthy, thus, a 20/80 compensation scheme for farmland is rational. For this moment, NYDC does not have a plan to provide housing for those farmers, but just 20% of urban land will be compensated. However, if needed, we will set up a related policy accordingly for the majority.	
When will the farmland be compensated?	Resettlement of farmland is one of the top priorities. The construction of the resettlement areas will occur in the first three years of the Phase 1 Development plan. The six main project components' under Phase 1 are confirmed, and the Project is ready to call for tender for construction approval from the Union Government. Once the projects are approved, the tender process will be initiated and awarded. NYDC plans to commence the project in 2020.	
The construction of bridge will commence first or the housing relocation will come first?	The existing villages will not need to be relocated, as there is no physical resettlement in this area. The houses, which are located within the proposed bridge construction area will be relocated first, before construction.	
For the resettlement plan, you mentioned that it will only be compensated the farmland but not our houses, nor the impact on livelihoods, nor the costs	Once the plan has been finalized and the bridge construction is approved, we will discuss the plans with the affected people in order to reach a mutual agreement. There will be discussions on how to	The resettlement memo will be provided in the IEE/EIA reports.

## Table 1.4 Key Questions Raised During Public Consultation Activities

Questions	Responses	SEA/EIA/IEE Consideration		
involved in the moving and resettlement process in a new area.	mitigate the socio-economic impacts on the local communities. We will have a discussion with all impacted households.			
I would like to know about compensation for the land and the houses engaging with the proposed Bridges and Roads?	They should be relocated with 100% compensation. Relevant government departments are responsible for compensation.			
Along the Hlaing Tharyar road, there are some business like petro station, gas station, motorcycle shop. What is the relocation plan for them?	The category of the buildings along the proposed main road will be reviewed. If they hold legal ownership of the area, they will have a discussion with the GAD and government. If they do not have any legal ownership, they have to be removed. There is 25% reserved area to resettle those buildings, which overlap with the construction of the proposed bridges and roads.			
Electricity				
Where is the power source for this project?	The Project may potentially get electricity from the Mee Lin Chaint (1,350 MW) power plant (in Ayeyarwady Region). The Yangon Regional Government discussed with Union Minister of Ministry of Electricity and Energy regarding the electricity requirements for the project and the Union Minister agreed to provide the power to NYDC. NYDC is also looking for private power investors as a secondary option for the power source. Transformer substations will be constructed within the New Yangon City and will provide 24-hour electricity for all industries.	<ul> <li>Power source question is discussed in more detail in Section 4.3 of the Power EIA Report on power generation.</li> <li>The proposed Project will be composed of:</li> <li>Transformer substations (one 230 kV and two 66 kV) and switching station (one 33 kV);</li> <li>Transmission lines; and</li> <li>Distribution lines including 66 kV, 33 kV and 11 kV lines.</li> </ul>		
Roads and Transportation				
Will there be an underground transportation system?	All the transportation facilities will be above ground.	The impacts from road construction increased traffic, and existing local infrastructure (roads) /		
What will be the width of roads in the New City?	The roads will be at least two lanes and included drainage on both sides. Some major roads will be up to four lanes.	local communities have been assessed in the Section 8 of the EIA Report for Roads.		
During Cyclone Nargis, Twantay-Hlaing Tharyar Road was not flooded but the Kha	NYDC has commissioned a dedicated Flood Risk Assessment conducted by Royal Haskoning. In accordance with good international			

Questions	Responses	SEA/EIA/IEE Consideration	
Lauk Chaik-Seikgyi Kanaungto road was flooded. The road level should be as high as possible and as high as the Twantay- Hlaing Tharyar Road to ensure it is protected from flooding.	practice, Royal Haskoning conducted flood analysis for 100-year events, considering tidal flooding, climate change, and precipitation. Flood protection for the Industrial Zones and Resettlement Areas will be prioritised. After that, the Project will upgrade the flood protection of the other infrastructure facilities as per the progress of the Phase 1 Development.		
The access road to West Kyee Myin Daing is rather bad. Does NYDC has a plan to upgrade it?	The conceptual design of the bridge has been completed and submitted to the Government for approval. Once the project is approved, tender invitations will be sent and the Project will begin constructing the access roads for the New City.		
Any consideration for the connection of main roads to each village?	We will collaborate with the local community and relevant authorities/parties.		
Bridge			
Is there any bridge construction in the Seikgyi Kanaungto Township?	For the whole Phase 1 Development, it is proposed to construct up to twelve bridges; two bridges will be built in Stage 1 of Phase 1. The design and location for all bridges for Phase 1 will be confirmed at the end of February 2019.	There is a separate EIA for bridge construction and operation for the whole project.	
When will the bridge construction be commenced?	We cannot confirm the time of commencement but we are trying to commence in 2020.	This information is included in Table 2.1 of the EIA Report on Bridges.	
Construction			
Where will the Project use sand and soil? We suggest the Project does not excavate the soil from the Twantay, Kawhmu, and Kungyankone area. We recommend taking the soil from the river bank.	We are planning to excavate from other areas (i.e., not the Project Area) as well as potentially excavating soil from the lake in the Project Area and Twantay Canal.	The mitigation measures for the potential impacts on the environment and people due to the construction in the Project Area are proposed in this SEA report.	
Water and Waste Water			
Will there be a storm water collection system?	A water treatment plant and storm water collection system are included as part of the Phase 1 Development.	The mitigation measures for the potential impacts of wastewater and storm water drainage systems	
Questions	Responses	SEA/EIA/IEE Consideration	
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		to local communities and environment are included in this SEA Report.	
Is it correct that the project will take the water from Toe River?	Water intake will be from Toe River; this has been studied by JICA, who prepared the 2040 Master Plan for Yangon Region. The water quality has been tested which suggested that the quality is good to use as a water source. Ground water from the Project Area will not be used due to its quality and concerns about land subsidence.	The impacts of water intake from the Toe River have been assessed in the Water EIA Report. The EIA Report assumes that no groundwater from the Project Area will be utilised given the potential impact on existing water resources.	
We are wondering whether there is any plan of water supply from centralized water supply system like Kyo Phyu. There is a water supply plan for Twantay, how about for Hlaing Tharyar. We want access to good quality of water.	Yangon has a master plan from JICA regarding water supply, and NYDC plans to take water from the Toe River, which is of good quality and quantity. NYDC is aware that there is a plan of JICA to get water from Kote Koe Wa and distribute to Hlaing Tharyar in 2023. We will take note and inform the relevant government departments.	This is not part of the SEA or the IEEs/EIAs Studies but NYDC is aware that this is the request from the community.	
If the water will be taken from the Toe River, this should be distributed to Seikgyi Kanaungto where the locals have facing issues with lack of water.	The company has noted the suggestions of water distribution issues and will submit it to relevant authorities.		
I would like to suggest to consider the waste water treatment plant for industrial waste in the Phase 1.	A policy for the Phase 1 Development of industries is currently being planned. Minimum standards to treat and dispose of the waste will be provided to the investors.	The potential impacts of both waste and wastewater management from Industrial Zone has been assessed in the Industrial Zone EIA.	
Land Utilization			
Is all the land within the Project Area farmland?	About 85% of the land is farmland in the Project Area.	Mitigation measures for the potential impacts of the changes in land utilisation are proposed in this SEA Report.	
Environment			
What about villages outside of Project Area's clean environment? Based on experiences with existing industrial zones, it is observed that after a few decades the environment will become affected. Will	The SEA and IEE/EIAs do not just focus on the Project Area. We also asses the surrounding area and include this in our mitigation recommendations. We have conducted primary baseline surveys and if the current baseline is degraded, it means that we will adopt stricter environmental management and mitigation measures for the Project. In	Environmental impacts and mitigation measures have been assessed in this SEA Report for the Project Area and all surrounding areas in the Area of Influence (i.e., an area where impacts may	

Questions	Responses	SEA/EIA/IEE Consideration
villages in Hlaing Tharyar Township have environmental impacts?	addition, monitoring plans will also be prepared and reported to the ECD every 6 months in order to confirm whether mitigation measures are effective.	occur; village tracts, wards and townships within or neighbouring the Project Area).
It is said that both, the Industrial Zone and Resettlement Area will be included in the Project Area. According to the environmental point of view, industries will discharge the chemicals and I would like to know whether there is any Management Plan for the potential impacts or not.	There will also be guidelines to be in line with the Myanmar National Environmental Quality (Emission) Guidelines. For example, there will be guidelines to clean the wastewater from industries before discharging and to water the gravel daily for controlling the dust to the surrounding area. NYDC will take responsibility for the City Development related to the Environmental Management Plan (EMP).	
I want to know the management plan of Pun Hlaing River and the creeks around, the location of the control water gate and the reason of silt sedimentation of Pun Hlaing River. In 2008 the creeks were shut and no way of silt and sediment to wash out, thus the river has been suffering from silt sedimentation.	We have our flood consultant, Royal Haskoning, Dutch company, who study about the current stage of flooding and river nature. For this moment, there are two floodgates. In coordination with them, we proposed five or six floodgates to not getting flood impact from NYDC. And we are also planning to de-sedimentation of the creeks as you see in the map, and also to create a scenic place for the people living around.	
I have a concern on the load capacity of the existing bridge at Hlaing Tharyar, which will be potentially affected by transporting the construction materials for NYDC project? Will the roads in Hlaing Tharyar be impacted by the New Yangon City Project activities? I want the Project to take accountability for any impact on the existing roads?	The construction contractors have to submit the number of vehicles, loading capacity of an individual vehicle and the schedule prior to commencing any construction activities. All vehicles must not overload the capacity of the bridge. When the joint venture contractors transfer the complete projects to us, we will ensure that they are accountable for any damage caused directly by their activity. For example, if the road is damaged by their activities, they will have to repair it.	
It is noted that most of the locations of baseline sampling points for air, water and noise indicators are in the same Township.	There is a methodology for selecting the baseline collection points. It is based on the residential areas in different townships and potential impacts of the Projects.	The methodology of the baseline data collection is provided in Appendix C.

Questions	Responses	SEA/EIA/IEE Consideration
Health		
There will be health impact from the Project, especially the dust produced by the vehicles passing through. Has this been considered?	For dust control measures, the Project Area needs to construct wheel wash bays where necessary, with the aim of reducing dust produced by site vehicles. Water spraying will be implemented at the Project Area to suppress dust.	Mitigation measures for the potential impacts on communities and occupational health due to the Project activities are proposed in this SEA Report.
How about the impact to health of the labours working inside the Project site?	There are two types of labourers: those who stay on-site and those who stay off-site. For the Phase 1 Development, there is NYDC's Health and Safety Guidelines which reflect not only Myanmar, but also international guidelines such as the International Finance Cooperation guidelines. In addition, the contractors will also have their own Health and Safety Plan.	
Traffic		
The mitigation measure for the traffic impact should be considered first in this Project.	Oriental Consultants from Japan was hired to conduct the traffic study for the 2040 master plan for the Yangon Regional Government. NYDC has appointed Oriental Consultants for New Yangon City Traffic Assessment and Transport Planning. This considers the estimation of population growth rate for 30 years, and the traffic consultant conducted two studies. The first one is the transportation plan for connecting the existing Yangon City and the New City. There will be about 12 bridges required for the entire project. The traffic consultant suggested the number of bridges required, based on population growth and employment opportunities. The traffic consultant also planned the connection routes of the existing railways with new ones, and the number of the bus services and bus stops not only to connect with other cities but also transport within the New City. The investors who are interested in providing public transport for the New City are being invited via local newspapers.	Mitigation measures for the potential impacts on traffic are proposed in this SEA Report.

#### Urban Management

Questions	Responses	SEA/EIA/IEE Consideration
Will there be any physical displacement for the people living in the Project Area?	The villages in the Project area will remain untouched and there will also be green spaces between the new developed areas and the existing villages.	Mitigation measures for the potential impacts to the villages in the Project Area from construction and operation of the Phase 1 Development are proposed in this SEA Report.
How will the city manage the population increase in the future and what is the process be for the Bill of Quantities (BoQ) and Quality Control (QC)?	There is a Master Plan prepared by AECOM and includes a consultant to countercheck the process of BoQ and QC.	Mitigation measures to manage planned population increases are proposed in this SEA Report in terms of resource use and associated impacts.
When will the community settle in the New City?	The industries will be constructed in 2022 and there will be job opportunities for locals after this time.	Mitigation measures for potential social Impacts are proposed in this SEA Report.
Does NYDC have any plans regarding the squatter areas for the New City?	NYDC understands the current squatter issues and ensures adequate workers' accommodation is included in the Project Area. The construction workers will be required to leave the Project Area once construction is complete.	Mitigation measures to manage the influx of workers during construction and operation phases and the impacts from this influx on local communities and environment (including squatters) are proposed in this SEA Report.
Is there any plan to include an area for the administrative departments?	NYDC will include administrative department areas that cover approximately 5% of the resettlement areas.	This is included in each project description of the Project main components' relevant IEEs/EIAs.
Are there any hotel zones in the Project Area?	There will be an approximately 20 square kilometre commercial and residential development areas, which include areas for hotels and condominiums.	
There are 2.3 million disabled persons according to census data. How is the project designed so services and infrastructure are assessable for disabled persons?	NYDC considered the design for disabled persons as per American with Disabilities Act (ADA) compliance, and Myanmar National Building Codes for buildings and infrastructure.	

Questions	Responses	SEA/EIA/IEE Consideration
People from different economic statuses want to purchase houses in this Project Area. How many options are there for them?	There will be different types of housing starting from one storied to up to mid to high rise buildings. We designed for the estimated 1.2 million people. Everyone can buy houses depending upon the amount of money they have. Houses will vary from private compounds and condominiums to affordable housing.	
Will the cemeteries from Seikgyi Kanaungto and Ah Lat Chaung be combined into one?	The existing cemeteries will remain as they are.	Mitigation measures for potential impacts on cultural heritage are proposed in the relevant IEEs/EIAs reports.
Is the New Yangon City Project Area chosen by the previous government or the current government?	The New Yangon City Project Area is chosen by the previous government.	This is not SEA/EIA/IEE consideration but NYDC is aware of the community concern.
Why did NYDC choose the current location as the Project Area?	The New Yangon City Project Area was approved under the previous government. The Yangon Regional Government worked with JICA for the 2040 Strategic Urban Development Plan for Yangon Region and proposed the locations for new developments and infrastructure. This Project is one of the 2040 JICA allocations, and the Yangon Regional Government chose the current Project Area according to that plan.	
How will the New Yangon City be named?	At this moment, the project is called the New Yangon City. For the name of the City, there will be discussions between the public, NYDC and other relevant government departments. If there is a name that the public prefers, it can be sent not only to NYDC's email but also to NYDC office.	
How many hospitals and schools are planned to be in the New Yangon City?	There is a planned map for basic infrastructure and people settlement as we have shown. We will have a discussion with the general administration management team and relevant administrative offices to discuss the required number of basic structures including schools and hospitals, reflecting the population according to international good practice. Other components such as the standard distance from public transport facilities (bus stations) and from community commercial and	Mitigation measures for the potential impacts on demographic pattern are proposed in this SEA Report.

Questions	Responses	SEA/EIA/IEE Consideration
	services areas, (retail shops and hospitals) to residential areas will follow international standards.	
Will there be urban farming included in New Yangon City Project?	Urban farming is generally for cities which are densely populated and lack availability of farming land. As New Yangon City Project and its nearby areas allow for nearby farming areas, we do not yet have a specific plan for urban farming.	None required.
Who is your target residence for new urban housing plan?	For the first five years, we target those who will mostly work for construction. There will be a lot of housing for workers at the development site as we consider their time spent on commuting between work and their home, and their quality family time.	This is not an SEA/IEE/EIA consideration but NYDC is aware of the concern.
I learnt that low cost housing complex is target for those who have income of about 300,000 to 400,000 Kyats and the government staff. How about the others who have lower income than that (for example, street vendors, daily waged workers, etc.)	There will be different payment methods: direct payment, bank loan, instalments, etc. Our concern is the affordability for the people who work for NYDC project implementation. The project is currently at the initial planning stage; we can provide you with more detailed information about this housing program when the plan is more advanced.	
I would like to know the earthquake resistance of the bridges and buildings.	The buildings and bridges will be constructed according to the Myanmar National Building Code (MNBC).	None required.
Waste Management		
What is the Waste Management system?	There will be industrial and residential waste. For industrial waste, we are discussing with interested investors including DOWA company, which is currently waste management facility in Thilawa. All the waste from the Project and the city will be managed in line with National Standards and Guidelines.	In terms of waste management, including generation and disposal, mitigation measures for the associated potential environmental and social impacts are proposed in this SEA Report.
Where will waste be discharged and how many acres will be set up for a dumpsite?	There is a plan for industrial waste and municipal waste will be disposed of like Thilawa Industrial Zone.	
How about waste management system for the new city?	On February 11th 2019, there was an announcement in The New Light of Myanmar newspaper, inviting the expression of interest for waste	

Questions	Responses	SEA/EIA/IEE Consideration
	management services. Approximately seven organizations submitted expressions of interest. We will carefully evaluate the applicants.	
Budget Management		
What is the budget for this project?	Around 1.68 billion USD is estimated for the development of Phase 1 Stage 1 and includes two Bridges, Roads, Power Transmission and Distribution Network, Water Treatment Plant, Waste Water Treatment Plant and Industrial Zone. We hope to start implementing next year (2020).	This is not an SEA/IEE/EIA consideration but NYDC is aware of the concern.
Industries		
Who will own the infrastructures such as industries? How long are they entitled to own?	As per the Myanmar Investment Commission (MIC) law, foreign investors will be permitted to use land for an initial period of up to 50 years, which can be extended for two additional consecutive periods of ten years each. The investors will build the required infrastructure for the Industrial Zone.	This is not an SEA/IEE/EIA consideration but NYDC is aware of the concern.
What will be the ratio for Small and Medium Enterprise (SME) in the Industrial Zone of the New City?	The types of sector and the percentage of their business in the Industrial Zone are displayed in the meeting materials. At this stage, the concept masterplan proposes a land use mix of 10% large (heavy) industry and 14% small (light) industry within the 90 km <sup>2</sup> . The exact percentage will be confirmed later.	
Farming Activities		
Is there any plan to break the farming for the farmers who are now planting the paddy in their fields?	For farmers, there will be an announcement in advance to regarding plantation activities. At present, there is no guidance and farmers can plant freely.	Mitigation measures for the potential impacts on economy are proposed in this SEA Report.
Employment Opportunity		
Will there be employment opportunities for local people?	There will be employment opportunities for people who live in and around the new city during the construction and operation of the Project.	Measures for employment management are proposed in this SEA Report.

#### DEVELOPMENT OF NEW YANGON CITY PHASE 1 SEA Report

Questions	Responses	SEA/EIA/IEE Consideration
I would like to request the company to create employment opportunities for disabled persons.	NYDC will record your suggestion and try to implement.	
What is the consideration of disabled people in the Yangon City?	There are two considerations for disabled people in the Project. First, the percentage of disabled labours in the workforce. Once the tender process is completed, we will discuss with investors and we can set up incentives for the industrial investor to hire disabled employees. At the moment, we do not know the exact percentage of disabled person in the workforce. Secondly, NYDC's design standards will meet Myanmar disability code (MNBC) and standards.	
We are a Civil Society Organization who has an interest in local people life and we would like to suggest you consider job opportunities for men. It seems that there are more job opportunities for women in industrial sector and less for men. Then men became jobless and that lead them to commit into crime. We suggest you create more job opportunity for men for a better gender balance for better way of life.	We will not discriminate between men and women for job opportunities. However, there will be more construction work within the first five years, and it is assumed that there will be more male-oriented jobs. There will be other kinds of job for women as well. Initially, where our people may lack knowledge of international standards, the investors will bring in their own people who can provide training. We are proposing to provide a vocational training school which will provide international certification before any factory is opened. People can be qualified through this program, so investors can get qualified local people.	
The labours who will work in the Project will be daily wages or monthly wages?	We are at the tender preparation stage, and we haven't decided yet. There will be daily and monthly wages depending on the level and nature of work.	
It is known that about 20,000 acres of farmlands will be acquired by the Project. If one acre can produce 60 baskets of paddy, there will be 1'200,000 baskets to be lost when the Project starts and the farmers will lose their job. Therefore, please consider this fact in doing the assessment.	The farmland will be upgraded to urban land, and land owners will get back 20 per cent of their farmland. There could be a livelihood impact during the transition from acquiring the land and returning. The suggestion is noted and included in the EIA report.	

Questions	Responses	SEA/EIA/IEE Consideration
The local community has very limited technical expertise and education to get jobs, therefore job opportunities may favour other nationalities such as the Chinese, and then the New City will become a Chinese City. Our people will become jobless and I am concerned.	Whoever wins the project tender - regardless of being Chinese or Korean or Japanese, we will make the agreement to put the quota for minimum 50% employment of Myanmar nationals. We are also looking for investors for the establishment of vocational schools, which will train local people for the skills required to work in industrial and commercial sectors (with international certification). If our local people have enough skills and international certification, investors will not need to bring people from other countries. The vocational schools are planned to be established prior to setting up of the first factory in the area.	
There are 103 households currently owning small commuter boats, and their livelihood depends on transporting people across the river. They will become jobless when there is a bridge. Have you considered the impact on their livelihood?	This has been noted and will be considered. The EIA will not only focus on environmental impact, but also social impact on the affected community. We will have a focus group discussion with the ferrymen after this consultation.	Mitigation measures for the potential impacts on economic and livelihood are included in the Bridges EIA Report.
What is the livelihood consideration for the farmers after acquiring the farmland?	Construction work opportunities will be available when the project commences. Potential investors agreed with NYDC that at least 50% of jobs will be available for locals during the construction phase. For operational phase, 900,000 positions will be available in 30 years and 600,000 for the first five years.	

### **1.7 Environmental and Social Management Framework**

The purpose of the ESMF is two-fold:

- The ESMF provides guidelines for the Phase 1 Development's Administrator to monitor the environmental and social performance of the sub-project components. This monitoring will cover all stages of the sub-project components, namely during the construction and operations of the initial sub-project components (or Project main components), during the construction and operations of additional sub-project components, and during the decommissioning phases of sub-project components; and
- The ESMF provides environmental and social mitigation guidelines to all sub-project developers and operators, on the recommended management practices for them to follow in order to manage environmental and social risks associated with any type of sub-project and at any stage. These recommended management practices are applicable to all sub-project developers and operators and to all their contractors and sub-contractors.

The ESMF is, therefore, an overarching document that aims at providing mitigation guidance for managing the environmental and social impacts that will be triggered by the development and operation of all New Yangon City's sub-project components.

As the Phase 1 Development entails a comprehensive range of development sub-projects, it is expected that most Myanmar regulations and standards will be relevant to the development of the Master Plan. These are listed in the individual IEEs/EIAs of the Project main components and will be listed in the legal registers of the other sub-projects that will be developed / operated.

As recommended under the below sections, each developer/ operator is expected to maintain an updated legal registrar relevant to its sub-project.

The recommendations provided under this ESMF are guided by good international industry practices in general and by the World Bank Group Environmental Health and Safety (EHS) Guidelines and the IFC Performance Standards in particular.

These documents, as updated, can be used as reference guidelines by sub-project developers and operators throughout the stages of each of the Phase 1 Development's sub-projects.

#### 1.8 Assessment Benchmarks: Relevant References

The Phase 1 Development positions itself within broader sustainable development aspirations, namely the United Nations SDGs, the Myanmar Sustainable Development Plan (2018-2030) and the Myanmar National Urban Policy Framework. To achieve such aspirations during construction and operation phases of the Phase 1 development, areas of focus must be identified, and measurable targets framed. These can be based on the environmental and social baseline assessment of the Project Area to be developed, on a high-level environmental and social impact assessment of the development of the Phase 1 Master Plan and on the outcomes of the stakeholder engagement process to date.

Such measurable targets, or assessment benchmarks, are intended to be used to guide the outcomes of future IEEs/EIAs as well as the overall Phase 1 Development. A desktop review has identified several international references, described in Section 9 following the presentation of the vision and aspiring performance indicators of the Phase 1 Development that may be used to inform which assessment benchmarks could be used. The desktop review includes NYDC's Master Plan, the United Nations SDGs, the Myanmar Sustainable Development Plan (2018-2030), the Myanmar National Urban Policy Framework, Strategic Urban Development Plan of the Great Yangon Region and additional references, such as the WHO Healthy Cities Setting and relevant urban indicators for sustainable cities used for different global locations. These assessment benchmarks provide indicators and targets that are similar in intent, but with various degrees of detail.

## 1.9 Assessment Benchmarks: Proposed SEA Framework Objectives and Indicators

The standard dimensions of sustainable development towards a fair, viable and liveable world include:

- Economic development;
- Social progress; and,
- Environmental responsibility.

The proposed SEA Framework Objectives (Table 1.5) draw from the above dimensions and from the review of potential assessment benchmarks for a sustainable city presented in Section 8 and encapsulated by the UN Sustainable Development Goal 11. They are to be supported by indicators proposed in Section 10.3.

SEA Objective	UN SDGs / Myanmar SDGs	Sub-objectives/ Targets
Maintain and improve the water quality and quantity of the rivers, creeks, reservoirs (surface water) and of groundwater	UN SDG 6, 14 Myanmar SDG 5.3	<ul> <li>Install and maintain a comprehensive water drainage system</li> <li>Install and maintain a comprehensive wastewater system, including a fit-for-purpose wastewater treatment system</li> <li>Install and maintain water metering and leak monitoring systems to minimise water losses</li> </ul>
Protect and enhance the soil's resources (quality and topography)	UN SDG 2, 15 Myanmar SDG 5.1	<ul> <li>Minimise the areas covered with asphalt</li> <li>Maintain a balanced layout of green areas</li> <li>Set up and maintain a flood management plan</li> </ul>
Manage waste in a sustainable manner	UN SDG 3, 6, 9 Myanmar SDG 5.6	<ul> <li>Encourage waste reduction: e.g. add campaigns, single-use plastic ban, plastic bags ban/ fee, public composting facilities</li> <li>Design and maintain drinkable water fountains</li> <li>Organise sustainable waste collection infrastructure and disposal facility for each different waste streams and with a focus on reusing and recycling</li> </ul>
Reduce air pollution and ensure continued improvements to air quality	UN SDG 11, 13 Myanmar SDG 5.1, 5.4	<ul> <li>Design an urban development plan and establish a traffic management plan that encourages public transportation, walking, cycling</li> <li>Build energy efficient infrastructure (housing, buildings, roads, utilities, etc.)</li> <li>Monitor air pollution and greenhouse gas emissions (GHG) emissions and enforce exceedances</li> <li>Avoid locating new development where air quality could negatively impact people's health</li> </ul>
Plan for the anticipated effects of climate change and other accidental events	UN SDG 13 Myanmar SDG 5.2	<ul> <li>Assess climate change risks and build resilient infrastructure</li> <li>Establish a comprehensive emergency preparedness and response plan, in terms of infrastructure, human capabilities, alarm and monitoring system; the potential emergency events may include: fire (contained and conflagration), heavy rainstorm/typhoon/thunderstorm, road incident or road obstruction, workers injury, explosion, and spillage of hazardous or potentially hazardous materials (on or off-site)</li> </ul>

 Table 1.5
 Proposed SEA Framework Objectives

SEA Objective	UN SDGs / Myanmar SDGs	Sub-objectives/ Targets
Develop infrastructure services	UN SDG 8, 9, 11 Myanmar SDG 3.6, 5.6	<ul> <li>Design and develop a comprehensive urban plan, catering for all utility services, transport infrastructure, economic services, housing types, public services</li> <li>Compensate agriculture land impacted by the development of the Master Plan through a Compensation Plan</li> </ul>
Help deliver equality of opportunity and access for all	UN SDG 1, 3, 4, 5, 7, 16 Myanmar SDG 3, 4, 5	<ul> <li>Address existing imbalances of inequality, deprivation and exclusion</li> <li>Improve access to education, lifelong learning and training opportunities</li> <li>Improve accessibility to affordable housing and employment opportunities, particularly for disadvantaged sections of society</li> <li>Compensate agriculture land impacted by the development of the Master Plan through a Compensation Plan</li> <li>Implement a Community Grievance System and a Workers' Code of Conduct</li> <li>Prioritise hiring of local workers</li> </ul>
Safeguard and improve workers health, safety and wellbeing, including contractors, subcontractors and other third party suppliers	UN SDG 3 Myanmar SDG 4.5	<ul> <li>Develop appropriate Occupational Health and Safety Management Plans (OHSMP) for each sub-project components with the following minimal mitigation components:         <ul> <li>Corporate OHS policy applicable to all operations</li> <li>OHS Manual of Procedures (SOPs), including ambient air quality monitoring procedure</li> <li>Multi-year OHS training plan for staff, including contractors, subcontractors, third parties</li> <li>Definition of OHS KPIs for monitoring and reporting</li> <li>Consolidated annual OHS performance reports</li> </ul> </li> </ul>
Safeguard and improve community health, safety and wellbeing, including in terms of noise	UN SDG 11 Myanmar SDG 5	<ul> <li>Design and maintain sports facilities during operational phase</li> <li>Ensure the area has a sufficient number and variety of hospitals, medical centres, doctors, nurses, firefighting system (firemen, fire stations, fire equipment, etc.), police, etc.</li> <li>Devote some space to urban gardens</li> <li>Maintain / set up cultural and religious heritage</li> <li>Design an urban development plan and establish a traffic management plan that encourages public transportation, walking, cycling to minimise the noise levels</li> <li>Develop a Community Health and Safety Management Plan (CHSMP) with the following minimal mitigation components:         <ul> <li>Community Grievance System Implementation</li> <li>Environmental Quality Monitoring</li> <li>Workers Code of Conduct implementation</li> </ul> </li> </ul>
Protect and enhance biodiversity, flora and fauna	UN SDG 14, 15 Myanmar SDG 3.1, 4, 5	<ul> <li>Maintain and achieve favourable condition of international and national sites of nature conservation importance</li> <li>Maintain the extend and enhance the quality of locally designated sites and priority habitats</li> <li>Maintain and enhance connectivity of corridors of semi-natural habitats</li> </ul>

The proposed SEA Framework Indicators for measuring the sustainable performance of the Phase 1 Development and monitoring its progress towards its sustainable development goals are summarised in **Appendix A** and grouped in three types: economic indicators, environmental indicators and social indicators.

### 2. INTRODUCTION

In 2013, the Yangon City Development Committee (YCDC) working alongside the Japanese International Cooperation Agency (JICA) developed the 2040 Strategic Urban Development Plan for Yangon Region and proposed the locations for new developments and infrastructure. The location selected for the New Yangon City (the Project) is one of the 2040 JICA allocations, and the Yangon Regional Government chose the current Project Area according to that plan.

In 2018, the New Yangon Development Company (NYDC) (the Project proponent) commissioned AECOM to conduct Master Planning for the Project. This process selected locations of the various facilities within the New Yangon City. This Strategic Environmental Assessment (SEA) Report was voluntarily commissioned to ERM Myanmar Company Limited in order to review the New Yangon City Phase 1 Master Plan and various other studies including the traffic and transport study, the socio-economic master plan, and the flood risk assessment for the New Yangon City.

This SEA Report is an overarching document to inform sustainable development of the New Yangon City Phase 1 project components. The main objective of this SEA is to propose an environmental and social management framework (ESMF) that will be used to manage potential environmental and social impacts arising from the development of all future Phase 1 projects. For this SEA, the ESMF has been produced to align with the Myanmar Sustainable Development Plan (MSDP) and the United Nations Sustainable Development Goals (UNSDGs). The Sea also includes proposed sustainability objectives and performance indicators for the administrator of the New Yangon City Phase 1 to assess progress made to achieve the sustainability objectives.

SEAs have been the subject of various academic research, international good practice recommendations (including by the International Finance Cooperation (IFC) and Work Bank Group (WBG) and on-the-ground uses and tests. SEAs are expected to be designed for a specific purpose and as such will be tailored to fit whatever purpose is sought for, in this case designing a new city to align with the MSDP/UNSDGs. The main aspect in the SEA methodology is to cater for high-level discussions around how to organize the parts in a sustainable manner for all.

It is important to note that this SEA is not, nor should be taken as, an EIA of any future facilities within the New Yangon City. Rather, the SEA will help provide the framework for sustainable development to be considered as part of future EIAs and gives guidance on where and when to employ such. It is fully expected that, where legislation requires it, or through the individual choice of developers, separate EIAs will be prepared for each and every applicable development within the New Yangon City. This SEA thereby provides the core backbone to ensuring that New Yangon City will be both and environmentally and socially acceptable development governed by the highest standards within Myanmar as they presently stand.

#### 2.1 Background

The **New Yangon Development Company, Ltd.** (NYDC), incorporated under the Yangon Regional Government (YRG), plans to develop the New Yangon City. The development of the overall project is proposed to consist of Phases (Phases 1 and 2 as shown in Figure 2.1).



Source: NYDC, 2018

### Figure 2.1 Phase 1 & 2 of New Yangon City

The New Yangon City is located in a semi-urban to rural area in Seikgyi Kanaungto, Twantay, Hlaing Tharyar and Kyee Myin Daing Townships to the West of Yangon.

The overall Phase 1 Project Area would be 88.3 sq.km. The masterplan includes residential areas of 30.93 sq.km, commercial areas of 6.41 sq.km, industrial areas of 22.37 sq.km, transport and logistics of 1.51 sq.km, green spaces of 12.01 sq.km, villages of 11.97 sq.km, civic amenities of 2.33 sq.km, and utilities (physical infrastructure) of 0.77 sq.km.

Further development of the Phase 1 has been aligned with the Japan International Cooperation Agency (JICA) 2040 Master Plan (2018) and other Master Plans issued by Myanmar authorities.

Phase 2 is located south of Phase 1 and will cover an area approximately 600 km<sup>2</sup> and is not covered under either the Master Plan or this SEA.

Phase 1 is being developed by NYDC with the support of different consultants which have undertaken a socio-economic study for the target economic and industrial sectors, prepared the strategic plan for the area, assessed flood risk, proposed transportation planning and assessed the management of potential environmental and social impacts associated with the development of Phase 1 through a Strategic Environmental Assessment (SEA) and five Environmental Impact Assessments (EIAs) and one Initial Environmental Examination (IEE), each dedicated to various Project main components.

## 2.2 Name and Address of the Proponent

Contact details of NYDC, the proponent of the Master Plan and of its components, are provided below:

Address: New Yangon Development Company, 56 Chindwin Road, Kamayut, Yangon, Myanmar

Telephone: +95 (9) 402111525

Email: <u>comments@nydc.com.mm</u>

NYDC's company registration certificate is provided in Appendix F.

#### 2.3 Environmental and Social Experts

**Environmental Resources Management** (ERM)<sup>3</sup> has been selected by NYDC to prepare the Strategic Environmental Assessment (SEA) for the New Yangon City Phase 1. ERM has been supported by local Myanmar consultants, **Environmental Quality Management** (EQM) and **Resource and Environment Myanmar** (REM), to assist with the public consultation and environmental baseline surveys.

### 2.4 Scope of the SEA

There are a number of approaches that can be undertaken to prepare an SEA. The scope of this SEA, includes the following key aspects:

- Designing and undertaking a Stakeholder Engagement Plan common to the SEA and the IEEs/EIAs of the Project main components (of the New Yangon City Phase 1);
- Developing sustainable development goals for the New Yangon City Phase 1 in reference to the Myanmar Sustainable Development Plan (MSDP) (2018-2030) and the United Nations Sustainable Development Goals (SDGs). These are proposed as the SEA Framework Objectives;
- Developing impact assessment criteria to be used as key metrics in evaluating the proposed New Yangon City as it develops further. These are proposed as the SEA Framework Performance Indicators; and
- Designing an Environmental and Social Management Framework (ESMF) to guide environmental and social management practices to be employed by the various developers and operators of sub-projects within the New Yangon City; such implementation is expected to support the protection of the environment and of the people potentially impacted by the Phase 1 development, and is thus expected to contribute towards the SEA Framework Objectives.

The development of the SEA also included:

- A scoping exercise, that included desk-based studies, field visits, primary data collection, and consultation and engagement activities,
- Regular and documented engagement activities with key parties on the contents of the proposed SEA deliverables (i.e. scoping report, presentations, report),
- The inclusion of the environmental and social baseline description of the Project Area based on an up-to-date description of the technical Master Plan and of the environmental and social conditions of the Project,
- A high-level assessment of potential environmental and social impacts that may be triggered by the development of the New Yangon City, and
- An overview of the relevant administrative framework.

#### 2.5 Purpose of the SEA Report

This SEA Report documents the SEA process undertaken for the Phase 1 Development and provides the proposed guidance for the six IEEs/EIAs' respective scopes of work and for any future IEEs/EIAs required under further development of the Phase 1. This guidance takes the form of:

www.erm.com Version: 02 Project No.: 0488716 Client: New Yangon Development Company Ltd.

<sup>&</sup>lt;sup>3</sup> Environmental Resources Management is the parent company for a number of entities registered in Myanmar, including ERM Myanmar Company Limited and Environmental Resources Management (ERM)-Hong Kong Limited. Both of these entities are part of the ERM Group of Companies.

- A proposed ESMF to manage potential environmental and social arising from the development of the Phase 1 targeted at both individual sub-project developers/ operators as well as the Administrator<sup>4</sup> of the New Yangon City Phase 1;
- Proposed Sustainability Objectives for the Administrator of the New Yangon City Phase 1 to drive the development of the New Yangon City Phase 1 (SEA Framework Objectives); and
- Proposed Sustainability Performance Indicators to be monitored and communicated on by the Administrator of the New Yangon City Phase 1 to assess progress made to achieve the sustainability objectives set for the New Yangon City Phase 1.

The SEA process consisted of an initial SEA Scoping Exercise that included desk-based studies, field visits, primary data collection, and consultation and engagement activities. This SEA Report provides an up-to-date description of the technical Master Plan and of the environmental and social conditions of the Project. The report also documents the stakeholder consultation activities undertaken to date.

This SEA Report further outlines the proposed ESMF to put in place and the proposed mitigation and enhancement measures to be implemented, including their monitoring, as well as the SEA Framework Objectives and SEA Framework Indicators proposed for the sustainable development of Phase 1.

The purpose of the SEA process and Report is to inform the sustainable development of the Master Plan's various project components. The ESMF aims to guide the various sub-projects' developers/ operators in integrating environmental and social considerations when implementing their individual projects. The ESMF and the SEA Framework Objectives and Indicators proposed in this SEA aim to guide the Administrator of the Phase 1 Development in monitoring and reporting on the various activities being implemented in the New Yangon City Phase 1 at any one time. This SEA Report sets out:

- The context and description of the Phase 1 Development;
- An overview of the administrative framework relevant to the proposed Phase 1 Development and its SEA;
- A description of the Phase 1 Development;
- A description of the Phase 1 Development's surrounding environment, incorporating environmental and social aspects;
- A high-level impact environmental and social assessment of the development of the Phase 1, including cumulative impacts;
- An Environmental and Social Management Framework to inform project developers/ operators on the environmental and social expectations of the New Yangon City, including the anticipated governance to manage the sub-projects to be implemented in the Project Area;
- A brief on the Stakeholder Engagement process to date and how it has been undertaken for both this SEA and the individual IEEs/EIAs covering different Phase 1 activities; and
- A presentation of proposed assessment benchmarks for sustainable development objectives of the Master Plan (SEA Framework Objectives) and impact assessment indicators (SEA Framework Indicators) of the activities pertaining to the development of the Phase 1.

<sup>&</sup>lt;sup>4</sup> The development of the New Yangon City Phase 1 is managed by an Administrator, which is, currently, NYDC. NYDC is 100% Yangon Regional Government owned. The objective of NYDC is to create economic growth, homes and jobs. The development of New Yangon City will be primarily based on Public-Private Partnership Models with the private sector playing a major role with equity investments. NYDC (or any other administrative body as decided by the government) will remain under the leadership of Yangon Regional Government and will therefore perform an administration role for the government.

### 3. OVERVIEW OF THE POLICY, LEGAL, AND REGULATORY FRAMEWORK

### 3.1 Context

The main individual components of the Phase 1 Development are subject to individual IEEs/EIAs, in accordance with the EIA Procedure (2015) and good international practices. A Stakeholder Engagement Plan (SEP) is being undertaken in parallel to this SEA, which is common to all Phase 1 Stage 1 individual IEEs/EIAs and the SEA.

There is no regulation covering SEA in Myanmar, however, some SEAs have recently been conducted with the support of MONREC, as recommended by good international practices and relevant academic and professional research. Examples of SEAs conducted in Myanmar include an SEA undertaken to inform the energy policy covering the development of hydropower generation in the country<sup>5</sup> as well as an SEA to inform the development programme of the Thilawa Special Economic Zone (SEZ).

In the absence of specific SEA regulatory framework in Myanmar, the regulatory requirements applicable to EIA in Myanmar and international regulations, conventions, and guidelines relevant to the Phase 1 Development's projects are proposed to be used to guide this SEA.

Ultimately, the SEA has been prepared to provide a high-level assessment of the environmental and social risks and impacts from the Phase 1 Development, and the recommended mitigation measures and indicators of sustainable development goals to integrate in the considerations for the New Yangon City components.

### 3.2 Overview of Myanmar Regulatory Framework

This Section presents a summary of the regulatory requirements applicable to the EIA process in Myanmar and international regulations, conventions, and guidelines relevant to the Phase 1 Development's projects and that are deemed relevant to the SEA process.

### 3.2.1 Myanmar Regulatory Authorities

Key ministries, agencies, and state-owned enterprises that have jurisdiction or are typically involved in IEEs and EIAs related to urban and industrial developments in Myanmar include the following:

- Union Government: The Department of Urban and Housing Development (DUHD), under the Ministry of Construction (MOC), formulates development strategies, prepares urban and regional development plans, and assesses proposals prepared by townships and cities. The implementation of these plans are executed by both regional and local authorities. DUHD drafted the Urban and Regional Development Planning (URDP) Law to bind together urban planning activities and regulation; the law is yet to be approved by the Union Parliament. A National Land Use Policy was adopted in 2016 under the National Land Resource Management Central Committee to standardise land-use classifications and practices across Myanmar. In line with this Policy, a National Urban Policy (NUP) framework is being developed to integrate spatially and manage systematically developments across Myanmar. Land developers interested in developing agricultural lands must apply to the Central Board for Farmland Management directed by the Union Head of the Ministry of Agriculture, Livestock and Irrigation (MOALI) to do so.
- Ministry of Natural Resources and Environmental Conservation (MONREC): The Environmental Conservation Department (ECD) of MONREC has ultimate responsibility in the EIA process in Myanmar;

<sup>&</sup>lt;sup>5</sup> SEA of the hydropower sector in Myanmar – resource page accessed from the IFC website at

https://www.ifc.org/wps/wcm/connect/industry\_ext\_content/ifc\_external\_corporate\_site/hydro+advisory/resources/sea+of+the+h ydropower+sector+in+myanmar+resources+page

- Ministry of Industry (MOI): The Directorate of Industrial Supervision and Inspection is the responsible department for the inspection of heavy industries and factories and whether these are in compliance with the regulations;
- Ministry of Electricity and Energy (MOEE): MOEE manages Health, Safety, and Environmental (HSE) issues of power generation operators in Myanmar and encourages operators to establish an HSE Management System and conduct EIAs for their projects;
- Ministry of Construction (MOC): The Department of Buildings is the key responsible government department for the inspection of buildings and infrastructure in Myanmar to ensure sustainability and maintenance of existing facilities.
- Ministry of Agriculture, Livestock and Irrigation (MOALI): The Department of Agriculture, Department of Agricultural Land Management and Statistics, Department of Irrigation and Water Utilization Management, and Department of Rural Development are responsible for land management and livelihood of communities;
- Myanmar Investment Commission (MIC): MIC is a government agency responsible for coordinating with ministries and other state entities to facilitate foreign investment in Myanmar. The MIC is also responsible for granting MIC permits which enable foreign investors to carry out business activities under the Myanmar Investment Law (2016);
- Ministry of Planning, Finance and Industry (MOPFI): The Planning, Finance, and Industry Department is involved in direct communication and coordination with various levels of government agencies for planning related issues;
- Ministry of Transport and Communications (MOTC): The Road Transport Administration Department and Road Transport Department are responsible for the operation and maintenance of major roads;
- Myanmar Port Authority (MPA) and the Directorate of Water Resources and Improvement of River Systems (DWIR): As well as other responsibilities, the MPA and DWIR are responsible for overseeing construction and operation of bridges.
- Yangon Region Government (YRG): YRG is responsible for reporting, planning, supervising projects, and providing public services as directed by the Union Government. YRG is the cabinet of Yangon Region and is responsible for overseeing the development of New Yangon City. A Planning Implementation Committee (PIC) has been set up to facilitate urban planning procedures under the National Comprehensive Development Plan, 2012-2031.
- Yangon City Development Committee (YCDC): The Yangon City Development Committee (YCDC) is the primary authority designated under the City of Yangon Development Law (2018) to implement urban development projects in Yangon City. The Department of City Planning and Land Administration under YCDC manages land administration issues while the Urban Planning Division (UPD) focuses on urban planning. YCDC is the administrative body of Yangon. It is responsible for the city's waste management, business licences and registries, water supply, roads and bridges, and environmental regulations.
- New Yangon Development Company (NYDC): NYDC is 100% owned by the YRG. The objective of NYDC is to create economic growth, homes and jobs. The development of New Yangon City will be primarily based on Public-Private Partnership Models with the private sector playing a major role with equity investments. NYDC (or any other administrative body as decided by the government) will remain under the leadership of Yangon Regional Government and will therefore perform an administration role for the government. It is tasked to develop approximately 20,000 acres of land west of central Yangon in Seikgyi Kanaungto, Twantay, Hlaing Tharyar, and Kyee Myin Daing Townships as a Phase 1 into an urban industrial district that will initiate creation of 2 million jobs. The vision of New Yangon City is to be a safe, smart and clean city that will serve as an example of efficiency, integrity and accountability. NYDC is currently governed by a Board of Directors consisting of five members. The development of the

New Yangon City Phase 1 is managed by an Administrator, which is, currently, NYDC. NYDC operates under its Chairman with three divisions: City Planning and Development, Corporate Development, Finance and Operations. NYDC is thus tasked with designing the Master Plan and its underlying requirements in terms of procurement, traffic, or environmental and social expectations. The Administrator of the existing villages remains under YRG. As the Project develops further, the New Yangon City's Administrator may remain under NYDC, may fall under another entity than NYDC or may be split between different entities.

### 3.2.2 Myanmar Legislation Relevant to the Project

The key laws related to environmental and social issues and hence relevant to the Project are listed in Table 3.1.

	Table 3.1	Myanmar Legislation and Relevance to Phase 1
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The National Environment Policy (2019)         Myanmar Climate Change Policy (2019)         National Comprehensive Development Plan, 2012 – 2031 (2013)         City of Development Law (2018)         The Constitution of the Republic of the Union of Myanmar (2008)         Disaster Management Laws and Rules (2013)         The Environmental Conservation Law (2012)         The Environmental Conservation Rules (2014)         EIA Procedure (2015)         Environmental Quality (Emissions) Guidelines (2015)         The Protection of Biodiversity and Conservation Areas Law (2018)         National Sustainable Development Strategy (2009)         The L and Acquisition Act (1894)
Myanmar Climate Change Policy (2019)         National Comprehensive Development Plan, 2012 – 2031 (2013)         City of Development Law (2018)         The Constitution of the Republic of the Union of Myanmar (2008)         Disaster Management Laws and Rules (2013)         The Environmental Conservation Law (2012)         The Environmental Conservation Rules (2014)         EIA Procedure (2015)         Environmental Quality (Emissions) Guidelines (2015)         The Protection of Biodiversity and Conservation Areas Law (2018)         National Sustainable Development Strategy (2009)         The Land Acquisition Act (1894)
National Comprehensive Development Plan, 2012 – 2031 (2013)         City of Development Law (2018)         The Constitution of the Republic of the Union of Myanmar (2008)         Disaster Management Laws and Rules (2013)         The Environmental Conservation Law (2012)         The Environmental Conservation Rules (2014)         EIA Procedure (2015)         Environmental Quality (Emissions) Guidelines (2015)         The Protection of Biodiversity and Conservation Areas Law (2018)         National Sustainable Development Strategy (2009)         The Land Acquisition Act (1894)
City of Development Law (2018)         The Constitution of the Republic of the Union of Myanmar (2008)         Disaster Management Laws and Rules (2013)         The Environmental Conservation Law (2012)         The Environmental Conservation Rules (2014)         EIA Procedure (2015)         Environmental Quality (Emissions) Guidelines (2015)         The Protection of Biodiversity and Conservation Areas Law (2018)         National Sustainable Development Strategy (2009)         The Land Acquisition Act (1894)
The Constitution of the Republic of the Union of Myanmar (2008)         Disaster Management Laws and Rules (2013)         The Environmental Conservation Law (2012)         The Environmental Conservation Rules (2014)         EIA Procedure (2015)         Environmental Quality (Emissions) Guidelines (2015)         The Protection of Biodiversity and Conservation Areas Law (2018)         National Sustainable Development Strategy (2009)         The Land Acquisition Act (1894)
Disaster Management Laws and Rules (2013)         The Environmental Conservation Law (2012)         The Environmental Conservation Rules (2014)         EIA Procedure (2015)         Environmental Quality (Emissions) Guidelines (2015)         The Protection of Biodiversity and Conservation Areas Law (2018)         National Sustainable Development Strategy (2009)         The Land Acquisition Act (1894)
The Environmental Conservation Law (2012)         The Environmental Conservation Rules (2014)         EIA Procedure (2015)         Environmental Quality (Emissions) Guidelines (2015)         The Protection of Biodiversity and Conservation Areas Law (2018)         National Sustainable Development Strategy (2009)         The L and Acquisition Act (1894)
The Environmental Conservation Rules (2014)         EIA Procedure (2015)         Environmental Quality (Emissions) Guidelines (2015)         The Protection of Biodiversity and Conservation Areas Law (2018)         National Sustainable Development Strategy (2009)         The L and Acquisition Act (1894)
EIA Procedure (2015)         Environmental Quality (Emissions) Guidelines (2015)         The Protection of Biodiversity and Conservation Areas Law (2018)         National Sustainable Development Strategy (2009)         The Land Acquisition Act (1894)
Environmental Quality (Emissions) Guidelines (2015) The Protection of Biodiversity and Conservation Areas Law (2018) National Sustainable Development Strategy (2009) The Land Acquisition Act (1894)
The Protection of Biodiversity and Conservation Areas Law (2018)          National Sustainable Development Strategy (2009)         The Land Acquisition Act (1894)
National Sustainable Development Strategy (2009)
The Land Acquisition Act (1894)
The Farmland Law (2012)
The Farmland Rules (2012)
The Vacant, Fallow and Virgin Lands Management Act (2012)
The Vacant, Fallow and Virgin Lands Management Rules (2012)
The Lower Burma Town and Village lands Act (1898)
The Land Nationalisation Act (1953)
The Protection of Preservation of Cultural Heritage Region Law (1998)
The Protection and Preservation of Antique Objects Law (2015)
The Protection and Preservation of Ancient Monuments Law (2015)
The Public Health Law (1972)
The Prevention and Control of Communicable Diseases Law (1995, revised in 2011)
The Prevention and Control of Communicable Diseases Law (1995, revised in 2011) The Prevention of Hazard from Chemicals and Related Substances Law (2013)
The Prevention and Control of Communicable Diseases Law (1995, revised in 2011)         The Prevention of Hazard from Chemicals and Related Substances Law (2013)         The Business for Ozone Depleting Substances: Notification No.37/2014

The Payment of Wages Law (2016)

Relevant Laws and Regulations
The Factory Act (1951)
The Leave and Holiday Act (1951, partially revised in 2014)
The Labour Organization Law (2011)
The Social Security Law (2012)
The Labour Organization Rule (2012)
The Labour Dispute Settlement Law (2012)
The Employment and Skill Development Law (2013)
The Minimum Wage Law/Rules (2013)
The Export and Import Law (2012)
Myanmar Fire Force Law (2015)
Myanmar Investment Law (2016), Rules (2017)
Motor Vehicle Law (2015)
Law of Protection of the Farmer Rights and Enhancement of their Benefits (2013)
The Highway Law (2000) (amend in 2014, 2015)
The Law Relating to the Use of Road and Bridge (1985) (amend in 2014 and 2015)
Yangon City Development Committee (YCDC) Law (2018)
Yangon Region Building Rules (2015)
Yangon Region Earthquake Preparedness and Response Plan (2019)
The Updated Strategic Urban Development Plan (2018)
National Urban Policy Framework (2016)
National Energy Policy (2014)
National Land Use Policy (2016)

Waste Management Strategy and Action Plan for Myanmar (2017-2030)

Myanmar National Building Code (2016)

### 3.2.3 Myanmar Environmental Quality (Emissions) Guidelines

The Environmental Quality (Emissions) Guidelines (EQEG) were enacted in 2015. These Guidelines provide the basis for regulation and control of emissions and discharges from sector specific projects in order to prevent pollution and protect the environment and public health. The standards relevant to the Phase 1 Development are provided in Table 3.2 to Table 3.9.

## Table 3.2 EQEG Air Emissions Parameters – General (Section 1.2 of EQEG)

Parameter	Unit	Guideline Value (µg/m³)
Nitrogen Dioxide	1 year	40
	1 hour	200
Ozone	8 hour (daily)	100
Particulate Matter (PM <sub>10</sub> ) <sup>a</sup>	1 year	20
	24 hour	50
Particulate Matter (PM <sub>2.5</sub> ) <sup>b</sup>	1 year	10

Parameter	Unit	Guideline Value (μg/m³)
	24 hour	25
Sulphur Dioxide	24 hour	20
	10 minute	500

<sup>a</sup> Particulate matter  $\leqslant$  10 $\mu m$ 

 $^{\text{b}}$  Particulate matter  $\leqslant$  2.5  $\mu m$ 

Table 3.3	EQEG Noise Level Parameters – General (	(Section 1.4 of EQEG)

Receptor	One hour LAeq (dBA) <sup>a</sup>		
	Daytime 07:00 – 22:00 (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	

<sup>a</sup> Equivalent continuous sound level in decibels (at the nearest sensitive receptor)

## Table 3.4EQEG Non-ionized Radiation Emissions – Transmission Lines<br/>(Section 2.2.10 of EQEG)

Frequency	Electric Field (V/m <sup>a</sup> )	Magnetic Field (µT <sup>b</sup> )
50 Hz <sup>c</sup>	5000	100
60 Hz <sup>c</sup>	4150	83

<sup>a</sup> volts per meter; <sup>b</sup> micro tesla; <sup>C</sup> Hertz

## Table 3.5EQEG Wastewater, Storm Water Runoff, Effluent and Sanitary<br/>Discharges – General (Section 1.3 of EQEG)

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Ammonia	mg/l	10
Arsenic	mg/l	0.1
Cadmium	mg/l	0.1
Chemical oxygen demand	mg/l	250
Chlorine (total residual)	mg/l	0.2
Chromium (hexavalent)	mg/l	0.1
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5
Cyanide (free)	mg/l	0.1
Cyanide (total)	mg/l	1

Parameter	Unit	Guideline Value
Fluoride	mg/l	20
Heavy metals (total)	mg/l	10
Iron	mg/l	3.5
Lead	mg/l	0.1
Mercury	mg/l	0.01
Nickel	mg/l	0.5
Oil and grease	mg/l	10
Ph	S.U.a	6-9
Phenols	mg/l	0.5
Selenium	mg/l	0.1
Silver	mg/l	0.5
Sulphide	mg/l	1
Temperature increase	C	<3 <sub>b</sub>
Total coliform bacteria	100 ml	400
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50
Zinc	mg/l	2

<sup>a</sup> Standard unit

<sup>b</sup> At the edge of a scientifically established mixing zone, which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

## Table 3.6EQEG Site Runoff and Effluent Levels – General (Section 1.3 of<br/>EQEG)

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Ammonia	mg/l	10
Arsenic	mg/l	0.1
Cadmium	mg/l	0.1

## Table 3.7EQEG Effluent Levels – Wastewater Treatment Facilities (Section2.5.2 of EQEG)

Parameter	Unit	Guideline Value
5-day Biochemical oxygen demand	mg/l	50
Ammonia	mg/l	10
Arsenic	mg/l	0.1
Cadmium	mg/l	0.1
Chemical oxygen demand	mg/l	250
Chlorine (total residual)	mg/l	0.2
Chromium (hexavalent)	mg/l	0.1
Chromium (total)	mg/l	0.5
Copper	mg/l	0.5
Cyanide (free)	mg/l	0.1
Cyanide (total)	mg/l	1
Fluoride	mg/l	20
Heavy metals (total)	mg/l	10
Iron	mg/l	3.5
Lead	mg/l	0.1
Mercury	mg/l	0.01
Nickel	mg/l	0.5
Oil and grease	mg/l	10
рН	S.U.a	6-9
Phenols	mg/l	0.5
Selenium	mg/l	0.1
Silver	mg/l	0.5
Sulphide	mg/l	1
Temperature increase	C	<3 <sub>b</sub>
Total coliform bacteria	100 ml	400
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50
Zinc	mg/l	2

<sup>a</sup> Standard unit

<sup>b</sup> At the edge of a scientifically established mixing zone, which takes into account ambient water quality, receiving water use, potential receptors and assimilative capacity; when the zone is not defined, use 100 meters from the point of discharge

# Table 3.8EQEG Bio Solids and Sludge Disposal – Wastewater Treatment<br/>Facilities (Section 2.5.2 of EQEG)

Parameter	Unit <sup>a</sup>	Guideline Value
Arsenic	mg/kg	75
Cadmium	mg/kg	85
Chromium (total)	mg/kg	3,000
Copper	mg/kg	4,300
Lead	mg/kg	840
Mercury	mg/kg	57
Molybdenum	mg/kg	75
Nickel	mg/kg	420
Selenium	mg/kg	100
Total coliform bacteria	g <sup>b</sup>	1,000
Zinc	mg/l	7,500

<sup>a</sup> Dry weight

<sup>b</sup> Per gram of total solids (dryweight)

## Table 3.9 EQEG Effluent Levels – Roads

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. <sup>a</sup>	6-9
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids	mg/l	50

<sup>a</sup> Standard unit

## 3.3 Relevant International Regulations and Guidelines

### 3.3.1 International Agreements and Conventions

The relevant international conventions to which Myanmar is a signatory are listed in Table 3.10.

### Table 3.10 Key International Conventions of Relevance to Phase 1

Legislation	Relevance to Phase 1	Ratification Status (in Myanmar)
Vienna Convention for the Protection of the Ozone Layer 1988 and Montreal Protocol on Substances that Deplete the Ozone Layer 1989	The Phase 1 Development activities may use or generate ozone depleting substances.	Accession 16 <sup>th</sup> Sep 1998 (Vienna) & Accession 24 <sup>th</sup> Nov 1993 (Montreal)
Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal	The Phase 1 Development activities may generate hazardous wastes (e.g. used oils).	Entered into force 6 <sup>th</sup> April 2015
United Nations Framework Convention on Climate Change 1992 (UNFCCC) and Kyoto Protocol 1997	The Phase 1 Development activities (during their construction and operation) will form part of Myanmar's total emissions output.	Entered into force 23 <sup>rd</sup> Feb 1995 (UNFCCC) and 16 <sup>th</sup> Feb 2005 (Kyoto Protocol)
United Nations Framework Convention on Climate Change 1992 (UNFCCC) and Paris Agreement 2015	The Phase 1 Development activities (during their construction and operation) will form part of Myanmar's total emissions output.	Signed 22 April 2016, ratified 19 September 2017; Agreement entered into force 4 November 2016
Convention on Biological Diversity 1992 and Myanmar's National Biodiversity Strategy and Action Plan 2015-2020	The Phase 1 Development activities (during their construction and operation) will impact the biodiversity of the area of influence.	Ratified 23 February 1995; Convention entered into force 29 December 1993
Workmen's Compensation (Accidents) Convention 1925	The Phase 1 Development activities (during their construction and operation) have risks to occupational health and safety.	Entered into force 16 February 1956
Workmen's Compensation (Occupational Diseases) Convention 1925 and its Revision 1934	The Phase 1 Development activities (during their construction and operation) have risks to occupational health and safety.	Entered into force 30 Sept 1927; Revision entered in force 17 May 2016
Cartagena Protocol on Biosafety to the Convention on Biological Diversity	The Phase 1 Development activities (during construction and operation) will impact the biodiversity baseline of the Project Area.	Accession 6 January 2015
Nagoya Protocol on access to genetic resources and the fair and equitable sharing of benefits arising from their utilisation to the Convention on Biological diversity	The Phase 1 Development activities (during construction and operation) will impact the biodiversity baseline of the Project Area.	Accession 8 January 2014

Legislation	Relevance to Phase 1	Ratification Status (in Myanmar)
WHO Framework Convention on Tobacco Control	The Phase 1 Development activities (during construction and operation) will have workers who may be smoking at work	Signed on 23 October 2003
Convention on the Elimination of All Forms of Discrimination against Women	The Phase 1 Development activities (during construction and operation) might adversely impact women	Accessed on 27 July 1997.
ILO Forced Labour Convention, 1930 (No.29)	The Phase 1 Development activities (during construction and operation) might pose risk to labour's rights and labour's working conditions	Ratified on 4 March 1955
International Covenant on Economic, Social and Cultural Rights	The Phase 1 Development activities (during construction and operation) might adversely impact social and cultural aspects	Signed on 16 July 2015
United Nations Convention against Corruption	The Phase 1 Development activities (during construction and operation) carry corruption risks	Signed on 5 December 2005

## 3.3.2 Good International Industry Practice Guidelines

NYDC will undertake the SEA and Project activities in a manner guided by good international industry practice (GIIP). Applicable guidelines that have been considered in preparing this SEA as well as each of the individual IEEs/EIAs include:

- International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability (2012);
- IFC Good Practice Note 'Managing Contractors' Environmental and Social Performance' (2017); and
- IFC Environmental, Health and Safety (EHS) guidelines, including:
  - General EHS Guidelines (2007);
  - Environmental, Health, and Safety Guidelines for Toll Roads (2007);
  - Environmental, Health, and Safety Guidelines for Water and Sanitation (2007);
  - Environmental, Health, and Safety Guidelines for Waste Management Facilities (2007); and
  - Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution (2007).

## 4. PROJECT DESCRIPTION

### 4.1 **Project Location**

The development of the New Yangon City Phase 1 is part of a wider planned development of an area allocated to the west of Yangon City, as illustrated in Figure 4.1.

The development of the New Yangon City Phase 1 is captured under a Master Plan development by AECOM on behalf of NYDC with the support of specialist consultants.



Source: NYDC, 2018

## Figure 4.1 Phase 1 & 2 of New Yangon City

Figure 4.2 presents the Project Area (i.e., the Phase 1 Development of the New Yangon City), which is located at the semi-urban to rural area in the Seikgyi-Kanaungto, Twantay, Hlaing Tharyar and Kyee Myin Daing Townships to the West of Yangon. It is separated from the main urban centre of Yangon by the Hlaing River to the East and from the Dala Township by the Twantay Canal to the south.





## 4.2 New Yangon City

### 4.2.1 Vision

Based on extensive background research, data analysis, and multiple stakeholder engagements, four main pillars for the Phase 1 Development have been selected and emphasised as principal enablers for Phase 1 Development to be able to become a desired living community and a business destination where industries and services can provide jobs while promoting sustainable development:

- A Resilient City: A city of robust eco-system that creates a vibrant and sustainable development;
- An Intelligent City: To ensure the future growth and sustainability of population by introducing smart elements;
- A Green City: To create lifestyle, business, community and industry nested in nature; and
- **People's City**: An inviting city that celebrates its rich contents and depth that bring citizen pride.

The vision is further developed into key principles that are translated into physical moves that have allowed the formulation of the spatial plan:

- Nature
  - Enhance flood protection and disaster management;
  - Tech based management of resources to enhance sustainability;
  - Provide ample and accessible green spaces for residents; and
  - Enhance liveability with active green spaces.
- Culture
  - Foster expressions of local culture in space and architecture;
  - Program spaces to showcase cultural vibrancy;
  - Integrate culture with the public realm and daily activities; and
  - Allow flexibility in spaces for multiple expressions and interpretations.
- Great Places
  - Create an identity for districts without compromising on flexibility;
  - Practice land-banking for unlocking future value;
  - Enhance quality of spaces with an active public realm; and
  - Promote diversity and inclusion in design of public spaces.
- Smart City
  - Enable timely responses through data collection and monitoring;
  - Create backbone infrastructure for command, control and monitoring;
  - Allow integration of smart enablers with the public realm for maximum outreach; and
  - Foster a culture of feedback loops to build confidence in systems.
- Industrial Ecosystem
  - Enable diversity and incremental growth towards higher-order industries;
  - Engage urban tech to increase efficiency and attract businesses;
  - Enforce protection of environment at all costs; and

- Focus on continued skill development.
- Connected Public Realm
  - Cluster around and densify transit corridors to increase usage;

- Allow for strong links between land use and transportation with Transit Oriented Developments;

- Promote public transit, discourage private modes through usage fees; and
- Aim for user convenience through multiple options.
- New Development Model
  - Enhance attractiveness through private sector participation;
  - Foster complementary relationships between different sectors of economy;
  - Incentivise development of public infrastructure and sustainability measures; and
  - Foster citizen participation and good governance.
- Catalyst of Growth
  - Safeguard future expansion potential to absorb changes;
  - Promote synergetic and planned growth of the city through analysis and monitoring;
  - Nurture and protect the natural environment for future generations; and
  - Allow decision-making through participation for greater ownership and pride in the city.

### 4.2.2 Analysis of Masterplan Alternatives

The overall vision and physical framework of the New Yangon City were put together to develop spatial planning options. The main considerations were: relationship with the existing city, future direction of development, location of city centre/major commercial node, location of industrial area, and heart of the city (AECOM, 2019).

Three alternatives were then tested against a set of KPIs (globally adopted benchmarks) using an analytical tool which considers connected neighbourhoods, workforce environment, sustainable urban structure and green infrastructure. The preferred option was selected as best performing among the alternatives. The indicators, scoring criterion, and benchmarks are summarised in Table 4.1.

Indic	ators	Scoring Criterion	Benchmark
Connected Neighbourhoods			
L1	Access to Transit	Scores 100 if at least 50% residents live within 800m from a Mass Rapid Transit or Bus Rapid Transit station	Have at least 50% within 800m (Leadership in Energy and Environmental Design for Neighbourhood Development)
L2	Access to Bicycle Network	Scores 100 if all residents live within 250m from a bicycle network	Have all residents live close to a bicycle network (Aspirational)
L3	Access to Parks and Open Space	Scores 100 if at least 90% residents live within 800m from a city park	Have at least 90% within 400m (Leadership in Energy and

## Table 4.1Indicators, Scoring Criterion, and Benchmarks to AssessPlanning Options

Indic	ators	Scoring Criterion	Benchmark
			Environmental Design for Neighbourhood Development)
L4	Access to Waterfront	Scores 100 if at least half of residents live within 800m from an accessible waterfront	Have half people live close to an accessible waterfront (Aspirational)
Work	force Environment	1	1
E1	Jobs near Transit	Scores 100 if at least 50% employees work within 800m from a Mass Rapid Transit or Bus Rapid Transit station	Have at least 50% within 800m (Leadership in Energy and Environmental Design for Neighbourhood Development)
E2	Jobs Closeness	Scores 100 if average job closeness is as low as 5.0 km	Have average commute distance less than 5.0 km (Aspirational)
E3	Job Housing Balance	Scores 100 if job-housing ration is between 1.3 to 1.7	1.3-1.7 (American Planning Association)
Sust	ainable Urban Structu	ire	
U1	Roadway Capacity per Capita	Scores 100 if major roadway capacity per population reaches 15.0	Have adequate roadway capacity for New Yangon City (aspirational)
U2	Transit Oriented Development Land Use Diversity	Scores 100 if average land use diversity index reaches 0.90 in Transit Oriented Development	Promote mixed use development around Transit Oriented Development (Aspirational)
Gree	n Infrastructure	Γ	
G1	Ecosystem Connectivity	Scores 100 if ecosystem connectivity index reaches 100%	Have a fully connected ecosystem for New Yangon City
G2	Park Space per Capita	Scores 100 if park space per thousand population reaches 1.0 hectare	Provide sufficient park space for residents (Aspirational)
G3	Natural Drainage	Scores 100 if natural drainage of canal system reaches 25 miles	Have at least 75% of existing canal system of New Yangon City area (Aspirational)

Source: AECOM, 2019

## 4.2.3 Preferred Option

Based on the indicators, scoring criterion, and benchmarks shown in Table 4.1, among three alternatives, Option 2 performed the best (Figure 4.3), which was further developed in the following details:

- Floor area ratio and density distribution;
- The Green-Blue Vision (Green Hierarchy, Ecology Network, Ecology Improvement): a hierarchy of city level to local green areas is proposed that can together provide around 12 14 square metre (sqm) of green area per resident (10sqm at masterplan level and 2 4 sqm at local level);

- Transit Oriented Development;
- Character District Cultural Corridor (Celebrating the Culture), Eco-link Corridor, Westside Gateway, City Centre, Concorde Plaza;
- Industrial Ecosystem Industry Value Chains, Industry Service Corridors; and
- Planned Unit Development Create Self Sustained Communities, Social Infrastructure Distribution.

Table 4.2 summarises the standard for facility distribution:

Table 4.2	Standard for Facility Distribution	

Facilities	Distribution
Primary School	1 per 15,000 persons
High / Middle School	1 per 25,000 persons
College / University	1 per 90,000 persons
Polyclinic	1 per 25,000 persons
Hospital	40 beds per 10,000 population
Wet Market	1 per 20,000 persons
Religious Sites	1 per 40,000 persons

Source: AECOM, 2019



Source: AECOM, 2019



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## 4.3 **Project Components**

Figure 4.4 shows the various main components of the Phase 1 Development, including existing villages, planned resettlement areas, existing main roads, planned new and expanded main roads, planned new green areas and water grid, and planned new infrastructure projects.



## Figure 4.4 Master Plan for New Yangon City Phase 1

The Project Area is planned to be 88.3 sq.km. The masterplan includes residential areas of 30.93 sq.km, commercial areas of 6.41 sq.km, industrial areas of 22.37 sq.km, transport and logistics of 1.51 sq.km, green spaces of 12.01 sq.km, villages of 11.97 sq.km, civic amenities of 2.33 sq.km, and utilities (physical infrastructure) of 0.77 sq.km. The Project Area will consist of:

- Existing villages to remain;
- Five new resettlement areas, with residential, commercial, office buildings, and supporting public and social infrastructure (administrative, schools, sports, healthcare, etc.), etc.;
- New green urban areas;
- New / rechannelled surface water reserves (ponds, creaks, etc.);
- Underlying transport (railways, tramways, footpaths, cycle paths, etc.) and connectivity infrastructure (inter-modal hubs, telecommunications network, etc.);
- Administrative areas (including fire stations, police stations and government administrative quarter); and
- Connectivity to outside existing utility systems and infrastructure, and to goods, services and people.

The Phase 1 Development is also composed of various Project main components that are being progressed as dedicated IEEs/EIAs:

Bridges:

- Bridge 1: connecting Kyee Myin Daing Township (near Bagaya Road and Kyee Myin Daing Kanner Junction) to the Project Area; and,

- Bridge 2: connecting Hlaing Tharyar Township to the Project Area.
- Roads:

- Permanent Auxiliary Support Infrastructure: Road 1, Road 2, Road 3, Sub-arterial roads, Collector roads, and

- Storm water network;
- Water:
  - Water treatment plant;
  - Raw water pipeline;
  - Treated water distribution lines; and
  - Water intake point;
- Wastewater:
  - Wastewater pumping stations;
  - Wastewater pipe network;
  - Sewage water tanks; and
  - Wastewater treatment plant and its associated subsidiary facilities;
- Power:
  - Transformer substation (one 230 kV, two 66 kV) and switching station (one 33 kV);
  - Main Transmission lines (from National Grid / Independent Power Producer (IPP) to 230 kV substation); and
  - Distribution lines (internal transmission lines) including 66 kV, 33 kV and 11 kV lines;
- Industrial Zone:
  - Area for industrial facilities covering approximately 13 sq.km.

The utilities supplies (potable water, wastewater, energy, solid waste) are primarily designed for new residents and users of New Yangon City. The existing villages fall outside of New Yangon City area. However, the existing villages can communicate with relevant government authorities and investors to obtain future supply.

Any other future development may require to be assessed under an IEE or EIA in accordance with Myanmar's EIA Procedure (2015). As part of these future assessments, the principles and objectives laid out in the SEA ESMF are expected to be considered.

#### 4.4 Investment

Infrastructure development lies at the core of economic growth, which in turn leads to investment, job creation, and ultimately poverty reduction. Myanmar lacks the necessary public funding to meet its infrastructure needs. Therefore, NYDC has chosen the preferred path of building a new city through the participation of the private sector as long-term equity investors. The goal of NYDC is to build infrastructure without assuming debts. The project will create partnerships between the public and private sectors with profit sharing. For the initial infrastructure work, NYDC will invest 8% (through land) and the selected investor will invest 92% (cost of construction of infrastructure). For profit sharing, this will increase incrementally from 5% at the outset until when the investor has made back their investment, when profit sharing will reach 25%.

#### 4.5 Land Acquisition

The land acquisition process for the Phase 1 Development is being managed by the Yangon Regional Government. The land acquisition process will trigger both economic displacement (from farmers and other land users) and physical displacement of a limited number of households and businesses (specifically for Phase 1 Stage 1, only in the area required for Bridge 1 in Kyee Myin Daing Township).

The policy currently adopted by the government mandates returning 20% of original land holding as net serviced and developable land. "Resettlement Areas" will be identified in New Yangon City and will be sub-divided based on plot ownership. The net plot requirement will be grossed up to include additional land required for a functioning township such as roads, community facilities / small scale commercial and green area.

NYDC will assist YRG in this process. More information on resettlement is provided in Appendix B.

#### 4.6 Waste Management

Building a new city requires a full complement of new hard and soft infrastructure, including for waste management. In February 2019, NYDC invited interested companies to begin the first step of the 'NYDC Challenge' for several infrastructure projects including municipal waste disposal. This included domestic, commercial, and industrial waste management. Municipal waste disposal proposals are requested to, in particular, take account of the Waste Management Strategy and Action Plan for Myanmar (2017-2030).

#### 4.7 Water Resources

An estimate of 450,000 m<sup>3</sup>/day will be used for water intake in New Yangon City Phase 1. For the initial stages this will be taken from the Toe River and in the future alternative sources will be considered. For example, the Pan Hlaing Sluice Project aims to provide better quality (less saline) water in the Pan Hlaing River. If this project goes ahead (in conjunction with the Hlaing Thar Yar Waste Water Project which aims to improve the industrial and domestic waste water in the area) then NYDC would consider water intake from Pan Hlaing River.

## 4.8 Corporate Social Responsibility (CSR)

NYDC will work closely with existing government partners on issues and policies related to land management, labour, education, government administration procedures and all related regulations. NYDC will encourage investors to set aside a percentage of profit to go towards CSR activities.

## 4.9 Relevant Studies of the New Yangon City Phase 1

Three studies have been conducted to assess the flood risk, traffic and transport, and socio-economy respectively in the New Yangon City Phase 1. The SEA report has taken these three studies into account to propose the ESMF and SEA framework objectives and indicators.

#### 4.9.1 Flood Risk Assessment

The Strategic Flood Risk Assessment (SFRA) was conducted by Royal Haskoning DHV. This work commenced in March 2018 and concluded in May 2019 with the publication of the Executive Summary on NYDC's website (https://www.nydc.com.mm/flood-risk-assessment-executive-summary/).

To understand what drives flooding in New Yangon, a baseline assessment was conducted at the start of the SFRA which described the topographically low-lying areas in the New Yangon City and distinguished two types of water systems that could cause flooding:

- Fluvial-Coastal System Hlaing River, Pan Hlaing River, and Twantay Canal. High water levels are caused by the strong tide and storm surges as well as sea level rise expected in the future. During monsoon season, water levels also increase in the system as the Ayeyarwady River discharges into the fluvial-coastal system surrounding the New Yangon City.
- Pluvial System New Yangon City will receive large amounts of rainfall with high intensities during the monsoon season, which need to be managed appropriately to drain sufficiently to avoid pluvial flooding in a developing urban setting.

Extreme situations for the New Yangon City will be a combination of the above fluvial-coastal-pluvial systems. A Flood Hazard Assessment quantified the severity of potential floods in the New Yangon City and was conducted for the different flood sources. 10-year, 50-year, 100-year, and 200-year flood return periods were analysed. It was concluded that the New Yangon City is prone to all three sources of flooding and a significant flood hazard is currently present at the Project Area, mainly due to the low-lying ground elevations, and that the central part of the Project Area is lower than its perimeter. Natural drainage of flood waters to the adjacent rivers and canals is therefore limited, so sufficient storage and drainage is required to prevent any pluvial flooding. A further detailed drainage study was recommended to identify the most appropriate drainage infrastructure, to define its dimensions (of e.g. flood gates, water control structures, canals and pumps) and the most effective balance between discharge pumping capacity and retention volume.

The Flood Risk Assessment was based on the land use of the conceptual masterplan of Phase 1. Three types of risk were quantified:

- Economic Risk;
- Personal Risk; and
- Fatality Risk.

It was concluded that the optimum protection level for the New Yangon City, from a risk management point of view, a protection level of 100-years is required at minimum.

The SFRA presented recommendations towards flood mitigation measures for flood risk reduction. A multi-layer safety approach recommended:

Prevention – river and coastal flood protection via a ring dyke system. This includes a single ring dyke along the riverfronts surrounding the entire plot of New Yangon City. Additional internal ring

dykes which are elevated main arterial roads, also function as an evacuation route during the flood events.

Spatial Planning and Zoning

- Sub-catchments – proposed platform and building levels will form sub-catchments within the New Yangon City, which will help control fluvial runoff and drainage. Layout and phasing of flood compartmentation will need iterations and optimization with master planning and the financial investment strategy.

- Water Sensitive Urban Design – this integrates the entire water cycle (i.e. management of storm water, ground water, wastewater, and water supply) into the urban design. This enables developers to create more liveable, healthier, and eco-friendlier cities. The concept of "delay, store, drain" will help reduce flood risk from pluvial hazards. The concept masterplan proposes water control structure (control gates), drainage design criteria (streams and drainage channels), and space for temporal storage of drainage water (retention ponds).

- Emergency Response and Resilience for residual risk, non-structural measures are recommended, such as:
  - Evacuation Routes including elevated roads;
  - Flood Early Warning System using technology and community awareness;
  - Integrated Flood Risk Management close inter-governmental relationships; and
  - Community Awareness campaigns, evacuation centres.

The SFRA concludes that the New Yangon City is prone to all three sources of flood (coastal, fluvial, and pluvial) and this can be mitigated via a multilayer approach of prevention, spatial planning and zoning, and emergency response and resilience. Alterations and optimisations should be made for the flood protection measures in the next design phase of the New Yangon City.

## 4.9.2 Traffic and Transport Study

The Traffic and Transport Study (TTS) was conducted by a team led by Oriental Consultants. This work commenced in August 2018 and concluded in May 2019 with the publication of the Executive Summary on NYDC's website (https://www.nydc.com.mm/traffic-transport-study-executive-summary/).

The masterplan for New Yangon City lays out four pillars for the development of the city and the TTS sets out by providing corresponding guiding principles for transport planning:

- Integrated and low-carbon transport;
- Innovation in transport technology;
- People-centred transport mobility; and
- World class transport infrastructure and services.

The TTS sets out transportation system objective that "this transportation plan targets developing a quality public transit system, safe and effective pedestrian and bicycle facilities that are well-integrated with transit, and a road system that meets the needs of moving people and goods". The following key performance indicators (KPIs) are proposed (Table 4.3).

ltem	KPI	KPI Description	KPI Target
1	Limited Personal Auto Use	Car use by New Yangon City residents for daily use (against all mechanized modes of transport).	Less than 20%

Table 4.3KPIs of Transportation System

ltem	KPI	KPI Description	KPI Target
2	Motorcycle Ban	Use of motorcycle for daily activities (weekdays) in New Yangon City is restricted (same as parts of Yangon City).	0% on weekdays
3	Traffic Congestion	Average peak hour volume to road capacity ratio of traffic (V/C ratio) on arterial and sub-arterial roadways in New Yangon City.	< 1.0
4	Public Transit Service Coverage	60% of New Yangon City residents can access transit on foot within 15 minutes of a mass rapid transit (MRT) station or 10 minutes of a secondary transit station.	60%
5	Public Transit Mode Share	70% or more of total trips are made by public modes of transport.	70% or more

Source: Oriental Consultants, 2019

The TTS provides eight strategies to achieve the following objectives:

- 1. **Integrated Land Use:** Design a land use plan that creates dense, mixed-use communities centred around public transportation hubs.
- 2. **High-Quality Public Transportation:** Develop world class public transport infrastructure and services using innovative and smart technology:
  - A primary transit network with two mass rapid transit lines;
  - A secondary transit network of five bus rapid transit (BRT) lines; and

- A tertiary public transit system of conventional YBS bus routes, supplemented by limited express bus lines serving the city.

The walk sheds (walking times) of the transit network were analysed to ensure compliance with KPI and the total coverage ratio of New Yangon City is 80.4% (residents can access transit on foot within 15 minutes of an mass rapid transit (MRT) station or 10 minutes of a secondary transit station).

The TTS recommended multi-modal facilities for Phase 1 New Yangon City that are summarised in Table 4.4.

Access Mode	MRT Stations	BRT Stations
Walk	High-quality footpaths surrounding station access escalators, elevators) to provide barrier-free acces	points with appropriate facilities (ramps, s for users of all abilities.
Bus	Dedicated bus transfer stops on MRTaligning streets and adjacent cross streets.	Dedicated bus transfer stops on adjacent cross streets.
Bicycle	Dedicated space for up to 2,000 bicycles (~4,000m <sup>2</sup> ) within 300 m of stations. Two to four bike share stations within 200 m of stations.	Dedicated space for up to 750 bicycles (~1,500 m <sup>2</sup> ) within 300 m of stations. One to two bike share stations within 200m of stations.
Kiss-and-Ride	Dedicated off-street kiss-and-ride drop off facilities within 100 m of stations.	Designated curb space on adjacent streets for kiss-and-ride drop offs.
Park-and-Ride	Space for approximately 2,000 cars at strategic station locations.	Space for approximately 1,500 cars at strategic station locations.

#### Table 4.4 Suggested Multi-modal Facilities for Phase 1 New Yangon City

Source: Oriental Consultants, 2019

3. **Road Network Hierarchy and Design:** Develop arterial road systems and corresponding roadbased public transport services in New Yangon City in a hierarchical manner for high-level mobility and accessibility.

In order to facilitate high-level mobility and connectivity for road-based public transport, freight and private vehicles, a hierarchy of five roadway classifications was identified for New Yangon City:

- Expressway – Roadways designed for high speed (100 kilometre per hour (kph)) with access control. The Expressway is the planned Outer Ring Road which is slated to make up the western boundary of New Yangon City;

- Arterials – Defined as roadways designed for mobility across regions or states, focused on mobility, generally with six vehicle lanes and with a design speed of 80 kph;

- Sub-Arterials – Defined as streets which focus on mobility generally with four vehicle lanes within regions with a design speed of 70 kph;

- Collector Streets – Defined as streets focused on accessibility, they typically have four vehicle lanes and a design speed of 60 kph; and

- Local Streets – Defined as streets where the focus is on accessibility, they typically have two vehicles lanes and are designed for a speed of 50 kph.

4. **Regional Connectivity:** Develop seamless transport networks and services connecting existing and new urban centres in Yangon with new clusters of activity in New Yangon City.

The results of the transportation model suggest that to meet future travel demand between the New Yangon City and the surrounding area, a total of 12 connections across the three bodies of water may be necessary. The timing of connection development was developed showing the number of vehicle lanes and short-term, medium-term, and long-term priorities.

- 5. Safe and High-Quality Pedestrian and Bicycle Facilities: Design optimal pedestrian and bicycling networks which maximize connectivity to transit and make walking and bicycling convenient and enjoyable. The primary recommendation for bicycling infrastructure in New Yangon City is to adopt a policy of installing protected bike lanes on all arterial, sub-arterial and collector streets.
- 6. **Shared-Mobility Choices:** Encourage shared mobility alternatives such as bike share, car sharing, and transportation network companies using advanced smart technologies to reduce car ownership and increase walking, biking, and transit use.
- 7. **Transportation Demand Management (TDM):** Discourage the use of personal cars for daily trips such as commuting through transportation demand management (TDM) strategies including area pricing, and parking management in New Yangon City's commercial and industrial areas. Limit the use of motorbikes in New Yangon City by gradually transitioning to a daytime, weekday, ban on motorbike use throughout the city.
- 8. **Goods Movement:** Provide road-based freight transport routes for efficient and economical goods transport to support industry and the residential population.

The TTS also included a Traffic Impact Assessment which evaluated the traffic impacts and provided mitigation measures at target intersections to enhance driver behaviour and to ease traffic congestion.

Parking will be provided throughout the New Yangon City. The minimum off-street car parking requirements are provided in Table 4.5.

Floor Usage*		Standard Minimum Carpark Requirements	Minimum Two Wheeler Parking Requirements	Minimum Service Vehicle Parking Requirements
Residential	Non-Affordable Housing	1 lot per 200 sqm gross floor area (GFA)	1 lot per unit	N/A
	Affordable Housing	1 lot per 40 units	1 lot per unit	N/A
Commercial	Office	1 lot per 200 sqm GFA	1 lot per 100 sqm GFA	Once space for garbage truck at each collection point
	Market, Shopping Centre, Retail	1 lot per 100 sqm GFA	1 lot per 100 sqm GFA	One space per 8,000 sqm GFA for loading / unloading
	Food and Beverage	1 lot per 50 sqm GFA plus 20%	1 lot per 100 sqm GFA	Space to be allocated for one service
	Hotel	1 lot per 200 sqm GFA plus 20%	1 lot per 100 sqm GFA	One space per 8,000 sqm GFA for loading / unloading
Industrial	Light Industry	<ol> <li>1 lot per 300 sqm GFA industry floor area</li> <li>1 lot 200 sqm GFA of administrative corporative floor area</li> </ol>	1 space per 100 sqm of usable area	One space per 3,000 sqm GFA for loading / unloading
	Heavy Industry	<ul> <li>1 lot per 1,000 sqm GFA of industry floor area</li> <li>1 lot per 200 sqm GFA of administrative and corporate floor area</li> </ul>	1 space per 500 sqm of usable area	One space per 3,000 sqm GFA for loading / unloading
Port and Logis	tics	<ol> <li>lot per 5,000 sqm of site area</li> <li>lot per 200 sqm GFA of administrative and corporate floor area</li> </ol>	1 space per 500 sqm of usable area	-

#### Table 4.5 **Off-Street Parking Requirements**

\* Requirements for other usage subject to review and approval by the authority on case-to-case basis Source: AECOM, 2019

#### 4.9.3 Socio-Economic Masterplan

The Socio Economic Master Plan (SEMP) was conducted by McKinsey. The SEMP Visioning Workshop was held on 24<sup>th</sup> March 2018 and the Final Presentation was held on 6<sup>th</sup> July 2018. All key stakeholders were invited to these events. The SEMP was concluded in September 2018 with the publication of the Executive Summary on NYDC's website (https://www.nydc.com.mm/socioeconomic-master-plan/). The SEMP comprises the following 13 interconnected elements which together form an integrated plan:

- Vision for New Yangon;
- Economic analysis and development of a sector strategy;
- Job creation plan;
- Human capital development plan;
- Infrastructure plan highlighting needs and priorities;
- Environmental sustainability plan;
- Strategy for managing urbanisation;
- Optimal asset mix;
- Fast-tracking and incentivising development of industrial corridor;
- Risk register and risk management plan;
- Delivery and implementation plan;
- Governance; and
- Financial plan.

The Vision for New Yangon City was determined to be "Productive City, Liveable City" – a city that will be Myanmar's new economic engine, while ensuring an inclusive, green and highly liveable experience for its residents. Several guiding principles emerged:

- Economic Growth:
  - Choose and promote development of the right sectors in which the city and country have competitive advantage; and
  - Put in place the right policies, incentives, and enablers to attract investment.
- Liveability:
  - City liveability helps to create jobs; and
  - City liveability has a direct impact on the quality of life of residents.
- Infrastructure:
  - Build for flexibility; and
  - Regional connectivity is important to stimulate growth.

Implementation guidelines and aspirational KPIs were developed and these are summarised in Table 4.6.

Guiding Principles	Aspirational S	Aspirational SEMP KPIs						
Economic Growth	Job Creation	Phase 1 will support up to 600-900,000 jobs. This is 400-600,000 jobs in New Yangon and 200-300,000 supply chain jobs in Myanmar.						
Liveability Mobility		Efficient and seamless public transportation system. 100% of the population will have access to multi-modal public transport. Parallel focus on walkability.						
	Health	For a robust healthcare system, New Yangon will aim to have up to 14 hospital beds per 1,000 people in line with international best practices. The city will target 80 years of life expectancy for its residents. Proper drainage and sanitation infrastructure will be established.						

#### Table 4.6 Implementation Guidelines and Aspirational SEMP KPIs

Guiding Principles	Aspirational S	EMP KPIs
	Environment	Up to 30% open spaces (filled with "green and blue") and recreational facilities to encourage healthy living and social integration. Environmental policies and guidelines will be drafted to build and sustain a "green city".
	Society	<ul><li>High quality education with fewer than 25 students per classroom.</li><li>Safety will be paramount, with a target of lowering crime rate to under 6 crimes per thousand people.</li><li>Affordable housing will be made a priority.</li></ul>
	Connectivity	Aim to be digitally connected by enabling 100% access to Wi-Fi in public spaces across the city and providing internet access to 100% of homes.
Infrastructure	Social Infrastructure	Integrated community hubs with residents able to access schools, hospitals and other civic amenities and public services, in addition to shopping, leisure and sporting facilities, within a 10-minute commute from their homes.
	Transport	New Yangon will aim to be well-connected within the city as well as across the river to Yangon. Connectivity within the city will be via electrically operated trams and/or (electric) buses, while connectivity to Yangon will be established via rail and/or bus in the mid to long term. The City will be walkable, with a target of providing all roads with foot paths and green canopy coverage.
	Utilities	New Yangon aspires to ensure 100% access to clean water and 100% treatment of wastewater before discharge. New Yangon will aim to provide 100% access to electricity with more than 95% power-grid reliability and an aspiration of meeting 20% of power needs with renewable (solar) energy.
	Smart City	Deploy pragmatic technology solutions for the wellbeing of its citizens. 100% CCTV coverage of public areas, citizen engagement apps, command and control centres.

Source: McKinsey, 2018

Many of these targets represent a significant step up from the current situation in Yangon and the rest of Myanmar. It is recognised that some of the target KPIs may be challenging to achieve in the short to medium term.

The SEMP's KPIs and benchmarks have been formulated to set the highest aspirations not just for New Yangon, but for the whole country as is develops. The SEMP formed the basis of the Masterplan which tested and developed the recommendations in a detailed context.

## 5. DESCRIPTION OF THE SURROUNDING ENVIRONMENT

This section provides the summary of the physical, biological, and social environment of the New Yangon City Phase 1 Development and its surrounding environment. The information provided is based on primary data collected for the Project from February to March 2019 as well as a review of published information provided by NYDC and from ERM's in-house library.

The purpose of reviewing the baseline conditions is to present an understanding of the potential environmental and social sensitivities of the Study Area. The full baseline section is included in **Appendix C** and a summary is provided below.

## 5.1 Setting the Study Limits

The **Project Area** is defined as the Phase 1 Master Plan, located in a semi-urban to rural area in Seikgyi Kanaungto, Twantay, Hlaing Tharyar and Kyee Myin Daing Townships to the West of Yangon.

This section presents the physical, environmental, socio-economic, cultural and visual characteristics of the **Study Area**. The **Study Area** is defined as the wider area in which the environmental and social conditions are evaluated with the sources of impact, in order to determine interactions and the magnitude and significance of potential impacts resulting from the Project.

For this Project, the **Study Area** is defined as a 2 km buffer around the whole New Yangon City Phase 1 Development. **Area of Influence** (AOI) is defined as the village tracts, wards and townships within or neighbouring the Project Area. Figure 5.1 shows the location of Phase 1 New Yangon City Area, Study Area and Area of Influence.



Figure 5.1 Location of Phase 1 New Yangon City Area, Study Area and Area of Influence

## 5.2 Physical and Environmental Baseline

The primary baseline survey was designed to cover the whole of the Phase 1 Development and includes surveys for air, noise, soil, ground water, surface water, and terrestrial and aquatic biodiversity. The details on survey locations and environmental survey results are provided in **Appendix D**.

## 5.2.1 Climate

The weather and climate of Myanmar are primarily influenced by the northeast and the southwest monsoons and the short transitional periods between them. The southwest monsoon (June to September) is characterised by extensive cloud cover, light rain almost daily, interspersed with rainsqualls or thunderstorms. The northeast monsoon (December to April) brings less cloud, scant rainfall, mild temperatures and lower humidity during winter (Suwannathatsa, et al, 2012).

The spring and autumn transition periods between the monsoons (April and May, October and November) are generally hot with very variable weather and heavy squalls. The transition periods are governed by the Inter-Tropical Convergence Zone (ITCZ), which separates the main wind streams of the northern and southern hemispheres. The ITCZ moves seasonally over the area (northwards in spring and southwards in autumn), with no well-defined weather pattern (Suwannathatsa, et al, 2012).

In Yangon, as with Myanmar in general, there is less rainfall in summer. The average maximum temperature is 29°C while average annual rainfall is 2,378 mm. The driest month is January, with 3 mm of rainfall and June is the wettest month with an average of 516 mm. The warmest month is April, with an average temperature of 30°C. January has the lowest average temperature of the year; 25 °C. During the year, the average temperatures vary by 5.5 °C (Climate Data Website, 2018).

## 5.2.2 Ambient Air Quality

 $NO_2$  and  $SO_2$  were sampled in 27 locations, and  $PM_{2.5}$  and  $PM_{10}$  were sampled in 18 locations in the Study Area at sensitive receptors, such as households. For ambient air quality, none of the values for  $NO_2$  exceeded the World Health Organisation (WHO) guidelines for human health.  $SO_2$  exceeded the WHO guideline for agriculture in one location; a monastery near Lay Eain Village, Twantay Township. The rest of the locations fall in the standards of WHO/EU Annual Mean Air Quality Critical Level (Agriculture). For  $PM_{2.5}$  and  $PM_{10}$ , the data were compared to the WHO standards for Human Health. There were exceedances of both  $PM_{2.5}$  and  $PM_{10}$  in all of the Townships surveyed except six out of the 18 locations. The results show that there are increased particulates in the air, which is most likely caused by climatic conditions at the time of the survey (the end of the dry season usually means increases in dust). Many of the surveyed locations were at houses close to a main road where vehicle use can also cause elevation of dust on the dry roads.

## 5.2.3 Ambient Noise

Noise levels were sampled in 27 locations in the Study Area at sensitive receptors, such as households. The survey indicated that ambient noise levels at many locations exceeded the IFC noise level guidelines (for residents). Ten out of 27 locations for day time and 15 out of 27 locations for night time exceeded the standard value by over 5db, whilst, only five out of 27 locations during day time did not exceed the standard. Based on these results, half of the surveyed area is over the acceptable noise level. It is likely that this noise was generated from private generators, loudspeakers, automatic farm machinery, and activities from vehicles or motorbikes and residential houses.

## 5.2.4 Soil Quality

Out of 24 sampling locations, one location (Seik Kan Thar Park, in between Kyee Myin Daing Strand Road and Yangon River, in Kyee Myin Daing Township) exceeded the Food and Agriculture Organization of the United Nations (FAO) Soil Bulletin 65 and the Dutch Standard, for Sulphide only.

## 5.2.5 Water Resources

Groundwater quality was sampled in 24 locations in the Study Area (i.e., wells in local villages). The results analysis was compared to the WHO Drinking Water Standards and Myanmar National Drinking Water Quality Standards (DWQS).

The groundwater samples met the WHO Drinking Water Standards, except for five locations for which the pH values were outside the recommended range (i.e., Obo ward, Kyee Myin Daing Township, Ah Lat Chaung village, Kyee Mying Daing Township, Kone village, Twantay Township, Wa Yon Seik village, Twantay Township, and Kan Gon village, Twantay Township) and one occurrence where arsenic level exceeds both WHO and National (DWQS) at Ka Lauk Ka Lu village, Twantay Township.

The majority of the sampling points exceeded the National DWQS for ammonia (as N) and chloride, while more than half of the sampling points exceed the standard for sulphide (as S2). Despite the exceedances, ammonia (as N) and chloride are not of health concern for drinking water (WHO, 2017). The elevated levels of sulphide (as S2) only slightly exceeded the standards.

Surface water was sampled in 24 locations in rivers, creeks, streams and ponds within the Study Area. The results analysis were compared to the WHO Drinking Water and Myanmar National Drinking Water Quality Standards (DWQS). None of the surface water sampling points exceeded the WHO standard; however, most of the sampling points exceed the National DWQS's chloride levels. Despite the exceedances, chloride is not of health concern for drinking water (WHO, 2017).

## 5.2.6 Natural Hazards

Myanmar is exposed to multiple natural hazards including cyclones, earthquakes, and flooding. These are discussed in the following sections.

#### 5.2.6.1 Storms and Cyclones

Gale force winds (17.2 ms<sup>-1</sup> or over) are mainly associated with local rainsqualls and with severe tropical storms or cyclones. The threat of cyclones with winds above 32.7 ms<sup>-1</sup> affects different areas at different times of the year affecting all areas, though the major tracks do not pass over the Andaman Sea (OCHA, 2011). Cyclones are most frequent from mid-May to early December.

#### 5.2.6.2 Flooding

Areas within the New Yangon City are prone to flooding due to the low elevation relative to its surroundings. Pluvial flood can occur due to runoff to low lying areas with limited drainage capacity. Fluvial flooding can occur when the surroundings are lower than the water in the surrounding rivers or canals (Royal Haskoning DHV, 2019).

The average tidal range of the Yangon River is about 6 m at spring tide and 3 m at neap tide. Modelling of the discharge of Yangon River indicates discharges ranging from <500 m<sup>3</sup>/s in April to approximately 7,000 m<sup>3</sup>/s in August, with tidal water level variations of around 1 to 6 m based on water level measurements at Monkey Point located downstream of the Study Area (De Koning and Janssen, 2015). In the Ayeyarwady Delta, which includes the Yangon River, drainage, salt intrusion, and flood protection are key concerns (EO Earth Website, 2016).

Two main forces dominate the Yangon River system that can result in fluvial floods (Royal Haskoning DHV, 2019):

- Increased water levels from the sea: there is a strong tide from the Gulf of Martaban. The spring tide range is approximately 5.4 m in the Hlaing River, and the neap tide range is approximately 2 m. In addition, storm surges can increase offshore water levels.
- Increased discharges during the monsoon period: the Irrawaddy River feeds the Yangon River with rainfall from the Irrawaddy River Basin and water levels increase by approximately 0.7 m during the monsoon period.

As part of the Phase 1 Development, NYDC initiated a Strategic Flood Risk Assessment to ensure that the proposed development takes account of flood risk. Royal Haskoning DHV was selected as the consultant to provide professional services to contribute to the development of New Yangon City's flood risk assessment services for Phase 1. The following are some of the main conclusions from the Strategic Flood Risk Assessment.

- The New Yangon City is prone to flooding due to the following three flood sources: tide and storm surge (coastal), river discharge (fluvial), and rainfall (pluvial). Among the three flood sources, coastal floods (in terms of days) are usually shorter in duration than fluvial floods (in terms of weeks).
- The flood risk profile for New Yangon City shows that the existing flood risk without flood protection is fairly high. Sea level rise will strongly impact the flood risk profile of New Yangon City in terms of economic risk as well as loss of life. Implementation of flood risk reduction measures is recommended (Royal Haskoning DHV, 2019).

## 5.2.6.3 Seismic Activity

A review of available literature has shown that Myanmar is seismologically unstable and vulnerable to earthquakes due to its location in the active Alpide seism tectonic belt and the young Alpine Himalayan-Sumatran orogenic belt (Willige et al., 2009). Historic records show that at least 15 major earthquakes with magnitudes M≥7.0 Richter scale (RS) have occurred in Myanmar in the last hundred years. These earthquakes occurred within Myanmar in the last century, in Yangon Region, these include on 27 March, 16 May, and 21 May 1931 and in 1970.

## 5.3 Biodiversity Baseline

Field surveys were conducted by local specialists during February and March 2019. The field surveys include fauna, and habitat mapping and flora, covering the whole of the Phase 1 Development area. The details on the Integrated Biodiversity Assessment Tool (IBAT) are provided in **Appendix E**.

## 5.3.1 Fauna

The survey covered a range of fauna species, including mammals, birds, fish, reptiles and amphibians, butterflies, and dragonflies. The fauna survey was conducted via direct observation in the field, observation of tracks and signs such as footprints and feeding signs in their natural habitats, and interview surveys with local communities. The four mammal species recorded were all classified as Least Concern on the International Union for Conservation of Nature (IUCN) red list.

A total of 80 bird species were recorded during the survey, with one (1) species classified as Near Threatened, 78 as Least Concern, and one (1) Not Yet Assessed on the IUCN red list. The near threatened species recorded is the Black-headed lbis.

For fish, the surveys identified three (3) Near Threatened species, 42 Least Concern species, one (1) Data Deficient species, and five (5) Not Yet Assessed on the IUCN Red List. According to FishBase (2019), a global species database of fish species, 26 out of 51 species reported are classified as migratory. Four (4) species recorded are endemic species (i.e., native and restricted to a certain place) (Living International Treasure, 2019).

For reptiles and amphibians, the surveys identified no species of conservation concern (as per IUCN Red List) and no endemic / range-restricted species, in total 10 species were reported.

During the survey, 28 butterflies species and 10 dragonflies were identified, of which none are classified as species of conservation concern according to the IUCN Red List (IUCN, 2019).

## 5.3.2 Habitat Mapping

Satellite imagery was used to map the land classes identified within the Project Area. These land classes were verified during the field investigations. The land classes include intensive agriculture,

woodland, residential area, and water bodies. Land class descriptions are provided in Table 5.1 and Figure 5.2 shows the distribution of land classes (habitat map) within the Project Area from survey data.

## 5.3.3 Flora

Of the 164 floral species identified during the surveys, one (1) species is Endangered, one (1) is Vulnerable, 21 species are classified as Least Concern, two (2) as Data Deficient and 139 as Not Yet Assessed on the IUCN Red List. Endemic/ restricted range floral species (Living International Treasures, 2019) were not observed during field survey.

Htan or Palmyrah Palm (*Borassus flabellifer*) is identified as Endangered on IUCN Red List and is found in India, Myanmar, and Cambodia. It is an economically important flora species and the root, leaves, seeds, and fruits are used for various purposes (Aman, et al., 2018). The exploration of natural resources and expansion of agricultural and human settlement are the main threats to the species. Mahogany (*Swietenia macrophylla*), which is listed as Vulnerable on the IUCN Red List, is a commercial timber, therefore logging and wood harvesting are the main causes of decreasing populations (IUCN, 2019).

Land Class	Description	Natural/ Modified Class	Photo (Source: ERM Field Survey, 2019)
Woodland	Woodland is a low density forest forming open habitats with plenty of sunlight and limited shade. Woodlands support shrubs and herbaceous plants including grasses. Small woodland patches are scattered throughout the Project Area.	Natural	
Agricultural Land	Agricultural land is typically land devoted to agriculture, the systematic and controlled use of other forms of life (particularly the rearing of livestock and production of crops) to produce food for humans or animals. It is therefore generally synonymous with both farmland or cropland, as well as pasture or rangeland. This type of land is the most predominant land class in the Project Area.	Modified	
Residential Area	Human settlements exist on the east and north of the Project Area (Hlaing, Kamayut, Kyee Myin Daing and Hlaing Tharyar), while small-scale human settlement exists throughout Project Area.	Modified	

# Table 5.1 Land Class Description



Source: REM



## 5.4 Social Baseline

The primary social baseline survey was designed to cover the whole of the Phase 1 Development and the Study Area that is defined as a 2 km buffer around the whole New Yangon City Phase 1 Development. Social baseline data was collected from 392 households, with a random sample of 21 village tracts / wards in Twantay, Seikgyi Kanaungto, Kyee Myin Daing, Hlaing Tharyar, Ahlone, and Dala Townships in March 2019. For details on methodology, please refer to **Appendix C**.

## 5.4.1 Demographic Conditions

The population in the Study Area is mostly urban whereas in the Project Area, the population is mostly rural. Population density is high (more than 1,000 inhabitants per km<sup>2</sup>) in four of the six townships. Five of the six townships exhibit population growth, which is typical in urban areas in Myanmar (General Administration Department Township Profile Report, 2019). In all townships of the Study Area, there are slightly more women than men (General Administration Department Township Profile Report, 2019).

Almost a third of the population of Twantay, Seikgyi Kanaungto, and Dala are less than 15 years old. Over 70% of the population of Kyee Myin Daing, Hlaing Tharyar, and Ahlone are between 15 to 65 years. In all townships of the Study Area, the elderly (over 65 years old) represent less than 8% of the population (Myanmar Population and Housing Census Township Report, 2014).

In the Study Area, there has been a decrease in birth rates over the last 20 years. More than one third (36%) of the Study Area's population is concentrated in the age group between 15 to 30 years old (Myanmar Population and Housing Census Township Report, 2014).

## 5.4.2 Public Services and Infrastructure

There is a total of 475 education facilities in the Study Area and 45% are located in Twantay Township. All the townships within the Study Area have a higher literacy rate than the Union level average of 90%. For Twantay (95%), Dala (93%), and Kyee Min Daing (96%), the literacy rate is lower than the Yangon regional average level (97%). Females within the Study Area have a relatively lower (almost 5% less) literacy rate than men.

There is a total of 329 healthcare facilities in the Study Area. Hlaing Tharyar has the largest number of healthcare facilities (42%) and the highest ratio of health professional-to-patient in the Study Area (1 doctor per every 37,665 inhabitants).

Electricity is the main source for lighting in four out of six townships. Whereas in Seikgyi Kanaungto Township and Twantay Township most inhabitants use other sources of energy such as battery, candle, kerosene, and generators.

Three out of six townships (Ahlone, Kyee Myin Daing and Hlaing Tharyar) in the Study Area use bottled/purified water as a main source of drinking water. The remaining three townships (Seikgyi Kanaungto, Twantay and Dala) mainly use pond/lake and tube well/borehole. Tap /piped water as a source for domestic water use represents less than 20% in all townships of the Study Area. In general, the main sources for domestic water is from tube well/borehole, pond/lake, and river/stream.

The most common method of transport to Yangon City from the Project Area is via boat, which takes 15 minutes compared to the road journey of over an hour.

## 5.4.3 Income and Livelihood of the Study Area

The main economic activities in the Study Area are small and medium businesses. Other activities include agriculture, river transportation, and casual labour (i.e. services according to fluctuating demands). In addition, there are small-scale fishing and dredging activities. Although there are slightly more working age women (15-65) than men in the Study Area, the labour force participation rate for men is significantly higher than for women (up to 47%).

# 5.4.4 Community Perceptions on the Project

According to household survey data collected, the most common concern of people interviewed in the Study Area is related to potential noise impact (58% of the total concerns of negative impacts). The influx of workers was also of concern to local communities, with nearly half of the interviewees seeing it as a potential negative impact (ERM, 2019). The perceptions of the Project's potential negative impacts vary slightly across Townships.

The main concerns can be split between environmental and social types. From a social perspective, worker influx, increase in crime and safety issues, increase in traffic, and loss of land or assets were the main concerns. From an environmental perspective, air, noise, and waste pollution were the main concerns.

The main concerns in rural areas also included the loss of farming land, compensation, and presence of squatters.

Residents from Twantay and Seikgyi Kanaungto recommend prioritising land compensation in the Project's schedule, to establish a fair land compensation procedure with clear criteria, support for livelihood restoration, and to conduct measures to prevent speculative in-migration. For livelihood restoration, they would like to receive support from NYDC for establishing small and medium businesses.

The men who provide boat/ferry services in Kyee Myin Daing were concerned about losing their jobs as they will compete with the bridges. They asked to be considered for specific support and compensation.

Women were especially concerned about a potential increase in crime. The main recommendations of women included providing affordable housing in the new city, building a maternity hospital, consider building water pipe distribution in Dala, and building the bridges as soon as possible.

According to the household survey data, the vast majority of interviewees (92%) anticipated that the Project will improve the existing infrastructure. They also expected that the Project will create job opportunities (76%) and increase annual income (68%). Compensation for land, on the other hand, is not considered to be a potential positive impact (31%) from the Project (ERM, 2019).

The focus group discussions have indicated that the main benefit perceived is the generation of new job opportunities. Improvements to roads and transportation infrastructure are the second perceived advantage of the Project. Other benefits include improvements to public infrastructure and services such as electricity, water, and healthcare, which leads to better living conditions.

## 6. HIGH LEVEL IMPACT ASSESSMENT

#### 6.1 Introduction and Approach

This section of the SEA Report presents the methodology used to conduct a high-level impact assessment for the purpose of the SEA. This methodology has been developed by ERM and is based on international good practice.

#### 6.1.1 Project Impacts

This section aims to identify the key environmental and social impacts of the New Yangon City Phase 1 through a scoping process. Potential impacts have been identified through a systematic process whereby the activities (both planned and unplanned) associated with the Phase 1 Development have been considered with respect to their potential to interact with environmental and social resources/ receptors. Scoping also aims to identify key data gaps and ways to fill those gaps along the SEA process. The following key activities were undertaken:

- Gathered information on the activities pertaining to the development of the New Yangon City Phase 1 from NYDC;
- Conducted primary environmental and social baseline surveys;
- Listed the potentially relevant environmental and socio-economic receptors in the Study Area;
- Mapped potential interactions between the activities pertaining to the development of the New Yangon City Phase 1 and environmental and socio-economic receptors; and
- Taking into consideration the information gathered on the extent and nature of the activities pertaining to the Phase 1 Development and the existing condition/ sensitivities of the receptors, the potential interactions have been prioritised in terms of their likelihood to cause significant impacts.

#### 6.1.2 Cumulative Impacts

The Phase 1 Development includes the construction and operation of project components spread out across the entire Phase 1 Project Area, which include: existing villages and planned resettlement areas, existing main roads and planned new and expanded main roads, planned new green areas and water grid, and planned new infrastructure projects.

These will generate cumulative impacts, which have been assessed through conducting a high-level impact assessment of the Study Area, based on desktop research, baseline data collection and discussions with local stakeholders.

#### 6.2 Impact Assessment Methodology

Some interactions between resources/receptors and activities pertaining to the Phase 1 Development have been identified as likely to lead to significant impacts and have been further investigated during this SEA ('scoped in'). Those interactions, which have been identified as unlikely to result in significant impacts have been scoped out and did not trigger further assessment in the SEA. The interactions, which are anticipated to generate significant environmental and social impacts, have served as a basis to establish the ESMF's proposed mitigation and enhancement measures.

The impact assessment steps are summarised in Figure 6.1 and comprise:

- Impact prediction: to determine what could potentially happen to resources/receptors as a consequence of the Phase 1 Development and its associated activities;
- Impact evaluation: to evaluate the significance of the predicted impacts by considering their magnitude or likelihood of occurrence (for unplanned events), 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; and
- Residual impact evaluation: to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.



Figure 6.1 Impact Assessment Process

As part of the SEA process, impacts have been predicted and evaluated at a high-level to inform the design of the ESMF's proposed mitigation and enhancement measures that are included in this SEA Report.

The ESMF includes recommended institutional arrangements at the sub-project component level and at the New Yangon City Phase 1's Administrator level to enable the ongoing analysis of residual impacts at a sub-project component's level.

The residual impacts at the New Yangon City Phase 1's level will be assessed through the monitoring of the proposed SEA Framework Sustainability Performance Indicators.

## 6.3 Impact Identification

IEEs and EIAs are being undertaken for the Project main components of the New Yangon City Phase 1. This SEA gathers in one document the main impacts each of the main components are expected to generate. In addition to these components, the New Yangon City Phase 1 also covers the residential, commercial, civic amenities areas, and green spaces. At the time of writing (March 2020), the definitive and comprehensive construction and operation details of these were not yet confirmed. All components of the New Yangon City Phase 1 are expected to undertake EIAs / IEEs in accordance with the requirements of the EIA Procedure (2015) whenever they are being developed.

Risks were identified for both planned (routine and non-routine) and unplanned (accidents/incidents) activities of the Project main components of the Phase 1 Development. Potential impacts were then determined based on the physical activity or hazard type e.g. light and noise.

Table 6.1 groups the potential impacts for all components of the New Yangon City Phase 1 and gathers the main identified impacts on the physical, biological, and social environments for anticipated activities for the construction phase, operation phase, and for unplanned events. If an interaction is considered likely, it is coloured in black in Table 6.1. Recommended mitigation and management actions to minimise the overall significance of impacts potentially generated by the projects that will be undertaken for the Phase 1 Development are provided under the ESMF.

An assessment of the Project main components undertaken concurrently is presented along with the anticipated requirements in terms of an additional number of workers in the Study Area, an additional number of vehicles, and additional demand of domestic wastewater treatment facilities. For these aspects, at least, the individual impacts evaluated in the respective IEEs / EIAs of the project components will be cumulative on the environment and other receptors.

Impacts from Phase 1 Development Activities			Physical Environment					Biological Environment				Human Environment		
	Ambient Air Quality	Ambient Noise and Vibration	Surface Water and Groundwater Quality	Hydrology and Hydrogeology	Soil Quality and Topography	Landscape and Visual Character	Terrestrial Flora	Terrestrial Fauna	Aquatic Flora and Fauna	Community Health and Safety	Demographic Pattern, Economy and Iivelihood	Occupational Health and Safety	Infrastructure Services	Cultural Heritage
Construction Phase														
Site preparation, excavation and filling works;														
Pilling and metal structure works (bridges)														
Pavement, marking and signing works (roads)														
Worker influx and worker camps														
Transportation of equipment, supplies and workforce														
Machinery maintenance / vehicle refuelling														
Waste storage and disposal														
Wastewater management														
Right of way clearance and access roads														
Labour, equipment and services supply														

# Table 6.1Scoping Matrix for the Phase 1 Development

Impacts from Phase 1 Development Activities	Physical Environment				Biological Environment			Human Environment						
	Ambient Air Quality	Ambient Noise and Vibration	Surface Water and Groundwater Quality	Hydrology and Hydrogeology	Soil Quality and Topography	Landscape and Visual Character	Terrestrial Flora	Terrestrial Fauna	Aquatic Flora and Fauna	Community Health and Safety	Demographic Pattern, Economy and livelihood	Occupational Health and Safety	Infrastructure Services	Cultural Heritage
Use of Powered Mechanical Equipment (PME)														
Construction of substations (power)														
Erection of transmission towers and stringing (power)														
Water pipeline installation works (water)														
Pre-commissioning and commissioning (water)														
Facilities construction (industrial zone)														
Operational phase														
Maintenance works														
Labour, equipment and services supply														
Transportation of equipment, cargo, and workforce														
Operation and maintenance of plants, intakes, pipelines (water, wastewater)														

Impacts from Phase 1 Development Activities	Physical Environment				Biological Environment			Human Environment						
	Ambient Air Quality	Ambient Noise and Vibration	Surface Water and Groundwater Quality	Hydrology and Hydrogeology	Soil Quality and Topography	Landscape and Visual Character	Terrestrial Flora	Terrestrial Fauna	Aquatic Flora and Fauna	Community Health and Safety	Demographic Pattern, Economy and livelihood	Occupational Health and Safety	Infrastructure Services	Cultural Heritage
Operation of transmission lines (power)														
Operation of substations (power)														
Operation of facilities (industrial zone)														
Operation of bridges														
Operation of roads														
Maintenance / vehicle refuelling														
Waste management														
Spille and looke				I										
Vehicle collision														

#### DEVELOPMENT OF NEW YANGON CITY PHASE 1 SEA Report

Keys

,	
	An interaction is not reasonably expected
	An interaction is reasonably possible but none of the resulting impacts is likely to lead to significant effects
	The interaction is reasonably possible and at least one of the resulting impacts is likely to lead to an effect that is significantly negative
	The interaction is reasonably possible and at least one of the resulting impacts is likely to lead to an effect that is significantly positive

# 6.3.1 Scoped Out Impacts

Potential interactions that were deemed not to result in a potentially significant impact (grey in the matrix) have been scoped out with justification. The rationale for scoping out these impacts is provided in Table 6.2.

Impact	Rationale for scoping out of assessment
Construction Phase	
Impacts to ambient noise and vibration from erection of transmission towers and stringing (power)	The noise emitted from the erection of transmission towers and stringing will be temporary. It is expected that noise levels could be managed and reduced by implementing good international industry practices such as erecting temporary noise barriers and deflectors, and proper maintenance of machinery, etc.
Impacts to soil quality and topography from erection of transmission towers and stringing (power)	Impact on soil quality will be limited during construction. With proper handling of chemicals and hazardous substances, contamination of soil is expected to be unlikely to happen.
Impacts to terrestrial flora from construction of substations (power); erection of transmission towers and stringing (power)	The Project footprint is mainly located on farmland and scrubland. Considering the habitats located within the Project Area, no significant impacts to terrestrial flora are expected to arise.
Impacts to terrestrial fauna from construction of substations (power); erection of transmission towers and stringing (power)	Construction activities may increase noise levels, which will affect the fauna movement to surrounding areas. Terrestrial fauna will also flee due to increasing noise and construction activities. Good international industry practices can reduce the adverse impacts to terrestrial fauna to what may be expected to be acceptable levels.
Impacts to aquatic flora and fauna from construction of substations (power); facilities construction (industrial zone)	The Project Area is located at the semi-urban and rural area in Twantay Township. The land is primarily used for agriculture. No effluents will be discharged into the Pan Hlaing river, Twantay Canal, or other creeks. As such, site preparation, excavation and filling works; and construction of substations would be expected to have limited impacts on aquatic flora and fauna.
Impacts to community health and safety from construction of substations (power); facilities construction (industrial zone)	With proper management of construction activities, impacts on community health and safety for site preparation would be expected to be limited.
Operation Phase	
Impacts to ambient air quality from operation of substations (power)	The impact on local air quality will be limited to emissions from vehicle movements during operation and maintenance activities. Impact could be expected to be local and its frequency will likely be expected to be limited. Thus, impacts are scoped out, as they are not expected to be significant.
Impacts to ambient noise and vibration from operation of substations (power)	The operation of the substations and transportation of equipment, cargo, and workforce are expected to be unlikely to cause high noise level.
Impacts to surface water and groundwater quality from	Impacts to surface water and groundwater quality from transportation network is not likely. It is anticipated that the impacts on surface water and

Table 6.2	Scoped-Out Analysis
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Impact	Rationale for scoping out of assessment
labour, equipment and services supply	groundwater quality can be managed and reduced by implementing good industry practices.
Impacts to soil quality and topography from labour, equipment and services supply	Impacts to soil quality and topography from labour, equipment and services supply are unlikely during operation. It is anticipated that the impacts on soil quality and topography can be managed and reduced by implementing good industry practices.
Impacts to community health and safety from operation of substations (power)	Activities during operation phase might have impacts on the community health. By implementing good industry practices, none of the resulting impacts would be expected to lead to significant effects.

## 6.3.2 Scoped In Impacts

## 6.3.2.1 Construction Phase Impacts

The following impacts have been identified during the scoping and impact assessment exercises to have the potential to be significant as a result of activities associated with the construction of subprojects under the Phase 1 Development:

- Impacts to ambient air quality from:
  - Site preparation, excavation and filling works;
  - Pilling and metal structure works (bridges);
  - Transportation of equipment, supplies and workforce;
  - Machinery maintenance / vehicle refuelling;
  - Right of way clearance and access roads;
  - Use of PME for construction;
  - Construction of substations (power);
  - Water pipeline installation works (water); and
  - Facilities construction (industrial zone)
- Impacts to ambient noise from:
  - Site preparation, excavation and filling works;
  - Pilling and metal structure works (bridges);
  - Worker influx and worker camps;
  - transportation of equipment, supplies and workforce;
  - right of way clearance and access roads;
  - Use of powered mechanical equipment (PME)
  - Construction of substations (power)
  - Water pipeline installation works (water); and
  - Facilities construction (industrial zone)
- Impacts to surface water and groundwater quality from:
  - Site preparation, excavation and filling works;
  - Pilling and metal structure works (bridges);

- Worker influx and worker camps;
- Waste storage and disposal;
- Wastewater management;
- Use of powered mechanical equipment (PME);
- Construction of substations (power);
- Water pipeline installation works (water);
- Pre-commissioning and commissioning (water); and
- Facilities construction (industrial zone)
- Impacts to hydrology and hydrogeology from:
  - Site preparation, excavation and filling works;
  - Pilling and metal structure works (bridges);
  - Wastewater management;
  - Water pipeline installation works (water)
- Impacts to soil quality and topography from:
  - Site preparation, excavation and filling works;
  - Pilling and metal structure works (bridges);
  - Pavement, marking and signing works (roads);
  - Waste storage and disposal;
  - Wastewater management;
  - Use of powered mechanical equipment (PME);
  - Construction of substations (power);
  - Water pipeline installation works (water);
  - Pre-commissioning and commissioning (water); and
  - Facilities construction (industrial zone)
- Impacts to landscape and visual character from:
  - Site preparation, excavation and filling works;
  - Pilling and metal structure works (bridges);
  - Pavement, marking and signing works (roads);
  - Construction of substations (power);
  - Erection of transmission towers and stringing (power);
  - Facilities construction (industrial zone)
- Impacts to terrestrial flora and fauna from:
  - Site preparation, excavation and filling works;
  - Waste storage and disposal;
  - Wastewater management;
  - Right of way clearance and access roads;
  - Water pipeline installation works (water);

- Pre-commissioning and commissioning (water);
- Facilities construction (industrial zone)
- Impacts to terrestrial fauna from:
  - Site preparation, excavation and filling works;
  - Transportation of equipment, supplies and workforce;
  - Waste storage and disposal;
  - Wastewater management;
  - Water pipeline installation works (water);
  - Pre-commissioning and commissioning (water);
  - Facilities construction (industrial zone)
- Impacts to aquatic flora and fauna from:
  - Site preparation, excavation and filling works;
  - Pilling and metal structure works (bridges);
  - Waste storage and disposal;
  - Wastewater management;
  - Water pipeline installation works (water);
  - Pre-commissioning and commissioning (water)
- Impacts to community health and safety from:
  - Site preparation, excavation and filling works;
  - Pilling and metal structure works (bridges);
  - Pavement, marking and signing works (roads);
  - Worker influx and worker camps;
  - transportation of equipment, supplies and workforce;
  - waste storage and disposal;
  - Wastewater management;
  - Right of way clearance and access roads;
  - Labour, equipment and services supply;
  - Use of PME;
  - Pre-commission and commissioning (water)
- Impacts to demographic pattern, economy and livelihood from:
  - Site preparation, excavation and filling works;
  - Piling and metal structure works (bridges);
  - Worker influx and worker camps;
  - Labour, equipment and services supply
- Impacts to occupational health and safety from:
  - Site preparation, excavation and filling works;
  - Piling and metal structure works (bridges);

- Pavement, marking and signing works (roads);
- Worker influx and worker camps;
- transportation of equipment supplies and workforce;
- Waste storage and disposal;
- Wastewater management;
- Right of way clearance and access roads;
- labour, equipment and services supply;
- Use of PME;
- Construction of substations (power);
- Erection of transmission towers and stringing (power);
- Water pipeline installation works (water);
- Pre-commissioning and commissioning (water);
- facilities construction (industrial zone)
- Impacts to infrastructure services from:
  - Site preparation, excavation and filling works;
  - Piling and metal structure works (bridges);
  - Worker influx and worker camps;
  - Transportation of equipment supplies and workforce;
  - Waste storage and disposal;
  - Right of way clearance and access roads;
  - Labour, equipment and services supply;
  - Use of PME;
  - Water pipeline installation works (water)
- Impacts to cultural heritage from:
  - Site preparation, excavation and filling works.

#### 6.3.2.2 Operational Phase Impacts

The following impacts have been identified during the scoping and impact assessment exercises to have the potential to be significant as a result of activities associated with the different operations of the Phase 1 Development:

- Impacts to ambient air quality from:
  - Transportation of equipment, cargo, and workforce
  - Operation and maintenance of plants, intakes, pipelines (water, wastewater)
  - Operation of roads
- Impacts to ambient noise from:
  - maintenance works
  - Transportation of equipment, cargo, and workforce
  - Operation and maintenance of plants, intakes, pipelines (water, wastewater)

- Operation of roads
- Impacts to surface water and groundwater quality from:
  - Operation and maintenance of plants, intakes, pipelines (water, wastewater)
  - Operation of roads
  - Maintenance / vehicle refueling
  - Waste management
- Impacts to hydrology and hydrogeology from:
  - Operation and maintenance of plants, intakes, pipelines (water, wastewater)
- Impacts to soil quality and topography from:
  - Operation and maintenance of plants, intakes, pipelines (water, wastewater)
  - Maintenance / vehicle refuelling
  - Waste management
- Impacts to landscape and visual character from:
  - Operation and maintenance of plants, intakes, pipelines (water, wastewater)
  - Operation of transmission lines (power)
  - Operation of substations (power)
  - Operation of facilities (industrial zone)
  - Operation of roads
  - Waste management
- Impacts to terrestrial flora from:
  - Operation and maintenance of plants, intakes, pipelines (water, wastewater)
  - Waste management
- Impacts to terrestrial fauna from:
  - Transportation of equipment, cargo, and workforce
  - Operation and maintenance of plants, intakes, pipelines (water, wastewater)
  - Operation of transmission lines (power)
  - Waste management
- Impacts to aquatic flora and fauna from:
  - Operation and maintenance of plants, intakes, pipelines (water, wastewater)
  - Waste management
- Impacts to community health and safety from:
  - Labour, equipment and services supply
  - Transportation of equipment, cargo, and workforce
  - Operation and maintenance of plants, intakes, pipelines (water, wastewater)
  - Operation of transmission lines (power)
  - Operation of facilities (industrial zone)
  - Operation of bridges

- Operation of roads
- Waste management
- Impacts to demographic pattern, economy and livelihood from:
  - Labour, equipment and services supply
- Impacts to occupational health and safety from:
  - Maintenance works
  - Labour, equipment and services supply
  - Transportation of equipment, cargo, and workforce
  - Operation and maintenance of plants, intakes, pipelines (water, wastewater)
  - Operation of transmission lines (power)
  - Operation of substations (power)
  - Operation of facilities (industrial zone)
  - Operation of bridges
  - Maintenance / vehicle refuelling
  - Waste management
- Impacts to infrastructure services from:
  - Labour, equipment and services supply
  - Waste management.

#### 6.3.2.3 Unplanned or Accidental Events

Unplanned or accidental events can be triggered by incidents happening during either construction or operation stages and caused by the work force, equipment, or supplies. Such events also include consequences of natural disasters (floods, cyclones, and/or earthquakes) that can lead to environmental or social impacts. The following impacts have been identified during the scoping and impact assessment exercises to have the potential to be significant as a result of unplanned or accidental events associated with the Phase 1 Development:

- Impacts to ambient air quality from:
  - Fire and explosion
- Impacts to surface water and groundwater quality from:
  - Spills and leaks
- Impacts to hydrology and hydrogeology from:
  - Spills and leaks
- Impacts to soil quality and topography from:
  - Spills and leaks
- Impacts to terrestrial flora from:
  - Spills and leaks; and
  - Fire and explosion
- Impacts to terrestrial fauna from:
  - Vehicle collision

- Spills and leaks; and
- Fire and explosion
- Impacts to aquatic flora and fauna from:
  - Spills and leaks; and
  - Fire and explosion
- Impacts to community health and safety from:
  - Vehicle collision;
  - Spills and leaks; and
  - Fire and explosion
- Impacts to demographic pattern, economy and livelihood from:
  - Spills and leaks
- Impacts to occupational health and safety from:
  - Vehicle collision;
  - Spills and leaks; and
  - Fire and explosion
- Impacts to infrastructure services from:
  - Vehicle collision; and
  - Spills and leaks.

#### 7. PUBLIC CONSULTATION AND DISCLOSURE

This section summarises the methodology and approach for stakeholder identification and analysis undertaken as part of the SEA. An overview of the consultations undertaken to date and recommendations for consultation and disclosure recommended as part of the SEA Study is also provided.

#### 7.1 Methodology and Approach

#### 7.1.1 Purpose of the Consultation

The specific objectives for stakeholder engagement were to:

- Inform relevant stakeholders about the project and the planned Project activities;
- Identify stakeholders and communities potentially affected by Project activities;
- Gather social and biological environmental baseline information; and,
- Engage with potentially affected groups to understand potential Project impacts, perceptions and concerns, and discuss appropriate mitigation measures.

#### 7.1.2 Stakeholder Engagement Principles

The following principles have been identified for driving and guiding the stakeholder engagement activities:

- The engagement strategy has been designed and implemented in a manner that is appropriate and cognisant of the specific economic, social, and cultural context of Myanmar, and specifically Yangon Region;
- Information disclosure has weighed risks and benefits. Considerations for non-disclosure have been weighed against the need for transparency and stakeholder groups to be informed;
- Engagement has been a two-way dialogue which has involved informing, listening, and seeking inputs, as well as sharing and exchanging views;
- Engagement has been free of intimidation and coercion;
- Updated have been provided to potentially affected and relevant stakeholders. The frequency of these updates have been commensurate to Project risks and any changes to the Project; and
- The Project has provided a feedback / grievance mechanism and opportunities to incorporate received feedback into the SEA and IEEs/EIAs. The feedback/grievance mechanism has been disclosed to impacted stakeholders.

In summary, the main principles were:

- Inclusive: The consultations were organised to ensure representation of potentially affected and interested stakeholders. Separate Focus Group Discussions (FGDs) were undertaken with local communities, village leaders, farmers, and women;
- Sharing of information: At the township and village level consultations, special emphasis was given to build community level understanding of the Phase 1 Development and all the information was provided in Myanmar language; and
- Participatory: Stakeholders were encouraged to actively participate in the consultations and were given the opportunity to ask questions.

## 7.1.3 Identification of Relevant Stakeholders and Potential Issues

The process of identifying potentially affected stakeholders started with scoping which is conducted to identify relevant issues and select the townships and villages potentially impacted. The scoping exercise involved both desk-based and preliminary consultation with a number of stakeholders including government authorities.

ERM's previous experience of stakeholder engagement in the Region was utilised to inform the stakeholder selection. This information is based on discussions with the General Administrative Department (GAD) representatives as well as previous project experience.

Stakeholder engagement is an ongoing process and as such new stakeholders may emerge as the Project progresses. If would be an additional stakeholder engagement activity to be undertaken for the Project, NYDC will inform all the stakeholders.

#### 7.1.3.1 National Authorities

This group of stakeholders include relevant ministries and governmental departments who regulate the Project. The authorities, which are likely to have the maximum influence on the Project, include the following:

- Ministry of Electricity and Energy;
- Ministry of Agriculture, Livestock and Irrigation;
- Ministry of Industry;
- Ministry of Transport and Communication;
- Ministry of Construction;
- Ministry of Planning, Finance, and Industry;
- Ministry of Natural Resources and Environmental Conservation;
- Directorate of Water Resources and Improvement of River Systems;
- Environmental Conservation Department;
- Myanmar Port Authority; and
- Myanmar Investment Commission.

## 7.1.3.2 Regional and Local Authorities

Regional and local authorities are defined as those agencies of the government, at the regional, district, and township levels who have the power to regulate or otherwise influence the Project in terms of establishing policy, granting permits and approvals for the Project, monitoring and enforcing compliance with the applicable rules and regulations, and making available the necessary resources for the Project. These departments can also provide relevant information for the impact assessment.

Engagement with the regional authorities was expected to fulfil the following needs:

- Seek expectations on stakeholder engagement and disclosure;
- Get necessary permission to engage with regional government departments as well as hold consultations;
- Provide introductory letters to meet various regional/local government departments and agencies;
- Obtain regional level data and information; and
- Get specific contacts of people to meet in the region, as well as for instructions.

Engagement with the local level administration is aimed at the following:

- Obtain necessary local permissions for meetings;
- Seek an understanding of the specific issues and stakeholder concerns at the local level. For example, information on any important development or conflict;
- Obtain district, township, and village/village tract/ward level social and environmental data;
- Provide introductions to key people at the township and village/village tract/ward level;
- Provide introductions to representatives of the administration to join and/or observe the consultation process; and
- Provide guidance on local security do's and don'ts.

Some of the key authorities at the regional and local level include the following:

- Yangon Regional Government (YRG);
- Yangon City Development Committee (YCDC);
- District and Township GAD;
- Regional Environmental Conservation Department;
- Regional Members of Parliament;
- Department of Highways;
- Department of Bridges;
- Directorate of Industrial Supervision and Inspection;
- Department of Rural Development; and
- Department of Public Health.

#### 7.1.3.3 Project Affected Communities and Individuals

Project affected communities and individuals include people who may be directly or indirectly affected by the Project's presence and activities and their representatives (leaders and other influential people) including (but not be limited to) the following:

- Village Tract leaders;
- Village/ward leaders;
- Civil Society Organizations (CSOs); and
- Vulnerable groups, including but not limited to, subsistence farmers, fishermen, migrant workers, minority communities, and women.

The various stakeholder groups have been engaged directly as well as through their representatives, including traditional leaders, elected representatives, opinion leaders, and other influential entities. In addition, the Project has consulted specifically with people representing potentially vulnerable or marginalised groups such as women, young people, landless people, the sick and disabled, and, ethnic minorities.

Five townships were identified for consultation as they are potentially within the Area of Influence (i.e. the area in which impacts could occur): Twantay, Kyee Myin Daing, Hlaing Tharyar, Seikgyi Kanaungto, and Ahlone Townships. The proposed village / ward level engagement was confirmed, and revised, with local stakeholders during the scoping engagement and with MONREC.

A list of the relevant townships and villages / wards for the stakeholder consultation is presented in Table 7.1 with their location shown in Figure 7.1.
Township / Village	Included in Engagement and Rationale	
Kyee Myin Daing (East) Township	This is required to inform the township and villages as the Bridge 1 and roads will be located in Kyee Myin Daing (East).	
Kyee Myin Daing (West) Township	This is required to inform township and wards as the Bridge 1 will be located in Kyee Myin Daing (West).	
Seikgyi Kanaungto Township	This is required to inform the township and villages as the roads will be located in Seikgyi Kanaungto.	
Hlaing Tharyar Township	This is required to inform township and wards as the Bridge 2 will be located in Hlaing Tharyar.	
Ahlone Township	This is required to inform township and wards as the Bridge 1 will be located near Ahlone. (Outside the project area)	
Twantay Township	This is required to inform the township and villages as the Bridge 2, Roads, Industrial Zones, Waste Water and Water Treatment Plants and Transformer Substation and Transmission Lines and distribution lines will be located in Twantay.	
Kha Lauk Chaik, Yae Kyaw, Ta Mar Ta Kaw, Ma Ngay Village Tracts (in Twantay Township)	This is required to inform the Village Tracts and Villages as the Bridge 2, Roads, Industrial Zones, Waste Water Treatment Plant and Transformer Substation and Transmission Lines and distribution lines will be located in those Village Tracts.	
Ku Lar Tan, Byauk Yoe and Kan Village Tracts (in Twantay Township)	This is required to inform the Village Tracts and Villages as the Roads, Industrial Zones, Waste Water and Water Treatment Plants and Transformer Substation and Transmission Lines and distribution lines will be located in those Village Tracts.	
Let Pan Gwa, Kyun Ka lay, Gyaung Waing and Ah Lat Chaung Village Tracts (in Twantay Township)	This is required to inform the Village Tracts and Villages as the Roads and Industrial Zone located near those villages.	

# Table 7.1 List of Townships and Villages / Wards Engaged for the SEA



Figure 7.1 Location of Townships and Village Tracts in the Vicinity of the Project

# 7.1.3.4 Non-Governmental Organisations (NGOs) and Civil Society Organizations (CSOs)

NGOs and CSOs include those who may have an interest in the Phase 1 Development and its social and environmental aspects. It includes members of the wider general public in the state and region, CSOs (such as cooperatives), professional associations, cultural groups, citizens' associations, environmental and social groups, and universities and other academic and research institutions undertaking work relevant to the Phase 1 Development, who may have views on the Phase 1 Development or information that will be useful for the assessment of impacts.

Some national/international NGOs/CSOs that have a local presence in Yangon Region include:

- Myanmar Centre for Responsible Business (MCRB);
- World Wildlife Fund (WWF);
- Wildlife Conservation Society (WCS);
- Fauna and Flora International (FFI);
- Myanmar Green Network (MGN);
- Myanmar Alliance for Transparency and Accountability (MATA);
- Earth Rights International (ERI);
- EcoDev;
- International Commission of Jurists;
- Myanmar Environmental Rehabilitation-conservation Network (MERN);
- Myanmar Women Affairs Federation;
- Myanmar Maternal and Child Welfare Association;
- Youth Empowerment Association;
- Water, Research, and Training Centre (WRTC);
- Water Mothers;
- Ayate Sit CSO (Twantay);
- Twantay Network; and
- Myat Thandar (Twantay).

### 7.1.3.5 Media

Usage of media and engagement was required during the IEE/EIA/SEA processes and for the purpose of disclosure and information dissemination.

### 7.1.3.6 Project Partners and Contractors

Other development investors are active in the western part of Yangon River. This may lead to cumulative impacts of these project activities. Therefore, it is essential to liaise with other investors to reduce and mitigate potential cumulative impacts associated with other activities in the area.

### 7.1.4 Stakeholder Mapping Matrix

The matrix shown in Figure 7.2 has been used to map the stakeholders.

	HIC	GH	
		Project Affected People;	Yangon Regional Government;
	-	Local CSOs;	Yangon City Development Committee;
	-	Village Tract Leaders;	Township Authorities;
	-	National and International NGOs;	<ul> <li>Ministry of Natural Resources and</li> </ul>
	-	Department of Highways;	Environmental Conservation; and
	-	Department of Bridges;	<ul> <li>Regional Parliament Representatives.</li> </ul>
	•	Directorate of Industrial Supervision and Inspection; and	
ST	•	Department of Rural Development.	Engaged, managed closely
ERE		Keep informed	
L		Monitor	Keep satisfied, engaged
		Media: and	Ministry of Transport and Communication:
		Other government departments	Ministry of Construction:
	-	Other government departments.	Ministry of Construction,     Ministry of Electricity and Energy:
			Environmental Cancentation Department
			(Yangon Regional representative); and
			<ul> <li>Contractors retained for managing the social aspects of the Project.</li> </ul>
	LO	w	HIGH
		INFLU	ENCE

Stakeholder Mapping Matrix

Figure 7.2

### 7.1.5 Key Engagement Activities

The stakeholder consultation meetings were structured as followed:

- Introduction and information disclosure: Introduce NYDC and ERM, the IEEs/EIAs/SEA, the proposed stakeholder engagement process, the potential environmental and social impacts and mitigations to help the stakeholders understand the Project, and the NYDC's intentions for engagement.
- Question and answer session: For all stakeholders in the meetings to raise concerns, comments, or questions to which NYDC and ERM can directly respond.
- Data collection: Collection of more in-depth information through household interviews with key stakeholder groups.

On the basis of the understanding of the Phase 1 Development and the stakeholders and the purpose of engagement, the following methods of engagement have been conducted for stakeholder engagement/consultation:

- Interviews: Interviews have been conducted with government officials and key informants like village leaders. These have been guided by a set of open ended and close-ended questions.
- Semi- Structured/ Structured Interviews and Checklists: Apart from discussions, the process of semi-structured/structured interviews and checklists was used as a method for inquiry in which a pre-determined set of open or closed questions or check points were used to gather further information pertaining to specific themes or issues. Detailed community profiles and topic specific (such as farming community) checklists have been administered to allow for a detailed understanding of the impacts of the Phase 1 Development. The interviews have also been undertaken with the institutional stakeholders and groups such as NGOs and civil society groups.
- Focus Group Discussion: A Focus Group Discussion (FGD) refers to a discussion carried out amongst a group of people (approximately 4 to 10) from a similar background/profile on a specific topic while being guided by a moderator. The primary purpose of such discussions is to gather an insight into the thought process of the group concerning a particular issue. FGDs have been undertaken with farmers, women, ferry operators, ward leaders, and village leaders.

All information collected was summarised and confirmed with stakeholders at the end of the discussions. Stakeholders were also given time to share their concerns and views and any further clarifications they required at the end of the interviews. All queries raised by the stakeholders were responded to and noted to feed into the impact assessment process for the IEE/EIAs/SEA.

### 7.1.6 Overall Approach and Scope

Stakeholder engagement was conducted across administrative levels, subject to permissions of responsible authorities. Figure 7.3 provides an overview of the levels engaged including national, regional, township, and village tract/village/ward levels.

Engagement, as specified in the EIA Procedure (2015), was undertaken in two phases in January and February 2019 and April 2019. A consultation team consisting of ERM and the NYDC representatives conducted meetings and consultations at the administrative levels and the village tract level. To ensure village level representation, a request was made to the Township GAD offices and village tract leaders for the community and interested organizations from the potentially impacted villages to be present.



### Figure 7.3 Engagement at Three Levels with Key Stakeholders

It should be noted that the engagement will continue on an active basis through the life of the Project. The purpose of this would be to allow the most effective and appropriate methods to be employed for maintaining a two- way dialogue with the relevant stakeholders.

The schedules of the Initial Public Consultation Engagement are shown in Table 7.2 and Table 7.3.

Level	Stakeholder Group	Purpose of Engagement	Key communication material and Method of
National	<ul> <li>Environmental Conservation Department;</li> <li>Ministry of Natural Resources and Environmental Conservation;</li> <li>Ministry of Industry;</li> <li>Ministry of Transport and Communication; and</li> <li>Ministry of Construction.</li> </ul>	<ul> <li>Seek clarity on the expectations on stakeholder engagement and disclosure;</li> <li>Get necessary permission and contacts to engage with government departments at different levels as well as to hold consultations; and</li> <li>Get access to useful data from national as well as regional offices.</li> </ul>	Engagement Key Communication material: Presentation on Phase 1 Development; and Seeking permission from relevant stakeholders Methods of meeting: Meetings and semi structured interviews.
State / Regional	<ul> <li>Yangon Regional Government;</li> <li>Yangon City Development Committee;</li> <li>General Administration Department (GAD);</li> <li>Township Development Committee;</li> <li>Environmental Conservation Department;</li> <li>Regional Members of Parliament; and</li> <li>Department of Social Welfare</li> </ul>	<ul> <li>Seek expectations on stakeholder engagement and disclosure;</li> <li>Seek introductory letters to meet various state/regional government departments and agencies;</li> <li>Seek clarity on the range of permissions and approvals required at different levels of regional government;</li> <li>Obtain regional level data and information; and</li> <li>Seek an understanding of the requirements and plan for government presence/participation in the consultation process.</li> </ul>	<ul> <li>Key Communication material:</li> <li>Presentation on Phase 1 Development;</li> <li>Presentation on SEA and EIA process and Stakeholder engagement; and</li> <li>Sharing of Project Information Document with contact information.</li> </ul> Methods of Engagement: <ul> <li>Meetings and semi structured interviews.</li> </ul>
Township	<ul> <li>Administrators GAD;</li> <li>Township Development Committees; and</li> <li>Local CSOs and NGOs.</li> </ul>	<ul> <li>Obtain necessary local permissions for meetings;</li> <li>Provide an understanding of the specific issues and stakeholder concerns at the local level;</li> <li>Obtain district and township level social and environmental data;</li> <li>Provide introductions to key people at the township and village tract level; and</li> <li>Provide guidance on local security do's and don'ts.</li> </ul>	<ul> <li>Key Communication material:</li> <li>Presentation on Project;</li> <li>Presentation on EIA and SEA process and Stakeholder engagement; and</li> <li>Sharing of Project Information Document with contact information.</li> <li>Methods of Engagement:</li> <li>Town hall meetings, FGDs.</li> </ul>
Village / Ward	<ul> <li>Village Tract / Ward Leaders;</li> <li>Village Leaders and Opinion Leaders;</li> <li>Farmers;</li> <li>Women,</li> <li>Local Community; and</li> <li>Village representatives of Schools, Hospitals, etc.</li> </ul>	<ul> <li>To make the community aware of the Phase 1 Development;</li> <li>To discuss potential impacts and mitigation;</li> <li>To communicate the next steps in the Study and public consultations; and</li> <li>Obtain village tract and village level social and environmental data.</li> </ul>	<ul> <li>Key Communication material:</li> <li>Presentation on Phase 1 Development and engagement; and</li> <li>Sharing of Project Information Document with contact information.</li> </ul>

# Table 7.2Stakeholder Groups per Level and Engagement Method and<br/>Purpose

Level	Stakeholder Group	Purpose of Engagement	Key communication material and Method of Engagement
			Methods of Engagement: Village Meetings, Focus Group Discussions Project affected people, and Interviews.

### 7.1.6.1 National Level

Stakeholder engagement at the national level was focused on government agencies with regulatory and policymaking responsibility. The purpose of early engagement was to introduce the Phase 1 Development and NYDC, to seek clarity on the IEE/EIA/SEA process and expectations on stakeholder engagement and disclosure. The required permissions for engagement were obtained from agencies at regional and township levels and get access to data and information for the IEE/EIA Studies.

### 7.1.6.2 Regional Level

Stakeholder engagement at the Regional Level focused on obtaining required permission for engagement activities at the township level and get access to information on local communities in the Area of Influence. At the Regional Level, NYDC met with a representative for the Chief Minister of Yangon, Regional level ECD and GAD, and members of Yangon Region Hluttaw.

### 7.1.6.3 Township / Village Tract Level

Meetings were conducted in the Townships of Ahlone, Dala, Kyee Myin Daing, Twantay, Seikgyi Kanaungto, and Hlaing Tharyar. The purpose of engagement was to make the township levels aware of the Phase 1 Development, seek an understanding of specific issues and stakeholder concerns, discuss potential impacts and mitigation measures, and obtain village and township level social and environmental data.

The key stakeholders engaged were:

- GAD (District and Township);
- Village Tract Leaders;
- Farmers;
- Civil society organizations; and
- NGOs.

These stakeholder groups and the relevant stakeholder are provided in Table 7.3.

Stakeholder Group	Stakeholders	
Government	Yangon Regional Government, District and Township General Administration Department, Member of Parliament, ECD, Department of Agricultural, land Management and Statistics, Rural Development Committee, Department of Road Construction, Department of Livestock, Breeding and Veterinary, Department of Information and Public Relations, Department of Public Health, Myanmar Police Force, Red Cross and Township and Village Tract Leaders.	
Local Communities	Village leaders, community leaders, village and ward patrons, development committee, women, fishermen, farmers, public workers, ferrymen, car driver, ferry boat owners and drivers, township and Village representative of schools, hospitals and monasteries.	
NGOs and CSOs	Myanmar Centre for Responsible Business (MCRB), Golden Future Organization, Tdh-L, Khanti Foundation, Drug Rehab Centre, Anti- Corruption and Public Life Raising Centre, DFIA (UKAID), Shwe Latt CBO, A Mi Myay, Sone See yar Disability organization, Women Anti-terror Organization, Self-Help Women Support and Raising Group, Ward Peace and Development Committee, Village Development Committee, Women Affair Association, and Free Funeral Services.	

### Table 7.3 Stakeholder Groups Consulted

### 7.2 Summary of Consultation and Activities Undertaken

### 7.2.1 Scoping Phase

During scoping, consultation meetings were held with various relevant stakeholders at Yangon regional level and township levels. The purpose of the scoping consultations was to present information of the Phase 1 Development, gather information on potentially affected people, and gather information on the potential data gaps and how these can be addressed for the SEA Report and main components' respective IEE/EIAs. Scoping consultation involved face-to-face meetings with a range of stakeholders including a representative for the Chief Minister of Yangon, Regional level ECD and GAD, Members of Yangon Region Hluttaw, Member of Pyithu Hluttaw, Director from the Department of Social Welfare, and Township GADs from the Project Area. The date, time, location, and purpose of each meeting is provided in Table 7.4.

Date, time	Location	Purpose of Engagement
Wednesday 23 <sup>rd</sup> January, 2019	Chief Minister Office Meeting	<ul> <li>Present information on the Phase 1 Development;</li> <li>Get approval for township/ward and village level meetings; and</li> <li>Gather concerns and suggestions from stakeholders.</li> </ul>
Wednesday 30 <sup>th</sup> January, 2019	Twantay Township GAD Office, Seikgyi Kanaungto Township GAD office and Kyee Myin Daing Township GAD Office	<ul> <li>Meeting arrangements and approvals</li> </ul>
Thursday 31 <sup>st</sup> January, 2019	Ahlone Township GAD office and Hlaing Tharyar Township GAD Office	<ul> <li>Meeting arrangements and approvals</li> </ul>
Friday 1 <sup>st</sup> February, 2019	Ahlone Township	<ul> <li>Present Phase 1 Development information to local government, ward</li> </ul>

 Table 7.4
 Consultation Activities Undertaken during Scoping

Date, time	Location	Purpose of Engagement
		<ul> <li>administrators, local communities and other interested parties;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake socio-baseline data collection; and</li> <li>Interview with Ward Administrators.</li> </ul>
Saturday 2 <sup>nd</sup> February, 2019	Twantay Township	<ul> <li>Present Phase 1 Development information to local government, ward administrators, local communities and other interested parties;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake socio-baseline data collection; and</li> <li>Interview with Ward Administrators.</li> </ul>
Saturday 2 <sup>nd</sup> February, 2019	Kyee Myin Daing Township	<ul> <li>Present Phase 1 Development information to local government, ward administrators, local communities and other interested parties;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake socio-baseline data collection; and</li> <li>Interview with Ward Administrators.</li> </ul>
Sunday 3 <sup>rd</sup> February, 2019	Seikgyi Kanaungto Township	<ul> <li>Present Phase 1 Development information to local government, ward administrators, local communities and other interested parties;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake socio-baseline data collection; and</li> <li>Interview with Ward Administrators.</li> </ul>
Sunday 3 <sup>rd</sup> February, 2019	Hlaing Tharyar Township	<ul> <li>Present Phase 1 Development information to local government, ward administrators, local communities and other interested parties;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake socio-baseline data collection; and</li> <li>Interview with Ward Administrators.</li> </ul>
Tuesday 19 <sup>th</sup> March, 2019	Myanmar Centre for Responsible Business	<ul> <li>Present Project information; and</li> <li>Gather concerns, suggestions and list of recommended stakeholders.</li> </ul>



Public Consultation Meeting in Seikgyi Kanaungto Township on 3rd February, 2019



Public Consultation Meeting in Ahlone Township on 5<sup>th</sup> February, 2019

# Figure 7.4 Photos from the Scoping Consultation Meetings

### 7.2.2 SEA/EIA Phase

During the SEA/IEE/EIA Phase, public consultation meetings were conducted in Townships and Village Tracts. There were six consultations in Townships and five consultations in Village Tracts. Township Level consultations were held in Ahlone, Dala, Hlaing Tharyar, Kyee Myin Daing, and Seikgyi Kanaungto Township. There were two village tracts meetings in Upper Ta Mar Ta Kaw and Than Phyu Yone village tracts in Twantay Township, two village tract meetings in Aye Ywar Ba Lote Nyunt Sat Ka Lay Ward and A Lat Chaung Village Tract in Kyee Myin Daing Township and one village tract meeting in A Twin Pa Dan Village Tract of Hlaing Tharyar Township. The meeting locations were selected with the Township and Village Tract leaders.

The meetings were attended by 57 people in Ahlone Township, 68 people in Dala Township, 92 people in Hlaing Tharyar Township, 848 people in Kyee Myin Daing Township, 76 people in Seikgyi Kanaungto Township, and 203 people in Twantay Township, consisting of: community, GAD, other representatives from related departments, NGOs, and CSOs.

ERM tried to organise a meeting with international Non-Governmental Organizations (iNGOs) who might be interested in the Phase 1 Development. The list included: UN-Habitat, GRET, Oxfam, Earth Rights International and International Commission of Jurists. Likewise, ERM tried to organise a meeting with local NGOs including PLAN, EcoDev, Paung Ku and Land Core Group. However, both meetings were cancelled due to the lack of interest and/or availability.

ERM also attended meeting with Union Level ministries in Naypyidaw in January 2020. This meeting was attended by various stakeholders. The comments and responses from these meetings are provided in **Appendix G** and considered in this Report.

The date, time, location, and stakeholders of each meeting is provided in Table 7.5.

Household interviews were held in ward and villages with stakeholders prior to the SEA/EIA consultation meetings.

Figure 7.5 provides representative photos from the SEA/EIA Phase consultation meetings and Figure 7.6 shows the location of the townships and village tracts visited for the public consultation.



Public Consultation Meeting in Twantay Township on 4th April, 2019



Public Consultation Meeting in Kyee Myin Daing Township on 2<sup>nd</sup> April, 2019

## Figure 7.5 Photos from the SEA Consultation Meetings

Date, time, location	Stakeholder	Purpose of Engagement
1 April 2019, 10 AM – 12 PM Ahlone Township	Meeting with Township level Authorities, Parliamentary representatives, Project Related Persons, CSOs, NGOs, Ward Leaders and local communities from Ahlone, Landmadaw, Sanchaung, Hlaing and Kamayut Townships	<ul> <li>Present Project information to Township level authorities, parliamentary representatives, project related persons, CSOs, NGOs, Ward leaders and local communities from Ahlone, Landmadaw, Sanchaung, Hlaing and Kamayut Townships;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake FGDs with women.</li> </ul>
2 April 2019, 10 AM – 12 PM Kyee Myin Daing Township (East)	Meeting with Ward Leaders, Related government officials, CSOs, NGOs, Project Related Persons and Communities from Wa Yone Seik Aye Ywar (West) Ward, Aye Ywar Ba Lote Nyunt Sat Ka Lay Ward	<ul> <li>Present Project information to Ward leaders, related government officials, CSOs, NGOs, project related persons and communities from Wa Yone Seik Aye Ywar (West) Ward, Aye Ywar Ba Lote Nyunt Sat Ka Lay Ward;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake FGDs with Ward leaders, farmers and women.</li> </ul>
2 April 2019, 2 PM – 4 PM Kyee Myin Daing Township (West)	Meeting with Ward Leaders, Related government officials, CSOs, NGOs, Project Related Persons and communities from Sat San Auk Yone A Latt Chaung Ward, Seik Kyee U Mya Ngar Zin Ward	<ul> <li>Present Project information to Ward leaders, related government officials, CSOs, NGOs, project related persons and communities from Sat San Auk Yone A Latt Chaung Ward and Seik Kyee U Mya Ngar Zin Ward;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake FGDs with Ward leaders, women and ferrymen.</li> </ul>
3 April 2019, 10 AM-12 PM Seikgyi Kanaungto Township	Township level Authorities, Parliamentary representatives, Project Related Persons, CSOs, NGOs, Ward Leaders and local communities from Seikgyi Kanaungto Township, Tha Khin Ba Thaung Ward	<ul> <li>Present Project information to Township level authorities, parliamentary representatives, project related persons, CSOs, NGOs, Ward leaders and local communities from Seikgyi Kanaungto Township and Tha Khin Ba Thaung Ward;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake FGDs with farmers and women.</li> </ul>
3 April 2019, 2 PM – 4 PM Twantay Township	Township level Authorities, Parliamentary representatives, Project Related Persons, CSOs, NGOs, Ward Leaders and local communities from Twantay Township	<ul> <li>Present project information to Township level authorities, parliamentary representatives, project related persons, CSOs, NGOs, Ward leaders and local communities from Twantay Township;</li> <li>Gather concerns and suggestions from stakeholders.</li> </ul>
4 April 2019, 10 AM - 12 PM	Meeting with Ward Leaders, Related government officials, CSOs, NGOs, Project	<ul> <li>Present Project information to Ward leaders, related</li> </ul>

 Table 7.5
 Consultation Activities Undertaken during SEA

Date, time, location	Stakeholder	Purpose of Engagement
Ta Mar Ta Kaw Village Tract, Twantay Township	<ul> <li>Related Persons and communities from the</li> <li>Project Area, including:</li> <li>Kyun Ka Lay Village Tract,</li> <li>Pa Tan Yae Kyaw Village Tract,</li> <li>Kha Lauk Chaik Village Tract,</li> <li>Ta Man Gyi Village Tract,</li> <li>Ta Mar Ta Kaw Village Tract,</li> <li>Gyaung Waing Village Tract,</li> <li>A Lat Chaung Village Tract, and</li> <li>Ma Ngay (Middle) Village Tract.</li> </ul>	<ul> <li>government officials, CSOs, NGOs, project related persons and communities from the Project Area;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake FGDs with women and farmers.</li> </ul>
4 April 2019, 2 PM – 4 PM Ku Lar Tan Thone Eain Village Tract, Twantay Township	<ul> <li>Meeting with Ward Leaders, Related government officials, CSOs, NGOs, Project</li> <li>Related Persons and communities from the</li> <li>Project Area, including: <ul> <li>Ku Lar Tan Thone Eain Village Tract,</li> <li>Kan Ywar Village Tract,</li> <li>Byauk Yoe Village Tract,</li> <li>Lat Pan Gwa Village Tract,</li> <li>Pyawbwe Lay Village Tract,</li> <li>Peik Swei Village Tract,</li> <li>Yangon Pauk Village Tract,</li> <li>Hpa Yar Ngoke To (North) Village Tract, Kyi Tan Village Tract, and</li> <li>Ka Li Htaw Village Tract.</li> </ul> </li> </ul>	<ul> <li>Present Project information to Ward leaders, related government officials, CSOs, NGOs, project related persons and communities from the Project Area;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake FGDs with women and farmers.</li> </ul>
5 April 2019, 10 AM – 12 PM Hlaing Tharyar Township	Township level Authorities, Parliamentary representatives, Project Related Person, CSOs, NGOs, Ward Leaders and local communities from Hlaing Tharyar Township.	<ul> <li>Present project information to Township level authorities, parliamentary representatives, Project related person, CSOs, NGOs, Ward leaders and local communities from Hlaing Tharyar Township;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake FGDs with women.</li> </ul>
5 April 2019, 2 PM – 4 PM Ah Pyin Pa Dan Village Tract, Hlaing Tharyar Township	<ul> <li>Meeting with Ward Leaders, Related government officials, CSOs, NGOs, Project Related Persons and Communities from the Project Area, including:</li> <li>Ah Pyin Pa Dan village Tract,</li> <li>Ah Twnin Pa Dan village Tract,</li> <li>Oke Kan Taung Kyar village tract, and</li> <li>Nyaung village tract.</li> </ul>	<ul> <li>Present project information to Ward leaders, related government officials, CSOs, NGOs, Project related persons and communities from the Project Area;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake FGDs with women and farmers.</li> </ul>
8 April 2019, 10 PM – 12 PM Dala Township	Meeting with Township level Authorities, Parliamentary representatives, Project Related Person, CSOs, NGOs, Ward Leaders and local communities from Dala Township.	<ul> <li>Present project information to Township level authorities, parliamentary representatives, Project related person, CSOs, NGOs, Ward leaders and local communities from Dala Township;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake FGDs with women.</li> </ul>
8 April 2019, 2 PM – 4 PM	Meeting with Township level Authorities, Parliamentary representatives, Project Related Persons, CSOs, NGOs, Ward	<ul> <li>Present project information to Township level authorities, parliamentary representatives, Project related persons, CSOs,</li> </ul>

Date, time, location	Stakeholder	Purpose of Engagement
Kyee Myin Daing Township	Leaders and local communities from Kyee Myin Daing (East) Township.	<ul> <li>NGOs, Ward leaders and local communities from Kyee Myin Daing (East) Township;</li> <li>Gather concerns and suggestions from stakeholders;</li> <li>Undertake FGDs with local communities.</li> </ul>
29 <sup>th</sup> January 2020, Naypyidaw	ECD, Ministry of Social Welfare, Relief and Resettlement, Department of Archaeology and National Museum, Ministry of Religious Affairs and Culture, Yangon City Development Committee, Ministry of Planning, Finance and Industrial, Ministry of Office of the Union Government, Mandalay Technical University, ECD Yangon Region, Ministry of Health and Sport	<ul> <li>Gather comments from Union Level stakeholders</li> </ul>



Figure 7.6 Meeting Locations for the Public Consultation Activities for the SEA of New Yangon City Phase 1

### 7.3 Results of Consultation

Table 7.6 summarises the key issues raised in public consultation meetings and presents the responses concerned with these issues and how these will be addressed in the SEA/EIA/IEE studies.

Table 7.6	Key Questions Raised During Scoping and SEA/EIA Public Consultation
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Questions	Responses	SEA/EIA/IEE Consideration
Land Compensation		
How will the company deal with land compensation?	A 20/80 compensation scheme was agreed with the Security, Peace, Stability and Rule of Law Working Committee. The previous government set 15/85 land compensation scheme, however, a 20/80 scheme is fairer.	The IEEs/EIAs will provide a high-level review of the resettlement / compensation process relevant to their project area.
What is the development plan for farmland compensation?	The compensated lands will be upgraded to residential (urban) land from farming land.	
What will be the compensation plan for farmers?	There is a difference between farmland and urban land. Urban land is more priceworthy, thus, a 20/80 compensation scheme for farmland is rational. For this moment, NYDC does not have a plan to provide housing for those farmers, but just 20% of urban land will be compensated. However, if needed, we will set up a related policy accordingly for the majority.	
When will the farmland be compensated?	Resettlement of farmland is one of the top priorities. The construction of the resettlement areas will occur in the first three years of the Phase 1 Development Plan. The six main project components' under Phase 1 are confirmed, and the Project is ready to call for tender for construction approval from the Union Government. Once the projects are approved, the tender process will be initiated and awarded. NYDC plans to commence the project in 2020.	
The construction of bridge will commence first or the housing relocation will come first?	The existing villages will not need to be relocated, as there is no physical resettlement in this area. The houses, which are located within the proposed Bridge construction area will be relocated first, before construction.	
For the resettlement plan, you mentioned that it will only be compensated the	Once the plan has been finalized and the bridge construction is approved, we will discuss the plans with the affected people in order to	The resettlement memo will be provided in the IEE/EIA reports.

Questions	Responses SEA/EIA/IEE Consideration	
farmland but not our houses, nor the impact on livelihoods, nor the costs involved in the moving and resettlement process in a new area.	reach a mutual agreement. There will be discussions on how to mitigate the socio-economic impacts on the local communities. We will have a discussion with all impacted households.	
I would like to know about compensation for the land and the houses engaging with the proposed Bridges and Roads?	They should be relocated with 100% compensation. Relevant government departments are responsible for the compensation.	
Along the Hlaing Tharyar road, there is some business like petro station, gas station, motorcycle shop. What is the relocation plan for them?	The category of the buildings along the proposed main road will be reviewed. If they hold legal ownership of the area, they will have a discussion with the GAD and government. If they do not have any legal ownership, they have to be removed. There is 25% reserved area to resettle those buildings, which overlap with the construction of the proposed bridges and roads.	
Electricity		
Where is the power source for this project?	The Project may potentially get electricity from the Mee Lin Chaint (1,350 MW) power plant (in Ayeyarwady Region). The Yangon Regional Government discussed with Union Minister of Ministry of Electricity and Energy regarding the electricity requirements for the project and the Union Minister agreed to provide the power to NYDC. NYDC is also looking for private power investors as a secondary option for the power source. Transformer substations will be constructed within the New Yangon City and will provide 24-hour electricity for all industries.	<ul> <li>Power source question is discussed in more detail in Section 4.3 of the Power EIA Report on power generation.</li> <li>The proposed Project will be composed of:</li> <li>Transformer substations (one 230 kV and two 66 kV) and switching station (one 33 kV);</li> <li>Transmission lines; and</li> <li>Distribution lines including 66 kV, 33 kV and 11 kV lines.</li> </ul>
Roads and Transportation		·
Will there be an underground transportation system?	All the transportation facilities will be above ground.	The impacts from road construction increased traffic, and existing local infrastructure (roads) /
What will be the width of roads in the New City?	The roads will be at least two lanes and included drainage on both sides. Some major roads will be up to four lanes.	local communities have been assessed in the Section 8 of the EIA Report for Roads.

Questions	Responses	SEA/EIA/IEE Consideration
During Cyclone Nargis, Twantay-Hlaing Tharyar Road was not flooded but the Kha Lauk Chaik-Seikgyi Kanaungto road was flooded. The road level should be as high as possible and as high as the Twantay- Hlaing Tharyar Road to ensure it is protected from flooding.	NYDC has commissioned a dedicated Flood Risk Assessment conducted by Royal Haskoning. In accordance with good international practice, Royal Haskoning conducted flood analysis for 100-year events, considering tidal flooding, climate change, and precipitation. Flood protection for the Industrial Zones and Resettlement Areas will be prioritised. After that, the Project will upgrade the flood protection of the other infrastructure facilities as per the progress of the Phase 1 Development.	
The access road to West Kyee Myin Daing is rather bad. Does NYDC has a plan to upgrade it?	The conceptual design of the bridge has been completed and submitted to the Government for approval. Once the project is approved, tender invitations will be sent and the Project will begin constructing the access roads for the New City.	
Any consideration for the connection of main roads to each village?	We will collaborate with the local community and relevant authorities/parties.	
Bridge		
Is there any bridge construction in the Seikgyi Kanaungto Township?	For the whole Phase 1 Development, it is proposed to construct up to twelve bridges; two bridges will be built in Stage 1 of Phase 1. The design and location for all bridges for Phase 1 will be confirmed at the end of February 2019.	There is a separate EIA for bridge construction and operation for the whole project.
When will the bridge construction be commenced?	We cannot confirm the time of commencement but we are trying to commence in 2020.	This information is included in Table 2.1 of the EIA Report on Bridges.
Construction		
Where will the Project use sand and soil? We suggest the Project does not excavate the soil from the Twantay, Kawhmu, and Kungyankone area. We recommend taking the soil from the river bank.	We are planning to excavate from other areas (i.e., not the Project Area) as well as potentially excavating soil from the lake in the Project Area and Twantay Canal.	The mitigation measures for the potential impacts on the environment and people due to the construction in the Project Area are proposed in this SEA report.
Water and Waste Water		

Questions	Responses SEA/EIA/IEE Consideration		
Will there be a storm water collection system?	A water treatment plant and storm water collection system are included as part of the Phase 1 Development.	The mitigation measures for the potential impacts of wastewater and storm water drainage systems to local communities and environment are included in this SEA Report.	
Is it correct that the project will take the water from Toe River?	Water intake will be from Toe River; this has been studied by JICA, who prepared the 2040 Master Plan for Yangon Region. The water quality has been tested which suggested that the quality is good to use as a water source. Ground water from the Project Area will not be used due to its quality and concerns about land subsidence.	The impacts of water intake from the Toe River have been assessed in the Water EIA Report. The EIA Report assumes that no groundwater from the Project Area will be utilised given the potential impact on existing water resources.	
We are wondering whether there is any plan of water supply from centralized water supply system like Kyo Phyu. There is a water supply plan for Twantay, how about for Hlaing Tharyar. We want access to good quality of water.	Yangon has a master plan from JICA regarding water supply, and NYDC plans to take water from the Toe River, which is of good quality and quantity. NYDC is aware that there is a plan of JICA to get water from Kote Koe Wa and distribute to Hlaing Tharyar in 2023. We will take note and inform the relevant government departments.	This is not part of the SEA or the IEEs/EIAs Studies but NYDC is aware that this is the request from the community.	
If the water will be taken from the Toe River, this should be distributed to Seikgyi Kanaungto where the locals have facing issues with lack of water.	The company has noted the suggestions of water distribution issues and will submit it to relevant authorities.		
I would like to suggest to consider the waste water treatment plant for industrial waste in the Phase 1.	A policy for the Phase 1 Development of industries is currently being planned. Minimum standards to treat and dispose of the waste will be provided to the investors.	The potential impacts of both waste and wastewater management from Industrial Zone has been assessed in the Industrial Zone EIA.	
Land Utilization			
Is all the land within the Project Area farmland?	About 85% of the land is farmland in the Project Area.	Mitigation measures for the potential impacts of the changes in land utilisation are proposed in this SEA Report.	
Environment			
What about villages outside of Project Area's clean environment? Based on experiences with existing industrial zones,	The SEA and IEE/EIAs do not just focus on the Project Area. We also asses the surrounding area and include this in our mitigation recommendations. We have conducted primary baseline surveys and if	Environmental impacts and mitigation measures have been assessed in this SEA Report for the Project Area and all surrounding areas in the Area	

Questions	Responses	SEA/EIA/IEE Consideration
it is observed that after a few decades the environment will become affected. Will villages in Hlaing Tharyar Township have environmental impacts?	the current baseline is degraded, it means that we will adopt stricter environmental management and mitigation measures for the Project. In addition, monitoring plans will also be prepared and reported to the ECD every 6 months in order to confirm whether mitigation measures are effective.	of Influence (i.e., area where impacts may occur; village tracts, wards and townships within or neighbouring the Project Area).
It is said that both, the Industrial Zone and Resettlement Area will be included in the Project Area. According to the environmental point of view, industries will discharge the chemicals and I would like to know whether there is any Management Plan for the potential impacts or not.	There will also be guidelines to be in line with the Myanmar National Environmental Quality (Emission) Guidelines. For example, there will be guidelines to clean the wastewater from industries before discharging and to water the gravel daily for controlling the dust to the surrounding area. NYDC will take responsibility for the City Development related to the Environmental Management Plan (EMP).	
I want to know the management plan of Pun Hlaing River and the creeks around, the location of the control water gate and the reason of silt sedimentation of Pun Hlaing River. In 2008 the creeks were shut and no way of silt and sediment to wash out, thus the river has been suffering from silt sedimentation	We have our flood consultant, Royal Haskoning, Dutch company, who study about the current stage of flooding and river nature. For this moment, there are two floodgates. In coordination with them, we proposed five or six floodgates to not getting flood impact from NYDC. And we are also planning to de-sedimentation of the creeks as you see in the map, and also to create a scenic place for the people living around.	
I have a concern on the load capacity of the existing bridge at Hlaing Tharyar, which will be potentially affected by transporting the construction materials for NYDC project? Will the roads in Hlaing Tharyar be impacted by the New Yangon City Project activities? I want the Project to take accountability for any impact on the existing roads?	The construction contractors have to submit the number of vehicles, loading capacity of individual vehicle and the schedule prior to commencing any construction activities. All vehicles must not overload the capacity of the bridge. When the joint venture contractors transfer the complete projects to us, we will ensure that they are accountable for any damage caused directly by their activity. For example, if the road is damaged by their activities, they will have to repair it.	

Questions	Responses SEA/EIA/IEE Consideration	
It is noted that most of the locations of baseline sampling points for air, water and noise indicators are in the same Township.	There is a methodology for selecting the baseline collection points. It is based on the residential areas in different townships and potential impacts of the Projects.Methodology of the baseline data collection provided in Appendix C.	
Health		
There will be health impact from the Project, especially the dust produced by the vehicles passing through. Has this been considered?	For dust control measures, the Project Area needs to construct wheel wash bays where necessary, with the aim of reducing dust produced by site vehicles. Water spraying will be implemented at the Project Area to supress dust.	Mitigation measures for the potential impacts on community and occupational health due to the Project activities are proposed in this SEA Report.
How about the impact to health of the labours working inside the Project site?	There are two types of labourers: those who stay on-site and those who stay off-site. For the Phase 1 Development, there is NYDC's Health and Safety Guidelines which reflect not only Myanmar, but also international guidelines such as the International Finance Cooperation guidelines. In addition, the contractors will also have their own Health and Safety Plan.	
Traffic		
The mitigation measure for the traffic impact should be considered first in this Project.	Oriental Consultants from Japan was hired to conduct the traffic study for the 2040 master plan for the Yangon Regional Government. NYDC has appointed Oriental Consultants for New Yangon City Traffic Assessment and Transport Planning. This considers the estimation of population growth rate for 30 years, and the traffic consultant conducted two studies. The first one is the transportation plan for connecting the existing Yangon City and the New City. There will be about 12 bridges required for the entire project. The traffic consultant suggested the number of bridges required, based on population growth and employment opportunities. The traffic consultant also planned the connection routes of the existing railways with new ones, and the number of the bus services and bus stops not only to connect with other cities but also transport within the New City. The investors who are interested in providing public transport for the New City are being invited via local newspapers.	Mitigation measures for the potential impacts on traffic are proposed in this SEA Report.

Questions	Responses	SEA/EIA/IEE Consideration		
Urban Management				
Will there be any physical displacement for the people living in the Project Area?	The villages in the Project area will remain untouched and there will also be green spaces between the new developed areas and the existing villages.	Mitigation measures for the potential impacts to the villages in the Project Area from construction and operation of the Phase 1 Development are proposed in this SEA Report.		
How will the city manage the population increase in the future and what is the process be for the Bill of Quantities (BoQ) and Quality Control (QC)?	There is a Master Plan prepared by AECOM and includes a consultant to countercheck the process of BoQ and QC.	Mitigation measures to manage planned population increases are proposed in this SEA Report in terms of resource use and associated impacts.		
When will the community settle in the New City?	The industries will be constructed in 2022 and there will be job opportunities for locals after this time.	Mitigation measures for potential social Impacts are proposed in this SEA Report.		
Does NYDC have any plans regarding the squatter areas for the New City?	NYDC understands the current squatter issues and ensures adequate workers' accommodation is included in the Project Area. The construction workers will be required leave the Project Area once construction is complete.	Mitigation measures to manage the influx of workers during construction and operation phases and the impacts from this influx on local communities and environment (including squatters) are proposed in this SEA Report.		
Is there any plan to include an area for the administrative departments?	NYDC will include administrative department areas that cover approximately 5% of the resettlement areas.	This is included in each project description of the Project main components' relevant IEEs/EIAs.		
Are there any hotel zones in the Project Area?	There will be an approximately 20 square kilometre commercial and residential development areas, which include areas for hotels and condominiums.			
There are 2.3 million disabled persons according to census data. How is the project designed so services and infrastructure are assessable for disabled persons?	NYDC considered the design for disabled persons as per American with Disabilities Act (ADA) compliance, and Myanmar National Building Codes for buildings and infrastructure.			

Questions	Responses	SEA/EIA/IEE Consideration
People from different economic statuses want to purchase houses in this Project Area. How many options are there for them?	There will be different types of housing starting from one storied to up to mid to high rise buildings. We designed for the estimated 1.2 million people. Everyone can buy houses depending upon the amount of money they have. Houses will vary from private compounds and condominiums to affordable housing.	
Will the cemeteries from Seikgyi Kanaungto and Ah Lat Chaung be combined into one?	The existing cemeteries will remain as they are.	Mitigation measures for potential impacts on cultural heritage are proposed in the relevant IEEs/EIAs reports.
Is the New Yangon City Project Area chosen by the previous government or the current government?	The New Yangon City Project Area is chosen by the previous government.	This is not SEA/EIA/IEE consideration but NYDC is aware of the community concern.
Why did NYDC choose the current location as the Project Area?	The New Yangon City Project Area was approved under the previous government. The Yangon Regional Government worked with JICA for the 2040 Strategic Urban Development Plan for Yangon Region and proposed the locations for new developments and infrastructure. This Project is one of the 2040 JICA allocations, and the Yangon Regional Government chose the current Project Area according to that plan.	
How will the New Yangon City be named?	At this moment, the project is called the New Yangon City. For the name of the City, there will be discussions between the public, NYDC and other relevant government departments. If there is a name that the public prefers, it can be sent not only to NYDC's email but also to NYDC office.	
How many hospitals and schools are planned to be in the New Yangon City?	There is a planned map for basic infrastructure and people settlement as we have shown. We will have a discussion with the general administration management team and relevant administrative offices to discuss the required number of basic structures including schools and hospitals, reflecting the population according to international good practice. Other components such as the standard distance from public transport facilities (bus stations) and from community commercial and	Mitigation measures for the potential impacts on demographic pattern are proposed in this SEA Report.

Questions	Responses	SEA/EIA/IEE Consideration
	services areas, (retail shops and hospitals) to residential areas will follow international standards.	
Will there be urban farming included in New Yangon City Project?	Urban farming is generally for cities which are densely populated and lack availability of farming land. As New Yangon City Project and its nearby areas allow for nearby farming areas, we do not yet have a specific plan for urban farming.	None required.
Who is your target residence for new urban housing plan?	For the first five years, we target those who will mostly work for construction. There will be a lot of housing for workers at the development site as we consider their time spent on commuting between work and their home, and their quality family time.	This is not an SEA/IEE/EIA consideration but NYDC is aware of the concern.
I learnt that low cost housing complex is target for those who have income of about 300,000 to 400,000 Kyats and the government staff. How about the others who have lower income than that (for example, street vendors, daily waged workers, etc.)	There will be different payment methods: direct payment, bank loan, instalments, etc. Our concern is the affordability for the people who work for NYDC project implementation. The project is currently at the initial planning stage; we can provide you with more detailed information about this housing program when the plan is more advanced.	
I would like to know the earthquake resistance of the bridges and buildings.	The buildings and bridges will be constructed according to the Myanmar National Building Code (MNBC).	None required.
Waste Management		
What is the Waste Management system?	There will be industrial and residential waste. For industrial waste, we are discussing with interested investors including DOWA company, which is currently waste management facility in Thilawa. All the waste from the Project and the city will be managed in line with National Standards and Guidelines.	In terms of waste management, including generation and disposal, mitigation measures for the associated potential environmental and social impacts are proposed in this SEA Report.
Where will waste be discharged and how many acres will be set up for a dumpsite?	There is a plan for industrial waste and municipal waste will be disposed of like Thilawa industrial Zone.	
How about waste management system for the new city?	On February 11th 2019, there was an announcement in The New Light of Myanmar newspaper, inviting the expression of interest for waste	

Questions	Responses	SEA/EIA/IEE Consideration	
	management services. Approximately seven organizations submitted expressions of interest. We will carefully evaluate the applicants.		
Budget Management			
What is the budget for this project?	Around 1.68 billion USD is estimated for the development of Phase 1 Stage 1 and includes two Bridges, Roads, Power Transmission and Distribution Network, Water Treatment Plant, Waste Water Treatment Plant and Industrial Zone. We hope to start implementing next year (2020).	This is not an SEA/IEE/EIA consideration but NYDC is aware of the concern.	
Industries			
Who will own the infrastructures such as industries? How long are they entitled to own?	As per the Myanmar Investment Commission (MIC) law, foreign investors will be permitted to use land for an initial period of up to 50 years, which can be extended for two additional consecutive periods of ten years each. The investors will build the required infrastructure for the Industrial Zone.	This is not an SEA/IEE/EIA consideration but NYDC is aware of the concern.	
What will be the ratio for Small and Medium Enterprise (SME) in the Industrial Zone of the New City?	The types of sector and the percentage of their business in the Industrial Zone are displayed in the meeting materials. At this stage, the concept masterplan proposes a land use mix of 10% large (heavy) industry and 14% small (light) industry within the 90 km <sup>2</sup> . The exact percentage will be confirmed later.		
Farming Activities			
Is there any plan to break the farming for the farmers who are now planting the paddy in their fields?	For farmers, there will be an announcement in advance to regarding plantation activities. At present, there is no guidance and farmers can plant freely.Mitigation measures for the pote economy are proposed in this SI		
Employment Opportunity			
Will there be employment opportunities for local people?	There will be employment opportunities for people who live in and around the new city during the construction and operation of the Project.	Measures for employment management are proposed in this SEA Report.	

Questions	Responses	SEA/EIA/IEE Consideration
I would like to request the company to create employment opportunities for disabled persons.	NYDC will record your suggestion and try to implement.	
What is the consideration of disabled people in the Yangon City?	There are two considerations for disabled people in the Project. First, the percentage of disabled labours in the workforce. Once the tender process is completed, we will discuss with investors and we can set up incentives for the industrial investor to hire disabled employees. At the moment, we do not know the exact percentage of disabled person in the workforce. Secondly, NYDC's design standards will meet Myanmar disability code (MNBC) and standards.	
We are a Civil Society Organization who has an interest in local people life and we would like to suggest you consider job opportunities for men. It seems that there are more job opportunities for women in industrial sector and less for men. Then men became jobless and that lead them to commit into crime. We suggest you create more job opportunity for men for a better gender balance for better way of life.	We will not discriminate between men and women for job opportunities. However, there will be more construction work within the first five years, and it is assumed that there will be more male-oriented jobs. There will be other kinds of job for women as well. Initially, where our people may lack knowledge of international standards, the investors will bring in their own people who can provide training. We are proposing to provide a vocational training school which will provide international certification before any factory is opened. People can be qualified through this program, so investors can get qualified local people.	
The labours who will work in the Project will be daily wages or monthly wages?	We are at the tender preparation stage, and we haven't decided yet. There will be daily and monthly wages depending on the level and nature of work.	
It is known that about 20,000 acres of farm lands will be acquired by the Project. If one acre can produce 60 baskets of paddy, there will be 1'200,000 baskets to be lost when the Project starts and the farmers will lose their job. Therefore, please consider this fact in doing the assessment.	The farmland will be upgraded to urban land, and land owners will get back 20 per cent of their farmland. There could be a livelihood impact during the transition from acquiring the land and returning. The suggestion is noted and included in the EIA report.	

Questions	Responses SEA/EIA/IEE Consideration			
The local community has very limited technical expertise and education to get jobs, therefore job opportunities may favour other nationalities such as the Chinese, and then the New City will become a Chinese City. Our people will become jobless and I am concerned.	Whoever wins the project tender - regardless of being Chinese or Korean or Japanese, we will make the agreement to put the quota for minimum 50% employment of Myanmar nationals. We are also looking for investors for the establishment of vocational schools, which will train local people for the skills required to work in industrial and commercial sectors (with international certification). If our local people have enough skills and international certification, investors will not need to bring people from other countries. The vocational schools are planned to be established prior to setting up of the first factory in the area.			
There are 103 households currently owning small commuter boats, and their livelihood depends on transporting people across the river. They will become jobless when there is a bridge. Have you considered the impact on their livelihood?	This has been noted and will be considered. The EIA will not only focus on environmental impact but also social impact on the affected community. We will have a focus group discussion with the ferrymen after this consultation.	Mitigation measures for the potential impacts on economic and livelihood are included in the Bridges EIA Report.		
What is the livelihood consideration for the farmers after acquiring the farmland?	Construction work opportunities will be available when the project commences. Potential investors agreed with NYDC that at least 50% of jobs will be available for locals during construction phase. For operational phase, 900,000 positions will be available in 30 years and 600,000 for the first five years.			

### 7.4 Further Ongoing Consultations

Future engagement activities will consist of the following and are shown in detail in Table 7.7:

- Further disclosure of Project information and SEA and IEE/EIA Reports, including opportunities to provide feedback;
- Engagement with relevant regional officials/authorities and government organizations on the outcomes of the SEA/IEE/EIA; and
- Ongoing communications with interested and potentially affected stakeholders during operation.
   Ongoing project information will be provided to local areas.

NYDC will provide an activity update in a notice to villagers prior to the start of the Phase 1 Development. A grievance mechanism will be in place during construction and operation in line with international good practice.

If significant issues, concerns, or impacts are identified, further stakeholder consultation with relevant, interested or affected stakeholders may be undertaken during operation.

Timing	Purpose	Stakeholder / Group	Method of communication / notification
Following lodgement of SEA/IEE/EIAs for assessment	Disclose SEA and EIA Reports	<ul> <li>Relevant regional officials/ authorities;</li> <li>Relevant Government organizations;</li> <li>Villagers;</li> <li>Other relevant stakeholders; and</li> <li>General public.</li> </ul>	<ul> <li>Hardcopy SEA/EIA executive summaries (Myanmar Language) made available in Yangon;</li> <li>Publish Phase 1 Development information on signboards at the Project Area;</li> <li>Regional and national advertising – via newspapers; and</li> <li>SEA/EIA (English) and executive summaries (Myanmar and English) available on NYDC website and in NYDC office.</li> </ul>
During the Project activities	Address any community concerns that may arise during Project activities	Implement the Grievance Mechanism	Grievance mechanism disclosed to the local community and government

 Table 7.7
 Stakeholder Communication and Notification

### 7.5 Disclosure

As per the requirements of the EIA Procedure (2015), NYDC has disclosed information on the Phase 1 Development on their website – <u>https://nydc.com.mm/</u> and signboards have been posted at the Project Area. Figure 7.7 provides the signboard. There have also been adverts in one English and one Myanmar newspaper and hard copies of the SEA/EIA/IEE Reports will be made available in the Project Area.

The advertisements for the scoping stage that were announced in The Global New Light of Myanmar (English) and The Mirror (Burmese) are provided in Figure 7.8 and Figure 7.9.



Figure 7.7 Signboard at the Phase 1 Development Boundary



More information about NYDC and the Projects can be found at NYDC website https://nydc.com.mm/.

English version of the Public Consultation advertisement published on 29th April, 2019

Figure 7.8 Newspaper Advertisement (Global New Light of Myanmar)

ရန်ကုန်မြိုသစ်စီမံကိန်းအိပ်ထမအဆင့်မဟာအစီအစဉ်အတွက် မဟာဗူ၊ဟာမြောက်သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာဆန်းစစ်ခြင်းနှင် ပတ်ဝန်းကျင်နှင့်လူမှုဝန်းကျင်ထိနိုက်မှုဆန်းစစ်ခြင်း ရန်ကုန်မြို့သစ်ဖွံ့ဖြိုးရေးကုမ္ပဏီလီမိတက် (NYDC) သည် မြန်မာနိုင်ငံ ရန်ကုန်တိုင်းဒေသကြီးရှိဆိပ်ကြီးခနောင်တို၊တွဲတေး၊ လှိုင်သာယာနှင့် ကြည့်မြင်တိုင်မြို နယ်တို့တွင်မြို့သစ်စီမံကိန်းလုပ်ငန်းဆောင်ရွက်ရန်ရည်ရွယ်ပါသည်။ စီမံကိန်းပထမ အဆင့်အပ်ထမအပိုင်းတွင်တံတားများ၊ လမ်းများ၊ လျှပ်စစ်ဓာတ်အား၊ စက်မှုဇုန်၊ ရေနှင့် ရေဆိုးဟူ၍စီမံကိန်း၆ခုပါဝင်ပါမည်။ မြန်မာနိုင်ငံပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဆိုင်ရာဥပဒေနှင့်နည်းဥပဒေအရ NYDC သည်စီမံကိန်းပထမအဆင့်၏ပထမအပိုင်းဖြစ်သည့် တံတားများ၊လမ်းများ၊ လျှပ်စစ် ဓာတ်အား၊ စက်မှုဇုန်၊ ရေနှင့်ရေဆိုးတို့အတွက် ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဆိုင်ရာ လိုက်နာဆောင်ရွက်မှုသက်သေခံလက်မှတ် (ECC) ရရှိရန် ပတ်ဝန်းကျင်နှင့်လူမှုဝန်း ကျင်ထိခိုက်မှုဆန်းစစ်ခြင်းအစီရင်ခံစာ (EIA) ၆စောင်ပြုလုပ်ဆောင်ရွက်ရန်လိုအပ် ပါသည်။ NYDC သည်ပတ်ဝန်းကျင်အပေါ် အစီအစဉ်များ၊ မူဝါဒများ၊ လျာထားချက် များနှင့် အခြားပဏာမမဟာဗျူဟာများ၏ သက်ရောက်မှုများကို အစီအစဉ်တကျ လေ့လာဆန်းစစ်ရန် စီမံကိန်းပထမအဆင့်အတွက် မဟာဗျူဟာမြောက်သဘာဝပတ် ဝန်းကျင်ဆိုင်ရာဆန်းစစ်ခြင်းအစီခုင်ခံစာ (SEA) ၁စောင်ကိုပါပြုလုပ်ဆောင်ရွက် သွားပါမည်။ NYDC ကိုယ်စား Environmental Resources Management (ERM) - Myanmar Limited, Resource and Environment Myanmar (REM) နှင့် Environment Quality Management (EQM) တိုက EIAs နှင့် SEA တို့အတွက် အခြေခံအချက်အလက်များကောက်ယူခြင်းနှင့်လူထုတွေ့ဆုံဆွေး နွေးခြင်းများကိုဆောင်ရွက်လျက်ရှိပါသည်။ EIAများကိုသယံဇာတ နှင့် သဘာဝပတ် ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနမှ ထုတ်ပြန်ထားသော ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်းဆိုင်ရာလုပ်ထုံးလုပ်နည်း (၂၀၁၅) အရလိုက်နာဆောင်ရွက်သွားပါမည်။ စီမံကိန်း၆ခုအတွက်နယ်ပယ်အတိုင်းအတာသတ်မှတ်ခြင်းအစီခုင်ခံစာကို သယံဇာတနှင့်သဘာ၀ပတ်ဝန်းကျင်ထိန်းသိမ်းရေးဝန်ကြီးဌာနရှိ ပတ်ဝန်းကျင်ထိန်းသိမ်း ရေးဦးစီးဌာနသို့တင်ပြပြီးဖြစ်ပါသည်။ NYDCနှင့်စီမံကိန်းဆိုင်ရာအသေးစိတ်အချက်အလက်များကိုပိုမိုသိရှိလိုပါက NYDC အဝက်ဘ်ဆိုဒ်ဖြစ်သောhttps://nydc.com.mm/တွင်လေ့လာနိုင်ပါသည်။ ຊີດເວົ້າໝາຍົງລູ စက်ပြင်သင်တုန်

Myanmar version of the Public Consultation advertisement published on 29th April, 2019

### Figure 7.9 Newspaper Advertisement (The Mirror)

### 7.6 Feedback Process and Grievance Mechanism

One of the most important aspects of the stakeholder engagement process is to provide feedback to the stakeholders. The intent and purpose of providing feedback is to ensure that relevant stakeholders, especially the local communities, are clearly communicated the process /stages /channels through which they will be informed about the Project.

### 7.6.1 Feedback Process during SEA

- Disclosure of the Scoping Findings: After submission of the Scoping Reports to MONREC, information of the Phase 1 Development was disclosed via newspaper adverts (one English and one Myanmar language) and on NYDC's website.
- Disclosure of SEA and IEE/EIA reports at Township Level: After submission of the SEA and IEE/EIA reports for approval, the Executive Summary of the SEA and IEE/EIA reports will be distributed at the Office of YRG and GAD offices where consultation meetings have taken place.
- Disclosure of approved SEA and EIA reports: The draft and final SEA and IEE/EIA reports will be made available at NYDC office and website. Information that the SEA and EIA Reports will be published in one English and one Myanmar newspaper.

### 7.6.2 Operations Phase

For the operations phase, a more detailed stakeholder engagement protocol will be developed. The most appropriate method for communication will be identified through the consultation process and the SEA/IEE/EIA.

### 7.6.3 Community Grievance Mechanism

A grievance mechanism will be created by NYDC so that stakeholders can raise questions or concerns with the Phase 1 Development and have the concerns addressed in a prompt and respectful manner.

The purpose of the grievance redress mechanism will be to provide a forum to the community and other relevant stakeholders to voice their concerns, queries, and issues with the Phase 1 Development. Such a mechanism would provide the stakeholders with one Phase 1 Development personnel or one channel through which their queries will be managed as well as ensure timely responses to each query. The detailed procedure will be formulated for the Phase 1 Development and will detail the process of receiving and recording grievances, assessing their validity, the timeframe in which the grievances have to be resolved, the roles and responsibilities for the implementation of the procedure, and the documentation and monitoring and review process. NYDC's grievance redress mechanism procedure is mentioned in Figure 7.10.



Figure 7.10 NYDC's Grievance Redress Mechanism Procedure
### 8. ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK

### 8.1 **Purpose of the ESMF**

This Section describes the Environmental and Social Management Framework (ESMF) for the Phase 1 Development.

The purpose of the ESMF is two-fold:

- This ESMF provides guidelines for the Phase 1 Development's Administrator to monitor the environmental and social performance of the sub-project components. This monitoring will cover all stages of the sub-project components, namely during the construction and operations of the initial sub-project components (or Project main components), during the construction and operations of additional sub-project components, and during the decommissioning phases of sub-project components; and
- This ESMF provides environmental and social mitigation guidelines to all sub-project developers and operators, on the recommended management practices for them to follow in order to manage environmental and social risks associated with any type of sub-project and at any stage. These recommended management practices are applicable to all sub-project developers and operators and to all their contractors and sub-contractors.

This ESMF is, therefore, an overarching document that aims at providing mitigation guidance for managing the environmental and social impacts that will be triggered by the development and operation of all New Yangon City's sub-project components.

### 8.2 Linkage to the Phase 1 Development of New Yangon City

This SEA and its proposed ESMF fit into the Master Planning work undertaken by NYDC. The ESMF aims at enabling the implementation of the vision set for the Phase 1 Development for NYDC (March 2020).

The implementation of the developmental and operational recommendations proposed under this ESMF should contribute to put in practice the vision set for NYDC (Section 4.2.1) and to enable the Phase 1 Development to reach the targets set under the Phase 1 Development's Master Plan, Traffic and Transport Plan (Section 4.9.2), and Socio Economic Master Plan (Section 0) Visioning in terms of master planning, transportation, environment, social infrastructure, power, water, and smart city.

### 8.3 Relevant Myanmar Regulations and Standards for all Sub-Projects

As the Phase 1 Development entails a comprehensive range of development sub-projects, it is expected that most Myanmar regulations and standards will be relevant to the development of the Master Plan. These are listed in the individual IEE/EIAs of the main Project components and will be listed in the legal registers of the other sub-projects that will be developed / operated.

As recommended under the below sections, each developer/ operator is expected to maintain an updated legal registrar relevant to its sub-project.

### 8.4 Relevant International Guidelines for all Sub-Projects

The recommendations provided under this ESMF are guided by good international industry practices in general and by the World Bank Group Environmental Health and Safety (EHS) Guidelines and the IFC Performance Standards in particular.

These documents, as updated, can be used as reference guidelines by sub-project developers and operators throughout the stages of each of the Phase 1 Development's sub-projects.

### 8.5 Recommended E&S Mitigation and Enhancement Measures

The SEA process has identified the main high-level impacts that may be triggered by the development of the sub-projects of the Phase 1 Development from an environmental perspective (see Section 6) and from a social perspective through the feedback process (see Section 7). As part of the SEA process, these main impacts have been related to five areas of activities that may occur during the development of the sub-projects of the Phase 1 Development. Mitigation measures have been identified for each area of activities and form the recommended environmental and social mitigation and enhancement measures under the SEA ESMF.

It is expected that these recommended environmental and social mitigation measures along with the ESMF Section of the SEA Report be communicated to each sub-project proponent participating to the Phase 1 Development at the design, construction, commissioning, operation and decommissioning stages of the sub-projects. These mitigation measures shall guide sub-project proponents in operationalising environmental and social mitigation and enhancement measures at each sub-project level and each sub-project stage.

Such implementation, at the sub-project level, shall contribute to the aspirations of the Phase 1 Development. The following diagrams (Figure 8.1 to Figure 8.5) gather the recommended mitigation measures by the type of sub-project activities and can be applied to any type of sub-project undertaken for the Phase 1 Development. These five areas of activities are:

- Occupational Health and Safety Management;
- Community Engagement;
- Water Runoff and Drainage System;
- Waste and Hazardous Material Management; and
- On Site Traffic Management.

# **OCCUPATIONAL HEALTH AND SAFETY PLAN**



Figure 8.1 Occupational Health and Safety Framework

#### ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK

## **COMMUNITY ENGAGEMENT**

#### **NEIGHBOURS**

#### RESPECT YOUR NEIGHBOURS

- · Minimise dust and noise generation
- Install an alarm system for emergency incidents
- · Fence individual Project sites so as not to expose the community to risks
- Implement pollution prevention measures for wastewater, air pollution, hazardous
- materials and wastes, noise pollution, etc.
- · Establish a Workers Code of Conduct
- Request contractors and their sub-contractors to implement similar plans (back-to-back responsibilities)
- · Install wheel cleaning facilities for individual project sites where necessary to prevent spread of dust and mud CULTURAL HERITAGE · Obtain rights of way clearance where needed RESPECT CULTURAL HERITAGE Build access roads following fair and transparent land acquisition process Maintain or repair public roads that may be specifically damaged by the Identify cultural heritage in the Project individual Project vehicles area and avoid/ minimise any adverse impact especially during site preparation, · Spray water at the Project sites to suppress dust during dry spells excavation and filling works Minimise visual impacts of the individual Project and Project activities COMMUNITIES DIALOGUE AND ENGAGE WITH THE COMMUNITIES 6 · Liaise with the communities to establish and maintain the Project and **UP-TO-DATE INFORMATION** NAME OF INDIVIDUAL PROJECT SITE resources, power resources, natural resources, etc.) State Project details, Project's parties' contact details Implement and disclose a Community Grievance Mechanism Communicate on planned Project schedule and · Hire locally and support vocational training NATURAL RESOURCES events that may impact community and other stake Run CSR mutually-beneficial initiatives holders · Report regularly on Project's engagement with stakeholders (dialogue, SHARE RESOURCES SUSTAINABLY AND EQUALLY Communicate on Project's Community Grievance grievances, dispute resolution, etc.) Mechanism and Include a guota for minimum 50% employment of Myanmar nationals · Do not block, divert or pollute natural streams communication channels Minimise use of natural resources (water use, wood, etc..) · Share the results of the environmental quality · Avoid damaging natural resources such as plants, trees, bushes monitoring and disclose on KPIs or threatening animals, fish, birds, etc. · Communicate on CSR activities Share natural resources with communities in a fair and transparent manner Workers Workers Code of Accommodation Conduct Complaints Camp Box CONTRACTORS' ACCOMMODATIONS CARE FOR YOUR WORKERS AND YOUR CONTRACTORS' WORKERS Follow the Workers' accommodation: processes and standards - A guidance note by IFC and EBRD (2009)

Figure 8.2 Community Engagement Framework

#### PUBLIC ROADS

#### SHARE THE ROADS FOR THE PROJECT'STRANSPORTATION OF EQUIPMENT, SUPPLIES, WORKFORCE

- · Avoid crossing settlements to the extent possible
- · Limit vehicle speed to 30km/hr when crossing settlements

- · Regularly inspect and clean public roads

- Community Emergency Preparedness and Response Plans (e.g. spills, leaks, fire, explosion, vehicle collision, natural hazards)
- · Liaise with the communities to manage population influx from workers and added pressure on social infrastructure (e.g. health, education, roads, water

#### ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK



## WATER RUNOFF AND DRAINAGE SYSTEM

## STORAGE

#### STORE WASTE, CHEMICAL AND HAZARDOUS MATERIAL RESPONSIBLY

- · Provide a bunded refuse collection area with impervious floor, appropriate waste containers and pollution prevention facilities
- Provide bunded chemical / hazardous material and hazardous waste storage areas with impervious floor, appropriate containers and pollution prevention facilities, including for fuel tanks, with capacity to accommodate 110% of the volume of the largest container
- Site waste storage area away from watercourses or potable water sources and from other sensitive receptors (e.g. villagers)
- Keep bunded areas locked and restrict access to trained personnel
- · Build secondary containment around on-site waste, chemical and hazardous material storage areas to avoid spillage of waste and leakage of leachate
- Collect contaminated surface water run-off and treat it as hazardous waste
- Drain the bund of rainwater after a rain event
- Pass surface runoff from bunded areas through oil traps prior to discharge to the wastewater and stormwater drainage systems
- Inspect and monitor bunded areas regularly, document and report on such inspections



#### **OIL LEAKS, SPILLS, ACCIDENTS**

#### PREVENT OIL LEAKS, SPILLS AND ACCIDENTS

- Pave areas dedicated to traffic but retain as much vegetated areas as possible
- · Conduct regular vehicle maintenance to prevent leaks and spills
- Establish Emergency Preparedness and Response Plans for each type of hazard e.g. storm, leaks, spills,
- fire, explosion, natural hazards, etc. Maintain emergency response/ spill control kits in
- place throughout Project site for containing spills and leaks and immediate clean up actions following spillages
- Have a trained emergency response team in place at all times

#### SYSTEMS DESIGN

#### DESIGN EFFECTIVE WASTEWATER AND STORMWATER DRAINAGE SYSTEMS

- Design and build both wastewater and storm water drainage systems that include drainage pipes, culverts and bunded areas for the controlled release of flows as well as oil / water separators and oil grit separators, sediment traps/ basins, etc. and bio management solutions
- Empty and clean the systems regularly by licensed operators
- Have surface water from bunded areas pass trough oil traps before discharge to the wastewater or storm water discharge systems
- When possible, connect to the public wastewater treatment facility or install one on-site Inspect and monitor drainage systems regularly, document and report on such inspections
- Design de-watering solutions that comply with EQEG discharges standards; access the possibility to collect groundwater into settling ponds to re-use water for ust suppression activities allowing groundwater discharge

#### NATURAL MITIGATION MEASURES

#### BIOMANAGE WATER RUNOFF

- · Retain as much vegetated areas as possible to help water infiltrate
- · Re-vegetate areas promptly with native plants and trees
- · Pave areas dedicated to traffic but retain as much vegetated areas as possible to minimise water runoff that needs to be diverted to storm channels and drains
- · Design or redesign vegetated areas that includes soil layers, mulch and plants to filter rainwater as it seeps into soil
- · Replace concrete with pavers, flagstones or bricks that allow water to soak in between items where possible or with aggregate base, gravel, mulch or crushed shells
- Install rain barrels or cisterns to catch storm water runoff from roofs and use such water to irrigate and for wheel cleaning
- · Dig shallows, gravel-filled trenches to catch and slow runoff, especially alongside driveways

#### ENGINEERING AND SYSTEMIC CONTROL MEASURES

#### CONTROL WATER POLLUTION FROM CONSTRUCTION SITES

- · Protect exposed soil surfaces by covering with mulch or a ground cover or filling with material as soon as possible
- · Dispose of debris and refuse promptly and properly to prevent them from entering receiving waters · Cover open on-site stockpiles of construction materials, excavated spoils, dredged materials, filling materials, wastes, etc.
- Cover vehicles carrying friable materials
- · Minimise sediment run-off, for instance install and operate wheel cleaning facilities
- · Use oils, fuels and chemicals in designated areas and pollution prevention facilities only
- · Have the oil contaminated water handled by local licensed wastewater contractors
- · Install and operate on-site oil water separators and holding facilities to accommodate planned and unanticipated releases of oily water
- Provide a sufficient number of male/ female toilets with either septic tanks (emptied regularly by licensed operator for disposal in approved facilities) or with connection to the public wastewater system
- install leak-proof sephic ranks that are adequately sized and placed in sheltered impervious bund/ containment (understand but not covered with soil, gravel, sand, concrete, just sheltered) · discharge grey water from showers and canteen kitchens into seaking pits equipped with grease treated as oil waste

SPREAD OF DISEASE

PREVENT WATER STAGNATION

Pave and protect area for concrete batching plants

### Figure 8.3 Water Runoff and Drainage System Framework

#### ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK

· Drain stagnant water through emptying and cleaning trapped systems or brushing off puddles to prevent mosquito breeding Keep rain barrels or cisterns enclosed and keep fish in water recipients to the extent possible to prevent mosquito breeding

# WASTE AND HAZARDOUS MATERIAL MANAGEMENT



Figure 8.4 Waste and Hazardous Material Management Framework

#### ENVIRONMENTAL AND SOCIAL MANAGEMENT FRAMEWORK

#### HAVE WASTE, CHEMICAL AND HAZARDOUS MATERIAL COLLECTED AND DISPOSED OF RESPONSIBILY

COLLECTION AND DISPOSAL





# **ON SITE TRAFFIC MANAGEMENT**

### LIGHTING

#### USE LIGHTING SMARTLY

- · Use LED and inward + downward light
- · Identify zones of low and high lighting requirements Minimise light pollution to people



#### OCCUPATIONAL HEALTH AND SAFETY

#### CONTRIBUTE TO PROJECT SITE OCCUPATIONAL HEALTH AND SAFETY

- · Spread vehicle movements over time
- · Monitor vehicle movements, vehicle maintenance status, stakeholders' grievances (e.g. on noise, dust, air quality, accidents, incidents, etc.)
- · Install traffic road signs, speed limits, pedestrian crossings, walkways, etc.
- Provide Project sites safety induction to all visitors upon site entry
- Develop and implement an Occupational Health and
- Safety Plan that includes training, KPIs, reporting, etc.
- Maintain first aid kits in place throughout Project sites
- Have a trained first aid team in place at all times



#### **OIL LEAKS, SPILLS AND ACCIDENTS**

#### PREVENT OIL LEAKS, SPILLS AND ACCIDENTS

Install oil/water separators, oil grit separators, storm water drainage system, wastewater drainage system, sediment traps and empty and clean the systems regularly - See Water runoff and drainage framework and Waste and hazardous material framework

- Pave areas for traffic
- Conduct regular vehicle maintenance to prevent leaks and spills
- Establish emergency preparedness and response plans for each type of hazard
- e.g. vehicle collision, run over people and/or domestic animals, leaks, spills,
- fire, explosion, natural hazards, etc.
- Equip vehicles with first aid kit and fire extinguisher
- Have a trained emergency response team in place at all times

## VEHICLES

### MANAGE VEHICLES SENSIBLY

- · Cover friable material
- Maintain clean roads to limit dust emission
- Limit vehicle speed to 20km/hr on individual Project sites
- Conduct regular vehicle maintenance for pollution prevention and energy efficiency Limit diesel-powered vehicles to reduce NOx and SO2 emissions
- Establish a Traffic Plan for the Project construction and operation phases
- Place company logo on the body of the vehicles

Submit, for any major planned construction activity, to the Transport Infrastructure Development Unit (TIDU), or its equivalent, the planned number of vehicles, their loading capacity and their traffic schedule prior to any major construction activity

Plan project-related traffic and liaise with other sub-project coordinators on such planning via the Transport Infrastructure Development Unit (TIDU), or its equivalent, to ensure that project-related vehicles do not overload the capacity of the bridges

# PARKING

- to lavatories

- connection to the public wastewater system · Install/ Assess the feasibility of installing solar panels over parking roofs

- sensitive receptors

NAME OF PROJECT SITE State Individual Project details State Project's parties' contact details (including main Contractors and Sub-Contractors)

## COMMUNITY HEALTH AND SAFETY

#### MAINTAIN COMMUNITY HEALTH AND SAFETY

- · Limit vehicle speed to 30km/hr along settlements and 200 m either way of entry/ exit of Project sites
- · Minimise traffic crossing settlements at night
- · Fence individual Project sites
- Project topsoil as backfill
- Vegetate and revegetate Project sites to stabilise exposed areas · Retain large trees to the extent possible for shade and dust reduction · Liaise with community representatives for Community Emergency Preparedness and Response Plan
- Address complaints related to traffic through a Community Grievance Mechanism · Perform site reinstatement, including repairing any damage caused during construction activities, and rehabilitation, including of existing roads where relevant

### Figure 8.5 On Site Traffic Management Framework

### ORGANISE PROJECT SITE PARKING WISELY

- · Locate vehicle parking close to entry/exit to minimise and optimize vehicle movements · Provide shaded resting areas for drivers, next
- · Provide a sufficient number of male/ female toilets with either septic tanks (emptied regularly by licensed operator) or with
- Implement a No Idling Policy
- · Locate vehicle parking area away from

· Plant buffer stretches (site hoarding) along the fence inside the Project sites, reusing

### 8.6 Recommended Mitigation for Unplanned Events

As referred to in Section 5.2.6, Myanmar is exposed to multiple natural hazards including cyclones, earthquakes, and flooding. Each project will have a specific Emergency Response Plan (ERP). It is noted that earthquake is one of the major natural hazard concerns for Yangon Region. As such, the ERP will be linked to the Yangon Region Earthquake Preparedness and Response Plan (2019), which aims to practice the preparedness measures and response functions that will be coordinated among the Yangon Region Disaster Management Work Committees and relevant departments and organisations to reduce earthquake-related risk. Meanwhile, all construction will comply with the requirements as set out in the Myanmar National Building Code (MNBC) and other relevant guidelines relating to seismic design.

In addition, each project will also follow the Ministry of Transport and Communications' framework to prevent oil pollution.

### 8.7 Institutional Arrangements at the Administrator Level

The Phase 1 Development will be managed by an Administrator which will be tasked with overseeing the development of the sub-project components during their design, construction, operation, and decommissioning stages, as relevant.

This includes overseeing how each developer/ operator and its contractors and sub-contractors will manage the environmental and social risks associated with the developer/ operator's sub-project.

This ESMF provides an overview of the environmental and social expectations of the Administrator from the sub-project developers and operators.

### 8.8 Management Processes at the Sub-Project Level

### 8.8.1 Introduction and Approach

Each of the Phase 1 Development's sub-project developers / operators is expected to put in place an Environmental and Social Management System (ESMS) within their respective organisations to enable the implementation of the recommended environmental and social mitigation and enhancement measures identified under this SEA. An ESMS is a set of policies, procedures and internal capacity that integrate environmental and social risk management into business processes<sup>6</sup>. These management processes include:

- An environmental and social organisational structure;
- Environmental and social impact identification and mitigation processes;
- Management programs; and
- An environmental and social documentation management organisation.

Figure 8.6 shows the Phase 1 Development Administrator, and Sub-Project Developers and Operators (PDO)'s roles and responsibilities at the sub-project level.

<sup>&</sup>lt;sup>6</sup> Source:

https://www.ifc.org/wps/wcm/connect/22dc7500483774689335f7299ede9589/ESMS+Handbook+General+v2.1.pdf?MOD=AJP ERES (accessed June 2019)



Figure 8.6 Management Processes at the Sub-Project Level

### 8.8.2 Organisational Structure

Sub-project developers / operators are expected to put in place a team of qualified experts dedicated and empowered to managing environment, social, health and safety matters in a sustainable manner and commensurate to the sub-project associated risks and potential impacts. These qualified experts should establish environment, social, health and safety policies, plans and procedures relevant to the sub-project's activities and with the support of the sub-project's senior management. These represent the documented aspect of the ESMS.

This qualified expert team should have the support of the top management and continuously work together with other divisions of the sub-project developers / operators to implement the ESMS. The roles, capabilities (soft and hard skills) of each member and communication channels should be written in a manual of functions and responsibilities.

The senior management of the sub-project developers / operators should endorse the ESMS of their activities at the Phase 1 Development through signing a publicly available Environmental and Social Policy dedicated to their business or activities and through signing the related plans and procedures (which may remain internal). The senior management of the sub-project developers / operators should retain overall responsibility for the sub-project's internal organisation and mitigation measures put in place to manage environmental and social risks and potential impacts associated with the sub-project (commitment). Environmental and Social Policies should be made publicly available and other relevant plans and procedures discussed with the Phase 1 Development's Administrator.

Qualified experts should be tasked to lead and train employees, workers and contractors to manage the environmental and social risks and potential impacts associated with the sub-project and to communicate on recommended management practices (awareness and implementation). The size of the team of qualified experts shall be commensurate to the sub-project's environment, social, health and safety risks and potential impacts.

These qualified experts should also be tasked with implementing the sub-project's environmental and social management measures, and to document, monitor and keep records of all environmental and social activities, in accordance with good international industry practices for documentation management.

Sufficient budget shall be allocated at all times by sub-project developers / operators to manage the environment, social, health and safety risks and potential impacts of the sub-projects at the Phase 1 Development. Qualified experts and management representatives from the other divisions of a sub-project are expected to meet regularly to review the implementation of the sub-project's environmental and social management measures, in a spirit of collaboration and of continuous improvement ('plan, do, check, act'). Corrective action plans shall be established and implemented for any non-compliance performance and relevant documentations shall be reviewed and updated as deemed relevant by the sub-project's management representatives. Indicators should be set to measure and improve on the actions undertaken under the ESMS, and yearly ESMS action and improvement plans should be established. Qualified experts and management representatives from the other divisions, such Procurement and Human Resources, of a sub-project should support the environmental and social team in the implementation and monitoring of these indicators, action and improvement plans and regularly report outcomes to the sub-project's senior management. The purpose remains to ensure all areas' respective commitment in the implementation and to enable effective regular management reviews of the ESMS.

The qualified experts shall also be responsible for coordinating the regular external reporting on the sub-project's environmental and social performance, in accordance with, at minimal, local regulations and with the sustainability performance indicators set out under this SEA report and other pre-agreed indicators relevant to their activity to the Phase 1 Development's Administrators. Such external reporting should also include external communication to stakeholders, as per a Stakeholder Engagement Plan dedicated to the sub-project, and the management of a Grievance Mechanism.

Finally, qualified experts, with the support of other relevant divisions such as procurement and human resources, are responsible for ensuring that the sub-project's environmental and social expectations, aligned with the Phase 1 Development's vision and this SEA and its ESMF, are communicated to and implemented by the sub-project's contractors and their sub-contractors, in accordance with the recommendations of the IFC Good Practice Note 'Managing Contractors' Environmental and Social Performance' (2017)<sup>7</sup>.

### 8.8.3 Identification of Risks and Impacts by Sub-Project Proponents

Sub-project developers / operators are expected to perform, on a regular basis and across environment, health, safety (Occupational Health and Safety) and social (labour and community) aspects, risk assessments to identify the potential negative environmental and social risks so that they can develop appropriate strategies to address these and their potential impacts.

Documented procedures should be put in place for the regular and systematic identification and prioritisation of such risks and impacts across all key activities. Employees, workers and contractors should be aware of and engaged in such process, with external experts involved as required, as well as affected communities and other external stakeholders, for both internal and external inputs. The risk assessments should be routinely reviewed and updated across existing, new and changing activities (at least once a year and any time there are significant changes to operations or external changes such as new laws and regulations). The risk assessment process should involve and be expected to be also performed by contractors, sub-contractors, third parties and supply chain as relevant. Risks in the supply chain should also be assessed.

The risk assessment process is a process that should review the following series of steps across environment, health, safety and social aspects on a regular basis:

- Prediction of impacts;
- Characterisation and evaluation of impacts;
- Assessment of impact magnitude and of receptor/ resource sensitivity (prioritisation according to both probability and severity of negative impacts);
- Identification of mitigation and enhancement measures;
- Evaluation of residual impacts (post implementation of mitigation and enhancement measures);
- Management of such mitigation and enhancement measures and monitoring, including through the documentation on a risk register and the maintenance of a legal register.

The risk assessment process should be scaled appropriately to the size and complexity of the relevant activities.

### 8.8.4 Management Programs at the Sub-Project Level

Management programs are centred on action plans and improved procedures to avoid, minimise or compensate/ offset for the risks and impacts that were identified. They should be routinely and consistently implemented. It is understood that the management programs are "living" documents that must be updated each time new impacts are expected and as part of the continuous improvement process.

Measurable sub-project-wide objectives and targets should be set to enable periodic review and update for continual improvement using annual plans. Management programs should be scaled appropriately to the size and complexity of the relevant activities.

<sup>&</sup>lt;sup>7</sup> Source: <u>https://www.ifc.org/wps/wcm/connect/topics\_ext\_content/ifc\_external\_corporate\_site/sustainability-at-ifc/publications/publications\_gpn\_escontractormanagement</u> (accessed June 2019)

Management programs can be implemented based on the recommended mitigation measures by area of sub-project activities and presented under Section 8.5.

Good international industry guidelines recommend to include, in the management programs, Emergency Preparedness and Response Plans (both internally and for the community) as well as a Stakeholder Engagement Plan (including Grievance Mechanism).

### 8.8.5 Documentation Management by Sub-Project Proponents

Sub-project developers and operators are expected to establish and work under an Environmental and Social Policy dedicated to their business that includes commitments towards, at a minimum, complying with local regulations and good international industry practices in terms of environment, health, safety and social issues and towards thriving to ensure effective environmental and social management practices aligned with the Phase 1 Development's vision.

Sub-project developers and operators are further expected to put in place and implement documented plans and procedures for identifying environmental and social risks and impacts and for mitigating them, in line with, at a minimum, the recommended environmental and social mitigation measures provided under this ESMF.

All environmental and social activities should be documented, monitored and records kept in accordance with good international industry practices for documentation management. Environmental and social policies should be made publicly available and other relevant plans and procedures discussed with the Phase 1 Development's Administrator.

Sub-project developers and operators will also be expected to report on a pre-agreed regular basis on their environmental and social performance, in accordance with, at a minimum, local regulations and with the sustainability performance indicators set out under this SEA report and other pre-agreed indicators relevant to their activity to the Phase 1 Development's Administrators.

### 9. ASSESSMENT BENCHMARKS: RELEVANT REFERENCES

### 9.1 Introduction

The Phase 1 Development is ambitious and will generate multi-formed and complex adverse and positive environmental and social impacts. It is proposed to prioritise these against the Myanmar Sustainable Development Plan, the United Nations Sustainable Development goals and selected recommended international guidance within a set of SEA Framework Objectives and a set of SEA Framework Indicators, to be discussed with stakeholders during consultations. These frameworks have contributed to the proposed Environmental and Social Management Framework that gathers proposed environmental and social mitigation measures to be put in place by sub-project developers / operators and to be monitored by the Phase 1 Development's Administrator.

The Phase 1 Development's vision is to emerge as a destination for economic development and new residents, to be a productive city and a liveable city. Its aspiration is to be clean, smart and safe, to improve Yangon's overall economic competitiveness and to be well integrated with Yangon infrastructure. The Phase 1 Development aims to be able to function as standalone city.

The Phase 1 Development positions itself within broader sustainable development aspirations, namely the United Nations SDGs, the Myanmar Sustainable Development Plan (2018-2030) and the Myanmar National Urban Policy Framework. To achieve such aspirations during construction and operation phases, areas of focus must be identified, and measurable targets framed. These are based on the environmental and social baseline assessment of the area to be developed, on a high-level environmental and social impact assessment of the development of the Master Plan and on the outcomes of the stakeholder engagement process to date.

Such measurable targets, or assessment benchmarks, are intended to be used to guide the outcomes of future IEEs/EIAs as well as the overall Phase 1 Development. A desktop review has identified several international references, described in the below Section following the presentation of the vision and aspiring performance indicators of the Phase 1 Development, that may be used to inform which assessment benchmarks could be used. The desktop review includes NYDC's Master Plan, the United Nations SDGs, the Myanmar Sustainable Development Plan (2018-2030), the Myanmar National Urban Policy Framework, Strategic Urban Development Plan of the Great Yangon Region and additional references, such as the WHO Healthy Cities Setting and relevant urban indicators for sustainable cities used for different global locations. These assessment benchmarks provide indicators and targets that are similar in intent, but with various degrees of detail.

### 9.2 Socio-Economic Master Plan for the New Yangon City

As discussed in Section 0, Phase 1 Development's vision is to be a 'Productive City, Liveable City'. These goals are expected to be achieved through world-class infrastructure and high-quality and transparent delivery and governance. To translate the vision in action, NYDC has also developed a comprehensive set of aspirations and metrics across economic, liveability and infrastructure goals for the Phase 1 Development.

### 9.3 United Nations Sustainable Development Goals

In 2015, world leaders agreed to 17 goals for a better world by 2030. These goals have been identified for their deemed power to end poverty, fight inequality and stop climate change. Guided by the goals, it is expected that governments, businesses, civil society and the general public work together to build a better future for everyone. These global goals for sustainable development are also called SDGs and they are associated with 169 targets.

SDG 11 provides targets to build sustainable cities and communities and is relevant to the New Yangon City. The objective of SDG 11 is to make cities and human settlements inclusive, safe, resilient and sustainable.

SDG 11 has seven (7) targets and three (3) associated policy targets, which are set out below in Table 9.1.

### Table 9.1 SDG 11 Targets

#### SDG 11 Sustainable Cities and Communities

#### Target 11.1: Safe and affordable housing

By 2030, ensure access for all to adequate, safe, and affordable housing and basic services and upgrade slums.

#### Target 11.2: Affordable and sustainable transport systems

By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities, and older persons.

#### Target 11.3: Inclusive and sustainable urbanisation

By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated, and sustainable human settlement planning and management in all countries.

#### Target 11.4: Protect the world's cultural and natural heritage

Strengthen efforts to protect and safeguard the world's cultural and natural heritage.

#### Target 11.5: Reduce the adverse effects of natural disasters

By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to the global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations.

#### Target 11.6: Reduce the environmental impacts of cities

By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.

#### Target 11.7: Provide access to safe and inclusive green and public spaces

By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities.

#### Target 11.A: Strong national and regional development planning

Support positive economic, social and environmental links between urban, peri-urban<sup>8</sup> and rural areas by strengthening national and regional development planning.

#### Target 11.B: Implement policies for inclusion, resource efficiency and disaster risk reduction

By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015–2030, holistic disaster risk management at all levels.

#### Target 11.C: Support least developed countries in sustainable and resilient building

Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials.

<sup>&</sup>lt;sup>8</sup> The landscape interface between town and the rural—urban transition zone where urban and rural uses mix)

#### Implications for the Project:

SDG Targets 11.1 to 11.7 are all relevant to the Phase 1 Development and are recommended to be incorporated in the proposed assessment benchmarks. The SEA process itself is contributing to addressing Targets 11.A and 11.B, which in turn should support the implementation of Targets 11.1 to 11.7, while Target 11.C pertains to international finance and technical flows therefore outside the scope of the SEA.

### 9.4 Myanmar Sustainable Development Plan (2018-2030)

The Myanmar Sustainable Development Plan (MSDP) is the expression of the country's national development vision – a vision that finds resonance in the global sustainable development agenda and which is of a peaceful, prosperous and democratic country.

The MSDP is intended to provide a whole-of-government development framework that offers coherence to existing strategic plans and policies, ensuring that they are executed in ways that are consistent with macro-level national development priorities. The MSDP is designed to achieve its aims through a coordinated effort involving public entities, the non-profit sector as well as the private sector.

The MSDP, as illustrated in Figure 9.1 is structured around three (3) Pillars, five (5) Goals, 28 Strategies and 215 Action Plans. All are firmly aligned with the SDGs, the 12 Point Economic Policy of the Union of Myanmar and various regional commitments which have made as part of the Greater Mekong Sub-region (GMS) Strategic Framework, the ASEAN Economic Community and others.



# Figure 9.1 The Myanmar Sustainable Development Plan Framework Summary

For each of the five goals, strategies have been developed. For each strategy, action plans have been identified, intended to be multi-dimensional, with successful implementation requiring the involvement of a broad range of stakeholders. Progress towards the action plans will typically require multiple programmes, projects and activities.

#### Implications for the Project:

The following Strategies are particularly relevant to the Phase 1 Development's SEA potential assessment benchmarks:

- Strategy 3.2 Support job creation in industry and services, especially through developing small and medium-sized enterprises (under Goal 3 Job Creation and Private Sector Led Growth - Pillar 2 Prosperity and Partnership);
- Strategy 3.3 Provide a secure, conductive investment enabling environment which eases the cost of doing business, boosts investor confidence and increases efficiencies (under Goal 3 Job Creation and Private Sector Led Growth Pillar 2 Prosperity and Partnership);
- Strategy 3.6 Build a priority infrastructure base that facilitates sustainable growth and economic diversification (under Goal 3 Job Creation and Private Sector Led Growth Pillar 2 Prosperity and Partnership);
- Strategy 4.1 Improve equitable access to high quality lifelong education opportunities (under Goal 4 Human Resources and Social Development for a 21st Century – Pillar 3 People and Planet);
- Strategy 4.2 Strengthen health services systems enabling the provision of universal health care
  using a path that is explicitly pro-poor (under Goal 4 Human Resources and Social Development
  for a 21st Century Pillar 3 People and Planet);
- Strategy 4.4 Increase secure access to food that is safe and well-balanced (under Goal 4 Human Resources and Social Development for a 21st Century – Pillar 3 People and Planet);
- Strategy 5.1 Ensure a clean environment together with healthy and functioning ecosystems (under Goal 5 Natural Resources and the Environment for Posterity of the Nation - Pillar 3 People and Planet);
- Strategy 5.2 Increase climate change resilience, reduce exposure to disasters and shocks while protecting livelihoods, and facilitates a shift to a low-carbon growth pathway (under Goal 5 Natural Resources and the Environment for Posterity of the Nation - Pillar 3 People and Planet);
- Strategy 5.3 Enable safe and equitable access to water and sanitation in ways that ensure environmental sustainability (under Goal 5 Natural Resources and the Environment for Posterity of the Nation - Pillar 3 People and Planet);
- Strategy 5.4 Provide affordable and reliable energy to populations and industries via an appropriate energy generation mix (under Goal 5 Natural Resources and the Environment for Posterity of the Nation - Pillar 3 People and Planet); and
- Strategy 5.6 Manage cities, towns, historical and cultural centres efficiently and sustainably (under Goal 5 Natural Resources and the Environment for Posterity of the Nation - Pillar 3 People and Planet).

### 9.5 Myanmar National Urban Policy Framework

The National Urban Policy Framework of Myanmar was prepared with the support of UN-Habitat and based on the Rapid Urban Diagnostic Report Myanmar published in February 2016.

The National Urban Policy (NUP) includes a set of fundamental principles as follows:

Equity	Urban settlements should support the equitable distribution of access to opportunities and resources including housing, jobs, education, services, and facilities.
Poverty Reduction	Urban settlements should contribute to poverty reduction through mobilizing powerful synergies for poverty reduction and providing manifold opportunities for economic development.

Administrative Integration	Strategies, programs and projects for urban settlements need to be integrated across levels of government (Union, state/region, municipal) and within government across the various portfolios that influence urban settlements.
Environmental Integration	Environmental concerns, impacts, and risks - particularly with regard to climate change and disaster resilience - should be considered in all spatial planning activities.
Good Governance	Urban/municipal development and management should be driven by good governance. Good governance has eight major characteristics: It is (i) participatory, (ii) consensus- oriented, (iii) accountable, (iv) transparent, (v) responsive, (vi) effective and efficient, (vii) equitable and inclusive, and (viii) follows the rule of law. The views of minorities are taken into account, and the most vulnerable groups in society participate in decision-making.
Subsidiarity	The municipal level of government (township level) should be enabled to provide all spatial planning tasks, perform local infrastructure development, and provide local urban infrastructural services.
Participation	Spatial planning, policies and programs need to collect the views of all social groups in the local community.
Efficiency	Urban settlements and their physical infrastructure should be planned and managed in such a way as to maximize the efficient use of scarce fiscal resources.

The NUP's principles are guided by six (6) goals, with one goal (Goal II Liveability) embedding SDG 11 into the context of NUP:

- Goal I: Economic Development;
- Goal II: Liveability;
- Goal III: Sustainability;
- Goal IV: Urban-Rural Linkages;
- Goal V: Preserving Rural/ Urban Balance; and
- Goal VI: Development of Professional Capacity in the Area of Spatial Planning.

The National Urban Policy Framework outlines five priority areas for further work on the National Urban Policy:

- Municipal governance and municipal finance;
- Urban legislation;
- Land governance;
- Housing; and
- Environmental and climate change issues with regard to urbanisation.

#### Implications for the Project

The National Urban Policy priority areas of urban legislation, land governance, housing, and environmental and climate change issues are particularly relevant to the Phase 1 Development's SEA potential assessment benchmarks.

### 9.6 National Environmental Policy of Myanmar

The National Environmental Policy published in 2019 provides long-term, strategic guidance for achieving a sustainable future for Myanmar. The Policy builds on Myanmar's 1994 National Environment Policy, the 1997 Myanmar Agenda 21, the 2009 National Sustainable Development Strategy. It is grounded in the environmental responsibilities in the 2008 Constitution of the Republic

of the Union of Myanmar, and the obligations contained in the 2012 Environmental Conservation Law. It also aligns with, and expands upon, the environmental considerations in the 2015 National Comprehensive Development Plan and the 2018 Myanmar Sustainable Development Plan. The Policy recognises and integrates Myanmar's commitments to Multilateral Environmental Agreements, including the 2015 Paris Agreement.

It requires the mainstreaming of environmental protection into planning and decision-making at all levels of government and in all sectors by providing long-term guidance for government organisations, civil society, the private sector, and development partners on the achievement of environmental protection and sustainable development objectives in Myanmar. Its detailed principles respect livelihood needs and development objectives while at the same time recognizing the full value of Myanmar's ecosystems and the implications of climate change. The Policy sets out 23 principles as the guiding framework for achieving the following:

- Clean environment and healthy, functioning ecosystems;
- Sustainable economic and social development; and
- Mainstreaming of environmental protection and management.

This Policy ensures that environmental protection continues to be a central objective in Myanmar's sustainable development pathway, by placing environmental considerations at the centre of efforts to promote economic and social development, reduce poverty, mitigate and adapt to climate change and minimise natural disaster risks.

#### **Implications for the Project**

The National Environmental Policy provided principles to the Phase 1 Development's SEA potential assessment benchmarks.

### 9.7 Myanmar Climate Change Policy

Myanmar Climate Change Policy published in 2019 provides long term direction and guidance to:

- Take and promote climate change action on adaptation and mitigation in Myanmar;
- Integrate climate change adaptation and mitigation considerations into Myanmar's national priorities and across all levels and sectors in an iterative and progressive manner; and
- Take decisions to create and maximise opportunities for sustainable, low carbon, climate resilient development, ensuring benefits for all.

The Policy refers to nine guiding principles as follows:

- Sustainable development;
- Precaution;
- Prevention;
- Environmental integrity;
- Shared responsibility and cooperation;
- Inclusiveness;
- Good governance;
- Climate justice and equity; and
- Gender equality and women's empowerment.

The Policy is intended to be implemented by taking actions primarily in the following six sectoral clusters:

Food and water security;

- Healthy ecosystems;
- Low-carbon and resilient growth;
- Resilient urban and rural settlements;
- Human wellbeing; and
- Knowledge, awareness and research.

Finally, the Policy is intended to be implemented by taking actions on the following eight areas:

- Laws, regulations, strategies, action plans and strategies;
- Institutions;
- Finance, budgets and investment;
- Capacity-building;
- Research and technology;
- Partnerships;
- Transparency and accountability; and
- Monitoring, evaluation, reporting and learning.

The Policy is accompanied by the related Myanmar Climate Change Strategy and Master Plan (2018-2030) as a guiding policy and strategic framework to ensure that concrete, coordinated and sustained action are taken over the long-term to transform Myanmar into a low-carbon and resilient country, which is able to develop in a sustainable manner.

#### **Implications for the Project**

The Climate Change Policy provided guidance to the Phase 1 Development's SEA potential assessment benchmarks.

### 9.8 Strategic Urban Development Plan of the Greater Yangon

The Strategic Urban Development Plan (SUDP) of the Greater Yangon was updated by JICA in 2018. It covers the entire Seikgyi Kanaungto, Hlaing Tharyar, and Kyee Myin Daing Townships and partial areas of periphery areas that includes the Twantay Township, which are part of the Phase 1 Development. The Plan has set out the development vision for Yangon City, aiming to turn it into an "attractive international port and logistics hub – a city of blue, green, and gold' (JICA, 2018). Four sub-drivers contribute to this vision:

- International Logistics Hub City: Attractive and competitive urban and logistics functions where more people and business gather from surrounding area since Yangon is the city with the largest economy and with an international gateway to Myanmar;
- **Knowledge and Comfortable City:** Everyone who lives and works in Yangon should be able to enjoy a more comfortable living in consideration of environmental and social aspects;
- Well-managed Infrastructure City: Provide a safer, more reliable and convenient urban life, and to realise economic development and industrialisation; and
- **Good Governance City:** Establish a good city both for living and business.

#### **Implications for the Project**

The SUDP provided the relevant vision and sub-drivers to the Phase 1 Development's SEA potential assessment benchmarks.

### 9.9 WHO Healthy Cities Setting

The Healthy Settings movement came out of the World Health Organisation (WHO) strategy of "Health for All" in 1980 and its approach was laid out in the 1986 Ottawa Charter for Health Promotion<sup>9</sup>. These documents supported the establishment of the holistic and multifaceted approach embodied by Healthy Settings programmes, as well as towards the integration of health promotion and sustainable development. The Sundsvall Statement of 1992 called for the creation of supportive environments with a focus on settings for health. The Jakarta Declaration of 1997 emphasized the value of settings for implementing comprehensive strategies and providing an infrastructure for health promotion. Today, various settings are used to facilitate the improvement of public health throughout the world.

A setting is where people actively use and shape the environment; thus it is also where people create or solve problems relating to health. Settings can normally be identified as having physical boundaries, a range of people with defined roles, and an organisational structure. Examples of settings include schools, worksites, hospitals, villages, and cities. Action to promote health through different settings can take many forms. Actions often involve some level of organisational development, including changes to the physical environment or to the organisational structure, administration and management. Settings can also be used to promote health, as they are vehicles to reach individuals, to gain access to services, and to synergistically bring together the interactions throughout the wider community.

The Health Promotion Glossary (1998) defines a healthy city as 'one that is continually creating and improving those physical and social environments and expanding those community resources which enable people to mutually support each other in performing all the functions of life and developing to their maximum potential.'

A Healthy City aims to:

- To create a health-supportive environment,
- To achieve a good quality of life,
- To provide basic sanitation & hygiene needs, and
- To supply access to health care.

The following 11 parameters for a Healthy City were identified for the WHO Healthy Cities Project in 1986<sup>10</sup>:

- A clean, safe, high-quality physical environment (including housing quality);
- An ecosystem which is stable now and sustainable in the long-term;
- A strong, mutually supportive and non-exploitive community;
- A high degree of public participation in and control over the decisions affecting one's life, health, and well-being;
- The meeting of basic needs (food, water, shelter, income, safety, and work) for all the city's people;
- Access to a wide variety of experiences and resources with the possibility of multiple contacts, interaction, and communication;
- A diverse, vital, and innovative city economy;

<sup>&</sup>lt;sup>9</sup> Source: World Health Organisation's website, <u>https://www.who.int/healthy\_settings/about/en/</u>

and https://www.who.int/healthy\_settings/types/cities/en/ (accessed December 2018)

<sup>&</sup>lt;sup>10</sup> Source: <u>https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3324614/</u> accessed 29 December 2018

- Encouragement of connectedness with the past, with the cultural and biological heritage, and with other groups and individuals;
- A city form that is compatible with and enhances the above parameters and behaviours;
- An optimum level of appropriate public-health and sick-care services accessible to all; and
- High health status (both high positive health status and low disease status).

Being a Healthy City depends upon health infrastructure and a commitment to improve a city's environs, as well as a willingness to forge the necessary connections in political, economic, and social arenas.

Today, over a thousand cities worldwide are part of the Healthy Cities network. Evaluations of Healthy Cities programmes have shown that they are successful in increasing understanding of health and environment linkages and in the creation of inter-sectoral partnerships to ensure a sustainable, widespread programme. The most successful Healthy Cities programmes maintain momentum from:

- The commitment of local community members;
- A clear vision;
- The ownership of policies;
- A wide array of stakeholders; and
- A process for institutionalising the programme.

#### Implications for the Project:

The Phase 1 Development represents a setting for the WHO Healthy Cities purpose. In particular, the following Healthy Cities' aims are particularly relevant to the Phase 1 Development's SEA potential assessment benchmarks:

- To create a health-supportive environment;
- To achieve a good quality of life;
- To provide basic sanitation and hygiene needs; and
- To supply access to health care.

### 9.10 Urban Indicators for Sustainable Cities

The Phase 1 Development's Master Plan, the United Nations SDGs, the Myanmar Sustainable Development Plan (2018-2030) and the Myanmar National Urban Policy Framework state broad objectives for an urban development like the Phase 1 Development. These must be supported by urban sustainability indicators.

Urban sustainability indicators are tools that allow city planners, city managers and policymakers to gauge the socio-economic and environmental impact of, for example, current urban designs, infrastructures, policies, waste disposal systems, pollution and access to services by citizens. They allow for the diagnosis of problems and pressures, and thus the identification of areas that would profit from being addressed through good governance and science-based responses. They also allow cities to monitor the success and impact of sustainability interventions.

A myriad of indicator toolkits have been advanced and tested in real cities by various organisations and research groups (Table 9.2). These toolkits are available for implementation by others, and usually include aspects of sustainable development beyond environmental dimensions only, such as public health and services, governance, income, business opportunities, and transport.

The challenge for urban authorities is deciding which toolkit best addresses the needs and goals of a particular city, which would be easy to implement and which are worth the financial and human effort.

In some cases, a selection of different toolkits may be desirable for a city home to a small population; in others, a large city may want to join an established global programme of indicators.

The *Science for Environment Policy* of the *European Commission* has gathered a range of indicator toolkits for sustainable cities in a report most recently updated in March 2018<sup>11</sup>. This Section is an extract from that report.

The use of indicators depends on a certain number of factors, which include (Food and Agriculture Organization of the United Nations, 2002):

- Without good data, based on monitoring, it is not possible to develop indicators;
- Performance measures imply that targets need to be set (i.e. against which performance can be compared);
- Different people living in different places have different values. Indicators must, therefore, be able to take into account different locations, people, cultures and institutions;
- Sets of indicators evolve over time;
- Sets of indicators are seldom, if ever, complete;
- Measurement of indicators tends to reduce uncertainty, but does not eliminate it; and
- Indicators can play an important role in how human activities influence the environment changing the indicators will most likely also change the system.

Table 9.2	Selected	Sustainable	Cities	Indicator	Toolkits

Indicator Toolkit	Organisation
China Urban Sustainability Index	China Urban Sustainability
City Blueprint	Waternet Amsterdam; KWR Water Cycle Research Institute
EEA Urban Metabolism Framework	European Environment Agency
European Green Capital Award	European Commission
European Green City Tool	European Union
European Green City Index	Economist Intelligence Unit; Siemens
European Green Leaf Award	European Union
Global City Indicators Program	Global City Indicators Facility
Indicators for Sustainability	Sustainable Cities International
Reference Framework for Sustainable Cities (RFSC)	RFSC
Sustainability Tools for Assessing and Rating Communities (STAR) Community Rating System	STAR
United for Smart Sustainable Cities (U4SSC) initiative – Key Performance Indicators	United Nations International Telecommunication Union (ITU)

<sup>&</sup>lt;sup>11</sup> Source: Science for Environment Policy (2018) In-Depth Report: Indicators for Sustainable Cities, European Commission (accessed from

http://ec.europa.eu/environment/integration/research/newsalert/pdf/indicators for sustainable cities IR12 en.pdf on 30 January 2019)

Indicator Toolkit	Organisation
Urban Audit Cities Statistics	Eurostat
Urban Ecosystem Europe - Informed Cities	International Council for Local Environmental Initiatives (ICLEI); Ambiente Italia
Urban Sustainability Indicators	European Foundation for the Improvement of Living and Working Conditions.

The above indicator toolkits have been reviewed as part of the preliminary desktop review. It is proposed to use the Performance Indicators defined by the United Nations International Telecommunication Union to define sustainability performance indicators and associated targets (Key Performance Indicators (KPIs)) on how to achieve Sustainable Development Goals. These performance indicators would be monitored, and their associated KPIs reviewed and revised, as the Phase 1 Development begins to ensure relevance and usefulness.

### 10. ASSESSMENT BENCHMARKS: PROPOSED SEA FRAMEWORK OBJECTIVES AND INDICATORS

### 10.1 Introduction

Decisions based on rational objective assessments and measurements are ultimately taken based on the values that society assigns to the environment and to its people. The undertaking of an SEA process aims at enabling adaptation to variations in the decision context and, from an analytical perspective, to emphasise the 'mixed scanning' and 'bounded rationality' features in the process design (Nilsson and Dalkmann 2001).

At the strategic level of any SEA, impacts are more difficult to predict and information becomes a bigger constraint than at IEE/EIA levels. An SEA, therefore, aims to deploy a systematic iterative process, which includes the measurement of quantifiable environmental attributes and of non-quantifiable values of environmental quality, as well as the treatment and formulation of alternatives and of criteria in the process, and public participation.

### 10.2 Proposed SEA Framework Objectives

The standard dimensions of sustainable development towards a fair, viable and liveable world, include:

- Economic development;
- Social progress; and,
- Environmental responsibility.

The proposed SEA framework objectives (Table 10.1) draw from the above dimensions and from the review of potential assessment benchmarks for a sustainable city presented in Section 8 and encapsulated by the UN Sustainable Development Goal 11. They are to be supported by indicators proposed in Section 10.3.

SEA Objective	UN SDGs / Myanmar SDGs	Sub-objectives/ Targets
Maintain and improve the water quality and quantity of the rivers, creeks, reservoirs (surface water) and of groundwater	UN SDG 6, 14 Myanmar SDG 5.3	<ul> <li>Install and maintain a comprehensive water drainage system</li> <li>Install and maintain a comprehensive wastewater system, including a fit-for-purpose wastewater treatment system</li> <li>Install and maintain water metering and leak monitoring systems to minimise water losses</li> </ul>
Protect and enhance the soil's resources (quality and topography)	UN SDG 2, 15 Myanmar SDG 5.1	<ul> <li>Minimise the areas covered with asphalt</li> <li>Maintain a balanced layout of green areas</li> <li>Set up and maintain a flood management plan</li> </ul>
Manage waste in a sustainable manner	UN SDG 3, 6, 9 Myanmar SDG 5.6	<ul> <li>Encourage waste reduction: e.g. add campaigns, single-use plastic ban, plastic bags ban/ fee, public composting facilities</li> <li>Design and maintain drinkable water fountains</li> <li>Organise sustainable waste collection infrastructure and disposal facility for each different waste streams and with a focus on reusing and recycling</li> </ul>

### Table 10.1 Proposed SEA Framework Objectives

SEA Objective	UN SDGs / Myanmar SDGs	Sub-objectives/ Targets
Reduce air pollution and ensure continued improvements to air quality	UN SDG 11, 13 Myanmar SDG 5.1, 5.4	<ul> <li>Design an urban development plan and establish a traffic management plan that encourages public transportation, walking, cycling</li> <li>Build energy efficient infrastructure (housing, buildings, roads, utilities, etc.)</li> <li>Monitor air pollution and greenhouse gas emissions (GHG) emissions and enforce exceedances</li> <li>Avoid locating new development where air quality could negatively impact upon people's health</li> </ul>
Plan for the anticipated effects of climate change and other accidental events	UN SDG 13 Myanmar SDG 5.2	<ul> <li>Assess climate change risks and build resilient infrastructure</li> <li>Establish a comprehensive emergency preparedness and response plan, in terms of infrastructure, human capabilities, alarm and monitoring system; the potential emergency events may include: fire (contained and conflagration), heavy rainstorm/typhoon/thunderstorm, road incident or road obstruction, workers injury, explosion, and spillage of hazardous or potentially-hazardous materials (on or off-site)</li> </ul>
Develop infrastructure services	UN SDG 8, 9, 11 Myanmar SDG 3.6, 5.6	<ul> <li>Design and develop a comprehensive urban plan, catering for all utility services, transport infrastructure, economic services, housing types, public services</li> <li>Compensate agriculture land impacted by the development of the Master Plan through a Compensation Plan</li> </ul>
Help deliver equality of opportunity and access for all	UN SDG 1, 3, 4, 5, 7, 16 Myanmar SDG 3, 4, 5	<ul> <li>Address existing imbalances of inequality, deprivation and exclusion</li> <li>Improve access to education, lifelong learning and training opportunities</li> <li>Improve accessibility to affordable housing and employment opportunities, particularly for disadvantaged sections of society</li> <li>Compensate agriculture land impacted by the development of the Master Plan through a Compensation Plan</li> <li>Implement a Community Grievance System and a Workers' Code of Conduct</li> <li>Prioritise hiring of local workers</li> </ul>
Safeguard and improve workers health, safety and wellbeing, including of contractors, subcontractors and other third party suppliers	UN SDG 3 Myanmar SDG 4.5	<ul> <li>Develop appropriate Occupational Health and Safety Management Plans (OHSMP) for each sub-project components with the following minimal mitigation components:</li> <li>Corporate OHS policy applicable to all operations</li> <li>OHS Manual of Procedures (SOPs), including ambient air quality monitoring procedure</li> <li>Multi-year OHS training plan for staff, including contractors, subcontractors, third parties;</li> <li>Definition of OHS KPIs for monitoring and reporting</li> <li>Consolidated annual OHS performance reports</li> </ul>
Safeguard and improve community health, safety and wellbeing, including in terms of noise	UN SDG 11 Myanmar SDG 5	<ul> <li>Design and maintain sports facilities during operational phase</li> <li>Ensure the area has a sufficient number and variety of hospitals, medical centres, doctors, nurses, firefighting system (firemen, fire stations, fire equipment, etc.), police, etc.</li> <li>Devote some space to urban gardens</li> <li>Maintain / set up cultural and religious heritage</li> <li>Design an urban development plan and establish a traffic management plan that encourages public transportation, walking, cycling to minimise the noise levels</li> <li>Develop a Community Health and Safety Management Plan (CHSMP) with the following minimal mitigation components:</li> <li>Community Grievance System Implementation</li> </ul>

SEA Objective	UN SDGs / Myanmar SDGs	Sub-objectives/ Targets
		<ul> <li>Environmental Quality Monitoring</li> <li>Workers Code of Conduct implementation</li> <li>Design and implement a Stakeholder Engagement Management Plan</li> </ul>
Protect and enhance biodiversity, flora and fauna	UN SDG 14, 15 Myanmar SDG 3.1, 4, 5	<ul> <li>Maintain and achieve a favourable condition of international and national sites of nature conservation importance</li> <li>Maintain the extent and enhance the quality of locally designated sites and priority habitats</li> <li>Maintain and enhance connectivity of corridors of semi-natural habitats</li> </ul>

### 10.3 Proposed SEA Framework Indicators

The proposed SEA framework indicators for measuring the sustainable performance of the Phase 1 Development and monitoring its progress towards its sustainable development goals are summarised in **Appendix A** and grouped in three types: economic indicators, environmental indicators and social indicators.

### 11. CONCLUSIONS AND RECOMMENDATIONS

### 11.1 Conclusions of the SEA Process

The proposed main components of the Phase 1 Development are covered by six individual IEEs and EIAs. The potential environmental and social risks and impacts and proposed mitigation measures of the overall Phase 1 Development, along with proposed sustainable development goals and impact assessment criteria to inform the different processes, are covered by this SEA.

A Scoping Report for the SEA was prepared to present the outcomes of the preliminary desktop review of the Study Area's environmental and social baseline, potential risks and impacts, and proposed SEA Framework objectives and indicators. The feedback obtained as part of the stakeholder engagement activities common to the individual IEEs/EIAs and to this SEA, and the follow-up work presented in the Terms of Reference of the SEA proposed in the SEA Scoping Report have been incorporated into this SEA Report that will also be subject to presentation to and discussion with stakeholders.

The SEA includes a proposed ESMF that can be used as an overarching reference document for the Environmental and Social Management Plans of the different project main components and can be provided to project developers and operators wishing to undertake a sub-project as part of the Phase 1 Development.

### 11.2 Recommendations

It is recommended that this SEA Report, including the proposed assessment benchmarks and ESMF, be submitted to MONREC for discussion.

The outcomes and feedback of the discussions will be incorporated in the SEA Final Report for the development of the Phase 1 Development and its individual components.

#### REFERENCES

- Another Development & The East Asia Institute. 2018. Access to Clean and Safe Water in Yangon A Case of Municipal Water Provision in Insein Township.
- China Communications Construction Company Limited. 2019. New Yangon City Phase 1 Development – Pre-Project Document.
- Climate Data Website. 2018. *Climate: Myanmar*. Accessed: 7 December 2018. Retrieved from: http://en.climate-data.org/location/317/
- De Koning, R.J. and M.P.J. Janssen. 2015. *Delft 3D-Flow Model of the Yangon Port Area*. Accessed: 27 November 2018. Retrieved from: https://repository.tudelft.nl/islandora/object/uuid:96917480-dc97-421e-b55e-6c560ce44264/datastream/OBJ/download.
- Department of Population. 2018. *Township Census Report Yangon*. Accessed: 10 January 2019. Retrieved from: http://www.dop.gov.mm/en/state-region/yangon
- EO Earth Website. 2016. Water Profile of Myanmar. Accessed: 7 December 2018. Retrieved from: http://www.eoearth.org/view/article/156974/
- European Commission. 2015. Science for Environment Policy (2018) In-Depth Report: Indicators for Sustainable Cities. Retrieved from: https://ec.europa.eu/environment/integration/research/newsalert/pdf/indicators\_for\_sustainabl e\_cities\_IR12\_en.pdf
- General Administration Department. 2017. Ahlone, Dala, Hlaing Tharyar, Kyee Myin Daing, Seikgyi Kanungto and Twantay Township Report
- Glasson J., Therivel R. and Chadwick A. 2012. *Introduction to Environmental Impact Assessment*, Fourth Edition, The Natural and Built Environment Series, Routledge
- Government of the Republic of Union of Myanmar .2016. *Preparatory Survey on Thilawa SEZ Development Project, Appendix A SEA* (accessed from http://open\_jicareport.jica.go.jp/pdf/12253993.pdf on 31 December 2018)
- Government of the Republic of Union of Myanmar (2018) *Myanmar Sustainable Development Plan* (2018-2030), *Ministry of Planning, Finance and Industry* (accessed from http://themimu.info/sites/themimu.info/files/documents/Core\_Doc\_Myanmar\_Sustainable\_Dev elopment\_Plan\_2018\_-\_2030\_Aug2018.pdf on 31 December 2018)
- International Finance Corporation. 2018. *Strategic Environmental Assessment of the Myanmar Hydropower Sector*. Retrieved from: https://www.ifc.org/wps/wcm/connect/industry\_ext\_content/ifc\_external\_corporate\_site/hydro+ advisory/resources/sea+of+the+hydropower+sector+in+myanmar+resources+page
- Japan International Cooperation Agency (2018) *The Republic of the Union of Myanmar A Strategic Urban Development Plan of Greater Yangon: The Project for the Strategic Urban Development Plan of the Greater Yangon* (accessed from http://open\_jicareport.jica.go.jp/pdf/12145967.pdf)
- Leeuw, de Evelyne (2012) *Do Healthy Cities Work? A logic of method for assessing impact and outcome of healthy cities*, Journal of Urban Health 2012 Apr; 89(2): 217-231 (accessed from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3324614/ on 29 December 2018)
- Ministry of Environmental Conservation and Forestry. 2012. *Myanmar's National Adaptation Programme of Action (NAPA) to Climate Change.*

- Ministry of Forestry. 2005. National Action Programme of Myanmar to Combat Desertification in the Context of United Nations Convention to Combat Desertification (UNCCD). Retrieved from: https://knowledge.unccd.int/sites/default/files/naps/myanmar-eng2005.pdf
- Ministry of Natural Resources and Environmental Conservation (MONREC) and Ministry of Electricity and Energy (MEE) (2018) *SEA of the Hydropower Sector in Myanmar* (accessed from https://www.ifc.org/wps/wcm/connect/industry\_ext\_content/ifc\_external\_corporate\_site/hydro+ advisory/resources/sea+of+the+hydropower+sector+in+myanmar+resources+page on 31 December 2018)
- Morrison-Saunders A. and Fisher T. (2006) *What is wrong with EIA and SEA anyway? A septic's perspective on sustainability assessment*, Journal of Environmental Assessment Policy and Management, Mar. 2006, Vol. 8, Issue 1, pp.19-39
- Nilsson M. and Dalkman H. (2001) *Decision making and Strategic Environmental Assessment*, Journal of Environmental Assessment Policy and Management, Sept. 2001, Vol. 3, Issue 3, pp.305-327
- ODPM (Office of the Deputy Prime Minister), Scottish Executive, Welsh Assembly Government and Department of the Environment, Northern Ireland (2005) *A practical guide to the strategic environmental assessment directive* (accessed from https://www.gov.uk/government/publications/strategic-environmental-assessment-directiveguidance on 29 December 2018)
- Partidario M.R. (2003) *Strategic environmental assessment (SEA)*, IAIA 2003 pre-meeting training course
- Royal Haskoning DHV. 2019. Strategic Flood Risk Assessment New Yangon City Final Report.
- Sadler B. and Verheem R. (1996) *SEA: status, challenges and future directions*, Report 53, The Hague, The Netherlands: Ministry of Housing, Spatial Planning and the Environment
- Sakai, Hiroshi, Yatsuka Kataoka, and Kensuke Fukushi. 2013. *Quality of Source Water and Drinking Water in Urban Areas of Myanmar*. Accessed: 7 December 2018. Retrieved from: https://www.hindawi.com/journals/tswj/2013/854261/
- Science for Environment Policy (2018) *Indicators for sustainable cities*. In-depth Report 12. Produced for the European Commission DG Environment by the Science Communication Unit, UWE, Bristol. Available at:

http://ec.europa.eu/environment/integration/research/newsalert/pdf/indicators\_for\_sustainable \_cities\_IR12\_en.pdf on 29 December 2018

- Suwannathatsa, S., Wongwises., P., Wannawong, W. and Vongvisessomjai, S. (2012) *The Costal current of the Andaman Sea revealed by reprocessed observations*. American journal of applied sciences
- Theilen-Willige, Barbara and George Pararas-Carayannis. 2009. "Natural Hazard Assessment of SW Myanmar – A Contribution of Remote Sensing and GIS Methods to the Detection of Areas Vulnerable to Earthquakes and Tsunami/ Cyclone Flooding." Science of Tsunami Hazards, 2(2), 108-128
- Tyler, N. A. (2014), A vision for cities, II International Symposium on Urban Mobility, Brasilia, 10 October 2014

Union of Myanmar. 2009. Hazard Profile – Myanmar.

United Nations (2015) *The 2030 Agenda for Sustainable Development* (accessed from https://sustainabledevelopment.un.org/post2015/transformingourworld on 29 December 2018)

- United Nations Habitat. 2016. *The Republic of the Union of Myanmar National Urban Policy Framework*. Retrieved from: http://unhabitat.org.mm/wp-content/uploads/2018/04/NATIONAL-URBAN-POLICY-FRAMEWORK.pdf
- United Nations Office for the Coordination of Humanitarian Affairs (OCHA), 2011. https://www.preventionweb.net/files/4164\_ochamyahazardv3110606.pdf. Accessed 2 July 2018.
- World Health Organisation. n.d. *Types of Healthy Settings Healthy Cities*. Retrieved from: https://www.who.int/healthy\_settings/types/cities/en/
- Wood C. (1991) EIA of policies, plans and programmes, EIA Newsletter 5, 2-3
- Yangon Region, Northern District, Township General Administration Department. 2017. "Hlaing Tharyar Township Information"
- Yangon Region, Southern District, Township General Administration Department. 2017. "Dala Township Information"
- Yangon Region, Southern District, Township General Administration Department. 2017. "Seikgyi Kanaungto Township Information"
- Yangon Region, Southern District, Township General Administration Department. 2017. "Twantay Township Information"
- Yangon Region, Southern District, Township General Administration Department. 2017. "Kyee Myin Daing Township Information"

Yangon Region, Western District, Township General Administration Department. 2017. "Ahlone Township Information"

APPENDIX A SEA FRAMEWORK INDICATORS

No.	Торіс	Indicator Reference	Indicator Name	Description	Unit of Measure	Notes	Mapping to SDG Goals and Targets	Mapping to Myanmar SDGs
1	ICT Infrastructure	C1.1.1	Internet access in a household	Proportion of households with internet access	%	<ul> <li>For any household member via a fixed or mobile network at any given time</li> <li>Data from local statistics department or extrapolated from national data or from an annual household survey</li> </ul>	9.c 17.8	3.7.7
2	Employment	C1.3.1	Employment rate	Employment rate	%	<ul> <li>As reported by local / national official body</li> <li>SDG 8.5.2 is "unemployment rate by sex, age group and people with disabilities" so the employment rate should be shown overall and per these sub- categories to the extent possible</li> </ul>	9.b	3.2
3	Water and Sanitation	C1.6.1	Availability of smart water meters	Proportion of the water consumers (households, companies, etc.) with smart water meters	%	Calculated as "number of smart water meters / total number of water meters"	9.1	5.3
4	Water and Sanitation	C1.6.1	Accessibility to clean potable water and recycling of water	Proportion of the water consumers (households, companies, etc.) with an improved water source	%	According to the Myanmar Census Township Report (2014), the definition of improved water source includes tap water / piped; tube well, borehole;	9.1	5.3

Table A.1Economy Indicators

No.	Торіс	Indicator Reference	Indicator Name	Description	Unit of Measure	Notes	Mapping to SDG Goals and Targets	Mapping to Myanmar SDGs
						protected well / spring; and bottled / purified water.		
5	Water and Sanitation	C1.6.1	Accessibility to an improved wastewater system	Proportion of water consumers with access to an improved wastewater system	%	Wastewater treatment capacity (in equivalent number of inhabitants)	9.1	5.3
6	Energy	C1.6.2	Availability of smart electricity meters	Proportion of the electricity consumers (households, companies, etc.) with smart electricity meters	%	Calculated as "number of smart electricity meters / total number of electricity meters"	9.1	5.4
7	Energy	C1.6.2	Availability of electricity meters	Proportion of electricity consumers (households, companies, etc.) with electricity meters	%	Calculated as "number of electricity meters / total number of electricity consumers"	9.1	5.4
8	Energy	C1.6.3	Electricity system outage frequency	Average number of electrical interruptions per customer per year	Number	<ul> <li>Same as System Average Interruption Frequency Index SAFI</li> <li>Calculated as "total number of customer interruptions / total number of customers served"</li> </ul>	7.b	5.4

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No.	Торіс	Indicator Reference	Indicator Name	Description	Unit of Measure	Notes	Mapping to SDG Goals and Targets	Mapping to Myanmar SDGs
9	Energy	C1.6.4	Electricity system outage time	Average length of electrical interruptions	Minutes	<ul> <li>Same as Customer Average Interruption Duration Index CADI</li> <li>Calculated as "sum of all customer interruption durations / total number of customers' interruptions"</li> </ul>	7.b	5.4
10	Transport (Physical Infrastructure)	C1.6.5	Public transport network	Length of public transport systems per 100 000 inhabitants	km/100,000 inhabitants	<ul> <li>Public transport includes high capacity (heavy rail, metro, subway systems, commuter rail systems) and light capacity (light rail streetcars and trams, buses, trolley buses)</li> <li>Calculated as "km of one way length (i.e. A km of a way that can be used back and forth) / one 100 000th of the city's population"</li> <li>Linked to Master Plan (9 May 2019) KPI U2 "TOD Land use diversity"</li> </ul>	11.2	5.6.5
11	Transport (Physical Infrastructure)	C1.6.6	Road traffic efficiency	Travel time index	Ratio	<ul> <li>Travel Time Index (TTI) is a measure of congestion</li> <li>Ratio of the travel time during the peak period to the time required to make the same trip at free-flow speeds</li> <li>Calculated as "travel time in the peak period / travel time in free-flow"</li> <li>Another way of calculating road traffic efficiency is to calculate people's average travel time, using</li> </ul>	11.2	3.6

No.	Торіс	Indicator Reference	Indicator Name	Description	Unit of Measure	Notes	Mapping to SDG Goals and Targets	Mapping to Myanmar SDGs
						<ul> <li>"sum of people's travel time per day / sum of people's travel time per year (or person – hour)". The shorter the travel time, the more efficient the road traffic.</li> <li>Linked to Master Plan (9 May 2019) KPI U1 "Roadway capacity per capita"</li> </ul>		
12	Transport (Physical Infrastructure)	C1.6.7	Real time public transport information	Proportion of public transport stops and stations with real- time traffic information available	%	<ul> <li>Calculated as "number of stops and stations with real time information / total number of stops and stations"</li> <li>Via electronic bulletin boards, smartphone apps, etc.</li> </ul>	11.2	5.6.5
13	Housing	A1.1.3	Household with a mobile device	Proportion of households with at least one smartphone or similar device	%	<ul> <li>Calculated as "number of smartphones or similar devices per household"</li> </ul>		

No	Торіс	Indicator Reference.	Indicator Name	Description	Unit of Measure	Notes	Mapping to SDG Goals and Targets	Mapping to Myanmar SDGs
1	Air Quality	C2.1.1	Air pollution	Air Quality Index (AQI) based on: Particulate matter (PM10, PM2.5) NO2 (nitrogen oxide) SO2 (sulphur dioxide) O3 (ozone) CO (carbon monoxide)	Number	<ul> <li>This indicator should be measured as annual mean levels of AQI</li> <li>Average concentrations can demonstrate long term exposure (chronic) while days exceeding demonstrate short term (acute) exposure - each of which has different impacts on the population; can be expressed as µg/m3</li> <li>SDG indicator 11.6.2 is "Annual mean levels of fine particulate matter in cities (population weighted)"</li> </ul>	11.6 12.4	5.6
2	Air Quality	C2.1.2	GHG emissions	Greenhouse gas emissions per capita	Tonne CO2e/ capita	<ul> <li>Methodologies include (but are not limited to): BSI Norm: PAS 2070 (city) International Panel on Climate Change (IPCC) Guidelines for national GHG inventories Global protocol for community-scale GHG emissions (GPC) (2014 Accounting and Reporting Standard)</li> <li>In CO2e, "e" means "equivalent" i.e. CO2 and every other GHG converted into CO2 with their Global Warming Potential</li> </ul>	7.a 11.6	5.2
3	Water and Sanitation	C2.2.1	Quality of drinking water	Index of compliance with standards relating to water quality	%	<ul> <li>Preferable reference: World Health Organisation (WHO) Guidelines for drinking-water quality or national reference</li> </ul>	6.3 6.4	5.3

### Table A.2 Environment Indicators
No	Торіс	Indicator Reference.	Indicator Name	Description	Unit of Measure	Notes	Mapping to SDG Goals and Targets	Mapping to Myanmar SDGs
				parameters for drinking water		<ul> <li>SDG indicator 6.3.2 is "Proportion of bodies of water with good ambient water quality"</li> <li>SDG indicator 6.4.2 is "Level of water stress: freshwater withdrawal as a proportion of available freshwater resources"</li> </ul>		
4	Water and Sanitation	C2.2.2	Access to an improved water source	Proportion of city population with sustainable access to improved water sources	%	<ul> <li>Calculated as "number of city inhabitants with improved water sources / total city population"</li> <li>Improved water sources include: piped water, public tap, borehole or pump, protected well, protected spring or rainwater</li> <li>SDG indicator 6.1.1 is "proportion of population using safely managed drinking water services"</li> </ul>	6.1 1.4	5.3
5	Water and Sanitation	C2.2.3	Water consumption	Water consumption per capita	'1/ day/ capita	<ul> <li>Calculated as "Total amount of water consumption (1/ day) / total number of city inhabitants"</li> <li>SDG indicator 6.1.1 is "Proportion of population using safely managed drinking water services"</li> </ul>	6.1 1.4 6.4	5.3
6	Water and Sanitation	C2.2.4	Wastewater treated	Proportion of wastewater receiving treatment	%	<ul> <li>Calculated as "total amount of wastewater that has undergone (primary/ secondary/ tertiary) treatment / total amount of wastewater produced in the city and collected" for each of primary, secondary and tertiary</li> <li>Primary: physical separation of suspended solids using primary clarifiers</li> </ul>	6.3 12.4	5.3

No	Торіс	Indicator Reference.	Indicator Name	Description	Unit of Measure	Notes	Mapping to SDG Goals and Targets	Mapping to Myanmar SDGs
						<ul> <li>Secondary: after primary treatment to remove or reduce contaminants or growths with a focus on biological oxygen demand (bod)</li> <li>Tertiary: after secondary treatment for further reductions in bod levels and other oxygen-demanding substances in the wastewater, remove nitrogen and phosphorous and including other separation techniques such as carbon adsorption, flocculation/ precipitation, membranes for advanced filtration, ion exchange, chlorination, dechlorination, reverse osmosis, etc.</li> <li>SDG indicator 12.4.2. Is "hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment"</li> </ul>		
7	Water and Sanitation	C2.2.5	Wastewater collection	Proportion of households served by wastewater collection	%	<ul> <li>Calculated as "Number of households served by wastewater collection / total number of households"</li> </ul>	6.3 1.4	5.3
8	Water and Sanitation	C2.2.6	Household sanitation	Proportion of the households with access to improved sanitation facilities	%	<ul> <li>Calculated as "Total number of households using improved sanitation and facilities / total number of households"</li> <li>Improved facilities include: flush or pour-flush to a piped sewer system, septic tank or pit latrine; ventilated improved pit latrine; pit latrine with slab; composting toilet</li> </ul>	6.2 1.4	5.3

No	Торіс	Indicator Reference.	Indicator Name	Description	Unit of Measure	Notes	Mapping to SDG Goals and Targets	Mapping to Myanmar SDGs
						<ul> <li>SDG indicator 6.2.1 is "Proportion of population using safely managed sanitation services, including a hand-washing facility with soap and water"</li> </ul>		
9	Noise	C2.3.1	Exposure to noise	Proportion of the city inhabitants exposed to noise levels above international/ national exposure limits	%	<ul> <li>Relevant standards include the World Bank Group Environmental, Health and Social (EHS) Guidelines</li> </ul>		5.6
10	Environment al Quality	C2.4.3	Availability of environmental information	Availability of information for the public and other stakeholders referencing relevant standards, regarding compliance, health and installation issues	Yes/ no			5.6
11	Environment al Quality	C2.4.4	Solid waste collection	Proportion of households with regular solid waste collection	%	<ul> <li>Calculated as "Number of households that are served by solid waste collection / total number of households         <ul> <li>SDG indicator 11.6.1 is</li> <li>"Proportion of urban solid waste regularly collected and with the adequate final discharge with regard to the total waste generated by cities"</li> </ul> </li> <li>SDG indicator 12.4.2. Is         <ul> <li>"Hazardous waste generated per</li> </ul> </li> </ul>	11.6 12.4 1.4	5.6.6

No	Торіс	Indicator Reference.	Indicator Name	Description	Unit of Measure	Notes	Mapping to SDG Goals and Targets	Mapping to Myanmar SDGs
						capita and proportion of hazardous waste treated, by type of treatment"		
12	Environment al Quality	C2.4.5	Solid waste treatment	Proportion of solid waste: a) disposed to sanitary landfills b) burnt in an open area c) incinerated d) disposed to an open dump e) recycled f) other with regard to total amount of solid waste produced	%	<ul> <li>Each treatment should be reported separately</li> <li>Calculated as "total amount of solid waste that is (disposed to landfills/ incinerated / burnt in an open area / disposed in an open dump / recycled / other) in tonnes / total amount of solid waste produced in tonnes"</li> <li>SDG indicator 11.6.1 is "proportion of urban solid waste regularly collected and with adequate final discharge with regard to the total waste generated by cities"</li> <li>SDG indicator 12.4.2. Is "hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment"</li> </ul>	11.6 12.4 1.4	5.6.6
13	Environment al Quality	C2.4.6	Green areas and public spaces	<ul> <li>Hectares of parks per 1,000 residents</li> <li>Residents who live within a 10 minutes' walk to a park</li> <li>Number of park options</li> </ul>	<ul> <li>Number</li> <li>%</li> </ul>	<ul> <li>Green space includes parks and nature areas that are publicly accessible</li> <li>SDG indicator 11.7.1 is "The average share of the built-up area of cities that is open space for public use for all, disaggregated by age group, sex and persons with disabilities"</li> <li>Linked to Master Plan (9 May 2019) KPI L3 "access to parks &amp; open spaces" and KPI G2 "Park space per capita"</li> </ul>	11.7	5.6.4

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No	Торіс	Indicator Reference.	Indicator Name	Description	Unit of Measure	Notes	Mapping to SDG Goals and Targets	Mapping to Myanmar SDGs
14	Energy	C2.6.1	Access to electricity	Proportion of households with access to electricity	%	<ul> <li>Calculated as "Number of households in the city with a connection to the electrical system / total number of households"</li> <li>SDG indicator 7.1.1. Is "Proportion of population with access to electricity"</li> </ul>	7.1 1.4	5.4
15	Energy	C2.6.2	Renewable energy consumption	Proportion of renewable energy consumed in the city	%	<ul> <li>Calculated as "Total consumption of electricity from renewable sources / total electricity consumption"</li> <li>Renewable sources include geothermal, solar, wind, hydro, tide, wave energy, biomass, etc.</li> <li>SDG indicator 7.2.1 is "Renewable energy share in the total final energy consumption"</li> </ul>	7.2	5.4 5.2
16	Energy	C2.6.3	Electricity consumption	Electricity consumption per capita	kWh/ day/ capita	<ul> <li>Calculated as "Total consumption of electricity (in kwh per day) / number of city inhabitants"</li> </ul>		5.4

No.	Торіс	Indicator Reference.	Indicator Name	Description	Unit of Measure	Notes	Mapping to SDG Goals and Targets	Mapping to Myanmar SDGs
1	Education	C3.1.1	Adult literacy	Adult literacy rate	%	<ul> <li>Adult literacy rate is defined as "the percentage of population aged 15 years and over who can both read and write with understanding a short simple statement on his/her everyday life. Generally, 'literacy' also encompasses 'numeracy', the ability to make simple arithmetic calculations"</li> <li>Data may be collected from local statistics department or may need to be extrapolated from national data</li> <li>Compare the future census report (if available) with the 2014 census report</li> <li>SDG indicator 4.6.1 is "percentage of population in a given group achieving at least a fixed level of proficiency in functional (a) literacy and (b) numeracy skills, by sex."</li> </ul>	4.6	4.1
2	Education	C3.1.2	School enrolment	Proportion of school-aged population	%	<ul> <li>Calculated as "Number of students/ pupils in primary and secondary levels in public and private schools / total</li> </ul>	4.1	4.1

Table A.3Social Indicators

No.	Торіс	Indicator Reference.	Indicator Name	Description	Unit of Measure	Notes	Mapping to SDG Goals and Targets	Mapping to Myanmar SDGs
				enrolled in schools		number of the school aged population"		
3	Education	C3.1.3	Higher education ratio	Proportion of city inhabitants with tertiary education degrees	%	<ul> <li>Tertiary education broadly refers to all post- secondary public and private education, including but not limited to universities, colleges, training institutes, community colleges, nursing schools, research laboratories, centres of excellence, distance learning centres</li> <li>Calculated as "number of city inhabitants holding at least one tertiary education degree / total adult population"</li> </ul>	4.3	4.1
4	Education	C3.1.4	Distribution of education facilities	Ratio of education facilities to persons	Number of facilities / number of persons	<ul> <li>Linked to Master Plan (9 May 2019) Section 4.8 "Social infrastructure distribution" with recommended standards for distribution of facilities:</li> <li>For primary school, the target would be one per 15,000 persons</li> <li>For middle / high school, the target would be one per 25,000 persons</li> <li>For college / university, the target would be one per 90,000 persons</li> </ul>	4.6	4.1

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No.	Торіс	Indicator Reference.	Indicator Name	Description	Unit of Measure	Notes	Mapping to SDG Goals and Targets	Mapping to Myanmar SDGs
5	Health	C3.2.1	Electronic and non-electronic health records	Proportion of city inhabitants with electronic and non-electronic health records	%	<ul> <li>A health record contains information on weight, height, heart rate, BMI, etc. Overtime</li> </ul>	3.8	4.2
6	Health	C3.2.3	Life expectancy	Average life expectancy indicates the number of years a new-born infant would live	Years	Data may be collected from local statistics department or may need to be extrapolated from regional or national data		4.2
7	Health	C3.2.4	Maternal mortality	Maternal deaths per 100,000 births	Rate	<ul> <li>Same as SDG indicator 3.1.1</li> </ul>	3.1	4.2
8	Health	C3.2.5	Doctors	Number of doctors per 100,000 inhabitants	number/ 100,000 inhabitants	<ul> <li>Calculated as "General or specialised doctors working in the city / one 100 000th of the city's population"</li> <li>SDG indicator 3.c.1 is "Health worker density and distribution"</li> </ul>	3.c	4.2
9	Health	C3.2.6	Health facilities distribution	Ratio of health facilities to persons	Number of facilities / number of persons	<ul> <li>Linked to Master Plan (9 May 2019) Section 4.8 "Social infrastructure distribution" with recommended standards for distribution of facilities:</li> <li>For polyclinic, the target would be one per 25,000 persons</li> </ul>	3.8	4.2

No.	Торіс	Indicator Reference.	Indicator Name	Description	Unit of Measure	Notes	Mapping to SDG Goals and Targets	Mapping to Myanmar SDGs
						<ul> <li>For hospital, the target would be 40 beds per 10,000 population</li> </ul>		
10	Safety (Disaster Relief, Emergency, ICT)	C3.3.1	Resilience plans	Presence of vulnerability assessment, financial (capital and operating) plans and technical systems for disaster mitigation	Checklist	<ul> <li>Checklist (yes/ no):         <ul> <li>(a) city infrastructures available for resilience</li> <li>(b) vulnerability assessment</li> <li>(c) financial (capital and operating) plans to mitigate vulnerabilities</li> <li>(d) technical systems to implement the plans</li> </ul> </li> <li>Vulnerability to heat, drought, flooding, earthquakes, typhoon, tsunami and other natural hazards are investigated, and adoption of disaster management</li> <li>Data of vulnerability assessment can be derived from historical data (expert interviews) and global maps regarding heat, drought, flooding, earthquakes, typhoon, tsunami, etc.</li> <li>E.g. From united nations office for disaster risk reduction</li> <li>SDG indicator 11.b.1 is "proportion of local governments that adopt and implement local disaster risk reduction strategies in line with the</li> </ul>	11.b 13.1 13.2 13.3	5.2

No.	Торіс	Indicator Reference.	Indicator Name	Description	Unit of Measure	Notes	Mapping to SDG Goals and Targets	Mapping to Myanmar SDGs
						Sendai framework for disaster risk reduction 2015-2030a"		
11	Safety (Disaster Relief, Emergency, ICT)	C3.3.2	Emergency Service Response Time	Average response time for emergency services	Minutes	<ul> <li>Emergency services include police, fire control and others</li> <li>Expressed as the average number of minutes and seconds taken to respond to emergency calls from initial call to arrival on- site</li> </ul>	13.1	5.2.6
12	Safety (Disaster Relief, Emergency, ICT)	C3.3.3	Information security and privacy protection	Existence of systems, rules and regulations to ensure information security and privacy protection in public service	Checklist	<ul> <li>The verification contains examination in four aspects (yes/ no):         <ul> <li>(a) legislation</li> <li>(b) regulations enforced in public service and facilities</li> <li>(c) regulations properly enforced for web services</li> <li>(d) coverage rate of qualified systems</li> </ul> </li> </ul>		5.2.6 3.7.7
13	Housing	C3.4.1	Housing expenditure	Proportion expenditure of income for housing	%	<ul> <li>Housing expenditure includes rent, mortgage, utility services, maintenance, energy efficiency repairs, other repairs         <ul> <li>calculated as "Housing expenditures / total household income"</li> </ul> </li> </ul>	11.1	
14	Housing	C3.4.2	Informal settlements	Proportion of urban population	%	Same as SDG indicator 11.1.1	11.1	3.2.7 4.5

No.	Торіс	Indicator Reference.	Indicator Name	Description	Unit of Measure	Notes	Mapping to SDG Goals and Targets	Mapping to Myanmar SDGs
				living in slums, informal settlements or inadequate housing		<ul> <li>Informal settlements include slums, informal settlements and inadequate housing as defined by UN-Habitat</li> </ul>		5.6.7 5.6.9
15	Culture	C3.5.1	Connected and non-connected libraries	Number of connected and non-connected libraries per 100 000 population	number/ 100,000 inhabitants	<ul> <li>Connected libraries are libraries which offer access to internet and electronic media and represent an information hub</li> </ul>	9.c 4.4	5.6.4
16	Culture	C3.5.2	Cultural infrastructure	Number of cultural institutions per 100,000 inhabitants	number/ 100,000 inhabitants	<ul> <li>'Cultural institutions' means a public or non-profit institution which engages in the cultural intellectual, scientific, environmental, educational or artistic enrichment of the people of the pre-defined area</li> <li>'Cultural institution' includes, without limitation, aquaria, botanical societies, historical societies, land conservation organisations, libraries, museums, performing arts associations or societies, scientific societies, wildlife conservation organisations and zoological societies</li> <li>'Cultural institution' does not mean any school or</li> </ul>	8.9 11.4	5.6.10

No.	Торіс	Indicator Reference.	Indicator Name	Description	Unit of Measure	Notes	Mapping to SDG Goals and Targets	Mapping to Myanmar SDGs
						any institution primarily engaged in religious or sectarian activities		
17	Social Inclusion	C3.6.2	Gender income equity	Ratio of average hourly earnings of female and male employees, by occupation, age group and persons with disabilities	Ratio	<ul> <li>Calculated as "Average hourly earnings of female employees / average hourly earnings of male employees"</li> <li>SDG indicator 8.5.1 is "Average hourly earnings of female and male employees, by occupation, age group and persons with disabilities"</li> </ul>	8.5 10.4 5.1	3.2.7 3.5.6 4.1 4.2 4.3
18	Social Inclusion	C3.6.3	Opportunities for people with special needs	Existence of public services and benefits for people with special needs	Checklist	<ul> <li>Public services and benefits checklist (yes/no):         <ul> <li>(a) public buildings:</li> <li>infrastructure available</li> <li>(b) education: higher education possible</li> <li>(c) jobs: availability</li> <li>(d) ICT: availability of customised services and information</li> <li>people with special needs indicate indigenous people and person with disabilities including age-related disabilities</li> </ul> </li> <li>SDG indicator 11.2.1 is "Proportion of the population that has convenient access to public transport,</li> </ul>	11.2 11.7 1.3 4.5 4.a 8.5 10.2	3.2.7 3.5.6 4.1 4.2 4.3

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No.	Торіс	Indicator Reference.	Indicator Name	Description	Unit of Measure	Notes	Mapping to SDG Goals and Targets	Mapping to Myanmar SDGs
						disaggregated by age group, sex and persons with disabilities"		

APPENDIX B NYDC'S RESETTLEMENT MEMO





## **Resettlement Plan**

# New Yangon City Project

16<sup>th</sup> December 2020 (Rev 02)

NEW YANGON DEVELOPMENT COMPANY LIMITED: 56, Chindwin Road, Kamayut Township, Yangon, Myanmar.



#### Resettlement Plan

#### 1. Overview

In 2014, In 2015, Yangon Regional Government (YRG) received Yangon Parliament approval to develop the existing undeveloped farmland located to the west of Yangon in west Kyee-Myin-Daing & Twante Township as a mixed-use urban area New Yangon City ("The Project"). On 12 Dec 2017, New Yangon Development Company LTD (NYDC) was created as a State Owned Enterprise (SOE) to oversee The Project. The first major task for city development in land acquisition and resettlement to farmland owners.

#### 2. Background and Project Timeline

Below are major milestone dates in regards to land acquisition and resettlement process of The Project.

- In 2014, Yangon Region Government received permission from the President office to start the land acquisition and resettlement process.
- In 2016, General Administrative Department (GAD) received signed participations from farmland owners supporting The Project.
- In 2018, the President office approved 20%/80% compensation scheme- farmland owners will get the 20% of their land ownership as urban lands within The Project and the Government will get 80% of their land ownership for the urban development.
- On 25 April 2019, Resettlement Committee was formed by Yangon Region Government.
- In 2019, GAD and NYDC hold stateholder meetings regarding 20% compensation's lotto system and resettled urban plot plans.
- From 9/9/2019 24/2/2020, Lotto events with farmland owners were implemented.
- From 10/10/2019 17/6/2020, Temporary land slips were issued to farmland owners.

#### 3. Resettlement Policy Framework

- Land Acquisition Act, 1894.
- Farmland Law, 2012.
- Physical relocation of households is not included.
- Cut-off-date was on 5 April 2018
- Physical relocation of households is not included.
- The implementation of resettlement activities is linked to the implementation of the investment activities of the project to ensure that a temporary restriction of access to farmland or any other sources of income does not occur before temporary land slips have issued paid.
- Compensate 20% (Net) area of original farmland ownership as urban lands in New Yangon City (NYC) area.
- 4. Stakeholders
  - Communities directly and indirectly affected by the Project –local communities and farmland owners



- Land owners, investors, developer, industrial enterprises, agricultural producers, ect.
- Other ministries includes Yangon Region Government (YRG), Yangon City Development Committee (YCDC), General Administrative Department (GAD), Department of Agriculture Land Management and Statistics, local community representatives, etc.

#### 5. Role and Responsiblities

Yangon Region Government (YRG) oversees the resettlement process.

General Administrative Department (GAD) handles the resettlement process.

Farmland Management Body (FMB) reviews and approves Land Use Change and resettlement scheme.

Department of Agriculture Land Management and Statistics handles the land use change, the land area mapping and recordations.

NYDC handles technical development of lotto system and settled urban land plots mapping for temporary land slips.

#### 6. Resettlement Committees and Objectives

To oversee the resettlement process, YRG formed the Resettlement Committee on 17 May 2019 including YRG minister HE.U Han Htun, secretary of YRG, Dy.Mayor YCDC, representatives from Yangon City Development Committee (YCDC), Ministry of Construction (MOC), Ministry of Electricity and Energy (MOEE), Yangon Region Road Division, Department of Agriculture Land Management and Statistics, Directorate of Water Resources and Improvement of River Systems (DWIR), Myanma Port Authority (MPA), General Administration Department (GAD), local community leaders.

Objectives of Committees are to:

- Create fair and transparent land compensation process for 20% urban land repayment scheme.
- Ensure that concerns & complaints from landowners and other stakeholders are manged, responded to and managed appropriately;
- Resolve all complaints emanating from the resettlement activities effectively and efficiently;
- Establish relationships of trust between committees, landowners, and local communities;
- Implement strict and unbiased the resettlement process.

#### 7. Resettlement Process

The Committee handles resettlement process and the following diagram summarizes a step-by-step process.





- i. The principle of 20% land compensation was approved by The President Office in 2018. The approximate location of five (5) resettlement locations was agreed by Yangon Region Government (YRG), General Administration Department (GAD) and local communities. Those areas are related directly to the estimated 20% of the land to be compensated. To align with New Yangon City's Masterplan, those five resettlement boundaries were adjusted by adding 25% of land for constructing basic infrastructure including roads, schools, markets, medical facilities, and parks. In February and March 2019, public stakeholder meetings were held to explain the updated boundaries and obtain feedback.
- ii. Resettlement Committee was formed on 25 April 2019 by Yangon Region Government (YRG) chaired by HE.U Han Htun. Resettlement Committee meetings were held regularly to discuss the lotto system, resettlement process, documentations, plot sizes, groupings, etc.



NYDC representatives presented three lottery systems and the Resettlement Committee selected the option that was most transparent and best aligned with the public. NYDC proposed the following standard plot sizes: 20'x60', 40'x60', 60'x60', 60'x80', 80'x80', 100'x100' (all in feet), and large plots, which are in line with the Urban and Housing Development Department and relevant City Development Committee's land regulation.

- iii. **To ensure accurate records, each plot's ownership detail list received from the Agriculture** Land Management and Statistic Department was checked and digitalized by the Working Task Force. During the ownership verification process, the Working Task Force also asked the landowners to confirm resettlement plot sizes they wish to be awarded.
- iv. After confirming plot sizes with farmland owners, the Working Task Force creates a master list for resettlement plots and submits it to Yangon Region Cabinet. Once approval is recevied, the lotto dates are set. The approved resettlement plot size list for each owner is posted at relevant administrative offices three (3) days prior to lotto dates.
- v. On August 17 and 24, 2019, stakeholder meetings were organized to explain the lottery system, which involves five steps as below:
  - Announcement of dates to pick lotto in respective land sizes groups;
  - Choose a representative to pick landowner's name for following step (3);
  - Landowner picks a number;
  - Register the chosen number with ownership details;
  - Redraw the draft resettlement maps according to the lottery number.
- vi. The 20% urban resettled plots to be awarded to each farmland owner varies as their farmland holdings are different. The pre-numbered draft maps were drawn before lotto and those were adjusted per their winning lotto numbers. As soon as the plot adjustment is done, NYDC explained to each owner about the location, type, and their resettled urban plot numbers.
- vii. Once each owner's plot size(s) is identified, the Committee submitted the list to Yangon Region Cabinet. After approval, the Working Task Force prepared the temporary land ownership slips for each plot including the plot maps prepared by NYDC.
- viii. From 9/9/2019 to 24/2/2020, the lotto events were held. Explanation of their urban resettled plots were carried out few weeks after lotto was done. Temporary land slips for each plots were prepared and paid to farmland owners ofter Yangon Region Government Cabinet approved the resettlement urban plot list. Temporary Land slips were paid to farmland owners from 10 Oct 2019 to 17 June 2020. After demarcation on ground is done, land owners can applied for Land Grant to YCDC.
  - ix. After the construction of necessary public infrastructure at resettlement locations, landowners can start using their urban lands with necessary permits, in accordance with rules and regulations.



#### 8. Livelihood Restoration

During various consultation events, farmers have explained to NYDC that since Nargis 2008, the land in the area has not been as fertile and therefore agricultural productivity has reduced dramatically. In general, farmers welcome the opportunity to resettle into urban land setting, based on the assumption that the urban land will be financially more valuable to the affected parties than the current low-quality agricultural land.

Any loss of income will be offset with job opportunities and vocational training opportunities to be progressed as part of New Yangon City. During construction phase, NYDC will encourage all Contractors (through an Environmental & Social Management Framework) to seek to hire and train employees from the local community. During operational phase, NYDC will encourage employers (factory owners, offices) to employ the local community and to provide relevant vocational training as part of that employment. These job opportunities and training will provide economic advantage.

#### 9. Monitoring and evaluation

Monitoring and evaluation will be handled with Grievance Redress Mechanism (GRM) which will be oversee by GRM Committee. New Yangon Development Company LTD (NYDC) has created the GRM in Appendix A.

~End~





Document Litle	Grievance Redress Mechanism
Project Name	New Yangon City
Location	West Kyee-Myin-Daing, Yangon
Project Proponent	New Yangon Development Company Ltd.
Contact Details for GRM	Email: <u>comments@nydc.com.mm</u>
	Tel: 09 40211 1525
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#### 1. Introduction Grievance Redress Mechanism

#### 10. Overview

New Yangon Development Company Ltd. (the "Company") (NYDC) is developing New Yangon City project (the "Project"). Phase 1 of New Yangon City is a 88.3 square kilometres (sq.km) mixed-use development located to the west of Yangon in Seikgyi Kanaungto, Twantay, Hlaing Tharyar and west Kyee Myin Daing Townships.

The Company has hereby established this project-level Grievance Redress Mechanism (GRM) for stakeholders who may be directly affected by the planning and construction activities (the "Affected Communities") of the Project.

#### 11. Key Objectives

The overarching objectives of GRM are to:

- Ensure that concerns & complaints (grievances) from Affected Communities and external communications from other stakeholders are responded to and managed appropriately (planned, timely and respectfully);
- Address negative Environmental and Social impacts of the project;
- Resolve all grievances emanating from the project activities effectively and efficiently;
- Establish relationships of trust between project staff, local communities and stakeholders;
- Resolve environmental and social grievance in the project areas;
- Develop a clear, transparent and efficient grievance redress process that will address the Affected Communities' concerns in an early, quick and direct manner, and at no cost to complainants.

#### 12. Stakeholders

- Affected Communities directly and indirectly affected by the Project includes local community and surrounding communities
- Project and neighbouring land users / owners includes developers, industrial enterprises, agricultural producers
- Other ministries includes Yangon Region Government (YRG), Yangon City Development Committee (YCDC), Myanmar Police Force, Myanmar Fire Services Department, Ministry of Construction (MOC), Directorate of Water Resources and Improvement of River Systems (DWIR), Ministry of Transport and Communications (MOTC), Ministry of Electricity and Energy (MOEE), etc.

For more detail, reference shall be made to the **Stakeholder Mapping in the Project's** Stakeholder Engagement Plan (and Strategic Environmental Assessment) and also to the outcomes of Stakeholder Consultation Events.

#### 13. The Grievance Committee



The GRM will be administered by The Grievance Committee. The Grievance Committee will also include representatives from key stakeholders such as NYDC Grievance Manager, NYDC Government Relationship Officer, NYDC Community Relationship Manager, JV's E&S Manager, JV's H&S Manager, JV Grievance Manager and Contractor's Grievance Officer.

The Grievance Committee will be amended from time to time: to better suit the different project development phase.

#### 2. Grievance Redress Mechanism Procedure

The Grievance Committee will handle grievances via a step-by-step process summarised in the following diagram. The diagram is described in detail below.







#### 2.1 Step 1 – Publicising the Mechanism

GRM information will be publishing as follows:

- Site Notice will be posted around the Project, in positions where they are clearly visible and legible to passers-by without the need for them to enter the site. It will be posted on relevant road frontages, and may change as the project planning & construction develops.
- Complaint Forms will be available. Representatives in the Site Office and administrative offices will be aware of this GRM, and will be open to talking to Affected Communities.
- All necessary forms and information will be posted on NYDC website.

The Site Notice (template) is provided in Appendix 1.

The GRM Complaint Form (template) is provided in Appendix 2.

#### 2.2 Step 2 – Receiving, Recording and Registering Grievances

#### 2.2.1 <u>Receiving Grievances</u>

As an outcome of the above methods of publicising, it is anticipated that the Company will receive grievances through various channels and methods as anticipated below:

- In person
  - a. To NYDC Grievance Manager or Grievance Committee.
    - Grievance Committee office is located at NYDC Site Office Twantay Highway, Ye Kyaw Village (near toll gate) and at NYDC Head Office 56 Chindwin Road, Kamayut, Yangon
- Electronic
  - a. Through the dedicated email address for GRM: <u>comments@nydc.com.mm</u>
  - b. Through NYDC's website general inquiries: <u>contact@nydc.com.mm</u>
- Traditional means
  - a. <u>Call:</u> Direct to the City Planning & Development Team phone number 09 40211 1525 (Burmese & English Speaking)
  - b. <u>Letter:</u> By letter to NYDC at registered office 56 Chindwin Road, Kamayut Township, Yangon or at Site Office near Toll Booth on Twantay Highway.

#### 2.2.2 <u>Recording and Registering Grievances</u>

NYDC Grievance Office will take a record and register it within 24 hours of it as it comes in using a standard template to pass to Grievance Officer. The GRM Recording (template) is provided in Appendix 3 and Appendix 4.

#### 2.3 Step 3 – Reviewing & Screening

Once Registered, NYDC Grievance Manager and Grievance Committee will promptly screen the nature of the grievance, and determine if the grievance falls within the scope of this GRM.



#### 2.3.1 <u>Reviewing</u>

Grievances may be considered to be out of scope or in scope, and will be screened accordingly.

#### 2.3.2 <u>Screening</u>

If the grievance is considered within scope, NYDC Grievance Manager will undertake a rapid assessment within 48 hours to identify the type (inquiries, concerns, complaints or claims) and the degree of complexity of the grievance, in line with the following categorisation:

Category	Description	Туре	Approach
Tier 1	A grievance for which NYDC Grievance Manager is already prepared to respond & resolve, based on existing NYDC information or some other previous grievance circumstance. Level 1 also includes grievances which are out of scope or an inquiry.	Routine	NYDC Grievance Manager drafts a sutiable response and seeks approval from The Grievance Committee. The resolution will be done within 14 working days.
Tier 2	A grievance for which NYDC Grievance Manager shall seek advice and coordination with other Grievance Committee Members.	Ad hoc	NYDC Grievance Manger works with investigating team to investigate, mitigate and respond. Approval required from The Grievance Committee. The resolution will be done within 30 working days.
Tier 3	A grievance which can be considered repeated and high- profile which may result in a wider negative impact on NYDC in general.	Potentially Significant	NYDC Grievance Officer works with NYDC Grievance Manager and The Grievance Committee to investigate, mitigate and respond.

#### 2.4 Step 4 – Investigating

Grievances which cannot be readily resolved by the Grievance Manager shall undergo investigation, depending on the type of grievance and the level of impacts, especially when they require technical expertise to be involved.

#### 2.5 Step 5 – Resolving, Responding & Closing Out

#### 2.5.1 <u>Resolving</u>

Depending on the Grievance, different approaches will be required. If necessary, meetings will be held with the concernec/affected persons/complaint and the officers to find solutions and create plans to redress the grievance. The deliberations of the meetings will be recorded in the format as in Appendix 5.



#### 2.5.2 <u>Closing Out</u>

After the Grievance Officer has provided the response, he/she should work carefully with the complainant, to confirm that they are satisfied with the response.

If the complainant is not satisfied with the proposed solution or the outcome of the agreed corrective actions, the Grievance Officer will schedule group or individual meetings as required, with participation of senior management of the Company and perhaps also the involvement of third parties such as local ward/township authorities, to further clarify the position of the Company and of complainants.

After completion of re-assessment of the case, the grievance can be closed out and documented if the complainant is satisfied with the results. Otherwise, the Committee will return the grievance to the complainant, close out and document the case. Complainants are free to take their grievances to an impartial mediator, a dispute resolution mechanism outside of the Company grievance mechanism. If it remains unresolved, legal action may be taken.

The Company will target to formally close all grievances within 5-20 working days of receipt.

#### 2.6 Reporting

NYDC Governance Manager will prepare the Quarterly Report on the Grievance Redressal issues of the Project for addition into reports. The format is given in Appendix 6 of this report.



Appendix 1 – Site Notice



ခင်အသိပေးခု

ဤလုပ်ငန်းခွင်သည် New Yangon Development Company Limited လက်အောက်မှ ရန်ကုန်မြို့သစ်စီမံရက်၏ လုပ်ငန်းခွင်ဖြစ်ပါသည်၊ အကြံပေးစာများ၊ မေးခွန်းများ နှင့် တိုင်ကြားစာများ ပေးပို့လိုပါက အောက်ဖော်ပြပါစီမံကိန်းတာဝန်ရှိသူအား ဆက်သွယ်ပေးပို့ နိုင်ပါသည်။

ဇုန်းနံပါတ်	ଅନ - ୫୦ <sup>1</sup> ୦୦୦ରିୀଷ
Email	<u>comments@nydc.com.mm</u>
సరిలా	New Yangon Development Company Ltd. 56 Chindwin Road, Kamayut Township, Yangon
Website	www.nydc.com.mm

l

### Site Notice

This site is under development by New Yangon Development Company Ltd., as part of New Yangon City Project.

If you have any comment, question or complaint, please contact the Project's responsible person as below:

Phone	09 40211 1525
Email	<u>comments@nydc.com.mm</u>
Registered	New Yangon Development Company Ltd.
Address	56 Chindwin Road, Kamayut Township, Yangon
Website	www.nydc.com.mm



Appendix 2 – Complaint Form



#### တိုင်ကြားချက်ပုံစံ

တိုဝ်ကြားလိုသည်များရှိခဲ့လျှင် ဤ ပုံစံအားပြည့်စုံစွာ ဖြည့်စွက်ပြီ းတင်ပြပေးပါက New Yangon Development Company Limited မှတာဝန်ရှိသူ ထံမှ ဆက်သွယ်ပါမည်။

နေ့စွဲ	_		
အမည်			
အဖွဲ့ အစည်း			
(ရှိခဲ့လျှင်)			
ඟරින			
Email Address			
ဖုန်းနံပါတ်			
တိင်ကြားရက်အားဖော်ဖြ	ໂຄຣິ		
တိုင်ကြားသူလက်မှတ်		တိုင်ကြားမှုအား မှတ်တမ်းတင်	

# (iff applicable) Address Email Address Phone Number Description of Complaint Signature of Complainant Recorded by Date Alternatively, please contact us at:

Complaint Form

If you have any complaint, please complete this form and a New Yangon Development Company Ltd. responsible person will contact you.

Date Name Organisation

#### ဆက်သွယ်ရန်လိပ်စာ

ဖုန်းနံပါတ်	ပ၉၄၀၂၁၁၁၅၂၅
Email Address	comments@nydc.com.mm
ရုံးစန်းလိပ်စာ	New Yangon Development Company Limited အမုတ်- ၅၆၊ ရှင်းတွင်းလမ်း ကမာရွတ်မြို့နယ်၊ ရန်ကုန်တိုင်းဒေသကြီး။
Website	www.nydc.com.mm

Phone	09 40211 1525
Email	comments@nydc.com.mm
Registered	New Yangon Development Company Ltd.
Address	56 Chindwin Road, Kamayut Township, Yangon
Website	www.nydc.com.mm



Appendix 3 – Recording



#### Grievance Redress Mechanism: Recording

Grievance Reference #	
Name of Recorder	
Date Grievance Received	
Date Grievance Acknowledged	
Method of Communication	
Affected Community	
Contact Information	
Name, Address, Phone etc.	
· ·	
Description of Complaint	
Screening Level 1,2,3	
Assessment & Investigation	
Initial proposed resolution /	
action	
Target Date for Closing	
Action taken	
Action taken	
Date Grievance Closed	



Appendix 4 – Register


# Grievance Redress Mechanism: Register

¥	Date Grievance Received	Date Grievance Acknowledged	Affected Community	Nature of Grievance	Target Date for Grievance Closure	Date Grievance Closed
001						
002						
003						
004						



Appendix 5 – Meeting Template



#### Grievance Redress Mechanism: Meeting Record Structure

Complainant Side	NIE/EE/Grievance Redress Committee Members
1}	1)
2)	2)
3}	3)
	4)
	5)

#### Summary of Grievance Meeting:


Key discussions:

1}	

2}

3}

4}

5}

Decisions Made/Recommendations by the Grievance Redress Committee:

1}

2]

3}

Status of Grievance (tick where applicable Solved \_\_\_\_\_\_ Unsolved \_\_\_\_\_\_

Chair person's name: \_\_\_\_\_

Chair person's signature:\_\_\_\_\_ Date (dd/mm/yyyy):\_\_\_\_\_



Appendix 6 - Resolving



# Quarterly Report of Registered Complaints (NIE-GRM/005)

Location ...... Date (dd/mm/yyyy) ..... Period (Quarter ending).....

#### i. Details of Complaints Received:

Place of issuing complaint	Name & Address of complainant	Location of complaint/concern	Date of Receipt	Complaint no.

#### ii. Details of Grievance Redress Meetings:

Date of meeting	Venue of meeting	Names of participants	Decisions/Recommendations made

#### iii. Details of Grievances addressed:

Date of issuing complaint	Category of complaint	Category of grievance	Brief description of grievance	Date of complete resolution

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#### Acronyms and Abbreviations

Name	Description
Aol	Area of Influence
AZE	Alliance for Zero Extinction
CBD	Central Business District
CSR	Corporate Social Responsibility
DWQS	Drinking Water Quality Standard
EBA	Endemic Bird Areas
EPAS	Electronic Perimeter Air Station
EQEG	Environmental Quality (Emissions) Guidelines
EQM	Environmental Quality Management
ERM	Environmental Resources Management
FAO	Food and Agriculture Organisation of the United Nations
FFI	Fauna and Flora International
FGD	Focus Group Discussion
GAD	General Administrative Department
GIIP	Good International Industry Practice
GPS	Global Positioning System
НН	Household
H&S	Health and Safety
IBA	Important Bird Area
IBAT	Integrated Biodiversity Assessment Tool
IFC	International Finance Corporation
iNGO	International Non-Governmental Organizations
IUCN	International Union for Conservation of Nature
ITCZ	Inter-Tropical Convergence Zone
JICA	Japan International Cooperation Agency
KBA	Key Biodiversity Area
KPIs	Key Performance Indicators
kV	Kilovolt
MATA	Myanmar Alliance for Transparency and Accountability
MCRB	Myanmar Centre for Responsible Business
MERN	Myanmar Environmental Rehabilitation-conservation Network
MGN	Myanmar Green Network
NBSAP	National Biodiversity Strategy and Action Plan
NGOs	Non-Governmental Organisations
NYDC	New Yangon Development Company Ltd.
PAP	Project Affected Peoples
PM	Particulate Matter

Name	Description
REM	Resource and Environment Myanmar
RHDHV	Royal Haskoning DHV
ROW	Right of Way
RS	Richter Scale
SDGs	Sustainable Development Goals
SEA	Strategic Environmental Assessment
SEP	Stakeholder Engagement Plan
SEZ	Special Economic Zone
Sq.km	Square kilometre
TSP	TOTAL Suspended Particles
UKAS	United Kingdom Accreditation Service
UK DEFRA	UK Department for the Environment, Food and Rural Affairs
UNESCO	United Nations Educational, Scientific and Cultural Organization
UN Habitat	United Nations Habitat
UPD	Urban Planning Division
US EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WCS	Wildlife Conservation Society
WWF	World Wildlife Fund
WHO	World Health Organization
WRTC	Water, Research, and Training Centre
YCDC	Yangon City Development Committee

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#### DESCRIPTION OF THE ENVIRONMENT 1.

#### 1.1 Introduction

This section describes the summary of the physical, biological, and social environment of the New Yangon City Phase 1 Development and its surrounding environment (as defined in Section 1.2). The information provided is based on primary data collected for the Project in February to March 2019 as well as a review of published information, provided by NYDC and from ERM's in-house library.

The purpose of reviewing the baseline conditions is to present an understanding of the potential environmental and social sensitivities of the Study Area.

#### 1.2 **Setting the Study Limits**

The Project Area is defined as the Phase 1 Master Plan, located in a semi-urban to rural area in Seikgyi Kanaungto, Twantay, Hlaing Tharyar and Kyee Myin Daing Townships to the West of Yangon.

This section presents the physical, environmental, socio-economic, cultural and visual characteristics of the Study Area. The Study Area is defined as the wider area in which the environmental and social conditions are evaluated with the sources of impact, in order to determine interactions and the magnitude and significance of potential impacts resulting from the Project.

For this Project, the Study Area is defined as a 2 km buffer around the New Yangon City Phase 1 Development; encompassing the Townships neighbouring the Project Area. Area of Influence (AOI) is defined as the village tracts, wards and townships within or neighbouring the Project Area.

Project Area, Study Area and AOI are shown in Figure 1.1.

#### 1.3 Methodology and Approach

Separate EIAs have been prepared to cover the bridges, power, water treatment, wastewater treatment, and industrial zone facilities. As part of the EIA requirement, a comprehensive primary baseline sampling programme has been conducted for the Phase 1 area. Although undertaking primary data sampling is not an IEE requirement under the local EIA procedure, considering the scale and nature of Phase 1 Stage 1 development of the New Yangon City, this section will also present the primary baseline findings for the roads facilities.

#### 1.3.1 Environmental Baseline

#### 1.3.1.1 Sampling Details

The primary baseline survey was designed to cover the Phase 1 Development and includes surveys for air, noise, soil, ground water, surface water, and terrestrial and aquatic biodiversity. A summary of the baseline data collection plan is provided in Table 1.1.

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Figure 1.1 Location of Project Area, Study Area and Area of Influence

DESCRIPTION OF THE ENVIRONMENT

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Table 1.1	Summary of Sampling Plan
	Cummary of Camping I lan

Торіс	Parameters	Number of Sites	Sample per Site	Total	Monitoring Frequency / Details
Air Quality	NO2, SO2,	27	1	27	Four weeks of continuous monitoring with diffusion tubes
Air Quality	PM10, PM2.5	18	1	18	One day (24hrs) continuous monitoring with machine
Noise	Sound Level (LAeq in dB(A))	27	1	27	Day time (07:00-22:00) and night time (22:00-07:00) monitoring for 24 hours for two days (1 weekday and 1 weekend)
Ground Water Quality	pH value, Temperature, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Oil and Grease, Total Nitrogen, Total Phosphorus (TP), Total Suspended Solids (TSS), Total Phenols, Mercury (Hg), Arsenic (As), Zinc (Zn), Copper (Cu), Total Chromium (Cr), Ammonia, Chlorine, Sulphide, Nitrate, Fluoride, Total Coliform.	24	3	72	In situ and lab analysis using existing well locations in villages.
Surface Water Quality	pH value, Temperature, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Oil and Grease, Total Nitrogen, Total Phosphorus (TP), Total Suspended Solids (TSS), Total Phenols, Mercury (Hg), Arsenic (As), Zinc (Zn), Copper (Cu), Total Chromium (Cr), Ammonia, Chlorine, Sulphide, Nitrate, Fluoride, Total Coliform.	24	3	72	In situ and lab analysis in Yangon River, Twantay Canal, local creeks and ponds, and Pan Hlaing River.
Soil Quality	pH, Iron (Fe), Cadmium (Cd), Lead (Pb), Zinc (Zn), Copper (Cu), moisture content	24	3	72	Lab analysis of soil within the Project footprint.
Biodiversity	Conduct habitat mapping and establish biodiversity indices, species inventory and identification of threatened species	9	Within 500m of Project and water	9	Surveys for birds, mammals, reptiles, fish, and
	For Aquatic fauna, this will include interviews of fishermen and local markets.		pipeline route		dragonflies/butterflies.

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#### 1.3.1.2 Survey Locations

The Phase 1 primary baseline plan was split into the nine (9) locations as shown in Table 1.2. The survey locations are provided in Figure 1.2, Figure 1.3, Figure 1.4, Figure 1.5, Figure 1.6, Figure 1.7 and Figure 1.8. For biodiversity, the nine areas in Table 1.2 were surveyed via transects and walkovers. Table 1.2 Samples per Location

No.	Area	Air (SO2, No2)	Air (PM2.5, 10)	Noise	Groundwater	Surface Water	Soil	Biodiversity
1	Bridge 1 (Hlaing River)	N1, N2, N3	PM1, PM2	N1, N2, N3	GW1, GW2, GW3	SW1, SW2, SW3	S1, S2, S3	B5
2	Bridge 2 (Pan Hlaing River)	N4, N5, N6	PM4, PM5	N4, N5, N6	GW4, GW5, GW6	SW4, SW5, SW6	S4, S5, S6	В4
3	Road (Project site)	N7, N8, N9	PM6, PM7	N7, N8, N9	GW7, GW8, GW9	SW7, SW8, SW9	S7, S8, S9	B8
4	Power 1 (230kV line and substation)	N10, N11, N12	PM16, PM10	N10, N11, N12	GW10, GW11, GW12	SW10, SW11, SW12	S10, S11, S12	B7
5	Power 1 (66kV line and substation)	N13, N14, N15	РМ3, РМ9	N13, N14, N15				В3
6	Water treatment plan and pipeline	N16, N17, N18	PM13, PM8	N16, N17, N18	GW13, GW14, GW15	SW13, SW14, SW14	S13, S14, S15	В9
7	Waste water treatment plant	N19, N20, N21	PM11, PM12	N19, N20, N21	GW16, GW17, GW18	SW16, SW17, SW18	S16, S17, S18	B6
8	Industrial zone (north)	N22, N23, N24	PM14, PM15	N22, N23, N24	GW19, GW20, GW21	SW19, SW20, SW21	S19, S20, S21	B2
9	Industrial zone (south)	N25, N26, N27	PM17, PM18	N25, N26, N27	GW22, GW23, GW24	SW22, SW23, SW24	S22, S23, S24	B1



Figure 1.2 Air Diffusion Tubes (NO<sub>2</sub> and SO<sub>2</sub>) Sampling Locations



Figure 1.3 PM<sub>10</sub> and PM<sub>2.5</sub> Monitoring Locations





Figure 1.4 Noise Monitoring Locations



Figure 1.5 Groundwater Sampling Locations



Figure 1.6 Surface Water Sampling Locations



Figure 1.7 Soil Sampling Locations



Figure 1.8 Biodiversity Survey Locations

The coordinates for the locations and survey results are provided in **Appendix D**.

# 1.3.1.3 Sampling Methodology

# Ambient Air Monitoring

Baseline ambient air monitoring was conducted within the Project Area at locations shown in Figure 1.2 and Figure 1.3. These locations 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 (Advanced Research WRF Version 3. NCAR Tech) data was used to generate meteorological data for the purpose of reviewing climatic conditions, regional air quality, and identifying representative sensitive receptors.

27 sites for NO<sub>2</sub> and SO<sub>2</sub> and 18 sites for PM<sub>10</sub> and PM<sub>2.5</sub> air quality monitoring sites were selected. At each monitoring location, measurements of NO<sub>2</sub> and SO<sub>2</sub> were taken using Palmes type diffusion tubes over a four (4) week period and measurements of PM<sub>10</sub> and PM<sub>2.5</sub> were undertaken using the Electronic Perimeter Air Station (EPAS) over a 24 hour period.

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 are undertaken to BS EN 13528. The technique is widely recognised internationally, including by the International Finance Corporation (IFC), United States Environmental Protection Agency (US EPA) and the UK Environment Agency. There is best practice guidance, adopted by this assessment, available from the US EPA and from the UK Department for the Environment, Food and Rural Affairs (DEFRA) on the siting and deployment of tubes. The analysis of the exposed tubes was completed through Ion Chromatography (United Kingdom Accreditation Service (UKAS) Accredited Method ISO/IEC 17025:2005).

#### Ambient Noise Monitoring

Baseline ambient noise monitoring was conducted within 5 km of the Project Area at locations shown in Figure 1.4. Noise monitoring (db (A)) was conducted at selected sensitive receptors such as nearby housing. The noise levels were recorded over a 24 hour period (day and night) for two consecutive days at each site, covering a weekday and a weekend day. The noise was measured using a Sound Level Meter (Model: SL-4023SD) along with an SD card real time data recorder (USB/RS232). The monitoring procedures, data analysis, and interpretation are carried out in accordance with the guidelines of US EPA and the manufacture.

#### Ground Water and Surface Water Quality

Water samples were collected using a clean sampling dipper in order to avoid sample contamination from other sources and in accordance with standard operating procedures. Before sample collection, appropriate measures including the wearing of disposable and powder-less gloves and rinsing of the sampling dipper with native water was carried out to condition, or equilibrate to the sample environment and make sure that all cleaning-solution residues are removed. The water-sampling dipper was immersed approximately 1 m into the water source and then filled into the sample bottles. Total dissolved solid (TDS), conductivity, chlorine, pH value, and temperature were measured on-site at the sampling locations according to standard procedures (USEPA, 2006).

After collecting the sample, the sample bottles will be kept in a cooling box with ice/ice packs until they reached the laboratory. All water samples were sent to ALS Hong Kong Laboratory for analysis in line with the parameters mentioned in Table 1.1. These parameters were selected as they are included in the World Health Organisation (WHO) Drinking Water standards and Myanmar

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(Environmental Quality (Emissions) Guidelines) EQEG and they can provide information on the quality of the water source (i.e., whether it is or is not polluted).

#### Soil Quality

Soil samples were collected from holes dug to a depth of approximately 50 cm using a soil auger (hand held drill). During sample collection, gloves were worn, and the gloves and drill were rinsed with clean water. Samples were transferred into wide-mouth glass bottles and sent to an accredited laboratory (ALS Hong Kong Laboratory) in Hong Kong. The soil samples were collected according to the standard procedure (Carter and Gregorich, 2006) and kept in cooling box at 4°C until they reached the laboratory. The parameters tested are provided in Table 5.1 and were selected based on the Dutch Standards for Soil Quality in order to provide information on the quality of the soil in line with recognised international standards.

#### **Biodiversity**

#### **Desktop Survey**

Publicly available sources of information were analysed to build an outline of known and likely ecological values for the Study Area. Aerial imagery was used to build a more complete spatial understanding of the pattern of vegetation communities and human uses on the site, and to map access routes and internal tracks. In addition, ecologists with experience of the Study Area were consulted where possible to obtain information about species known to be present or previously recorded from the site, and other ecological values considered by them to be relevant.

#### **Field Observation**

#### Flora

A Global Positioning System (GPS) was used to navigate and mark coordinates between sample points in/around the Study Area. Field observations were conducted within the Phase 1 Project Area. During the field survey period, plotless sampling methods and transect sampling methods were used. Plotless sampling methods are based on the random selection of points within a particular survey area whereas a transect is a long, thin quadrat that is used to sample along with narrow areas or to sample across different habitats. Pace-transects were used where the ecologist strides along an imaginary line across the sampling area and uses their foot placement to determine specific sampling points.

All trees, shrubs, herbs, and cultivated crops were recorded and listed. Identification of plants and animal species was conducted with assistance of local people. The identified species and families were translated to scientific name with assistance of a checklist of trees, shrubs, herbs and climbers of Myanmar (Kress, et al, 2003).

#### <u>Fauna</u>

#### (1) Mammals

The data collection for mammal species was conducted in three ways; (1) direct observation of mammals in the field, (2) observation of track and signs such as footprints, scat, and feeding signs in their natural habitats, and (3) interview surveys with local communities. Mammal surveys were conducted, by point count and transect count methods, during the day-time. The direct observation method was used for the species of tree dwelling mammals, such as squirrels and tree shrews. The track and sign observation method was used for some small carnivores (meat eaters). All encountered signs and footprints found by track and sign observation were examined and then photo records were taken for species identification. The presence or absence of well-known mammal species was confirmed by interviewing local people familiar with the Project Area.

(2) Reptiles and Amphibians

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Reptile and amphibian surveys were conducted through direct observation and active searching within the Study Area in all major representative habitat types and in potential hiding places such as among leaf litter, inside holes and under stones and logs within the study area. Surveys were conducted during the day-time. Visual observations, documented where possible by photographs, were made of some captured specimens that were not collected for preservation. Wherever possible, animals were captured by hand.

(3) Butterflies and Dragonflies

Butterfly and dragonfly surveys were conducted through direct observation and active searching in the Study Area in all different habitats by using point count method. Animals were recorded by taking photos and then identified to species level using reference books (Kinyon, S. 2004).

#### (4) Bird

A random point count method<sup>1</sup> was used for bird surveys and photos were taken for species identification, observed numbers, and habitat utilisation. Species identification was conducted using field guidebooks, with binoculars, camera, and GPS. Nocturnal birds were observed at dusk. Point count and opportunistic methods (incidental sightings) were used to census the species richness and point counting was used to get the relative measure of bird abundance.

#### (5) Aquatic

Interviews with local fisherman from the Study Area were conducted as well as collection of specimens. Questions asked related to fishing processes including the type of gear used, number of times fishing was conducted per day, and the target species. The fishes were collected from the main rivers, ponds, and creeks in the Study Area with the help of fishers and were photographed and measured. A survey of the local fish markets was also conducted including interviews of fishers present.

#### Interview survey

In addition to field observation, secondary data was also collected by interviewing local residents. In the interview survey, the surveyor visited residents in and around the Project Area and recorded the name of plants and animals they had observed using photographs. The historic situation of flora and fauna, and any changes they had observed in biodiversity was also discussed.

#### 1.3.2 Social Baseline

The social baseline information collected for the EIA Report is based on a review of published information, as well as through a review of available literature from NYDC and from ERM's in-house library.

The following tools were used for the primary social baseline data collection:

- Household Questionnaires: Conducted with people over 17 years old who live in the Study Area. The main socioeconomic indicators evaluated are sex, age, family composition, language, literacy, educational degree, diseases, access to basic services, economic activity, expenses and household income, means of communication and transportation, perceptions of potential project's impacts.
- Village Socio-economic Interview: Conducted with the village/ward leaders. Questions include: access to basic services, local public infrastructure, main source of income, access to credit, and perceptions and concerns about the Project.

<sup>&</sup>lt;sup>1</sup> Point count is a tally of all birds detected by sight and sound by a single observer located at a fixed position during a specified period of time.

Farmers' Focus Group Discussions: Conducted with local farmers. Questions include types of crops, size of farmland, equipment, access to credit, hiring of workforce, irrigation methods, destination market for the harvest, and perceptions and concerns about the Project.

Womens' Focus Group Discussions: Conducted with local women. Questions include main women economic activities, role of the women in the household, role of women in the village/ward, women leadership, main women problems in daily life, and women perceptions and concerns about the Project.

Data were collected from 392 households, with a random sample of 21 village tracts / wards in six Townships between 4<sup>th</sup> and 12<sup>th</sup> -March 2019. The following paragraphs describe the process to determine the sampling size for the household surveys, and the tools that were used to collect primary data.

The sample size was calculated using the formula shown in Figure 1.9.



Source: Cochran, W.G. Sampling Techniques (3rd ed.). New York: Wiley & Sons, 1977

# Figure 1.9 Sampling Formula

In the formula:

- N (Universe) is the total number from which the random sampling is selected. In this case, the universe is 76,009, the total household (HH) number within the Townships of Twantay, Seikgyi Kanaungto, Kyee Myin Daing, Hlaing Tharyar, Ahlone and Dala.
- **p** (Maximum Variability) is the value of variability. The value of variable of this Project is 0.5 as the HH within the Study Area is scattered in both urban and rural areas.
- **e** (Expected Error) is the margin of error that can be made within the sampling size. In order to minimize errors, a larger sampling size is preferred. The recommended margin of error is 0.05.
- **Z** (Confidence Interval) refers to the percentage of results repeating again.

For the household surveys; the sampling distribution was determined by the area (in km) of the respective township which is located within the Study Area. Table 1.3 shows the sampling distribution per township of the socio-economic interviews.

Township	Area of Villages Tracts / Wards within the Study Area	Percentage of the Villages Tracts / Wards' Area inside the Study Area	Sampling Size (households)
Twantay	124 km <sup>2</sup>	67%	265
Seikgyi Kanaungto	12 km <sup>2</sup>	7%	26
Kyee Myin Daing	13 km <sup>2</sup>	7%	27
Hlaing Tharyar	22 km <sup>2</sup>	12%	48
Ahlone	3 km <sup>2</sup>	2%	8
Dala	8 km <sup>2</sup>	5%	19
Total	183 km²	100%	392

#### Table 1.3 Sampling Distribution of the Household Surveys

The qualitative social research tools applied per Township are detailed in Table 1.4.

Township	Village Socio-economic Interview	Farmer's FGD	Women's FGD
Twantay	3	4	3
Seikgyi Kanaungto	3	1	1
Kyee Myin Daing	4	2	5
Hlaing Tharyar	3	-	2
Ahlone	3	-	1
Dala	-	-	1
Date	1 to 3 February	1 to 8 April	1 to 8 April

#### Table 1.4 Summary of Qualitative Surveys

A Focus Group Discussion (FGD) refers to a discussion carried out amongst a group of people (2-8) from a similar background/profile on a specific topic while being guided by a moderator. The primary purpose of such discussions is to gather an insight into the thought process of the group in regards to a particular issue.

# **1.4 Public Administration and Planning**

The Project is located in Twantay, Seikgyi Kanaungto, and Kyee Myin Daing (West) Townships of Yangon Region and neighboured by Hlaing Tharyar, Ahlone, and Dala Townships. Twantay, Seikgyi Kanaungto, and Dala Townships are under the administration of Southern District, Kyee Myin Daing Township is under the administration of Western District, and Hlaing Tharyar is under the administration of Northern District.

Yangon Region has the smallest area and highest population density among all 14 States and Regions and 1 Union Territory of Myanmar. Yangon Region is composed of 45 townships and one sub-township; 33 of these Townships are in the city area under Yangon City Development Committee (YCDC) (United Nations Development Programme, 2015). The population and area of the Townships in the Study Area are provided in Table 5.5. Twantay Township does not fall under the administration of YCDC management; the others do fall under the YCDC management.

District	Township	Number Nu of urban of wards vi tra	Number of	Number Population of 2014 Cens		Total Area in	Density (people/km <sup>2)</sup>
			village tracts	Total	Female	km <sup>2</sup>	
Yangon	Ahlone	11	0	55,412	54%	3	16,394
(West)	Kyee Myin Daing	22	0	111,566	53%	4.5	25,015
Yangon (North)	Hlaing Tharyar	20	10	686,827	53%	84	8,230
Yangon	Dala	23	23	173,376	51%	230	755
(South)	Seikgyi Kanaungto	9	0	33,978	50%	12.	2,808
	Twantay	8	66	226,803	51%	722	314

#### Table 1.5 Townships in the Study Area with Population and Area

Source: UNDP Myanmar, 2015

# 1.5 Legally Protected National, Regional or State Areas

There are 39 Protected Areas in Myanmar covering an area of 38,906 km<sup>2</sup>. Based on Myanmar's National Biodiversity Strategy and Action Plan (NBSAP) from 2015 to 2020, there are plans to establish nine more Protected Areas in three phases from 2020 to 2021. With the addition of these nine proposed areas, the total area under protection in Myanmar will be 52,932 km<sup>2</sup>, representing a coverage of 7.82% of the country's total land area (National Biodiversity Strategy and Action Plan, 2015).

There are no protected or sensitive areas within the Project Area or Study Area (i.e., within 2 km of the Project). Within a 50 km radius of the Project Area, there is one national protected area (Hlawga National Wildlife Park), one Endemic Bird Area (EBA) and three key biodiversity areas (KBAs). The closest KBA has located 14 km to the north. Information on these areas is provided in Table 5.6 and their location in relation to the Project Area is shown in Figure 5.10.



Figure 1.10 Key Biodiversity Area, Endemic Bird Areas, and Protected Areas

Protected Area / Endemic Bird Area / Key Biodiversity Areas	Details and Key Species	Nearest Distance from the Phase 1 New Yangon City Area
Hlawga National Wildlife Park	<ul> <li>Area: 6km<sup>2</sup></li> <li>Year designed: 2012</li> <li>Designated for: <i>Columba punicea</i> (Palecapped pigeon) (VU)</li> <li>IUCN category IV</li> </ul>	19 km north
Endemic Bird Area	<ul> <li>Area: 160,000 km<sup>2</sup></li> <li>Year designed: Unknown</li> <li>Designated for: Two restricted species:         <ul> <li>(1) White-throated babbler (Turdoides gularis): Least concern (2) Hooded treepie (Crypsirina cucullata): Vulnerable</li> </ul> </li> </ul>	5 km north
Hlawga Reservoir KBA	<ul> <li>Area: 23 km<sup>2</sup></li> <li>Year designated: 2012</li> <li>Designated for: <i>Dalbergia cultrata</i> (Yindaik) (EN), <i>Dipterocarpus alatus</i> (Kanyin-byu) (EN), <i>Hopea odorata</i> (Thingan) (VU).</li> <li>Terrestrial KBA</li> </ul>	14 km north
Payagyi Terrestrial KBA	<ul> <li>Area: 2 km<sup>2</sup></li> <li>Year designated: 2012</li> <li>Designated for: <i>Grus Antigone</i> (Sarus crane) (VU), Congregatory waterbirds</li> <li>Terrestrial KBA</li> </ul>	18 km west
Maletto Inn fresh water KBA	<ul> <li>Area: 386 km<sup>2</sup></li> <li>Year designated: 2012</li> <li>Designated for: <i>Grus Antigone</i> (Sarus crane) (VU), <i>Emberiza aureola</i> (Yellow-breasted Bunting) (EN), and other water birds</li> <li>Freshwater KBA</li> </ul>	17 km west

# Table 1.6Protected, Sensitive, and Key Biodiversity Areas within 50 km of<br/>the Project Area

Note: IUCN Red List Designations: EN – Endangered, VU – Vulnerable, IUCN category IV- Habitat/Species Management Area which aims to protect particular species or habitats and management reflects this priority (IUCN, 2019).

# 1.5.1 Key Biodiversity Areas

In Myanmar, KBAs fall in different land management categories including protected areas, conservation area, protected forests, reserve forests, and other resource and land use areas (International Finance Cooperation, 2012). Therefore, they accommodate different management systems, which include government, private, community-led and joint management. The closest KBA to the Project is 14 km to the north and there are no KBAs in the Study Area.

# 1.5.2 Alliance for Zero Extinction Sites

Alliance for Zero Extinction (AZE) Sites are the sites that hold the last remaining populations of 1,483 of the Earth's most threatened species (Alliance for Zero Extinction, 2019). There are no AZE Sites located within a 50 km radius of the Project Area.

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#### Important Bird and Biodiversity Areas 1.5.3

There is no important bird and biodiversity area in the Project area and a 50 m radius of the Project Area (Bird Life International, 2019).

#### 1.5.4 World Heritage Areas

According to the United Nations Educational, Scientific and Cultural Organization (UNESCO), cultural heritage refers to monuments, groups of buildings and sites with historical, aesthetic, archaeological, scientific, ethnological or anthropological value, while natural heritage refers to outstanding physical. biological and geological formations, habitats of threatened species of animals and plants and areas with scientific, conservation or aesthetic value (UNESCO World Heritage Centre, 2008). There are no World Heritage Areas within 50 km of the Project Area.

#### 1.5.5 **RAMSAR Sites**

The Convention on Wetlands, called the RAMSAR Convention, is the intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources (RAMSAR, 2019). There are no RAMSAR sites within 50 km of the Project Area.

#### 1.5.6 Endemic Bird Areas

Endemic Bird Areas (EBAs) are regions of the world that represent natural areas of bird endemism where the distributions of two or more restricted-range bird species overlap. A restricted-range species is defined as one having a historical breeding range of no more than 50,000 km.

The Project site is located 5 km nort of the Irrawaddy Plains EBA (BirdLife International, 2005) which extends across the lowlands (sea level up to 1,000 metres) where there are distinct wet and dry seasons and the indigenous vegetation is tropical dry deciduous monsoon forest dominated by Dipterocarpus spp. There is also a small area of tropical thorn forest in the driest, central part.

Two restricted range species occur in Irrawaddy Plains EBA (BirdLife International, 2019):

- White-throated babbler (Turdoides gularis): Least concern; and
- Hooded treepie (Crypsirina cucullata): Vulnerable.

#### 1.6 **Physical Characteristics**

Baseline information on the physical environment of the Study Area is provided in the following sections.

#### Ambient Air Quality 1.6.1

#### 1.6.1.1 Desktop Data Review

Air quality monitoring was first conducted in Yangon in 2007 by the Department of Medical Research and Yangon City Development Committee (YCDC) (Ohnmar May Tin Hlaing et al., 2009). The monitoring results indicated that particulate matter (as Total Suspended Particles (TSP) and PM<sub>10</sub>) were the main pollutants of concern. The PM<sub>10</sub> levels in Yangon are two to three times higher than the World Health Organisation (WHO) guideline levels for human health of 50 µg/m<sup>3</sup>. Comparison between the residential, commercial, and industrial areas of Yangon showed that the commercial areas typically have higher levels of TSP and PM<sub>10</sub> compared to residential and industrial sites (Ohnmar May Tin Hlaing et al., 2009).

#### 1.6.1.2 Ambient Air Quality Survey Results (2019)

As discussed in Section 5.3.1.3, primary air quality data were collected for the Project for PM<sub>2.5</sub> and PM<sub>10</sub> and NO<sub>2</sub> and SO<sub>2</sub>. Surveys were conducted for NO<sub>2</sub> and SO<sub>2</sub> between 19 February and 22

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March 2019 continuously with the tubes left in place for four weeks. For PM<sub>2.5</sub> and PM<sub>10</sub>, data was collected between 15<sup>th</sup> and 24<sup>th</sup> February 2019, and between 12<sup>th</sup> and 21<sup>st</sup> March 2019. Survey locations are shown in Figure 1.2 and Figure 1.3.

Representative photos of the air sampling equipment used for the Project are provided in Figure 1.11, Figure 1.12, Figure 1.13, and Figure 1.14.



Source: ERM 2019

# Figure 1.11 Ambient Air Quality Survey at Point ADT-8, Let Pan Village for PM<sub>10</sub> and PM<sub>2.5</sub>



Source: ERM 2019





Source: ERM 2019

Figure 1.13 Ambient Air Quality Survey at Point PM-4, Ah Pyin Pa Dan Village for NO<sub>2</sub> and SO<sub>2</sub>



Source: ERM 2019

# Figure 1.14 Ambient Air Quality Survey at Point PM-16, Lay Eain Village for NO<sub>2</sub> and SO<sub>2</sub>

Results of the NO<sub>2</sub> and SO<sub>2</sub> survey, and  $PM_{2.5}$  and  $PM_{10}$  are shown in Table 1.7 and Table 1.8. The full survey reports for ambient air quality monitoring are provided in Appendix C. The tubes for analysis were left in place for four weeks. When the survey team went to collect the tubes; some were found to be missing and are shown as "not available" in Table 1.7 and Table 1.8; these include:

- NO<sub>2</sub> and SO<sub>2</sub> tubes at Monastery, near Ah Twin Pa Dan Village, Hlaing Tharyar Township;
- NO2 tube at ADT-2, Monastery, Kyee Myin Daing (West) Township;
- ADT-19, Pagoda, near Ma Ngay Village, Twantay Township; and
- SO<sub>2</sub> tube at ADT-15, School, near Kun Tar Village, Twantay Township.

Sampling Point	Location	NO₂ annual mean (ug/m³)	SO <sub>2</sub> 24-hour mean (ug/m <sup>3</sup> )
ADT-1	School, Kyee Myin Daing (East) Township	33.3	3.1
ADT-2	Monastery, Kyee Myin Daing (West) Township	Not available	2.8
ADT-3	Monastery, near Kone village, Twantay Township	11.9	2.1
ADT-4	Resident compound, near Yangon – Pathein Road, Hlaing Tharyar Township	27.7	2.7
ADT-5	Monastery, near Ah Twin Pa Dan Village, Hlaing Tharyar Township	Not available	Not available

# Table 1.7Ambient Air Quality Survey Results (NO2 and SO2) (2019)

Sampling Point	Location	NO <sub>2</sub> annual mean (ug/m <sup>3</sup> )	SO <sub>2</sub> 24-hour mean (ug/m <sup>3</sup> )
ADT-6	Pagoda, near Ah Pyin Pa Dan Village, Hlaing Tharyar Township	15.4	2.3
ADT-7	Resident compound near Ah Lel Village, Twantay Township	11.6	1.5
ADT-8	Monastery, Let Pan Gwa Village, Twantay Township	7.4	<1.5
ADT-9	Monastery, Pathein Village, near Seikgyi Kanaungto Township	8.5	2.8
ADT-10	Resident Compound, near Yangon – Twantay Road, Twantay Township	10.5	2.0
ADT-11	Monastery, near Ta Man Gyi Village, Twantay Township	9.9	2.6
ADT-12	Open compound, near Upper Tamar Takaw Village, Twantay Township	13.2	2.6
ADT-13	Monastery, near Gyaung Waing Gyi Village, Twantay Township	10.4	2.2
ADT-14	School, near Kone village, Twantay Township	13.1	2.1
ADT-15	School, near Kun Tar Village, Twantay Township	10.1	Not available
ADT-16	Monastery, near Kun Tar Village, Twantay Township	9.0	1.9
ADT-17	Monastery, near Kan Kone Village, Twantay Township	11.4	2.3
ADT-18	School, near Pan Hlaing Wa Village, Twantay Township	4.9	1.6
ADT-19	Pagoda, near Ma Ngay Village, Twantay Township	Not available	1.8
ADT-20	Monastery, near Yae Oke Kan Village, Hlaing Tharyar Township	21.2	5.2
ADT-21	Resident Compound, near Ah Pyin Pa Dan Village, Hlaing Tharyar Township	18.0	<1.3
ADT-22	Monastery, near Lower Tamar Takaw Village, Twantay Township	9.3	1.8
ADT-23	Monastery, near Upper Tamar Takaw Village, Twantay Township	12.3	1.4
ADT-24	Monastery, near Lay Eain Village, Twantay Township	11.4	38.9
ADT-25	Monastery, near Thone Eain Village, Twantay Township	10.1	2.5
ADT-26	Monastery, near Than Phyu Yone village, Twantay Township	10.7	2.3

Sampling Point	Location	NO₂ annual mean (ug/m³)	SO <sub>2</sub> 24-hour mean (ug/m <sup>3</sup> )
ADT-27	Monastery, near Kalar Tan Village, Twantay Township	9.3	1.6
WHO/EU Annual Mean Air Quality Critical Level (Agriculture)		-	20
NEQEG Annual Me	an Air Quality Guideline (Human Health)	40	-

Note: results in red exceed the WHO/EU Annual Mean Air Quality Critical Level (Agriculture)

WHO Guideline values:Nitrogen dioxide (NO2)40 μg/m3 annual meanSulfur dioxide (SO2)20 μg/m3 24-hour mean
			-	
Sampling Point	Sampling Date (Start –End)	Location	PM <sub>10</sub> μg/m <sup>3</sup> 24–hours mean	PM <sub>2.5</sub> µg/m <sup>3</sup> 24–hours mean
PM-1	15.2.2019 – 16.2.2019	Kyee Myin Daing Township	72	50
PM-2	17.3.2019 – 18.3.2019	Chaung(Chaung Wa) Village, Kyee Myin Daing Township	68	52
PM-3	18.3.2019 – 19.3.2019	Kone village, Twantay Township	63	39
PM-4	16.2.2019 – 17.2.2019	Ah Pyin Pa Dan Village, Hlaing Tharyar Township	55	36
PM-5	17.2.2019 – 18.2.2019	Phaya Ngu Village, Twantay Township	54	24
PM-6	14.3.2019 – 15.3.2019	Let Pan Village, Twantay Township	63	39
PM-7	15.3.2019 – 16.3.2019	Kan Hla Village, Twantay Township	78	49
PM-8	22.2.2019 – 23.2.2019	Ta Man Gyi Village, Twantay Township	44	26
PM-9	16.3.2019 – 17.3.2019	Gyaung Waing Gyi Village, Twantay Township	61	44
PM-10	23.2.2019 – 24.2.2019	Kon Tar Village, Twantay Township	39	20
PM-11	19.3.2019 – 20.3.2019	Mya Kan Thar Village, Twantay Township	58	42
PM-12	20.2.2019 – 21.2.2019	Ma Ngay Village, Twantay Township	41	26
PM-13	20.3.2019 – 21.3.2019	Agga Tan village, Twantay Township	50	27
PM-14	18.2.2019 – 19.2.2019	Lower Tamar Takaw Village, Twantay Township	32	20
PM-15	19.2.2019 – 20.2.2019	Upper Tamar Takaw Village, Twantay Township	43	28
PM-16	21.2.2019 – 22.2.2019	Lay Eain Village, Twantay Township	40	24
PM-17	13.3.2019 – 14.3.2019	Thone Eain Village, Twantay Township	68	38
PM-18	12.3.2019 – 13.3.2019	Than Phyu Yone village, Twantay Township	62	38

# Table 1.8 Ambient Air Quality Survey Results (PM<sub>2.5</sub> and PM<sub>10</sub>) (2019)

Note: results in red exceed the WHO Air Quality Standards for Human Health WHO Air Quality Guideline values - Particulate Matter (PM) Fine Particulate Matter (PM2.5) 25 μg/m3 24-hour mean Coarse Particulate Matter (PM10) 50 μg/m3 24-hour mean

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NO<sub>2</sub> and SO<sub>2</sub> were sampled in 27 locations, and PM<sub>2.5</sub> and PM<sub>10</sub> were sampled in 18 locations in the Study Area at sensitive receptors, such as households. For ambient air quality, none of the values for NO<sub>2</sub> exceeded the World Health Organisation (WHO) guidelines for human health. SO<sub>2</sub> exceeded the WHO guideline for agriculture in one location; a monastery near Lay Eain Village, Twantay Township. The rest of the locations fall in the standards of WHO/EU Annual Mean Air Quality Critical Level (Agriculture). For PM<sub>2.5</sub> and PM<sub>10</sub>, the data were compared to the WHO standards for Human Health. There were exceedances of both PM<sub>2.5</sub> and PM<sub>10</sub> in all of the Townships surveyed except six out of the 18 locations. The results show that there are increased particulates in the air, which is most likely caused by climatic conditions at the time of the survey (the end of the dry season usually means increases in dust). Many of the surveyed locations were at houses close to a main road where vehicle use can also cause elevation of dust on the dry roads.

# 1.6.2 Ambient Noise

# 1.6.2.1 Desktop Data Review

There is no secondary data in the Project Area regarding ambient noise. Ambient noise levels (LAeq) may have the potential to exceed the EQEG limits for the night time noise standards and daytime noise standards, depending on the effect of noise emission sources in the area e.g., cars, motorcycles.

# 1.6.2.2 Survey Results (2019)

Primary ambient noise data were conducted for the Project at 27 locations between the 16<sup>th</sup> February and 10<sup>th</sup> March 2019. Survey locations are shown in Figure 1.4. Representative photos taken during the field survey are shown in Figure 1.15 and Figure 1.16.



Source: ERM 2019

# Figure 1.15 Ambient Noise Survey at Point N-3, Kone Village



Source: ERM 2019

# Figure 1.16 Ambient Noise Survey at Point N-25, Thone Eain Village

Noise levels were sampled in sensitive receptors, such as households. The survey indicated that ambient noise levels at many locations exceeded the IFC noise level guidelines (for residents). Ten out of 27 locations for day time and 15 out of 27 locations for night time exceeded the standard value by over 5dB, whilst, only five out of 27 locations during day time did not exceed the standard (Table 1.9). Based on these results, half of the surveyed area is over the acceptable noise level. It is likely that this noise was generated from private generators, loud speakers, automatic farm machinery, and activities from vehicles or motorbikes and residential houses.

Sample ID	Survey One Ho (dBA)	Results ur LAeq	IFC Nois guideline resident)	e level es (for	Location information
	Day Time 7:00- 22:00	Night Time 22:00- 7:00	Day Time	Night Time	
N-1	76	68	55	45	School, Bagaya Street, Near Kyee Myin Daing Railway Station, Kyee Myin Daing Township
N-2	58	44	55	45	Chaung(Chaung Wa) Village, Kyee Myin Daing Township
N-3	51	49	55	45	Kone village, Twantay Township
N-4	59	53	55	45	Near Pann Hlaing Bridge, beside of Hlaing Tharyar – Twantay road, Hlaing Tharyar Township
N-5	65	64	55	45	Ah Pyin Pa Dan Village, Hlaing Tharyar Township
N-6	74	70	55 45		Aung Taw Mu Pagoda, Twantay Township

## Table 1.9 Ambient Nosie Survey Results (2019)

### DESCRIPTION OF THE ENVIRONMENT

Sample ID	ple Survey Results IFC Noise lev One Hour LAeq guidelines (fo (dBA) resident)				Location information
	Day Time 7:00- 22:00	Night Time 22:00- 7:00	Day Time	Night Time	
N-7	59	52	55	45	About 0.67km southwest of Wa Yon Seik Village, Twantay Township
N-8	59	58	55	45	Let Pan Village, Twantay Township
N-9	61	57	55	45	Near about 0.37km west of Kanaungto Bridge
N-10	56	51	55	45	Junction of Kan Village assess road and Twantay- Hlaing Tharyar Road
N-11	58	62	55	45	Ta Man Gyi Village, Twantay Township
N-12	64	54	55	45	Beside of Twantay-Hlaing Tharyar Road, Near about 1.52km north of Lay Eain Village, Twantay Township
N-13	71	62	55	45	Gyaung Waing Gyi Village, Twantay Township
N-14	60	59	55	45	Near about 1.2km west of Kone Village, Twantay Township
N-15	52	42	55	45	Near about 1.68km northeast of Kon Tar Village, Twantay Township
N-16	58	48	55	45	Monastery of Kon Tar Village, Twantay Township
N-17	74	63	55	45	Located at the beside of Maubin- Twantay road, near Mya Kan Thar Village, Twantay Township
N-18	56	48	55	45	Near Raw water pipeline and Pan Hlaing/ Agga Tan village, Twantay Township
N-19	53	49	55	45	Monastery compound of Ma Ngay Village, Twantay Township
N-20	63	54	55	45	Oke Kan Thaung Kyar Village, Hlaing Tharyar Township
N-21	67	59	55	45	Near about 0.42km south of Pan Hlaing Bridge and beside of Hlaing Tharyar – Twantay Road
N-22	71	58	55	45	Lower Tamar Takaw Village, Twantay Township
N-23	63	66	55	45	Upper Tamar Takaw Village, Twantay Township
N-24	53	49	55	45	Lay Eain Village, Twantay Township
N-25	48	46	55	45	School of Thone Eain Village, Twantay Township
N-26	51	48	55	45	Monastery of Than Phyu Yone village, Twantay Township
N-27	67	64	55	45	Ka Lar Tan Village, Twantay Township

Note: results in red exceed the IFC Noise level guidelines (for resident)

IFC Noise level guidelines (for resident) One Hour LAeq (dBA) 55 Daytime and 45 Nighttime

# Geology, Topography and Soils

# 1.6.3.1 Desktop Data Review

1.6.3

The geological landscape in this part of Myanmar is characterised by the Indo-Burman Ranges which branch southwards from the eastern Himalayas and the Irrawaddy Valley Basin also known as the Inner Myanmar Tertiary Basin.

Yangon is underlain by alluvial deposits, the non-marine fluviatile sediments of Irrawady Formation, and hard, massive sandstone of Pegu Series. The alluvial deposits are composed of gravel, clay, silts, sand and laterite, which lies upon the eroded surface of Irrawady Formation at 5 m above mean sea level. The central part of Yangon is occupied by the anticlinal ridge as a backbone, 30 m above mean sea level and covered with sands, sand rock, soft sandstones, shale, clays, and lateritic of the Irrawady Formation. The hard compact sandstone and shale of Pegu series can be found at the northwest corner of Hlawga Lake. Alluvial deposits are found in the surrounding areas of the ridge whereas lateritic soils can be found along the ridge (Hla Aung, 2011). Figure 1.17 provides the soil map for Yangon.



Source: Land Use Bureau of Yangon

# Figure 1.17 Soil Map of Yangon

# 1.6.3.2 Soil Survey Results (2019)

Primary soil quality survey was conducted for the Project at 24 locations. Soil samples were collected within the Project Area from 25th February 2019 to 4th March 2019. Survey locations are shown in Figure 5.7.

Some representative photos taken during the field survey are shown in Figure 5.18 and Figure 5.19.



Source: ERM 2019



### DESCRIPTION OF THE ENVIRONMENT



Source: ERM 2019

# Figure 1.19 Soil sample collection at S-9, near Shwe Ain Kyi Village

Description of the survey points and the results of the survey are shown in Table 1.10 and Table 1.11 respectively.

Sampling location	Description
S-1	Located in the No. (2), Seik Kan Thar Park between Kyee Myin Daing Strand Road and Yangon River and taken from a small canal of the park. The soil is light brown coloured clayey silt.
S-2	Located at the west side of Kyee Myin Daing Township and 0.64 km away from Yangon River in a paddy field. The soil is light brown coloured silty clay.
S-3	Located in a paddy field of the Kon Village beside the Kon Village-Sat Ga Lay road. The soil is light grey coloured silty clay.
S-4	Located between Shwe Than Lwin Industrial Zone and Pan Hlaing Bridge in grass land. The soil is buff coloured silty clay.
S-5	Located at the Phaya Ngu Village and beside the Pan Hlaing bridge right bank of the Pan Hlaing river in a banana plantation. The soil is dark brown coloured silty clay.
S-6	Located in a paddy field of West of Wa Yone Seik Village and 0.75 km away from Pan Hlaing river. The soil is light brown coloured silty clay.

Table 1.10	Description of Soil Sampling Locations
------------	----------------------------------------

#### Sampling Description location Located at South-West of the Shwe Ain Kyi Village and near Htone stream in a paddy field. S-7 The soil is brown coloured silty clay. Located North-West of the Set Kalay Village and distance from 0.75 km of the Twantay S-8 canal in a dried paddy field. The soil is light grey coloured silty clay. Located between left side of the Hlaing Tharyar to Twantay Road in a paddy field. The soil S-9 sample is Dark brown coloured silty clay. The sampling point is located to the East of the Ta Man Gyi Village (and stream) in a paddy S-10 field. The soil is light yellow coloured clay. Located to the North-West of the Upper Tamar Takaw Village in a paddy field on the left of S-11 the Hlaing Tharyar to Twantay Road. The soil is light grey coloured clay. Located at South-West of the Gyaung Waing Gyi Village and downstream of the Gyaung S-12 Waing stream in a paddy field. The soil is light brown coloured silty clay. Located upstream of the Kon Village stream and 1.15 km away from West of the Kon Village S-13 in a paddy field. The soil is light black coloured clay. Located to the South of the Htein Kone Village and near the In Kyan stream in a paddy field. S-14 The soil is yellowish grey coloured lateritic clay. Located in a paddy field of the Kon Tar Village and near upstream of Kun Ta stream. The S-15 soil is light brown coloured silty clay. Located near the Ma Daing stream and 0.33 km away from Twantay canal in a banana S-16 plantation of the Kan Kone Village. The soil is yellowish brown coloured lateritic clay. Located in a banana plantation at the Agga Tan Village and 1.30 km from Toe river. The soil S-17 is dark brown coloured sandy silt. Located in a paddy field at the North-West of the Lower Tamar Takaw Village and beside the S-18 Phon Pyoe Yae road. The soil is light brown coloured silty clay. Located in a bamboo forest and near a plantation beside the Ko Po stream and North-West S-19 of Kha Lauk Chaik Village. The soil is light brown coloured silty clay. Located in a forest area to the North-East of the Phaya Ngu Village and 0.46 km away from S-20 the Pan Hlaing river. The soil is light brown coloured silt. Located in a paddy field, East of the Upper Tamar Takaw Village. The soil is dark brown S-21 coloured silty clay. Located in a paddy field, North-East of the Lay Eain Village and near the Ta Man Gyi S-22 stream. The soil is silty clay. Located East of the Than Phyu Yone Village and 0.25 km away from Twantay cana in a S-23 paddy field. The soil is light yellow coloured clay. Located to the North-East of the Ka Lar Tan Village and near Thar Zi stream in a paddy field S-24 that is 0.23 km from Twantay canal. The soil is yellowish brown coloured lateritic clay.

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Parameters	Physical and Aggrega	ate Properties	Metals and Major Cations										
	Moisture Content (dried @ 103°C)	pH Value	Ammonia as N	Chloride	Fluoride	Sulphide as S2	Total Phosphorus as P						
FAO Soil Bulletin 65 & Dutch Standards	O Soil Bulletin N/A N/A & Dutch ndards		N/A	0.8	20-300	85	15-150						
Units			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg						
S-1	14.2	8.4	26,333	0.3	55	223	143						
S-2	21.6	7.9	46,233	< 0.2	32	26	83						
S-3	21.8	7.4	44,000	< 0.2	25	17	75						
S-4	26.9	7.0	49,700	< 0.2	< 0.2 36		101						
S-5	29.1	6.3	43,333	< 0.2	32	24	90						
S-6	20.0	7.9	50,266	< 0.2	35	26	97						
S-7	21.3	7.1	42,400	< 0.2	27	19	84						
S-8	18.1	6.8	52,300	< 0.2	34	24	105						
S-9	23.3	6.2	37,400	< 0.2	23	18	66						
S-10	24.2	6.5	45,800	< 0.2	29	18	88						
S-11	25.0	7.1	47,900	< 0.2	32	23	96						
S-12	24.7	8.1	54,966	< 0.2	38	28	107						
S-13	21.7	7.8	48,500	< 0.2	31	23	92						
S-14	24.0	6.7	48,033	< 0.2	33	19	91						
S-15	21.4	8.1	51,466	< 0.2	33	27	98						
S-16	13.8 6.7		22,066	< 0.2	13	12	25						
S-17 23.4 6.5		46,933	< 0.2	34	22	97							

# Table 1.11Soil Quality Survey Results (2019)

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Parameters	Physical and Aggregat	e Properties	Metals and Major	Metals and Major Cations									
	Moisture Content (dried @ 103°C)	pH Value	Ammonia as N	Chloride	Fluoride	Sulphide as S2	Total Phosphorus as P						
FAO Soil Bulletin 65 & Dutch Standards	N/A	N/A	N/A	0.8	20-300	85	15-150						
S-18	17.8	7.9	50,033	< 0.2	34	25	96						
S-19	20.1	6.5	40,900	< 0.2	31	22	89						
S-20	17.7	6.5	47,333	< 0.2	36	26	101						
S-21	21.9	7.9	49,800	< 0.2	34	23	100						
S-22	22.9	7.0	44,066	< 0.2	31	23	94						
S-23	24.7 7.6		42,666	< 0.2	33	24	81						
S-24	26.4	7.3	48,500	< 0.2	32	24	93						

Note: results in red exceed the FAO Soil Bulletin 65 & Dutch Standards

Out of 24 sampling locations, one location (Seik Kan Thar Park (in between Kyee Myin Daing Strand Road and Yangon River) in Kyee Myin Daing Township) exceeded the Food and Agriculture Organization of the United Nations (FAO) Soil Bulletin 65 and the Dutch Standard, for Sulphide only. There were no other exceedances of baseline standards.

# 1.6.4 Climate

The weather and climate of Myanmar are primarily influenced by the northeast and the southwest monsoons and the short transitional periods between them. The southwest monsoon (June to September) is characterised by extensive cloud cover, light rain almost daily, interspersed with rain squalls or thunderstorms. The northeast monsoon (December to April) brings less cloud, scant rainfall, mild temperatures and lower humidity during winter (Suwannathatsa, et al, 2012).

The spring and autumn transition periods between the monsoons (April and May, October and November) are generally hot with very variable weather and heavy squalls. The transition periods are governed by the Inter-Tropical Convergence Zone (ITCZ) which separates the main wind streams of the northern and southern hemispheres. The ITCZ moves seasonally over the area (northwards in spring and southwards in autumn), with no well-defined weather pattern (Suwannathatsa, et al, 2012).

In Yangon, as with Myanmar in general, there is much less rainfall in summer. The average maximum temperature is 29°C while the average annual rainfall is 2,378 mm (Figure 1.20). The driest month is January, with 3 mm of rainfall and June is the wettest month with an average of 516 mm. The warmest month is April, with an average temperature of 30°C. January has the lowest average temperature of the year; 25 °C. During the year, the average temperatures vary by 5.5 °C (Climate Data Website, 2018).





Source: Climate Data website, 2018

# Figure 1.20 Average Monthly Temperature and Rainfall Chart of Yangon, Myanmar

# 1.6.5 Natural Hazards

Myanmar is exposed to multiple natural hazards including cyclones, earthquakes, and flooding. These are discussed in the following sections.

# 1.6.5.1 Storms and Cyclones

Gale force winds (17.2 ms<sup>-1</sup> or over) are mainly associated with local rain squalls and with severe tropical storms or cyclones. The central region receives the worst buffeting during the summer monsoon. The threat of cyclones with winds above 32.7 ms<sup>-1</sup> affects different areas at different times of the year, affecting all areas though the major tracks do not pass over the Andaman Sea (OCHA, 2011). Cyclones are most frequent from mid-May to early December.

# 1.6.5.2 Flooding

Areas within the New Yangon City are prone to flooding due to the low elevation relative to its surroundings. Pluvial flood can occur due to runoff to low lying areas with limited drainage capacity. Fluvial flooding can occur when the surroundings are lower than the water in the surrounding river or canal (Royal Haskoning DHV, 2019).

The average tidal range of the Yangon River is about 6 m at spring tide and 3 m at neap tide. Modelling of the discharge of Yangon River indicates discharges ranging from <500 m<sup>3</sup>/s in April to approximately 7,000 m<sup>3</sup>/s in August, with tidal water level variations of around 1 to 6 m based on water level measurements at Monkey Point located downstream of the Study Area (De Koning and Janssen, 2015). In the Ayeyarwady Delta, which includes the Yangon River, drainage, salt intrusion, and flood protection are key concerns (EO Earth Website, 2016).

Two main forces dominate the Yangon River system that can result in fluvial floods (Royal Haskoning DHV, 2019):

- Increased water levels from the sea: there is a strong tide from the Gulf of Martaban. The spring tide range is approximately 5.4 m in the Hlaing River, and the neap tide range is approximately 2 m. In addition, storm surges can increase offshore water levels.
- Increased discharges during the monsoon period: the Irrawaddy River feeds the Yangon River with rainfall from the Irrawaddy River Basin and water levels increase by an additional approximate 0.7 m during the monsoon period.

As part of the Phase 1 Development NYDC initiated a Strategic Flood Risk Assessment to ensure that the proposed development takes account of flood risk. Royal Haskoning DHV (RHDHV) was selected as the consultant to provide professional services to contribute to the development of New Yangon City's flood risk assessment services for Phase 1. The following are some of the main conclusions from the Strategic Flood Risk Assessment.

- The New Yangon City is prone to flooding due to the following three flood sources: tide and storm surge (coastal), river discharge (fluvial) and rainfall (pluvial). Among the three flood sources, coastal floods (in terms of days) are usually shorter in duration than fluvial flood (in terms of weeks).
- The flood risk profile for New Yangon City shows that the existing flood risk without flood protection is high. Sea level rise will strongly influence the flood risk profile of New Yangon City in terms of economic risk as well as loss-of life. Implementation of flood risk reduction measures is recommended. (Royal Haskoning DHV, 2019).

# 1.6.5.3 Earthquake Risk

A review of available literature has shown that Myanmar is seismologically unstable and vulnerable to earthquakes due to its location in the active Alpide seismotectonic belt and the young Alpine Himalayan-Sumatran orogenic belt (Willige et al., 2009). Historic records show that at least 15 major

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earthquakes with magnitudes M≥7.0 Richter scale (RS) have occurred in Myanmar in the last hundred years. These earthquakes occurred within Myanmar in the last century, in Yangon Region, these include on 27 March, 16 May, and 21 May 1931 and in 1970. Figure 1.21 presents the locations of historic earthquakes in Yangon taken from United States Geological Survey (USGS) data from 2017.



Source: USGS Website, 2019



# 1.6.6 Water Resources

# 1.6.6.1 Desktop Data Review

In Yangon City, municipal water supply only reaches around 38% of the population. The remainder uses alternative sources such as groundwater, tube wells, and private water vendors etc., which are untreated and unlikely to meet the bacteriological guidelines for drinking (Another Development & East Asia Institute, 2018).

# Fluvial-Coastal System

New Yangon City is surrounded by the Pan Hlaing River in the north, the Hlaing River in the east and the Twantay Canal in the south. These three channels are part of a larger hydraulic system in Yangon Region (Figure 1.22).

The Twantay Canal is a manmade canal to create a shortcut between Yangon and the Irrawaddy River for navigation. As the river system is morphologically active, the outer bend of the Yangon River started to erode, creating the possibility of a direct shortcut between the Hlaing and the Twantay Canal and loss of land. The river bend was stabilised by river band protection in 1914. The Pan Hlaing Rive used to be the main navigation route towards Nyaungdone, however, the river siltated and vessels were rerouted through the Kokkowa River. To regulate water inflow into the Pan Hlaing River, a sluice gate, gate (Mezali Sluice 2) was constructed between 2014 and 2016 (Royal Haskoning DHV, 2019).

# Groundwater

Groundwater is an important source of water supply for various uses and is used to meet the needs of city. Ground water is especially important for Yangon City, as many local communities rely on groundwater for domestic purposes. The number of tube wells increased from 17 in 1983 to 442 in 2014, operated solely by YCDC (Another Development & East Asia Institute, 2018).

Ground water depletion is progressing at a fast rate given the conditions in Yangon City. Population dynamics, rural-urban migration, urban area expansion, industrialisation, improved living standard, and insufficient water supply accounts for the increasing ground water usage in Yangon. Although 85% of the city is covered by high potential growth area, there is still a dependence on the long-term rechargeable value. This implies that the more groundwater extraction exceeds the rate of rechargeable value, the more the potential ground water source decreases (Another Development & East Asia Institute, 2018).

# Surface Water

A study carried out in 2013 (Hiroshi Sakai, et al, 2013) sampled river waters from Yangon River and Pan Hlaing River. The total coliform level of the river waters in Yangon was close to 50 total coliforms per ml, indicating that the river can be used for drinking water after treatment. Amongst the sampling points on the Yangon River, the sampling point approximately 4 km south of the Project Area has significantly higher (21 fold higher) total coliform level than those sampling points in the centre of the river.

Analysis of chemical levels in river water samples indicated that the dissolved organic carbon (DOC) was less than 3mg C L<sup>-1</sup>. Levels of the Chlorine (CI–) ion increased downstream. The levels of Bromine (Br) ion and Arsenic (As) displayed a similar trend, although the increase was not as marked. In contrast to the elemental measurements, DOC, dissolved total nitrogen (DTN), and nitrate were stable along the river flow. It was therefore assumed that the sources of CI–, Br– and As were different from those of carbon and nitrogen. Overall, lake and river water quality were considered good in terms of their chemical parameters, but levels of bacterial contamination are concerns (Hiroshi Sakai, et al, 2013).



Source: Royal Haskoning DHV, 2019.

# Figure 1.22 Overview of the Hydraulic System around New Yangon City

# Drainage System

Precipitation that falls within the New Yangon City will infiltrate in the ground or runoff through natural creeks and manmade ditches and drainage canals. The natural creeks are connected to the hydraulic river system and they are therefore tidal. These creeks can speed up the infiltration of

### DESCRIPTION OF THE ENVIRONMENT

fluvial flood water into the area. However, when properly designed, they could function as a drain and add value to the liveability of the area by bringing water and nature into the city (Royal Haskoning DHV, 2019).

# 1.6.6.2 Groundwater Survey Results (2019)

Primary ground water quality survey was conducted at 24 locations between 17<sup>th</sup> February and 8<sup>th</sup> March 2019. Survey locations are shown in Figure 1.5.

Representative photos of sampling during the field survey are shown in Figure 1.23 and Figure 1.24.



Source: ERM 2019



# DESCRIPTION OF THE ENVIRONMENT



Source: ERM 2019

# Figure 1.24 Ground water sample collection at GW-10, near Kan Village

Descriptions of the survey points and the results of the survey are shown in Table 1.12 and Table 1.13 respectively.

Sampling location	Description
GW-1	Located in Obo ward, Kyee Myin Daing Township from wells at a depths of around 120 ft. The residents utilise this water for domestic purposes and the wells are located 0.16 km from the Hlaing River.
GW-2	Located at the Ah Lat Chaung village, Kyee Myin Daing Township from wells at a depth of between 90 and 140 ft. Villagers utilise the well for domestic purposes.
GW-3	Located in Kone village, Twantay Township. The well depth was between 75 and 100 ft. and the water is used for domestic purposes.
GW-4	Located at the Tharaphu Soe Myint Factory, Hlaing Tharyar Township with a depth of between 60 and 240 ft. The water is used for domestic purposes.
GW-5	Located in Phaya Ngu Village, Twantay Township at a depth of between 50 and 140 ft. The water is used for domestic purposes.
GW-6	Located in Htin Su village, Twantay Township with a well depth of around 30 to 40 ft. The water is used for domestic purposes.
GW-7	Located in Wa Yon Seik village, Twantay Township at a depth of around 120 ft. The water is used for domestic purposes.

Table 1.12	Description	of Ground	Water S	Sampling	Locations
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#### SEA Report

Sampling location	Description
GW-8	Located in Chaung Pyar village, Twantay Township at a depth of between 20 and 35 ft. The water is used for domestic purposes.
GW-9	Located in Kan Hla Village, Seikgyi Kanaungto Township at a depth of between 25 and 45 ft. The water is used for domestic purposes.
GW-10	Located in Kone Tangyi village, Twantay Township at a depth of 90 and 110 ft. The water is used for domestic purposes.
GW-11	Located in Kun Tar village, Twantay Township at a depth of 50 and 130 ft. The water is used for domestic purposes.
GW-12	Located in Ka Lauk Ka Lu village, Twantay Township at a depth of between 45 and 65 ft. The water is used for domestic purposes.
GW-13	Located in Gyaung Waing Gyi village, Twantay Township at a depth of 45 ft. The water is used for domestic purposes.
GW-14	Located in Ywar Lay village, Twantay Township at a depth of 34 and 40 ft. The water is used for domestic purposes.
GW-15	Located in Htein Kone village, Twantay Township at a depth of 120 ft. The water is used for domestic purposes.
GW-16	Located in Ta Man Gyi village, Twantay Township at a depth of 45 and 126 ft. The water is used for domestic purposes.
GW-17	Located in Kan Gon village, Twantay Township at a depth of 130 and 230 ft. The water is used for domestic purposes.
GW-18	Located in Pan Hlaing Wa village, Twantay Township at a depth of 70 and 90 ft. The water is used for domestic purposes.
GW-19	Located in Kha Lauk Chaik village, Twantay Township at a depth of 60 ft. The water is used for domestic purposes.
GW-20	Located in Lower Tamar Takaw Village, Twantay Township at a depth of between 40 and 120 ft. The water is used for domestic purposes.
GW-21	Located in Upper Tamar Takaw Village, Twantay Township at a depth of between 60 and 160 ft. The water is used for domestic purposes.
GW-22	Located in Lay Eain Village, Twantay Township at the depth of between 45 and 100 ft. The water is used for domestic purposes.
GW-23	Located in Thon Ein village, Twantay Township at the depth of between 80 and 120 ft. The water is used for domestic purposes.
GW-24	Located in Than Byu Yon village, Twantay Township at the depth of between 85 and 100 ft. The water is used for domestic purposes.

Groundwater quality was sampled at 24 locations in the Study Area (i.e., wells in local villages). The results analysis were compared to the WHO Drinking Water Standards (i.e., seven parameters (pH, fluoride, nitrate (as N), arsenic, chromium, copper, and mercury)) and Myanmar National Drinking Water Quality Standards (DWQS) (i.e., 11 parameters (pH, ammonia (as N), chloride, fluoride, sulphide (as S2), nitrate (as N), arsenic, chromium, copper, mercury, and zinc)).

The groundwater samples met the WHO Drinking Water Standards, except for five locations for which the pH values were outside the recommended range (i.e., Obo ward, Kyee Myin Daing Township, Ah Lat Chaung village, Kyee Mying Daing Township, Kone village, Twantay Township, Wa Yon Seik village, Twantay Township, and Kan Gon village, Twantay Township). There was one occurrence where arsenic levels exceeded both WHO and National (DWQS) at atKa Lauk Ka Lu village, Twantay Township.

The majority of the sampling points exceeded the National DWQS for ammonia (as N) and chloride, while more than half of the sampling points exceeded the standard for sulphide (as S2). Despite the exceedances, ammonia (as N) and chloride are not of health concern for drinking water (WHO, 2017). The elevated levels of sulphide (as S2) only slightly exceeded the standards.

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	Physica Aggrega Propert	l and ate ies	Inorga	nic Non-	metallic	Parame	ters			Metals and Major Cations - Filtered						Aggregate Organics					
Parameters	Suspended solid	Hd	Ammonia as N	Chloride	Fluoride	Sulphide as S2-	Total Phosphorus as P	Nitrate as N	Total Nitrate as N	Arsenic	Chromium	Copper	Mercury	Zinc	Biochemical Oxygen Demand	Chemical Oxygen Demand	Oil & Grease	Phenols (Total)	Total Coliform		
Unit	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L	mg/ L	mg/L	MPN/ 100ml		
ОНМ	-	6.5 to 8.5	_*	_*	1.5	-	-	50	-	0.01	0.05	2	0.006	_*	-	-	-	-	-		
Myanmar DWQS	-	6.5 to 8.5	1.5	250	1.5	0.05	-	50	-	0.05	0.05	2	0.001	3	-	-	-	-	-		
GW-1	<2	6.1	0.6	125	0.1	<0.1	<0.01	6.3	7.3	0.01	0.010	0.001	0.0005	0.1	<2	14	<2	<0.1	<1.8		
GW-2	2	5.9	1.8	1,101	0.1	<0.1	0.0	<0.01	1.8	0.01	0.001	0.002	0.0005	0.01	<2	<5	<2	<0.1	443		
GW-3	47.3	4.8	5.6	1,698	0.1	<0.1	0.2	0.1	7.1	0.01	0.001	0.004	0.0005	0.1	4	23.7	<2	<0.1	2,634		
GW-4	23.3	7.5	3.9	721	0.3	0.1	1.2	0.4	4.7	0.02	0.001	0.001	0.0005	0.01	5.3	8.3	<2.0	0.1	443		
GW-5	9.7	7.2	1.8	770	0.2	0.1	0.7	0.0	1.8	0.01	0.001	0.001	0.0005	0.01	3.0	8.0	<2.0	0.1	217		
GW-6	33.3	7.4	0.1	820	0.2	0.1	0.5	0.7	1.3	0.01	0.001	0.001	0.0005	0.01	2.0	49.7	<2.0	0.1	520		

# Table 1.13 Ground Water Quality Survey Results (2019)

	Physical and Aggregate PropertiesInorganic Non-metallic Parameters										Metals and Major Cations - Filtered						Aggregate Organics				
Parameters	Suspended solid	Hd	Ammonia as N	Chloride	Fluoride	Sulphide as S2-	Total Phosphorus as P	Nitrate as N	Total Nitrate as N	Arsenic	Chromium	Copper	Mercury	Zinc	Biochemical Oxygen Demand	Chemical Oxygen Demand	Oil & Grease	Phenols (Total)	Total Coliform		
Unit	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L	mg/ L	mg/L	MPN/ 100ml		
ОНМ	-	6.5 to 8.5	_*	_*	1.5	-	-	50	-	0.01	0.05	2	0.006	-*	-	-	-	-	-		
Myanmar DWQS	-	6.5 to 8.5	1.5	250	1.5	0.05	-	50	-	0.05	0.05	2	0.001	3	-	-	-	-	-		
GW-7	2.3	6.4	2.9	618	0.1	0.1	0.0	0.0	3.0	0.01	0.001	0.001	0.0005	0.01	2.3	5.0	<2.0	0.1	760		
GW-8	19.67	7.1	0.51	477	0.27	<0.1	1.42	0.17	0.6	0.01	0.001	0.001	0.0005	0.01	<2	11	<2	<0.1	2400		
GW-9	20.3	7.1	0.9	1,779	0.2	<0.1	1.6	0.01	0.9	0.01	0.001	0.002	0.0005	0.01	<2	9	<2	<0.1	1,260		
GW- 10	7.0	7.4	2.5	663	0.8	0.1	0.4	0.1	2.9	0.01	0.001	0.001	0.0005	0.01	2.3	7.3	<2.0	0.1	1,093		
GW- 11	4.3	7.2	6.5	1,038	0.4	0.1	1.2	0.2	6.7	0.01	0.001	0.001	0.0005	0.01	4.0	8.7	<2.0	0.1	1,093		

	Physica Aggreg Propert	al and ate ies	Inorga	nic Non-	metallic	Parame	eters			Metal	s and Maj	or Cation	s - Filtered		Aggre	gate Or	ganics	i	
Parameters	Suspended solid	Hd	Ammonia as N	Chloride	Fluoride	Sulphide as S2-	Total Phosphorus as P	Nitrate as N	Total Nitrate as N	Arsenic	Chromium	Copper	Mercury	Zinc	Biochemical Oxygen Demand	Chemical Oxygen Demand	Oil & Grease	Phenols (Total)	Total Coliform
Unit	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L	mg/ L	mg/L	MPN/ 100ml
ОНМ	-	6.5 to 8.5	_*	_*	1.5	-	-	50	-	0.01	0.05	2	0.006	_*	-	-	-	-	-
Myanmar DWQS	-	6.5 to 8.5	1.5	250	1.5	0.05	-	50	-	0.05	0.05	2	0.001	3	-	_	-	-	-
GW- 12	32.7	7.6	8.7	485	0.4	0.1	2.0	0.0	8.9	0.3	0.001	0.001	0.0005	0.01	4.3	12.3	<2.0	0.1	860
GW- 13	20.3	7.2	3.4	2,146	0.2	<0.1	2.7	0.0	3.5	0.01	0.001	0.001	0.0005	0.01	3.3	24	<2	<0.1	2,200
GW- 14	13.7	7.7	2.4	251	0.4	0.1	1.6	0.1	2.6	0.02	0.001	0.001	0.0005	0.01	2.7	5.0	<2.0	0.1	594
GW- 15	21.3	7.2	10.7	1,376	0.2	<0.1	2.9	0.3	11.0	0.01	0.001	0.001	0.0005	0.01	2.5	12.5	<2	<0.1	1,733

	Physica Aggreg Propert	al and ate ties	Inorga	nic Non	-metallic	: Parame	eters			Metal	s and Ma	jor Cation	s - Filtered		Aggre	gate Or	ganics	i	
Parameters	Suspended solid	Hd	Ammonia as N	Chloride	Fluoride	Sulphide as S2-	Total Phosphorus as P	Nitrate as N	Total Nitrate as N	Arsenic	Chromium	Copper	Mercury	Zinc	Biochemical Oxygen Demand	Chemical Oxygen Demand	Oil & Grease	Phenols (Total)	Total Coliform
Unit	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L	mg/ L	mg/L	MPN/ 100ml
ОНМ	-	6.5 to 8.5	-*	_*	1.5	-	-	50	-	0.01	0.05	2	0.006	_*	-	-	-	-	-
Myanmar DWQS	-	6.5 to 8.5	1.5	250	1.5	0.05	-	50	-	0.05	0.05	2	0.001	3	-	-	-	-	-
GW- 16	2.0	7.3	1.6	424	0.6	0.1	0.0	0.0	1.7	0.01	0.001	0.001	0.0005	0.01	2.0	5.0	2.0	0.1	1,093
GW- 17	21.7	6.4	0.5	613	0.2	0.1	0.2	0.0	0.8	0.01	0.001	0.001	0.0005	0.01	2.0	6.6	<2	0.1	294
GW- 18	13.3	7.1	5.11	917	0.13	0.1	0.5	0.02	5.4	0.01	0.001	0.001	0.0005	0.01	3	12	<2	0.1	468
GW- 19	16.0	7.1	0.7	1,123	0.2	0.1	1.5	0.0	0.7	0.01	0.001	0.001	0.0005	0.01	2.0	7.3	<2.0	0.1	637

	Physica Aggrega Properti	l and ate ies	Inorga	nic Non-	metallic	Parame	ters			Metals	s and Maj	or Cation	s - Filtered		Aggre	gate Or	ganics		
Parameters	Suspended solid	Hd	Ammonia as N	Chloride	Fluoride	Sulphide as S2-	Total Phosphorus as P	Nitrate as N	Total Nitrate as N	Arsenic	Chromium	Copper	Mercury	Zinc	Biochemical Oxygen Demand	Chemical Oxygen Demand	Oil & Grease	Phenols (Total)	Total Coliform
Unit	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L	mg/ L	mg/L	MPN/ 100ml
ОНМ	-	6.5 to 8.5	_*	_*	1.5	-	-	50	-	0.01	0.05	2	0.006	_*	-	-	-	-	-
Myanmar DWQS	-	6.5 to 8.5	1.5	250	1.5	0.05	-	50	-	0.05	0.05	2	0.001	3	-	-	-	-	-
GW- 20	44.3	7.1	1.0	1,820	0.2	0.1	2.7	0.0	1.1	0.01	0.001	0.001	0.0005	0.01	2.0	17.7	<2.0	0.1	1243
GW- 21	5.3	7.1	9.6	2,660	0.3	0.1	1.6	1.6	12.3	0.01	0.001	0.001	0.0005	0.01	3.0	17.0	<2.0	0.1	747
GW- 22	16.7	7.6	12.7	2,366	0.2	0.1	1.2	0.0	13.2	0.1	0.001	0.001	0.0005	0.01	4.0	25.0	<2.0	0.1	2433
GW- 23	<2	7.4	2.5	1,173	0.2	<0.1	0.03	0.01	2.9	0.01	0.001	0.001	0.0005	0.01	<2	<5	<2	<0.1	1300

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	Physica Aggreg Propert	al and ate ties	Inorga	nic Non	-metallic	Parame	eters			Metals	s and Maje	or Cation	s - Filtered		Aggre	gate Or	ganics		
Parameters	Suspended solid	Hd	Ammonia as N	Chloride	Fluoride	Sulphide as S2-	Total Phosphorus as P	Nitrate as N	Total Nitrate as N	Arsenic	Chromium	Copper	Mercury	Zinc	Biochemical Oxygen Demand	Chemical Oxygen Demand	Oil & Grease	Phenols (Total)	Total Coliform
Unit	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L	mg/ L	mg/L	MPN/ 100ml
ОНМ	-	6.5 to 8.5	_*	_*	1.5	-	-	50	-	0.01	0.05	2	0.006	-*	-	-	-	-	-
Myanmar DWQS	-	6.5 to 8.5	1.5	250	1.5	0.05	-	50	-	0.05	0.05	2	0.001	3	-	-	-	-	-
GW- 24	<2	7.2	1.53	502	0.53	<0.1	0.01	0.02	1.53	0.01	0.001	0.001	0.0005	0.01	<2	<5	<2	<0.1	1160

\* WHO Drinking Water Standards suggested Ammonia as N, Chloride and Zinc are not of health concern at levels found in drinking water.

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#### Key

Roy	
	Exceed both standards
	Exceed WHO Guidelines for Drinking Water Quality
	Exceed Myanmar National Drinking Water Quality

# 1.6.6.3 Surface Water Survey Results (2019)

Primary surface water quality surveys were conducted at 24 locations between 17 February and 8 March 2019. Survey locations are shown in Figure 1.6 and representative photos taken during the field survey are shown in Figure 1.25 and Figure 1.26.



Source: ERM 2019





Source: ERM 2019

# Figure 1.26 Surface water sample collection at SW-9, Near Kan Village

A description of the survey points and the results of the survey are shown in Table 1.14 and Table 1.15 respectively.

Sampling location	Water Depth (m)	Description
SW-1	1.5	Located upstream of the Yangon River, Kyee Myin Daing Township. The water samples were collected during low tide. Turbidity was high and the colour was pale yellow.
SW-2	1.5	Located downstream of the Yangon River, Seikgyi Kanaungto Township. The water samples were collected during low tide and turbidity was high. The colour was pale yellow.
SW-3	1.5	Located in Kon Village, Twantay Township stream which is used for transportation and fishing. The water samples were collected during high tide, turbidity was medium and coloured was light yellow.
SW-4	1.5	Located in the Pan Hlaing River, Twantay Township. The water samples were collected during high tide. Turbidity was high and colour was yellow.
SW-5	1.5	Located upstream of the Pan Hlaing River, Twantay Township. The water samples were collected during high tide. Turbidity was high and colour was yellow.

Table 1.14	Description	of Surface	Water Sam	plina l	
	Booonption	or ourraoo	Thator Gain	Pillig i	_ooutions

Sampling location	Water Depth (m)	Description
SW-6	1.5	Located downstream near the junction of the stream and Pan Hlaing River, Twantay Township. The water samples were collected during high tide, turbidity was high and colour was yellow.
SW-7	1.0	Located downstream of the Gyaung Waing stream, Twantay Township. The stream is used for transportation, agriculture, and fishing. Turbidity was high and colour was yellow. The water samples were collected during high tide.
SW-8	1.5	Located at the Kanaungto creek, Seikgyi Kanaungto Township. The creek is used for transportation, agriculture and fishing. The water samples were collected during low tide. Turbidity was high and colour was yellow.
SW-9	1.0	Located in a canal in Twantay Township that is used for agriculture and livestock. Turbidity was low and colour was clear.
SW-10	0.2	Located in a canal in Twantay Township that is used for agriculture and livestock. Turbidity was low and colour was clear.
SW-11	1.5	Located near the junction of the Gyaung Waing stream, Seikgyi Kanaungto Township and Yangon River. Turbidity was medium and colour was pale yellow. The water samples were collected during high tide.
SW-12	1.5	Located upstream of Kon Village stream, Twantay Township. The stream is used for transportation and fishing. The water samples were collected during high tide, turbidity was medium and colour was pale yellow.
SW-13	1.5	Located in a canal in Twantay Township that is used for agriculture and fishing. The water samples turbidity was medium and colour was clear.
SW-14	0.5	Located in the Kun Ta stream, Twantay Township that is used for agriculture and fishing. The water samples turbidity was medium and colour is clear.
SW-15	1.5	Located near the junction of the Zi Byu Gon stream and Twantay canal, Twantay Township. The stream is used for transportation, agriculture and fishing. The turbidity was medium and colour was pale yellow. The water samples are collected during high tide.
SW-16	1.5	Located near the junction of the Ka Wet Kin stream and Toe River, Twantay Township. The stream is used for transportation, agriculture, and fishing. The water samples are collected during high tide. The turbidity was medium and colour was pale yellow.
SW-17	1.5	Located at the Pan Hlaing River, Twantay Township. The water samples are collected during high tide. Turbidity was high and colour was yellow.
SW-18	1.5	Located downstream near the junction of the stream and Pan Hlaing River, Twantay Township. The stream is used for transportation, agriculture, and fishing. Turbidity was high and colour was yellow. The water samples are collected during high tide.
SW-19	0.15	Located in a canal in Twantay Township that is used for agriculture and livestock. The water samples turbidity was low and colour was clear.
SW-20	1.0	The water sampling points of SW-20 is in the canal, Twantay Township. It is used for agriculture. The water samples turbidity was low and colour was clear.
SW-21	0.5	Located in a canal in Twantay Township that is used for agriculture and fishing. The water samples turbidity was medium and the colour was pale yellow.

Sampling location	Water Depth (m)	Description
SW-22	0.5	Located in a canal in Twantay Township that is used for agriculture. The water samples turbidity was low and colour was clear.
SW-23	1.5	Located in a canal in Twantay Township that is used for agriculture. The water samples were collected during low tide. Turbidity was high and colour was yellow.
SW-24	1.5	Located near the junction of the Let Pan Gwa stream and Twantay canal, Twantay Township. The stream is used for transportation, agriculture, and fishing. The water samples were collected during low tide. The turbidity was high and colour was yellow.

SEA Report

	Physica Aggreg Propert	al and ate ies	Inorga	anic Nor	-metallio	c Param	eters			Metals	s and Maj	or Cation	ıs - Filtered	k	Aggre	egate Or	ganic	S	
Parameters	Suspended solid	Hd	Ammonia as N	Chloride	Fluoride	Sulphide as S2	Total Phosphorus as P	Nitrate as N	Total Nitrate as N	Arsenic	Chromium	Copper	Mercury	Zinc	Biochemical Oxygen Demand	Chemical Oxygen Demand	Oil & Grease	Phenols (Total)	Total Coliform
Unit (Lab)	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/ L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L	mg/ L	mg/L	MPN/100 ml
ОНМ	-	6.5 to 8.5	_*	_*	1.5	-	-	50	-	0.01	0.05	2	0.006	_*	-	-	-	-	-
Myanmar DWQS	-	6.5 to 8.5	1.5	250	1.5	0.05	-	50	-	0.05	0.05	2	0.001	3	-	-	-	-	-
SW-1	4541	7.8	0.1	3530	0.2	<0.1	0.8	0.8	1.7	0.01	0.001	0.003	0.0005	0.01	<2	<50	<2	<0.1	>160000
SW-2	852	7.8	0.1	2656	0.2	<0.1	0.4	0.8	1.1	0.01	0.001	0.001	0.0005	0.01	<2	<50	<2	<0.1	124667
SW-3	67	7.6	0.06	2550	0.20	<0.1	0.08	0.74	0.9	0.01	0.001	0.001	0.0005	0.01	<2	<10	<2	<0.1	92000
SW-4	2396	7.6	0.2	805	0.1	<0.1	0.7	0.77	1.4	0.01	0.001	0.001	0.0005	0.01	<2	39	<2	<0.1	114667
SW-5	1876	7.7	0.2	783	0.1	<0.1	0.6	0.75	1.2	0.01	0.001	0.001	0.0005	0.01	<2	50	<2	<0.1	137333

# Table 1.15 Surface Water Quality Survey Results (2019)

	Physical and Aggregate Properties		Inorga	anic Non	-metallio	c Paramo	eters			Metals	s and Maj	or Cation	s - Filtereo	ł	Aggre	gate Or	ganics	6	
Parameters	Suspended solid	Hd	Ammonia as N	Chloride	Fluoride	Sulphide as S2	Total Phosphorus as P	Nitrate as N	Total Nitrate as N	Arsenic	Chromium	Copper	Mercury	Zinc	Biochemical Oxygen Demand	Chemical Oxygen Demand	Oil & Grease	Phenols (Total)	Total Coliform
Unit (Lab)	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/ L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L	mg/ L	mg/L	MPN/100 ml
ОНМ	-	6.5 to 8.5	-*	_*	1.5	-	-	50	-	0.01	0.05	2	0.006	_*	-	-	-	-	-
Myanmar DWQS	-	6.5 to 8.5	1.5	250	1.5	0.05	-	50	-	0.05	0.05	2	0.001	3	-	-	-	-	-
SW-6	1366	7.4	0.1	820	0.2	0.1	0.5	0.7	1.3	0.01	0.001	0.001	0.0005	0.01	2	50	<2	0.1	108467
SW-7	1860	7.7	0.2	2015	0.2	<0.1	0.6	0.7	1.5	0.01	0.001	0.002	0.0005	0.01	<2	46	<2	<0.1	137333
SW-8	830	7.9	0.1	1129	0.1	<0.1	0.4	0.5	0.7	0.01	0.001	0.001	0.0005	0.01	<2	26	<2	<0.1	89333
SW-9	57	7.4	0.31	1460	0.2	<0.1	0.05	0.42	1.03	0.01	0.001	0.001	0.0005	0.01	<2	9	<2	<0.1	46666
SW-10	46	7.1	0.3	1326	0.3		0.1	0.1	1.1	0.01	0.001	0.001	0.0005	0.01	2.3	24	<2	0.1	61867
SW-11	4583	7.8	0.2	2470	0.3	<0.1	1.1	0.8	1.7	0.01	0.001	0.001	0.0005	0.01	<2	58	<2	<0.1	160000

	Physica Aggrega Propert	II and ate ies	Inorga	anic Non	i-metallio	e Paramo	eters			Metals	s and Maj	or Cations	s - Filtered	d	Aggre	gate Oı	ganics	5	
Parameters	Suspended solid	Hď	Ammonia as N	Chloride	Fluoride	Sulphide as S2	Total Phosphorus as P	Nitrate as N	Total Nitrate as N	Arsenic	Chromium	Copper	Mercury	Zinc	Biochemical Oxygen Demand	Chemical Oxygen Demand	Oil & Grease	Phenols (Total)	Total Coliform
Unit (Lab)	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/ L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L	mg/ L	mg/L	MPN/100 ml
ОНМ	-	6.5 to 8.5	_*	_*	1.5	-	-	50	-	0.01	0.05	2	0.006	_*	-	-	-	-	-
Myanmar DWQS	-	6.5 to 8.5	1.5	250	1.5	0.05	-	50	-	0.05	0.05	2	0.001	3	-	-	-	-	-
SW-12	35	7.7	0.1	2273	0.2	<0.1	0.1	0.6	0.7	0.01	0.001	0.001	0.0005	0.01	<2	<10	<2		18633
SW-13	117	7.7	0.1	2366	0.2	<0.1	0.1	0.68	0.8	0.01	0.001	0.002	0.0005	0.01	<2	12	<2	<0.1	38667
SW-14	51	7.4	0.3	1636	0.27		0.1	0.34	1.2	0.01	0.001	0.001	0.0005	0.01	2.7	14	<2	<0.1	56667
SW-15	73	7.7	0.1	860	0.3	0.1	0.1	0.2	1.1	0.01	0.001	0.001	0.0005	0.01	2.0	19	<2	0.1	7467
SW-16	69	7.3	0.1	36	0.2	0.1	0.2	0.74	1.63	0.01	0.001	0.001	0.0005	0.01	5.7	32	<2	0.1	5333
SW-17	27,266	7.5	0.6	818	0.1	<0.1	8.7	0.5	9.4	0.01	0.001	0.001	0.0005	0.01	4	273	<2	<0.1	160,000
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Physical and Aggregate Properties			Inorga	anic Non	-metallio	c Param	eters			Metals	s and Maj	jor Cation	s - Filteree	d	Aggre	egate Oi	rganics	6	
Parameters	Suspended solid	Н	Ammonia as N	Chloride	Fluoride	Sulphide as S2	Total Phosphorus as P	Nitrate as N	Total Nitrate as N	Arsenic	Chromium	Copper	Mercury	Zinc	Biochemical Oxygen Demand	Chemical Oxygen Demand	Oil & Grease	Phenols (Total)	Total Coliform
Unit (Lab)	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/ L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L	mg/ L	mg/L	MPN/100 ml
OHW	-	6.5 to 8.5	_*	_*	1.5	-	-	50	-	0.01	0.05	2	0.006	_*	-	-	-	-	-
Myanmar DWQS	-	6.5 to 8.5	1.5	250	1.5	0.05	-	50	-	0.05	0.05	2	0.001	3	-	-	-	-	-
SW-18	26,147	7.6	0.5	872	0.1	<0.1	3.7	0.6	5.6	0.01	0.001	0.001	0.0005	0.01	3.7	660	<2	<0.1	160,000
SW-19	309	6.7	3.0	1,963	0.2	0.1	0.3	0.0	5.8	0.01	0.001	0.001	0.0005	0.01	12.3	119	<2	0.1	160,000
SW-20	897	7.8	0.2	1,736	0.2	0.1	0.4	0.7	1.4	0.01	0.001	0.001	0.0005	0.01	2.3	37	<2	0.1	160,000
SW-21	171	7.6	0.2	1,816	0.2		0.2	0.7	1.0	0.01	0.001	0.001	0.0005	0.01	2	16	<2	0.1	137,333
SW-22	76	8.1	0.23	1,380	0.27	0.1	0.1	0.2	0.9	0.01	0.001	0.001	0.0005	0.01	3.7	20	<2	0.1	160,000
SW-23	1636	8.0	0.1	283	0.1	<0.1	0.6	0.2	0.8	0.01	0.001	0.001	0.0005	0.01	<2	40	<2	<0.1	118,333

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	Physical and       Inorganic Non-metallic Parameters         Aggregate       Properties						Metals	Metals and Major Cations - Filtered Aggregate Organics											
Parameters	Suspended solid	Hq	Ammonia as N	Chloride	Fluoride	Sulphide as S2	Total Phosphorus as P	Nitrate as N	Total Nitrate as N	Arsenic	Chromium	Copper	Mercury	Zinc	Biochemical Oxygen Demand	Chemical Oxygen Demand	Oil & Grease	Phenols (Total)	Total Coliform
Unit (Lab)	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/ L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L	mg/ L	mg/L	MPN/100 ml
ОНМ	-	6.5 to 8.5	-*	_*	1.5	-	-	50	-	0.01	0.05	2	0.006	_*	-	-	-	-	-
Myanmar DWQS	-	6.5 to 8.5	1.5	250	1.5	0.05	-	50	-	0.05	0.05	2	0.001	3	-	-	-	-	-
SW-24	1,392	8	0.1	460	0.1	<0.1	0.5	0.3	0.7	0.01	0.001	0.001	0.0005	0.01	<2	30	<2	<0.1	124,667

\* WHO Drinking Water Standards suggested Ammonia as N, Chloride and Zinc are not of health concern at levels found in drinking water.

Key

 Exceed both standards

 Exceed WHO Guidelines for Drinking Water Quality

 Exceed Myanmar National Drinking Water Quality

Surface water was sampled in 24 locations in rivers, creeks, streams and ponds within the Study Area. The results analysis were compared to the WHO Drinking Water Standards (i.e., seven parameters (pH, fluoride, nitrate (as N), arsenic, chromium, copper, and mercury) likely to impact health) and Myanmar National Drinking Water Quality Standards (DWQS) (i.e., 11 parameters (pH, ammonia (as N), chloride, fluoride, sulphide (as S2), nitrate (as N), arsenic, chromium, copper, mercury, and zinc)).

None of the surface water sampling points exceeded the WHO standard; however, most of the sampling points Chloride levels exceed the National DWQS. Despite the exceedances, chloride is not of health concern for drinking water (WHO, 2017).

Ammonia, chloride, sulphide, nitrate (total, measured as N), and zinc can be naturally found in surface water. Phosphorus, oil and grease, phenols, and total coliforms usually indicate anthropogenic sources of pollution, such as fertilisers, fuels and petroleum products, and pesticides and sewage (WHO, 2017; Michałowicz & Duda, 2007).

Regarding ammonia, apart from SW-19 (located in a canal in Twantay Township), which has a relatively high level of Ammonia (3 mg/L), the other survey stations are all under 1 mg/L.

High concentrations of chloride (3,530 mg/L) were recorded at some survey points, such as SW-1, which reflects the surrounding environment characteristics: brackish water in tidal estuaries may have chloride levels between 500 and 5,000 mg/L (USEPA, 2006). Nitrates, meanwhile, are commonly found in water, as they are an important nutrient for plants. Nitrate can also be an inorganic contaminant derived from man-made sources (USGS, 2009 and 2010). The U.S. Environmental Protection Agency (USEPA) (1998) has established a level of 10 mg/L total nitrate (measured as nitrogen) as the Maximum Contaminant Level Goal and Maximum Contaminant Level in drinking water. There are no exceedances of the standards for any of the All water results presented in Table 5.15 do not exceed this standard.

Zinc concentrations in surface water usually do not exceed 0.01 mg/L (WHO, 2017); this is also the case for the Project water samples (Table 1.15). Zinc is an important trace element and is not of health or environmental concerns at levels found during the survey.

The concentrations of phenol vary depending on the environmental conditions. For natural water, the amount of phenol is approximately 0.002 mg/L, while river water polluted by petroleum processing can have around 40 mg/L phenol (WHO, 2017). Chlorophenols are the most widespread and the largest group of phenols (Michałowicz & Duda, 2007). According to WHO standards for drinking water, concentrations of this group of phenols should not exceed 0.2 mg/L. All results presented in Table 1.15 are under this standard guideline amount.

Phosphorus and phosphate, which are the major nutrients required for plant nutrition, are essential for life. However, Total Phosphorus as P can be particularly toxic (USEPA, 1976). At SW-17 (located in the Pun Hlaing River), concentrations of phosphorus (associated with accelerated eutrophication of waters, USEPA, 1976) and total coliforms are high. Therefore, this sampling location could be impacted by domestic sewage disposal.

Suspended solid and total coliform values at some places are very high as according to the lab results considering that water samples are taken from the rivers and streams surfaces.

# **1.7 Biological Components**

# 1.7.1 Desktop Assessment Results

# 1.7.1.1 EcoRegion Description

The Project Area is characterised by generally flat plain area with rivers, creeks, channels, and lakes. The area has low elevation comprising no hills and low-lying fields. The nearest shoreline is around 50 km from Project Area. As the land use of the region is mostly intensive agricultural land and human settlement, there are limited records of varieties of wildlife species (General Administrative Development Township Profile Report, 2017).

# 1.7.1.2 Species of Conservation Significance

The Integrated Biodiversity Assessment Tool (Integrated Biodiversity Assessment Tool, 2019) was used to identify threatened species likely to occur within 50 km of the Project Area. Threatened species were identified via the Integrated Biodiversity Assessment Tool (IBAT) species grid, freshwater species grid and nearby IBAs. Of the threatened species identified, there were 23 bird species, 41 fish species, 41 invertebrate species, 15 mammal species, three (3) plant species, seven (7) marine animal, and six (6) reptile species. Species listed as International Union for Conservation of Nature (IUCN) Critically Endangered (CR), Endangered (EN), Vulnerable (VU) and restricted range were screened for this purpose. There are eight migratory bird and 18 migratory fish species from this data source within 50 km of the Project which is species of conservation significance from IBAT report (Living International Treasure, 2019, Fish Base, 2019). One (1) restricted range species and one (1) endemic species were also recorded (IBAT, 2019) (Living International Treasure, 2019). The information from IBAT is summarised in **Appendix D**.

# 1.7.1.3 Invasive Species

An invasive species is an organism that inhabits a non-native ecosystem and can often reproduce in large numbers and spread over vast areas, damaging native species (Moore, B. A., 2005). Aside from impacts on local biodiversity, invasive species can also cause socio-cultural and economic impacts. There are 48 known invasive species in Myanmar which, are listed in Table 1.16 (Moore, B. A., 2005). Of the total 164 flora species recorded during survey in the Study Area (Table 1.16), only four (4) species are recorded as invasive species. These are shown in pink in Table 1.16.

Taxonomic Group	Scientific Name	Common Name
Virus	Banana bunchy top virus (BBTV)	-
Bacteria	Yersinia pestis	-
Plant	Acacia auriculiformis +	Acacia
Plant	Acacia longifolia	-
Plant	Acacia mangium	-
Plant	Adenanthera pavonina	-
Plant	Ageratum conyzoides <sup>+</sup>	Goat Weed
Plant	Alternanthera philoxeroides	-
Plant	Cardamine flexuosa	Wavy Bittercress
Plant	Chromolaena odorata	Siam Weed, Bitter Bush
Plant	Eichhornia crassipes	Water Hyacinth

# Table 1.16 Invasive Species

Taxonomic Group	Scientific Name	Common Name
Plant	Eichhornia crus-galli <sup>+</sup>	Barnyard Grass
Plant	Hyptis suaveolens <sup>+</sup>	Bush Tea
Plant	Imperata cylindrica	Blady Grass
Plant	Lantana camara +	Lantana
Plant	Leucaena leucocephala	-
Plant	Limnocharis flava	-
Plant	Loranthus pulverulentus +	Mistletoe
Plant	Mikania micrantha +	Mile-a-Minute
Plant	Mimosa diplotricha +	Giant Sensitive Plant
Plant	Mimosa pigra +	Giant Sensitive Plant
Plant	Paspalum conjugatum +	Buffalo Grass
Plant	Pennisetum spp. +	Mission Grass
Plant	Prosopis juliflora +	Mesquite
Plant	Sorgum halepense +	Johnson Grass
Plant	Ziziphus mauritiana	Chinese Date
Algae	Acanthophora spicifera	-
Insect	Aedes aegypti	Yellow Fever Mosquito
Insect	Brontispa longissima	Coconut Leaf Beetle
Insect	Matanastria grisea +	Gypsy Moth
Insect	Paratrechina longicornis	Longhorn Crazy Ant
Insect	Solenopsis geminata	Tropical fire Ant
Insect	Tapinoma melanocephalum	Ghost Ant
Insect	Trogoderma granarium	Khapra Beetle
Invertebrate	Achatina fulica <sup>+</sup>	Giant African Snail
Invertebrate	Pomacea canaliculata +	Golden Apple Snail
Invertebrate	<i>Teredo</i> spp. <sup>+</sup>	Shipworm
Invertebrate	Varroa jacobsoii *	Parasitic Bee Mite
Fish	Clarias gariepinus	African Sharptooth Catfish
Fish	Ctenopharyngodon idella	Grass Carp
Fish	Cyprinus carpio	European Carp
Fish	Gambusia affinis	Mosquito Fish
Fish	Hypophthalmichthys nobilis	Bighead Carp
Fish	Oreochromis aureus	Tilapia
Fish	Poecilia reticulata	Guppy
Fish	Labeo rohita	Rohu
Reptile	Hemidactylus frenatus	Common House Gecko
Mammal	Rattus exulans	Polynesian Rat/Pacific Rat

Notes: + Additionally sourced from Myanmar NBSAP 2015-2020 (2015), Moore, B. A., 2005

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Acacia mangiumm, Ageratum conyzoides, Chromolaena odorata, and Leucaena leucocephala were recorded in the Project site.

# 1.7.2 Field Survey Findings

Field surveys were conducted by local specialists between 15 February and 5 March -2019 as discussed in Section 5.3.1. The results of these surveys are provided in the following sections.

# 1.7.2.1 Fauna

The survey covered a range of fauna species, including mammals, birds, fish, reptiles and amphibians, butterflies, and dragonflies. The fauna survey was conducted via direct observation in the field, observation of track and signs such as footprints and feeding signs in their natural habitats, and interview surveys with local communities. A summary of the number of species recorded is provided in Table 1.17.

Fauna Group	Total Number of Species
Mammals	4
Birds	80
Fish	51
Reptiles and amphibians	10
Butterflies	28
Dragonflies	10
TOTAL	183

# Table 1.17 Number of Species Record during Survey

# Mammals

Mammals were identified through direct observation and interview surveys and four mammal species were recorded. All are classified as Least Concern on the International Union for Conservation of Nature (IUCN) red list (Table 1.18).

No	Common Name	Scientific Name	Family Name	IUCN Status <sup>1</sup>	Record Method
1	Common Palm Civet	Paradoxurus hermaphroditus	Viverridae	LC	Interviewed
2	Greater Bandicoot Rat	Bandicota indica	Muridae	LC	Observed
3	Small Indian Civet	Viverricula indica	Viverridae	LC	Interviewed
4	Small Asian Mongoose	Herpestes javanicus	Herpestidae	LC	Interviewed

# Table 1.18 Mammals Species Recorded during Surveys

<sup>1</sup>= IUCN (2019): LC = Least Concerned



Source: IUCN (2019)



# **Birds**

A total of 80 bird species were recorded during the survey, with one (1) species classified as Near Threatened, 78 as Least concern, and one (1) Not Yet Assessed on the IUCN red list (Table 1.19). The near threatened species recorded is the Black-headed Ibis (Figure 1.28), a nomadic water bird, which is found in the wetlands of India, Pakistan, Sri Lanka, Nepal, China, Bangladesh, Myanmar, Thailand, Vietnam and Cambodia (Chaudhury and Koli., 2011). The population of Black-headed Ibis has been decreasing over the last few decades due to hunting, trade, agricultural pollution, and habitat destruction and degradation (Bird Life International, 2019).

Of total 80 birds species recorded, 31 species are classified as migratory birds according to Bird Life International (2019). No restricted range bird species were found (Living International Treasure, 2019).

No	Common Name	Scientific Name	Family	IUCN 1	Migratory <sup>2</sup>	Restricted Range <sup>3</sup>
1	Ashy Drongo	Dicrurus leucophaeus	Dicruridae	LC	Y	-
2	Ashy Woodswallow	Artamus fuscus	Artimidae	LC	Y	-

	Table	1.19	Bird	<b>Species</b>
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No	Common Name	Scientific Name	Family			
				IUCN 1	Migratory <sup>2</sup>	Restricted Range <sup>3</sup>
3	Asian Barred Owlet	Glaucidium cuculoides	Strigidae	LC	-	-
4	Asian Openbill	Anastomus oscitans	Ciconiidae	LC	-	-
5	Asian Palm-Swift	Cypsiurus balasiensis	Apodidae	LC	-	-
6	Asian pied Starling	Gracupica contra	Sturnidae	LC	-	-
7	Ayeyarwaddy Bulbul	Pyconotus blanfordi	Pycnontidae	LC	-	-
8	Barn Swallow	Hirundo rustica	Hirundinidae	LC	Y	-
9	Baya Weaver	Ploceus philippinus	Ploceidae	LC	-	-
10	Black Drongo	Dicrurus macrocerus	Dicruridae	LC	Y	-
11	Black Kite	Milvus migrans	Accipitridae	LC	Y	-
12	Black-Capped Kingfisher	Halcyon pileata	Alcedinidae	LC	Y	-
13	Black-crowned night-heron	Nycticorax	Ardeidae	LC	Y	-
14	Black-headed Gull	Chroicocephalus ridibundus	Laridae	LC	-	-
15	Black-headed Ibis	Threskiornis melanocephalus	Threskiornithidae	NT	Y	-
16	Black-hooded Oriole	Oriolus xanthornus	Oriolidae	LC	-	-
17	Black-shoulder Kite	Elanus axillaris	Accipitridae	LC	-	-
18	Black-winged stilt	Himantopus himantopus	Recurvirostridae	LC	Y	-
19	Blue-tailed Bee- eater	Merops philippinus	Meropidae	LC	Y	-
20	Brahminy Kite	Haliastur indus	Accipitridae	LC	-	-
21	Bronze-winged Jacana	Metopidius indicus	Jacanidae	LC	-	-
22	Brown Shrike	Lanius cristatus	Laniidae	LC	Y	-
23	Brown-headed Gull	Chroicocephalus relictus	Laridae	LC	-	-
24	Chestnut-headed Bee-eater	Merops leschenaulti	Meropidae	LC	Y	-
25	Chinese Pond- heron	Ardecola bacchus	Ardeidae	LC	Y	-
26	Cinnamon Bittern	Ixobrychus cinnamomeus	Ardeidae	LC	-	-

No	Common Name	Scientific Name	Family			
				IUCN 1	Migratory <sup>2</sup>	Restricted Range <sup>3</sup>
27	Common lora	Aegithina tiphia	Aegithininae	LC	-	-
28	Common Kestrel	Falco tinnunculus	Falconidae	LC	Y	-
29	Common Kingfisher	Aalcedo atthis	Alcedinidae	LC	-	-
30	Common Myna	Acridotheres tristis	Sturnidae	LC	-	-
31	Common Sandpiper	Actitis hypoleucos	Scolopacidae	LC	Y	-
32	Common Snipe	Gallinago gallinago	Scolopacidae	LC	Y	-
33	Common Tailorbird	Orthotomus sutorius	Sylviidae	LC	-	-
34	Coppersmith Barbet	Megalaima haemacephala	Ramphastidae	LC	-	-
35	Eastern cattle Egret	Bubuclus coromandus	Ardeidae	LC	-	-
36	Eurasian Tree Sparrow	Passer montanus	Passeridae	LC	-	-
37	Glossy Ibis	Plegadis falcinellus	Threskiornithidae	LC	Y	-
38	Great Egret	Ardea alba	Ardeidae	LC	Y	-
39	Greater Coucal	Centropus sinensis	Cuculidae	LC	-	-
40	Grey-capped pygmy Woodpecker	Dendrocopos canicapillus	Picidae	LC	-	-
41	House Crow	Corvus splendens	Corvidae	LC	-	-
42	House Sparrow	Passer domesticus	Passeridae	LC	-	-
43	Indian Roller	Coracias benghalensis	Coraciidae	LC	-	-
44	Intermediate Egret	Mesophoyx intermedia	Ardeidae	LC	-	-
45	Jungle Myna	Acridotheres fuscus	Sturnidae	LC	-	-
46	Large-billed Crow	Corvus macrorhynchos	Corvidae	LC	-	-
47	Lesser Coucal	Centropus bengalensis	Cuculidae	LC	-	-
48	Lesser Whistling- duck	Dendrocygna javanica	Anatinaes	LC	-	-
49	Little Cormorant	Phalacrocorax niger	Phalacrocoracidae	LC	-	-
50	Little Egret	Egretta garzetta	Ardeidae	LC	Y	-
51	Little Green bee- eater	Merops orientalis	Meropidae	LC	Y	-
52	Little Ring Plover	Charadrius dubius	Charadriidae	LC	Y	-

### DESCRIPTION OF THE ENVIRONMENT

No	Common Name	Scientific Name	Family			
				IUCN 1	Migratory <sup>2</sup>	Restricted Range <sup>3</sup>
53	Oriental Magpie- robin	Copsychus saularis	Muscicapidae	LC	-	-
54	Osprey	Pandion haliaetus	Pandionidae	LC	Y	-
55	Paddyfield Pipit	Anthus rufulus	Motacillidae	LC	-	-
56	Pied Bushchat	Saxicola caprata	Muscicapidae	LC	Y	-
57	Pied Harrier	Circus melanoleucos	Accipitridae	LC	Y	-
58	Plaintive Cuckoo	Cacomantis merulinnus	Cuculidae	LC	Y	-
59	Purple Heron	Ardea purpurea	Ardeidae	LC	Y	-
60	Red Collared Dove	Streptopelia tranquebarica	Columbidae	LC	Y	-
61	Red-vented Bulbul	Pyconotus cafer	Pycnontidae	LC	-	-
62	Red-wattled Lapwing	Vanellus indicus	Charadriidae	LC	-	-
63	Red-whiskered Bulbul	Pycnonotus jocosus	Pycnontidae	LC	-	-
64	Rock Pigeon	Columba livia	Columbidae	LC	-	-
65	Rose-ringed Parakeet	Psittacula Krameri	Psittadae	LC	-	-
66	Ruddy-breasted crake	Porzana fusca	Rallidae	LC	-	-
67	Rufescent Prinia	Prinia rufescens	Cisticiolidae	LC	-	-
68	Scaly-breasted Munia	Lonchura punctulata	Estrildidae	LC	-	-
69	Scarlet-backed Flowerpecker	Dicaeum cruentatum	Dicaeidae	LC	-	-
70	Siberian Stonechat	Saxicola maurus	Muscicapidae	NE	-	-
71	Spotted Dove	Streptopelia chinensis	Columbidae	LC	-	-
72	Taiga Flycatcher	Ficedula albicilla	Muscicapidae	LC	Y	-
73	White Wagtail	Motacilla alba	Motacillidae	LC	Y	-
74	White-breasted Waterhen	Amaurornis phoenicurus	Rallidae	LC	Y	-
75	White-rump Munia	Lonchura striata	Estrildidae	LC	-	-
76	White-throated Fantail	Rhipidura albicollis	Rhipiduridae	LC	-	-
77	White-winged Tern	Chlidonias niger	Laridae	LC	-	-
78	Wood Sanpiper	Tringa glareola	Scolopacidae	LC	Y	-

No	Common Name	Scientific Name	Family	IUCN 1	Migratory <sup>2</sup>	Restricted Range <sup>3</sup>
79	Yellow-bellied Prinia	Prinia flaviventris	Cisticiolidae	LC	-	-
80	Zitting Cisticola	Cisticola juncidis	Cisticolidae	LC	-	-

<sup>1</sup> = IUCN (2019): LC = Least Concerned, NE = Not Evaluated, NT = Nearly Threatened

<sup>2</sup> = Bird Life International (2019): Y=Yes
 <sup>3</sup> = Living International Treasures (2019)



Source: ERM Field Survey (2019)

Note: Black-headed Ibis is reported on the IUCN Red List as Near Threatened

# Figure 1.28 Black-headed Ibis (Threskiornis melanocephalus)



Source: ERM Field Survey (2019)

# Figure 1.29 Rose-ringed Parakeet (Psittacula Krameri)

# Fish

Fish surveys involved interviews with local fishers and trapping of fish during February and March of 2019. During the survey, 51 fish species were identified with some examples provided in Figure 1.30 and Figure 1.31. A full list of all fish species and their associated IUCN red list status are provided in Table 1.20. The surveys identified three (3) Near Threatened species, 42 Least Concern species, one (1) Data Deficient species and five (5) Not Yet Assessed species on the IUCN Red List. According to FishBase (2019), a global species database of fish species, there are 26 migratory fish species out of a total of 51 species reported are classified as migratory. Four (4) species recorded are endemic species (i.e., native and restricted to a certain place) (Living International Treasure, 2019).

Boal (*Wallago attu*), Indian Butter-catfish (*Ompok bimaculatus*) and Manipur Osteobrama (*Osteobrama belangeri*) are listed as Near Threatened species. Boal (*Wallago attu*) is a fast growing catfish and a good market demand species for its high nutritional value and protein content (Gupta, S., 2015). Boal inhabits at both flowing water and still water and is widely distributed in India, Bangladesh, Pakistan, Sri Lanka, Nepal, Afghanistan, Indonesia, Myanmar, Thailand, Vietnam and Cambodia (Chondar, S. L., 1999) (Pethiyagoda, R., 1991). The population of Boal is decreasing due to over harvesting, environmental degradation, pollution, and improper water course management (Patra, M., K., et al., 2005).

Indian Butter-catfish is widely distributed in the plains and submontane regions of India, Pakistan, Bangladesh, Myanmar, Sri Lanka, and Afghanistan (Raizada, S., et al., 2013). The population of this species has declined in last five decades to more than 50% (Sridhar, S., et al., 1998); fishing and harvesting aquatic resources are main factors of the decline (IUCN, 2019). Manipur Osteobrama is a carp endemic to Manipur Region of India, Myanmar, and Yunnan province of China. The species has

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been critically endangered in Manipur region of India likely by a result of blockage of reproductive migration after the construction of barrage (Basudha, C., 2007), whereas there is still sizeable sub-population in Myanmar (Living International Treasures , 2019).

No	Common Name	Family	Scientific Name	IUCN 1Error! Bookmark not	Migratory <sup>2</sup>	Endemic <sup>3</sup>
1	Angra Labeo	Cyprinidae	Labeo angra	LC	Po	-
2	Asiatic Snakehead	Channidae	Channa orientalis	LC	-	-
3	Back-line Rasbora	Cyprinidae	Rasbora daniconius	LC	Po	-
4	Banana Fish	Cobitidae	Acantopsis choirorhynchos	LC	-	-
5	Batchwa Vacha	Schilbeidae	Eutropiichthys vacha	LC	Po	-
6	Blyth's Loach	Cobitidae	Botia berdmorei	NE	-	-
7	Boal	Siluridae	Wallago attu	NT	Po	-
8	Boga Labeo	Cyprinidae	Labeo boga	LC	Po	-
9	Burmese Carplet	Cyprinidae	Amblypharyngodon atkinsonii	LC	-	Y
10	Burmese Erethistes	Sisoridae	Erethistes maesotensis	LC	-	-
11	Burmese Loach	Cobitidae	Botia histrionica	LC	-	-
12	Burmese River Shad	Clupeidae	Gudusia variegata	LC	Am	-
13	Burmese Spinyeel	Mastacembelidae	Macrognathus zebrinus	LC	-	Y
14	Catla	Cyprinidae	Catla catla	NE	Po	-
15	Chola Barb	Cyprinidae	Puntius chola	LC	Po	-
16	Climbing Perch	Anabantidae	Anabas testudineus	DD	Po	-
17	Cunma Osteobrama	Cyprinidae	Osteobrama cunma	LC	-	-
18	Freshwater Garfish	Belonidae	Xenentodon cancila	LC	Am	-
19	Gangetic Mystus	Bagridae	Mystus cavasius	LC	Am	-
20	Giant Snakehead	Channidae	Channa marulius	LC	Po	-
21	Grey Feather-back	Notopteridae	Notopterus notopterus	LC	Po	-
22	Indian Butter-catfish	Siluridae	Ompok bimaculatus	NT	Po	-
23	Indian Gagata	Sisoridae	Gagata cenia	LC	-	-
24	Indian Glass-barb	Cyprinidae	Chela laubuca	NE	-	-
25	Indian Glassy fish	Ambassidae	Parambassis ranga	LC	Po	-
26	Indian Potasi	Schilbeidae	Neotropius acutirostris	LC	-	-
27	Karnataka Labeo	Cyprinidae	Labeo calbasu	LC	Po	-
28	Magur	Clariidae	Clarias batrachus	LC	Po	-
29	Malabar Loach	Cobitidae	Lepidocephalus thermalis	LC	-	-

# Table 1.20 Fish Species Recorded during Surveys

# DESCRIPTION OF THE ENVIRONMENT

No	Common Name	Family	Scientific Name	IUCN 1Error! Bookmark not	Migratory <sup>2</sup>	Endemic <sup>3</sup>
30	Manipur Osteobrama	Cyprinidae	Osteobrama belangeri	NT	-	Y
31	Morar	Cyprinidae	Aspidoparia morar	LC	-	-
32	Moulmein Labeo	Cyprinidae	Labeo stoliczkae	NE	-	Y
33	Mrigal	Cyprinidae	Cirrhinus mrigala	LC	-	-
34	Murree Labeo	Cyprinidae	Labeo microphthalmus	LC	-	-
35	-	Bagridae	Mystus corsula	LC	-	-
36	-	Balitoridae	Acanthocobitis rubidipinnis	LC	-	-
37	Ocellated Pufferfish	Tetraodontidae	Tetraodon cutcutia	LC	Po	-
38	One-stripe Spinyeel	Mastacembelidae	Macrognathus aral	LC	-	-
39	Pulcher Mystus	Bagridae	Mystus pulcher	LC	-	-
40	Rice Swampeel	Synbranchidae	Monopterus albus	LC	Po	-
41	Rohu	Cyprinidae	Labeo rohita	LC	Po	-
42	Sittang Mystus	Bagridae	Mystus leucophasis	LC	-	-
43	Slender Barb	Cyprinidae	Rasbora daniconius	LC	Po	-
44	Snakeskin Gourami	Belontiidae	Trichogaster pectoralis	NE	Po	-
45	Spotted Snakehead	Channidae	Channa punctatus	LC	Po	-
46	Stinging Catfish	Heteropneustidae	Heteropneustes fossilis	LC	-	-
47	Stripled Gourami	Belontiidae	Colisa labiosa	LC	-	-
48	Tank Goby	Gobiidae	Glossogobius giuris	LC	Am	-
49	Ticto Barb	Cyprinidae	Puntius ticto	LC	Po	-
50	Tilapia	Cichlidae	Oreochromis spp	LC	-	-
51	Tire-track Spinyeel	Mastacembelidae	Mastacembelus armatus	LC	Po	-

<sup>1</sup> =IUNC (2019): DD = Data Deficient, LC = Least Concerned, NE = Not Evaluated, NT = Near Threatened, <sup>2</sup> =Fishbase (2019): Y=Yes

 $^{3}$  =Living International Treasure (2019): Oc = Oceanodromous, Am = Amphidromous, Po = Potamodromous, - Oc = Oceanodromous fish, which occur widely throughout the world's oceans, live and migrate wholly in the seaOceanodromous,

Am = Amphidromous, which refers to fishes that regularly migrate between freshwater and the sea (in both directions), but not for the purpose of breeding, as in anadromous and catadromous species. Amphidromous, Po = Potamodromous, refers to a fish that migrates within fresh water only Potamodromous, -



Source: ERM Field Survey (2019)





Source: ERM Field Survey (2019)

# Figure 1.31 Snakeskin gourami (Trichogaster pectoralis)

Reptiles and Amphibians

Ten reptile species were identified during the surveys with some example photographs provide in Figure 1.32 and Figure 1.33. A full list of the species recorded and their associated IUCN protected status (IUCN, 2019) is presented in Table 1.21. The surveys identified no species of conservation concern (as per IUCN Red List) and no endemic / range restricted species.

No	Common Name	Scientific Name	Family Name	IUCN Status <sup>1</sup>	Endemic/ Restricted range <sup>2</sup>
1	Asian Grass Frog	Fejervarya limnocharis	Dicroglossidae	LC	-
2	Asian House Gecko	Hemidactylus frenatus	Gekkonidae	LC	-
3	Banded Krait	Bungarus fasciatus	Elapidae	LC	-
4	Blue forest Lizard	Calotes mystaceus	Agamidae	NE	-
5	Chequered Keelback Water Snake	Xenochrophis piscator	Colubridae	LC	-
6	Common Sun Skink	Eutropis macularia	Scincidae	LC	-
7	Garden Lizard	Calotes versicolor	Agamidae	NE	-
8	Monocled Cobra	Naja Kaouthia	Elapidae	LC	-
9	Russell Viper	Doboia russelii	Viperidae	LC	-
10	Spotted Forest Skink	Sphenomorphus maculatus	Scincidae	LC	-

# Table 1.21 Reptiles Species Recorded during Surveys

<sup>1</sup> =IUCN (2019): LC = Least Concerned, NE = Not Evaluated

<sup>2</sup> =Living International Treasure (2019)

# DESCRIPTION OF THE ENVIRONMENT



Source: ERM Field Survey (2019)





Source: ERM Field Survey (2019)

# Figure 1.33 Chequered Keelback Water Snake (Xenochrophis piscator)

# Butterflies and Dragonflies

During the survey, 28 butterflies (Table 1.22) and 10 dragonflies (Table 1.23) were identified; with representative photos provided in Figure 1.34 and Figure 1.35. No butterfly or dragonfly species are classified as species of conservation concern according to the IUCN Red List (IUCN, 2019).

No.	Common Name	Family Name	Scientific Name	IUCN <sup>1</sup>
1	Blue Tiger	Nymphalidae	Tirumala limniae	NE
2	Bush Hopper	Hesperridae	Ampittia dioscorides	NE
3	Cabbage White	Pieridae	Pieris canidia	NE
4	Chestnut-streaked sailor	Nymphalidae	Neptis junbah	NE
5	Common Crow	Nymphalidae	Euploea core	LC
6	Common Palmfly	Nymphalidae	Elymnias hypermnestra	NE
7	Common Sailor	Nymphalidae	Neptis hylas	NE
8	Common Small Flat	Hesperiidae	Sarangesa dasahara	NE
9	Common Tiger	Nymphalidae	Danaus genutia	NE
10	Formosan Swift	Hesperridae	Borbo cinnara	NE

Table 1 22	<b>Butterflies</b>	Recorded	durina	Survey	١c
	Dullermes	Recorded	uuring	Survey	/3

### DESCRIPTION OF THE ENVIRONMENT

No.	Common Name	Family Name	Scientific Name	IUCN <sup>1</sup>
11	Gram Blue	Lycaenidae	Euchrysops cnejus	NE
12	Great Orange Tip	Pieridae	Hebomoia glaucippe	NE
13	Grey Pansy	Nymphalidae	Junonia atlites	NE
14	Lemon Emigrant	Pieridae	Catopsilia pomona	NE
15	Lemon Emigrant	Pieridae	Catopsilia pomona	NE
16	Leopard	Nymphalidae	Phalanta phalantha	NE
17	Lesser Dart	Hesperridae	Potanthus omaha	NE
18	Mottled Emigrant	Pieridae	Catopsilia pomona	NE
19	Painted Jezebel	Pieridae	Delias hyparete	NE
20	Peacock Pansy	Nymphalidae	Junonia almana	NE
21	Pecks Skimmer	Hesperiidae	Polites peckius	NE
22	Plain Tiger	Nymphalidae	Danaus chrysippus	NE
23	Psyche	Pieridae	Leptosia nina	NE
24	Sea Jewel Blue	Lycaenidae	Plebejus samudra	NE
25	Striped Albatross	Pieridae	Appias libythea	NE
26	Tawny Coster	Nymphalidae	Acraea violae	NE
27	Three spot grass yellow	Pieridae	Eurema blanda	NE
28	Yellow Orange-tip	Pieridae	Ixias pyrene	NE

<sup>1</sup> =IUCN (2019): LC = Least Concerned, NE = Not Evaluated

# Table 1.23 Dragonflies Recorded during Survey

No.	Common Name	Family Name	Scientific Name	IUCN <sup>1</sup> Error! Bookmark not defined.
1	Ditch Jewel	Libellulidae	Brachythemis contaminata	LC
2	-	Coenagrionidae	Ischnura rufostigma	LC
3	Blue Ground Skimmer	Libellulidae	Diplacodes trivialis	LC
4	Green Marsh Hawk	Libellulidae	Orthetrum sabina	LC
5	Orange Marsh Dart	Coenagrionidae	Ceriagrion rubiae	LC
6	Pied Paddy Skimmer	Libellulidae	Neurothemis tullia	LC
7	Saffron-faced blue dart	Coenagrionidae	Pseudagrion rubriceps	LC
8	Scarlet rock glider	Libellulidae	Trithemis kirbyi	LC
9	Scarlet Skimmer	Libellulidae	Crocothemis servilia	LC
10	Yellow-barred flutterer	Libellulidae	Rhyothemis phyllis	LC

<sup>1</sup> =IUCN (2019): LC = Least Concerned



### Source: ERM Field Survey (2019)





Source: ERM Field Survey (2019)

# Figure 1.35 Pied Paddy Skimmer (Neurothemis tullia)

# 1.7.2.2 Habitat Mapping

Satellite imagery was used to map the land classes identified within the Project Area. These land classes were verified during the field investigations. The land classes include intensive agriculture, woodland, residential area, and water bodies. Land class descriptions are provided in Table 1.24 and Figure 1.36 presents the distribution of land classes (habitat map) within the Project Area from survey data.

Land Class	Description	Natural/ Modified Class	Photo (Source: ERM Field Survey, 2019)
Woodland	Woodland is a low-density forest forming open habitats with plenty of sunlight and limited shade. Woodlands support shrubs and herbaceous plants including grasses. Small woodland patches are scattered throughout the Project Area.	Natural	
Agricultural Land	Agricultural land is typically land devoted to agriculture, the systematic and controlled use of other forms of life, particularly the rearing of livestock and production of crops, to produce food for humans or animals. It is therefore generally synonymous with both farmland or cropland, as well as pasture or rangeland. This type of land is the most predominant land class in the Project Area.	Modified	
Residential Area	Human settlements occur on the east and north of the Project Area (Hlaing, Kamayut, Kyee Myin Daing and Hlaing Tharyar), while small-scale human settlement structures occur throughout Project Area.	Modified	

# Table 1.24 Land Class Description



Source: REM

# Figure 1.36 Land Class Distribution

# 1.7.2.3 Flora

Of the 164 floral species identified during the surveys, one (1) species is Endangered, one (1) is Vulnerable, 21 species were classified as Least Concern, two (2) as Data Deficient and 139 as Not Yet Assessed on the IUCN Red List. Endemic/ restricted range floral species (Living International Treasures, 2019) were not observed during field survey (Living International Treasures, 2019). Table 1.25 provides the findings of the flora survey for the Project Area.

Htan or Palmyrah Palm (*Borassus flabellifer*) is identified as Endangered on IUCN Red List (Figure 5.37) and is found in India, Myanmar, and Cambodia. It is an economically important flora species and the part of the plant such as root, leaves, seeds and fruits are used for various purposes (Aman, et al., 2018). The exploration of natural resources and expansion of agricultural and human settlement are the main threats to the species. Mahogany (*Swietenia macrophylla*), which is listed as Vulnerable on the IUCN Red List, is a commercial timber, therefore logging and wood harvesting are the main causes of decreasing populations (IUCN, 2019). Palmyrah Palm and Mahogany were found in sampling points B1 to B3, B5, and B7 to- B9 in Figure 5.8.

No	Common Name	Family Name	Scientific Name	IUCN <sup>1</sup>	Endemic / Restricted Range <sup>2</sup>
1	Alolay	Capparaceae	Capparis tenera	LC	-
2	Aung-me-nyo	Fabaceae	Clitoria ternatea	NE	-
3	Banda	Combretaceae	Terminalia catappa	NE	-
4	Bauk-pin	Solanaceae	Physalis angula	NE	-
5	Bawdi-nyaung	Moraceae	Ficus religiosa	LC	-
6	Bawsagaing	Mimosaceae	Leucaena leucocephala	LC	-
7	Beda	Pontederiaceae	Monochoria vaginalis	NE	-
8	Bizat	Asteraceae	Chromolaena odorata	NE	-
9	Bu	Cucurbitaceae	Lagenaria siceraria	NE	-
10	Byaing-che	Asteraceae	Gnaphalium indicum	NE	-
11	Chin Ya	Euphorbiaceae	Fluegga virosa	NE	-
12	Chin-baung	Malvaceae	Hibiscus cannabinus	NE	-
13	Dan	Lythraceae	Lawsonia alba	NE	-
14	Dan-da-lun	Moringaceae	Moringa oleifera	NE	-
15	Dani	Areaceae	Nypa fruticans	NE	-
16	Dawei-hmaing	Combretaceae	Lumnitzera racemosa	NE	-
17	Egayit	Bignoniaceae	Millingtonia hortensis	NE	-
18	Gangaw	Hypericaceae	Mesua ferrea	NE	-
19	Gonmin	Zingiberaceae	Alpinia allughas	LC	-
20	Gwe	Anacardiaceae	Spondias pinnata	LC	-
21	Hin-nu-nwe- subak	Amaranthaceae	Amaranthus spinosus	NE	-
22	Hin-nu-nwe	Amaranthaceae	Amaranthus blitoides	NE	-

# Table 1.25 Floral Species Recorded during Survey

	•				
No	Common Name	Family Name	Scientific Name	IUCN <sup>1</sup>	Endemic / Restricted Range <sup>2</sup>
23	Hmyinwa	Poaceae	Dendrocalamus membranaceus	NE	-
24	Hnin-pan	Agavaceae	Polianthes tuberosa	LC	-
25	Htan	Arecaceae	Borassus flabellifer	EN	-
26	Htikayon	Mimosaceae	Mimosa pudica	NE	-
27	Hti-ka-yone	Mimosaceae	Mimosa rubicaulis	NE	-
28	Htiyo-wa	Poaceae	Thyrsostachys siamensis	NE	-
29	Ingyin	Dipterocarpaceae	Shorea siamensis	NE	-
30	Kadet	Capparaceae	Crateva magna	LC	-
31	Kadu-hpo	Asteraceae	Ageratum conyzoides	NE	-
32	Kala-magyi	Mimosaceae	Pithecellobium dulce	NE	-
33	Kanaphaw	Amaranthaceae	Alternanthera nodiflora	NE	-
34	Kanaso	Euphorbiaceae	Baccaurea flaccida	NE	-
35	Kathit	Fabaceae	Erythrina fusca	NE	-
36	Katsi-hne	Poaceae	Setaria forbesiana	NE	-
37	Katsine	Tiliaceae	Triumfetta annua	NE	-
38	Kayu	Asclepiadaceae	Sarcolobus globosus	NE	-
39	Kazun	Convolvulaceae	Ipomoea batatas	NE	-
40	Kazun-gyi	Convolvulaceae	Argyreia nervosa	NE	-
41	Kazun-nwe	Convolvulaceae	Ipomoea turbinate	NE	-
42	Khan	Apocynaceae	Carissa carandas	NE	-
43	Khaung-yan	Malvaceae	Hibiscus rosa-sinensis	LC	-
44	Kha-we-yaing	Cucurbitaceae	Luffa acutangula	NE	-
45	Khaya	Acanthaceae	Acanthus ebracteatus	NE	-
46	Khayan	Solanaceae	Solanaum melongena	NE	-
47	Khayan-kazaw	Solanaceae	Solanum indicum	NE	-
48	Khayay	Sapotaceae	Manikara hexandra	NE	-
49	Khwele-ya	Fabaceae	Mucuna pruriens	NE	-
50	Kinmon	Cucurnbitaceae	Cephalandra indica	DD	-
51	Kinmun-gyin	Mimosaceae	Acacia concinna	NE	-
52	Kiss-me-quick	Euphorbiaceae	Euphorbia milii	NE	-
53	Kokko	Mimosaceae	Albizia lebbek	NE	-
54	Kunthi-pin	Araceae	Areca catechu	NE	-
55	Kyahin-bin	Convolvulaceae	Operculina turpethum	LC	-
56	Kyan	Poaceae	Saccharum officinarum	NE	-
57	Kyar	Nymphaeaceae	Nymphaea alba	NE	-

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No	Common Name	Family Name	Scientific Name	IUCN <sup>1</sup>	Endemic / Restricted Range <sup>2</sup>
58	Kyaungban	Verbenaceae	Vitex trifolia	NE	-
59	Kyaung-sha	Bignoniaceae	Oroxylum indica	NE	-
60	Kyeik-hman	Asteraceae	Eclipta alba	NE	-
61	Kyet-mauk-sue- pyan	Amaranthaceae	Achyranthes aspera	NE	-
62	Kyet-tha-hin	Euphorbiaceae	Phyllanthus niruri	NE	-
63	Kyi-ah	Cucurbitaceae	Citrullus colocynthis	NE	-
64	Kyu	Poaceae	Arundo donax	NE	-
65	Kyun	Verbenaceae	Tectona grandis	NE	-
66	Lamu	Sapindaceae	Arytera littoralis	LC	-
67	La-thar-pan	Convolvulaceae	Ipomoea carnea	NE	-
68	Lay-hnyin	Myrtaceae	Syzgium aromaticum	NE	-
69	Letpan	Bombacaceae	Bombax ceiba	NE	-
70	Magyi	Caesalpiniaceae	Tamarindus indica	DD	-
71	Ma-hlwa	Bignonniaceae	Markhamia stipulata	NE	-
72	Mahogany	Meliaceae	Swietenia macrophylla	VN	-
73	Malaka	Myrtaceae	Psidium guajava	NE	-
74	Malaysia-padauk	Mimosaceae	Acacia auriculiformis	NE	-
75	Man-gan-sha	Mimosaceae	Acacia mangium	NE	-
76	Ma-u	Rubiaceae	Anthocephalus morindaefolius	NE	-
77	Мауо	Asclepiadaceae	Calotropis procera	NE	-
78	Mezali	Caesalpiniaceae	Senna siamea	NE	-
79	Meze	Sapotceae	Madhuca longifolia	NE	-
80	Migaung-kunbat	Acanthaceae	Hygrophila phlomoides	LC	-
81	Minbaw	Arecaceae	Caryota mitis	NE	-
82	Mohbin	Steruliaceae	Scaphium scaphigerum	NE	-
83	Mon-nyin	Brassicaceae	Brassica campestris	NE	-
84	Mye-sa	Poaceae	Cynodon dactylon	LC	-
85	Mye-ziphyu	Euphorbiaceae	Phyllanthus urinaria	LC	-
86	Nabe	Anacardiaceae	Lannea coromandelica	NE	-
87	Nagasat	Dracaenaceae	Sansevieria trifasciata	NE	-
88	Nan-lon-kyaing	Mimosaceae	Acacia farnesiana	NE	-
89	Nay-kyar	Asteraceae	Tithonia diversifolia	NE	-
90	Ngayan-padu	Verbenaceae	Clerodendrum natans	NE	-
91	Ngayok	Solanaceae	Capsicum annuum	NE	-

No	Common Name	Family Name	Scientific Name	IUCN <sup>1</sup>	Endemic / Restricted Range <sup>2</sup>
92	Nget-pyaw	Musaceae	Musa sapientum	NE	-
93	Ngu	Caesalpiniaceae	Cassia fistula	NE	-
94	Nyan	Fabicaceae	Sesbania bispinosa	NE	-
95	Nyaung-peinne	Moraceae	Ficus altissima	NE	-
96	Ohn	Arecaceae	Cocas nucifera	NE	-
97	Okhne	Moraceae	Streblus asper	NE	-
98	Padauk	Fabaceae	Pterocarpus macrocarpus	NE	-
99	Pauk	Fabaceae	Butea frondosa	NE	-
100	Paukpan-byu	Fabaceae	Sesbania grandiflora	NE	-
101	Payok	Lauraceae	Cinnamomum camphora	NE	-
102	Pazun-sar	Amaranthaceae	Alternanthera sessilis	NE	-
103	Pein	Araceae	Colocasia esculenta	NE	-
104	Peinne	Moraceae	Artocarpus heterophyllus	NE	-
105	Pein-pan	Araceae	Alocasia gageana	LC	-
106	Pe-pazun	Fabaceae	Cyamopsis tetragonloba	NE	-
107	Pin-gu-hteik-peik	Lamiaceae	Leucas cephalotes	NE	-
108	Pinle-kabwe	Casuarinaceae	Casuarina equisetifolia	NE	-
109	Pin-sein	Lamiaceae	Ocimum americanum	NE	-
110	Pone-nyet	Hypericaceae	Calophyllum inophyllum	NE	-
111	Ponna-yeik	Rubiaceae	Ixora arborea	NE	-
112	Pyiban-nyo	Caesalpinaceae	Cassia glauca	NE	-
113	Pyindaw-thein	Rutaceae	Murraya koenigii	NE	-
114	Pyinma	Lythraceae	Lagerstromia speciosa	NE	-
115	Sabalin	Poaceae	Cymbopogon citratus	NE	-
116	Sabe	Oleaceae	Jasminum arborescens	NE	-
117	Satthwa	Cyperaceae	Hypolytrum nemorum	NE	-
118	Sein-ban-gyi	Caesalpinaceae	Delonix rigia	NE	-
119	Sein-chai-pan	Asteraceae	Coreopsis tinctoria	NE	-
120	Sekku-pan	Nyctaginaceae	Bougainvillea spectabilis	NE	-
121	Sethayathi	Apocynaceae	Thevetia peruviana	NE	-
122	Shauk	Rutaceae	Citrus aurantiifolia	NE	-
123	Shwe-nwe	Lauraceae	Lindera pulcherrima	NE	-
124	Sin-hna-maung	Boraginaceae	Heliotropium indium	NE	-
125	Si-ohn	Arecacese	Elaeis guineensis	NE	-
126	Sit	Mimosaceae	Albizia procera	NE	-

No	Common Name	Family Name	Scientific Name	IUCN <sup>1</sup>	Endemic / Restricted Range <sup>2</sup>
127	Swe-daw	Caesalpiniaceae	Bauhinia acuminata	NE	-
128	Tama	Meliaceae	Azadirachta indica	LC	-
129	Tamyetse	Poaceae	Thysanolaena maxima	NE	-
130	Taung-let-pan	Bombacaceae	Bombax insigne	LC	-
131	Taw-pin-sein	Limaceae	Leucas aspera	NE	-
132	Taw-sabyit	Vitaceae	Cayratia trifolia	NE	-
133	Tha-but-kha	kha Cucurbitaceae <i>Luffa aegyptiaca</i>		NE	-
134	Thabye	Myrtaceae	Syzygium syzygioides	NE	-
135	Thabye Gyi	Myrtaceae	Syzygium grande	LC	-
136	Thagya	Sapotaceae	Achras zapota	NE	-
137	Thaman-shaw	Malvaceae	Thespesia lampas	LC	-
138	Thanakha	Meliaceae	Aglaia odoratissima	NE	-
139	Than-manaing- kyauk-manaing	Fabaceae	Indigofera linifolia	NE	-
140	Thanut	Boraginaceae	Cordia dichotoma	NE	-
141	Thayet	Anacardiaceae	Mangifera indica	NE	-
142	Thi	Rutaceae	Limonia acidissima	LC	-
143	Thiho-thayet	Anacardiaceae	Anacardium occidentale	NE	-
144	Thinbaw	Caricaceae	Carica papaya	NE	-
145	Thinbaw-ma-hnyo	Apocynaceae	Catharanthus roseus	NE	-
146	Thinbaw-mezali	Caesalpiniaceae	Peltophorum pterocarpum	NE	-
147	Thinbaw-zibyu	Euphorbiaceae	Phyllanthus acidus	NE	-
148	U-ca-lit	Myrtaceae	Eucalyptus camaldulensis	NE	-
149	Wa-bo	Poaceae	Dendrocalamus brinanicus	NE	-
150	Wabo-gyi	Poaceae	Dendrocalamus giganteus	LC	-
151	Wah	Malvaceae	Gossypium herbaceum	NE	-
152	Wanet	Poaceae	Dendrocalamus longispathus	NE	-
153	Wa-payaung	Poaceae	Dendrocalamus brandisii	NE	-
154	Ye-kazun	Convolvulaceae	Ipomoea aquatica	NE	-
155	Ye-kyi	Lecythidaceae	Barringtonia acutangula	LC	-
156	Ye-tama	Meliaceae	Cedrela febrifuga	NE	-
157	Ye-thapan	Moraceae	Ficus glomerata	NE	-
158	Үеуо	Rubiaceae	Morinda angustifolia	NE	-
159	Yonbade	Malvaceae	Abelmoschus esculentus	NE	-
160	Yonbade	Malvaceae	Hibiscus esculentus	NE	-

No	Common Name	Family Name	Scientific Name	IUCN <sup>1</sup>	Endemic / Restricted Range <sup>2</sup>
161	Ywe	Fabaceae	Abrus precatorius	NE	-
162	Ywet-hla	Euphorbiaceae	Codiaeum variegatum	NE	-
163	Zalat	Apocynaceae	Tabernaemontana divaricata	NE	-
164	Zi	Rhamnaceae	Ziziphus jujuba	NE	-

<sup>1</sup> = IUCN (2019): DD= Data Deficient, EN=Endangered, LC = Least Concerned, NA = Not applicable, NE = Not Evaluated, VU=Vulnerable

<sup>2</sup> = Living International Treasure (2019)



Source: ERM Field Survey, 2019

# Figure 1.37 Htan (Borassus flabellifer)

# 1.8 Socio-Economic Components

This section aims to outline the socio-economic background of the Study Area. It includes the following components:

- Overview of Townships within the Study Area;
- Demography;
- Education;
- Public health;
- Living conditions and public services;
- Water and Sanitation;
- Income and livelihood; and
- Local perceptions of the Project.

**Overview of Townships within the Study Area** 

1.8.1

*1.8.1.1* Yangon Region Yangon's transport infrastructure includes roads, railways, ports, and airports. There are a number of roads connecting Yangon Region with other States and Regions of Myanmar. There is a railway station in Yangon that connects to different parts of the country. Yangon Port receives international and domestic vessels and Twantay Canal connects Yangon River with Irrawaddy River. The biggest international airport in the country is located in Yangon (ERM Field Data, 2019).

# 1.8.1.2 Twantay Township

Twantay Township uses both road and water transport. A highway provides access to all neighbouring townships and up to Ayeyarwaddy Region. There are two bus lines with 250 buses, which transport to and from Dala Township and Hlaing Tharyar Townships. A 93-mile asphalt road connects Twantay Township to its four neighbouring townships Dala, Hlaing Tharyar, Kun Chan Kone, and Mau Pin. There are four waterways connecting Twantay and other neighbouring villages and a 50-bed hospital (Twantay GAD Report, 2017).

# 1.8.1.3 Seikgyi Kanaungto Township

In Seikgyi Kanaungto Township, there is one road connecting to the rest of the city. This road starts on Hlaing Tharyar Township and passes through Twantay Township. There is also a bridge, and a harbour where boats from other areas (including Maw Tin Harbour or Warden Jetty) dock.

# 1.8.1.4 Kyee Myin Daing Township

In Kyee Myin Daing Township, there are three main roads in Urban Kyee Myin Daing – Strand Road, Lower Kyee Myin Daing Road and Bagaya Road. The Yangon circular train can be also found in Lower Kyee Myin Daing Road. All the roads in Kyee Myin Daing Urban side are concreted or asphalt. There are four wards in Kyee Myin Daing west within the Project Area. Some access roads are paved with concrete but most of them do not have paved roads, only dirt tracks.

# 1.8.1.5 Hlaing Tharyar Township

In Hlaing Tharyar Township, there are two main roads connected to Yangon through Aung Zay Ya Bridge and Bayinnaung Bridge. The Yangon to Pathein Road crosses Hlaing Tharyar Township and Pun Hlaing Bridge connects Twantay and Hlaing Tharyar Township. There are five industrial zones in Hlaing Tharyar and a 200-bed hospital. There is also a large Htein Pin Cemetery and solid waste disposal site. Figure 5.38 shows a representative photo of the industrial zone in Hlaing Tharyar.

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Source: ERM (2019)

# Figure 1.38 Industry in Hlaing Tharyar Industrial Zone

# 1.8.1.6 Ahlone Township

In Ahlone Township, there are four main roads – Baho Road, Heavy-Duty Vehicle Commercial Bypass Road, Kyee Myin Daing Kannar Road, and Ahlone Road. The Yangon circular train can be also found on Ahlone road which has five bus stops.

Three ports with four wharfs can be found near to the Yangon River in Ahlone. Those ports are Asia World Port Terminal, Myanmar Industrial Port (MIP) and Ahlone International Port Terminal (A.I.P.T).

# 1.8.1.7 Dala Township

In Dala Township, there is a main road and the Dala pier, which ferries cars and people from Pansodan Pier of Yangon to Dala. The Dala Ferry Terminal transports approximately 30,000 passengers per day. A bridge connecting Yangon City and Dala Township is planned in the future.

# 1.8.2 Demographic Conditions

# 1.8.2.1 Population Density and Growth Rate

According to the General Administration Department (GAD) Township Profile Report, the highest population density in the Study Area is in Ahlone Township, with 20,400 inhabitants per square kilometre (inh/km<sup>2</sup>), which is much higher than the average population density of Yangon's urban areas (2,844 inh/km<sup>2</sup>) (General Administration Department Township Profile Report, 2019).

The lowest population density within the Study Area is Twantay, with 318 inh/km<sup>2</sup>, which is slightly higher than the average density of Yangon's rural areas (198 inh/km<sup>2</sup>).

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Between 2017 and 2019, the total population of the Townships that fall within the Study Area increased by 35,194. Hlaing Tharyar, with a 2% increase, has the highest inter-census growth rate in the Study Area. This means that during the period indicated, the population of that Township increased by two inhabitants per every 100 inhabitants per year. The only Township which shows a negative growth rate is Seikgyi Kanaungto, with a 1.6% decrease in population. This means that its population decreased by approximately two inhabitants per year (General Administration Department Township Profile Report, 2019). Table 1.26 summarises the density and population growth rate between 2017 and 2019.

Townships	Area (km²)	Population		Population Density (Inh./km <sup>2</sup> )		Inter-census growth rate
		2017	2019	2017	2019	(per 100 inhabitants)
Twantay	724.9	227,953	230,806	315	318	0.4
Seikgyi Kanaungto	7.9	33,944	32,286	4,297	4,087	-1.6
Kyee Myin Daing	12.5	101,287	102,462	8,103	8,197	0.4
Hlaing Tharyar	67.4	409,709	433,967	6,079	6,439	2
Ahlone	2.7	54,843	55,079	20,312	20,400	0.1
Dala	224.1	154,563	162,893	690	727	1.8

 Table 1.26
 Density and Population Growth Rate

Source: General Administration Department Township Profile Report, 2017 & 2019

# 1.8.2.2 Urban and Rural Population

Rural areas are classified by the GAD as village tracts. Generally, these are areas have low population density and are predominantly agricultural land. Urban areas are classified by the GAD as wards. Generally these areas have an increased density of building structures, population, and better infrastructural development compared to rural areas (Myanmar Population and Housing Census Township Report, 2014).

According to the GAD reports in 2017, the population in the Study Area mostly live in urban areas. The entire population in Seikgyi Kanaungto, Kyee Myin Daing, and Ahlone Townships is classed as urban, while more than two thirds of the population in Hlaing Tharyar (78%) and Dala (69%) live in urban areas. Twantay is the only case with more than 70% of population living in rural areas. As shown in Figure 5.39, between 2014 and 2017, there has been a slight increase of urban population in Twantay, Hlaing Tharyar and Dala, as well as in Yangon Region (General Administration Department Township Profile Report, 2017).

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Source: Myanmar Population and Housing Census Township Report, 2014; General Administration Department Township Profile Report, 2017

# Figure 1.39 Urban Population with in the Study Area

# 1.8.2.3 Ratio of Males to Females

As shown in Table 1.27, in Yangon there are 96 males per 100 females. Females outnumbering males can be observed across the Study Area. Hlaing Tharyar and Seikgyi Kanaungto have less than 90 males per 100 females, while Twantay has 98 males for every 100 females (General Administration Department Township Profile Report, 2017).

	Female		Male		Males per 100
	Number	Percentage	Number	Percentage	Females
Yangon Region	3,392,121	52%	3,081,239	48%	96
Twantay	116,082	51%	111,871	49%	98
Seikgyi Kanaungto	17,181	51%	16,763	49%	88
Kyee Myin Daing	54,013	53%	47,274	47%	94
Hlaing Tharyar	211,540	52%	198,169	48%	85
Ahlone	29,692	54%	25,151	46%	95
Dala	79,382	51%	75,181	49%	96

Table 1.27	Ratio of Males to Females
	Ratio of Males to remales

Source: General Administration Department Township Profile Report, 2017

# 1.8.2.4 Age Group Distribution

Table 1.28 shows the breakdown of population by age group. Twantay, Seikgyi Kanaungto, and Dala have a relatively large youth population. Each of which has nearly one-third of total population aged less than 15. In

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terms of population aged 65 and above, apart from Kyee Myin Daing and Ahlone, the other Townships have a lower percentage than the regional level of 5% (Myanmar Population and Housing Census Township Report, 2014).

Age Group	0-14	15-64	65 and over	
Yangon Region	24%	71%	5%	
Twantay	30%	65%	5%	
Seikgyi Kanaungto	30%	66%	4%	
Kyee Myin Daing	22%	72%	6%	
Hlaing Tharyar	24%	73%	3%	
Ahlone	16%	77%	7%	
Dala	29%	67%	4%	

#### **Table 1.28** Breakdown of Population by Age Groups

Source: Myanmar Population and Housing Census Township Report, 2014

# 1.8.2.5 Population Pyramid

A population pyramid shows the current resident profile and helps predict how the population will increase or decrease over time. A population pyramid can be categorised into three types: expansive (young and growing), constrictive (elderly and shrinking), and stationary (little or no population growth). Table 1.29 shows the population pyramids for each Township of the Study Area.

# Table 1.29 Population Pyramids



#### **Population Pyramid**







Source: Myanmar Population and Housing Census Township Report, 2014

### Remarks

Hlaing Tharyar Township

Type: Expansive- Stationary

As in Kyee Myin Daing, the population pyramid in Hlaing Tharyar shows a narrowing of the base that has remained unchanged over the last fifteen years. Due to the maintenance of this trend, it can be said that the type of pyramid is in a process of change between from an expansive pyramid to a stationary one. It means with a controlled birth rate and a better life expectancy. Regarding sex distribution, a greater proportion of the female population is observed in the five-year groups between 15 and 25 years, which indicates a possible male migration happened approximately 25 years ago.

#### **Ahlone Township**

#### Type: Expansive

The population pyramid in Ahlone shows a pointed tip, which indicates high mortality. The decreasing birth rate started 25 years ago. It shows a young population. The biggest age group is concentrated between 15 and 25 years old. The distribution according to sex is homogeneous.

#### **Dala Township**

#### Type: Expansive

In Dala Township the population pyramid is expansive, with a broad base compared to the higher age groups. It shows a very young population, mostly concentrated between 0 to 35 years old. As in Twantay and Seikgyi Kanaungto Townships, there has been a decreasing birth rate since over the last 10 years, although mortality remains high.
#### 1.8.2.6 Migration

According to household survey data collected for the Project (ERM, 2019), 94% of the people interviewed were born within the Study Area. The remaining 6% of households migrated from different places such as Rakhine, Mandalay, Nay Pyi Taw, Magway, Ayeyarwaddy, and Bago (Figure 1.40).

#### 1.8.2.7 Ethnicity

According to household survey data collected for the Project (ERM, 2019), 94% of the interviewees in the Study Area belong to Burmese ethnic group, while 6% are Kayin and Indian (Figure 1.40).

#### 1.8.2.8 Religion

According to household survey data collected for the Project (ERM, 2019), 99% of the interviewees are Buddhists, while 1% are others (Figure 1.40).



Source: ERM Field Data (2019)

#### Figure 1.40 Demographic Characteristics of the Study Area

#### 1.8.3 Education

#### 1.8.3.1 Education Facilities

The number of schools within the Townships in the Study Area is summarised in Table 1.30. Twantay has the most schools, while Ahlone has the least. Dala does not have middle schools, so middle school students from Dala have to travel to other Townships. In addition, only Hlaing Tharyar has a university (General Administration Department Township Profile Report, 2017). A representative photo of a Basic Education Middle School is shown in Figure 1.41.

## Table 1.30 Number of Schools within the Townships in the Study Area

Township	University	High School	Middle School	Primary School	Nursery School	Monastic Education	Total
Seikgyi Kanaungto	-	2	1	14	1	-	18
Twantay	-	8	22	183	2	1	216
Kyee Myin Daing	-	7	5	11	13	2	38
Hlaing Tharyar	1	8	18	32	16	16	91
Ahlone	-	7	1	6	2	-	16
Dala	-	11	-	53	3	29	96

Source: General Administration Department Township Profile Report, 2017



Source: ERM (2019)

#### Figure 1.41 Middle School in the Study Area (Kyee Myin Daing Township)

#### 1.8.3.2 Access to Education

The primary school enrolment rate in Seikgyi Kanaungto, Hlaing Tharyar, Kyee Myin Daing, Ahlone, and Dala Township is 100%, while Twantay is 97% (General Administration Department Township Profile Report, 2017).

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In terms of literacy (Figure 1.42), all Townships within the Study Area have a higher rate than the Union level (90%). Within Yangon, Twantay (95%), Dala (93%), and Kyee Min Daing (96%) have a lower literacy rate than the overall regional level (97%) (Myanmar Population and Housing Census Township Report, 2014).

There is a gender gap in literacy (Figure 1.42). Females within the Townships of the Study Area have a relatively lower literacy rate which is particularly evident in Dala Township, where there is a 5% difference between males (96%) and females (91%).



Source: Myanmar Population and Housing Census Township Report, 2014

#### Figure 1.42 Male and Female Literacy Rates (Persons aged 15 and over)

#### 1.8.3.3 Community Perceptions of Education Facilities and Services

In the household questionnaire, one (1) is good, two (2) is fair, three (3) is bad, and four (4) is not available in the area. As such, one is most satisfied while four refers to the lack of facilities and services. According to the household survey data (ERM, 2019) (Figure 5.43), interviewees from Seikgyi Kanaungto Township are the most satisfied with the existing local education facilities and services (with an average score of 1.6 (fair) out of 4), while interviewees from Dala are the least satisfied (with an average score of 2.8 (bad)) (ERM, 2019). According to the focus group discussions, the availability of education facilities near their villages is the main reason for the education satisfaction of the interviewees.

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Note: 1-good; 2-fair, 3-bad; 4-not available in the area Source: ERM Field Data (2019)

#### Figure 1.43 Community Perceptions of Education Facilities and Services

#### Public Health 1.8.4

#### 1.8.4.1 Public Health Facilities

Table 1.31 summarises the number of public health facilities within the Townships in the Study Area and Table 1.32 shows the health professional-to-patient ratios. For both doctors to total population ratio, and nurse and total population ratio, Kyee Myin Daing has the lowest ratio, while Hlaing Tharyar has the highest ratio.

For the ratio of rural health assistant and total population ratio, Ahlone has the lowest ratio, while Hlaing Tharyar has the highest ratio (General Administration Department Township Profile Report, 2017). Figure 1.44 shows a representative photo of a small clinic in the Study Area (Dala Township).

According to the women focus group discussion, women have access to family planning services and use either pills or injections as contraceptive. Women perceive that the most common diseases they face are diabetes, hypertension, stroke, and breast and uterus cancer.

#### Table 1.31 Public Health Facilities within the Townships in the Study Area

Township	Hospitals		Clinics	Rural Health Centres	Total
	Public	Private			
Seikgyi Kanaungto	1	-	6	4	11
Twantay	3	-	-	41	44
Kyee Myin Daing	3	-	65	5	73
Hlaing Tharyar	2	2	133	2	139
Ahlone	-	2	48	-	50
Dala	3	-	3	6	12

Source: General Administration Department Township Profile Report, 2017

# Table 1.32Health Professional-to-Patient Ratios within the Townships in the Study<br/>Area

Township	Medical doctors to total population	Nurses to total population	Rural Health Assistants to total population
Seikgyi Kanaungto	1:4,849	1:5,657	-
Twantay	1:32,564	1:12,664	1:37,992
Kyee Myin Daing	1:16,881	1:7,791	1:101,287
Hlaing Tharyar	1:37,655	1:18,827	1:414,209
Ahlone	1:27,422	1:9,141	1:27,422
Dala	1:25,760	1:8,586	1:77,281

Source: General Administration Department Township Profile Report, 2017





Source: ERM (2019)

#### Figure 1.44 Township Hospital in the Study Area (Dala Township)

#### 1.8.4.2 Infant and Juvenile Mortality Rate

Both the infant (under age one) and juvenile (under age five) mortality rate (per 1,000 live births) of the Townships in the Study Area are lower than the Union average (Myanmar Population and Housing Census Township Report, 2014) as shown in Figure 1.45.

Apart from Ahlone and Dala Township, the other four Townships in the Study Area: Twantay, Hlaing Tharyar, Kyee Myin Daing, and Seikgyi Kanaungto have a higher infant and juvenile mortality rate than the regional level (Myanmar Population and Housing Census Township Report, 2014).

Twantay has the highest infant and juvenile mortality rate (Myanmar Population and Housing Census Township Report, 2014) (Figure 1.45).



Source: Myanmar Population and Housing Census Township Report, 2014

#### Figure 1.45 Infant and Juvenile Mortality Rates (per 1,000 Live Births)

#### 1.8.4.3 Community Perceptions of Public Health Facilities and Services

According to the household surveys result, colds are the most common illness, followed by high blood pressure (ERM, 2019).

In the household questionnaire, one (1) is good, two (2) is fair, three (3) is bad, and four (4) is not available in the area. As such, one is most satisfied while four refers to the lack of facilities and services. Interviewees from Ahlone are the most satisfied with the existing public health facilities and services (with an average score of 1.3 (good) out of 4), while interviewees from Twantay are the least satisfied (with an average score of 3.1 (bad)) (Figure 5.46). More than half of the interviewees from Twantay (55 %) and more than a third of the interviewees from Hlaing Tharyar (40%) stated that local public health facilities and services are unavailable in their community (ERM, 2019).





Note: 1-good; 2-fair, 3-bad; 4-not available in the area Source: ERM Field Data (2019)

### Figure 1.46 Community Perceptions of Public Health Facilities and Services

#### 1.8.5 Living Conditions and Public Services

#### 1.8.5.1 Electricity

In terms of electricity for cooking, Ahlone Township and use mainly electricity as the main source (82%) as do the majority of households surveyed in Kyee Myin Daing (67%). Both Ahlone and Kyee Myin Daing west are connected to the national grid. In Twantay, firewood is the main energy source for cooking (84%) as there is only limited connection to the national grid. In Hlaing Tharyar Township, the use of electricity (41%) and charcoal (50%) for cooking are both dominant.

Seikgyi Kanaungto residents use a mixed energy source of electricity (48%), firewood (25%) and charcoal (27%) as do residents in Dala Township, who use electricity (22%), firewood (26%) and charcoal (45%) for cooking (Myanmar Population and Housing Census Township Report, 2014).

Table 1.33 shows the main source of energy for cooking in each Township within the Study Area.

# Table 1.33 Main Source of Energy for Cooking in the Townships with the StudyArea



Source: Myanmar Population and Housing Census Township Report, 2014

The majority of households in Ahlone Township (99%) use electricity as the main source of lighting. However, only 16% of Twantay residents have access to electricity, and depend on battery and kerosene for lighting. Residents from Kyee Myin Daing, Hlaing Tharyar, and Seikgyi Kanaungto have good access to electricity (more than 70% of households). In Dala, nearly half of the residents (48.2%) have access to electricity for lighting (Myanmar Population and Housing Census Township Report, 2014). Table 5.34 shows the main source of energy for lighting in each Township within the Study Area. Figure 5.47 shows a representative electrical substation in the Study Area (Dala Township).

# Table 1.34 Main Source of Energy for Lighting in the Townships within the StudyArea



Source: Myanmar Population and Housing Census Township Report, 2014



Source: ERM (2019)

#### Figure 1.47 Township Electrical Substation in the Study Area (Dala Township)

#### 1.8.5.2 Transportation

Around 500 boats were observed within Seikgyi Kanaungto Township during the site visit in March 2019 (ERM, 2019) and approximately 100 boats cross to Yangon daily between 5:30 am to 8:00 pm; the journey takes around 15 minutes. Travelling to Yangon by car takes around two hours (depending on traffic and road conditions). Figure 5.48 shows the main road between Yangon and Hlaing Tharyar. The local community in the Project Area depend on boat transport to reach Yangon City.

People in Twantay Township mostly use the ferry from the Dala crossing of the Yangon River, which takes about 10 minutes (shown in Figure 5.49) and the fee is 200 Myanmar Kyat (MMK). Despite its convenience and affordability, ferry safety remains an issue. A bridge is also planned to be constructed connecting Yangon to Dala which will have entrances in downtown Yangon's Phonegyi Road and in Dala to provide an alternative to crossing the Yangon River. In Dala Township, the local community mostly use bicycles and motorcycles for transportation (ERM, 2017).

Hlaing Tharyar Township has access to Yangon via a road bridge. There is one highway bus terminal, Dagon Ayeyar Highway Bus Terminal, for buses to other regions (mostly Ayeyarwaddy) (ERM, 2017).



Source: ERM (2019)





Source: ERM (2019)

#### Figure 1.49 Water Transport in Dala Township

#### 1.8.5.3 Community Perceptions of Living Conditions and Public Services

In the household questionnaire, 1 is good, 2 is fair, 3 is bad, and 4 is not available in the area. As such, 1 is most satisfied while 4 refers to the lack of facilities and services. According to the household survey results, the vast majority of interviewees (89%) consider the existing electricity services good, with an average score lower than 1.5 out of 4 (Figure 1.50). However, 22 interviewees from Ku Lar Tan, Kha Lauk Chaik, and Agga Tan Kyaung Su village tract in Twantay Township mentioned that electricity is not available in their area (ERM, 2019).



Note: 1-good; 2-fair, 3-bad; 4-not available in the area

Source: ERM Field Data (2019)

#### Figure 1.50 Community Perceptions of Electricity Services

In the household questionnaires, one (1) is good, two (2) is fair, three (3) is bad, and four (4) is not available in the area. As such, one is most satisfied while four refers to the lack of facilities and services. According to the household survey result (Figure 5.51), interviewees from Kyee Myin Daing Township are least satisfied with all Townships surveyed with the existing roads and transportation, with an average score of 2.5 (fair/bad) out of 4. The other Townships consider the transport accessibility acceptable, with an average score below 2 (fair) out of 4 (ERM, 2019). At the village tract level, within Twantay Township, more than half of the interviewees from Gyaung Waing Gyi (67%) and Ah Lat Chaung (76%) village tract gave a bad review on the existing roads and transportation (ERM, 2019). Figure 5.52 shows a typical dirt road in Kyee Myin Daing (West) Township.

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Note: 1-good; 2-fair, 3-bad; 4-not available in the area Source: ERM Field Data (2019)



Figure 1.51 Community Perceptions of Roads and Transportation

Source: ERM (2019)



#### 1.8.6 Water and Sanitation

#### 1.8.6.1 Drinking Water Supply

According to Myanmar Population and Housing Census Township Report (2014), improved water sources include the following:

- Tap water / piped;
- Tube well, borehole;
- Protected well / spring; and
- Bottled / purified water.

Unimproved water sources include the following:

- Unprotected well / spring;
- Pool / Pond / Lake;
- River / Stream / Canal; and
- Waterfall / Rainwater.

Ahlone, Kyee Myin Daing, and Hlaing Tharyar Townships used improved water sources. For Ahlone Township, residents mainly use improved water source as 72% use bottled / purified water and around 23% use tube wells or boreholes (Myanmar Population and Housing Census Township Report, 2014) (Table 1.35). For Kyee Myin Daing Township, more than two third of the residents (68%) use improved water source, with 38% using bottled / purified water (Myanmar Population and Housing Census Township Report, 2014). For Hlaing Tharyar Township, residents mainly use improved water source (91%), with 68% using bottled / purified water (Myanmar Population and Housing Census Township Report, 2014).

In Seikgyi Kanaungto, Twantay and Dala, most people use unimproved water sources. For Seikgyi Kanaungto Township, only 3% of residents use improved water sources with the vast majority of residents (97%) using unimproved water sources and mostly pool / pond / lake sources (Myanmar Population and Housing Census Township Report, 2014). For Twantay Township, less than half of the residents (40%) use improved water sources with 43% using pool / pond / lake and around 10% using river / stream / canal (Myanmar Population and Housing Census Township Report, 2014). In Dala, 8% of households surveyed use improved water sources with 85% using pool / pond / lake water for drinking (Myanmar Population and Housing Census Township Report, 2014).

A representative photo of an unimproved drinking water source in Twantay Township is shown in Figure 1.53.

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Source: ERM (2019)



#### Table 1.35 Main Source of Drinking Water in the Townships within the Study Area



Source: Myanmar Population and Housing Census Township Report, 2014

#### 1.8.6.2 Domestic Water Supply

Domestic water supply includes water used for washing, cooking, etc. The domestic water sources in the Study Area are shown per Township in Table 1.36. Ahlone, Kyee Myin Daing, and Hlaing Tharyar Township use mostly tube wells (over 75% in all cases) with the remainder supplied from tap water / piped and/or ponds (Myanmar Population and Housing Census Township Report, 2014).

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For Seikgyi Kanaungto Township, almost all of the domestic water (99%) is from pool / pond / lake sources (Myanmar Population and Housing Census Township Report, 2014).

Twantay Township has the most diverse sources of non-drinking use water with around 29% from tube well and borehole, and 32 % use pool / pond / lake. The remainder is shared by other sources such as river / stream / canal (17%), and unprotected wells / springs (7.3%) (Myanmar Population and Housing Census Township Report, 2014).

For Dala Township, 85% of domestic water is from pool / pond / lake, followed by bottled / purified water (6%) and other sources (Myanmar Population and Housing Census Township Report, 2014).





Source: Myanmar Population and Housing Census Township Report, 2014

#### 1.8.6.3 Sanitation

In comparison to the country average, apart from Twantay which is slightly lower (73%), the other five Townships from the Study Area have a higher improved sanitation rate<sup>2</sup> than the Union (74%) (Myanmar Population and Housing Census Township Report, 2014).

Within Yangon, Twantay (73%), Kyee Myin Daing (65%), Seikgyi Kanaungto (86%) and Dala (85%) have a lower improved sanitation rate than the regional level (91%) (Table 1.37). Figure 1.54 shows the breakdown of access to sanitation in the Study Area. Water seal (improved pit latrine) remains the most common latrine within the Study Area with a range of between 65% and 93% of all Townships using this type of latrine (Myanmar Population and Housing Census Township Report, 2014).

	Improved Sanitation Rate (i.e. flush and water seal (improved pit latrine))
Union	74%
Yangon Region	91%
Township Level	
Twantay	73%
Hlaing Tharyar	94%
Ahlone	98%
Kyee Myin Daing	75%
Seikgyi Kanaungto	86%
Dala	85%

#### Table 1.37 Comparison of Improved Sanitation Rate

Source: Myanmar Population and Housing Census Township Report, 2014

<sup>&</sup>lt;sup>2</sup> Improved sanitation rate herein refers to flush and water seal (improved pit latrine).



Source: Myanmar Population and Housing Census Township Report, 2014

#### Figure 1.54 Breakdown of Access to Sanitation

#### 1.8.6.4 Community Perceptions of Water and Sanitation

In the household questionnaires, one (1) is good, two (2) is fair, three (3) is bad, and four (4) is not available in the area. As such, one is most satisfied while four refers to the lack of facilities and services. According to the household survey result, the interviewees find the existing sanitation acceptable, with an average score below 2 (fair) out of 4 (ERM, 2019) (Figure 5.55).

#### DESCRIPTION OF THE ENVIRONMENT

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Note: 1-good; 2-fair, 3-bad; 4-not available in the area Source: ERM Field Data (2019)

#### Figure 1.55 Community Perceptions of Sanitation

In the household questionnaires, one (1) is good, two (2) is fair, three (3) is bad, and four (4) is not available in the area. As such, one is most satisfied while four refers to the lack of facilities and services. According to the household survey result (Figure 5.56), interviewees from the Study Area find the drinking water acceptable (with an average score lower than 2 (fair) out of 4). Within the Study Area, residents of Kyee Myin Daing Township consider the drinking water supply relatively poor compared to elsewhere in the Study Area (ERM, 2019).

#### DESCRIPTION OF THE ENVIRONMENT

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Note: 1-good; 2-fair, 3-bad; 4-not available in the area Source: ERM Field Data (2019)

#### Figure 1.56 Community Perceptions of Drinking Water

### 1.8.7 Income and Livelihood of the Study Area

#### 1.8.7.1 Overview

Although Seikgyi Kanaungto and Twantay Townships are within the Yangon Region, economic development in these areas lags compared to the Townships across the river. Businesses include agriculture, river transportation, and casual labour (i.e. workers who provide services according to the fluctuating demands) who work in Yangon. Small-scale fishing and dredging activities are also common activities in the Study Area. The majority of the dredging is undertaken in Dala Township (ERM, 2017). Dredging vessels observed in the Yangon River and stockpiles of dredged materials in Dala are shown in Figure 5.57 and Figure 5.58.

The type of work and number of workers in each Township is provided in Table 5.38 (GAD data, 2017).



Source: ERM (2019)





Source: ERM (2019)

### Figure 1.58 Stockpiles of dredged material in Dala Township

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Township	Types of work and number of workers
Seikgyi Kanaungto	<ul> <li>63 small scale business with 254 workers</li> <li>1 private dry and wet dockyard with 210 workers</li> <li>1 private rice mill with 59 workers</li> </ul>
Twantay	<ul> <li>55 small scale business with 270 workers</li> <li>2 private car maintenance workshops with 10 workers</li> <li>68 private business with 288 workers</li> </ul>
Hlaing Tharyar	<ul> <li>92 small scale business with 287 workers</li> <li>1 state owned garment factory with 596 workers</li> <li>802 private companies with 126,475 workers</li> </ul>
Kyee Myin Daing	<ul> <li>16 small scale business with 184 workers</li> <li>6 private business with 194 workers</li> <li>2 state owned saw mills with 346 workers</li> </ul>
Ahlone	<ul> <li>11 small scale business with 67 workers</li> <li>2 private business with 141 workers</li> <li>1 state owned electricity distribution service with 94 workers</li> <li>1 state owned furniture factory with 365 workers</li> </ul>
Dala	<ul> <li>2 government industries with 380 workers</li> <li>14 private industries with 75 workers</li> <li>27 small scale business with 38 workers</li> </ul>

#### **Table 1.38** Types of Work and Number of Workers

Source: General Administration Department Township Profile Report, 2017

A breakdown of the common livelihood types for Townships in the Study Area is presented in Table 1.39.

#### Livelihoods in the Townships within the Study Area **Table 1.39**

Township	Livelihood
Kyee Myin Daing	Agriculture, Fishing, Casual Labour, Government Service, Private Companies, Casual Labour, Self Employed, Dock Service, Business (Shop)
Hlaing Tharyar	Business (Shop), Industrial Workers, Casual labour, Government Service, Private Companies
Twantay	Agriculture, Business (Sewing Robe for monks/shops), Government Service, Private Company, Industrial Workers, Agricultural labourers, Fishing
Seikgyi Kanaungto	Agriculture, fishing, Casual labour, Sampan Service (boat ferry service), Government Service, Company Staff
Dala	Casual Labour, Government Service, Services and Trading, Agriculture, Others
Ahlone	Casual Labour, Company Staff, Government Service, Self Employed, Business (Shop)

Source: ERM Field Data (2019)

Hlaing Tharyar Township is one of the biggest and most populated Townships in Yangon Region and the population is mostly comprised of migrant workers from Ayeyarwaddy Region (ERM data collection, 2019). The migrant workers work in the Hlaing Tharyar industrial zone, particularly in garment and food processing factories. In Hlaing Tharyar Township, the proportion of employed persons working in manufacturing is the highest compared to other types of employment at 29%.

According to interviews and focus group discussions undertaken by ERM in 2019, the main economic activity for women in the Study Area is working in garment factories. Other common jobs for women include working in local shops and fish markets, government services, agriculture, and sewing businesses. Within agricultural activities, there is no difference in the roles of women and men as both help in land preparation, buying seeds and fertilizers, sowing, weeding and harvesting. Most of the interviewees stated that the women's role is focused on children's education, decision making for children, and household chores.

#### 1.8.7.2 Agriculture and Livestock

Paddy is the main crop and grown only during the rainy season (Figure 5.59). There are other seasonal crops grown such as black gram and green gram. Eugenia leaf is also cultivated. No agricultural activities are reported in Hlaing Tharyar Township. There are 118,523 acres of agricultural land in Twantay Township, 87 acres in Seikgvi Kanaungto Township, and 1,767 acres in Kyee Myin Daing Township, and 46,294 acres in Dala Township. However, there is no agricultural land in Ahlone and Hlaing Tharyar Townships (GAD Township Report, 2017).

Of all farming households consulted, the average rice production is 50 to 60 basket per acre in the Study Area (ERM, 2019). The harvest is sold in national domestic markets. Labourers are hired with an average wage per day between 3,000 and 10,000 MMK.

For livestock rearing, the communities in the Study Area raise pigs, sheep, goats, chickens, and ducks, for both consumption and to sell at the local market (Figure 5.60 provides a photo of duck livestock rearing in the Study Area). Cows/buffalos are also used for agricultural purposes. A few families of Twantay, Seikgyi Kanaungto, and Kyee Myin Daing fish in the creeks and Hlaing River for consumption.



Source: ERM (2019)

#### Figure 1.59 Paddy Field in Twantay Township



Source: ERM (2019)

#### Figure 1.60 Livestock Rearing in Twantay Township

#### 1.8.7.3 Labour Force Participation Rate

The labour force herein refers to people aged from 15 to 64. The labour force participation rate of Townships within the Study Area is lower than 70%. Dala Township has the lowest participation rate (59%) (Myanmar Population and Housing Census Report, 2014). There is a significant gender gap, with fewer women joining the labour force. The difference between male and female labour force participation rate ranges from 30% (Ahlone Township) to 47% (Seikgyi Kanaungto Township) (Figure 5.61).



Source: Myanmar Population and Housing Census Township Report, 2014

#### Figure 1.61 Labour Force Participation Rate of Townships within the Study Area

#### 1.8.7.4 Community Perceptions of Job Opportunities

In the household questionnaires, one (1) is good, two (2) is fair, three (3) is bad, and four (4) is not available in the area. As such, one is most satisfied while four refers to the lack of facilities and services. According to the household survey results, all the Townships with the Study Area find the existing job opportunities acceptable, with an average score below 2 (fair) out of 4 (Figure 5.62). However, according to the focus group discussions, women perceive that they have fewer job opportunities than men do.



Note: 1-good; 2-fair, 3-bad; 4-not available in the area Source: ERM Field Data (2019)

#### Figure 1.62 Community Perceptions of Job Opportunities

#### 1.8.8 Community Perceptions of the Project

#### 1.8.8.1 Sources of Project Information

Figure 1.63 summarises the way local communities were informed about the Project. According to the household survey results, approximately a third of the interviewees (33%) knew about the Project from their relatives or friends, followed by media (25%), and local government or village leaders (17%). Around 5% stated that they did not know about the Project until the IEE meetings.

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Source: ERM Field Data (2019)

Figure 1.63 Sources of Project Information

#### 1.8.8.2 Community Perceptions of the Project's Potential Negative Impacts

According to the household survey data, the most common concern of the people interviewed in the Study Area is related to potential noise impacts. The influx of workers also concerned the local communities, with nearly half of the interviewees seeing it as a potential negative impact (ERM, 2019). The perceptions of the Project's potential negative impacts vary slightly across Townships. Figure 5.64 presents the community perceptions of the Project's potential negative impacts of each Township.

The main concerns can be split into environmental and social. For social concerns; worker influx, increase in crime and safety issues, increase in traffic, and loss of land or assets were the main concerns. For environmental; air, noise, and waste pollution were the main concerns.

The main concerns in rural areas were loss of farming land, compensation, and presence of squatters.

Residents from Twantay and Seikgyi Kanaungto recommended prioritising land compensation in the Project's schedule, to establish a fair land compensation procedure with clear criteria, support for livelihood restoration, and to conduct preventive measures to prevent speculative in-migration. For livelihood restoration, they would like to receive support from NYDC for establishing small and medium businesses.

The men who provide boat/ferry services in Kyee Myin Daing were concerned about losing their jobs, as they will compete with the bridges. They asked to be considered for specific support and compensation.

Women are especially concerned about a potential increase in crime. The main recommendations of women are to provide affordable housing in the new city, to build a maternity hospital, to consider building water pipe distribution in Dala, and to build the bridge as soon as possible.



Source: ERM Field Data (2019)

#### Figure 1.64 Perceptions of the Potential Negative Impacts in the Study Area

#### 1.8.8.3 Community Perceptions of the Project's Potential Positive Impacts

According to the household surveys, the vast majority of interviewees (92%) anticipated that the Project would improve the existing infrastructure. They also expected that the Project would create job opportunities (76%) and increase their annual income (68%). Compensation for land, on the other hand, is not considered a potential positive impact (31%) from the Project (ERM, 2019). Figure 5.65 shows the community perceptions of the project's potential positive impacts of each Township.

The focus group discussions indicate that the main benefit perceived is the generation of new job opportunities. Improvements to roads and transportation infrastructure is the second perceived advantage of the Project. Other benefits include improvements to public infrastructure and services such as electricity, water, and healthcare that would lead to improved living conditions.



Source: ERM Field Data (2019)

#### Figure 1.65 Perceptions of the Potential Positive Impacts in the Study Area

#### **1.9 Cultural Characteristics**

Yangon Region has a number of culturally historically significant areas, particularly Buddhist sites. There are also pagodas, monasteries, mosques, churches, Hindu temples, and Buddhist ordination halls located in the Study Area that are considered as important cultural centres for the local communities.

There are three historically significant pagodas in Twantay Township; Shwe San Daw, San Taw Kyo, Maung Tee, Kyaik Byaung Pyi, and Kyaik Kay Thar San Taw Kyo. However, these are not located in the Project Area. There are two built heritage items, which are more than one hundred years old in the Project Area; the Thathana Wai Pon La monastery and the Kha Lauk Chaint Police Station.

Thathana Wai Pon La monastery is located in Ma Ngay Ah Le Village Tract and was built in 1870 (Figure 5.67). One of the buildings in the monastery was constructed with 246 teak pillars and numerous cultural artefacts are on display. There is a religiously important "Wi Thu Gar Ma" ordination hall and the land was given by an Indian King as religious land, which cannot be taken by any government (Figure 5.68). Figure 5.69 shows the cultural artefact in Thathana Wai Pon La Monastery. The Police Station, which was built in 1905, is located in Kha Lauk Chaint Village Tract (Figure 5.70).

There are 552 Monatries, 176 Pagodas, 72 Churches, 45 Nunneries, 26 Hindu Temples and nine Mosques, as shown in Table 5.40 and depicted locations in Figure 5.66.

## Table 1.40 Cultural Heritage from Townships in the Study Area

Townships	Pagodas	Monasteries	Nunneries	Churches	Mosques	Hindu Temples
Seikgyi Kanaungto	16	15	-	-	1	6
Twantay	104	263	32	61	5	11
Kyee Myin Daing	9	21	-	7	1	5
Hlaing Tharyar	3	157	6	-	-	-
Ahlone	6	9	-	4	2	4
Dala	38	87	7	-	-	-
Total	176	552	45	72	9	26

Source: General Administration Department Township Profile Report, 2017
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Figure 1.66 Cultural Heritage within the Study Area

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Source: ERM (2019)

# Figure 1.67 Thathana Wai Pon La Monastery in Ma Ngay Ahlae Village, Twantay Township



Source: ERM (2019)

Figure 1.68 "Wi Thu Gar Ma" Ordination Hall in Ma Ngay Ahlae Village Tract, Twantay Township

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Source: ERM (2019)

# Figure 1.69 Cultural Artefact in Thathana Wai Pon La Monastery in Ma Ngay Ahlae Village, Twantay Township



Source: ERM (2019)

# Figure 1.70 Police Station in Kha Lauk Chaint Village Tract, Twantay Township

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### 1.10 Visual Characteristics

The New Yangon City would be potentially visible to communities living in the Townships of Hlaing Tharyar, Kyee Myin Daing, Seikgyi Kanaungto, Twantay, Dala, and Ahlone. Currently, the east of Yangon River is mainly urban area, with relatively tall commercial and residential buildings. The west of Yangon River, on the other hand, is mainly a rural area with paddy fields.

### 1.11 Summary

The following bullets summarise the main findings of the social baseline section:

- The population in the Study Area is mostly urban whereas, in the Project Area, the population is mostly rural. Population density is high (more than 1,000 inhabitants per km<sup>2</sup>) in four of the six townships. Five of the six townships exhibit population growth, which is typical in urban areas in Myanmar.
- In all townships of the Study Area, there are slightly more women than men.
- Almost a third of the population of Twantay, Seikgyi Kanaungto and Dala is less than 15 years old. Over 70% of the population of Kyee Myin Daing, Hlaing Tharyar and Ahlone are between 15 to 65 years. In all townships of the Study Area, the elderly (over 65 years old) represent less than 8% of the population.
- In the Study Area, there has been a decrease in birth rates over the last 20 years. More than one third (36%) of the Study Area's population is concentrated in the age group between 15 to 30 years old.
- There are 475 education facilities in the Study Area and 45% are located in Twantay Township. All the townships within the Study Area have a higher literacy rate than the Union level average of 90%. For Twantay (95%), Dala (93%), and Kyee Min Daing (96%), the literacy rate is lower than the Yangon regional average level (97%). Females within the Study Area have a relatively lower (almost 5% less) literacy rate than men.
- There are 329 healthcare facilities in the Study Area. Hlaing Tharyar has the largest number of healthcare facilities (42%) and the highest ratio of health professional-to-patient in the Study Area (one doctor per every 37,665 inhabitants).
- Electricity is the main source for lighting in four out of six townships. Whereas in Seikgyi Kanaungto Township and Twantay Twantay most inhabitants use other sources of energy such as battery, candle, kerosene, and generators.
- Three out of six townships (Ahlone, Kyee Myin Daing and Hlaing Tharyar) in the Study Area use bottled/purified water as main source of drinking water. The remaining three townships (Seikgyi Kanaungto, Twantay and Dala) mainly use pond/lake and tube well/borehole. Tap /piped water as a source for domestic water use represents less than 20% in all townships of the Study Area. In general, the main sources for domestic water is from tube well/borehole, pond/lake, and river/stream.
- The most common method of transport to Yangon City from the Project Area is via boat, which takes 15 minutes compared to the road journey of over an hour.
- The main economic activities in the Study Area are small and medium businesses. Other activities include agriculture, river transportation, and casual labour (i.e. services according to fluctuating demands). In addition, there are small scale fishing and dredging activities. Although there are slightly more working age women (15-65) than men in the Study Area, the labour force participation rate for men is significantly higher than for women (up to 47%).
- There are two built heritage items, which are more than one hundred years old in the Project Area: the Thathana Wai Pon La monastery and the Kha Lauk Chaint Police Station. There are 552 Monatries, 176 Pagodas, 72 Churches, 45 Nunneries, 26 Hindu Temples and nine Mosques.

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- The major social concerns about the Project among the population of the Study Area are worker influx (47%), and increase in crime and safety issues (45%); while the main perceptions of social benefits are infrastructure improvement (91%), and job opportunity (80%).
- For environmental concerns, noise pollution (52%) and air pollution (35%) were the most mentioned. No positive perception of the environmental was raised during the social survey.
- There is no Key Biodiversity Area, Protected Area, World Heritage and RAMSAR Site within the Project area. The project area is located 5 km north of the Irrawaddy Plains EBA. There were no endemic and restricted range bird species identified during the baseline survey.
- One bird and three fishes species were identified as IUCN red listed during the baseline survey. There is no observation of IUCN red listed mammal, reptiles and butterflies species during survey.
- Out of 164 surveyed flora species listed during the survey, two flora species were identified IUCN red listed.

### REFERENCES

- Another Development & The East Asia Institute. 2018. Access to Clean and Safe Water in Yangon A Case of Municipal Water Provision in Insein Township.
- Climate Data Website. 2018. *Climate: Myanmar*. Accessed: 7 December 2018. Retrieved from: http://en.climate-data.org/location/317/
- De Koning, R.J. and M.P.J. Janssen. 2015. *Delft 3D-Flow Model of the Yangon Port Area*. Accessed: 27 November 2018. Retrieved from: https://repository.tudelft.nl/islandora/object/uuid:96917480-dc97-421e-b55e-6c560ce44264/datastream/OBJ/download.
- Department of Population. 2018. *Township Census Report Yangon*. Accessed: 10 January 2019. Retrieved from: http://www.dop.gov.mm/en/state-region/yangon
- EO Earth Website. 2016. Water Profile of Myanmar. Accessed: 7 December 2018. Retrieved from: http://www.eoearth.org/view/article/156974/
- General Administration Department. 2017. Ahlone, Dala, Hlaing Tharyar, Kyee Myin Daing, Seikgyi Kanungto and Twantay Township Report
- Royal Haskoning DHV. 2019. Strategic Flood Risk Assessment New Yangon City Final Report.
- Sadler B. and Verheem R. (1996) SEA: status, challenges and future directions, Report 53, The Hague, The Netherlands: Ministry of Housing, Spatial Planning and the Environment
- Suwannathatsa, S., Wongwises., P., Wannawong, W. and Vongvisessomjai, S. (2012) The Costal current of the Andaman Sea revealed by reprocessed observations. American journal of applied sciences
- Theilen-Willige, Barbara and George Pararas-Carayannis. 2009. "Natural Hazard Assessment of SW Myanmar – A Contribution of Remote Sensing and GIS Methods to the Detection of Areas Vulnerable to Earthquakes and Tsunami/ Cyclone Flooding." Science of Tsunami Hazards, 2(2), 108-128
- Union of Myanmar. 2009. Hazard Profile Myanmar.
- United Nations (2015) The 2030 Agenda for Sustainable Development (accessed from https://sustainabledevelopment.un.org/post2015/transformingourworld on 29 December 2018)
- United Nations Habitat. 2016. The Republic of the Union of Myanmar National Urban Policy Framework. Retrieved from: http://unhabitat.org.mm/wp-content/uploads/2018/04/NATIONAL-URBAN-POLICY-FRAMEWORK.pdf
- United Nations Office for the Coordination of Humanitarian Affairs (OCHA), 2011. https://www.preventionweb.net/files/4164\_ochamyahazardv3110606.pdf. Accessed 2 July 2018.
- World Health Organisation. n.d. Types of Healthy Settings Healthy Cities. Retrieved from: https://www.who.int/healthy\_settings/types/cities/en/
- Yangon Region, Northern District, Township General Administration Department. 2017. "Hlaing Tharyar Township Information"
- Yangon Region, Southern District, Township General Administration Department. 2017. "Dala Township Information"
- Yangon Region, Southern District, Township General Administration Department. 2017. "Seikgyi Kanaungto Township Information"

#### SEA FOR THE DEVELOPMENT OF NEW YANGON CITY PHASE 1 MASTERPLAN SEA Report

Yangon Region, Southern District, Township General Administration Department. 2017. "Twantay Township Information"

Yangon Region, Southern District, Township General Administration Department. 2017. "Kyee Myin Daing Township Information"

Yangon Region, Western District, Township General Administration Department. 2017. "Ahlone Township Information"

# APPENDIX D ENVIRONMENTAL BASELINE SURVEY LOCATIONS AND ENVIRONMENTAL SURVEY RESULTS

Point	Coordinates (WGS 84)			
	N	E		
Ambient Air Quality (NO <sub>2</sub> and SO <sub>2</sub> )	,			
ADT-1	16.803264	96.124753		
ADT-2	16.804967	96.114354		
ADT-3	16.806102	96.099470		
ADT-4	16.870940	96.038071		
ADT-5	16.861296	96.029461		
ADT-6	16.849506	96.037227		
ADT-7	16.824670	96.083698		
ADT-8	16.760518	96.068516		
ADT-9	16.760106	96.089170		
ADT-10	16.794806	96.032705		
ADT-11	16.801929	96.027169		
ADT-12	16.825692	96.035332		
ADT-13	16.783762	96.089721		
ADT-14	16.805385	96.097491		
ADT-15	16.795386	96.043954		
ADT-16	16.793501	96.042994		
ADT-17	16.723597	95.935637		
ADT-18	16.656449	95.823498		
ADT-19	16.825651	96.067627		
ADT-20	16.860150	96.048519		
ADT-21	16.854224	96.036686		
ADT-22	16.830354	96.048658		
ADT-23	16.820556	96.044556		
ADT-24	16.810184	96.034246		
ADT-25	16.750942	96.039579		
ADT-26	16.735903	96.029803		
ADT-27	16.741511	96.049501		

# **Coordinates for Survey Locations**

Point	Coordinates (WGS 84)			
	N	E		
Ambient Air Quality ( $PM_{10}$ and $PM_{2.5}$ )	·			
PM-1	16.804639	96.127208		
PM-2	16.805673	96.114035		
PM-3	16.805926	96.099812		
PM-4	16.861406	96.029297		
PM-5	16.849486	96.037808		
PM-6	16.762666	96.067962		
PM-7	16.759176	96.089642		
PM-8	16.801600	96.029156		
PM-9	16.786272	96.097664		
PM-10	16.795131	96.044050		
PM-11	16.723173	95.933445		
PM-12	16.822897	96.068300		
PM-13	16.656749	95.823830		
PM-14	16.831489	96.045858		
PM-15	16.817947	96.044536		
PM-16	16.810131	96.033956		
PM-17	16.750821	96.040089		
PM-18	16.735792	96.029071		
Noise		1		
N-1	16.804055	96.123389		
N-2	16.804917	96.114250		
N-3	16.8058	96.099068		
N-4	16.8643	96.035850		
N-5	16.86025	96.029770		
N-6	16.84943	96.037624		
N-7	16.82465	96.083776		
N-8	16.76197	96.068389		
N-9	16.804055	96.089118		
N-10	16.804917	96.031595		

Point	Coordinates (WGS 84)	
	N	E
N-11	16.805801	96.030106
N-12	16.864298	96.036136
N-13	16.860254	96.089658
N-14	16.849431	96.086667
N-15	16.824652	96.053475
N-16	16.761972	96.043004
N-17	16.760369	95.935605
N-18	16.796339	95.826077
N-19	16.802666	96.068481
N-20	16.825889	96.045800
N-21	16.783946	96.036060
N-22	16.807023	96.045878
N-23	16.804687	96.045977
N-24	16.793384	96.033277
N-25	16.725589	96.037558
N-26	16.657488	96.029747
N-27	16.822162	96.047208
Ground water		
GW-1A	16.80402	96.12306
GW-1B	16.80403	96.12348
GW-1C	16.80369	96.12245
GW-2A	16.80319	96.11239
GW-2B	16.80338	96.11256
GW-2C	16.80335	96.11226
GW-3A	16.80659	96.09796
GW-3B	16.80625	96.09756
GW-3C	16.80634	96.09726
GW-4A	16.86298	96.03502
GW-4B	16.86155	96.03517
GW-4C	16.86113	96.034

Point	Coordinates (WGS 84)			
	Ν	E		
GW-5A	16.8564	96.03608		
GW-5B	16.85608	96.03532		
GW-5C	16.85497	96.03503		
GW-6A	16.84693	96.0328		
GW-6B	16.84738	96.03363		
GW-6C	16.84763	96.03423		
GW-7A	16.82729	96.09409		
GW-7B	16.82738	96.09351		
GW-7C	16.82751	96.09326		
GW-8A	16.78139	96.08083		
GW-8B	16.78167	96.08		
GW-8C	16.78174	96.08046		
GW-9A	16.75861	96.08654		
GW-9B	16.75861	96.08694		
GW-9C	16.75861	96.08722		
GW-10A	16.7956	96.02826		
GW-10B	16.79548	96.02746		
GW-10C	16.79499	96.02787		
GW-11A	16.79403	96.0427		
GW-11B	16.79445	96.0437		
GW-11C	16.79488	96.04325		
GW-12A	16.82618	96.03129		
GW-12B	16.82653	96.0299		
GW-12C	16.82685	96.02928		
GW-13A	16.78306	96.08972		
GW-13B	16.78278	96.08972		
GW-13C	16.78308	96.09005		
GW-14A	16.78705	96.06273		
GW-14B	16.78685	96.06232		
GW-14C	16.78742	96.06247		

Point	Coordinates (WGS 84)			
	N	E		
GW-15A	16.8169	96.06272		
GW-15B	16.81714	96.06429		
GW-15C	16.81832	96.0642		
GW-16A	16.80076	96.02886		
GW-16B	16.80063	96.02837		
GW-16C	16.80114	96.02828		
GW-17A	16.72405	95.9337		
GW-17B	16.72477	95.93507		
GW-17C	16.72497	95.93562		
GW-18A	16.65787	95.82613		
GW-18B	16.65815	95.82608		
GW-18C	16.6594	95.82722		
GW-19A	16.84003	96.06311		
GW-19B	16.84007	96.06298		
GW-19C	16.84000	96.06292		
GW-20A	96.04617	16.83197		
GW-20B	96.04645	16.83248		
GW-20C	96.04665	16.83373		
GW-21A	96.0472	16.82248		
GW-21B	96.04683	16.82152		
GW-21C	96.04603	16.82053		
GW-22A	96.03337	16.81256		
GW-22B	96.0348	16.81336		
GW-22C	96.03369	16.81093		
GW-23A	96.03861	16.75000		
GW-23B	96.03889	16.75000		
GW-23C	96.03848	16.74954		
GW-24A	96.03000	16.73722		
GW-24B	96.03000	16.73806		
GW-24C	96.03016	16.73886		

Point	Coordinates (WGS 84)			
	N	E		
Surface water		1		
SW-1A	16.8072	96.119233		
SW-1B	16.80581	96.119558		
SW-1C	16.80479	96.119494		
SW-2A	16.77051	96.134163		
SW-2B	16.77009	96.136615		
SW-2C	16.77065	96.139038		
SW-3A	16.80741	96.101208		
SW-3B	16.80787	96.101854		
SW-3C	16.80824	96.102354		
SW-4A	16.85979	96.031236		
SW-4B	16.8604	96.032714		
SW-4C	16.86051	96.034044		
SW-5A	16.84912	96.028158		
SW-5B	16.85024	96.028713		
SW-5C	16.85125	96.029211		
SW-6A	16.82976	96.080241		
SW-6B	16.83044	96.079751		
SW-6C	16.8318	96.079736		
SW-7A	16.78494	96.085925		
SW-7B	16.78490	96.08716		
SW-7C	16.78490	96.08788		
SW-8A	16.75093	96.083268		
SW-8B	16.7517	96.084635		
SW-8C	16.75249	96.085475		
SW-9A	16.79654	96.031531		
SW-9B	16.79729	96.031585		
SW-9C	16.79830	96.031689		
SW-10A	16.82419	96.035661		
SW-10B	16.82520	96.035893		

Point	Coordinates (WGS 84)	
	N	E
SW-10C	16.82663	96.035994
SW-11A	16.7817	96.112856
SW-11B	16.78126	96.114075
SW-11C	16.78108	96.115482
SW-12A	16.80716	96.086246
SW-12B	16.80687	96.087922
SW-12C	16.80708	96.089437
SW-13A	16.81368	96.058956
SW-13B	16.81329	96.060164
SW-13C	16.8128	96.061663
SW-14A	16.79874	96.045923
SW-14B	16.79763	96.045622
SW-14C	16.79723	96.045276
SW-15A	16.72224	95.922555
SW-15B	16.72159	95.923849
SW-15C	16.72085	95.925176
SW-16A	16.65594	95.826235
SW-16B	16.65596	95.827627
SW-16C	16.6560	95.829386
SW-17A	16.85834	96.045133
SW-17B	16.85749	96.046525
SW-17C	16.85672	96.047585
SW-18A	16.84965	96.058094
SW-18B	16.84887	96.059287
SW-18C	16.84802	96.060387
SW-19A	16.83872	96.034851
SW-19B	16.83858	96.035603
SW-19C	16.83848	96.03612
SW-20A	16.82684	96.047127
SW-20B	16.82749	96.047416

Point	Coordinates (WGS 84)		
	N	E	
SW-20C	16.8285	96.047471	
SW-21A	16.8183	96.043929	
SW-21B	16.8184	96.044436	
SW-21C	16.81824	96.044971	
SW-22A	16.80826	96.031908	
SW-22B	16.80847	96.032609	
SW-22C	16.80861	96.033055	
SW-23A	16.7335	96.02858	
SW-23B	16.73397	96.029985	
SW-23C	16.7341	96.031643	
SW-24A	16.73843	96.043313	
SW-24B	16.73916	96.044577	
SW-24C	16.73957	96.046122	
Soil			
S-1	16.80778	96.121679	
S-2	16.80510	96.109845	
S-3	16.80557	96.10045	
S-4	16.86291	96.035384	
S-5	16.85855	96.035079	
S-6	16.82464	96.081733	
S-7	16.76625	96.045716	
S-8	16.75602	96.071836	
S-9	16.79367	96.031568	
S-10	16.80249	96.034606	
S-11	16.82683	96.037668	
S-12	16.78083	96.085927	
S-13	16.80615	96.087242	
S-14	16.80819	96.059456	
S-15	16.79578	96.04195	
S-16	16.72600	95.935233	

Point	Coordinates (WGS 84)			
	Ν	E		
S-17	16.66202	95.824333		
S-18	16.83767	96.042528		
S-19	16.84583	96.049538		
S-20	16.85495	96.040083		
S-21	16.81994	96.04862		
S-22	16.81243	96.03782		
S-23	16.73735	96.0325		
S-24	16.74423	96.051777		
Biodiversity				
B-1	16.74106	96.03123		
B-2	16.82208	96.04425		
B-3	16.78986	96.08608		
B-4	16.86004	96.0362		
B-5	16.80472	96.1185		
B-6	16.84632	96.04894		
B-7	16.79721	96.03772		
B-8	16.76776	96.04657		
B-9	16.65772	95.82643		







Photos of Air Diffusion Tubes Setup at the survey locations

Sampling Point	Location	NO <sub>2</sub> (ug/m <sup>3</sup> )	SO <sub>2</sub> (ug/m <sup>3</sup> )
ADT-1	School, Kyee Myin Daing (East) Township	33.3	3.1
ADT-2	Monastery, Kyee Myin Daing (West) Township	Not available	2.8
ADT-3	Monastery, near Kone village, Twantay Township	11.9	2.1
ADT-4	Resident compound, near Yangon – Pathein Road, Hlaing Tharyar Township	27.7	2.7
ADT-5	Monastery, near Ah Twin Pa Dan Village, Hlaing Tharyar Township	Not available	Not available
ADT-6	Pagoda, near Ah Pyin Pa Dan Village, Hlaing Tharyar Township	15.4	2.3
ADT-7	Resident compound near Ah Lel Village, Twantay Township	11.6	1.5
ADT-8	Monastery, Let Pan Gwa Village, Twantay Township	7.4	<1.5
ADT-9	Monastery, Pathein Village, near Seikgyi Kanaungto Township	8.5	2.8
ADT-10	Resident Compound, near Yangon – Twantay Road, Twantay Township	10.5	2.0
ADT-11	Monastery, near Ta Man Gyi Village, Twantay Township	9.9	2.6
ADT-12	Open compound, near Upper Tamar Takaw Village, Twantay Township	13.2	2.6
ADT-13	Monastery, near Gyaung Waing Gyi Village, Twantay Township	10.4	2.2
ADT-14	School, near Kone village, Twantay Township	13.1	2.1
ADT-15	School, near Kun Tar Village, Twantay Township	10.1	Not available
ADT-16	Monastery, near Kun Tar Village, Twantay Township	9.0	1.9
ADT-17	Monastery, near Kan Kone Village, Twantay Township	11.4	2.3
ADT-18	School, near Pan Hlaing Wa Village, Twantay Township	4.9	1.6
ADT-19	Pagoda, near Ma Ngay Village, Twantay Township	Not available	1.8

# Ambient Air Quality Survey Results (NO2 and SO2) (2019)

Sampling Point	Location	NO <sub>2</sub> (ug/m <sup>3</sup> )	SO₂ (ug/m³)
ADT-20	Monastery, near Yae Oke Kan Village, Hlaing Tharyar Township	21.2	5.2
ADT-21	Resident Compound, near Ah Pyin Pa Dan Village, Hlaing Tharyar Township	18.0	<1.3
ADT-22	Monastery, near Lower Tamar Takaw Village, Twantay Township	9.3	1.8
ADT-23	Monastery, near Upper Tamar Takaw Village, Twantay Township	12.3	1.4
ADT-24	Monastery, near Lay Eain Village, Twantay Township	11.4	38.9
ADT-25	Monastery, near Thone Eain Village, Twantay Township	10.1	2.5
ADT-26	Monastery, near Than Phyu Yone village, Twantay Township	10.7	2.3
ADT-27	27 Monastery, near Kalar Tan Village, Twantay Township		1.6
WHO/EU Annual M	ean Air Quality Critical Level (Agriculture)	-	20
NEQEG Annual Me	an Air Quality Guideline (Human Health)	40	-

Note: results in red exceed the WHO/EU Annual Mean Air Quality Critical Level (Agriculture)





(A division of Gradko International Ltd.) St. Martins House, 77 Wales Street Winchester, Hampshire SO23 0RH tel.: 01962 860331 fax: 01962 841339 e-mail:diffusion@gradko.co.uk

# LABORATORY ANALYSIS REPORT

DETERMINATION OF SULPHUR DIOXIDE IN DIFFUSION TUBES BY ION CHROMATOGRAPHY

REPORT NUMBER N02355R N02355

BOOKING IN REFERENCE No

DESPATCH NOTE No

49595 CUSTOMER ERM - Hong Kong Attn: Edmund Taylor 16-F Berkshire House 25 Westlands Road **Quarry Bay** 

Hong Kong

DATE SAMPLES RECEIVED 25/03/2019

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1 1

#### JOB NUMBER NYDC 10488716

			Sample	Date	Date	Exposure	<b>SO</b> 4 <sup>2-</sup>	μgSO <sub>4</sub> ²-	SO <sub>2</sub>	SO <sub>2</sub>
	Location		Number	Exposed	Finished	Hours	µg/ml	- Blank	μg/m³*	ppb*
N 16.870999	E 96.038119	(ADT-4)	1311860	19/02/2019	22/03/2019	741.00	0.17	0.16	2.69	1.01
16.860201	E 96.048495	(ADT-20)	1311862	19/02/2019	22/03/2019	740.28	0.33	0.32	5.22	1.96
16.854562	E 96.036650	(ADT-21)	1311863	19/02/2019	19/03/2019	674.00	<0.08	<0.07	<1.30	<0.49
16.803260	E 96.124839	(ADT-1)	1311864	19/02/2019	19/03/2019	685.83	0.18	0.17	3.07	1.15
16.849465	E 96.037119	(ADT-6)	1311865	19/02/2019	19/03/2019	683.00	0.14	0.13	2.29	0.86
16.830357	E 96.048625	(ADT-22)	1311866	20/02/2019	19/03/2019	653.58	0.11	0.10	1.81	0.68
16.825588	E 96.067671	(ADT-19)	1311867	20/02/2019	19/03/2019	652.50	0.10	0.10	1.80	0.68
16.824641	E 96.083700	(ADT-7)	1311868	20/02/2019	19/03/2019	651.58	0.09	0.08	1.51	0.57
16.804884	E 96.114250	(ADT-2)	1311887	20/02/2019	19/03/2019	648.67	0.15	0.15	2.75	1.03
16.783700	E 96.089750	(ADT-13)	1311870	20/02/2019	19/03/2019	646.92	0.12	0.12	2.19	0.82
16.806092	E 96.099477	(ADT-3)	1311871	20/02/2019	19/03/2019	646.67	0.12	0.11	2.08	0.78
16.805561	E 96.097434	(ADT-14)	1311872	20/02/2019	19/03/2019	646.58	0.12	0.11	2.14	0.80
16.825667	E 96.035418	(ADT-12)	1311873	21/02/2019	22/03/2019	695.83	0.16	0.15	2.65	0.99
16.820555	E 96.044559	(ADT-23)	1311874	21/02/2019	22/03/2019	695.67	0.09	0.08	1.42	0.53
16.809698	E 96.034221	(ADT-24)	1311875	21/02/2019	22/03/2019	695.25	2.23	2.22	38.90	14.59
16.801752	E 96.027350	(ADT-11)	1311876	21/02/2019	22/03/2019	694.33	0.16	0.15	2.59	0.97
16.793414	E 96.043071	(ADT-16)	1311878	21/02/2019	22/03/2019	693.92	0.12	0.11	1.90	0.71
16.760170	E 96.089285	(ADT-9)	1311879	22/02/2019	19/03/2019	600.67	0.14	0.14	2.78	1.04
16.760502	E 96.068644	(ADT-8)	1311880	22/02/2019	19/03/2019	598.50	<0.08	<0.07	<1.47	<0.55
N 16.741449	E 96.049488	(ADT-27)	1311881	22/02/2019	19/03/2019	597.00	0.09	0.08	1.61	0.60
16.750925	E 96.039645	(ADT-25)	1311882	23/02/2019	19/03/2019	575.92	0.12	0.12	2.47	0.93
16.735704	E 96.029700	(ADT-26)	1311883	23/02/2019	19/03/2019	570.92	0.11	0.11	2.26	0.85
16.723762	E 95.935502	(ADT-17)	1311884	24/02/2019	19/03/2019	549.83	0.11	0.11	2.33	0.87
16.656532	E 95.823339	(ADT-18)	1311885	24/02/2019	19/03/2019	549.08	0.08	0.07	1.64	0.62
16.794881	E 96.032687	(ADT-10)	1311886	24/02/2019	22/03/2019	621.83	0.11	0.10	1.99	0.75

Samples have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. Data provided by the client and any subsequent calculations shall be indicated by an asterisk (\*), these calculations and results are not within the scope of our UKAS accreditation. The results within this report relate only to the items tested. Any queries concerning data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

Form LQF32b Issue 8 – June 2018

**REPORT OFFICIALLY CHECKED** 

**Report Number N023** 

555K	Page 1 of 2
	Gradko International Ltd
This sign:	ture confirms the authenticity of these results
Signed	1 Cates
67 - L	L. Gates, Laboratory Manager



tel.: 01962 860331 fax: 01962 841339 e-mail:diffusion@gradko.co.uk



# LABORATORY ANALYSIS REPORT

Laboratory B	0.01		
Comment: Results are blank sub Results reported as <0.08µg SO4 <sup>2</sup>	tracted <sup>-</sup> are below the reporting limit.		
Overall M.U.	±9.6%	Reporting Limit	0.08µg SO4 <sup>2-</sup>
Analyst Name	Sam Minns	Report Checked By	K.Paldamova
Date of Analysis	01/04/2019	Date of Report	03/04/2019

Analysis has been carried out in accordance with in-house method GLM1

Samples have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. Data provided by the client and any subsequent calculations shall be indicated by an asterisk (\*), these calculations and results are not within the scope of our UKAS accreditation. The results within this report relate only to the items tested. Any queries concerning data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

Form LQF32b Issue 8 – June 2018

REPORT OFFICIALLY CHECKED

**Report Number N02355R** 

<b>33K</b>	Page 2 01 2
	Gradko International Ltd
This signa	ture confirms the authenticity of these results
Signed	flates
	L. Gates, Laboratory Manager





(A division of Gradko International Ltd.) St. Martins House, 77 Wales Street Winchester, Hampshire SO23 0RH tel.: 01962 860331 fax: 01962 841339 e-mail:diffusion@gradko.co.uk

LABORATORY ANALYSIS REPORT							
NITROGEN DIOXIDE IN DIFFUSION TUBES BY U.V.SPECTROPHOTOMETRY							
REPORT NUMBER	N02423R						
BOOKING IN REFERENCE	N02423						
DESPATCH NOTE	49595	Atta (Estavor) d	<b>F</b> l				
CUSTOMER	ERM - HONG KO	ng Attn: Eamuna House	laylor				
	25 Westlands R	oad					
	Quarry Bay						
	Hong Kong						
DATE SAMPLES RECEIVED	25/03/2019						
JOB REFERENCE	NYDC / 048871	6					
	Sample	Exposur	e Data				μg NO₂
Location	Number	Date On	Date Off	Time (hr.)	μg/m <sup>3</sup> *	ppb *	on tube
N 16.870999 - E 96.038119 (ADT-04)	1311830	19/02/2019	22/03/2019	741.00	27.72	14.47	1.49
N 16.860201 - E 96.048495 (ADT-20)	1311832	19/02/2019	22/03/2019	740.28	21.23	11.08	1.14
N 16.859562 - E 96.036650 (ADT-21)	1311833	19/02/2019	19/03/2019	674.00	17.96	9.38	0.88
N 16.803260 - E 96.124839 (ADT-01)	1311834	19/02/2019	19/03/2019	673.83	33.28	17.37	1.63
N 16.849465 - E 96.037119 (ADT-06)	1311835	19/02/2019	19/03/2019	671.00	15.36	8.02	0.75
N 16.830357 - E 96.048625 (ADT-22)	1311836	20/02/2019	19/03/2019	653.58	9.35	4.88	0.44
N 16.825588 - E 96.067671 (ADT-19)	1311837	20/02/2019	19/03/2019	652.50	11.64	6.08	0.55
N 16.824641 - E 96.083700 (ADT-07)	1311838	20/02/2019	19/03/2019	651.58	11.59	6.05	0.55
N 16.783700 - E 96.089750 (ADT-13)	1311840	20/02/2019	19/03/2019	646.92	10.36	5.41	0.49
N 16.806092 - E 96.099477 (ADT-03)	1311841	20/02/2019	19/03/2019	646.67	11.92	6.22	0.56
N 16.805561 - E 96.097431 (ADT-14)	1311842	20/02/2019	19/03/2019	646.58	13.09	6.83	0.62
N 16.825667 - E 96.035918 (ADT-12)	1311843	21/02/2019	22/03/2019	695.83	13.21	6.89	0.67
N 16.820555 - E 96.044559 (ADT-23)	1311844	21/02/2019	22/03/2019	695.67	12.26	6.40	0.62
N 16.809698 - E 96.034220 (ADT-24)	1311845	21/02/2019	22/03/2019	695.25	11.44	5.97	0.58
N 16.801752 - E 96.027350 (ADT-11)	1311846	21/02/2019	22/03/2019	694.33	9.93	5.18	0.50
N 16.795367 - E 96.043952 (ADT-15)	1311847	21/02/2019	22/03/2019	694.08	10.09	5.27	0.51
N 16.793414 - E 96.043071 (ADT-16)	1311848	21/02/2019	22/03/2019	694.25	9.02	4.71	0.46
N 16.760170 - E 96.089285 (ADT-09)	1311849	22/02/2019	19/03/2019	600.67	8.50	4.44	0.37
N 16.760502 - E 96.068644 (ADT-08)	1311850	22/02/2019	19/03/2019	598.50	7.36	3.84	0.32
N 16.741449 - E 96.049488 (ADT-27)	1311851	22/02/2019	19/03/2019	596.83	9.27	4.84	0.40
N 16.750925 - E 96.039645 (ADT-25)	1311852	23/02/2019	19/03/2019	575.92	10.06	5.25	0.42
N 16.735704 - E 96.029700 (ADT-26)	1311853	23/02/2019	19/03/2019	570.92	10.65	5.56	0.44
N 16.723762 - E 95.935502 (ADT-17)	1311854	24/02/2019	19/03/2019	549.83	11.41	5.96	0.46
N 16.656532 - E 95.823339 (ADT-18)	1311855	24/02/2019	19/03/2019	549.08	4.86	2.54	0.19
N 16.794881 - E 96.032687 (ADT-10)	1311856	24/02/2019	22/03/2019	621.83	10.51	5.49	0.48

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0.000

Samples have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. Data provided by the client and any subsequent calculations shall be indicated by an asterisk (\*), these calculations and results are not within the scope of our UKAS accreditation. The results within this report relate only to the items tested. Any queries concerning data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

Form LQF32b Issue 8 – June 2018

REPORT OFFICIALLY CHECKED

**Report Number N02423R** 

23R	Page 1 of 2
1.00	Gradko International Ltd
This sign:	ature confirms the authenticity of these results
Signed	1 Cales
	L. Gates, Laboratory Manager





(A division of Gradko International Ltd.) St. Martins House, 77 Wales Street Winchester, Hampshire SO23 0RH tel.: 01962 860331 fax: 01962 841339 e-mail:diffusion@gradko.co.uk

# LABORATORY ANALYSIS REPORT

#### Comment: Results are not blank subtracted

#### Tubes 1311831 & 1311839 were not received for analysis. Results have been corrected to a temperature of 293 K (20°)

Overall M.U.	±9.7%	Limit of Detection	0.030µgNO <sub>2</sub>
Analyst Name	Agata Szymonik	Report Checked By	Adam Robinson
Date of Analysis	08/04/2019	Date of Report	08/04/2019

Analysis carried out in accordance with documented in-house Laboratory Method GLM7

Samples have been tested within the scope of Gradko International Ltd. Laboratory Quality Procedures. Data provided by the client and any subsequent calculations shall be indicated by an asterisk (\*), these calculations and results are not within the scope of our UKAS accreditation. The results within this report relate only to the items tested. Any queries concerning data in this report should be directed to the Laboratory Manager Gradko International Ltd. This report is not to be reproduced, except in full, without the written permission of Gradko International Ltd.

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23K	Page 2 of 2
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9	L. Gates, Laboratory Manager

# **Existing Background Ambient Air Quality Report**

# On

# The proposed New Yangon City Development project located in the Yangon Region

(Kyimyindaing Township, Hlaingthaya Township and Tawnte Township)



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### **Executive Summary**

In order to determine the existing background ambient air quality status around the proposed New Yangon City Development (NYCD) project to be located in Yangon Region, the levels of background ambient air parameters monitored in Kyimyindaing Township, Hlaingthaya Township and Tawnte Township throughout the survey period were compared with air quality guidelines from National Environmental Quality (Emission) Guideline stated by Environmental Conservation Department (ECD).

Regarding the findings of 24hr average ambient air concentrations monitored around the proposed development project located in Yangon Region, the existing baseline particulates level PM10 and PM 2.5 of all locations met the guideline except some locations including Location (PM1) and location (PM 4) which are located in the urban area (Kyimyindaing Township) and preiurban area (Hlaingthaya Township) respectively comparing to other rural locations in the Tawnte Township.

### 1. Introduction

The ambient air monitoring had been conducted in the vicinity within 2km around the proposed New Yangon City project located at Twantay Township, Yangon Region, where people are spending several hours working both weekdays and weekends.

### 2. Objective

It was aimed to reveal the existing baseline ambient air quality around the project site.

### **3** Ambient air monitoring locations

Locations of air sampling stations are listed in **Table 3-1**. The air quality sampling methodology used for this project is described in the annex.

- Point 1 Kyimyindaing Township
- Point 2 Apyin Badan village, Hlaingthaya Township
- Point 3 Phayar Ngu village, Tawnte Township
- Point 4 Lower Tamar Takaw village, Tawnte Township
- Point 5 Upper Tamar Takaw village Tawnte Township,
- Point 6 Ma Ngay village, Tawnte Township
- Point 7 Lay Eain village, Tawnte Township
- Point 8 Taman Gyi village, Tawnte Township
- Point 9 Kon Tar village, Tawnte Township

Table 3.1	Air comr	ling loss	tions for	hasalina	GURMON	Fohrmory	2010
Table 3.1	All'salli	Jiing loca	uons ior	Dasenne	survey,	repruary,	2019

		Coordinates		Start	
Points	Locations	Ν	Ε	Date	<b>End Date</b>
1	Air monitoring station Location (PM-1) at Kyi Myin Daing	16°48'16.70"	96° 7'37.95"	15.2.2019	16.2.2019
2	Air monitoring station Location (PM-4) at Apyin Badan village, Hlaingthaya Township	16°51'41.06"	96° 1'45.47"	16.2.2019	17.2.2019
3	Air monitoring station Location (PM-5) at Phayar Ngu village, Tawnte Township	16°50'58.15"	96° 2'16.11"	17.2.2019	18.2.2019
4	Air monitoring station Location (PM-14) at Lower Tamar Takaw village, Tawnte Township	16°49'53.36"	96° 2'45.09"	18.2.2019	19.2.2019
5	Air monitoring station Location (PM-15) at Upper Tamar Takaw village, Tawnte Township	16°49'4.61"	96° 2'40.33"	19.2.2019	20.2.2019

6	Air monitoring station Location (PM-12) at Ma Ngay village, Tawnte Township	16°49'22.43"	96° 4'5.88"	20.2.2019	21.2.2019
7	Air monitoring station Location (PM-16) at Lay Eain village, Tawnte Township	16°48'36.47"	96° 2'2.24"	21.2.2019	22.2.2019
8	Air monitoring station Location (PM-8) at Taman Gyi village, Tawnte Township	16°48'5.76"	96° 1'44.96"	22.2.2019	23.2.2019
9	Air monitoring station Location (PM-10) at Kon Tar village, Tawnte Township	16°47'42.47"	96° 2'38.58"	23.2.2019	24.2.2019

**3.1** Point (1): The existing baseline ambient air monitoring location (PM-1), Kyimyindaing Township



Figure 3.1: Location map of ambient air monitoring at (PM-1), Kyimyindaing Township



Figure 3.2: Ambient air monitoring at point PM-1, Kyimyindaing Township

The PM-1 is located at the Kyimyindaing Township which is approximately 2 km radius around the proposed project site. Regarding particulates, Table 3.2 presents both the 24hr average levels of PM10 (72  $\mu$ g/m<sup>3</sup>) and PM 2.5 (50  $\mu$ g/m<sup>3</sup>) did not meet the National Environmental Air Quality Guidelinby ECD.

Parameters	Concentration	National Environmental Air				
	(24hr average) except some	Quality Guideline (ECD)/WHO				
	Gases (NO2, CO and O3)*	Guideline (24hr average)				
PM10	72 <sup>a</sup> (2 <sup>b</sup> -119 <sup>c</sup> ) μg/m <sup>3</sup>	50 μg/m <sup>3</sup>				
PM 2.5(µg/m <sup>3</sup> )	50 <sup>a</sup> (1 <sup>b</sup> -92 <sup>c</sup> ) μg/m3	25 μg/m <sup>3</sup>				
Remark:						
There were 28 times of car passing around by the monitoring area.						

Fable 3.2:	Ambient	air mor	nitoring	at point	(PM-1).	. Kvin	vindaing
	morene		mor mg	at point	(	, 1xy111	'y maanig

<sup>*a*</sup> Average <sup>*b*</sup> Min <sup>*c*</sup> Max

Referring to National Environmental Air Quality Guideline (ECD), the color codes are categorized in order to reveal the general air quality status around the project area.

Green – meets the standards

Yellow (slightly over)

Orange (exceeding)

**3.2** Point (2): The existing baseline ambient air monitoring at Location (PM-4), Apyin Badan village, Hlaingthaya Township



Figure 3.3: Location map of ambient air monitoring at point (PM-4), Apyin Badan village



Figure 3.4: Ambient air monitoring at point PM-4, Apyin Badan village

The PM-4 is located approximately 3 km radius around the proposed project site. Regarding particulates, Table 3.3 presents both the 24hr average levels of PM10 (55  $\mu$ g/m<sup>3</sup>) and PM 2.5 (36  $\mu g/m^3$ ) which did not meet the National Environmental Air Quality Guideline (ECD).

Table 5.5. Allible	Table 5.5. Amblent an monitoring at point (1 11-4), Apyin Datan vinage						
Parameters	Concentration	National Environmental Air					
	(24hr average) except some	Quality Guideline (ECD)/WHO					
	Gases (NO2, CO and O3)*	Guideline (24hr average)					
PM10	55 <sup>a</sup> (2 <sup>b</sup> -160 <sup>c</sup> ) μg/m <sup>3</sup>	50 μg/m <sup>3</sup>					
PM 2.5(µg/m <sup>3</sup> )	36 <sup>a</sup> (1 <sup>b</sup> -97 <sup>c</sup> ) μg/m3	25 μg/m <sup>3</sup>					
Remark:							
There were 52 times of truck car, 48 times of car and 160 times of motor cycle passing							

Table 3.3: Ambient air monitorir	g at	point (	(PM-4)	, Ap	yin	Badan	village
----------------------------------	------	---------	--------	------	-----	-------	---------

around by the monitoring area.

<sup>a</sup>, Average <sup>b</sup> Min <sup>c</sup>Max

Referring to National Environmental Air Quality Guideline (ECD), the color codes are categorized in order to reveal the general air quality status around the project area.

Green – meets the standards

Yellow (slightly over)

Orange (exceeding)

Environmental Quality Management

**3.3** Point (3): The existing baseline ambient air monitoring at Location (PM-5), Phayar Ngu village, Tawnte Township



Figure 3.5: Ambient air monitoring at point (PM-5), Phayar Ngu village



Figure 3.6: Ambient air monitoring at point PM-5, Phayar Ngu

The PM-5 2 is located approximately 2 km radius around the proposed project site. Regarding particulates, Table 3.4 presents the levels of PM10 ( $54\mu g/m^3$ ) did not met the guideline and PM 2.5 ( $24\mu g/m^3$ ) which more or less met the National Environmental Air Quality Guideline (ECD).

Table 3.4. Amblent an monitoring at point (1 M-3), I hayar Ngu vinage						
Parameters	Concentration	National Environmental Ai				
	(24hr average) except some	Quality Guideline (ECD)/WHO				
	Gases (NO2, CO and O3)*	Guideline (24hr average)				
PM10	$54^{a}(2^{b}-120^{c}) \ \mu g/m^{3}$	$50 \ \mu g/m^3$				
PM 2.5(µg/m <sup>3</sup> )	24 <sup>a</sup> (1 <sup>b</sup> -73 <sup>c</sup> ) μg/m3	25 μg/m <sup>3</sup>				
Remark:						
There were 8 times of car and 14 times of motor cycle passing around by the monitoring						
area.						

<b>Fable 3.4: Ambient air monitoring at p</b>	ooint (PM-5), Phayar Ngu village
-----------------------------------------------	----------------------------------

<sup>a</sup> Average <sup>b</sup> Min <sup>c</sup>Max

Referring to National Environmental Air Quality Guideline (ECD), the color codes are categorized in order to reveal the general air quality status around the project area. Green – meets the standards Yellow (slightly over)

Yellow (slightly over)

Orange (exceeding)
3.4 Point (4): The existing baseline ambient air monitoring at Location (PM-14), Lower Tamar Takaw village, Tawnte Township



Figure 3.7: Location map of ambient air monitoring at point (PM-14), Lower Tamar Takaw village



Figure 3.8: Ambient air monitoring at point PM-14, Lower Tamar Takaw village

The PM-14 is located within the proposed project site. Regarding particulates, Table 3.5 presents both the levels of PM10 (32  $\mu$ g/m<sup>3</sup>) and PM 2.5 (24  $\mu$ g/m<sup>3</sup>) which met the National Environmental Air Quality Guideline (ECD) (24hr average).

Parameters	Concentration	National Environmental Air			
	(24hr average) except some	Quality Guideline (ECD)/WHO			
	Gases (NO2, CO and O3)*	Guideline (24hr average)			
PM10	$32^{a}(2^{b}-84^{c}) \mu g/m^{3}$	$50 \ \mu g/m^3$			
PM 2.5(µg/m <sup>3</sup> )	20 <sup>a</sup> (1 <sup>b</sup> -73 <sup>c</sup> ) μg/m3	25 μg/m <sup>3</sup>			
Remark:					
There were 9 times of car and 21 times of motor cycle passing around by the monitoring					
area.					

Table 3.5: Ambient air monitoring at point (PM-14), Lower Tamar Takaw

,<sup>a</sup> Average <sup>b</sup> Min <sup>c</sup>Max

Referring to National Environmental Air Quality Guideline (ECD), the color codes are categorized in order to reveal the general air quality status around the project area.

Green – meets the standards

Yellow (slightly over)

3.5 Point (5): The existing baseline ambient air monitoring at Location (PM-5), Upper Tamar Takaw, Tawnte Township



Figure 3.9: Location map of ambient air monitoring at point (PM-15), Upper Tamar Takaw



Figure 3.10: Ambient air monitoring at point PM-15, Upper Tamar Takaw village

The PM-15 is located within the proposed project site. Regarding particulates, Table 3.6 presents both the levels of PM10 (43  $\mu$ g/m<sup>3</sup>) and PM 2.5 (28 $\mu$ g/m<sup>3</sup>) which met the National Environmental Air Quality Guideline (ECD) (24hr average).

Parameters	Concentration	National Environmental Air				
	(24hr average) except some	Quality Guideline (ECD)/WHO				
	Gases (NO2, CO and O3)*	Guideline (24hr average)				
PM10	$43^{a}(2^{b}-148^{c}) \mu g/m^{3}$	$50 \ \mu g/m^3$				
PM 2.5(µg/m <sup>3</sup> )	28 <sup>a</sup> (1 <sup>b</sup> -124 <sup>c</sup> ) μg/m3	25 μg/m <sup>3</sup>				
Remark:						
There were 19 times of car and 44 times of motor cycle passing around by the monitoring						

Table 3.6: Ambient air monitoring at point (PM-15), Upper Tamar Takaw Village

There were 19 times of car and 44 times of motor cycle passing around by the ind area. And aslo, 1 generator was running 9 hours near the monitoring area.

,<sup>a</sup> Average <sup>b</sup> Min <sup>c</sup>Max

Referring to National Environmental Air Quality Guideline (ECD), the color codes are categorized in order to reveal the general air quality status around the project area.

Green – meets the standards

Yellow (slightly over)

**3.6** Point (6): The existing baseline ambient air monitoring at Location (PM-12), Ma Ngay village, Tawnte Township



Figure 3.11: Location map of ambient air monitoring at point (PM-12), Ma Ngay village



Figure 3.12: Ambient air monitoring at point PM-12, Ma Ngay village

The PM-12 is located within the proposed project site. Regarding particulates, Table 3.7 presents both the levels of PM10 (41  $\mu$ g/m<sup>3</sup>) and PM 2.5 (26  $\mu$ g/m<sup>3</sup>) which met the National Environmental Air Quality Guideline (ECD) (24hr average).

Parameters	Concentration	National Environmental Air					
	(24hr average) except some	Quality Guideline (ECD)/WHO					
	Gases (NO2, CO and O3)*	Guideline (24hr average)					
PM10	$41^{a}(2^{b}-155^{c}) \ \mu g/m^{3}$	$50 \ \mu g/m^3$					
PM 2.5(µg/m <sup>3</sup> )	26 <sup>a</sup> (6 <sup>b</sup> -204 <sup>c</sup> ) μg/m3	25 μg/m <sup>3</sup>					
Remark:							
There were 42 times of car and 122 times of motor cycle passing around by the monitoring							
area							

# Table 3.7: Ambient air monitoring at point (PM-12), Ma Ngay village

<sup>a</sup> Average <sup>b</sup> Min <sup>c</sup>Max

Referring to National Environmental Air Quality Guideline (ECD), the color codes are categorized in order to reveal the general air quality status around the project area.

Green – meets the standards

Yellow (slightly over)

Orange (exceeding)

**3.7** Point (7): The existing baseline ambient air monitoring at Location (PM-16), Lay Eain village, Tawnte Township



Figure 3.13: Location map of ambient air monitoring at point (PM-16), Lay Eain village



Figure 3.14: Ambient air monitoring at point PM-16, Lay Eain village

The PM-16 is located within the proposed project site. Regarding particulates, Table 3.8 presents both the levels of PM10 (40  $\mu$ g/m<sup>3</sup>) and PM 2.5 (24  $\mu$ g/m<sup>3</sup>) which met the National Environmental Air Quality Guideline (ECD) (24hr average).

Table 5.6. Amblent an monitoring at point (1301 10); Eay Lain vinage						
Parameters	Concentration	National Environmental Air				
	(24hr average) except some	Quality Guideline (ECD)/WHO				
	Gases (NO2, CO and O3)*	Guideline (24hr average)				
PM10	$40^{a}(2^{b}-166^{c}) \ \mu g/m^{3}$	$50 \ \mu g/m^3$				
PM 2.5(µg/m <sup>3</sup> )	24 <sup>a</sup> (1 <sup>b</sup> -158 <sup>c</sup> ) μg/m3	25 μg/m <sup>3</sup>				
Remark:						
There were 10 times of car and 22 times of motor cycle passing around by the monitoring						
area.						

Table 3.8: Ambient air monitoring at point (PM-16), Lay Eain village

<sup>a</sup> Average <sup>b</sup> Min <sup>c</sup>Max

Referring to National Environmental Air Quality Guideline (ECD), the color codes are categorized in order to reveal the general air quality status around the project area.

Green – meets the standards

Yellow (slightly over)

**3.8** Point (8): The existing baseline ambient air monitoring at Location (PM-8), Taman Gyi village, Tawnte Township



Figure 3.15: Location map of ambient air monitoring at point (PM-8), Taman Gyi village



Figure 3.16: Ambient air monitoring at point PM-8, Taman Gyi village

The PM-8 is located within the proposed project site. Regarding particulates, Table 3.9 presents both the levels of PM10 (44  $\mu$ g/m<sup>3</sup>) and PM 2.5 (26  $\mu$ g/m<sup>3</sup>) which were lower than the National Environmental Air Quality Guideline (ECD) adopted from WHO Guideline (24hr average).

Table 3.9. Amblent an monitoring at point (1 11-6), Taman Gyrvinage							
Parameters	Concentration	National Environmental Air					
	(24hr average) except some	Quality Guideline (ECD)/WHO					
	Gases (NO2, CO and O3)*	Guideline (24hr average)					
PM10	$44^{a}(2^{b}-173^{c}) \ \mu g/m^{3}$	$50 \ \mu g/m^3$					
PM 2.5(µg/m <sup>3</sup> )	26 <sup>a</sup> (1 <sup>b</sup> -166 <sup>c</sup> ) μg/m3	25 μg/m <sup>3</sup>					
Remark:							
There were 146 times of motor cycle passing around by the monitoring area.							

<b>Fable 3.9: Ambient air monitorin</b>	ig at point	(PM-8), Taman	ı Gyi village
-----------------------------------------	-------------	---------------	---------------

<sup>a</sup> Average <sup>b</sup> Min <sup>c</sup>Max

Referring to National Environmental Air Quality Guideline (ECD), the color codes are categorized in order to reveal the general air quality status around the project area.

Green – meets the standards

Yellow (slightly over)





Figure 3.17: Ambient air monitoring at point (PM-10), Kon Tar village



Figure 3.18: Ambient air monitoring at point PM-10, KonTar village

The PM-10 is located within the proposed project site. Regarding particulates, Table 3.10 presents both the levels of PM10 (39  $\mu$ g/m<sup>3</sup>) and PM 2.5 (20 $\mu$ g/m<sup>3</sup>) which met the National Environmental Air Quality Guideline (ECD) (24hr average).

Tuble Cilor Hills	Tuble 5:10: Timblent an montoring at point (1 11 10); Ron Tai vinage						
Parameters	Concentration	National Environmental Air					
	(24hr average) except some	Quality Guideline (ECD)/WHO					
	Gases (NO2, CO and O3)*	Guideline (24hr average)					
PM10	$39^{a}(2^{b}-106^{c}) \ \mu g/m^{3}$	$50 \ \mu g/m^3$					
PM 2.5(µg/m <sup>3</sup> )	20 <sup>a</sup> (1 <sup>b</sup> -101 <sup>c</sup> ) μg/m3	25 μg/m <sup>3</sup>					
Remark:							
There were 8 times of car and 122 times of motor cycle passing around by the monitoring							
area.							

Table 3.10: Ambient air monitoring at point (PM-10), KonTar village

<sup>a</sup> Average <sup>b</sup> Min <sup>c</sup>Max

Referring to National Environmental Air Quality Guideline (ECD), the color codes are categorized in order to reveal the general air quality status around the project area.

Green – meets the standards

Yellow (slightly over)

# **Baseline Ambient Air Quality Monitoring Report**

# On

The proposed New Yangon City project located at the TwantayTownship, Yangon Region

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		Than Phyu Yone village	
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		Location (PM-17), Thone Eain village (Twantay Township)	
	3.3	Point (3) The existing baseline ambient air monitoring at	7
		Location (PM-6), Lat Pan village (Twantay Township)	
	3.4	Point (4) The existing baseline ambient air monitoring at	9
		Location (PM-7), Kan Hla village (Twantay Township)	
	3.5	Point (5) The existing baseline ambient air monitoring at	11
		Location (PM-9), Gyaungwaing Gyi village (Twantay Township)	
	3.6	Point (6) The existing baseline ambient air monitoring at	13
		Location (PM-2), Alat Chaung(Chaung Wa) village (Kyeemyindaing Tow	vnship)
	3.7	Point (7) The existing baseline ambient air monitoring at	15
		Location (PM-3), Kone village (Twantay Township)	
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# Table

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3.7	Ambient air monitoring at PM-2, Alat Chaung (Chaung Wa) village (Kyimyeendai	ng
	Township)	14
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# **FIGURES:**

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#### **Executive Summary**

In order to determine the existing baseline air quality status at and around the proposed New Yangon City project located at Twantay Township and Kyeemyindaing Township under the Yangon Region, the levels of ambient air parameters monitored throughout the survey period were compared with National Air Quality Guidelines, stated by Environmental Conservation Department (ECD) in 2015.

Regarding the findings of 24hr average ambient air concentrations monitored around the proposed Yangon New City project, the existing baseline particulates level PM10 and PM 2.5 did not meet the guidelines respectively except at point PM-13 (Agga Tan village) in which met the air quality guideline.

According to the field observation, the source of air pollutants mainly came from vehicles emissions.

# 1. Introduction

The ambient air monitoring had been conducted in the vicinity within 2km around the proposed New Yangon City project located at Twantay Township and Kyeemyindaing Township under the Yangon Region where people are spending several hours working both weekdays and weekends.

## 2. Objective

It was aimed to reveal the existing baseline ambient air quality at and around the project site.

### 3 Ambient air monitoring locations

Locations of air sampling stations are listed in **Table 3-1**. The air quality sampling methodology used for this project is described in the annex.

- Point 1 Than Phyu Yone village
- Point 2 Thone Eain village
- Point 3 Lat Pan village
- Point 4 Kan Hla village
- Point 5 Gyaungwaing Gyi village
- Point 6 Alat Chaung(Chaung Wa) village
- Point 7 Kone village
- Point 8 Mya Kan Thar village
- Point 9 Agga Tan village

### Table 3.1 Air sampling locations for baseline survey, March, 2019

		Coordinates		Start	
Points	Locations	Ν	Ε	Date	<b>End Date</b>
1	Air monitoring station Location (PM-18) Than Phyu Yone village	16°44'8.85"	96° 1'44.65"	12.3.2019	13.3.2019
2	Air monitoring station Location (PM-17) at Thone Eain village	16°45'2.96"	96° 2'24.32"	13.3.2019	14.3.2019
3	Air monitoring station Location (PM-6) at Lat Pan village	16°45'45.60"	96° 4'4.66"	14.3.2019	15.5.2019
4	Air monitoring station Location (PM-7) at Kan Hla village	16°45'33.03"	96° 5'22.71"	15.3.2019	16.3.2019
5	Air monitoring station Location (PM-9) at Gyaungwaing Gyi village	16°47'10.58"	96° 5'51.59"	16.3.2019	17.3.2019
6	Air monitoring station Location (PM-2) at Alat Chaung(Chaung Wa) village	16°48'20.42"	96° 6'50.53"	17.3.2019	18.3.2019
7	Air monitoring station Location (PM-3) at Kone village	16°48'21.33"	96° 5'59.32"	18.3.2019	19.3.2019

8	Air monitoring station Location (PM-11) at Mya Kan Thar village	16°43'23.42"	95°56'0.40"	19.3.2019	20.2.2019
9	Air monitoring station Location (PM-13) at Agga Tan village	16°39'24.30"	95°49'25.79"	20.3.2019	21.3.2019

**3.1** Point (1): The existing baseline ambient air monitoring location (PM-18), Than Phyu Yone village (Twantay Township)



Figure 3.1: Map of ambient air monitoring at (PM-18), Than Phyu Yone village



Figure 3.2: Ambient air monitoring at point PM-18, Than Phyu Yone village

The PM-18 is located within the proposed project site. Regarding particulates, Table 3.2 presents both the levels of PM10 ( $62 \ \mu g/m^3$ ) and PM 2.5 ( $38 \ \mu g/m^3$ ) did not meet the National Air Quality Guideline (ECD) adopted from WHO Guideline (24hr average).

Table 3.2: Ambient air	monitoring at point	(PM-18), Than	Phyu Yone	e village (Twanta	ıy
Township)					

Parameters	Concentration (24hr average)	National Environmental Air Quality Guideline (ECD)/WHO Guideline (24hr average)	
PM10	$62^{a}(2^{b}-162^{c}) \mu g/m^{3}$	50 μg/m³	
PM 2.5(µg/m <sup>3</sup> )	38 <sup>a</sup> (1 <sup>b</sup> -176) μg/m3	25 μg/m <sup>3</sup>	
Remark:			
There were approximate 49 times of motor cycle passing by the monitoring area.			

<sup>*a*</sup> Average <sup>*b*</sup> Min <sup>*c*</sup> Max

Referring to National Environmental Air Quality Guideline (ECD), the color codes are categorized in order to reveal the general air quality status around the project area.

Green – meets the standards

Yellow (slightly over)





Figure 3.3: Map of ambient air monitoring at point (PM-17), Thone Eain village



Figure 3.4: Ambient air monitoring at point PM-17, Thone Eain village

The PM-17 is located within the proposed project site. Regarding particulates, Table 3.3 presents both the levels of PM10 (68  $\mu$ g/m<sup>3</sup>) and PM 2.5 (38  $\mu$ g/m<sup>3</sup>) which did not meet the National Air Quality Guideline (ECD) adopted from WHO Guideline (24hr average).

Cable 3.3: Ambient air monitoring at point (PM-17), Thone Eain village (Twanta)	y
'ownship)	

Parameters	Concentration (24hr average)	National Environmental Air Quality Guideline (ECD)/WHO Guideline (24hr average)	
PM10	68 <sup>a</sup> (2 <sup>b</sup> -195 <sup>c</sup> ) μg/m <sup>3</sup>	50 μg/m³	
PM 2.5(µg/m <sup>3</sup> )	38ª(1 <sup>b</sup> 127 <sup>c</sup> ) μg/m3	25 μg/m <sup>3</sup>	
Remark:			
There were 26 times of car and 78 times of motor cycle passing by the monitoring area.			

,<sup>a</sup> Average <sup>b</sup> Min <sup>c</sup>Max

Referring to National Environmental Air Quality Guideline (ECD), the color codes are categorized in order to reveal the general air quality status around the project area.

Green – meets the standards

Yellow (slightly over)

**3.3** Point (3): The existing baseline ambient air monitoring at Location (PM-6), Lat Pan village (Twantay Township)



Figure 3.5: Map of ambient air monitoring at point (PM-6), Lat Pan village



Figure 3.6: Ambient air monitoring at point PM-6, Lat Pan village

The PM-6 is located within the proposed project site. Regarding particulates, Table 3.4 presents both the levels of PM10 (63  $\mu$ g/m<sup>3</sup>) and PM 2.5 (39  $\mu$ g/m<sup>3</sup>) which did not meet the National Air Quality Guideline (ECD) adopted from WHO Guideline (24hr average).

Parameters	Concentration (24hr average)	National Environmental Air Quality Guideline (ECD)/WHO Guideline (24hr average)	
PM10	$63^{a}(2^{b}-181^{c}) \mu g/m^{3}$	50 μg/m <sup>3</sup>	
PM 2.5(µg/m <sup>3</sup> )	39 <sup>a</sup> (1 <sup>b</sup> -144 <sup>c</sup> ) μg/m3	25 μg/m <sup>3</sup>	
Remark:			
There were 6 times of car and 24 times of motor cycle passing by the monitoring area.			

<sup>a</sup> Average <sup>b</sup> Min <sup>c</sup>Max

Referring to National Environmental Air Quality Guideline (ECD), the color codes are categorized in order to reveal the general air quality status around the project area.

Green – meets the standards

Yellow (slightly over)

3.4 Point (4): The existing baseline ambient air monitoring at Location (PM-7), Kan Hla village



Figure 3.7: Map of ambient air monitoring at point (PM-7), Kan Hla village



Figure 3.8: Ambient air monitoring at point PM-7, Kan Hla village

The PM-7 is located within the proposed project site. Regarding particulates, Table 3.5 presents both the levels of PM10 (78  $\mu$ g/m<sup>3</sup>) and PM 2.5 (49  $\mu$ g/m<sup>3</sup>) which did not meet the National Air Quality Guideline (ECD) adopted from WHO Guideline (24hr average).

Table 3.5: Ambie	nt air monitoring at point (PM-7	7), Kan Hla village (Twantay
Township)		

Parameters	Concentration (24hr average) except some Gases (NO2, CO and O3)*	National Environmental Air Quality Guideline (ECD)/WHO Guideline (24hr average)	
PM10	$78^{a}(2^{b}-251^{c}) \mu g/m^{3}$	50 μg/m³	
PM 2.5(µg/m <sup>3</sup> )	49 <sup>a</sup> (1 <sup>b</sup> -151 <sup>c</sup> ) μg/m3	25 μg/m <sup>3</sup>	
Remark:			
There were 18 times of motor cycle passing by the monitoring area.			

,<sup>a</sup> Average <sup>b</sup> Min <sup>c</sup>Max

Referring to National Environmental Air Quality Guideline (ECD), the color codes are categorized in order to reveal the general air quality status around the project area.

Green – meets the standards

Yellow (slightly over)

**3.5** Point (5): The existing baseline ambient air monitoring at Location (PM-9), Gyaungwaing Gyi village (Twantay Township)



Figure 3.9: Map of ambient air monitoring at point (PM-9), Gyaungwaing Gyi village



Figure 3.10: Ambient air monitoring at point PM-9, Gyaungwaing Gyi village

The PM-9 is located within the proposed project site. Regarding particulates, Table 3.6 presents both the levels of PM10 ( $61\mu g/m^3$ ) and PM 2.5 ( $44\mu g/m^3$ ) which did not meet the National Air Quality Guideline (ECD) adopted from WHO Guideline (24hr average).

Table 3.6: Ambie	nt air monito	ring at poi	nt (PM-9), (	Gyaungv	waing G	yi Village ('	Twantay
Township)							
	0	· · ·		NT 4	1 .	4 1 4	•

Parameters	Concentration (24hr average) except some Gases (NO2, CO and O3)*	National Environmental Air Quality Guideline (ECD)/WHO Guideline (24hr average)	
PM10	$61^{a}(2^{b}-144^{c}) \mu g/m^{3}$	50 μg/m <sup>3</sup>	
PM 2.5(µg/m³)	44 <sup>a</sup> (1 <sup>b</sup> -116 <sup>c</sup> ) μg/m3	25 μg/m <sup>3</sup>	
Remark:			
There were 36 times of car and 180 times of motor cycle passing by the monitoring area.			

And also, there were 1 generator running for 5 hours near the monitoring area.

,<sup>a</sup> Average <sup>b</sup> Min <sup>c</sup>Max

Referring to National Environmental Air Quality Guideline (ECD), the color codes are categorized in order to reveal the general air quality status around the project area.

Green – meets the standards

Yellow (slightly over)

3.6 Point (6): The existing baseline ambient air monitoring at Location (PM-2), Alat Chaung(Chaung Wa) village (Kyeemyindaing Township)



Figure 3.11: Map of ambient air monitoring at point (PM-2), Alat Chaung(Chaung Wa) village



Figure 3.12: Ambient air monitoring at point PM-2, Alat Chaung(Chaung Wa) village

The PM-2 is located within the proposed project site. Regarding particulates, Table 3.7 presents both the levels of PM10 (68  $\mu$ g/m<sup>3</sup>) and PM 2.5 (52  $\mu$ g/m<sup>3</sup>) which did not meet the National Air Quality Guideline (ECD) adopted from WHO Guideline (24hr average).

Гаble 3.7: Ambient air monitoring at point (PM-2), Alat Chaung (Chaung Wa) vill	age
(Kyeemyindaing Township)	

Parameters	Concentration (24hr average) except some Gases (NO2, CO and O3)*	National Environmental Air Quality Guideline (ECD)/WHO Guideline (24hr average)	
PM10	$68^{a}(2^{b}-189^{c}) \ \mu g/m^{3}$	50 μg/m <sup>3</sup>	
PM 2.5(µg/m <sup>3</sup> )	52 <sup>a</sup> (1 <sup>b</sup> -150 <sup>c</sup> ) μg/m3	25 μg/m <sup>3</sup>	
Remark:			
There were 32 times of car and 360 times of motor cycle passing by the monitoring area			

<sup>a</sup> Average <sup>b</sup> Min <sup>c</sup>Max

Referring to National Environmental Air Quality Guideline (ECD), the color codes are categorized in order to reveal the general air quality status around the project area.

Green – meets the standards

Yellow (slightly over)





Figure 3.13: Map of ambient air monitoring at point (PM-3), Kone village



Figure 3.14: Ambient air monitoring at point PM-3, Kone village

The PM-3 is located within the proposed project site. Regarding particulates, Table 3.8 presents both the levels of PM10 (63  $\mu$ g/m<sup>3</sup>) and PM 2.5 (39  $\mu$ g/m<sup>3</sup>) which were higher than the National Air Quality Guideline (ECD) adopted from WHO Guideline (24hr average).

<b>Fable 3.8: Ambie</b>	nt air monitoring at point (PM-	-3), Kone village (Twantay Township)
	Concentration	National Environmental Air

Parameters	Concentration (24hr average) except some Gases (NO2, CO and O3)*	National Environmental Air Quality Guideline (ECD)/WHO Guideline (24hr average)		
PM10	$63^{a}(2^{b}-154^{c}) \mu g/m^{3}$	50 μg/m <sup>3</sup>		
PM 2.5(µg/m <sup>3</sup> )	39 <sup>a</sup> (1 <sup>b</sup> -116 <sup>c</sup> ) μg/m3	25 μg/m <sup>3</sup>		
Remark:				
There were 22 times of motor cycle passing by the monitoring area				

<sup>a</sup> Average <sup>b</sup> Min <sup>c</sup>Max

Referring to National Environmental Air Quality Guideline (ECD), the color codes are categorized in order to reveal the general air quality status around the project area.

Green – meets the standards

Yellow (slightly over)

# **3.8** Point (8): The existing baseline ambient air monitoring at Location (PM-11), Mya Kan Thar village (Twantay Township)



Figure 3.15: Map of ambient air monitoring at point (PM-11), Mya Kan Thar village



Figure 3.16: Ambient air monitoring at point PM-11, Mya Kan Thar village

The PM-11 is located within the proposed project site. Regarding particulates, Table 3.9 presents both the levels of PM10 (58  $\mu$ g/m<sup>3</sup>) and PM 2.5 (42  $\mu$ g/m<sup>3</sup>) which did not meet the National Air Quality Guideline (ECD) adopted from WHO Guideline (24hr average).

Table 3.9: Am	bient air monit	oring at point (I	PM-11), Mya	Kan Thai	· village (Twantay
Township)					

Parameters	Concentration (24hr average) except some Gases (NO2, CO and O3)*	National Environmental Air Quality Guideline (ECD)/WHO Guideline (24hr average)		
PM10	$58^{a}(2^{b}-167^{c}) \mu g/m^{3}$	50 μg/m <sup>3</sup>		
PM 2.5(µg/m <sup>3</sup> )	42 <sup>a</sup> (1 <sup>b</sup> -132 <sup>c</sup> ) μg/m3	25 μg/m <sup>3</sup>		
Remark:				
There were 42 times of motor cycle, 28 times of motor boat and 60 times ferryboat passing				
by the monitoring area.				

<sup>a</sup> Average <sup>b</sup> Min <sup>c</sup>Max

Referring to National Environmental Air Quality Guideline (ECD), the color codes are categorized in order to reveal the general air quality status around the project area.

Green – meets the standards

Yellow (slightly over)

# **3.9** Point (9): The existing baseline ambient air monitoring at Location (PM-13), Agga Tan village (Twantay Township)



Figure 3.17: Map of ambient air monitoring at point (PM-13), Agga Tan village



Figure 3.18: Ambient air monitoring at point PM-13, Agga Tan village

The PM-13 is located within the proposed project site. Regarding particulates, Table 3.10 presents the levels of PM10 (50  $\mu$ g/m<sup>3</sup>) met the guideline and PM 2.5 (27 $\mu$ g/m<sup>3</sup>) which more or less meet the National Air Quality Guideline (ECD) adopted from WHO Guideline (24hr average).

Table 3.10: Ambient air monitoring at point	(PM-13), Agga	Tan village (Twantay
Township)		

Parameters	Concentration (24hr average) except some Gases (NO2, CO and O3)*	National Environmental Air Quality Guideline (ECD)/WHO Guideline (24hr average)
PM10	$50^{\rm a}(2^{\rm b}-246^{\rm c})\ \mu g/m^3$	$50 \ \mu g/m^3$
PM 2.5(µg/m <sup>3</sup> )	$27^{a}(1^{b}-143^{c}) \ \mu g/m3$	25 μg/m <sup>3</sup>
Remark:		

There were 8 times of car, 12 times of motor cycle and 40 times of motor boat passing by the monitoring area.

<sup>a</sup> Average <sup>b</sup> Min <sup>c</sup>Max

Referring to National Environmental Air Quality Guideline (ECD), the color codes are categorized in order to reveal the general air quality status around the project area.

Green – meets the standards

Yellow (slightly over)

#### Environmental Baseline Survey for New Yangon Development Project, Yangon Region

#### 1. Field Survey

REM team was conducted the environmental baseline survey to know the existing Environmental condition around the area in Yangon Region.

There are 27 locations of noise level, 24 locations of surface water quality, 24 locations of groundwater quality and 24 locations of soil quality were surveyed. Terrestrial ecology and biodiversity survey were also carried out in and around the project area.

#### 1.1 Noise Level

#### Survey Item

Myanmar government issued the National Environmental Quality (Emission) Guidelines in 2015 and thus the survey result was evaluated by comparing with this standard.

			Environmental Standard (Myanmar)		
No.	No. Parameter		Category	Day time 7:00-22:00	Night time 22:00-7:00
1	A-weighted loudness equivalent (L <sub>Aeq</sub> )	dB	Residential, educational, institutional	55	45

Table 1.1-1         Survey parameters for noise level	Table 1.1-1	Survey parameters	for noise le	vel
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Source: National Environmental Quality (Emission) Guidelines, 2015

#### Summary of sampling points

The detail of the locations of noise level monitoring points are shown below.

#### Table 1.1-2Locations of noise level monitoring points

No	Sample ID	Coordinates	Site Description
1	N-1	16°48'14.60"N 96° 7'24.20"E	Bagayar Street, Near Kyimyindaing Railway Station, Kyeemyindaing Township, Possible noise sources may came from traffic and residents activities.
2	N-2	16°48'17.70"N 96° 6'51.30"E	Alat Chaung Village, Kyeemyindaing Township, Possible noise sources may come from traffic and residents activities.
3	N-3	16°48'20.88"N 96° 5'56.64"E	Kon Ywa,Twantay Township, Possible noise sources may came from motorbike and residents activities

4	N-4	16°51'51.47"N 96° 2'9.06"E	Near Pann Hlaing Bridge, beside of Hlaingthayar – Twantay road, Hlaingthayar Township. Possible noise sources may came from traffic and residents activities.
5	N-5	16°51'36.91"N 96° 1'47.17"E	Apyin Padan Village, Hlaingthayar Township. Possible noise sources may came from traffic, motorbike and residents activities.
6	N-6	16°50'57.95"N 96° 2'15.45"E	Aung Taw Mu Pagoda, Twantay Township, beside of Hlaingthayar – Twantay road. Possible noise sources may came from motorbike and residents activities.
7	N-7	16°49'28.75"N 96° 5'1.59"E	About 0.67km southwest of Wayonzeik Village,Twantay Township. located at the beside of Ayeywa to Wayonzeik assess road. Unusual noise may be come from motorbike.
8	N-8	16°45'43.10"N 96° 4'6.20"E	Let Pan Gwa Village, Twantay Township. Unusual noise may be come from motorbike and resident activities.
9	N-9	16°45'37.33"N 96° 5'20.82"E	Near about 0.37km west of Kanaungto bridge. Possible noise sources may came from traffic, motorbike and residents activities.
10	N-10	16°47'46.82"N 96° 1'53.74"E	Junction of Kan Ywa assess road and Twantay-Hlaingthaya road. Possible noise sources may came from traffic, motorbike and residents activities.
11	N-11	16°48'9.60"N 96° 1'48.38"E	Tamangyi Village,Twantay Township, Possible noise sources may came from traffic, motorbike and residents activities.
12	N-12	16°49'33.20"N 96° 2'10.09"E	Beside of Twantay-Hlaingthaya Road, Near about 1.52km north of Le Eain village. Possible noise sources may came from traffic, motorbike and residents activities.
13	N-13	16°47'2.21"N 96° 5'22.77"E	Gyaung Waing Village, Twantay Township, Possible noise sources may came from motorbike and residents activities.
14	N-14	16°48'25.28"N 96° 5'12.00"E	Near about 1.2km west of Kone Ywa Village,Twantay Township, Unusual noise may be come from generator running and resident activities.
15	N-15	16°48'16.87"N 96° 3'12.51"E	Near about 1.68km northeast of Kun Ta Village,Twantay Township, Unusual noise may be come from speaker, air craft and resident activities.
16	N-16	16°47'36.18"N 96° 2'34.81"E	Monestry of Kun Ta Village, Twantay Township, Unusual noise may be come from speaker, air craft, motorbike and resident activities.
17	N-17	16°43'32.12"N 95°56'8.18"E	Located at the beside of Maubin- Twantay road, near Mya Kanthar Village,Twantay Township. Possible noise sources may came from traffic activity.
18	N-18	16°39'26.96"N 95°49'33.88"E	Near Raw water pipeline and Pan Hlaing/A Ka Htan Village,Twantay Township. Possible noise source may be come from water transportation activity and residential activity.
19	N-19	16°49'19.78"N 96° 4'6.53"E	Monestry compound of Ma nge-Ale ywa village,Twantay Township. Possible noise source may be come from speaker and residential activity.
----	------	--------------------------------	---------------------------------------------------------------------------------------------------------------------------------------------------------
20	N-20	16°51'32.07"N 96° 2'44.88"E	Okkan Thaung Kyar Village, Hlaingthayar Township. Possible noise source may be come from traffic, motorbike and residential activity.
21	N-21	16°51'21.22"N 96° 2'9.82"E	Near about 0.42km south of Pan Hlaing Bridge and beside of Hlaingthayar - Twantay road. Possible noise source may be come from traffic activity.
22	N-22	16°49'59.56"N 96° 2'45.16"E	Ta ma ta kaw Auk,Twantay Township, Possible noise source may be come from residential activity.
23	N-23	16°49'15.40"N 96° 2'45.52"E	Ta ma ta kaw atet, Twantay Township, Possible noise source may be come from residential activity.
24	N-24	16°48'44.35"N 96° 1'59.80"E	Lay Eain Village, Twantay Township, Possible noise source may be come from traffic and residential activity.
25	N-25	16°44'59.77"N 96° 2'15.21"E	Located at the primary school compound of Thon ein Village, School,Twantay Township. Possible noise source may be come from residential activity.
26	N-26	16°44'8.07"N 96° 1'47.09"E	Installed at the monestry compound of Thanbyuyon village,Twantay Township. Possible noise source may be come from residential activity.
27	N-27	16°44'32.61"N 96° 2'49.95"E	Conducted at Kaladan Village, Twantay Township Possible noise source may be come from residential activity and motorbike.



Figure 1.1-1 Location map of noise level monitoring points

### Survey Period

Noise level survey was conducted 48 hours as one weekday and one weekend consecutively. The measurement duration is shown in Table 1.1-3.

Somulo ID	Duration		
Sample ID	Weekday	Weekend	
N-1	18 <sup>th</sup> – 19 <sup>th</sup> February, 2019	16 <sup>th</sup> – 17 <sup>th</sup> February, 2019	
N-2	18 <sup>th</sup> – 19 <sup>th</sup> February, 2019	17 <sup>th</sup> – 18 <sup>th</sup> February, 2019	
N-3	22 <sup>nd</sup> – 23 <sup>rd</sup> February, 2019	23 <sup>rd</sup> – 24 <sup>th</sup> February, 2019	
N-4	18 <sup>th</sup> – 19 <sup>th</sup> February, 2019	16 <sup>th</sup> – 17 <sup>th</sup> February, 2019	
N-5	18 <sup>th</sup> – 19 <sup>th</sup> February, 2019	16 <sup>th</sup> – 17 <sup>th</sup> February, 2019	
N-6	18 <sup>th</sup> – 19 <sup>th</sup> February, 2019	16 <sup>th</sup> – 17 <sup>th</sup> February, 2019	

Table 1.1-3Survey duration for Noise Level

N-7	21 <sup>st</sup> – 22 <sup>nd</sup> February, 2019	23 <sup>rd</sup> – 24 <sup>th</sup> February, 2019
N-8	18 <sup>th</sup> – 19 <sup>th</sup> February, 2019	17 <sup>th</sup> – 18 <sup>th</sup> February, 2019
N-9	25 <sup>th</sup> -26 <sup>th</sup> February, 2019	23 <sup>rd</sup> – 24 <sup>th</sup> February, 2019
N-10	25 <sup>th</sup> -26 <sup>th</sup> February, 2019	23 <sup>rd</sup> – 24 <sup>th</sup> February, 2019
N-11	21 <sup>st</sup> – 22 <sup>nd</sup> February, 2019	23 <sup>rd</sup> – 24 <sup>th</sup> February, 2019
N-12	25 <sup>th</sup> -26 <sup>th</sup> February, 2019	23 <sup>rd</sup> – 24 <sup>th</sup> February, 2019
N-13	25 <sup>th</sup> -26 <sup>th</sup> February, 2019	23 <sup>rd</sup> – 24 <sup>th</sup> February, 2019
N-14	25 <sup>th</sup> -26 <sup>th</sup> February, 2019	24 <sup>th</sup> – 25 <sup>th</sup> February, 2019
N-15	25 <sup>th</sup> -26 <sup>th</sup> February, 2019	24 <sup>th</sup> – 25 <sup>th</sup> February, 2019
N-16	25 <sup>th</sup> -26 <sup>th</sup> February, 2019	24 <sup>th</sup> – 25 <sup>th</sup> February, 2019
N-17	4 <sup>th</sup> – 5 <sup>th</sup> March, 2019	2 <sup>nd</sup> -3 <sup>rd</sup> March, 2019
N-18	4 <sup>th</sup> – 5 <sup>th</sup> March, 2019	2 <sup>nd</sup> -3 <sup>rd</sup> March, 2019
N-19	4 <sup>th</sup> – 5 <sup>th</sup> March, 2019	2 <sup>nd</sup> -3 <sup>rd</sup> March, 2019
N-20	4 <sup>th</sup> – 5 <sup>th</sup> March, 2019	2 <sup>nd</sup> - 3 <sup>rd</sup> March, 2019
N-21	4 <sup>th</sup> – 5 <sup>th</sup> March, 2019	2 <sup>nd</sup> - 3 <sup>rd</sup> March, 2019
N-22	4 <sup>th</sup> – 5 <sup>th</sup> March, 2019	2 <sup>nd</sup> - 3 <sup>rd</sup> March, 2019
N-23	4 <sup>th</sup> – 5 <sup>th</sup> March, 2019	2 <sup>nd</sup> - 3 <sup>rd</sup> March, 2019
N-24	$8^{th} - 9^{th}$ March, 2019	9 <sup>th</sup> – 10 <sup>th</sup> March, 2019
N-25	8 <sup>th</sup> – 9 <sup>th</sup> March, 2019	9 <sup>th</sup> – 10 <sup>th</sup> March, 2019
N-26	8 <sup>th</sup> – 9 <sup>th</sup> March, 2019	9 <sup>th</sup> – 10 <sup>th</sup> March, 2019
N-27	8 <sup>th</sup> – 9 <sup>th</sup> March, 2019	9 <sup>th</sup> – 10 <sup>th</sup> March, 2019





Figure 1.1-4 Survey activities of noise monitoring

### Survey Method

Measurement of environmental sound level was conducted by referring to the recommendation of International Organization for Standardization (ISO), i.e. ISO 1996-1:2003 and ISO 1996-2:2007. The instrumentation used for noise quality survey is shown in the following Table 1.1-4. Noise meter was set up to record the log as ten minutes intervals during survey period.

Table 1.1-4	Instrumentation	for noise survey
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Instrumentation	Description
Sound level meter	Sound level meter with SD Card, Model SL-4023SD

### Survey Result

All survey points of noise level (weekday/weekend) daytime and night time (LAeq) results were shown in Table 1.1-5. These results were compared by Myanmar National Environmental Quality (Emission) guideline from residential and commercial environment. The calculation method of raw noise data was used by the following array formula in the excel sheet was calculated one day LAeq. This formula is firstly used for hourly LAeq and then for the 24 hours LAeq.

10\*LOG10 (AVERGAE (10^ ((RANGE)/10))).

	Weekday		Weekend	
Sample ID	Daytime 7:00- 22:00	Night Time 22:00-7:00	Daytime 7:00- 22:00	Night Time 22:00-7:00
N-1	72	65	73	63
N-2	52	42	54	42
N-3	49	48	51	48
N-4	58	52	58	51
N-5	62	51	59	50
N-6	70	63	67	62
N-7	57	49	55	52
N-8	55	43	54	48
N-9	60	56	61	58
N-10	54	50	54	50
N-11	49	47	53	53
N-12	63	52	62	51
N-13	71	61	57	52
N-14	58	59	57	58
N-15	48	40	48	42
N-16	53	46	55	48
N-17	71	64	69	58
N-18	52	45	51	44
N-19	49	44	50	46
N-20	61	49	59	51
N-21	66	58	56	51
N-22	56	57	65	52
N-23	60	53	60	58
N-24	50	45	52	46
N-25	44	44	48	45
N-26	46	48	48	46
N-27	66	59	65	60

## Table 1.1-5A-weighted loudness equivalent (LAeq) level

Unit: dB(A)

## 1.2 Water quality

#### Survey Item

Parameters for water quality including both groundwater and surface water survey are determined so as to cover the parameters of existing environmental standards. There are 24 ground water sampling points as well as 24 surface water sampling points.

#### Summary of sampling points

The locations of sampling points are shown in following tables. The detail of each sampling point is described below.

Sampling Points	Coordinates	Description of Sampling Points
CW 1A	16°48'14.48"N	The GW-1 points are Obo ward, Kyi Myintdaing Township. The sampling
GW-IA	96° 7'23.00"E	points A, B and C are same depth 120 ft. The residents utilize as domestic
GW-1B	16°48'14.52"N	water The wells are situated distance 0.16 km from Hlaing River and have
GWID	96° 7'24.51"E	
GW-1C	16°48'13.27"N	the samity in sampling water.
	96° /'20.81"E	
GW-2A	16°48'11.4/" 96° 6'44 60"E	
	16°48'12.15"N	The sampling points are situated at the Alat Chaung village. The well depth of
GW-2B	96° 6'45.23"E	the GW-2A is 90 ft, B is 140 ft and C is 110 ft depth. The villagers are using domestic water
GW-2C	16°48'12.07"N	domestic water.
GW 20	96° 6'44.13"E	
GW-3A	96° 5'52.65"E	The ground water sampling points were collected at the Kone Ywa village.
CIN AD	16°48'22.50"N	The sampling well depth of GW-3A is 100 ft, B is 97 ft and C is 75 ft depth.
GW-3B	96° 5'51.21"E	The ground water are utilized domestic water.
GW-3C	16°48'22.81"N	
	96° 5'50.15"E	
GW-4A	96° 2'6.06"E	The GW-4A sampling point is located at the Tharaphy Soe Myint Factory
CWV 4D	16°51'41.58''N	The well depth is 240 ft and utilize as domestic water. GW-4B and C measured illegal residents and well depth are same 60 ft. The resident u
GW-4B	96° 2'6.60"E	
GW-4C	16°51'40.08"N 96° 2'2 40"E	domestic water.
	16°51'23 04"N	
GW-5A	96° 2'9.90"E	
CW 5R	16°51'21.90"N	The sampling points are lacated Pa Yar Ngu village. The GW-5A and B are same depth 140 ft. GW-5C well depth is 50 ft. The residents are utilized
GW-3D	96° 2'7.14"E	domestic water.
GW-5C	16°51'17.88"N 96° 2'6 12"F	
	16°50'48.96"N	
GW-6A	96° 1'58.08"E	
GW-6B	16°50'50.58"N	and B are well depth are same 40 ft. The sampling point C is 30 ft depth. The
	96° 2'1.08"E	residents are using only domestic water.
GW-6C	96° 2'3.24"E	
CIV 54	16°49'38.23"N	
GW-7A	96° 5'38.72"Е	The compling points of the GW 7 are at the We Ven Zeik village. The well
GW-7B	16°49'38.55"N	depths of the sampling points or the Gw-7 are same 120 ft depth. It is utilized only
	16°49'39 04"N	domestic water.
GW-7C	96° 5'35.75"E	
CW 9A	16°46'53.00"N	The GW-8 sampling points are measured and taken at the Chaung Pyar
GW-ðA	96° 4'51.00"E	village. GW-8A is 20 ft, B is 35 ft and C is 30 ft the well depth. The residents
GW-8B	16°46'54.00"N	are using domestic water.

Table 1.2-1Sampling points of ground water quality survey

	96° 4'48.00"E	
GW-8C	16°46'54.26"N 96° 4'49 67"E	
	16°45'30 98"N	
GW-9A	96° 5'11.53"E	The water samples are collected at the Kanhla village. The GW-9A and C
CW OP	16°45'31.00"N	depth is 25 ft and B is 45 ft depth. The ground water are used only domestic
GW-9D	96° 5'13.00"E	water.
GW-9C	16°45'31.00"N	
	16°47'44 15"N	
<b>GW-10A</b>	96° 1'41.74"E	
	16°47'43.73"N	The sampling points of the GW-10 are situated at the Kone Tangyi village.
GW-10B	96° 1'38.84"E	The well depth of the GW-10A is 110 $\pi$ , B is 94 $\pi$ and C is 90 $\pi$ depth. The villagers are using domestic water
CTV 10.C	16°47'41.96"N	magers are using domestic mater.
GW-10C	96° 1'40.33"E	
GW-11A	10 47 58.52 N 96° 2'33.72"E	
	16°47'40.02"N	The sampling points are located at the Kun Ta village and GW-11A is 50 ft
GW-11B	96° 2'37.32"Е	depth. The GW-11B well depth is 58 ft and C is 130 ft. The residents are using only demostic water
	16°47'41.58"N	using only domestic water.
GW-11C	96° 2'35.70"E	
CW 124	16°49'34.26"N 96° 1'52 63"E	
GW-12A	16°49'35 49"N	The GW-12 sampling points are taken at the Ka Lauk Ka Lu village. The well
GW-12B	96° 1'47.65"E	depth of the sampling point GW-12A and B is same 65 ft depth. The GW-12C
	16°49'36.65"N	is 45 ft depth. The villagers are utilizing as domestic water.
GW-12C	96° 1'45.42"E	
CW 12 A	16°46'59.00"N	
GW-13A	90° 5°25.00° E	The sampling points of the GW-13 are measured and collected at the Gyaung
GW-13B	96° 5'23.00"E	Waing village. The well depths of the sampling points are same 45 ft. The ground water are used domestic water.
	16°46'59.09"N	
GW-13C	96° 5'24.18"E	
CIV 114	16°47'13.38"N	
GW-14A	96° 3'45.84"E	The GW-14 sampling points are situated at the Ywalay village. The well
GW-14B	96° 3'44.34"E	depth of the sampling points are GW-14A 40ft, B is 38 ft and C is 34 ft. The
	16°47'14.70"N	villagers are utilizing only domestic water.
GW-14C	96° 3'44.88"E	
	16°49'0.85"N	
GW-15A	96° 3'45./9"E	The sampling points are measured and taken at the Htain Gon village. The
GW-15B	96° 3'51.43"E	the domestic water.
	16°49'5.95"N	
GW-15C	96° 3'51.13"E	
	16°48'2.74"N	
GW-16A	96° 1'43.88"E	The ground water samples were collected at the Ta Man Gyi village. GW-16A
GW-16B	16°48'2.26"N 96° 1'42.12"E	is 126 ft depth, B is 45 ft depth and C is 100 ft depth. The ground water is
011102	16°48'4.10"N	used domestic water.
GW-16C	96° 1'41.79"E	
	16°43'26.58"N	
GW-17A	95°56'1.32"E	The GW-17 sampling points are taken at the Kan Gon village. The well
GW-17R	10°45'29.16"N 95°56'6 24"F	depths of the sampling points are A-230 ft, B-200 ft and C-130 ft. The
GW-I/D	16°43'29.88"N	residents are utilized as domestic water.
GW-17C	95°56'8.22"E	
	16°39'28.32"N	The compling points are situated at the Day III-in- W- willow The II
GW-18A	95°49'34.08"E	depths of the sampling points are GW-18A is 80 ft. B is 90 ft and C is 70 ft
CW 19B	16°39'29.34"N	The villagers are using only domestic water.
GW-18B	93-49-33.90"E	

GW-18C	16°39'33.84"N 95°49'37.98"E	
GW-19A	16°50'24.09"N 96° 3'47.21"E	
GW-19B	16°50'24.25"N 96° 3'46.71"E	The sampling points of the GW-19 are located at the Kha Lauk Chaik village. The well depth of the sampling point A and B is 50 ft and C is 60 ft depth. The residents are utilizing as domestic water
GW-19C	16°50'24.00"N 96° 3'46.52"E	The residents are utilizing as domestic water.
GW-20A	16°49'55.08"N 96° 2'46.20"E	The GW-20 sampling points are situated at the Ta Ma Ta Kaw Auk village.
GW-20B	16°49'56.94"N 96° 2'47.22"E	The GW-20A is taken at the primary school of the village and well depth is 120 ft. Another two points are same depth 40 ft. Local residents are use only
GW-20C	16°50'1.44"N 96° 2'47.95"E	domestic water.
GW-21A	16°49'20.94"N 96° 2'49.92"E	The compling points are leasted at the To Ma To Kaw Atot village. The GW
GW-21B	16°49'17.46"N 96° 2'48.60"E	21A well depth is 160 ft, B well depth is 140 ft and C well depth is 60 ft. The villagers are utilizing as domestic water.
GW-21C	16°49'13.92"N 96° 2'45.72"E	
GW-22A	16°48'45.20"N 96° 2'0.12"E	The CW 22 compline points are measured at the Le Fin willoce. The well
GW-22B	16°48'48.10"N 96° 2'5.28"E	depth of the GW-22 sampling points are measured at the Le Ein vinage. The wen depth of the GW-22A is 45 ft and B is 100 ft depth. GW-22C is 80 ft depth.
GW-22C	16°48'39.34"N 96° 2'1.30"E	The residents are using only domestic water.
GW-23A	16°45'0.00"N 96° 2'19.00"E	The water sample are collected at the Thon Ein village. The GW-23A is taken
GW-23B	16°45'0.00"N 96° 2'20.00"E	at the primary school of the Thon Ein village and well depth is 120 ft. Other two points are residential area and GW-23B well depth is 120 ft. The well
GW-23C	16°44'58.35"N 96° 2'18.51"E	depth of the GW-23C is 80 ft and villagers are utilizing domestic water.
GW-24A	16°44'14.00"N 96° 1'48.00"E	
GW-24B	16°44'17.00"N 96° 1'48.00"E	sampling well depth of GW-24A is 85 ft. B and C sampling points well depth are same 100 ft. The local are using only domestic water
GW-24C	16°44'19.88"N 96° 1'48.56"E	are same roo it. The focal are using only domostic water.

Table 1.2-2	Sampling po	oints of surface	water quality s	survey
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Sampling Points	Coordinates	Description of Sampling Points
SW-1A	16°48'25.92"N 96° 7'9.24"E	The surface water sampling points are in the upstream of Yangon River. It is
SW-1B	16°48'20.92"N 96° 7'10.41"E	used for transportation and fishing. The water samples are collected low tide. Transparency is low and coloured is pale yellow.
SW-1C	16°48'17.23"N 96° 7'10.18"E	
SW-2A	16°46'13.84"N 96° 8'2.99"E	The water sampling points of SW-2 are in the downstream of Yangon River.
SW-2B	16°46'12.32"N 96° 8'11.81"E	It is used for transportation and fishing. The water samples are taken low tide and transparency is low. The coloured is pale yellow.
SW-2C	16°46'14.35"N 96° 8'20.54"E	
SW-3A	16°48'26.66"N 96° 6'4.35"E	The SW-3 is situated at the downstream of Kon Ywa stream. It is used for transportation and fishing. The water samples are taken high tide
SW-3B	16°48'28.33"N 96° 6'6.68"E	transportation and rising. The water samples are taken high tide,
	16°48'29.67"N	

SW-3C	96° 6'8.48"E	
SW-4A	16°51'35.26"N 96° 1'52.45"E	The sampling points of SW-4 are located at the Pan Hlaing River. It is used
	16°51'37.45"N	for transportation, agriculture and fishing. The water samples are measured
SW-4B	96° 1'57.77"E	high tide. Transparency is low and coloured is yellow.
	16°51'37.84"N	
SW-4C	96° 2'2.56"E	
	16°50'56.84"N	
SW-5A	96° 1'41.37"Е	The surface water sampling points are at the upstream of the Pan Hlaing
	16°51'0.87"N	River. It is used for transportation, agriculture and fishing. The water samples
SW-5B	96° 1'43.37"E	are measured high tide. Transparency is low and coloured is yellow.
611 F.G	16°51'4.50"N	
SW-5C	96° 1'45.16"E	
	16°49'47.13"N	
SW-6A	90° 4'48.87" E	SW-6 is in the downstream where it is near the junction of the stream and Pan
SW (D	16°49'49.5/"N 06° 4'47 11"E	Haing River. It is used for transportation, agriculture and fishing. The water samples are measured high tide, transparency is low and coloured is vellow.
SW-0B	90 447.11 E	samples are measured high fide, transparency is low and coloured is yenow.
SW-6C	10°49'54.40"N 96° 4'47 05"F	
500-00	90 447.05 E	
SW-7A	96° 5'9.33"E	The surface surface counting a sinte of the SW 7 and at the descent source of the
SWIA	16°47'5.65"N	The surface water sampling points of the $Sw - i$ are at the downstream of the Gyaung Waing stream. It is used for transportation agriculture and fishing
SW-7B	96° 5'13.78"E	The transparency is low and coloured is vellow. The water samples are
	16°47'5.63"N	measured high tide.
SW-7C	96° 5'16.37"E	
	16°45'3.36"N	
SW-8A	96° 4'59.77"E	The sampling points of SW-8 are located at the Kha Naung Do creek. It is
	16°45'6.11"N	used for transportation, agriculture and fishing. The water samples are
SW-8B	96° 5'4.69"E	measured low tide. Transparency is low and coloured is yellow.
	16°45'8.96"N	
SW-8C	96° 5'7.71"E	
	16°47'47.53"N	
SW-9A	96° 1'53.51"E	The SW-9 is in the canal. It is used for agriculture and mini-livestock. The
	16°47'50.24"N	water samples transparency is high and coloured is clear.
SW-9B	96° 1'53./1"E	
SW OC	16°47'53.87"N	
514-90	90 1 34.00 E	
SW 10A	10°49'27.09"N 96° 2'8 38"E	
5 W-10A	16°40'30 73"N	The water sampling points of SW-10 is in the canal. It is used for agriculture and mini livestock. The water samples transparency is high and coloured is
SW-10B	96° 2'9 22"F	clear.
511100	16°49'35 87"N	
SW-10C	96° 2'9.58"E	
-	16°46'54.12"N	
SW-11A	96° 6'46.28"E	The surface water sampling points of the SW-11 are near the junction of the
	16°46'52.53"N	Gyaung Waing stream and Yangon River. It is used for transportation,
SW-11B	96° 6'50.67"E	agriculture and fishing. The transparency is medium and coloured is pale
	16°46'51.89"N	yellow. The water samples are measured high tide.
SW-11C	96° 6'55.74"E	
	16°48'25.77"N	
SW-12A	96° 5'10.49"E	The SW-12 is situated at the upstream of Kon Ywa stream. It is used for
	16°48'24.75"N	transportation and fishing. The water samples are taken high tide,
SW-12B	<b>12B</b> 96° 5'16.52"E transpare	transparency is medium and coloured is pale yellow.
GW 100	16°48'25.51"N	
SW-12C	96° 5'21.98"E	
CW/ 12 4	16°48'49.24"N 06° 3'32 24"E	
5W-13A	70 332.24 E	The water sampling points of SW-13 is in the canal. It is used for agriculture
SW/ 12D	10-404/.00"N 96° 3'36 50"F	and fishing. The water samples transparency is medium and coloured is clear.
5 W-13B	16°48'46 00"N	4
SW_13C	10 40 40.09 IN 96° 3'41 99"F	
5W-13C	70 JT1.77 E	

SW-14A	16°47'55.47"N 96° 2'45.32"E	The SW 14 is in the Kun To stream. It is used for agriculture and fishing. The			
SW-14B	16°47'51.46"N 96° 2'44.24"E	water samples transparency is medium and coloured is clear.			
SW-14C	16°47'50.01"N 96° 2'43.00"E				
SW-15A	16°43'20.07"N 95°55'21.20"E	The surface water sampling points of the SW-15 are near the junction of the			
SW-15B	16°43'17.72"N 95°55'25.86"E	Zi Byu Gon stream and Twente canal. It is used for transportation, agriculture and fishing. The transparency is medium and coloured is pale yellow. The			
SW-15C	16°43'15.07"N 95°55'30.64"E	water samples are measured high tide.			
SW-16A	16°39'21.40"N 95°49'34.45"E	The surface water sampling points are near the junction of the Ka Wet Kin			
SW-16B	16°39'21.46"N 95°49'39.46"E	stream and Toe River. It is used for transportation, agriculture and fishing. The water samples are measured high tide. The transparency is medium and			
SW-16C	16°39'21.61"N 95°49'45.79"E	coloured is pale yellow.			
SW-17A	16°51'30.04"N 96° 2'42.48"E	The sampling points of SW-17are located at the Pan Hlaing River. It is used			
SW-17B	16°51'26.95"N 96° 2'47.49"E	for transportation, agriculture and fishing. The water samples are measured high tide. Transparency is low and coloured is yellow.			
SW-17C	16°51'24.18"N 96° 2'51.31"E				
SW-18A	16°50'58.74"N 96° 3'29.14"E	SW-18 is in the downstream where it is near the junction of the stream and			
SW-18B	16°50'55.92"N 96° 3'33.44"E	Pan Hlaing River. It is used for transportation, agriculture and fishing. Transparency is low and coloured is yellow. The water samples are measured			
SW-18C	16°50'52.87"N 96° 3'37.39"E	high tide.			
SW-19A	16°50'19.40"N 96° 2'5.46"E	The water sampling points of SW-19 is in the canal. It is used for agriculture			
SW-19B	16°50'18.89"N 16°50'18.89"N	and mini livestock. The water samples transparency is high and coloured is clear.			
SW-19C	16°50'18.54"N 96° 2'10.04"E				
SW-20A	16°49'36.62"N 96° 2'49.66"E				
SW-20B	16°49'38.98"N 96° 2'50.70"E	The water sampling points of SW-20 is in the canal. It is used for agriculture. The water samples transparency is high and coloured is clear.			
SW-20C	16°49'42.61"N 96° 2'50.90"E				
SW-21A	16°49'5.90"N 96° 2'38.15"E	The SW-21 is in the canal. It is used for agriculture and fishing. The water			
SW-21B	16°49'6.22"N 96° 2'39.97"E	samples transparency is medium. The coloured is pale yellow.			
SW-21C	16°49'5.65"N 96° 2'41.90"E				
SW-22A	16°48'29.72"N 96° 1'54.87"E	The sampling points of SW-22 are in the canal. It is used for agriculture. The			
SW-22B	16°48'30.49"N 96° 1'57.40"E	water samples transparency is high and coloured is clear.			
SW-22C	16°48'30.98"N 96° 1'59.00"E				
SW-23A	16°44'0.58"N 96° 1'42.89"E	The sampling points are located at the Twenty canal. It is used for			
SW-23B	16°44'2.30"N 96° 1'47.95"E	transportation, agriculture and fishing. The water samples are measured low tide. Transparency is low and coloured is yellow.			
SW-23C	16°44'2.76"N 96° 1'53.92"E				
	16°44'18.36"N	The SW-24 sampling points are near the junction of the Let Pan Gwa stream			

SW-24A	96° 2'35.93"E	and Twente canal. It is used for transportation, agriculture and fishing. The
	16°44'20.98"N	water samples are measured low tide. The transparency is low and coloured is
SW-24B	96° 2'40.48"E	yellow.
	16°44'22.45"N	
SW-24C	96° 2'46.04"E	



Figure 1.2-1 Location map of groundwater quality survey



Figure 1.2-2 Location map of surface water quality survey





1.2-3 Ground water sampling





1.2-3 Surface water sampling

### Survey Period

Water quality survey was conducted during 17 February to 9 March, 2019.

### Survey Method

Water samples were taken by Alpha horizontal water sampler and collected in sterilized sample containers. All sampling was in strict accordance with recognized standard procedures. The parameters as pH and temperature were measured at each site concurrently with sample collection. All samples were kept in iced boxes and were transported to the laboratory and stored at 2-4 °C refrigerators.

No.	Equipment	Manufacturer	Originate Country	Model
1	Multiparameter (Water Probe)	Horiba	Japan	U-50G

Table 1.2-3Field Equipment for water quality survey

2	Alpha Bottle (Water	Wildlife Supply	Indonesia	-
	Sampler)	Company®		

### Survey Result

Water quality results are shown in the following tables.

No.	Date	Sample ID	Tube Well Depth(ft)	рН	Tem (C)	Total Coliform (mg/l)
1.	17.2.2019	GW-1A	120	5.60	27.94	<1.8
		GW-1B	120	5.64	27.97	<1.8
		GW-1C	120	5.89	28.50	<1.8
2.	24.2.2019	GW-2A	90	5.84	28.32	450
		GW-2B	140	5.97	28.29	680
		GW-2C	110	5.86	28.30	200
3.	24.2.2019	GW-3A	100	6.74	27.83	<1.8
		GW-3B	97	5.84	28.32	7,900
		GW-3C	75	5.44	28.45	<1.8
4.	5.3.2019	GW-4A	240	7.28	28.20	200
		GW-4B	60	7.23	27.90	930
		GW-4C	60	7.25	28.10	200
5.	5.3.2019	GW-5A	140	7.08	27.70	200
		GW-5B	140	7.04	28.30	450
		GW-5C	50	7.06	27.90	<1.8
6.	5.3.2019	GW-6A	40	6.88	28.20	680
		GW-6B	40	6.62	28.10	680
		GW-6C	30	6.96	28.00	200
7.	6.3.2019	GW-7A	120	6.57	28.90	680
		GW-7B	120	6.78	28.30	200
		GW-7C	120	6.22	27.70	1,400
8.	21.2.2019	GW-8A	20	6.77	28.96	4,000
		GW-8B	35	6.79	28.17	1,100
		GW-8C	30	6.59	28.05	2,100
9.	22.2.2019	GW-9A	25	6.95	29.91	1,700
		GW-9B	45	6.91	28.75	680
		GW-9C	25	6.91	28.73	1,400
10.	8.3.2019	GW-10A	110	7.42	29.76	1,400
		GW-10B	94	7.53	30.06	780
		GW-10C	90	7.35	29.48	1,100

Table 1.2-4Water quality result (Ground water)

11.	8.3.2019	GW-11A	50	7.30	28.00	1,400
		GW-11B	58	6.20	28.30	680
		GW-11C	130	7.49	28.50	1,200
12.	9.3.2019	GW-12A	65	7.67	29.38	1,700
		GW-12B	65	7.75	28.80	680
		GW-12C	45	7.67	28.00	200
13.	21.2.2019	GW-13A	45	7.12	28.72	3,400
		GW-13B	45	7.11	29.61	2,000
		GW-13C	45	6.97	29.78	1,200
14.	9.3.2019	GW-14A	40	7.47	31.15	<1.8
		GW-14B	38	7.27	29.27	680
		GW-14C	34	7.31	29.01	1,100
15.	23.2.2019	GW-15A	120	6.95	28.79	1,300
		GW-15B	120	7.47	28.61	2,200
		GW-15C	120	7.11	28.93	1,700
16.	8.3.2019	GW-16A	126	7.33	28.59	1,200
		GW-16B	45	7.43	28.85	1,400
		GW-16C	100	7.35	28.74	680
17.	2.3.2019	GW-17A	230	6.88	28.94	680
		GW-17B	200	6.63	28.20	200
		GW-17C	130	6.45	28.30	<1.8
18.	2.3.2019	GW-18A	80	6.95	29.60	<1.8
		GW-18B	90	6.80	28.00	<1.8
		GW-18C	70	7.30	27.80	1,400
19.	6.3.2019	GW-19A	50	6.82	27.60	780
		GW-19B	50	6.12	27.30	680
		GW-19C	60	6.10	27.30	450
20.	7.3.2019	GW-20A	120	7.06	30.92	1,700
		GW-20B	40	7.20	29.55	930
		GW-20C	40	7.13	30.34	1,100
21.	7.3.2019	GW-21A	160	6.88	27.57	780
		GW-21B	140	6.96	27.43	780
		GW-21C	60	7.37	27.68	680
22.	9.3.2019	GW-22A	45	6.40	30.44	3,900
		GW-22B	100	6.15	31.20	2,300
		GW-22C	80	6.41	28.80	1,100
23.	22.2.2019	GW-23A	120	7.19	29.08	1,400
		GW-23B	120	7.07	28.55	1,100
		GW-23C	80	7.06	28.30	1,400

24.	22.2.2019	GW-24A	85	6.95	28.43	1,300
		GW-24B	100	7.04	28.18	780
		GW-24C	100	6.98	28.12	1,400

Table 1.2-4Water quality result (Surface water)

No.	Date	Sample ID	Sampling Depth (m)	рН	Tem (C)	Total Coliform (mg/l)
1.	19.2.2019	SW-1A	1.5	7.67	27.79	>160,000
		SW-1B	1.5	7.72	27.92	>160,000
		SW-1C	1.5	7.88	27.20	160,000
2.	21.2.2019	SW-2A	1.5	7.71	29.90	>160,000
		SW-2B	1.5	7.78	29.97	54,000
		SW-2C	1.5	7.67	30.03	>160,000
3.	24.2.2019	SW-3A	1.5	7.45	28.94	92,000
		SW-3B	1.5	7.37	28.97	160,000
		SW-3C	1.5	7.51	29.00	24,000
4.	20.2.2019	SW-4A	1.5	7.53	27.75	92,000
		SW-4B	1.5	7.32	27.81	92,000
		SW-4C	1.5	7.50	27.77	160,000
5.	20.2.2019	SW-5A	1.5	7.50	27.74	160,000
		SW-5B	1.5	7.62	27.87	>160,000
		SW-5C	1.5	7.48	27.96	92,000
6.	6.3.2019	SW-6A	1.5	8.02	28.50	>160,000
		SW-6B	1.5	8.12	29.12	>160,000
		SW-6C	1.5	8.08	29.24	54,000
7.	22.2.2019	SW-7A	1.0	6.43	28.40	>160,000
		SW-7B	1.0	6.37	28.45	160,000
		SW-7C	1.0	6.40	28.43	92,000
8.	19.2.2019	SW-8A	1.5	7.89	29.54	54,000
		SW-8B	1.5	7.73	29.68	160,000
		SW-8C	1.5	7.81	29.61	54,000
9.	24.2.2019	SW-9A	1.0	7.47	31.10	92,000
		SW-9B	1.0	7.32	31.35	34,000
		SW-9C	1.0	7.41	31.39	14,000
10.	9.3.2019	SW-10A	0.2	6.75	32.29	160,000
		SW-10B	0.2	6.97	32.34	24,000
		SW-10C	0.2	8.24	32.49	1,600
11.	21.2.2019	SW-11A	1.5	7.69	28.16	>160,000

		SW-11B	1.5	7.74	28.32	>160,000
		SW-11C	1.5	7.65	28.29	>160,000
12.	23.2.2019	SW-12A	1.5	7.67	29.86	35,000
		SW-12B	1.5	7.61	29.90	13,000
		SW-12C	1.5	7.54	29.96	7,900
13.	23.2.2019	SW-13A	1.5	7.56	29.56	92,000
		SW-13B	1.5	7.74	30.00	11,000
		SW-13C	1.5	7.74	30.24	13,000
14.	8.3.2019	SW-14A	0.5	7.51	30.40	92,000
		SW-14B	0.5	7.75	31.20	24,000
		SW-14C	0.5	7.64	31.70	54,000
15.	2.3.2019	SW-15A	1.5	8.30	31.00	4,700
		SW-15B	1.5	8.23	30.82	4,700
		SW-15C	1.5	8.27	30.79	13,000
16.	2.3.2019	SW-16A	1.5	7.71	29.50	4,700
		SW-16B	1.5	7.83	30.30	7,900
		SW-16C	1.5	7.64	31.60	3,400
17.	20.2.2019	SW-17A	1.5	7.43	29.10	>160,000
		SW-17B	1.5	7.52	29.19	>160,000
		SW-17C	1.5	7.48	29.17	>160,000
18.	20.2.2019	SW-18A	1.5	7.68	28.54	>160,000
		SW-18B	1.5	7.73	28.32	>160,000
		SW-18C	1.5	7.71	28.35	>160,000
19.	5.3.2019	SW-19A	0.15	7.51	32.10	>160,000
		SW-19B	0.15	7.62	32.30	>160,000
		SW-19C	0.15	7.43	32.38	>160,000
20.	7.3.2019	SW-20A	1.0	7.81	32.07	160,000
		SW-20B	1.0	7.88	32.10	>160,000
		SW-20C	1.0	7.78	31.97	>160,000
21.	7.3.2019	SW-21A	0.5	8.23	29.93	>160,000
		SW-21B	0.5	8.20	30.04	92,000
		SW-21C	0.5	8.32	30.25	>160,000
22.	9.3.2019	SW-22A	0.5	7.63	32.20	>160,000
		SW-22B	0.5	7.83	32.67	160,000
		SW-22C	0.5	8.62	33.73	>160,000
23.	19.2.2019	SW-23A	1.5	7.73	27.23	35,000
		SW-23B	1.5	8.14	27.35	>160,000
		SW-23C	1.5	7.51	27.12	160,000
24.	19.2.2019	SW-24A	1.5	7.64	27.80	>160,000

	SW-24B	1.5	7.68	27.96	>160,000
	SW-24C	1.5	7.58	28.10	54,000

## 1.3 Soil quality

### Survey Item

There are 24 sampling points for soil quality in the study area.

### Summary of sampling points

The locations of sampling points are shown in following table. The detail of each sampling point is described below.

Sampling Point	Coordinates	Description of Sampling Point
S- 1A/1B/1C	16°48'27.99"N 96° 7'18.05"E	The S1 sampling points is located in the No.(2), Seik Kan Thar Park where it is between Kyee Myindaing Kanner Road and Yangon River. The soil sample took in the canal of the park and was taken 30-50 cm depth by composite sampling method. The composition of the soil is light brown coloured clayey silt.
S- 2A/2B/2C	16°48'18.37"N 96° 6'35.44"E	It is situated at the West of Sat Ga Lay Kyi Myindaing village and 0.64 km away from Yangon River. It is in the paddy field and the composition of the soil is light brown coloured silty clay and soil sample was taken 30-50 cm depth.
S- 3A/3B/3C	16°48'20.04"N 96° 6'1.62"E	The sampling point is in the paddy field of the Kon Ywa village. It is situated beside the Kon Ywa-Sat Ga Lay road and was taken 30-50 cm depth. The soil composed light grey coloured sily clay.
S- 4A/4B/4C	16°51'46.46"N 96° 2'7.39"E	The soil sampling of the S4 is located between Shwe Than Lwin Industrial Zone and Pann Hlaing Bridge. The soil samples were taken from grass land and sampling 30-50 cm depth and composed buff coloured silty clay.
S- 5A/5B/5C	16°51'30.77"N 96° 2'6.29"E	S5 sampling point is in the banana plantation. It is situated at the Pa Ya Ngu village and beside the Pan Hlaing bridge right bank of the Pan Hlaing river. The soil composition is dark brown colored silty clay and took 30-50 cm depth.
S- 6A/6B/6C	16°49'28.69"N 96° 4'54.24"E	It is West of Wa Yon Zeik village and 0.75 km away from Pan Hlaing river. It is in the paddy field. The soil samples were taken 30-50 cm depth and composition is light brown coloured silty clay.
S- 7A/7B/7C	16°45'58.50"N 96° 2'44.58"E	The sampling point is located South-West of the Aing Gyi village and near Htone stream. It is in the paddy field and the soil sample composed brown coloured silty clay. The sample was taken 30-50 cm depth.
S- 8A/8B/8C	16°45'21.66"N 96° 4'18.61"E	S-8 sampling point is in the field. It is located North-West of the Awa Set Ga Le village and distance from 0.75 km of the Twante canal. It is composed light grey coloured silty clay and soil sample depth is 30-50 cm.
S- 9A/9B/9C	16°47'37.21"N 96° 1'53.65"E	It is located between left side of the Hlaing Tha Yar to Twante Road and paddy field. It is North-West of the Kan Ywa village and sample took 30-50 cm depth. The composition of the soil sample is Dark brown colored silty clay.
S- 10A/10B/10C	16°48'8.95"N 96° 2'4.59"E	The sampling point is the East of the Ta Man Gyi village and sample was taken between paddy field. The Kun Ta stream is located the East of the sampling point. The soil sample composed light yellow colored clay and depth is 30-50 cm.
S- 11A/11B/11C	16°49'36.60"N 96° 2'15.61"E	It is in the paddy field, left side of the Hlaing Tha Yar to Twante Road. The sampling point is located North-West of the Ta Ma Ta Kaw atet village. The soil sampling 40-65 cm depth and composed light grey coloured clay.
S- 12A/12B/12C	16°46'51.01"N 96° 5'9.34"E	The S-12 is located South-West of the Gyaung Waing village and downstream of the Gyaung Waing stream. It is in the paddy field, composition of the soil is light brown coloured silty clay and the sample depth is 30-50 cm.

Table 1.3-1	Sampling poin	ts for soil	Quality S	Survey
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S- 13A/13B/13C	16°48'22.13"N 96° 5'14.07"E	The sampling point is located upstream of the Kon Ywa stream and 1.15 km away from West of the Kon Ywa village. It is in the paddy field and composition of the soil is light black coloured clay and was taken 30-50 cm depth.
S- 14A/14B/14C	16°48'29.47"N 96° 3'34.04"E	It is situated the South of the Htein Gon village and near upstream of the In Kyan stream. The soil sample taken in the paddy field, depth from 30-50cm and composed yellowish grey coloured lateritic clay.
S- 15A/15B/15C	16°47'44.82"N 96° 2'31.02"E	It is in the paddy field of the Kun Ta village and near upstream of Kun Ta stream. The soil sample was taken 30-50 cm depth and composition is light brown coloured silty clay.
S- 16A/16B/16C	16°43'33.60"N 95°56'6.84"E	The soil sampling point is in the banana plantation of the Kan Gon village. It is located near the Ma Daing stream and 0.33 km away from Twante canal. It is taken 30-50 cm depth and composed of yellowish brown coloured lateritec clay.
S- 17A/17B/17C	16°39'43.26"N 95°49'27.60"E	It is situated in the banana plantation at the Akadam village. The sampling point is 1.30 km distance from Toe river and sampling depth is 50-70 cm. The soil composition is dark brown coloured sandy silt.
S- 18A/18B/18C	16°50'15.63"N 96° 2'33.10"E	S-18 sample point is in the paddy field at the North-West of the Ta Ma Ta Kaw Auk village. It is situated beside of the Phon Pyoe Yae road. The soil sample was taken 30-50 cm depth and compose light brown coloured silty clay.
S- 19A/19B/19C	16°50'44.98"N 96° 2'58.34"E	The soil sampling point of the S-19 is located in the bamboo forest and near plantation. It is beside the Ko Po stream and North-West of Kha Lauk Chaik village. The composition of the soil is light brown coloured silty clay and 30-50 cm depth.
S- 20A/20B/20C	16°51'17.82"N 96° 2'24.30"E	The sampling point is in the forest at the North-East of the Pa Ya Ngu village. It is 0.46 km away from the Pan Hlaing river. The soil composed light brown colored silt and sample was taken from 30-50 cm depth.
S- 21A/21B/21C	16°49'11.79"N 96° 2'55.03"E	It is situated in the paddy field, East of the Ta Ma Ta Kaw atet village. It is composed Dark Brown colored silty clay and the sample depth is 30-50 cm.
S- 22A/22B/22C	16°48'44.75"N 96° 2'16.16"E	It is in the paddy North-East of the Le Ein village and near the Ta Man Gyi stream. The soil sample composition is silty clay and sample took 30-50 cm depth.
S- 23A/23B/23C	16°44'14.46"N 96° 1'57.00"E	The S-23 sample point is located East of the Than Byu Yon village and 0.25 km away from Twante canal. It is in the paddy field and soil sample sampling 30-50 cm depth. The composition of the soil sample is light yellow coloured clay.
S- 24A/24B/24C	16°44'39.22"N 96° 3'6.40"E	The soil sampling point is situated North-East of the Ka La Dan village and near Thar Zi stream. It is in the paddy field and 0.23 km distance from Twante canal. The soil sample was taken 30-50 cm depth and composed yellowish brown coloured lateritic clay.



#### Figure 3.1-1 Location map of soil quality survey



Figure 1.3-2

Soil sampling

## Survey Period

Water quality survey was conducted during 25 February to 2 March, 2019.

### Survey method

For soil sampling, the standard environmental sampler (soil auger) was applied. The sampler is a stainlesssteel tube that is sharpened on one end and fitted with a long, T-shaped handle. This tube is approximately three inches inside diameter. In order to refrain from contamination, about 00-30 cm of top soil was removed by the sampler before sampling. Most of samples were taken and collected from 30-50 cm depth by cleaned bottle. The soil sample sampling, firstly find the original coordinate point where it is referred S1-A and other two points were taken triangle shape by distance interval about 5-10 m depend on ground condition. During sample collection, wear the glove, rinse glove and soil auger with clean water. Then sample was taken and collected in cleaned wide-mouth glass bottle. Chemical preservation of soil is not generally recommended. Samples were cooled in an ice box which temperature was under 4°C. Samples were protected from sunlight to minimize any potential reaction.

Field equipment used on site are also shown in the table.

No.	Equipment	Originate Country	Model
1	Soil Auger (Hand held)	U.S.A	AMS

Field Equipment for Sediment and Soil Quality	Survey
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# **Ecology Baseline Report**

### 1. Scope and Purpose of the baseline study

The scope and purpose of the ecological baseline study are:

1. To provide comprehensive and accurate information on the ecological baseline;

2. To identify and predict potential ecological impacts;

3. To evaluate the significance of the impacts identified;

4. To recommend effective and practicable alternatives and mitigation measures; and

5. To recommend the need for and the scope of an appropriate monitoring and audit programme.

### 2. Site Reconnaissance

A targeted site reconnaissance was conducted from 15<sup>th</sup> February to 5<sup>th</sup> March, 2019 to groundtruth information gathered and supplements it with site observations, data and photographs. The site reconnaissance targeted the following specific ecological objectives:

• To name, describe and map vegetation communities and habitats present within the Project Area at a suitable scale, using existing community nomenclature where possible;

• To identify, describe and map other ecologically sensitive areas within the Project Area such as springs, watercourses and other water bodies;

• To the extent possible within the survey time frame and season, determine if species of conservation significance known or predicted likely to be present in the Study Area are actually present within the Project Area;

• To identify opportunities for future ecological monitoring and enhancement within the framework of the proposed project.

### 3. Methodology

The methodologies used in the baseline study were discussed below.

### 3.1 Desktop Survey

Publicly available sources of information were analyzed to build an outline of known and likely

ecological values for the Study Area. Aerial imagery was used to build a more complete spatial understanding of the pattern of vegetation communities and human uses on the site, and to map access routes and internal tracks. In addition, ecologists with experience of the Study Area were consulted where possible to obtain information about species known to be present or previously recorded from the site, and other ecological values considered by them to be relevant.

#### **3.2 Field Observation**

#### (1) Flora

A Global Positioning System was used to navigate and mark coordinates between sample points in/around the study area. Field observation was conducted within boundary of each project area. During the field survey period, plotless sampling method and transect sampling method were used. Plotless sampling methods are based on the random selection of points within a particular survey area. Transect is a Long, thin quadrat that are used to sample along narrow ecotones or to sample across ecotones to get better averages. There are three transect sampling techniques such as Line transect, belt transect and pace transect among which we used pace transect sampling technique. Pace-transects were established when the observer strides along an imaginary line across the sample site, and uses their foot placement to determine specific sampling points. In addition, all trees, shrubs, herbs and cultivated crops were recorded and listed. Identification of plants and animal species was conducted with assistances of skilled local people. The identified species and families were translated to scientific name with assistance of a checklist of trees, shrubs, herbs and climbers of Myanmar.

#### (2) Fauna

#### (i) Mammal

The data collection for mammal species will conduct in three ways; (1) Direct Observing of mammals in the field, (2) Observation of track and signs such as footprints, scat and feeding signs in their natural habitats, and (3) Interview survey. Mammal Survey was done by point count and transects count method during day time survey. The direct observation method was used for the species of arboreal mammals such as squirrels and tree shrews. Track and sign observation method was used for some small carnivores. All encountered signs and footprints found by track and sign observation were examined and then took photo record for species

identification. The presence or absence of the very well-known mammal species was confirmed by interviewing local people already familiar with the forest.

### (ii) Herpetology

Herpeto fauna surveys was conducted through direct observation and active searching in all major representative habitat types within boundary of each project area and in potential hiding places such as among leaf litter, inside holes and under stones and logs within the study area. Surveys will conduct during day time periods. Visual observations, documented where possible by photographs, were made of some captured specimens that were not collected for preservation. Wherever possible, herpetofauna was captured by hand. A photo record was taken by digital camera. Their morphometric characters of each specimen were recorded such as sizes, shapes, patterns, spots, stripes, and color and body length in the data sheet.

### (iii) Butterflies and Odonata

Butterflies and Odonata survey were conducted through direct observation and active searching in all different habitats within boundary of each project area by using point count method subject to the on-site conditions. Butterflies species and odonata species were collected by taking photo and then identify the species with reference book.

### (iv) Bird

Random Point count method was used for the bird survey and took the photo for species identification, observed numbers and habitat utilization. Species identification was done by using the field guide books, with help of the binoculars, camera and GPS. Nocturnal birds were observed when it becomes dusk. Point count and opportunistic methods were used to census the species richness and point counting was used to get the relative measure of bird abundance.

### (v) Aquatic

Interviewed with local fisherman from the study area were conducted during the collection of the specimen. Fishermen were interviewed with regard to fishery process including kinds of gear used, number of fishing time per day, target species. The fishing gears are trap, hook and line and gill nets. The water body of each project area was studied for aquatic fauna. The fishes were collected with the help of the fishermen during the survey period. The fishes were photographed soon after the collection and measurements were also taken for key characteristics. Indirect

observation was conducted at a market and interviewed with fishermen about kind and quality of fishery product.

### 3.3 Interview survey

In addition to the field observation, secondary data was also surveyed by interviewing from local residents and literature reviewing. In the interview survey, the surveyor visited the residents in and around the survey area and interviewed the name of plants and animals existing in and around the area. Also, the past situation of flora and fauna, and the change on biodiversity and ecosystem in the area was interviewed for examination.



Fig 1: Interview survey with local people

### 4. Survey Area

The location of the survey area was shown in figure 2 to 10 and the pin points in the figure were the survey points.



Fig 2: Location of survey area (B1)



Fig 3: Location of survey area (B2)



Fig 4: Location of survey area (B3)



Fig 5: Location of survey area (B4)



Fig 6: Location of survey area (B5)



Fig 7: Location of survey area (B6)



Fig 8: Location of survey area (B7)



Fig 9: Location of survey area (B8)



Fig 10: Location of surveya area (B9)

### 5. Survey Result

### 5.1 Flora

### (1) Habitat

In and around the Area of proposed project area, three major habitat types were observed namely (1) some extent of trees in residential area, (2) agricultural land and (3) wood land (green area). Habitat Map of proposed project area was shown in Figure 12 and Sceneries of the Survey Area was shown in Figure 11.



Fig 11: Sceneries of the survey area

### (2) Habitat Map and Land use map

To obtain the habitat map and land use map, there was combination between field observation and secondary image from Google Earth and generate it applying in GIS software. At first, the field observations were performed for habitat survey at site collecting the data with the Garmin GPS and upload it in ArcGIS. On the other hand, the Google image was visually digitized based on the primary field survey. Finally, the habitat map and land use mpa were analyzed based on both of field survey and secondary image data using the ArcGIS software and Google Earth software.

Sources & Tools

- Google Earth Images
- ArcGIS 10.4
- Garmin GPS etrex 30

### Field survey



## Fig 12: Habitat map of the survey area

### (3) Vegetation Communities

In and around the project area, agricultural land, forest land and along the river side some extent of sand bank were found.

Community name	Land form	Description
Woodland	Woodland may form a transition	Woodland is a low-density forest forming
	to shrubland under drier	open habitats with plenty of sunlight and
	conditions or during early stages	limited shade. Woodlands may support an
	of primary or secondary	understory of shrubs and herbaceous plants
	succession. Higher density areas	including grasses.
	of trees with a largely closed	
	canopy that provides extensive	
	and nearly continuous shade are	
	referred to as forests.	
Agricultural Land	Land able to be used for farming	Agricultural land is typically land devoted to
	is called "cultivable land or	agriculture, the systematic and controlled
	agricultural land". Agricultural	use of other forms of life-particularly the
	land or agriculturally-zoned land	rearing of livestock and production of
	refers to plots that are permitted to	crops—to produce food for humans. It is
	be used for agricultural activities,	thus generally synonymous with both
	without regard to its present use or	farmland or cropland, as well as pasture or
	even suitability.	rangeland.

## **Table 1: Vegetation Community Description**

### (4) Survey Result

There were 66 plant species in B1 area, 76 plant species in B2 area, 76 plant species in B3 area, 60 plant species in B4 area, 68 plant species in B5 area, 44 plant species in B6 area, 52 plant species in B7 area, 58 plant species in B8 area and 84 plant species in B9 area identified in the proposed project area. List of identified plant species were presented in table 2 to 10.

Table 2. List of plant species recorded in the survey area (D)	Table 2: List of	plant species	recorded in	the survey	area (	<b>B1</b> )
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No	Family Name	Scientific Name	Common Name	Habitat	Distribution	IUCN
1	Mimosaceae	Albizia lebbek	Kokko	Tree	Reported from	NE
					Myanmar	
2	Moringaceae	Moringa oleifera	Dan-da-lun	Tree	Cultivated	NE
3	Mimosaceae	Mimosa pudica	Htikayon	Herb	Wide	NE

4	Musaceae	Musa sapientum	Nget-pyaw	Herb	Cultivated	NE
5	Arecaceae	Borassus flabellifer	Htan	Tree	Bago, Mandalay, Sagaing, Taninthayi	EN
6	Mimosaceae	Leucaena leucocephala	Bawsagaing	Tree	Mandalay, Sagaing, Yangon	NE
7	Meliaceae	Azadirachta indica	Tama	Tree	Wide	NE
8	Amaranthaceae	Alternanthera nodiflora	Kanaphaw	Herb	Yangon, Mandalay, Taninthayi	LC
9	Arecaceae	Cocas nucifera	Ohn	Tree	Cultivated	NE
10	Euphorbiaceae	Phyllanthus niruri	Kyet-tha-hin	Shrub	Wide	NE
11	Sapindaceae	Arytera littoralis	Lamu	Small Tree	Kachin, Mon, Sagaing, Taninthayi	LR/LC
12	Areaceae	Nypa fruticans	Dani	Tree	Ayeyarwady	LC
13	Fabaceae	Pterocarpus macrocarpus	Padauk	Tree	Bago, Mandalay, Sagaing, Taninthayi	NE
14	Myrtaceae	Eucalyptus camaldulensis	U-ca-lit	Tree	Cultivated	NE
15	Euphorbiaceae	Fluegga virosa	Chin ya	Small Tree	Wide	NE
16	Moraceae	Artocarpus heterophyllus	Peinne	Tree	Cultivated	NE
17	Caesalpiniaceae	Bauhinia acuminata	Swe-daw	Small Tree	Wide	LC
18	Anacardiaceae	Mangifera indica	Thayet	Tree	Wide	NE
19	Fabaceae	Sesbania grandiflora	Paukpan-byu	Small Tree	Cultivated	NE
20	Lythraceae	Lagerstromia speciosa	Pyinma	Tree	Reported from Myanmar	NE
21	Moraceae	Ficus religiosa	Bawdi-nyaung	Tree	Cultivated	NE
22	Sapotaceae	Manikara hexandra	Khayay	Tree	Cultivated	NE

23	Nyctaginaceae	Bougainvillea spectabilis	Sekku-pan	Climber/ Creeper	Cultivated	NE
24	Mimosaceae	Acacia	Malavsia-	Small	Cultivated	LC
		auriculiformis	padauk	Tree		
25	Rubiaceae	Ixora arborea	Ponna-yeik	Small Tree	Ayeyarwady, Mon, Taninthayi, Yangon	NE
26	Myrtaceae	Syzygium syzygioides	Thabye	Tree	Tannthayi, Yangon	NE
27	Mimosaceae	Albizia procera	Sit	Tree	Reported from Myanmar	NE
28	Mimosaceae	Acacia mangium	Man-gan-sha	Small Tree	Cultivated	NE
29	Cucurbitaceae	Luffa acutangula	Kha-we-yaing	Climber/ Creeper	Cultivated	NE
30	Caesalpiniaceae	Peltophorum pterocarpum	Thinbaw-mezali	Tree	Cultivated	NE
31	Acanthaceae	Hygrophila phlomoides	Migaung-kunbat	Herb	Bago, Taninthayi, Yangon	NE
32	Cucurbitaceae	Lagenaria siceraria	Bu	Climber/ Creeper	Cultivated	NE
33	Combretaceae	Lumnitzera racemosa	Dawei-hmaing	Small Tree	Bago, Rakhine	NE
34	Oleaceae	Jasminum arborescens	Sabe	Shrub/ Climber	MAgway, Mandalay, Yangon	NE
35	Boraginaceae	Heliotropium indium	Sin-hna-maung	Herb	Yangon	NE
36	Araceae	Colocasia esculenta	Pein	Herb	Cultivated	LC
37	Convolvulaceae	Ipomoea turbinate	Kazun-nwe	Creeper	Yangon	NE
38	Boraginaceae	Cordia dichotoma	Thanut	Tree	Kachin, Kayah, Mandalay, Shan, Yangon	NE
39	Myrtaceae	Psidium guajava	Malaka	Small Tree	Cultivated	NE
40	Meliaceae	Swietenia macrophylla	Mahogany	Tree	Cultivated	VU
41	Steruliaceae	Scaphium scaphigerum	Mohbin	Tree	Mon, Taninthayi	NE
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42	Mimosaceae	Pithecellobium dulce	Kala-magyi	Tree	Magway, Mandalay	NE
43	Rubiaceae	Morinda angustifolia	Үеуо	Small Tree	Wide	NE
44	Convolvulaceae	Ipomoea aquatica	Ye-kazun	Climber/ Creeper	Wide	LC
45	Zingiberaceae	Alpinia allughas	Gonmin	Herb	Kachin, Kayah, Kayin, Mandalay, Rakhine, Sagaing, Shan, Yangon	NE
46	Acanthaceae	Acanthus ebracteatus	Khaya	Shrub	Ayeyarwady, Rakhine, Taninthayi	LC
47	Rhamnaceae	Ziziphus jujuba	Zi	Tree	Cultivated	NE
48	Pontederiaceae	Monochoria vaginalis	Beda	Aquatic	Taninthayi, Yangon	LC
49	Asteraceae	Chromolaena odorata	Bizat	Shrub	Wide	NE
50	Fabaceae	Mucuna pruriens	Khwele-ya	Climber	Bago, Chin, Kayin, Kayin, Mandalay, Mandalay, Sagaing, Sagaing, Shan, Yangon	NE
51	Poaceae	Arundo donax	Куи	Grass	Reported from Myanmar	LC
52	Convolvulaceae	Ipomoea carnea	La-thar-pan	Climber/ Creeper	Yangon	NE
53	Cucurbitaceae	Luffa aegyptiaca	Tha-but-kha	Climber/ Creeper	Cultivated	NE
54	Boraginaceae	Cordia dichotoma	Thanut	Tree	Kachin, Kayah, Mandalay, Shan, Yangon	NE
55	Poaceae	Cynodon dactylon	Mye-sa	Grass	Wide	NE
56	Capparaceae	Crateva magna	Kadet	Tree	Wide	NE

57	Anacardiaceae	Lannea coromandelica	Nabe	Tree	Bago, Kayin, Mandalay, Rakhine, Shan, Taninthayi, Yangon	NE
58	Rutaceae	Citrus aurantiifolia	Shauk	Shrub	Cultivated	NE
59	Poaceae	Thyrsostachys siamensis	Htiyo-wa	Bamboo	Cultivated	NE
60	Nymphaeaceae	Nymphaea alba	Kyar	Aquatic	Reported from Myanmar	LC
61	Myrtaceae	Syzgium aromaticum	Lay-hnyin	Small Tree	Cultivated	NE
62	Mimosaceae	Acacia concinna	Kinmun-gyin	Climber/ Creeper	Cultivated	NE
63	Vitaceae	Cayratia trifolia	Taw-sabyit	Climber/ Creeper	Bago, Mandalay, Yangon, Unknown	NE
64	Lythraceae	Lawsonia alba	Dan	Shrub	Cultivated	NE
65	Amaranthaceae	Amaranthus blitoides	Hin-nu-nwe	Herb	Wide	NE
66	Poaceae	Setaria forbesiana	Katsi-hne	Grass	Mandalay	NE

LR/LC = Least Concerned/Lower Risk

EN = Endangered

VU = Vulnerable

## Table 3: List of plant species recorded in survey area (B2)

No	Family Name	Scientific Name	Common Name	Habitat	Distribution	IUCN
1	Asclepiadaceae	Calotropis	Mayo	S	Magway, Mandalay,	NE
		procera			Sagaing, Shan	
2	Moringaceae	Moringa oleifera	Dan-da-lun	Т	Cultivated	NE
3	Mimosaceae	Mimosa pudica	Htikayon	Н	Wide	NE
4	Musaceae	Musa sapientum	Nget-pyaw	Н	Cultivated	NE
5	Caesalpiniaceae	Senna siamea	Mezali	Т	Reported from	NE
					Myanmar	
6	Mimosaceae	Albizia lebbek	Kokko	Т	Reported from	NE
					Myanmar	
7	Caesalpiniaceae	Tamarindus	Magyi	Т	Cultiveted	NE
		indica				
8	Caricaceae	Carica papaya	Thinbaw	ST	Cultivated	DD

9	Arecaceae	Borassus	Htan	Т	Bago, Mandalay,	EN
		flabellifer			Sagaing, Taninthayi	
10	Mimosaceae	Leucaena	Bawsagaing	Т	Mandalay, Sagaing,	NE
		leucocephala			Yangon	
11	Meliaceae	Azadirachta	Tama	Т	Wide	NE
		indica				
12	Caesalpinaceae	Delonix rigia	Sein-ban-gyi	Т	Cultivated	NE
13	Fabaceae	Pterocarpus	Padauk	Т	Bago, Mandalay,	NE
		macrocarpus			Sagaing, Taninthayi	
14	Myrtaceae	Eucalyptus	U-ca-lit	Т	Cultivated	NE
		camaldulensis				
15	Euphorbiaceae	Fluegga virosa	Chin ya	ST	Wide	NE
16	Moraceae	Artocarpus	Peinne	Т	Cultivated	NE
		heterophyllus				
17	Caesalpiniaceae	Bauhinia	Swe-daw	ST	Wide	LC
		acuminata				
18	Anacardiaceae	Mangifera indica	Thayet	Т	Wide	NE
19	Fabaceae	Sesbania	Paukpan-byu	ST	Cultivated	NE
		grandiflora				
20	Lythraceae	Lagerstromia	Pyinma	Т	Reported from	NE
		speciosa			Myanmar	
21	Moraceae	Ficus religiosa	Bawdi-nyaung	Т	Cultivated	NE
22	Araceae	Areca catechu	Kunthi-pin	ST	Cultivated	NE
23	Nyctaginaceae	Bougainvillea	Sekku-pan	Cl/Cr	Cultivated	NE
		spectabilis				
24	Mimosaceae	Acacia	Malaysia-	ST	Cultivated	LC
		auriculiformis	padauk			
25	Combretaceae	Terminalia	Banda	Т	Cultivated	NE
		catappa				
26	Amaranthaceae	Alternanthera	Kanaphaw	Н	Yangon, Mandalay,	LC
		nodiflora			Taninthayi	
27	Arecaceae	Cocas nucifera	Ohn	Т	Cultivated	NE
28	Euphorbiaceae	Phyllanthus niruri	Kyet-tha-hin	S	Wide	NE
29	Sapindaceae	Arytera littoralis	Lamu	ST	Kachin, Mon,	LR/LC
					Sagaing, Taninthayi	
30	Areaceae	Nypa fruticans	Dani	Т	Ayeyarwady	LC
31	Poaceae	Dendrocalamus	Waya	В	Bago, Mandalay,	NE
		longispathus			Mon, Rakhine, Shan,	
					Taninthayi, Yangon	
32	Casuarinaceae	Casuarina	Pinle-kabwe	Т	Cultivated	NE
		equisetifolia				

33	Rubiaceae	Ixora arborea	Ponna-yeik	ST	Ayeyarwady, Mon, Taninthayi, Yangon	NE
34	Myrtaceae	Syzygium syzygioides	Thabye	Т	Tannthayi, Yangon	NE
35	Mimosaceae	Albizia procera	Sit	Т	Reported from Myanmar	NE
36	Verbenaceae	Tectona grandis	Kyun	Т	Wide	NE
37	Amaranthaceae	Alternanthera sessilis	Pazun-sar	Н	Yangon	LC
38	Fabaceae	Cyamopsis tetragonloba	Pe-pazun	S	Bago	NE
39	Boraginaceae	Heliotropium indium	Sin-hna-maung	Н	Yangon	NE
40	Rutaceae	Limonia acidissima	Thi	Т	Magway, Mandalay	NE
41	Araceae	Colocasia esculenta	Pein	Н	Cultivated	LC
42	Convolvulaceae	Ipomoea turbinate	Kazun-nwe	Cr	Yangon	NE
43	Boraginaceae	Cordia dichotoma	Thanut	Т	Kachin, Kayah, Mandalay, Shan, Yangon	NE
44	Malvaceae	Thespesia lampas	Thaman-shaw	S	Chin, Mandalay, Taninthayi	NE
45	Sapotceae	Madhuca longifolia	Meze	Т	Magway, Mandalay, Yangon, Unknown	NE
46	Meliaceae	Swietenia macrophylla	Mahogany	Т	Cultivated	VU
47	Euphorbiaceae	Codiaeum variegatum	Ywet-hla	S	Cultivated	NE
48	Mimosaceae	Pithecellobium dulce	Kala-magyi	Т	Magway, Mandalay	NE
49	Rubiaceae	Morinda angustifolia	Yeyo	ST	Wide	NE
50	Sapotaceae	Manikara hexandra	Khayay	Т	Cultivated	NE
51	Meliaceae	Aglaia odoratissima	Thanakha	Т	Bago, Taninthayi	NE
52	Solanaceae	Physalis angula	Bauk-pin	Н	Bago, Taninthayi, Yangon	LC
53	Apocynaceae	Thevetia peruviana	Sethayathi	ST	Cultivated	NE
54	Myrtaceae	Psidium guajava	Malaka	ST	Cultivated	NE
55	Bignoniaceae	Oroxylum indica	Kyaung-sha	Т	Wide	NE

56	Steruliaceae	Scaphium scaphigerum	Mohbin	Т	Mon, Taninthayi	NE
57	Fabaceae	Indigofera linifolia	Than-manaing- kyauk-manaing	S	Wide	LC
58	Bignoniaceae	Millingtonia hortensis	Egayit	Т	Wide	NE
59	Combretaceae	Lumnitzera racemosa	Dawei-hmaing	ST	Bago, Rakhine	NE
60	Oleaceae	Jasminum arborescens	Sabe	S/Cl	MAgway, Mandalay, Yangon	NE
61	Anacardiaceae	Spondias pinnata	Gwe	Т	Reported from Myanmar	NE
62	Bignonniaceae	Markhamia stipulata	Ma-hlwa	Т	Wide	NE
63	Mimosaceae	Acacia mangium	Man-gan-sha	ST	Cultivated	NE
64	Poaceae	Dendrocalamus longispathus	Wanet	В	Bago, Mandalay, Mon, Rakhine, Shan, Taninthayi, Yangon	NE
65	Caesalpiniaceae	Peltophorum pterocarpum	Thinbaw-mezali	Т	Cultivated	NE
66	Acanthaceae	Hygrophila phlomoides	Migaung-kunbat	Н	Bago, Taninthayi, Yangon	NE
67	Cucurbitaceae	Lagenaria siceraria	Bu	Cl/Cr	Cultivated	NE
68	Amaranthaceae	Achyranthes aspera	Kyet-mauk-sue- pyan	Н	Magway, Yangon	NE
69	Cucurbitaceae	Luffa acutangula	Kha-we-yaing	Cl/Cr	Cultivated	NE
70	Euphorbiaceae	Baccaurea flaccida	Kanaso	Т	Mon, Taninthayi, Yangon, Unknown	NE
71	Bombacaceae	Bombax insigne	Taung-let-pan	Т	Wide	NE
72	Asteraceae	Tithonia diversifolia	Nay-kyar	S	Shan, Mandalay, Bago	NE
73	Caesalpinaceae	Cassia glauca	Pyiban-nyo	ST	Cultivated	NE
74	Dracaenaceae	Sansevieria trifasciata	Nagasat	Н	Yangon	NE
75	Asteraceae	Coreopsis tinctoria	Sein-chai-pan	Н	Cultivated	NE
76	Asteraceae	Gnaphalium indicum	Byaing-che	Н	Magway, Yangon	NE

**DD** = **Data Deficit NE** = 1

**NE = Not Evaluated VU = Vulnerable** 

LR/LC = Lower Risk/Least Concerned

EN = Endangered

No	Family Name	Scientific Name	Common Name	Habitat	Distribution	IUCN
1	Mimosaceae	Acacia	Malaysia-	Small	Cultivated	LC
		auriculiformis	padauk	Tree		
2	Poaceae	Arundo donax	Kyu	Grass	Reported from	LC
					Myanmar	
3	Musaceae	Musa sapientum	Nget-pyaw	Herb	Cultivated	NE
4	Arecaceae	Cocas nucifera	Ohn	Tree	Cultivated	NE
5	Rhamnaceae	Ziziphus jujuba	Zi	Tree	Cultivated	NE
6	Mimosaceae	Albizia lebbek	Kokko	Tree	Reported from	NE
					Myanmar	
7	Caesalpiniaceae	Tamarindus indica	Magyi	Tree	Cultiveted	NE
8	Moraceae	Ficus religiosa	Bawdi-nyaung	Tree	Cultivated	NE
9	Myrtaceae	Syzygium	Thabye	Tree	Tannthayi, Yangon	NE
		syzygioides				
10	Fabaceae	Sesbania	Paukpan-byu	Small	Cultivated	NE
		grandiflora		Tree		
11	Steruliaceae	Scaphium	Mohbin	Tree	Mon, Taninthayi	NE
		scaphigerum				
12	Myrtaceae	Eucalyptus	U-ca-lit	Tree	Cultivated	NE
		camaldulensis				
13	Convolvulaceae	Ipomoea carnea	La-thar-pan	Climber/	Yangon	NE
				Creeper		
14	Arecaceae	Borassus flabellifer	Htan	Tree	Bago, Mandalay,	EN
					Sagaing, Taninthayi	
15	Sapotaceae	Manikara hexandra	Khayay	Tree	Cultivated	NE
16	Bignoniaceae	Oroxylum indica	Kyaung-sha	Tree	Wide	NE
17	Cucurbitaceae	Lagenaria siceraria	Bu	Climber/	Cultivated	NE
				Creeper		
18	Combretaceae	Terminalia catappa	Banda	Tree	Cultivated	NE
19	Acanthaceae	Acanthus	Khaya	Shrub	Ayeyarwady,	LC
		ebracteatus			Rakhine, Taninthayi	
20	Caesalpinaceae	Delonix rigia	Sein-ban-gyi	Tree	Cultivated	NE
21	Mimosaceae	Pithecellobium	Kala-magyi	Tree	Magway, Mandalay	NE
		dulce				
22	Mimosaceae	Acacia mangium	Man-gan-sha	Small	Cultivated	NE
				Tree		
23	Acanthaceae	Hygrophila	Migaung-kunbat	Herb	Bago, Taninthayi,	NE
		phlomoides	_		Yangon	
24	Asclepiadaceae	Calotropis procera	Mayo	Shrub	Magway, Mandalay,	NE
					Sagaing, Shan	

 Table 4: List of plant species recorded in survey area (B3)

25	Sapindaceae	Arytera littoralis	Lamu	Small	Kachin, Mon,	LR/LC
				Tree	Sagaing, Taninthayi	
26	Euphorbiaceae	Fluegga virosa	Chin ya	Small	Wide	NE
				Tree		
27	Euphorbiaceae	Phyllanthus niruri	Kyet-tha-hin	Shrub	Wide	NE
28	Cucurbitaceae	Luffa aegyptiaca	Tha-but-kha	Climber/	Cultivated	NE
				Creeper		
29	Zingiberaceae	Alpinia allughas	Gonmin	Herb	Kachin, Kayah,	NE
					Kayin, Mandalay,	
					Rakhine, Sagaing,	
					Shan, Yangon	
30	Convolvulaceae	Ipomoea aquatica	Ye-kazun	Climber/	Wide	LC
				Creeper		
31	Malvaceae	Abelmoschus	Yonbade	Shrub	Cultivated	NE
		esculentus				
32	Lamiaceae	Ocimum	Pin-sein	Herb	Cultivated	NE
		americanum				
33	Asclepiadaceae	Sarcolobus	Kayu	Climber/	Ayeyarwady, Bago,	NE
		globosus		Creeper	Taninthayi	
34	Myrtaceae	Syzgium	Lay-hnyin	Small	Cultivated	NE
		aromaticum		Tree		
35	Poaceae	Dendrocalamus	Hmyinwa	Bamboo	Bago, Kachin, Kayin,	LC
		membranaceus			Mon, Shan,	
					Taninthayi	

## EN = Endangered

## Table 5: List of plant species recorded in survey area (B4) Image: Control of the second second

No	Family Name	Scientific Name	Common Name	Habitat	Distribution	IUCN
1	Fabaceae	Pterocarpus	Padauk	Tree	Bago, Mandalay,	NE
		macrocarpus			Sagaing,	
					Taninthayi	
2	Asteraceae	Chromolaena	Bizat	Shrub	Wide	NE
		odorata				
3	Mimosaceae	Mimosa pudica	Htikayon	Herb	Wide	NE
4	Musaceae	Musa sapientum	Nget-pyaw	Herb	Cultivated	NE
5	Euphorbiaceae	Codiaeum	Ywet-hla	Shrub	Cultivated	NE
		variegatum				
6	Mimosaceae	Albizia lebbek	Kokko	Tree	Reported from	NE
					Myanmar	
7	Caesalpiniaceae	Tamarindus	Magyi	Tree	Cultiveted	NE
		indica				

8	Fabaceae	Erythrina fusca	Kathit	Tree	Ayeyarwady, Bago, Yangon	NE
9	Euphorbiaceae	Phyllanthus niruri	Kyet-tha-hin	Shrub	Wide	NE
10	Mimosaceae	Leucaena leucocephala	Bawsagaing	Tree	Mandalay, Sagaing, Yangon	NE
11	Meliaceae	Azadirachta indica	Tama	Tree	Wide	NE
12	Caesalpinaceae	Delonix rigia	Sein-ban-gyi	Tree	Cultivated	NE
13	Mimosaceae	Pithecellobium dulce	Kala-magyi	Tree	Magway, Mandalay	NE
14	Moraceae	Artocarpus heterophyllus	Peinne	Tree	Cultivated	NE
15	Myrtaceae	Psidium guajava	Malaka	Small Tree	Cultivated	NE
16	Rhamnaceae	Ziziphus jujuba	Zi	Tree	Cultivated	NE
17	Moringaceae	Moringa oleifera	Dan-da-lun	Tree	Cultivated	NE
18	Myrtaceae	Eucalyptus camaldulensis	U-ca-lit	Tree	Cultivated	NE
19	Euphorbiaceae	Fluegga virosa	Chin ya	Small Tree	Wide	NE
20	Steruliaceae	Scaphium scaphigerum	Mohbin	Tree	Mon, Taninthayi	NE
21	Fabaceae	Sesbania grandiflora	Paukpan-byu	Small Tree	Cultivated	NE
22	Anacardiaceae	Mangifera indica	Thayet	Tree	Wide	NE
23	Combretaceae	Terminalia catappa	Banda	Tree	Cultivated	NE
24	Amaranthaceae	Alternanthera nodiflora	Kanaphaw	Herb	Yangon, Mandalay, Taninthayi	LC
25	Arecaceae	Cocas nucifera	Ohn	Tree	Cultivated	NE
26	Pontederiaceae	Monochoria vaginalis	Beda	Aquatic	Taninthayi, Yangon	LC
27	Moraceae	Ficus religiosa	Bawdi-nyaung	Tree	Cultivated	NE
28	Rubiaceae	Morinda angustifolia	Уеуо	Small Tree	Wide	NE
29	Bombacaceae	Bombax ceiba	Letpan	Tree	Wide	NE
30	Acanthaceae	Acanthus ebracteatus	Khaya	Shrub	Ayeyarwady, Rakhine, Taninthayi	LC

31	Sapindaceae	Arytera littoralis	Lamu	Small	Kachin, Mon,	LR/LC
	_			Tree	Sagaing,	
					Taninthayi	
32	Poaceae	Dendrocalamus	Wanet	Bamboo	Bago, Mandalay,	NE
		longispathus			Mon, Rakhine,	
					Shan, Taninthayi,	
					Yangon	
33	Malvaceae	Hibiscus	Chin-baung	Shrub	Cultivated	NE
		cannabinus				
34	Moraceae	Ficus glomerata	Ye-thapan	Tree	Bago, Kachin,	NE
					Mandalay,	
					Yangon	
35	Solanaceae	Capsicum	Ngayok	Shrub	Cultivated	NE
		аппиит				
36	Poaceae	Cymbopogon	Sabalin	Grass	Cultivated	NE
		citratus				
37	Convolvulaceae	Ipomoea	Ye-kazun	Climber/	Wide	NE
		aquatica		Creeper		
38	Convolvulaceae	Ipomoea batatas	Kazun	Climber/	Cultivated	NE
				Creeper		
39	Amaranthaceae	Amaranthus	Hin-nu-new-	Herb	Cultivated	NE
		spinosus	subak			
40	Brassicaceae	Brassica	Mon-nyin	Herb	Cultivated	NE
		campestris				
41	Solanaceae	Solanaum	Khayan	Shrub	Cultivated	NE
		melongena				
42	Sapotaceae	Manikara	Khayay	Tree	Cultivated	NE
		hexandra		~ 1	~	
43	Apocynaceae	Tabernaemontan	Zalat	Shrub	Cultivated	NE
	<b>D</b> 1 1'	a divaricata		G 11	<b>XX7' 1</b>	
44	Euphorbiaceae	Fluegga virosa	Chin ya	Small	W1de	NE
4.5		· · ·		Tree		
45	Rutaceae	Limonia	Thi	Tree	Magway,	NE
16		acidissima			Mandalay	
46	Sapotaceae	Achras zapota	Thagya	Tree	Cultivated	NE
47	Araceae	Colocasia	Pein	Herb	Cultivated	LC
40		esculenta	TT1 1 .		D V 1	
48	Myrtaceae	Syzygium	Thabye gyi	Iree	Bago, Kachin,	NE
		grande			Sagaing,	
					Taninthayı,	
40		י וו ות			Y angon	
49	Euphorbiaceae	Phyllanthus	Mye-zıphyu	Herb	W1de	NE
		urinaria		1		

50	Poaceae	Thysanolaena maxima	Tamyetse	Grass	Bago, Mandalay, Shan, Yangon	NE
51	Amaranthaceae	Achyranthes aspera	Kyet-mauk-pyan	Herb	Magway, Yangon	NE
52	Malvaceae	Hibiscus esculentus	Yonbade	Shrub	Cultivated	NE
53	Asclepiadaceae	Calotropis procera	Мауо	Shrub	Magway, Mandalay, Sagaing, Shan	NE
54	Fabaceae	Mucuna pruriens	Khwele-ya	Climber	Bago, Chin, Kayin, Kayin, Mandalay, Mandalay, Sagaing, Sagaing, Shan, Yangon	NE
55	Solanaceae	Solanum indicum	Khayan-kazaw	Shrub	Bago, Mandalay, Shan, Yangon	NE
56	Mimosaceae	Acacia auriculiformis	Malaysia- padauk	Small Tree	Cultivated	LC
57	Fabaceae	Cyamopsis tetragonloba	Pe-pazun	Shrub	Bago	NE
58	Malvaceae	Gossypium herbaceum	Wah	Shrub	Cultivated	NE
59	Arecacese	Elaeis guineensis	Si-ohn	Tree	Cultivated	LC
60	Poaceae	Saccharum officinarum	Kyan	Grass	Cultivated	NE

## LR/LC = Lower Risk/Least Concerned

## Table 6: List of plant species recorded in survey area (B5) Image: Comparison of the second seco

No	Family Name	Scientific Name	Common Name	Habitat	Distribution	IUCN
1	Caesalpinaceae	Delonix rigia	Sein-ban-gyi	Tree	Cultivated	NE
2	Fabaceae	Pterocarpus	Padauk	Tree	Bago,	NE
		macrocarpus			Mandalay,	
					Sagaing,	
					Taninthayi	
3	Moraceae	Streblus asper	Okhne	Small	Bago, Sagaing,	NE
				Tree	Taninthayi	
4	Musaceae	Musa sapientum	Nget-pyaw	Herb	Cultivated	NE
5	Caesalpiniaceae	Senna siamea	Mezali	Tree	Reported from	NE
					Myanmar	

6	Mimosaceae	Albizia lebbek	Kokko	Tree	Reported from Myanmar	NE
7	Caesalpiniaceae	Tamarindus indica	Magyi	Tree	Cultiveted	NE
8	Caricaceae	Carica papaya	Thinbaw	Small Tree	Cultivated	DD
9	Arecaceae	Borassus flabellifer	Htan	Tree	Bago, Mandalay, Sagaing, Taninthayi	EN
10	Mimosaceae	Leucaena leucocephala	Bawsagaing	Tree	Mandalay, Sagaing, Yangon	NE
11	Rhamnaceae	Ziziphus jujuba	Zi	Tree	Cultivated	NE
12	Moringaceae	Moringa oleifera	Dan-da-lun	Tree	Cultivated	NE
13	Moraceae	Artocarpus heterophyllus	Peinne	Tree	Cultivated	NE
14	Myrtaceae	Eucalyptus camaldulensis	U-ca-lit	Tree	Cultivated	NE
15	Anacardiaceae	Mangifera indica	Thayet	Tree	Wide	NE
16	Mimosaceae	Acacia auriculiformis	Malaysia- padauk	Small Tree	Cultivated	LC
17	Combretaceae	Terminalia catappa	Banda	Tree	Cultivated	NE
18	Fabaceae	Sesbania grandiflora	Paukpan-byu	Small Tree	Cultivated	NE
19	Lythraceae	Lagerstromia speciosa	Pyinma	Tree	Reported from Myanmar	NE
20	Arecaceae	Cocas nucifera	Ohn	Tree	Cultivated	NE
21	Pontederiaceae	Monochoria vaginalis	Beda	Aquatic	Taninthayi, Yangon	LC
22	Poaceae	Arundo donax	Kyu	Grass	Reported from Myanmar	LC
23	Acanthaceae	Acanthus ebracteatus	Khaya	Shrub	Ayeyarwady, Rakhine, Taninthayi	LC
24	Sapindaceae	Arytera littoralis	Lamu	Small Tree	Kachin, Mon, Sagaing, Taninthayi	LR/LC
25	Areaceae	Nypa fruticans	Dani	Tree	Ayeyarwady	LC
26	Convolvulaceae	Ipomoea carnea	La-thar-pan	Climber/ Creeper	Yangon	NE

27	Casuarinaceae	Casuarina equisetifolia	Pinle-kabwe	Tree	Cultivated	NE
28	Apocynaceae	Carissa carandas	Khan	Small Tree	Cultivated	NE
29	Nyctaginaceae	Bougainvillea spectabilis	Sekku-pan	Climber/ Creeper	Cultivated	NE
30	Rutaceae	Citrus aurantiifolia	Shauk	Shrub	Cultivated	NE
31	Rubiaceae	Ixora arborea	Ponna-yeik	Small Tree	Ayeyarwady, Mon, Taninthayi, Yangon	NE
32	Myrtaceae	Syzygium syzygioides	Thabye	Tree	Tannthayi, Yangon	NE
33	Convolvulaceae	Ipomoea aquatica	Ye-kazun	Climber/ Creeper	Wide	NE
34	Verbenaceae	Tectona grandis	Kyun	Tree	Wide	NE
35	Mimosaceae	Albizia procera	Sit	Tree	Reported from Myanmar	NE
36	Moraceae	Ficus glomerata	Ye-thapan	Tree	Bago, Kachin, Mandalay, Yangon	NE
37	Araceae	Colocasia esculenta	Pein	Herb	Cultivated	LC
38	Malvaceae	Hibiscus rosa- sinensis	Khaung-yan	Shrub	Cultivated	NE
39	Cucurbitaceae	Luffa aegyptiaca	Tha-but-kha	Climber/ Creeper	Cultivated	NE
40	Boraginaceae	Cordia dichotoma	Thanut	Tree	Kachin, Kayah, Mandalay, Shan, Yangon	NE
41	Malvaceae	Thespesia lampas	Thaman-shaw	Shrub	Chin, Mandalay, Taninthayi	NE
42	Hypericaceae	Mesua ferrea	Gangaw	Tree	Cultivated	NE
43	Mimosaceae	Pithecellobium dulce	Kala-magyi	Tree	Magway, Mandalay	NE
44	Myrtaceae	Psidium guajava	Malaka	Small Tree	Cultivated	NE
45	Moraceae	Ficus religiosa	Bawdi-nyaung	Tree	Cultivated	NE
46	Rubiaceae	Morinda angustifolia	Үеуо	Small Tree	Wide	NE

47	Sapotaceae	Manikara hexandra	Khayay	Tree	Cultivated	NE
48	Apocynaceae	Tabernaemontana divaricata	Zalat	Shrub	Cultivated	NE
49	Meliaceae	Cedrela febrifuga	Ye-tama	Tree	Kachin, Sagaing	NE
50	Caesalpiniaceae	Cassia fistula	Ngu	Tree	Wide	NE
51	Poaceae	Cynodon dactylon	Mye-sa	Grass	Wide	NE
52	Meliaceae	Aglaia odoratissima	Thanakha	Tree	Bago, Taninthayi	NE
53	Lauraceae	Cinnamomum camphora	Payok	Tree	Cultivated	NE
54	Arecaceae	Caryota mitis	Minbaw	Tree	Ayeyarwady, Bago, Kayah, Mon, Rskhine, Shan, Taninthayi, Yangon	NE
55	Rutaceae	Murraya koenigii	Pyindaw-thein	Small Tree	Cultivated	NE
56	Araceae	Areca catechu	Kunthi-pin	Small Tree	Cultivated	NE
57	Capparaceae	Capparis tenera	Alolay	Climber	Bago, Kachin, Mandalay, Yangon, Unknown	NE
58	Agavaceae	Polianthes tuberosa	Hnin-pan	Herb	Cultivated	NE
59	Lauraceae	Lindera pulcherrima	Shwe-nwe	Tree	Chin, Kachin, Mon	NE
60	Apocynaceae	Thevetia peruviana	Sethayathi	Small Tree	Cultivated	NE
61	Solanaceae	Physalis angula	Bauk-pin	Herb	Bago, Taninthayi, Yangon	LC
62	Lythraceae	Lawsonia alba	Dan	Shrub	Cultivated	NE
63	Cyperaceae	Hypolytrum nemorum	Satthwa	Herb	Kachin, Sagaing, Shan, Taninthayi	NE
64	Cucurnbitaceae	Cephalandra indica	Kinmon	Climber/ Creeper	Ayeyarwady, Kayin, Mandalay, Mon, Yangon	NE

65	Euphorbiaceae	Euphorbia milii	Kiss-me-quick	Shrub	Cultivated	DD
66	Dipterocarpaceae	Shorea siamensis	Ingyin	Tree	Wide	LC
67	Araceae	Alocasia gageana	Pein-pan	Herb	Reported from Myanmar	NE
68	Moraceae	Ficus altissima	Nyaung-peinne	Tree	Kachin, Mandalay, Taninthayi, Yangon	NE

## DD = Data Deficit

LR/LC = Lower Risk/Least Concerned EN = Endangered

### Table 7: List of plant species recorded in survey area (B6)

No	Family Name	Scientific Name	Common Name	Habitat	Distribution	IUCN
1	Mimosaceae	Acacia	Malaysia-	Small	Cultivated	LC
		auriculiformis	padauk	Tree		
2	Euphorbiaceae	Fluegga virosa	Chin ya	Small	Wide	NE
				Tree		
3	Mimosaceae	Leucaena	Bawsagaing	Tree	Mandalay, Sagaing,	NE
		leucocephala			Yangon	
4	Musaceae	Musa sapientum	Nget-pyaw	Herb	Cultivated	NE
5	Caesalpiniaceae	Senna siamea	Mezali	Tree	Reported from	NE
					Myanmar	
6	Mimosaceae	Albizia lebbek	Kokko	Tree	Reported from	NE
					Myanmar	
7	Caesalpiniaceae	Tamarindus indica	Magyi	Tree	Cultiveted	NE
8	Moraceae	Ficus religiosa	Bawdi-nyaung	Tree	Cultivated	NE
9	Araceae	Areca catechu	Kunthi-pin	Small	Cultivated	NE
				Tree		
10	Anacardiaceae	Mangifera indica	Thayet	Tree	Wide	NE
11	Fabaceae	Sesbania	Paukpan-byu	Small	Cultivated	NE
		grandiflora		Tree		
12	Amaranthaceae	Alternanthera	Kanaphaw	Herb	Yangon, Mandalay,	LC
		nodiflora			Taninthayi	
13	Arecaceae	Cocas nucifera	Ohn	Tree	Cultivated	NE
14	Euphorbiaceae	Phyllanthus niruri	Kyet-tha-hin	Shrub	Wide	NE
15	Boraginaceae	Heliotropium	Sin-hna-maung	Herb	Yangon	NE
		indium				
16	Areaceae	Nypa fruticans	Dani	Tree	Ayeyarwady	LC
17	Myrtaceae	Syzygium	Thabye	Tree	Tannthayi, Yangon	NE
		syzygioides				

18	Mimosaceae	Albizia procera	Sit	Tree	Reported from Myanmar	NE
19	Araceae	Colocasia esculenta	Pein	Herb	Cultivated	LC
20	Convolvulaceae	Ipomoea turbinate	Kazun-nwe	Creeper	Yangon	NE
21	Boraginaceae	Cordia dichotoma	Thanut	Tree	Kachin, Kayah, Mandalay, Shan, Yangon	NE
22	Malvaceae	Thespesia lampas	Thaman-shaw	Shrub	Chin, Mandalay, Taninthayi	NE
23	Myrtaceae	Psidium guajava	Malaka	Small Tree	Cultivated	NE
24	Steruliaceae	Scaphium scaphigerum	Mohbin	Tree	Mon, Taninthayi	NE
25	Poaceae	Dendrocalamus longispathus	Wanet	Bamboo	Bago, Mandalay, Mon, Rakhine, Shan, Taninthayi, Yangon	NE
26	Asteraceae	Coreopsis tinctoria	Sein-chai-pan	Herb	Cultivated	NE
27	Asteraceae	Gnaphalium indicum	Byaing-che	Herb	Magway, Yangon	NE
28	Poaceae	Dendrocalamus longispathus	Waya	Bamboo	Bago, Mandalay, Mon, Rakhine, Shan, Taninthayi, Yangon	NE
29	Amaranthaceae	Achyranthes aspera	Kyet-mauk-sue- pyan	Herb	Magway, Yangon	NE
30	Poaceae	Arundo donax	Куи	Grass	Reported from Myanmar	LC
31	Acanthaceae	Acanthus ebracteatus	Khaya	Shrub	Ayeyarwady, Rakhine, Taninthayi	LC
32	Lecythidaceae	Barringtonia acutangula	Ye-kyi	Tree	Wide	NE
33	Asteraceae	Chromolaena odorata	Bizat	Shrub	Wide	NE
34	Rhamnaceae	Ziziphus jujuba	Zi	Tree	Cultivated	NE
35	Convolvulaceae	Ipomoea aquatica	Ye-kazun	Climber/ Creeper	Wide	NE
36	Verbenaceae	Clerodendrum natans	Ngayan-padu	Shrub	Reported from Myanmar	NE
37	Convolvulaceae	Operculina turpethum	Kyahin-bin	Climber/ Creeper	Wide	NE
38	Poaceae	Saccharum officinarum	Kyan	Grass	Cultivated	NE

39	Rubiaceae	Anthocephalus	Ma-u	Tree	Bago, Magway,	NE
		morindaefolius			Mandalay, Sagaing,	
					Yangon	
40	Moraceae	Streblus asper	Okhne	Small	Bago, Sagaing,	NE
				Tree	Taninthayi	
41	Cucurnbitaceae	Cephalandra indica	Kinmon	Climber/	Ayeyarwady, Kayin,	NE
				Creeper	Mandalay, Mon,	
					Yangon	
42	Malvaceae	Hibiscus	Chin-baung	Shrub	Cultivated	NE
		cannabinus				
43	Zingiberaceae	Alpinia allughas	Gonmin	Herb	Kachin, Kayah,	NE
					Kayin, Mandalay,	
					Rakhine, Sagaing,	
					Shan, Yangon	
44	Asteraceae	Eclipta alba	Kyeik-hman	Herb	Reported from	LC
					Myanmar	

## LC = Least Concerned

# Table 8: List of plant species recorded in survey area (B7)

No	Family Name	Scientific Name	Common Name	Habitat	Distribution	IUCN
1	Mimosaceae	Acacia	Malaysia-	Small	Cultivated	LC
		auriculiformis	padauk	Tree		
2	Poaceae	Arundo donax	Kyu	Grass	Reported from	LC
					Myanmar	
3	Mimosaceae	Leucaena	Bawsagaing	Tree	Mandalay, Sagaing,	NE
		leucocephala			Yangon	
4	Musaceae	Musa sapientum	Nget-pyaw	Herb	Cultivated	NE
5	Caesalpiniaceae	Senna siamea	Mezali	Tree	Reported from	NE
					Myanmar	
6	Mimosaceae	Albizia lebbek	Kokko	Tree	Reported from	NE
					Myanmar	
7	Caesalpiniaceae	Tamarindus	Magyi	Tree	Cultiveted	NE
		indica				
8	Moraceae	Ficus religiosa	Bawdi-nyaung	Tree	Cultivated	NE
9	Myrtaceae	Syzygium	Thabye	Tree	Tannthayi, Yangon	NE
		syzygioides				
10	Verbenaceae	Vitex trifolia	Kyaungban	Small	Wide	NE
				Tree		
11	Fabaceae	Sesbania	Paukpan-byu	Small	Cultivated	NE
		grandiflora		Tree		

12	Amaranthaceae	Alternanthera nodiflora	Kanaphaw	Herb	Yangon, Mandalay, Taninthayi	LC
13	Arecaceae	Cocas nucifera	Ohn	Tree	Cultivated	NE
14	Araceae	Colocasia esculenta	Pein	Herb	Cultivated	LC
15	Boraginaceae	Heliotropium indium	Sin-hna-maung	Herb	Yangon	NE
16	Asteraceae	Chromolaena odorata	Bizat	Shrub	Wide	NE
17	Rhamnaceae	Ziziphus jujuba	Zi	Tree	Cultivated	NE
18	Convolvulaceae	Ipomoea aquatica	Ye-kazun	Climber/ Creeper	Wide	NE
19	Poaceae	Dendrocalamus longispathus	Wanet	Bamboo	Bago, Mandalay, Mon, Rakhine, Shan, Taninthayi, Yangon	NE
20	Myrtaceae	Psidium guajava	Malaka	Small Tree	Cultivated	NE
21	Steruliaceae	Scaphium scaphigerum	Mohbin	Tree	Mon, Taninthayi	NE
22	Myrtaceae	Eucalyptus camaldulensis	U-ca-lit	Tree	Cultivated	NE
23	Lythraceae	Lagerstromia speciosa	Pyinma	Tree	Reported from Myanmar	NE
24	Moraceae	Artocarpus heterophyllus	Peinne	Tree	Cultivated	NE
25	Nyctaginaceae	Bougainvillea spectabilis	Sekku-pan	Climber/ Creeper	Cultivated	NE
26	Capparaceae	Crateva magna	Kadet	Tree	Wide	NE
27	Anacardiaceae	Lannea coromandelica	Nabe	Tree	Bago, Kayin, Mandalay, Rakhine, Shan, Taninthayi, Yangon	NE
28	Malvaceae	Thespesia lampas	Thaman-shaw	Shrub	Chin, Mandalay, Taninthayi	NE
29	Convolvulaceae	Ipomoea carnea	La-thar-pan	Climber/ Creeper	Yangon	NE
30	Pontederiaceae	Monochoria vaginalis	Beda	Aquatic	Taninthayi, Yangon	LC
31	Meliaceae	Azadirachta indica	Tama	Tree	Wide	NE
32	Arecaceae	Borassus flabellifer	Htan	Tree	Bago, Mandalay, Sagaing, Taninthayi	EN

33	Rubiaceae	Morinda	Yeyo	Small	Wide	NE
		angustifolia		Tree		
34	Sapotaceae	Manikara	Khayay	Tree	Cultivated	NE
		hexandra				
35	Apocynaceae	Thevetia	Sethayathi	Small	Cultivated	NE
		peruviana		Tree		
36	Solanaceae	Physalis angula	Bauk-pin	Herb	Bago, Taninthayi, Yangon	LC
37	Combretaceae	Terminalia	Banda	Tree	Cultivated	NE
		catappa				
38	Rutaceae	Citrus	Shauk	Shrub	Cultivated	NE
		aurantiifolia				
39	Moringaceae	Moringa oleifera	Dan-da-lun	Tree	Cultivated	NE
40	Rubiaceae	Ixora arborea	Ponna-yeik	Small	Ayeyarwady, Mon,	NE
				Tree	Taninthayi, Yangon	
41	Bignoniaceae	Oroxylum indica	Kyaung-sha	Tree	Wide	NE
42	Poaceae	Cymbopogon	Sabalin	Grass	Cultivated	NE
		citratus				
43	Oleaceae	Jasminum	Sabe	Shrub,	MAgway, Mandalay,	NE
		arborescens		Climber	Yangon	
44	Fabaceae	Pterocarpus	Padauk	Tree	Bago, Mandalay,	NE
		macrocarpus			Sagaing, Taninthayi	
45	Cucurbitaceae	Lagenaria	Bu	Climber/	Cultivated	NE
		siceraria		Creeper		
46	Araceae	Areca catechu	Kunthi-pin	Small	Cultivated	NE
				Tree		
47	Apocynaceae	Catharanthus	Thinbaw-ma-	Shrub	Cultivated	NE
		roseus	hnyo			
48	Mimosaceae	Mimosa	Hti-ka-yone	Herb	Yangon	NE
		rubicaulis				
49	Cucurbitaceae	Luffa acutangula	Kha-we-yaing	Climber/	Cultivated	NE
				Creeper		
50	Poaceae	Thyrsostachys	Htiyo-wa	Bamboo	Cultivated	NE
		siamensis				
51	Malvaceae	Gossypium	Wah	Shrub	Cultivated	NE
		herbaceum				
52	Poaceae	Dendrocalamus	Wa-payaung	Bamboo	Reported from	NE
		brandisii			Myanmar	

**EN** = Endangered

No	Family Name	Scientific Name	Common Name	Habitat	Distribution	IUCN
1	Arecaceae	Borassus	Htan	Tree	Bago, Mandalay,	EN
		flabellifer			Sagaing, Taninthayi	
2	Mimosaceae	Leucaena	Bawsagaing	Tree	Mandalay, Sagaing,	NE
		leucocephala			Yangon	
3	Mimosaceae	Mimosa pudica	Htikayon	Herb	Wide	NE
4	Mimosaceae	Albizia lebbek	Kokko	Tree	Reported from	NE
					Myanmar	
5	Caesalpiniaceae	Tamarindus	Magyi	Tree	Cultiveted	NE
		indica				
6	Myrtaceae	Syzygium	Thabye	Tree	Tannthayi, Yangon	NE
		syzygioides				
7	Mimosaceae	Albizia procera	Sit	Tree	Reported from	NE
					Myanmar	
8	Amaranthaceae	Alternanthera	Kanaphaw	Herb	Yangon, Mandalay,	LC
		nodiflora			Taninthayi	
9	Arecaceae	Cocas nucifera	Ohn	Tree	Cultivated	NE
10	Moraceae	Ficus religiosa	Bawdi-nyaung	Tree	Cultivated	NE
11	Araceae	Areca catechu	Kunthi-pin	Small	Cultivated	NE
				Tree		
12	Caesalpinaceae	Delonix rigia	Sein-ban-gyi	Tree	Cultivated	NE
13	Fabaceae	Pterocarpus	Padauk	Tree	Bago, Mandalay,	NE
		macrocarpus			Sagaing, Taninthayi	
14	Myrtaceae	Eucalyptus	U-ca-lit	Tree	Cultivated	NE
		camaldulensis				
15	Euphorbiaceae	Fluegga virosa	Chin ya	Small	Wide	NE
				Tree		
16	Moraceae	Artocarpus	Peinne	Tree	Cultivated	NE
		heterophyllus				
17	Euphorbiaceae	Phyllanthus	Kyet-tha-hin	Shrub	Wide	NE
10		niruri				
18	Anacardiaceae	Mangifera	Thayet	Tree	Wide	NE
1.0		indica		~ 11	~	
19	Fabaceae	Sesbania	Paukpan-byu	Small	Cultivated	NE
•		grandiflora		Tree		
20	Mimosaceae	Acacia	Malaysia-	Small	Cultivated	LC
01		auriculiformis	padauk	Tree		
21	Combretaceae	Terminalia	Banda	Iree	Cultivated	NE
- 22		catappa		TT 1		
22	Araceae	Colocasia	Pein	Herb	Cultivated	
		esculenta				

 Table 9: List of plant species recorded in survey area (B8)

23	Boraginaceae	Heliotropium indium	Sin-hna-maung	Herb	Yangon	NE
24	Myrtaceae	Psidium guajava	Malaka	Small Tree	Cultivated	NE
25	Convolvulaceae	Ipomoea turbinate	Kazun-nwe	Creeper	Yangon	NE
26	Solanaceae	Physalis minima	Bauk-pin	Herb	Bago, Taninthayi, Yangon	LC
27	Steruliaceae	Scaphium scaphigerum	Mohbin	Tree	Mon, Taninthayi	NE
28	Acanthaceae	Hygrophila phlomoides	Migaung-kunbat	Herb	Bago, Taninthayi, Yangon	NE
29	Cucurbitaceae	Lagenaria siceraria	Bu	Climber/ Creeper	Cultivated	NE
30	Cucurbitaceae	Luffa acutangula	Kha-we-yaing	Climber/ Creeper	Cultivated	NE
31	Poaceae	Arundo donax	Куи	Grass	Reported from Myanmar	LC
32	Rhamnaceae	Ziziphus jujuba	Zi	Tree	Cultivated	NE
33	Myrtaceae	Syzgium aromaticum	Lay-hnyin	Small Tree	Cultivated	NE
34	Anacardiaceae	Lannea coromandelica	Nabe	Tree	Bago, Kayin, Mandalay, Rakhine, Shan, Taninthayi, Yangon	NE
35	Poaceae	Thyrsostachys siamensis	Htiyo-wa	Bamboo	Cultivated	NE
36	Asteraceae	Chromolaena odorata	Bizat	Shrub	Wide	NE
37	Moraceae	Streblus asper	Okhne	Small Tree	Bago, Sagaing, Taninthayi	NE
38	Rubiaceae	Anthocephalus morindaefolius	Ma-u	Tree	Bago, Magway, Mandalay, Sagaing, Yangon	NE
39	Poaceae	Dendrocalamus longispathus	Wanet	Bamboo	Bago, Mandalay, Mon, Rakhine, Shan, Taninthayi, Yangon	NE
40	Pontederiaceae	Monochoria vaginalis	Beda	Aquatic	Taninthayi, Yangon	LC
41	Apocynaceae	Carissa carandas	Khan	Small Tree	Cultivated	NE
42	Poaceae	Cynodon dactylon	Mye-sa	Grass	Wide	NE

43	Verbenaceae	Clerodendrum	Ngayan-padu	Shrub	Reported from	NE
		natans			Myanmar	
44	Convolvulaceae	Ipomoea carnea	La-thar-pan	Climber/	Yangon	NE
				Creeper		
45	Lythraceae	Lagerstromia	Pyinma	Tree	Reported from	NE
		speciosa			Myanmar	
46	Hypericaceae	Calophyllum	Pone-nyet	Tree	Mon, Taninthayi	LC
		inophyllum				
47	Amaranthaceae	Achyranthes	Kyet-mauk-pyan	Herb	Magway, Yangon	NE
		aspera	5 15			
48	Convolvulaceae	Іротоеа	Ye-kazun	Climber/	Wide	NE
		aquatica		Creeper		
49	Brassicaceae	Brassica	Mon-nvin	Herb	Cultivated	NE
.,	Diussieueeue	campestris	ivion nym	11010	Cultivited	1.12
50	Malvaceae	Hibiscus	Chin-baung	Shrub	Cultivated	NE
50	Warvaceae	cannahinus	chill buung	Sinuo	Cultivated	T L
51	Fabicaceae	Sashania	Nyan	Shrub	Rakhine Sagaing	IC
51	Tableaceae	bispinosa	INYall	Silluo	Rakinine, Sagaing	LC
52	Limaaaa		Tour nin soin	Chauh	Daga Mandalay	NE
32	Limaceae	Leucas aspera	raw-pin-sein	Shrub	Shan Vanaan	INE
52			17 1 1	C1 1	Shan, Yangon	
53	Asteraceae	Ageratum	Kadu-hpo	Shrub	Mandalay, Shan,	NE
		conyzoides			Yangon	
54	Lamiaceae	Leucas	Pin-gu-hteik-	Shrub	Ayeyarwady, Bago,	NE
		cephalotes	peik		Chin, Kayah,	
					Mandalay, Sagaing	
55	Euphorbiaceae	Phyllanthus	Mye-ziphyu	Herb	Wide	NE
		urinaria				
56	Fabaceae	Abrus	Ywe	Climber/	Wide	NE
		precatorius		Creeper		
57	Convolvulaceae	Operculina	Kyahin-bin	Climber/	Wide	NE
		turpethum	-	Creeper		
58	Nymphaeaceae	Nymphaea alba	Kyar	Aquatic	Reported from	LC
					Myanmar	

## EN = Endangered

## Table 10: List of plant species recorded in survey area (B9)

No	Family Name	Scientific Name	Common Name	Habitat	Distribution	IUCN
1	Asclepiadaceae	Calotropis	Mayo	Shrub	Magway, Mandalay,	NE
		procera			Sagaing, Shan	
2	Asteraceae	Chromolaena	Bizat	Shrub	Wide	NE
		odorata				

3	Mimosaceae	Mimosa pudica	Htikayon	Herb	Wide	NE
4	Musaceae	Musa sapientum	Nget-pyaw	Herb	Cultivated	NE
5	Caesalpiniaceae	Senna siamea	Mezali	Tree	Reported from	NE
					Myanmar	
6	Mimosaceae	Albizia lebbek	Kokko	Tree	Reported from	NE
					Myanmar	
7	Caesalpiniaceae	Tamarindus	Magyi	Tree	Cultiveted	NE
		indica				
8	Caricaceae	Carica papaya	Thinbaw	Small	Cultivated	DD
				Tree		
9	Arecaceae	Borassus	Htan	Tree	Bago, Mandalay,	EN
		flabellifer			Sagaing, Taninthayi	
10	Mimosaceae	Leucaena	Bawsagaing	Tree	Mandalay, Sagaing,	NE
		leucocephala			Yangon	
11	Meliaceae	Azadirachta	Tama	Tree	Wide	NE
		indica				
12	Caesalpinaceae	Delonix rigia	Sein-ban-gyi	Tree	Cultivated	NE
13	Fabaceae	Pterocarpus	Padauk	Tree	Bago, Mandalay,	NE
		macrocarpus			Sagaing, Taninthayi	
14	Moraceae	Streblus asper	Okhne	Small	Bago, Sagaing,	NE
				Tree	Taninthayi	
15	Vitaceae	Cayratia trifolia	Taw-sabyit	Climber/	Bago, Mandalay,	NE
				Creeper	Yangon, Unknown	
16	Rhamnaceae	Ziziphus jujuba	Zi	Tree	Cultivated	NE
17	Moringaceae	Moringa oleifera	Dan-da-lun	Tree	Cultivated	NE
18	Solanaceae	Solanum	Khayan-kazaw	Shrub	Bago, Mandalay,	NE
		indicum			Shan, Yangon	
19	Myrtaceae	Eucalyptus	U-ca-lit	Tree	Cultivated	NE
		camaldulensis				
20	Euphorbiaceae	Fluegga virosa	Chin ya	Small	Wide	NE
				Tree		
21	Moraceae	Artocarpus	Peinne	Tree	Cultivated	NE
		heterophyllus				
22	Caesalpiniaceae	Bauhinia	Swe-daw	Small	Wide	LC
		acuminata		Tree		
23	Anacardiaceae	Mangifera	Thayet	Tree	Wide	NE
		indica				
24	Steruliaceae	Scaphium	Mohbin	Tree	Mon, Taninthayi	NE
		scaphigerum				
25	Fabaceae	Sesbania	Paukpan-byu	Small	Cultivated	NE
		grandiflora		Tree		
26	Lythraceae	Lagerstromia	Pyinma	Tree	Reported from	NE
		speciosa			Myanmar	

27	Moraceae	Ficus religiosa	Bawdi-nyaung	Tree	Cultivated	NE
28	Araceae	Areca catechu	Kunthi-pin	Small	Cultivated	NE
				Tree		
29	Moraceae	Ficus glomerata	Ye-thapan	Tree	Bago, Kachin,	NE
					Mandalay, Yangon	
30	Mimosaceae	Acacia	Malaysia-	Small	Cultivated	LC
		auriculiformis	padauk	Tree		
31	Combretaceae	Terminalia	Banda	Tree	Cultivated	NE
		catappa				
32	Amaranthaceae	Alternanthera	Kanaphaw	Herb	Yangon, Mandalay,	LC
		nodiflora			Taninthayi	
33	Arecaceae	Cocas nucifera	Ohn	Tree	Cultivated	NE
34	Pontederiaceae	Monochoria vaginalis	Beda	Aquatic	Tanınthayı, Yangon	LC
35	Poaceae	Arundo donax	Kvu	Grass	Reported from	LC
00	1 0 0 0 0 0 0			01000	Myanmar	20
36	Bombacaceae	Bombax ceiba	Letpan	Tree	Wide	NE
			1		- 10	
37	Fabaceae	Butea frondosa	Pauk	Tree	Reported from	NE
20	A 1'	A 1:	T1 1 41 4	T	Myanmar	
38	Anacardiaceae	Anacardium	I hiho-thayet	Iree	Cultivated	NE
20	Decesso	occidentale	Were	Dambaa	Daga Mandalari	NE
39	Poaceae	Denarocalamus	waya	Bamboo	Bago, Mandalay, Mon Bakhina Shan	NE
		iongispainus			Taninthavi Vangon	
40	Acanthaceae	Acanthus	Khava	Shrub	Avevarwady	IC
40	Acanthaccac	ebracteatus	Kilaya	Silluo	Rakhine Taninthavi	LC
41	Sanindaceae	Arvtera littoralis	Lamu	Small	Kachin Mon	LR/LC
11	Supinduceue	n yiera intorans	Duniu	Tree	Sagaing, Taninthavi	
42	Areaceae	Nypa fruticans	Dani	Tree	Avevarwady	LC
43	Convolvulaceae	Ipomoea carnea	La-thar-pan	Climber/	Yangon	NE
			2	Creeper	1 mgon	1.2
44	Casuarinaceae	Casuarina	Pinle-kabwe	Tree	Cultivated	NE
		equisetifolia				
45	Lecythidaceae	Barringtonia	Ye-kyi	Tree	Wide	NE
		acutangula				
46	Fabaceae	Erythrina fusca	Kathit	Tree	Ayeyarwady, Bago,	NE
					Yangon	
47	Apocynaceae	Carissa	Khan	Small	Cultivated	NE
		carandas		Tree		
48	Euphorbiaceae	Phyllanthus	Kyet-tha-hin	Shrub	Wide	NE
		niruri				

49	Convolvulaceae	Operculina	Kyahin-bin	Climber/	Wide	NE
		turpethum		Creeper		
50	Nyctaginaceae	Bougainvillea	Sekku-pan	Climber/	Cultivated	NE
		spectabilis		Creeper		
51	Rutaceae	Citrus	Shauk	Shrub	Cultivated	NE
		aurantiifolia				
52	Rubiaceae	Ixora arborea	Ponna-yeik	Small	Ayeyarwady, Mon,	NE
				Tree	Taninthayi, Yangon	
53	Myrtaceae	Syzygium	Thabye	Tree	Tannthayi, Yangon	NE
		syzygioides				
54	Convolvulaceae	Іротоеа	Ye-kazun	Climber/	Wide	NE
		aquatica		Creeper		
55	Verbenaceae	Tectona grandis	Kyun	Tree	Wide	NE
56	Amaranthaceae	Alternanthera	Pazun-sar	Herb	Yangon	LC
		sessilis				
57	Poaceae	Thyrsostachys	Htiyo-wa	Bamboo	Cultivated	NE
		siamensis				
58	Boraginaceae	Heliotropium	Sin-hna-maung	Herb	Yangon	NE
		indium				
59	Capparaceae	Crateva magna	Kadet	Tree	Wide	NE
60	Cucurbitaceae	Citrullus	Kyi-ah	Climber/	Wide	NE
		colocynthis		Creeper		
61	Verbenaceae	Clerodendrum	Ngayan-padu	Shrub	Reported from	NE
		natans			Myanmar	
62	Anacardiaceae	Lannea	Nabe	Tree	Bago, Kayin,	NE
		coromandelica			Mandalay, Rakhine,	
					Shan, Taninthayi,	
					Yangon	
63	Mimosaceae	Albizia procera	Sit	Tree	Reported from	NE
		_			Myanmar	
64	Poaceae	Dendrocalamus	Wa-bo	Bamboo	Reported from	NE
		brinanicus			Myanmar	
65	Rutaceae	Limonia	Thi	Tree	Magway, Mandalay	NE
		acidissima				
66	Araceae	Colocasia	Pein	Herb	Cultivated	LC
		esculenta				
67	Malvaceae	Hibiscus rosa-	Khaung-yan	Shrub	Cultivated	NE
		sinensis				
68	Mimosaceae	Acacia	Nan-lon-kyaing	Small	Cultivated	NE
		farnesiana		Tree		
69	Poaceae	Dendrocalamus	Wabo-gyi	Bamboo	Mon, Kayin,	LC
		giganteus			Mandalay, Sagaing,	
					Shan, Ayeyarwady	

		aciaus		Iree	wyanmar	
84	Euphorbiaceae	Phyllanthus	I hinbaw-zibyu	Small	Reported from	NE
83	Hypericaceae	Mesua ferrea	Gangaw	Tree	Cultivated	NE
82	Hypericaceae	Calophyllum inophyllum	Pone-nyet	Tree	Mon, Taninthayi	LC
81	Zingiberaceae	Alpinia allughas	Gonmin	Herb	Kachin, Kayah, Kayin, Mandalay, Rakhine, Sagaing, Shan, Yangon	NE
80	Tiliaceae	Triumfetta annua	Katsine	Shrub	Wide	NE
79	Malvaceae	Thespesia lampas	Thaman-shaw	Shrub	Chin, Mandalay, Taninthayi	NE
78	Boraginaceae	Cordia dichotoma	Thanut	Tree	Kachin, Kayah, Mandalay, Shan, Yangon	NE
77	Convolvulaceae	Ipomoea turbinate	Kazun-nwe	Creeper	Yangon	NE
76	Convolvulaceae	Argyreia nervosa	Kazun-gyi	Creeper	Reported from Myanmar	NE
75	Fabaceae	Clitoria ternatea	Aung-me-nyo	Climber/ Creeper	Kachin, Mandalay, Sagaing, Yangon	NE
74	Sapotceae	Madhuca longifolia	Meze	Tree	Magway, Mandalay, Yangon, Unknown	NE
73	Cucurbitaceae	Luffa aegyptiaca	Tha-but-kha	Climber/ Creeper	Cultivated	NE
72	Rubiaceae	Anthocephalus morindaefolius	Ma-u	Tree	Bago, Magway, Mandalay, Sagaing, Yangon	NE
71	Meliaceae	Swietenia macrophylla	Mahogany	Tree	Cultivated	VU
70	Caesalpinaceae	Peltophorum pterocarpum	Thinbaw-mezali	Tree	Cultivated	NE

## **VU** = **Vulnerable EN** = **Endangered**

## 5.2 Fauna

#### (1) Habitat

The wildlife groups of the survey area consist of 5 groups of animals: mammals, birds, insects, Herpet and Fish. Fauna species habitat was found in small pools at the lower elevation, paddy

field and low plain, some herpect were found in houses and trees. Habitat Map of project area was already shown in Figure 12 and Sceneries of the Survey Area are shown in Figure 11.

### (2) Survey Result

Fauna	Survey area	No. of species	Fauna	Survey Area	No. of species
Mammal	B1	2 species	Herpet	B1	6 species
	B2	3 species		B2	8 species
	B3	2 species		B3	5 species
	B4	3 species		B4	4 species
	B5	2 species		B5	4 species
	B6	2 species		B6	6 species
	B7	2 species		B7	6 species
	B8	3 species		B8	6 species
	B9	3 species		B9	6 species
Bird	B1	56 species	Butterfly and	B1	8 species (butterfly)
			Dragonfly		6 species (dragonfly)
	B2	53 species		B2	12 species (butterfly)
					7 species (dragonfly)
	B3	47 species		B3	4 species (butterfly)
					5 species (dragonfly)
	B4	53 species		B4	8 species (butterfly)
					3 species (dragonfly)
	B5	62 speices		B5	2 species (butterfly)
					5 species (dragonfly)
	B6	47 species		B6	11 species (butterfly)
					3 species (dragonfly)
	B7	53 species		B7	5 species (butterfly)
					3 species (dragonfly)
	B8	47 species		B8	9 species (butterfly)
					5 species (dragonfly)
	B9	82 species		B9	12 species (butterfly)
					4 species (dragonfly)
Aquatic	B1	32 species			
	B2	32 speceis			
	B3	50 species			
	B4	50 species			
	B5	50 species			
	B6	40 species			
	B7	50 species			
	B8	50 species			
	B9	50 species	]		

The survey result of fauna species recorded in survey areas are listed below.

## (i) Birds

A total of 56 bird species in B1 area, 53 bird species in B2 area, 47 bird species in B3 area, 53 speceis in B4 area, 62 speceis in B5 area, 47 speceis in B6 area, 53 speceis in B7 area, 47 species in B8 area and 82 species in B9 area were recorded in the proposed project area. List of bird species recorded in survey area are described with table 11 to 19.

No	Scientific Name	Common Name	Family	Quantity	IUCN
1	Dendrocygna javanica	Lesser Whistling-duck	Anatinaes	2	LC
2	Phalacrocorax niger	Little cormorant	Phalacrocoracidae	5	LC
3	Egretta garzetta	Little Egret	Ardeidae	6	LC
4	Mesophoyx intermedia	Intermediate Egret	Ardeidae	5	LC
5	Ardea alba	Great Egret	Ardeidae	2	LC
6	Bubuclus coromandus	Eastern cattle Egret	Ardeidae	21	LC
7	Ardecola bacchus	Chinese pond-heron	Ardeidae	6	LC
8	Nycticorax nycticorax	Black-crowned night- heron	Ardeidae	2	LC
9	Ixobrychus cinnamomeus	Cinnamon bittern	Ardeidae	1	LC
10	Anastomus oscitans	Asian openbill	Ciconiidae	30+	LC
11	Threskiornis melanocephalus	Black-headed Ibis	Threskiornithidae	9	NT
12	Plegadis falcinellus	Glossy Ibis	Threskiornithidae	16	LC
13	Milvus migrans	Black kite	Accipitridae	1	LC
14	Gallinago gallinago	Common snipe	Scolopacidae	1	LC
15	Actitis hypoleucos	Common sandpiper	Scolopacidae	4	LC
16	Tringa glareola	Wood sanpiper	Scolopacidae	20	LC
17	Vanellus indicus	Red-wattled Lapwing	Charadriidae	5	LC
18	Megalaima haemacephala	Coppersmith Barbet	Ramphastidae	4	LC
19	Coracias benghalensis	Indian Roller	Coraciidae	2	LC
20	Aalcedo atthis	Common Kingfisher	Alcedinidae	1	LC
21	Halcyon smyrnensis	White-throated Kingfisher	Alcedinidae	5	LC
22	Merops orientalis	Little green bee-eater	Meropidae	30+	LC
23	Centropus sinensis	Greater Coucal	Cuculidae	2	LC
24	Cacomantis merulinnus	Plaintive cuckoo	Cuculidae	2	LC
25	Cypsiurus balasiensis	Asian Palm-Swift	Apodidae	30+	LC
26	Streptopelia chinensis	Spotted Dove	Columbidae	30+	LC
27	Streptopelia tranquebarica	Red collared Dove	Columbidae	14	LC

Table	11:	List	of Bird	<b>Species</b>	recorded	from	the	Survey	area	<b>(B1</b> )	)
				1				•		· ·	e

28	Columba livia	Rock Pigeon	Columbidae	16	LC
29	Corvus splendens	House Crow	Corvidae	6	LC
30	Corvus macrorhynchos	Large-billed Crow	Corvidae	2	LC
31	Lanius cristatus	Brown Shrike	Laniidae	2	LC
32	Hirundo rustica	Barn Swallow	Hirundinidae	30+	LC
33	Artamus fuscus	Ashy Woodswallow	Artimidae	2	LC
34	Oriolus xanthornus	Black-hooded Oriole	Oriolidae	4	LC
35	Aegithina tiphia	Common Iora	Aegithininae	1	LC
36	Dicrurus macrocerus	Black Drongo	Dicruridae	14	LC
37	Dicrurus leucophaeus	Ashy Drongo	Dicruridae	2	LC
38	Copsychus saularis	Oriental Magpie-robin	Muscicapidae	1	LC
39	Pyconotus cafer	Red-vented Bulbul	Pycnontidae	10	LC
40	Pycnonotus jocosus	Red-whiskered Bulbul	Pycnontidae	9	LC
41	Pyconotus blanfordi	Ayeyarwaddy Bulbul	Pycnontidae	6	LC/
					Endemic
42	Acridotheres tristis	Common Myna	Sturnidae	30+	LC
43	Acridotheres fuscus	Jungle Myna	Sturnidae	18	LC
	Ū.				
44	Saxicola caprata	Pied Bushchat	Muscicapidae	6	LC
44 45	Saxicola caprata Saxicola maurus	Pied Bushchat         Siberian stonechat	Muscicapidae Muscicapidae	6 5	LC NE
44 45 46	Saxicola caprata Saxicola maurus Cisticola juncidis	Pied BushchatSiberian stonechatZitting cisticola	Muscicapidae Muscicapidae Cisticolidae	6 5 14	LC NE LC
44 45 46 47	Saxicola caprata Saxicola maurus Cisticola juncidis Prinia flaxiventris	Pied BushchatSiberian stonechatZitting cisticolaPlain prinia	Muscicapidae Muscicapidae Cisticolidae Cisticiolidae	6 5 14 20	LC NE LC LC
44 45 46 47 48	Saxicola caprata Saxicola maurus Cisticola juncidis Prinia flaxiventris Prinia flaviventris	Pied BushchatSiberian stonechatZitting cisticolaPlain priniaYellow-bellied Prinia	Muscicapidae Muscicapidae Cisticolidae Cisticiolidae Cisticiolidae	6 5 14 20 8	LC NE LC LC LC
44 45 46 47 48 49	Saxicola caprata Saxicola maurus Cisticola juncidis Prinia flaxiventris Prinia flaviventris Orthotomus sutorius	Pied BushchatSiberian stonechatZitting cisticolaPlain priniaYellow-bellied PriniaCommon Tailorbird	Muscicapidae Muscicapidae Cisticolidae Cisticiolidae Cisticiolidae Sylviidae	6 5 14 20 8 1	LC NE LC LC LC LC
44 45 46 47 48 49 50	Saxicola caprata Saxicola maurus Cisticola juncidis Prinia flaxiventris Prinia flaviventris Orthotomus sutorius Ploceus philippinus	Pied BushchatSiberian stonechatZitting cisticolaPlain priniaYellow-bellied PriniaCommon TailorbirdBaya weaver	Muscicapidae Muscicapidae Cisticolidae Cisticiolidae Cisticiolidae Sylviidae Ploceidae	6 5 14 20 8 1 20	LC NE LC LC LC LC LC LC
44 45 46 47 48 49 50 51	Saxicola caprata Saxicola maurus Cisticola juncidis Prinia flaxiventris Prinia flaviventris Orthotomus sutorius Ploceus philippinus Anthus rufulus	Pied BushchatSiberian stonechatZitting cisticolaPlain priniaYellow-bellied PriniaCommon TailorbirdBaya weaverPaddyfield pipit	Muscicapidae Muscicapidae Cisticolidae Cisticiolidae Cisticiolidae Sylviidae Ploceidae Motacillidae	6 5 14 20 8 1 20 2	LC NE LC LC LC LC LC LC
44 45 46 47 48 49 50 51 52	Saxicola caprata Saxicola maurus Cisticola juncidis Prinia flaxiventris Prinia flaviventris Orthotomus sutorius Ploceus philippinus Anthus rufulus Motacilla alba	Pied BushchatSiberian stonechatZitting cisticolaPlain priniaYellow-bellied PriniaCommon TailorbirdBaya weaverPaddyfield pipitWhite wagtail	Muscicapidae Muscicapidae Cisticolidae Cisticiolidae Cisticiolidae Sylviidae Ploceidae Motacillidae	6 5 14 20 8 1 20 2 6	LC NE LC LC LC LC LC LC LC LC
44           45           46           47           48           49           50           51           52           53	Saxicola caprata Saxicola maurus Cisticola juncidis Prinia flaxiventris Prinia flaviventris Orthotomus sutorius Ploceus philippinus Anthus rufulus Motacilla alba Lonchura striata	Pied BushchatSiberian stonechatZitting cisticolaPlain priniaYellow-bellied PriniaCommon TailorbirdBaya weaverPaddyfield pipitWhite wagtailWhite-rump Munia	Muscicapidae Muscicapidae Cisticolidae Cisticiolidae Cisticiolidae Sylviidae Ploceidae Motacillidae Estrildidae	6 5 14 20 8 1 20 2 6 9	LC NE LC LC LC LC LC LC LC LC LC
44           45           46           47           48           49           50           51           52           53           54	Saxicola caprata Saxicola maurus Cisticola juncidis Prinia flaxiventris Prinia flaviventris Orthotomus sutorius Ploceus philippinus Anthus rufulus Motacilla alba Lonchura striata Lonchura punctulata	Pied BushchatSiberian stonechatZitting cisticolaPlain priniaYellow-bellied PriniaCommon TailorbirdBaya weaverPaddyfield pipitWhite wagtailWhite-rump MuniaScaly-breasted Munia	Muscicapidae Muscicapidae Cisticolidae Cisticiolidae Cisticiolidae Sylviidae Ploceidae Motacillidae Estrildidae Estrildidae	6         5         14         20         8         1         20         2         6         9         14	LC NE LC LC LC LC LC LC LC LC LC LC
44         45         46         47         48         49         50         51         52         53         54         55	Saxicola caprata Saxicola maurus Cisticola juncidis Prinia flaxiventris Prinia flaviventris Orthotomus sutorius Ploceus philippinus Anthus rufulus Motacilla alba Lonchura striata Lonchura punctulata Passer domesticus	Pied BushchatSiberian stonechatZitting cisticolaPlain priniaYellow-bellied PriniaCommon TailorbirdBaya weaverPaddyfield pipitWhite wagtailWhite-rump MuniaScaly-breasted MuniaHouse sparrow	Muscicapidae Muscicapidae Cisticolidae Cisticiolidae Cisticiolidae Sylviidae Ploceidae Motacillidae Estrildidae Estrildidae Passeridae	6 5 14 20 8 1 20 2 6 9 14 30+	LC NE LC LC LC LC LC LC LC LC LC LC

LC = Least Concerned

NT = Near Threatened







Common snipe (Gallinago gallinago)





Lesser Whistling-duck (*Dendrocygna javanica*) Plain prinia (*Prinia flaxiventris*) Fig 13: Some photo of bird species recorded in survey area (B1)

Tuble 12. Else of bit a species recorded in survey area (D2)
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No	Scientific Name	Common Name	Family	Quantity	IUCN
1	Dendrocygna javanica	Lesser Whistling-duck	Anatinae	4	LC
2	Phalacrocorax niger	Little cormorant	Phalacrocoracidae	6	LC
3	Egretta garzetta	Little Egret	Ardeidae	2	LC
4	Mesophoyx intermedia	Intermediate Egret	Ardeidae	1	LC
5	Bubuclus coromandus	Eastern cattle Egret	Ardeidae	14	LC
6	Ardecola bacchus	Chinese pond-heron	Ardeidae	2	LC
7	Nycticorax nycticorax	Black-crowned night-	Ardeidae	1	LC
		heron			
8	Anastomus oscitans	Asian openbill	Ciconiidae	30+	LC
9	Threskiornis	Black-headed Ibis	Threskiornithidae	6	NT
	melanocephalus				
10	Plegadis falcinellus	Glossy Ibis	Threskiornithidae	14	LC
11	Milvus migrans	Black kite	Accipitridae	1	LC

12	Circus melanoleucos	Pied Harrier	Accipitridae	1	LC
13	Falco tinnunculus	Common Kestrel	Falconidae	1	LC
14	Gallinago gallinago	Common snipe	Scolopacidae	2	LC
15	Vanellus indicus	Red-wattled Lapwing	Charadriidae	6	LC
16	Megalaima haemacephala	Coppersmith Barbet	Ramphastidae	4	LC
17	Coracias benghalensis	Indian Roller	Coraciidae	2	LC
18	Aalcedo atthis	Common Kingfisher	Alcedinidae	2	LC
19	Merops orientalis	Little green bee-eater	Meropidae	30+	LC
20	Merops philippinus	Blue-tailed Bee-eater	Meropidae	4	LC
21	Centropus bengalensis	Lesser Coucal	Cuculidae	1	LC
22	Centropus sinensis	Greater Coucal	Cuculidae	8	LC
23	Cypsiurus balasiensis	Asian Palm-Swift	Apodidae	30+	LC
24	Streptopelia chinensis	Spotted Dove	Columbidae	30+	LC
25	Streptopelia tranquebarica	Red collared Dove	Columbidae	14	LC
26	Columba livia	Rock Pigeon	Columbidae	6	LC
27	Corvus splendens	House Crow	Corvidae	6	LC
28	Corvus macrorhynchos	Large-billed Crow	Corvidae	4	LC
29	Lanius cristatus	Brown Shrike	Laniidae	6	LC
30	Hirundo rustica	Barn Swallow	Hirundinidae	30+	LC
31	Artamus fuscus	Ashy Woodswallow	Artimidae	4	LC
32	Oriolus xanthornus	Black-hooded Oriole	Oriolidae	4	LC
33	Aegithina tiphia	Common Iora	Aegithininae	10	LC
34	Dicrurus macrocerus	Black Drongo	Dicruridae	8	LC
35	Dicrurus leucophaeus	Ashy Drongo	Dicruridae	8	LC
36	Copsychus saularis	Oriental Magpie-robin	Muscicapidae	1	LC
37	Pyconotus cafer	Red-vented Bulbul	Pycnontidae	11	LC
38	Pycnonotus jocosus	Red-whiskered Bulbul	Pycnontidae	9	LC
39	Pyconotus blanfordi	Ayeyarwaddy Bulbul	Pycnontidae	10	LC/
					Endemic
40	Acridotheres tristis	Common Myna	Sturnidae	30+	LC
41	Acridotheres fuscus	Jungle Myna	Sturnidae	21	LC
42	Saxicola caprata	Pied Bushchat	Muscicapidae	2	LC
43	Saxicola maurus	Siberian stonechat	Muscicapidae	1	NE
44	Cisticola juncidis	Zitting cisticola	Cisticolidae	12	LC
45	Prinia flaxiventris	Plain prinia	Cisticiolidae	18	LC
46	Prinia flaviventris	Yellow-bellied Prinia	Cisticiolidae	8	LC
47	Ploceus philippinus	Baya weaver	Ploceidae	10	LC
48	Anthus rufulus	Paddyfield pipit	Motacillidae	2	LC
49	Motacilla alba	White wagtail	Motacillidae	2	LC
50	Lonchura striata	White-rump Munia	Estrildidae	12	LC
51	Lonchura punctulata	Scaly-breasted Munia	Estrildidae	30+	LC

52	Passer domesticus	House sparrow	Passeridae	30+	LC
53	Passer montanus	Eurasian Tree Sparrow	Passeridae	14	LC

LC = Least Concerned



Coppersmith Barbet (Megalaima haemacephala)





Little cormorant (*Phalacrocorax niger*)



Brown Shrike (*Lanius cristatus*) Pied Bushchat (*Saxicola caprata*) (Female) Fig 14: Some photo of bird species recorded in survey area (B2)

Table 13: List of bird species recorded in survey area (B3)

No	Scientific Name	Common Name	Family	Quantity	IUCN
1	Dendrocygna javanica	Lesser Whistling-duck	Anatinae	2	LC
2	Phalacrocorax niger	Little cormorant	Phalacrocoracidae	6	LC
3	Egretta garzetta	Little Egret	Ardeidae	2	LC
4	Bubuclus coromandus	Eastern cattle Egret	Ardeidae	2	LC
5	Ardecola bacchus	Chinese pond-heron	Ardeidae	1	LC
6	Nycticorax nycticorax	Black-crowned night-	Ardeidae	3	LC
		heron			
7	Anastomus oscitans	Asian openbill	Ciconiidae	22	LC
8	Threskiornis	Black-headed Ibis	Threskiornithidae	5	NT
	melanocephalus				

9	Plegadis falcinellus	Glossy Ibis	Threskiornithidae	10	LC
10	Milvus migrans	Black kite	Accipitridae	1	LC
11	Metopidius indicus	Bronze-winged Jacana	Jacanidae	6	LC
12	Tringa glareola	Wood sanpiper	Scolopacidae	18	LC
13	Vanellus indicus	Red-wattled Lapwing	Charadriidae	6	LC
14	Megalaima haemacephala	Coppersmith Barbet	Ramphastidae	4	LC
15	Coracias benghalensis	Indian Roller	Coraciidae	2	LC
16	Aalcedo atthis	Common Kingfisher	Alcedinidae	1	LC
17	Halcyon smyrnensis	White-throated	Alcedinidae	4	LC
		Kingfisher			
18	Merops orientalis	Little green bee-eater	Meropidae	30+	LC
19	Merops philippinus	Blue-tailed Bee-eater	Meropidae	4	LC
20	Centropus sinensis	Greater Coucal	Cuculidae	8	LC
21	Streptopelia chinensis	Spotted Dove	Columbidae	30+	LC
22	Streptopelia tranquebarica	Red collared Dove	Columbidae	14	LC
23	Columba livia	Rock Pigeon	Columbidae	8	LC
24	Corvus splendens	House Crow	Corvidae	6	LC
25	Corvus macrorhynchos	Large-billed Crow	Corvidae	4	LC
26	Lanius cristatus	Brown Shrike	Laniidae	4	LC
27	Hirundo rustica	Barn Swallow	Hirundinidae	30+	LC
28	Dicrurus macrocerus	Black Drongo	Dicruridae	19	LC
29	Dicrurus leucophaeus	Ashy Drongo	Dicruridae	5	LC
30	Copsychus saularis	Oriental Magpie-robin	Muscicapidae	4	LC
31	Pyconotus cafer	Red-vented Bulbul	Pycnontidae	30+	LC
32	Pycnonotus jocosus	Red-whiskered Bulbul	Pycnontidae	16	LC
33	Pyconotus blanfordi	Ayeyarwaddy Bulbul	Pycnontidae	22	LC/
					Endemic
34	Acridotheres tristis	Common Myna	Sturnidae	30+	LC
35	Acridotheres fuscus	Jungle Myna	Sturnidae	21	LC
36	Gracupica contra	Asian pied Starling	Sturnidae	5	LC
37	Saxicola caprata	Pied Bushchat	Muscicapidae	2	LC
38	Saxicola maurus	Siberian stonechat	Muscicapidae	6	NE
39	Cisticola juncidis	Zitting cisticola	Cisticolidae	30	LC
40	Prinia flaxiventris	Plain prinia	Cisticiolidae	18	LC
41	Ploceus philippinus	Baya weaver	Ploceidae	8	LC
42	Anthus rufulus	Paddyfield pipit	Motacillidae	16	LC
43	Motacilla alba	White wagtail	Motacillidae	2	LC
44	Lonchura striata	White-rump Munia	Estrildidae	17	LC
45	Lonchura punctulata	Scaly-breasted Munia	Estrildidae	20	LC
46	Passer domesticus	House sparrow	Passeridae	30+	LC
47	Passer montanus	Eurasian Tree Sparrow	Passeridae	29	LC

#### NT = Near Threatened



Spotted Dove (*Streptopelia chinensis*)





Black kite (Milvus migrans)



Paddyfield pipit (Anthus rufulus)Bronze-winged Jacana (Metopidius indicus)Fig 15: Some photo of Bird species recorded in the survey area (B3)

No	Scientific Name	Common Name	Family	Quantity	IUCN
1	Dendrocygna javanica	Lesser Whistling-duck	Anatinae	2	LC
2	Phalacrocorax niger	Little cormorant	Phalacrocoracidae	6	LC
3	Egretta garzetta	Little Egret	Ardeidae	2	LC
4	Mesophoyx intermedia	Intermediate Egret	Ardeidae	2	LC
5	Ardea alba	Great Egret	Ardeidae	1	LC
6	Bubuclus coromandus	Eastern cattle Egret	Ardeidae	3	LC
7	Ardecola bacchus	Chinese pond-heron	Ardeidae	17	LC
8	Nycticorax nycticorax	Black-crowned night-	Ardeidae	1	LC
		heron			
9	Anastomus oscitans	Asian openbill	Ciconiidae	30+	LC
10	Haliastur indus	Brahminy kite	Accipitridae	1	LC
11	Milvus migrans	Black kite	Accipitridae	2	LC

Table 14: List of bird species recorded in survey area (B4)

12	Elanus axillaris	Black-shoulder Kite	Accipitridae	1	LC
13	Charadrius dubius	Little ring plover	Charadriidae	6	LC
14	Actitis hypoleucos	Common sandpiper	Scolopacidae	4	LC
15	Vanellus indicus	Red-wattled Lapwing	Charadriidae	2	LC
16	Megalaima haemacephala	Coppersmith Barbet	Ramphastidae	6	LC
17	Coracias benghalensis	Indian Roller	Coraciidae	1	LC
18	Aalcedo atthis	Common Kingfisher	Alcedinidae	1	LC
19	Halcyon smyrnensis	White-throated Kingfisher	Alcedinidae	4	LC
20	Merops orientalis	Little green bee-eater	Meropidae	8	LC
21	Merops philippinus	Blue-tailed Bee-eater	Meropidae	2	LC
22	Merops leschenaulti	Chestnut-headed Bee- eater	Meropidae	2	LC
23	Centropus sinensis	Greater Coucal	Cuculidae	8	LC
24	Streptopelia chinensis	Spotted Dove	Columbidae	20	LC
25	Streptopelia tranquebarica	Red collared Dove	Columbidae	4	LC
26	Columba livia	Rock Pigeon	Columbidae	4	LC
27	Corvus splendens	House Crow	Corvidae	8	LC
28	Corvus macrorhynchos	Large-billed Crow	Corvidae	2	LC
29	Lanius cristatus	Brown Shrike	Laniidae	5	LC
30	Hirundo rustica	Barn Swallow	Hirundinidae	30+	LC
31	Artamus fuscus	Ashy Woodswallow	Artimidae	4	LC
32	Oriolus xanthornus	Black-hooded Oriole	Oriolidae	2	LC
33	Aegithina tiphia	Common Iora	Aegithininae	4	LC
34	Dicrurus macrocerus	Black Drongo	Dicruridae	30+	LC
35	Dicrurus leucophaeus	Ashy Drongo	Dicruridae	6	LC
36	Pyconotus cafer	Red-vented Bulbul	Pycnontidae	5	LC
37	Pycnonotus jocosus	Red-whiskered Bulbul	Pycnontidae	2	LC
38	Pyconotus blanfordi	Ayeyarwaddy Bulbul	Pycnontidae	6	LC/
					Endemic
39	Acridotheres tristis	Common Myna	Sturnidae	30	LC
40	Acridotheres fuscus	Jungle Myna	Sturnidae	18	LC
41	Saxicola caprata	Pied Bushchat	Muscicapidae	8	LC
42	Saxicola maurus	Siberian stonechat	Muscicapidae	16	NE
43	Cisticola juncidis	Zitting cisticola	Cisticolidae	9	LC
44	Prinia flaxiventris	Plain prinia	Cisticiolidae	17	LC
45	Prinia rufescens	Rufescent Prinia	Cisticiolidae	9	LC
46	Prinia flaviventris	Yellow-bellied Prinia	Cisticiolidae	4	LC
47	Ploceus philippinus	Baya weaver	Ploceidae	18	LC
48	Anthus rufulus	Paddyfield pipit	Motacillidae	4	LC
49	Motacilla alba	White wagtail	Motacillidae	2	LC
50	Lonchura striata	White-rump Munia	Estrildidae	9	LC

51	Lonchura punctulata	Scaly-breasted Munia	Estrildidae	18	LC
52	Passer domesticus	House sparrow	Passeridae	30+	LC
53	Passer montanus	Eurasian Tree Sparrow	Passeridae	29	LC

#### LC = Least Concerned



Black Drongo (Dicrurus macrocers)





Common sandpiper (Actitis hypoleucos)



Yellow-bellied Prinia (Prinia flaviventris)Asian openbill (Anastomus oscitans)Fig 16: Some photo of Bird species recorded in the survey area (B4)

No	Scientific Name	Common Name	Family	Quantity	IUCN
1	Dendrocygna	Lesser Whistling-duck	Anatinae	2	LC
	javanica				
2	Phalacrocorax niger	Little cormorant	Phalacrocoracidae	6	LC
3	Egretta garzetta	Little Egret	Ardeidae	6	LC
4	Mesophoyx	Intermediate Egret	Ardeidae	5	LC
	intermedia				
5	Ardea alba	Great Egret	Ardeidae	2	LC

#### Table 15: List of bird species recorded in survey area (B5)

6	Bubuclus	Eastern cattle Egret	Ardeidae	14	LC
	coromandus				
7	Ardecola bacchus	Chinese pond-heron	Ardeidae	10	LC
8	Nycticorax	Black-crowned night-	Ardeidae	1	LC
	nycticorax	heron			
9	Ixobrychus	Cinnamon bittern	Ardeidae	1	LC
	cinnamomeus				
10	Anastomus oscitans	Asian openbill	Ciconiidae	14	LC
11	Threskiornis	Black-headed Ibis	Threskiornithidae	8	NT
	melanocephalus				
12	Plegadis falcinellus	Glossy Ibis	Threskiornithidae	14	LC
13	Haliastur indus	Brahminy kite	Accipitridae	1	LC
14	Milvus migrans	Black kite	Accipitridae	2	LC
15	Elanus axillaris	Black-shoulder Kite	Accipitridae	1	LC
16	Vanellus indicus	Red-wattled Lapwing	Charadriidae	4	LC
17	Megalaima	Coppersmith Barbet	Ramphastidae	4	LC
	haemacephala				
18	Coracias	Indian Roller	Coraciidae	2	LC
	benghalensis				
19	Aalcedo atthis	Common Kingfisher	Alcedinidae	1	LC
20	Halcyon smyrnensis	White-throated Kingfisher	Alcedinidae	2	LC
21	Halcyon pileata	Black-Capped Kingfisher	Alcedinidae	1	LC
22	Merops orientalis	Little green bee-eater	Meropidae	18	LC
23	Merops philippinus	Blue-tailed Bee-eater	Meropidae	2	LC
24	Centropus sinensis	Greater Coucal	Cuculidae	2	LC
25	Cacomantis	Plaintive cuckoo	Cuculidae	2	LC
	merulinnus				
26	Cypsiurus balasiensis	Asian Palm-Swift	Apodidae	30+	LC
27	Glaucidium	Asian Barred Owlet	Strigidae	1	LC
	cuculoides				
28	Streptopelia	Spotted Dove	Columbidae	30+	LC
	chinensis				
29	Streptopelia	Red collared Dove	Columbidae	9	LC
	tranquebarica				
30	Columba livia	Rock Pigeon	Columbidae	8	LC
31	Corvus splendens	House Crow	Corvidae	6	LC
32	Corvus	Large-billed Crow	Corvidae	4	LC
	macrorhynchos				
33	Lanius cristatus	Brown Shrike	Laniidae	2	LC
34	Hirundo rustica	Barn Swallow	Hirundinidae	30+	LC
35	Artamus fuscus	Ashy Woodswallow	Artimidae	4	LC
36	Oriolus xanthornus	Black-hooded Oriole	Oriolidae	4	LC
37	Aegithina tiphia	Common Iora	Aegithininae	4	LC
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38	Dicrurus macrocerus	Black Drongo	Dicruridae	6	LC
39	Dicrurus	Ashy Drongo	Dicruridae	2	LC
	leucophaeus				
40	Copsychus saularis	Oriental Magpie-robin	Muscicapidae	2	LC
41	Ficedula albicilla	Taiga Flycatcher		1	LC
42	Pyconotus cafer	Red-vented Bulbul	Pycnontidae	16	LC
43	Pycnonotus jocosus	Red-whiskered Bulbul	Pycnontidae	10	LC
44	Pyconotus blanfordi	Ayeyarwaddy Bulbul	Pycnontidae	10	LC/ Endemic
45	Acridotheres tristis	Common Myna	Sturnidae	30+	LC
46	Acridotheres fuscus	Jungle Myna	Sturnidae	21	LC
47	Saxicola caprata	Pied Bushchat	Muscicapidae	6	LC
48	Saxicola maurus	Siberian stonechat	Muscicapidae	4	NE
49	Cisticola juncidis	Zitting cisticola	Cisticolidae	14	LC
50	Prinia flaxiventris	Plain prinia	Cisticiolidae	18	LC
51	Prinia rufescens	Rufescent Prinia	Cisticiolidae	7	LC
52	Prinia flaviventris	Yellow-bellied Prinia	Cisticiolidae	9	LC
53	Rhipidura albicollis	White-throated Fantail	Rhipiduridae	6	LC
54	Orthotomus sutorius	Common Tailorbird	Sylviidae	5	LC
55	Dicaeum cruentatum	Scarlet-backed	Dicaeidae	9	LC
		Flowerpecker			
56	Ploceus philippinus	Baya weaver	Ploceidae	8	LC
57	Anthus rufulus	Paddyfield pipit	Motacillidae	4	LC
58	Motacilla alba	White wagtail	Motacillidae	4	LC
59	Lonchura striata	White-rump Munia	Estrildidae	12	LC
60	Lonchura punctulata	Scaly-breasted Munia	Estrildidae	18	LC
61	Passer domesticus	House sparrow	Passeridae	30+	LC
62	Passer montanus	Eurasian Tree Sparrow	Passeridae	29	LC

**NE = Not Evaluated** 

LC = Least Concerned

NT = Near Threatened



White-throated Kingfisher (Halcyon smyrnensis)



Scaly-breasted Munia (Lonchura punctulata)





White wagtail (Motacilla alba)Oriental Magpie-robin (Copsychus saularis)Fig 17: Some photo of Bird species recorded in the survey area (B5)

Table 1	16:	List (	of bird	species	recorded	in	survey	area (	<b>B6</b>	)
							•/	,		

No	Scientific Name	Common Name	Family	Quantity	IUCN
1	Phalacrocorax niger	Little cormorant	Phalacrocoracidae	2	LC
2	Egretta garzetta	Little Egret	Ardeidae	6	LC
3	Bubuclus coromandus	Eastern cattle Egret	Ardeidae	2	LC
4	Ardecola bacchus	Chinese pond-heron	Ardeidae	2	LC
5	Ardea purpurea	Purple heron	Ardeidae	1	LC
6	Anastomus oscitans	Asian openbill	Ciconiidae	20	LC
7	Plegadis falcinellus	Glossy Ibis	Threskiornithidae	22	LC
8	Haliastur indus	Brahminy kite	Accipitridae	1	LC
9	Milvus migrans	Black kite	Accipitridae	1	LC
10	Elanus axillaris	Black-shoulder Kite	Accipitridae	1	LC
11	Falco tinnunculus	Common Kestrel	Falconidae	1	LC
12	Megalaima haemacephala	Coppersmith Barbet	Ramphastidae	6	LC
13	Coracias benghalensis	Indian Roller	Coraciidae	4	LC

14	Halcyon smyrnensis	White-throated	Alcedinidae	4	LC
		Kingfisher			
15	Merops orientalis	Little green bee-eater	Meropidae	14	LC
16	Centropus sinensis	Greater Coucal	Cuculidae	1	LC
17	Psittacula Krameri	Rose-ringed Parakeet	Psittadae	1	LC
18	Cacomantis merulinnus	Plaintive cuckoo	Cuculidae	2	LC
19	Cypsiurus balasiensis	Asian Palm-Swift	Apodidae	20	LC
20	Streptopelia chinensis	Spotted Dove	Columbidae	19	LC
21	Streptopelia tranquebarica	Red collared Dove	Columbidae	10	LC
22	Columba livia	Rock Pigeon	Columbidae	14	LC
23	Corvus splendens	House Crow	Corvidae	8	LC
24	Lanius cristatus	Brown Shrike	Laniidae	6	LC
25	Hirundo rustica	Barn Swallow	Hirundinidae	4	LC
26	Artamus fuscus	Ashy Woodswallow	Artimidae	4	LC
27	Oriolus xanthornus	Black-hooded Oriole	Oriolidae	2	LC
28	Aegithina tiphia	Common Iora	Aegithininae	4	LC
29	Dicrurus macrocerus	Black Drongo	Dicruridae	5	LC
30	Dicrurus leucophaeus	Ashy Drongo	Dicruridae	4	LC
31	Pyconotus cafer	Red-vented Bulbul	Pycnontidae	14	LC
32	Pycnonotus jocosus	Red-whiskered Bulbul	Pycnontidae	10	LC
33	Pyconotus blanfordi	Ayeyarwaddy Bulbul	Pycnontidae	8	LC/
					Endemic
34	Acridotheres tristis	Common Myna	Sturnidae	16	LC
35	Acridotheres fuscus	Jungle Myna	Sturnidae	10	LC
36	Saxicola caprata	Pied Bushchat	Muscicapidae	5	LC
37	Saxicola maurus	Siberian stonechat	Muscicapidae	6	NE
38	Cisticola juncidis	Zitting cisticola	Cisticolidae	6	LC
39	Prinia flaxiventris	Plain prinia	Cisticiolidae	14	LC
40	Prinia flaviventris	Yellow-bellied Prinia	Cisticiolidae	4	LC
41	Ploceus philippinus	Baya weaver	Ploceidae	8	LC
42	Anthus rufulus	Paddyfield pipit	Motacillidae	16	LC
43	Motacilla alba	White wagtail	Motacillidae	2	LC
44	Lonchura striata	White-rump Munia	Estrildidae	10	LC
45	Lonchura punctulata	Scaly-breasted Munia	Estrildidae	19	LC
46	Passer domesticus	House sparrow	Passeridae	20	LC
47	Passer montanus	Eurasian Tree Sparrow	Passeridae	19	LC

**NE** = Not Evaluated



Plain prinia (Prinia flaxiventris)





Rose-ringed Parakeet (Psittacula Krameri)



Plaintive cuckoo (Cacomantis merulinnus)Red-vented Bulbul (Pyconotus cafer)Fig 18: Some photo of Bird species recorded in the survey area (B6)

Table 17: List of bird species recorded in survey area (B7)	
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No	Scientific Name	Common Name	Family	Quantity	IUCN
1	Dendrocygna javanica	Lesser Whistling-duck	Anatinae	2	LC
2	Phalacrocorax niger	Little cormorant	Phalacrocoracidae	2	LC
3	Egretta garzetta	Little Egret	Ardeidae	4	LC
4	Mesophoyx intermedia	Intermediate Egret	Ardeidae	4	LC
5	Ardea alba	Great Egret	Ardeidae	2	LC
6	Bubuclus coromandus	Eastern cattle Egret	Ardeidae	14	LC
7	Ardecola bacchus	Chinese pond-heron	Ardeidae	5	LC
8	Ardea purpurea	Purple heron	Ardeidae	1	LC
9	Ixobrychus cinnamomeus	Cinnamon bittern	Ardeidae	1	LC
10	Anastomus oscitans	Asian openbill	Ciconiidae	20	LC
11	Threskiornis	Black-headed Ibis	Threskiornithidae	4	NT
	melanocephalus				
12	Plegadis falcinellus	Glossy Ibis	Threskiornithidae	10	LC

13	Milvus migrans	Black kite	Accipitridae	1	LC
14	Megalaima haemacephala	Coppersmith Barbet	Ramphastidae	4	LC
15	Coracias benghalensis	Indian Roller	Coraciidae	2	LC
16	Aalcedo atthis	Common Kingfisher	Alcedinidae	1	LC
17	Halcyon smyrnensis	White-throated	Alcedinidae	2	LC
		Kingfisher			
18	Merops orientalis	Little green bee-eater	Meropidae	8	LC
19	Centropus sinensis	Greater Coucal	Cuculidae	2	LC
20	Cacomantis merulinnus	Plaintive cuckoo	Cuculidae	2	LC
21	Cypsiurus balasiensis	Asian Palm-Swift	Apodidae	20	LC
22	Streptopelia chinensis	Spotted Dove	Columbidae	14	LC
23	Streptopelia tranquebarica	Red collared Dove	Columbidae	8	LC
24	Columba livia	Rock Pigeon	Columbidae	8	LC
25	Corvus splendens	House Crow	Corvidae	6	LC
26	Corvus macrorhynchos	Large-billed Crow	Corvidae	4	LC
27	Lanius cristatus	Brown Shrike	Laniidae	2	LC
28	Hirundo rustica	Barn Swallow	Hirundinidae	20	LC
29	Artamus fuscus	Ashy Woodswallow	Artimidae	2	LC
30	Oriolus xanthornus	Black-hooded Oriole	Oriolidae	4	LC
31	Aegithina tiphia	Common Iora	Aegithininae	4	LC
32	Dicrurus macrocerus	Black Drongo	Dicruridae	8	LC
33	Dicrurus leucophaeus	Ashy Drongo	Dicruridae	4	LC
34	Copsychus saularis	Oriental Magpie-robin	Muscicapidae	2	LC
35	Pyconotus cafer	Red-vented Bulbul	Pycnontidae	20	LC
36	Pycnonotus jocosus	Red-whiskered Bulbul	Pycnontidae	10	LC
37	Pyconotus blanfordi	Ayeyarwaddy Bulbul	Pycnontidae	10	LC/
					Endemic
38	Acridotheres tristis	Common Myna	Sturnidae	20	LC
39	Acridotheres fuscus	Jungle Myna	Sturnidae	14	LC
40	Saxicola caprata	Pied Bushchat	Muscicapidae	8	LC
41	Saxicola maurus	Siberian stonechat	Muscicapidae	5	NE
42	Cisticola juncidis	Zitting cisticola	Cisticolidae	8	LC
43	Prinia flaxiventris	Plain prinia	Cisticiolidae	4	LC
44	Prinia flaviventris	Yellow-bellied Prinia	Cisticiolidae	4	LC
45	Rhipidura albicollis	White-throated Fantail	Rhipiduridae	2	LC
46	Orthotomus sutorius	Common Tailorbird	Sylviidae	2	LC
47	Dicaeum cruentatum	Scarlet-backed	Dicaeidae	4	LC
		Flowerpecker			
48	Ploceus philippinus	Baya weaver	Ploceidae	8	LC
49	Motacilla alba	White wagtail	Motacillidae	2	LC
50	Lonchura striata	White-rump Munia	Estrildidae	9	LC
51	Lonchura punctulata	Scaly-breasted Munia	Estrildidae	12	LC

52	Passer domesticus	House sparrow	Passeridae	20	LC
53	Passer montanus	Eurasian Tree Sparrow	Passeridae	16	LC

**NE = Not Evaluated LC = Least Concerned** 

### NT = Near Threatened



Plain prinia (Prinia flaxiventris)





Indian Roller (Coracias benghalensis)



Common Kestrel (Falco tinnunculus)Asian openbill (Anastomus oscitans)Fig 19: Some photo of Bird species recorded in the survey area (B7)

### Table 18: List of bird species recorded in survey area (B8)

No	Scientific Name	Common Name	Family	Quantity	IUCN
1	Dendrocygna javanica	Lesser Whistling-duck	Anatinae	2	LC
2	Phalacrocorax niger	Little cormorant	Phalacrocoracidae	6	LC
3	Egretta garzetta	Little Egret	Ardeidae	2	LC
4	Bubuclus coromandus	Eastern cattle Egret	Ardeidae	2	LC
5	Ardecola bacchus	Chinese pond-heron	Ardeidae	6	LC
6	Anastomus oscitans	Asian openbill	Ciconiidae	22	LC
7	Threskiornis	Black-headed Ibis	Threskiornithidae	10	NT
	melanocephalus				

8	Plegadis falcinellus	Glossy Ibis	Threskiornithidae	12	LC
9	Milvus migrans	Black kite	Accipitridae	1	LC
10	Vanellus indicus	Red-wattled Lapwing	Charadriidae	2	LC
11	Megalaima haemacephala	Coppersmith Barbet	Ramphastidae	4	LC
12	Dendrocopos canicapillus	Grey-capped pygmy	Picidae	1	LC
		Woodpecker			
13	Coracias benghalensis	Indian Roller	Coraciidae	2	LC
14	Aalcedo atthis	Common Kingfisher	Alcedinidae	1	LC
15	Halcyon smyrnensis	White-throated Kingfisher	Alcedinidae	2	LC
16	Merops orientalis	Little green bee-eater	Meropidae	8	LC
17	Merops philippinus	Blue-tailed Bee-eater	Meropidae	2	LC
18	Centropus sinensis	Greater Coucal	Cuculidae	2	LC
19	Psittacula Krameri	Rose-ringed Parakeet	Psittadae	1	LC
20	Cypsiurus balasiensis	Asian Palm-Swift	Apodidae	20	LC
21	Streptopelia chinensis	Spotted Dove	Columbidae	30+	LC
22	Streptopelia tranquebarica	Red collared Dove	Columbidae	6	LC
23	Columba livia	Rock Pigeon	Columbidae	8	LC
24	Corvus splendens	House Crow	Corvidae	6	LC
25	Corvus macrorhynchos	Large-billed Crow	Corvidae	4	LC
26	Lanius cristatus	Brown Shrike	Laniidae	4	LC
27	Hirundo rustica	Barn Swallow	Hirundinidae	10	LC
28	Artamus fuscus	Ashy Woodswallow	Artimidae	2	LC
29	Aegithina tiphia	Common Iora	Aegithininae	5	LC
30	Dicrurus macrocerus	Black Drongo	Dicruridae	4	LC
31	Dicrurus leucophaeus	Ashy Drongo	Dicruridae	2	LC
32	Pyconotus cafer	Red-vented Bulbul	Pycnontidae	16	LC
33	Pycnonotus jocosus	Red-whiskered Bulbul	Pycnontidae	10	LC
34	Pyconotus blanfordi	Ayeyarwaddy Bulbul	Pycnontidae	8	LC/
					Endemic
35	Acridotheres tristis	Common Myna	Sturnidae	14	LC
36	Acridotheres fuscus	Jungle Myna	Sturnidae	5	LC
37	Saxicola caprata	Pied Bushchat	Muscicapidae	8	LC
38	Saxicola maurus	Siberian stonechat	Muscicapidae	6	NE
39	Cisticola juncidis	Zitting cisticola	Cisticolidae	15	LC
40	Prinia flaxiventris	Plain prinia	Cisticiolidae	10	LC
41	Ploceus philippinus	Baya weaver	Ploceidae	15	LC
42	Anthus rufulus	Paddyfield pipit	Motacillidae	2	LC
43	Motacilla alba	White wagtail	Motacillidae	2	LC
44	Lonchura striata	White-rump Munia	Estrildidae	10	LC
45	Lonchura punctulata	Scaly-breasted Munia	Estrildidae	16	LC
46	Passer domesticus	House sparrow	Passeridae	17	LC

47	Passer montanus	Eurasian Tree Sparrow	Passeridae	16	LC
		-			

**NE = Not Evaluated LC = Least Concerned** 

### NT = Near Threatened



Common Myna (Acridotheres tristis)





Asian openbill (Anastomus oscitans)



Red collared Dove (Streptopelia tranquebarica)Red-whiskered Bulbul (Pycnonotus jocosus)Fig 20: Some photo of Bird species recorded in the survey area (B8)

Table 19: List of bird species recorded in survey area (B9)

No	Scientific Name	Common Name	Family	Quantity	IUCN
1	Dendrocygna javanica	Lesser Whistling-duck	Anatinae	4	LC
2	Phalacrocorax niger	Little cormorant	Phalacrocoracidae	6	LC
3	Egretta garzetta	Little Egret	Ardeidae	4	LC
4	Mesophoyx intermedia	Intermediate Egret	Ardeidae	6	LC
5	Ardea alba	Great Egret	Ardeidae	4	LC
6	Bubuclus coromandus	Eastern cattle Egret	Ardeidae	20	LC
7	Ardecola bacchus	Chinese pond-heron	Ardeidae	12	LC
8	Nycticorax nycticorax	Black-crowned night-heron	Ardeidae	4	LC
9	Ardea purpurea	Purple heron	Ardeidae	2	LC

10	Ixobrychus	Cinnamon bittern	Ardeidae	1	LC
	cinnamomeus				
11	Anastomus oscitans	Asian openbill	Ciconiidae	40+	LC
12	Threskiornis	Black-headed Ibis	Threskiornithidae	15	NT
	melanocephalus				
13	Plegadis falcinellus	Glossy Ibis	Threskiornithidae	20+	LC
14	Haliastur indus	Brahminy kite	Accipitridae	2	LC
15	Milvus migrans	Black kite	Accipitridae	6	LC
16	Elanus axillaris	Black-shoulder Kite	Accipitridae	2	LC
17	Pandion haliaetus	Osprey	Pandionidae	1	LC
18	Circus melanoleucos	Pied Harrier	Accipitridae	1	LC
19	Falco tinnunculus	Common Kestrel	Falconidae	1	LC
20	Porzana fusca	Ruddy-breasted crake	Rallidae	1	LC
21	Amaurornis phoenicurus	White-breasted waterhen	Rallidae	2	LC
22	Himantopus himantopus	Black-winged stilt	Recurvirostridae	30	LC
23	Metopidius indicus	Bronze-winged Jacana	Jacanidae	6	LC
24	Charadrius dubius	Little ring plover	Charadriidae	8	LC
25	Gallinago gallinago Common snipe		Scolopacidae	2	LC
26	Actitis hypoleucos	eucos Common sandpiper		12	LC
27	Tringa glareola	Wood sanpiper	Scolopacidae	30+	LC
28	Vanellus indicus	Red-wattled Lapwing	Charadriidae	15	LC
29	Chlidonias niger	White-winged Tern	Laridae	30+	LC
30	Chroicocephalus relictus	Brown-headed Gull	Laridae	30+	LC
31	Chroicocephalus	Black-headed Gull	Laridae	30+	LC
	ridibundus				
32	Megalaima	Coppersmith Barbet	Ramphastidae	10	LC
	haemacephala				
33	Dendrocopos	Grey-capped pygmy	Picidae	1	LC
	canicapillus	Woodpecker			
34	Coracias benghalensis	Indian Roller	Coraciidae	16	LC
35	Aalcedo atthis	Common Kingfisher	Alcedinidae	8	LC
36	Halcyon smyrnensis	White-throated Kingfisher	Alcedinidae	16	LC
37	Halcyon pileata	Black-Capped Kingfisher	Alcedinidae	2	LC
38	Merops orientalis	Little green bee-eater	Meropidae	30+	LC
39	Merops philippinus	Blue-tailed Bee-eater	Meropidae	18	LC
40	Merops leschenaulti	Chestnut-headed Bee-eater	Meropidae	4	LC
41	Centropus bengalensis	Lesser Coucal	Cuculidae	1	LC
42	Centropus sinensis	Greater Coucal	Cuculidae	15	LC
43	Psittacula Krameri	Rose-ringed Parakeet	Psittadae	4	LC
44	Cacomantis merulinnus	Plaintive cuckoo	Cuculidae	8	LC
45	Cypsiurus balasiensis	Asian Palm-Swift	Apodidae	30+	LC
46	Glaucidium cuculoides	Asian Barred Owlet	Strigidae	1	LC

47	Streptopelia chinensis	Spotted Dove	Columbidae	30+	LC
48	Streptopelia	Red collared Dove	Columbidae	30	LC
	tranquebarica				
49	Columba livia	Rock Pigeon	Columbidae	30+	LC
50	Corvus splendens	House Crow	Corvidae	30+	LC
51	Corvus macrorhynchos	Large-billed Crow	Corvidae	21	LC
52	Lanius cristatus	Brown Shrike	Laniidae	9	LC
53	Hirundo rustica	Barn Swallow	Hirundinidae	30+	LC
54	Artamus fuscus	Ashy Woodswallow	Artimidae	8	LC
55	Oriolus xanthornus	Black-hooded Oriole	Oriolidae	5	LC
56	Aegithina tiphia	Common Iora	Aegithininae	4	LC
57	Dicrurus macrocerus	Black Drongo	Dicruridae	30+	LC
58	Dicrurus leucophaeus	Ashy Drongo	Dicruridae	9	LC
59	Copsychus saularis	Oriental Magpie-robin	Muscicapidae	14	LC
60	Ficedula albicilla	Taiga Flycatcher	Muscicapidae	6	LC
61	Pyconotus cafer	Red-vented Bulbul	Pycnontidae	30+	LC
62	Pycnonotus jocosus	Red-whiskered Bulbul	Pycnontidae	24	LC
63	Pyconotus blanfordi	Ayeyarwaddy Bulbul	Pycnontidae	26	LC/
					Endemic
64	Acridotheres tristis	Common Myna	Sturnidae	30+	LC
65	Acridotheres fuscus	Jungle Myna	Sturnidae	30+	LC
66	Gracupica contra	Asian pied Starling	Sturnidae	15	LC
67	Saxicola caprata	Pied Bushchat	Muscicapidae	14	LC
68	Saxicola maurus	Siberian stonechat	Muscicapidae	16	NE
69	Cisticola juncidis	Zitting cisticola	Cisticolidae	20	LC
70	Prinia flaxiventris	Plain prinia	Cisticiolidae	30+	LC
71	Prinia rufescens	Rufescent Prinia	Cisticiolidae	2	LC
72	Prinia flaviventris	Yellow-bellied Prinia	Cisticiolidae	18	LC
73	Rhipidura albicollis	White-throated Fantail	Rhipiduridae	9	LC
74	Orthotomus sutorius	Common Tailorbird	Sylviidae	2	LC
75	Dicaeum cruentatum	Scarlet-backed	Dicaeidae	5	LC
		Flowerpecker			
76	Ploceus philippinus	Baya weaver	Ploceidae	30+	LC
77	Anthus rufulus	Paddyfield pipit	Motacillidae	6	LC
78	Motacilla alba	White wagtail	Motacillidae	21	LC
79	Lonchura striata	White-rump Munia	Estrildidae	20	LC
80	Lonchura punctulata	Scaly-breasted Munia	Estrildidae	30+	LC
81	Passer domesticus	House sparrow	Passeridae	30+	LC
82	Passer montanus	Eurasian Tree Sparrow	Passeridae	30+	LC

**NE = Not Evaluated LC = Least Concerned** 

NT = Near Threatened



Common Tailorbird (Orthotomus sutorius)





White-throated Fantail (Rhipidura albicollis)



Black-winged stilt (*Himantopus himantopus*)Ruddy-breasted crake (*Porzana fusca*)Fig 21: Some photo of Bird species recorded in the survey area (B9)

#### (ii) Mammals

A total of 4 mammal species of 4 genera belonging to 3 families were recorded in survey sites during the survey period. During the survey period, 2 mammal species in B1, 3 mammal species in B2, 2 mammal species in B3, 3 mammal species in B4, 2 mammal species in B5, 2 mammal species in B6, 2 mammal species in B7, 3 mammal species B8 and 3 mammal species in B9. Base on globally threatened status of the recorded species, there was no threatened species in survey area. In accordance with the Protection of Wildlife, Wild Plants and Conservation of Natural Areas Act 15(A), two species were listed as Protected Wild Animals and one species observed as Completely Wild Animal.

No	Scientific Name	Common Name	Family Name	Observation	Myanmar	IUCN
				Status	Status	Status
1	Viverricula indica	Small Indian	Viverridae	Interviewed	Completely	LC
		Civet			Protected	
					Wild	
					Animal	
2	Herpestes	Small Asian	Herpestidae	observed	Protected	LC
	javanicus	Mongoose			Wild	
					Animals	

# Table 20: List of Mammal Species recorded in the Survey area (B1)

LC = Least Concerned

# Table 21: List of Mammal Species recorded in the Survey area (B2)

No	Scientific Name	Common Name	Family Name	Observsation	IUCN	Myanmar
				Status	Status	Status
1	Viverricula	Small Indian	Viverridae	Interviewed	LC	Completely
	indica	Civet				Protected
						Wild
						Animal
2	Paradoxurus	Common Palm	Viverridae	Interviewed	LC	Protected
	hermaphroditus	Civet				Wild
						Animals
3	Herpestes	Small Asian	Herpestidae	Interviewed	LC	Protected
	javanicus	Mongoose				Wild
						Animals

LC = Least Concerned

# Table 22: List of Mammal Species recorded in the Survey area (B3)

No	Scientific Name	Common Name	Family Name	Observation	IUCN	Myanmar
				Status	Status	Status
1	Viverricula indica	Small Indian	Viverridae	Interviewed	LC	Completely
		Civet				Protected
						Wild
						Animal
2	Paradoxurus	Common Palm	Viverridae	Interviewed	LC	Protected
	hermaphroditus	Civet				Wild
						Animals

No	Scientific Name	Common Name	Family Name	Observation	IUCN	Myanmar
				status	Status	Status
1	Viverricula indica	Small Indian	Viverridae	interviewed	LC	Completely
		Civet				Protected
						Wild
						Animal
2	Paradoxurus	Common Palm	Viverridae	interviewed	LC	Protected
	hermaphroditus	Civet				Wild
						Animals
3	Herpestes	Small Asian	Herpestidae	observed	LC	Protected
	javanicus	Mongoose				Wild
						Animals

# Table 23: List of Mammal Species recorded in the Survey area (B4)

LC = Least Concerned

# Table 24: List of Mammal Species recorded in the Survey area (B5)

No	Scientific Name	Common Name	Family Name	Observation	IUCN	Myanmar
				Status	Status	Status
1	Viverricula indica	Small Indian	Viverridae	Interviewed	LC	Completely
		Civet				Protected
						Wild
						Animal
2	Herpestes	Small Asian	Herpestidae	Interviewed	LC	Protected
	javanicus	Mongoose				Wild
						Animals

LC = Least Concerned

# Table 25: List of Mammal Species recorded in the Survey area (B6)

No	Scientific Name	Common Name	Family Name	Observation	IUCN	Myanmar
				Status	Status	Status
1	Viverricula indica	Small Indian	Viverridae	Interviewed	LC	Completely
		Civet				Protected
						Wild
						Animal
2	Herpestes	Small Asian	Herpestidae	Interviewed	LC	Protected
	javanicus	Mongoose				Wild
						Animals

No	Scientific Name	Common Name	Family Name	Observation	IUCN	Myanmar
				Status	Status	Status
1	Viverricula indica	Small Indian	Viverridae	Interviewed	LC	Completely
		Civet				Protected
						Wild
						Animal
2	Paradoxurus	Common Palm	Viverridae	Interviewed	LC	Protected
	hermaphroditus	Civet				Wild
						Animals

# Table 26: List of Mammal Species recorded in the Survey area (B7)

LC = Least Concerned

# Table 27: List of Mammal Species recorded in the Survey area (B8)

No	Scientific Name	Common Name	Family Name	Observation	IUCN	Myanmar
				Status	Status	Status
1	Viverricula indica	Small Indian	Viverridae	Interviewed	LC	Completely
		Civet				Protected
						Wild
						Animal
2	Herpestes	Small Asian	Herpestidae	Interviewed	LC	Protected
	javanicus	Mongoose				Wild
						Animals
3	Bandicota indica	Greater Bandicoot	Muridae	Observed	LC	
		Rat				

LC = Least Concerned

# Table 28: List of Mammal Species recorded in the Survey area (B9)

No	Scientific Name	Common Name	Family Name	Observation	IUCN	Myanmar
				Status	Status	Status
1	Viverricula	Small Indian	Viverridae	Interviewed	LC	Protected
	indica	Civet				Wild
						Animals
2	Paradoxurus	Common Palm	Viverridae	Interviewed	LC	Protected
	hermaphroditus	Civet				Wild
						Animals
3	Herpestes	Small Asian	Herpestidae	Interviewed	LC	Protected
	javanicus	Mongoose				Wild
						Animals



Greater Bandicoot Rat Fig 22: Photo of mammal species recorded in survey areas

### (iii) Herpect

A total nine reptile species, 8 genera belonging to six families were recorded from survey sites during the survey period. Among then, within the survey area, six reptile and amphibian species in B1, eight reptile and amphibian species in B2, five reptile and amphibian species in B3, four reptile and amphibian species in B4, four reptile and amphibian species in B5, six reptile and amphibian species in B6, six reptile and one amphibian species in B7, six reptile and amphibian species in B8 and six reptile and amphibian species in B9. Base on globally threatened status of the recorded species, there was no threatened species IUCN Red list 2019 were conducted during the survey period. There was no endemic species in this area.

No	Scientific Name	Common Name	Family Name	IUCN	Observation
				Status	Status
1	Doboia russelii	Russell viper	Viperidae	LC	Interview
2	Naja Kaouthia	Monocled Cobra	Elapidae	LC	Interview
3	Calotes versicolor	Garden Lizard	Agamidae	NE	Observe
4	Calotes mystaceus	Blue forest Lizard	Agamidae	NE	Observe
5	Hemidactylus frenatus	Asian House Gecko	Gekkonidae	LC	Observe
6	Eutropis macularia	Common Sun Skink	Scincidae	LC	Observe

 Table 29: List of Herpect species recorded in survey area (B1)

**NE = Not Evaluated** 

No	Scientific Name	Common Name	Family Name	IUCN	Observation
				Status	Status
1	Doboia russelii	Russell viper	Viperidae	LC	Interview
2	Naja Kaouthia	Monocled Cobra	Elapidae	LC	Interview
3	Calotes versicolor	Garden Lizard	Agamidae	NE	Observe
4	Calotes mystaceus	Blue forest Lizard	Agamidae	NE	Observe
5	Hemidactylus frenatus	Asian House Gecko	Gekkonidae	LC	Observe
6	Sphenomorphus maculatus	Spotted Forest Skink	Scincidae	LC	Observe
7	Bungarus fasciatus	Banded Krait	Elapidae	LC	Interview
8	Xenochrophis piscator	Chequered keelback		LC	Observe
		water snake			

# Table 30: List of Herpet species recorded in survey area (B2)

#### **NE = Not Evaluated**

#### LC = Least Concerned

# Table 31: List of Herpet species recorded in survey area (B3)

No	Scientific Name	Common Name	Family Name	IUCN	Observation
				Status	Status
1	Doboia russelii	Russell viper	Viperidae	LC	Interview
2	Calotes versicolor	Garden Lizard	Agamidae	NE	Observe
3	Calotes mystaceus	Blue forest Lizard	Agamidae	NE	Observe
4	Hemidactylus frenatus	Asian House Gecko	Gekkonidae	LC	Observe
5	Sphenomorphus maculatus	Spotted Forest Skink	Scincidae	LC	Observe

### **NE = Not Evaluated**

LC = Least Concerned

# Table 32: List of Herpet species recorded in survey area (B4)

No	Scientific Name	Common Nam	Family Name	IUCN	Observation
				Status	Status
1	Doboia russelii	Russell viper	Viperidae	LC	Interview
2	Naja Kaouthia	Monocled Cobra	Elapidae	LC	Interview
3	Calotes versicolor	Garden Lizard	Agamidae	NE	Observe
4	Sphenomorphus maculatus	Spotted Forest Skink	Scincidae	LC	Observe

**NE = Not Evaluated** 

No	Scientific Name	Common Name	Family Name	IUCN	Observation
				Status	Status
1	Doboia russelii	Russell viper	Viperidae	LC	Interview
2	Naja Kaouthia	Monocled Cobra	Elapidae	LC	Interview
3	Calotes versicolor	Garden Lizard	Agamidae	NE	Observe
4	Calotes mystaceus	Blue forest Lizard	Agamidae	NE	Observe

# Table 33: List of Herpet species recorded in survey area (B5)

**NE = Not Evaluated** 

LC = Least Concerned

# Table 34: List of Herpet species recorded in survey area (B6)

No	Scientific Name	Common Name	Family Name	IUCN	Observation
				Status	Status
1	Doboia russelii	Russell viper	Viperidae	LC	Interview
2	Naja Kaouthia	Monocled Cobra	Elapidae	LC	Interview
3	Calotes versicolor	Garden Lizard	Agamidae	NE	Observe
4	Calotes mystaceus	Blue forest Lizard	Agamidae	NE	Observe
5	Hemidactylus frenatus	Asian House Gecko	Gekkonidae	LC	Observe
6	Eutropis macularia	Common Sun Skink	Scincidae	LC	Observe

#### **NE = Not Evaluated**

#### LC = Least Concerned

# Table 35: List of Herpet species recorded in survey area (B7)

No	Scientific Name	Common Name	Family Name	IUCN	Observation
				Status	Status
1	Doboia russelii	Russell viper	Viperidae	LC	Interview
2	Naja Kaouthia	Monocled Cobra	Elapidae	LC	Interview
3	Calotes versicolor	Garden Lizard	Agamidae	NE	Observe
4	Calotes mystaceus	Blue forest Lizard	Agamidae	NE	Observe
5	Hemidactylus frenatus	Asian House Gecko	Gekkonidae	LC	Observe
6	Sphenomorphus maculatus	Spotted Forest Skink	Scincidae	LC	Observe

**NE** = **Not Evaluated** 

LC = Least Concerned

### Table 36: List of Herpet species recorded in survey area (B8)

No	Scientific Name	Common Name	Family Name	IUCN	Observation
				Status	Status
1	Doboia russelii	Russell viper	Viperidae	LC	Interview
2	Fejervarya limnocharis	Asian grass Frog	Dicroglossidae	LC	Observe
3	Calotes versicolor	Garden Lizard	Agamidae	NE	Observe

4	Calotes mystaceus	Blue forest Lizard	Agamidae	NE	Observe
5	Hemidactylus frenatus	Asian House Gecko	Gekkonidae	LC	Observe
6	Xenochrophis piscator	Chequered keelback water	Colubridae	LC	Observe
		snake			

**NE = Not Evaluated** 

#### LC = Least Concerned

# Table 37: List of Herpet species recorded in survey area (B9)

No	Scientific Name	Common Name	Family Name	IUCN	Observation
				Status	Status
1	Doboia russelii	Russell viper	Viperidae	LC	Interview
2	Calotes versicolor	Garden Lizard	Agamidae	NE	Observe
3	Calotes mystaceus	Blue forest Lizard	Agamidae	NE	Observe
4	Hemidactylus frenatus	Asian House Gecko	Gekkonidae	LC	Observe
5	Sphenomorphus maculatus	Spotted Forest Skink	Scincidae	LC	Observe
6	Xenochrophis piscator	Chequered keelback	Colubridae	NE	Observe
		water snake			

### **NE** = **Not Evaluated**

# LC = Least Concerned



**Spotted Forest Skink** 



Garden Lizard





**Garden Lizard** 

**Blue forest Lizard** 



Asian House Gecko





Asian grass Frog

Asian House Gecko



Chequered keelback water snake



# (iv) Fish

Field surveys and interviews with local fishermen who lived near the study area were conducted during the collection of the specimens. Fishing activities are mostly traditional method.

Fishermen were interviewed with regard to fishery process. A total of 50 species distributed 15 family were identified and recorded from the project area and near the stream. The highest number of species (50 species) in study site B3, B5, B7, B8, B9 and 40 species in B6 and then the lowest number of species (32 species) in B1, B2, B4 respectively. The most occurrence species are *Puntius chola*, *Catla catla*, *Labeo rohita*. The dominant Family is Cyprinidae. According to the IUCN Red List of threatened species (2019), 3 species were near threatened species, and they were *Osteobrama belangeri*, *Ompok bimaculatus*, *Wallago attu* species. Other was least concerned and not evaluated.

No	Family	Scientific Name	Common Name	IUCN	Remark
1	Notopteridae	Notopterus notopterus	Grey feather-back	LC	Interview
2	Cyprinidae	Catla catla	Catla	Not	Interview
				Evaluated	
3	Cyprinidae	Cirrhinus mrigala	Mrigal	LC	Interview
4	Cyprinidae	Labeo angra	Angra labeo	LC	Interview
5	Cyprinidae	Labeo boga	Boga labeo	LC	Interview
6	Cyprinidae	Labeo calbasu	Karnataka labeo	LC	Interview
7	Cyprinidae	Labeo microphthalmus	Murree labeo	LC	Interview
8	Cyprinidae	Labeo rohita	Rohu	LC	Interview
9	Cyprinidae	Osteobrama belangeri	Manipur osteobrama	NT	Interview
10	Cyprinidae	Puntius chola	Chola barb	LC	Observe
11	Cyprinidae	Puntius ticto	Ticto barb	LC	Interview
12	Cyprinidae	Amblypharyngodon	Burmese carplet	LC	Interview
		atkinsonii			
13	Cyprinidae	Aspidoparia morar	Morar	LC	Observe
14	Cobitidae	Lepidocephalus thermalis	Malabar loach	LC	Interview
15	Bagridae	Mystus cavasius	Gangetic mystus	LC	Observe
16	Bagridae	Mystus leucophasis	Sittang mystus	LC	Interview
17	Bagridae	Mystus pulcher	Pulcher mystus	LC	Interview
18	Siluridae	Ompok bimaculatus	Indian butter-catfish	NT	Interview
19	Sisoridae	Erethistes maesotensis	Burmese erethistes	LC	Observe
20	Clariidae	Clarias batrachus	Magur	LC	Interview
21	Heteropneustidae	Heteropneustes fossilis	Stinging catfish	LC	Interview
22	Belonidae	Xenentodon cancila	Freshwater garfish	LC	Interview
23	Synbranchidae	Monopterus albus	Rice swampeel	LC	Interview
24	Ambassidae	Parambassis ranga	Indian glassy fish	LC	Observe
25	Cichlidae	Oreochromis spp	Tilapia	LC	Interview
26	Gobiidae	Glossogobius giuris	Tank goby	LC	Interview

Table 38: List of fish species recorded in the survey area (B1)

27	Anabantidae	Anabas testudineus	Climbing perch	DD	Interview
28	Belontiidae	Colisa labiosa	Stripled gourami	LC	Interview
29	Belontiidae	Trichogaster pectoralis	Snakeskin gourami	Not	Observe
				Evaluated	
30	Channidae	Channa marulius	Giant snakehead	LC	Interview
31	Channidae	Channa orientalis	Asiatic snakehead	LC	Interview
32	Channidae	Channa punctatus	Spotted snakehead	LC	Interview

# NT = Near Threatened

# Table 39: List of fish species recorded in the survey area (B2)

No	Family	Scientific Name	Common Name	IUCN	Remark
1	Notopteridae	Notopterus notopterus	Grey feather-back	LC	Interview
2	Cyprinidae	Catla catla	Catla	Not	Interview
				Evaluated	
3	Cyprinidae	Cirrhinus mrigala	Mrigal	LC	Interview
4	Cyprinidae	Labeo angra	Angra labeo	LC	Interview
5	Cyprinidae	Labeo boga	Boga labeo	LC	Interview
6	Cyprinidae	Labeo calbasu	Karnataka labeo	LC	Interview
7	Cyprinidae	Labeo microphthalmus	Murree labeo	LC	Interview
8	Cyprinidae	Labeo rohita	Rohu	LC	Interview
9	Cyprinidae	Osteobrama belangeri	Manipur osteobrama	NT	Interview
10	Cyprinidae	Puntius chola	Chola barb	LC	Observe
11	Cyprinidae	Puntius ticto	Ticto barb	LC	Interview
12	Cyprinidae	Amblypharyngodon	Burmese carplet	LC	Interview
		atkinsonii			
13	Cyprinidae	Aspidoparia morar	Morar	LC	Observe
14	Cobitidae	Lepidocephalus thermalis	Malabar loach	LC	Interview
15	Bagridae	Mystus cavasius	Gangetic mystus	LC	Observe
16	Bagridae	Mystus leucophasis	Sittang mystus	LC	Interview
17	Bagridae	Mystus pulcher	Pulcher mystus	LC	Interview
18	Siluridae	Ompok bimaculatus	Indian butter-catfish	NT	Interview
19	Sisoridae	Erethistes maesotensis	Burmese erethistes	LC	Observe
20	Clariidae	Clarias batrachus	Magur	LC	Interview
21	Heteropneustidae	Heteropneustes fossilis	Stinging catfish	LC	Interview
22	Belonidae	Xenentodon cancila	Freshwater garfish	LC	Interview
23	Synbranchidae	Monopterus albus	Rice swampeel	LC	Interview
24	Ambassidae	Parambassis ranga	Indian glassy fish	LC	Observe
25	Cichlidae	Oreochromis spp	Tilapia	LC	Interview
26	Gobiidae	Glossogobius giuris	Tank goby	LC	Interview
27	Anabantidae	Anabas testudineus	Climbing perch	DD	Interview
28	Belontiidae	Colisa labiosa	Stripled gourami	LC	Interview

29	Belontiidae	Trichogaster pectoralis	Snakeskin gourami	Not	Observe
				Evaluated	
30	Channidae	Channa marulius	Giant snakehead	LC	Interview
31	Channidae	Channa orientalis	Asiatic snakehead	LC	Interview
32	Channidae	Channa punctatus	Spotted snakehead	LC	Interview
DD					

### NT = Near Threatened



Trichogaster pectoralis



Parambassis ranga

Puntius chola



*Aspidoparia morar* Fig 24: Photo of Fish Species recorded in the survey area (B2)

# Table 40: List of fish species recorded in the survey area (B3)

No	Family	Scientific Name	Common Name	IUCN	Remark
1	Notopteridae	Notopterus notopterus	Grey feather-back	LC	Interview
2	Clupeidae	Gudusia variegata	Burmese River Shad	LC	Interview
3	Cyprinidae	Catla catla	Catla	Not Evaluated	Interview
4	Cyprinidae	Cirrhinus mrigala	Mrigal	LC	Interview
5	Cyprinidae	Labeo angra	Angra labeo	LC	Interview

6	Cyprinidae	Labeo boga	Boga labeo	LC	Interview
7	Cyprinidae	Labeo calbasu	Karnataka labeo	LC	Interview
8	Cyprinidae	Labeo microphthalmus	Murree labeo	LC	Interview
9	Cyprinidae	Labeo rohita	Rohu	LC	Interview
10	Cyprinidae	Labeo stoliczkae	Moulmein labeo	Not Evaluated	Interview
11	Cyprinidae	Osteobrama belangeri	Manipur osteobrama	NT	Interview
12	Cyprinidae	Osteobrama cunma	Cunma osteobrama	LC	Interview
13	Cyprinidae	Puntius chola	Chola barb	LC	Interview
14	Cyprinidae	Puntius ticto	Ticto barb	LC	Interview
15	Cyprinidae	Chela laubuca	Indian glass-barb	Not Evaluated	Interview
16	Cyprinidae	Amblypharyngodon atkinsonii	Burmese carplet	LC	Interview
17	Cyprinidae	Aspidoparia morar	Morar	LC	Interview
18	Cyprinidae	Rasbora daniconius	Back-line rasbora	LC	Interview
19	Balitoridae	Acanthocobitis rubidipinnis	Nil	LC	Interview
20	Cobitidae	Acantopsis choirorhynchos	Banana fish	LC	Interview
21	Cobitidae	Lepidocephalus thermalis	Malabar loach	LC	Interview
22	Cobitidae	Botia berdmorei	Blyth's loach	Not Evaluated	Interview
23	Cobitidae	Botia histrionica	Burmese loach	LC	Interview
24	Bagridae	Mystus cavasius	Gangetic mystus	LC	Interview
25	Bagridae	Mystus corsula	Nil	LC	Interview
26	Bagridae	Mystus leucophasis	Sittang mystus	LC	Interview
27	Bagridae	Mystus pulcher	Pulcher mystus	LC	Interview
28	Siluridae	Ompok bimaculatus	Indian butter-catfish	NT	Interview
29	Siluridae	Wallago attu	Boal	NT	Interview
30	Schilbeidae	Eutropiichthys vacha	Batchwa vacha	LC	Interview
31	Schilbeidae	Neotropius acutirostris	Indian potasi	LC	Interview
32	Sisoridae	Erethistes maesotensis	Burmese erethistes	Not Evaluated	Interview
33	Sisoridae	Gagata cenia	Indian gagata	LC	Interview
34	Clariidae	Clarias batrachus	Magur	LC	Interview
35	Heteropneustidae	Heteropneustes fossilis	Stinging catfish	LC	Interview
36	Belonidae	Xenentodon cancila	Freshwater garfish	LC	Interview
37	Synbranchidae	Monopterus albus	Rice swampeel	LC	Interview
38	Mastacembelidae	Macrognathus aral	One-stripe spinyeel	LC	Interview
39	Mastacembelidae	Macrognathus zebrinus	Burmese spinyeel	LC	Interview
40	Mastacembelidae	Mastacembelus armatus	Tire-track spinyeel	LC	Interview
41	Ambassidae	Parambassis ranga	Indian glassy fish	LC	Interview
42	Cichlidae	Oreochromis spp	Tilapia	Not Evaluated	Interview
43	Gobiidae	Glossogobius giuris	Tank goby	LC	Interview
44	Anabantidae	Anabas testudineus	Climbing perch	DD	Interview
45	Belontiidae	Colisa labiosa	Stripled gourami	LC	Interview
46	Belontiidae	Trichogaster pectoralis	Snakeskin gourami	Not Evaluated	Interview

47	Channidae	Channa marulius	Giant snakehead	LC	Interview
48	Channidae	Channa orientalis	Asiatic snakehead	LC	Interview
49	Channidae	Channa punctatus	Spotted snakehead	LC	Interview
50	Tetraodontidae	Tetraodon cutcutia	Ocellated pufferfish	LC	Interview

# NT = Near Threatened

# Table 41: List of fish species recorded in the survey area (B4)

No	Family	Scientific Name	Common Name	IUCN	Remark
1	Notopteridae	Notopterus notopterus	Grey feather-back	LC	Interview
2	Cyprinidae	Catla catla	Catla	LC	Interview
3	Cyprinidae	Cirrhinus mrigala	Mrigal	LC	Interview
4	Cyprinidae	Labeo angra	Angra labeo	LC	Interview
5	Cyprinidae	Labeo boga	Boga labeo	LC	Interview
6	Cyprinidae	Labeo calbasu	Karnataka labeo	LC	Interview
7	Cyprinidae	Labeo microphthalmus	Murree labeo	LC	Interview
8	Cyprinidae	Labeo rohita	Rohu	LC	Interview
9	Cyprinidae	Osteobrama belangeri	Manipur osteobrama	NT	Interview
10	Cyprinidae	Puntius chola	Chola barb	LC	Interview
11	Cyprinidae	Puntius ticto	Ticto barb	LC	Interview
12	Cyprinidae	Amblypharyngodon atkinsonii	Burmese carplet	LC	Interview
13	Cyprinidae	Aspidoparia morar	Morar	LC	Interview
14	Cobitidae	Lepidocephalus thermalis	Malabar loach	LC	Interview
15	Bagridae	Mystus cavasius	Gangetic mystus	LC	Interview
16	Bagridae	Mystus leucophasis	Sittang mystus	LC	Interview
17	Bagridae	Mystus pulcher	Pulcher mystus	LC	Interview
18	Siluridae	Ompok bimaculatus	Indian butter-catfish	NT	Interview
19	Sisoridae	Erethistes maesotensis	Burmese erethistes	Not	Interview
				Evaluated	
20	Clariidae	Clarias batrachus	Magur	LC	Interview
21	Heteropneustidae	Heteropneustes fossilis	Stinging catfish	LC	Interview
22	Belonidae	Xenentodon cancila	Freshwater garfish	LC	Interview
23	Synbranchidae	Monopterus albus	Rice swampeel	LC	Observe
24	Ambassidae	Parambassis ranga	Indian glassy fish	LC	Interview
25	Cichlidae	Oreochromis spp	Tilapia	-	Interview
26	Gobiidae	Glossogobius giuris	Tank goby	LC	Interview
27	Anabantidae	Anabas testudineus	Climbing perch	DD	observe
28	Belontiidae	Colisa labiosa	Stripled gourami	LC	Interview
29	Belontiidae	Trichogaster pectoralis	Snakeskin gourami	Not	Observe
				Evaluated	

30	Channidae	Channa marulius	Giant snakehead	LC	Interview				
31	Channidae	Channa orientalis	Asiatic snakehead	Not	Interview				
				Evaluated					
32	Channidae	Channa punctatus	Spotted snakehead	LC	Observe				
LC	LC = Least Concerned								

LC – Least Concerned

# NT = Near Threatened



Trichogaster pectoralis





Channa punctatus



*Monopterus albus* Fig 25: Photo of Fish Species recorded in the survey area (B4)

No	Family	Scientific Name	Common Name	IUCN	Remark
1	Notopteridae	Notopterus notopterus	Grey feather-back	LC	Interview
2	Clupeidae	Gudusia variegata	Burmese River Shad	LC	Interview
3	Cyprinidae	Catla catla	Catla	Not	Interview
				Evaluated	
4	Cyprinidae	Cirrhinus mrigala	Mrigal	LC	Interview
5	Cyprinidae	Labeo angra	Angra labeo	LC	Interview
6	Cyprinidae	Labeo boga	Boga labeo	LC	Interview

Table 42: List of fish species recorded in the survey area (B5)

7	Cyprinidae	Labeo calbasu	Karnataka labeo	LC	Interview
8	Cyprinidae	Labeo microphthalmus	Murree labeo	LC	Interview
9	Cyprinidae	Labeo rohita	Rohu	LC	Interview
10	Cyprinidae	Labeo stoliczkae	Moulmein labeo	Not	Interview
				Evaluated	
11	Cyprinidae	Osteobrama belangeri	Manipur osteobrama	NT	Interview
12	Cyprinidae	Osteobrama cunma	Cunma osteobrama	LC	Interview
13	Cyprinidae	Puntius chola	Chola barb	LC	Interview
14	Cyprinidae	Puntius ticto	Ticto barb	LC	Interview
15	Cyprinidae	Chela laubuca	Indian glass-barb	Not	Interview
				Evaluated	
16	Cyprinidae	Amblypharyngodon	Burmese carplet	LC	Interview
		atkinsonii			
17	Cyprinidae	Aspidoparia morar	Morar	LC	Interview
18	Cyprinidae	Rasbora daniconius	Back-line rasbora	LC	Interview
19	Balitoridae	Acanthocobitis	Nil	LC	Interview
		rubidipinnis			
20	Cobitidae	Acantopsis	Banana fish	LC	Interview
		choirorhynchos			
21	Cobitidae	Lepidocephalus	Malabar loach	LC	Interview
		thermalis			
22	Cobitidae	Botia berdmorei	Blyth's loach	Not	Interview
				Evaluated	
23	Cobitidae	Botia histrionica	Burmese loach	LC	Interview
24	Bagridae	Mystus cavasius	Gangetic mystus	LC	Interview
25	Bagridae	Mystus corsula	Nil	LC	Interview
26	Bagridae	Mystus leucophasis	Sittang mystus	LC	Interview
27	Bagridae	Mystus pulcher	Pulcher mystus	LC	Interview
28	Siluridae	Ompok bimaculatus	Indian butter-catfish	NT	Interview
29	Siluridae	Wallago attu	Boal	NT	Interview
30	Schilbeidae	Eutropiichthys vacha	Batchwa vacha	LC	Interview
31	Schilbeidae	Neotropius acutirostris	Indian potasi	LC	Interview
32	Sisoridae	Erethistes maesotensis	Burmese erethistes	Not	Interview
				Evaluated	
33	Sisoridae	Gagata cenia	Indian gagata	LC	Interview
34	Clariidae	Clarias batrachus	Magur	LC	Interview
35	Heteropneustidae	Heteropneustes fossilis	Stinging catfish	LC	Interview
36	Belonidae	Xenentodon cancila	Freshwater garfish	LC	Interview
37	Synbranchidae	Monopterus albus	Rice swampeel	LC	Interview
38	Mastacembelidae	Macrognathus aral	One-stripe spinyeel	LC	Interview
39	Mastacembelidae	Macrognathus zebrinus	Burmese spinyeel	LC	Interview
40	Mastacembelidae	Mastacembelus armatus	Tire-track spinyeel	LC	Interview

41	Ambassidae	Parambassis ranga	Indian glassy fish	LC	Interview
42	Cichlidae	Oreochromis spp	Tilapia	Not	Interview
				Evaluated	
43	Gobiidae	Glossogobius giuris	Tank goby	LC	Interview
44	Anabantidae	Anabas testudineus	Climbing perch	DD	Interview
45	Belontiidae	Colisa labiosa	Stripled gourami	LC	Interview
46	Belontiidae	Trichogaster pectoralis	Snakeskin gourami	Not	Interview
				Evaluated	
47	Channidae	Channa marulius	Giant snakehead	LC	Interview
48	Channidae	Channa orientalis	Asiatic snakehead	LC	Observe
49	Channidae	Channa punctatus	Spotted snakehead	LC	Interview
50	Tetraodontidae	Tetraodon cutcutia	Ocellated pufferfish	LC	Interview

LC = Least Concerned

### NT = Near Threatened



Fig 26: Photo of Fish Species recorded in the survey area (B5)

# Table 43: List of fish species recorded in the survey area (B6)

No	Family	Scientific Name	Common Name	IUCN	Remark
1	Notopteridae	Notopterus notopterus	Grey feather-back	LC	Interview
2	Clupeidae	Gudusia variegata	Burmese River Shad	LC	Interview
3	Cyprinidae	Catla catla	catla	LC	Interview
4	Cyprinidae	Cirrhinus mrigala	Mrigal	LC	Interview
5	Cyprinidae	Labeo angra	Angra labeo	LC	Interview
6	Cyprinidae	Labeo boga	Boga labeo	LC	Interview
7	Cyprinidae	Labeo calbasu	Karnataka labeo	LC	Interview
8	Cyprinidae	Labeo microphthalmus	Murree labeo	LC	Interview
9	Cyprinidae	Labeo rohita	Rohu	LC	Interview
10	Cyprinidae	Labeo stoliczkae	Moulmein labeo	Not	Interview
				Evaluated	
11	Cyprinidae	Osteobrama belangeri	Manipur osteobrama	NT	Interview

12	Cyprinidae	Osteobrama cunma	Cunma osteobrama	LC	Interview
13	Cyprinidae	Puntius chola	Chola barb	LC	Interview
14	Cyprinidae	Puntius ticto	Ticto barb	LC	Interview
15	Cyprinidae	Chela laubuca	Indian glass-barb	Not	Interview
				Evaluated	
16	Cyprinidae	Amblypharyngodon atkinsonii	Burmese carplet	LC	Interview
17	Cyprinidae	Aspidoparia morar	Morar	LC	Interview
18	Cyprinidae	Rasbora daniconius	Slender Barb	LC	Interview
19	Cobitidae	Lepidocephalus thermalis	Malabar loach	LC	Interview
20	Bagridae	Mystus cavasius	Gangetic mystus	LC	Interview
21	Schilbeidae	Neotropius acutirostris	Indian potasi	LC	Interview
22	Sisoridae	Erethistes maesotensis	Burmese erethistes	Not	Interview
				Evaluated	
23	Sisoridae	Gagata cenia	Indian gagata	LC	Interview
24	Clariidae	Clarias batrachus	Magur	LC	Interview
25	Heteropneustidae	Heteropneustes fossilis	Stinging catfish	LC	Interview
26	Belonidae	Xenentodon cancila	Freshwater garfish	LC	Observe
27	Synbranchidae	Monopterus albus	Rice swampeel	LC	Interview
28	Mastacembelidae	Macrognathus aral	One-stripe spinyeel	LC	Interview
29	Mastacembelidae	Macrognathus zebrinus	Burmese spinyeel	LC	Interview
30	Mastacembelidae	Mastacembelus armatus	Tire-track spinyeel	LC	Interview
31	Ambassidae	Parambassis ranga	Indian glassy fish	LC	Interview
32	Cichlidae	Oreochromis spp	Tilapia	Not	Interview
				Evaluated	
33	Gobiidae	Glossogobius giuris	Tank goby	LC	Interview
34	Anabantidae	Anabas testudineus	Climbing perch	DD	Interview
35	Belontiidae	Colisa labiosa	Stripled gourami	LC	Interview
36	Belontiidae	Trichogaster pectoralis	Snakeskin gourami	Not	Interview
				Evaluated	
37	Channidae	Channa marulius	Giant snakehead	LC	Interview
38	Channidae	Channa orientalis	Asiatic snakehead	Not	Interview
				Evaluated	
39	Channidae	Channa punctatus	Spotted snakehead	Not	Interview
				Evaluated	
40	Tetraodontidae	Tetraodon cutcutia	Ocellated pufferfish	LC	Interview

NT = Near Threatened



Fig 27: Photo of Fish Species recorded in the survey area (B6)

No	Family	Scientific Name	Common Name	IUCN	Remark
1	Notopteridae	Notopterus notopterus	Grey feather-back	LC	Interview
2	Clupeidae	Gudusia variegata	Burmese River Shad	LC	Interview
3	Cyprinidae	Catla catla	Catla	Not	Interview
				Evaluated	
4	Cyprinidae	Cirrhinus mrigala	Mrigal	LC	Interview
5	Cyprinidae	Labeo angra	Angra labeo	LC	Interview
6	Cyprinidae	Labeo boga	Boga labeo	LC	Interview
7	Cyprinidae	Labeo calbasu	Karnataka labeo	LC	Interview
8	Cyprinidae	Labeo microphthalmus	Murree labeo	LC	Interview
9	Cyprinidae	Labeo rohita	Rohu	LC	Interview
10	Cyprinidae	Labeo stoliczkae	Moulmein labeo	Not	Interview
				Evaluated	
11	Cyprinidae	Osteobrama belangeri	Manipur osteobrama	NT	Interview
12	Cyprinidae	Osteobrama cunma	Cunma osteobrama	LC	Interview
13	Cyprinidae	Puntius chola	Chola barb	LC	Interview
14	Cyprinidae	Puntius ticto	Ticto barb	LC	Interview
15	Cyprinidae	Chela laubuca	Indian glass-barb	Not	Interview
				Evaluated	
16	Cyprinidae	Amblypharyngodon atkinsonii	Burmese carplet	LC	Interview
17	Cyprinidae	Aspidoparia morar	Morar	LC	Interview
18	Cyprinidae	Rasbora daniconius	Back-line rasbora	LC	Interview
19	Balitoridae	Acanthocobitis rubidipinnis	Nil	LC	Interview
20	Cobitidae	Acantopsis choirorhynchos	Banana fish	LC	Interview
21	Cobitidae	Lepidocephalus thermalis	Malabar loach	LC	Interview
22	Cobitidae	Botia berdmorei	Blyth's loach	Not	Interview
				Evaluated	

Table 44: List of fish species recorded in the survey area (B7)

23	Cobitidae	Botia histrionica	Burmese loach	LC	Interview
24	Bagridae	Mystus cavasius	Gangetic mystus	LC	Interview
25	Bagridae	Mystus corsula	Nil	LC	Interview
26	Bagridae	Mystus leucophasis	Sittang mystus	LC	Interview
27	Bagridae	Mystus pulcher	Pulcher mystus	LC	Interview
28	Siluridae	Ompok bimaculatus	Indian butter-catfish	NT	Interview
29	Siluridae	Wallago attu	Boal	NT	Interview
30	Schilbeidae	Eutropiichthys vacha	Batchwa vacha	LC	Interview
31	Schilbeidae	Neotropius acutirostris	Indian potasi	LC	Interview
32	Sisoridae	Erethistes maesotensis	Burmese erethistes	LC	Interview
33	Sisoridae	Gagata cenia	Indian gagata	LC	Interview
34	Clariidae	Clarias batrachus	Magur	LC	Interview
35	Heteropneustidae	Heteropneustes fossilis	Stinging catfish	LC	Interview
36	Belonidae	Xenentodon cancila	Freshwater garfish	LC	Interview
37	Synbranchidae	Monopterus albus	Rice swampeel	LC	Interview
38	Mastacembelidae	Macrognathus aral	One-stripe spinyeel	LC	Interview
39	Mastacembelidae	Macrognathus zebrinus	Burmese spinyeel	LC	Interview
40	Mastacembelidae	Mastacembelus armatus	Tire-track spinyeel	LC	Interview
41	Ambassidae	Parambassisranga	Indian glassy fish	LC	Interview
42	Cichlidae	Oreochromis spp	Tilapia	LC	Interview
43	Gobiidae	Glossogobius giuris	Tank goby	LC	Interview
44	Anabantidae	Anabas testudineus	Climbing perch	DD	Interview
45	Belontiidae	Colisa labiosa	Stripled gourami	LC	Interview
46	Belontiidae	Trichogaster pectoralis	Snakeskin gourami	Not	Interview
				Evaluated	
47	Channidae	Channa marulius	Giant snakehead	LC	Interview
48	Channidae	Channa orientalis	Asiatic snakehead	LC	Interview
49	Channidae	Channa punctatus	Spotted snakehead	LC	Interview
50	Tetraodontidae	Tetraodon cutcutia	Ocellated pufferfish	LC	Interview

#### NT = Near Threatened

# Table 45: List of fish species recorded in the survey area (B8)

No	Family	Scientific Name	Common Name	IUCN	Remark
1	Notopteridae	Notopterus notopterus	Grey feather-back	LC	Interview
2	Clupeidae	Gudusia variegata	Burmese River Shad	LC	Interview
3	Cyprinidae	Catla catla	Catla	Not Evaluated	Interview
4	Cyprinidae	Cirrhinus mrigala	Mrigal	LC	Interview
5	Cyprinidae	Labeo angra	Angra labeo	LC	Interview
6	Cyprinidae	Labeo boga	Boga labeo	LC	Interview
7	Cyprinidae	Labeo calbasu	Karnataka labeo	LC	Interview

8	Cyprinidae	Labeo microphthalmus	Murree labeo	LC	Interview
9	Cyprinidae	Labeo rohita	Rohu	LC	Interview
10	Cyprinidae	Labeo stoliczkae	Moulmein labeo	Not Evaluated	Interview
11	Cyprinidae	Osteobrama belangeri	Manipur osteobrama	NT	Interview
12	Cyprinidae	Osteobrama cunma	Cunma osteobrama	LC	Interview
13	Cyprinidae	Puntius chola	Chola barb	LC	Interview
14	Cyprinidae	Puntius ticto	Ticto barb	LC	Interview
15	Cyprinidae	Chela laubuca	Indian glass-barb	Not Evaluated	Interview
16	Cyprinidae	Amblypharyngodon	Burmese carplet	LC	Interview
		atkinsonii			
17	Cyprinidae	Aspidoparia morar	Morar	LC	Interview
18	Cyprinidae	Rasbora daniconius	Back-line rasbora	LC	Interview
19	Balitoridae	Acanthocobitis	Nil	LC	Interview
		rubidipinnis			
20	Cobitidae	Acantopsis	Banana fish	LC	Interview
		choirorhynchos			
21	Cobitidae	Lepidocephalus thermalis	Malabar loach	LC	Interview
22	Cobitidae	Botia berdmorei	Blyth's loach	Not Evaluated	Interview
23	Cobitidae	Botia histrionica	Burmese loach	LC	Interview
24	Bagridae	Mystus cavasius	Gangetic mystus	LC	Interview
25	Bagridae	Mystus corsula	Nil	LC	Interview
26	Bagridae	Mystus leucophasis	Sittang mystus	LC	Interview
27	Bagridae	Mystus pulcher	Pulcher mystus	LC	Interview
28	Siluridae	Ompok bimaculatus	Indian butter-catfish	NT	Interview
29	Siluridae	Wallago attu	Boal	NT	Interview
30	Schilbeidae	Eutropiichthys vacha	Batchwa vacha	LC	Interview
31	Schilbeidae	Neotropius acutirostris	Indian potasi	LC	Interview
32	Sisoridae	Erethistes maesotensis	Burmese erethistes	LC	Interview
33	Sisoridae	Gagata cenia	Indian gagata	LC	Interview
34	Clariidae	Clarias batrachus	Magur	LC	Interview
35	Heteropneustidae	Heteropneustes fossilis	Stinging catfish	LC	Interview
36	Belonidae	Xenentodon cancila	Freshwater garfish	LC	Interview
37	Synbranchidae	Monopterus albus	Rice swampeel	LC	Interview
38	Mastacembelidae	Macrognathus aral	One-stripe spinyeel	LC	Interview
39	Mastacembelidae	Macrognathus zebrinus	Burmese spinyeel	LC	Interview
40	Mastacembelidae	Mastacembelus armatus	Tire-track spinyeel	LC	Interview
41	Ambassidae	Parambassis ranga	Indian glassy fish	LC	Interview
42	Cichlidae	Oreochromis spp	Tilapia	LC	Interview
43	Gobiidae	Glossogobius giuris	Tank goby	LC	Interview
44	Anabantidae	Anabas testudineus	Climbing perch	DD	Interview
45	Belontiidae	Colisa labiosa	Stripled gourami	LC	Interview
46	Belontiidae	Trichogaster pectoralis	Snakeskin gourami	Not Evaluated	Interview
47	Channidae	Channa marulius	Giant snakehead	LC	Interview

48	Channidae	Channa orientalis	Asiatic snakehead	LC	Interview
49	Channidae	Channa punctatus	Spotted snakehead	LC	Interview
50	Tetraodontidae	Tetraodon cutcutia	Ocellated pufferfish	LC	Interview

LC = Least Concerned

### NT = Near Threatened

# Table 46: List of fish species recorded in the survey area (B9)

No	Family	Scientific Name	Common Name	IUCN	Remark
1	Notopteridae	Notopterus notopterus	Grey feather-back	LC	Observe
2	Clupeidae	Gudusia variegata	Burmese River Shad	LC	Interview
3	Cyprinidae	Catla catla	Catla	Not	Interview
				Evaluated	
4	Cyprinidae	Cirrhinus mrigala	Mrigal	LC	Observe
5	Cyprinidae	Labeo angra	Angra labeo	LC	Interview
6	Cyprinidae	Labeo boga	Boga labeo	LC	Interview
7	Cyprinidae	Labeo calbasu	Karnataka labeo	LC	Interview
8	Cyprinidae	Labeo microphthalmus	Murree labeo	LC	Interview
9	Cyprinidae	Labeo rohita	Rohu	LC	Observe
10	Cyprinidae	Labeo stoliczkae	Moulmein labeo	Not	Interview
				Evaluated	
11	Cyprinidae	Osteobrama belangeri	Manipur osteobrama	NT	Interview
12	Cyprinidae	Osteobrama cunma	Cunma osteobrama	LC	Interview
13	Cyprinidae	Puntius chola	Chola barb	LC	Interview
14	Cyprinidae	Puntius ticto	Ticto barb	LC	Observe
15	Cyprinidae	Chela laubuca	Indian glass-barb	Not	Interview
				Evaluated	
16	Cyprinidae	Amblypharyngodon atkinsonii	Burmese carplet	LC	Interview
17	Cyprinidae	Aspidoparia morar	Morar	LC	Observe
18	Cyprinidae	Rasbora daniconius	Back-line rasbora	LC	Interview
19	Balitoridae	Acanthocobitis rubidipinnis	Nil	LC	Interview
20	Cobitidae	Acantopsis choirorhynchos	Banana fish	LC	Interview
21	Cobitidae	Lepidocephalus thermalis	Malabar loach	LC	Interview
22	Cobitidae	Botia berdmorei	Blyth's loach	Not	Interview
				Evaluated	
23	Cobitidae	Botia histrionica	Burmese loach	LC	Interview
24	Bagridae	Mystus cavasius	Gangetic mystus	LC	Observe
25	Bagridae	Mystus corsula	Nil	LC	Interview
26	Bagridae	Mystus leucophasis	Sittang mystus	LC	Interview
27	Bagridae	Mystus pulcher	Pulcher mystus	LC	Interview
28	Siluridae	Ompok bimaculatus	Indian butter-catfish	NT	Interview
29	Siluridae	Wallago attu	Boal	NT	Interview
30	Schilbeidae	Eutropiichthys vacha	Batchwa vacha	LC	Interview

31	Schilbeidae	Neotropius acutirostris	Indian potasi	LC	Interview
32	Sisoridae	Erethistes maesotensis	Burmese erethistes	LC	Interview
33	Sisoridae	Gagata cenia	Indian gagata	LC	Interview
34	Clariidae	Clarias batrachus	Magur	LC	Interview
35	Heteropneustidae	Heteropneustes fossilis	Stinging catfish	LC	Interview
36	Belonidae	Xenentodon cancila	Freshwater garfish	LC	Interview
37	Synbranchidae	Monopterus albus	Rice swampeel	LC	Interview
38	Mastacembelidae	Macrognathus aral	One-stripe spinyeel	LC	Interview
39	Mastacembelidae	Macrognathus zebrinus	Burmese spinyeel	LC	Interview
40	Mastacembelidae	Mastacembelus armatus	Tire-track spinyeel	LC	Interview
41	Ambassidae	Parambassis ranga	Indian glassy fish	LC	Observe
42	Cichlidae	Oreochromis spp	Tilapia	Not	Interview
				Evaluated	
43	Gobiidae	Glossogobius giuris	Tank goby	LC	Interview
44	Anabantidae	Anabas testudineus	Climbing perch	DD	Observe
45	Belontiidae	Colisa labiosa	Stripled gourami	LC	Interview
46	Belontiidae	Trichogaster pectoralis	Snakeskin gourami	Not list	Interview
47	Channidae	Channa marulius	Giant snakehead	LC	Interview
48	Channidae	Channa orientalis	Asiatic snakehead	LC	Observe
49	Channidae	Channa punctatus	Spotted snakehead	LC	Interview
50	Tetraodontidae	Tetraodon cutcutia	Ocellated pufferfish	LC	Interview
DD	= Data Deficit	LC = Least Concerned	•	•	-

# NT = Near Threatened



Channa orientalis



Notopterus notopterus



*Anabas testudineus* Fig 28: Photo of Fish Species recorded in the survey area (B9)

# (v) Butterfly

A total of 81 butterfly species belonging to 4 families were recorded from survey sites during the survey period. During the survey period, 8 butterfly species in B1 and B4, 12 butterfly species in B2, B5 and B9, 4 butterfly species in B3, 11 butterfly species in B6, 5 butterfly species in B7 and 9 butterfly species in B8. According to the IUCN Red List (2018-1), *Euploea core* is least concern and were not under any major threatened.

No.	Family Name	Species Name	Common Name	IUCN
1	Pieridae	Eurema blanda	Three-spot grass yellow	NE
2	Pieridae	Ixias pyrene	Yellow Orange-tip	NE
3	Nymphalidae	Danaus chrysippus	Plain Tiger	NE
4	Nymphalidae	Danaus genutia	Common Tiger	NE
5	Nymphalidae	Junonia atlites	Grey Pansy	NE
6	Lycaenidae	Euchrysops cnejus	Gram Blue	NE
7	Hesperridae	Ampittia dioscorides	Bush Hopper	NE
8	Hesperridae	Borbo cinnara	Formosan Swift	NE

Table 47: List of butter	Iv species	recorded from	the survey	v area (	<b>B1</b> )
				,	

**NE = Not Evaluated** 





Borbo cinnara (Formosan Swift)Ampittia dioscorides (Bush Hopper)Fig 29: Photo of butterfly species recorded in the survey area (B1)

Table 48: List of butterfl	species recorded	from the survey ar	'ea (B2)
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No.	Family Name	Species Name	Common Name	IUCN
1	Pieridae	Leptosia nina	Psyche	NE
2	Pieridae	Eurema blanda	Three spot grass yellow	NE
3	Nymphalidae	Acraea violae	Tawny Coster	NE
4	Nymphalidae	Euploea core	Common Crow	LC
5	Nymphalidae	Danaus genutia	Common Tiger	NE
6	Nymphalidae	Danaus chrysippus	Plain Tiger	NE
7	Nymphalidae	Junonia atlites	Grey Pansy	NE
8	Nymphalidae	Junonia almana	Peacock Pansy	NE
9	Nymphalidae	Tirumala limniae	Blue Tiger	NE
10	Nymphalidae	Elymnias hypermnestra	Common Palmfly	NE

11	Hesperiidae	Borbo cinnara	Formosan Swift	NE
12	Hesperiidae	Polites peckius	Pecks Skimmer	NE

#### **NE = Not Evaluated**

### LC = Least Concerned



Eurema blanda (Three spot grass yellow)



*Elymnias hypermnestra* (Common Palmfly) *Danaus chrysippus* (Plain Tiger) Fig 30: Photo of butterfly species recorded in survey area (B2)

# Table 49: List of butterfly species recorded from the survey area (B3)

No.	Family Name	Species Name	Common Name	IUCN
1	Nymphalidae	Danaus genutia	Common Tiger	NE
2	Nymphalidae	Danaus chrysippus	Plain Tiger	NE
3	Nymphalidae	Junonia atlites	Grey Pansy	NE
4	Nymphalidae	Junonia almana	Peacock Pansy	NE

**NE = Not Evaluated** 



Acraea violae (Tawny Coster)






Danau genutia (Common Tiger)Junonia almana (Peacock Pansy)Fig 31: Photo of butterfly species recorded in survey area (B3)

No.	Family Name	Species Name	Common Name	IUCN
1	Pieridae	Leptosia nina	Psyche	NE
2	Pieridae	Eurema blanda	Three spot grass yellow	NE
3	Nymphalidae	Acraea violae	Tawny Coster	NE
4	Nymphalidae	Danaus genutia	Common Tiger	NE
5	Nymphalidae	Danaus chrysippus	Plain Tiger	NE
6	Nymphalidae	Junonia atlites	Grey Pansy	NE
7	Nymphalidae	Junonia almana	Peacock Pansy	NE
8	Nymphalidae	Neptis junbah	Chestnut-streaked sailor	NE

Table 50: List of butterfly species recorded from the survey area (B4)

**NE = Not Evaluated** 





Danaus genutia (Common Tiger)Neptis junbah (Chestnut-streaked sailor)Fig 32: Photo of butterfly species recorded in survey area (B4)

No.	Family Name	Species Name	Common Name	IUCN
1	Pieridae	Catopsilia pomona	Lemon Emigrant	NE
2	Pieridae	Pieris canidia	Cabbage White	NE
3	Pieridae	Hebomoia glaucippe	Great Orange tip	NE
4	Pieridae	Leptosia nina	Psyche	NE
5	Pieridae	Eurema blanda	Three spot grass yellow	NE
6	Nymphalidae	Acraea violae	Tawny Coster	NE
7	Nymphalidae	Danaus genutia	Common Tiger	NE
8	Nymphalidae	Danaus chrysippus	Plain Tiger	NE
9	Nymphalidae	Junonia atlites	Grey Pansy	NE
10	Nymphalidae	Junonia almana	Peacock Pansy	NE
11	Nymphalidae	Neptis hylas	Common Sailor	NE
12	Nymphalidae	Phalanta phalantha	Leopard	NE

 Table 51: List of butterfly species recorded from the survey area (B5)
 Image: Comparison of the survey area (B5)

**NE** = **Not** Evaluated





<i>Junonia almana</i> (Peacock Pansy)	Acraea violae (Tawny Coster)
Fig 33: Photo of butter	Ty species recorded in survey area (B5)

Table 52: List of butterfly	y species recorded from	the survey area (B6)
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No.	Family Name	Species Name	Common Name	IUCN
1	Pieridae	Catopsilia pomona	Lemon Emigrant	NE
2	Pieridae	Eurema blanda	Three spot grass yellow	NE
3	Pieridae	Leptosia nina	Psyche	NE
4	Nymphalidae	Euploea core	Common Crow	LC
5	Nymphalidae	Danaus genutia	Common Tiger	NE
6	Nymphalidae	Danaus chrysippus	Plain Tiger	NE
7	Nymphalidae	Junonia atlites	Grey Pansy	NE
8	Nymphalidae	Junonia almana	Peacock Pansy	NE
9	Nymphalidae	Tirumala limniae	Blue Tiger	NE

10	Lycaenidae	Plebejus samudra	Sea Jewel Blue	NE
11	Hesperiidae	Borbo cinnara	Formosan Swift	NE

**NE = Not Evaluated** 





*Eurema blanda* (Three spot grass yellow) *Euploea core* (Common Crow) Fig 34: Photo of butterfly species recorded in survey area (B6)

Table 5	3: I	ist o	f butterfly	sne	ecies	recorded	from	the	survev	area	<b>B7</b>	۱
I abit 5	J. L	ist o	1 Dutter II	sp	<b>UIUS</b>	iccoraca	nom	une	Survey	arca	( <b>D</b> /)	,

No.	Family Name	Species Name	Common Name	IUCN
1	Nymphalidae	Tirumala limniae	Blue Tiger	NE
2	Nymphalidae	Danaus chrysippus	Plain Tiger	NE
3	Nymphalidae	Junonia atlites	Grey Pansy	NE
4	Nymphalidae	Junonia almana	Peacock Pansy	NE
5	Hesperiidae	Borbo cinnara	Formosan Swift	NE

**NE** = Not Evaluated





Danau genutia (Common Tiger)Junonia almana (Peacock Pansy)Fig 35: Photo of butterfly species recorded in survey area (B7)

No.	Family Name	Species Name	Common Name	IUCN
1	Pieridae	Catopsilia pomona	Mottled Emigrant	NE
2	Pieridae	Leptosia nina	Psyche	NE
3	Pieridae	Eurema blanda	Three-spot grass yellow	NE
4	Nymphalidae	Danaus chrysippus	Plain Tiger	NE
5	Nymphalidae	Danaus genutia	Common Tiger	NE
6	Nymphalidae	Junonia almana	Peacock Pansy	NE
7	Nymphalidae	Junonia atlites	Grey Pansy	NE
8	Hesperridae	Borbo cinnara	Formosan Swift	NE
9	Hesperridae	Potanthus omaha	Lesser Dart	NE

 Table 54: List of butterfly species recorded from the survey area (B8)

**NE = Not Evaluated** 





*Eurama blanda* (Three-spot grass yellow) *Danaus genutia* (Common Tiger) Fig 36: Photo of butterfly species recorded in survey area (B8)

No.	Family Name	Species Name	Common Name	IUCN
1	Pieridae	Catopsilia pomona	Mottled Emigrant	NE
2	Pieridae	Appias libythea	Striped Albatross	NE
3	Pieridae	Delias hyparete	Painted Jezebel	NE
4	Pieridae	Hebomoia glaucippe	Great Orange Tip	NE
5	Pieridae	Eurema blanda	Three-spot grass yellow	NE
6	Nymphalidae	Danaus genutia	Common Tiger	NE
7	Nymphalidae	Danaus chrysippus	Plain Tiger	NE
8	Nymphalidae	Euploea core	Common crow	LC
9	Nymphalidae	Junonia almana	Peacock Pansy	NE
11	Nymphalidae	Junonia atlites	Grey Pansy	NE
12	Hesperiidae	Sarangesa dasahara	Common Small Flat	NE

 Table 55: List of butterfly species recorded from the survey area (B9)

**NE** = Not Evaluated **LC** = Least Concerned





Appia libythea (Striped Albatross)Junonia almana (Peacock Pansy)Fig 37: Photo of butterfly species recorded in survey area (B9)

### (vi) Dragonfly

During the survey period, 39 species of dragonfly and damselfly species were recorded from the survey area. Dragonfly species are family Libellulidae and Damselfly species are Coenagrionidae. During the field observation, 4 dragonfly species and 2 damselfly species in B1, 6 dragonfly species and 1 damselfly species in B2, 3 dragonfly species in B3 and B4, 5 dragonfly species in B5, 3 dragonfly species in B6 and B7, 4 dragonfly species and 1 damselfly species in B8 and 4 dragonfly species in B9. All species are least concerned according the IUCN Red List of 2019. In the survery area, the very common family is Libellulidae. There are no endangered species (IUCN Red List 2019) present at the project site.

No.	Family Name	Species Name	Common Name	IUCN
1	Coenagrionidae	Pseudagrion rubriceps	Saffron-faced blue dart	LC
2	Coenagrionidae	Ceriagrion rubiae	Orange Marsh Dart	LC
3	Libellulidae	Neurothemis tullia	Pied Paddy Skimmer	LC
4	Libellulidae	Crocothemis servilia	Scarlet Skimmer	LC
5	Libellulidae	Orthetrum sabina	Green Marsh Hawk	LC
6	Libellulidae	Brachythemis contaminata	Ditch Jewel	LC

Table 56: List of dragonfly species recorded in survey area (B1)

LC = Least Concerned



Crocothemis servilia (Scarlet Skimmer)



Neurothemis tullia (Pied Paddy Skimmer)

Fig 38: Photo of dragonfly species recorded in survey area (B1)

No.	Family Name	Species Name	Common Name	IUCN
1	Libellulidae	Crocothemis servilia	Scarlet Skimmer	LC
2	Libellulidae	Brachythemis contaminata	Ditch Jewel	LC
3	Libellulidae	Orthetrum sabina	Green Marsh Hawk	LC
4	Libellulidae	Neurothemis tullia	Pied Paddy Skimmer	LC
5	Libellulidae	Diplacodes trivialis	Blue Ground Skimmer	LC
6	Libellulidae	Rhyothemis phyllis	Yellow-barred flutterer	LC
7	Libellulidae	Trithemis kirbyi	Scarlet rock glider	LC

 Table 57: List of dragonfly species recorded in survey area (B2)

LC = Least Concerned





Crocothemis servilia (Scarlet Skimmer)Brachythemis contaminata (Ditch Jewel)Fig 39: Photo of dragonfly species recorded in survey area (B2)

No	Family Name	Scientific Name	Common Name	IUCN
1	Libellulidae	Crocothemis servilia	Scarlet Skimmer	LC
2	Libellulidae	Brachythemis contaminata	Ditch Jewel	LC
3	Libellulidae	Orthetrum sabina	Green Marsh Hawk	LC

Table 5	8: List	of dragonfly	species	recorded in	survey area	<b>(B3)</b>
			1		•	· ·

### LC = Least Concerned





Crocothemis servilia (Scarlet Skimmer)Brachythemis contaminata (Ditch Jewel)Fig 40: Photo of dragonfly species recorded in survey area (B3)

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No.	Family Name	Scientific Name	Common Name	IUCN
1	Libellulidae	Crocothemis servilia	Scarlet Skimmer	LC
2	Libellulidae	Brachythemis contaminata	Ditch Jewel	LC
3	Libellulidae	Orthetrum sabina	Green Marsh Hawk	LC

Table 59: List of dragonfly species recorded in survey area (B4)

LC = Least	Concerned
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Brachythemis contaminata (Ditch Jewel)Orthetrum sabina (Green Marsh Hawk)Fig 41: Photo of dragonfly species recorded in survey area (B4)

No.	Family Name	Scientific Name	Common Name	IUCN
1	Libellulidae	Crocothemis servilia	Scarlet Skimmer	LC
2	Libellulidae	Brachythemis contaminata	Ditch Jewel	LC
3	Libellulidae	Orthetrum sabina	Green Marsh Hawk	LC
4	Libellulidae	Neurothemis tullia	Pied Paddy Skimmer	LC
5	Libellulidae	Diplacodes trivialis	Blue Ground Skimmer	LC

Table 60	: List of	dragonfly	species	recorded i	in survev	area (	( <b>B5</b> )	)
1 4010 000		anagoning	species	recoraca	in sen vej	area (		,

LC = Least Concerned





Crocothemis servilia (Scarlet Skimmer)Brachythemis contaminata (Ditch Jewel)Fig 42: Photo of dragonfly species recorded in survey area (B5)

No.	Family Name	Species Name	Common Name	IUCN
1	Libellulidae	Crocothemis servilia	Scarlet Skimmer	LC
2	Libellulidae	Brachythemis contaminata	Ditch Jewel	LC
3	Libellulidae	Orthetrum sabina	Green Marsh Hawk	LC

### Table 61: List of dragonfly species recorded in survey area (B6)

LC = Least Concerned





Orthetrum sabina (Green Marsh Hawk)Brachythemis contaminata (Ditch Jewel)Fig 43: Photo of dragonfly species recorded in survey area (B6)

No.	Family Name	Scientific Name	Common Name	IUCN
1	Libellulidae	Crocothemis servilia	Scarlet Skimmer	LC
2	Libellulidae	Brachythemis contaminata	Ditch Jewel	LC
3	Libellulidae	Orthetrum sabina	Green Marsh Hawk	LC

Table 62: List of dragonfly species recorded in survey area (B7)

LC = Least Concerned





Orthetrum sabina (Green Marsh Hawk)Brachythemis contaminata (Ditch Jewel)Fig 44: Photo of dragonfly species recorded in survey area (B7)

No.	Family Name	Scientific Name	Common Name	IUCN
1	Coenagrionidae	Ischnura rufostigma	-	LC
2	Libellulidae	Neurothemis tullia	Pied Paddy Skimmer	LC
3	Libellulidae	Brachythemis contaminata	Ditch Jewel	LC
4	Libellulidae	Orthetrum sabina	Green Marsh Hawk	LC
5	Libellulidae	Diplacodes trivialis	Blue Ground Skimmer	LC

### Table 63: List of dragonfly species recorded in survey area (B8)

### LC = Least Concerned



*Neurothemis tullia* (Pied Paddy Skimmer)





Brachythemis contaminata (Ditch Jewel)



Orthetrum sabina (Green Marsh Hawk) Ischnura rufostigma Fig 45: Photo of dragonfly species recorded in survey area (B8)

No.	Family Name	Scientific Name	Common Name	IUCN
1	Libellulidae	Neurothemis tullia	Pied Paddy Skimmer	LC
2	Libellulidae	Brachythemis contaminata	Ditch Jewel	LC
3	Libellulidae	Orthetrum sabina	Green Marsh Hawk	LC
4	Libellulidae	Diplacodes trivialis	Blue Ground Skimmer	LC
LC = Least Concerned				

Table 64: List of dragonfly species recorded in survey area (B9)



*Neurothemis tullia* (Pied Paddy Skimmer)





Brachythemis contaminata (Ditch Jewel)



Orthetrum sabina (Green Marsh Hawk)Diplacodes trivialis(Blue Ground Skimmer)Fig 46: Photo of dragonfly species recorded in survey area (B9)

### References

#### Flora

1. W. John Kress, Robert A. Defilippes, Ellen Farr and Daw Yin Kyi, A Check List of the Trees, Shrubs, Herbs and Climbers of Myanmar.

2. Dr. Khin Maung Lwin and Dr. Myat Kay Thwe Lwin, Medicinal Plant List of Myanmar.

#### MAMMALS

1. Bates, P. J. J. and D. L. Harrison, 1997.Bats of the Indian Subcontinent, Harrison Zoological Museum, Sevenoaks, Kent, UK.

2. CITES, 2016.Convention on International Trade in Endangered Species of Wild Fauna and Flora, Appendices I, II and III.

3. Francis, C.M. 2001. A photographic guide to mammals of Thailand and South-east Asia. Asia Books Co, Ltd., Bangkok. 128 pp.

4. Francis, C.M. 2008. A Field Guide to the Mammals of Thailand and South-East Asia. Asia Books Co, Ltd., Bangkok. 392 pp.

5. IUCN. 2013. IUCN Red List of Threatened Species. Version 2017 3.1 (Online). Available: www.iucnredlist.org.

6. Kanjanavanit, O. 1997. The Mammal Tracks of Thailand. Green World Foundation, Bangkok.89 pp.

7. KyawNyuntLwin. 1995. Mammals of Myanmar. Nawarat Press, Yangon. 65 pp.

8. Parr, J.W.K. and Tin Than.Undated. Large Mammals of Myanmar. Stars Empire Printing Service, Yangon. 274 pp. 90

#### HERPETOLOGY

1. Chan-ard, T.2003.A photographic guide to Amphibian in Thailand.Se-education Public Company Limited. Thailand. pp 176.

2. CITES, 2016.Convention on International Trade in Endangered Species of Wild Fauna and Flora, Appendices I, II and III.

3. Cox, M.J, Dijk, P.P.V, Nabhitabhata, J and Thirakhupt, K.2006.A photographic guide to Snakes and other Reptiles of Thailand and South-East Asia. Asia books Co., Ltd. Thailand.

4. Das, I.2010. A field guide to the Reptiles of Thailand & South-East Asia. Asia books Co., Ltd. Thailand. pp 376.

5. IUCN. 2013. IUCN Red List of Threatened Species. Version 2017 3.1 (Online). Available: www.iucnrelist.org. 28

6. Kalyar, Platt. S. G, Win KoKo, KhinMyoMyo, Kyaw Moe and Me Me Soe.2012. Photographic Guide to the Freshwater Turtles and Tortoises of Myanmar. Turtle Conservation Team for Educational Purposes. pp 54.

7. Mimeograph for the Nature and Conservation Wildlife Department (NWCD) of inle region (2008). (Personal communication).

### ENTOMOLOGY

1. IUCN. 2013. IUCN Red List of Threatened Species. Version 2017 3.1 (Online). Available: www.iucnrelist.org.

2. Kehimkar, I. 2013. The book of Indian butterflies. Published by Bombay natural history society. pp. 497

3. Kinyon, S. 2004. An illustrated checklist for the butterflies of Myanmar.Zoology Department of Yangon University.

4. Walters, M. 2010. The complete illustrated World Encyclopedia of insects. pp. 256.

5. NWcd, 2008, An Illustrated checklist for the butterfliesspecies in inle lake region.

#### AVIFAUNA

1. Robson, C. 2011. New Holland field guide to the birds of South-east Asia. New Holland Publisher, London, 544 pp.

2. Pamela C. Rasmussen, John C. Anderton "Birds of South Asia the Ripley Guide – Volume 2: Attributes and Status Second Edition".

3. IUCN (2016). IUCN Red List of threatened species. Version 2017<www.iucnredlist.org>.

### AQUATIC

1. Day, F., 1889. The Fauna of British India including Ceylon and Burma Fishes. Vol I and II. Taylor and Francis, England.

2. Jayaram, K.C., 2013. The freshwater fishes of India region. Zoological Survey of India, Calcutta.

3. Vidthayanon, C., Temrichckakin, A., Myint Pe, 2005. Inland fishes of Myanmar. Southeast Asian Fisheries Development Center. Thailand (1-150).

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ANALYICAL CHEMISTRY & TESTING SERVICES



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Project Order number	SURFACE WATER, GROUNDWATER AND SOIL TESTING – NYDC BASELINE SURVEY / 0488716 NYDC EBS (FEB - MAR) Runder HKE/1277a/2019			Date Samples Received	: 27-Feb-2019 : 18-Mar-2019
C-O-C number Site	: H013481, 483-485, 487-491 : NYDC PROJECT AREA			No. of samples received No. of samples analysed	: 72 : 72

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#### General Comments

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release. When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes. Testing period is from 27-Feb-2019 to 18-Mar-2019. Key: LOR = Limit of reporting; CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

#### Specific Comments for Work Order: HK1908351

Sample(s) were received in ambient condition.

Water sample(s) analysed and reported on as received basis.

EP026C - Due to high chloride content, samples #4-6,26,28,30,35-36,46-49,51,56-57,61-62,68-71 required dilution prior to Chemical Oxygen Demand analysis, LOR has been adjusted accordingly.

Water sample(s) were filtered prior to dissolved metal analysis.

EA002 - Calibration range of pH value is 4.0 - 10.0. Results exceeding this range is for reference only.

EA002 - pH value is reported as at 25°C.

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### Analytical Results

Sub-Matrix: WATER		Clie	ent sample ID	GW-1A	GW-1B	GW-1C	SW-1A	SW-1B
	Clie	ent sampli	ng date / time	17-Feb-2019 15:15	17-Feb-2019 15:35	17-Feb-2019 16:00	19-Feb-2019 16:30	19-Feb-2019 16:40
Compound	CAS Number	LOR	Unit	HK1908351-001	HK1908351-002	HK1908351-003	HK1908351-004	HK1908351-005
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	6.0	6.0	6.2	7.8	7.8
EA025: Suspended Solids (SS)		2	mg/L	<2	<2	<2	5400	723
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	123	37	216	3370	3530
EK040: Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.1	0.2	0.2
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.13	0.02	1.75	0.11	0.07
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	6.11	8.06	4.60	0.80	0.78
EK062P: Total Nitrogen as N		0.1	mg/L	6.6	8.2	7.0	2.0	1.2
EK067P: Total Phosphorus as P		0.01	mg/L	<0.01	<0.01	<0.01	1.16	0.34
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	<5	<5	14	<50	<50
EP030: Biochemical Oxygen Demand		2	mg/L	<2	<2	<2	<2	<2
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	<10	<10	<10	<10	<10
EG020: Chromium	7440-47-3	1	µg/L	5	6	6	<1	<1
EG020: Copper	7440-50-8	1	µg/L	1	1	<1	3	3
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	µg/L	60	20	110	<10	<10

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Sub-Matrix: WATER		Clie	ent sample ID	SW-1C	SW-23A	SW-23B	SW-23C	SW-24A
	Cli	ent samplii	ng date / time	19-Feb-2019 16:50	19-Feb-2019 13:15	19-Feb-2019 13:25	19-Feb-2019 13:30	19-Feb-2019 13:45
Compound	CAS Number	LOR	Unit	HK1908351-006	HK1908351-007	HK1908351-008	HK1908351-009	HK1908351-010
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	7.8	8.1	8.0	8.0	8.0
EA025: Suspended Solids (SS)		2	mg/L	7500	1020	2760	1130	2310
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	3690	328	304	218	331
EK040: Fluoride	16984-48-8	0.1	mg/L	0.2	0.2	0.1	0.1	0.1
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.12	0.08	0.12	0.12	0.11
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	0.81	0.23	0.24	0.18	0.24
EK062P: Total Nitrogen as N		0.1	mg/L	2.0	0.6	1.2	0.6	1.0
EK067P: Total Phosphorus as P		0.01	mg/L	1.11	0.44	0.81	0.46	0.72
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	<50	35	62	24	52
EP030: Biochemical Oxygen Demand		2	mg/L	<2	<2	<2	<2	<2
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	<10	<10	<10	<10	<10
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	4	1	1	1	1
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	<10	<10	<10

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Sub-Matrix: WATER		Clie	ent sample ID	SW-24B	SW-24C	SW-17A	SW-17B	SW-17C
	Cli	ent samplii	ng date / time	19-Feb-2019 13:55	19-Feb-2019 14:05	20-Feb-2019 15:00	20-Feb-2019 15:10	20-Feb-2019 15:20
Compound	CAS Number	LOR	Unit	HK1908351-011	HK1908351-012	HK1908351-013	HK1908351-014	HK1908351-015
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	8.0	8.0	7.5	7.5	7.5
EA025: Suspended Solids (SS)		2	mg/L	1020	845	11700	40600	29500
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	456	594	804	843	809
EK040: Fluoride	16984-48-8	0.1	mg/L	0.1	0.1	0.1	0.1	0.1
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.09	0.08	0.46	0.68	0.60
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	0.27	0.32	0.78	0.29	0.34
EK062P: Total Nitrogen as N		0.1	mg/L	0.6	0.6	7.1	10.2	10.8
EK067P: Total Phosphorus as P		0.01	mg/L	0.41	0.35	7.47	9.14	9.51
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	21	19	184	352	284
EP030: Biochemical Oxygen Demand		2	mg/L	<2	<2	3	5	4
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	<10	<10	<10	<10	<10
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	1	1	1	1	2
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	<10	<10	<10

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Sub-Matrix: WATER		Clie	ent sample ID	SW-18A	SW-18B	SW-18C	SW-4A	SW-4B
	Cli	ent sampli	ng date / time	20-Feb-2019 14:30	20-Feb-2019 14:40	20-Feb-2019 14:50	20-Feb-2019 15:50	20-Feb-2019 16:00
Compound	CAS Number	LOR	Unit	HK1908351-016	HK1908351-017	HK1908351-018	HK1908351-019	HK1908351-020
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	7.6	7.5	7.6	7.7	7.6
EA025: Suspended Solids (SS)		2	mg/L	2440	4300	71700	918	2840
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	877	894	845	817	797
EK040: Fluoride	16984-48-8	0.1	mg/L	0.1	0.1	0.1	0.1	0.1
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.31	0.36	0.83	0.13	0.20
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	0.84	0.83	0.17	0.75	0.77
EK062P: Total Nitrogen as N		0.1	mg/L	1.5	1.8	13.6	1.1	1.5
EK067P: Total Phosphorus as P		0.01	mg/L	0.71	1.01	9.51	0.43	0.78
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	51	70	1860	24	54
EP030: Biochemical Oxygen Demand		2	mg/L	3	3	5	<2	<2
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	<10	<10	<10	<10	<10
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	<1	<1	<1	1	1
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	<10	<10	<10

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Sub-Matrix: WATER		Clie	ent sample ID	SW-4C	SW-5A	SW-5B	SW-5C	SW-8A
	Cli	ent sampli	ng date / time	20-Feb-2019 16:10	20-Feb-2019 16:40	20-Feb-2019 16:50	20-Feb-2019 17:00	19-Feb-2019 14:15
Compound	CAS Number	LOR	Unit	HK1908351-021	HK1908351-022	HK1908351-023	HK1908351-024	HK1908351-025
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	7.5	7.6	7.7	7.7	8.0
EA025: Suspended Solids (SS)		2	mg/L	3430	3430	1570	630	1130
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	801	748	769	833	999
EK040: Fluoride	16984-48-8	0.1	mg/L	0.1	0.1	0.1	0.1	0.1
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.22	0.24	0.20	0.18	0.10
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	0.79	0.78	0.75	0.72	0.46
EK062P: Total Nitrogen as N		0.1	mg/L	1.7	1.6	1.2	0.9	0.8
EK067P: Total Phosphorus as P		0.01	mg/L	1.02	0.94	0.58	0.28	0.44
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	39	81	52	18	26
EP030: Biochemical Oxygen Demand		2	mg/L	<2	<2	<2	<2	<2
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	<10	<10	<10	<10	<10
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	2	1	1	1	<1
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	<10	<10	<10

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Sub-Matrix: WATER		Clie	ent sample ID	SW-8B	SW-8C	SW-13A	SW-13B	SW-13C
	Cli	ent sampli	ing date / time	19-Feb-2019 14:25	19-Feb-2019 14:35	23-Feb-2019 13:05	23-Feb-2019 13:15	23-Feb-2019 13:25
Compound	CAS Number	LOR	Unit	HK1908351-026	HK1908351-027	HK1908351-028	HK1908351-029	HK1908351-030
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	8.0	7.8	7.7	7.8	7.6
EA025: Suspended Solids (SS)		2	mg/L	292	1070	116	172	63
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	1110	1280	2460	2480	2160
EK040: Fluoride	16984-48-8	0.1	mg/L	0.2	0.1	0.2	0.2	0.2
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.09	0.09	0.10	0.07	0.11
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	0.45	0.52	0.71	0.74	0.59
EK062P: Total Nitrogen as N		0.1	mg/L	0.6	0.8	0.8	0.8	0.8
EK067P: Total Phosphorus as P		0.01	mg/L	0.23	0.42	0.10	0.12	0.08
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	<10	25	<10	12	<10
EP030: Biochemical Oxygen Demand		2	mg/L	<2	<2	<2	<2	<2
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	<10	<10	<10	<10	<10
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	1	1	2	2	2
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	<10	<10	<10

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Sub-Matrix: WATER		Clie	ent sample ID	GW-15A	GW-15B	GW-15C	GW-9A	GW-9B
	Cli	ent samplii	ng date / time	23-Feb-2019 11:40	23-Feb-2019 11:50	23-Feb-2019 12:00	22-Feb-2019 15:05	22-Feb-2019 15:15
Compound	CAS Number	LOR	Unit	HK1908351-031	HK1908351-032	HK1908351-033	HK1908351-034	HK1908351-035
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	7.2	7.5	7.0	7.2	7.0
EA025: Suspended Solids (SS)		2	mg/L	7	16	41	15	16
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	809	1140	2180	887	2400
EK040: Fluoride	16984-48-8	0.1	mg/L	0.3	0.2	0.2	0.3	0.3
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	20.8	8.00	3.20	0.50	0.80
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	0.01	0.82	0.02	0.01	0.01
EK062P: Total Nitrogen as N		0.1	mg/L	21.8	8.1	3.2	0.5	0.8
EK067P: Total Phosphorus as P		0.01	mg/L	3.89	1.10	3.63	2.05	1.29
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	11	<5	14	9	<10
EP030: Biochemical Oxygen Demand		2	mg/L	3	2	<2	<2	<2
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	μg/L	<10	<10	<10	10	<10
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	<1	<1	<1	2	<1
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	<10	<10	<10

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Sub-Matrix: WATER		Clie	ent sample ID	GW-9C	GW-23A	GW-23B	GW-23C	SW-7A	
	Clie	ent samplii	ng date / time	22-Feb-2019 15:25	22-Feb-2019 16:10	22-Feb-2019 16:20	22-Feb-2019 16:30	22-Feb-2019 10:50	
Compound	CAS Number	LOR	Unit	HK1908351-036	HK1908351-037	HK1908351-038	HK1908351-039	HK1908351-040	
EA/ED: Physical and Aggregate Properties									
EA002: pH Value		0.1	pH Unit	7.0	7.4	7.3	7.4	7.7	
EA025: Suspended Solids (SS)		2	mg/L	30	<2	<2	<2	2070	
ED/EK: Inorganic Nonmetallic Parameters									
ED045K: Chloride	16887-00-6	1	mg/L	2050	1180	1170	1170	2000	
EK040: Fluoride	16984-48-8	0.1	mg/L	0.1	0.2	0.2	0.2	0.2	
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	1.40	2.70	2.47	2.28	0.16	
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	0.01	0.01	0.01	<0.01	0.72	
EK062P: Total Nitrogen as N		0.1	mg/L	1.4	3.2	2.9	2.5	1.5	
EK067P: Total Phosphorus as P		0.01	mg/L	1.42	0.05	0.02	0.02	0.66	
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	
EP: Aggregate Organics									
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2	
EP026C: Chemical Oxygen Demand		5	mg/L	<10	<5	<5	<5	55	
EP030: Biochemical Oxygen Demand		2	mg/L	<2	<2	3	<2	<2	
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	
EG: Metals and Major Cations - Filtered									
EG020: Arsenic	7440-38-2	10	µg/L	<10	<10	<10	<10	<10	
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1	
EG020: Copper	7440-50-8	1	µg/L	<1	<1	<1	<1	2	
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	<10	<10	<10	

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Sub-Matrix: WATER		Clie	ent sample ID	SW-7B	SW-7C	GW-3A	GW-3B	GW-3C
	Clie	ent samplii	ng date / time	22-Feb-2019 11:00	22-Feb-2019 11:10	24-Feb-2019 11:10	24-Feb-2019 11:20	24-Feb-2019 11:30
Compound	CAS Number	LOR	Unit	HK1908351-041	HK1908351-042	HK1908351-043	HK1908351-044	HK1908351-045
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	7.7	7.7	3.0	6.5	5.0
EA025: Suspended Solids (SS)		2	mg/L	1650	1740	10	51	81
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	2030	2040	2490	705	1900
EK040: Fluoride	16984-48-8	0.1	mg/L	0.2	0.2	0.1	0.1	0.1
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.16	0.16	3.00	8.98	4.96
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	0.72	0.72	<0.01	0.05	<0.01
EK062P: Total Nitrogen as N		0.1	mg/L	1.5	1.4	3.0	10.5	7.8
EK067P: Total Phosphorus as P		0.01	mg/L	0.62	0.63	0.03	0.61	0.08
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	37	56	20	7	44
EP030: Biochemical Oxygen Demand		2	mg/L	<2	<2	4	<2	4
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	<10	<10	<10	<10	<10
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	2	2	9	<1	<1
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	300	<10	10

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Sub-Matrix: WATER		Clie	ent sample ID	SW-12A	SW-12B	SW-12C	SW-3A	GW-2A
	Cli	ient samplii	ng date / time	23-Feb-2019 15:50	23-Feb-2019 16:00	23-Feb-2019 16:10	24-Feb-2019 09:50	24-Feb-2019 11:00
Compound	CAS Number	LOR	Unit	HK1908351-046	HK1908351-047	HK1908351-048	HK1908351-049	HK1908351-050
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	7.6	7.7	7.8	7.7	6.1
EA025: Suspended Solids (SS)		2	mg/L	30	38	37	87	<2
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	2260	2260	2300	2660	552
EK040: Fluoride	16984-48-8	0.1	mg/L	0.2	0.2	0.2	0.2	0.1
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.07	0.05	0.05	0.06	3.00
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	0.38	0.70	0.71	0.76	<0.01
EK062P: Total Nitrogen as N		0.1	mg/L	0.5	0.8	0.8	0.9	3.0
EK067P: Total Phosphorus as P		0.01	mg/L	0.07	0.07	0.06	0.09	0.01
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	<10	<10	<10	<10	<5
EP030: Biochemical Oxygen Demand		2	mg/L	<2	<2	<2	<2	<2
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	<10	<10	<10	<10	<10
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	<1	1	<1	2	<1
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	<10	<10	<10

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Sub-Matrix: WATER		Clie	ent sample ID	GW-2B	GW-2C	SW-9A	SW-9B	SW-9C
	Cli	ient samplii	ng date / time	24-Feb-2019 11:10	24-Feb-2019 11:20	24-Feb-2019 13:00	24-Feb-2019 13:10	24-Feb-2019 13:20
Compound	CAS Number	LOR	Unit	HK1908351-051	HK1908351-052	HK1908351-053	HK1908351-054	HK1908351-055
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	5.6	6.0	7.4	7.5	7.4
EA025: Suspended Solids (SS)		2	mg/L	<2	<2	80	29	63
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	2070	682	1460	1450	1470
EK040: Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.2	0.2	0.2
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.34	2.00	0.31	0.33	0.29
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	0.40	0.43	0.43
EK062P: Total Nitrogen as N		0.1	mg/L	0.3	2.0	1.0	1.1	1.0
EK067P: Total Phosphorus as P		0.01	mg/L	<0.01	0.01	0.06	0.04	0.06
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	<10	<5	10	8	10
EP030: Biochemical Oxygen Demand		2	mg/L	<2	<2	2	<2	<2
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	<10	<10	<10	<10	<10
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	5	<1	1	1	1
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	µg/L	20	<10	<10	<10	<10

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Sub-Matrix: WATER		Clie	ent sample ID	SW-3B	SW-3C	GW-8A	GW-8B	GW-8C
	Cli	ient samplii	ng date / time	24-Feb-2019 10:00	24-Feb-2019 10:10	21-Feb-2019 10:00	21-Feb-2019 10:10	21-Feb-2019 10:20
Compound	CAS Number	LOR	Unit	HK1908351-056	HK1908351-057	HK1908351-058	HK1908351-059	HK1908351-060
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	7.7	7.6	7.1	7.0	7.2
EA025: Suspended Solids (SS)		2	mg/L	49	67	15	28	16
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	2660	2330	555	486	390
EK040: Fluoride	16984-48-8	0.1	mg/L	0.2	0.2	0.3	0.2	0.3
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.04	0.07	0.47	0.57	0.50
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	0.77	0.69	<0.01	<0.01	0.17
EK062P: Total Nitrogen as N		0.1	mg/L	0.9	0.9	0.5	0.6	0.7
EK067P: Total Phosphorus as P		0.01	mg/L	0.07	0.09	1.21	1.65	1.39
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	<10	<10	9	14	10
EP030: Biochemical Oxygen Demand		2	mg/L	<2	<2	<2	<2	<2
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	<10	<10	<10	<10	<10
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	1	1	2	<1	<1
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	<10	<10	<10

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Sub-Matrix: WATER		Client sample ID		GW-13A	GW-13B	GW-13C	GW-24A	GW-24B
	Clie	ent sampli	ng date / time	21-Feb-2019 11:10	21-Feb-2019 11:20	21-Feb-2019 11:30	22-Feb-2019 10:30	22-Feb-2019 10:40
Compound	CAS Number	LOR	Unit	HK1908351-061	HK1908351-062	HK1908351-063	HK1908351-064	HK1908351-065
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	7.2	7.3	7.2	7.2	7.2
EA025: Suspended Solids (SS)		2	mg/L	20	26	15	<2	<2
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	1240	3640	1560	500	520
EK040: Fluoride	16984-48-8	0.1	mg/L	0.3	0.2	0.2	0.5	0.6
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.88	8.00	1.40	1.60	1.40
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	0.02	0.01	0.01	<0.01	<0.01
EK062P: Total Nitrogen as N		0.1	mg/L	0.9	8.3	1.4	1.6	1.4
EK067P: Total Phosphorus as P		0.01	mg/L	2.57	3.49	2.10	0.01	0.02
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	<10	<50	13	<5	<5
EP030: Biochemical Oxygen Demand		2	mg/L	<2	<2	6	<2	<2
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	μg/L	<10	<10	<10	<10	<10
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	<1	<1	<1	<1	<1
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	<10	<10	<10

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Sub-Matrix: WATER		Client sample ID		SW-11A	SW-11B	SW-11C	SW-2A	SW-2B
	Clie	ent sampli	ng date / time	19-Feb-2019 09:30	19-Feb-2019 09:40	19-Feb-2019 09:50	19-Feb-2019 11:00	19-Feb-2019 11:10
Compound	CAS Number	LOR	Unit	HK1908351-066	HK1908351-067	HK1908351-068	HK1908351-069	HK1908351-070
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	7.7	7.8	7.8	7.8	7.8
EA025: Suspended Solids (SS)		2	mg/L	4930	4490	4330	656	642
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	2170	2170	3070	2710	2620
EK040: Fluoride	16984-48-8	0.1	mg/L	0.3	0.3	0.2	0.2	0.2
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.10	0.26	0.15	0.10	0.10
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	0.76	0.75	0.80	0.79	0.78
EK062P: Total Nitrogen as N		0.1	mg/L	1.8	1.8	1.6	1.0	1.0
EK067P: Total Phosphorus as P		0.01	mg/L	1.13	1.09	1.08	0.32	0.31
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	62	62	<50	<50	<50
EP030: Biochemical Oxygen Demand		2	mg/L	<2	<2	<2	<2	<2
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	<10	<10	<10	<10	<10
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	1	<1	<1	<1	<1
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	<10	<10	<10

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HK1906351							(
Sub-Matrix: WATER		Clie	ent sample ID	SW-2C	GW-24C	 	
	Clie	ent samplii	ng date / time	19-Feb-2019 11:20	22-Feb-2019 10:50	 	
Compound	CAS Number	LOR	Unit	HK1908351-071	HK1908351-072	 	
EA/ED: Physical and Aggregate Properties							
EA002: pH Value		0.1	pH Unit	7.8	7.3	 	
EA025: Suspended Solids (SS)		2	mg/L	1260	<2	 	
ED/EK: Inorganic Nonmetallic Parameters							
ED045K: Chloride	16887-00-6	1	mg/L	2640	488	 	
EK040: Fluoride	16984-48-8	0.1	mg/L	0.2	0.5	 	
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.08	1.59	 	
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	0.78	0.02	 	
EK062P: Total Nitrogen as N		0.1	mg/L	1.2	1.6	 	
EK067P: Total Phosphorus as P		0.01	mg/L	0.53	0.01	 	
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	 	
EP: Aggregate Organics							
EP020: Oil & Grease		2	mg/L	<2	<2	 	
EP026C: Chemical Oxygen Demand		5	mg/L	<50	<5	 	
EP030: Biochemical Oxygen Demand		2	mg/L	<2	<2	 	
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	 	
EG: Metals and Major Cations - Filtered							
EG020: Arsenic	7440-38-2	10	µg/L	<10	<10	 	
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	 	
EG020: Copper	7440-50-8	1	µg/L	<1	<1	 	
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	 	
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	 	

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### Laboratory Duplicate (DUP) Report

Matrix: WATER			Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	
EA/ED: Physical and Age	gregate Properties (QC Lot: 22113	32)							
HK1908351-001	GW-1A	EA025: Suspended Solids (SS)		2	mg/L	<2	<2	0.00	
HK1908351-011	SW-24B	EA025: Suspended Solids (SS)		2	mg/L	1020	1060	4.27	
EA/ED: Physical and Age	gregate Properties (QC Lot: 22113	33)							
HK1908351-021	SW-4C	EA025: Suspended Solids (SS)		2	mg/L	3430	3430	0.0583	
HK1908351-031	GW-15A	EA025: Suspended Solids (SS)		2	mg/L	7	7	0.00	
EA/ED: Physical and Age	gregate Properties (QC Lot: 22113	34)				1			
HK1908351-041	SW-7B	EA025: Suspended Solids (SS)		2	mg/L	1650	1680	1.86	
HK1908351-051	GW-2B	EA025: Suspended Solids (SS)		2	mg/L	<2	<2	0.00	
EA/ED: Physical and Age	gregate Properties (QC Lot: 22113	35)							
HK1908351-061	GW-13A	EA025: Suspended Solids (SS)		2	mg/L	20	19	5.22	
HK1908351-071	SW-2C	EA025: Suspended Solids (SS)		2	mg/L	1260	1290	2.90	
EA/ED: Physical and Age	gregate Properties (QC Lot: 22113	81)				1			
HK1908351-001	GW-1A	EA002: pH Value		0.1	pH Unit	6.0	5.9	0.00	
HK1908351-011	SW-24B	EA002: pH Value		0.1	pH Unit	8.0	8.0	0.00	
EA/ED: Physical and Age	gregate Properties (QC Lot: 22113	82)							
HK1908351-021	SW-4C	EA002: pH Value		0.1	pH Unit	7.5	7.5	0.00	
HK1908351-031	GW-15A	EA002: pH Value		0.1	pH Unit	7.2	7.2	0.00	
EA/ED: Physical and Age	gregate Properties (QC Lot: 22113	83)				1			
HK1908351-041	SW-7B	EA002: pH Value		0.1	pH Unit	7.7	7.7	0.00	
HK1908351-051	GW-2B	EA002: pH Value		0.1	pH Unit	5.6	5.6	0.00	
EA/ED: Physical and Ag	gregate Properties (QC Lot: 22113	884)				1			
HK1908351-061	GW-13A	EA002: pH Value		0.1	pH Unit	7.2	7.3	0.00	
HK1908351-071	SW-2C	EA002: pH Value		0.1	pH Unit	7.8	7.8	0.00	
ED/EK: Inorganic Nonme	tallic Parameters (QC Lot: 22113	98)							
HK1908351-020	SW-4B	EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.20	0.18	10.1	
ED/EK: Inorganic Nonme	etallic Parameters (QC Lot: 22113	99)				1			
HK1908351-040	SW-7A	EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.16	0.15	7.86	
ED/EK: Inorganic Nonme	etallic Parameters (QC Lot: 221140	00)				1			
HK1908351-060	GW-8C	EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.50	0.50	0.00	
ED/EK: Inorganic Nonme	stallic Parameters (QC Lot: 221140	01)							

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Matrix: WATER				Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	<b>RPD</b> (%)		
ED/EK: Inorganic Nonmet	allic Parameters (QC Lot: 221140	1) - Continued								
HK1908351-072	GW-24C	EK055K: Ammonia as N	7664-41-7	0.01	mg/L	1.59	1.70	6.29		
ED/EK: Inorganic Nonmeta	allic Parameters (QC Lot: 221316	5)								
HK1908351-010	SW-24A	EK067P: Total Phosphorus as P		0.01	mg/L	0.72	0.73	1.72		
ED/EK: Inorganic Nonmeta	allic Parameters (QC Lot: 221316	6)								
HK1908351-010	SW-24A	EK062P: Total Nitrogen as N		0.1	mg/L	1.0	1.0	0.00		
ED/EK: Inorganic Nonmeta	allic Parameters (QC Lot: 221316	7)								
HK1908351-030	SW-13C	EK062P: Total Nitrogen as N		0.1	mg/L	0.8	0.8	0.00		
ED/EK: Inorganic Nonmeta	allic Parameters (QC Lot: 221316	8)								
HK1908351-030	SW-13C	EK067P: Total Phosphorus as P		0.01	mg/L	0.08	0.08	0.00		
ED/EK: Inorganic Nonmeta	allic Parameters (QC Lot: 221316	9)								
HK1908351-050	GW-2A	EK062P: Total Nitrogen as N		0.1	mg/L	3.0	3.0	0.00		
ED/EK: Inorganic Nonmet	allic Parameters (QC Lot: 221317	'0)								
HK1908351-050	GW-2A	EK067P: Total Phosphorus as P		0.01	mg/L	0.01	0.01	0.00		
ED/EK: Inorganic Nonmet	allic Parameters (QC Lot: 221317	(1)								
HK1908351-070	SW-2B	EK062P: Total Nitrogen as N		0.1	mg/L	1.0	1.0	0.00		
ED/EK: Inorganic Nonmet	allic Parameters (QC Lot: 221317	2)								
HK1908351-070	SW-2B	EK067P: Total Phosphorus as P		0.01	mg/L	0.31	0.31	0.00		
ED/EK: Inorganic Nonmet	allic Parameters (QC Lot: 221346	5)								
HK1908490-001	Anonymous	EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	0.00		
ED/EK: Inorganic Nonmet	allic Parameters (QC Lot: 221346	6)								
HK1908351-016	SW-18A	EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	0.00		
ED/EK: Inorganic Nonmet	allic Parameters (QC Lot: 221346	57)								
HK1908351-037	GW-23A	EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	0.00		
ED/EK: Inorganic Nonmet	allic Parameters (QC Lot: 221511	8)								
HK1908351-010	SW-24A	ED045K: Chloride	16887-00-6	1	mg/L	331	330	0.348		
ED/EK: Inorganic Nonmet	allic Parameters (QC Lot: 221511	9)								
HK1908351-030	SW-13C	ED045K: Chloride	16887-00-6	1	mg/L	2160	2140	1.03		
ED/EK: Inorganic Nonmet	allic Parameters (QC Lot: 221512	20)								
HK1908351-050	GW-2A	ED045K: Chloride	16887-00-6	1	mg/L	552	539	2.52		
ED/EK: Inorganic Nonmeta	allic Parameters (QC Lot: 221512	1)								
HK1908351-070	SW-2B	ED045K: Chloride	16887-00-6	1	mg/L	2620	2560	1.98		
ED/EK: Inorganic Nonmeta	allic Parameters (QC Lot: 221741	6)	1							

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Matrix: WATER				Laboratory Duplicate (DUP) Report							
Laboratory	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate	<b>RPD</b> (%)			
sample ID							Result				
ED/EK: Inorganic Nonme	tallic Parameters (QC Lot: 221	17416) - Continued									
HK1908872-001	Anonymous	EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	0.00			
ED/EK: Inorganic Nonme	tallic Parameters (QC Lot: 222	22971)									
HK1908351-001	GW-1A	EK040: Fluoride	16984-48-8	0.1	mg/L	<0.1	<0.1	0.00			
ED/EK: Inorganic Nonme	tallic Parameters (QC Lot: 222	22972)									
HK1908351-021	SW-4C	EK040: Fluoride	16984-48-8	0.1	mg/L	0.1	0.1	0.00			
ED/EK: Inorganic Nonme	tallic Parameters (QC Lot: 222	22973)									
HK1908351-041	SW-7B	EK040: Fluoride	16984-48-8	0.1	mg/L	0.2	0.2	0.00			
ED/EK: Inorganic Nonme	tallic Parameters (QC Lot: 222	22974)									
HK1908351-061	GW-13A	EK040: Fluoride	16984-48-8	0.1	mg/L	0.3	0.3	0.00			
EP: Aggregate Organics	(QC Lot: 2215026)										
HK1908490-001	Anonymous	EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	0.00			
EP: Aggregate Organics	(QC Lot: 2215044)										
HK1908351-001	GW-1A	EP026C: Chemical Oxygen Demand		5	mg/L	<5	<5	0.00			
EP: Aggregate Organics	(QC Lot: 2215048)										
HK1908861-001	Anonymous	EP026C: Chemical Oxygen Demand		5	mg/L	<5	<5	0.00			
EP: Aggregate Organics	(QC Lot: 2217280)										
HK1908351-031	GW-15A	EP026C: Chemical Oxygen Demand		5	mg/L	11	11	0.00			
EP: Aggregate Organics	(QC Lot: 2217281)										
HK1908351-044	GW-3B	EP026C: Chemical Oxygen Demand		5	mg/L	7	6	0.00			
EP: Aggregate Organics	(QC Lot: 2219590)										
HK1908351-058	GW-8A	EP026C: Chemical Oxygen Demand		5	mg/L	9	11	15.7			
EP: Aggregate Organics	(QC Lot: 2220857)										
HK1908351-032	GW-15B	EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	0.00			
EP: Aggregate Organics	(QC Lot: 2220858)										
HK1908351-039	GW-23C	EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	0.00			
EP: Aggregate Organics	(QC Lot: 2222018)										
HK1908351-050	GW-2A	EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	0.00			
EP: Aggregate Organics	(QC Lot: 2222019)										
HK1908351-069	SW-2A	EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	0.00			
EP: Aggregate Organics	(QC Lot: 2223225)										
HK1909558-002	Anonymous	EP026C: Chemical Oxygen Demand		5	mg/L	18	17	0.00			
EG: Metals and Major Ca	tions - Filtered (QC Lot: 22124	420)									

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	NATERryClient sample IDMethod: Compound2als and Major Cations - Filtered (QC Lot: 2212420)- Continued8351-002GW-1BEG020: MercuryEG020: ChromiumEG020: ChromiumEG020: CopperEG020: ChromiumEG020: ZincEG020: Chromium8351-022SW-5AEG020: MercuryEG020: ChromiumEG020: ChromiumEG020: ChromiumEG020: Chromium8351-022SW-5AEG020: MercuryEG020: ChromiumEG020: ChromiumEG0		Laboratory Dunlicate (DLIP) Report							
	0//		242.W	(05				222 (11)		
Laboratory sample ID	Client sample ID	Methoa: Compound	CAS NUMDer	LUR	Unit	Unginal Result	Duplicate Result	RPD (%)		
EG: Metals and Major (	Cations - Filtered (QC Lot: 2	212420) - Continued					7.000.0			
HK1908351-002	GW-1B	EG020: Mercury	7439-97-6	0.5	ua/L	<0.5	<0.5	0.00		
	-	EG020: Chromium	7440-47-3	1	ua/L	6	7	0.00		
		EG020: Copper	7440-50-8	1	ua/L	1	<1	0.00		
		EG020: Arsenic	7440-38-2	10	ug/l	<10	<10	0.00		
		EG020: Zinc	7440-66-6	10	µg/l	20	30	0.00		
EG: Metals and Major (	Cations - Filtered (QC Lot: 2	212421)		10	P9, E	20	00	0.00		
HK1908351-022	SW-5A	EG020: Mercury	7439-97-6	0.5	ua/L	<0.5	<0.5	0.00		
		EG020: Chromium	7440-47-3	1	ua/L	<1	<1	0.00		
		EG020: Copper	7440-50-8	1	ua/L	1	1	0.00		
	EG020: Arsenic	7440-38-2	10	ua/L	<10	<10	0.00			
	EG020: Copper EG020: Arsenic EG020: Zinc	EG020: Zinc	7440-66-6	10	ua/L	<10	<10	0.00		
EG: Metals and Maior	Cations - Filtered (QC Lot: 2	212422)			10					
HK1908351-042	SW-7C	EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	0.00		
		EG020: Chromium	7440-47-3	1	µg/L	<1	<1	0.00		
	WATER         Method: Composition           yy         Client sample ID         Method: Composition           2         GW-1B         EG020: Merculee           8351-002         GW-1B         EG020: Coppation           8351-002         GW-1B         EG020: Coppation           8351-002         GW-1B         EG020: Coppation           8351-002         SW-5A         EG020: Coppation           8351-022         SW-5A         EG020: Coppation           8351-042         SW-7C         EG020: Coppation           8351-042         SW-7C         EG020: Coppation           8351-042         SW-7C         EG020: Coppation           8351-042         SW-7C         EG020: Coppation           8351-042         GW-13B         EG020: Coppation           8351-062         GW-13B         EG020: Coppation           8351-062         GW-13B         EG020: Coppation           8351-062         EG020: Coppation         EG020: Coppation	EG020: Copper	7440-50-8	1	µg/L	2	1	0.00		
		EG020: Arsenic	7440-38-2	10	ua/L	<10	<10	0.00		
	Citers       Citent sample ID       Method: Compound         i and Major Cations - Filtered (QC Lot: 2212420)       - Continued         i51-002       GW-1B       EG020: Mercury         i51-002       GW-1B       EG020: Copper         is and Major Cations - Filtered (QC Lot: 2212421)       EG020: Arsenic         is and Major Cations - Filtered (QC Lot: 2212421)       EG020: Mercury         i51-022       SW-5A       EG020: Mercury         i51-022       SW-5A       EG020: Copper         i51-022       SW-5A       EG020: Copper         i51-023       SW-5A       EG020: Copper         i51-042       SW-7C       EG020: Copper         i51-042       SW-7C       EG020: Mercury         i51-042       SW-7C       EG020: Copper         i51-062       GW-13B       EG020: Copper         i51-062       GW-13B       EG020: Chromium         i5020: Copper       EG020: Chromium       EG020: Chromium         i5020: Copper       EG020: Chromium       EG020: Chromium	7440-66-6	10	µg/L	<10	<10	0.00			
EG: Metals and Major	Cations - Filtered (QC Lot: 2	212423)	1		10	1				
HK1908351-062	GW-13B	EG020: Mercury	7439-97-6	0.5	μg/L	<0.5	<0.5	0.00		
		EG020: Chromium	7440-47-3	1	μg/L	<1	<1	0.00		
		EG020: Copper	7440-50-8	1	µg/L	<1	<1	0.00		
		EG020: Arsenic	7440-38-2	10	μg/L	<10	<10	0.00		
		EG020: Zinc	7440-66-6	10	ug/l	<10	<10	0.00		

### Method Blank (MB), Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report

Matrix: WATER			Method Blank (MB	) Report	Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report							
			Spike	Spike Recovery (%)		Recovery Limits(%)		RPD (%)				
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	DCS	Low	High	Value	Control	
											Limit	
EA/ED: Physical and Aggregate Properties (QC Lo	EA/ED: Physical and Aggregate Properties (QC Lot: 2211332)											
EA025: Suspended Solids (SS)		2	mg/L	<2	10 mg/L	93.5		81	120			

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Matrix: WATER			Method Blank (ME	3) Report	Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
				1	Spike	Spike Re	асоvегу (%)	Recove	ary Limits(%)	RP	D (%)
Method: Compound CAS	S Number	LOR	Unit	Result	Concentration	LCS	DCS	Low	High	Value	Control
											Limit
EA/ED: Physical and Aggregate Properties (QC Lot: 2211	333)										
EA025: Suspended Solids (SS)		2	mg/L	<2	10 mg/L	85.5		81	120		
EA/ED: Physical and Aggregate Properties (QC Lot: 2211	334)										
EA025: Suspended Solids (SS)		2	mg/L	<2	10 mg/L	86.0		81	120		
EA/ED: Physical and Aggregate Properties (QC Lot: 2211	335)										
EA025: Suspended Solids (SS)		2	mg/L	<2	10 mg/L	102		81	120		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 22113	398)										
EK055K: Ammonia as N 7	664-41-7	0.01	mg/L	<0.01	0.5 mg/L	102		88	109		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 22113	399)										
EK055K: Ammonia as N 7	664-41-7	0.01	mg/L	<0.01	0.5 mg/L	102		88	109		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 22114	400)										
EK055K: Ammonia as N 7	664-41-7	0.01	mg/L	<0.01	0.5 mg/L	102		88	109		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 22114	401)										
EK055K: Ammonia as N 7	664-41-7	0.01	mg/L	<0.01	0.5 mg/L	99.6		88	109		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 2213	165)										
EK067P: Total Phosphorus as P		0.01	mg/L	<0.01	0.5 mg/L	97.6		90	104		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 2213	166)										
EK062P: Total Nitrogen as N		0.1	mg/L	<0.1	0.5 mg/L	99.4		92	116		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 2213	167)										
EK062P: Total Nitrogen as N		0.1	mg/L	<0.1	0.5 mg/L	98.6		92	116		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 2213	168)										
EK067P: Total Phosphorus as P		0.01	mg/L	<0.01	0.5 mg/L	98.9		90	104		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 2213	169)										
EK062P: Total Nitrogen as N		0.1	mg/L	<0.1	0.5 mg/L	99.0		92	116		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 2213	170)										
EK067P: Total Phosphorus as P		0.01	mg/L	<0.01	0.5 mg/L	98.7		90	104		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 2213	171)										
EK062P: Total Nitrogen as N		0.1	mg/L	<0.1	0.5 mg/L	94.7		92	116		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 2213	172)										
EK067P: Total Phosphorus as P		0.01	mg/L	<0.01	0.5 mg/L	97.6		90	104		
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Matrix: WATER			Method Blank (ME	i) Report		Laboratory Contro	ol Spike (LCS) and Labon	atory Control S	pike Duplicate (	DCS) Report	Pepport          RPD (%)         Control         Limit         Jane       Control         Image: Second Sec				
					Spike	Spike Red	covery (%)	Recove	ory Limits(%)	RPI	D (%)				
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	DCS	Low	High	Value	Control				
											Limit				
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 22	13465)														
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	0.4835 mg/L	99.9		80	112						
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 22	13466)				-										
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	0.4835 mg/L	97.5		80	112						
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 22	13467)														
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	0.4835 mg/L	97.5		80	112						
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 22	15118)														
ED045K: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	98.2		87	108						
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 22	15119)														
ED045K: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	97.3		87	108						
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 22	15120)														
ED045K: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	98.8		87	108						
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 22	15121)														
ED045K: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	99.9		87	108						
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 22	17416)														
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	0.4935 mg/L	96.4		80	112						
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 22	22971)														
EK040: Fluoride	16984-48-8	0.1	mg/L	<0.1	0.5 mg/L	95.6		90	109						
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 22	22972)														
EK040: Fluoride	16984-48-8	0.1	mg/L	<0.1	0.5 mg/L	98.8		90	109						
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 22	22973)				· · · · · · · · · · · · · · · · · · ·										
EK040: Fluoride	16984-48-8	0.1	mg/L	<0.1	0.5 mg/L	100		90	109						
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 22	22974)														
EK040: Fluoride	16984-48-8	0.1	mg/L	<0.1	0.5 mg/L	98.4		90	109						
EP: Aggregate Organics (QC Lot: 2211182)															
EP030: Biochemical Oxygen Demand			mg/L		198 mg/L	107		84	119						
EP: Aggregate Organics (QC Lot: 2211505)															
EP030: Biochemical Oxygen Demand			mg/L		198 mg/L	102		84	119						
EP: Aggregate Organics (QC Lot: 2211506)															
EP030: Biochemical Oxygen Demand			mg/L		198 mg/L	105		84	119						

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Matrix: WATER	[		Method Blank (ME	3) Report		Laboratory Contro	ol Spike (LCS) and Labor	atory Control S	pike Duplicate (	DCS) Report	
					Spike	Spike Rei	со <b>vегу</b> (%)	Recove	ory Limits(%)	RP	D (%)
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	DCS	Low	High	Value	Control
											Limit
EP: Aggregate Organics (QC Lot: 2211507)				1			1	1	1		
EP030: Biochemical Oxygen Demand			mg/L		198 mg/L	109		84	119		
EP: Aggregate Organics (QC Lot: 2211508)							1	1			
EP030: Biochemical Oxygen Demand			mg/L		198 mg/L	109		84	119		
EP: Aggregate Organics (QC Lot: 2212545)											
EP030: Biochemical Oxygen Demand			mg/L		198 mg/L	102		84	119		
EP: Aggregate Organics (QC Lot: 2215026)											
EP035: Phenols (Total)		0.1	mg/L	<0.1	0.5666 mg/L	86.0		82	112		
EP: Aggregate Organics (QC Lot: 2215044)											
EP026C: Chemical Oxygen Demand			mg/L		25 mg/L	97.2		92	110		
					250 mg/L	99.8		95	105		
EP: Aggregate Organics (QC Lot: 2215048)											
EP026C: Chemical Oxygen Demand			mg/L		25 mg/L	103		92	110		
					250 mg/L	99.8		95	105		
EP: Aggregate Organics (QC Lot: 2217280)							1	1			1
EP026C: Chemical Oxygen Demand			mg/L		25 mg/L	100		92	110		
					250 mg/L	101		95	105		
EP: Aggregate Organics (QC Lot: 2217281)			1					1			
EP026C: Chemical Oxygen Demand			mg/L		25 mg/L	98.4		92	110		
					250 mg/L	101		95	105		
EP: Aggregate Organics (QC Lot: 2218408)			1	1			1		1		1
EP020: Oil & Grease		2	mg/L	<2	20 mg/L	92.4		80	106		
EP: Aggregate Organics (QC Lot: 2219590)			1	1			1	1	1		
EP026C: Chemical Oxygen Demand			mg/L		25 mg/L	96.4		92	110		
EP: Aggregate Organics (QC Lot: 2220857)											1
EP035: Phenols (Total)		0.1	mg/L	<0.1	0.5666 mg/L	107		82	112		
EP: Aggregate Organics (QC Lot: 2220858)											
EP035: Phenols (Total)		0.1	mg/L	<0.1	0.5666 mg/L	93.7		82	112		
EP: Aggregate Organics (QC Lot: 2222018)											
EP035: Phenols (Total)		0.1	mg/L	<0.1	0.5666 mg/L	96.3		82	112		

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Matrix: WATER	[		Method Blank (ML	3) Report		Laboratory Contro	ol Spike (LCS) and Labor	atory Control S	pike Duplicate (i	DCS) Report	
					Spike	Spike Red	covery (%)	Recove	ry Limits(%)	RP	D (%)
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	DCS	Low	High	Value	Control
											Limit
EP: Aggregate Organics (QC Lot: 2222019)											
EP035: Phenols (Total)		0.1	mg/L	<0.1	0.5666 mg/L	92.1		82	112		
EP: Aggregate Organics (QC Lot: 2223225)											
EP026C: Chemical Oxygen Demand			mg/L		25 mg/L	102		92	110		
					250 mg/L	95.8		95	105		
EP: Aggregate Organics (QC Lot: 2227307)											
EP020: Oil & Grease		2	mg/L	<2	20 mg/L	92.8		80	106		
EP: Aggregate Organics (QC Lot: 2227308)											
EP020: Oil & Grease		2	mg/L	<2	20 mg/L	86.8		80	106		
EP: Aggregate Organics (QC Lot: 2228018)											
EP020: Oil & Grease		2	mg/L	<2	20 mg/L	98.4		80	106		
EP: Aggregate Organics (QC Lot: 2230159)											
EP020: Oil & Grease		2	mg/L	<2	20 mg/L	88.8		80	106		
EG: Metals and Major Cations - Filtered (QC Lot: 2	2212420)										
EG020: Arsenic	7440-38-2	10	μg/L	<10	100 µg/L	94.6		85	112		
EG020: Chromium	7440-47-3	1	μg/L	<1	100 µg/L	93.2		86	111		
EG020: Copper	7440-50-8	1	μg/L	<1	100 µg/L	101		85	113		
EG020: Mercury	7439-97-6	0.5	μg/L	<0.5	2 µg/L	94.1		85	115		
EG020: Zinc	7440-66-6	10	μg/L	<10	100 µg/L	98.9		85	113		
EG: Metals and Major Cations - Filtered (QC Lot: 2	2212421)										
EG020: Arsenic	7440-38-2	10	µg/L	<10	100 µg/L	96.3		85	112		
EG020: Chromium	7440-47-3	1	μg/L	<1	100 µg/L	97.3		86	111		
EG020: Copper	7440-50-8	1	μg/L	<1	100 µg/L	106		85	113		
EG020: Mercury	7439-97-6	0.5	μg/L	<0.5	2 µg/L	96.2		85	115		
EG020: Zinc	7440-66-6	10	µg/L	<10	100 µg/L	100		85	113		
EG: Metals and Major Cations - Filtered (QC Lot: 2	2212422)							1			
EG020: Arsenic	7440-38-2	10	µg/L	<10	100 µg/L	89.3		85	112		
EG020: Chromium	7440-47-3	1	µg/L	<1	100 µg/L	91.4		86	111		
EG020: Copper	7440-50-8	1	µg/L	<1	100 µg/L	96.2		85	113		
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	2 µg/L	88.6		85	115		

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Matrix: WATER			Method Blank (MB	) Report		Laboratory Contr	ol Spike (LCS) and Labol	ratory Control S	pike Duplicate (i	DCS) Report	
					Spike	Spike Re	covery (%)	Recovery Limits(%)		<b>RPD</b> (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	DCS	Low	High	Value	Control
											Limit
EG: Metals and Major Cations - Filtered (QC Lot: 2212422) - Continued											
EG020: Zinc	7440-66-6	10	µg/L	<10	100 µg/L	93.3		85	113		
EG: Metals and Major Cations - Filtered (QC Lot	: 2212423)										
EG020: Arsenic	7440-38-2	10	µg/L	<10	100 µg/L	91.1		85	112		
EG020: Chromium	7440-47-3	1	µg/L	<1	100 µg/L	93.3		86	111		
EG020: Copper	7440-50-8	1	µg/L	<1	100 µg/L	96.4		85	113		
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	2 µg/L	90.7		85	115		
EG020: Zinc	7440-66-6	10	µg/L	<10	100 µg/L	91.8		85	113		



#### Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

Matrix: WATER					Matrix Spil	ke (MS) and Matri	x Spike Duplic	ate (MSD) Re	port	RPD (%) lue Control Limit							
				Spike	Spike Re	со <i>vөгу</i> (%)	Recovery	Limits (%)	RPL	<b>)</b> (%)							
Laboratory	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control							
sample ID										Limit							
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2211	398)															
HK1908351-020	SW-4B	EK055K: Ammonia as N	7664-41-7	0.5 mg/L	98.6		75	125									
ED/EK: Inorganie	c Nonmetallic Parameters (QC Lot: 2211	399)															
HK1908351-040	SW-7A	EK055K: Ammonia as N	7664-41-7	0.5 mg/L	93.5		75	125									
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2211	400)															
HK1908351-060	GW-8C	EK055K: Ammonia as N	7664-41-7	0.5 mg/L	99.6		75	125									
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2211	401)															
HK1908351-072	GW-24C	EK055K: Ammonia as N	7664-41-7	5 mg/L	109		75	125									
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2213	165)															
HK1908351-010	SW-24A	EK067P: Total Phosphorus as P		0.5 mg/L	78.3		75	125									
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2213	166)															
HK1908351-010	SW-24A	EK062P: Total Nitrogen as N		0.5 mg/L	92.1		75	125									
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2213	167)															
HK1908351-030	SW-13C	EK062P: Total Nitrogen as N		0.5 mg/L	102		75	125									
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2213	168)															
HK1908351-030	SW-13C	EK067P: Total Phosphorus as P		0.5 mg/L	88.8		75	125									
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2213	169)															
HK1908351-050	GW-2A	EK062P: Total Nitrogen as N		5 mg/L	100		75	125									
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2213	170)															
HK1908351-050	GW-2A	EK067P: Total Phosphorus as P		0.5 mg/L	95.0		75	125									
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2213	171)															
HK1908351-070	SW-2B	EK062P: Total Nitrogen as N		0.5 mg/L	85.1		75	125									
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2213	172)															
- HK1908351-070	SW-2B	EK067P: Total Phosphorus as P		0.5 mg/L	89.9		75	125									
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2213	465)															
HK1908490-001	Anonymous	EK085: Sulphide as S2-	18496-25-	0.1934 mg/L	95.3		75	125									
			8														

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Matrix: WATER				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report								
				Spike	Spike Re	асо <i>vөгу</i> (%)	Recovery I	Limits (%)	RPD	(%)		
Laboratory	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control		
sample ID										Limit		
ED/EK: Inorganie	c Nonmetallic Parameters (QC Lot: 2213	466)			1					1		
HK1908351-016	SW-18A	EK085: Sulphide as S2-	18496-25-	0.1934 mg/L	94.5		75	125				
			8									
ED/EK: Inorganie	c Nonmetallic Parameters (QC Lot: 2213	467)			1							
HK1908351-037	GW-23A	EK085: Sulphide as S2-	18496-25-	0.1934 mg/L	96.8		75	125				
			8									
ED/EK: Inorganie	c Nonmetallic Parameters (QC Lot: 2215	118)			1	1						
HK1908351-010	SW-24A	ED045K: Chloride	16887-00-	500 mg/L	101		75	125				
			6									
ED/EK: Inorganie	c Nonmetallic Parameters (QC Lot: 2215	119)			1	1						
HK1908351-030	SW-13C	ED045K: Chloride	16887-00-	500 mg/L	# Not		75	125				
			6		Determined							
ED/EK: Inorganie	c Nonmetallic Parameters (QC Lot: 2215	120)			1		I		1	I		
HK1908351-050	GW-2A	ED045K: Chloride	16887-00-	500 mg/L	98.7		75	125				
			6									
ED/EK: Inorganie	c Nonmetallic Parameters (QC Lot: 2215	121)			1		I		I	I		
HK1908351-070	SW-2B	ED045K: Chloride	16887-00-	500 mg/L	# Not		75	125				
			6		Determined							
ED/EK: Inorganie	c Nonmetallic Parameters (QC Lot: 2217	416)			1	1	1		1	I		
HK1908872-001	Anonymous	EK085: Sulphide as S2-	18496-25-	0.1974 mg/L	97.3		75	125				
			8									
EP: Aggregate C	Organics (QC Lot: 2215044)					1						
HK1908351-001	GW-1A	EP026C: Chemical Oxygen Demand		10 mg/L	103		75	125				
EP: Aggregate C	Organics (QC Lot: 2215048)				1		I		I	I		
HK1908525-001	Anonymous	EP026C: Chemical Oxygen Demand		10 mg/L	106		75	125				
EP: Aggregate C	Organics (QC Lot: 2217280)											
HK1908351-031	GW-15A	EP026C: Chemical Oxygen Demand		10 mg/L	103		75	125				
EP: Aggregate C	Organics (QC Lot: 2217281)											
HK1908351-044	GW-3B	EP026C: Chemical Oxygen Demand		10 mg/L	100		75	125				

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Client	:	ERM MYANMAR LTD
Work Order		HK1908351



Matrix: WATER	Matrix: WATER				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report								
				Spike	Spike R	ecovery (%)	Recovery	Limits (%)	RPL	<b>)</b> (%)			
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control Limit			
EP: Aggregate (	Organics (QC Lot: 2219590)						•						
HK1908351-058	GW-8A	EP026C: Chemical Oxygen Demand		10 mg/L	96.0		75	125					
EP: Aggregate (	Organics (QC Lot: 2223225)												
HK1909558-002	Anonymous	EP026C: Chemical Oxygen Demand		10 mg/L	86.0		75	125					
EG: Metals and	Major Cations - Filtered (QC I	Lot: 2212420)							·				
HK1908351-001	GW-1A	EG020: Arsenic	7440-38-2	100 µg/L	96.6		75	125					
		EG020: Chromium	7440-47-3	100 µg/L	101		75	125					
		EG020: Copper	7440-50-8	100 µg/L	101		75	125					
		EG020: Mercury	7439-97-6	2 µg/L	99.3		75	125					
		EG020: Zinc	7440-66-6	100 µg/L	97.9		75	125					
EG: Metals and	Major Cations - Filtered (QC I	Lot: 2212421)											
HK1908351-021 §	SW-4C	EG020: Arsenic	7440-38-2	100 µg/L	97.0		75	125					
		EG020: Chromium	7440-47-3	100 µg/L	102		75	125					
		EG020: Copper	7440-50-8	100 µg/L	98.0		75	125					
		EG020: Mercury	7439-97-6	2 µg/L	101		75	125					
		EG020: Zinc	7440-66-6	100 µg/L	98.3		75	125					
EG: Metals and	Major Cations - Filtered (QC I	Lot: 2212422)											
HK1908351-041	SW-7B	EG020: Arsenic	7440-38-2	100 µg/L	94.8		75	125					
		EG020: Chromium	7440-47-3	100 µg/L	97.7		75	125					
		EG020: Copper	7440-50-8	100 µg/L	94.2		75	125					
		EG020: Mercury	7439-97-6	2 µg/L	95.0		75	125					
		EG020: Zinc	7440-66-6	100 µg/L	91.0		75	125					
EG: Metals and	Major Cations - Filtered (QC I	Lot: 2212423)											
HK1908351-061	GW-13A	EG020: Arsenic	7440-38-2	100 µg/L	100		75	125					
		EG020: Chromium	7440-47-3	100 µg/L	94.8		75	125					
		EG020: Copper	7440-50-8	100 µg/L	99.9		75	125					
		EG020: Mercury	7439-97-6	2 µg/L	88.1		75	125					
		EG020: Zinc	7440-66-6	100 µg/L	97.4		75	125					

#### ALS Technichem (HK) Pty Ltd

#### **ALS Laboratory Group**

ANALYICAL CHEMISTRY & TESTING SERVICES



#### CERTIFICATE OF ANALYSIS

Client	ERM MYANMAR LTD	Laboratory	ALS Technichem (HK) Pty Ltd	Page	: 1 of 29
Contact Address	EBECKY SUMMONS UNIT 01, 20TH FLR, CRYSTAL TOWER, JUNCTION SQUARE, KYUN TAW ROAD, KAMAYUT TOWNSHIP, YANGON, MYANMAR	Contact Address	<ul> <li>Richard Fung</li> <li>11/F., Chung Shun Knitting</li> <li>Centre, 1 - 3 Wing Yip Street,</li> <li>Kwai Chung, N.T., Hong Kong</li> </ul>	Work Order	: HK1909927
E-mail Telephone Facsimile	: Becky.Summons@erm.com : +95 0 1230 4405 :	E-mail Telephone Facsimile	<ul> <li>richard.fung@alsglobal.com</li> <li>+852 2610 1044</li> <li>+852 2610 2021</li> </ul>		
Project Order number	SURFACE WATER, GROUNDWATER AND SOIL TESTING NYDC EBS (Feb – March)	- NYDC BASELINE S Quote number	URVEY / 0488716 : HKE/1277a/2019	Date Samples Received	: 07-Mar-2019 : 22-Mar-2019
C-O-C number Site	: H013492-H013495 : NYDC PROJECT AREA			No. of samples received No. of samples analysed	: 84 : 84

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This document has been signed by those names that appear on this report and are the authorised signatories.

Signatories	Position	Authorised results for
Richard Forg		
0		
Fung Lim Chee, Richard	General Manager	Inorganics
Kidand Jung.		
Fung Lim Chee, Richard	General Manager	Metals

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#### General Comments

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release. When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes. Testing period is from 07-Mar-2019 to 20-Mar-2019. Key: LOR = Limit of reporting; CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

#### Specific Comments for Work Order: HK1909927

Sample(s) were received in chilled condition.

Water sample(s) analysed and reported on as received basis.

Soil sample(s) analysed on an as received basis. Result(s) reported on dry weight basis.

Water sample(s) were filtered prior to dissolved metal analysis.

EA002SOIL - For pH value analysis, soil sample(s) analysed on as air-dry weight basis. pH value determined and reported on a 1:5 soil / water extract.

Sample(s) as received, digested by In-house method E-ASTM D3974-09 prior to determination of metals. The In-house method is developed based on ASTM D3974-09 method.

EA002 - Calibration range of pH value is 4.0 - 10.0. Results exceeding this range is for reference only.

EA002 - pH value is reported as at 25°C.

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#### Analytical Results

Sub-Matrix: SOIL		Clie	ent sample ID	S-16A	S-16B	S-16C	S-7A	S-7B
	Clie	ent sampli	ng date / time	04-Mar-2019 12:00	04-Mar-2019 12:10	04-Mar-2019 12:20	04-Mar-2019 14:00	04-Mar-2019 14:10
Compound	CAS Number	LOR	Unit	HK1909927-013	HK1909927-014	HK1909927-015	HK1909927-016	HK1909927-017
EA/ED: Physical and Aggregate Properties								
EA002SOIL: pH Value		0.1	pH Unit	5.4	7.3	7.4	7.6	6.8
EA055: Moisture Content (dried @ 103°C)		0.1	%	8.0	18.5	15.0	20.9	21.7
EG: Metals and Major Cations								
EG020: Cadmium	7440-43-9	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EG020: Copper	7440-50-8	1	mg/kg	14	11	14	31	25
EG020: Lead	7439-92-1	1	mg/kg	15	10	12	20	20
EG020: Zinc	7440-66-6	1	mg/kg	34	19	24	92	80
EG032: Iron	7439-89-6	5	mg/kg	22800	18200	25200	46300	41500

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Sub-Matrix: SOIL		Clie	ent sample ID	S-7C	S-17A	S-17B	S-17C	S-8A
	Clie	ent samplii	ng date / time	04-Mar-2019 14:20	04-Mar-2019 10:45	04-Mar-2019 10:55	04-Mar-2019 11:05	01-Mar-2019 15:45
Compound	CAS Number	LOR	Unit	HK1909927-018	HK1909927-019	HK1909927-020	HK1909927-021	HK1909927-022
EA/ED: Physical and Aggregate Properties								
EA002SOIL: pH Value		0.1	pH Unit	7.0	6.5	6.5	6.4	6.7
EA055: Moisture Content (dried @ 103°C)		0.1	%	21.2	24.2	23.6	22.3	16.8
EG: Metals and Major Cations								
EG020: Cadmium	7440-43-9	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EG020: Copper	7440-50-8	1	mg/kg	25	35	34	34	34
EG020: Lead	7439-92-1	1	mg/kg	19	23	22	22	23
EG020: Zinc	7440-66-6	1	mg/kg	81	102	95	95	104
EG032: Iron	7439-89-6	5	mg/kg	39400	48600	48900	43300	51800

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Sub-Matrix: SOIL		Clie	ent sample ID	S-8B	S-8C	S-14A	S-14B	S-14C
	Clie	ent samplin	ng date / time	01-Mar-2019 15:55	01-Mar-2019 16:05	01-Mar-2019 10:10	01-Mar-2019 10:20	01-Mar-2019 10:30
Compound	CAS Number	LOR	Unit	HK1909927-023	HK1909927-024	HK1909927-025	HK1909927-026	HK1909927-027
EA/ED: Physical and Aggregate Properties								
EA002SOIL: pH Value		0.1	pH Unit	7.0	6.6	6.8	7.2	6.1
EA055: Moisture Content (dried @ 103°C)		0.1	%	17.7	19.7	24.4	23.4	24.3
EG: Metals and Major Cations								
EG020: Cadmium	7440-43-9	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EG020: Copper	7440-50-8	1	mg/kg	35	34	34	34	31
EG020: Lead	7439-92-1	1	mg/kg	26	24	21	19	19
EG020: Zinc	7440-66-6	1	mg/kg	106	106	94	94	87
EG032: Iron	7439-89-6	5	mg/kg	54100	51000	48800	49000	46300

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Sub-Matrix: SOIL		Clie	ent sample ID	S-22A	S-22B	S-22C	S-5A	S-5B
	Clie	ent sampli	ng date / time	01-Mar-2019 11:45	01-Mar-2019 11:55	01-Mar-2019 12:05	25-Feb-2019 12:12	25-Feb-2019 12:20
Compound	CAS Number	LOR	Unit	HK1909927-028	HK1909927-029	HK1909927-030	HK1909927-031	HK1909927-032
EA/ED: Physical and Aggregate Properties								
EA002SOIL: pH Value		0.1	pH Unit	7.1	6.7	7.1	6.2	6.7
EA055: Moisture Content (dried @ 103°C)		0.1	%	22.1	22.8	23.9	29.0	28.8
EG: Metals and Major Cations								
EG020: Cadmium	7440-43-9	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EG020: Copper	7440-50-8	1	mg/kg	31	28	36	31	32
EG020: Lead	7439-92-1	1	mg/kg	22	22	25	23	24
EG020: Zinc	7440-66-6	1	mg/kg	93	97	94	87	91
EG032: Iron	7439-89-6	5	mg/kg	47100	44000	41100	41600	42500

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Sub-Matrix: SOIL		Clie	nt sample ID	S-5C	S-18A	S-18B	S-18C	S-20A
	Clie	ent samplin	ng date / time	25-Feb-2019 12:30	25-Feb-2019 15:05	25-Feb-2019 15:13	25-Feb-2019 15:17	25-Feb-2019 14:15
Compound	CAS Number LOR Unit			HK1909927-033	HK1909927-034	HK1909927-035	HK1909927-036	HK1909927-037
EA/ED: Physical and Aggregate Properties								
EA002SOIL: pH Value		0.1	pH Unit	6.0	7.7	7.9	8.0	6.7
EA055: Moisture Content (dried @ 103°C)		0.1	%	29.6	16.2	18.1	19.0	17.3
EG: Metals and Major Cations								
EG020: Cadmium	7440-43-9	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EG020: Copper	7440-50-8	1	mg/kg	35	33	37	34	36
EG020: Lead	7439-92-1	1	mg/kg	27	24	25	28	26
EG020: Zinc	7440-66-6	1	mg/kg	94	94	101	94	99
EG032: Iron	7439-89-6	5	mg/kg	45900	47300	49700	53100	47500

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Sub-Matrix: SOIL		Clie	ent sample ID	S-20B	S-20C	S-1A	S-1B	S-1C
	Cli	ent samplii	ng date / time	25-Feb-2019 14:22	25-Feb-2019 14:30	25-Feb-2019 09:10	25-Feb-2019 09:30	25-Feb-2019 09:40
Compound	CAS Number	LOR	Unit	HK1909927-038	HK1909927-039	HK1909927-040	HK1909927-041	HK1909927-042
EA/ED: Physical and Aggregate Properties								
EA002SOIL: pH Value		0.1	pH Unit	6.6	6.3	8.5	8.4	8.4
EA055: Moisture Content (dried @ 103°C)		0.1	%	17.5	18.4	19.0	10.9	12.8
EG: Metals and Major Cations								
EG020: Cadmium	7440-43-9	0.2	mg/kg	<0.2	<0.2	<0.2	0.3	0.3
EG020: Copper	7440-50-8	1	mg/kg	37	36	38	57	72
EG020: Lead	7439-92-1	1	mg/kg	26	27	161	232	278
EG020: Zinc	7440-66-6	1	mg/kg	101	103	154	138	138
EG032: Iron	7439-89-6	5	mg/kg	46400	48100	29000	25000	25000

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Sub-Matrix: <b>SOIL</b>		Clie	nt sample ID	S-4A	S-4B	S-4C	S-11A	S-11B
	Clie	ent samplin	ng date / time	25-Feb-2019 11:12	25-Feb-2019 11:21	25-Feb-2019 11:30	26-Feb-2019 10:40	26-Feb-2019 10:52
Compound	CAS Number LOR Unit			HK1909927-043	HK1909927-044	HK1909927-045	HK1909927-046	HK1909927-047
EA/ED: Physical and Aggregate Properties								
EA002SOIL: pH Value		0.1	pH Unit	6.8	6.0	8.2	6.9	7.0
EA055: Moisture Content (dried @ 103°C)		0.1	%	32.6	25.6	22.6	24.3	25.2
EG: Metals and Major Cations								
EG020: Cadmium	7440-43-9	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EG020: Copper	7440-50-8	1	mg/kg	43	34	32	32	31
EG020: Lead	7439-92-1	1	mg/kg	30	25	23	25	21
EG020: Zinc	7440-66-6	1	mg/kg	113	95	95	97	96
EG032: Iron	7439-89-6	5	mg/kg	53700	45600	49800	49900	42600

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Sub-Matrix: SOIL		Clie	ent sample ID	S-11C	S-9A	S-9B	S-9C	S-19A
	Clie	ent sampli	ng date / time	26-Feb-2019 11:02	26-Feb-2019 13:55	26-Feb-2019 14:10	26-Feb-2019 14:15	26-Feb-2019 09:45
Compound	CAS Number	LOR	Unit	HK1909927-048	HK1909927-049	HK1909927-050	HK1909927-051	HK1909927-052
EA/ED: Physical and Aggregate Properties								
EA002SOIL: pH Value		0.1	pH Unit	7.3	6.1	6.4	6.0	6.3
EA055: Moisture Content (dried @ 103°C)		0.1	%	25.4	24.1	23.1	22.8	15.0
EG: Metals and Major Cations								
EG020: Cadmium	7440-43-9	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EG020: Copper	7440-50-8	1	mg/kg	33	26	20	23	29
EG020: Lead	7439-92-1	1	mg/kg	25	20	16	18	21
EG020: Zinc	7440-66-6	1	mg/kg	97	72	58	70	83
EG032: Iron	7439-89-6	5	mg/kg	51200	36000	36200	40000	39100

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Sub-Matrix: SOIL		Clie	ent sample ID	S-19B	S-19C	S-21A	S-21B	S-21C
	Clie	ent sampli	ng date / time	26-Feb-2019 09:55	26-Feb-2019 10:05	26-Feb-2019 11:40	26-Feb-2019 11:55	26-Feb-2019 12:03
Compound	CAS Number	LOR	Unit	HK1909927-053	HK1909927-054	HK1909927-055	HK1909927-056	HK1909927-057
EA/ED: Physical and Aggregate Properties								
EA002SOIL: pH Value		0.1	pH Unit	6.9	6.3	8.0	7.8	8.0
EA055: Moisture Content (dried @ 103°C)		0.1	%	26.4	18.9	22.1	21.6	22.1
EG: Metals and Major Cations								
EG020: Cadmium	7440-43-9	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EG020: Copper	7440-50-8	1	mg/kg	30	34	33	34	35
EG020: Lead	7439-92-1	1	mg/kg	22	24	21	23	25
EG020: Zinc	7440-66-6	1	mg/kg	82	104	98	102	102
EG032: Iron	7439-89-6	5	mg/kg	40700	42900	48200	49200	52000

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Sub-Matrix: SOIL		Clie	ent sample ID	S-10A	S-10B	S-10C	S-6A	S-6B
	Clie	ent samplii	ng date / time	26-Feb-2019 14:55	26-Feb-2019 15:00	26-Feb-2019 15:10	27-Feb-2019 16:15	27-Feb-2019 16:25
Compound	CAS Number	LOR	Unit	HK1909927-058	HK1909927-059	HK1909927-060	HK1909927-061	HK1909927-062
EA/ED: Physical and Aggregate Properties								
EA002SOIL: pH Value		0.1	pH Unit	6.5	6.6	6.4	7.5	8.0
EA055: Moisture Content (dried @ 103°C)		0.1	%	25.6	24.6	22.4	20.0	17.7
EG: Metals and Major Cations								
EG020: Cadmium	7440-43-9	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EG020: Copper	7440-50-8	1	mg/kg	29	30	28	35	36
EG020: Lead	7439-92-1	1	mg/kg	17	21	18	27	27
EG020: Zinc	7440-66-6	1	mg/kg	89	88	89	96	99
EG032: Iron	7439-89-6	5	mg/kg	44400	47700	45300	52300	51400

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Sub-Matrix: SOIL		Clie	ent sample ID	S-6C	S-13A	S-13B	S-13C	S-3A
	Clie	ent sampli	ng date / time	27-Feb-2019 16:35	27-Feb-2019 11:50	27-Feb-2019 12:00	27-Feb-2019 12:10	27-Feb-2019 13:00
Compound	CAS Number	LOR	Unit	HK1909927-063	HK1909927-064	HK1909927-065	HK1909927-066	HK1909927-067
EA/ED: Physical and Aggregate Properties								
EA002SOIL: pH Value		0.1	pH Unit	8.2	7.9	7.5	8.0	7.1
EA055: Moisture Content (dried @ 103°C)		0.1	%	22.2	21.8	21.4	21.8	22.0
EG: Metals and Major Cations								
EG020: Cadmium	7440-43-9	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EG020: Copper	7440-50-8	1	mg/kg	36	32	31	31	24
EG020: Lead	7439-92-1	1	mg/kg	25	22	24	24	17
EG020: Zinc	7440-66-6	1	mg/kg	98	95	91	91	73
EG032: Iron	7439-89-6	5	mg/kg	47100	47300	50000	48200	45400

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Sub-Matrix: SOIL		Clie	ent sample ID	S-3B	S-3C	S-2A	S-2B	S-2C
	Clie	ent samplii	ng date / time	27-Feb-2019 13:10	27-Feb-2019 13:20	27-Feb-2019 15:03	27-Feb-2019 15:16	27-Feb-2019 15:25
Compound	CAS Number	LOR	Unit	HK1909927-068	HK1909927-069	HK1909927-070	HK1909927-071	HK1909927-072
EA/ED: Physical and Aggregate Properties								
EA002SOIL: pH Value		0.1	pH Unit	7.5	7.6	7.6	8.0	8.1
EA055: Moisture Content (dried @ 103°C)		0.1	%	21.7	21.8	20.9	22.1	21.7
EG: Metals and Major Cations								
EG020: Cadmium	7440-43-9	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EG020: Copper	7440-50-8	1	mg/kg	27	26	31	31	34
EG020: Lead	7439-92-1	1	mg/kg	18	16	24	25	29
EG020: Zinc	7440-66-6	1	mg/kg	79	73	70	86	95
EG032: Iron	7439-89-6	5	mg/kg	45100	41500	37000	50000	51700

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Sub-Matrix: SOIL		Clie	ent sample ID	S-24A	S-24B	S-24C	S-15A	S-15B
	Clie	ent samplii	ng date / time	28-Feb-2019 11:40	28-Feb-2019 11:50	28-Feb-2019 12:00	28-Feb-2019 12:50	28-Feb-2019 13:00
Compound	CAS Number	LOR	Unit	HK1909927-073	HK1909927-074	HK1909927-075	HK1909927-076	HK1909927-077
EA/ED: Physical and Aggregate Properties								
EA002SOIL: pH Value		0.1	pH Unit	7.2	7.2	7.4	8.1	8.0
EA055: Moisture Content (dried @ 103°C)		0.1	%	25.1	26.8	27.3	20.8	21.2
EG: Metals and Major Cations								
EG020: Cadmium	7440-43-9	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EG020: Copper	7440-50-8	1	mg/kg	30	34	34	32	33
EG020: Lead	7439-92-1	1	mg/kg	22	26	26	30	30
EG020: Zinc	7440-66-6	1	mg/kg	86	98	97	95	99
EG032: Iron	7439-89-6	5	mg/kg	44600	50800	50100	50600	52400

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Sub-Matrix: SOIL		Clie	ent sample ID	S-15C	S-23A	S-23B	S-23C	S-12A
	Cli	ent samplii	ng date / time	28-Feb-2019 13:10	28-Feb-2019 10:16	28-Feb-2019 10:26	28-Feb-2019 10:38	28-Feb-2019 16:00
Compound	CAS Number	LOR	Unit	HK1909927-078	HK1909927-079	HK1909927-080	HK1909927-081	HK1909927-082
EA/ED: Physical and Aggregate Properties								
EA002SOIL: pH Value		0.1	pH Unit	8.1	7.2	8.2	7.5	8.1
EA055: Moisture Content (dried @ 103°C)		0.1	%	22.2	25.5	24.1	24.4	24.6
EG: Metals and Major Cations								
EG020: Cadmium	7440-43-9	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
EG020: Copper	7440-50-8	1	mg/kg	34	32	36	33	38
EG020: Lead	7439-92-1	1	mg/kg	23	23	28	23	28
EG020: Zinc	7440-66-6	1	mg/kg	100	58	99	87	106
EG032: Iron	7439-89-6	5	mg/kg	51400	34200	49300	44500	56700

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Sub-Matrix: SOIL	Client sample ID			S-12B	S-12C	 	
	Cli	ient sampli	ng date / time	28-Feb-2019 16:10	28-Feb-2019 16:20	 	
Compound	CAS Number	LOR	Unit	HK1909927-083	HK1909927-084	 	
EA/ED: Physical and Aggregate Properties							
EA002SOIL: pH Value		0.1	pH Unit	7.9	8.2	 	
EA055: Moisture Content (dried @ 103°C)		0.1	%	24.8	24.8	 	
EG: Metals and Major Cations							
EG020: Cadmium	7440-43-9	0.2	mg/kg	<0.2	<0.2	 	
EG020: Copper	7440-50-8	1	mg/kg	39	37	 	
EG020: Lead	7439-92-1	1	mg/kg	28	29	 	
EG020: Zinc	7440-66-6	1	mg/kg	109	106	 	
EG032: Iron	7439-89-6	5	mg/kg	51000	57200	 	

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Sub-Matrix: WATER		Clie	ent sample ID	SW-15A	SW-15B	SW-15C	GW-17A	GW-17B
	Cli	ient samplii	ng date / time	02-Mar-2019 14:30	02-Mar-2019 15:00	02-Mar-2019 15:30	02-Mar-2019 13:20	02-Mar-2019 13:35
Compound	CAS Number	LOR	Unit	HK1909927-001	HK1909927-002	HK1909927-003	HK1909927-004	HK1909927-005
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	7.7	7.7	7.8	6.3	6.5
EA025: Suspended Solids (SS)		2	mg/L	104	66	49	26	16
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	853	856	872	179	250
EK040: Fluoride	16984-48-8	0.1	mg/L	0.3	0.3	0.3	0.2	0.2
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.16	0.17	0.07	0.26	0.41
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	0.27	0.27	0.20	<0.01	<0.01
EK062P: Total Nitrogen as N		0.1	mg/L	1.1	1.1	1.2	0.5	0.8
EK067P: Total Phosphorus as P		0.01	mg/L	0.13	0.12	0.13	0.17	0.16
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	19	18	20	<5	<5
EP030: Biochemical Oxygen Demand		2	mg/L	2	<2	<2	<2	<2
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	<10	<10	<10	<10	<10
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	<1	1	1	<1	<1
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	<10	<10	<10

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Sub-Matrix: WATER		Clie	ent sample ID	GW-17C	SW-16A	SW-16B	SW-16C	GW-18A
	Client sample           Client sampling date / ti.           CAS Number         LOR         Unit           s          0.1         pH Un            2         mg/L           16887-00-6         1         mg/L           16887-00-6         1         mg/L           16984-48-8         0.1         mg/L           14797-55-8         0.01         mg/L           14797-55-8         0.1         mg/L            0.1         mg/L            2         mg/L            2         mg/L            2         mg/L            2         mg/L            2         mg/L            2 <td< td=""><td>ng date / time</td><td>02-Mar-2019 13:50</td><td>02-Mar-2019 09:50</td><td>02-Mar-2019 10:00</td><td>02-Mar-2019 10:15</td><td>02-Mar-2019 11:00</td></td<>	ng date / time	02-Mar-2019 13:50	02-Mar-2019 09:50	02-Mar-2019 10:00	02-Mar-2019 10:15	02-Mar-2019 11:00	
Compound	CAS Number	LOR	Unit	HK1909927-006	HK1909927-007	HK1909927-008	HK1909927-009	HK1909927-010
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	6.5	7.3	7.3	7.3	7.0
EA025: Suspended Solids (SS)		2	mg/L	23	64	61	83	7
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	1410	36	36	36	1190
EK040: Fluoride	16984-48-8	0.1	mg/L	0.2	0.2	0.2	0.2	0.1
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.82	0.14	0.07	0.13	3.54
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	<0.01	0.74	0.73	0.75	0.02
EK062P: Total Nitrogen as N		0.1	mg/L	1.0	1.7	1.6	1.6	4.2
EK067P: Total Phosphorus as P		0.01	mg/L	0.22	0.20	0.18	0.20	0.04
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	<10	32	29	34	<10
EP030: Biochemical Oxygen Demand		2	mg/L	<2	6	6	5	<2
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	<10	<10	<10	<10	<10
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	<1	<1	<1	1	<1
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	<10	<10	<10

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11(1909921							
Sub-Matrix: WATER		Clie	ent sample ID	GW-18B	GW-18C	 	
	Clie	ent samplii	ng date / time	02-Mar-2019 11:15	02-Mar-2019 11:30	 	
Compound	CAS Number	LOR	Unit	HK1909927-011	HK1909927-012	 	
EA/ED: Physical and Aggregate Properties							
EA002: pH Value		0.1	pH Unit	7.0	7.3	 	
EA025: Suspended Solids (SS)		2	mg/L	<2	31	 	
ED/EK: Inorganic Nonmetallic Parameters							
ED045K: Chloride	16887-00-6	1	mg/L	1240	323	 	
EK040: Fluoride	16984-48-8	0.1	mg/L	0.1	0.2	 	
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	6.65	5.14	 	
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	0.01	0.03	 	
EK062P: Total Nitrogen as N		0.1	mg/L	6.7	5.3	 	
EK067P: Total Phosphorus as P		0.01	mg/L	0.05	1.58	 	
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	 	
EP: Aggregate Organics							
EP020: Oil & Grease		2	mg/L	<2	<2	 	
EP026C: Chemical Oxygen Demand		5	mg/L	<10	16	 	
EP030: Biochemical Oxygen Demand		2	mg/L	5	<2	 	
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	 	
EG: Metals and Major Cations - Filtered							
EG020: Arsenic	7440-38-2	10	µg/L	<10	<10	 	
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	 	
EG020: Copper	7440-50-8	1	µg/L	1	<1	 	
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	 	
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	 	

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Work Order		HK1909927



#### Laboratory Duplicate (DUP) Report

Matrix: SOIL					Labo	ratory Duplicate (DUP)	Report	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	<b>RPD</b> (%)
EA/ED: Physical and Agg	regate Properties (QC Lot:	2227032)						
HK1909927-013	S-16A	EA055: Moisture Content (dried @ 103°C)		0.1	%	8.0	7.9	1.38
HK1909927-023	S-8B	EA055: Moisture Content (dried @ 103°C)		0.1	%	17.7	17.5	1.30
EA/ED: Physical and Agg	regate Properties (QC Lot:	2227033)						
HK1909927-033	S-5C	EA055: Moisture Content (dried @ 103°C)		0.1	%	29.6	30.1	1.64
HK1909927-043	S-4A	EA055: Moisture Content (dried @ 103°C)		0.1	%	32.6	33.3	1.90
EA/ED: Physical and Agg	regate Properties (QC Lot:	2227034)						
HK1909927-053	S-19B	EA055: Moisture Content (dried @ 103°C)		0.1	%	26.4	27.5	4.08
HK1909927-063	S-6C	EA055: Moisture Content (dried @ 103°C)		0.1	%	22.2	21.9	1.58
EA/ED: Physical and Agg	regate Properties (QC Lot:	2227035)						
HK1909927-073	S-24A	EA055: Moisture Content (dried @ 103°C)		0.1	%	25.1	24.6	1.91
HK1909927-083	S-12B	EA055: Moisture Content (dried @ 103°C)		0.1	%	24.8	25.2	1.22
EA/ED: Physical and Agg	regate Properties (QC Lot:	2227709)						
HK1909927-013	S-16A	EA002SOIL: pH Value		0.1	pH Unit	5.4	5.4	0.00
HK1909927-023	S-8B	EA002SOIL: pH Value		0.1	pH Unit	7.0	6.9	0.00
EA/ED: Physical and Agg	regate Properties (QC Lot:	2227710)						
HK1909927-033	S-5C	EA002SOIL: pH Value		0.1	pH Unit	6.0	6.0	0.00
HK1909927-043	S-4A	EA002SOIL: pH Value		0.1	pH Unit	6.8	6.7	0.00
EA/ED: Physical and Agg	regate Properties (QC Lot:	2227711)						
HK1909927-053	S-19B	EA002SOIL: pH Value		0.1	pH Unit	6.9	6.8	0.00
HK1909927-063	S-6C	EA002SOIL: pH Value		0.1	pH Unit	8.2	8.1	0.00
EA/ED: Physical and Agg	regate Properties (QC Lot:	2227712)						
HK1909927-073	S-24A	EA002SOIL: pH Value		0.1	pH Unit	7.2	7.2	0.00
HK1909927-083	S-12B	EA002SOIL: pH Value		0.1	pH Unit	7.9	8.0	0.00
EG: Metals and Major Ca	tions (QC Lot: 2226796)							
HK1909927-014	S-16B	EG032: Iron	7439-89-6	5	mg/kg	18200	17400	4.11
EG: Metals and Major Ca	tions (QC Lot: 2226797)							
HK1909927-014	S-16B	EG020: Cadmium	7440-43-9	0.2	mg/kg	<0.2	<0.2	0.00
		EG020: Copper	7440-50-8	1	mg/kg	11	13	12.7
		EG020: Lead	7439-92-1	1	mg/kg	10	10	0.00
		EG020: Zinc	7440-66-6	1	mg/kg	19	20	6.48

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Matrix: SOIL			Γ		Labo	pratory Duplicate (DUP)	Report	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	<b>RPD</b> (%)
EG: Metals and Major (	Cations (QC Lot: 2226798)							
HK1909927-034	S-18A	EG020: Cadmium	7440-43-9	0.2	mg/kg	<0.2	<0.2	0.00
		EG020: Copper	7440-50-8	1	mg/kg	33	34	0.00
		EG020: Lead	7439-92-1	1	mg/kg	24	24	0.00
		EG020: Zinc	7440-66-6	1	mg/kg	94	94	0.00
EG: Metals and Major (	Cations (QC Lot: 2226799)							
HK1909927-034	S-18A	EG032: Iron	7439-89-6	5	mg/kg	47300	48200	1.91
EG: Metals and Major (	Cations (QC Lot: 2226801)							
HK1909927-051	S-9C	EG020: Cadmium	7440-43-9	0.2	mg/kg	<0.2	<0.2	0.00
		EG020: Copper	7440-50-8	1	mg/kg	23	24	4.88
		EG020: Lead	7439-92-1	1	mg/kg	18	18	0.00
		EG020: Zinc	7440-66-6	1	mg/kg	70	73	4.44
EG: Metals and Major (	Cations (QC Lot: 2226802)							
HK1909927-051	S-9C	EG032: Iron	7439-89-6	5	mg/kg	40000	39200	2.01
EG: Metals and Major (	Cations (QC Lot: 2226803)							
HK1909927-071	HK1909927-071 S-2B	EG020: Cadmium	7440-43-9	0.2	mg/kg	<0.2	<0.2	0.00
		EG020: Copper	7440-50-8	1	mg/kg	31	33	5.02
		EG020: Lead	7439-92-1	1	mg/kg	25	26	0.00
		EG020: Zinc	7440-66-6	1	mg/kg	86	84	1.65
EG: Metals and Major (	Cations (QC Lot: 2226804)							
HK1909927-071	S-2B	EG032: Iron	7439-89-6	5	mg/kg	50000	48900	2.28
Matrix: WATER					Labo	pratory Duplicate (DUP)	Report	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	, Duplicate Result	RPD (%)
EA/ED: Physical and A	gregate Properties (QC Lot:	2225292)						
HK1909831-001	Anonymous	EA002: pH Value		0.1	pH Unit	7.4	7.5	0.00
HK1910099-001	Anonymous	EA002: pH Value		0.1	pH Unit	4.8	4.7	0.00
EA/ED: Physical and A	ggregate Properties (QC Lot:	2225447)						
HK1909927-010	GW-18A	EA002: pH Value		0.1	pH Unit	7.0	7.0	0.00
EA/ED: Physical and A	ggregate Properties (QC Lot:	2226768)						
HK1909917-005	Anonymous	EA025: Suspended Solids (SS)		2	mg/L	96	94	1.78
HK1909927-002	SW-15B	EA025: Suspended Solids (SS)		2	mg/L	66	68	1.94
EA/ED: Physical and A	ggregate Properties (QC Lot:	2226769)						



Matrix: WATER					Lab	oratory Duplicate (DUP)	Report	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	<b>RPD</b> (%)
EA/ED: Physical and Age	regate Properties (QC Lot:	2226769) - Continued						
HK1909927-012	GW-18C	EA025: Suspended Solids (SS)		2	mg/L	31	32	3.84
HK1910224-010	Anonymous	EA025: Suspended Solids (SS)		2	mg/L	9	10	12.0
ED/EK: Inorganic Nonme	tallic Parameters (QC Lot:	2225463)						
HK1909667-002	Anonymous	ED045K: Chloride	16887-00-6	1	mg/L	484	472	2.48
ED/EK: Inorganic Nonme	tallic Parameters (QC Lot:	2226816)						
HK1909927-010	GW-18A	EK055K: Ammonia as N	7664-41-7	0.01	mg/L	3.54	3.69	4.29
ED/EK: Inorganic Nonme	tallic Parameters (QC Lot:	2227005)						
HK1909138-002	Anonymous	EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	0.00
ED/EK: Inorganic Nonme	tallic Parameters (QC Lot:	2227006)						
HK1909927-003	SW-15C	EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	0.00
D/EK: Inorganic Nonme	tallic Parameters (QC Lot:	2227422)						
HK1909927-001	SW-15A	EK040: Fluoride	16984-48-8	0.1	mg/L	0.3	0.3	0.00
D/EK: Inorganic Nonme	tallic Parameters (QC Lot:	2235620)						
HK1909927-010	GW-18A	EK067P: Total Phosphorus as P		0.01	mg/L	0.04	0.04	0.00
D/EK: Inorganic Nonme	tallic Parameters (QC Lot:	2235622)						
HK1909927-010	GW-18A	EK062P: Total Nitrogen as N		0.1	mg/L	4.2	4.2	0.00
P: Aggregate Organics	(QC Lot: 2240352)							
HK1909927-005	GW-17B	EP026C: Chemical Oxygen Demand		5	mg/L	<5	<5	0.00
EP: Aggregate Organics	(QC Lot: 2240361)							
HK1910044-001	Anonymous	EP035: Phenols (Total)		0.1	mg/L	0.1	0.1	0.00
P: Aggregate Organics	(QC Lot: 2242962)							
HK1910669-001	Anonymous	EP026C: Chemical Oxygen Demand		5	mg/L	18	17	5.62
G: Metals and Major Ca	tions - Filtered (QC Lot: 22	26773)						
HK1909927-002	SW-15B	EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	0.00
		EG020: Chromium	7440-47-3	1	µg/L	<1	<1	0.00
		EG020: Copper	7440-50-8	1	µg/L	1	1	0.00
		EG020: Arsenic	7440-38-2	10	µg/L	<10	<10	0.00
		EG020: Zinc	7440-66-6	10	µg/L	<10	<10	0.00

Method Blank (MB), Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report

Matrix: SOIL

Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report

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Matrix: SOIL		Method Blank (MB) Report				Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report					
					Spike	Spike Re	со <b>vегу</b> (%)	Recove	ry Limits(%)	RP	D (%)
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	DCS	Low	High	Value	Control
											Limit
EG: Metals and Major Cations (QC Lot: 2226796)					-						
EG032: Iron	7439-89-6	5	mg/kg	<5	100 mg/kg	100		85	115		
EG: Metals and Major Cations (QC Lot: 2226797)											
EG020: Cadmium	7440-43-9	0.2	mg/kg	<0.2	5 mg/kg	94.5		87	110		
EG020: Copper	7440-50-8	1	mg/kg	<1	5 mg/kg	104		89	114		
EG020: Lead	7439-92-1	1	mg/kg	<1	5 mg/kg	102		92	115		
EG020: Zinc	7440-66-6	1	mg/kg	<1	5 mg/kg	103		85	115		
EG: Metals and Major Cations (QC Lot: 2226798)											
EG020: Cadmium	7440-43-9	0.2	mg/kg	<0.2	5 mg/kg	96.6		87	110		
EG020: Copper	7440-50-8	1	mg/kg	<1	5 mg/kg	102		89	114		
EG020: Lead	7439-92-1	1	mg/kg	<1	5 mg/kg	102		92	115		
EG020: Zinc	7440-66-6	1	mg/kg	<1	5 mg/kg	105		85	115		
EG: Metals and Major Cations (QC Lot: 2226799)											
EG032: Iron	7439-89-6	5	mg/kg	<5	100 mg/kg	102		85	115		
EG: Metals and Major Cations (QC Lot: 2226801)											
EG020: Cadmium	7440-43-9	0.2	mg/kg	<0.2	5 mg/kg	98.9		87	110		
EG020: Copper	7440-50-8	1	mg/kg	<1	5 mg/kg	99.8		89	114		
EG020: Lead	7439-92-1	1	mg/kg	<1	5 mg/kg	100.0		92	115		
EG020: Zinc	7440-66-6	1	mg/kg	<1	5 mg/kg	105		85	115		
EG: Metals and Major Cations (QC Lot: 2226802)											
EG032: Iron	7439-89-6	5	mg/kg	<5	100 mg/kg	98.9		85	115		
EG: Metals and Major Cations (QC Lot: 2226803)											
EG020: Cadmium	7440-43-9	0.2	mg/kg	<0.2	5 mg/kg	101		87	110		
EG020: Copper	7440-50-8	1	mg/kg	<1	5 mg/kg	98.8		89	114		
EG020: Lead	7439-92-1	1	mg/kg	<1	5 mg/kg	101		92	115		
EG020: Zinc	7440-66-6	1	mg/kg	<1	5 mg/kg	103		85	115		
EG: Metals and Major Cations (QC Lot: 2226804)											
EG032: Iron	7439-89-6	5	mg/kg	<5	100 mg/kg	102		85	115		
Matrix: WATER Method Blank (MB) Report				) Report		Laboratory Contr	ol Spike (LCS) and Labor	atory Control S	oike Duplicate (i	DCS) Report	

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Matrix: WATER		Method Blank (MB) Report				Laboratory Cont	Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report				
				1	Spike	Spike Re	covery (%)	Recove	ary Limits(%)	RPI	D (%)
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	DCS	Low	High	Value	Control
											Limit
EA/ED: Physical and Aggregate Properties (QC	Lot: 2226768)										
EA025: Suspended Solids (SS)		2	mg/L	<2	10 mg/L	94.0		81	120		
EA/ED: Physical and Aggregate Properties (QC	Lot: 2226769)										
EA025: Suspended Solids (SS)		2	mg/L	<2	10 mg/L	93.5		81	120		
ED/EK: Inorganic Nonmetallic Parameters (QC	Lot: 2225463)										
ED045K: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	103		87	108		
ED/EK: Inorganic Nonmetallic Parameters (QC	Lot: 2226816)										
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	0.5 mg/L	98.7		88	109		
ED/EK: Inorganic Nonmetallic Parameters (QC	Lot: 2227005)										
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	0.4735 mg/L	102		80	112		
ED/EK: Inorganic Nonmetallic Parameters (QC	Lot: 2227006)										
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	0.4735 mg/L	99.3		80	112		
ED/EK: Inorganic Nonmetallic Parameters (QC	Lot: 2227422)										
EK040: Fluoride	16984-48-8	0.1	mg/L	<0.1	0.5 mg/L	106		90	109		
ED/EK: Inorganic Nonmetallic Parameters (QC	Lot: 2235620)										
EK067P: Total Phosphorus as P		0.01	mg/L	<0.01	0.5 mg/L	99.0		90	104		
ED/EK: Inorganic Nonmetallic Parameters (QC	Lot: 2235622)										
EK062P: Total Nitrogen as N		0.1	mg/L	<0.1	0.5 mg/L	99.9		92	116		
EP: Aggregate Organics (QC Lot: 2224780)											
EP030: Biochemical Oxygen Demand			mg/L		198 mg/L	100		84	119		
EP: Aggregate Organics (QC Lot: 2225480)											
EP030: Biochemical Oxygen Demand			mg/L		198 mg/L	103		84	119		
EP: Aggregate Organics (QC Lot: 2240352)											
EP026C: Chemical Oxygen Demand			mg/L		25 mg/L	97.2		92	110		
					250 mg/L	97.4		95	105		
EP: Aggregate Organics (QC Lot: 2240361)											
EP035: Phenols (Total)		0.1	mg/L	<0.1	0.5557 mg/L	99.9		82	112		
EP: Aggregate Organics (QC Lot: 2241675)											
EP020: Oil & Grease		2	mg/L	<2	20 mg/L	97.2		80	106		
EP: Aggregate Organics (QC Lot: 2242962)											

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Matrix: WATER		Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report							
					Spike	Spike Re	covery (%)	Recove	ary Limits(%)	RP	D (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	DCS	Low	High	Value	Control	
											Limit	
EP: Aggregate Organics (QC Lot: 2242962)	- Continued											
EP026C: Chemical Oxygen Demand			mg/L		25 mg/L	102		92	110			
					250 mg/L	101		95	105			
EG: Metals and Major Cations - Filtered (QC	Lot: 2226773)											
EG020: Arsenic	7440-38-2	10	µg/L	<10	100 µg/L	99.8		85	112			
EG020: Chromium	7440-47-3	1	µg/L	<1	100 µg/L	96.5		86	111			
EG020: Copper	7440-50-8	1	µg/L	<1	100 µg/L	101		85	113			
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	2 µg/L	99.2		85	115			
EG020: Zinc	7440-66-6	10	µg/L	<10	100 µg/L	101		85	113			



#### Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

controlState<	Matrix: SOIL			Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report								
Calcons ample DMethods CompoundCAS AlumberConventeringMSDMSDLowHighValueControlsample DSolarS					Spike	Spike Recovery (%)		Recovery Limits (%)		<b>RPD</b> (%)		
emple /D         Image: mode / Control (CC Lot: 2226796)         EGG 202: Icon / CC Lot: 2226797)         EGG 202: Icon / CC Lot: 2226797)         #K100mg/k / CC Lot: 2226797)         #K100mg/k / CC Lot: 2226797)         #K100mg / CC Lot: 2226797)         EGG 202: Icon / CC Lot: 2226790         Figure / CC Lot: 2226790 <th coi:<="" th=""><th>Laboratory</th><th>Client sample ID</th><th>Method: Compound</th><th>CAS Number</th><th>Concentration</th><th>MS</th><th>MSD</th><th>Low</th><th>High</th><th>Value</th><th>Control</th></th>	<th>Laboratory</th> <th>Client sample ID</th> <th>Method: Compound</th> <th>CAS Number</th> <th>Concentration</th> <th>MS</th> <th>MSD</th> <th>Low</th> <th>High</th> <th>Value</th> <th>Control</th>	Laboratory	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control
EG: Maths and Major Cations (QC Lot: 2226796)       EG032: Ion       713.98-98       10 mg/kg       % No        75       125           EG: Maths and Major Cations (QC Lot: 2226797)       EG032: Cadmium       7440-430       S mg/kg       98.8        75       125           EG: Cations (QC Lot: 2226797)       EG032: Cadmium       7440-430       S mg/kg       98.8        75       125           EG: Cations (QC Lot: 2226797)       EG032: Cadmium       7440-430       S mg/kg       98.4        75       125           EG: Cations (QC Lot: 2226792)       EG032: Cadmium       7440-430       S mg/kg       98.4        75       125           EG: Cations (QC Lot: 2226798)       EG032: Cadmium       7440-430       S mg/kg       98.6        75       125            H:190927-03       S-50       EG032: Cadmium       7404-93       S mg/kg       98.0        75       125           H:190927-03       S-50       EG032: Cadmium       740-498       S mg/kg       98.00	sample ID										Limit	
HK 1009927-013       S-16A       EG032: Ion       7439-894       100 mg/kg       # Not	EG: Metals and	Major Cations (QC Lot: 22267	96)									
Control of Color: 2226707       Control of Color: 2226707       Control of Color: 2226707       Control of Color: 2226707         EG8. Mediae and Mejor Cations (CC Loi: 2226707)       EG020: Cooper       7440-430       5 mg/kg       98.4        75       125           EG020: Cooper       7440-430       5 mg/kg       98.4        75       125           EG020: Catedia       7440-80       5 mg/kg       98.4        75       125           EG020: Catedia       7440-80       5 mg/kg       98.6        75       125           EG020: Cation       7440-80       5 mg/kg       98.6        75       125           HK199927-033       SeC       EG020: Cadmium       7440-43       5 mg/kg       98.6        75       125           EG02: Catedia       7499-20       S mg/kg       #Not        75       125	HK1909927-013	S-16A	EG032: Iron	7439-89-6	100 mg/kg	# Not		75	125			
EG: Metals and Major Cations (OC Lot: 2228797)       EG020: Cadmium       740-043       S mg/kg       98.8        75       125           EG020: Cooper       7440-58       S mg/kg       97.4        75       125           EG020: Cooper       7440-58       S mg/kg       84.9        75       125           EG020: Lead       749-921       S mg/kg       84.9        75       125           EG020: Lead       749-921       S mg/kg       98.6        75       125           HX1099927-033       S-5C       EG020: Cadmium       7440-43       S mg/kg       98.6        75       125           HX1099927-033       S-5C       EG020: Cadmium       7440-43       S mg/kg       98.6        75       125           HX1099927-033       S-5C       EG020: Cadmium       7440-43       S mg/kg       86.6        75       125           HX1099927-033       S-5C       EG032: Iron       749-942       S						Determined						
HK 1909927-013       S-16A       EG020: Cooper       7440-508       5 mg/kg       97.4        75       125           EG020: Cooper       7440-508       5 mg/kg       84.9        75       125           EG020: Cooper       7440-508       5 mg/kg       84.9        75       125           EG020: Cance       7440-508       5 mg/kg       84.9        75       125           EG020: Cance       7440-508       5 mg/kg       84.0        75       125           HK 190927-033       S-50       EG020: Com/mum       7440-50       5 mg/kg       98.6        75       125           HK 190927-033       S-50       EG020: Com/mum       7404-29       5 mg/kg       98.6        75       125           HK 190927-033       S-50       EG020: Com/mum       7404-29       5 mg/kg       8.0        75       125           HK 190927-033       S-50       EG020: Icad       7404-04.5       5 mg/kg	EG: Metals and	Major Cations (QC Lot: 22267	97)									
E6020: Copper         740-080         5 mg/kg         97.4          75         125             E0020: Lad         7439-921         5 mg/kg         84.9          75         125	HK1909927-013	S-16A	EG020: Cadmium	7440-43-9	5 mg/kg	98.8		75	125			
EG020: Lead         739-921         5 mg/kg         84.9          75         125             EG020: Zinc         7404-666         5 mg/kg         8 Mot Determined          75         125             EG: Metals and Victor 2226799)         EG020: Zinc         7404-067         5 mg/kg         98.6          75         125             HK1909927-033         S-5         EG020: Cadmilum         7404-050         5 mg/kg         98.6          755         125             EG020: Cadmilum         7404-050         5 mg/kg         98.6          755         125             EG020: Cadmilum         7404-050         5 mg/kg         98.6          755         125             HV190927-033         S-5C         EG020: Zinc         7404-066         5 mg/kg         #Not			EG020: Copper	7440-50-8	5 mg/kg	97.4		75	125			
EG: Details and Major Cations (OC Lot: 2226798)         EGO20: Cadmium         7440-66-6         5 mg/kg         # Not Determined			EG020: Lead	7439-92-1	5 mg/kg	84.9		75	125			
Image: Calcing (QC Lot: 2226796)       Edd20: Cadmium       Triangle (Calcing (QC Lot: 2226796)       Edd20: Cadmium       Triangle (Calcing (QC Lot: 2226796)       Edd20: Cadmium       Triangle (Calcing (QC Lot: 2226796)       Final (Calcing (QC Lot: 2226796))       Final (Calcing (QC			EG020: Zinc	7440-66-6	5 mg/kg	# Not		75	125			
Biologic Stations (QC Lot: 2226799)         F0020: Copper       7440-43-9       5 mg/kg       98.6        75       125           E0200: Copper       7440-50-8       5 mg/kg       #Not        75       125           E020: Copper       7440-50-8       5 mg/kg       #Not        75       125           E020: Copper       7440-66-8       5 mg/kg       #Not        75       125           E020: Cledd       7430-66-8       5 mg/kg       #Not        75       125           E020: Cledd       7430-66-8       5 mg/kg       #Not        75       125           Helse and Mejor Cations (QC Lot: 2226799         HT         E020: Cledd       740-66-8       5 mg/kg       #Not        75       125           Ht/100 Mg/kg       #Not       100 mg/kg       #Not       100       125           E020: Cledd						Determined						
HK1909927-033       S-SC       EG020: Cadmium       740-43-9       5 mg/kg       98.6        75       125           EG020: Copper       740-60-8       5 mg/kg       #Not Determined        75       125            EG020: Leed       7439-92-1       5 mg/kg       86.6        76       125           EG020: Zinc       7440-66-8       5 mg/kg       #Not Determined        75       125           EG: Metals and Mijor Cations (QC Lot: 2226799)        7440-66-8       100 mg/kg       #Not Determined        75       125           HK1909927-030       S-SC       EG032: Iron       7440-63-9       5 mg/kg       #Not Determined        75       125           HK1909927-050       S-9B       EG020: Cadmium       7440-43-9       5 mg/kg       99.7        75       125           HK1909927-050       S-9B       EG020: Cadmium       7440-43-9       5 mg/kg       99.7        75       125           E	EG: Metals and	Maior Cations (QC Lot: 22267	98)	· · · · ·								
EG20: Copper         740-50-8         5 mg/kg         # Not Determined         7.5         1.25	HK1909927-033	S-5C	EG020: Cadmium	7440-43-9	5 mg/kg	98.6		75	125			
Image: Constraint of the second sec			EG020: Copper	7440-50-8	5 mg/kg	# Not		75	125			
End of the second sec						Determined						
EG020: Zinc         T40-66- 2000         Smg/kg         # Not Determined 2000         T5         125 2000 2000 2000 2000 2000 2000         T5         125 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000 2000			EG020: Lead	7439-92-1	5 mg/kg	86.6		75	125			
Image: Constraint of Calcity 2226799         EG032: Iron         Calcity and Calcity 2226790         #Not Calcity 2226790         #Not Calcity 2226790         Most Calcity 2226800			EG020: Zinc	7440-66-6	5 mg/kg	# Not		75	125			
EG: Metals and Najor Cattons (QC Lot: 2226799)       EG032: Iron       7439-89-6       100 mg/kg       # Not Determined       75       125           EG: Metals and Major Cattons (QC Lot: 2226801)       EG020: Cadmlum       7440-43-9       5 mg/kg       99.7        75       125           HK1909927-050       S-9B       EG020: Cadmlum       7440-43-9       5 mg/kg       99.7        75       125           EG020: Copper       7440-05-0       5 mg/kg       99.7        75       125           EG020: Copper       7440-05-0       5 mg/kg       99.7        75       125           EG020: Lead       7439-92-1       5 mg/kg       83.4        75       125           EG020: Zinc       740-06-0       5 mg/kg       # Not        75       125           EG: Metals and Wajor Cattors       EG032: Iron       740-06-0       5 mg/kg       # Not        75       125           HK1909927-050       S-9B       EG032: Iron       7439-89-6       100 m						Determined						
HK 1909927-033       S-SC       EG032: Iron       7439-89-6       100 mg/kg       # Not Determined        75       125           EG: Metals and Jurge Cations (QC Lot: 2226801)       EG020: Cadmium       7440-43-9       5 mg/kg       99.7        75       125           HK 1909927-030       S-9B       EG020: Cadmium       7440-43-9       5 mg/kg       99.7        75       125            EG020: Copper       7440-50-8       5 mg/kg       99.7       7.8       75       125	EG: Metals and	Major Cations (QC Lot: 22267	99)									
Image: Note of the second se	HK1909927-033	S-5C	EG032: Iron	7439-89-6	100 mg/kg	# Not		75	125			
EG: Metals and Wajor Cations (QC Lot: 2226801)         HK1909927-050       S-9B       EG020: Cadmium       7440-43-9       5 mg/kg       99.7        75       125           EG020: Copper       7440-50-8       5 mg/kg       83.4        75       125           EG020: Lead       7430-92-1       5 mg/kg       77.8        75       125           EG020: Zinc       7440-66-6       5 mg/kg       # Not        75       125           EG020: Zinc       7440-66-6       5 mg/kg       # Not        75       125           EG020: Zinc       7440-66-6       5 mg/kg       # Not        75       125           EG020: Zinc       7440-66-6       5 mg/kg       # Not        75       125           EG020: Zinc       7430-89-6       100 mg/kg       # Not        75       125           HK1909927-050       S-9B       EG032: Iron       7439-89-6       100 mg/kg       # Not <td< td=""><td></td><td></td><td></td><td></td><td></td><td>Determined</td><td></td><td></td><td></td><td></td><td></td></td<>						Determined						
HK1909927-050       S-9B       EG020: Cadmium       7440-43-9       5 mg/kg       99.7        75       125           EG020: Copper       7440-50-8       5 mg/kg       83.4        75       125           EG020: Lead       7439-92-1       5 mg/kg       77.8        75       125           EG020: Zinc       7440-66-6       5 mg/kg       #Not        75       125           HK1909927-050       S-9B       EG032: Iron       7439-89-6       100 mg/kg       #Not        75       125           HK1909927-050       S-9B       EG032: Iron       7439-89-6       100 mg/kg       #Not        75       125	EG: Metals and	Maior Cations (QC Lot: 22268)	01)									
EG020: Copper       7440-50-8       5 mg/kg       83.4        75       125           EG020: Lead       7439-92-1       5 mg/kg       77.8        75       125           EG020: Zinc       7440-66-6       5 mg/kg       # Not        75       125           EG020: Zinc       7440-66-6       5 mg/kg       # Not        75       125           HK1909927-050       S-9B       EG032: Iron       7439-89-6       100 mg/kg       # Not        75       125           HK1909927-050       S-9B       EG032: Iron       7439-89-6       100 mg/kg       # Not        75       125	HK1909927-050	) S-9B	EG020: Cadmium	7440-43-9	5 mg/kg	99.7		75	125			
EG020: Lead       7439-92-1       5 mg/kg       77.8        75       125           EG020: Zinc       7440-66-6       5 mg/kg       # Not        75       125           EG: Metals and Major Cations (QC Lot: 2226802)        FG032: Iron       7439-89-6       100 mg/kg       # Not        75       125           HK1909927-050       S-9B       EG032: Iron       7439-89-6       100 mg/kg       # Not        75       125			EG020: Copper	7440-50-8	5 mg/kg	83.4		75	125			
EG020: Zinc       7440-66-6       5 mg/kg       # Not Determined        75       125           EG: Metals and Major Cations (QC Lot: 2226802)       EG032: Iron       7430-80-6       100 mg/kg       # Not Determined        75       125			EG020: Lead	7439-92-1	5 mg/kg	77.8		75	125			
Image: Not of the state of			EG020: Zinc	7440-66-6	5 mg/kg	# Not		75	125			
EG: Metals and Major Cations (QC Lot: 2226802)         HK1909927-050       S-9B       EG032: Iron       7439-89-6       100 mg/kg       # Not        75       125           Determined       Determi						Determined						
HK1909927-050 S-9B EG032: Iron 7439-89-6 100 mg/kg # Not 75 125	EG: Metals and	Major Cations (QC Lot: 22268	02)									
Determined Determined	HK1909927-050	S-9B	EG032: Iron	7439-89-6	100 mg/kg	# Not		75	125			
					- •	Determined						
EG' Matals and Major Cations (OCL of: 2226803)	EG: Metals and	Maior Cations (OC Lot: 22268)	03)	· · · · · · · · · · · · · · · · · · ·								

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Client	:	ERM MYANMAR LTD
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Matrix: SOIL			Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report							
				Spike	Spike Recovery (%)		Recovery Limits (%)		<b>RPD</b> (%)	
Laboratory	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control
sample ID										Limit
EG: Metals and	Major Cations (QC Lot: 2226803) - Cont	inued								
HK1909927-070	S-2A	EG020: Cadmium	7440-43-9	5 mg/kg	100		75	125		
		EG020: Copper	7440-50-8	5 mg/kg	# Not		75	125		
					Determined					
		EG020: Lead	7439-92-1	5 mg/kg	87.8		75	125		
		EG020: Zinc	7440-66-6	5 mg/kg	# Not		75	125		
					Determined					
EG: Metals and	Major Cations (QC Lot: 2226804)	1			1		1		1	
HK1909927-070	S-2A	EG032: Iron	7439-89-6	100 mg/kg	# Not		75	125		
					Determined					
Matrix: WATER			Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report							
				Spike	Spike Recovery (%)		Recovery Limits (%)		RPD (%)	
Laboratory	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control
sample ID										Limit
ED/EK: Inorgani	ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 2225463)									
HK1909667-002	Anonymous	ED045K: Chloride	16887-00-	500 mg/L	100		75	125		
			6							
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2226	816)				1				
HK1909927-010	GW-18A	EK055K: Ammonia as N	7664-41-7	5 mg/L	117		75	125		
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2227	005)								
HK1909138-002	Anonymous	EK085: Sulphide as S2-	18496-25-	0.1894 mg/L	104		75	125		
			8							
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 2227006)										
HK1909927-003	SW-15C	EK085: Sulphide as S2-	18496-25-	0.1894 mg/L	98.3		75	125		
			8							
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2235	620)								
HK1909927-010	GW-18A	EK067P: Total Phosphorus as P		0.5 mg/L	78.9		75	125		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot: 2235622)										
HK1909927-010	GW-18A	EK062P: Total Nitrogen as N		5 mg/L	100		75	125		
EP: Aggregate C	Organics (QC Lot: 2240352)									

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Matrix: WATER			Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report							
			Spike	Spike Recovery (%)		Recovery Limits (%)		<b>RPD</b> (%)		
Laboratory	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control
sample ID										Limit
EP: Aggregate Organics (QC Lot: 2240352) - Continued										
HK1909927-005	GW-17B	EP026C: Chemical Oxygen Demand		10 mg/L	106		75	125		
EP: Aggregate C	Organics (QC Lot: 2242962)									
HK1910669-001	Anonymous	EP026C: Chemical Oxygen Demand		10 mg/L	92.0		75	125		
EG: Metals and Major Cations - Filtered (QC Lot: 2226773)										
HK1909927-001	SW-15A	EG020: Arsenic	7440-38-2	100 µg/L	99.6		75	125		
		EG020: Chromium	7440-47-3	100 µg/L	97.8		75	125		
		EG020: Copper	7440-50-8	100 µg/L	96.6		75	125		
		EG020: Mercury	7439-97-6	2 µg/L	93.8		75	125		
		EG020: Zinc	7440-66-6	100 µg/L	94.1		75	125		
### ALS Technichem (HK) Pty Ltd

### **ALS Laboratory Group**

ANALYICAL CHEMISTRY & TESTING SERVICES



### CERTIFICATE OF ANALYSIS

Client	ERM MYANMAR LTD	Laboratory	ALS Technichem (HK) Pty Ltd	Page	: 1 of 24
Contact Address	EBECKY SUMMONS SUITE 628, 6TH FLOOR, HLEDAN CENTRE, CORNER OF PYAY ROAD AND HLEDAN ROAD, KAMARYUT TOWNSHIP, YANGON, MYANMAR	Contact Address	<ul> <li>Richard Fung</li> <li>11/F., Chung Shun Knitting</li> <li>Centre, 1 - 3 Wing Yip Street,</li> <li>Kwai Chung, N.T., Hong Kong</li> </ul>	Work Order	: HK1911130
E-mail Telephone Facsimile	: Becky.Summons@erm.com : +95 0 1230 4405 :	E-mail Telephone Facsimile	<ul> <li>richard.fung@alsglobal.com</li> <li>+852 2610 1044</li> <li>+852 2610 2021</li> </ul>		
Project Order number	SURFACE WATER, GROUNDWATER AND SOIL TESTING	- NYDC BASELINE S Quote number	URVEY / 0488716 : HKE/1277a/2019	Date Samples Received Issue Date	: 14-Mar-2019 : 02-Apr-2019
C-O-C number Site	: H013496-H013500 : NYDC PROJECT AREA			No. of samples received No. of samples analysed	: 60 : 60

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This document has been signed by those names that appear on this report and are the authorised signatories.

Signatories	Position	Authorised results for	
Richard Jong			
0			
Fung Lim Chee, Richard	General Manager	Inorganics	
Richard Juny			
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Fung Lim Chee, Richard	General Manager	Metals_ENV	

#### ALS Technichem (HK) Pty Ltd Partof the ALS Laboratory Group

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### General Comments

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release. When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes. Testing period is from 14-Mar-2019 to 02-Apr-2019. Key: LOR = Limit of reporting; CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.

#### Specific Comments for Work Order: HK1911130

Sample(s) were received in chilled condition.

Water sample(s) analysed and reported on as received basis.

EP026C - Due to high chloride content, samples #4,23-24,35,53 required dilution prior to Chemical Oxygen Demand analysis, LOR has been adjusted accordingly.

Water sample(s) were filtered prior to dissolved metal analysis.

EA002 - Calibration range of pH value is 4.0 - 10.0. Results exceeding this range is for reference only.

EA002 - pH value is reported as at 25°C.



### Analytical Results

Sub-Matrix: WATER		Clie	ent sample ID	SW-19A	SW-19B	SW-19C	GW-6A	GW-6B
	Clie	ent sampli	ng date / time	05-Mar-2019 10:20	05-Mar-2019 10:30	05-Mar-2019 10:40	05-Mar-2019 11:15	05-Mar-2019 11:30
Compound	CAS Number	LOR	Unit	HK1911130-001	HK1911130-002	HK1911130-003	HK1911130-004	HK1911130-005
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	6.6	6.6	6.9	7.1	7.0
EA025: Suspended Solids (SS)		2	mg/L	257	340	331	38	33
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	1970	2020	1900	1700	1160
EK040: Fluoride	16984-48-8	0.1	mg/L	0.2	0.2	0.2	0.2	0.2
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	2.99	3.30	2.64	0.81	0.62
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	0.01	<0.01	<0.01	<0.01	0.02
EK062P: Total Nitrogen as N		0.1	mg/L	4.6	7.2	5.7	0.8	0.7
EK067P: Total Phosphorus as P		0.01	mg/L	0.26	0.22	0.41	1.81	1.61
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	83	153	121	<10	9
EP030: Biochemical Oxygen Demand		2	mg/L	5	8	24	5	2
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	μg/L	<10	<10	<10	<10	<10
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	1	1	<1	<1	2
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	<10	<10	<10

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Sub-Matrix: WATER		Clie	ent sample ID	GW-6C	GW-5A	GW-5B	GW-5C	GW-19B
	Clie	ent samplii	ng date / time	05-Mar-2019 11:47	05-Mar-2019 13:35	05-Mar-2019 13:20	05-Mar-2019 13:05	06-Mar-2019 16:15
Compound	CAS Number	LOR	Unit	HK1911130-006	HK1911130-007	HK1911130-008	HK1911130-009	HK1911130-010
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	7.0	7.2	7.2	7.2	7.1
EA025: Suspended Solids (SS)		2	mg/L	29	9	13	7	18
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	825	484	577	1250	1220
EK040: Fluoride	16984-48-8	0.1	mg/L	0.2	0.2	0.2	0.3	0.2
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.63	0.66	0.97	3.79	0.78
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	<0.01	0.01	0.02
EK062P: Total Nitrogen as N		0.1	mg/L	0.8	0.7	1.0	3.8	0.8
EK067P: Total Phosphorus as P		0.01	mg/L	2.79	0.69	1.07	0.42	1.60
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	11	7	9	8	9
EP030: Biochemical Oxygen Demand		2	mg/L	2	<2	<2	5	<2
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	<10	20	<10	10	20
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	<1	<1	<1	<1	<1
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	ua/L	<10	<10	<10	<10	<10

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Sub-Matrix: WATER		Clie	ent sample ID	GW-19C	GW-4A	SW-20A	SW-20B	SW-20C
	Clie	ent sampli	ng date / time	06-Mar-2019 16:30	05-Mar-2019 16:00	07-Mar-2019 10:00	07-Mar-2019 10:15	07-Mar-2019 10:30
Compound	CAS Number	LOR	Unit	HK1911130-011	HK1911130-012	HK1911130-013	HK1911130-014	HK1911130-015
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	7.2	7.2	7.9	7.8	7.8
EA025: Suspended Solids (SS)		2	mg/L	14	<2	631	840	1220
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	1110	871	1730	1720	1760
EK040: Fluoride	16984-48-8	0.1	mg/L	0.2	0.3	0.2	0.2	0.2
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.71	2.56	0.12	0.23	0.18
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	<0.01	1.00	0.71	0.71	0.73
EK062P: Total Nitrogen as N		0.1	mg/L	0.7	3.6	1.3	1.4	1.5
EK067P: Total Phosphorus as P		0.01	mg/L	1.36	0.15	0.33	0.37	0.49
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	<5	6	31	37	44
EP030: Biochemical Oxygen Demand		2	mg/L	<2	4	2	2	3
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	10	<10	<10	<10	<10
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	<1	<1	<1	<1	<1
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	ua/L	<10	<10	<10	<10	<10

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Sub-Matrix: WATER		Clie	ent sample ID	GW-20A	GW-20B	GW-20C	GW-22C	SW-21A
	Cli	ent sampli	ng date / time	07-Mar-2019 13:00	07-Mar-2019 13:15	07-Mar-2019 13:35	09-Mar-2019 15:30	07-Mar-2019 14:30
Compound	CAS Number	LOR	Unit	HK1911130-016	HK1911130-017	HK1911130-018	HK1911130-019	HK1911130-020
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	7.0	7.3	7.1	7.4	7.6
EA025: Suspended Solids (SS)		2	mg/L	39	50	44	27	121
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	2470	1460	1530	2290	1790
EK040: Fluoride	16984-48-8	0.1	mg/L	0.2	0.2	0.2	0.2	0.2
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	1.30	0.83	0.75	10.0	0.16
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	<0.01	0.08	0.01	<0.01	0.70
EK062P: Total Nitrogen as N		0.1	mg/L	1.3	1.0	0.9	10.1	1.0
EK067P: Total Phosphorus as P		0.01	mg/L	1.52	3.50	3.18	1.93	0.12
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	13	22	18	13	13
EP030: Biochemical Oxygen Demand		2	mg/L	<2	<2	<2	8	<2
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	<10	<10	<10	130	<10
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	<1	<1	1	<1	<1
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	<10	<10	<10

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Sub-Matrix: WATER		Clie	ent sample ID	SW-21B	SW-21C	GW-21A	GW-21B	GW-21C
	Clie	ent sampli	ng date / time	07-Mar-2019 14:50	07-Mar-2019 15:10	07-Mar-2019 11:30	07-Mar-2019 11:40	07-Mar-2019 11:50
Compound	CAS Number	LOR	Unit	HK1911130-021	HK1911130-022	HK1911130-023	HK1911130-024	HK1911130-025
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	7.7	7.6	7.1	7.0	7.3
EA025: Suspended Solids (SS)		2	mg/L	146	245	<2	<2	12
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	1800	1860	3560	2930	1490
EK040: Fluoride	16984-48-8	0.1	mg/L	0.2	0.2	0.4	0.3	0.3
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.18	0.15	8.77	14.0	6.11
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	0.69	0.68	4.60	0.03	0.02
EK062P: Total Nitrogen as N		0.1	mg/L	1.0	1.1	16.0	14.7	6.1
EK067P: Total Phosphorus as P		0.01	mg/L	0.13	0.20	0.02	0.01	4.77
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	13	22	<50	<50	17
EP030: Biochemical Oxygen Demand		2	mg/L	<2	2	17	20	3
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	<10	<10	<10	<10	20
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	<1	<1	<1	<1	<1
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	<10	<10	<10

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Sub-Matrix: WATER		Clie	ent sample ID	SW-6A	SW-6B	SW-6C	GW-7A	GW-7B
	Clie	ent sampli	ing date / time	06-Mar-2019 14:30	06-Mar-2019 14:50	06-Mar-2019 15:10	06-Mar-2019 10:15	06-Mar-2019 10:25
Compound	CAS Number	LOR	Unit	HK1911130-026	HK1911130-027	HK1911130-028	HK1911130-029	HK1911130-030
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	7.5	7.2	7.6	6.4	6.5
EA025: Suspended Solids (SS)		2	mg/L	2250	1200	648	<2	3
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	846	819	795	448	470
EK040: Fluoride	16984-48-8	0.1	mg/L	0.2	0.2	0.2	0.2	0.1
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.12	0.08	0.10	3.86	3.07
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	0.88	0.53	0.74	<0.01	0.06
EK062P: Total Nitrogen as N		0.1	mg/L	1.6	1.3	1.0	4.0	3.1
EK067P: Total Phosphorus as P		0.01	mg/L	0.64	0.46	0.28	0.02	0.03
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	58	64	27	<5	<5
EP030: Biochemical Oxygen Demand		2	mg/L	<2	<2	<2	<2	3
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	<10	<10	<10	<10	<10
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	<1	<1	<1	<1	<1
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	<10	<10	<10

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Sub-Matrix: WATER		Clie	ent sample ID	GW-7C	GW-19A	GW-11A	GW-11B	GW-11C
	Clie	ent sampli	ing date / time	06-Mar-2019 10:40	06-Mar-2019 21:00	08-Mar-2019 22:00	08-Mar-2019 22:20	08-Mar-2019 22:40
Compound	CAS Number	LOR	Unit	HK1911130-031	HK1911130-032	HK1911130-033	HK1911130-034	HK1911130-035
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	6.2	7.1	7.2	7.4	7.1
EA025: Suspended Solids (SS)		2	mg/L	<2	16	<2	<2	9
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	938	1040	728	767	1620
EK040: Fluoride	16984-48-8	0.1	mg/L	0.1	0.2	0.3	0.4	0.4
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	1.80	0.61	5.00	5.75	7.95
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	0.58	0.03	0.01
EK062P: Total Nitrogen as N		0.1	mg/L	1.8	0.6	6.0	6.0	8.0
EK067P: Total Phosphorus as P		0.01	mg/L	0.01	1.54	1.31	2.06	0.32
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	<5	8	6	10	<10
EP030: Biochemical Oxygen Demand		2	mg/L	<2	<2	3	6	3
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	<10	10	10	100	<10
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	<1	<1	<1	<1	<1
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	ua/L	<10	<10	<10	<10	<10

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Sub-Matrix: WATER		Clie	ent sample ID	SW-10A	SW-10C	SW-14A	SW-14B	SW-14C
	Clie	ent sampli	ng date / time	09-Mar-2019 21:00	09-Mar-2019 21:30	08-Mar-2019 12:00	08-Mar-2019 14:15	08-Mar-2019 14:30
Compound	CAS Number	LOR	Unit	HK1911130-036	HK1911130-037	HK1911130-038	HK1911130-039	HK1911130-040
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	6.6	7.2	7.4	7.4	7.3
EA025: Suspended Solids (SS)		2	mg/L	58	50	49	50	56
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	1370	1290	1580	1660	1670
EK040: Fluoride	16984-48-8	0.1	mg/L	0.3	0.2	0.3	0.2	0.2
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.41	0.20	0.19	0.28	0.37
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	0.19	0.05	0.31	0.36	0.35
EK062P: Total Nitrogen as N		0.1	mg/L	1.2	0.8	1.0	1.2	1.4
EK067P: Total Phosphorus as P		0.01	mg/L	0.05	0.05	0.07	0.10	0.12
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	23	27	14	13	16
EP030: Biochemical Oxygen Demand		2	mg/L	3	<2	2	2	4
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	<10	<10	<10	<10	<10
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	1	1	1	1	1
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	<10	<10	<10

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Sub-Matrix: WATER		Clie	ent sample ID	GW-16A	GW-16B	GW-16C	GW-10A	GW-10B
	Cli	ent sampli	ng date / time	08-Mar-2019 15:00	08-Mar-2019 15:15	08-Mar-2019 15:30	08-Mar-2019 16:00	08-Mar-2019 16:15
Compound	CAS Number	LOR	Unit	HK1911130-041	HK1911130-042	HK1911130-043	HK1911130-044	HK1911130-045
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	7.2	7.3	7.3	7.3	7.6
EA025: Suspended Solids (SS)		2	mg/L	<2	<2	<2	<2	17
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	357	459	457	476	1050
EK040: Fluoride	16984-48-8	0.1	mg/L	0.6	0.6	0.6	0.8	0.9
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	1.53	1.66	1.64	1.25	5.32
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
EK062P: Total Nitrogen as N		0.1	mg/L	1.8	1.7	1.7	1.8	5.3
EK067P: Total Phosphorus as P		0.01	mg/L	0.02	0.03	0.03	0.03	1.20
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	0.2	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	<5	<5	<5	<5	12
EP030: Biochemical Oxygen Demand		2	mg/L	<2	<2	<2	3	2
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	<10	<10	<10	<10	<10
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	<1	<1	<1	<1	<1
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	<10	<10	<10

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Sub-Matrix: WATER		Clie	ent sample ID	GW-10C	GW-12A	GW-12B	GW-12C	GW-4B
	Cli	ent samplii	ng date / time	08-Mar-2019 16:30	09-Mar-2019 16:00	09-Mar-2019 16:15	09-Mar-2019 16:30	05-Mar-2019 16:15
Compound	CAS Number	LOR	Unit	HK1911130-046	HK1911130-047	HK1911130-048	HK1911130-049	HK1911130-050
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	7.3	7.6	7.6	7.5	7.6
EA025: Suspended Solids (SS)		2	mg/L	<2	90	6	<2	34
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	463	708	374	374	678
EK040: Fluoride	16984-48-8	0.1	mg/L	0.7	0.4	0.4	0.4	0.3
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.86	9.29	8.79	8.04	4.40
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	0.23	0.01	0.01	0.01	0.04
EK062P: Total Nitrogen as N		0.1	mg/L	1.6	9.3	9.0	8.4	5.6
EK067P: Total Phosphorus as P		0.01	mg/L	0.02	1.64	2.45	2.02	1.85
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	<5	13	13	11	10
EP030: Biochemical Oxygen Demand		2	mg/L	<2	2	9	2	6
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	<10	380	420	310	20
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	<1	<1	<1	<1	<1
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	<10	<10	<10

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Sub-Matrix: WATER		Clie	ent sample ID	GW-4C	GW-22A	GW-22B	GW-14A	GW-14B
	Clie	ent sampli	ing date / time	05-Mar-2019 16:32	09-Mar-2019 15:00	09-Mar-2019 15:15	08-Mar-2019 12:00	08-Mar-2019 12:15
Compound	CAS Number	LOR	Unit	HK1911130-051	HK1911130-052	HK1911130-053	HK1911130-054	HK1911130-055
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	7.8	7.7	7.8	7.7	7.5
EA025: Suspended Solids (SS)		2	mg/L	34	21	<2	3	24
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	614	1820	2990	129	546
EK040: Fluoride	16984-48-8	0.1	mg/L	0.3	0.2	0.3	0.4	0.3
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	4.63	18.0	9.99	1.48	3.82
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	0.02	<0.01	<0.01	0.16	0.02
EK062P: Total Nitrogen as N		0.1	mg/L	5.0	18.8	10.8	2.1	3.8
EK067P: Total Phosphorus as P		0.01	mg/L	1.62	1.60	0.01	1.78	1.28
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	9	12	<50	<5	<5
EP030: Biochemical Oxygen Demand		2	mg/L	6	<2	<2	3	3
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	20	80	<10	20	<10
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	<1	<1	<1	<1	<1
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	ua/L	<10	<10	<10	<10	<10

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Sub-Matrix: WATER		Clie	ent sample ID	GW-14C	SW-22A	SW-22B	SW-22C	SW-10B
	Clie	ent sampli	ng date / time	08-Mar-2019 12:30	09-Mar-2019 10:30	09-Mar-2019 10:45	09-Mar-2019 11:00	09-Mar-2019 09:15
Compound	CAS Number	LOR	Unit	HK1911130-056	HK1911130-057	HK1911130-058	HK1911130-059	HK1911130-060
EA/ED: Physical and Aggregate Properties								
EA002: pH Value		0.1	pH Unit	7.9	7.6	8.3	8.3	7.5
EA025: Suspended Solids (SS)		2	mg/L	14	130	71	26	32
ED/EK: Inorganic Nonmetallic Parameters								
ED045K: Chloride	16887-00-6	1	mg/L	79	1230	1610	1300	1320
EK040: Fluoride	16984-48-8	0.1	mg/L	0.4	0.3	0.3	0.2	0.3
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	1.80	0.49	0.09	0.10	0.14
EK058A: Nitrate as N	14797-55-8	0.01	mg/L	0.05	0.23	0.25	0.10	0.03
EK062P: Total Nitrogen as N		0.1	mg/L	1.8	1.3	0.8	0.6	1.2
EK067P: Total Phosphorus as P		0.01	mg/L	1.67	0.12	0.09	0.06	0.08
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EP: Aggregate Organics								
EP020: Oil & Grease		2	mg/L	<2	<2	<2	<2	<2
EP026C: Chemical Oxygen Demand		5	mg/L	<5	22	20	18	23
EP030: Biochemical Oxygen Demand		2	mg/L	<2	7	<2	<2	<2
EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
EG: Metals and Major Cations - Filtered								
EG020: Arsenic	7440-38-2	10	µg/L	20	<10	<10	<10	<10
EG020: Chromium	7440-47-3	1	µg/L	<1	<1	<1	<1	<1
EG020: Copper	7440-50-8	1	µg/L	<1	<1	1	1	1
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5
EG020: Zinc	7440-66-6	10	µg/L	<10	<10	<10	<10	<10

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### Laboratory Duplicate (DUP) Report

Matrix: WATER					Labora	atory Duplicate (DUP)	Report	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)
EA/ED: Physical and Age	regate Properties (QC Lot: 22360	6)						
HK1911130-001	SW-19A	EA025: Suspended Solids (SS)		2	mg/L	257	244	5.43
HK1911130-011	GW-19C	EA025: Suspended Solids (SS)		2	mg/L	14	14	0.00
EA/ED: Physical and Age	regate Properties (QC Lot: 22360	7)						
HK1911130-021	SW-21B	EA025: Suspended Solids (SS)		2	mg/L	146	146	0.00
HK1911130-031	GW-7C	EA025: Suspended Solids (SS)		2	mg/L	<2	<2	0.00
EA/ED: Physical and Age	regate Properties (QC Lot: 22360	8)						
HK1911130-041	GW-16A	EA025: Suspended Solids (SS)		2	mg/L	<2	<2	0.00
HK1911130-051	GW-4C	EA025: Suspended Solids (SS)		2	mg/L	34	36	7.55
EA/ED: Physical and Age	regate Properties (QC Lot: 22372	59)						
HK1911094-001	Anonymous	EA002: pH Value		0.1	pH Unit	7.9	7.9	0.00
HK1911130-009	GW-5C	EA002: pH Value		0.1	pH Unit	7.2	7.2	0.00
EA/ED: Physical and Age	regate Properties (QC Lot: 223726	30)						
HK1911130-019	GW-22C	EA002: pH Value		0.1	pH Unit	7.4	7.4	0.00
HK1911130-029	GW-7A	EA002: pH Value		0.1	pH Unit	6.4	6.4	0.00
EA/ED: Physical and Age	regate Properties (QC Lot: 223726	31)						
HK1911130-039	SW-14B	EA002: pH Value		0.1	pH Unit	7.4	7.4	0.00
HK1911130-049	GW-12C	EA002: pH Value		0.1	pH Unit	7.5	7.5	0.00
EA/ED: Physical and Age	regate Properties (QC Lot: 223726	32)						
HK1911130-059	SW-22C	EA002: pH Value		0.1	pH Unit	8.3	8.3	0.00
ED/EK: Inorganic Nonme	tallic Parameters (QC Lot: 224109	5)						
HK1911130-001	SW-19A	ED045K: Chloride	16887-00-6	1	mg/L	1970	2020	2.32
ED/EK: Inorganic Nonme	tallic Parameters (QC Lot: 224109	6)						
HK1911130-021	SW-21B	ED045K: Chloride	16887-00-6	1	mg/L	1800	1800	0.303
ED/EK: Inorganic Nonme	tallic Parameters (QC Lot: 224109	7)						
HK1911130-041	GW-16A	ED045K: Chloride	16887-00-6	1	mg/L	357	362	1.31
ED/EK: Inorganic Nonme	tallic Parameters (QC Lot: 224127	2)						
HK1911130-020	SW-21A	EK062P: Total Nitrogen as N		0.1	mg/L	1.0	1.0	0.00
ED/EK: Inorganic Nonme	tallic Parameters (QC Lot: 224127	3)						
HK1911130-020	SW-21A	EK067P: Total Phosphorus as P		0.01	mg/L	0.12	0.12	0.00
ED/EK: Inorganic Nonme	tallic Parameters (QC Lot: 224127	4)						

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Matrix: WATER	TER Client sample ID Method: Compound		Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	
ED/EK: Inorganic Noni	netallic Parameters (QC Lot:	2241274) - Continued							
HK1911130-040	SW-14C	EK062P: Total Nitrogen as N		0.1	mg/L	1.4	1.4	0.00	
ED/EK: Inorganic Noni	metallic Parameters (QC Lot:	2241275)							
HK1911130-040	SW-14C	EK067P: Total Phosphorus as P		0.01	mg/L	0.12	0.12	0.00	
ED/EK: Inorganic Noni	metallic Parameters (QC Lot:	2241276)							
HK1911130-060	SW-10B	EK062P: Total Nitrogen as N		0.1	mg/L	1.2	1.1	0.00	
ED/EK: Inorganic Noni	metallic Parameters (QC Lot:	2241277)							
HK1911130-060	SW-10B	EK067P: Total Phosphorus as P		0.01	mg/L	0.08	0.08	0.00	
ED/EK: Inorganic Noni	metallic Parameters (QC Lot:	2243202)							
HK1911130-010	GW-19B	EK055K: Ammonia as N	7664-41-7	0.01	mg/L	0.78	0.79	1.64	
ED/EK: Inorganic Noni	metallic Parameters (QC Lot:	2243203)							
HK1911130-030	GW-7B	EK055K: Ammonia as N	7664-41-7	0.01	mg/L	3.07	3.00	2.16	
ED/EK: Inorganic Noni	metallic Parameters (QC Lot:	2243204)							
HK1911130-050	GW-4B	EK055K: Ammonia as N	7664-41-7	0.01	mg/L	4.40	4.26	3.17	
ED/EK: Inorganic Noni	metallic Parameters (QC Lot:	2243208)							
HK1911130-001	SW-19A	EK040: Fluoride	16984-48-8	0.1	mg/L	0.2	0.2	0.00	
ED/EK: Inorganic Noni	metallic Parameters (QC Lot:	2243209)							
HK1911130-021	SW-21B	EK040: Fluoride	16984-48-8	0.1	mg/L	0.2	0.2	0.00	
ED/EK: Inorganic Noni	metallic Parameters (QC Lot:	2243210)							
HK1911130-041	GW-16A	EK040: Fluoride	16984-48-8	0.1	mg/L	0.6	0.6	0.00	
ED/EK: Inorganic Noni	metallic Parameters (QC Lot:	2246883)							
HK1911130-001	SW-19A	EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	0.00	
ED/EK: Inorganic Noni	metallic Parameters (QC Lot:	2246884)							
HK1911130-021	SW-21B	EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	0.00	
ED/EK: Inorganic Noni	metallic Parameters (QC Lot:	2246885)	· · ·						
HK1911130-041	GW-16A	EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	<0.1	0.00	
EP: Aggregate Organi	cs (QC Lot: 2240361)								
HK1910044-001	Anonymous	EP035: Phenols (Total)		0.1	mg/L	0.1	0.1	0.00	
EP: Aggregate Organi	cs (QC Lot: 2242966)								
HK1911130-004	GW-6A	EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	0.00	
EP: Aggregate Organic	cs (QC Lot: 2248261)				-				
HK1911130-024	GW-21B	EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	0.00	
- D: Aggrogato Organi	no. (OC Lat: 2250090)				Ŭ				

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Matrix: WATER					Labol	ratory Duplicate (DUP)	Report	
Laboratory	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate	<b>RPD</b> (%)
	(0.0						Kesult	
EP: Aggregate Organics	(QC Lot: 2250980) - Conti					-	0	10.1
HK1911130-007	GW-5A	EP026C: Chemical Oxygen Demand		5	mg/L	1	8	19.4
EP: Aggregate Organics	(QC Lot: 2250981)					_	_	
HK1911130-029	GW-7A	EP026C: Chemical Oxygen Demand		5	mg/L	<5	<5	0.00
EP: Aggregate Organics	(QC Lot: 2250982)							
HK1911130-041	GW-16A	EP026C: Chemical Oxygen Demand		5	mg/L	<5	<5	0.00
EP: Aggregate Organics	(QC Lot: 2254055)							
HK1911130-054	GW-14A	EP026C: Chemical Oxygen Demand		5	mg/L	<5	<5	0.00
EP: Aggregate Organics	(QC Lot: 2254135)				1		1	1
HK1911130-043	GW-16C	EP035: Phenols (Total)		0.1	mg/L	<0.1	<0.1	0.00
EG: Metals and Major Ca	tions - Filtered (QC Lot: 22	37214)						
HK1911130-002 SW-19B	SW-19B	EG020: Mercury	7439-97-6	0.5	μg/L	<0.5	<0.5	0.00
		EG020: Chromium	7440-47-3	1	µg/L	<1	<1	0.00
		EG020: Copper	7440-50-8	1	μg/L	1	1	0.00
		EG020: Arsenic	7440-38-2	10	μg/L	<10	<10	0.00
		EG020: Zinc	7440-66-6	10	µg/L	<10	<10	0.00
EG: Metals and Major Ca	tions - Filtered (QC Lot: 22	37215)						
HK1911130-022	SW-21C	EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	<0.5	0.00
		EG020: Chromium	7440-47-3	1	µg/L	<1	<1	0.00
		EG020: Copper	7440-50-8	1	µg/L	<1	<1	0.00
		EG020: Arsenic	7440-38-2	10	ug/l	<10	<10	0.00
		EG020: Zinc	7440-66-6	10	µg/1	<10	<10	0.00
EG: Metals and Major Co	tions - Filtered (OC Lat: 22	27216)	1440.00-0	10	₽9'E	-10	-10	0.00
	GW-16B	FG020: Mercupy	7/30-07 6	0.5	uo/l	<0.5	<0.5	0.00
11(1911130-042	GW-10D		7439-97-0	0.5	μg/L	-0.5	-0.5	0.00
			7440-47-3	1	µg/∟	<u> </u>	<u></u>	0.00
			/440-50-8	1	µg/L	<1	<1	0.00
		EG020: Arsenic	7440-38-2	10	µg/L	<10	<10	0.00
		EG020: Zinc	7440-66-6	10	µg/L	<10	<10	0.00

Method Blank (MB), Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report

Matrix: WATER	Method Blank (MB) Report		Laboratory Control Spike (LCS) and Labora	story Control Spike Duplicate (	DCS) Report
		Spike	Spike Recovery (%)	Recovery Limits(%)	RPD (%)
		Concentration			

Page Number:18 of 24Client:ERM MYANMAR LTDWork OrderHK1911130



Matrix: WATER	[		Method Blank (ME	3) Report	Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
Method: Compound	CAS Number	LOR	Unit	Result	Spike Concentration	LCSSpike Re	covery (%)DCS	L <i>®la</i> cover	ry Lir <b>hlig(t</b> %)	Value	RPD (%) Control Limit
EA/ED: Physical and Aggregate Properties (QC Lot	t: 2236016)										
EA025: Suspended Solids (SS)		2	mg/L	<2	10 mg/L	92.0		81	120		
EA/ED: Physical and Aggregate Properties (QC Lot	t: 2236017)										
EA025: Suspended Solids (SS)		2	mg/L	<2	10 mg/L	100		81	120		
EA/ED: Physical and Aggregate Properties (QC Lot	t: 2236018)										
EA025: Suspended Solids (SS)		2	mg/L	<2	10 mg/L	106		81	120		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot:	: 2241095)										
ED045K: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	94.5		87	108		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot	: 2241096)										
ED045K: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	93.9		87	108		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot:	: 2241097)										
ED045K: Chloride	16887-00-6	1	mg/L	<1	10 mg/L	92.4		87	108		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot:	: 2241272)										
EK062P: Total Nitrogen as N		0.1	mg/L	<0.1	0.5 mg/L	104		92	116		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot	: 2241273)										
EK067P: Total Phosphorus as P		0.01	mg/L	<0.01	0.5 mg/L	96.0		90	104		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot	: 2241274)										
EK062P: Total Nitrogen as N		0.1	mg/L	<0.1	0.5 mg/L	105		92	116		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot:	: 2241275)										
EK067P: Total Phosphorus as P		0.01	mg/L	<0.01	0.5 mg/L	98.1		90	104		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot:	: 2241276)										
EK062P: Total Nitrogen as N		0.1	mg/L	<0.1	0.5 mg/L	106		92	116		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot	: 2241277)										
EK067P: Total Phosphorus as P		0.01	mg/L	<0.01	0.5 mg/L	97.3		90	104		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot:	: 2243202)										
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	0.5 mg/L	94.4		88	109		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot:	: 2243203)										
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	0.5 mg/L	96.0		88	109		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot:	: 2243204)										
EK055K: Ammonia as N	7664-41-7	0.01	mg/L	<0.01	0.5 mg/L	95.6		88	109		
ED/EK: Inorganic Nonmetallic Parameters (QC Lot:	: 2243208)										

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Matrix: WATER		Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
				1	Spike	Spike Red	covery (%)	Recove	ny Limits(%)	RPL	D (%)
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	DCS	Low	High	Value	Control
											Limit
ED/EK: Inorganic Nonmetallic Parameters (QC Lo	ot: 2243208) - Cor	ntinued									
EK040: Fluoride	16984-48-8	0.1	mg/L	<0.1	0.5 mg/L	102		90	109		
ED/EK: Inorganic Nonmetallic Parameters (QC Lo	ot: 2243209)										
EK040: Fluoride	16984-48-8	0.1	mg/L	<0.1	0.5 mg/L	105		90	109		
ED/EK: Inorganic Nonmetallic Parameters (QC Lo	ot: 2243210)										
EK040: Fluoride	16984-48-8	0.1	mg/L	<0.1	0.5 mg/L	96.0		90	109		
ED/EK: Inorganic Nonmetallic Parameters (QC Lo	ot: 2246883)										
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	0.464 mg/L	107		80	112		
ED/EK: Inorganic Nonmetallic Parameters (QC Lo	ot: 2246884)										
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	0.464 mg/L	109		80	112		
ED/EK: Inorganic Nonmetallic Parameters (QC Lo	ot: 2246885)										
EK085: Sulphide as S2-	18496-25-8	0.1	mg/L	<0.1	0.464 mg/L	105		80	112		
EP: Aggregate Organics (QC Lot: 2238295)											
EP030: Biochemical Oxygen Demand			mg/L		198 mg/L	96.7		84	119		
EP: Aggregate Organics (QC Lot: 2238781)											
EP030: Biochemical Oxygen Demand			mg/L		198 mg/L	93.6		84	119		
EP: Aggregate Organics (QC Lot: 2239146)											
EP030: Biochemical Oxygen Demand			mg/L		198 mg/L	96.5		84	119		
EP: Aggregate Organics (QC Lot: 2239147)											
EP030: Biochemical Oxygen Demand			mg/L		198 mg/L	96.5		84	119		
EP: Aggregate Organics (QC Lot: 2239148)											
EP030: Biochemical Oxygen Demand			mg/L		198 mg/L	89.7		84	119		
EP: Aggregate Organics (QC Lot: 2240361)											
EP035: Phenols (Total)		0.1	mg/L	<0.1	0.5557 mg/L	99.9		82	112		
EP: Aggregate Organics (QC Lot: 2242966)											
EP035: Phenols (Total)		0.1	mg/L	<0.1	0.5557 mg/L	85.2		82	112		
EP: Aggregate Organics (QC Lot: 2248261)											
EP035: Phenols (Total)		0.1	mg/L	<0.1	0.5557 mg/L	93.0		82	112		
EP: Aggregate Organics (QC Lot: 2249328)											
EP020: Oil & Grease		2	mg/L	<2	20 mg/L	94.8		80	106		

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Matrix: WATER		Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report						
					Spike	Spike Re	covery (%)	Recove	ry Limits(%)	RPI	D (%)
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	DCS	Low	High	Value	Control
											Limit
EP: Aggregate Organics (QC Lot: 2249332)											
EP020: Oil & Grease		2	mg/L	<2	20 mg/L	96.8		80	106		
EP: Aggregate Organics (QC Lot: 2250980)											
EP026C: Chemical Oxygen Demand			mg/L		25 mg/L	100		92	110		
					250 mg/L	97.1		95	105		
EP: Aggregate Organics (QC Lot: 2250981)											
EP026C: Chemical Oxygen Demand			mg/L		25 mg/L	93.6		92	110		
					250 mg/L	97.1		95	105		
EP: Aggregate Organics (QC Lot: 2250982)											
EP026C: Chemical Oxygen Demand			mg/L		25 mg/L	100		92	110		
					250 mg/L	97.1		95	105		
EP: Aggregate Organics (QC Lot: 2251702)											
EP020: Oil & Grease		2	mg/L	<2	20 mg/L	90.4		80	106		
EP: Aggregate Organics (QC Lot: 2252215)											
EP020: Oil & Grease		2	mg/L	<2	20 mg/L	89.9		80	106		
EP: Aggregate Organics (QC Lot: 2254055)											
EP026C: Chemical Oxygen Demand			mg/L		25 mg/L	96.4		92	110		
					250 mg/L	97.1		95	105		
EP: Aggregate Organics (QC Lot: 2254135)											
EP035: Phenols (Total)		0.1	mg/L	<0.1	0.5557 mg/L	104		82	112		
EG: Metals and Major Cations - Filtered (QC Lot: 223	37214)										
EG020: Arsenic	7440-38-2	10	µg/L	<10	100 µg/L	95.7		85	112		
EG020: Chromium	7440-47-3	1	µg/L	<1	100 µg/L	100		86	111		
EG020: Copper	7440-50-8	1	µg/L	<1	100 µg/L	101		85	113		
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	2 µg/L	102		85	115		
EG020: Zinc	7440-66-6	10	µg/L	<10	100 µg/L	89.6		85	113		
EG: Metals and Major Cations - Filtered (QC Lot: 223	37215)										
EG020: Arsenic	7440-38-2	10	µg/L	<10	100 µg/L	97.4		85	112		
EG020: Chromium	7440-47-3	1	µg/L	<1	100 µg/L	96.7		86	111		
EG020: Copper	7440-50-8	1	µg/L	<1	100 µg/L	102		85	113		

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Matrix: WATER		Method Blank (MB) Report			Laboratory Control Spike (LCS) and Laboratory Control Spike Duplicate (DCS) Report							
					Spike	Spike Re	covery (%)	Recove	ory Limits(%)	RP	D (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	DCS	Low	High	Value	Control	
											Limit	
EG: Metals and Major Cations - Filte	red (QC Lot: 2237215) - Contir	nued										
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	2 µg/L	104		85	115			
EG020: Zinc	7440-66-6	10	µg/L	<10	100 µg/L	90.5		85	113			
EG: Metals and Major Cations - Filte	red (QC Lot: 2237216)											
EG020: Arsenic	7440-38-2	10	µg/L	<10	100 µg/L	98.7		85	112			
EG020: Chromium	7440-47-3	1	µg/L	<1	100 µg/L	96.7		86	111			
EG020: Copper	7440-50-8	1	µg/L	<1	100 µg/L	100		85	113			
EG020: Mercury	7439-97-6	0.5	µg/L	<0.5	2 µg/L	98.4		85	115			
EG020: Zinc	7440-66-6	10	µg/L	<10	100 µg/L	92.9		85	113			



### Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report

Matrix: WATER			Matrix Spike (MS) and Matrix Spike Duplicate (MSD) I						Report		
				Spike	Spike Re	covery (%)	Recovery	Limits (%)	RPL	0 (%)	
Laboratory	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control	
sample ID										Limit	
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2241	095)									
HK1911130-001	SW-19A	ED045K: Chloride	16887-00-	1000 mg/L	108		75	125			
			6								
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2241	096)					1			1	
HK1911130-021	SW-21B	ED045K: Chloride	16887-00-	1000 mg/L	108		75	125			
			6								
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2241	097)					1			I	
HK1911130-041	GW-16A	ED045K: Chloride	16887-00-	1000 mg/L	102		75	125			
			6								
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2241)	272)								1	
HK1911130-020	SW-21A	EK062P: Total Nitrogen as N		0.5 mg/L	95.0		75	125			
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2241	273)									
HK1911130-020	SW-21A	EK067P: Total Phosphorus as P		0.5 mg/L	92.0		75	125			
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2241)	274)									
HK1911130-040	SW-14C	EK062P: Total Nitrogen as N		0.5 mg/L	91.4		75	125			
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2241)	275)									
HK1911130-040	SW-14C	EK067P: Total Phosphorus as P		0.5 mg/L	93.0		75	125			
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2241)	276)									
HK1911130-060	SW-10B	EK062P: Total Nitrogen as N		0.5 mg/L	84.3		75	125			
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2241	277)									
HK1911130-060	SW-10B	EK067P: Total Phosphorus as P		0.5 mg/L	95.2		75	125			
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2243	202)									
HK1911130-010	GW-19B	EK055K: Ammonia as N	7664-41-7	0.5 mg/L	98.1		75	125			
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2243	203)									
HK1911130-030	GW-7B	EK055K: Ammonia as N	7664-41-7	5 mg/L	103		75	125			
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2243	204)									
HK1911130-050	GW-4B	EK055K: Ammonia as N	7664-41-7	5 mg/L	99.6		75	125			
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2246	883)		_							
		/									

# Page Number: 23 of 24Client: ERM MYANMAR LTDWork OrderHK1911130



Matrix: WATER				Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report						
				Spike	Spike R	ecovery (%)	Recovery	Limits (%)	RPD	(%)
Laboratory	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control
sample ID										Limit
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2246	883) - Continued								
HK1911130-001	SW-19A	EK085: Sulphide as S2-	18496-25-	0.1856 mg/L	105		75	125		
			8							
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2246	384)								
HK1911130-021	SW-21B	EK085: Sulphide as S2-	18496-25-	0.1856 mg/L	100		75	125		
			8							
ED/EK: Inorgani	c Nonmetallic Parameters (QC Lot: 2246	385)								
HK1911130-041	GW-16A	EK085: Sulphide as S2-	18496-25-	0.1856 mg/L	96.7		75	125		
			8							
EP: Aggregate C	Organics (QC Lot: 2250980)									
HK1911130-007	GW-5A	EP026C: Chemical Oxygen Demand		10 mg/L	92.0		75	125		
EP: Aggregate C	Organics (QC Lot: 2250981)									
HK1911130-029	GW-7A	EP026C: Chemical Oxygen Demand		10 mg/L	90.0		75	125		
EP: Aggregate C	Organics (QC Lot: 2250982)									
HK1911130-041	GW-16A	EP026C: Chemical Oxygen Demand		10 mg/L	98.0		75	125		
EP: Aggregate C	Organics (QC Lot: 2254055)									
HK1911130-054	GW-14A	EP026C: Chemical Oxygen Demand		10 mg/L	99.0		75	125		
EG: Metals and	Major Cations - Filtered (QC Lot: 223721	4)								
HK1911130-001	SW-19A	EG020: Arsenic	7440-38-2	100 µg/L	102		75	125		
		EG020: Chromium	7440-47-3	100 µg/L	95.5		75	125		
		EG020: Copper	7440-50-8	100 µg/L	97.2		75	125		
		EG020: Mercury	7439-97-6	2 µg/L	91.0		75	125		
		EG020: Zinc	7440-66-6	100 µg/L	84.8		75	125		
EG: Metals and	Major Cations - Filtered (QC Lot: 223721	5)								
HK1911130-021	SW-21B	EG020: Arsenic	7440-38-2	100 µg/L	101		75	125		
		EG020: Chromium	7440-47-3	100 µg/L	92.9		75	125		
		EG020: Copper	7440-50-8	100 µg/L	94.8		75	125		
		EG020: Mercury	7439-97-6	2 µg/L	93.4		75	125		
		EG020: Zinc	7440-66-6	100 µg/L	84.5		75	125		
EG: Metals and	Major Cations - Filtered (QC Lot: 223721	6)								

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Client	ERM MYANMAR LTD
Work Order	HK1911130



Matrix: WATER	Matrix: WATER					Matrix Spike (MS) and Matrix Spike Duplicate (MSD) Report					
				Spike	Spike Recovery (%)		Recovery Limits (%)		<b>RPD</b> (%)		
Laboratory	Client sample ID	Method: Compound	CAS Number	Concentration	MS	MSD	Low	High	Value	Control	
sample ID										Limit	
EG: Metals and Major Cations - Filtered (QC Lot: 2237216) - Continued											
HK1911130-041	GW-16A	EG020: Arsenic	7440-38-2	100 µg/L	102		75	125			
		EG020: Chromium	7440-47-3	100 µg/L	95.3		75	125			
		EG020: Copper	7440-50-8	100 µg/L	99.4		75	125			
		EG020: Mercury	7439-97-6	2 µg/L	90.6		75	125			
		EG020: Zinc	7440-66-6	100 µg/L	89.1		75	125			



PROJECT	: NEW YANG	NEW YANGON DEVELOPMENT PROJECT							
CUSTOMER NAME	: RESOURCE	E AND ENVIRONMENT MYANAMR	CO.,LTD						
ADDRESS	: B 702, DEL	TA PLAZA, SHWEGONDAING ROA	D, BAHAN TOWNSHIP,	YANGON, MYAN	IMAR. TEL.+95973013	448			
SAMPLING SOURCE	: SW-1A, SW	-1B, SW-1C							
SAMPLE TYPE	: SURFACE \	WATER	SUBMITTAL/ RECEIPT NO. : 3/2/2019						
SAMPLING DATE	ING DATE : FEBRUARY 19,2019			RECEIVED DATE : FEBRUARY 20, 2019					
SAMPLING TIME	1.1		ANALYSIS DATE : FEBR		RUARY 20-MARCH 12, 2019				
SAMPLING METHOD	:-		ANALYSIS NO. : LAAO		022-LAA024/2019				
SAMPLING BY	: CUSTOMER	2	REPORT NO.						
	UNIT METHOD OF ANALYSIS		RESULT	RESULT	RESULT				
PARAMETER		SW-1A	SW-1B	SW-1C	DETECTION				
			LAA022/2019	LAA023/2019	LAA024/2019	LIMIT			
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	>160,000	>160,000	160,000	1.8			
SAMPLE CONDITION									
WATER'S COLOUR/TURBID	)		BROWN / TURBID	BROWN / TURBID	BROWN / TURBID				
SEDIMENT			BROWN	BROWN	BROWN				

SM : APHA/AWWAWEF STANDARD METHOD FOR THE EXAMINATION OF WATER AND WASTEWATER, 23<sup>rd</sup> EDITION, 2017



(MS TOE TOE HLAING)

### LABORATORY HEAD

DATE APRIL 3,2019

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PROJECT	: NEW YANG	SON DEVELOPMENT PROJECT							
CUSTOMER NAME	: RESOURCI	E AND ENVIRONMENT MYANAMR	CO.,LTD						
ADDRESS	: B 702, DEL	TA PLAZA, SHWEGONDAING ROA	D, BAHAN TOWNSHIP,	YANGON, MYANM	AR TEL +959730	13448			
SAMPLING SOURCE	: SW-2A, SW	/-2B, SW-2C				10440			
SAMPLE TYPE	: SURFACE	WATER	SUBMITTAL/ RECEIPT NO 9/2/2019						
SAMPLING DATE	: FEBRUARY	21,2019	RECEIVED DATE	RECEIVED DATE : FEBRUARY 24 2010					
SAMPLING TIME	:-		ANALYSIS DATE	: FEBRU	ARY 24-MARCH 16, 2019				
SAMPLING METHOD	12		ANALYSIS NO. : LAADE		36-LAA068/2019				
SAMPLING BY	: CUSTOMER	2	REPORT NO.	: L00066	-L00068/2019				
		UNIT METHOD OF ANALYSIS	RESULT	RESULT	RESULT	T			
PARAMETER	UNIT		SW-2A	SW-2B	SW-2C	DETECTION LIMIT			
			LAA066/2019	LAA067/2019	LAA068/2019				
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	>160,000	54,000	>160,000	1.8			
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT		·	GREY / TURBID GREY	GREY / TURBID GREY	GREY / TURBID GREY				

SM : APHA/AWWAWEF STANDARD METHOD FOR THE EXAMINATION OF WATER AND WASTEWATER, 23<sup>rd</sup> EDITION, 2017

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(MS TOE TOE HLAING)	
LABORATORY HEAD	
DATE APRIL 3,2019	

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PROJECT	: NEW YANG	IEW YANGON DEVELOPMENT PROJECT						
CUSTOMER NAME	: RESOURCE	E AND ENVIRONMENT MYANAMR	CO.,LTD					
ADDRESS	: B 702, DEL	TA PLAZA, SHWEGONDAING ROA	D, BAHAN TOWNSHIP, Y	ANGON, MYANA	AR. TEL.+95973	3013448		
SAMPLING SOURCE	: SW-3A, SW	/-3B, SW-3C						
SAMPLE TYPE	: SURFACE	WATER	SUBMITTAL/ RECEIPT NO. : 10/2/2019					
SAMPLING DATE	IPLING DATE : FEBRUARY 24,2019		RECEIVED DATE	RECEIVED DATE : FEBRUARY 25 2019				
SAMPLING TIME	:-		ANALYSIS DATE	NALYSIS DATE : FEBRUARY 25-MARCH 17, 2019				
SAMPLING METHOD	1		ANALYSIS NO. : LAA072-LAA074/2019			, _=		
SAMPLING BY	: CUSTOMER	2	REPORT NO. : L00072-L00074/201					
	UNIT METHOD OF ANALYSIS		RESULT	RESULT	RESULT			
PARAMETER		SW-3A	SW-3B	SW-3C	DETECTION LIMIT			
			LAA072/2019	LAA073/2019	LAA074/2019			
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM: 9221 B)	92,000	160,000	24,000	1.8		
SAMPLE CONDITION								
WATER'S COLOUR/TURBID			GREY /	GREY /	GREY /			
SEDIMENT			TURBID	TURBID GREY	TURBID GREY			

SM : APHA/AWWAWEF STANDARD METHOD FOR THE EXAMINATION OF WATER AND WASTEWATER, 23<sup>rd</sup> EDITION, 2017

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: NEW YANG	EW YANGON DEVELOPMENT PROJECT							
: RESOURCE	E AND ENVIRONMENT MYANAMR	CO.,LTD						
: B 702, DEL	TA PLAZA, SHWEGONDAING ROA	D, BAHAN TOWNSHIP, Y	ANGON, MYANN	IAR. TEL.+95973	013448			
: SW-4A, SW	/-4B, SW-4C							
: SURFACE	WATER	SUBMITTAL/ RECEIPT NO. : 4/2/2019						
: FEBRUARY 20, 2019		RECEIVED DATE	: FEBRU	ARY 21, 2019				
:-	5	ANALYSIS DATE	: FEBRU	UARY 21-MARCH 13, 2019				
1.00		ANALYSIS NO.	: LAA034	: LAA034-LAA036/2019				
: CUSTOMER	2	<b>REPORT NO.</b> : L00034-L00036/2019						
UNIT METHOD OF ANALYSIS		RESULT	RESULT	RESULT	1			
	METHOD OF ANALYSIS	SW-4A	SW-4B	SW-4C	DETECTION LIMIT			
		LAA034/2019	LAA035/2019	LAA036/2019				
MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	92,000	92,000	160,000	1.8			
		**************************************						
		BROWN /	BROWN /	BROWN /	4			
		TURBID	TURBID	TURBID				
	: NEW YANG : RESOURCI : B 702, DEL : SW-4A, SW : SURFACE : FEBRUARY : - : - : CUSTOMER UNIT MPN/100 mL	: NEW YANGON DEVELOPMENT PROJECT : RESOURCE AND ENVIRONMENT MYANAMR : B 702, DELTA PLAZA, SHWEGONDAING ROA : SW-4A, SW-4B, SW-4C : SURFACE WATER : FEBRUARY 20, 2019 : - : - : CUSTOMER UNIT METHOD OF ANALYSIS MPN/100 mL MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	: NEW YANGON DEVELOPMENT PROJECT : RESOURCE AND ENVIRONMENT MYANAMR CO.,LTD : B 702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, Y : SW-4A, SW-4B, SW-4C : SURFACE WATER : SUBMITTAL/ RECEIPT : FEBRUARY 20, 2019 : - ANALYSIS DATE : - ANALYSIS DATE : - ANALYSIS NO. : CUSTOMER METHOD OF ANALYSIS MPN/100 mL MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B) BROWN / TURBID BROWN / TURBID	: NEW YANGON DEVELOPMENT PROJECT : RESOURCE AND ENVIRONMENT MYANAMR CO.,LTD : B 702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANM : SW-4A, SW-4B, SW-4C : SURFACE WATER : SUBRITAL/ RECEIPT NO. : 4/2/201 : FEBRUARY 20, 2019 RECEIVED DATE : ANALYSIS DATE : ANALYSIS DATE : CUSTOMER REPORT NO. : LAA034 : CUSTOMER METHOD OF ANALYSIS MPN/100 mL MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B) REOWN / BROWN / TURBID BROWN / BROWN / TURBID BROWN / BROWN / TURBID BROWN / BROWN / TURBID BROWN / BROWN / BROWN / BRO	: NEW YANGON DEVELOPMENT PROJECT : RESOURCE AND ENVIRONMENT MYANAMR CO.,LTD : B 702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR. TEL.+95973 : SW-4A, SW-4B, SW-4C : SURFACE WATER : SUBMITTAL/ RECEIPT NO. : 4/2/2019 : FEBRUARY 20, 2019 RECEIVED DATE : FEBRUARY 20, 2019 : FEBRUARY 20, 2019 : FEBRUARY 20, 2019 : CUSTOMER REPORT NO. : LAA034-LAA036/2019 : CUSTOMER REPORT NO. : L00034-L00036/2019 : CUSTOMER REPORT NO. : L00034-L00036/2019 MPN/100 mL MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B) BROWN / BROWN / BROWN / BROWN / BROWN / TURBID BROWN / BROWN / BROWN / BROWN / BROWN / DURBID			

SM : APHA/AWWAWEF STANDARD METHOD FOR THE EXAMINATION OF WATER AND WASTEWATER, 23rd EDITION, 2017



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PROJECT	: NEW YANGO	NEW YANGON DEVELOPMENT PROJECT						
CUSTOMER NAME	: RESOURCE	AND ENVIRONMENT MYANAMR CO.,LT	0					
ADDRESS	: B 702, DELT	A PLAZA, SHWEGONDAING ROAD, BAH	AN TOWNSHIP, Y	ANGON, MYANA	AR. TEL.+95973	3013448		
SAMPLING SOURCE	: SW-5A, SW-	5B, SW-5C						
SAMPLE TYPE	: SURFACE W	ATER SUB	MITTAL/ RECEIPT	ITTAL/ RECEIPT NO. : 4/2/2019				
SAMPLING DATE	MPLING DATE : FEBRUARY 20, 2019			: FEBRU	JARY 21, 2019			
SAMPLING TIME		ANA	LYSIS DATE	: FEBRU	JARY 21-MARCH 13, 2019			
SAMPLING METHOD	:-	ANA	ANALYSIS NO. : LAA037-LAA039/2019					
SAMPLING BY	: CUSTOMER	REP	REPORT NO. : L00037-L00039/2019					
			RESULT	RESULT	RESULT			
PARAMETER	UNIT	UNIT METHOD OF ANALYSIS		SW-5B	SW-5C	DETECTION LIMIT		
			LAA037/2019	LAA038/2019	LAA039/2019			
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQU (SM:9221 B)	160,000	>160,000	92,000	1.8		
SAMPLE CONDITION		And Carlo Charles and Anno 2000 and an anno 2000 a						
WATER'S COLOUR/TURBID			BROWN /	BROWN /	BROWN /			
SEDIMENT			TURBID BROWN	TURBID BROWN	TURBID BROWN			

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OJECT : N	EW YANGON									
		EW YANGON DEVELOPMENT PROJECT								
STOMER NAME : R	RESOURCE AN	D ENVIRONMENT MYANAMR	CO.,LTD							
DRESS : B	702, DELTA F	PLAZA, SHWEGONDAING ROA	D, BAHAN TOWNSHIP, Y	ANGON, MYANM	AR TEL +95973	013448				
MPLING SOURCE : SI	W-6A, SW-6B,	SW-6C				010110				
MPLE TYPE : SU	URFACE WAT	ER	SUBMITTAL/ RECEIPT NO 5/3/2019							
MPLING DATE : M	: MARCH 6,2019		RECEIVED DATE : MARCH 11 2019							
MPLING TIME :-	1-		ANALYSIS DATE : M		RCH 11-MARCH 31 2019					
MPLING METHOD :-	:-		ANALYSIS NO.	: LAA126	-LAA128/2019	2010				
MPLING BY : CU	USTOMER		REPORT NO.	: L00126-L00128/2019						
			RESULT	RESULT	RESULT	1				
PARAMETER	UNIT METHOD OF ANALY	METHOD OF ANALYSIS	SW-6A	SW-6B	SW-6C	DETECTION LIMIT				
			LAA126/2019	LAA127/2019	LAA128/2019					
AL COLIFORM MP	PN/100 mL ML	JLTIPLE TUBE FERMENTATION CHNIQUE (SM:9221 B)	>160,000	>160,000	54,000	1.8				
IPLE CONDITION	terreter entre entreterreterreterreterre	and the second								
ER'S COLOUR/TURBID			BROWN /	BROWN /	BROWN /					
IMENT			TURBID	TURBID	TURBID					
MPLING SOURCE : SI MPLE TYPE : SI MPLING DATE : M. MPLING DATE : M. MPLING TIME : - MPLING METHOD : - MPLING METHOD : - MPLING BY : CL PARAMETER AL COLIFORM MP ITERIA IPLE CONDITION TER'S COLOUR/TURBID	URFACE WAT IARCH 6,2019 USTOMER UNIT	METHOD OF ANALYSIS JUTIPLE TUBE FERMENTATION SCHNIQUE (SM:9221 B)	D, BAHAN TOWNSHIP, Y SUBMITTAL/ RECEIP RECEIVED DATE ANALYSIS DATE ANALYSIS NO. REPORT NO. RESULT SW-6A LAA126/2019 >160,000 BROWN / TURBID BROWN	<pre>/ANGON, MYANM /ANGON, MYANM /ANGON, SUBJECT</pre>	IAR. TEL.+95973 9 1 11, 2019 1 11-MARCH 31, 3-LAA128/2019 -L00128/2019 RESULT SW-5C LAA128/2019 54,000 BROWN / TURBID BROWN	013448 2019 DETEC1				

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PROJECT	· NEW VANC	NEW VANCON DEVELOPMENT DEOJECT						
TROJECT	. NEW TANG	SON DEVELOPMENT PROJECT						
CUSTOMER NAME	: RESOURCE	E AND ENVIRONMENT MYANAMR	CO.,LTD					
ADDRESS	: B 702, DEL	TA PLAZA, SHWEGONDAING ROA	D, BAHAN TOWNSHIP, Y	ANGON, MYANM	AR. TEL.+9597301:	3448		
SAMPLING SOURCE	: SW-7A, SW	I-7B, SW-7C						
SAMPLE TYPE	: SURFACE	WATER	SUBMITTAL/ RECEIPT NO. : 8/2/2019					
SAMPLING DATE	: FEBRUARY 22,2019		RECEIVED DATE : FEBRUARY 23, 2019					
SAMPLING TIME	:-		ANALYSIS DATE	ALYSIS DATE : FEBRUARY 23-MARCH 15, 2019				
SAMPLING METHOD			ANALYSIS NO. : LAA063-LAA065/2019					
SAMPLING BY	: CUSTOMER	२	REPORT NO. : L00063-L00065/2019					
	UNIT METHOD OF ANALYSI		RESULT	RESULT	RESULT			
PARAMETER		METHOD OF ANALYSIS	SW-7A	SW-7B	SW-7C	DETECTION		
			LAA063/2019	LAA064/2019	LAA065/2019	LIMIT		
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	>160,000	160,000	92,000	1.8		
SAMPLE CONDITION					**************************************			
WATER'S COLOUR/TURBID	- I		BROWN /	BROWN /	BROWN /			
			TURBID	TURBID	TURBID			
SEDIMENT			BROWN	BROWN	BROWN			

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PROJECT	: NEW YANGO	ON DEVELOPMENT PROJECT						
CUSTOMER NAME	: RESOURCE	AND ENVIRONMENT MYANAMR CO.,	LTD					
ADDRESS	: B 702, DELT	A PLAZA, SHWEGONDAING ROAD, BA	AHAN TOWNSHIP, YAN	GON, MYANMAR.	TEL.+9597301344	8		
SAMPLING SOURCE	: SW-8A, SW-8	BB, SW-8C						
SAMPLE TYPE	: SURFACE W	ATER SI	UBMITTAL/ RECEIPT NO	ITTAL/ RECEIPT NO. : 3/2/2019				
SAMPLING DATE	ATE : FEBRUARY 19,2019 RECEIV			: FEBRUARY	20, 2019			
SAMPLING TIME	:-	AI	NALYSIS DATE	: FEBRUARY	: FEBRUARY 20-MARCH 12, 2019			
SAMPLING METHOD	:- ANALY		NALYSIS NO.	: LAA025-LA	A027/2019			
SAMPLING BY	: CUSTOMER	RI	EPORT NO.	: L00025-L00	: L00025-L00027/2019			
			RESULT	RESULT	RESULT			
PARAMETER	UNIT	METHOD OF ANALYSIS	SW-8A	SW-8B	SW-8C	DETECTION		
			LAA025/2019	LAA026/2019	LAA027/2019	LIMIT		
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIC (SM:9221 B)	QUE 54,000	160,000	54,000	1.8		
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT			GREY / TURBID GREY	GREY / TURBID GREY	GREY / TURBID GREY			

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PROJECT	: NEW YANGON DEVELOPMENT PROJECT								
CUSTOMER NAME	: RESOURCE AND ENVIRONMENT MYANAMR CO.,LTD								
ADDRESS	: B 702, DEL	: B 702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR. TEL.+95973013448							
SAMPLING SOURCE	: SW-9A, SW-9B, SW-9C								
SAMPLE TYPE	: SURFACE WATER SU		SUBMITTAL/ RECEIPT	MITTAL/ RECEIPT NO. : 10/2/2019					
SAMPLING DATE	: FEBRUARY 24,2019		RECEIVED DATE	ED DATE : FEBRUARY 25, 2019					
SAMPLING TIME	÷-		ANALYSIS DATE	: FEBRUARY 25-MARCH 17, 2019					
SAMPLING METHOD			ANALYSIS NO.	ANALYSIS NO. : LAA075-LAA077/2019					
SAMPLING BY	: CUSTOMER	R	REPORT NO.	: L00075-L	.00077/2019				
	UNIT METHOD OF ANALYSIS		RESULT	RESULT	RESULT				
PARAMETER		SW-9A	SW-9B	SW-9C	DETECTION				
			LAA075/2019	LAA076/2019	LAA077/2019	LIMIT			
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM: 9221 B)	92,000	34,000	14,000	1.8			
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT	)		GREY / TURBID GREY	GREY / TURBID GREY	GREY / TURBID GREY				

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PROJECT	: NEW YANGON DEVELOPMENT PROJECT							
CUSTOMER NAME	: RESOURCE AND ENVIRONMENT MYANAMR CO.,LTD							
ADDRESS	: B 702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR. TEL.+95973013448							
SAMPLING SOURCE	: SW-10A, SW-10B, SW-10C							
SAMPLE TYPE	: SURFACE N	WATER	SUBMITTAL/ RECEIP	AL/ RECEIPT NO. : 8/3/2019				
SAMPLING DATE	: MARCH 9,2019		RECEIVED DATE	: MARC	H 18, 2019			
SAMPLING TIME			ANALYSIS DATE	: MARCH 18-APRIL 7 2019				
SAMPLING METHOD	: GRAB		ANALYSIS NO.	NALYSIS NO. : LAA162-LAA164/2019				
SAMPLING BY	: RU		REPORT NO. : L00162-L00164/2019					
	UNIT METHOD OF ANALYSIS		RESULT	RESULT RESULT RES	RESULT			
PARAMETER		SW-10A	SW-10B	SW-10C	DETECTION LIMIT			
		LAA162/2019	LAA163/2019	LAA164/2019				
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	160,000	24,000	1,600	1.8		
SAMPLE CONDITION								
WATER'S COLOUR/TURBID		COLORLESS /	COLORLESS /	COLORLESS /				
SEDIMENT			GREY	TURBID GREY	TURBID			

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PROJECT	: NEW YANGON DEVELOPMENT PROJECT							
CUSTOMER NAME	: RESOURCE AND ENVIRONMENT MYANAMR CO., LTD							
ADDRESS	: B 702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR, TEL, +95973013448							
SAMPLING SOURCE	: SW-11A, SW-11B, SW-11C							
SAMPLE TYPE	: SURFACE	WATER	SUBMITTAL/ RECEIPT	UBMITTAL/ RECEIPT NO. : 9/2/2019				
SAMPLING DATE	: FEBRUARY 21,2019		RECEIVED DATE	RECEIVED DATE : FEBRUARY 24 2019				
SAMPLING TIME			ANALYSIS DATE	: FEBRUARY 24-MARCH 16 2010				
SAMPLING METHOD			ANALYSIS NO.	: LAA069-LAA071/2019				
SAMPLING BY	: CUSTOMER	२ -	REPORT NO. : L00069-L00071/2019					
	UNIT METHOD OF ANALYSIS		RESULT	RESULT	RESULT	1		
PARAMETER		SW-11A	SW-11B	SW-11C	DETECTION LIMIT			
		LAA069/2019	LAA070/2019	LAA071/2019				
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	>160,000	>160,000	>160,000	1.8		
SAMPLE CONDITION	d	land the second s						
WATER'S COLOUR/TURBID SEDIMENT		BROWN / TURBID BROWN	BROWN / TURBID	BROWN / TURBID				

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PROJECT	: NEW YANGON DEVELOPMENT PROJECT							
CUSTOMER NAME	: RESOURCE AND ENVIRONMENT MYANAMR CO.,LTD							
ADDRESS	: B 702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR, TEL, +95973013448							
SAMPLING SOURCE	: SW-12A, SW-12B, SW-12C							
SAMPLE TYPE	: SURFACE	WATER	SUBMITTAL/ RECEIPT	NO. : 12/2/20	19			
SAMPLING DATE	: FEBRUARY 23,2019		RECEIVED DATE	RECEIVED DATE : FEBRUARY 28 2019				
SAMPLING TIME	10 <sup>-1</sup>		ANALYSIS DATE	: FEBRUARY 28-MARCH 22, 2019				
SAMPLING METHOD	14		ANALYSIS NO.	YSIS NO. : LAA087-LAA089/2019				
SAMPLING BY	: CUSTOMER	र	REPORT NO.	REPORT NO. : L00087-L00089/2019				
	UNIT METHOD OF ANALYSIS	METHOD OF ANALYSIS	RESULT	RESULT	RESULT			
PARAMETER			SW-12A	SW-12B	SW-12C	DETECTION		
		LAA087/2019	LAA088/2019	LAA089/2019	LIMIT			
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	35,000	13,000	7,900	1.8		
SAMPLE CONDITION		dan dan series and a series of the series of						
WATER'S COLOUR/TURBID		GREY /	GREY /	GREY /				
SEDIMENT		TURBID GREY	TURBID	TURBID				

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PROJECT	: NEW YANG	: NEW YANGON DEVELOPMENT PROJECT							
CUSTOMER NAME	: RESOURC	: RESOURCE AND ENVIRONMENT MYANAMR CO., LTD							
ADDRESS	: B 702, DEL	: B 702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR, TEL +95973013448							
SAMPLING SOURCE	: SW-13A, S	: SW-13A, SW-13B, SW-13C							
SAMPLE TYPE	: SURFACE	: SURFACE WATER SUBMITTAL/ RECEIPT NO. : 12/2/2019							
SAMPLING DATE	: FEBRUARY	23,2019	RECEIVED DATE : FEBRUARY		JARY 28, 2019				
SAMPLING TIME			ANALYSIS DATE	22 2019					
SAMPLING METHOD	:-		ANALYSIS NO. : LAA090-LAA092/2019		22, 2010				
SAMPLING BY	: CUSTOME	र	REPORT NO. : L00090-L00092/2019						
	UNIT METHOD OF ANALYSIS		RESULT	RESULT	RESULT				
PARAMETER		METHOD OF ANALYSIS	SW-13A	SW-13B	SW-13C	DETECTION LIMIT			
			LAA090/2019	LAA091/2019	LAA092/2019				
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	92,000	11,000	13,000	1.8			
SAMPLE CONDITION				l 					
WATER'S COLOUR/TURBID			GREY /	GREY /	GREY /				
SEDIMENT			TURBID	TURBID	TURBID				

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PROJECT	: NEW YANGON DEVELOPMENT PROJECT								
CUSTOMER NAME	: RESOURCE	: RESOURCE AND ENVIRONMENT MYANAMR CO.,LTD							
ADDRESS	: B 702, DELT	: B 702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR, TEL:+95973013448							
SAMPLING SOURCE	: SW-14A, SW	: SW-14A, SW-14B, SW-14C							
SAMPLE TYPE	: SURFACE V	VATER	SUBMITTAL/ RECEIP	SUBMITTAL/ RECEIPT NO. : 6/3/2019					
SAMPLING DATE	: MARCH 8,20	019	RECEIVED DATE	RECEIVED DATE : MARCH 13 2019					
SAMPLING TIME	:-		ANALYSIS DATE	: MARC	H 13-APRIL 2 . 20	19			
SAMPLING METHOD	: GRAB	: GRAB		ANALYSIS NO. : LAA144-LAA146/2019					
SAMPLING BY	: RU		REPORT NO. : L00144-L00146/2019						
	UNIT METHOD OF ANALYSIS		RESULT	RESULT	RESULT	1			
PARAMETER		SW-14A	SW-14B	SW-14C	DETECTION LIMIT				
			LAA144/2019	LAA145/2019	LAA146/2019				
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	92,000	24,000	54,000	1.8			
SAMPLE CONDITION									
WATER'S COLOUR/TURBID			COLORLESS / TURBID	COLORLESS / TURBID	COLORLESS / TURBID				
SEDIMENT			GREY	GREY	GREY				

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PROJECT	: NEW YANG	NEW YANGON DEVELOPMENT PROJECT							
CUSTOMER NAME	: RESOURC	: RESOURCE AND ENVIRONMENT MYANAMR CO.,LTD							
ADDRESS	: B 702, DEL	: B 702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR, TEL, +95973013448							
SAMPLING SOURCE	: SW-15A, SI	SW-15A, SW-15B, SW-15C							
SAMPLE TYPE	: SURFACE	WATER	SUBMITTAL/ RECEIP	SUBMITTAL/ RECEIPT NO : 3/3/2019					
SAMPLING DATE	: MARCH 2,2019 : - : -		RECEIVED DATE MARC		H 5, 2019				
SAMPLING TIME			ANALYSIS DATE : MARCH 5-MARCH 25, 201			9			
SAMPLING METHOD			ANALYSIS NO.	-					
SAMPLING BY	: CUSTOMER		REPORT NO. : L00099-L00101/2019						
	UNIT METHOD OF ANALYSIS		RESULT	RESULT	RESULT				
PARAMETER		SW-15A	SW-15B	SW-15C	DETECTION				
		LAA099/2019	LAA100/2019	LAA101/2019	LIMIT				
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	4,700	4,700	13,000	1.8			
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT			GREY / TURBID GREY	GREY / TURBID	GREY / TURBID				

SM : APHA/AWWA/WEF STANDARD METHOD FOR THE EXAMINATION OF WATER AND WASTEWATER, 23<sup>rd</sup> EDITION, 2017

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PROJECT	: NEW YANGON DEVELOPMENT PROJECT									
CUSTOMER NAME	: RESOURCE	: RESOURCE AND ENVIRONMENT MYANAMR CO., LTD								
ADDRESS	: B 702, DEL	: B 702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR, TEL +95973013448								
SAMPLING SOURCE	: SW-16A, SI	: SW-16A, SW-16B, SW-16C								
SAMPLE TYPE	: SURFACE	WATER	SUBMITTAL/ RECEIP	SUBMITTAL/ RECEIPT NO. : 3/3/2019						
SAMPLING DATE	: MARCH 2,2019		RECEIVED DATE : MARCH 5 2019							
SAMPLING TIME	17		ANALYSIS DATE : MARCH 5-MARCH 25 2019							
SAMPLING METHOD	:-		ANALYSIS NO. : LAA102-LAA104/2019							
SAMPLING BY	: CUSTOMER	R	REPORT NO. : L00102-L00104/2019							
			RESULT	RESULT	RESULT					
PARAMETER	UNIT	NIT METHOD OF ANALYSIS	SW-16A	SW-16B	SW-16C	DETECTION				
			LAA102/2019	LAA103/2019	LAA104/2019	LIMIT				
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	4,700	7,900	3,400	1.8				
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT			GREY / TURBID GREY	GREY / TURBID GREY	GREY / TURBID GREY					

SM : APHA/AWWAWEF STANDARD METHOD FOR THE EXAMINATION OF WATER AND WASTEWATER, 23<sup>rd</sup> EDITION, 2017

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PROJECT	: NEW YANGON DEVELOPMENT PROJECT							
CUSTOMER NAME	: RESOURCE	: RESOURCE AND ENVIRONMENT MYANAMR CO.,LTD						
ADDRESS	: B 702, DEL	: B 702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR, TEL, +95973013448						
SAMPLING SOURCE	: SW-17A, S	: SW-17A, SW-17B, SW-17C						
SAMPLE TYPE	: SURFACE	WATER	SUBMITTAL/ RECEIPT	SUBMITTAL/ RECEIPT NO. : 4/2/2019				
SAMPLING DATE	: FEBRUARY 20,2019		RECEIVED DATE : FEBRUARY 21, 2019					
SAMPLING TIME	2 F		ANALYSIS DATE	ANALYSIS DATE : FEBRUARY 21-MARCH 13 2019				
SAMPLING METHOD	:-		ANALYSIS NO. : LAA040-LAA042/2019					
SAMPLING BY	: CUSTOMER	2	REPORT NO. : L00040-L00042/2019					
	UNIT	METHOD OF ANALYSIS	RESULT	RESULT	RESULT			
PARAMETER			SW-17A	SW-17B	SW-17C	DETECTION		
			LAA040/2019	LAA041/2019	LAA042/2019	LIMIT		
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	>160,000	>160,000	>160,000	1.8		
SAMPLE CONDITION								
WATER'S COLOUR/TURBID			DARK BROWN / VERY TURBID	DARK BROWN /				
SEDIMENT		DARK	DARK	DARK				

SM : APHA/AWWA/WEF STANDARD METHOD FOR THE EXAMINATION OF WATER AND WASTEWATER, 23rd EDITION, 2017

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PROJECT	: NEW YANGON DEVELOPMENT PROJECT							
CUSTOMER NAME	: RESOURCE	: RESOURCE AND ENVIRONMENT MYANAMR CO., LTD						
ADDRESS	: B 702, DEL	: B 702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR, TEL +95973013448						
SAMPLING SOURCE	: SW-18A, SW-18B, SW-18C							
SAMPLE TYPE	: SURFACE	WATER	SUBMITTAL/ RECEIPT	JBMITTAL/ RECEIPT NO. : 4/2/2019				
SAMPLING DATE	: FEBRUARY	/ 20,2019	RECEIVED DATE : FEBRUARY 21 2019					
SAMPLING TIME	1.4		ANALYSIS DATE	ANALYSIS DATE : FEBRUARY 21-MARCH 13 2019				
SAMPLING METHOD	3. <del></del>		ANALYSIS NO.	ANALYSIS NO. : LAA043-LAA045/2019				
SAMPLING BY	: CUSTOMER		REPORT NO.	REPORT NO. : L00043-L00045/2019				
	UNIT METHOD OF ANALYSI		RESULT	RESULT	RESULT			
PARAMETER		METHOD OF ANALYSIS	SW-18A	SW-18B	SW-18C	DETECTION LIMIT		
			LAA043/2019	LAA044/2019	LAA045/2019			
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	>160,000	>160,000	>160,000	1.8		
SAMPLE CONDITION								
WATER'S COLOUR/TURBID			BROWN /	BROWN /	BROWN /			
SEDIMENT		TURBID BROWN	TURBID BROWN	TURBID				

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PROJECT	: NEW YANGON DEVELOPMENT PROJECT							
CUSTOMER NAME	: RESOURCE AND ENVIRONMENT MYANAMR CO.,LTD							
ADDRESS	: B 702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR, TEL +95973013448							
SAMPLING SOURCE	: SW-19A, SW-19B, SW-19C							
SAMPLE TYPE	: SURFACE \	WATER	SUBMITTAL/ RECEIPT	NO. : 4/3/201	19			
SAMPLING DATE	: MARCH 5,2	019	RECEIVED DATE : MARCH 7, 2019					
SAMPLING TIME			ANALYSIS DATE	ANALYSIS DATE : MARCH 7-MARCH 27 2019				
SAMPLING METHOD	:-		ANALYSIS NO. : LAA120-LAA122/2019					
SAMPLING BY	: CUSTOMER	R	REPORT NO. : L00120-L00122/2019					
	UNIT METHOD OF A		RESULT	RESULT	RESULT			
PARAMETER		METHOD OF ANALYSIS	SW-19A	SW-19B	SW-19C	DETECTION LIMIT		
-			LAA120/2019	LAA121/2019	LAA122/2019			
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	>160,000	>160,000	>160,000	1.8		
SAMPLE CONDITION								
WATER'S COLOUR/TURBID		GREY /	GREY /	GREY /				
SEDIMENT		TURBID GREY	TURBID GREY	TURBID GREY				

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PROJECT	: NEW YANGON DEVELOPMENT PROJECT								
CUSTOMER NAME	: RESOURCE	: RESOURCE AND ENVIRONMENT MYANAMR CO.,LTD							
ADDRESS	: B 702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR. TEL.+95973013448								
SAMPLING SOURCE	: SW-20A, SW-20B, SW-20C								
SAMPLE TYPE	: SURFACE	WATER	SUBMITTAL/ RECEIPT NO. : 6/3/2019						
SAMPLING DATE	: MARCH 7,2	019	RECEIVED DATE : MARCH 13, 2019						
SAMPLING TIME	:-		ANALYSIS DATE : MARCH 13-APRIL 2 . 2019						
SAMPLING METHOD	: GRAB		ANALYSIS NO.	: LAA141	: LAA141-LAA143/2019				
SAMPLING BY	: RU		REPORT NO.	: L00141	-L00143/2019				
		JNIT METHOD OF ANALYSIS	RESULT	RESULT	RESULT				
PARAMETER	UNIT		SW-20A	SW-20B	SW-20C	DETECTION			
			LAA141/2019	LAA142/2019	LAA143/2019	LIMIT			
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	160,000	>160,000	>160,000	1.8			
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT		**************************************	GREY / TURBID BROWN	GREY / TURBID BROWN	GREY / TURBID BROWN				

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PROJECT	: NEW YANGON DEVELOPMENT PROJECT								
CUSTOMER NAME	: RESOURCE AND ENVIRONMENT MYANAMR CO.,LTD								
ADDRESS	: B 702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR. TEL.+95973013448								
SAMPLING SOURCE	: SW-21A, SV	: SW-21A, SW-21B, SW-21C							
SAMPLE TYPE	: SURFACE	WATER	SUBMITTAL/ RECEIP	SUBMITTAL/ RECEIPT NO. : 5/3/2019					
SAMPLING DATE	: MARCH 7,2019		RECEIVED DATE : MARCH 11, 2019		1 11, 2019				
SAMPLING TIME	1.4		ANALYSIS DATE : MARCH 1		111-MARCH 31, 2019				
SAMPLING METHOD	:-		ANALYSIS NO.	: LAA132-LAA134/2019					
SAMPLING BY	: CUSTOMER	2	REPORT NO. : L00132-L00134/2019						
		IT METHOD OF ANALYSIS	RESULT	RESULT	RESULT				
PARAMETER	UNIT		SW-21A	SW-21B	SW-21C	DETECTION			
			LAA132/2019	LAA133/2019	LAA134/2019	LIMIT			
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	>160,000	92,000	>160,000	1.8			
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT			GREY / TURBID GREY	GREY / TURBID GREY	GREY / TURBID GREY				

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PROJECT	: NEW YANG	W YANGON DEVELOPMENT PROJECT						
CUSTOMER NAME	: RESOURCE	SOURCE AND ENVIRONMENT MYANAMR CO., LTD						
ADDRESS	: B 702, DEL	TA PLAZA, SHWEGONDAING ROA	D, BAHAN TOWNSHIP, Y	ANGON, MYANM	IAR. TEL.+959730	13448		
SAMPLING SOURCE	: SW-22A, SV	N-22B, SW-22C						
SAMPLE TYPE	: SURFACE \	WATER	SUBMITTAL/ RECEIPT	SUBMITTAL/ RECEIPT NO. : 8/3/2019				
SAMPLING DATE	: MARCH 9,2019		RECEIVED DATE	: MARCH	1 18, 2019			
SAMPLING TIME			ANALYSIS DATE : MARCH 18-APRIL 7. 2		1 18-APRIL 7, 201	9		
SAMPLING METHOD	: GRAB		ANALYSIS NO. : LAA16		5-LAA167/2019			
SAMPLING BY	: RU		REPORT NO.	: L00165	-L00167/2019			
			RESULT	RESULT	RESULT	1		
PARAMETER	UNIT	METHOD OF ANALYSIS	SW-22A	SW-22B	SW-22C	DETECTION LIMIT		
			LAA165/2019	LAA166/2019	LAA167/2019			
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	>160,000	160,000	>160,000	1.8		
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT			GREY / TURBID BLACK	GREY / TURBID BLACK	GREY / TURBID BLACK			

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PROJECT	: NEW YANGO	YANGON DEVELOPMENT PROJECT					
CUSTOMER NAME	: RESOURCE	DURCE AND ENVIRONMENT MYANAMR CO., LTD					
ADDRESS	: B 702, DELT	A PLAZA, SHWEGONDAING ROAD, B	AHAN TOWNSHIP, YAN	GON, MYANMAR	. TEL.+959730134	48	
SAMPLING SOURCE	: SW-23A, SW	3A, SW-23B, SW-23C					
SAMPLE TYPE	: SURFACE W	ATER S	UBMITTAL/ RECEIPT NO	<b>D</b> . : 3/2/2019			
SAMPLING DATE	: FEBRUARY	19,2019 R	ECEIVED DATE	: FEBRUAR	Y 20, 2019		
SAMPLING TIME	:-	:- ANA :- ANA		: FEBRUAR	: FEBRUARY 20-MARCH 12, 2019 : LAA028-LAA030/2019		
SAMPLING METHOD	:-			: LAA028-LA			
SAMPLING BY	: CUSTOMER	R	EPORT NO.	: L00028-L0	0030/2019		
			RESULT	RESULT	RESULT		
PARAMETER	UNIT	METHOD OF ANALYSIS	SW-23A	SW-23B	SW-23C	DETECTION	
			LAA028/2019	LAA029/2019	LAA030/2019	LIMIT	
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHN (SM:9221 B)	IQUE 35,000	>160,000	160,000	1.8	
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT			GREY / TURBID	GREY / TURBID	GREY / TURBID		

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PROJECT	: NEW YANG	ON DEVELOPMENT PROJECT						
CUSTOMER NAME	: RESOURCE	RESOURCE AND ENVIRONMENT MYANAMR CO.,LTD						
ADDRESS	: B 702, DEL	TA PLAZA, SHWEGONDAING ROA	D, BAHAN TOWNSHIP, Y	ANGON, MYANN	IAR. TEL.+95973	013448		
SAMPLING SOURCE	: SW-24A, SN	W-24A, SW-24B, SW-24C						
SAMPLE TYPE	: SURFACE	SURFACE WATER SUBMITTAL/ RECEIPT NO. : 3/2/2019						
SAMPLING DATE	: FEBRUARY	19,2019	RECEIVED DATE	: FEBRU	ARY 20, 2019	·		
SAMPLING TIME	*		ANALYSIS DATE	: FEBRU	ARY 20-MARCH	12, 2019		
SAMPLING METHOD	:-		ANALYSIS NO. : LAA031-LAA033/2019					
SAMPLING BY	: CUSTOMER	: CUSTOMER REPORT NO. : L00031-L00033/2019						
			RESULT	RESULT	RESULT			
PARAMETER	UNIT	UNIT METHOD OF ANALYSIS	SW-24A	SW-24B	SW-24C	DETECTION LIMIT		
			LAA031/2019	LAA032/2019	LAA033/2019			
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	>160,000	>160,000	54,000	1.8		
SAMPLE CONDITION			11.0001 (					
WATER'S COLOUR/TURBID			BROWN /	BROWN /	BROWN /			
SEDIMENT			TURBID	TURBID	TURBID			
SEDIMENT			BROWN	BROWN	BROWN			

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PROJECT	: NEW YANG	ON DEVELOPMENT PROJECT						
CUSTOMER NAME	: RESOURCE	RESOURCE AND ENVIRONMENT MYANAMR CO.,LTD						
ADDRESS	: B 702, DELT	702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR, TEL, +95973013448						
SAMPLING SOURCE	: GW-1A, GW	-1B, GW-1C				10110		
SAMPLE TYPE	: GROUNDW	GROUNDWATER SUBMITTAL/ RECEIPT NO. : 11/2/2019						
SAMPLING DATE	: FEBRUARY	17,2019	RECEIVED DATE	: FEBRI	JARY 18, 2019			
SAMPLING TIME	:-		ANALYSIS DATE : FEBRUARY 18-MARCH 10, 2019 ANALYSIS NO. : LAA093-LAA095/2019			10 2019		
SAMPLING METHOD	i -							
SAMPLING BY	: CUSTOMER		REPORT NO.	: L0009	3-L00095/2019			
			RESULT	RESULT	RESULT			
PARAMETER	UNIT	METHOD OF ANALYSIS	GW-1A	GW-1B	GW-1C	DETECTION LIMIT		
			LAA093/2019	LAA094/2019	LAA095/2019	]		
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM 2012:9221 B)	<1.8	<1.8	<1.8	1.8		
SAMPLE CONDITION								
WATER'S COLOUR/TURBID			COLORLESS /	COLORLESS /	COLORLESS /			

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PROJECT	: NEW YANG	NEW YANGON DEVELOPMENT PROJECT						
CUSTOMER NAME	: RESOURCE	ESOURCE AND ENVIRONMENT MYANAMR CO.,LTD						
ADDRESS	: B 702, DEL	702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR. TEL.+95973013448						
SAMPLING SOURCE	: GW-2A, GW	V-2B, GW-2C						
SAMPLE TYPE	: GROUND V	ROUND WATER SUBMITTAL/ RECEIPT NO. : 10/2/2019						
SAMPLING DATE	: FEBRUARY	24,2019	RECEIVED DATE	: FEBRL	JARY 25, 2019			
SAMPLING TIME			ANALYSIS DATE	: FEBRU	JARY 25-MARCH 17	2019		
SAMPLING METHOD	1-		ANALYSIS NO. : LAA078-LAA080/2019					
SAMPLING BY	: CUSTOMER	R	REPORT NO.	: L00078	3-L00080/2019			
			RESULT	RESULT	RESULT	1		
PARAMETER	UNIT	METHOD OF ANALYSIS	GW-2A	GW-2B	GW-2C	DETECTION		
			LAA078/2019	LAA079/2019	LAA080/2019	LIMIT		
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM: 9221 B)	450	680	200	1.8		
SAMPLE CONDITION	h			_				
WATER'S COLOUR/TURBID			COLORLESS/	COLORLESS/	COLORLESS/			
SEDIMENT	- 74		CLEAR	CLEAR	CLEAR			

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PROJECT	: NEW YANG	EW YANGON DEVELOPMENT PROJECT					
CUSTOMER NAME	: RESOURCE	OURCE AND ENVIRONMENT MYANAMR CO.,LTD					
ADDRESS	: B 702, DEL	TA PLAZA, SHWEGONDAING ROA	D, BAHAN TOWNSHIP, Y	ANGON, MYANM	AR. TEL.+95973013	3448	
SAMPLING SOURCE	: GW-3A, GW	/-3B, GW-3C					
SAMPLE TYPE	: GROUND W	VATER	SUBMITTAL/ RECEIPT	NO. : 10/2/20	19		
SAMPLING DATE	: FEBRUARY	24,2019	RECEIVED DATE	: FEBRU	ARY 25, 2019		
SAMPLING TIME	:-		ANALYSIS DATE	: FEBRU	ARY 25-MARCH 17	, 2019	
SAMPLING METHOD	:-		ANALYSIS NO.	ANALYSIS NO. : LAA081-LAA083/2019			
SAMPLING BY	: CUSTOMER	R	REPORT NO.	: L00081-	L00083/2019		
SAMPLING BY			RESULT	RESULT	RESULT		
PARAMETER	UNIT	METHOD OF ANALYSIS	GW-3A	GW-3B	GW-3C	DETECTION	
			LAA081/2019	, YANGON, MYANMAR. TEL.+959 IPT NO. : 10/2/2019 : FEBRUARY 25, 2019 : FEBRUARY 25-MARC : LAA081-LAA083/2019 : L00081-L00083/2019 RESULT RESULT GW-3B GW-3C JAA082/2019 LAA083/20 7,900 <1.8 GREY / GREY / TURBID TURBID GREY BROWN	LAA083/2019	LIMIT	
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM: 9221 B)	<1.8	7,900	<1.8	1.8	
SAMPLE CONDITION			********				
WATER'S COLOUR/TURBIE	)		GREY /	GREY /	GREY /		
SEDIMENT			TURBID	TURBID	TURBID		
OLDIWENT			GREY	GREY	BROWN	4	

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PROJECT	: NEW YANG	IEW YANGON DEVELOPMENT PROJECT					
CUSTOMER NAME	: RESOURCE	RESOURCE AND ENVIRONMENT MYANAMR CO., LTD					
ADDRESS	: B 702, DELT	702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR. TEL.+95973013448					
SAMPLING SOURCE	: GW-4A, GW	GW-4A, GW-4B, GW-4C					
SAMPLE TYPE	: GROUNDWA	: GROUNDWATER S : MARCH 5, 2019 R		SUBMITTAL/ RECEIPT NO. : 4/3/2019			
SAMPLING DATE	: MARCH 5, 2			: MARC	H 7, 2019		
SAMPLING TIME			ANALYSIS DATE : MARCH 7-MARCH 27, 2019			9	
SAMPLING METHOD	:-		ANALYSIS NO.	INALYSIS NO. : LAA111-LAA113/2019			
SAMPLING BY	: CUSTOMER		REPORT NO.	<b>REPORT NO.</b> : L00111-L00113/2019			
			RESULT	RESULT	RESULT		
PARAMETER	UNIT	METHOD OF ANALYSIS	OJECT AYANAMR CO.,LTD AING ROAD, BAHAN TOWNSHIP, YANGON, MYANMA SUBMITTAL/ RECEIPT NO. : 4/3/2019 RECEIVED DATE : MARCH : ANALYSIS DATE : MARCH : ANALYSIS NO. : LAA111-L REPORT NO. : LO0111-L REPORT NO. : L00111-L MALYSIS GW-4A GW-4B LAA111/2019 LAA112/2019 NTATION 200 930 () COLORLESS / COLORLESS / TURBID TURBID GREY GREY	GW-4B	GW-4C	DETECTION	
				LAA113/2019	LIMIT		
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	200	930	200	1.8	
SAMPLE CONDITION		Anna an			10000110001000000000000000000000000000		
WATER'S COLOUR/TURBIE	)		COLORLESS / TURBID	COLORLESS / TURBID	COLORLESS / TURBID		
SEDIMENT			GREY	GREY	GREY		

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PROJECT	: NEW YANG	EW YANGON DEVELOPMENT PROJECT						
CUSTOMER NAME	: RESOURCE	ESOURCE AND ENVIRONMENT MYANAMR CO., LTD						
ADDRESS	: B 702, DEL	702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR. TEL.+95973013448						
SAMPLING SOURCE	: GW-5A, GW	N-5A, GW-5B, GW-5C						
SAMPLE TYPE	: GROUNDW	GROUNDWATER SUBMITTAL/ RECEIPT NO. : 4/3/2019			9			
SAMPLING DATE	: MARCH 5,2	: MARCH 5,2019 REC		: MARCI	4 7, 2019			
SAMPLING TIME			ANALYSIS DATE	NALYSIS DATE : MARCH 7-MARCH 27, 2019				
SAMPLING METHOD	:-		ANALYSIS NO.	NALYSIS NO. : LAA114-LAA116/2019				
SAMPLING BY	: CUSTOMER	R	REPORT NO.	: L00114	-L00116/2019			
			RESULT	RESULT	RESULT			
PARAMETER	UNIT	METHOD OF ANALYSIS	GW-5A	GW-5B	GW-5C	DETECTION LIMI		
			LAA114/2019	LAA115/2019	LAA116/2019			
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	200	450	<1.8	1.8		
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT			GREY / TURBID GREY	GREY / TURBID GREY	GREY / TURBID GREY			

SM : APHA/AWWA/WEF STANDARD METHOD FOR THE EXAMINATION OF WATER AND WASTEWATER, 23<sup>rd</sup> EDITION, 2017

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DATE APRIL 3,2019

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PROJECT	: NEW YANG	V YANGON DEVELOPMENT PROJECT						
CUSTOMER NAME	: RESOURC	SOURCE AND ENVIRONMENT MYANAMR CO.,LTD						
ADDRESS	: B 702, DEL	702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR, TEL +95973013448						
SAMPLING SOURCE	: GW-6A, GV	W-6A, GW-6B, GW-6C						
SAMPLE TYPE	: GROUNDW	ATER	SUBMITTAL/ RECEIP	SUBMITTAL/ RECEIPT NO. : 4/3/2019				
SAMPLING DATE	: MARCH 5,2	: MARCH 5,2019		: MARCI	H 7. 2019			
SAMPLING TIME	14		ANALYSIS DATE : MARCH 7-MARCH 27			019		
SAMPLING METHOD	1		ANALYSIS NO. : LAA117-LAA119/2019					
SAMPLING BY	: CUSTOMER	2	REPORT NO.	: L00117	-L00119/2019			
			RESULT	RESULT	RESULT	1		
PARAMETER	UNIT	METHOD OF ANALYSIS	GW-6A	GW-6B	GW-6C	DETECTION LIMIT		
			LAA117/2019	LAA118/2019	LAA119/2019	1		
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	680	680	200	1.8		
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT			GREY / TURBID GREY	GREY / TURBID	GREY / TURBID			

SM : APHA/AWWAWEF STANDARD METHOD FOR THE EXAMINATION OF WATER AND WASTEWATER, 23<sup>rd</sup> EDITION, 2017

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PROJECT	: NEW YANG	VYANGON DEVELOPMENT PROJECT						
CUSTOMER NAME	: RESOURCI	SOURCE AND ENVIRONMENT MYANAMR CO.,LTD						
ADDRESS	: B 702, DEL	02, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR. TEL.+95973013448						
SAMPLING SOURCE	: GW-7A, GV	N-7A, GW-7B, GW-7C						
SAMPLE TYPE	: GROUNDW	ATER	SUBMITTAL/ RECEIP	T NO. : 5/3/201	19			
SAMPLING DATE	: MARCH 6,2	: MARCH 6,2019		: MARCI	H 11, 2019			
SAMPLING TIME	24-		ANALYSIS DATE	IALYSIS DATE : MARCH 11-MARCH 31, 2019				
SAMPLING METHOD	:-		ANALYSIS NO. : LAA123-LAA125/2019					
SAMPLING BY	: CUSTOME	र	REPORT NO.	: L00123	3-L00125/2019			
			RESULT	RESULT	RESULT	1		
PARAMETER	UNIT	METHOD OF ANALYSIS	GW-7A	GW-7B	GW-7C	DETECTION		
	AMPLE TYPE : GROUNDWATER   AMPLING DATE : MARCH 6,2019   AMPLING TIME : -   AMPLING METHOD : -   AMPLING BY : CUSTOMER   PARAMETER UNIT   DTAL COLIFORM MPN/100 mL MULTIF   ACTERIA TECHN		LAA123/2019	LAA124/2019	LAA125/2019	LIMIT		
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	680	200	1,400	1.8		
SAMPLE CONDITION	-Pannet out introduced							
WATER'S COLOUR/TURBIE	)		COLORLESS / TURBID	COLORLESS / TURBID	COLORLESS / TURBID			
SEDIMENT			DARK	DARK	DARK			

SM : APHA/AWWAWEF STANDARD METHOD FOR THE EXAMINATION OF WATER AND WASTEWATER, 23<sup>rd</sup> EDITION, 2017



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PROJECT	: NEW YANG	W YANGON DEVELOPMENT PROJECT					
CUSTOMER NAME	: RESOURC	E AND ENVIRONMENT MYANAMR	CO.,LTD				
ADDRESS	: B 702, DEL	702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR, TEL +95973013448					
SAMPLING SOURCE	: GW-8A, GV	V-8A, GW-8B, GW-8C					
SAMPLE TYPE	: GROUNDW	ATER	SUBMITTAL/ RECEIP	SUBMITTAL/ RECEIPT NO. : 7/2/2019			
SAMPLING DATE	: FEBRUARY	: FEBRUARY 21,2019 RE		: FEBRU	ARY 23, 2019		
SAMPLING TIME	:-		ANALYSIS DATE	2019			
SAMPLING METHOD	: GRAB		ANALYSIS NO. : LAA048-LAA050/2019				
SAMPLING BY	: CUSTOMER	۲ 🗖	REPORT NO.	: L00048	-L00050/2019		
			RESULT	RESULT	RESULT		
PARAMETER	UNIT	METHOD OF ANALYSIS	GW-8A	GW-8B	GW-8C	DETECTION	
			LAA048/2019	LAA049/2019	LAA050/2019	LIMIT	
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	4,000	1,100	2,100	1.8	
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT		L	GREY / TURBID GREY	GREY / TURBID GREY	GREY / TURBID GREY		

SM : APHA/AWWA/WEF STANDARD METHOD FOR THE EXAMINATION OF WATER AND WASTEWATER, 23<sup>rd</sup> EDITION, 2017

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PROJECT	: NEW YANG	ON DEVELOPMENT PROJECT				
CUSTOMER NAME	: RESOURCE	SOURCE AND ENVIRONMENT MYANAMR CO., LTD				
ADDRESS	: B 702, DELT	A PLAZA, SHWEGONDAING ROAD	, BAHAN TOWNSHIP, Y	ANGON, MYANMA	R. TEL.+959730134	148
SAMPLING SOURCE	: GW-9A, GW-	-9B, GW-9C				110
SAMPLE TYPE	: GROUNDWA	ATER	SUBMITTAL/ RECEIP	TNO. : 8/2/201	9	
SAMPLING DATE	: FEBRUARY	: FEBRUARY 22,2019		: FEBRU	ARY 23, 2019	
SAMPLING TIME	1.4		ANALYSIS DATE	ANALYSIS DATE : FEBRUARY 23-MARCH 15, 2019		
SAMPLING METHOD	:-		ANALYSIS NO.	: LAA054	-LAA056/2019	2010
SAMPLING BY	: CUSTOMER		REPORT NO.	: L00054	L00056/2019	
			RESULT	RESULT	RESULT	
PARAMETER	UNIT	METHOD OF ANALYSIS	GW-9A	GW-9B	GW-9C	DETECTION
			LAA054/2019	LAA055/2019	LAA056/2019	LIMIT
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	1,700	680	1,400	1.8
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT	)		GREY / TURBID GREY	GREY / TURBID GREY	GREY / TURBID GREY	

SM : APHA/AWWA/WEF STANDARD METHOD FOR THE EXAMINATION OF WATER AND WASTEWATER, 23<sup>rd</sup> EDITION, 2017

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PROJECT	: NEW YANG	NEW YANGON DEVELOPMENT PROJECT					
CUSTOMER NAME	: RESOURCE	E AND ENVIRONMENT MYANAMR	CO.,LTD				
ADDRESS	: B 702, DEL	TA PLAZA, SHWEGONDAING ROA	D, BAHAN TOWNSHIP.	YANGON, MYANI	MAR TEL +959730	113448	
SAMPLING SOURCE	: GW-10A, G	W-10B, GW-10C				10440	
SAMPLE TYPE	: GROUNDW	ATER	SUBMITTAL/ RECEIP	T NO. : 7/3/20	19		
SAMPLING DATE	: MARCH 8,2	2019	RECEIVED DATE	: MARC	H 14. 2019		
SAMPLING TIME	:-		ANALYSIS DATE	: MARC	H 14-APRIL 3, 201	19	
SAMPLING METHOD	:-		ANALYSIS NO.		: LAA156-LAA158/2019		
SAMPLING BY	: CUSTOMER	र	REPORT NO.	: L0015	6-L00158/2019		
			RESULT	RESULT	RESULT		
PARAMETER	UNIT	METHOD OF ANALYSIS	GW-10A	GW-10B	GW-10C	DETECTION LIMIT	
			LAA156/2019	LAA157/2019	LAA158/2019		
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B))	1,400	780	1,100	1.8	
SAMPLE CONDITION	The second s		(11) (1) (1) (1) (1) (1) (1) (1) (1) (1)				
WATER'S COLOUR/TURBID	1		COLORLESS / TURBID GREY	COLORLESS / TURBID GREY	COLORLESS / TURBID		

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PROJECT	: NEW YANG	: NEW YANGON DEVELOPMENT PROJECT				
CUSTOMER NAME	: RESOURCI	E AND ENVIRONMENT MYANAMR	CO.,LTD			
ADDRESS	: B 702, DEL	TA PLAZA, SHWEGONDAING ROA	D, BAHAN TOWNSHIP.	YANGON, MYANN	AR. TEL +9597301	3448
SAMPLING SOURCE	: GW-11A, G	W-11B, GW-11C	_			5440
SAMPLE TYPE	: GROUNDW	ATER	SUBMITTAL/ RECEIP	PT NO. : 7/3/201	9	
SAMPLING DATE	: MARCH 8,2	2019	RECEIVED DATE	: MARCI	1 14, 2019	
SAMPLING TIME	:		ANALYSIS DATE	: MARCI	1 14-APRIL 3 2019	
SAMPLING METHOD	1-		ANALYSIS NO.	: LAA15	3-LAA155/2019	
SAMPLING BY	: CUSTOMER	2	REPORT NO.	: L00153	-L00155/2019	
			RESULT	RESULT	RESULT	1
PARAMETER	UNIT	METHOD OF ANALYSIS	GW-11A	GW-11B	GW-11C	DETECTION
-			LAA153/2019	LAA154/2019	LAA155/2019	LIMIT
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	1,400	680	1,200	1.8
SAMPLE CONDITION						
WATER'S COLOUR/TURBID			COLORLESS / TURBID	GREY / TURBID	COLORLESS / TURBID	
			GREY	GREY	GREY	

SM : APHA/AWWA/WEF STANDARD METHOD FOR THE EXAMINATION OF WATER AND WASTEWATER, 23<sup>rd</sup> EDITION, 2017



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PROJECT	: NEW YANG	NEW YANGON DEVELOPMENT PROJECT				
CUSTOMER NAME	: RESOURC	E AND ENVIRONMENT MYANAMR	CO.,LTD			
ADDRESS	: B 702, DEL	TA PLAZA, SHWEGONDAING ROA	D, BAHAN TOWNSHIP,	YANGON, MYANN	AR. TEL.+9597301	3448
SAMPLING SOURCE	: GW-12A, G	W-12B, GW-12C				5110
SAMPLE TYPE	: GROUNDWATER		SUBMITTAL/ RECEIP	T NO. : 8/3/20	19	
SAMPLING DATE	: MARCH 9,2019		RECEIVED DATE	: MARC	H 18, 2019	
SAMPLING TIME	:-		ANALYSIS DATE	: MARC	H 18-APRIL 7 2019	
SAMPLING METHOD	: GRAB		ANALYSIS NO. : LAA168-I AA170/2019			
SAMPLING BY	: RU		REPORT NO.	: L00168	B-L00170/2019	
<b>.</b>			RESULT	RESULT	RESULT	1
PARAMETER	UNIT	METHOD OF ANALYSIS	GW-12A	GW-12B	GW-12C	DETECTION
	-		LAA168/2019	LAA169/2019	LAA170/2019	LIMIT
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	1,700	680	200	1.8
SAMPLE CONDITION		deneration of second				
WATER'S COLOUR/TURBID			COLORLESS / LITTLE TURBID	COLORLESS / LITTLE TURBID	COLORLESS / LITTLE TURBID	
			GREY	GREY	GREY	

SM : APHA/AWWAWEF STANDARD METHOD FOR THE EXAMINATION OF WATER AND WASTEWATER, 23rd EDITION, 2017

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PROJECT	: NEW YANG	GON DEVELOPMENT PROJECT				
CUSTOMER NAME	: RESOURCE	E AND ENVIRONMENT MYANAMR	CO.,LTD			
ADDRESS	: B 702, DEL	TA PLAZA, SHWEGONDAING ROA	D, BAHAN TOWNSHIP. Y	ANGON, MYANN	AR TEL +9597301	3448
SAMPLING SOURCE	: GW-13A, G	W-13B, GW-13C				5440
SAMPLE TYPE	: GROUNDW	ATER	SUBMITTAL/ RECEIP	TNO. : 7/2/201	9	
SAMPLING DATE	: FEBRUARY	21,2019	RECEIVED DATE	: FEBRU	ARY 23, 2019	
SAMPLING TIME	1-		ANALYSIS DATE	: FEBRU	ARY 23-MARCH 15	2019
SAMPLING METHOD	:- AN		ANALYSIS NO.	NALYSIS NO. : LAA051-LAA053/2019		
SAMPLING BY	: CUSTOMER	2	REPORT NO.	: L00051	-L00053/2019	
			RESULT	RESULT	RESULT	1
PARAMETER	UNIT	METHOD OF ANALYSIS	GW-13A	GW-13B	GW-13C	DETECTION
			LAA051/2019	LAA052/2019	LAA053/2019	LIMIT
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	3,400	2,000	1,200	1.8
SAMPLE CONDITION						
WATER'S COLOUR/TURBID			GREY / LITTLE TURBID	GREY / LITTLE TURBID	GREY / LITTLE	
SEDIMENT			GREY	GREY	GREY	

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PROJECT	: NEW YANG	EW YANGON DEVELOPMENT PROJECT				
CUSTOMER NAME	: RESOURCE	E AND ENVIRONMENT MYANAMR	CO.,LTD			
ADDRESS	: B 702, DEL	TA PLAZA, SHWEGONDAING ROA	D, BAHAN TOWNSHIP.	YANGON, MYANI	MAR TEL +959730	113448
SAMPLING SOURCE	: GW-14A, G	W-14B, GW-14C				10440
SAMPLE TYPE	: GROUNDW	ATER	SUBMITTAL/ RECEIP	T NO. : 7/3/20	19	
SAMPLING DATE	: MARCH 9,2	2019	RECEIVED DATE	: MARC	H 14 2019	
SAMPLING TIME	1-		ANALYSIS DATE	: MARC	H 14-APRIL 3 201	10
SAMPLING METHOD	:- AN		ANALYSIS NO.	ANALYSIS NO. : LAA150-LAA152/2019		
SAMPLING BY	: CUSTOMER	2	REPORT NO.	: L0015	D-L00152/2019	
			RESULT	RESULT	RESULT	1
PARAMETER	UNIT	METHOD OF ANALYSIS	GW-14A	GW-14B	GW-14C	DETECTION LIMIT
			LAA150/2019	LAA151/2019	LAA152/2019	1
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	<1.8	680	1,100	1.8
SAMPLE CONDITION	harman an a	dan				
WATER'S COLOUR/TURBID			COLORLESS / TURBID GREY	COLORLESS / TURBID GREY	COLORLESS / TURBID GREY	

SM : APHA/AWWA/WEF STANDARD METHOD FOR THE EXAMINATION OF WATER AND WASTEWATER, 23<sup>rd</sup> EDITION, 2017



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PROJECT	: NEW YANG	NEW YANGON DEVELOPMENT PROJECT				
CUSTOMER NAME	: RESOURCI	ESOURCE AND ENVIRONMENT MYANAMR CO.,LTD				
ADDRESS	: B 702, DEL	TA PLAZA, SHWEGONDAING ROA	D, BAHAN TOWNSHIP, Y	ANGON, MYANN	IAR. TEL.+95973	013448
SAMPLING SOURCE	: GW-15A, G	W-15B, GW-15C				
SAMPLE TYPE	: GROUNDW	ATER	SUBMITTAL/ RECEIPT	NO. : 12/2/20	19	
SAMPLING DATE	: FEBRUARY	23,2019	RECEIVED DATE	: FEBRU	ARY 28, 2019	
SAMPLING TIME	:-		ANALYSIS DATE	: FEBRU	ARY 28-MARCH	22, 2019
SAMPLING METHOD	:- 4		ANALYSIS NO.	NALYSIS NO. : LAA084-LAA086/2019		
SAMPLING BY	: CUSTOMER	2	REPORT NO.	: L00084	-L00086/2019	
			RESULT	RESULT	RESULT	
PARAMETER	UNIT	METHOD OF ANALYSIS	GW-15A	GW-15B	GW-15C	DETECTION LIMIT
			LAA084/2019	LAA085/2019	LAA086/2019	
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	1,300	2,200	1,700	1.8
SAMPLE CONDITION		a harman ann a shain a sa an ann an ann an ann an ann an ann an				
WATER'S COLOUR/TURBID			GREY / TURBID	GREY / TURBID	GREY / TURBID	
SEDIMENT			GREY	GREY	GREY	

SM : APHA/AWWAWEF STANDARD METHOD FOR THE EXAMINATION OF WATER AND WASTEWATER, 23<sup>rd</sup> EDITION, 2017

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PROJECT	: NEW YANG	EW YANGON DEVELOPMENT PROJECT				
CUSTOMER NAME	: RESOURC	E AND ENVIRONMENT MYANAMR	CO.,LTD			
ADDRESS	: B 702, DEL	TA PLAZA, SHWEGONDAING ROA	D, BAHAN TOWNSHIP,	YANGON, MYANN	MAR. TEL.+959730	13448
SAMPLING SOURCE	: GW-16A, G	W-16B, GW-16C				
SAMPLE TYPE	: GROUNDW	ATER	SUBMITTAL/ RECEIPT NO. : 7/3/2019			
SAMPLING DATE	: MARCH 8,2	2019	RECEIVED DATE	: MARC	H 14, 2019	
SAMPLING TIME			ANALYSIS DATE	: MARC	H 14-APRIL 3, 201	9
SAMPLING METHOD	:-	ANALYSI		ALYSIS NO. : LAA147-LAA149/2019		
SAMPLING BY	: CUSTOMER	२	<b>REPORT NO.</b> : L00147-L00 <sup>7</sup>		7-L00149/2019	
			RESULT	RESULT	RESULT	1
PARAMETER	UNIT	METHOD OF ANALYSIS	GW-16A	GW-16B	GW-16C	DETECTION LIMIT
			LAA147/2019	LAA148/2019	LAA149/2019	
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	1,200	1,400	680	1.8
SAMPLE CONDITION	ales annuni ar annu					
WATER'S COLOUR/TURBI	D		COLORLESS / TURBID GREY	COLORLESS / TURBID GREY	COLORLESS / TURBID GREY	

SM : APHA/AWWAWEF STANDARD METHOD FOR THE EXAMINATION OF WATER AND WASTEWATER, 23rd EDITION, 2017



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PROJECT	: NEW YANG	IEW YANGON DEVELOPMENT PROJECT					
CUSTOMER NAME	: RESOURCE	RESOURCE AND ENVIRONMENT MYANAMR CO., LTD					
ADDRESS	: B 702, DEL	TA PLAZA, SHWEGONDAING ROA	D, BAHAN TOWNSHIP, Y	ANGON, MYANM	AR. TEL.+95973013	3448	
SAMPLING SOURCE	: GW-17A, G	W-17B, GW-17C					
SAMPLE TYPE	: GROUNDW	ATER	SUBMITTAL/ RECEIP	<b>F NO.</b> : 3/3/201	9		
SAMPLING DATE	: MARCH 2,2	019	RECEIVED DATE	: MARCH	1 5, 2019		
SAMPLING TIME	:- I j		ANALYSIS DATE	ANALYSIS DATE : MARCH 5-MARCH 25, 2019		9	
SAMPLING METHOD	3-		ANALYSIS NO.	: LAA108	-LAA110/2019		
SAMPLING BY	: CUSTOMER	2	REPORT NO.	: L00108	-L00110/2019		
			RESULT	RESULT	RESULT		
PARAMETER	UNIT	METHOD OF ANALYSIS	GW-17A	GW-17B	GW-17C	DETECTION	
			LAA108/2019	LAA109/2019	LAA110/2019	LIMIT	
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	680	200	<1.8	1.8	
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT			GREY / TURBID GREY	GREY / TURBID GREY	GREY / TURBID GREY		

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PROJECT	: NEW YANG	NEW YANGON DEVELOPMENT PROJECT				
CUSTOMER NAME	: RESOURC	ESOURCE AND ENVIRONMENT MYANAMR CO.,LTD				
ADDRESS	: B 702, DEL	TA PLAZA, SHWEGONDAING ROA	D, BAHAN TOWNSHIP,	YANGON, MYANA	AR. TEL.+9597301	3448
SAMPLING SOURCE	: GW-18A, G	W-18B, GW-18C				
SAMPLE TYPE	: GROUND V	WATER	SUBMITTAL/ RECEIP	T NO. : 3/3/20	19	
SAMPLING DATE	: MARCH 2,2019 R		RECEIVED DATE	: MARC	H 5. 2019	
SAMPLING TIME	:-	:- AN		ALYSIS DATE : MARCH 5. MARCH 25, 2019		
SAMPLING METHOD	:-	ANALYSIS NO. : LAA105-LAA10		5-LAA107/2019	A107/2019	
SAMPLING BY	: CUSTOME	र	REPORT NO.	: L00105	5-L00107/2019	
			RESULT	RESULT	RESULT	1
PARAMETER	UNIT	METHOD OF ANALYSIS	GW-18A	GW-18B	GW-18C	DETECTION
			LAA105/2019	LAA106/2019	LAA107/2019	LIMIT
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	<1.8	<1.8	1,400	1.8
SAMPLE CONDITION WATER'S COLOUR/TURBID			COLORLESS / TURBID	COLORLESS / TURBID	COLORLESS /	
SEDIMENT			GREY	GREY	GREY	

SM : APHA/AWWA/WEF STANDARD METHOD FOR THE EXAMINATION OF WATER AND WASTEWATER, 23<sup>rd</sup> EDITION, 2017



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PROJECT	: NEW YANG	IEW YANGON DEVELOPMENT PROJECT					
CUSTOMER NAME	: RESOURCE	RESOURCE AND ENVIRONMENT MYANAMR CO., LTD					
ADDRESS	: B 702, DEL	TA PLAZA, SHWEGONDAING ROA	D. BAHAN TOWNSHIP.	ANGON MYANM	AR TEL +95973013	MAR	
SAMPLING SOURCE	: GW-19A, G	W-19B, GW-19C				7440	
SAMPLE TYPE	: GROUNDW	ATER	SUBMITTAL/ RECEIP	TNO. : 5/3/201	9		
SAMPLING DATE	: MARCH 6,2	019	RECEIVED DATE	: MARCH	111 2019		
SAMPLING TIME			ANALYSIS DATE	NALYSIS DATE : MARCH 11-MARCH 21 2010			
SAMPLING METHOD	:-		ANALYSIS NO.	: LAA129	-I AA131/2019		
SAMPLING BY	: CUSTOMER		REPORT NO.	: L00129	-L00131/2019		
			RESULT	RESULT	RESULT		
PARAMETER	UNIT	METHOD OF ANALYSIS	GW-19A	GW-19B	GW-19C	DETECTION	
			LAA129/2019	LAA130/2019	LAA131/2019	LIMIT	
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	780	680	450	1.8	
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT			GREY / TURBID GREY	GREY / TURBID GREY	GREY / TURBID GREY		

SM : APHA/AWWAWEF STANDARD METHOD FOR THE EXAMINATION OF WATER AND WASTEWATER, 23rd EDITION, 2017

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DATE APRIL 3,2019

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PROJECT	: NEW YANGON DEVELOPMENT PROJECT						
CUSTOMER NAME	: RESOURCE AND ENVIRONMENT MYANAMR CO.,LTD						
ADDRESS	: B 702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR. TEL.+95973013448						
SAMPLING SOURCE	: GW-20A, GW-20B, GW-20C						
SAMPLE TYPE	: GROUNDWATER SUBMITTAL/ RECEIPT NO. : 6/3/2019						
SAMPLING DATE	: MARCH 7,2019		RECEIVED DATE : MARCH 13, 2019				
SAMPLING TIME	1.20		ANALYSIS DATE	ANALYSIS DATE : MARCH 13-APRIL 2 _ 2019			
SAMPLING METHOD	: GRAB		ANALYSIS NO. : LAA138-LAA140/2019				
SAMPLING BY	: RU		REPORT NO. : L00138-L00140/2019				
	UNIT METHOD OF ANALYSI		RESULT	RESULT	RESULT	1	
PARAMETER		METHOD OF ANALYSIS	GW-20A	GW-20B	GW-20C	DETECTION	
			LAA138/2019	LAA139/2019	LAA140/2019	LIMIT	
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	1,700	930	1,100	1.8	
SAMPLE CONDITION							
WATER'S COLOUR/TURBID			COLORLESS / TURBID	COLORLESS / TURBID	COLORLESS / TURBID		
SEDIMENT			GREY	GREY	GREY		

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PROJECT	: NEW YANG	: NEW YANGON DEVELOPMENT PROJECT						
CUSTOMER NAME	: RESOURCE AND ENVIRONMENT MYANAMR CO.,LTD							
ADDRESS	: B 702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR, TEL, +95973013448							
SAMPLING SOURCE	: GW-21A, GW-21B, GW-21C							
SAMPLE TYPE	: GROUNDW	ATER	SUBMITTAL/ RECEIPT NO. : 6/3/2019					
SAMPLING DATE	: MARCH 7,2019 : -		RECEIVED DATE : MARCH 13, 2019 ANALYSIS DATE : MARCH 13-APRIL 2, 2019					
SAMPLING TIME								
SAMPLING METHOD	2.6		ANALYSIS NO. : LAA135-LAA137/2019					
SAMPLING BY	: REM		REPORT NO.	: L00135	-L00137/2019			
	UNIT METHOD OF ANALYSIS		RESULT	RESULT	RESULT			
PARAMETER		GW-21A	GW-21B	GW-21C	DETECTION			
			LAA135/2019	LAA136/2019	LAA137/2019	LIMIT		
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	780	780	680	1.8		
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT			GREY / TURBID BROWN	GREY / TURBID BROWN	GREY / TURBID BROWN	_		

SM : APHA/AWWA/WEF STANDARD METHOD FOR THE EXAMINATION OF WATER AND WASTEWATER, 23<sup>rd</sup> EDITION, 2017

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PROJECT	: NEW YANGON DEVELOPMENT PROJECT							
CUSTOMER NAME	: RESOURCE AND ENVIRONMENT MYANAMR CO.,LTD							
ADDRESS	: B 702, DEL	: B 702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR. TEL.+95973013448						
SAMPLING SOURCE	: GW-22A, GW-22B, GW-22C							
SAMPLE TYPE	: GROUNDW	ATER	SUBMITTAL/ RECEIP	SUBMITTAL/ RECEIPT NO. : 8/3/2019				
SAMPLING DATE	ATE : MARCH 9,2019		RECEIVED DATE : MARCH 18, 2019					
SAMPLING TIME			ANALYSIS DATE : MARCH 18-APRIL 7, 2019					
SAMPLING METHOD	:-		ANALYSIS NO. : LAA159-LAA161/2019					
SAMPLING BY	: CUSTOMER REPORT NO. : L00159-L00161/2019							
			RESULT	RESULT	RESULT			
PARAMETER	UNIT	METHOD OF ANALYSIS	GW-22A	GW-22B	GW-22C	DETECTION		
			LAA159/2019	LAA160/2019	LAA161/2019	LIMIT		
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B))	3,900	2,300	1,100	1.8		
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT			GREY / TURBID GREY	GREY / TURBID GREY	GREY / TURBID GREY			

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PROJECT	: NEW YANGON DEVELOPMENT PROJECT							
CUSTOMER NAME	: RESOURCE AND ENVIRONMENT MYANAMR CO.,LTD							
ADDRESS	: B 702, DEL	TA PLAZA, SHWEGONDAING ROA	D, BAHAN TOWNSHIP, Y	AHAN TOWNSHIP, YANGON, MYANMAR, TEL.+95973013448				
SAMPLING SOURCE	: GW-23A, GW-23B, GW-23C							
SAMPLE TYPE	: GROUNDWATER		SUBMITTAL/ RECEIPT NO. : 8/2/2019					
SAMPLING DATE	: FEBRUARY 22,2019		RECEIVED DATE	RECEIVED DATE : FEBRUARY 23, 2019				
SAMPLING TIME	5.e. 5-		ANALYSIS DATE : FEBRUARY 23-MARCH 15, 20 ANALYSIS NO. : LAA057-LAA059/2019			2019		
SAMPLING METHOD								
SAMPLING BY	: CUSTOMER	2	REPORT NO. : L00057-L00059/2019					
	UNIT METHOD OF ANALYSIS		RESULT	RESULT	RESULT			
PARAMETER		GW-23A	GW-23B	GW-23C	DETECTION			
			LAA057/2019	LAA058/2019	LAA059/2019	LIMIT		
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	1,400	1,100	1,400	1.8		
SAMPLE CONDITION WATER'S COLOUR/TURBID SEDIMENT	Arrest		GREY / TURBID GREY	GREY / TURBID GREY	GREY / TURBID GREY			

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PROJECT	: NEW YANGON DEVELOPMENT PROJECT						
CUSTOMER NAME	: RESOURCE AND ENVIRONMENT MYANAMR CO.,LTD						
ADDRESS	: B 702, DELTA PLAZA, SHWEGONDAING ROAD, BAHAN TOWNSHIP, YANGON, MYANMAR. TEL.+95973013448						
SAMPLING SOURCE	: GW-24A, GW-24B, GW-24C						
SAMPLE TYPE	: GROUNDW	ATER	SUBMITTAL/ RECEIPT NO. : 8/2/2019				
SAMPLING DATE	: FEBRUARY 22,2019		RECEIVED DATE : FEBRUARY 23, 2019				
SAMPLING TIME	1-		ANALYSIS DATE : FEBRUARY 23-MARCH 15, 2019				
SAMPLING METHOD	:-		ANALYSIS NO. : LAA060-LAA062/2019				
SAMPLING BY	: CUSTOMER	R	REPORT NO. : L00060-L00062/2019				
	UNIT METHOD OF ANALYSIS	METHOD OF ANALYSIS	RESULT	RESULT	RESULT		
PARAMETER			GW-24A	GW-24B	GW-24C	DETECTION	
		LAA060/2019	LAA061/2019	LAA062/2019	LIMIT		
TOTAL COLIFORM BACTERIA	MPN/100 mL	MULTIPLE TUBE FERMENTATION TECHNIQUE (SM:9221 B)	1,300	780	1,400	1.8	
SAMPLE CONDITION							
WATER'S COLOUR/TURBID		COLORLESS / TURBID	COLORLESS / TURBID	COLORLESS / TURBID			
SEDIMENT			GREY	GREY	GREY		

SM : APHA/AWWA/WEF STANDARD METHOD FOR THE EXAMINATION OF WATER AND WASTEWATER, 23<sup>rd</sup> EDITION, 2017

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## APPENDIX E INTEGRATED BIODIVERSITY ASSESSMENT TOOL (IBAT)

## Potential Species of Conservation Significance (IBAT)

Taxon omic Group	Scientific Name	Common Name	Source	IUCN Status <sup>1</sup>	Myanmar Listing <sup>2</sup>	Endemic/ Restricted Range <sup>3</sup>	Migratory <sup>4 &amp;5</sup>
Birds	Calidris pygmaea	Spoon-billed sandpiper	IBAT Species Grid	CR	-	-	Y
Birds	Emberiza aureola	Yellow-breasted bunting	IBAT Species Grid	CR	-	-	Y
Birds	Gyps bengalensis	White-rumped vulture	IBAT Species Grid	CR	-	-	-
Birds	Gyps tenuirostris	Slender-billed vulture	IBAT Species Grid	CR	-	-	-
Birds	Sarcogyps calvus	Red-headed vulture	IBAT Species Grid	CR	-	-	-
Birds	Aquila nipalensis	Steppe eagle	IBAT Species Grid	EN	-	-	Y
Birds	Asarcornis scutulata	White-winged duck	IBAT Species Grid	EN	СР	-	-
Birds	Haliaeetus leucoryphus	Pallas's fish-eagle	IBAT Species Grid	EN	-	-	Y
Birds	Heliopais personatus	Masked finfoot	IBAT Species Grid	EN	CP	-	-
Birds	Leptoptilos dubius	Greater adjutant	IBAT Species Grid	EN	CP	-	Y
Birds	Lonchura oryzivora	Java sparrow	IBAT Species Grid	EN	-	-	-
Birds	Pavo muticus	Green peafowl	IBAT Species Grid	EN	-	-	-
Birds	Sterna acuticauda	Black-bellied tern	IBAT Species Grid	EN	-	-	-
Birds	Antigone antigone	Sarus crane	IBAT Species Grid	VU	-	-	-
Birds	Buceros bicornis	Great hornbill	IBAT Species Grid	VU	СР	-	Y
Birds	Chrysomma altirostre	Jerdon's babbler	IBAT Species Grid	VU	-	R	-
Birds	Ciconia episcopus	Asian woollyneck	IBAT Species Grid	VU	-	-	-
Birds	Clanga clanga	Greater spotted eagle	IBAT Species Grid	VU	-	-	Y

Taxon omic Group	Scientific Name	Common Name	Source	IUCN Status <sup>1</sup>	Myanmar Listing <sup>2</sup>	Endemic/ Restricted Range <sup>3</sup>	Migratory <sup>4 &amp;5</sup>
Birds	Clanga hastata	Indian spotted eagle	IBAT Species Grid	VU	-	-	-
Birds	Gallinago nemoricola	Wood snipe	IBAT Species Grid	VU	CP	-	-
Birds	Leptoptilos javanicus	Lesser adjutant	IBAT Species Grid	VU	-	-	Y
Birds	Rhyticeros undulatus	Wreathed hornbill	IBAT Species Grid	VU	-	-	-
Birds	Rynchops albicollis	Indian skimmer	IBAT Species Grid	VU	-	-	Y
Fishes	Carcharhinus hemiodon	Pondicherry shark	IBAT Species Grid	CR	-	-	-
Fishes	Glyphis siamensis	Irrawaddy river shark	IBAT Species Grid	CR	-	E	-
Fishes	Pristis pristis	Largetooth sawfish	IBAT Species Grid	CR	-	-	Oc
Fishes	Pristis zijsron	Green sawfish	IBAT Species Grid	CR	-	-	-
Fishes	Aetomylaeus maculatus	Mottled eagle ray	IBAT Species Grid	EN	-	-	-
Fishes	Anoxypristis cuspidata	Narrow sawfish	IBAT Species Grid	EN	-	-	Am
Fishes	Isurus oxyrinchus	Shortfin mako	IBAT Species Grid	EN	-	-	Oc
Fishes	Isurus paucus	Longfin mako	IBAT Species Grid	EN	-	-	Oc
Fishes	Lamiopsis temminckii	Broadfin shark	IBAT Species Grid	EN	-	-	Am
Fishes	Rhincodon typus	Whale shark	IBAT Species Grid	EN	-	-	Oc
Fishes	Sphyrna lewini	Scalloped hammerhead	IBAT Species Grid	EN	-	-	Oc
Fishes	Sphyrna mokarran	Great hammerhead	IBAT Species Grid	EN	-	-	Oc
Fishes	Urogymnus polylepis	-	IBAT Species Grid	EN	-	-	Po
Fishes	Aetobatus ocellatus	Spotted eagle ray	IBAT Species Grid	VU	-	-	-
Fishes	Aetomylaeus nichofii	Banded eagle ray	IBAT Species Grid	VU	-	-	Am

Taxon omic Group	Scientific Name	Common Name	Source	IUCN Status <sup>1</sup>	Myanmar Listing <sup>2</sup>	Endemic/ Restricted Range <sup>3</sup>	Migratory <sup>4 &amp;5</sup>
Fishes	Alopias pelagicus	Pelagic thresher	IBAT Species Grid	VU	-	-	Oc
Fishes	Alopias vulpinus	Common thresher shark	IBAT Species Grid	VU	-	-	Oc
Fishes	Carcharhinus Iongimanus	Oceanic whitetip shark	IBAT Species Grid	VU	-	-	Oc
Fishes	Carcharias taurus	Sand tiger shark	IBAT Species Grid	VU	-	-	Oc
Fishes	Carcharodon carcharias	White shark	IBAT Species Grid	VU	-	-	Oc
Fishes	Glaucostegus granulatus	Sharpnose guitarfish	IBAT Species Grid	VU	-	-	-
Fishes	Glaucostegus obtusus	Widenose guitarfish	IBAT Species Grid	VU	-	-	-
Fishes	Glaucostegus typus	Giant shovelnose ray	IBAT Species Grid	VU	-	-	-
Fishes	Hemigaleus microstoma	Sickelfin weasel shark	IBAT Species Grid	VU	-	-	-
Fishes	Hemipristis elongata	Snaggletooth shark	IBAT Species Grid	VU	-	-	-
Fishes	Himantura uarnak	Reticulate whipray	IBAT Species Grid	VU	-	-	Am
Fishes	Hippocampus histrix	Thorny seahorse	IBAT Species Grid	VU	-	-	-
Fishes	Hippocampus kelloggi	Great seahorse	IBAT Species Grid	VU	-	-	-
Fishes	Hippocampus spinosissimus	Hedgehog seahorse	IBAT Species Grid	VU	-	-	-
Fishes	Hippocampus trimaculatus	Three-spot seahorse	IBAT Species Grid	VU	-	-	-
Fishes	Maculabatis gerrardi	Whitespotted whipray	IBAT Species Grid	VU	-	-	-
Fishes	Mobula birostris	Giant manta ray	IBAT Species Grid	VU	-	-	Oc
Fishes	Mola mola	Ocean sunfish	IBAT Species Grid	VU	-	-	Oc
Fishes	Negaprion acutidens	Sharptooth lemon shark	IBAT Species Grid	VU	-	-	-
Fishes	Omobranchus smithi	-	IBAT Species Grid	VU	-	-	-

Taxon omic Group	Scientific Name	Common Name	Source	IUCN Status <sup>1</sup>	Myanmar Listing <sup>2</sup>	Endemic/ Restricted Range <sup>3</sup>	Migratory <sup>4 &amp;5</sup>
Fishes	Pateobatis jenkinsii	Jenkins' whipray	IBAT Species Grid	VU	-	-	-
Fishes	Pateobatis uarnacoides	Bleeker's whipray	IBAT Species Grid	VU	-	-	-
Fishes	Rhina ancylostoma	Bowmouth guitarfish	IBAT Species Grid	VU	-	-	-
Fishes	Rhinoptera javanica	Javanese cownose ray	IBAT Species Grid	VU	-	-	-
Fishes	Taeniurops meyeni	Blotched fantail ray	IBAT Species Grid	VU	-	-	-
Fishes	Urogymnus asperrimus	Porcupine ray	IBAT Species Grid	VU	-	-	-
Mamm als	Helarctos malayanus	Sun bear	IBAT Species Grid	VU	СР	-	-
Mamm als	Axis porcinus	Hog deer	IBAT Species Grid	EN	SP	-	-
Mamm als	Balaenoptera musculus	Blue whale	IBAT Species Grid	EN	-	-	-
Mamm als	Cuon alpinus	Dhole	IBAT Species Grid	EN	-	-	-
Mamm als	Orcaella brevirostris	Irrawaddy dolphin	IBAT Species Grid	EN	СР	-	-
Mamm als	Trachypithecus phayrei	Phayre's leaf-monkey	IBAT Species Grid	EN	-	-	-
Mamm als	Arctonyx collaris	Greater hog badger	IBAT Species Grid	VU	-	-	-
Mamm als	Dugong dugon	Dugong	IBAT Species Grid	VU	СР	-	-
Mamm als	Lutrogale perspicillata	Smooth-coated otter	IBAT Species Grid	VU	-	-	-
Mamm als	Neophocaena phocaenoides	Indo-pacific finless porpoise	IBAT Species Grid	VU	-	-	-
Mamm als	Nycticebus bengalensis	Bengal slow loris	IBAT Species Grid	VU	-	-	-
Mamm als	Panthera pardus	Leopard	IBAT Species Grid	VU	СР	-	-
Mamm als	Rusa unicolor	Sambar	IBAT Species Grid	VU	-	-	-
Mamm als	Sousa chinensis	Indo-pacific humpback dolphin	IBAT Species Grid	VU	-	-	-

Taxon omic Group	Scientific Name	Common Name	Source	IUCN Status <sup>1</sup>	Myanmar Listing <sup>2</sup>	Endemic/ Restricted Range <sup>3</sup>	Migratory <sup>4 &amp;5</sup>
Mamm als	Ursus thibetanus	Asiatic black bear	IBAT Species Grid	VU	NP	-	-
Marine Animal	Holothuria lessoni	-	IBAT Species Grid	EN	-	-	-
Marine Animal	Holothuria scabra	-	IBAT Species Grid	EN	-	-	-
Marine Animal	Thelenota ananas	-	IBAT Species Grid	EN	-	-	-
Marine Animal	Actinopyga echinites	-	IBAT Species Grid	VU	-	-	-
Marine Animal	Actinopyga miliaris	-	IBAT Species Grid	VU	-	-	-
Marine Animal	Holothuria fuscogilva	-	IBAT Species Grid	VU	-	-	-
Marine Animal	Stichopus herrmanni	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Acropora rudis	-	IBAT Species Grid	EN	-	-	-
Inverte brates	Acropora aculeus	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Acropora acuminata	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Acropora aspera	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Acropora dendrum	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Acropora donei	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Acropora echinata	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Acropora hoeksemai	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Acropora horrida	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Acropora listeri	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Acropora lovelli	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Acropora multiacuta	-	IBAT Species Grid	VU	-	-	-

Taxon omic Group	Scientific Name	Common Name	Source	IUCN Status <sup>1</sup>	Myanmar Listing <sup>2</sup>	Endemic/ Restricted Range <sup>3</sup>	Migratory <sup>4 &amp;5</sup>
Inverte brates	Acropora palmerae	_	IBAT Species Grid	VU	-	-	-
Inverte brates	Acropora turaki	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Acropora vaughani	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Acropora verweyi	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Alveopora allingi	_	IBAT Species Grid	VU	-	-	-
Inverte brates	Astreopora moretonensis	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Euphyllia ancora	_	IBAT Species Grid	VU	-	-	-
Inverte brates	Galaxea astreata	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Goniopora burgosi	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Goniopora planulata	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Heliopora coerulea	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Isopora cuneata	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Leptastrea aequalis	_	IBAT Species Grid	VU	-	-	-
Inverte brates	Montipora angulata	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Pachyseris rugosa	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Pavona cactus	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Pavona decussata	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Pavona venosa	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Pectinia alcicornis	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Pectinia lactuca	-	IBAT Species Grid	VU	-	-	-

Taxon omic Group	Scientific Name	Common Name	Source	IUCN Status <sup>1</sup>	Myanmar Listing <sup>2</sup>	Endemic/ Restricted Range <sup>3</sup>	Migratory <sup>4 &amp; 5</sup>
Inverte brates	Physogyra lichtensteini	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Pocillopora ankeli	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Porites aranetai	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Porites nigrescens	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Symphyllia hassi	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Turbinaria mesenterina	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Turbinaria peltata	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Turbinaria reniformis	-	IBAT Species Grid	VU	-	-	-
Inverte brates	Turbinaria stellulata	-	IBAT Species Grid	VU	-	-	-
Reptile s	Dermochelys coriacea	Leatherback	IBAT Species Grid	VU	СР	-	-
Reptile s	Enhydris vorisi	-	IBAT Species Grid	EN	-	-	-
Reptile s	Lepidochelys olivacea	Olive ridley	IBAT Species Grid	VU	СР	-	-
Reptile s	Ophiophagus hannah	King cobra	IBAT Species Grid	VU	-	-	-
Reptile s	Python bivittatus	Burmese python	IBAT Species Grid	VU	-	-	-
Reptile s	Batagur baska	Northern river terrapin	IBAT Species Grid	CR	-	-	-
Plants	Sonneratia griffithii	-	IBAT Species Grid	CR	-	-	-
Plants	Heritiera fomes	-	IBAT Species Grid	EN	-	-	-
Plants	Halophila beccarii	Ocean turf grass	IBAT Species Grid	VU	-	-	-

1= IUCN Red List: CR=Critically Endangered, EN=Endangered, VU=Vulnerable, 2=Myanmar Protected Species (1994): CP= Completely Protected Species, NP= Normally Protected Species, SP=Seasonally Protected Species, 3= Integrated Biodiversity Assessment Tool (2019) and Living International Treasure (2019): E = Endemic species,

R=Restricted

4= Bird Life International (2019): Y = Yes

5= FishBase: Oc = Oceanodromous, Am = Amphidromous, Po=Potamodromous

### APPENDIX F NYDC'S COMPANY REGISTRATION CERTIFICATE



**Company Information** 

Date of Appointment:

N/A

## **Myanmar Companies Online Registry - Company Extract**

Company Name (English) NEW YANGON DEVELOPMENT COMPANY LIMITED **Company Name (Myanmar)** 

**Registration Number Registration Date** Status 114946508 12/12/2017 Registered **Company Type Foreign Company Small Company** Private Company Limited by Shares under the Special No Company Act 1950 **Principal Activity Date of Last Annual Return Previous Registration Number** 1SC/2017-2018(YGN) Addresses **Registered Office In Union** 56 Chindwin Road Kamayut Township Yangon Region, Myanmar Officers DAW HLAING MAW OO Name: Type: Director Date of Appointment: 20/06/2019 Date of Birth: 07/05/1958 Nationality: Myanmar N.R.C./Passport: 12/YAKANA(N)020880 Gender: Female **Business Occupation:** Secretary, Yangon City **Development Committee** MR. GEORGE YONG-BOON YEO Name: Type: Director Date of Appointment: N/A Date of Birth: 13/09/1954 N.R.C./Passport: Nationality: Singapore E5784654J Gender: Male **Business Occupation:** Director **U SOE LWIN** Name: Type: Director Date of Appointment: 20/06/2019 Date of Birth: 17/11/1953 Nationality: N.R.C./Passport: Myanmar 12/DAGANA(N)024566 Gender: Male **Business Occupation:** Vice-Mayor, Yagon City **Development Committee** Name: U THEIM WAI (A.K.A MR. SERGE Type: Director PUN) Date of Appointment: N/A Date of Birth: 08/05/1953 Nationality: Myanmar N.R.C./Passport: 12/MAGATA(N)084053 Gender: Male Business Occupation: Director Name: **U TUN MYAT** Director Type:

Date of Birth:

20/09/1942



## Myanmar Companies Online Registry - Company Extract

<b>Company</b> NEW YAN	<b>y Name (English)</b> NGON DEVELOPMEN	IT COMPANY LIMITED	Compa -	iny Name (Myanm	ar)
Nationality: Gender:		Myanmar Male	N.R.C./ Busines	Passport: s Occupation:	12/KATATA(N)026265 Retired UN assistant secretary general
Ultimate H	olding Company				
Name of Ulti	mate Holding Company	Jurisdict	on of Incorporation	Re	gistration Number
Yangon Regi	ion Government	Myanm	ar	Es Re	tablished by the Constitution of the epublic of the Union of Myanmar (2008)
Share Capi	tal Structure				
Total Shares	Issued by Company	Currency	of Share Capital		
1,000,000		ММК			
Class	Description		Total Number	Total Amount Paid	Total Amount Unpaid
ORD	Ordinary		1,000,000	10,000,000,000.00	0.00
Members					
Name of Co Registratior	ompany: n Number:	YANGON CITY D Established by t City Developme (2013)	EVELOPMENT COM ne Yangon Jurisdic nt Law	MITTEE tion of Incorporation	n: Myanmar
Class	Description		Total Number	Total Amount Paid	Total Amount Unpaid
ORD	Ordinary		1	10,000.00	0.00
Name of Co	ompany:	YANGON REGIO	N GOVERNMENT		
Registratior	n Number:	Established by t Constitution of t Republic of the Myanmar (2008	ne Jurisdic he Jnion of )	tion of Incorporation	n: Myanmar
Class	Description		Total Number	Total Amount Paid	Total Amount Unpaid
ORD	Ordinary		999,999	9,999,990,000.00	0.00

#### Mortgages and Charges

#### Form / Filing Type

No records available

Details about all mortgages and charges can be accessed from the Company Profile Filing History at no charge.

**Filing History** 

**Effective Date** 



## **Myanmar Companies Online Registry - Company Extract**

Company Name (English) NEW YANGON DEVELOPMENT COMPANY LIMITED

**Company Name (Myanmar)** 

Form / Filing TypeEffective DateD-1 | Particulars of directors and secretary08/07/2019B-4 | Application for re-registration of a private company limited by shares formed under the Special Company17/01/2019Act 195017/01/2019



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