Environmental & Social Impact Assessment
Landmark Project
Yangon, Myanmar

Prepared for:

Meeyahta Development Limited
The Campus, 1 Office Park,
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Pun Hlaing Estate
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Prepared by:

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ENVIRON

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MEEYAHTA DEVELOPMENT LIMITED

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ENVIRONMENTAL PLEDGE

Date 12 June 2018

Meeyahta Development Limited (MDL) hereby acknowledge that:

1. The ESIA Report is accurate, and complete and based on scientific procedures;
2. The ESIA has been conducted in accordance with the 2015 EIA procedures and has considered and recognized relevant laws including Labour Laws of Myanmar.

MDL commits to comply with all Myanmar laws and regulations in the implementation of this Project.

It states its commitments to implement the recommendations to protect the environment, provide for the safety of its workers and employees and the community.

All recommended mitigation measures and Environmental and Social Management Plans, Monitoring Programmes presented in this Environmental and Social Impact Assessment (ESIA) will be implemented by the company to best of its abilities.

It will ensure to best of our abilities that its employees, and contractors/sub-contractors are fully obeyed and complied with all applicable laws. This include the Environmental Conservation Law, Forestry Law, The 2015 EIA Procedures and all labour laws and all applicable laws of the Republic of the Union of Myanmar.

Stephen Purvis
General Manager

Commitments of the Landmark Project

<table>
<tr><th>Project Proponent's Commitment Source</th><th>Commitment</th></tr>
<tr><td>Chapter 1 – Executive Summary</td><td>Project Proponent has provided a brief description of the studies conducted on existing Environment, Alternatives studies including Location alternatives, Design and Construction Alternatives, Equipment and Material Alternatives, the proposed project's Activities in Sequence and Assessment of Impacts and its Environmental Management Plan (EMP).</td></tr>
<tr><td>Chapter 2 – Introduction</td><td>Project Proponents has appointed ENVIRON Myanmar Co. Ltd., (ENVIRON) to conduct an ESIA for the Landmark Project in Yangon. ENVIRON Myanmar is a global environmental consultancy with Myanmar entity, registered since February 2014.</td></tr>
<tr><td>Section 2.5 – Reference to Other Study Reports</td><td>Project Proponent has undertaken multiple supporting studies which contributed to the ESIA as follows;

• Traffic Impact Assessment;
• Hazardous Materials and Contaminated Land Survey;
• Geotechnical Investigations;
• Ground Investigations;
• Groundwater Survey at Downtown Yangon, Myanmar;
• Utilities Survey;
• Pile Load Test for constructions and testing; and
• Structural Dilapidation Survey Report;
• Heritage Impact Assessment Report – Former Myanmar Railways HQ Building & Historic Neighbourhood; and
• Former Myanmar Railways Headquarters Building – Architectural Heritage Survey Report.</td></tr>
<tr><td colspan="2">Chapter 3 Policy, Legal and Institutional Framework</td></tr>
<tr><td>Section 3.1. – Corporate Environmental and Social Policies</td><td>Project Proponent as part of Yoma Strategic Holdings group of companies, has adopted a comprehensive Environmental, Health and Safety (EH&S) Policy.

Project Proponent is committed to comply with Environmental and Social Management System (ESMS)</td></tr>
</table>

Project Proponent's Commitment Source	Commitment
	which is a set of Management and Procedures which allow an organization to analyze, control, reduce the environmental and social impacts of its activities, minimize risks and improve operational efficiency. Project Proponent's ESMS highlights the importance and objectives of integrated environmental and social assessment to identify the impacts, risks and opportunities, effective community engagement and the management of environmental and social performance throughout the lifetime of the project through engagement between the clients, employees, affected communities and other stakeholders.
Section 3.2 – Policy and Legal Framework	The Project Proponent is committed to comply with the current laws, regulations, notifications, instructions and procedures enacted by Myanmar Government and relevant regional authorities described in this particular section; • Environmental Related Legislation • National Environmental Policy (1994) • Myanmar Constitution (2008) • Environmental Conservation Law (2012) • Environmental Conservation Rules (2014) • Environmental Impact Assessment Procedure (2015) • Myanmar Investment Law (2016) • Myanmar Investment Commission Notification (2013) • Conservation of Water Resources and Rivers Law (2006) • Law on Safety and Health in the Workplace (2014) • Occupational Safety and Health law (DRAFT) 2017 • Social Security Law (2012) • Minimum Wage Law (2013) • Employment and Skill Development Law (2013) • The Workmen Compensation Act, 1923 (amended 2005) • Public Health Law (1972) • Law on the Preservation and Protecting of Ancient Buildings (2015) • The City of Yangon Development (Amendment) Law (1996) • Guidelines for High-rise Building Construction Projects (Water Supply and Sanitation) (2017) • Fire Force Law (2015)

Project Proponent's Commitment Source	Commitment
	As well as those related to the environmental conservation specified by MONREC and other relevant authorities attached as Annex 1.
Section 3.3 – Government Institutional Framework Section 3.4 – National Environmental Quality (Emission) Guidelines (2015)	Project Proponent is committed to comply with the National Commission for Environmental Affairs/MONREC and National Environmental Quality (Emission) Guidelines (2015).
Section 3.5 – Permit Requirements	The Project Proponent is committed to obtain and comply with a number of regulatory permits and licenses issued by several different agencies in Myanmar. The primary permits or licenses obtained for the Project and their status (as of August 2018) are described.
Section 3.5.1 – MIC Permit Requirements	Project Proponent is committed to comply with MIC Permit decision related to environmental conservation.
Section 3.5.2 – YCDC's HIC Approval in Principle	Project Proponent is committed to comply with the height limit and distance set up by the authority with the Shwe Dagon Pagoda.
Section 3.6 – International and Regional Treaties	Project Proponent is committed to comply with following International and Regional treaties Applicable to the Project where applicable; 1. Vienna Convention for the Protection of the Ozone Layer 2. Montreal Protocol on Substances that Deplete the Ozone Layer 3. London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer 4. United Nations Framework Convention on Climate Change (UNFCCC) 5. Vienna Convention for the Protection of Ozone Layer 6. Montreal Protocol on Substances that Deplete the Ozone Layer 7. London Amendment to the Montreal Protocol 8. Kyoto Protocol to the United Nations Framework Convention on Climate Change 9. Stockholm Convention on Persistent Organic Pollutants 10. Copenhagen Amendment to Montreal Protocol on Substances that deplete the Ozone Layer
Chapter 4 Project Description and Alternative Selection	
Section 4.3 – Project Development and Implementation Time Schedule	The project proponent is committed to implement the Project as per the time schedule – Table 4.2.

Project Proponent's Commitment Source	Commitment
Section 4.4.1 - Land Ownership	Project Proponent has leased the land from the Myanma Railways of Ministry of Transport and Communications for International Hotel Project and the Landmark Project together with the agreed and signed built-operate-transfer (BOT). The lease is for an initial period of 50 years commencing 1 January 1998.
Section 4.4.2 – Project Components	Project Proponent is committed to establish the Mixed used development comprising below components; 1. Office Towers 2. Hotel Tower 3. Residential Tower (Serviced Apartment) 4. Retail Podium 5. Basement Parking The site plan and detail layout of the proposed development component of the project is shown in Figure 4.6 and 4.7.
Section 4.4.8 - Utilities	Project Proponent has conducted a studies and committed to carry out the plan as proposed for the demand needed for utilities; Electricity supply, water supply, sewage and fuel. Project Proponent will coordinate closely with Yangon Electricity Supply Corporation (YESC) before carrying out any action items from the permit of New Main Power Supply Line Extension and New Electrical Service to the Site for both construction and operational phases which was granted on 18 May 2018. Project Proponent will negotiate and coordinate with YCDC to connect to the YCDC water supply network and the project has already put in place the connection point ready to connect once the infrastructure has upgraded in the project area.
Section 4.4.9 – Fire Prevention System Section 4.4.10 – Ventilation System Section 4.4.11 – Lighting Protection System Section 4.4.12 – Internal Traffic Circulation	Project Proponent is committed to implement following plans for the Project's Operation phase; 1. Fire Prevention System 2. Ventilation Systems 3. Lightening Protection System 4. Internal Traffic Circulation
Section 4.4.13 – Greening Plan	Project Proponent is committed to plant the type and quantities of tress as described Greening Plan in the Operation Phase.

Project Proponent’s Commitment Source	Commitment
Section 4.5 – Sustainability Design	Project Proponent has engaged design consult to implement sustainable design construction and building operational measure. Committed to use Passive design features considered include; • low E glazing on architectural windows to reduce solar heat gain • associated operational energy consumption by way of reduced air conditioning load, insulation of external walls, etc. • natural day lighting and ventilation will be utilised as much as possible Project Proponent is committed that Landmark Project is being designed to ensure that the development will not strain Yangon City's water resources. Strategies such as the extraction of groundwater, recycling of treated effluent as make-up water for cooling towers, low flow rate sanitary fittings, low water consumption water closets, water sub-metering and leak detection system, etc. will work together to allow Landmark Project to achieve significant water savings compared to a building of this nature and size. The Project Proponent will aim to ensure that appointed contractors will implement environmentally sustainable construction measures such as monitoring energy usage, water usage and waste generation. The Project Proponent is committed in the process of obtaining the IFC EDGE (Excellence in Design for Greater Efficiency) certification. In order to qualify for IFC EDGE certification, a building must achieve a 20% reduction in energy, water and embodied energy in materials compared to a conventional building.
Section 4.6 – Pre Construction Surveys	Project Proponent has undertaken Pre-construction surveys mainly focused on following area; • Hazardous Materials Assessment; • Site Topographical Survey; • Soil Investigation work; • Utilities Survey; • Pile Load Test for constructions and testing; • Traffic Study;

Project Proponent's Commitment Source	Commitment
	• Structural Dilapidation Survey; and • Groundwater Pumping Test
Chapter 5 – Description of the Environment	Project Proponent has conducted study on the existing environment on the Area of Influence (AoI) of the project as appropriate and depending on the impact nature. The predicted AoI highlights the components of the environment concerns and establishes the baseline conditions prior to implementation of the proposed project. Physical Environment studies include; 1. Site Setting 2. Topography 3. Geology 4. Soil 5. Hydrogeology 6. Hydrology 7. Climate and Meteorology 8. Natural Hazards (earth quakes and storms) 9. Landscape Character and Visual Amenity
Section 5.5 – Air Quality Section 5.6 – Noise Quality Section 5.7 – Soil and Ground Water Section 5.8 – Biological Environment Section 5.9 – Socio Economic Environment Section 5.10 – Existing traffic Condition	Project Proponent has done baseline studies on – 1. Air Quality 2. Noise Quality 3. Soil and Groundwater 4. Biological Environment 5. Socio-Economic Environment 6. Existing Traffic Condition
Chapter 6 – Impact and Risk Assessment and Mitigation Measures	Project Proponent is committed to implement mitigations measures for the list of potential environmental and social issues relevant to the Project based on the Myanmar EIA rules and regulations.
Section 6.4 - Air Quality	**Air Quality** a) Fugitive Dust • Taking into account the baseline air quality monitoring finding which show levels of PM_{10}, $PM_{2.5}$, and SO_2 higher than NEQEG, necessary measures to suppress pollutant emissions from all potential sources will be considered. • The potential air quality impacts arising from the construction activities at the Project site will be

Project Proponent's Commitment Source	Commitment
	mitigated by implementing standard dust suppression measures as described below. - Routine water spray throughout the construction phase. - Provide designate access way (demarcation) for site moving vehicles. This access way shall be concrete paved/ compacted/ sand layer where possible. - Keep access area wet. - Provide ceiling cover to batching plant to prevent spread of dust during concrete mixing process. - Keep sprinkler system in the batching plant for routine spray of water during the mixing operation. - Water spray during extraction of piling works. - Cover materials with impervious sheeting. - Install PVC strip curtains for batching plant stockpiles. - Provide wheel washing facilities at the site entrance/ egress. - Exposed earth shall be properly treated by compaction and keep the surface wet. - All dusty materials shall be sprayed with water immediately prior to loading or unloading or transfer operation. - Vehicle carrying a load of dusty materials shall be covered entirely with clean impervious sheet. - Dusty materials shall not be loaded to a higher level than the side and tailboards and shall be covered by tarpaulin. b) Vehicular/ Equipment Emission The control of vehicular or equipment emission can be achieved by observing good construction practice procedures such as: • Turning off equipment when not in use. • Lorries/ trucks waiting for more than 10 minutes will turn off their engines. • Carry out regular maintenance of all vehicles, plants and equipment. • Install proper enclosures to the working areas to minimise the spread of fume and smoke.
Section 6.5 – Noise	**Noise** The noise impacts that will be generated during the project's construction of the Project will be minimised using appropriate mitigation measures, regular

Project Proponent's Commitment Source	Commitment
	monitoring and auditing. These requirements will form part of the contractual requirements to be enforced in construction planning and at times of actually carrying out the works. • Alternative Construction Methodologies • Use of Silencers & Enclosures • Use of Movable Noise Barrier • d) Good International Industry Practice • e) Noise Monitoring •
Section 6.6 – Vibration	In the absence of Myanmar vibration standards, a number of vibration criteria have been reviewed for suitability to be adopted in this study. These include the following: • Construction vibration damage criteria recommended by the High-Speed Ground Transportation Noise and Vibration Impact Assessment – US Department of Transport (DOT), September 2012 (**Table 6.12**); • German Standard DIN 4150-3 1999 Structural Vibration – Part 3: Effects of vibration on structures (for structural damage) **(Table 6.13);** and • Ground-borne Vibration (GBV) Impact Criteria (for annoyance assessment) for General Assessment suggested by High-Speed Ground Transportation Noise and Vibration Impact Assessment – USDOT, September 2012 (**Table 6.14**). **Mitigation Measures** • Pre-condition dilapidation survey was conducted in 2014 on St. Gabriel's Church compound, Bogyoke Aung San Market Blocks 1 & 2 as well as other neighbouring buildings and pubic infrastructure. Information from the survey is used for damage risk assessment, establish a reference baseline and serve as a basis for post-construction repairs where required. • Controlled demolition of the existing buildings. • Installation of vibration meters and crack gauges at the Project site to check the vibration impacts (Photo 6.1). 24-hours continuous monitoring is carried out to monitor the potential impact to the neighbours during construction phase. • ZoI of the Excavation with Potential Vibration Impact

Project Proponent's Commitment Source	Commitment
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Section 6.7 – Water Quality Impacts	Project Proponent is committed to implement mitigation measures for Water Quality Impacts. **Construction Phase** **Earthworks** • Erosion and Sedimentation Control Plan (ESCP) will be integrated into the earthworks plan • All catch pits and trenches required during the earthworks will be located, designed and constructed in a manner that will minimise the potential threat of downstream flooding. • Surface runoff from the site will be disposed of by temporary drainage or pumping systems of by other methods capable of keeping the site free of water and protected fro damage due to water. • Any washout of construction or excavated materials will be diverted to the drainage system via sediment traps. • Any disturbed earth caused by construction activities or fill operations will be firmly consolidated and compacted by earth moving vehicles and compactors to reduce the rate of possible erosion and release of loose soil particles. • Denuded stretches will be re-vegetated or sealed immediately after the construction works. • Suitable re-vegetation programmes will be planted as quickly as possible on exposed areas to reduce surface runoff and sediment loss. • Uncovered stockpiles of excavated material or topsoil and fill material are prone to erosion and therefore will be protected. Small stockpiles can be covered with tarpaulin sheets and large stockpiles will be stabilised by erosion blankets and regularly damped. • Wheel washing facilities at the ingress / egress point of the Project site to remove dirt/ soil from vehicles and machinery leaving the site. All surface discharge from the wheel washing facilities will be channelled into the temporary drainage system. • Stockpiles of construction aggregate, spoil and excavated soil will be located at areas within the project site that do not permit direct run off into water courses and are generally flat. • On site storage of excessive quantities of such materials will be avoided and where not possible the use of geotextile material or tarpaulin covers will be considered to minimize erosion.

Project Proponent's Commitment Source	Commitment
	• Stockpiles will be covered. • Stockpiling of the excavated material shall be minimised by scheduling the construction programme in a way that one section of the alignment can be construction and completed before excavation works of the next section commence. • Temporary sand bags will be installed when the site platform is higher to avoid runoff into public domain. **Sedimentation Retention Structures** • Sediment retention structures such as silt traps or catch pits of adequate sizes will be provided at suitable locations within the active works area within the Project site to remove soil and sediment in the surface runoff prior to discharge into the receiving drainage channels. • The silt traps/catch pits will be regularly maintained and desilted to provide maximum silt removal efficiencies. **Sewage Discharge** • The Project has installed six (6) 9 m^3 capacity septic tanks on-site. • Sewage effluent generated from the workers' facilities will either be treated via temporary bioseptic treatment tanks which will be flushed out by YCDC approximately four (4) times a month and as and when required since it is accessible for inspection by the Contractor **Spillage of Oil, Fuel and Chemicals** • All vehicles and plant servicing, vehicle wash bays and lubricating bays shall be sheltered from rain and the drainage in these areas shall be connected to drains via a petrol interceptor. • All generators, fuel and oil storage shall be within bunded areas. Drainage from the areas shall be connected to drains via a petrol interceptor. • Drip collection devices will be provided. **Operation Phase** • treat the sewage effluent from the sanitary facilities located at the various development components of the Project and sullage from development components,

Project Proponent's Commitment Source	Commitment
	• Wastewater treatment plant (WWTP) will be constructed onsite. All soil and waste will discharge to a centralised WWTP • Rain Water harvesting system is considered as a alternative source if necessary.
Section 6.8 – Soil and Groundwater Contamination	Construction Phase: • A secured area (enclosed with hardstanding impervious base) will be provided for the storage of any hazardous materials and hazardous wastes; • All temporary fuel tanks and drum storage areas are equipped with concrete or steel retention trays or temporary pit with plastic sheet and sand; • All activities that may result in the potential release of hazardous materials to the ground such as changing of engine oils and lubrication oils from construction vehicles, equipment and generators on site are performed only on designated sealed areas or on drip trays and plastic sheet to reduce the risk of direct spill into the underlying soil and groundwater. Spent oil must be handled and disposed of as scheduled waste; • Any accidental spills of fuel, oil or other hazardous chemicals will be cleaned up immediately. The recovered media (contaminated soil, absorbent pads, rags, etc.) will be disposed of as scheduled waste; and • Disinfection of groundwater before offsite release is required as the baseline ground water investigation results indicates the presence of E.coli and coliforms in concentrations exceeding the standards for effluents discharge in Myanmar. **Operational Phase** • The five diesel storage tanks within the Diesel Storage Room will be located within concrete-bunded enclosures capable of containing 110% of the contents of the largest tank within each enclosure. The floor of the bunded enclosures will be concrete-lined with an impermeable liner to prevent contaminant from permeating into the ground; • Appropriate instrumentation and control/trigger alarm to warn of possible overfilling and to provide an alert mechanism in the event of significant fuel/chemical loss will be provided for the storage tanks; • Operational control which includes regular/routine surveys, inspection and maintenance of the diesel fuel tanks and their ancillary facilities (pumps, valves and

Project Proponent’s Commitment Source	Commitment
	pipes) will be integrated into the Project’s environmental management practices so as to identify and rectify any significant fuel losses or ongoing spills/leakages which may be occurring; • Areas where regular or periodic handling and dispensing of liquid hazardous material are undertaken, such as the diesel storage area and the building maintenance store will be concrete-paved with appropriate secondary containment (drip trays and bunded areas) provided. • Any accidental spills will be assessed on a case by case basis and remedied, including excavation and disposal of any contaminated soil (classified as hazardous wastes) at a secure disposal facility approved by the YCDC. • Procedures and work instructions on proper handling of diesel and maintenance chemicals as well as the disposal procedures for hazardous wastes will be developed and effectively communicated to all operations and maintenance personnel; • Material Safety Data Sheets (MSDS) will be provided for the diesel and any other chemicals (e.g. chemicals used for the maintenance activities, used at the WWTP and for the cooling towers) stored within the Project site; • Corrosion protection for steel tanks and their ancillary facilities (pumps, valves and pipes) will be provided to prevent leaks.
Section 6.9 Waste	**Construction Phase** **(a) Non-Hazardous Solid Waste** The potential environmental impacts arising from the improper management of municipal wastes can be minimised with the implementation of the following practices: • Good housekeeping practices are essential within the site; • Segregation of waste for re-use and recycling; • General construction spoil will be recycled on site as much as possible. For example, construction aggregate materials may be considered as possible backfill material; • Domestic waste generated from the site offices will be stored in suitable covered receptacles or stored within enclosed areas and collected regularly by a YCDC-

Project Proponent's Commitment Source	Commitment
	licensed contractor for disposal at approved disposal/ landfill sites; and • Unsalvageable construction spoil will be stockpiled at a designated site and where practicable sold to salvage yard operators or other contractors interested in recycling the material. **b) Hazardous Wastes** • The hazardous wastes generated during the construction phase as described above will require proper handling, storage and disposal. • An Exposure Control Plan has been developed for removal of ACM and SMF as far as necessary to facilitate safe work area for demolition workers ahead. • Chemical wastes will be properly packed, labelled and disposed of by licensed contractor. • No products or substances including chemicals or fibrous materials are brought to the site without a current MSDS. All storage and use of hazardous substance and dangerous goods • are in accordance with the MSDS and legislative requirements. • All dangerous goods or combustible liquids are stored in accordance to MSDS requirements. • Dangerous goods will be stored away from ignition sources and in non-hazardous area e.g. non-flammable cabinets, cages, non-corrosive containers, etc. • All employees involved in the use of products classified as hazardous or dangerous are provided with information and training to allow safe completion of the required task. **Operation Phase** • Waste collection areas will be provided within the Project during the occupancy/operational stage. • The hazardous and non-hazardous wastes will be hauled offsite by contractors licensed under one of the six waste collection companies appointed by the YCDC. Collection will be carried out once in every two days since accumulated wastes at the hotel premise will pose a health risk and nuisance to the occupants within the Project area as well as visitors/guests. • A waste separation system will be implemented within the Project site and options for waste recycling be considered in line with good practices for hotels and

Project Proponent’s Commitment Source	Commitment
	embassies in Yangon to minimise the volume of wastes to be disposed to the landfill.
Section 6.10 – Socio Economic Aspects	**Construction Phase** • The project will create a lot of jobs for locals which are estimated as 86 jobs under direct employment by the project management company and 4,000 jobs under contractors’ and subcontractors’ employment. • The contractor shall comply with all the relevant labour laws applicable to the contractor’s personnel, including Laws relating to their employment (including wages and working hours), health, safety, welfare, immigration and emigration and shall allow them all their legal rights. • Project Proponent will ensure compliance to the following international practices with respect to the workforce: • promote the fair treatment, non-discrimination and equal opportunity of workers; • establish, maintain and improve the worker-management relationship; • promote compliance with national labour and employment laws; • protect the workforce, including vulnerable groups such as children or migrant workers, • workers engaged by third parties, and workers in the project proponent’s supply chain; • promote safe and healthy working conditions and workforce health and well-being; and • Prohibit any use of forced labour. **Operation** **Increased Employment Opportunities:** • The entire Project is expected to provide job opportunities for a significant number of employees across a wide range of levels. • Expatriate employees where required will train locals until such time the locals attain sufficient skills and technical knowledge to subsequently take over the responsibilities from the expatriates. • For local employment alone, it is estimated that approximately 620 jobs will be created under direct employment by hotel operating companies, offices, retail and property management companies.

Project Proponent's Commitment Source	Commitment
Section 6.11 Landscape and Visual Impacts	Some of the mitigation measures to be implemented during the construction phase are as follows: • Trees to be transplanted will be retained at a proper nursery; • Phased segmental root pruning for trees will be retained and transplanted over a few months period prior to lifting or site formation works which affect the existing rootball of trees identified for retention. The extent of the pruning will be equal to half of the spread of the canopy; • Pruning of the branches of existing trees identified for transplantation and retention will be based on the principle of crown thinning maintaining their form and amenity value; • All works affecting the trees identified for retention and transplantation will be carefully monitored. This includes the key stages in the preparation of trees, the implementation of • protection measures and health monitoring throughout the construction period; and • The tree transplanting and planting works will be implemented by approved Landscape Contractors and inspected and approved on site by a qualified Landscape Architect. **Operation Phase:** Measures put in place to protect the landscape components and to create an aesthetic/ visual impact include the following: • All landscape and visual mitigation works will be financed, and implemented by the project developer; • To create the plaza to the West of the cultural heritage building to increase public access to the site and to open up views of the building façade; • To restore the cultural heritage buildings and to create landscaped gardens in order to beneficially affect the landscape character and quality of the area; and • To retain trees that have historic value and contribute most to the landscape and visual amenity of the site and its immediate environment.
Section 6.13 Traffic	**Traffic Management during Construction**

Project Proponent’s Commitment Source	Commitment
	• Construction traffic will avoid peak traffic hours and adhere to YCDC limitations on vehicle size during specified hours of the day. • It is estimated that an average of 2,400 trucks will be required monthly to transport the excess soil to the YCDC approved disposal. • These trucks will be using the routes designated by YCDC in their approvals. **Traffic and Pedestrian Improvement Measures** The proposed Project will include some improvements to the pedestrian and traffic in the vicinity of the site such as: • Traffic signal optimization at Bogyoke Aung San – Alan Pya Junction • To adjust the traffic signal timing at Bogyoke & Alan Pya Junction to synchronize with the future traffic including development generated traffic. • Provide traffic warning signs and safety devices internally and externally for safety purpose of vehicles especially at the exit on Alan Pya Pagoda Road where situated at the foot of the bridge. • Access management on Bogyoke Aung San Road: • The rejected route is proposed in order to accommodate the rejected vehicle smoothly without any obstacle on Bogyoke Aung San Road. • The security control can be operated with minimal effect out the obstruction on the main site access and Boygoke Aung San Road. • 20 m median is provided between the main accesses of Landmark and PYN to accommodate convenient and safe pedestrian crossing. • Staff will be hired to manage traffic and control safety of pedestrian at the main access and PYN access.
Section 6.14 Occupational Health and Safety	Occupational Health and Safety Project Proponent has issued a Guidelines on Minimum Health & Safety Standards for Major Works and its compliance during the implementation of the Project. The safety and health management plan must contain at minimum at following: A safety policy; • Safe work practices; • Safety training (including local subcontractors);

Project Proponent's Commitment Source	Commitment
	• Group meetings; • Incident investigation and analysis; • In-house safety rules and regulations; • Safety promotion; • Evaluation, selection and control of sub-contractors; • Safety inspections; • Maintenance regime for machinery and equipment; • Hazard analysis; • Control of movement and use of hazardous substances; • Emergency preparedness; and • Disaster Risk Reduction Measure • Occupational health programs. A Monthly Health & Safety Report which covers: • Monthly Incident/ Accident Return Summary Table (Project to date) and Accident Statistic Summary; • Investigation and Analysis of the findings in site inspection; how the action was taken on findings immediately; • Number of workers who participated in the safety induction and list of trainings that is conducted in the month (**Photo 6.2**); • Topic of Tool Box Meetings and briefings and number of attendance in Tool Box Meetings (**Photo 6.3**); • Number of site safety inspection done in the month and major findings of it; • Monthly Plant/ Machinery & Equipment Inspection; • Monthly Safety & Health Program carried out as a Safety Promotion Program; and • H&S Team Organization Chart (updated every month). • Daily visual inspection has been carried out by SPADS HSE Team on contractors to ensure proper PPE are used and activities are carried out according to method statement **Construction phrase** The general amenities in the construction yards will comprise potable water supply (bottled water will be provided in the event such supply does not exist), temporary sanitary facilities,

Project Proponent's Commitment Source	Commitment
	changing/ locker rooms and rest areas. To cater for minor cuts and bruises, and medical condition, adequate medical first-aid kits are to be provided. Three (3) levels of surveillance health to be carried out are as follows: • Normal health surveillance for all workers; • Reinforced health surveillance for sensitive population such as those with previous health issues and disease, women, night shift workers, workers above 55 years old and workers with BMI below 19 or above 28; and • Specific medical surveillance for equipment operator, welder and scaffolder. Health and safety instructions will be developed for issuance to workers and for the more dangerous work (for example the demolition activities and, the removal, storage and handling of hazardous materials from the building prior to demolition), specific hazard-related training and briefing on the use of construction machinery, tools, appliances and personal protection equipment. Knowledge on the health and safety rules of these workers will also be checked periodically to ascertain their understanding. Management of workers' health and safety will be carried out by implementing the following: • Protective fencing or tape will be provided at the boundaries of these zones and the appropriate warning signs, markings and safety signs; • Areas where workers will stay temporarily (example, rest areas) will be located outside of any hazardous or dangerous zones; • A work permit will be issued for any work to be carried out within these zones. The work permit will indicate the area where the work is to be carried out, a description of work in a hazardous/ dangerous zone, conditions for safe execution of work, the time of beginning and completion of the work, the list of team members and person responsible for safety in the process of the work; • The persons entitled to issue work permits will determine the need for such work and a possibility for its safe execution; they will be responsible for the implementation of the precautionary measures

Project Proponent's Commitment Source	Commitment
	mentioned in the work permit. A job description will be developed for each type of work; and • Workers will be protected from over-exertion and ergonomic injuries and illnesses, slips and falls, and work at heights. Measures to be put in place include: - Training workers in lifting and materials handling techniques and setting weight limits; - Planning the layout of the work site to minimize the need for manual transfer of heavy loads; - Selecting tools that reduce force requirements and holding times; - Sorting and placing loose construction materials or demolition debris in established areas away from foot paths; - Cleaning up excessive waste debris and liquid spills regularly; - Training and use of temporary fall prevention devices as rails, and barriers; - Training and use of personal fall arrest systems, such as full body harnesses and energy absorbing lanyards able to support heavy loads. **Hazardous Materials Management** The following measures are planned to prevent the release or the spills of hazardous substances: To prevent accidental spills of petroleum products in the process of the filling of vehicles or machinery secondary containment measures will be provided in the form of containment - Trays and vehicle filling permitted to be carried out at designated areas provided with hardstanding and catch drains; - Maintenance of construction machinery will be carried out only at designated areas where there is adequate protection to prevent the migration of spilled fuel or lubricants to the soil and groundwater; - Durable waste receptacles will be installed at construction sites for the collection of oil contaminated waste materials and soil; all wastes will be disposed of separately as hazardous waste at a facility approved by the YCDC; and - Use of trained personnel to identify and remove hazardous materials for example asbestos, PCB's, electrical components containing mercury per the Hazardous Materials Management Plan

Project Proponent's Commitment Source	Commitment
	prepared in the Hazardous Materials Assessment report.
Section 6.15 Community Health and Safety	Mitigation Measures: Impacts on community health and safety can be mitigated through good practices and close cooperation between the site managers, contractors, communities and local authorities, as below: • Provision of pedestrian walk ways with shelter during FMI demolition with awareness signage and lightings for the walk ways during night time (**Photo 6.6**). • A Traffic Management Plan has been established to indicate the traffic routes to be followed and speed limit to be complied with in order to reduce risk to the local communities. • Enforcement of a speed limit for vehicles related to construction activities of the project. • Establishment of a security team to monitor entrance to the construction site.
Section 6.16 Disaster Risk Reduction Measure	**Disaster Risk Reduction Measure** The prevention measures for natural disaster and emergency are included as part of the Emergency Response Plan. Health & Safety team of both SPADPS and Contractor (BTJV) have conducted several drills for any emergency situations such as flood, earthquake fire and site accident etc. during construction period. All the drills are required to be conducted at least once a year. **Earthquake** **CQHP Requirements** The Landmark buildings' structures are designed to source no. 2 since it is an official government confirmation. In terms of other safety measures, geotrchnical Design of Pile, Factor of Safety, Pile Load Test – ULT, Soil Capacity, Pile Load Test –WLT, Pile Capacity Utilisation Ratio and Structural Design of Bored Pile were considered and tested for safe working load (SWL).

Project Proponent's Commitment Source	Commitment
	Flood Risk The following drainage system has been constructed on-site with YCDC's permit and approval: Temporary Construction Drainage Plan Permanent Drainage Plan for both construction and operation phase
Chapter 8 – Environmental and Social Management Plan	The Project Proponent is committed to establish and implement set environmental and social management requirements for the Project via its contractual documents with relevant parties amongst others, the Main Contractor appointed for the construction phase of the Project and the managing entities appointed to operate the various development components within the Project Site. The potential environmental impacts and its corresponding mitigation measures for each phase of the Project are summarized in the following tables: • EMP Construction phase – **Table 8.1** • EMP Operational phase – **Table 8.2**
	Project Proponent is committed to allocate Budget for EMP Implementation **Table 8.3** summarizes the budget allocated by the project developer to finance the environmental services and the mitigation measures and monitoring of the ESMP.
Section 8.8 Environmental Monitoring Programme	Project Proponent is committed to conduct following Environmental Monitoring Programme for both construction and operation phase. **Construction Phase** The proposed environmental monitoring program for the Project, including the parameters to be monitored, sampling locations (Figure 8.2), frequency and duration as well as the applicable standards is presented in Table 8.4. The environmental monitoring results will be compared to

Project Proponent's Commitment Source	Commitment
	the applicable national standards or other relevant standards in the absence of national standards. During the excavation and construction of substructure, groundwater and vibration levels are monitored as presented in Table 8.5. For the construction phase, the contractor monitors the groundwater level weekly from 9 water standpipes as shown in Figure 8.3. **Operation Phase** Monitoring wells will be installed for Groundwater condition of the aquifers in the project area. The water level will be measured twice a month through the whole year in operation phase so that seasonal fluctuation of groundwater level can be observed. This data is useful for designing the depth of pump setting, observing the change in quantitative and qualitative groundwater potentials of the project area. **Refer to ;** Table 8.4: Environmental Monitoring Programme Table 8.5: Groundwater and Vibration Monitoring during Construction Phase
Section 8.9 Training and Awareness	Project Proponent is committed to effectively implement EMSP, Project employees, contractors and sub-contractors will be made aware of the ESMP and its requirements. The training shall include, but not limited to the following components: • General environmental awareness; • Environmental impacts and associated pollution prevention and mitigation measures for the Project; • Awareness of the ESMP; • Housekeeping in relation to the construction area; • Construction activities; • Work procedures; and • Spill response training
Section 8.10 Management Plans	Project Proponent is committed to establish and implement as required of all mitigation and management measures as identified.

Project Proponent's Commitment Source	Commitment
	Project Proponent is committed to effectively implement the following management plans as the outcomes of the ESIA throughout the life of the Project: • Occupational Health and Safety Plan (Annex 6a); • Emergency Response Plan (Annex 6b); • Waste Management Plan (Annex 6c); • Traffic Management Plan (Annex 6d); • Energy Saving Plan (Annex 6e); and • Water Use Management Plan (Annex 6f).
Section 8.11 Project-Level Grievance Redress Mechanism Objectives and Scope	Project Proponent is committed and implemented to the project-level Grievance Redress Mechanism (GRM) for the people in the communities who are directly affected by construction activities of the Project. The GRM will be administered by the Internal Grievance Committee which will be formed as shown in Figure 8.3 Grievance Redress Procedures Refer to; Figure 8.5: Notices for Public Grievance Figure 8.6: Complaint Form Figure 8.7: Grievance Redress Procedures
Chapter 9 Public Consultation and Disclosure	The Project Proponent, since the initiation of the project development in 201, has carried out separate consultations with individual stakeholder groups. In order to optimize mutual exchange and maximize the outcomes of the particular discussion, specific focused groups were met individually throughout the various stages of the Project. Consultation carried out by the Project Proponent; • FMI Center employees, and business tenants from Grand Meeyahta Executive Residences and FMI Center were consulted in separate meetings. • The meeting with YCDC Engineering Department (Building) took place in August 2013 and building design and planning parameters were discussed in the meeting. • Conservation measures were presented in the meeting with Yangon Heritage Trust in 2013. The PP also met with Department of Archaeology and National Museum on archaeological excavation on site matter. Issues related to Conservation

Project Proponent's Commitment Source	Commitment
	Management Plan (CMP) were presented in another meeting with YHT in December 2014. • Individual public consultation meetings were conducted in August 2016 to inform the public near the project area and to receive their concerns. The residences who are located in the project impact area in Pabedan, Kyauktada, and Dagon, shopkeepers from Bogyoke Market, and the committee from St. Gabriel's Church Union were met to exchange views, concerns, and measures that the project has planned for the upcoming construction. **Further Ongoing Consultations** The Project Proponent considers that further consultations with all stakeholders are necessary and the project proponent makes the commitment to consult frequently with all related and relevant authorities. • The project plans to inform the stakeholders after EIA is approved. • Various departments from YCDC, Ministry of Construction, Myanmar Railways, ECD from MONREC, and other administrative bodies will be consulted frequently to seek their inputs in the development of the Project. • The general public will be informed regularly and consulted to seek their views, concerns, and inputs even if no complain is made for the project activities. • Occasional meetings with St. Gabriel Church committee will be arranged to review the pre-condition survey results and the development progress. • Random informal meeting with the other project affected people will be arranged to press further concerns. • All views, concerns, and inputs from further ongoing consultations will be registered and given due consideration for timely modification of the development plans.

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Director General
Environmental Conservation Department
Ministry of Natural Resources & Environmental Conservation

ရက်စွဲ ၊၂၀၁၈ ခုနှစ်၊စက်တင်ဘာလ ၁၀ ရက်

၂၀၁၈ ခုနှစ် ဇူလိုင်လ ၂၆ ရက်နေ့၌ Review Team Assessment အစည်းအဝေးတွင် သုံးသပ်ချက်အရ Meeyahta Development Limited (MDL) မှ အောက်ပါအတိုင်းကတိပြုဝန်ခံပါသည်။ MDL သည် မြန်မာနိုင်ငံဥပဒေများအရ ပြဋ္ဌာန်းထားသော သက်ဆိုင်ရာ အကျုံးဝင် ပြဋ္ဌာန်းချက်များနှင့်အညီ အကောင်းဆုံး လိုက်နာ ဆောင်ရွက်မည်ဖြစ်ပါသည်။

စဉ်	ဥပဒေ	လိုက်နာရမည့်ပုဒ်မ/နည်းဥပဒေများ	မှတ်ချက်
၁။	ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး ဥပဒေ၊ (၂၀၁၂)	ပုဒ်မ ၇(ဏ)၊၁၄၊၁၅၊၂၄၊၃၂)	MDL သည် ဤဥပဒေပါ သက် ဆိုင်ရာ ပြဋ္ဌာန်းချက်များ နှင့် ဆောင်ရွက်မည် ဖြစ်ကြောင်းနှင့်ဥပဒေနှင့်အညီ ဆောင် ရွက်ရန် လိုအပ် သည်များကို အချိန်နှင့် အမျှဝန်ကြီးဌာန၏ ပင်မကန်ထရိုက် တာနှင့် အခြားသော သက်ဆိုင်ရာ စာချုပ် ဝင်များ သို့အကြောင်း ကြားမည် ဖြစ်ပါ သည်။
၂။	ပတ်ဝန်းကျင်ထိန်းသိမ်းရေး နည်းဥပဒေများ၊ (၂၀၁၄)	နည်းဥပဒေ ၆၉	
၃။	ပတ်ဝန်းကျင်ထိန်းသိမ်းမှုဆန်း စစ်ခြင်းလုပ်ထုံးလုပ်နည်း၊ (၂၀၁၅)	အပိုဒ် ၁၀၂ မှ ၁၁၀ ၊ ၁၁၃၊၁၁၅၊၁၁၇	
၄။	အမျိုးသားပတ်ဝန်းကျင်ဆိုင်ရာ အရည်အသွေး(ထုတ်လုပ်မှု) လမ်းညွှန်ချက်များ၊ (၂၀၁၅)	-	
၅။	တိုင်းရင်းသားလူမျိုးများ အခွင့် အရေးကာကွယ်စောင့်ရှောက် ရေးဥပဒေ၊ (၂၀၁၅)	ပုဒ်မ ၅	MDL သည် ဤဥပဒေပါ သက် ဆိုင်ရာ ပြဋ္ဌာန်းချက်များ နှင့် ဆောင် ရွက် မည် ဖြစ်ကြောင်းနှင့် ဥပဒေနှင့် အညီ ဆောင်ရွက်ရန် လိုအပ် သည် များကို အချိန်နှင့် အမျှဝန်ကြီးဌာန၏ ပင်မ ကန်ထရိုက်

စဉ်	ဥပဒေ	လိုက်နာရမည့်ပုဒ်မ/နည်းဥပဒေများ	မှတ်ချက်
			တာ နှင့်အခြား သော သက်ဆိုင်ရာ စာချုပ်ဝင်များသို့ အကြောင်းကြားမည်ဖြစ်ပါ သည်။
၆။	မြန်မာနိုင်ငံရင်းနှီးမြှုပ်နှံမှု ဥပဒေ၊ (၂၀၁၆)	ပုဒ်မ ၅၀၊၅၁၊၆၅ (ဆ) (ဈ) (ည) (ဋ) (ဌ) (ဍ) (ဏ) (တ) (ထ)၊၇၃	MDL သည် ဤဥပဒေပါ သက်ဆိုင်ရာပြဋ္ဌာန်းချက်များ နှင့် ဆောင်ဆောင် ရွက်မည်ဖြစ်ကြောင်း နှင့်ဥပဒေနှင့် အညီ ဆောင်ရွက် ရန် လိုအပ်သည် များကို အချိန် နှင့်အမှုဌ ငင်း၏ပင်မ ကန်ထရိုက်တာနှင့် အခြားသော သက်ဆိုင်ရာ စာချုပ်ဝင်များသို့ အကြောင်းကြားမည်ဖြစ်ပါသည်။
၇။	ပြည်သူ့ကျန်းမာရေးဥပဒေ (၁၉၇၂)	ပုဒ်မ ၃၊၅	MDL သည် သတ်မှတ်ထား သော ၎င်း၏လုပ်ဆောင်ချက် များ/တာန် များ များကို ဆောင်ရွက် ရာတွင် သက်ဆိုင်ရာအာဏာ ပိုင်အဖွဲ့အစည်းသို့ အပြည့်အ၀ အကူအညီ နှင့်/ သို့မဟုတ် အထောက်အပံ့ပြု မည်ဖြစ်ပြီး ယင်းနှင့်အညီဆောင်ရွက်ရန် လိုအပ်သည် များကို အချိန်နှင့် အမှု ၎င်း၏ပင်မကန်ထ ရိုက် တာ နှင့် အခြားသော သက် ဆိုင်ရာ စာချုပ်ဝင်များသို့ အ ကြောင်းကြားမည်ဖြစ်ပါသည်။
၈။	ကူးစက်ရောဂါများကာကွယ်နှိမ်နင်းရေး ဥပဒေ (၁၉၉၅)	ပုဒ်မ ၃၊၄၊၉၊၁၁	MDL သည် ဤဥပဒေပါ သက်ဆိုင်ရာပြဋ္ဌာန်းချက်များ နှင့် ဆောင်ရွဆောင်ရွက်မည်ဖြစ်ကြောင်း နှင့် ဥပဒေ နှင့်အညီ ဆောင်ရွက်ရန် လိုအပ် သည်များကို အချိန် နှင့်အမှု၎င်း၏ ပင်မကန်ထ

စဉ်	ဥပဒေ	လိုက်နာရမည့်ပုဒ်မ/နည်းဥပဒေများ	မှတ်ချက်
			ရိုက်တာနှင့် အခြား သော သက်ဆိုင်ရာ စာချုပ်ဝင်များ သို့အကြောင်း ကြားမည်ဖြစ်ပါ သည်။ MDL သည် သတ်မှတ်ထား သော ၎င်း၏လုပ်ဆောင်ချက်များ/တာဝန်များကို ဆောင်ရွက်ရာတွင် သက်ဆိုင်ရာ အာဏာ ပိုင်အဖွဲ့အစည်းသို့ အပြည့်အဝ အကူအညီ နှင့်/သို့မဟုတ် အထောက် အပံ့ပြုမည်ဖြစ်ပြီးယင်း နှင့်အညီ ဆောင်ရွက်ရန် လိုအပ်သည် များကို အချိန်နှင့်အ မျှ ၎င်း၏ပင်မ ကန်ထရိုက် တာနှင် အခြားသော သက်ဆိုင် ရာ စာချုပ်ဝင်များသို့အ ကြောင်း ကြားမည်ဖြစ်ပါ သည်။
၉။	ဆေးလိပ်နှင့်ဆေးရွက်ကြီးထွက်ပစ္စည်းသောက်သုံးမှုထိန်းချုပ်ရေး ဥပဒေ (၂၀၀၆)	ပုဒ်မ ၅	MDL သည် သတ်မှတ်ထား သော ၎င်း၏လုပ်ဆောင်ချက်များ/တာဝန်များကို ဆောင်ရွက်ရာတွင် သက်ဆိုင်ရာအာဏာ ပိုင်အဖွဲ့အစည်း သို့ အပြည့် အဝ အကူအညီ နှင့်/သို့မဟုတ် အထောက်အပံ့ပြုမည်ဖြစ်ပြီး ယင်းနှင့်အညီ ဆောင်ရွက်ရန် လိုအပ်သည် များကို အချိန်နှင့် အမျှ ၎င်း၏ပင်မ ကန်ထရိုက်တာနှင် အခြားသော သက်ဆိုင် ရာ စာချုပ်ဝင်များသို့အ ကြောင်း ကြားမည်ဖြစ်ပါသည်။
၁၀။	ရေနံနှင့်ရေနံထွက်ပစ္စည်းဆိုင်ရာ ဥပဒေ (၂၀၁၇)	ပုဒ်မ ၉ (က) (င)၊ ၁၀ (က) (ခ) (ဃ) (င)၊ ၁၁	MDL သည် ဤဥပဒေပါ သက်ဆိုင်ရာပြဋ္ဌာန်းချက်များ နှင့် ဆောင်ဆောင် ရွက်မည်ဖြစ်ကြောင်းနှင့်

စဉ်	ဥပဒေ	လိုက်နာရမည့်ပုဒ်မ/နည်းဥပဒေ များ	မှတ်ချက်
			ဥပဒေ နှင့်အညီ ဆောင်ရွက်ရန် လိုအပ် သည်များကို အချိန်နှင့် အမှုရင်း၏ ပင်မကန်ထရိုက် တာနှင့် အခြားသော သက်ဆိုင် ရာစာချုပ်ဝင်များ သို့ အကြောင်း ကြားမည်ဖြစ်ပါ သည်။
၁၁။	အလုပ်သမားအဖွဲ့ အစည်း ဥပဒေ (၂၀၁၁)	ပုဒ်မ ၁၇ မှ ၂၂ ထိ	MDL သည် သက်ဆိုင်ရာ အလုပ် သမားဥပဒေများ နှင့် အညီ ဆောင်ရွက်မည်ဖြစ် ကြောင်းနှင့် ဥပဒေ နှင့်အညီ ဆောင်ရွက်ရန် လိုအပ် သည် များကို အချိန်နှင့်အမှုရင်း၏ ပင်မ ကန်ထရိုက်တာနှင့် အခြား သော သ သက်ဆိုင်ရာ စာချုပ်ဝင် များသို့ အကြောင်း ကြားမည် ဖြစ်ပါသည်။
၁၂။	အလုပ်သမားအငြင်းပွားမှု ဖြေ ဖြေရှင်းရေး ဥပဒေ (၂၀၁၂)	ပုဒ်မ ၃၈၊၃၉၊၄၀၊၆၁	MDL သည် သက်ဆိုင်ရာ အလုပ် သမားဥပဒေများ နှင့် အညီ ဆောင်ရွက်မည်ဖြစ် ကြောင်းနှင့် ဥပဒေ နှင့်အညီ ဆောင်ရွက်ရန် လိုအပ် သည် များကို အချိန်နှင့်အမှု ရင်း၏ ပင်မကန်ထရိုက်တာနှင့် အခြား သောသက်ဆိုင်ရာ စာချုပ်ဝင် များ သို့ အကြောင်း ကြားမည် ဖြစ်ပါသည်။
၁၃။	အလုပ်အကိုင်နှင့်ကျွမ်းကျင်မှုဖွံ့ ဖြိုး တိုးတက်ရေး ဥပဒေ (၂၀၁၃)	ပုဒ်မ ၅၊၁၄၊၃၀ (က) (ခ)	MDL သည် သက်ဆိုင်ရာ အလုပ်သမား ဥပဒေများ နှင့် အညီ ဆောင်ရွက်မည်ဖြစ် ကြောင်းနှင့် ဥပဒေနှင့်အညီ ဆောင်ရွက်ရန် လိုအပ်သည် များကို အချိန်နှင့် အမှု ရင်း၏ ပင်မ ကန်ထရိုက်တာ နှင့် အခြားသော သက်ဆိုင်ရာ စာချုပ်ဝင်များသို့ အကြောင်း ကြား မည်ဖြစ်ပါသည်။

စဉ်	ဥပဒေ	လိုက်နာရမည့်ပုဒ်မ/နည်းဥပဒေများ	မှတ်ချက်
၁၄။	၂၀၁၃ ခုနှစ်၊ အနည်းဆုံး အခကြေးငွေ ဥပဒေ	ပုဒ်မ ၁၂၊၁၃ (က) (ခ) (ဂ) (ဃ) (င) (စ) (ဆ)	MDL သည် သက်ဆိုင်ရာ အလုပ်သမားဥပဒေများနှင့် အညီ ဆောင်ရွက်မည်ဖြစ်ကြောင်းနှင့် ဥပဒေနှင့်အညီ ဆောင်ရွက်ရန် လိုအပ် သည်များကို အချိန်နှင့်အမျှငင်း၏ ပင်မကန်ထရိုက်တာ နှင့် အခြားသောသက်ဆိုင်ရာ စာချုပ်ဝင် များသို့ အကြောင်း ကြား မည်ဖြစ်ပါသည်။
၁၅။	၂၀၁၆ ခုနှစ်၊ အခကြေးငွေ ပေးချေရေး ဥပဒေ	ပုဒ်မ၃၊၄၊၅၊၁၄ နှင့်အခန်း ၃၁	MDL သည် သက်ဆိုင်ရာ အလုပ်သမားဥပဒေများနှင့် အညီ ဆောင်ရွက်မည်ဖြစ် ကြောင်းနှင့် ဥပဒေနှင့်အညီ ဆောင်ရွက်ရန် လိုအပ် သည်များကို အချိန်နှင့်အမျှငင်း၏ ပင်မကန်ထရိုက်တာ နှင့် အခြားသောသက်ဆိုင်ရာ စာချုပ်ဝင် များသို့ အကြောင်း ကြားမည်ဖြစ် ပါသည်။
၁၆။	ခွင့်နှင့်အလုပ်ပိတ်ရက်များ အက်ဥပဒေ (၁၉၅၁)		MDL သည် သက်ဆိုင်ရာ အလုပ်သမားဥပဒေများနှင့် အညီ ဆောင်ရွက်မည်ဖြစ် ကြောင်းနှင့် ဥပဒေနှင့်အညီ ဆောင်ရွက်ရန် လိုအပ် သည်များကို အချိန်နှင့်အမျှငင်း၏ ပင်မကန်ထရိုက်တာ နှင့် အခြားသောသက်ဆိုင်ရာ စာချုပ်ဝင် များသို့ အကြောင်း ကြားမည်ဖြစ် ပါသည်။
၁၇။	အလုပ်ရုံများ အက်ဥပဒေ (၁၉၅၁)	လုပ်ငန်းခွင်လုံခြုံရေး၊ဘေးကင်းရေး၊ ကျန်းမာရေး၊ လူမှုဖူလုံရေး ဆိုင်ရာပြဋ္ဌာန်းချက်များ	MDL သည် ဤဥပဒေပါ သက်ဆိုင်ရာပြဋ္ဌာန်းချက်များနှင့်အညီ ဆောင်ရွက်မည်ဖြစ် ကြောင်း နှင့် ဥပဒေနှင့်အညီ ဆောင်ရွက် ရန် လိုအပ်သည် များကို အချိန်နှင့် အမျှငင်း၏ပင်မ ကန်ထရိုက်တာ နှင့် အခြား

စဉ်	ဥပဒေ	လိုက်နာရမည့်ပုဒ်မ/နည်းဥပဒေများ	မှတ်ချက်
			သောသက်ဆိုင်ရာ စာချုပ်ဝင် များ သို့ အကြောင်းကြား မည်ဖြစ်ပါသည်။
၁၈။	လူမှုဖူလုံရေး ဥပဒေ (၂၀၁၂)	ပုဒ်မ ၁၁(က)၊ ၁၅(က)၊ ၁၈(ခ)၊ ၄၈၊၄၉၊ ၇၅	MDL သည် သက်ဆိုင်ရာ အလုပ်သမားဥပဒေများနှင့် အညီ ဆောင်ရွက်မည်ဖြစ် ကြောင်းနှင့်ဥပဒေနှင့် အညီ ဆောင်ရွက်ရန် လိုအပ် သည်များကို အချိန်နှင့်အမျှငင်း၏ ပင်မကန်ထရိုက်တာ နှင့် အခြား သော သက်ဆိုင်ရာ စာချုပ်ဝင် များသို့ အကြောင်း ကြားမည် ဖြစ် ပါသည်။
၁၉။	Worker Compensation Act (1951)		MDL သည် သက်ဆိုင်ရာ အလုပ်သမားဥပဒေများနှင့် အညီ ဆောင်ရွက်မည်ဖြစ် ကြောင်းနှင့်ဥပဒေနှင့် အညီ ဆောင်ရွက်ရန် လိုအပ် သည်များကို အချိန်နှင့်အမျှငင်း၏ ပင်မကန်ထရိုက်တာ နှင့် အခြားသောသက်ဆိုင်ရာ စာချုပ်ဝင် များသို့ အကြောင်း ကြားမည် ဖြစ်ပါသည်။
၂၀။	မြန်မာနိုင်ငံအင်ဂျီနီယာကောင်စီ ဥပဒေ (၂၀၁၃)	ပုဒ်မ ၃၁(က) (ခ)၊ ၃၇	MDL သည် ဤဥပဒေပါ သက် ဆိုင်ရာ ပြဋ္ဌာန်းချက်များနှင့် အညီ ဆောင်ရွက်မည် ဖြစ် ကြောင်း နှင့် ဥပဒေနှင့်အညီ ဆောင်ရွက်ရန် လိုအပ်သည် များကို အချိန်နှင့် အမျှငင်း၏ပင်မ ကန်ထရိုက်တာ နှင့် အခြားသော သက်ဆိုင်ရာ စာချုပ်ဝင်များ သို့ အကြောင်း ကြားမည်ဖြစ်ပါသည်။
၂၁။	မြန်မာ့မီးသတ်တပ်ဖွဲ့ ဥပဒေ (၂၀၁၅)	ပုဒ်မ ၂၅	MDL သည် ဤဥပဒေပါ သက် ဆိုင်ရာပြဋ္ဌာန်းချက်များနှင့်အညီ

စဉ်	ဥပဒေ	လိုက်နာရမည့်ပုဒ်မ/နည်းဥပဒေများ	မှတ်ချက်
			ဆောင်ရွက်မည် ဖြစ် ကြောင်း နှင့် ဥပဒေနှင့်အညီ ဆောင်ရွက် ရန် လိုအပ်သည်များကို အချိန် နှင့် အမှု ၎င်း၏ပင်မ ကန်ထ ရိုက်တာနှင့် အခြားသောသက် ဆိုင်ရာ စာချုပ်ဝင်များ သို့ အကြောင်း ကြားမည်ဖြစ်ပါ သည်။
၂၂။	ယဉ်ကျေးမှုအမွေအနှစ်ဒေသများ ကာကွယ်ထိန်းသိမ်းရေး ဥပဒေ (၁၉၉၈)	ပုဒ်မ ၈၊ ပုဒ်မ ၁၃ (က နှင့် ခ)၊ ပုဒ်မ ၂၂	MDL သည် ဤဥပဒေပါ သက်ဆိုင်ရာပြဋ္ဌာန်းချက်များနှင့်အညီ ဆောင်ရွက်မည်ဖြစ်ကြောင်းနှင့် ဥပဒေနှင့်အညီ ဆောင်ရွက်ရန် လိုအပ်သည်များကိုအချိန်နှင့်အမှု ၎င်း၏ပင်မကန်ထရိုက်တာ နှင့် အခြားသောသက်ဆိုင်ရာ စာချုပ်ဝင်များ သို့ အကြောင်း ကြားမည် ဖြစ်ပါသည်။
၂၃။	ရှေးဟောင်းအဆောက်အအုံ ကာကွယ် ထိန်းသိမ်းရေး ဥပဒေ (၂၀၁၅)	ပုဒ်မ ၁၂၊၁၅၊၂၀	MDL သည် ဤဥပဒေပါ သက်ဆိုင်ရာပြဋ္ဌာန်းချက်များနှင့်အညီ ဆောင်ရွက်မည်ဖြစ်ကြောင်းနှင့် ဥပဒေနှင့်အညီ ဆောင်ရွက်ရန် လိုအပ်သည်များကို အချိန်နှင့် အမှု ၎င်း၏ပင်မကန်ထရိုက်တာ နှင့် အခြားသောသက်ဆိုင်ရာ စာချုပ်ဝင်များ သို့ အကြောင်း ကြားမည်ဖြစ်ပါသည်။
၂၄။	ရှေးဟောင်းဝတ္ထုပစ္စည်းကာကွယ် ထိန်းသိမ်းရေး ဥပဒေ (၂၀၁၅)	ပုဒ်မ ၁၂	MDL သည် ဤဥပဒေပါ သက်ဆိုင်ရာပြဋ္ဌာန်းချက်များနှင့်အညီ ဆောင်ရွက်မည် ဖြစ် ကြောင်း နှင့် ဥပဒေနှင့်အညီ ဆောင်ရွက် ရန် လိုအပ်သည် များကို အချိန်နှင့်အမှု

စဉ်	ဥပဒေ	လိုက်နာရမည့်ပုဒ်မ/နည်းဥပဒေများ	မှတ်ချက်
			၎င်း၏ပင်မ ကန်ထရိုက်တာ နှင့် အခြားသော သက်ဆိုင်ရာ စာချုပ် ဝင်များ သို့ အကြောင်း ကြား မည်ဖြစ်ပါသည်။
၂၅။	ပို့ကုန်သွင်းကုန် ဥပဒေ (၂၀၁၂)	ပုဒ်မ ၇	MDL သည် ဤဥပဒေပါ သက်ဆိုင်ရာပြဋ္ဌာန်းချက်များနှင့်အညီ ဆောင်ရွက်မည်ဖြစ်ကြောင်းနှင့် ဥပဒေနှင့်အညီ ဆောင်ရွက်ရန် လိုအပ်သည်များကို အချိန်နှင့် အမျှ ၎င်း၏ပင်မကန်ထရိုက်တာ နှင့် အခြားသော သက်ဆိုင်ရာ စာချုပ်ဝင်များ သို့ အကြောင်း ကြားမည်ဖြစ်ပါသည်။
၂၆။	ရန်ကုန်မြို့တော်စည်ပင်သာယာရေး ဥပဒေ (၂၀၁၈)		MDL သည် ဤဥပဒေပါ သက်ဆိုင်ရာပြဋ္ဌာန်းချက်များနှင့်အညီ ဆောင်ရွက်မည်ဖြစ်ကြောင်းနှင့် ဥပဒေနှင့်အညီ ဆောင်ရွက်ရန် လိုအပ်သည်များကို အချိန်နှင့် အမျှ ၎င်း၏ပင်မကန်ထရိုက်တာ နှင့် အခြားသော သက်ဆိုင်ရာ စာချုပ်ဝင်များ သို့ အကြောင်း ကြားမည်ဖြစ်ပါသည်။ MDL သည် သတ်မှတ်ထား သော ၎င်း၏လုပ်ဆောင်ချက်များ/တာဝန်များကို ဆောင်ရွက်ရာ တွင် သက်ဆိုင်ရာ အာဏာပိုင် အဖွဲ့အစည်းသို့ အပြည့်အဝအကူအညီ နှင့်/ သို့မဟုတ် အထောက်အပံ့ပြု မည်ဖြစ်ပြီးယင်း နှင့်အညီ ဆောင်ရွက်ရန် လို အပ်သည် များကို အချိန်နှင့်အမျှ ၎င်း၏ ပင်မကန်ထရိုက်တာနှင့် အခြားသောသက်ဆိုင်ရာ စာချုပ်ဝင် များ သို့

စဉ်	ဥပဒေ	လိုက်နာရမည့်ပုဒ်မ/နည်းဥပဒေများ	မှတ်ချက်
			အကြောင်း ကြားမည် ဖြစ်ပါသည်။
၂၇။	Petroleum Rules 1937	အခန်း ၃ နှင့် ၄	MDL သည် ဤဥပဒေပါ သက်ဆိုင်ရာပြဋ္ဌာန်းချက်များနှင့်အညီ ဆောင်ရွက်မည် ဖြစ်ကြောင်း နှင့် ဥပဒေနှင့်အညီ ဆောင်ရွက် ရန် လိုအပ်သည်များကို အချိန် နှင့်အမျှ ၎င်း၏ပင်မ ကန်ထ ရိုက်တာ နှင့် အခြားသော သက်ဆိုင်ရာ စာချုပ်ဝင်များ သို့ အကြောင်း ကြားမည်ဖြစ် ပါသည်။
၂၈။	မြန်မာနိုင်ငံရင်းနှီးမြှုပ်နှံမှုနည်းဥပဒေများ (၂၀၁၇)	နည်း ၂၀၂၊၂၀၃၊၂၀၆	MDL သည် ဤဥပဒေပါ သက်ဆိုင်ရာပြဋ္ဌာန်းချက်များ နှင့်အညီ ဆောင်ရွက်ပါမည်။
၂၉။	မော်တော်ယာဉ်ဥပဒေ (၂၀၁၅)	ဆူညံမှု၊ ဖုန်ယာဉ်ကြော ရှုပ်ထွေးခြင်း၊အခိုးအငွေ့ ထုတ်ခြင်းမရှိစေရန် ယင်းတို့နှင့် ဆိုင်သည့် ပြဋ္ဌာန်းချက်များ	MDL သည် ဤဥပဒေပါ သက်ဆိုင်ရာပြဋ္ဌာန်းချက်များ နှင့်အညီ ဆောင်ရွက်မည် ဖြစ်ကြောင်းနှင့် ဥပဒေနှင့်အညီ ဆောင်ရွက်ရန် လိုအပ်သည်များကို အချိန်နှင့်အမျှ ၎င်း ၏ ပင်မကန်ထရိုက်တာ နှင့် အခြားသောသက်ဆိုင်ရာ စာချုပ် ဝင်များ သို့ အကြောင်းကြား မည်ဖြစ်ပါ သည်။
၃၀။	မောတော်ယာဉ်နည်းဥပဒေများ (၁၉၇၈)		MDL သည် ဤဥပဒေပါ သက် ဆိုင်ရာ ပြဋ္ဌာန်းချက်များ နှင့်အညီ ဆောင်ရွက်မည် ဖြစ်ကြောင်းနှင့် ဥပဒေနှင့်အညီ ဆောင်ရွက်ရန်လို အပ်သည်များကို အချိန် နှင့် အမျှ ၎င်း၏ပင်မ ကန်ထရိုက် တာ နှင့် အခြား သောသက် ဆိုင်ရာ စာချုပ်ဝင် များသို့ အကြောင်း ကြား မည်ဖြစ်ပါ သည်။
၃၁။	မြန်မာ့ဆိပ်ကမ်း အာဏာပိုင်ဥပဒေ		MDL သည် ဤဥပဒေပါ သက်ဆိုင်ရာပြဋ္ဌာန်းချက်များ နှင့်အညီ

			မည် ဖြစ်ကြောင်းနှင့် ဥပဒေနှင့်အညီ ဆောင်ရွက်ရန်လို အပ်သည်များကို အချိန် နှင့် အမျှ ၎င်း၏ပင်မ ကန်ထရိုက် တာ နှင့် အခြား သောသက် ဆိုင်ရာ စာချုပ်ဝင် များသို့ အကြောင်း ကြား မည်ဖြစ်ပါ သည်။
၃၁။	မြန်မာ့ဆိပ်ကမ်း အာဏာပိုင် ဥပဒေ		MDL သည် ဤဥပဒေပါ သက် ဆိုင်ရာပြဋ္ဌာန်းချက်များ နှင့်အညီ ဆောင်ရွက်မည် ဖြစ်ကြောင်းနှင့် ဥပဒေ နှင့်အညီ ဆောင်ရွက်ရန် လို အပ်သည် များ ကို အချိန်နှင့်အမျှ ၎င်း ၏ ပင်မကန် ထရိုက်တာ နှင့် အခြား သောသက် ဆိုင်ရာ စာချုပ် ဝင်များ သို့ အကြောင်း ကြား မည်ဖြစ်ပါ သည်။
၃၂။	မြန်မာနိုင်ငံအာမခံ လုပ်ငန်း ဥပဒေ	ပုဒ်မ ၁၅ နှင့် ပုဒ်မ ၁၆	MDL သည် ဤဥပဒေပါ သက် ဆိုင်ရာပြဋ္ဌာန်းချက်များ နှင့်အညီ ဆောင်ရွက်မည် ဖြစ်ကြောင်းနှင့် ဥပဒေ နှင့်အညီ ဆောင်ရွက်ရန် လို အပ်သည် များ ကို အချိန်နှင့်အမျှ ၎င်း ၏ ပင်မကန် ထရိုက်တာ နှင့် အခြား သောသက် ဆိုင်ရာ စာချုပ် ဝင်များ သို့ အကြောင်း ကြား မည်ဖြစ်ပါ သည်။

(Stephen Purvis)
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Ministry of Natural Resources & Environmental Conservation

10 September 2018

Referring to the feedback made in Review Team Assessment meeting held on 26 July 2018, Meeyahta Development Limited (MDL) hereby acknowledge that MDL shall act in accordance with any applicable/relevant provisions under the specific sections of following Laws of Myanmar to best of its abilities.

No.	Law Title	Specific Sections/Chapters to be complied	Remarks from MDL
1	Environmental Conservation Law, 2012	Section 7 (o), Section 14, Section 15, Section 24 and Section 32	MDL shall act in accordance with the applicable sections under this law and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
2	Environmental Conservation Rules, 2014	Rule 69	
3	Environmental Impact Assessment Rules and Regulations 2015	From paragraph 102 to 110, 113, 115, 117	
4	National Environmental Quality (Emission) Guidelines 2015	-	
5	Law Protecting Ethnic Rights 2015	Section 5	MDL shall act in accordance with the applicable sections under this law and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
6	Myanmar Investment Law 2016	Section 50, Section 51 and Section 65 (f) (i) (j) (k) (l) (m) (n) (o) (p), Section 73	MDL shall act in accordance with the applicable sections under this law and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
7	The Public Health Law 1972	Section 3 and Section 5	MDL shall provide full assistance and/or support to the relevant

No.	Law Title	Specific Sections/Chapters to be complied	Remarks from MDL
			authority in carrying out its functions/duties as applicable and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
8	Prevention and Control of Communicable Diseases law 1995	Section 3, Section 4, Section 9 and Section 11	MDL shall act in accordance with the applicable sections under this law and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same. MDL shall provide full assistance and/or support to the relevant authority in carrying out its functions/duties as applicable and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
9	The Control of Smoking and Consumption of Tobacco Product Law 2006	Section 5	MDL shall provide full assistance and/or support to the relevant authority in carrying out its functions/duties as applicable and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
10	Myanmar Petroleum and Petroleum Products law 2017	Section 9 (a) & (c), Section 10 (a) (b) (d) (e) and Section 11	MDL shall act in accordance with the applicable sections under this law and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
11	Labor Organization Law 2011	Section 17 to Section 22	MDL shall act in accordance with relevant Labour Laws and shall

No.	Law Title	Specific Sections/Chapters to be complied	Remarks from MDL
			give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
12	The Settlement of Labour Dispute Law 2012	Section 38, Section 39 and Section 40	MDL shall act in accordance with relevant Labour Laws and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
13	Employment and Skill Development law 2013	Section 5, Section 14 and Section 30 (a) & (b)	MDL shall act in accordance with relevant Labour Laws and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
14	Minimum Wages Law 2013	Section 12 and Section 13 (a), (b), (c), (d), (e), (f)	MDL shall act in accordance with relevant Labour Laws and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
15	Myanmar – Payment of Wage Law 2016	Section 3, Section 4, Section 5 and Section 14	MDL shall act in accordance with relevant Labour Laws and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
16	Myanmar- Leave and Holidays Act 1951		MDL shall act in accordance with relevant Labour Laws and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.

No.	Law Title	Specific Sections/Chapters to be complied	Remarks from MDL
17	The Factory Act, 1951	Related section regarding the site safety, health and social security	MDL shall act in accordance with the applicable sections under this law and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
18	Social Security law 2012	Section 11 (a), Section 15 (a), Section 18 (b), Section 48, Section 49 and Section 75	MDL shall act in accordance with relevant Labour Laws and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
19	Worker Compensation Act 1951		MDL shall act in accordance with relevant Labour Laws and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
20	Myanmar Engineering Council Law 2013	Section 31 (a) & (b) and Section 37	MDL shall act in accordance with the applicable sections under this law and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
21	Fire Force Law 2015	Section 25	MDL shall act in accordance with the applicable sections under this law and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
22	Protection and Preservation of Cultural Heritage Law 1998	Section 8, Section13 (a & b) and Section 22	MDL shall act in accordance with the applicable sections under this law and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
23	The Protection and Preservation of Ancient Monuments Law 2015	Section 12,15,20	MDL shall act in accordance with the applicable sections under this law and shall give notice to its

No.	Law Title	Specific Sections/Chapters to be complied	Remarks from MDL
			Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
24	The Protection and Preservation of Antiquities Law 2015	Section 12	MDL shall act in accordance with the applicable sections under this law and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
25	Export and Import Law 2012	Section 7	MDL shall act in accordance with the applicable sections under this law and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
26	The City of Yangon Development Law 2018		MDL shall act in accordance with the applicable sections under this law and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same. MDL shall provide full assistance and/or support to the relevant authority in carrying out its functions/duties as applicable and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
27	Petroleum Rules 1937	Chapter 3 and Chapter 4	MDL shall act in accordance with the applicable sections under this law and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
28	Myanmar Investment Law 2017	Section 202, Section 203 and Section 206	MDL shall act in accordance with the applicable sections under this law.

No.	Law Title	Specific Sections/Chapters to be complied	Remarks from MDL
29	Motor Vehicle Law 2015	Related section regarding noise, traffic jam and exhaust emission	MDL shall act in accordance with the applicable sections under this law and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
30	Motor Vehicle Rules 1987		MDL shall act in accordance with the applicable sections under this law and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
31	Myanmar Port Authority Law 2015		MDL shall act in accordance with the applicable sections under this law and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.
32	Myanmar Insurance Law 1993	Section 15 and Section 16	MDL shall act in accordance with the applicable sections under this law and shall give notice to its Main Contractor and any other relevant third parties from time to time of the requirement to act in accordance with the same.

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List of Abbreviations

$\mu g/m^3$	microgram per cubic meter
AAGR	Average Annual Growth Rate
ACM	Asbestos-Containing Materials
ADB	Asian Development Bank
AHUs	Air handling units
AIP	Approval in principle
AoI	Area of Influence
APHA	American Public Health Association
AQG	Air Quality Guidelines
ASEAN	Association of Southeast Asian Nations
ASRs	Air Sensitive Receivers
ASTM	American Standard for Testing Methodology
bgl	Below ground level
BMI	body mass index
BOD	Biological Oxygen Demand
BOH	Back-of-House
BOT	Build-operate-transfer
BTJV	BYMA – Taisei Joint Venture
BYMA	BYMA Pte Ltd
CBD	Central Business District
CBP	Continuous Bore Pile
CDUs	Condensing units
CFU/ 100 ml	Colony Forming Unit per 100 millilitres
Cl	Chloride
CMP	Conservation Management Plan
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COC	Chemical of Concern
COD	Chemical Oxygen Demand
CQHP	Committee for Quality Control of Highrise Building Projects
dB(A)	A-weighted decibels
DIV	Dutch Intervention Values
DOS	Degree of Saturation
DTV	Dutch Target Values
E&S	Environmental and social
E. coli	*Escherichia Coli*
EBS	Environmental Baseline Study
EC	electrical conductivity
ECC	Environmental Conservation Council
ECD	Environmental Conservation Department
EDGE	Excellence in Design for Greater Efficiency
EH&S	Environment Health and Safety
EHS	Extra Heavy Standard Tree
EIA	Environmental Impact Assessment

EM&A	Environmental Monitoring and Audit
EMAP	Environmental Monitoring and Audit Programme
EMP	Environmental Management Plan
EMSP	Environmental and Social Management Plan
ENVIRON	ENVIRON Myanmar Company Limited
ERP	Emergency Response Plan
ESA	Environmental Site Assessment
ESCP	Erosion and Sedimentation Control Plan
ESIA	Environmental and Social Impact Assessment
ESMS	Environmental and Social Management System
ET	Environmental Team
F	Fluoride
F&B	Food and Beverage
FCUs	Fan coil units
FDS	Fire Dynamic Simulator
FGLLID	Factories and General Labor Law Department
FIR	Foreign Investment Rules
FMI	First Myanmar Investment Ltd.
ft^2	square feet
GAD	General Administration Departments
GBV	Ground-borne Vibration
GDP	Gross Domestic Product
GFA	Gross Floor Area
GIIP	Good International Industry Practice
GRM	Grievance Redress Mechanism
GSS	Gas sensitive semiconductors
HCM	Highway Capacity Manual
HIA	Heritage Impact Assessment
HIC	Highrise Inspection Committee
HRB	High-Rise Building
HS	Heavy Standard Tree
HSE	Health, Safety and Environmental
HSES	Health, safety, environmental & social
IAIA	International Association for Impact Assessment
IAQM	Institute of Air Quality Management
ICA	Inner City Area
IEC	Independent Environmental Consultant
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IFC PS	International Finance Corporation Performance Standards
ILO	International Labour Organisation
ISCST3	Industrial Source complex Short Term
JTC	Singapore Jurong Town Corporation
km	kilometre
km^2	square kilometre

km/h	Kilometre per hour
kVA	kilo-volt-ampere
kWh/ year	kilowatt hour per year
LBP	Lead Based Paints
LOR	Limits of Reporting
LOS	Level of Service
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
m	meter
m^2	square meter
m^3	cubic meter
m^3/year	cubic meter per year
m bgl	meter below ground level
mg/l	milligram per litre
m/s	meter per second
MBR	Membrane BioReactor
MIC	Myanmar Investment Commission
MDL	Meeyahta Development Limited
MIL 2016	Myanmar Investment Law 2016
MOECAF	Ministry of Environmental Conservation and Forestry
MoF	Minister of Forestry
MONREC	Ministry of Natural Resources and Environmental Conservation
MPN	Most probable number
MRB	Myanmar Railways Building
MRCS	Myanmar Red Cross Society
MSDS	Material Safety Data Sheets
MSL	mean sea level
MW	Monitoring Well
NAAQS	National Ambient Air Quality Standards
NCEA	National Commission for Environmental Affairs
NEQEG	National Environmental Quality (Emission) Guidelines
NGOs	Non-governmental organisations
NIF	Noise Insulation Fabric
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
NSRs	Noise Sensitive Receivers
O_3	Ozone
ODS	Ozone Depleting Substances
OH&S	Occupational, health and safety
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated Biphenyls
PCCD	Pollution Control and Cleansing Department
PE	Project Engineer
PGA	Peak ground acceleration
PM	Particulate matter

$PM_{2.5}$	Particulate Matter less than 2.5 micron
PM_{10}	Particulate Matter less than 10 micron
PP	Project Proponent
PPE	Personal Protective Equipment
PPV	Peak Particle Velocity
PS	Performance Standard
PYL	Peninsula Yangon Limited
PYN	The Peninsula Yangon
QSE	Quality, Safety and Environment
SMF	Synthetic Mineral Fiber
SO_2	Sulfur Dioxide
SO_4	Sulphate
SO_x	Sulfur Oxides
SOPs	Standard Operating Procedures
SPAPM	SPA Project Management
SPPs	Stand Pipe Piezometers
SPT	Standard Penetration Test
ST	Standard Tree
SVOC	Semi-Volatile Organic Compounds
SWL	Safe working load
TIA	Traffic Impact Assessment
TDS	Total Dissolved Solids
TOR	Terms of Reference
TOC	Total organic carbon
TPH	Total Petroleum Hydrocarbons
TSP	Total Suspended Particulates
TSS	Total Suspended Solid
TW	Tube well
UNFCCC	United Nations Framework Convention on Climate Change
USCS	Unified Soil Classification System
USDOT	United States Department of Transport
USEPA	United States Environmental Protection Agency
UV	Ultra violet
VAV	Variable air volume
VOC	Volatile Organic Compounds
VSRs	Vibration Sensitive Receivers
VRF	Variable refrigerant flow
WHO	World Health Organization
WWTP	Wastewater Treatment Plant
YCDC	Yangon City Development Committee
YESC	Yangon Electricity Supply Corporation
YHT	Yangon Heritage Trust
ZoI	Zone of Impact

1 EXECUTIVE SUMMARY

1.1 Introduction

Meeyahta Development Limited (MDL) intends to redevelop the company's existing 6.35 acres plot in the Yangon City Centre into a premium mixed development scheme comprising residential, commercial, retail and hotel components known as the Landmark Project (hereinafter referred to as the "Project"). MDL is a joint venture between Yoma Strategic and its esteemed partners, Mitsubishi Corporation, Mitsubishi Estate, the International Finance Corporation (IFC), the Asian Development Bank (ADB) and First Myanmar Investment Company Limited (FMI).

The Project site is located in the Yangon Central Business District (CBD) within the Pabedan Township and covers an area of 6.35 acres (25,700 m^2). It is a built environment located at the busiest commercial hub of Yangon City. The overall development site is being shared between the Project and the International Hotel Project of Peninsula Yangon Limited (PYL).

MDL has engaged ENVIRON Myanmar to conduct an Environmental Impact Assessment (EIA). The EIA was undertaken by a team of consultants from ENVIRON with technical and project-related inputs from the project teams which include the following: SPA Project Management Ltd., Meinhardt (Thailand) Ltd., and Balmond Studio. Strictly abiding by the Myanmar requirements, EIA processes began with screening and developing the scoping report with the Terms of Reference (TOR) for the EIA. Subsequently, alternatives for designs and implementation plans, soil surveys, air and water quality surveys, traffic assessments, socio-economic survey and engagements with regulatory departments and other stakeholders individually were conducted. With the development of the EIA, design modifications were executed to comply with the requirements

1.2 Brief Description of the Project

The proposed Project site is located at 380, Bogyoke Aung San Road, Pabedan Township, Yangon, Myanmar. The FMI Centre, the Grand Meeyahta Executive Residence, Zawgyi House and a few other smaller structures are situated in the project compound.

Meeyahta International Hotel Limited has leased the land from the Myanma Railways of Ministry of Transport and Communications for International Hotel Project and the Landmark Project together with the agreed and signed built-operate-transfer (BOT). The lease is for an initial period of 50 years commencing 1 January 1998.

The proposed Project will be developed in several phases and the development will be carried out in sequence. It is anticipated that the entire project will take approximately 54 months.

The proposed Landmark Project will develop the Peninsula Residence, business hotel and serviced apartments, two office towers, a retail podium, and a basement car parking lot. Upon completion of the Project, the total gross floor area (GFA) will be approximately 200,000 square meter (m^2) (2.15 million square feet (ft^2)).

The proposed Project will be developed in several phases and the development will be carried out in sequence. Following plan illustrates the estimation of the project implementation:

- Demolition of Grand Meeyahta Executive Residence – 5 months;
- Demolition of FMI Centre – 5 months;

- Foundation and substructure works, basement tank foundation and substructure works – 36 months;
- Superstructure works, mechanical, electrical and plumbing works, interior design and fit out works, final finishes and equipment installation works, testing and commissioning works – 35 months; and
- Application for occupation permits – 6 months.

It is anticipated that the entire project will take approximately 54 months.

During construction stage, the electricity 3,200,000 kilowatt hour per year (kWh/year) while total water supply required is estimated to be 212,104 cubic meter (m^3) throughout the construction stage.

The water requirement for the proposed Project is expected to be 365,000 m^3 per year. The primary source of water supply for the proposed Project is groundwater with the secondary source obtained from the municipal supply. Yangon City Development Committee (YCDC) has agreed to negotiate to connect to the YCDC water supply network and the project has already put in place the connection point ready to connect once the infrastructure has upgraded in the project area.

The total estimated demand for electricity for all the components is 70,953,600 kWh/year. In order to fulfil the energy demands for the development, electricity will be sourced primarily from the Thida Substation with the secondary source from the Railway Substation. Six (6) standby centralised generators with the back-up capacity of 100% will be installed as well to ensure undisrupted power.

Wastewater generated during the operational phase of the development includes sewage effluent from the sanitary facilities and sullage comprising wash waters from bathrooms, sinks, kitchen and showers. These wastewater streams will be treated within the proposed Wastewater Treatment Plant (WWTP) which is a Membrane BioReactor (MBR) with a design capacity of 1,200 m^3/day. The treated effluent will be polished and transferred to the cooling tower water make-up water tank.

In addition, Landmark Project is in the process of obtaining the IFC EDGE (Excellence in Design for Greater Efficiency) certification.

1.3 Existing Environment

The proposed Site is situated at a built environment in a busy commercial hub of Yangon and the whole area currently has many new developments. Due to the nature of the Project and planned environmental safeguard measures, its potential Area of Influence (AoI) area is minimal in the project's stages, which include construction phase, operation phase, and decommissioning phase. Existing physical, natural, and socio-economic conditions including the traffic conditions and access roads will be the primary focus of the study for environmental protection purposes. Physical setting of the site environment, topography, geology, soil, hydrogeology, hydrology, climate and meteorology, flora and fauna status, and socio-economic status will be investigated for the study.

1.3.1 Site Setting

The Project is located in the City of Yangon within the Yangon Region, Union of Myanmar. Located in the heart of Lower Myanmar, Yangon City lies at the convergence of the Yangon and Bago Rivers on the eastern margin of Ayeyarwady Delta and approximately 30 kilometres

(km) away from the coastline bordering the Gulf of Martaban. The Yangon Region is bordered by the Bago Region in the north and east, the Gulf of Martaban in the south and Ayeyarwady Region in the west.

The site is a L-shaped land parcel (16º46’ 50.84” N, 96º 09’31.58” E (northeast corner) and 16º 46’46.24” N, 96º09’26.78” E (south corner)) with an area of approximately 25,700 m^2 (6.35 acres). the site is a built-up area comprises a number of existing buildings, namely, the FMI Centre, Grand Meeyahta Executive Residence, Zawgyi House, two residential brick buildings, parking areas and a variety of smaller structures associated with the existing site.

1.3.2 Topography

The site is relatively flat, with a gentle downward slope from the northeast boundary (10.97 m) to the southwest (7.75 m).

1.3.3 Geology

The Yangon area is underlain by alluvial deposits (Pliestocene to Recent), the non-marine fluvialtile sediments of Irrawady formation (Pliocene), and hard, massive sandstone of Pegu series (early-late Miocene). Alluvial deposits are composed of gravel, clay, silts, sands and laterite which lie upon the eroded surface of the Irrawaddy formation at 3 – 4.6 m above mean sea level (MSL). The rock type in Yangon is mainly soft rocks consisting of sandstone, shale, limestones and conglomerate.

Technically, Yangon is situated in the southern part of the Central Lowland, which is one of the three major tectonic provinces of Myanmar. The Taungnio Range of the Gyophyu catchments area of Taikkyi District, north of Yangon, through the Thanlyin Bridge, south of Yangon forming a series of isolated hill was probably caused by the progressive deformation of the Upper Miocene rocks.

1.3.4 Soil

The underlying soil type at the Project site and its surroundings is characterized as the Meadow and Meadow Alluvial Soil. Meadow soil is soil which occurs near the river plains with occasional tidal floods, is non-carbonate and usually contains large amounts of salt. Both materials mainly comprise silty clay loam and neutral soil where they are rich in available plant nutrient.

1.3.5 Hydrogeology

Yangon is rich in groundwater resources conserved by unconsolidated Tertiary-Quaternary deposits. In Yangon, groundwater is mostly extracted from valley filled deposits and Ayeyarwady sandstones. Based on local geological considerations, potential groundwater source of Yangon can be roughly divided into two sub regions, namely the low potential area and high potential area.

Low potential areas are areas with the rock units of Hlawga Shale, Thadugan Sandstones and Basepet Alternation of upper Pegu Group (Miocene epoch) and Danyingon Clays of Irrawaddy rocks. High potential area covers approximately 85% of the Yangon city, including Pabedan where the Project site is located.

1.3.6 Hydrology

The Project site lies along the catchment of the Pazundaung River which flows east of the Site in a southerly direction to converge into the Yangon River. The Yangon River (also known as

the Rangoon River or Hlaing River) is formed by the confluence of the Pegu and Myitmaka rivers and flows into the Gulf of Martaban which is part of the larger Andaman Sea.

1.3.7 Climate and Meteorology

Yangon has a tropical monsoon climate under the Koppen climate classification system. The City typically experiences a distinct rainy season from the month of May through to October where a substantial amount of precipitation occurs; and dry season which commences from November and ends in April.

During the course of a year, average temperatures show some variance with average highs ranging from 26°C to 36°C and average lows occurring between 18°C and 25°C. The hottest period is between February and May, with little or no rain.

Historically, the average annual mean rainfall for Yangon was 2,681 mm with the annual average rainy days of 129.3 days.

1.3.8 Surrounding Landuse

Overall, the primary landuse of the areas surrounding the site is a mix of commercial and residential purposes.

1.3.9 Baseline Air Quality

Baseline air quality was measured at potential air sensitive receptors that may be affected by the Project. The daily average concentrations of PM_{10} were higher than National Environmental Quality (Emission) Guidelines (NEQEG) 2015 limits (50 $\mu g/m^3$) at all receptors (LM1, LM2 and LM3), being 63 microgram per cubic meter ($\mu g/m^3$), 58 $\mu g/m^3$ and 64 $\mu g/m^3$, respectively. For $PM_{2.5}$ concentration, the daily average values were also higher than NEQEG 2015 limits (25 $\mu g/m^3$) at all sites (LM1, LM2 and LM3), being 59 $\mu g/m^3$, 38 $\mu g/m^3$ and 51 $\mu g/m^3$, respectively. For sulfur dioxides (SO_2) concentrations, all the monitoring findings were higher than NEQEG 2015 limits at 42 $\mu g/m^3$, 94 $\mu g/m^3$ and 75 $\mu g/m^3$, respectively. Average hourly nitrogen oxides (NOx) concentrations for LM1, LM2, and LM3 were 61 $\mu g/m^3$, 77 $\mu g/m^3$, and 94 $\mu g/m^3$, respectively and these concentrations were lower than the NEQEG 2015 value of 200 $\mu g/m^3$ at all monitoring sites but NOx concentrations exceeding the NEQEG 2015 hourly standard were observed between 10 am and 12 pm.

It is important to note that findings from the baseline air quality monitoring showed higher levels of PM_{10} (particulate matter less than 10 micron), $PM_{2.5}$ (particulate matter less than 2.5 micron), and SO_2 exceeding NEQEG 2015 guideline values even before the project construction activities commenced.

1.3.10 Baseline Noise Level

The noise monitoring programme was conducted at representative noise sensitive receivers at and near the Landmark project. Two periods of twelve hours continuous monitoring of noise levels were investigated for comparison with the NEQEG 2015 limits for day and night. In this study, all ambient noise levels at all sites exceeded the noise level guidelines for residential, institutional and educational but is well below the allowable limits for industrial and commercial.

1.3.11 Soil and Groundwater

An intrusive soil and groundwater investigation was performed at the Project site to ascertain the baseline soil and groundwater conditions. As there are currently no compound-specific

reference standards for assessing the presence of soil and groundwater impact in Myanmar, the baseline analytical results were compared against the Dutch Standards 2009 (Rev 2012).

Dutch Target Values (DTV) exceedances in soil were reported for all metals and metalloids tested for except total chromium and molybdenum, selected sum polycyclic aromatic hydrocarbon (PAH) and mineral oil. Among samples tested, TP11 has reported an exceedance of the Dutch Intervention Values (DIV) limit for copper (190 mg/kg) with a reading of 600 mg/kg. Further, a trace of total coliform concentration was found in the soil samples. This group includes faecal coliform (e.g., Escherichia coli (E. coli)), as well as other forms of naturally occurring coliform found in soil.

Groundwater levels were measured at 10.1 meter below ground level (m bgl) (MW1), 6.73 m bgl (MW2), 7.71 m bgl (MW3) and 11.3 m bgl (MW4) during sampling and/ or purging. Barium in all four monitoring wells was found to exceed the DTV. The groundwater quality at the Project site is generally in compliance with the prescribed limits.

Total coliform was present in groundwater samples MW3 and MW4, recording at 30,000 Colony Forming Unit per 100 millilitres (CFU/100 ml) and 500 CFU/100 ml, respectively. There are presently no limits for this parameter in surface water or groundwater quality. The Myanmar effluent standards stipulate limits for total coliform at <400 most probable number per 100 ml (MPN/100ml) of coliform bacteria. The detected CFUs in MW3 and MW4 are above this limit and as such groundwater pumped from the site cannot be discharged to the public sewer system without prior treatment.

1.3.12 Biological Environment

The Project site is a built-environment and the species of flora surveyed at the site are native species not uncommon to the Yangon area. There were no protected species or species of conservation value identified. Common birds which have become adapted to the urban environment can be observed throughout the year.

1.3.13 Socio-economic Survey

The proposed Landmark Project is located within the commercial complex of the downtown Yangon and it is surrounded by Dagon, Pabedan, and Kyauktada Townships. There are seven Wards, namely Yawmin Gyi Ward in Dagon Township, Wards 1, 2 and 3 in Kyauktada Township, and Wards 5, 8 and 11 in Pabedan Township, are located within the immediate impact zone of the proposed Project.

The socio-economic survey was undertaken for the project affected areas in late July 2016. The survey findings were incorporated in the earlier section of the report. Socio-economic survey targeted the stakeholders in the surrounding areas including Pabedan, Kyauktada, Dagon, and Bogyoke Market. Survey found that all in all majority of the respondents chose not to comment and showed no interest in learning more about the project despite overwhelming majority expressed favorable remark for the project. Repeated concerns for increase in traffic congestion, noise, vibration, and dust ranked top generally in Pabedan Township. For Kyauktada Township, noise, vibration, solid waste, and wastewater were viewed as important issues. Respondents from Dagon Township deemed that noise, vibration, and security were serious matters. All in all from the survey results, successive major concerns can be noted as noise, vibration, and traffic congestion respectively.

A series of public consultations for individual groups of residences from the projected affected areas were carried out in August 2016. Around 60 participants attended the consultation sessions.

The participants from the project affected people from Pabedan Township, Kyauktada Township, Yawmingyi Quarter and the committee from St. Gabriel Church raised several issues during public consultation meeting. The major issues raised include noise, dust pollution and vibration level from the construction, waste management, increasing traffics congestion due to the construction activities and damages on the roads. In addition, the participants also requested for information regarding the project's arrangement for the current employees, demolition method and design about the basement parking lots, building strength for earthquake resistance, protection of the heritage building and impacts on the St. Gabriel Church building.

The Project Proponent considers that further consultations with all stakeholders are necessary and the project proponent makes the commitment to consult frequently.

1.3.14 Existing Traffic Condition

The junctions in base scenario (existing year 2016) are generally operating under capacity in terms of level of service (LOS) and degree of saturation (DOS) and there is reserve capacity for the traffic flows in the future. Some extended queuing may occur during peak flow periods but delay to vehicles is not excessive most of the time.

1.4 Alternative Studies

In pre-planning stage, the project considers various alternatives for many aspects of the project. In doing so, the possibility of the place without the project is the option that the project evaluated to predict potential pollutions. Aside from the opportunities lost, leaving the place untouched will not escape future pollutions. With sound environmental management systems in place within the project, the existing degree of pollution level will get even reduced with the project implementation.

1.4.1 Location Alternatives

As a consequence of rapid economic growth that came side by side with the opening up of the country which was formerly self-isolated, Myanmar land price has skyrocketed drastically. In addition to skyrocketing land cost, limited availability of vacant lands to develop in central Yangon restricts the project to look for other locations. After evaluating several sites, the chosen location proved to meet the requirements of the project, the site's location in the commercial hub of Yangon with existing necessary infrastructures such as major roads, railways, and nearby commercial structures offers the best advantages to the project. The new development will also prove to be economically and financially beneficial compared to the current status of the site. Without the project and proper restoration work, abandoned heritage Peninsula Yangon (PYN) building and a few other structures will be overgrown with shrubs and grass and will gradually fall into ruins while no other major environmental adverse impacts would be generated. In addition to economic advantages, the present location offers opportunities to reduce impacts as there is no environmentally sensitive receptors in the immediate area.

1.4.2 Design and Construction Alternatives

In order to curb adverse impacts on the environment, the proposed project embraces modern designs, which accommodate energy efficiency, and innovative methods of construction that proactively address pollutions. Tender will be awarded to environmentally conscious and competent construction firms to reduce both construction time and pollutions. Project designs have been developed not only to arouse attraction but also to improve energy efficiency. Moreover, contemporary architecture and structural strength to last and meet environmental challenges which distinctly feature the specific characteristics of the project designs.

On the contrary to abstaining as-built construction method, the project's structural development will primarily be based on as-planned method in sequence. To minimize the level of environmental degradation, mitigation measures will be implemented for each sequence of the project development. As-planned construction application will accommodate the project's management's plan to negate the project's impacts.

In addition to selection of as-planned approach, the project will strictly abide by the mitigation requirements set forth by the Environmental Management Plan from the Environmental and Social Impact Assessment (ESIA) for the project. Uncontrolled nature in as-built construction may lead to pollution contribution while the project's as-planned construction will provide well thought out procedures to combat pollutions ahead of the implementation activities. The main feature of the project's construction development is establishing environmental safeguards prior to the respective activities.

Precast flat panel system, 3D volumetric construction, and hybrid concrete construction were comparatively considered in the selection for construction systems. With relevancy to the local situation and availability, hybrid concrete construction, flat slabs application, and tunnel form systems will be employed as appropriate. Among the existing construction alternatives, these systems offer simplicity, rapid turnaround, consistent performance, and quality. Despite having the lack of building codes locally, the project plans to borrow other applicable building codes suitable to the environment.

1.4.3 Equipment and Material Alternatives

Despite adopting rigorous safeguards, the proposed project plans to take conscious approach in selection of materials and equipment. Environmentally friendly and least polluting materials from reliable suppliers will be prioritized for the project. Newer equipment with better energy efficiency rating or the least emission rate will be utilized for the project use in every stage of the project. Moreover, the project will adhere to follow regular maintenance schedule for all equipment and vehicles. In considering alternatives for equipment, the project makes sure to take into account the creation of employment opportunities as well.

The use of hydraulic breakers would be very noisy during demolition of existing buildings at the project site which are close to the sensitive receivers. In mitigation, the use of hydraulic crusher is proposed as an alternative. Hydraulic crushers are typically 6-12 dB(A) (A-weighted decibels) quieter when compared to conventional demolition with hydraulic breakers. It is, however, recognised that hydraulic crushers have their limitations and hence, it is proposed that they will not be used in isolation but in tandem with hydraulic breakers to minimise the impacts. The hydraulic breakers can create holes on structural elements to facilitate ease of crushing by the jaws of hydraulic crushers and to deal with oversize ones that are not practically crushed.

In order to limit soil exposure and erosion potential, earthworks will be sequenced and timed. Duration of earthworks will be shortened by planned sequences. Temporary covers will be applied to ditch and excavation sites where appropriate.

In conclusion, the project's management has chosen attractive designs with reliability and energy efficiency features, the most appropriate construction technologies with environmental focus and shortening construction period (as much as feasible), and the equipment and materials with the least pollution possibility. Together with these conscious choices, the project's environmental management plan will exceed its objectives to minimize adverse impacts resulting from the project implementation.

1.5 The Proposed Project's Activities in Sequence

The principal activities envisaged during the construction phase are as follows:

- Setting up and management of temporary facilities;
- Transportation of materials and machinery;
- Demolition and site clearing;
- Infrastructure and utility development;
- Construction of building structures;
- Offsite improvements per Traffic Impact Assessment; and
- Landscape and re-vegetation.

1.6 Assessments of Impacts

Based on the findings of the assessment, mitigation measures have been developed to minimize and manage these impacts to meet prevailing regulatory requirements and in accordance with Good International Industry Practice (GIIP). It is important to note that the Project site is a developed site (built environment) located within an urban setting. Much of the environmental impacts associated with the development of the site from its original state have occurred more than 100 years ago.

The assessment of potential direct and indirect environmental and socio-economic adverse/beneficial impacts that may arise as a result of the Project is divided into two sections, with each section representing a stage in the life-cycle of the project, i.e. construction phase and operational phase. Mitigation measures for the impacts identified will be incorporated in the Environmental Management Plan (EMP).

1.6.1 Air Pollution

a) Construction Phase impacts

Potential sources of air quality impacts during the construction phase include fugitive dust arising from the following activities:

- Site preparation works such as excavation, levelling, compaction and trenching;
- Movement of heavy construction vehicles and machinery within the site and during transportation operations;
- Material handling (delivery, unloading and use of construction aggregates and structural fill);
- Demolition of existing building on-site;

- Operation of the batching plant; and
- Material/ soil tracked out of the site and deposited on local roads

The exhaust emissions emitted from vehicles and machinery engines will contain NOx, SOx (sulfur oxides), CO (carbon monoxide), volatile organic compounds (VOC), particulates and smoke.

The main air quality parameter of concern is fugitive dust, represented by TSP (total suspended particulates) and a small fraction of PM_{10}. Major activities that will contribute to fugitive dust impact include site clearance, demolition of buildings, excavation and operation of the batching plant.

The incremental air quality ground level concentrations due to heavy construction activities have been predicted conservatively by quantitative air modelling. Taking into account the baseline PM_{10} and $PM_{2.5}$ levels, the cumulative impact is predicted to be above the standards with higher values for the Church (denoted by A2) which is situated very close to the western boundary of the Project Site. Mitigation measures have to be implemented to reduce the dust impact in particular at the Church.

Through proper implementation of dust control measures recommended in the next section, construction fugitive dust will be able to be controlled at source. An EMAP (environmental monitoring and audit programme) will be implemented to verify the actual impacts and to provide the mechanism for adjustment of site activities to achieve acceptable TSP levels at relevant ASRs (air sensitive receivers). This includes the worst-case of prohibiting dusty construction activities during Sunday services at the Church which is the nearest receptor and/or other sensitive use to be agreed amongst the affected stakeholders and the Project Proponent.

b) Operational Phase Impacts

During the operational phase of the Project, there will be no sources of significant air emissions. The Project has committed to the use of clean gaseous fuel [liquefied petroleum gas (LPG) (3000 gallons), liquefied natural gas (LNG), etc.] for heating or other purposes. Liquid fuel such as diesel will only be used for emergency generators. As such, air pollution will be a minor issue during the operational phase of the Project.

1.6.2 Noise

a) Construction Phase Impacts

Noise impact during the demolition of the existing structure and the construction phase has been conservatively predicted based on the latest construction program and equipment inventory likely to be deployed.

As a worst case, without any noise mitigation measures, the maximum noise exceedance could reach 4 dB(A) above the noise criteria at the Church (N2) for a duration of 13 months within the 5-year long demolition and construction period.

In view of works that will be carried out at close proximity to the Church at N2, a number of alternative construction methodologies have been proposed to attenuate the noise impacts. These include the use of hydraulic crusher in tandem with hydraulic breaker in the demolition of buildings together with the use of noise insulation fabric on the scaffolding to reduce the noise impact.

b) Operation Phase Impacts

Noise impacts are not expected to be significant during the operational phase of the Project. The main sources of noise generation will be traffic noise from the increased vehicular movement by the employees of the office towers, the residents of the service apartments/ condominiums, and the guests staying at the hotels onsite. As these sources are mobile and intermittent, and the surrounding area is a highly commercialized environment with common exposure to traffic noise, it is concluded that the contribution will not be significant.

1.6.3 Vibration

Based on the vibration assessment conducted, the noisiest tasks are predicted to be associated with piling and demolition works.

1.6.4 Water Pollution

a) Construction Phase Impacts

With the commencement of construction, following water quality impacts are expected:

- Soil erosion from construction activities:
- Potentially contaminated surface runoff arising from the site, and
- Sewage from temporary on-site sanitary facilities.

The potential impacts on soil and groundwater resources during the construction phase are likely to be attributed to erosion, spills, and leakages. Demolition and site clearance, construction activities, movements of heavy equipment and vehicles, pile foundation activities, loading, and unloading operations will likely to cause dust, noise, and vibration.

The types of solid wastes generated during the construction phase can be broadly categorised based on their nature and ultimate disposal method into the following:

- Non-hazardous solid waste: e.g. demolition debris, excavated soil, construction spoil from the construction works, general waste, and
- Hazardous wastes: demolition waste of old structures potentially contain hazardous materials such as asbestos-containing material (ACM), lead-based paints (LBP) and mold.

Overall, the impacts arising from the management of non-hazardous and hazardous wastes at the Project site during the construction phase are predicted to be short-term and localized and can be effectively mitigated with the implementation of appropriate construction management practices.

Potential air pollution during the construction phase will be from the vehicles, welding activities, and cooking for workers. Accumulation of traffic delay by the number of vehicles for the construction and the project development will also pose a related impact during the construction.

Temporary loss of opportunities for the street vendors can be expected as the project commences its construction activities. Conceptualizing of narrowed walkway could be felt by pedestrians as fence are erected for safety reason. However, the actual walkway's width will not be affected by the project. The walkway got narrowed by YCDC's road expansion work.

b) Operation Phase Impacts

During the operation phase, the main source of water quality impact will be domestic wastewater which comprises sewage and sullage. Stormwater from the Project site will be conveyed via a network of permanent drains which will discharge via the northern boundary of the site into the existing canal. The project plans to treat domestic wastewater and the treated water will be recycled for the use in cooling operations. From domestic wastewater, only compressed solid sludge will be handed over to a competent party for final disposal. Treated water will be recycled for cooling tower make-up water.

Accidents and spills of hazardous materials/chemicals or cleaning agents from housekeeping will have the potential to result in adverse impacts on soil and groundwater resources during the operational phase of the development if not adequately mitigated.

Solid waste generated at the site will primarily be domestic in nature (paper, plastics, packaging, food waste, etc.). Non-hazardous wastes arising from the occupancy of the residential tower blocks and the hotel include domestic wastes such as kitchen, garden and office wastes. Small quantities of hazardous wastes, such as spent oil and used fluorescent bulbs together with spent containers for cleaning agents will be generated from the operation of the hotel largely from the housekeeping operations and periodic maintenance activities.

The major point-source emissions arising from the operational phase include six (6) standby centralised generators and emissions from diesel engine exhaust pipes from fire pump engine. Other minor sources of emissions include exhaust emissions of the vehicles used by the residents, hotel guest and visitors.

1.6.5 Soil and Groundwater Contamination

a) Construction Phase Impacts

The potential impacts on soil and groundwater resources during the construction phase are likely to be attributed to improper management and handling of hazardous materials stored at the site. Potential sources of impacts anticipated during the construction activities of the Project include:

- Accidental spillage and leakage arising from the handling and storage of hazardous materials/chemicals in diesel skid tanks, chemical/fuel dispensers and storage drums, jerry cans or carboys that contain lube oil, hydraulic oil, paints and organic solvents and other chemicals used during the construction phase;
- Leakage arising from vehicle engine oil change, equipment and machinery, as well as refueling activities;
- Spills as a result of inappropriate hazardous waste storage and disposal practices;
- Improper discharge of untreated sewage; and
- Groundwater dewatering activity.

Soil and groundwater impacts arising from accidental spillage and leakage of hazardous chemicals and wastes during the construction phase are assessed to be not significant due to the limited quantities of chemicals used at any one time on-site during construction. Any potential soil and groundwater contamination is likely to be localised and surficial. These impacts can be readily addressed by implementing appropriate mitigation measures as recommended in the proceeding section.

Groundwater pumping may be required where foundation excavations extend below static water levels. However, the need for significant groundwater discharge is unlikely. In the unlikely event that some dewatering is required, the extracted water will be conveyed via the silt trap proposed for the construction works area and disinfected prior to discharge into the site's drainage system.

b) Operational Phase Impacts

The areas of concern for the potential soil and groundwater contamination during the operational phase of the Project include:

- Diesel storage room covering a footprint of 135 m^2 which houses 3 metal skid tanks (each with a storage capacity of 20,000 litres) and 2 tanks (with a storage capacity of 10,000 m^3)
- Chemical store for the storage of chemical related to maintenance activities, the WWTP and the cooling towers (anti-fouling agents, corrosion inhibitors, biocides);
- The emergency firewater pumphouse;
- Standby generators (including their diesel day tanks); and
- Hazardous wastes store.

Accidental release of hazardous materials/chemicals has the potential to result in adverse impacts on soil and groundwater resources during the operational phase of the development. Both organic and inorganic contaminants in soil and groundwater have the potential to pose short term and long term threats to human health, safety and sensitive environmental receptors. For example, the accumulation of VOCs as a result of petroleum hydrocarbon spills into the underlying soil and groundwater may reach levels in subsurface utility systems, or the concentrations of these vapours may cause acute health effects to facility and maintenance workers.

Groundwater contamination issues are long-term in nature. Certain contaminants are resistant to biodegradation and will persist in the environment for many years after the source of contamination has been removed. The presence of these residual contaminants in the soil and groundwater may pose an unacceptable risk particularly since groundwater is a valuable resource in Yangon and is currently the main source of water supply.

During the operational phase of the project, groundwater will be abstracted for use within the development for the sanitary facilities, landscaping, swimming pool general washing, and potable use.

1.6.6 Waste

a) Construction Phase Impacts

The potential impacts arising from the improper management of both non-hazardous and hazardous waste categories include the following:

- Improperly managed wastes may enter public drainage system potentially obstructing the drainage flow;
- Grouting materials, oil & grease, paints, etc. may potentially contaminate the surface runoff arising from Project site;
- Improper disposal of putrescible municipal wastes onsite would attract disease carrying rodents and insects which are possible health risks to the employees within the Project site as well as create an odour nuisance within the site;

- Indiscriminate dumping of construction wastes (hazardous) at open areas within the Project site may potentially contribute to soil and groundwater contamination;
- Ineffective management of waste onsite including large stockpiles of excavated materials will also create aesthetic impacts as the Project site is located along one of the main streets within the city of Yangon; and
- Improperly managed construction wastes are also potential fire hazards within the site.

Overall, the impacts arising from the management of non-hazardous and hazardous wastes at the project site during the construction phase are predicted to be short-term and localized and can be effectively mitigated with the implementation of appropriate construction management practices.

b) Operational Phase Impacts

Non-hazardous wastes arising from the occupancy of the residential tower blocks and the hotel include kitchen wastes, office wastes from the administration offices of the hotel, wastes generated by the hotel guests, garden wastes and miscellaneous wastes which may include waste paper, plastic, cardboards etc.

Small quantities of hazardous wastes will be generated from the operation of the hotel largely from the periodic maintenance activities.

The primary concern with regards to hazardous and municipal wastes management is improper disposal at unauthorised sites.

Improper disposal of these wastes will lead to potential surface water, groundwater and soil contamination. It will also contribute to unhealthy and unattractive surroundings.

1.6.7 Social-economic Aspects

a) Construction Phase Impacts

During construction, the project will create a lot of jobs for locals. Many of the workers who will work during the construction stage of the project will be employed from Yangon Region, and the logistic services that have importance in the realisation of the project (such as fuel purchases, accommodation of the workers and necessities, construction material necessities among others) will be procured from the Yangon region. Similar necessities during the operation stage will be met from the Yangon region as far as possible. It is expected that the regional economy will be affected positively.

b) Operational Phase Impacts

The key benefits accrued by the Yangon Division and the neighbouring regions include the following:

- **Inflow of Foreign Direct Investment:** The implementation of the Project will entail a substantial capital investment which will have a multiplier effect on the country's economy. This is in line with the Government of Myanmar's efforts to encourage foreign investments to Myanmar to support the rapid growth and expansion of the economy;
- **Transfer of Technology/Training:** The Project will provide opportunities for training and professional development of the Myanmar employees to be hired to be part of the development, mainly in the hospitality and commercial sectors. The transfer of technology will take place at the point when employees are sent for training overseas in neighbouring

countries and also, by way of regular visits by foreign specialists whose services may be engaged to provide onsite job training to the local staff;

- **Growth of Other Supporting Businesses:** The Project which will be located in the Yangon city centre is expected to create new business opportunities.
- **Increased Employment Opportunities:** The entire Project is expected to provide job opportunities for a significant number of employees across a wide range of levels. Expatriate employees where required will train locals until such time the locals attain sufficient skills and technical knowledge to subsequently take over the responsibilities from the expatriates. For local employment alone, it is estimated that approximately 620 jobs will be created under direct employment by hotel operating companies, offices, retail and property management companies. Regarding indirect employment which is employed by office tenants and retail tenants, there will be approximately 6,000 of new jobs. Additionally, further job opportunities will become available for the local population as a result of the growth in the other supporting sectors identified above;
- **Economic Benefits:** The proposed Project is expected to bring about positive multiplier effects to the Myanmar economy. The total direct and indirect contributions to the Myanmar economy by the Project are expected to be significant. In addition, the Project is expected to generate significant tax revenue for the Myanmar Government over its lifetime.
- **Business for Local Suppliers:** Creation of demand for local supplies for the following sections including food and beverage and textile/garment.
- Improvement of pedestrian and traffic movement and provision for signalization and relocation of the pedestrian crossing at Bogyoke Aung San Road will benefit the local area and will ease traffic and pedestrian movement.

1.6.8 Traffic

a) Construction Phase Impacts

The existing access to Grand Meeyahta on Bogyoke Aung San Road will be used during construction, and the construction is expected to take almost 5 years with majority of the vehicles entering and exiting the site during the basement excavation at the start of construction period.

Construction traffic will avoid peak traffic hours and adhere to YCDC limitations on vehicle size during specified hours of the day.

It is estimated that an average of 2,400 trucks will be required monthly to transport the excess soil to the YCDC approved disposal. These trucks will be using the routes designated by YCDC in their approvals.

b) Operational Phase Impacts

Analysis of the Sule Shangri-La Junction has been undertaken for 2021 with the proposed Project. The development traffic distribution is based on the existing percentage distribution at the junction. Although the traffic is shown to access from the south it is assumed that this traffic will also enter from north or west (only passing through the junction once on entering).

With the development traffic, the junction capacity is significantly impacted. In order to alleviate the impact, junction improvement measures should be implemented. Signal phasing optimization is used in this study as this measure is one of the most efficient and simplest measures and slight changes on shared lane configuration on eastbound and southbound directions as well.

1.6.9 Occupational Health and Safety

a) Construction Phase Impacts

In the process of executing work at the hazardous working areas, the workers may be impacted by the following:

- Increased dust in the ambient air in working zones;
- Increased temperature of equipment surfaces;
- Increased vibration levels;
- Moving machinery or its moving parts; and
- Common injuries likely to be encountered include over-exertion, dehydration especially during the hot season, minor cuts and bruises, ergonomic injuries and illnesses are among the most common causes of injuries in construction and decommissioning sites.

Increased incidences of communicable diseases represent a potentially health threat to project personnel including the contractor, the workforce and residents of local communities.

Infrequent or improper removal of construction debris including the vegetative biomass cleared from the Project site will contribute to unhealthy surroundings which provide an ideal habitat for disease-vectors such as mosquitoes, flies and rats which potentially cause health impacts to the workers and the neighbouring areas.

Risks may arise from handling or being exposed to hazardous materials that will be used at the construction areas within the Project site.

A significant increase in movement of heavy vehicles for the transport of construction materials and equipment will increase the risk of traffic-related accidents and injuries to workers and the local community.

b) Operational Phase Impacts

During the operational phase of the Project, health and safety impacts will be significantly reduced and limited to maintenance activities and handling of hazardous materials (diesel, chemicals used for the WWTP, chemicals used for the treatment of groundwater and the treatment of the water used in the swimming pools at the hotels, chemicals used for the cooling towers (anti-fouling agents, corrosion inhibitors, biocides, etc.), paints, lube oils, grease and thinner. In ensuring safe handling of these materials, material safety data sheets (MSDS) for each chemical will be obtained and the corresponding storage and handling measures will be implemented, including provision of appropriate personal protective equipment.

1.7 Environmental Management Plan

The Environmental and Social Management Plan (ESMP) establishes the strategy on how environmental and social impacts will be managed throughout the stages of development, i.e. the construction and operational phases of the Project and provides a framework upon which the Project Developer will set environmental and social management requirements for the Project via its contractual documents with relevant parties amongst others, the Main Contractor appointed for the construction phase of the Project and the managing entities appointed to operate the various development components within the Project Site.

Within the ESMP roles and responsibilities for all relevant parties that will be involved in the implementation of the Plan are explained. Another important component of an ESMP is training and awareness.

The Final ESMP will be developed upon completion of the ESIA process, the public notification and stakeholder engagement process, upon receipt of feedback from the regulatory agencies, any ESIA approval conditions and completion of the detailed construction methodology and the detailed design. The EMP of some critical issues during construction and operational phases are illustrated in **Table 1.1** and **Table 1.2**, respectively.

Table 1.3 summarizes the budget allocated by the project developer to finance the environmental services and the mitigation measures and monitoring of the ESMP.

Table 1.1: Environmental and Social Management Plan during Construction Phase

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
Air Quality				
Potential sources include: • Site preparation works such as excavation, levelling, compaction and trenching • Movement of heavy construction vehicles and machinery within the site and during transportation operations; • Material handling (delivery, unloading and use of construction aggregates and structural fill); • Demolition of existing building on-site; • Operation of the batching plant; • Material/soil tracked out of the site and deposited on local roads; and • Exhaust emissions emitted from vehicle and machinery engine exhaust emissions will contain NOx, SOx, CO and VOCs.	Mitigation measures involving standard dust suppression measures include: • Carry out regular surface damping or wetting on general site areas, stockpiled fill and aggregates especially during dry ambient conditions; • Provide site enclosure and covering of any aggregates or stockpiles; • Ensure that all hardstanding areas and access roads within the site are wet twice a day; • Provide wheel-washing facilities or trough at the ingress/egress points. These facilities will be equipped with (1) a temporary hardstanding of sufficient size to accommodate a standard sized vehicle and equipped with a sump; and (2) high pressure water jets. • Vehicles operating within the Project site and especially within the construction works area will adhere to speed limits not exceeding 10 km/hr. • Surface damping will be carried out on a 50 m road stretch on the public road outside the site's access point. • All construction vehicles transporting dusty materials will be secured with appropriate materials/sheets to prevent the escape of fugitive dust.	Ambient air quality monitoring to be carried out monthly at two locations along the Project site boundary and one location at the Church compound. The monitoring will be carried out by an independent environmental specialist. Parameters to be monitored include TSP, PM_{10} (particulate matter less than 10 micron), SO_2 and NO_2.	An independent environmental specialist appointed by ET	Submission of monthly air monitoring reports to the ET, IEC and PP.

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
	• Open burning on the site premises is strictly prohibited. The control of vehicular emissions can be achieved by observing good construction practice procedures such as: • Turning of equipment when not in use; • Lorries/trucks waiting for more than 10 minutes will turn off their engines; and; • Regular maintenance of construction vehicles/equipment.			
Vibration				
The main construction activities that will generate vibration include: • Demolition of buildings, mainly with the use of backhoe mounted hydraulic breakers; • Main buildings early construction works; • Piling Works for the main buildings; • Main Building Pile Caps, Basement Slabs & Podium; and • Construction of the Towers	• Pre-construction surveys will be conducted prior to commencement of major site works such as demolition, piling and foundation works. • Sequential work arrangement to avoid cumulative vibration impacts • Noise and vibration barrier will be erected	Identify monitoring points for vibration, and monitor vibration impacts with proper instrumentation.	Contractor	Submission of monthly vibration monitoring reports to the PP.
Noise				
The main construction activities that will generate noise include: • Main buildings early construction works;	Mitigation measures which will be implemented include: • Consideration for alternative construction methodologies: The use of hydraulic breakers should be avoided and hydraulic	Noise monitoring to be carried out monthly at two locations along the Project site boundary and one location at the Church compound.	An independent environmental specialist appointed by ET.	Submission of monthly noise monitoring report to the PP.

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
• Piling Works for the main buildings; • Main Building Pile Caps, Basement Slabs & Podium; and • Construction of the Towers	crushers should be used instead. There crushers are typically 6-12 dB(A) quieter. • Use of mobile barriers: Movable noise barriers will be used as necessary to achieve 5 dB(A) reduction for movable construction equipment or 10 dB(A) for stationary ones. Implement Good International Industry Practice (GIIP) as follows: • Construct walled enclosures around especially for noisy activities, or cluster of noisy equipment; • The Contractor will submit the method statement to the Engineer for comments on the construction methods, use of equipment, and noise mitigation measures intended to be implemented on-site; • The Contractor will submit the method statement to the Engineer for comments on the construction methods, use of equipment and noise mitigation measures intended to be implemented on-site; • The Contractor will devise and execute working methods to minimize the noise impact on the surrounding sensitive uses, and to provide experienced personnel with suitable training to ensure that those methods are implemented; • Noisy equipment and noisy activities will be kept as far away from the NSRs as possible;	The monitoring will be carried out by an independent environmental specialist over a 24-hour period.		

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
	• Unused equipment will be turned off and the parallel use of noisy equipment/ machinery will be avoided; • Queuing of dump trucks will be avoided. Their intermittent use will be avoided between loading cycles or may be throttled down to a minimum to reduce noise; • Regular maintenance of all plant and equipment; and • Material stockpiles and other structures will be effectively utilised as noise barriers, where practicable.			
Water Quality				
Soil erosion	• Sediment retention structures such as silt traps or catch pits of adequate sizes will be provided at suitable locations within the active works area within the Project site to remove soil and sediment in the surface runoff prior to discharge into the receiving drainage channels. The silt traps/catch pits will be regularly maintained and de-silted to provide maximum silt removal efficiencies. Oil and grease removal facilities will also be provided to ensure the overflows from the silt trap do not have traces of oil and grease. • These structures will be located, designed and constructed in a manner that will minimise the potential threat of downstream flooding. • Any disturbed earth caused by construction activities or fill operations will	Inspection of silt traps will be carried out by the Contractor as required. Based on the inspection, as required, silt traps/catch pits will be desludged to maximise silt removal efficiencies. The overflow from the silt traps will be monitored on a quarterly basis to ensure compliance to the following limit: • Total Suspended Solids (TSS): 50 mg/l Other parameters to be monitored on a quarterly basis include the following: • BOD: 30 mg/l	Earthworks Contractor	Development of an Erosion and Sedimentation Control Plan (ESCP) for integration into the Earthworks and Drainage Plan which will be submitted to the YCDC and related agencies.

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
	be firmly consolidated and compacted by earth moving vehicles and compactors to reduce the rate of possible erosion and release of loose soil particles. • Denuded stretches will be re-vegetated or sealed immediately after the construction works. Suitable re-vegetation programmes will be planted as quickly as possible on exposed areas to reduce surface runoff and sediment loss. • Uncovered stockpiles of excavated material or topsoil and fill material are prone to erosion and therefore will be protected. Small stockpiles can be covered with tarpaulin sheets and large stockpiles will be stabilised by erosion blankets and regularly damped. • Construction of a wash trough at the ingress/ egress point of the Project site to remove dirt/soil from vehicles and machinery leaving the site. The wash trough will have spray jet facilities and all surface discharge from the wash trough will be channelled into the temporary drainage system • Stockpiles of construction aggregate spoil and excavated soil will be located at areas within the project site that do not permit direct run off into water courses and are generally flat. On site storage of excessive quantities of such materials will be avoided and where not possible the use of geotextile material or tarpaulin covers will be considered to minimise erosion.	• COD: 125 mg/l • Total Coliform: 400 MPN/100 ml • Oil and Grease: 10 mg/l • pH: 6.0 – 9.0		

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
Construction runoff and drainage	Temporary and/ or permanent drainage systems will be installed immediately following the site preparation works to minimise downstream flooding.	Visual monitoring of the temporary and/or permanent drainage system will be carried out on a weekly basis and immediately after a heavy rainfall event. If these channels are obstructed, measures will be taken to prevent drainage impedance.	Contractor	Provision for proper management of sewage effluent from temporary sanitary facilities to be included in the Construction Method Statement.
Sewage Effluent and Domestic Wastewaters	• Appropriate sanitary facilities will be provided and properly maintained for construction workers throughout the construction stage. Direct discharge of untreated sewage into underlying soil, groundwater or surface water is prohibited. If portable toilets are used at the site, they must be of sufficient numbers and meet the requirements of Yangon City Development Council. • Temporary septic systems will be provided for use at the proposed site to prevent any release of untreated sewage into YCDC main drain. • These facilities will be maintained and cleaned on a daily basis.	Periodical desludging of the septic will be carried out by YCDC. The effluent will be monitored on a quarterly basis to ensure compliance to the following limit: • TSS: 50 mg/l Other parameters to be monitored on a quarterly basis include the following: • BOD: 30 mg/l • COD: 125 mg/l • Total Coliform: 400 MPN/100 ml • Oil and Grease: 10 mg/l • pH: 6.0 – 9.0	An independent environmental specialist appointed by ET	

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
Soil and Groundwater				
Accidental spills and leaks from handling and storage of hazardous materials	• A secured area (enclosed with hardstanding impervious base) will be provided for the storage of any hazardous materials and hazardous wastes. • All temporary fuel tanks and drum storage areas will be provided with drip collection devices and be sited on sealed areas (for example, concrete paved areas) with appropriate bunding for accidental spill containment. A valve will be installed at the discharge outlet of the bunded area. • Any accidental spills of fuel, oil or other hazardous chemicals will be cleaned up immediately. The recovered media (contaminated soil, absorbent pads, rags etc.) will be disposed of as hazardous waste.	Daily inspection of the hazardous materials storage area. Any spills observed, or any deterioration in the integrity of the storage containers (e.g. tanks, drums) will be addressed immediately.	Contractor	Submission of weekly inspection reports to the ET and the PE.
Leaks from vehicle engine and refuelling activities	• All activities that may result in the potential release of hazardous materials to the ground such as changing of engine oils and lubrication oils from construction vehicles, equipment and generators on site will be performed only on designated sealed areas or on drip trays to reduce the risk of direct spill into the underlying soil and groundwater. Spent oil must be handled and disposed of as hazardous waste.	Daily inspection of the areas designated for refuelling. Any spills observed will be contained and removed with the use of sand, sawdust chemical absorbents	Contractor	Submission of weekly inspection reports to the ET and the PE.
Improper discharge of untreated sewage	• Appropriate sanitary facilities will be provided and properly maintained for construction workers throughout the construction stage. Direct discharge of untreated sewage into underlying soil,	The sanitary facilities to be cleaned twice daily. The portable chemical toilets will be maintained per the manufacturer's requirements.	Contractor	

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
	groundwater or surface water is prohibited. If portable toilets are procured to the site, they must be of sufficient numbers and meet the requirements of Yangon City Development Council. • Temporary septic systems will be provided for use at the proposed site to prevent any release of untreated sewage into YCDC main drain. • These facilities will be maintained and cleaned on a daily basis.	If temporary septic systems are used, periodical desludging will be carried out. Provision for proper management of sewage effluent from temporary sanitary facilities to be included in the Construction Method Statement.		
Non - Hazardous Waste Management				
Improper management of waste will potential result in the following: • Drainage impedance • Contamination of the surface runoff caused by the chemicals used at the Project site • Odour impacts • Possible health risks caused by disease vectors • Possibility of fires at the Project site	• Good housekeeping practices are essential within the site. Open burning of any form of construction waste material within the Project site is strictly prohibited as apart from polluting the atmosphere and reducing the ambient air quality at the site, the activity poses a risk of fire spreading to the hazardous materials storage areas (example, diesel storage area). • General construction spoil will be recycled on site as much as possible. For example, construction aggregate materials may be considered as possible backfill material; • Domestic waste generated from the site offices and workers' temporary cabins will be stored in suitable covered receptacles or stored within enclosed areas and collected regularly by a YCDC-licensed contractor for disposal at an approved disposal/ landfill site; and	Daily inspection on housekeeping, storage and disposal of non-hazardous waste generation from the Project Site will be carried out. .	Contractor	Submission of weekly report on the quantity and type of waste generated and its disposal method. Copies of the receipts used in the sale and/or of the waste materials will also be appended in the report

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
	• Unsalvageable construction spoil will be stockpiled at a designated site and sold to salvage yard operators or other contractors interested in recycling the material.			
Hazardous Waste Management				
Waste from demolition of old structures potentially containing hazardous materials such as ACM, SMF, PCB, LBP, ODS, radioactive smoke detectors, mercury containing materials, hazardous chemicals/wastes, mold and biological hazards. Other sources also include waste generated from construction activities including spent filter cartridges, small quantities of waste of industrial paints and various type of spent soil and soil/rags contaminated with oily residue.	• As presently there is no collection system for hazardous waste in Yangon, the YCDC entrusts PCCD to collect industrial waste, together with municipal and general waste. • PCCD collects industrial waste on request. • Project management team will meet with PCCD to discuss available options in deciding the best option in ensuring safe management and disposal of hazardous waste.	Daily inspection on housekeeping, storage and disposal of hazardous waste generation from the Project Site will be carried out.	Contractor	Submission of weekly report on the quantity and type of hazardous waste generated and its disposal method. Copies of the receipts used in the sale and/or of the waste materials will also be appended in the report.
Landscape and Visual				
Temporary adverse landscape and visual impacts during the demolition and construction phase. Construction of Project will also impact the existing trees within the site.	A decorative hoarding will be erected around the periphery of the site to screen the temporary construction works from the local low level receivers, mainly pedestrians. The proposed hoarding would provide a unified edge treatment and interface between the construction site and its landscape context. Mitigation measure to retain existing trees include: • Phased segmental root pruning for tress; • Pruning of branches of existing trees;	Daily inspection of the hoarding to ensure there are no breaches or damaged areas.	Contractor	Submission of weekly reports to the PP and the PE.

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
	• Increase watering of existing vegetation; • All works affecting the tree identified for retention and transplantation will be carefully monitored; and • Tree transplanting and planting works will be implemented by approved Landscape Contractors, inspected and approved by qualified Landscape Architect.			
Traffic and Transportation				
Increase in construction traffic.	• Construction traffic will avoid the peak traffic hours and adhere to YCDC limitations on vehicle size during specified hours of the day.	No monitoring programme required.	Not applicable	Not applicable
Health and Safety				
Factors affecting the health and safety of the workers: • Hazardous working areas/dangerous zones; • Communicable disease and vector borne disease; • Exposure to hazardous materials/ chemicals; and • Traffic safety	The Guidelines on Minimum Health & Safety Standards for Major Works developed by SPAPM will be adopted for the construction and operational phases of the project.	During the construction phase, provisions will be made for the appointment of a Health and Safety Officer at the Project site. Alternatively, one of the members of the ET can assume the role of managing the health and safety requirements at the Project site.	Project Health and Safety Officer/ET	Submission of weekly report on any issue regarding to safety and health issues on site to PP.

Table 1.2: Environmental and Social Management Plan during Operational Phase

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
Air Quality				
During the operational phase of the Project, there will be no significant sources of air emissions.	No mitigation measures required.	No monitoring programme required.	Not applicable	Not applicable
Vibration				
During the operation phase of the Project, no significant sources of vibration impacts are envisaged.	No mitigation measures required.	No monitoring programme required.	Not applicable	Not applicable
Noise				
Except for minor increase in traffic noise due to the occupancy of the various development components of the Project, no significant impacts are envisaged.	No mitigation measures required.	No monitoring programme required.	Not applicable	Not applicable
Water Quality				
Sewage and sullage	A wastewater treatment plant (WWTP) will be constructed onsite designed based on the peak water demand of 1,100 m^3/day.	Implementation of preventive maintenance programmes and performance monitoring programmes as stipulated under the manufacturer's specification. The treated effluent from the WWTP will be monitored once a week to ensure compliance to the design specifications and to ensure compliance with the requirements of MONREC. The specific parameters to be monitored will be confirmed in conjunction with MONREC as presently there are no prescribed limits for treated effluent.	Company appointed for the operation and maintenance of the WWTP.	Submission of weekly monitoring report of the treated effluent from the WWTP.

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
Soil and Groundwater				
Contamination of soil and groundwater as a result of hazardous materials (diesel and chemicals) spillage.	• The five diesel storage tanks to be installed within the Diesel Storage Room will be located within concrete-bunded enclosures capable of containing 110% of the contents of the largest tank within each enclosure. The floor of the bunded enclosures will be concrete-lined with an impermeable liner to prevent contaminant from permeating into the ground; • Appropriate instrumentation and control/trigger alarm to warn of possible overfilling and to provide an alert mechanism in the event of significant fuel/chemical loss will be provided for the storage tanks; • Operational control which includes regular/routine surveys, inspection and maintenance of the diesel fuel tanks and their ancillary facilities (pumps, valves and pipes) will be integrated into the Project's environmental management practices so as to identify and rectify any significant product losses or ongoing spills/leakages which may be occurring; • Areas where regular or periodic handling and dispensing of liquid hazardous material are undertaken, such as the diesel storage area and the building maintenance store will be concrete-paved with appropriate	Daily inspection of the Diesel Storage Room including the piping, valves and related structures by the maintenance crew appointed during the operational phase of the Project. During the inspection, a checklist which addresses the management measures of the ESIA will be used. The groundwater quality at the Project site will be monitored every month during the lifetime of the development. The number of monitoring wells and the specific parameters to be monitored will be decided in conjunction with MONREC. At a minimum, three wells will be located to represent the groundwater quality up-gradient and down-gradient of the site. If contaminants are present at concentrations above the groundwater quality screening levels (example, the Dutch Intervention Values (DIVs), further assessments will be necessary to determine the nature and extent of the contamination, as well as to remove the potential source(s) of contamination.	Company appointed to carry out maintenance activities for the Project Site.	Submission of weekly inspection reports to the PP. Submission of monthly groundwater quality monitoring report to the ET and the PP

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
	secondary containment (drip trays and bunded areas) provided. • Any accidental spills will be assessed on a case by case basis and remedied, including excavation and disposal of any contaminated soil (classified as hazardous wastes) at a secure disposal facility approved by the YCDC. • Procedures and work instructions on proper handling of diesel and maintenance chemicals as well as the disposal procedures for hazardous wastes will be developed and effectively communicated to all operations and maintenance personnel; • Material Safety Data Sheets (MSDS) to be provided for the diesel and any other chemicals (e.g. chemicals used for the maintenance activities, used at the WWTP and for the cooling towers) stored within the Project site; • Corrosion protection for steel tanks and their ancillary facilities (pumps, valves and pipes) will be provided to prevent leaks.			

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
Non-Hazardous and Hazardous Waste Management				
Non-hazardous waste arising from occupancy of residential tower and hotel include: • Kitchen waste, • Office waste from administrative offices; • Hotel guests waste; • Garden waste; and • Miscellaneous waste.	Project management team will meet with PCCD to discuss available options in deciding the best option in ensuring safe management and disposal of the non-hazardous and hazardous waste.	Daily inspection on housekeeping, storage and disposal of hazardous waste generation from the Project Site will be carried out.	Contractor	
Hazardous waste will be generated in small quantities, largely from the operation of hotel's periodic maintenance activities including: • Used fluorescent bulbs; • Spent oils and solvents from hotel maintenance department; • Discarded or off-specification chemicals; • Containers, bags or equipment contaminated with chemicals or mineral oil; and • Rags, plastics, papers or filters contaminated with chemical or oils.				

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
Landscape and Visual				
Only positive impacts are envisaged.	A landscape management plan has been prepared for the Project site, including tree preservation and landscape work with measures are the followings: • To create plaza to the West of the cultural heritage building; • To restore the cultural heritage buildings; • To create landscaped garden; • To retain tress with historic values.	A qualified landscape architect will be employed to manage the landscape elements of the Project site.	PP	Submission of bi-yearly reports on the landscape management at the Project site.
Traffic and Transportation				
Increase in traffic and pedestrian volume around the vicinity.	• Improved footway surface along the boundary of the site • Left in/ left out access on Bogyoke Aung San Road (currently right in/ right out conflicting with traffic) • Relocation of pedestrian crossing on Bogyoke Aung San Road to align with the retail and office buildings • Signalization of the pedestrian crossing for improved pedestrian safety (traffic and pedestrian volumes will increase in future and so will conflicts so signalization would be required even without The Landmark project) • Removal of on street parking along the site boundary at Bogyoke Aung	No monitoring programme required.	Not applicable	Not applicable

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
	San Road to improve traffic flow and safety. • Improve lane markings and geometry of Bogyoke Aung San Road • Pedestrian connection / escalator in the north east corner of the site providing air conditioned and traffic free route through the retail podium from Alan Pya Pagoda Road towards Bogyoke Aung San Road. • Ensuring that access is designed with suitable gradients and visibility according to international standards (UK, Singapore). • At the main access car park ramp - providing car park ticket booths on Basement 1 level to avoid queuing back onto Bogyoke Aung San Road. Other booths within the development will be a minimum of 30m from the road (standard applied in Bangkok).			
Compliance with Labor Standards				
• Compliance of the Company and its Contractors and subcontractors with national labor laws and relevant ILO core labor standards • Payment of mandated minimum wages • Payment of mandated benefits of workers • Prohibited employment of child labor and forced labor	National labor law and measures to comply with relevant ILO labor standard conventions, including the following international practices with respect to the construction workforce: • promote the fair treatment, non-discrimination and equal opportunity of workers; • establish, maintain and improve the worker-management relationship;	No monitoring programme required as the ESMS carries out regular audits on labor standards.	ESMS Coordinator/ Director	Submission of yearly reports on the Labor Standards compliance at the Project site

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
• Non-discrimination, etc.	• promote compliance with national labor and employment laws; • protect the workforce, including vulnerable groups such as children or workers engaged by third parties, and workers in the project proponent's supply chain; • promote safe and healthy working conditions and workforce health and well-being; and prohibit any use of forced labor.			

Table 1.3: Budget Planned for Environmental and Social Management Measures

Items	Responsible Party	Construction Phase		Operational Phase	
		Cost Item	Budget (US$)	Cost Item	Budget (US$)
Monitoring • Air Quality • Vibration • Noise Quality • Water Quality • Non-Hazardous Waste Management Compliance with Labor Standards Health & Safety ** Cost for E&S training is included in the Management Compliance with Labour Standards*	Contractor's Environmental Control Measures	$ 421,736 $ 552,000 $ 3,680,000	4,653,736	Not Relevant	-
Air Quality		Air Monitoring Cost	48,000		
Noise Quality		Noise Monitoring Cost	16,000		
Water Quality		Stormwater detention system & diversion budget	331,345	Construction cost of wastewater treatment plant	908,710
Soil & Groundwater		Investigations	123,071		
Hazardous Waste Management		Haz-mat investigations & remediation	473,350		

Items	Responsible Party	Construction Phase		Operational Phase	
		Cost Item	Budget (US$)	Cost Item	Budget (US$)
Non-Hazardous & Hazardous Waste Management				Installation of waste handling bins, compactors	82,000
Landscape & Visual		Hoarding cost Trees transplantation cost	32,785 32,785	Landscaped garden budget; Landscape Architect	1,311,400
Traffic & Transportation		Traffic engineering studies	40,000	Offsite infrastructure budget; Pedestrian connection/escalator in the north east corner providing air conditioned and traffic free route; Car park ticket booths	473,350
Total			**5,751,072**		**2,775,460**

၁။ စီမံကိန်းလုပ်ငန်းအကျဉ်းချုပ်နှင့် နောက်ခံအကြောင်းအရာ

၁(၁) နိဒါန်း

Meeyahta Development Limited (MDL) သည် လက်ရှိပိုင်ဆိုင်သော ရန်ကုန်မြို့လယ်ရှိ မြေ ၆.၃၅ ဧက တွင် Landmark Project (ဤမှနောင်တွင် "စီမံကိန်း" ဟုခေါ်ဆိုပါမည်) ကို အကောင်အထည် ဖော်ဆောင်ရွက်ရန် ရည်ရွယ်ပြီး စီမံကိန်းသည် လူနေအိမ်ခန်းများ၊ ရုံးခန်းများ၊ ဆိုင်ခန်းများ နှင့် ဟိုတယ်များ စုပေါင်းပါဝင်မည့် အဆင့်မြင့် စီမံကိန်း တစ်ခုဖြစ်ပါသည်။ MDL ဆိုသည်မှာ Yoma Strategic နှင့် ၄င်း၏ အကျိုးတူပူးပေါင်းဆောင်ရွက်သူများဖြစ်သည့် Mitsubishi Corporation ၊ Mitsubishi Estate ၊ International Finance Corporation ၊ Asian Development Bank နှင့် First Myanmar Investment Company Limited တို့ ဖက်စပ်လုပ်ကိုင်မည့် ကုမ္ပဏီဖြစ်ပါသည်။

စီမံကိန်း ဧရိယာသည် ၆.၃၅ ဧက ကျယ်ဝန်းပြီး တည်နေရာသည် ရန်ကုန်မြို့၏ လူအစည်ကားဆုံးနေရာတွင် တည်ရှိပြီး ပတ်ဝန်းကျင်၌ စီးပွားရေးလုပ်ငန်းများကို တစ်စုတစ်စည်းတည်း တွေ့ရှိနိုင်ပါသည်။ ရင်းနှီးတည်ဆောက်ရာ လုပ်ငန်းခွင် တွင် Landmark Project နှင့် Peninsula Yangon Limited (PYL) ဟိုတယ်စီမံကိန်းစသည်ဖြင့် စီမံကိန်းနှစ်ခုပါဝင်သည်။

MDL သည် ပတ်ဝန်းကျင်ထိခိုက်မှု ဆန်းစစ်ခြင်း (EIA) ကို ဆောင်ရွက်ရန် ENVIRON Myanmar ကို ငှားရမ်းခဲ့ပါသည်။ ENVIRON မှ အကြံပေးပုဂ္ဂိုလ်များ၊ SPA Project Management Ltd. ၊ Meinhardt (Thailand) Ltd. နှင့် Balmond Studio တို့မှ စီမံကိန်းအဖွဲ့များသည် (EIA) ကို ပူးပေါင်းဆောင်ရွက်ခဲ့ကြပါသည်။ EIA လုပ်ငန်းစဉ်ကို ဆောင်ရွက်ရာတွင် မြန်မာနိုင်ငံ၏ ဥပဒေ၊ စည်းမျဉ်း လိုအပ်ချက်များနှင့်အညီ လိုက်နာဆောင်ရွက်ခဲ့ပြီး အစီရင်ခံစာ၏ လုပ်ငန်းနယ်ပယ်ကို စစ်ဆေးခြင်း ၊ ပြန်လည်ဖွဲ့စည်း တည်ဆောက်ခြင်းနှင့် EIA ရည်ရွယ်ချက်နှင့် လုပ်ငန်းနယ်ပယ်ကို ဆုံးဖြတ်သည့် Terms of Reference (TOR) အားရေးဆွဲခြင်းတို့ကို စတင်ပြင်ဆင်ဆောင်ရွက်ခဲ့ပါသည်။ ထို့နောက် အစီအစဉ်များကို ဒီဇိုင်း ရေးဆွဲခြင်း၊ အကောင်အထည်ဖော်ဆောင်ရွက်ခြင်း၊ မြေတိုင်းတာခြင်း၊ လေနှင့်ရေအရည်အသွေးများကို ဆန်းစစ်ခြင်း၊ ယာဉ်အသွားအလာ အခြေအနေကို ဆန်းစစ်ခြင်း၊ လူမှုစီးပွားရေးဆိုင်ရာ လေ့လာဆန်းစစ်ချက်များ၊ စည်းမျဉ်းချမှတ်ကြီး ကြပ်သူများ၊ အကျိုးစီးပွားပါဝင်သူများနှင့်တွေ့ဆုံဆွေးနွေးခြင်းတို့ကိုဆောင်ရွက်ခဲ့ပါသည်။ EIA ကိုအကောင်အထည်ဖော်ဆောင် ရွက်စဉ်တွင် လိုအပ်ချက်များနှင့် ကိုက်ညီမှုရှိစေရန် ဒီဇိုင်းပြုပြင် ပြောင်းလဲရေးများကို ဆောင်ရွက်ခဲ့ပါသည်။

၁(၂) စီမံကိန်းကိုအကျဉ်းချုပ်ဖော်ပြခြင်း

အဆိုပြုထားသည့် စီမံကိန်းလုပ်ငန်းခွင်သည် ၃၈၀၊ ဗိုလ်ချုပ်အောင်ဆန်းလမ်း၊ ပန်းဘဲတန်းမြို့နယ်၊ ရန်ကုန်၊ မြန်မာတွင် တည်ရှိပါသည်။ လုပ်ငန်းခွင်တည်နေရာပြမြေပုံကို ပတ်ဝန်းကျင်နှင့်လူမှုဝန်းကျင် ထိခိုက်မှုဆန်းစစ်ခြင်း အစီရင်ခံစာ (ESIA report) တွင် ထည့်သွင်းဖော်ပြထားပါသည်။ First Myanmar Investment Co. Ltd (FMI) Centre ၊ Grand Meeyahta Executive Residence ၊ Zawgyi House နှင့် အခြား အဆောက်အဦးအသေးစားများသည် စီမံကိန်းဝင်းအတွင်း တည်ရှိပါသည်။

အဆိုပြုစီမံကိန်းအရ Peninsula Residence ၊ လုပ်ငန်းသုံးဟိုတယ်၊ အသုံးအဆောင်ပစ္စည်း အပြည့်အစုံပါရှိသည့် လူနေ အိမ်ခန်းများ၊ office tower အဆောက်အဦး နှစ်လုံး၊ ဆိုင်ခန်းများနှင့် မြေအောက် ယာဉ်ရပ်နားရာနေရာတို့ကို ရင်းနှီးတည် ဆောက်မည်ဖြစ်သည်။ စီမံကိန်းပြီးစီးသည့်အခါ စုစုပေါင်းကြမ်းခင်း ဧရိယာသည် ခန့်မှန်းခြေအားဖြင့် ၂၀၀,၀၀၀ စတုရန်း မီတာ (၂.၁၅ သန်း စတုရန်းပေ) ရှိမည်ဖြစ်သည်။

အဆိုပြုစီမံကိန်းအတွက် ရေလိုအပ်ချက်သည် တစ်နှစ်လျှင် ကုဗမီတာပေါင်း ၃၆၅၀၀၀ ဖြစ်သည်။ အဆိုပြု စီမံကိန်း အတွက် အသုံးပြုမည့် အဓိကရေအရင်းအမြစ်သည် မြေအောက်ရေဖြစ်ပြီး ဒုတိယဦးစားပေးအနေဖြင့် စည်ပင်သာယာမှ ဖြန့်ဖြူးသည့်ရေကို အားထားမည်ဖြစ်သည်။ စီမံကိန်းတွင်ပါဝင်မည့် အစိတ်အပိုင်းများ အားလုံး အတွက် လျှပ်စစ်မီး လိုအပ်ချက်သည် တစ်နှစ်လျှင် စုစုပေါင်း ၇,၀၉၅၃,၆၀၀ ကီလိုဝပ်နာရီ ဖြစ်သည်ဟု ခန့်မှန်းရရှိပါသည်။ တည်ဆောက်ဆဲ ကာလတွင် ရေနှင့်လျှပ်စစ်မီး လိုအပ်ချက်သည် ၂၁၂,၁၀၄ ကုဗမီတာ နှင့် [၃,၂၀၀,၀၀၀] ကီလိုဝပ်နာရီ ဖြစ်ပါသည်။

အဆိုပြုစီမံကိန်း ကို အဆင့်များစွာဖြင့် အကောင်အထည်ဖော် ဆောင်ရွက်မည်ဖြစ်ပြီး အစီအစဉ်အလိုက် ဆောင်ရွက်သွား ပါမည်။ စီမံကိန်း အကောင်အထည်ဖော်ရန် အောက်ဖော်ပြပါအတိုင်း အစီအစဉ်ရေးဆွဲခန့်မှန်းထားပါသည် -

- Grand Meeyahta Executive Residence ကို ဖြိုဖျက်ခြင်း – ကြာမြင့်ချိန် ငါး လ၊
- FMI Centre ကို ဖြိုဖျက်ခြင်း – ကြာမြင့်ချိန် ငါးလ၊
- အခြေခံ အုတ်မြစ်နှင့် အဆောက်အအုံအောက်ခြေ ဆောက်လုပ်ခြင်း ၊ Basement Tank များအတွက် အခြေခံ အုတ်မြစ် နှင့် အဆောက်အအုံအောက်ခြေ ဆောက်လုပ်ခြင်းလုပ်ငန်း – ကြာမြင့်ချိန် ၃၆ လ၊
- အပေါ်ထပ် အဆောက်အအုံများ ဆောက်လုပ်ခြင်း၊ စက်မှုလုပ်ငန်း၊ လျှပ်စစ်နှင့် ပိုက်လိုင်းများ သွယ်တန်းခြင်း၊ အခန်းတွင်း ဒီဇိုင်းနှင့်ပစ္စည်းကိရိယာများ တပ်ဆင်ခြင်း၊ အချောသတ်လုပ်ငန်းများ၊ စက်ပစ္စည်း များ တပ်ဆင်ခြင်း၊ စစ်ဆေးခြင်းလုပ်ငန်းများ- ကြာမြင့်ချိန် ၃၅ လ၊ နှင့်
- နေထိုင်ခွင့်လျှောက်ထားခြင်း – ကြာမြင့်ချိန် ၆ လ ဖြစ်ပါသည်။

စီမံကိန်းတစ်ခုလုံးသည် ခန့်မှန်းခြေ စုစုပေါင်း ၅၄ လ ကြာမြင့်နိုင်ပါသည်။

၁(၃) လက်ရှိပတ်ဝန်းကျင် အခြေအနေ

အဆိုပြုစီမံကိန်းကို တည်ဆောက်မည့်ပတ်ဝန်းကျင်သည် လူစည်ကားပြီးစီးပွားရေးလုပ်ငန်းများ အများအပြား တည်ရှိ သည့်ပတ်ဝန်းကျင်ဖြစ်ပြီး ဧရိယာတစ်ခုလုံးသည်ဆောက်လုပ်ဆဲ အဆောက်အဦး အသစ်များဖြင့် ပြည့်နှက်လျက်ရှိပါသည်။ စီမံကိန်း၏ သဘာဝနှင့်ပတ်ဝန်းကျင် ဘေးအန္တရာယ်ကင်းရှင်းရေးအတွက် ကြိုတင်စီမံထားသည့် အစီအစဉ်များကြောင့် စီမံကိန်းတည်ဆောက်ရေးကာလ၊ လုပ်ငန်းလည် ပတ်ဆောင် ရွက်မည့်ကာလ နှင့် စစ်ဆေးပြီး စိတ်ချရသည့်အခြေအနေသို့ ရောက်ရှိမည့်ကာလစသည့် စီမံကိန်းအဆင့်ဆင့်တွင် ပတ်ဝန်းကျင် အပေါ် လွှမ်းမိုးသက်ရောက်မှု အလားအလာ [Area of Influence (AoI)] သည် နည်းပါးသည်။ AoI ကြောင့် ကန့်သတ်ရမည့်အကွာအဝေးကို ပဏာမလေ့လာ ဆန်းစစ်သည့်အခါ ထိခိုက်မှုသည် တစ်ကီလိုမီတာ အကွာအဝေး အထိ သက်ရောက်ရန် အလားအလာရှိသည်ဟု ကြိုတင် ခန့်မှန်းရသောကြောင့် AoI ကို စီမံကိန်း၏ အချင်းဝက် ပတ်လည် ၁ တစ်ကီလိုမီတာ အဖြစ်ထားရှိပါသည်။ လက်ရှိ မျက်မြင်ကိုယ်တွေ့အခြေအနေ၊ သဘာဝ ပတ်ဝန်းကျင်၊ လူမှုစီးပွားအခြေအနေ၊ ယာဉ်အသွားအလာအခြေအနေ နှင့် လမ်းမသို့ အဆက်အသွယ် ပြုလုပ်ရမည့် အခြေအနေတို့ကို သဘာဝပတ်ဝန်းကျင် ထိန်းသိမ်းကာကွယ်သည့် ရည်ရွယ် ချက်အတွက် အဓိက ဦးစားပေးဆောင်ရွက်သွားပါမည်။ လုပ်ငန်းခွင်ဝန်းကျင်၏ နောက်ခံတည်နေရာ၊ မြေမျက်နှာပြင် အနိမ့်အမြင့်၊ မြေ၊ ရေအရင်းအမြစ် စမ်းသပ်တိုင်းတာခြင်း ၊ ရေအရင်းအမြစ်၊ ရာသီဥတုအခြေအနေ၊ ဇလဗေဒ၊ သစ်ပင် ပန်းမန်နှင့် တိရစ္ဆာန်များ အခြေအနေ၊ လူမှုစီးပွားရေး အခြေအနေတို့ကို လေ့လာဆန်းစစ်သွားပါမည်။

၁(၃)(၁) လုပ်ငန်းခွင်တည်နေရာနှင့် ပတ်ဝန်းကျင်မြေအသုံးချမှုများ

စီမံကိန်းသည် ပြည်ထောင်စုသမ္မတမြန်မာနိုင်ငံ၊ ရန်ကုန်တိုင်းဒေသကြီး၊ ရန်ကုန်မြို့ တွင် တည်ရှိပါသည်။ အောက်မြန်မာ နိုင်ငံ၏ အထင်ကရနေရာတွင် အခြေတည်ထားသောရန်ကုန်မြို့သည် ဧရာဝတီမြစ်ဝ ကျွန်းပေါ်ဒေသ၏ အရှေ့ဘက် ရန်ကုန်နှင့်ပဲခူးမြစ်များ စုဆုံသည့်နေရာတွင်တည်ရှိပြီး မုတ္တမကွေ့၏ကမ်းရိုးတန်းမှ ခန့်မှန်းခြေ ၃၀ ကီလိုမီတာ ကွာဝေး ပါသည်။ ရန်ကုန်တိုင်းဒေသကြီး၏ မြောက်နှင့်အရှေ့ဘက်တွင် ပဲခူးတိုင်းဒေသကြီးတည်ရှိပြီး တောင်ဘက်တွင် မုတ္တမ ကွေ့၊ အနောက်ဘက်တွင် ဧရာဝတီတိုင်း ဒေသကြီးတည်ရှိပါသည်။

စီမံကိန်းသည် L ပုံသဏ္ဍာန် ရှိပြီး [16º46′ 50.84″ N 96º 09′31.58″ E (အရှေ့မြောက်ထောင့်) နှင့် 16º 46′46.24″ N ၊ 96º09′26.78″ E (တောင်ထောင့်)] ဧရိယာသည် ခန့်မှန်းခြေ ၂၅၇၀၀ စတုရန်းမီတာ (၆.၃၅ ဧက) ဖြစ်သည်။

၁(၃)(၂) မြေမျက်နှာပြင်အနိမ့်အမြင့်

မြေမျက်နှာပြင်အနိမ့်အမြင့် စမ်းသပ်တိုင်းတာမှုအရ ရရှိသောအချက်အလက်များ အပေါ်မူတည်လျက် စီမံကိန်းသည် အများအားဖြင့် မြေအနိမ့်ပိုင်းတွင်တည်ရှိပြီး အရှေ့မြောက် နယ်မြေ (RL+10.97 m) မှ အနောက်တောင် နယ်မြေ (RL+7.75 m) သို့ အနည်းငယ်နိမ့်ဆင်းသွားသော လျှောစောက်တစ်ခု ရှိပါသည်။

၁(၃)(၃) ဘူမိဗေဒ

ရန်ကုန်ဧရိယာ၏ အောက်ခံမြေသည် နုန်းမြေအနည်ထိုင်များ (Pliestocene to Recent) ၊ ပင်လယ်မှမဟုတ်ဘဲ ရေဝတီမြစ်မှပါလာသော အနည်၊ အနှစ်များ နှင့် နုန်းများ (Pliocene) နှင့် ပဲခူးရိုးမတောင်တန်းများမှ မာကျော၍၊ အရေအတွက်များသော သဲကျောက်များ (early-late Miocene) ဖြင့် ဖွဲ့စည်းထားပါသည်။ နုန်းမြေ အနည်များတွင် ကျောက်စရစ်များ၊ မြေစေးများ၊ နုန်းများ၊ သဲနှင့်ဂဝံများ ပါရှိပြီး ၎င်းတို့သည် ပင်လယ်ရေမျက်နှာပြင် အထက် ၃-၄.၆ မီတာ ၊ ရေဝတီမြစ်၏ရေတိုက်စားထားသော မျက်နှာပြင်အပေါ်၌တည်ရှိပါသည်။ ရန်ကုန်မြို့ရှိကျောက် အမျိုးအစားတွင် သဲ ကျောက်၊ နုန်းကျောက်၊ ထုံးကျောက် နှင့် စရစ်ဖြုန်းကျောက် စသည့် နူးညံ့သည့်ကျောက်များ ပါရှိသည်။

ရန်ကုန်မြို့သည် မြန်မာနိုင်ငံ၏ အဓိကပြတ်ရွေ့ကြောင်းကြီး ၃ ခု မှတစ်ခုဖြစ်သော ဗဟိုမြေနိမ့်ပိုင်း (Central Lowland) ၏ တောင်ဘက်ယွန်းယွန်းတွင် တည်ရှိပါသည်။ ရန်ကုန်မြို့ မြောက်ဘက်ရှိ၊ တိုက်ကြီးခရိုင်၊ ဂျိုးဖြူ မိုးရေခံရပ်ဝန်း၊ တောင်ညို ဧရိယာမှ ရန်ကုန်မြို့၏ တောင်ဘက်ရှိ သန်လျင်တံတား တစ်လျှောက်ဖြစ် ပေါ်လျက်ရှိသော သီးခြားကုန်းပြင်မြင့်များသည် Upper Miocene ကျောက်များ ဆက်တိုက်ပြိုကွဲခြင်းကြောင့် ဖြစ်ပေါ်လာသည်ဟုယူဆရသည်။

၁(၃)(၄) မြေအနေအထား

စီမံကိန်းလုပ်ငန်းခွင်နှင့် ပတ်ဝန်းကျင်ရှိ အောက်ခံမြေ အမျိုးအစားသည် မြစ်ချောင်းအနီး မြက်ခင်းပြင်မြေနှင့် နုန်းမြေ ဆန်သော မြက်ခင်းပြင်မြေ အမျိုးအစားဖြစ်ကြောင်း ခွဲခြားသိရှိရသည်။ မြက်ခင်းပြင်မြေသည် ရုံဖန်ရံခါ ဒီရေတက်သော မြစ်ကမ်းလွင်ပြင်အနီးတွင် တွေ့ရှိရသည့် မြေအမျိုးအစားဖြစ်ပြီး ကာဗွန်နိုက်ဓာတ်မပါဝင်ဘဲ ဆားပမာဏအများအပြား ပါဝင်သည်။ မြေသားတွင်အဓိကပါဝင်သည့် ပစ္စည်းများသည် silty clay loam နှင့် neutral soil ဖြစ်ပြီး အပင် သန်စွမ်းစေသည့် ဓာတ်ပါရှိသည်။

၁(၃)(၅) ဇလဘူမိဗေဒဆိုင်ရာ

ရန်ကုန်မြို့သည် လွန်ခဲ့သောနှစ်ပေါင်း ၆၅ သန်းမှ ၆ သန်း (Tertiary-Quaternary) ကာလအတွင်းဖြစ် ပေါ် ခဲ့သည့် ကျစ်လျစ်မာကျောမှုမရှိသည့် အနည်အနှစ်များက ထိန်းသိမ်းထားသောကြောင့် မြေအောက်ရေကြွယ်ဝ သည့်အရပ်ဖြစ် သည်။ ရန်ကုန်ရှိ မြေအောက်ရေကို အများအားဖြင့် ချိုင့်ဝှမ်းများနှင့် ရေဝတီသဲကျောက်များမှ ထုတ်ယူရရှိသည်။

၁(၃)(၆) ဇလဗေဒဆိုင်ရာ

စီမံကိန်းလုပ်ငန်းခွင်သည် ပုဇွန်တောင်ချောင်း၏ မိုးရေခံရပ်ဝန်းတစ်လျှောက်တည်ရှိပြီး ၄င်းချောင်းသည် လုပ်ငန်းခွင်၏ အရှေ့ဘက်တွင်စီးဆင်းနေကာ တောင်ဘက်အတိုင်းဆင်းလာ၍ ရန်ကုန်မြစ်နှင့်စုဆုံသည်။ ရန်ကုန်မြစ် သို့မဟုတ် လှိုင်မြစ်သည် ပဲခူးနှင့်မြစ်မခမြစ်တို့ ပေါင်းစုံရာမှဖြစ်ပေါ်လာပြီး ကပ္ပလီပင်လယ်၏ အစိတ်အပိုင်း တစ်ရပ်ဖြစ်သည့် မုတ္တမ ကွေ့အတွင်းသို့ စီးဝင်ပါသည်။

၁(၃)(၇) ရာသီဥတုနှင့်မိုးလေဝသ

Koppen ရာသီဥတုများ ခွဲခြားသတ်မှတ်ခြင်းစနစ်အရ ရန်ကုန်မြို့သည် အပူပိုင်းမုတ်သုံရာသီဥတုရှိသော ဒေသဖြစ်သည်။ ရန်ကုန်မြို့တွင် မေလနှောင်းပိုင်းမှ အောက်တိုဘာလအထိ မိုးရွာသွန်းပြီး မိုးရေချိန်ပမာဏများ ပြားသည်။ ခြောက် သွေ့သောရာသီဥတုသည် နိုဝင်ဘာလတွင်စတင်ပြီး ဧပြီလတွင်ပြီးဆုံးသည်။ တစ်နှစ်ပတ်လုံး ပျမ်းမျှအပူချိန်သည် 26°C မှ 36°C အကြားဖြစ်ပြီး အပူချိန်လျော့နည်းသည့်ကာလတွင် 18°C မှ 25°C အထိ ဖြစ်သည်။

၁(၃)(၈) ပတ်ဝန်းကျင်မြေနေရာ အသုံးပြုမှု

စီမံကိန်း ပတ်ဝန်းကျင်ရှိမြေနေရာများတွင်အဓိကအားဖြင့် စီးပွားရေးနှင့် လူနေအိမ်များဖြင့် ရောယှက်၍ တည့်ရှိနေပါသည်။

၁(၃)(၉) အခြေခံမျဉ်းရှိပတ်ဝန်းကျင်လေထု၊ ဆူညံသံများ နှင့် တုန်ခါမှုများကို လေ့လာစောင့်ကြည့်ခြင်း

အဆိုပြုစီမံကိန်းသည် မြန်မာနိုင်ငံ၏ စီးပွားရေးနှင့်ကုန်သွယ်ရေး အချက်အချာဗဟိုဌာနတွင်တည်ရှိပြီး မော်တော်ကားလမ်းများ၊ ရထားလမ်းများ၊ ရေလမ်းကြောင်းနှင့် လေကြောင်းများဆုံတွေ့သည့် သယ်ယူပို့ဆောင်ရေး အသိုက်အမြုံ အနီးတွင်တည်ရှိပါသည်။ ထို့ကြောင့် စီမံကိန်းဧရိယာတစ်ဝိုက်တွင် အဓိကဖြစ်ပေါ်နိုင်သည့် လေထုညစ်ညမ်းမှုသည် ယာဉ် မျိုးစုံမှထွက်ရှိသည့် အခိုးအငွေ့များကြောင့်ဖြစ်ပြီး စက်မှုလက်မှုလုပ်ငန်းများ မှထွက်ရှိသည့် အခိုးအငွေ့များသည် အတိုင်းအတာ အနည်းငယ်အထိသာ အကျိုးသက်ရောက်နိုင်ပါသည်။

စီမံကိန်းကြောင့် လေထုအပေါ်အကျိုးသက်ရောက်မှုရှိ/မရှိကို လေ့လာဆန်းစစ်ရန် အထိအခိုက်ခံနိုင်မှုကို စမ်းသပ်တိုင်း တာသည့် air sensitive receptors များဖြင့် အခြေခံမျဉ်းရှိ လေထုအရည်အသွေးကို တိုင်းတာ ခဲ့ပါသည်။ ၂၀၁၃ ခုနှစ် အောက်တိုဘာလ ၂၂ ရက် တွင် ၊ ညနေ ၆ နာရီမှ ၇ နာရီခွဲကြား ယာဉ်ကြောပိတ်ဆို့သည့် အချိန်တွင် စီမံကိန်း လုပ်ငန်းခွင်၏ မြောက်ဘက်၊ တောင်ဘက်နှင့် အနောက်ဘက် နေရာသုံးနေရာတွင် total suspended particulates (TSP) ကိုတိုင်းတာခဲ့ပါသည်။ အလင်းပြန့်ကျဲသည့် သီအိုရီအပေါ်မူတည်၍ လုပ်ငန်းဆောင်ရွက်သော Dust Trak Aerosol Monitor (Model 8520) ကိုအသုံးပြုခဲ့ပါသည်။ TSP တိုင်းတာရရှိမှုများကို Table ES-2 တွင်ပြသထားပါသည်။

၁(၃)(၃) ဘူမိဗေဒ

ရန်ကုန်ဧရိယာ၏ အောက်ခံမြေသည် နုန်းမြေအနည်ထိုင်များ (Pliestocene to Recent) ၊ ပင်လယ်မှမဟုတ်ဘဲ ရေဝတီမြစ်မှပါလာသော အနည်၊ အနှစ်များ နှင့် နုန်းများ (Pliocene) နှင့် ပဲခူးရိုးမတောင်တန်းများမှ မာကျော၍၊ အရေအတွက်များသော သဲကျောက်များ (early-late Miocene) ဖြင့် ဖွဲ့စည်းထားပါသည်။ နုန်းမြေ အနည်များတွင် ကျောက်စရစ်များ၊ မြေစေးများ၊ နုန်းများ၊ သဲနှင့်ဂဝံများ ပါရှိပြီး ၄င်းတို့သည် ပင်လယ်ရေမျက်နှာပြင် အထက် ၃-၄.၆ မီတာ ၊ ရေဝတီမြစ်၏ရေတိုက်စားထားသော မျက်နှာပြင်အပေါ်၌တည်ရှိပါသည်။ ရန်ကုန်မြို့ရှိကျောက်အမျိုးအစားတွင် သဲ ကျောက်၊ နုန်းကျောက်၊ ထုံးကျောက် နှင့် စရစ်ဖြုန်းကျောက် စသည့် နူးညံ့သည့်ကျောက်များ ပါရှိသည်။

ရန်ကုန်မြို့သည် မြန်မာနိုင်ငံ၏ အဓိကပြတ်ရွေ့ကြောင်းကြီး ၃ ခု မှတစ်ခုဖြစ်သော ဗဟိုမြေနိမ့်ပိုင်း (Central Lowland) ၏ တောင်ဘက်ယွန်းယွန်းတွင် တည်ရှိပါသည်။ ရန်ကုန်မြို့ မြောက်ဘက်ရှိ၊ တိုက်ကြီးခရိုင်၊ ဂျုံးဖြူမိုးရေခံရပ်ဝန်း၊ တောင်ညို ဧရိယာမှ ရန်ကုန်မြို့၏ တောင်ဘက်ရှိ သန်လျင်တံတား တစ်လျှောက်ဖြစ် ပေါ်လျက်ရှိသော သီးခြားကုန်းပြင်မြင့်များသည် Upper Miocene ကျောက်များ ဆက်တိုက်ပြိုကွဲခြင်းကြောင့် ဖြစ်ပေါ်လာသည်ဟုယူဆရသည်။

၁(၃)(၄) မြေအနေအထား

စီမံကိန်းလုပ်ငန်းခွင်နှင့် ပတ်ဝန်းကျင်ရှိ အောက်ခံမြေ အမျိုးအစားသည် မြစ်ချောင်းအနီး မြက်ခင်းပြင်မြေနှင့် နုန်းမြေ ဆန်သော မြက်ခင်းပြင်မြေ အမျိုးအစားဖြစ်ကြောင်း ခွဲခြားသိရှိရသည်။ မြက်ခင်းပြင်မြေသည် ရံဖန်ရံခါ ဒီရေတက်သော မြစ်ကမ်းလွင်ပြင်အနီးတွင် တွေ့ရှိရသည့် မြေအမျိုးအစားဖြစ်ပြီး ကာဗွန်နိတ်ဓာတ်မပါဝင်ဘဲ ဆားပမာဏအများအပြား ပါဝင်သည်။ မြေသားတွင်အဓိကပါဝင်သည့် ပစ္စည်းများသည် silty clay loam နှင့် neutral soil ဖြစ်ပြီး အပင် သန့်စွမ်းစေသည့် ဓာတ်ပါရှိသည်။

၁(၃)(၅) ဇလဘူမိဗေဒဆိုင်ရာ

ရန်ကုန်မြို့သည် လွန်ခဲ့သောနှစ်ပေါင်း ၆၅ သန်းမှ ၆ သန်း (Tertiary-Quaternary) ကာလအတွင်းဖြစ် ပေါ် ခဲ့သည့် ကျစ်လျစ်မာကျောမှုမရှိသည့် အနည်အနှစ်များက ထိန်းသိမ်းထားသောကြောင့် မြေအောက်ရေကြွယ်ဝသည့်အရပ်ဖြစ် သည်။ ရန်ကုန်ရှိ မြေအောက်ရေကို အများအားဖြင့် ချိုင့်ဝှမ်းများနှင့် ရေဝတီသဲကျောက်များမှ ထုတ်ယူရရှိသည်။

၁(၃)(၆) ဇလဗေဒဆိုင်ရာ

စီမံကိန်းလုပ်ငန်းခွင်သည် ပုဇွန်တောင်ချောင်း၏ မိုးရေခံရပ်ဝန်းတစ်လျှောက်တည်ရှိပြီး ၎င်းချောင်းသည် လုပ်ငန်းခွင်၏ အရှေ့ဘက်တွင်စီးဆင်းနေကာ တောင်ဘက်အတိုင်းဆင်းလာ၍ ရန်ကုန်မြစ်နှင့်စုဆုံသည်။ ရန်ကုန်မြစ် သို့မဟုတ် လှိုင်မြစ်သည် ပဲခူးနှင့်မြစ်မခမြစ်တို့ ပေါင်းစုံရာမှဖြစ်ပေါ်လာပြီး ကပ္ပလီပင်လယ်၏ အစိတ်အပိုင်း တစ်ရပ်ဖြစ်သည့် မုတ္တမ ကွေ့အတွင်းသို့ စီးဝင်ပါသည်။

၁(၃)(၇) ရာသီဥတုနှင့်မိုးလေဝသ

Koppen ရာသီဥတုများ ခွဲခြားသတ်မှတ်ခြင်းစနစ်အရ ရန်ကုန်မြို့သည် အပူပိုင်းမုတ်သုံရာသီဥတုရှိသော ဒေသဖြစ်သည်။ ရန်ကုန်မြို့တွင် မေလနှောင်းပိုင်းမှ အောက်တိုဘာလအထိ မိုးရွာသွန်းပြီး မိုးရေချိန်ပမာဏများ ပြားသည်။ ခြောက် သွေ့သောရာသီဥတုသည် နိုဝင်ဘာလတွင်စတင်ပြီး ဧပြီလတွင်ပြီးဆုံးသည်။ တစ်နှစ်ပတ်လုံး ပျမ်းမျှအပူချိန်သည် 26°C မှ 36°C အကြားဖြစ်ပြီး အပူချိန်လျော့နည်းသည့်ကာလတွင် 18°C မှ 25°C အထိ ဖြစ်သည်။

၁(၃)(၈) ပတ်ဝန်းကျင်မြေနေရာ အသုံးပြုမှု

စီမံကိန်း ပတ်ဝန်းကျင်ရှိမြေနေရာများတွင်အဓိကအားဖြင့် စီးပွားရေးနှင့် လူနေအိမ်များဖြင့် ရောယှက်၍ တည့်ရှိနေပါသည်။

၁(၃)(၉) အခြေခံမျဉ်းရှိပတ်ဝန်းကျင်လေထု၊ ဆူညံသံများ နှင့် တုန်ခါမှုများကို လေ့လာစောင့်ကြည့်ခြင်း

အဆိုပြုစီမံကိန်းသည် မြန်မာနိုင်ငံ၏ စီးပွားရေးနှင့်ကုန်သွယ်ရေး အချက်အချာဗဟိုဌာနတွင်တည်ရှိပြီး မော်တော်ကားလမ်းများ၊ ရထားလမ်းများ၊ ရေလမ်းကြောင်းနှင့် လေကြောင်းများဆုံတွေ့သည့် သယ်ယူပို့ဆောင်ရေး အသိုက်အမြုံ အနီးတွင်တည်ရှိပါသည်။ ထို့ကြောင့် စီမံကိန်းဧရိယာတစ်ဝိုက်တွင် အဓိကဖြစ်ပေါ် နိုင်သည့် လေထုညစ်ညမ်းမှုသည် ယာဉ် မျိုးစုံမှထွက်ရှိသည့် အခိုးအငွေ့များကြောင့်ဖြစ်ပြီး စက်မှုလက်မှုလုပ်ငန်းများ မှထွက်ရှိသည့် အခိုးအငွေ့များသည် အတိုင်းအတာ အနည်းငယ်အထိသာ အကျိုးသက်ရောက်နိုင်ပါသည်။

စီမံကိန်းကြောင့် လေထုအပေါ်အကျိုးသက်ရောက်မှုရှိ/မရှိကို လေ့လာဆန်းစစ်ရန် အထိအခိုက်ခံနိုင်မှုကို စမ်းသပ်တိုင်း တာသည့် air sensitive receptors များဖြင့် အခြေခံမျဉ်းရှိ လေထုအရည်အသွေးကို တိုင်းတာခဲ့ပါသည်။ ၂၀၁၃ ခုနှစ် အောက်တိုဘာလ ၂၂ ရက် တွင် ၊ ညနေ ၆ နာရီမှ ၇ နာရီခွဲကြား ယာဉ်ကြောပိတ်ဆို့သည့် အချိန်တွင် စီမံကိန်း လုပ်ငန်းခွင်၏ မြောက်ဘက်၊ တောင်ဘက်နှင့် အနောက်ဘက် နေရာသုံးနေရာတွင် total suspended particulates (TSP) ကိုတိုင်းတာခဲ့ပါသည်။ အလင်းပြန့်ကျဲသည့် သီအိုရီအပေါ်မူတည်၍ လုပ်ငန်းဆောင်ရွက်သော Dust Trak Aerosol Monitor (Model 8520) ကိုအသုံးပြုခဲ့ပါသည်။ TSP တိုင်းတာရရှိမှုများကို Table ES-2 တွင်ပြသထားပါသည်။

Table ES-1: အနီးပတ်ဝန်းကျင်ရှိလေထုအရည်အသွေးအဆင့်များ

ဒေသတွင်းလေထုအရည်အသွေး တိုင်းတာခြင်း၏ ရလဒ်များကို နေရာဒေသအတိအကျမှ အချက်အလက်မှန်ကန်စွာဖြင့် ရရှိထားခြင်းဖြစ်သည်။ MONREC ၏ လိုအပ်ချက်အသစ်များကြောင့် ENVIRON သည် ၂၀၁၅ ခုနှစ်ဖေဖော်ဝါရီတွင် လေထုနှင့်ဆူညံသံ အရည်အသွေးကို အခြေခံမျဉ်းဖြင့်တိုင်းတာ၍ အချက်အလက်များရယူရန် two-season baseline data များကိုဆောင်ရွက်ရယူခဲ့ပါသည်။ ဒုတိယအကြိမ်ပြုလုပ်သည့် လေထုအရည်အသွေး စမ်းသပ်တိုင်းတာခြင်းတွင် PM10 (10 micron ထက်လျော့နည်းသည့် အမှုန်) နှင့် PM2.5 (2.5 micron ထက် လျော့နည်းသည့် အမှုန်) ၊ NO2 (Nitrogen Dioxide) နှင့် SO2 (Sulfur Dioxide) တို့ကိုတိုင်းတာခဲ့ပါသည်။

၁.၃.၁၀ အခြေခံမျဉ်းရှိပတ်ဝန်းကျင် ဆူညံသံများ

လုပ်ငန်းခွင်နေရာသုံးခုရှိ အချက်အလက်များကို လေ့လာဆန်းစစ်ခဲ့ပါသည်။ လေထုအရည်အသွေး တိုင်းတာသည့် ဒုတိယ အစီအစဉ်၏ တွေ့ရှိချက်များအရ ဖမ်းယူတိုင်းတာသည့်စက်များ (LM1, LM2 နှင့် LM3) အားလုံးတွင် 63 µg/m3 ၊ 58 µg/m3 နှင့် 64 µg/m3 တို့ကို အသီးသီးတိုင်းတာမိသောကြောင့် PM10 နေ့စဉ်ပျမ်းမျှစုစည်းကျရောက်မှုသည် National Environmental Quality (Emission) Guideline (NEQEG) 2015 (50 µg/m3) ထက်များပြားနေကြောင်း တွေ့ရှိရသည်။ PM2.5 concentration အတွက် နေ့စဉ်ပျမ်းမျှတန်ဖိုးသည် လုပ်ငန်းခွင်နေရာများ (LM1, LM2 နှင့် LM3) အားလုံး၌ 59 µg/m3 ၊ 38 µg/m3 နှင့် 51 µg/m3 အသီးသီးအဖြစ် NEQEG 2015 (25 µg/m3) ထက်များပြားနေကြောင်း၊ SO2 concentration သည် လေ့လာစောင့်ကြည့်သည့် အမှတ်များအားလုံး၌ NEQEG 2015 ထက်များပြားနေကြောင်း တွေ့ရှိရသည်။ Nitrogen Oxides (NOx) နာရီအလိုက်ပျမ်းမျှစုစည်းမှုသည် လုပ်ငန်းခွင်များအားလုံးရှိ LM1 ၊ LM2 နှင့် LM3 အတွက် 61 µg/m3 ၊ 77 µg/m3 နှင့် 94 µg/m3 အဖြစ် အသီးသီးရှိပြီး NEQEG 2015 guideline value 200 µg/m3 ထက်လျော့နည်းနေကြောင်း တွေ့ရှိရသည်။ သို့ရာတွင် နံနက် ၁၀ နာရီ နှင့် နေ့လည် ၁၂ နာရီ အကြားတွင် NOx concentrations သည် WHO hourly standard ထက်မြင့်မားနေကြောင်းတွေ့ရှိရသည်။

ဆူညံသံများကို လေ့လာစောင့်ကြည့်သည့် အစီအစဉ်အရ Landmark project နှင့် အနီးအနားတစ်ဝိုက်တွင် ဆူညံသံ ဖမ်းယူသည့် noise sensitive receiver များတပ်ဆင်ခဲ့ပါသည်။ air receptor များနှင့် တူညီသောနေရာတွင် လေ့လာ စောင့်ကြည့်သည့် အမှတ်များကို ခန့်မှန်းခြေနေရာချထားခဲ့ပါသည်။ ၂၀၁၅ ခုနှစ် ဖေဖော်ဝါရီတွင် ပြုလုပ်ခဲ့သည့် အကြို စမ်းသပ်တိုင်းတာမှုများအတွင်း noise sensitive receiver (NSR) အမျိုးအပြားကို အသုံးပြုစစ်ဆေးခဲ့ပါသည်။ စီမံကိန်း လုပ်ငန်းခွင် တည်နေရာနှင့် အကျိုးသက်ရောက်ခြင်း ခံရမည့် ပုဂ္ဂိုလ်အရေအတွက်ကို ခန့်မှန်း၍ ပထမအဆင့် NSR များ ကို နေရာရွေးချယ်ချထားခဲ့ပါသည်။ NSR များအားလုံးအနက် ဘုရားကျောင်းတွင်

နေရာချထားသော N2 အမှတ် နေရာ၌ ဆူညံသံကို အခြားနေရာအမှတ်များထက် ပိုမိုဖမ်းယူမိပါသည်။ အဘယ်ကြောင့်ဆိုသော ဘုရားကျောင်းတည်နေရာသည် အခြားအသံဖမ်းယူစက်များ တပ်ဆင်ထားသည့် နေရာများနှင့် နှိုင်းယှဉ်ပါက စီမံကိန်းလုပ်ငန်းခွင်နှင့် ပိုမိုနီးကပ်သော ကြောင့်ဖြစ်သည်။ သို့ရာတွင် ဘုရားကျောင်း အနီးပတ်ဝန်းကျင်ရှိ ဆူညံသံအဆင့်သည် [62 + 4 = 66 dB(A)] ရှိပြီး ဆောက်လုပ်ရေးလုပ်ငန်းခွင်အတွက် သတ်မှတ်ထားသော ဆူညံသံအဆင့် (4 dBA) ကို ထပ်မံပေါင်းထည့်စေကာမူ IFC ကခွင့်ပြုသတ်မှတ်ထားသည့် အကန့်အသတ်အောက် လျော့နည်းနေကြောင်းတွေ့ရှိရသည်။

တည်ဆောက်ရေးကာလတွင် တုန်ခါမှုများ၏အရင်းအမြစ်သည် Grand Meeyahta နှင့် FMI Centre ကိုဖြိုဖျက်ခြင်း ကြောင့်ဖြစ်သည်။ အဆက်မပြတ်တုန်ခါမှုများကြောင့် အကျိုးသက်ရောက်မှုကို လျှော့ချရန် အဆောက်အဦးများ ဖြိုဖျက် သည့်လုပ်ငန်းစဉ်ကို အဆင့်အလိုက်ဆောင်ရွက်သွားပါမည်။ တည်ဆောက်ရေး လုပ်ငန်းများကို လေ့လာဆန်းစစ်ရာတွင် အဆောက်အဦးများကို ဖြိုဖျက်သည့်အတွက်ကြောင့် တုန်ခါမှုဖြစ်ပွား ကြောင်းတွေ့ရှိရသည်။ hydraulic breaker များ တွင်မြေတူးမြေကော်စက်များကို ထည့်သွင်းအသုံးပြု၍ တုန်ခါမှုကိုလေ့လာဆန်းစစ်ခဲ့ပါသည်။ မြေသယ်ယာဉ်နှင့် ရွေ့ လျားနိုင်သောကရိန်းစက်များကဲ့သို့ အခြား ဆောက်လုပ်ရေးဆက်စပ်ပစ္စည်းများသည် Lv value အရ 10-12 dB ထက် ပိုမိုနိမ့်သောကြောင့် ဖြတ်တောက်ကိရိယာများကိုသာ အသုံးပြုနိုင်သည်။ ၂၀၁၃ ခုနှစ် အောက်တိုဘာလတွင် စီမံကိန်း လုပ်ငန်းခွင် အတွင်း တုန်ခါမှုကိုဖမ်းယူသည့် ကိရိယာ "VSRs" ကိုအသုံးပြု၍ နည်းစနစ်၊ သဘာဝနှင့်တုန်ခါမှု၏အကျိုး သက်ရောက်မှုကြောင့် ထိခိုက်မည့်လူအရေအတွက်တို့ကို ခွဲခြားသတ်မှတ်ခဲ့ပါသည်။

Grand Meeyahta နှင့် FMI Centre ကိုဖြိုဖျက်ရာတွင် တုန်ခါစေမှုကိုဖြစ်ပေါ်စေမည့် အဓိကကိရိယာသည် ဟိုက်ဒရောလစ် ဖြတ်တောက်ကိရိယာဖြစ်သည်။ ထို့ကြောင့် Transportation- and Construction-Induced Vibration Guidance Manual အပေါ်မူတည်လျက် ဆောင်ရွက်သွားပါမည်။ အထက်ဖော်ပြပါ နည်းစနစ်အရ အဆောက်အဦးပျက်စီး မှုနှင့် လူအများစိတ်အနှောင့်အယှက်ဖြစ်မှု ရှုထောင့်များအရ တုန်ခါခြင်း၏ အကျိုးသက်ရောက်မှုကို တွက်ချက်ပါမည်။ VSR အရခန့်မှန်းရာတွင် တုန်ခါမှုကြောင့် လက်မခံနိုင် သောအကျိုးသက်ရောက်မှု တစ်စုံတစ်ရာမရှိကြောင်း တွေ့ရှိရသည်။

၁(၃)(၁၁) မြေဆီလွှာ နှင့် မြေအောက်ရေတို့ပါဝင်သည့် ရေအရည်အသွေးကို အခြေခံမျဉ်းမှ စမ်းသပ်တိုင်းတာခြင်း

အခြေခံမျဉ်းရှိ မြေဆီလွှာနှင့်မြေအောက်ရေအခြေအနေ လေ့လာစိစစ်ရန် မြေဆီလွှာနှင့်မြေအောက်ရေတို့ကို ထွင်းဖောက် ၍စမ်းသပ်တိုင်းတာခြင်းကို စီမံကိန်းလုပ်ငန်းခွင်တွင် ဆောင်ရွက်ခဲ့ပါသည်။ စမ်းသပ်တိုင်း တာခြင်းများကို အမေရိကန် ပြည်ထောင်စု၏ အပြင်ဘက်တွင်အသုံးပြုနိုင်သော American Standard for Testing

Methodology (ASTM) ၊ Standard Practice for Environmental Site Assessments (ESA) E 1527-05 (Phase I ESA) နှင့် ASTM E 1903-11 (Phase II ESA) တို့အပေါ်အခြေခံလျက်ဆောင်ရွက်ခဲ့ပါသည်။

၂၀၁၂ ခုနှစ် အောက်တိုဘာလ ၁၈ မှ ၂၀၁၂ ခုနှစ် နိုဝင်ဘာလ ၂၄ အထိ မြေဆီလွှာကိုတိုးချဲ့စမ်းသပ်တိုင်းတာခဲ့ပါသည်။ စမ်းသပ်တိုင်းတာရာတွင် ပါဝင်သောလုပ်ငန်းနယ်ပယ်သည် မြေမျက်နှာပြင်၏ အခြေအနေကို စမ်းသပ်တိုင်းတာခြင်း၊ Standard Penetration Test (SPT) ကိုဆောင်ရွက်ခြင်း၊ ဓာတ်ခွဲစမ်းသပ်ရန် မြေနမူနာများကိုစုဆောင်းခြင်း နှင့် Pumping Test ကို ဆောင်ရွက်ခဲ့ပါသည်။

၁၅၀ မီလီမီတာ အချင်းဝက်ရှိ လွန်တူးစက်နှင့် စက်တပ်လွန်တူးစက် (BH-1 to BH-4) တို့ကိုအသုံးပြု၍ ကျင်းပေါင်း ၄ ကျင်းကို မြေမျက်နှာပြင် အောက် ၂ အနက် မီတာ အထိတူးဖော်ခဲ့ပြီး တစ်ကျင်းစီ၏ တည်နေရာသည် အမှန်တကယ် ရှိသောရေမျက်နှာပြင်အထိ ရောက်ရှိခဲ့ပါသည်။ လက်အားသုံး လွန်တူးစက်ဖြင့် မြေသား အနေအထားအပေါ် မူတည်၍ တိမ်သောလွန်တွင်းပေါင်း ၆ တွင်းကို ပျမ်းမျှ အနက် ၂ မီတာ မှ အများဆုံး ၄.၂ မီတာ အထိရောက်ရှိစေရန် တူးဖော်ခဲ့ပါ သည်။ တည်နေရာများအားလုံးတွင် မြေအောက်သို့လွန်တူးဖော်ရာတွင် ထပ်မံကြိုတင်ကာကွယ်မှုအနေဖြင့် လွန်တွင်းများ ကိုအများဆုံး အနက် ၁.၅ မီတာ အထိ ပထမဦးစွာ စက်အကူအညီမပါဘဲတူးဖော်ခဲ့ပါသည်။ မြေသားနမူနာများကို လွန်တွင်းများမှရယူခဲ့ပြီး ကျောက်သားပါဝင်သည့်မြေသားကို Unified Soil Classification System (USCS) နှင့်အညီ စမ်းသပ်တိုင်းတာခဲ့ပါသည်။

တိမ်သောမြေအောက်ရေမှ နမူနာရယူနိုင်ရန် လွန်တွင်း ၄ တွင်း (MW1 to MW4) ကို မြေအောက်ရေကို စမ်းသပ်တိုင်းတာ မည့် ရေတွင်းများ [groundwater monitoring wells (MW)] အဖြစ်ပြောင်းလဲခဲ့ပါသည်။ ရေတွင်းများအဖြစ် ပြင်ဆင် ဆောင်ရွက်ပြီးနောက် ရေတွင်းများအောက်ခြေတွင် အနည်ထိုင်နေမည့် အမှုန်အမွှားများကိုဖယ်ရှားရန် ဆောင်ရွက်ရမည်။ ရေတွင်းတစ်တွင်းစီမှရေများကို တစ်ခါသုံး PVC ကိရိယာဖြင့် စနစ်တကျခပ်ထုတ်ရမည်။ စမ်းသပ်တိုင်းတာမည့် ရေတွင်း များတွင် ရေများသန့်စင်ပြီး အနည်အနှစ်များ မရှိတော့သည်အထိ အဆက်မပြတ်ဆောင်ရွက်ရမည်။ လွန်တွင်းများ တူး ဖော်ခြင်းနှင့် စမ်းသပ်တိုင်းတာမည့် ရေတွင်းများတပ်ဆင်သည့် အဆင့်တွင် စမ်းသပ်တိုင်းတာမည့် ရေတွင်းတစ်တွင်းစီရှိ တည်ငြိမ်သော ရေမျက်နှာပြင် [Static water level (SWL)] ကိုတိုင်းတာရန် dip meter ကိုအသုံးပြုရမည်။ မြေအောက် ရေနမူနာကိုရယူရန် ကောင်းမွန်စွာသန့်စင်ထားသော ရေခပ်ထုတ်မည့်ခွက်များကို အသုံးပြုရမည်။ ရေသန့်စင်ခြင်း နှင့် နမူနာရယူခြင်း လုပ်ငန်းစဉ်အတွင်း တိုင်းတာရယူခဲ့သည့် မြေအောက်ရေ အရည်အသွေးတွင် အပူချိန်၊ pH ၊ ပျော်ဝင်နေ သည့် အရာဝတ္ထုများ [total dissolved solids (TDS)] နှင့်လျှပ်ကူးနိုင်မှု [electrical conductivity (EC)] တို့ပါဝင်သည်။

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မြေဆီလွှာ နှင့် မြေအောက်ရေအတွက် ပုံတူနမူနာတစ်ခုစီအပါအဝင် မြေဆီလွှာအတွက် နမူနာ ၁၅ ခုနှင့် မြေအောက်ရေ အတွက် နမူနာ ၇ ခု တို့ကို ဓာတုဗေဒနည်းအရ လေ့လာဆန်းစစ်ခဲ့ပါသည်။ United States Environmental Protection Agency (USEPA) နှင့် American Public Health Association (APHA) တို့၏ စံချိန်စံနှုန်းများ အပေါ်မူတည်၍ မြေဆီလွှာနှင့်မြေအောက်ရေတို့ကို စမ်းသပ်ခဲ့ပါသည်။ မြန်မာနိုင်ငံတွင် တရားဝင်အသုံးပြုသော စံချိန်စံနှုန်းမရှိ သောကြောင့် နမူနာများကို Singapore Jurong Town Corporation (JTC) Environmental Baseline Study (EBS) Guidelines များအရ ထောက်ခံထားသော မူဘောင်အတွင်း လေ့လာဆန်းစစ်ခဲ့ပါသည်။ ၂၀၁၃ ခုနှစ် စက်တင်ဘာလ မှ နိုဝင်ဘာ အတွင်း နောက်ထပ် လွန်တွင်းပေါင်း ၃၄ တွင်းကို ထပ်မံတူးဖော်ခဲ့ပါသည်။

အထက်တွင် ဖော်ပြခဲ့သည့်အတိုင်း အန္တရာယ်ရှိသောပစ္စည်းများကို လေ့လာဆန်းစစ်ရာတွင် မြေဆီလွှာတွင် chromium၊ molybdenum, PAHs နှင့် သတ္တုဆီ အရောအနှောမှလွဲ၍ သတ္တုနှင့် သတ္တုစပ်များ ၏ DTV ပါဝင်မှု မြင့်မားခြင်းကို တွေ့ရှိ ရသည်။ နမူနာများကို စမ်းသပ်ရာတွင် TP11 သည် ကြေးနီအတွက် (190 mg/kg) (reading 600 mg/kg) ဖြင့် DIV ကန့်သတ်ချက် ကျော်လွန်သည်ကို တွေ့ရှိရသည်။ ကြေးနီများ အများအပြား အနည်ထိုင်စုပြုံခြင်းကို စီးပွားရေးနှင့်စက်မှု လက်မှုလုပ်ငန်းများ လုပ်ကိုင်သည့်အခါ တိုက်ရိုက်ထိ တွေ့မိသည့် အခါ အန္တရာယ်ကျရောက်ခြင်းရှိ/မရှိကို အောက်ဖော်ပြပါ အခြားစံနှုန်းများနှင့် နှိုင်းယှဉ်ခဲ့ပါသည်။ စီးပွားရေးနှင့် စက်မှုလက်မှုလုပ်ငန်းများ ဆောင်ရွက်ရာတွင် မြေဆီလွှာနှင့် (အရေ ပြားထိတွေ့ မိခြင်းနှင့် မျိုချမိခြင်းတို့ အပါအဝင်) ထိတွေ့နိုင်မည့်အန္တရာယ်အတွက်နှိုင်းယှဉ်လေ့လာခဲ့သော စံချိန်စံနှုန်းများ အရအများပြည်သူ (နှင့် တူးဖော်ရေးလုပ်ငန်းဆောင်ရွက်မည့် အလုပ်သမားများ) အတွက် လက်ရှိကြေးနီအနည်ထိုင် တည်ရှိမှုများသည် အကျိုးသက်ရောက်မှု မဖြစ်နိုင်ကြောင်းတွေ့ရှိရသည်။

ထို့အပြင် မြေနမူနာများတွင် coliform စုစည်းနေခြင်းကိုတွေ့ရှိရသည်။ coliform တွင် faecal coliform (ဥပမာ - Escherichia coli (E. coli)) နှင့် မြေတွင် သဘာဝအတိုင်းတွေ့ရှိရသည့် coliform များကို တွေ့ရှိရသည်။ coliform အများစုသည် ကျန်းမာရေးအတွက် အန္တရာယ်မဖြစ်စေပါ။ ဖြစ်ပေါ်လာနိုင်သည့် အန္တရာယ်များဖြစ်သည့် မြေကြီးများကို မတော်တဆ မြိုချမိခြင်း စသည်တို့ကိုကာကွယ်ရန် ကိုယ်ပိုင်သုံး ကာကွယ်ရေးကိရိယာများ [personal protective equipment (PPE)] ကို အသုံးပြုခြင်း၊ မကြာခဏလက်ဆေးခြင်းကဲ့သို့ ကောင်းမွန်သော သန့်ရှင်းရေး အလေ့အထဖြင့် ကာကွယ်နိုင်ပါသည်။

မြေအောက်ရေ မျက်နှာပြင်များကို နမူနာယူခြင်းနှင့် သန့်စင်ခြင်းပြုလုပ်သည့်အခါ တိုင်းတာရာတွင် 10.1 m bgl (MW1) ၊ 6.73 m bgl (MW2) ၊ 7.71 m bgl (MW3) နှင့် 11.3 m bgl (MW4) တို့ကို တိုင်းတာရရှိပါသည်။ စမ်းသပ်တိုင်းတာ သည့် ရေတွင်းများတွင် တွေ့ရှိရသော Barium သည် DTV တန်ဖိုးကို ကျော်လွန်ကြောင်း

တွေ့ရှိရသည်။ စီမံကိန်း လုပ်ငန်း ခွင်ရှိ မြေအောက်ရေအရည်အသွေးသည် သတ်မှတ်ထားသော ကန့်သတ်ချက်များနှင့် အများအားဖြင့်ကိုက်ညီမှုရှိပါသည်။

မြေအောက်ရေ နမူနာ MW3 နှင့် MW4 တွင် coliform များတွေ့ရှိရပြီး ၎င်းတို့ကို 30,000 Colony Forming Unit per 100 millilitres (CFU/100 ml) နှင့် 500 CFU/100 ml အသီးသီးတွင် မှတ်တမ်းတင်ခဲ့ပါသည်။ ရေမျက်နှာပြင်နှင့် မြေ အောက်ရေ အရည်အသွေးတို့တွင်အဆိုပါ ကန့်သတ်ချက်ဘောင်ကို လက်ရှိတွင်တားမြစ် ကန့်သတ်ထားခြင်း မရှိပါ။ မြန်မာနိုင်ငံတွင် ရေဆိုးများတွင် ပါဝင်သည့် total coliform အတွက် ပြဋ္ဌာန်းထားသော ကန့်သတ်ချက်သည် ၁၀၀ မီလီ လီတာ တွင် coliform bacteria အကောင်ရေ ၄၀၀ (MPN/100ml) အောက်လျော့နည်းရမည်ဖြစ်သည်။ MW3 နှင့် MW4 တွင်တွေ့ရှိရသော CFU သည် အဆိုပါ ကန့်သတ်ချက်ကိုကျော်လွန်ပြီး လုပ်ငန်းခွင်မှ စုပ်ယူရရှိသည့် မြေအောက် ရေကိုသန့်စင်မှုမပြုဘဲ အများပြည်သူသုံးသန့်စင်ရေးစနစ်သို့ ပို့လွှတ်၍ မရနိုင်ပါ။ မြေအောက်ရေကို ဓာတ်ခွဲစမ်းသပ် သည့် ရလဒ်များကို အောက်ဖော်ပြပါဇယားများ တွင် ပြသထားပါသည်။

မြေအောက်ရေ အရည်အသွေးကို လေ့လာဆန်းစစ်ရာတွင် barium ၊ nickel ၊ zinc ၊ total coliform count ၊ pH ၊ Biological Oxygen Demand (BOD) ၊ Chemical Oxygen Demand (COD) ၊ total organic carbon (TOC) ၊ fluoride ၊ chloride ၊ sulphate (SO4) ၊ နိုက်ထရိုက်တွင် ပါရှိသည့် ammonia နှင့်လျှပ်ကူးမှု တို့ပါဝင်ကြောင်း တွေ့ရှိရ သည်။ ယေဘူယျအားဖြင့် barium ၊ nickel ၊ zinc နှင့် လျှပ်ကူးမှုတို့ကို စက်မှုလက်မှုမှ စွန့်ပစ်သည့်ရေဆိုးများတွင် လည်းတိုင်းတာတွေ့ရှိရသည်။

၁(၃)(၁၂) ဇီဝဗေဒဆိုင်ရာ ပတ်ဝန်းကျင်

စီမံကိန်း၏ပတ်ဝန်းကျင်တွင် အဆောက်အဦးများတည်ရှိပြီး လုပ်ငန်းခွင်တွင် လေ့လာတွေ့ရှိရသော သစ်ပင်ပန်းမန်အမျိုး အစားသည် ရန်ကုန်ဧရိယာတွင် မြင်တွေ့ရမြဲဖြစ်သည့် ဒေသခံအမျိုးအစားဖြစ်သည်။ ထိန်းသိမ်းကာကွယ်စောင့်ရှောက် ရမည့် မျိုးစိတ်များကိုမတွေ့ရှိရပါ။ မြို့နေရာနှင့် လိုက်လျောညီထွေစွာ နေထိုင်သော ငှက်မျိုးစိတ်များကို တစ်နှစ်ပတ်လုံး တွေ့မြင်နိုင်ပါသည်။

၁(၃)(၁၃) လူမှု စီးပွားရေး စစ်တမ်း

အဆိုပြုထားသော အထင်ကရစီမံကိန်းသည် ရန်ကုန်မြို့ စီးပွားရေး အချက်အချာကျသော နေရာတွင် တည်ရှိပြီး ဒဂုံ၊ ပန်းပဲတန်းနှင့် ကျောက်တံတား မြို့နယ်များကြားတွင် တည်ရှိပါသည်။ ဒဂုံမြို့နယ်တွင် ယောမင်းကြီး ရပ်ကွပ်၊ ကျောက်တံတားမြို့နယ်တွင် ရပ်ကွက် ၁၂ နှင့် ၃၊ ပန်းပဲတန်းမြို့နယ်တွင် ရပ်ကွက် ၅၊၈ နှင့် ၁၁ ဟုအမည်ရသော ရပ်ကွက်များ စုစုပေါင်း ၇ ရပ်ကွက်သည် အဆိုပြုထားသော စီမံကိန်း၏ အကျိုးသက်ရောက်မှုများကို ချက်ချင်း ခံစားရမည့် ရပ်ကွက်များဖြစ်ပါသည်။

လူမှုစီးပွားရေး စစ်တမ်းကို ၂၀၁၆ ခုနှစ် ဇူလိုင်လ နှောင်းပိုင်းတွင် စီမံကိန်း၏ အကျိုးသက်ရောက်မှုရှိမည့် နေရာများအတွက် ကောက်ယူခဲ့ခြင်းဖြစ်ပါသည်။ စစ်တမ်း၏တွေ့ရှိချက်များကို အစီရင်ခံစာ၏ အစောပိုင်း ကဏ္ဍတွင် စုစည်းဖော်ပြခဲ့ပြီး ဖြစ်ပါသည်။ လူမှုစီးပွားရေး စစ်တမ်းသည် ပန်းပဲတန်း၊ ကျောက်တံတား၊ ဒဂုံနှင့် ဗိုလ်ချုပ်ဈေးအပါအဝင် အနီးပတ်ဝန်းကျင်နေရာများရှိ စီမံကိန်းနှင့် ပါဝင်ပတ်သက်နေသူများကို ဦးတည်ပါသည်။ စစ်တမ်းဖြေဆိုသူအများစုသည် စီမံကိန်းကို ခွင့်ပြုသည့် မှတ်ချက်များ ပေးခဲ့သော်လည်း ဖြေဆိုသူအများစုသည် မှတ်ချက်မပေးသည့်နည်းလမ်းကို ရွေးချယ်ခဲ့ပြီး စီမံကိန်းအကြောင်း နောက်ထပ် သိလိုစိတ်မရှိကြောင်း ပြသခဲ့သည်ဟု စစ်တမ်းအရ သိရှိခဲ့ရသည်။ ပန်းပဲတန်း မြို့နယ်အတွင်းတွင် ယဉ်ကြောပိတ်ဆို့မှုများ၊ ဆူညံသံများ၊ တုန်ခါမှုများ၊ ဖုန်အမှုန်များ များပြားလာမည်ကို ထပ်တလဲလဲ စိုးရိမ်သည့် အခြေအနေများ ရှိခဲ့သည်။ ကျောက်တံတား မြို့နယ်အတွက်မှာ ဆူညံသံ၊ တုန်ခါမှု၊ စွန့်ပစ်ပစ္စည်းအစိုင်အခဲများနှင့် ရေဆိုးများကို အရေးကြီးသည့် ကိစ္စရပ်များအဖြစ် ရှုမြင်ကြသည်။ ဒဂုံမြို့နယ်မှ စစ်တမ်းဖြေဆိုသူများအနေဖြင့် ဆူညံသံ၊ တုန်ခါမှုနှင့် လုံခြုံမှုရှိရေး ကိစ္စများသည် အရေးကြီး ကိစ္စရပ်များ ဖြစ်ကြသည်။ စစ်တမ်း၏ ရလာဒ်အားလုံးအရ အဓိကစိုးရိမ် ပူပန်ကြ သည့် အချက်များမှာ ဆူညံသံ၊ တုန်ခါမှုနှင့် ယဉ်ကြောပိတ်ဆို့မှုတို့ အသီးသီး ဖြစ်ကြသည်။ ၂၀၁၆ ခုနှစ် ဩဂုတ်လတွင် စီမံကိန်းအားဖြင့် အကျိုးသက်ရောင်မှုရှိသော ဒေသများတွင် နေထိုင်သူ သီးခြား အုပ်စုများကို လုထုဆွေးနွေးတိုင်ပင်မှုများ ပြုလုပ်ခဲ့သည်။ ဆွေးနွေးအကြံပေးပွဲကို တတ်ရောက်သူ ၆၀ ဦးခန့် ရှိခဲ့သည်။

ပန်းပဲတန်းမြို့နယ်၊ ကျောက်တံတားမြို့နယ်၊ ရောမင်းကြီး ရပ်ကွက်များမှ စီမံကိန်း၏ အကျိုးသက်ရောက်မှုကို ခံစားကြရမည့်သူများနှင့် St. Gabriel ဘုရားကျောင်းမှ ကော်မတီဝင်များထဲမှ ဆွေးနွေးအကြံပေးပွဲကို ပါဝင်တတ် ရောက်ခဲ့သူများသည် လူထုဆွေးနွေးအကြံပေးအစည်းအဝေးပွဲအတွင်း အချက်များစွာကို ထောက်ပြခဲ့ပါသည်။ ထောက်ပြခဲ့သော အဓိကအချက်များထဲတွင် ဆူညံသံများ၊ ဖုန်အမှုန်များပျံ့နှံ့သစ်ညမ်းခြင်းနှင့် ဆောက်လုပ်နေစဉ် ဖြစ်ပေါ်မည့် တုန်ခါမှုအတိုင်းအတာ၊ စွန့်ပစ်ပစ္စည်း စီမံခန့်ခွဲမှု၊ ဆောက်လုပ်ရေးလုပ်ငန်းများကြောင့် ယဉ်ကြော ပိတ်ဆို့မှုများဖြစ်ပေါ် ခြင်းနှင့် လမ်းမများပေါ်တွင် ပျက်စီးမှုများဖြစ်ပေါ် ခြင်းတို့ ပါဝင်ပါသည်။ ထို့ပြင် ပါဝင် ဆွေးနွေးခဲ့သူများသည် လက်ရှိလုပ်ကိုင်နေသည့် ဝန်ထမ်းများအတွက် စီမံကိန်းက ဆောင်ရွက်ပေးမည့် အစီအစဉ် များ၊ အဆောက်အဦးဖြိုဖျက်ခြင်းနည်းလမ်းများ၊ မြေအောက်ကားပါကင် ဒီဇိုင်း၊ အဆောက်အဦး၏ ငလျှင်ဒါဏ် ခံနိုင်မှုအား၊ ရှေးဟောင်းအမွေအနှစ်အဆောက်အဦးများကို ကာကွယ်မှုနှင့် St. Gabriel ဘုရားကျောင်း အဆောက် အဦးအပေါ် ကျရောက်လာမည့် အကျိုးသက်ရောက်မှုများနှင့်ပတ်သက်သည့် အချက်အလတ်များ ကိုလည်း တောင်းဆိုခဲ့ပါသည်။ စီမံကိန်းတွင် ပါဝင်ပတ်သတ်သူများအားလုံးနှင့် ထပ်ဆင့် အကြံပေးဆွေးနွေးမှု များကို ပြုလုပ်ရန်လိုအပ်သည်ဟု စီမံကိန်းကို အကောင်အထည်ဖော်သည့်အဖွဲ့အစည်းအနေဖြင့် မှတ်ယူထားပြီး မကြာ ခဏ ဆွေးနွေးအကြံပေးသွားရန်လည်း ဆုံးဖြတ်ထားကြပါသည်။

၁(၃)(၁၄) ယာဉ်အသွားအလာကိုလေ့လာခြင်း

မြန်မာနိုင်ငံရှိယာဉ်လမ်းကြောင်း အခြေအနေကိုလေ့လာရန် အစိုးရကထုတ်ပြန်ထားသည့် လမ်းညွှန်ချက်မရှိပါ။ ယာဉ်ကြောပိတ်ဆို့မှုကိုဆန်းစစ်ခြင်း [Traffic Impact Assessment (TIA)] အစီရင်ခံစာအရ (၁) စီမံကိန်း၏လက်ရှိ ယာဉ်ကြောအခြေအနေ၊ လမ်းသွားလမ်းလာများနှင့် အများပြည်သူသယ်ယူ ပို့ဆောင်ရေးအခြေအနေ (၂) လမ်းမများနှင့် ဆက်သွယ်မှု၊ လှည့်လည်သွားလာမှုနှင့် ယာဉ်ရပ်နားမှုအတွက် အဓိကအဆိုပြုချက်များကို ရွေးချယ်ပြသမှုများ (၃) ယာဉ် လမ်းကြောင်းအခြေအနေနှင့် ယာဉ်များစုပြုံရပ်နားသည့်အချိန်ကို နေ့စဉ်နှင့် နာရီအလိုက် တွက်ချက်မှုများ (၄) လမ်း ကွန်ရက်ချိတ်ဆက် အသုံးပြုနိုင်မှုအခြေအနေနှင့် ယာဉ်ကြောအခြေအနေ၊ လမ်းသွားလမ်းလာများနှင့် အများပြည်သူ သယ်ယူပို့ဆောင်ရေးကို ပိုမိုကောင်းမွန်အောင်ဆောင်ရွက်ရန် အဆိုပြုချက်များနှင့် (၅) တည်ဆောက်ရေးလုပ်ငန်းသုံး ယာဉ်များအသုံးပြုရန် အဆိုပြုလမ်းကြောင်းများနှင့် အချိန်များကို ခွဲခြားသတ်မှတ်ထားပါသည်။

ရန်ကုန်မြို့တွင် ခရီးသွားလာရာတွင် ဘတ်စ်ကားအသုံးပြုမှု ၈၀% နှင့် ရထားအသုံးပြုမှုသည် ၃% ရှိပါသည်။ ကိုယ်ပိုင် ယာဉ်ပိုင်ဆိုင်မှု မြင့်တက်လာသော်လည်း ပြည်သူအများစုသည် ခရီးသွားလာရေးအတွက် အများပြည်သူသယ်ယူပို့ ဆောင်ရေးကွန်ရက်ကိုသာ အသုံးပြုနေကြဆဲဖြစ်သည်။ စီမံကိန်းရင်းနှီးတည်ဆောက်ရာနေရာသည် အများပြည်သူ သယ်ယူပို့ဆောင်ရေးကွန်ရက်မှ လမ်းလျှောက်သွားနိုင်သည့် အကွာအဝေးတွင်တည်ရှိပါသည်။ အလုံပြဘုရားလမ်းပေါ် ရှိ ယောမင်းကြီးလမ်းမှတ်တိုင်မှ ၂၀ မီတာ နှင့် ရန်ကုန်ဘူတာကြီးမှတ်တိုင်မှ ၃၈၀ မီတာ အကွာအဝေး အသီးသီးတွင် စီမံကိန်းလုပ်ငန်းခွင် တည်ရှိပါသည်။ စီမံကိန်းသည် ဗိုလ်ချုပ်အောင် ဆန်းလမ်းပေါ်တွင်ရှိသော ဗိုလ်ချုပ်ဈေးမှတ်တိုင်နှင့် ဆူးလေဘုရားလမ်းပေါ် ရှိ ဆူးလေမှတ်တိုင်မှ ၃၀၀ မီတာ နှင့် ၂၁၀ မီတာ အသီးသီးကွာဝေးပါသည်။

ရန်ကုန်၏လူဦးရေသည် ၂၀၁၁ ခုနှစ်က ကောက်ယူခဲ့သောစစ်တမ်းအရ ခန့်မှန်းခြေ ၆ သန်းရှိပြီး တစ်နှစ်လျှင် ခန့်မှန်းခြေ ၃% တိုးတက်လျက်ရှိသည်။ ၂၀၁၅ ခုနှစ်တွင် ခန့်မှန်းလူဦးရေသည် ၆.၇၅ သန်းဖြစ်သည်။ အစိုးရ၏စာရင်းများအရ မြန်မာနိုင်ငံ၏ ကားအစီးရေ ၆၀% သည် ရန်ကုန်မြို့တွင် မှတ်ပုံတင်ထားကြောင်း သိရှိရသည်။ လက်ရှိတွင် ရန်ကုန်မြို့ အတွင်း မော်တော်ဆိုင်ကယ် စီးနင်းခြင်းကိုတားမြစ်ထားပြီး နေ့စဉ်ခရီးသွားလာမှုတွင် ဘတ်စ်ကားအသုံးပြုမှုသည် ၈၀% ကျော် ရှိသည်။

ရန်ကုန်မြို့ပတ်ရထားလမ်းကို အဆင့်မြှင့်တင်ရန်နှင့် ဘတ်စ်ကားစနစ်နှင့် အခြားလျင်မြန်ပြီး အလှည့်ကျပြေးဆွဲမည့် သယ်ယူပို့ဆောင်ရေးစနစ်များကို အကောင်အထည်ဖော်ရန် ယခင်ကပင် အစီအစဉ်ရေးဆွဲခဲ့သော်လည်း ကနဦးအဆင့် တွင်သာရှိပြီး စီမံကိန်းတည်ဆောက်ပြီးစီး၍ ဖွင့်လှစ်မည့်နောင်ငါးနှစ်မတိုင်မီ ယင်းအစီအစဉ်များကို အကောင်အထည်ဖော် ရန် ခဲယဉ်းပါသည်။

SIDRA Intersection (Version 5.1) ကို အသုံးပြု၍ လက်ရှိလမ်းဆုံလမ်းခွများရှိ ယာဉ်ကြောအခြေအနေကိုနှင့် ယာဉ် အရေအတွက် ခံနိုင်ရည်ရှိမှုကို လေ့လာဆန်းစစ်ခဲ့ပါသည်။ လမ်းဆုံများတွင် Level of Service (LOS) ကို အဓိက တိုင်းတာပြီး LOS ဆိုသည်မှာ လုပ်ငန်းလည်ပတ်မှုအခြေအနေ အနည်းအများကို ဖော်ပြသည့် စကားလုံးဖြစ်သည်။ SIDRA Intersection အစီအစဉ်တွင် HCM 2000 (Highway Capacity Manual) အပေါ်မူတည်၍ နှောင့်နှေးကြန့်ကြာမှု အခြေ အနေဖြင့် LOS ကိုဆုံးဖြတ်ပါသည်။ LOS သည် A (အကောင်းဆုံး) မှ F (အဆိုးဆုံး) အထိကွဲပြားပါသည်။ Table ES-1 တွင်ဖော်ပြထားသည့်အတိုင်း လမ်းဆုံများရှိယာဉ်ကြောပိတ်ဆို့မှုကို ထိန်းချုပ်နိုင်သည့်အခြေအနေကို LOS အညွှန်းကိန်း အရ HCM 2000 အဖြစ် သတ်မှတ်ပါသည်။

SIDRA Intersection အရ အခြားတိုင်းတာမှုများသည် degree of saturation (DOS) ဖြစ်ပြီးအောက်ဖော်ပြပါ အတိုင်း တွေ့ရှိရသည် -

- ၀.၉ နှင့် ယင်းအောက် လျော့နည်းသည့် DOS သည် အားရကျေနပ်ဖွယ်ကောင်းသော ယာဉ်လမ်းကြောင်း အခြေ အနေကိုပြသသည်၊
- ၀.၉ နှင့် ၁ အကြားရှိ DOS သည် ယာဉ်လမ်းကြောင်းတွင် ဝန်နှင့်အားမျှသည်ဟုယူဆရမည်၊
- ၁ ထက်များသော DOS ကို ရရှိနိုင်သော်လည်း ယင်းအခြေအနေသည် လမ်းဆုံလမ်းခွများတွင် ယာဉ်သွားလာလည် ပတ်မှုသည် ဒီဇိုင်းရေးဆွဲထားသော စွမ်းဆောင်ရည်အောက် လျော့နည်းသည်ဟုရလဒ်ထွက်သည်။ ၁.၂ ရရှိသော DOS သည် ယာဉ်လမ်းကြောင်းပိတ်ဆို့မှုကိုပြသပြီး တန်းစီစောင့်ဆိုင်းခြင်းများ ၊ နှောင့်နှေးခြင်းများ ဖြစ်ပေါ်နိုင်သည်။

လက်ရှိလမ်းဆုံများ၏ ဂျီသြမေထြီနှင့် ယာဉ်အရေအတွက်ကို လေ့လာဆန်းစစ်ရာ၌ (၂၀၁၃ ခုနှစ်) ကို အခြေနှစ်အဖြစ် ထားရှိလျက် နှိုင်းယှဉ်လေ့လာခဲ့ပြီး LOS and DOS အရ ယာဉ်ကြောထိန်းချုပ်နိုင်မှု အသင့်အတင့်ရှိပြီး အနာဂတ်တွင် ယာဉ်အသွားအလာများအတွက် တုံ့ပြန်နိုင်မည့်စွမ်းဆောင်ရည်များ ရှိသည်ကိုတွေ့ရှိရသည်။ ယာဉ်အသွားအလာများပြား သည့်အချိန်တွင် ယာဉ်များတန်းစီစောင့်ဆိုင်းခြင်း ဖြစ်ပေါ်နိုင်သော်လည်း အချိန်အများစုတွင် ယာဉ်များစုပြုံပိတ်ဆို့နေခြင်း မရှိနိုင်ဟုခန့်မှန်းရသည်။

အနာဂတ်ကို အခြေနှစ်အဖြစ်ထားရှိလျက် လေ့လာဆန်းစစ်ရာတွင် လမ်းဆုံများတွင် တစ်နှစ်လျှင် ၅% ဖြင့် ယာဉ်အသွား အလာများပြားလာနိုင်သော်လည်း အားရကျေနပ်ဖွယ် ထိန်းချုပ်ဆောင်ရွက်နိုင်မည်ဟု ခန့်မှန်းရသည်။ သို့ရာတွင် ယာဉ် ကြောပိတ်ဆို့မှုသည် တစ်နှစ်လျှင် ၁၀% ဖြင့် တိုးတက်လာပါက နှောင့်နှေးကြန့်ကြာမှုများကို သိသိသာသာတွေ့ကြုံရ နိုင်သည်။ နံနက်ပိုင်းယာဉ်ကြောပိတ်ဆို့မှုကို ညနေပိုင်းယာဉ်ကြောပိတ်ဆို့မှုထက် ပိုမိုကောင်းမွန်စွာ ဖြေရှင်းနိုင်မည်ဟု ခန့်မှန်းရသည်။

စီမံကိန်းကိုအပြည့်အဝ အကောင်အထည်ဖော်ဆောင်ရွက်ပြီးသည်နှင့် Peninsula Residence ၊ Business Hotel ၊ ဆိုင်ခန်းများနှင့် Office Tower 3 နှင့် 4 တို့ကြောင့် စီမံကိန်းတည်နေရာကို ကမ္ဘာလှည့်ခရီးသွားများနှင့် ဧည့်သည်များပိုမို လာရောက်လည်ပတ်မည်ဟု ခန့်မှန်းရပါသည်။ ထို့ကြောင့် ဗိုလ်ချုပ်အောင်ဆန်းလမ်းနှင့် အလံပြဘုရားလမ်းတို့တွင် ယာဉ်အသွားအလာ ပိုမိုများပြားလာနိုင်ပါသည်။ စီမံကိန်းလုပ်ငန်းခွင်အတွက် ဆူးလေရှုန်ဂရီလာ လမ်းဆုံကို ၂၀၁၈ ခုနှစ် တွင် လေ့လာဆန်းစစ်ခဲ့ပါသည်။ ယာဉ်အသွားအလာ ချောင်လည်မှု၊ တိုးတက်မှုကို လက်ရှိလမ်းဆုံများတွင် ယာဉ်များ သွားလာနေသည့် ရာခိုင်နှုန်းအပေါ် မူတည်၍ တွက်ချက်ခဲ့ပါသည်။ ယာဉ်အသွားအလာကို တောင်ဘက်မှနေ၍ ချိတ်ဆက် အသုံးပြုရမည်ဖြစ်သော်လည်း (လမ်းဆုံကို တစ်ကြိမ်တည်းဖြတ်သန်းခြင်းဖြင့်) မြောက်ဘက် သို့မဟုတ် အနောက်ဘက် မှလည်း ယာဉ်အသွားအလာပြုလုပ်နိုင်ပါသည်။

၁(၄) အခြားနည်းလမ်းဖြင့်လေ့လာသုံးသပ်ခြင်း

ကြိုတင်စီစဉ်သည့် အဆင့်တွင် စီမံကိန်း၏ လက္ခဏာရပ်များ အတွက် ရွေးချယ်စရာ နည်းလမ်းအမျိုးမျိုး ကို ထားရှိ ဆောင် ရွက် ခြင်းဖြစ်သည်။ စီမံကိန်းမဆောင်ရွက်သည့် နေရာ တွင် ဖြစ်ပေါ်လာနိုင်သည့် ညစ်ညမ်းမှုကို ခန့်မှန်းသုံးသပ်ခြင်းသည် လည်း ဆောင်ရွက်မည့် အခြားနည်းလမ်းတစ်ခုဖြစ်သည်။ နေရာတစ်ခု ကို အသုံးမပြုဘဲ ထားခြင်း သည် အခွင့်အရေးများ ဆုံးရှုံးရုံ သာမက အနာဂတ်တွင် ဖြစ်ပေါ်လာမည့် ညစ်ညမ်းမှုများကိုလည်း တားဆီးနိုင်စွမ်းမရှိပါ။ စီမံကိန်း ဆောင်ရွက် သည့် နေရာအတွင်း ပတ်ဝန်းကျင် စီမံခန့်ခွဲမှု စနစ် များကို ခိုင်မာစွာ တည်ဆောက်နိုင်ပါက လက်ရှိတည် ရှိနေ သော ညစ်ညမ်း မှု အဆင့်ကို ပင် စီမံကိန်း အကောင်အထည်ဖော်ခြင်း နှင့် တစ်ပြိုင်နက် လျှော့ချနိုင်ပါသည်။

၁(၄)(၁) အခြားတည်နေရာများကိုလက်ခံစဉ်းစားခြင်း

တစ်သီးတစ်သန့် ရပ်တည်လျက်ရှိသော နိုင်ငံအဖြစ်မှ ပွင့်လင်းမြင်သာ သောနိုင်ငံအဖြစ်သို့ ပြောင်းလဲပြီး စီးပွားရေး တိုး တက်လာ သော အကျိုးဆက်အနေဖြင့် မြန်မာနိုင်ငံ၏ မြေဈေးကွက်သည် အဆမတန် မြင့်မားလျက်ရှိပါသည်။ အဆ မတန် မြင့်မားသော မြေဈေးနှုန်းများအပြင် ရန်ကုန်မြို့လယ်တွင် ရင်းနှီးတည်ဆောက်ရန် မြေနေရာ အလွတ်များ လည်း ရှားပါး လျက် ရှိပါသည်။ ထို့ကြောင့် စီမံကိန်းအတွက် အခြား မြေနေရာများ ရှာဖွေရာတွင် ကန့်သတ်ချက်များ၊ အခက် အခဲများ ကြုံ တွေ့ရပါသည်။ မြေနေရာအများအပြားကို လေ့လာကြည့်ရှုပြီးနောက် လက်ရှိဆောက်လုပ်မည့် စီမံကိန်း မြေနေရာ သည် စီမံကိန်း၏ လိုအပ်ချက်များအားလုံးကို ဖြည့်ဆည်းပေးနိုင်မည့် အနေအထား ဖြစ်သည်။ အဘယ်ကြောင့် ဆိုသော စီမံကိန်း နေရာသည် ရန်ကုန်မြို့၏ စီးပွားရေး အချက်အချာ ကျသော နေရာဖြစ်ပြီး လက်ရှိ တည်ဆဲ အခြေခံ အဆောက် အဦး များ၊ အဓိက လမ်းမကြီးများ၊ ရထားလမ်းများ၊ အနီးအနား ရှိ စီးပွားရေးလုပ်ငန်း ဆိုင်ရာ

အဆောက် အဦးများ သည် စီမံကိန်း အတွက် အကောင်းဆုံး အကျိုးကျေးဇူး ဖြစ်ထွန်းစေသည်။ ရင်းနှီးတည်ဆောက်မည့် အဆောက် အဦး အသစ် များသည် စီးပွားရေး နှင့် ငွေရေးကြေးရေး အရ အကျိုးကျေးဇူးဖြစ်ထွန်း စေနိုင်ပါသည်။ စီမံကိန်းလုပ်ငန်း နှင့် ပြုပြင်မွမ်းမံ သည့် လုပ်ငန်းများ မရှိပါက သဘာဝ ပတ်ဝန်းကျင်ဆိုင်ရာ ဆိုးကျိုးများ မဖြစ်ပေါ်စေကာမူ စွန့်ပစ်ထားသည့် ယဉ်ကျေးမှု အမွေအနှစ် PYN အဆောက်အဦးနှင့် အခြား အဆောက်အဦး များတွင် ခြုံနွယ်ပိတ်ပေါင်းများ ထူထပ်လာမည်ဖြစ်ပြီး ပျက်စီးသွားနိုင်ပါသည်။ စီးပွားရေး အရ အကျိုးအမြတ်ရှိရုံသာမက လက်ရှိစီမံကိန်းတည်နေရာ၏ ကပ်လျက် ဧရိယာ တွင် သဘာဝ ပတ်ဝန်းကျင်ထိန်းသိမ်းသည့် အစီအစဉ်များ မရှိသေးသောကြောင့် သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ ဆိုးကျိုး သက် ရောက်မှုများ ကို လျှော့ချနိုင်သည့် အခွင့်အရေးများကိုလည်း ရရှိနိုင်ပါသည်။

၁(၄)(၂) ဒီဇိုင်းနှင့်တည်ဆောက်ရေးအခြားနည်းလမ်းများ

သဘာဝ ပတ်ဝန်းကျင်အပေါ် ဆိုးကျိုးသက်ရောက်မှုကို ထိန်းချုပ်ဟန့်တားနိုင်ရန် အဆိုပြုစီမံကိန်းကို ခေတ်မီဒီဇိုင်းဖြင့် တည်ဆောက်မည်ဖြစ်ပြီး စွမ်းအင်ကို အလေအလွင့်မရှိ၊ အကျိုးရှိစွာ အသုံးချ၍ ညစ်ညမ်းမှုများကို ထုတ်ဖော် သိရှိနိုင် မည့် တည် ဆောက်ရေးနည်းစနစ်များကို လည်း တီထွင်အသုံးပြုပါမည်။ တည်ဆောက်မည့် အချိန်ကာလ နှင့် ညစ်ညမ်းမှု ကို လျှော့ ချနိုင်မည့်၊ ကျွမ်းကျင် တည်ဆောက်ရေး ကုမ္ပဏီများ နှင့် သဘာဝပတ်ဝန်းကျင် ကို အလေးထားသော ဆောက် လုပ်ရေး ကုမ္ပဏီများ ကို တင်ဒါဖြင့် ရွေးချယ်ခေါ်ယူပါမည်။ စွမ်းအင် ကို အလေအလွင့်မရှိ အကျိုးရှိရှိ အသုံးပြုနိုင်ရန် နှင့် စိတ်ဝင်စားမှု များပြားစေရန် စီမံကိန်းဒီဇိုင်းကို ပုံစံဖော် တည်ဆောက်ပါမည်။ ထို့အပြင် ခေတ်ပြိုင် ဗိသုကာ လက်ရာ များ ကို အသုံးပြု၍ ခိုင်ခံ့လှပသည့် ပုံစံများ၊ သဘာဝပတ်ဝန်းကျင် ကို ခံနိုင်ရည်ရှိသော တမူထူးခြားသည့် ဒီဇိုင်းများဖြင့် စီမံကိန်းကို ပုံဖော်ပါမည်။

အဆောက်အဦးတည်ဆောက်မှု ပြီးစီးသည့်အခါ မှ ဒီဇိုင်းရေးဆွဲမှု နှင့် သွေဖည်ခြင်း ရှိ/မရှိ စစ်ဆေးသည့် နည်းစနစ် (as-built construction method) ကို အသုံးပြုမည့် အစား စီမံကိန်း၏ အဆောက်အဦး ပုံစံ များကို ဆောက်လုပ်ရာတွင် ကြိုတင်စီမံထားသည့် အတိုင်း တည်ဆောက်မည့် နည်းစနစ် (as-planned method) ကို အစဉ်လိုက်အသုံးပြုသွားပါမည်။ သဘာဝပတ်ဝန်းကျင် အရည်အသွေးနိမ့်ကျမှု မရှိစေရန် စီမံကိန်းတည်ဆောက် သည့် အဆင့်တစ်ခုစီ၌ လျော့ပါး သက်သာ စေမည့်နည်းလမ်းများကို အကောင်အထည်ဖော် ဆောင်ရွက်သွားပါ မည်။ ကြိုတင်စီမံထားသည့် အတိုင်း တည် ဆောက် မည့် နည်းစနစ် ကိုအသုံးပြုခြင်းကြောင့် စီမံကိန်းကြောင့် ဆိုးကျိုးသက်ရောက်နိုင်မှုကို ဟန့်တားမည့် အစီအစဉ် နှင့် လိုက်လျောညီထွေမှုရှိပါသည်။

ကြိုတင်စီမံသည့်အတိုင်း တည်ဆောက်မည့် နည်းလမ်းကို ရွေးချယ်အသုံးပြုသည့် အပြင် စီမံကိန်းအတွက် ဆောင်ရွက် မည့် ESIA မှပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်အရ သတ်မှတ်ထားသည့် ဆိုးကျိုးသက်ရောက်မှုများ လျော့နည်း သက်သာ စေမည့် လိုအပ်ချက်များကို တင်းတင်းကြပ်ကြပ် လိုက်နာဆောင်ရွက်မည်ဖြစ်သည်။ အဆောက်အဦး တည် ဆောက်မှု ပြီးစီးသည့်အခါ မှ ဒီဇိုင်းရေးဆွဲမှု နှင့် သွေဖည်ခြင်း ရှိ/မရှိ စစ်ဆေးသည့် နည်းစနစ် သည် သဘာဝ အရ ထိန်းချုပ်၍ မရ နိုင်ဘဲ ပတ်ဝန်းကျင် ညစ်ညမ်းမှု ကို ဖြစ်ပေါ်စေနိုင်ပြီး ကြိုတင်စီမံထား သည့် အတိုင်း တသွေမတိမ်း တည်ဆောက်မည့် နည်း စနစ်သည် အကောင်အထည် ဖော်ဆောင်ရွက်ခြင်း မပြုမီ ဖြစ်ပေါ်လာမည့် ပတ်ဝန်းကျင် ညစ်ညမ်းမှုများကို တိုက် ဖျက် နိုင်ပါလိမ့်မည်။ စီမံကိန်းတည် ဆောက်မည့် အဓိက လက္ခဏာရပ်သည် သက်ဆိုင်ရာ လုပ်ငန်းများ မဆောင် ရွက်မီ ပတ်ဝန်း ကျင်တွင် လုံခြုံမှုရှိခြင်း နှင့် ညစ်ညမ်းမှုမရှိစေရေး အတွက် ထိန်းသိမ်းကာကွယ်ခြင်း ဖြစ်သည်။

တည်ဆောက်ရေး လုပ်ငန်းစနစ်များ ရွေးချယ်ရာတွင် ပုံသွန်းလောင်းပြီးသည့် ကွန်ကရစ်ပြားများကို အချပ်လိုက် ကပ်၍ တည်ဆောက်သည့် စနစ် (Precast flat panel system) ၊ 3D volumetric construction နှင့် ကွန်ကရစ်နှင့် တိုင်လုံး တိုင်ချွန်များ ပေါင်းစပ်တည်ဆောက်သည့် စနစ် (hybrid concrete construction) တို့ကို နှိုင်းယှဉ် လျက် ရွေးချယ် ဆောင်ရွက်သွားပါမည်။ ဒေသတွင်း အခြေအနေနှင့် ပစ္စည်းအင်အား၊ လူအင်အား ရရှိနိုင်မှု အပေါ်မူ တည်လျက် ကွန်ကရစ်နှင့် တိုင်လုံး တိုင်ချွန်များ ပေါင်းစပ်တည်ဆောက်သည့် စနစ် ၊ ကွန်ကရစ်များကို ချပ်ပြားလိုက် သွန်းလောင်း၍ အသုံးပြုသည့် စနစ်နှင့် အထပ်လိုက် လှိုဏ်ခေါင်းသဏ္ဍာန် ပြုလုပ်၍ တည်ဆောက်သည့် စနစ်များကို သင့်လျော်သလို အသုံးပြုသွားပါမည်။ လက်ရှိအသုံးပြုနေသည့် တည်ဆောက် ရေး စနစ်များ သည် ရိုးရှင်းလွယ်ကူခြင်း၊ လျင်မြန်လွယ် ကူ စွာ နောက်ကြောင်းပြန်လှည့်၍ တည်ဆောက်နိုင်ခြင်း၊ တသမတ်တည်း ညီညွတ်စွာ အသုံးပြုနိုင်ခြင်း နှင့် အရည်အသွေး ကောင်းမွန်ခြင်း တို့ ပါရှိသည်။ နိုင်ငံအတွင်း အသုံးပြုသော အဆောက်အဦး ကုဒ်နံပါတ်များ မရှိသော်လည်း ပတ်ဝန်းကျင် နှင့် လိုက်လျော ညီထွေဖြစ်မည့် အဆောက်အဦးကုဒ်နံပါတ်များကို အခြားစနစ်များမှ သင့်လျော်သလို ငှားရမ်းအသုံးပြု သွားပါမည်။

၁(၄)(၃) အခြားရွေးချယ်ရန်စက်ကိရိယာပစ္စည်းများ

ပြင်းထန်သည့် ဘေးအန္တရာယ်ကင်းရှင်းရေး စီမံချက်များကို ချမှတ်ဆောင်ရွက်ထားသော်လည်း စီမံကိန်းအတွက် စက် ပစ္စည်း၊ ကိရိယာများကို သေချာစွာ ရွေးချယ်စိစစ်မည်ဖြစ်သည်။ ပတ်ဝန်းကျင်အတွက် ကောင်းမွန်ပြီး ညစ်ညမ်းမှု အနည်း ဆုံးဖြစ်ပေါ်စေမည့် ပစ္စည်းကိရိယာများကို ထောက်ပံ့ပေးနိုင်မည့် လုပ်ငန်းရှင်များကို စီမံကိန်း အတွက် ဦးစားပေး ရွေးချယ် ပါမည်။ စီမံကိန်း၏ အဆင့်တစ်ဆင့်တိုင်းတွင် စွမ်းအင်သုံးစွဲမှု နည်းပါးသော စက်ပစ္စည်းအသစ်များ၊ အခိုးအငွေ့များ ထုတ် လွှတ်မှု အနည်းဆုံးဖြစ်သော ကိရိယာများကို အသုံးပြုသွားပါမည်။ ထို့အပြင် စက်ပစ္စည်း၊ ကိရိယာ၊ ယာဉ်များ အားလုံးကို ပုံမှန်ထိန်းသိမ်းရန် အချိန်ဇယားဖြင့် တိတိကျကျ

လိုက်နာဆောင်ရွက်သွားပါမည်။ ပစ္စည်းကိရိယာများအစား လူ အင်အား ကို အသုံးပြုနိုင်ရန် စီမံကိန်းအတွက် အလုပ်အကိုင်အခွင့်အလမ်းများကို ဖန်တီးသွားပါမည်။

စီမံကိန်း အတွင်းရှိ လက်ရှိအဆောက်အဦးများကို ဖြိုချဖျက်ဆီး ရာတွင် တုံ့ပြန်နိုင်သော ဖမ်းယူ စက်များနှင့် နီးကပ် စွာ ဟိုက်ဒရောလစ်ဖြတ်တောက်စက်များကို အသုံးပြုပါက ဆူညံသံများ ဖြစ်ပေါ်စေနိုင်ပါသည်။ လျော့ပါးသက်သာစေရန် ဟိုက်ဒရောလစ် crusher ကို အစားထိုး အသုံးပြုရန် အဆိုပြုထားပါသည်။ ဟိုက်ဒရောလစ် crushers များသည် အများ အားဖြင့် 6-12 dB(A) ရှိပြီး ဟိုက်ဒရောလစ် ဖြတ်တောက်စက်များနှင့် နှိုင်းယှဉ်ပါက ပိုမိုငြိမ်သက်သည်ကို တွေ့ရှိရသည်။ ဟိုက်ဒရောလစ် crushers များတွင်လည်း ကန့်သတ်ချက်များရှိသောကြောင့် ၎င်းတို့တစ်ခုတည်းကို သီးခြားအသုံးမပြုဘဲ hydraulic breaker များနှင့် တွဲဖက်အသုံးပြု၍ အကျိုးသက်ရောက်မှုကို လျှော့ချသွားပါမည်။ ဟိုက်ဒရောလစ် breaker များကို hydraulic crusher များ၏ အသွားများဖြင့် တိုက်စားရာတွင် ပိုမိုလွယ်ကူအဆင်ပြေစေရန် ဟိုက်ဒရောလစ် breaker ကိုအသုံးပြု၍ အပေါက်ဖောက် ဆောင်ရွက်သွားပါမည်။ ပုံမှန်အားဖြင့် ကျိုးကြေလေ့မရှိသော ပစ္စည်းများကို ဖြတ်တောက်ရာတွင်လည်း ဟိုက်ဒရောလစ် breaker များကို အသုံးပြုသွားပါမည်။

မြေဆီလွှာ နှင့် ထိတွေ့ခြင်း နှင့် တိုက်စားခံရခြင်းတို့ကို ကန့်သတ်နိုင်ရန် မြေပြင်ပေါ်ဆောင်ရွက်မှုများကို အချိန်သတ် မှတ်၍အစီအစဉ်အလိုက်ဆောင်ရွက်သွားပါမည်။ မြေပြင်အပေါ်တွင်ဆောင်ရွက်မည့် လုပ်ငန်းများကိုကြိုတင်စီမံ ထားသည့် အတိုင်းတတ်နိုင်သရွေ့ အချိန်တိုအတွင်းပြီးစီးအောင် ဆောင်ရွက်သွားပါမည်။ တူးဖော်ထားသောတွင်းများနှင့် ကျင်းများကို သင့်လျော်သလို ယာယီအကာအရံများ နှင့် ဖုံးအုပ်ထားပါမည်။

အချုပ်ဆိုရလျှင် စီမံကိန်းအတွက် လူအများစိတ်ဝင်စားပြီး ဆွဲဆောင်မှုရှိသော၊ ယုံကြည်စိတ်ချရသော၊ စွမ်းအင်အသုံးပြုမှု ချွေတာနိုင်သောလက္ခဏာ ရပ်များပါဝင်သည့်ဒီဇိုင်းကိုရွေးချယ် ထားပြီးသဘာဝပတ်ဝန်းကျင်ကို အလေးထားသော၊ (လုပ်ငန်း ဖြစ်မြောက်နိုင်ခြေ အများအပြားနှင့်) ပတ်ဝန်းကျင် ညစ်ညမ်းမှု အနည်းဆုံးဖြင့် တည်ဆောက်မှုကာလ လျှော့ချနိုင်သော သင့်လျော်မှုအရှိဆုံး တည်ဆောက်ရေး နည်းပညာကို အသုံးပြုမည်ဖြစ်သည်။ အထက်ပါအတိုင်း ရွေးချယ်မှုပြုပြီးနောက် စီမံကိန်းအတွက် ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှု အစီအစဉ်အရ စီမံကိန်းကို အကောင်အထည်ဖော် ဆောင်ရွက်ခြင်း ကြောင့် ဖြစ်ပေါ်လာမည့်ဆိုးကျိုးများကို လျော့ပါးသက်သာစေရန် ရည်မှန်းချက်ကျော်လွန်အောင်ဆောင်ရွက်သွားနိုင်မည်ဖြစ်သည်။

၁(၅) အဆိုပြုစီမံကိန်း လုပ်ငန်းအစီအစဉ်

တည်ဆောက်ရေးအဆင့်တွင် ဆောင်ရွက်မည့် အစီအစဉ်များ ကို အောက်ပါအတိုင်းခန့်မှန်းထားပါသည် -

- ယာယီအသုံးပြုမည့် အသုံးအဆောင်ပစ္စည်းများကို တပ်ဆင်ခြင်းနှင့် စီမံခန့်ခွဲခြင်း၊

- ပစ္စည်းကိရိယာများ နှင့် စက်ပစ္စည်းများကို သယ်ယူပို့ဆောင်ခြင်း၊
- အဆောက်အဦးများဖြိုဖျက်ခြင်း နှင့် လုပ်ငန်းခွင်ရှင်းလင်းခြင်း၊
- အခြေခံအဆောက်အဦး နှင့် ရေ၊ မီးစသည့် လိုအပ်ချက်များကို တည်ဆောက်ခြင်း၊
- တည်ဆောက်ရေးနှင့် အဆောက်အဦး ပုံစံများ၊
- ယာဉ်လမ်းကြောင်း သက်ရောက်မှု ဆန်းစစ်ချက် (Traffic Impact Assessment) အရ လုပ်ငန်းခွင်ပြင်ပတွင် စီမံဆောင်ရွက်ခြင်း၊ နှင့်
- မြေမျက်နှာပြင်ညှိခြင်း နှင့် သစ်ပင်ပန်းမန်များ ပြန်လည်စိုက်ပျိုးခြင်း။

တည်ဆောက်ရေးလုပ်ငန်းတွင် ပါဝင်မည့် စက်ပစ္စည်းကိရိယာများမှာ -

- တိုင်ဆိုင်းကြိုးများ (Piling rigs) ၊
- မြေထိုးစက် (Bulldozer)၊
- မြေတူးစက်များ (Excavators)၊
- ကရိန်းများ (Cranes)၊
- လော်ရီကားများ/သယ်ယူပို့ဆောင်ရေး ထရပ်ကားများ၊ နှင့်
- ကွန်ကရစ်ထုတ်လုပ်မည့် ကိရိယာများဖြစ်သည်။

၁(၆) အကျိုးသက်ရောက်မှုများကို လေ့လာဆန်းစစ်ခြင်း

ရန်ကုန်မြို့၌ စီမံကိန်းတစ်ခု ကို အကောင်အထည်ဖော်ဆောင်ရွက်လျှင် ဖြစ်ပေါ်လာနိုင်သည့် ပတ်ဝန်းကျင် အပေါ် သက် ရောက်မှု၊ ဆိုးကျိုးများကို ဤအခန်းတွင် ခွဲခြားသတ်မှတ်၍ လေ့လာဆန်းစစ်ထားပါသည်။ လေ့လာတွေ့ ရှိချက် များ အပေါ် မူ တည်လျက် Good International Industry Practice (GIIP) နှင့် အညီ တည်ဆဲ စည်းမျဉ်း၊ ဥပဒေ ဆိုင်ရာ လိုအပ် ချက်များကို ကိုက်ညီစေရန် ဆိုးကျိုးများနှင့် အကျိုးသက်ရောက်မှုများကို စီမံခန့်ခွဲရန် နှင့် လျော့ပါးအောင် ဆောင် ရွက်ရန် လျော့ပါး သက်သာ စေမည့် စီမံချက်များကို အကောင်အထည် ဖော်ဆောင် ရွက်ခဲ့ပါသည်။ စီမံကိန်း လုပ်ငန်းခွင်သည် မြို့ ပေါ် တွင် တည်ထားခြင်းဖြစ်ပြီး ဖွံ့ဖြိုးဆဲ ပတ်ဝန်းကျင်၌ တည်ရှိနေကြောင်း သတိချပ်ရန် အရေး ကြီးသည်။ လုပ်ငန်း ခွင် ကို မူလအခြေအနေ မှစတင်ရင်းနှီး တည်ဆောက် ရာ၌ ဆက်စပ်နေသည့် သဘာဝပတ်ဝန်းကျင်ဆိုင်ရာ အကျိုးသက် ရောက် မှု များသည် လွန်ခဲ့သောနှစ်ပေါင်း ၁၀၀ ကာလကပင်ကြုံတွေ့ပြီးသော အခြေအနေများ ဖြစ်သည်။

၁.၆.၁ လေထုညစ်ညမ်းခြင်း

က။ ဆောက်လုပ်ခြင်းအဆင့်အကျိုးသက်ရောက်မှုများ

ဆောက်လုပ်ခြင်းအဆင့်အတောအတွင်းလေထုညစ်ညမ်းရခြင်း၏
အဓိကအကြောင်းအရင်းများမှာအောက်ပါတို့ကိုပြုလုပ်ခြင်းကြောင့် ဖုန်အမှုန်များပျံ့နှံ့ခြင်းတို့ ပါဝင်ပါသည်။

- မြေတူးခြင်း၊ မြေညှိခြင်း၊ မြေသိပ်ခြင်း၊ မြောင်းတူးခြင်းစသည့် လုပ်ငန်းခွင် ပြင်ဆင်ခြင်းလုပ်ငန်းများ။
- လုပ်ငန်းခွင်အတွင်းနှင့်သယ်ယူပို့ဆောင်ရေးလုပ်ငန်းများဆောင်ရွက်စဉ်အတွင်းဆောက်လုပ်ရေးလုပ်ငန်းသုံးအကြီးစားယဉ်နှင့် စက်ယန္တရားကြီးများမောင်းနှင်ခြင်း။
- အရာဝတ္တု ပစ္စည်းများကိုင်တွယ်အသုံးပြုခြင်း (ဆောက်လုပ်ရေးလုပ်ငန်းသုံးသဲ၊ ကျောက်များ၊ အဆောက်အဦးဆောက်လုပ်ရန်အတွက် ဖို့ရမည့် မြေသားများကိုပို့ဆောင်ခြင်း၊ ကုန်တင်ခြင်းနှင့် အသုံးပြုခြင်း)
- ဆောက်လုပ်ရေးလုပ်ငန်းခွင်တွင် ရှိနှင့်နေပြီးဖြစ်သောအဆောက်အဦကို ဖြိုဖျက်ခြင်း။
- ဘိလပ်မြေဖျော်စက်ကိုအသုံးပြုခြင်းနှင့်
- လုပ်ငန်းခွင်အတွင်းမှ မြေသားနှင့် အရာဝတ္ထုပစ္စည်းများကိုသယ်ထုတ်ပြီးလုပ်ငန်းခွင်သုံးလမ်းပေါ်တွင် စုပုံခြင်း။

ယဉ်နှင့် စက်ယန္တရားကြီးများ၏ အင်ဂျင်များမှ ထွက်သောအိတ်ဇောထုတ်လွှတ်မှုများတွင် နိုက်ထရိုဂျင်အောက်ဆိုဒ် (NOx)၊ဆာလဖာအောက်ဆိုက် Sox၊ ကာဗွန်မိုနောက်ဆိုဒ် CO၊ အငွေ့ပျံလွယ်သည့် အော်ဂဲနစ်ကွန်ပေါင်းများ(VOC)၊ ဖုန် အမှုန်များနှင့် မီးခိုးတို့ ပါဝင်ပါသည်။

လေထုအရည်အသွေးကိုအဓိကထိခိုက်စေသောအကြောင်းအရင်းမှာTSP(ထရိုင်ဆိုဒီယမ် ဖော့စဖိတ်) ဖြင့် ကိုယ်စားပြုသည့် ပျံ့နှံ့နေသောဖုန်မှုန့်များ၊ အမှုန်ငယ်ကလေးများပွတ်တိုက်ခြင်းပင် ဖြစ်သည်။ ဖုန်မှုန့်များ ကိုပျံ့နှံ့စေသောအဓိကအကြောင်းအရင်းများမှာလုပ်ငန်းခွင်ရှင်းလင်းခြင်း၊ အဆောက်အဦးများကို ဖြိုချဖျက်ဆီး ခြင်း၊ မြေတူးခြင်းနှင့် ဘိလပ်မြေဖျော်စက်ကိုကိုင်တွယ်အသုံးပြုခြင်းတို့ ဖြစ်ပါသည်။

အကြီးစားဆောက်လုပ်ရေးလုပ်ငန်းများကြောင့် မြေပြင်တွင် လေထုညစ်ညမ်းမှု တဖြည်းဖြည်းများ လာနိုင်သည်ဟုလေထုညစ်ညမ်းမှုကိုအကြိမ်ကြိမ်တိုင်းတာခြင်းအားဖြင့် သတိပေးခန့်မှန်းခဲ့ပြီး ဖြစ်ပါသည်။ PM10 နှင့် PM2.5 အရွယ်အစားရှိသောအခြေခံအမှုန်များ၏ ပမာဏကို ကြည့်မည်ဆိုလျှင် အမှုန်များ စုဝေးလာမှုသည် စီမံကိန်းလုပ်ငန်းခွင်၏ အနောက်ဖက် နယ်နိမိတ်နှင့် အလွန်နီးကပ်စွာတည်ရှိနေသော (A2ဟုအမှတ်အသား ပြုထားသည့်) ဘုရားကျောင်းအတွက် စံနှုန်းသတ်မှတ်ချက်ထက် ကျော်လွန်လာနိုင်သည် ဟုခန့်မှန်းထားကြပါ

သည်။ ထိုဘုရားကျောင်းအပေါ် ကျရောက်လာမည့် ဖုန်အမှုန်များ၏ အကျိုးသက်ရောက်မှုကို လျှော့ချနိုင်ဖို့အတွက် သက်ရောက်မှု လျှော့ချရေးအစီအမံများကိုအကောင်အထည်ဖော် ဆောင်ရွက်ရပါမည်။

နောက်လာမည့် ကဏ္ဍတွင် အကြံပြုဖော်ပြပေးမည့် ဖုန်အမှုန် ထိန်းချုပ်ရေးအကောင်အထည်ဖော် ဆောင်ရွက်မှုများမှ တဆင့် ဆောက်လုပ်ရေးလုပ်ငန်းကြောင့် ဖြစ်ပေါ်လာသည့် ဖုန်အမှုန် ပျံ့နှံ့ခြင်းကိုမူလအရင်းအမြစ်မှစ၍ ထိန်းချုပ်နိုင်ပါလိမ့်မည်။ အမှန်တကယ် ဖြစ်ပေါ်လာမည့် အကျိုးသက်ရောက်မှုများကိုစစ်ဆေးအတည်ပြုရန်နှင့် သက်ဆိုင်ရာ ASR(ပျက်စီးယိုယွင်းနေသည့် ကွန်ကရစ်များ) တွင် လက်ခံနိုင်လောက်သော TSP ပမာဏသာရှိနေစေရန်အတွက် လုပ်ငန်းခွင်တွင်းလုပ်ဆောင်မှုများကိုထိန်းညှိပေးရန် နည်းလမ်းများဖြင့် ပံ့ပိုးပေးဖို့ EM&A အစီအစဉ်တစ်ရပ်ကိုအကောင်အထည်ဖော် ဆောင်ရွက်ရမည်။ အကျိုးဆက်ကိုခံစားရမည့် အနီးဆုံးဘုရားကျောင်းတွင် ဘုရားဝတ်ပြုသည့် တနင်္ဂနွေနေ့၌ ဖုန်အမှုန်များပျံ့နှံ့စေမည့် အဆိုးရွားဆုံး ဆောက်လုပ်ရေး လုပ်ငန်းများကိုမလုပ်ဆောင်ရန် တားမြစ်ထားခြင်း နှင့်/သို့မဟုတ် ထိခိုက်ထားသော ပါဝင်သူများနှင့် စီမံကိန်းကိုအကောင်အထည်ဖော်ဆောင်ရွက်သူများအကြားသဘောတူညီမှုကိုရရှိစေဖို့ အခြားသောထိခိုက် လွယ်သည့်အရာများကိုလုပ်ဆောင်အသုံးပြုခြင်းကိုတားမြစ်ထားခြင်းတို့ အဆိုပါ အစီအစဉ်တွင် ပါဝင်ပါသည်။

ခ။ ဆောက်လုပ်ပြီးအဆင့် အကျိုးသက်ရောက်မှုများ

စီမံကိန်း၏ ဆောက်လုပ်ပြီးအဆင့် အတောအတွင်းသိသိသာသာလေထုညစ်ညမ်းစေမည့် အရင်းအမြစ်များရှိတော့မည့်မဟုတ်ပါ။ စီမံကိန်းတွင် အပူပေးခြင်းနှင့် အခြားကိစ္စများအတွက် သန့်ရှင်းသောဓါတ်ငွေ့လောင်စာ (LPG (ဂါလံ ၃၀၀၀) LNG စသည်.)တို့ကိုသာအသုံးပြုပါမည်။ ဒီဇယ်ကဲ့သို့သောလောင်စာအရည်ကို အရေးပေါ်မီးစက်မောင်းရန်အတွက်သာအသုံးပြုပါမည်။ ထို့ကြောင့် ဆောက်လုပ်ပြီးအဆင့်တွင် လေထုညစ်ညမ်းမှုသည် အသေးစား ပြဿနာတစ်ခုသာ ဖြစ်ပါသည်။

၁.၆.၂ ဆူညံသံများ

က။ ဆောက်လုပ်ခြင်းအဆင့် အကျိုးသက်ရောက်မှုများ

ရှိနှင့်နေပြီးသောအဆောက်အဦးများကို ဖြိုချဖျက်ဆီးခြင်းနှင့် ဆောက်လုပ်ရေးလုပ်ငန်းများလုပ်ဆောင်နေသည့် အချိန်အတောအတွင်း ဖြစ်ပေါ်လာမည့် ဆူညံသံများကို နောက်ဆုံးရဆောက်လုပ်ရေးအစီအစဉ်နှင့် အသုံးပြုနိုင်ခြေရှိသည့် ပစ္စည်းကရိယာများစာရင်းအရ သတိပေးခန့်မှန်းထားပါသည်။

ဆူညံသံလျှော့ချရေးအစီအမံများမပြုလုပ်ထားသည့် အဆိုးရွားဆုံးအခြေအနေမျိုး၌ ၅ နှစ်တာကြာမြင့်သည့် အဆောက်အဦးဖြိုချဖျက်ဆီးခြင်းနှင့် ဆောက်လုပ်ခြင်းကာလအတွင်း ၁၃ လ တိုင်တိုင် ဘုရားကျောင်း (N2) တွင်

ဆူညံသံများသည် သတ်မှတ်ထားသောစံနှုန်းထက်ကိုကျော်လွန်၍ အများဆုံးအနေဖြင့် 4 dB(A) အထိရောက်ရှိနိုင်ပါသည်။

N2 ၌ ဘုရားကျောင်းနှင့် ကပ်လျက် လုပ်ဆောင်မည့် အလုပ်များကို ကြည့်လျှင် ဆူညံသံများလျှော့ပါးစေဖို့အတွက် အစားထိုးလုပ်ဆောင်နိုင်မည့် ဆောက်လုပ်ရေးနည်းလမ်းများကိုတင်ပြထားပါသည်။ ဤနည်းလမ်းများထဲတွင် ဆူညံသံများကိုလျှော့နည်းစေဖို့အတွက် အဆောက်အဦးများကို ဖြိုချဖျက်ဆီးရာတွင် ဟိုက်ဒရောလစ် ထုခွဲစက်နှင့်အတူ ဟိုက်ဒရောလစ် ကြိတ်ခြေစက် တို့ကိုအသုံးပြုခြင်း၊ ဆူညံသံကာကွယ်သည့် အထည်များ ကိုအသုံးပြုခြင်းတို့ ပါဝင်သည်။

ခ။ ဆောက်လုပ်ပြီးအဆင့် အကျိုးသက်ရောက်မှုများ

စီမံကိန်း၏ ဆောက်လုပ်ပြီးအဆင့်၌ ဆူညံသံများ၏ အကျိုးသက်ရောက်မှုများမှာသိသာထင်ရှားခြင်းမရှိတော့ပါ။ ဆူညံသံဖြစ်ပေါ်စေမည့် အဓိကအကြောင်းအရင်းများမှာရုံးခန်းများဖွင့်လှစ်ထားသည့် အဆောက်အဦးများမှ ဝန်ထမ်းများ ၊ ကွန်ဒို၊ တိုက်ခန်းအတွင်းနေထိုင်ကြသူများ၊ လုပ်ငန်းခွင်အတွင်းရှိဟိုတယ်များတွင် တည်းခိုနေထိုင်နေကြသည့် ဧည့်သည်များ၏ ယဉ်သွားယဉ်လာများမှ ထွက်ပေါ်သည့် ဆူညံသံများသာဖြစ်ပါသည်။ အဆိုပါဆူညံသံများကိုထွက်ပေါ်စေ သည့်အရာများမှာနေရာ အတည်တကျမရှိဘဲအမြဲ တစေဖြစ်ပေါ်နေခြင်းလည်းမရှိသလို အနီးပတ်ဝန်းကျင်ရှိ ဒေသများသည်လည်းယဉ် သွားယဉ်လာဆူညံသံများ ကိုအမြဲကြားနေရသည့် စီးပွားရေးအချက်အချာဒေသဖြစ်ခြင်းကြောင့် စီမံကိန်းကြောင့် ထွက်ပေါ်လာမည့် ဆူညံသံမှာသိသာထင်ရှားခြင်းရှိမည်မဟုတ်ဟုကောက်ချက်ချထားပါသည်။

၁.၆.၃ တုန်ခါခြင်း

တုန်ခါမှု အကဲဖြတ်လေ့လာချက်များအရအဆူညံဆုံးသောလုပ်ငန်းကိစ္စများသည် ပိုင်ရိုက်ခြင်း(piling)နှင့် ဖြိုချဖျက်ဆီးခြင်းလုပ်ငန်းစဉ်များနှင့် ဆက်စပ်နေသည်ဟုခန့်မှန်းထားပါသည်။

၁.၆.၄ ရေညစ်ညမ်းမှု

က။ ဆောက်လုပ်ခြင်းအဆင့် အကျိုးသက်ရောက်မှုများ

ဆောက်လုပ်ရေးလုပ်ငန်းခွင်ကိုစတင်သည်နှင့် အောက်ပါ ရေအရည်အသွေးဆိုင်ရာအကျိုးသက်ရောက်မှုများ ဖြစ်ပေါ် နိုင်မည်ဟုခန့်မှန်းထားပါသည်။

- ဆောက်လုပ်ရေးလုပ်ငန်းကြောင့် မြေဆီလွှာတိုက်စားခြင်း
- လုပ်ငန်းခွင်မှ ဖြစ်ပေါ်လာသည့် ညစ်ညမ်းသည့် ရေများမျောပါသွားခြင်း နှင့်
- လုပ်ငန်းခွင်အတွင်းရှိယာယီတည်ဆောက်ထားသောသန့်စင်ခန်းများမှ အညစ်အကြေးများ

ဆောက်လုပ်ခြင်းအဆင့်အတွင်းမြေဆီလွှာနှင့် မြေအောက်ရေအရင်းအမြစ်များကိုပျက်စီးစေမည့် အဓိက အကြောင်းအရင်းများမှာတိုက်စားခြင်း၊ ဖိတ်စင်ခြင်း၊ ယိုစိမ့်ခြင်းတို့ ဖြစ်နိုင်ပါသည်။ ဖြိုချဖျက်ဆီးခြင်း၊ လုပ်ငန်းခွင်ရှင်းလင်းခြင်း၊ ဆောက်လုပ်ရေးလုပ်ငန်းစဉ်များ၊ အကြီးစားကရိယာများနှင့် ယဉ်များ၏ လှုပ်ရှားမှုများ၊ ကုန်တင်ခြင်းနှင့် ကုန်ချခြင်းများကြောင့် ဖုန်အမှုန်များ၊ ဆူညံသံများနှင့် တုန်ခါခြင်းများကို ဖြစ်စေနိုင်ပါသည်။

ဆောက်လုပ်ခြင်းအဆင့်အတွင်းထွက်ပေါ်လာသောစွန့်ပစ်ပစ္စည်းအစိုင်အခဲအမျိုးအစားများကို ၎င်းတို့၏ သဘောသဘာဝနှင့် နောက်ဆုံးစွန့်ပစ်ခြင်းနည်းလမ်းများကိုလိုက်၍ အောက်ပါအတိုင်း အမျိုးအစား ခွဲခြားနိုင် ပါသည်။

- အန္တရာယ်မရှိသောစွန့်ပစ်ပစ္စည်းအစိုင်အခဲများဥပမာ- ဖြိုချဖျတ်ဆီးခြင်းမှ ထွက်ပေါ်လာသည့် အကျိုးအပဲ့အစအနများ၊ မြေတူးခြင်းကြောင့် ထွက်ပေါ်လာသည့် မြေစာများ၊ ဆောက်လုပ်ရေးလုပ်ငန်းမှ ထွက်ပေါ်လာ သည့် အပျက်အစီးများ၊ ယေဘုယျ စွန့်ပစ် ပစ္စည်းများနှင့်
- အန္တရာယ်ရှိသောစွန့်ပစ်ပစ္စည်းများ - ကျောက်ဂွမ်းပါဝင်သော ပစ္စည်းကရိယာများ၊ ခဲကိုအသုံးပြုထားသောသုတ်ဆေးများနှင့် ပုံစံခွက်များကဲ့သို့သော အန္တရာယ်ရှိသည့် ပစ္စည်းများပါဝင်သည့် အဆောက်အဦးဟောင်းများကို ဖြိုဖျက်ခြင်းမှ ထွက်ပေါ်လာသည့် စွန့်ပစ်ပစ္စည်းများ

ခြုံငုံ၍ဆိုရလျှင် ဆောက်လုပ်ခြင်းအဆင့်တောအတွင်း စီမံကိန်းလုပ်ငန်းခွင်တွင် အန္တရာယ်ဖြစ်စေသည့် စွန့်ပစ်ပစ္စည်းများနှင့် အန္တရာယ်မဖြစ်စေသည့် စွန့်ပစ်ပစ္စည်းများကို စီမံခန့်ခွဲခြင်းမှ ထွက်ပေါ်လာမည့် အကျိုးရလာဒ်များသည် ရေတိုသာဖြစ်ပြီး ကန့်သတ်ထားနိုင်ကာ သင့်တော်သည့် ဆောက်လုပ်ရေး စီမံခန့်ခွဲမှု အလေ့အထများကို အကောင်အထည်ဖော်ခြင်းအားဖြင့် ထိထိရောက်ရောက် လျော့ပါးအောင် ပြုလုပ်နိုင်ပါသည်။

ဆောက်လုပ်ခြင်းအဆင့်အတောအတွင်း အဓိကဖြစ်ပေါ်နိုင်သည့် လေထုညစ်ညမ်းခြင်းများသည် မော်တော်ယဉ်များ၊ ဂဟေဆော်သည့် လုပ်ငန်းများနှင့် အလုပ်သမားများအတွက် ချက်ပြုတ်ခြင်းတို့မှ ထွက်ပေါ်နိုင်ပါသည်။ ဆောက်လုပ်ရေးလုပ်ငန်းနှင့် စီမံကိန်း ဖွံ့ဖြိုးရေး လုပ်ငန်းများအတွက် မော်တော်ယဉ်များ၏ သွားလာမှု နှောင့်နှေးကြန့်ကြာခြင်းများ များပြားလာသည့်အခါတွင်လည်း ဆောက်လုပ်ရေးလုပ်ငန်းစဉ်အတွင်း လေထုညစ် ညမ်းမှုများ ဖြစ်ပေါ်နိုင်ပါသည်။

စီမံကိန်းအရ ဆောက်လုပ်ရေးလုပ်ငန်းစဉ်များကို စတင်စဉ်တွင် လမ်းဘေးဈေးသည်များသည်လည်း ယာယီအခွင့်အလမ်းဆုံးရှုံးမှုများ ဖြစ်ပေါ်နိုင်ပါသည်။ လုံခြုံရေးအတွက် ခြံစည်းရိုးများကို ကာရံမည်ဖြစ်သောကြောင့် လမ်းသွားလမ်းလာများအနေဖြင့် သွားလာရသည့်လမ်းမှာ ကျဉ်းမြောင်းသွားသည်ဟု ခံစားရနိုင်ပါသည်။ သို့သော်လည်း စီမံကိန်းကြောင့် လူသွားလမ်း၏အကျယ်အဝန်းအပေါ် အကျိုးသက်ရောက်လိမ့်မည်မဟုတ်ပါ။ လူသွားလမ်းမှာ ရန်ကုန်မြို့တော် ဖွံ့ဖြိုးတိုးတတ်ရေး ကော်မတီ၏ လမ်းမကြီးချဲ့ထွင်ခြင်းလုပ်ငန်းများကြောင့် ကျဉ်းမြောင်းသွားရခြင်းဖြစ်ပါသည်။

ခ။ ဆောက်လုပ်ပြီးအဆင့် အကျိုးသက်ရောက်မှုများ

ဆောက်လုပ်ပြီးအဆင့်အတွင်းတွင် ရေထုအရည်အသွေးကို ညစ်ညမ်းစေသည့် အဓိကအကြောင်းအရင်းမှာ အညစ်အကြေးစွန့်ထုတ်သည့်ရေများနှင့် မီးဖို၊ရေချိုးခန်း၊အိမ်သာတို့မှ စွန့်ထုတ်သည့် ရေများကို ပေါင်းစုထားသည့် လုပ်ငန်းခွင်တွင်း ရေဆိုးများကြောင့် ဖြစ်ပါသည်။ စီမံကိန်းလုပ်ငန်းခွင်အတွင်း မိုးကြီးခြင်း ကြောင့် လျှံကျလာမည့် ရေများကို ပုံသေတူးဖော်ထားသည့် ရေနုတ်မြောင်းများဖြင့် ချိတ်ဆက်သယ်ဆောင်ပြီး လုပ်ငန်းခွင်၏ မြောက်ဖက် နယ်နိမိတ်တွင် ရှိနှင့်ပြီးသော တူးမြောင်းအတွင်းသို့ စွန့်ထုတ်ပါမည်။ စီမံကိန်းအတွင်း လုပ်ငန်းခွင်အတွင်း ထွက်ပေါ်လာသည့် ရေဆိုးများကို သန့်စင်ရန် စီစဉ်ထားပြီး သန့်စင်ပြီးရေများကို အအေးခံသည့် လုပ်ငန်းစဉ်များတွင် ပြန်လည် အသုံးပြုပါမည်။ လုပ်ငန်းခွင်အတွင်း ထွက်ပေါ်လာသည့် ရေဆိုးများမှ ဖိသိပ်ထားသည့် အညစ်အကြေးအစိုင်အခဲများကိုသာ အပြီးသတ်စွန့်ပစ်မည်ဖြစ်ပါသည်။ သန့်စင်ထားသော ရေများကို ရေအငွေ့ပျံ သော အအေးခံသည့် စင်များတွင် ပြန်လည်အသုံးပြုပါမည်။

အန္တရာယ်ရှိသည့် ပစ္စည်းများ/ဓါတုပစ္စည်းများ သို့မဟုတ် အိမ်သုံး သန့်ရှင်းရေလုပ်သည့် ပစ္စည်းများ ဖိတ်စင်ခြင်း၊ မတော်တဆဖြစ်ခြင်းများကို အဆောတလျှင် အန္တရာယ်လျော့ပါးအောင် မလုပ်ဆောင်လျှင် ဖွံ့ဖြိုးရေးလုပ်ငန်း၏ ဆောက်လုပ်ပြီးအဆင့်တွင် မြေဆီလွှာနှင့် မြေအောက်ရေ အရင်းအမြစ်များအပေါ် ပြင်းထန်ဆိုးရွားသည့် အကျိုးသက်ရောက်မှုများကို ဖြစ်ပေါ်စေနိုင်ပါသည်။

လုပ်ငန်းခွင်တွင်းမှ ထွက်ရှိလာသည့် စွန့်ပစ်ပစ္စည်းအစိုင်အခဲများကို အဓိကအားဖြင့် အမျိုးအစားကိုလိုက်၍ သိမ်းဆည်းပါမည်။(စက္ကူ၊ ပလက်စတစ်၊ အိတ်ခွံ၊ စားကြွင်းစားကျန် စသည်) လူနေမိုးမျှော်တိုက်ခန်းတွဲများနှင့် ဟိုတယ်များမှ ထွက်ရှိလာသည့် အန္တရာယ်မဖြစ်စေသည့် စွန့်ပစ်ပစ္စည်းများတွင် မီးဖိုချောင်၊ ဥယျာဉ်နှင့် ရုံးခန်း စသည်တို့မှ ထွက်ရှိသော စွန့်ပစ်ပစ္စည်းများ ပါဝင်သည်။ အသုံးပြုပြီးသော ဆီများ၊ မီးသီးများနှင့်အတူ သန့်ရှင်းရေးလုပ်သည့် ပစ္စည်းများ ထည့်ထားသည့် အသုံးပြုပြီးသော ခွက်များသည် အဓိကအားဖြင့် အိမ်တွင်း ဝေယျာဝစ္စများနှင့် ပုံမှန် ထိန်းသိမ်းရေး လုပ်ငန်းစဉ်များစသည့် ဟိုတယ်၏ စီမံဆောင်ရွက်မှုများမှ ထွက်ပေါ်ပါမည်။

ဆောက်လုပ်ပြီးအဆင့်တွင် ထွက်ပေါ်လာမည့် အဓိက လေထုညစ်ညမ်းမှုများသည် အရံသင့်ထားရှိသော မီးစက် ၁၈ လုံးမှ ထွက်ပေါ်နိုင်ပြီး ဒီဇယ်သုံး မီးသတ်ရေစုပ်စက်အင်ဂျင်၏ အိတ်ဇောပိုက်မှလည်း ထုတ်လွှတ်နိုင်ပါသည်။ အခြား အရေးမကြီးသည့် လေထုညစ်ညမ်းမှုများမှာ နေထိုင်သူများ၊ ဟိုတယ်သို့လာသော ဧည့်သည်များ၏ မော်တော်ယဉ်များမှ ထုတ်လွှတ်ခြင်းပင်ဖြစ်ပါသည်။

၁.၆.၅ မြေဆီလွှာနှင့် မြေအောက်ရေ ညစ်ညမ်းခြင်း

က။ ဆောက်လုပ်ခြင်းအဆင့် အကျိုးသက်ရောက်မှုများ

ဆောက်လုပ်ခြင်းအဆင့်အတွင်း ဖြစ်ပေါ်သော မြေဆီလွှာနှင့် မြေအောက်ရေ ညစ်ညမ်းမှုများ၏ အဓိက အကြောင်းအရင်းမှာ လုပ်ငန်းခွင်အတွင်း သိမ်းဆည်းထားသော အန္တရာယ်ရှိသည့် ပစ္စည်းများကို နည်းမှန် လမ်းမှန်ဖြင့် စီမံခန့်ခွဲမှု၊ ကိုင်တွယ်မှု မရှိခြင်းကြောင့် ဖြစ်ပေါ်နိုင်ပါသည်။ စီမံကိန်း၏ ဆောက်လုပ်ရေး လုပ်ငန်းစဉ်များအတွင်း ညစ်ညမ်းမှုကို ဖြစ်ပေါ်စေမည့် အဓိကအကြောင်းအရင်းများမှာ

- ဆောက်လုပ်ခြင်းအဆင့်တွင် အသုံးပြုသော ချောဆီများ၊ ဟိုက်ဒရောလစ်ဆီများ၊ သုတ်ဆေးများနှင့် အော်ဂဲနစ်ပျော်ရည်များနှင့် အခြားသော ဓါတုပစ္စည်းများ ပါဝင်နေသော ဒီဇယ်သိုလှောင်ကန်များ၊ ဓါတုပစ္စည်း/လောင်စာဆီထုတ်တိုင်ကီများနှင့် သိုလှောင်တိုင်ကီများ၊ ဂါလံပုံးများ၊ ဆီပုံးများထဲတွင် အန္တရယ်ရှိသော ပစ္စည်းများ/ဓါတုပစ္စည်းများကို သိုလှောင်ခြင်း၊ ကိုင်တွယ်ခြင်းတို့မှ ဖြစ်ပေါ်လာသော မတော်တဆ ဖိတ်ကျခြင်း၊ ယိုစိမ့်ခြင်းများ။
- မော်တော်ယဉ်များ၊ စက်ကရိယာများ၊ ယန္တရားများကို အင်ဂျင်ဝိုင်လဲလှယ်ခြင်းနှင့် လောင်စာ ထပ်မံဖြည့် သွင်းခြင်း လုပ်ငန်းများမှ ဖြစ်ပေါ်လာသည့် ယိုစိမ့်မှုများ။
- အန္တရာယ်ရှိသော အညစ်အကြေးများကို နည်းလမ်းမှန်ကန်မှုမရှိဘဲ သိုလှောင်ခြင်း၊ စွန့်ပစ်ခြင်းတို့ကြောင့် ဖြစ်ပေါ်လာသော ဖိတ်စင်မှုများ။ ရေဆိုးရေညစ်များကို နည်းလမ်းမှန်ကန်မှုမရှိဘဲ စွန့်ပစ်ခြင်း နှင့်
- မြေအောက်ရေ ဖယ်ထုတ်ခြင်း လုပ်ငန်းများ။

ဆောက်လုပ်စဉ်အတွင်း လုပ်ငန်းခွင်တိုင်းတွင် အသုံးပြုသော ဓါတုပစ္စည်းပမာဏမှာ နည်းပါးလှသည့်အတွက် ဆောက်လုပ်ခြင်းအဆင့်အတွင်း အန္တရာယ်ရှိသော ဓါတုပစ္စည်းများ၊ စွန့်ပစ်ပစ္စည်းများ ဖိတ်စင်ခြင်း၊ ယိုစိမ့်ခြင်း တို့ကြောင့် ဖြစ်ပေါ်လာသော မြေဆီလွှာနှင့် မြေအောက်ရေ ညစ်ညမ်းခြင်းများသည် သိသာထင်ရှားခြင်း မရှိပါ။ မြေဆီလွှာနှင့် မြေအောက်ရေ ညစ်ညမ်းမှုတိုင်းကို ကန့်သတ်ထိန်းချုပ်နိုင်ပြီး ၄င်းတို့မှာ အပေါ်ယံတွင်သာ ဖြစ်ပေါ်ခြင်းဖြစ်နိုင်ပါသည်။ ဆက်လက်ဖော်ပြမည့် ကဏ္ဍတွင် အကြံပြုထားသည့်အတိုင်း သင့်တော်သော အန္တရယ်လျော့ချရေး အစီအမံများကို အကောင်အထည်ဖော်ဆောင်ရွက်ခြင်းအားဖြင့် ၄င်းအကျိုးဆက်များကို အလျှင်အမြန် ဖော်ထုတ်နိုင်ပါသည်။

ဖောင်ဒေးရှင်း မြေတူးခြင်းကို မြေအောက်ရေမျက်နှာပြင်အောက်ကျော်လွန်၍ တူးပါက မြေအောက်ရေ စုပ်ထုတ်ခြင်းကို ပြုလုပ်ရမည်။ သို့သော် မြေအောက်ရေကို အများအပြား စုပ်ယူစွန့်ပစ်ခြင်းကို ပြုလုပ်ရန် မလိုအပ်နိုင်ပါ။ မြေအောက်ရေအနည်းငယ်စုပ်ထုတ်ရန် မလိုအပ်နိုင်သော်လည်း လိုအပ်သော အခြေအနေမျိုး များတွင် စုပ်ယူထားသော ရေများကို ဆောက်လုပ်ရေးလုပ်ငန်းခွင်အတွက် အသုံးပြုသည့် ရေထုတ်ကန်မှတဆင့် သယ်ယူ ပြီး လုပ်ငန်းခွင်၏ ရေဆိုးထုတ်စနစ်အတွင်းသို့ မစွန့်ပစ်မီ ဦးစွာ ပိုးသတ်ပါမည်။

ခ။ ဆောက်လုပ်ပြီး အဆင့် အကျိုးသက်ရောက်မှုများ

စီမံကိန်း၏ ဆောက်လုပ်ပြီး အဆင့် တွင် မြေဆီလွှာနှင့် မြေအောက်ရေ ညစ်ညမ်းခြင်းကို ဖြစ်ပေါ်စေနိုင်သည့် အရာများထဲတွင် အောက်ဖော်ပြပါ အချက်များပါဝင်သည်။

- (တစ်ကန်စီလျှင် လီတာ ၂၀၀၀၀ သိုလှောင်နိုင်သည့်) သတ္တုလှောင်ကန် ၃ ကန်နှင့် (ကုဗမီတာ ၁၀၀၀၀ ဝင်ဆန့်သော) ကန် ၂ ကန် ထည့်သွင်းထားသည့် ၁၃၅ စတုရန်းမီတာ ကျယ်ဝန်းသည့် ဒီဇယ်သိုလှောင်ရာ အခန်း။
- ပြုပြင်ထိန်းသိမ်းခြင်း လုပ်ငန်းစဉ်များအတွက် ဓါတုပစ္စည်းသိုလှောင်ရာနေရာ၊ ရေသန့်စင်စက်နှင့် အအေးခံစင် (ပုပ်သိုးခြင်းကာကွယ်သည့်အရာများ၊ ဆွေးမြေ့ပျက်စီးခြင်းကို နှေးကွေးစေသည့် ဓါတုပစ္စည်းများ၊ ပိုးသတ်ဆေးများ)
- အရေးပေါ်မီးသတ်ရေဖြန်းကန်
- (ဒီဇယ်သိုလှောင်တိုင်ကီများပါဝင်သည့်) အရံသင့်ထားရှိသော မီးစက်များ
- အန္တရာယ်ရှိသည့် စွန့်ပစ်ပစ္စည်း သိုလှောင်ရုံများ

အန္တရာယ်ဖြစ်စေနိုင်သည့် ပစ္စည်းများ၊ ဓါတုပစ္စည်းများကို မတော်တဆ ဖောက်ချမိခြင်းကြောင့် ဖွံ့ဖြိုးမှု လုပ်ငန်းစဉ်၏ တည်ဆောက်ပြီးအဆင့်တွင် မြေဆီလွှာနှင့် မြေအောက်ရေ အရင်းအမြစ်များအပေါ် ဆိုးရွားပြင်း ထန်သည့် အကျိုးဆက်များကို ဖြစ်ပေါ်စေသည်။ မြေဆီလွှာနှင့် မြေအောက်ရေထဲတွင် ရှိသော အော်ဂဲနစ် နှင့် အော်ဂဲနစ်မဟုတ်သော အဆိပ်အတောက်နှစ်မျိုးစလုံးတို့သည် လူများ၏ ကျန်းမာရေး၊ လုံခြုံရေးနှင့် ထိရှလွယ်သော သဘာဝပတ်ဝန်းကျင်နေရာများအတွက် ရေတိုရော ရေရှည်မှာပါ အန္တရာယ်များ ဖြစ်ပေါ်စေ နိုင်ပါသည်။ ဥပမာအားဖြင့် ရေနံဟိုက်ဒရိုကာဗွန်များ မြေဆီလွှာနှင့် မြေအောက်ရေထဲသို့ ဖိတ်စင်ကျသွား ခြင်းကြောင့် ဖြစ်ပေါ်လာသော အငွေ့ပျံနိုင်သော အောဂဲနစ်ကွန်ပေါင်းများ(VOCs) စုပုံလာခြင်းကြောင့် မြေသားဒုတိယလွှာအသုံးချခြင်းစနစ်များအထိ ရောက်ရှိလာနိုင်သည် သို့မဟုတ် ၄င်းအငွေ့များ သိပ်သည်းလာ ခြင်းကြောင့် ပြုပြင်ထိန်းသိမ်းရေး လုပ်သားများအပေါ် ကြီးမားသည့် ကျန်းမာရေး အကျိုးသက်ရောက်မှုများ ဖြစ်ပေါ်လာနိုင်သည်။

မြေအောက်ရေ ညစ်ညမ်းခြင်းကိစ္စမှာ သဘောသဘာဝအရ ကြာမြင့်တတ်သည့် ကိစ္စတစ်ရပ်ဖြစ်ပါသည်။ တချို့သော ညစ်ညမ်းစေသည့်အရာများသည် ဆွေးမြေ့ပျက်စီးခြင်းကို ခံနိုင်ရည်ရှိကြပြီး ညစ်ညမ်းစေသည့် အဓိကအရာကို ဖယ်ထုတ်လိုက်ပြီး နှစ်ပေါင်းများစွာ ကြာသည့်တိုင်အောင် ပတ်ဝန်းကျင်တွင် ဆက်လက် တည်ရှိ နေနိုင်ပါသည်။ မြေအောက်ရေသည် ရန်ကုန်မြို့ရှိ တန်ဖိုးကြီးမားလှသည့် အရင်းအမြစ်တစ်ခုဖြစ်ပြီး လက်ရှိ အချိန်တွင် ရေပေးဝေရေးပြုလုပ်သည့် အဓိကအရင်းအမြစ်ဖြစ်သောကြောင့် မြေဆီလွှာနှင့် မြေအောက် ရေထဲ တွင် ၄င်းညစ်ညမ်းစွန့်ပစ်ပစ္စည်းများ ပါရှိခြင်းသည် လုံးဝလက်မခံနိုင်သည့် အန္တရာယ်ဖြစ်နိုင်ပါသည်။

စီမံကိန်း၏ ဆောက်လုပ်ပြီး အဆင့်အတောအတွင်း သန့်စင်ခန်းများ၊ မြေပြင်ခြင်းများ၊ ရေကူးကန်များ၊ ဆေးကြောခြင်းများနှင့် သောက်သုံးခြင်းတို့အတွက် ဖွံ့ဖြိုးမှုလုပ်ငန်းစဉ်အတွင်း မြေအောက်ရေကို ထုတ်ယူ သုံးစွဲပါမည်။

၁.၁.၆ စွန့်ပစ်ပစ္စည်းများ

က။ ဆောက်လုပ်ခြင်းအဆင့် အကျိုးသက်ရောက်မှုများ

အန္တရာယ်ရှိသော ပစ္စည်းများနှင့် အန္တရာယ်မရှိသော ပစ္စည်း နှစ်မျိုးစလုံးကို မမှန်မကန်သုံးစွဲခြင်းမှ ဖြစ်ပေါ်လာသော အဓိကအကျိုးသက်ရောက်မှုများတွင် အောက်ပါအချက်များ ပါဝင်သည်။

- မှန်ကန်စွာ စီမံခန့်ခွဲခြင်းမရှိသည့် စွန့်ပစ်ပစ္စည်းများသည် အများသုံး ရေနုတ်မြောင်းများထဲသို့ ဝင်ရောက်သွားပြီး ရေနုတ်မြောင်းများ၏ ရေစီးဆင်းမှုကို ပိတ်ဆို့စေမည်။
- အပေါက်ဖာစက်များ၊ ဆီနှင့် ချောဆီများ၊ သုတ်ဆေးများ စသည်တို့သည် စီမံကိန်း လုပ်ငန်းခွင်မှ ပေါ်ထွက်လာသော ညစ်ညမ်းသည့် ရေများ မျောပါခြင်း ဖြစ်ပေါ် နိုင်ပါသည်။
- လုပ်ငန်းခွင်အတွင်း ဆွေးမြေ့စေနိုင်သည့် စွန့်ပစ်ပစ္စည်းများကို မမှန်မကန်စွန့်ပစ်ခြင်းအားဖြင့် ကိုက်ဖြတ်စား သတ္တဝါများနှင့် အင်းဆက်ပိုးမွှားများသယ်ဆောင်လာသော ရောဂါပိုးများကို ဆွဲဆောင် သည့်အတွက် စီမံကိန်းလုပ်ငန်းခွင်အတွင်း ဝန်ထမ်းများကို ကျန်းမာရေးအန္တရာယ်ဖြစ်ပေါ်စေနိုင်ပြီး လုပ်ငန်းခွင်အတွင်း အနံ့ဆိုးများကိုလည်း ထွက်ပေါ်စေနိုင်ပါသည်။
- စီမံကိန်းလုပ်ငန်းခွင်အတွင်း မြေကွပ်လပ်များပေါ်တွင် (အန္တရာယ်ရှိသည့်) ဆောက်လုပ်ရေး စွန့်ပစ်ပစ္စည်းများကို ခွဲခြားခြင်းမရှိဘဲ စွန့်ပစ်ခြင်းကြောင့် မြေဆီလွှာနှင့် မြေအောက်ရေတို့ကို ညစ်ညမ်းစေနိုင်ပါသည်။
- စီမံကိန်းလုပ်ငန်းခွင်သည် ရန်ကုန်မြို့အတွင်းရှိ အဓိကလမ်းတစ်လမ်းပေါ်တွင် တည်ရှိသည့်အတွက် မြေတူးထားသည့် မြေစာများကို ကြီးမားသော အပုံကြီးများအဖြစ် စုပုံထားခြင်းအပါအဝင် လုပ်ငန်းခွင်အတွင် ထိရောက်မှုမရှိသော စွန့်ပစ်ပစ္စည်းဆိုင်ရာ စီမံခန့်ခွဲမှုများကြောင့် အမြင်တင့်တယ်မှု မရှိခြင်း ဖြစ်ပေါ် နိုင်ပြီး
- ဆောက်လုပ်ရေး စွန့်ပစ်ပစ္စည်းများကို မမှန်မကန် စီမံခန့်ခွဲခြင်းကြောင့် လုပ်ငန်းခွင်အတွင်း မီးဘေးအန္တရာယ်ကိုလည်း ဖြစ်ပေါ်စေနိုင်ပါသည်။

ခြုံငုံ၍ပြောရလျှင် ဆောက်လုပ်ခြင်းအဆင့်အတောအတွင်း စီမံကိန်း လုပ်ငန်းခွင်၌ အန္တရာယ်ရှိသော စွန့်ပစ်ပစ္စည်းများနှင့် အန္တရာယ်မရှိသော စွန့်ပစ်ပစ္စည်းများကို စီမံခန့်ခွဲမှုမှာ ထွက်ပေါ်လာသော အကျိုးသက်ရောက်မှုများသည်

ရေတိုသာဖြစ်၍ ထိန်းချုပ်နိုင်ပြီး သင်တော်သည့် ဆောက်လုပ်ရေး စီမံခန့်ခွဲမှု အလေ့အထများကို အကောင် အထည်ဖော်ဆောင်ရွက်ခြင်းအားဖြင့် ထိထိရောက်ရောက် လျှော့ချနိုင်ပါသည်။

ခ။ ဆောက်လုပ်ပြီး အဆင့် အကျိုးသက်ရောက်မှုများ

လူနေ မိုးမျှော်တိုက်ခန်းတွဲများနှင့် ဟိုတယ်များမှ ထွက်ပေါ်လာသော အန္တရာယ်မရှိသည့် စွန့်ပစ်ပစ္စည်းများတွင် မီးဖိုချောင်ထွက် အမှိုက်များ၊ ဟိုတယ်၏ စီမံအုပ်ချုပ်ရေးရုံးခန်းများမှထွက်လာသော စွန့်ပစ်ပစ္စည်းများ၊ ဟိုတယ် သို့လာရောက်သော ဧည့်သည်များမှ စွန့်ပစ်သည့်အမှိုက်များ၊ ဥယျာဉ်ခြံမှထွက်သော အမှိုက်များနှင့် စွန့်ပစ် စက္ကူ ပလက်စတစ်၊ စက္ကူကတ္တူစသည်တို့ ပါဝင်ပါသည်။

ဟိုတယ်ကို ပုံမှန် ထိန်းသိမ်းခြင်းမှ အဓိကအားဖြင့် ထွက်ရှိပြီး ဟိုတယ်ကို စီမံခန့်ခွဲခြင်းမှ အန္တရာယ်ဖြစ်စေနိုင်သည့် စွန့်ပစ်ပစ္စည်းအနည်းငယ် ထွက်ရှိနိုင်ပါသည်။ အန္တရယ်ရှိပြီး ဆွေးမြေ့လွယ်သည့် အမှိုက်များကို စီမံခန့်ခွဲခြင်း နှင့်ပတ်သတ်၍ အဓိကစိတ်ပူရမည့်အချက်မှာ အမှိုက်စွန့်ပစ်ခွင့်မရှိသည့်နေရာများတွင် မမှန်မကန် အမှိုက်စွန့် ပစ်ခြင်းပင် ဖြစ်ပါသည်။

၄င်းစွန့်ပစ်ပစ္စည်းများကို စနစ်တကျ စွန့်ပစ်ခြင်းမရှိခြင်းကြောင့် မြေမျက်နှာပြင်ပေါ် ရှိရေ၊ မြေအောက်ရေနှင့် မြေဆီလွှာညစ်ညမ်းမှုများကို ဖြစ်စေနိုင်ပါသည်။ ထို့အပြင် ကျန်းမာရေးနှင့်မညီညွှတ်ဘဲ ဆွဲဆောင်မှုမရှိသည့် ပတ်ဝန်းကျင်များကိုလည်း ဖြစ်ပေါ်စေနိုင်ပါသည်။

၁.၆.၇ လူမှုစီးပွားရေး ရှုထောင့်

က။ ဆောက်လုပ်ခြင်း အဆင့် အကျိုးသက်ရောက်မှု

ဆောက်လုပ်ရေး လုပ်ဆောင်နေစဉ်အတွင်း စီမံကိန်းကြောင့် ဒေသခံများ အလုပ်အများအပြားကို ရရှိနိုင်ပါသည်။ စီမံကိန်း၏ ဆောက်လုပ်သည့်အဆင့်အတောအတွင်း အလုပ်လာရောက်လုပ်ကိုင်မည့် အလုပ်သမားများစွာကို ရန်ကုန်တိုင်းဒေသကြီးမှ အလုပ်ခန့်အပ်မည်ဖြစ်ပြီး စီမံကိန်းကို အကောင်အထည်ဖော်ရာတွင် အရေးကြီးသည့် ထောက်ပံ့ပို့ဆောင်ရေး ဝန်ဆောင်မှုများ (ဥပမာ လောင်စာဆီဝယ်ယူခြင်း၊ အလုပ်သမားများ၏ နေထိုင်စား သောက်ခြင်းနှင့် လိုအပ်ချက်များ၊ အခြားအရာများထဲမှ ဆောက်လုပ်ရေး လုပ်ငန်းခွင် လိုအပ်ချက်များ)ကို ရန်ကုန်တိုင်းဒေသကြီးအတွင်းမှ ဝယ်ယူပါမည်။ ဆောက်လုပ်ပြီးအဆင့်အတွင်း တူညီသော လိုအပ်ချက်များ ကိုလည်း ရန်ကုန်တိုင်းဒေသကြီးအတွင်းမှာပင် တတ်နိုင်သမျှ ရှာဖွေသွားပါမည်။ ဒေသဆိုင်ရာစီးပွား ရေးသည် လည်း တိုးတတ်လာပါလိမ့်မည်ဟု မျှော်လင့်ရပါသည်။

ခ။ ဆောက်လုပ်ပြီး အဆင့် အကျိုးသက်ရောက်မှုများ

ရန်ကုန်တိုင်းဒေသကြီးနှင့် ပတ်ဝန်းကျင် တိုင်းဒေသကြီးများမှ ရရှိမည့် အဓိကအကျိုးအမြတ်များမှာ အောက်ပါ အတိုင်း ဖြစ်ပါသည်။

- နိုင်ငံခြား တိုက်ရိုက်ရင်းနှီးမြှုပ်နှံမှု စီးဝင်ခြင်း - စီမံကိန်းကို အကောင်အထည်ဖော်ဆောင်ရွက်ခြင်းကြောင့် နိုင်ငံ၏ စီးပွားရေးအပေါ် ဆပွားအကျိုးသက်ရောက်မှုကို ဖြစ်စေနိုင်သည့် များပြားသော ငွေအရင်းအနှီး ရင်းနှီးမြှုပ်နှံမှုများကို ရရှိနိုင်မည်ဖြစ်ပါသည်။ ၎င်းစီမံကိန်းသည် နိုင်ငံစီးပွားရေးကို အလျှင်အမြန် ကြီးထွားဖွံ့ဖြိုးလာစေရန် ထောက်ပံ့ပေးဖို့ မြန်မာနိုင်ငံတွင်းသို့ နိုင်ငံခြားရင်းနှီးမြှုပ်နှံမှုများကို ခေါ်ယူရန် မြန်မာနိုင်ငံတော်အစိုးရ၏ ကြိုးပမ်းနေမှုနှင့်လည်း ကိုက်ညီပါသည်။
- နည်းပညာများ၊ သင်တန်းများ လွှဲပြောင်းပေးခြင်း - အဓိကအားဖြင့် ဝန်ဆောင်မှုနှင့် စီးပွားရေး ကဏ္ဍများ ဖွံ့ဖြိုးတိုးတက်ရေးတွင် ပါဝင်လုပ်ကိုင်မည့် မြန်မာဝန်ထမ်းများ၏ အတတ်ပညာဆိုင်ရာ ဖွံ့ဖြိုးတိုးတက်မှု နှင့် လေ့ကျင့်ခြင်းတို့ကို ဆောင်ရွက်နိုင်မည့် အခွင့်အလမ်းများကို စီမံကိန်း အကောင်အထည်ဖော် ဆောင်ရွက်ခြင်းအားဖြင့် ရရှိပါလိမ့်မည်။ ဝန်ထမ်းများကို အိမ်နီးချင်းနိုင်ငံများဆီသို့ လေ့ကျင့်သင်ယူရန် စေလွှတ်ခြင်းနှင့် ဒေသခံဝန်ထမ်းများကို အလုပ်ခွင်သင်တန်းပေးရန်အတွက် တာဝန်ပေးအပ်ထားသည့် နိုင်ငံခြားသား ကျွမ်းကျင်ပညာရှင်များ ပုံမှန်လာရောက် ခြင်းအားဖြင့် နည်းပညာများကို လွှဲပြောင်းရယူနိုင်ပါလိမ့်မည်။
- အခြားအထောက်အပံ့ပေးသော စီးပွားရေးလုပ်ငန်းများ၏ ဖွံ့ဖြိုးတိုးတက်မှု - ရန်ကုန်မြို့လယ်တွင် တည်ရှိမည့် စီမံကိန်းသည် စီးပွားရေး အခွင့်အလမ်းအသစ်များကို ဖန်တီးနိုင်မည်ဟု မျှော်လင့်ပါသည်။
- အလုပ်အကိုင်အခွင့်အလမ်းများ တိုးပွားလာမှု - စီမံကိန်းတစ်ခုလုံးသည် အလွှာပေါင်းစုံမှ ဝန်ထမ်း အမြောက်အများအတွက် အလုပ်အကိုင်အခွင့်အလမ်းများကို ပေးအပ်ပါလိမ့်မည်။
- ဒေသခံ များအနေဖြင့် နိုင်ငံရပ်ခြားတွင်နေထိုင်သည့် ကျွမ်းကျင်ပညာရှင်များထံမှ အလုပ်တာဝန်များကို လက်ခံရယူနိုင်မည့် လုံလောက်သော အရည်အသွေးများနှင့် နည်းပညာပိုင်းဆိုင်ရာ ဗဟုသုတများကို ရရှိသည့်အချိန်အထိ ပြည်ပတွင်နေထိုင်သော ဝန်ထမ်းများက ဒေသခံများကို လိုအပ်သည့်နေရာများတွင် လေ့ကျင့် သင်ကြားသွားပါမည်။ ဒေသခံ အလုပ်အကိုင်များကိုပင်လျှင် ဟိုတယ်စီမံဆောင်ရွက်ရေး ကုမ္ပဏီများ၊ ရုံးခန်းများ၊ လက်လီဆိုင်များနှင့် ပိုင်ဆိုင်မှု စီမံခန့်ခွဲရေး ကုမ္ပဏီများ မှ တိုက်ရိုက်ခန့်ထားမည့် အလုပ်အကိုင်ပေါင်း ၆၂၀ ခန့်ရှိမည်ဟု ခန့်မှန်းထားပါသည်။ ရုံးခန်းငှါးရမ်းသူများ၊ လက်လီဆိုင် ငှါးရမ်းသူများမှ ခန့်အပ်မည်ဖြစ်သော တိုက်ရိုက်ခန့်အပ်ခြင်းမဟုတ်သည့် အလုပ်အကိုင်များမှာ အလုပ်အကိုင်အသစ်ပေါင်း ၆၀၀၀ ခန့်ရှိမည့်ဟု ခန့်မှန်းထားပါသည်။ ထို့အပြင် အထက်တွင်ဖော် ပြခဲ့သော အခြားအထောက်အပံ့ပေးသည့် ကဏ္ဍများ တိုးတတ်လာခြင်း၏ အကျိုးရလာဒ်ကြောင့် ဒေသခံများ အတွက် နောက်ထပ် အလုပ်အကိုင်အခွင့်အလမ်းများလည်း ထပ်မံရောက်ရှိ လာမည်ဖြစ်ပါ သည်။

- စီးပွားရေး အကျိုးအမြတ်များ - အဆိုပြုထားသည့် စီမံကိန်းသည် မြန်မာ့စီးပွားရေးအတွက် အပေါင်းလက္ခဏာဆောင်သည့် ဆပွားအကျိုးရလာဒ်များကို ယူဆောင်လာမည်ဟု ခန့်မှန်းထားပါသည်။ စီမံကိန်းအနေဖြင့် မြန်မာ့စီးပွားရေးအတွက် တိုက်ရိုက်ပံ့ပိုးပေးမှုများနှင့် တိုက်ရိုက်မဟုတ်သော စုစုပေါင်း ပံ့ပိုးပေးမှုများမှာ ထင်ထင်ရှားရှားဖြစ်ပေါ်လာမည်ဟု မျှော်မှန်းထားပါသည်။ ထို့ပြင် စီမံကိန်း အနေဖြင့် စီမံကိန်းကာလအတောအတွင်း မြန်မာနိုင်ငံတော်အစိုးရအတွက် များပြားသည့် အခွန်ငွေများ ကို ဖန်တီးပေးနိုင်မည်ဟု မျှော်မှန်းထားပါသည်။
- ဒေသခံ ပံ့ပိုးသူများအတွက် စီးပွားရေးလုပ်ငန်း - အစားအစာနှင့် အဖျော်ယမကာ၊ အထည်လိပ် အထည်ချုပ်လုပ်ငန်းများ အပါအဝင် အောက်ပါ ကဏ္ဍများအတွက် ဒေသထွက် ပစ္စည်းများအတွက် ဝယ်လိုအား ဖန်တီးပေးခြင်း။
- လမ်းသွားလမ်းလာများနှင့် ယဉ်သွားယဉ်လာများ သွားလာမှု အဆင့်မြှင့်တင်ခြင်း၊ ဗိုလ်ချုပ်အောင် ဆန်းလမ်း၏ ယဉ်အသွားအလာအချက်ပြမှုများအတွက် ထောက်ပံ့ပေးခြင်းနှင့် လူကူးမျဉ်းကြားများကို နေရာပြောင်းလဲသတ်မှတ်ခြင်း တို့အားဖြင့် ဒေသခံနေရာဒေသအတွက် အကျိုးရှိစေပြီး ယဉ်သွား ယဉ်လာများ၊ လမ်းသွားလမ်းလာများအတွက်လည်း သွားလာရပိုမို လွယ်ကူစေပါသည်။

၁.၆.၈ ယဉ်သွားယဉ်လာ

က။ ဆောက်လုပ်ခြင်း အဆင့် အကျိုးသက်ရောက်မှုများ

ဆောက်လုပ်နေစဉ်အတွင်း ဗိုလ်ချုပ်အောင်ဆန်းလမ်းပေါ်တွင်တည်ရှိနှင့်ပြီးဖြစ်သော ဘူတာကြီးသို့ ဝင်ပေါက်ကို အသုံးပြုသွားမည်ဖြစ်ပြီး အဓိကအားဖြင့် ဆောက်လုပ်ရေးကာလ အစပိုင်း၌ မြေအောက်ခန်းအတွက် တူးဖော်နေစဉ်အတွင်း လုပ်ငန်းခွင်အတွင်းသို့ အဝင်အထွက်ပြုလုပ်သော ယဉ်များကို အသုံးပြုမည်ဖြစ်ပြီး ဆောက်လုပ်ရေးကာလမှာ ၅ နှစ် နီးပါး ကြာမြင့်မည်ဟု မျှော်မှန်းထားပါသည်။

ဆောက်လုပ်ရေး ယဉ်သွားယဉ်လာများသည် ယဉ်ကြောရှုပ်သည့်အချိန်များကို ရှောင်ကျဉ်မည်ဖြစ်ပြီး နေ့တစ် နေ့၏ သတ်မှတ်နာရီများအတွင်း သွားလာရမည်ဖြစ်သော ရန်ကုန်မြို့တော် ဖွံ့ဖြိုးတိုးတတ်ရေး ကော်မတီ က ချမှတ်ထားသည့် ယဉ်အရွယ်အစား သတ်မှတ်ချက်များကို လိုက်နာပါမည်။

ရန်ကုန်မြို့တော် ဖွံ့ဖြိုးတိုးတတ်ရေးကော်မတီက သတ်မှတ်ပေးထားသော စွန့်ပစ်ရန်နေရာတွင် ပိုနေသော မြေစာများကို သယ်ယူစွန့်ပစ်ရန်အတွက် လစဉ် ထရပ်ကားအစီးရေ ၂၄၀၀ ခန့် လိုအပ်မည်ဟု မျှော်မှန်း ထားပါသည်။ ၎င်း ထရပ်ကားများသည် ရန်ကုန်မြို့တော်ဖွံ့ဖြိုးတိုးတတ်ရေးကော်မတီက ခွင့်ပြုထား သော လမ်းကြောင်းအတိုင်း မောင်းနှင်အသုံးပြုမည်ဖြစ်ပါသည်။

ခ။ ဆောက်လုပ်ပြီး အဆင့် အကျိုးသက်ရောက်မှုများ

ဆူးလေ ရှန်ဂရီလာ လမ်းဆုံကို ခွဲခြမ်းလေ့လာမှုအား အဆိုတင်သွင်းထားသော စီမံကိန်းနှင့်အတူ ၂၀၂၁ ခုနှစ်တွင် တာဝန်ယူဆောင်ရွက်သွားမည်ဖြစ်သည်။ ယဉ်သွားယဉ်လာ ဖြန့်ဝေခြင်းဆိုင်ရာ တိုးတတ်မှုသည် ရှိနှင့်ပြီးသော လမ်းဆုံ၌ဖြန့်ဝေခြင်း ရာခိုင်နှုန်းပေါ်တွင် မှီတည်နေပါသည်။ ယဉ်သွားယဉ်လာကို တောင်ဖက်မှ ပြုလုပ်မည်ဟု ဖော်ပြထားသော်လည်း ၄င်းယဉ်အသွားအလာကို မြောက်ဖက်မှသော်လည်းကောင်း အနောက်ဖက်မှသော် လည်းကောင်း(အထဲဝင်သော တစ်ကြိမ်သာ လမ်းဆုံကို ဖြတ်ပါသည်) ဝင်ရောက်ပါမည်။

ယဉ်သွားယဉ်လာ တိုးတတ်ကောင်းမွန်လာသည်နှင့်အမျှ လမ်းဆုံအပေါ် ဆိုးကျိုးသက်ရောက်မှုမှာလည်း များပြား လာမည်ဖြစ်ပါသည်။ အကျိုးသက်ရောက်မှုများကို လျော့ချဖို့အတွက် လမ်းဆုံ တိုးတတ်ကောင်းမွန်ရေး အစီအမံများကို အကောင်အထည်ဖော်ဆောင်ရွက်သင့်ပါသည်။ Signal Phrasing optimization တိုင်းတာမှုသည် ထိရောက်မှုအရှိဆုံးဖြစ်ပြီး အရိုးရှင်းဆုံးသော တိုင်းတာခြင်းလည်း ဖြစ်ခြင်းကြောင့် ဤလေ့လာမှုတွင် ၄င်းတိုင်းတာခြင်းနည်းလမ်းကို အသုံးပြုထားပြီး အရှေ့ဖက်နှင့် တောင်ဖက်တို့ရှိ မျှဝေလမ်း ကြောင်းပုံသဏ္ဍာန် (shared lane configuration) တွင် ပြောင်းလဲမှု အနည်းငယ် ပြုလုပ်ထားပါသည်။

၁.၆.၉ လုပ်ငန်းခွင် ကျန်းမာရေးနှင့် လုံခြုံရေး

က။ ဆောက်လုပ်ခြင်းအဆင့် အကျိုးသက်ရောက်မှုများ

အန္တရာယ်ရှိသော အလုပ်ခွင်နေရာများတွင် အလုပ်လုပ်ဆောင်ရသည့်အခါ အလုပ်သမားများသည် အောက်ပါ အကျိုးသက်ရောက်မှုများကို ကြုံတွေ့နိုင်ပါသည်။

- အလုပ်ခွင်အနီးရှိလေထုအတွင်း ဖုန်အမှုန်များ တိုးပွားလာခြင်း
- ကရိယာများ၏ မျက်နှာပြင်တွင် အပူချိန်မြင့်တတ်လာခြင်း
- တုန်ခါမှု အဆင့် မြင့်မားလာခြင်း
- ယန္တရားများ ရွေ့လျားခြင်းသို့မဟုတ် ၄င်းတို့၏ အစိတ်အပိုင်းများ ရွေ့လျားခြင်းများနှင့်
- အထူးသဖြင့် နွေရာသီတွင် ပင်ပန်းလွန်ခြင်း၊ ရေဓါတ်ခမ်းခြောက်ခြင်း၊ အသေးစား ပြတ်ရှ၊ ပွန်းပဲ့ရာများ၊ ပတ်ဝန်းကျင်အခြေအနေတို့ကြောင့် ဖြစ်သော ထိခိုက်ဒါဏ်ရာများ၊ ဖျားနာခြင်းစသည့် အဖြစ်များသော ထိခိုက်မှုများသည် ဆောက်လုပ်ရေးလုပ်ငန်းများနှင့် လုပ်ငန်းခွင်ဖျက်သိမ်းခြင်းလုပ်ငန်းများတွင် အဖြစ် အများဆုံးသော ထိခိုက်ဒါဏ်ရာ ရရှိမှုများပင် ဖြစ်ပါသည်။ ကူးစက်နိုင်သော ရောဂါပိုးများ ပွားများလာ ခြင်းကြောင့် ကန်ထရိုက်တာ၊ အလုပ်သမားများနှင့် ဒေသခံများအပါအဝင် စီမံကိန်းဝန်ထမ်းများ၏ ကျန်းမာရေးအန္တရာယ်ကို ဖြစ်စေနိုင်ပါသည်။

စီမံကိန်းလုပ်ငန်းခွင်မှ ရှင်းထုတ်လိုက်သော ဟင်းသီးဟင်းရွက် အပုပ်များအပါအဝင် ဆောက်လုပ်ခြင်းမှ ထွက်လာသည့် အကျိုးအပဲ့အစအနများကို ပုံမှန်မစွန့်ပစ်လျှင် သို့မဟုတ် မှန်ကန်စွာ မစွန့်ပစ်လျှင် အလုပ်သမား

များနှင့် အနီးပတ်ဝန်းကျင်ဒေသခံများသို့ ကျန်းမာရေး ဆိုးကျိုးများကို ဖြစ်စေနိုင်သော ခြင်၊ ယင်ကောင်၊ ကြွက် အစရှိသော ရောဂါပိုးမွှားသယ်ဆောင်သူများအတွက် ကောင်းမွန်သော နေထိုင်ရာနေရာများဖြစ်စေပြီး ကျန်းမာရေးနှင့် မသင့်တော်သော ပတ်ဝန်းကျင်ကို ဖန်တီးပေးပါသည်။

စီမံကိန်း လုပ်ငန်းခွင်အတွင်း ဆောက်လုပ်ရာနေရာများတွင် အသုံးပြုသော အန္တရာယ်ဖြစ်စေသည့် ပစ္စည်းများနှင့် ထိတွေ့မိခြင်း သို့မဟုတ် ကိုင်တွယ်ခြင်းမှ အန္တရာယ်များ ကျရောက်လာနိုင်ပါသည်။

ဆောက်လုပ်ရေးလုပ်ငန်းသုံး ပစ္စည်းကရိယာများကို သယ်ယူပို့ဆောင်ခြင်းအတွက် အကြီးစား မော်တော်ယဉ်များ သွားလာလှုပ်ရှားမှု သိသိသာသာ များပြားလာခြင်းကြောင့် ယဉ်သွားယဉ်လာမှုများနှင့် သက်ဆိုင်သော မတော်တဆမှုများနှင့် အလုပ်သမားများနှင့် ဒေသခံများ ထိခိုက်ဒါဏ်ရာရခြင်းတို့ များပြားလာနိုင်ပါသည်။

ခ။ ဆောက်လုပ်ပြီး အဆင့် အကျိုးသက်ရောက်မှုများ

စီမံကိန်း၏ ဆောက်လုပ်ပြီးအဆင့်အတောအတွင်း ကျန်းမာရေးနှင့် လုံခြုံရေးထိခိုက်မှုများမှာ သိသိသာသာ လျော့ကျသွားမည်ဖြစ်ပြီး ထိမ်းသိမ်းခြင်း လုပ်ငန်းများ၊ အန္တရယ်ရှိသည့် ပစ္စည်းများ (ဒီဇယ်၊ ရေသန့်စင်စက်အတွက်အသုံးပြုသော ဓါတုပစ္စည်းများ၊ မြေအောက်ရေ သန့်စင်ခြင်းနှင့် ဟိုတယ်ရေကူးကန်တွင်း ရေသန့်စင်ရာတွင်သုံးသော ဓါတုပစ္စည်းများ၊ အအေးခံစင်တွင် အသုံးပြုသော ဓါတုပစ္စည်းများ၊ (ပုပ်သိုးမှုကို ကာကွယ်ပေးသော ပစ္စည်းများ၊ ဆွေးမြေ့ပျက်စီးမှု ကာကွယ်ပေးသော ဓါတုပစ္စည်းများ၊ ပိုးသတ်ဆေးများစသည်) သုတ်ဆေးများ၊ ချောဆီများ၊ အမဲဆီများ၊ သင်နာများ) ကို ကိုယ်တွယ်အသုံးပြုရခြင်းလည်း လျော့နည်းသွားပါမည်။ ၄င်းပစ္စည်းများကို ကိုင်တွယ်အသုံးပြုရာတွင် အန္တရာယ်ကင်းစေဖို့အတွက် ဓါတုပစ္စည်းတစ်ခုချင်းစီအတွက် ပစ္စည်းဘေးကင်းမှုအချက်အလတ်စာရွက်(MSDS) ကို ရယူမည်ဖြစ်ပြီး သင့်တော်သော တကိုယ်ရည်အကာအကွယ်ပေးသည့် ကရိယာများထောက်ပံ့ပေးခြင်းအပါအဝင် သိုလှောင်ခြင်းနှင့် ကိုင်တွယ်ခြင်းအတွက် သင့်လျော်သော စီမံမှုများကို အကောင်အထည်ဖော် ဆောင်ရွက်ရပါမည်။

၁(၇) ပတ်ဝန်းကျင်စီမံခန့်ခွဲမှုအစီအစဉ်

ပတ်ဝန်းကျင်မှုနှင့်လူမှုဝန်းကျင် စီမံခန့်ခွဲမှု အစီအစဉ် [Environmental and Social Management Plan (ESMP)] တွင် စီမံကိန်း ၏ တည်ဆောက်ရေး နှင့် လုပ်ငန်းလည်ပတ်ရေး အဆင့်များတွင် ပတ်ဝန်းကျင်နှင့် လူမှုဝန်းကျင် ထိခိုက်မှုများ ကို မည်ကဲ့သို့ စီမံခန့်ခွဲမည်ကို ဖော်ပြသည့် ဗျူဟာ တစ်ရပ်ပါရှိပြီး စီမံကိန်းကို ရင်းနှီးတည်ဆောက်သူသည် စီမံကိန်း တည် ဆောက်မှု အတွက် ခန့်အပ်ထားသည့် အမိကကန်ထရိုက်တာ နှင့် စီမံကိန်းလုပ်ငန်းခွင် အတွင်း အမျိုးမျိုးသော ရင်းနှီး တည် ဆောက်မှု ပုံစံများကို လုပ်ငန်းလည်ပတ် ဆောင်ရွက်ရန် ခန့်အပ်ထားသည့် စီမံအုပ်ချုပ်သူ အဖွဲ့အစည်းများ စသည့် သက်ဆိုင်ရာ အဖွဲ့အစည်းများ နှင့် ချုပ်ဆိုထားသော စာရွက်စာတမ်းများ

မှတစ်ဆင့် စီမံကိန်းအတွက် လိုအပ် သော သဘာဝပတ်ဝန်းကျင်နှင့်လူမှုဝန်းကျင် စီမံခန့်ခွဲမှုများကိုချမှတ်ဆောင်ရွက်မည့်လုပ်ငန်းမူဘောင်တစ်ရပ်ကိုသတ်မှတ်မည် ဖြစ်သည်။

လုပ်ငန်းအစီအစဉ် ကို အကောင်အထည်ဖော်ဆောင်ရွက်ရာတွင် ပါဝင်မည့် သက်ဆိုင်ရာ အဖွဲ့အစည်းများ၊ ပုဂ္ဂိုလ်များ၏ အခန်း ကဏ္ဍနှင့် တာဝန်များကို ESMP တွင် ရှင်းလင်းတင်ပြထားပါသည်။ ESMP ၏ နောက်ထပ်အရေးကြီးသော ကဏ္ဍ တစ်ခု သည် လေ့ကျင့်သင်တန်းပေးခြင်း နှင့် နိုးကြားစေရန် လှုံ့ဆော်ခြင်း တို့ ဖြစ်ပါသည်။

ESIA လုပ်ငန်းစဉ် ဆောင်ရွက်ခြင်း၊ ပြည်သူလူထု ကို အသိပေးခြင်း၊ တွေ့ဆုံဆွေးနွေးခြင်း ၊ စည်းမျဉ်းချမှတ်ကြီးကြပ်သူ များထံမှ တုံ့ပြန်မှု ရရှိခြင်း၊ ESIA ကို ခွင့်ပြုသည့် အခြေအနေ ၊ တည်ဆောက်ရေး နည်းစနစ်အသေးစိတ်များ၊ အသေး စိတ် ဒီဇိုင်းတို့ ပြီးဆုံးသည် နှင့် တစ်ပြိုင်နက် နောက်ဆုံး ESMP လုပ်ငန်းစဉ်ကိုဆောင်ရွက်ပါမည်။ EMP ၏ သတိပြုရ မည့် ကိစ္စရပ်နှင့် ပြဿနာရပ်များကို Table ES-5 တွင် ဖော်ပြထားပါသည်။

2 INTRODUCTION

2.1 Project Overview

This Document is the Environmental and Social Impact Assessment (ESIA) Report for the proposed Landmark Project (hereinafter will be referred to as the “Project”) located in the Pabedan Township, Yangon, Myanmar. This Report was prepared for the approval of the Ministry of Natural Resources and Environmental Conservation (MONREC) in compliance with the Myanmar Environmental Impact Assessment (EIA) Procedure 2015. This ESIA Report assesses the impacts from activities carried out in the pre-construction, construction, and operational phases of the Project.

As a result of rapid urbanization, economic prospects and a positive growth outlook predicted by Asian Development Bank (ADB), Myanmar’s construction sector is expanding. This is evident in the planning and implementation of a large number of infrastructure projects within and around the main cities. The Country is in need of the development of urban structures to support the current growth and, to achieve its long-term development goals. New roads and highways, upgrading of railway facilities, improvements in telecommunication and construction of power plants, deep sea ports, airports and industrial estates are necessary to attract capital investments from Japan, Korea, Europe and ASEAN (Association of Southeast Asian Nations) neighbours. There is also a keen interest by private developers and the Government in preserving the existing colonial era architecture and other cultural heritage buildings as part of the urbanization process as it is envisaged that this approach will contribute towards long-term financial gains.

In aiming to meet the development demands described above, joint ventures and strategic business partnerships between foreign and local companies are embarking on the development of new hotels, residential, commercial buildings, as well as to restore existing heritage buildings which were vacated when the Government relocated to Nay Pyi Taw. Specifically, Yangon City is set to undergo a major transformation aligned with the strategic urban development theme “Yangon 2040, A City of Green and Gold". This urban development includes efforts to conserve and restore Myanmar's unique heritage buildings.

The Project concept which involves the development of a combination of hotels, office tower blocks, service apartments, condominiums and a retail complex fulfils the development needs described above by providing hotel and residential accommodation and, opportunities for business to operate within the retail complex.

The Project involves a number of strategic business alliances, including the partnership with Mitsubishi Corporation and Mitsubishi Estate for the Business Hotel, the luxury condominium and service apartments, the office towers and the retail podium. The International Finance Corporation (IFC) and the Asian Development Bank (ADB) are also investors in this Project. Both IFC and ADB have conducted an environmental and social due diligence on the project and their findings are available on their corporate websites. IFC has disclosed the Environmental and Social Review Summary and the Environmental and Social Action Plan of the Project. ADB has uploaded on its corporate website the Initial Environmental Examination (IEE).

2.2 Objectives of the ESIA

The goal of an ESIA is to identify potential environment and socio-economic impacts and evaluate the risk of these impacts during the phase of project implementation, namely, the pre-construction, construction and future operation of the Project. As part of this process, the positive effects on the surroundings will be maximized and best practices will be employed to avoid, mitigate and minimize any possible negative impacts. Findings in this Report will demonstrate to MONREC, relevant regulatory authorities and stakeholders on:

- the acceptability of adverse environmental consequences that are likely to arise as a result of the Project;
- the conditions and requirements for the design, construction and operation of the Project to mitigate against adverse environmental consequences; and
- the acceptability of residual impacts after the proposed mitigation measures are implemented.

The Project Proponent is committed to the establishment of environmental and social practices for the Project that not only comply with the legal requirements established by the nation of Myanmar but also to conform to:

- applicable IFC Performance Standards (PS) (IFC, 2012);
- the IFC "Environmental, Health, and Safety General Guidelines" (IFC, 2007a); and
- the EIA principles of the International Association for Impact Assessment (IAIA).

2.3 Presentation of the Project Proponent and Overview

Meeyahta Development Limited (MDL) intends to redevelop the company's existing 6.35 acres plot in the Yangon City Centre into a premium mixed development scheme comprising residential, commercial, retail and hotel components known as the Landmark Project (hereinafter referred to as the "Project"). MDL is a joint venture between Yoma Strategic and its esteemed partners, Mitsubishi Corporation, Mitsubishi Estate, IFC, ADB and First Myanmar Investment Company Limited (FMI).

All enquiries pertaining to the Project shall be submitted to:

Meeyahta Development Limited
The Campus, 1 Office Park,
Rain Tree Drive, Pun Hlaing Estate,
Hlaing Thayar Township,
Yangon, 11401, Myanmar
Tel: +95 1 3687766
Fax: +95 1 3687687, 3687698, 3687699

2.4 Presentation of the Environmental and Social Experts

MDL has appointed ENVIRON Myanmar Co. Ltd., (ENVIRON) to conduct an ESIA for the Landmark Project in Yangon. ENVIRON Myanmar is a global environmental consultancy with Myanmar entity, registered since February 2014. ENVIRON combines resources across geographic boundaries and technical and scientific disciplines to provide clients with the best, most responsive team — whether responding to existing challenges, evaluating opportunities to improve performance, or seeking to reduce future liabilities. Despite its young establishment in Myanmar, ENVIRON has already made its presence known and has been awarded various IEEs and ESIA projects.

The ESIA Team involved in the Project including their qualifications are provided in **Table 2.1**.

Table 2.1: ENVIRON Personnel for the ESIA and Their Qualifications

Name	Qualification	Responsibility
Dr. Virginia Alzina	B.A./ M.A. in Sociology MSc. In Environmental Sciences Ph.D. in Environmental Engineering and Management	Socio-economic analysis, cultural heritage, landscape, visual, public participation, traffic and health and safety
Mr. Neil Daetwyler	B.Sc. Engineering Geology; Chartered Engineer, Chartered Environmentalist	Senior Quality Control and Environmental Reviewer
Mr. Roger Leung	B.Eng. Mechanical Engineering, M.Sc. Civil & Structural Engineering	Senior Air, Noise and Vibration Specialist
Ms. Vijayalakshmi Benjamin Samuel	B.Sc., M.Sc., Biotechnology, MBA	Project description, Water, Soil and groundwater, waste
Mr. Andy Cheung	M.Sc. Building Service Engineering, M.Sc. Environmental Engineering	Green Building Design
Ms. Chiara Metallo	MSc, Physics and Geophysics, FIAQM, MIEnvSC	Senior Air Quality Specialist
Dr. Flordeliz Guarin	Ph.D. (Environmental Biology) M.Sc. (Marine Biology) B.Sc. (Zoology) Certified US Green Building LEED (Leadership in Energy and Environmental Design) Green Associate	Director; Environmental Expert
Mr. Josiah Bolwes	M.S in Water and Wastewater Engineering	Senior Water Quality, Field Specialist
Dr. Zin Mar Lwin	Ph.D. in Environmental Science M. Agr. Sc. (Crop Science) B. Agr. Sc. (Agricultural Science)	Environmental and Agricultural Expert

Name	Qualification	Responsibility
Dr. Raoul M. Cola	Ph.D. Philippine Studies, Society and Culture MA Philippine Studies, Society and Culture BA Political Science	Social advisor
Dr. Khin OO	Ph.D. Agricultural Extension M. Agr Sc Agricultural Extension B. Agr. Sc Agriculture	Socio-economic Specialist
Ms. Kaythi Soe Myint	M.P.H Primary Health Care and Social Health	Administrative manager and health expert
Ms. Khaing Thwe Oo	M.E Chemical Engineering M.E Air Quality	Air quality and chemical engineer

All enquiries pertaining to this study shall be directed to:

ENVIRON Myanmar Limited
4th Floor, Building17, MICT Park
Hlaing Township, Yangon
Telephone: +95 1 654 914

This ESIA prepared for the Project has been undertaken with technical and project-related input from the following team of engineers and architects:

Project Management:

SPA Design & Project Services Ltd.
A member of YOMA Strategic Holdings Group
#372 - 380, Bogyoke Aung San Road
Pabedan Township,
Yangon, Myanmar
Telephone: + 95 1 9253 871

Project Engineer:

Meinhardt (Thailand) Ltd.
6th, 15th, 16th Floor, Thanapoom Tower
1550 New Petchburi Road
Makkasan, Ratchtevee
Bangkok 10400, Thailand
Telephone: +66 2207 0568
Fax: +66 2207 0574
www.meinhardtgroup.com

Project Architect:

Balmond Studio
Unit 9, 190a New North Road
London N1 7BJ
United Kingdom

2.5 Reference to Other Study Reports

MDL has undertaken multiple supporting studies which contributed to the ESIA. These include the following:

- Traffic Impact Assessment;
- Hazardous Materials and Contaminated Land Survey;
- Geotechnical Investigations;
- Ground Investigations;
- Groundwater Survey at Downtown Yangon, Myanmar;
- Utilities Survey;
- Pile Load Test for constructions and testing; and
- Structural Dilapidation Survey Report;
- Heritage Impact Assessment Report – Former Myanmar Railways Headquarters Building & Historic Neighbourhood; and
- Former Myanmar Railways Headquarters Building – Architectural Heritage Survey Report.

3 POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

In order to promote environmentally sustainable development, the Government of Myanmar has established the necessary legal and institutional requirements to ensure that environmental and socio-economic factors are deliberated during the early stages of project planning.

Under Section 42 (n) of the National Environmental Conservation Law the Ministry of Natural Resources and Environmental Conservation (MONREC) has been empowered to enforce requirements of the necessary rules to implement the Law. Under the provision of this Law, the MONREC has prepared Environmental Impact Assessment (EIA) Rules and Regulations (in 2014), that requires any project likely to have a significant impact or change on the environment to undertake an environmental impact assessment and obtain approval for implementation of the project. The Rules define the EIA as the process of assessing the significant impacts of a proposed project on the physical, biological and socio-economic environment and includes an Environmental Management Plan (EMP) and a social impact assessment report. The submission of this ESIA to MONREC for approval prior to project commencement is a legal requirement. This has been confirmed by the Yangon City Development Committee's (YCDC) Environmental Conservation Department.

MDL has commissioned ENVIRON to prepare an ESIA for the Project which complies with applicable national laws, rules and regulations issued by the Myanmar government agencies, as well as to satisfy current international best practice stipulated under the International Finance Corporation Performance Standards (2012).

3.1 Corporate Environmental and Social Policies

3.1.1 Environmental, Health and Safety Policy

MDL, as part of Yoma Strategic Holdings group of companies, has adopted a comprehensive Environmental, Health and Safety (EH&S) Policy. The objective and commitments of the EH&S policy are outlined in **Figure 3.1**.

3.1.2 MDL's Environmental and Social Management System

Environmental and Social Management System (ESMS) is a set of Management and Procedures which allow an organization to analyze, control, reduce the environmental and social impacts of its activities, minimize risks and improve operational efficiency. MDL, as part of Yoma Strategic Holdings group of companies, has adopted the ESMS of the Group as well as the ESMS at the project level.

An ESMS is composed of standard operating procedures (SOPs) which explain how a policy is to be implemented and serve as an instructional resource to deliver consistent results, high quality products and services. IFC's relevant performance standards have been followed to best focus on resources management, environmental management and occupational health and safety.

Figure 3.1: Yoma Strategic Holding' Environmental, Health and Safety Policy

Yoma Strategic Holdings Ltd - EH&S Policy

YOMA
STRATEGIC HOLDINGS LTD.

Objective

Yoma Strategic Holdings Ltd ("YSH") and its subsidiaries ("the Group") have implemented its policy on 'Environment, Health and Safety' in support of a Group wide Corporate Governance framework, to:

- foster greater awareness of sustainable approaches across the group;
- enhance its capabilities to identify and manage adverse impacts from all business activities; and
- instill a culture of 'no harm, less pollution and wider conservation approaches to protect the environment' in all business operations.

Our commitment

In line with International Finance Corporation's (IFC) Performance Standards, Asia Development Bank's (ADB) Safeguard policy, national environmental policies and other applicable laws, the Group is required to safeguard the environment by:

- incorporating environmental and social considerations into business strategy, and allocate adequate resources to manage EH&S risks associated with projects;
- promoting a safe, clean and healthy environment and better work culture to minimise any adverse environment, health, safety and social impacts arising out of operations;
- establishing EH&S system and processes to adhere & comply with applicable legislation, regulations and other requirements pertaining to environment, health, safety, labour and community at large;
- optimising the energy and resources with minimising wastes, increasing use of environmentally sustainable products, materials and services;
- monitoring, reporting and improving of applicable procedures and performances (where required) regularly; and
- communicating EH&S policy to all employees, contractors, suppliers and business partners.

This policy will be disseminated and published to all employees, contractors, suppliers and business partners together with all updates and clarifications.

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MDL's ESMS highlights the importance and objectives of integrated environmental and social assessment to identify the impacts, risks and opportunities, effective community engagement and the management of environmental and social performance throughout the lifetime of the project through engagement between the clients, employees, affected communities and other stakeholders. Fair treatment, non-discrimination and equal opportunities to workers, maintain an effective worker-management relationship, comply with national employment and labour laws, protect vulnerable categories of workers, enhance the efficiency and productivity of their operations, and strengthen worker commitment and retention are managed to be promoted. In each project-level, approach to resource efficiency and pollution prevention and control in line with internationally disseminated technologies and practices to eradicate level of pollution to air, water and land has been considered.

MDL's performance standards are to avoid or minimize risks and impacts on the health and safety of the affected communities from normal and abnormal operations during the project life-cycle and, to ensure that safeguarding the project personnel and property is carried out in accordance with relevant human rights principles and minimizing risks to the affected communities. Avoiding physical or economic displacement or minimize impacts on displaced individuals or communities through appropriate measures such as fair compensation and improving livelihoods and living conditions are regarded group's top priority. MDL protects and conserves biodiversity and ecosystem, avoid and mitigate threats to biodiversity arising from business activities. The performance standards ensure the right of indigenous peoples. Business activities might not limit their economic, social and legal status and are required to ensure that respecting the identity, culture and natural resource-based livelihood of indigenous people and reduce exposure to impoverishment and disease. The objectives of performance standard also focus to protect properties and sites of archaeological, historical, cultural, artistic, religious and other unique environmental features and avoid damage to cultural heritage due to business activities.

Environmental and social (E&S) screening and due diligence of potential project is part of MDL's ESMS conducting screening process to establish the mitigation measures necessary in reducing any identified environmental and social risks. Site visit is part of screen process to fully understand potential environmental and social risks associated with the project and results will be categorized according to groups risk rating definition, treated with mitigating action.

The group has the Policy of Labor and working conditions which meets all relevant national laws, ILO (International Labour Organisation) fundamental core and comply with laws, regulations and legal requirements applicable. All employees are inducted and provided with an employee handbook and company ensure business partners must follow similar fundamental rules in employment. Occupational health and safety (OH&S) management promotes a safe and healthy working environment by providing an effective framework that allows to identify and control its health and safety risks, reduce the potential for accidents, aid legislative compliance and improve overall operational performance. The group's OH&S policy provide guidelines to safe and healthy work environment through establishing, implementing and maintaining an effective occupational health and safety management program to achieve overall group's objectives and targets.

Land acquisition due to the business activities which may result in relocation or loss of shelter and economic displacement of individuals or communities. MDL's resettlement plans are built around a development strategy, compensation, resettlement and rehabilitation packages that is designed to improve or at least restore the economic and social base of those being relocated by business activities. The contents and level of resettlement plan will vary with

circumstances, particularly the magnitude of resettlement. A mechanism has been opened for stakeholder engagement and Community Grievance. Stakeholder engagement consultation will be undertaken during all phases of the project and intend to communicate project progress, material changes to the project, record grievances received, and corrective action taken. It must be revised regularly, documented and reviewed all documented consultation on regular basis. All employees, workers, stakeholders and affected communities can voice their concerns and opinion with dignity via an impartial decision marker. The procedures are made available on the group's websites and notice board throughout the organization. All grievances received must be forwarded to the relevant personnel and implemented according to response mechanism. The group will disclose relevant information of the project and seek acknowledgement of the stakeholders and local community. Communication will be make available to reach the relevant stakeholders in appropriate manner and make it accessible. The group holds public consultation and willing to participate in stakeholder engagement. Necessary consultation is required for the projects with potential impact to the local community. Development decisions will be based on community values, rather than economic values. The assessment covers the scope of the affected area, the extent and significance of impacts resulted from proposed development and potential cumulative impacts to the affected communities.

Emergency Preparedness and Response is also another key component of ESMS. The purpose of emergency preparedness is to ensure the organization has developed and communicated plans that will allow for the effective management of emergencies. In the Emergency Response Plan (ERP), all key personnel can be notified within the shortest period of time and appropriate immediate actions be taken to mitigate the consequences of an incident/accident. The group's emergency response is a combination of physical action and management support to deal with major decision. To prepare and evaluate the effectiveness of the program, periodic based emergency drill will be conducted.

MDL is committed to provide biodiversity management on affected environment, with particularly focus on on-site disturbance at designated site, off-site impacts on surrounding habitats, disturbance and fragmentation impacts and sourcing of material impacts.

Project specific resource efficiency plans has been developed and the group implement feasible measures for improving efficiency in consumption of energy, water and other material inputs. Using resources efficiently will make an easy way to maintain a strong focus on their performance, predominantly looking at financial measures and their interaction with community and with a physical environment. YCDC service will be sought to discharge hazardous materials from site usage. Disposal area must be set up on site and all damaged and used materials must be discharged in the designated area. Effluent water from the site will be run off either to the ground or reuse as treated water.

All persons responsible for undertaking work during the project must be trained based on individual requirements. Managers will identify the knowledge and skills necessary for implementation of the management systems and programs and identify training requirements in accordance with company's rules and regulations. Training material will be customized and vary from written manuals, online programs, computer-based training and audio lessons. MDL applies own routine corporate monitoring and reporting programs. In addition to routine monitoring, the group will undertake regular audits of compliance with the ESMS and overall implementation. Frequency of the audits may be varied depending on the project and results will be make available to regulatory authorities and systematically documented. The audit will address the performance of both the group and any contractors and subcontractors. To ensure

whether the works undertaken are in accordance with the specification and contractual requirements, project director may take overall supervision of the construction of the project and monitoring the works done by contractor and environmental coordinator.

OH&S Team/ Safety personnel will be responsible to monitor the health and safety of employees, visitors and the public, carry out regular inspection during construction, reporting to the group on a regular basis and supervising the contractor's activities. Contractors are assigned to inspect if of the health and safety protection is carried out as indicated. Violation may be reported to relevant managers. Environmental Coordinator is responsible for carrying out environmental and social monitoring program and evaluate environmental risks and impacts. Environmental Management will become routine function during construction and operational phases. Risk Management will be reviewed in accordance with requirements including annual audit and investment partner reporting requirements such as IFC's requirements. Contractors will be required to allocate the responsibility of overseeing compliance with the company's standard and responsible for the implementation of all measures in IFC's standard. The principal contractor will be responsible for the implementation of all measures included in the ESMP for all activities undertaken in terms of the construction contract. Compliance reviews will be submitted by the principal contractor to the relevant management team on a periodical basis. Systematic mitigation measurement will be required after project phase by accessing, rechecking and overviewing in accordance with company's SOPs. Facility management, process improvements, compliance, relationships with the local community and the supply chain will be followed up in accordance with terms of reference. Recruiting and management assets, adjusting budgets and receiving and handling complaints will be taken care by responsible stakeholders and senior management.

3.2 Policy and Legal Framework

3.2.1 Environmental Related Legislation

This Section reviews the policy and legal framework and structures set up to protect the environment, as well as ongoing activities that are intended to promote sustainable development and environmental protection.

The Project Proponent is committed to comply with the current laws, regulations, notifications, instructions and procedures enacted by Myanmar Government and relevant regional authorities as well as those related to the environmental conservation specified by MONREC and other relevant authorities.

3.2.1.1 National Environmental Policy (1994)

The National Environmental Policy of December 1994 integrates environmental considerations into the development process and acknowledges that, while there is a sovereign right to use natural resources, environmental protection should be the primary objective at all times.

This policy states: *The wealth of a nation is its people, its cultural heritage, its environment and its natural resources. The objective of Myanmar's environment policy is aimed at achieving harmony and balance between these through the integration of environmental considerations into the development process to enhance the quality of the life of all its citizens. Every nation has a sovereign right to utilize its natural resources in accordance with its environmental policies, but great care must be taken not to exceed its jurisdiction or infringe upon the interests of other nations. It is the responsibility of the State and every citizen to preserve its natural*

resources in the interest of present and future generations. Environmental protection should always be the primary objective in seeking the development."

3.2.1.2 Myanmar Constitution (2008)

The 2008 Constitution affirms that the Government will conserve Myanmar's natural environment and that the National Parliament can enact environmental and other protective laws.

3.2.1.3 Environmental Conservation Law (2012)

The Environmental Conservation Law was enacted in March 2012 and is Myanmar's first environmental legislation. The Law empowers the Ministry of Environmental Conservation and Forestry (MOECAF) to establish a system for environmental impact assessment to regulate projects that may result in significant environmental impacts.

The Environmental Conservation Law was enacted to implement the national environmental policy of 1994. It lays down basic principles and provides guidance to systematically integrate environmental conservation matters with the sustainable development works. The Law paves the way for the preparation of EIAs and/ or SIAs. In addition, some MOECAF broad powers granted under the law require the approval of the Union Government and the Environmental Conservation Council (ECC) but without the clear power and basis for the approval.

Specifically, it emphasizes the need to reduce air pollution, water pollution and land pollution. It also requires public engagement to increase the awareness of the affected people with respect to environmental pollution and social issues and encourages public participation. The responsibility to enforce these requirements has been given to the MONREC. Chapter IV, Section 7(m) requires the conduct of an Environmental and Social Impact Assessment. Under this chapter, the Law stipulates environmental quality standards on water quality, underground water quality, atmospheric quality, emissions, effluents, solid wastes and other environmental quality standards.

Chapter IX, Section 19 of the Law requires the MOECAF to cooperate with the relevant Government departments and organizations for the conservation of cultural heritages sites, and cultural monuments for the benefit of current and future generations.

The obligations of Business Owners and Occupiers under the Environmental Conservation Law is that the polluter must clean, discharge, dispose or keep pollutants in accordance with the prescribed standards. The owner or occupier of business activities, materials or places that are the source of the pollution must install or use an on-site facility or controlling equipment to monitor, control, manage, reduce or eliminate environmental pollution. If this is not possible, it must be arranged to dispose the wastes in accordance with environmental sound methods.

No one shall violate any prohibition contained in the rules, notifications, orders, directives and procedures issued under the Environmental Conservation Law. The violation of this prohibition constitutes an offence punishable by imprisonment with a term not exceeding 1 year, a monetary fine, or both.

Overall, the Law has listed a set of broad principles and empowers MOECAF to enforce environmental standards, environmental conservation, conservation of natural and cultural resources, process for businesses to apply for permissions to engage in an enterprise that has the potential to damage the environment, stipulates the prohibitions and describes the offences and their respective penalties.

3.2.1.4 Environmental Conservation Rules (2014)

The Environmental Conservation Rules 2014 detail the environmental policy and implementation framework of the 2012 Environmental Conservation Law. According to the Rules, MONREC with the approval of the Environmental Conservation Committee is authorized to prescribe: (a) the amount of liability owing from a person or entity causing environmental damage; and (b) the amounts of contribution to be made to the Environmental Management Funds by persons or entities engaged in environmental services and extraction of natural resources.

The Ministry is also authorized to specify: (a) the projects, businesses, services, or investments for which EIA must be conducted; and (b) the businesses, work sites, or factories that can potentially damage the environment for which prior permission from the Ministry must be sought. The second list must be approved by the Union Government and confirmed by the Committee. However, it is important to note that even if a project, business, service, or investment does not fall under those for which EIA must be conducted, the Ministry may still require an Initial Environmental Examination in order to determine whether an EIA is in fact necessary. Additionally, companies must seek the confirmation of the Ministry before appointing an EIA service provider.

3.2.1.5 Environmental Impact Assessment Procedure (2015)

The Environmental Conservation Law, under Section 42(n) gives the responsibility to MOECAF to issue necessary rules to implement the law. Under this provision, the Ministry has issued the Environmental Impact Assessment Rules and Regulations.

The Environmental Impact Assessment Rules define the EIA as the process of studying the significant impact of a proposed project on the physical, biological and socioeconomic environment and includes an environmental management plan and a social impact assessment report. It also states that every project proponent is required to carry out an Environmental Impact Assessment of a proposed project and shall prepare an Environmental Impact Assessment Report detailing every stage of the assessment and its conclusion to MONREC, the successor of MOECAF.

The Environmental Impact Assessment Procedures came into effect in December 2015 and provides legislation for environmental and social governance of economic development in Myanmar, under the Environmental Conservation Law 2012 and Environmental Conservation Rules 2014 of the National Environmental Policy for Myanmar 1994. The procedures define requirements for EIA and IEE. The procedures strengthen the Environmental Conservation Law. The newly approved procedures outline screening and scoping criteria that define which projects may be subject to the regulation. According to the regulation, the proposed Project is classified as a project requiring a full EIA under the Category of (VII) (10) “Infrastructure – construction of multi-stories and apartment building with height more than 60m”.

3.2.1.6 Myanmar Investment Law (2016)

The new Myanmar Investment Law 2016 (MIL 2016) has been enacted on 18 October 2016. The new MIL is a consolidation of the Myanmar Citizen Investment Law (2013) and the Myanmar Foreign Investment Law (2012). It lays down the legal framework and core principles of the new investment regime and left it to further rules and notifications to flesh out the framework.

The Investment Rules (the Rules) were published by the Ministry of Planning and Finance on 30 March 2017 and the so-called Negative List was published on 10 April 2017 via Notification 15/2017.

The Myanmar Investment Commission (MIC) had already published Notification No. 10/2017 dated 22 February 2017 announcing the determination of tax exemption zones (the Notification 10/2017), Notification No. 11/2017 dated 3 March 2017 which delegates certain decision-making powers for the endorsement process to the regional and state-level investment committees (the Notification 11/2017) and Notification No. 13/2017 dated 1 April 2017 prescribing the classification of promoted sectors (Notification 13/2017).

3.2.1.7 Myanmar Investment Commission Notification (2013)

The MIC Notification includes a list of Economic Activities Permitted with Specific Conditions (Item 3.3 in Notification 1) which require Environmental Impact Assessments. These include construction of large-scale residential buildings, construction of large-scale hotels and conducting business activities at significant monument places related to history and cultural (22).

3.2.1.8 Conservation of Water Resources and Rivers Law (2006)

The aims of this Law are as follows;

i) to conserve and protect the water resources and rivers system for beneficial utilization of the public;

ii) to enable smooth and safe waterways navigation along rivers and creeks;

iii) to contribute to the development of the State economy through improving water resources and river system; and

iv) to protect against environmental impacts.

3.2.2 Occupational Health & Safety Related Legislation

3.2.2.1 Law on Safety and Health in the Workplace (2014)

The Law on Safety and Health in Workplaces drafted by the Ministry of Labor, Employment and Social Security, has been promulgated in 2014. This Law, which shall complement the Factories Act (1951) and other prevailing laws, rules and regulations governing workplace safety and health. The Law contains provisions for the prevention of workplace hazards and diseases and the establishment of safe and healthy workplace.

3.2.2.2 Occupational Safety and Health Law (Draft) (2017)

The objectives of this Law are as follows:

i) to effectively implement measures related to safety and health in every industry;

ii) to establish the duties and responsibilities of those who are responsible under this Law, including Workers and Employers, so as to reduce workplace accidents and occupational diseases;

iii) to work with employers, workers and others who are responsible under this Law to prevent accidents and occupational diseases in the increasing number of workplaces as a result of economic growth; and

iv) to set occupational safety and health standards which reflect the context of Myanmar while conforming with the regional and internal ones so as to create safe and healthy workplaces.

3.2.2.3 Social Security Law (2012)

The objectives of this Law are as follows:

i) to support the development of the State's economy through the increase of production to enjoy more security in social life and health care of workers who are major productive force of the Union by the collective guaranty of the employer, worker and the Union for enabling to fulfil health and social needs of the workers;

ii) to enjoy more security in social life and health care by the public by their voluntary insurance;

iii) to raise public reliance upon the social security system by providing benefits which are commensurate with the realities;

iv) to have the right to draw back some of the contributions paid by the employers and the workers as savings, in accord with the stipulations; and

v) to obtain the right to continued medical treatment, family assistance benefit, invalidity benefit, superannuation benefit, survivors' benefit, unemployment benefit, the right to residency and ownership of housing after retirement in addition to health care and pecuniary benefit for sickness, maternity, decease and employment injury of the workers.

In this Law, formation of social security offices, hospitals, clinics and appointing staff; social security system and benefits; applicability to employment injury benefit insurance system of employment injury benefit fund and benefits; provisions relating to both social security fund and employment injury benefit fund; establishing and maintaining the social security fund and employment injury benefit fund; contributing and subsidization from the union consolidated fund; taking administrative action, settlement of disputes and appeal were stated.

3.2.2.4 Minimum Wage Law (2013)

The Minimum Wage Law came into effect on 4 June 2013 and the minimum wage was determined in August 2015. Minimum wage is prescribed for all enterprises with more than 15 employees. This Law was enacted to meet with the essential needs of the workers, and their families, who are working at the commercial, production and service, agricultural and livestock breeding businesses and with the purpose of increasing the capacity of the workers and for the development of competitiveness.

3.2.2.5 Employment and Skill Development Law (2013)

Employment and Skill Development Law was enacted on 30 August 2013. This Law covers creating job opportunities, reducing the unemployment rate, developing discipline and capability of employees. The Law also covers conducting training to employees systematically and technically, dispatching employees to attend external training courses to promote their skills in the workplace. The Law allowed using youths over 16 years of age as apprentices and giving them trainings in accordance with rules and regulations laid down by the Skills Development Association.

3.2.2.6 The Workmen Compensation Act, 1923 (amended 2005)

In the Workmen's compensation Act, 1923, the expression "Kyats 2,160 and Kyats 7,200" contained in clause A (i) of sub-section (1) of section 4, the expression "two hundred Kyats" contained in clause A (ii) of sub-section (1) of section 4, the expression "Kyats 3,024 and Kyats 10,080" contained in clause B (i) of sub-section (1) of section 4, the expression "twelve hundred Kyats" contained in clause B (ii) of sub-section (1) of section 4, the expression.

- "one hundred Kyats" contained in the proviso of sub-section (1) of section 8 shall be substituted respectively by the expression "the amount of compensation prescribed by notification by the Ministry of Labour, with the approval of the Government."

The expression “subject to a maximum of thirty Kyats" contained in clause D (ii) of sub-section (1) of section 4 of the Workmen's Compensation Act, 1923 shall be deleted.

The expression "ten Kyats" contained in sub-section (2) of section 8, the expression "twenty-five Kyats" contained in sub-section (4) of section 8, the expression "three hundred Kyats" contained in the first proviso of sub-section (1) of section 30 of the Workmen's Compensation Act, 1923 shall be substituted respectively by the expression "the amount of money prescribed by notification by the Ministry of Labour, with the approval of the Government.

The expression "shall be punishable with fine which may extend to one hundred Kyats" contained in sub-section (1) of section 18 A of the Workmen's Compensation Act, 1923 shall be substituted by the expression "shall be punishable with fine which may extend to Kyats 10,000."

3.2.2.7 Public Health Law (1972)

The purpose of this Law is to ensure the public health include not only the employees but also the public as well as cooperation with the Health Department. This Law involves the protection of public health by controlling the quality and cleanliness of food, drugs, environmental sanitation, epidemic diseases and regulation of private clinics. The project owner is required to cooperate with the authorized person or organization in line with the Sections 3 and 5 of the said Law.

3.2.3 Cultural and Heritage Related Legislation

3.2.3.1 Law on the Preservation and Protecting of Ancient Buildings (2015)

The objectives of this Law are:

i) to implement the protection and preservation policy for the perpetuation of ancient monuments which have existed for many years;

ii) to protect and preserve cultural heritage regions and ancient monuments so that they are not destroyed by natural disaster or man;

iii) to uplift hereditary pride and to cause dynamism of patriotic spirit of citizens by protecting and preserving cultural heritage regions;

iv) to promote public awareness and will as to the high value of the protection and preservation of cultural heritage regions;

v) to explore and preserve new ancient monuments;

vi) to protect cultural heritage regions from destruction; and

vii) to implement protection and preservation of ancient monuments in conformity with international conventions and regional agreements.

3.2.4 The City of Yangon Development (Amendment) Law (1996)

This Law was enacted in 1996 to ensure that the development of the City of Yangon is carry out effectively, the duties and responsibilities of the committee were stated at the Section 7 of Chapter 3.

3.2.5 Guidelines for High-rise Building Construction Projects (Water Supply and Sanitation) (2017)

Guidelines for High-Rise Building Construction Projects (Water Supply and Sanitation) was enacted on 23 February 2017 by the Committee for Quality Control of High-rise Building Construction Projects (CQHP).

All designs on High-Rise Building (HRB) undertaken by a foreign firm/ company shall be duly endorsed/ countersigned by a Professional Engineer (Water Supply and Sanitation) when submitting an application for a HRB Project to CQHP.

Under this Guidelines, there are 9 sub-guidelines as listed below:

Guideline I – Site Inspection

Guideline II - Geotechnical Investigations Related to Sanitary Works

Guideline III – Cold and Hot Water Supply

Guideline IV – Sanitation

Guideline V – Garbage Collection and Disposal

Guideline VI – Design Concepts and Calculations (Water Supply)

Guideline VII – Design Concepts and Calculations (Sanitation)

Guideline VIII – Water, Sanitation and Plumbing-Related Drawings

Guideline IX – Operation and Maintenance

3.2.6 The Fire Force Law (2015)

The Fire Force Law was enacted on 17 March 2015 and the objectives of Myanmar Fire Force Law are:

i) to take precautionary and preventive measure and loss of state own property, private property, cultural heritage and the lives and property of public due to fire and other natural disasters;
ii) to organize fire brigade systemically and to train the fire brigade;
iii) To prevent from fire and to conduct release work when fire disaster, natural disaster, epidemic disease or any kind of certain danger occurs;
iv) To educate, organize an inside extensively so as to achieve public corporation; and
v) To participate if in need for national security, peace for the citizens and law and order.

The relevant Government Department or organization shall, for the purpose of precaution and prevention, obtain the approval of the Fire force Department before granting permission for the following cases:

i) Constructing three-storied and above buildings market and condominium buildings;
ii) Operating hotel, motel, guest house enterprise;
iii) Constructing factory, workshop, storage facilities and warehouse;

iv) Operating business expose to fire hazard by using in inflammable materials or explosive materials; and

v) Producing and selling fire-extinguishing apparatuses.

The relevant Government Department or organization shall obtain the opinion of the Fire Services Department for the purpose of fire precaution and prevention, when laying down plans for construction for town, village and downtown or village development plans.

3.3 Government Institutional Framework

3.3.1 National Commission for Environmental Affairs/ MONREC

The National Commission for Environmental Affairs (NCEA), also known as the Environmental Conservation Committee, was formed in 1990. It was then chaired by the Minister of Foreign Affairs until 2005 when the NCEA was transferred under the Minister of Forestry (MoF) who assumed the role of the NCEA chairperson. At this point, the NCEA became MOECAF and finally changed as the present MONREC in 2016. The responsibilities of the MONREC include the setting of environmental standards, creating environmental policies for using natural resources and laying down rules and regulations for control pollution, as well as to create short and long-term environmental policies, which balance environmental needs with development requirements.

3.4 National Environmental Quality (Emission) Guidelines (2015)

MONREC promulgated the National Environmental Quality (Emission) Guidelines (NEQEG) for general and industry-specific, that provide the basis for regulation and control of noise, vibration, air emissions, and liquid discharges from various sources in order to prevent pollution for purposes of protection of human and ecosystem health by ensuring that pollutant concentrations do not reach or exceed ambient guidelines and standards. The Guidelines apply to projects that generate noise or air emissions, and/or that have either direct or indirect discharge of process water, wastewater from utility operations or storm water to the environment. These Guidelines specifically apply to all project types listed in the EIA Procedure under ‘Categorization of Economic Activities for Assessment Purposes’ which sets out projects that are subject to EIA or IEE.

3.4.1 General Air Emissions Guidelines

The general air emission guidelines will be applied for the projects which have significant sources of air emission and or potential for significant impacts to ambient air quality. The following general air emission guidelines values should be complied.

Parameter	Averaging Period	Guideline Value (µg/m^3)
Nitrogen dioxide (NO_2)	1-Year 1-hour	40 200
Ozone (O_3)	8-hour daily maximum	100
PM_{10}	1-Year 24-hour	20 50

Parameter	Averaging Period	Guideline Value (µg/m³)
$PM_{2.5}$	1-Year 24-hour	10 25
Sulfur dioxide (SO_2)	24-hour 10-minute	20 500

3.4.2 General Noise Level

The general noise level guidelines should be applied when predicted or measured noise impacts form the proposed project activities or its facilities and operation exceed the applicable noise level guideline at the most sensitive point of reception. Noise impact should not exceed the levels shown below.

Receptor	One Hour LAeq (dBA)[a]	
	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

[a] Equivalent continuous sound level in decibels

3.4.3 Effluent Levels

The following guidance values are applicable during construction phase of the proposed Project.

Parameter	Unit	Guidance Value
Biological Oxygen Demand (BOD)	mg/l	30
Chemical Oxygen Demand (COD)	mg/l	125
Oil and grease	mg/l	10
pH	S.U.[a]	6-9
Total coliform bacteria	100 ml	400
Total nitrogen	mg/l	10
Total phosphorus	mg/l	2
Total suspended solids (TSS)	mg/l	50

Note: [a] Standard Unit

3.5 Permit Requirements

The Project is subject to a number of regulatory permits and licenses issued by several different agencies in Myanmar. The primary permits or licenses obtained for the Project and their status (as of August 2018) are as follows:

No	Description	Status	Date Approved
1.	MIC Permit	Approved	15 Jan 2017
2.	Tree Removal Permit	Approved	
	- Early works		1 Nov 2013
	- MEB Pile Load Testing Area		25 Jan 2017
	- Storm Drain Diversion Area		8 Feb 2017
	- Deep Excavation Works at Myanmar Railway Building (MRB)		28 Nov 2016
3.	Demolition Permit		
	- Auxiliary Buildings	Approved	6 Dec 2013
	- Grand Meeyahta	Approved	29 Aug 2016
	- FMI	Approved	19 Dec 2017
	- ZawGyi House	Approved	10 Jan 2017
4.	Temporary Construction Fence Permit	Approved	16 May 2014
5.	Pile Load Test Permit	Approved	28 Dec 2016
6.	D-Wall + Continuous Bore Pile (CBP) Permit	Approved	22 Jan 2018
7.	Piling Permit	Approved	26 Oct 2017
8.	Fire Department Approval	Approved	1 July 2015
9.	Storm Drain Diversion Permit	Approved	10 Jan 2017
10.	Utility Permit (new main power supply line extension and new electrical service to the site)	Approved	18 May 2018
11.	Relocation of existing high voltage cables	Approved	20 Dec 2013
12.	Batching Plant Permit	Approved	16 Oct 2017
13.	Hotel Construction	Approved	4 Aug 2017
14.	Tower Crane Permit	Approved	17 Aug 2017
15.	Excavation and Foundation Permit	Approved	23 July 2018
16.	Construction Permit	Submitted (awaiting approval)	
17.	Offsite Permanent Works	To be submitted	
18.	LPG Tank/ Diesel Storage Tank Permit	To be submitted	
19.	Storm Drain Connection Permit from YCDC Department of Roads & Bridges	To be submitted	
20.	Tube Wells Drilling Permit	To be submitted	
21.	ESIA Approval by MONREC	Approved	20 Nov 2018
22.	Prior Permit by Department of Archaeology and National Museum	Approved	13 Nov 2018

3.5.1 MIC Permit Requirements

MIC Permit was issued on 15 January 2017 (Permit No. 1210/2017) by the MIC according to Section 13, sub-section (b) of the Republic of the Union of Myanmar Foreign Investment Law.

Decision of the MIC on the proposal for "Construction, Management and Leasing of Retail Podium, Branded Residences (Tower – 1), Hotel and Serviced Residences (Tower – 2), Office Towers (Towers – 3 and 4) under the name of Meeyahta Development Limited was also issued together with the MIC Permit dated 15 January 2017. A copy of the MIC Decision was also sent to nine (9) Ministries including MONREC.

The condition from MIC Decision related to environmental conservation is as follows:

No	Conditions from MIC Decision	Action Implemented
1	Meeyahta Development Limited shall be responsible for the preservation of the environment at and around the area of the project site. In addition to this, Meeyahta Development Limited shall carry out as per instructions made by Ministry of Natural Resources and Environmental Conservation in which to conduct and report the ESIA and before the implementation of the proposed project and to submit the EMP which describe the measure to be taken for preventing, mitigation and monitoring significant environmental impacts resulting from the implementation and operation of proposed project or business or activity has to be prepared and submitted and to perform activities in accordance with this EMP to abide by the environmental policy, Environmental Conservation Law and other environmental related rules and regulations meanwhile Meeyahta Development Limited has made a commitment to conduct EMP and ESIA report through ENVIRON.	1) Environmental Impact Assessment has submitted to MONREC in 2013. 2) EMP has been implemented and submitted to MONREC 3) Both ESIA and EMP has abide as per the Environmental Policy, Environmental Conservation Law and other environmental related rules and regulations.

3.5.2 YCDC's HIC Approval in Principle

MDL has obtained Approval in Principle (AIP) from the High-Rise Inspection Committee (HIC) on 14th November 2014 for the Landmark Project (**Annex 1**). The height of the buildings shall not exceed the limit set for the designated project area and the distance of the Project from the Shwedagon Pagoda.

3.6 International and Regional Treaties

Myanmar has signed 31 international treaties related to the environment and those, which are applicable to the proposed Project, are listed in **Table 3.1**. Of this list of international treaties signed by Myanmar, the most relevant for the Project are the ones related to the Ozone Layer, Climate Change and Persistent Organic Pollutants.

Table 3.1: International and Regional Treaties Applicable to the Project

No	Name
1	Vienna Convention for the Protection of the Ozone Layer
2	Montreal Protocol on Substances that Deplete the Ozone Layer
3	London Amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer
4	United Nations Framework Convention on Climate Change (UNFCCC)
5	Vienna Convention for the Protection of Ozone Layer
6	Montreal Protocol on Substances that Deplete the Ozone Layer
7	London Amendment to the Montreal Protocol
8	Kyoto Protocol to the United Nations Framework Convention on Climate Change
9	Stockholm Convention on Persistent Organic Pollutants
10	Copenhagen Amendment to Montreal Protocol on Substances that deplete the Ozone Layer

4 PROJECT DESCRIPTION AND ALTERNATIVE SELECTION

4.1 Project Background

The proposed Project, located at the northwest corner of Bogyoke Aung San Road and Sule Pagoda Road within the Pabedan Township, is a built environment comprises the following main buildings:

i. The FMI Centre: an approximately 17 years old 11-storey building serving as an office and commercial building and was demolished in May 2018;
ii. The Grand Meeyahta Executive Residence: an 18-year-old, 10-storey concrete building which has been vacant since October 2013 and was demolished in June 2017;
iii. Zawgyi House: a former two-storey residential brick building which was used as a restaurant until April 2014 and was demolished in January 2017;
iv. Two residential scale two-storey brick buildings aged approximately 50 years old (old staff house and old church building) which were used for temporary accommodation and storage purposes and was demolished in 2018; and
v. A variety of smaller supporting structures associates with the previous land use.

A more detailed description of the buildings and related structures is presented in **Table 4.1** and shown in **Figure 4.1**.

Table 4.1: Project Site Areas and Features

Area	Features
1	• Two (2-storey residential-scale structures, which are approximately 50 years old (old staff house and old church building). Recently demolished. • Aboveground concrete water tank inside a storage shed north of the old staff house (currently unused) • Aboveground concrete water tank north of the old church building (currently unused) • Vacant, generally unpaved area to the east, west and south of the structures, with bushes, trees and rubbish. Old pump parts, metal scaffolds and rubber pipes observed on the vacant lot south of the old church building
2	• Façade of the Grand Meeyahta Executive Residence and paved driveway entrance to the site. The driveway entrance is lined with trees and shrubs
3	• Concrete block-paved parking area for approximately 100 cars • Former residential two-storey brick structure that was used as a café (Zawgyi House) • Temporary container van offices for Site developers
4	Utilities and parking area for FMI Centre building comprising: • Generator shed for one existing generator (500 kilovolt Amperes-kVA); two more generators (350 kVA and 630 kVA) currently being installed; • Chiller area; • Toilets at the western sector;

Area	Features
	• Storage shed at the western sector; • Waste dumping area at the southwest corner; and • Septic tank area at the western perimeter.

5	• Grand Meeyahta Executive Residence utilities area:
	• Wastewater treatment plant (WWTP) comprising:
	  ○ Concrete aboveground equalisation tank
	  ○ Concrete aboveground aeration tank
	  ○ Steel aboveground sedimentation tank
	  ○ Concrete aboveground sludge storage tank
	  ○ Underground storage tanks 1 (64.07 m^3) and 2 (64.07 m^3)
	• Two chillers;
	• Generator shed; and
	• Oil drums shed.

6	• Parking area for approximately 50 cars; • Grand tube well (TW) 1 at the north-eastern corner; All tube wells on site are approximately 30 m (100 feet); and • Grand waste dumping area at the eastern perimeter.

7	10-storey Grand Meeyahta Executive Residences; each floor with 10 units. Third floor with a garden/ patio. Public areas primarily are the ground floor, first and second floor.
	Approximately 15 years old. Utilities include:
	• Swimming pool with underground water dosing tank to the north
	• Laundry area on the eastern perimeter
	• Restaurants on first and second floors
	• Grease sump at the ground floor restaurant
	• Unused tube well at the north-eastern corner Waste dumping area at the north-eastern corner
	• Raw water treatment plant at the south-western corner comprising:
	  ○ Aboveground concrete raw water tank
	  ○ Tube well (TW2)
	  ○ Treatment tanks
	  ○ Water supply pumps
	• Fire pump room
	  ○ Two transformers
	  ○ Fire pump
	  ○ Underground concrete treated water tank (120 m^3 capacity)
	  ○ 200-L diesel steel aboveground tank for fire pump

Area	Features
8	11-storey FMI Centre; approximately 17 years old. A utilities room is located at the sub-basement level comprising: • One transformer • Two 150-ton chillers and pumps • Two water supply pumps • Fire pump • One 750 kVA generator set and blower • 200-L diesel steel aboveground tank for the generator. Septic tank area north of the FMI Centre. • Two in use tube wells along the western perimeter of FMI

4.2 Project Location

The Project is located in the Yangon Central Business District (CBD) within the Pabedan Township. It covers an area of 25,700 m^2 (6.35 acres) and is bounded by Bogyoke Aung San Road and Sule Pagoda Road. Buildings adjacent to the Project include the Bogyoke Aung San Market, St. Gabriel's Church, Central Railway Station, Sule Shangri-La Hotel, Central Hotel and the main railway line. The overall development site is being shared between the Project and the International Hotel Project of Peninsula Yangon Limited (PYL). The site location of the Project site is shown in **Figure 4.2** and an aerial view of the site and its surrounding areas within a 300 m radius are presented in **Figure 4.3**.

4.3 Project Development and Implementation Time Schedule

The Project will be developed using a phased approach and the project implementation schedule is presented in **Table 4.2**. It is anticipated that the entire project will take approximately 54 months.

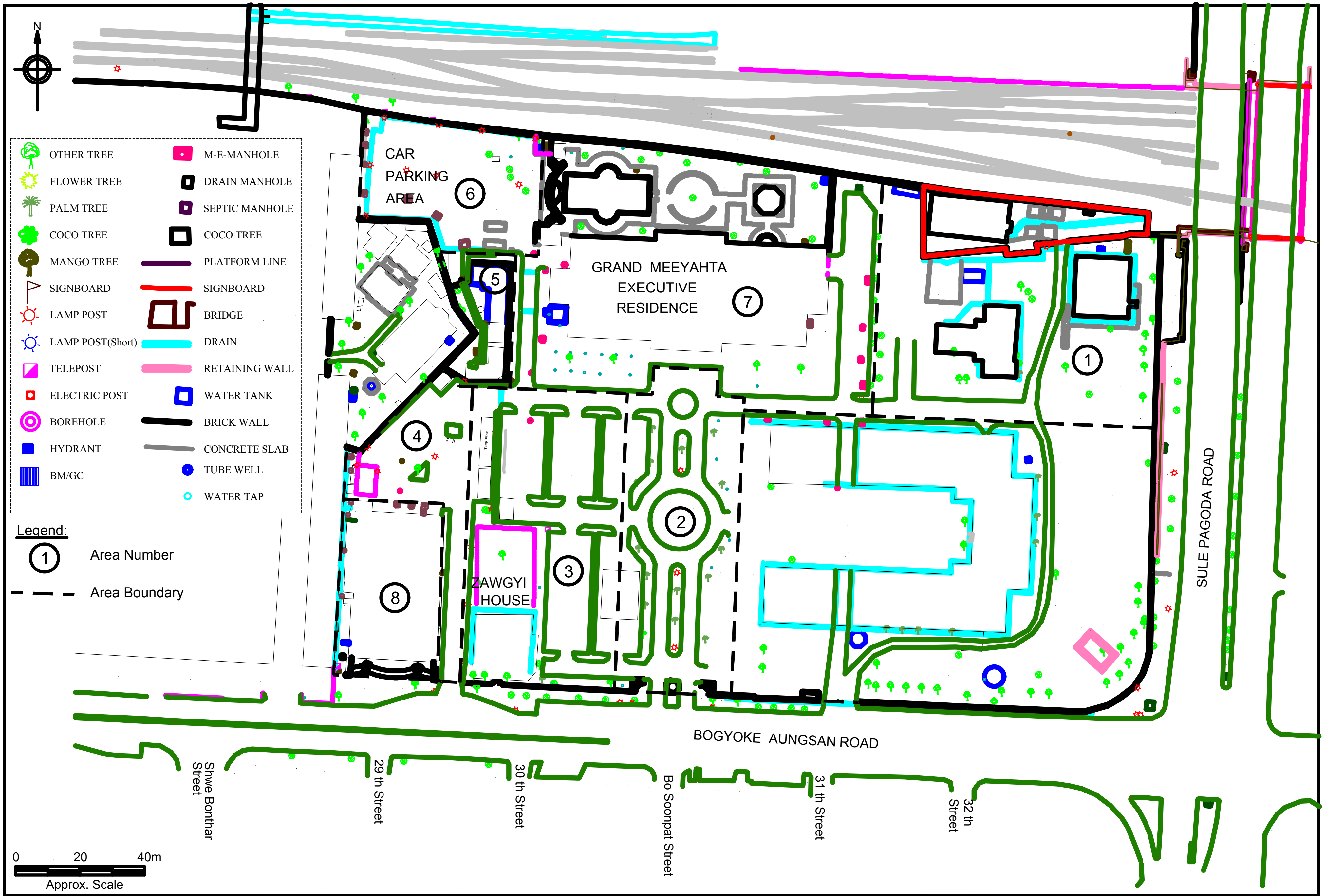

Figure 4.1: Area Location Map

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Figure 4.2: Regional Location of Project Site

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Figure 4.3: Aerial View of Site and the Surrounding Areas within a 300 m Radius

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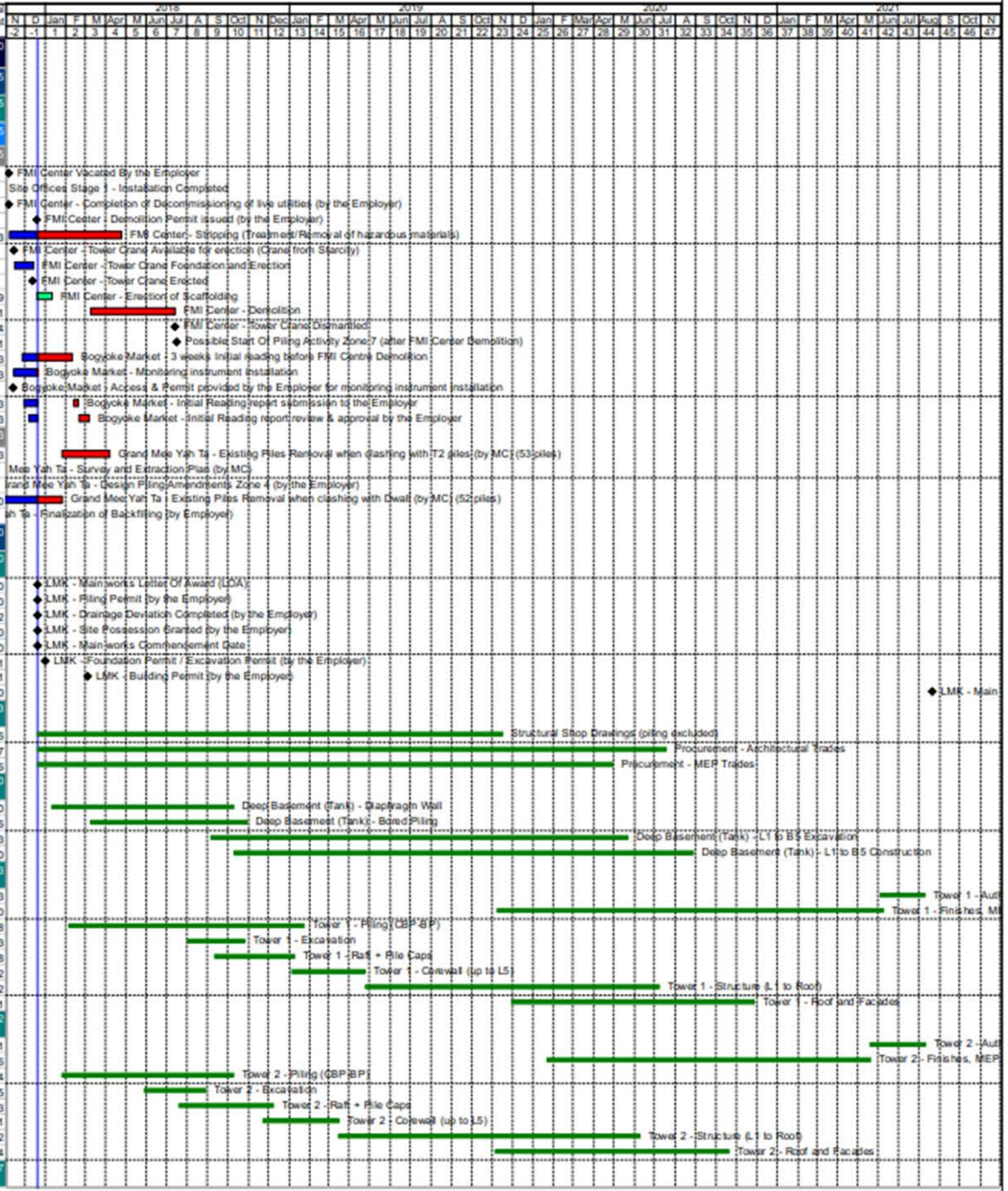
Yoma Central Project - Programme

Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
Yoma Central Project - Program		1090	17-Jun-17 A	20-Aug-21	0
YCP - MAIN WORKS		280	17-Jun-17 A	16-Jul-18	5
Construction		280	17-Jun-17 A	16-Jul-18	5
Enabling Works		280	17-Jun-17 A	16-Jul-18	5
Demolition works (FMI)		195	25-Oct-17 A	16-Jul-18	5
YC-MW-DE-C010	FMI Center Vacated By the Employer	0		07-Nov-17	
YC-MW-DE-C020	Site Offices Stage 1 - Installation Completed	0		25-Oct-17 A	
YC-MW-DE-C030	FMI Center - Completion of Decommissioning of live utilities (by the Employer)	0		07-Nov-17	
YC-MW-DE-C040	FMI Center - Demolition Permit issued (by the Employer)	0		19-Dec-17	
YC-MW-DE-C050	FMI Center - Stripping (Treatment/Removal of hazardous materials)	94	08-Nov-17 A	25-Apr-18	3
YC-MW-DE-C060	FMI Center - Tower Crane Available for erection (Crane from Starcity)	0		15-Nov-17	
YC-MW-DE-C070	FMI Center - Tower Crane Foundation and Erection	24	16-Nov-17 A	13-Dec-17	
YC-MW-DE-C080	FMI Center - Tower Crane Erected	0		13-Dec-17	
YC-MW-DE-C090	FMI Center - Erection of Scaffolding	62	20-Dec-17 A	10-Jan-18	29
YC-MW-DE-C100	FMI Center - Demolition	89	10-Mar-18	13-Jul-18	1
YC-MW-DE-C110	FMI Center - Tower Crane Dismantled	0		13-Jul-18	4
YC-MW-DE-C115	Possible Start Of Piling Activity Zone 7 (after FMI Center Demolition)	0	16-Jul-18		1
YC-MW-DE-C245	Bogyoke Market - 3 weeks Initial reading before FMI Centre Demolition	18	28-Nov-17 A	10-Feb-18	3
YC-MW-DE-C250	Bogyoke Market - Monitoring instrument installation	18	15-Nov-17 A	20-Dec-17	3
YC-MW-DE-C255	Bogyoke Market - Access & Permit provided by the Employer for monitoring instrument instal	0		14-Nov-17	
YC-MW-DE-C260	Bogyoke Market - Initial Reading report submission to the Employer	6	30-Nov-17 A	19-Feb-18	3
YC-MW-DE-C265	Bogyoke Market - Initial Reading report review & approval by the Employer	12	08-Dec-17 A	07-Mar-18	3
Demolition works (GMYT)		243	17-Jun-17 A	07-Apr-18	3
YC-MW-DE-C130	Grand Mee Yah Ta - Existing Piles Removal when clashing with T2 piles (by MC) (53 piles)	58	26-Jan-18	07-Apr-18	3
YC-MW-DM-C210	Grand Mee Yah Ta - Survey and Extraction Plan (by MC)	14	22-Aug-17 A	06-Sep-17 A	
YC-MW-DM-C220	Grand Mee Yah Ta - Design Piling Amendments Zone 4 (by the Employer)	30	07-Sep-17 A	12-Oct-17 A	
YC-MW-DM-C230	Grand Mee Yah Ta - Existing Piles Removal when clashing with Dwall (by MC) (52 piles)	60	13-Oct-17 A	26-Jan-18	0
YC-OT-DE-C010	Grand Mee Yah Ta - Finalization of Backfilling (by Employer)	24	17-Jun-17 A	14-Jul-17 A	
YCP - SUMMARY		1019	26-Aug-17 A	20-Aug-21	0
Summary - Major Key Dates		1030	20-Dec-17	20-Aug-21	0
YCP-SU-KD-030	LMK - Main works Letter Of Award (LOA)	0	20-Dec-17		1030
YCP-SU-KD-050	LMK - Piling Permit (by the Employer)	0		20-Dec-17	1030
YCP-SU-KD-060	LMK - Drainage Deviation Completed (by the Employer)	0		20-Dec-17	-42
YCP-SU-KD-070	LMK - Site Possession Granted (by the Employer)	0		20-Dec-17	1030
YCP-SU-KD-090	LMK - Main works Commencement Date	0	20-Dec-17		1030
YCP-SU-KD-100	LMK - Foundation Permit / Excavation Permit (by the Employer)	0		01-Jan-18	1021
YCP-SU-KD-120	LMK - Building Permit (by the Employer)	0		05-Mar-18	971
YCP-SU-KD-130	LMK - Main Works Completion Date	0		20-Aug-21	0
Summary - General		791	26-Aug-17 A	17-Jul-20	63
SU-DE-SHD10	Structural Shop Drawings (piling excluded)	557	22-Nov-17 A	16-Nov-19	96
SU-PR-PRP30	Procurement - Architectural Trades	723	20-Dec-17	17-Jul-20	57
SU-PR-PRP40	Procurement - MEP Trades	660	26-Aug-17 A	29-Apr-20	126
Summary - Deep Basement (Tank) - Top Down Construction		659	11-Jan-18	27-Aug-20	0
SU-BA-STC10	Deep Basement (Tank) - Diaphragm Wall	180	11-Jan-18	09-Oct-18	0
SU-BA-STC20	Deep Basement (Tank) - Bored Piling	145	10-Mar-18	30-Oct-18	6
SU-BA-STC30	Deep Basement (Tank) - L1 to B5 Excavation	443	06-Sep-18	22-May-20	3
SU-BA-STC40	Deep Basement (Tank) - L1 to B5 Construction	479	11-Oct-18	27-Aug-20	0
Summary - T1 Construction		983	05-Feb-18	09-Aug-21	3
SU-T1-AIC70	Tower 1 - Authorities Inspections, and Hand Over Process	50	04-Jun-21	09-Aug-21	3
SU-T1-FMC60	Tower 1 - Finishes, MEP, Fitting Out	447	08-Nov-19	07-Jun-21	50
SU-T1-STC10	Tower 1 - Piling (CBP-BP)	269	05-Feb-18	22-Jan-19	88
SU-T1-STC20	Tower 1 - Excavation	64	02-Aug-18	25-Oct-18	3
SU-T1-STC30	Tower 1 - Raft + Pile Caps	95	11-Sep-18	08-Jan-19	158
SU-T1-STC40	Tower 1 - Corewall (up to L5)	82	05-Jan-19	24-Apr-19	2
SU-T1-STC50	Tower 1 - Structure (L1 to Roof)	342	25-Apr-19	08-Jul-20	2
SU-T1-STC55	Tower 1 - Roof and Facades	282	30-Nov-19	27-Nov-20	81
Summary - T2 Construction		992	26-Jan-18	10-Aug-21	2
SU-T2-AIC70	Tower 2 - Authorities Inspections, and Hand Over Process	64	20-May-21	10-Aug-21	1
SU-T2-FMC60	Tower 2 - Finishes, MEP, Fitting Out	372	22-Jan-20	19-May-21	66
SU-T2-STC10	Tower 2 - Piling (CBP-BP)	193	26-Jan-18	09-Oct-18	44
SU-T2-STC20	Tower 2 - Excavation	68	29-May-18	28-Aug-18	5
SU-T2-STC30	Tower 2 - Raft + Pile Caps	109	20-Jul-18	08-Dec-18	3
SU-T2-STC40	Tower 2 - Corewall (up to L5)	93	23-Nov-18	15-Mar-19	1
SU-T2-STC50	Tower 2 - Structure (L1 to Roof)	342	16-Mar-19	08-Jun-20	12
SU-T2-STC55	Tower 2 - Roof and Facades	269	06-Nov-19	20-Oct-20	94
Summary - T3 Construction		963	06-Mar-18	11-Aug-21	7



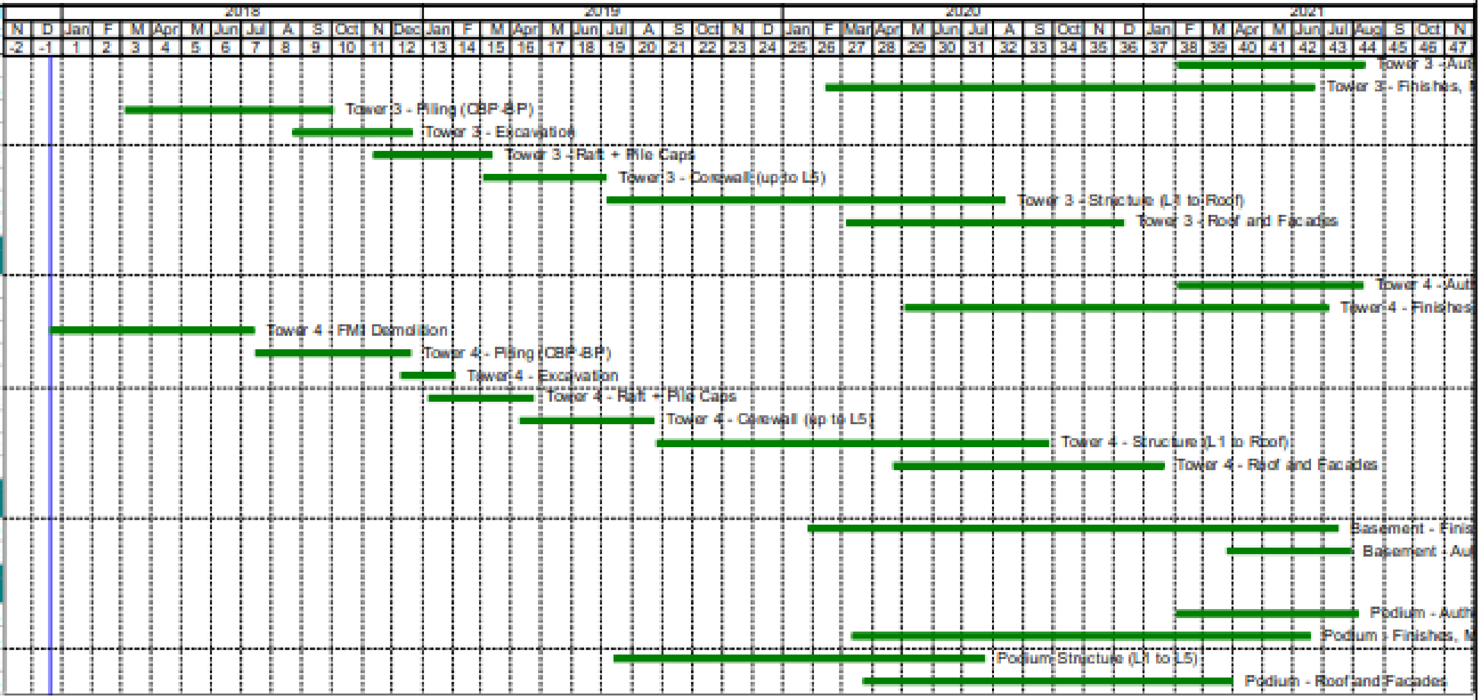
Remaining Level of Effort | Remaining Work | Milestone
Actual Work | Critical Remaining Work

Table 4.2: Project Implementation Schedule

ENVIRON

Yoma Central Project - Programme

Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
SU-T3-AIC70	Tower 3 - Authorities Inspections, and Hand Over Process	140	05-Feb-21	11-Aug-21	1
SU-T3-FMC60	Tower 3 - Finishes, MEP, Fitting Out	380	14-Feb-20	22-Jun-21	45
SU-T3-STC10	Tower 3 - Piling (CBP-BP)	157	06-Mar-18	02-Oct-18	1
SU-T3-STC20	Tower 3 - Excavation	96	24-Aug-18	21-Dec-18	1
SU-T3-STC30	Tower 3 - Raft + Pile Caps	98	13-Nov-18	12-Mar-19	17
SU-T3-STC40	Tower 3 - Corewall (up to L5)	93	04-Mar-19	05-Jul-19	1
SU-T3-STC50	Tower 3 - Structure (L1 to Roof)	308	08-Jul-19	12-Aug-20	0
SU-T3-STC55	Tower 3 - Roof and Facades	214	07-Mar-20	10-Dec-20	193
Summary - T4 Construction		1070	07-Nov-17 A	10-Aug-21	8
SU-T4-AIC70	Tower 4 - Authorities Inspections, and Hand Over Process	139	05-Feb-21	10-Aug-21	1
SU-T4-FMC60	Tower 4 - Finishes, MEP, Fitting Out	334	04-May-20	05-Jul-21	34
SU-T4-STC05	Tower 4 - FMI Demolition	161	07-Nov-17 A	13-Jul-18	1
SU-T4-STC10	Tower 4 - Piling (CBP-BP)	121	16-Jul-18	19-Dec-18	1
SU-T4-STC20	Tower 4 - Excavation	44	11-Dec-18	01-Feb-19	1
SU-T4-STC30	Tower 4 - Raft + Pile Caps	79	08-Jan-19	23-Apr-19	12
SU-T4-STC40	Tower 4 - Corewall (up to L5)	98	10-Apr-19	23-Aug-19	1
SU-T4-STC50	Tower 4 - Structure (L1 to Roof)	308	26-Aug-19	25-Sep-20	2
SU-T4-STC55	Tower 4 - Roof and Facades	216	23-Apr-20	20-Jan-21	1
Summary - Basement Construction		422	27-Jan-20	28-Jul-21	12
SU-BA-FMC60	Basement - Finishes, MEP, Fitting Out	414	27-Jan-20	15-Jul-21	0
SU-BA-TCC60	Basement - Authorities Inspections, and Hand Over Process	90	26-Mar-21	28-Jul-21	12
Summary - Podium Construction		580	15-Jul-19	05-Aug-21	5
SU-PO-AIC70	Podium - Authorities Inspections, and Hand Over Process	137	03-Feb-21	05-Aug-21	5
SU-PO-FMC60	Podium - Finishes, MEP, Fitting Out	356	12-Mar-20	18-Jun-21	25
SU-PO-STC10	Podium Structure (L1 to L5)	288	15-Jul-19	22-Jul-20	14
SU-PO-STC55	Podium - Roof and Facades	290	23-Mar-20	31-Mar-21	65



Remaining Level of Effort | Remaining Work | Milestone
Actual Work | Critical Remaining Work

Table 4.2: Project Implementation Schedule

4.4 Project Description

4.4.1 Land Ownership

Meeyahta International Hotel Limited has leased the land from the Myanma Railways of Ministry of Transport and Communications for International Hotel Project and the Landmark Project together with the agreed and signed built-operate-transfer (BOT). The lease is for an initial period of 50 years commencing 1 January 1998 (**Annex 2**).

4.4.2 Project Components

The Landmark Project involves the establishment of a premium mixed development scheme comprising the following components (**Figure 4.4**):

1. Office Towers
2. Hotel Tower
3. Residential Tower (Serviced Apartment)
4. Retail Podium
5. Basement Parking

The gross floor area of the four major components is tabulated in **Table 4.3** and shown in **Figure 4.5**.

Table 4.3: Major Components of the Landmark Project

Components	Gross Floor Area (m^2)	No. of Units	No. of Storeys
Residential Tower	37,253	101	26
Hotel Tower (Tower 2)			
• Hotel rooms	49,778	280	22
• Serviced apartments		90	
Office Towers			
• Tower 3	44,662	93	18
• Tower 4	39,290	73	18
Retail Podium	37,191		4
Basement Parking		1,253	5

The site plan and layout of the proposed development component of the Project is shown in **Figure 4.6** and **Figure 4.7**, respectively.

Figure 4.4: Project Perspectives

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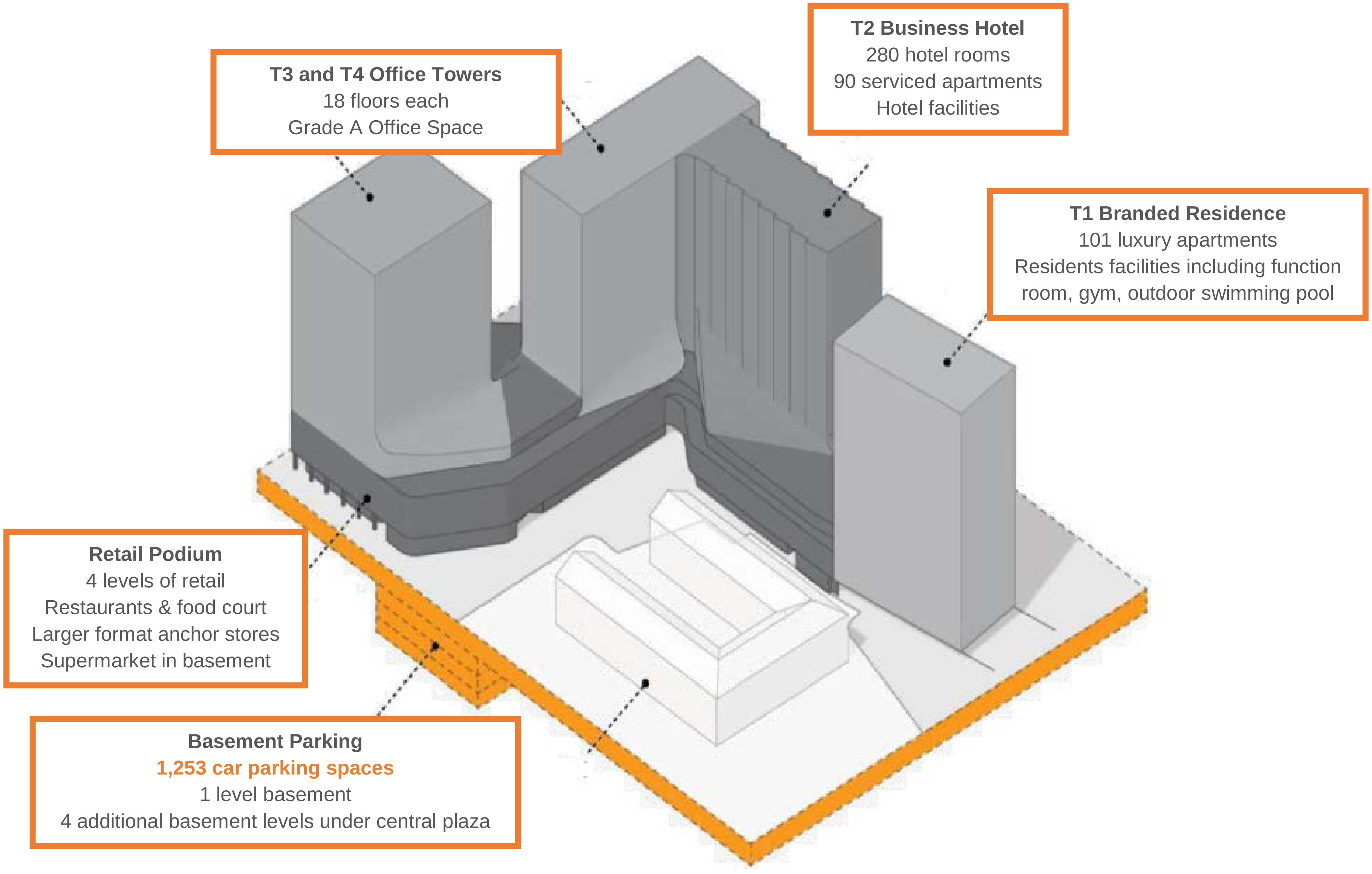

Figure 4.5: Project Development Components

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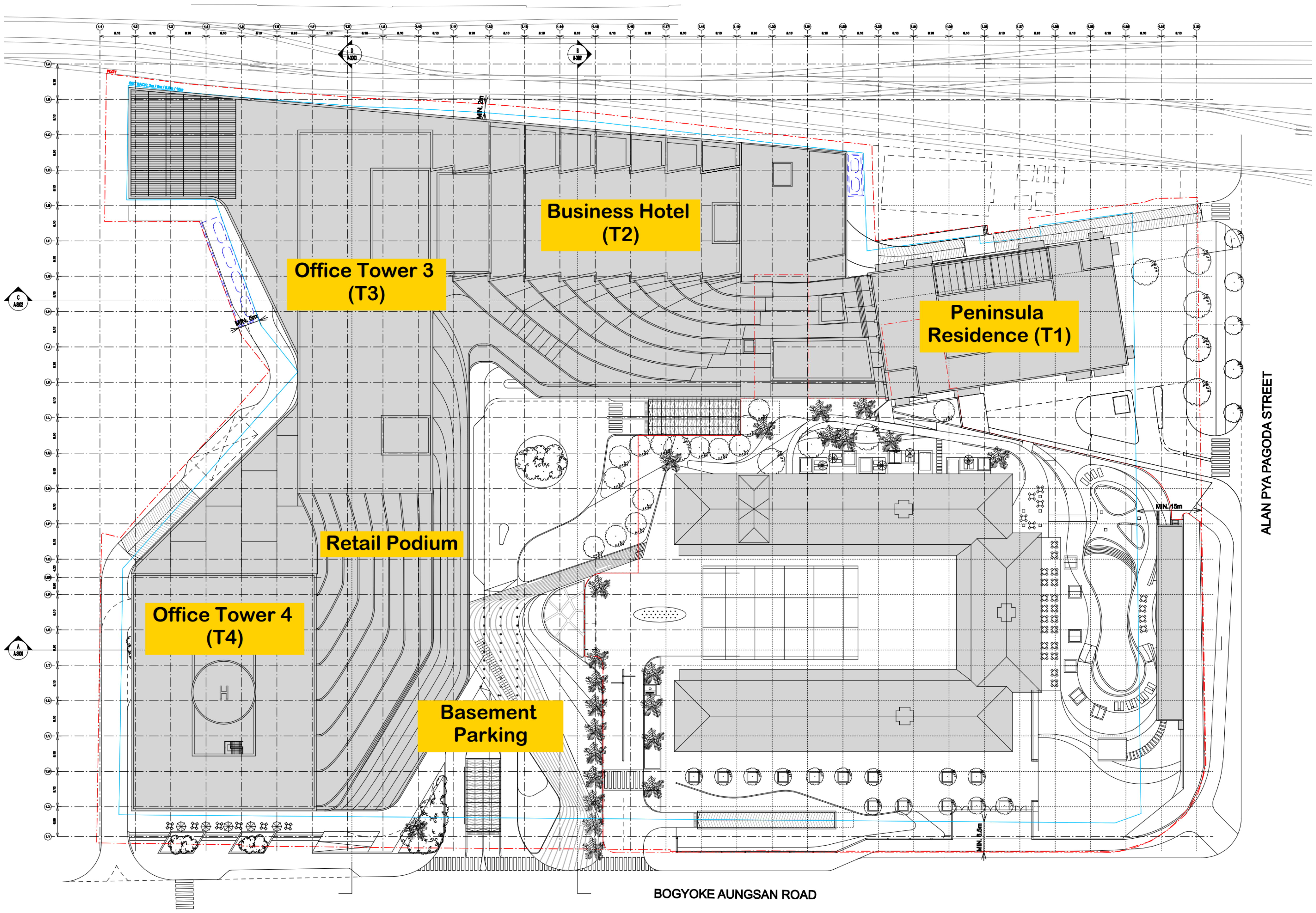

Figure 4.6: Proposed Site Plan

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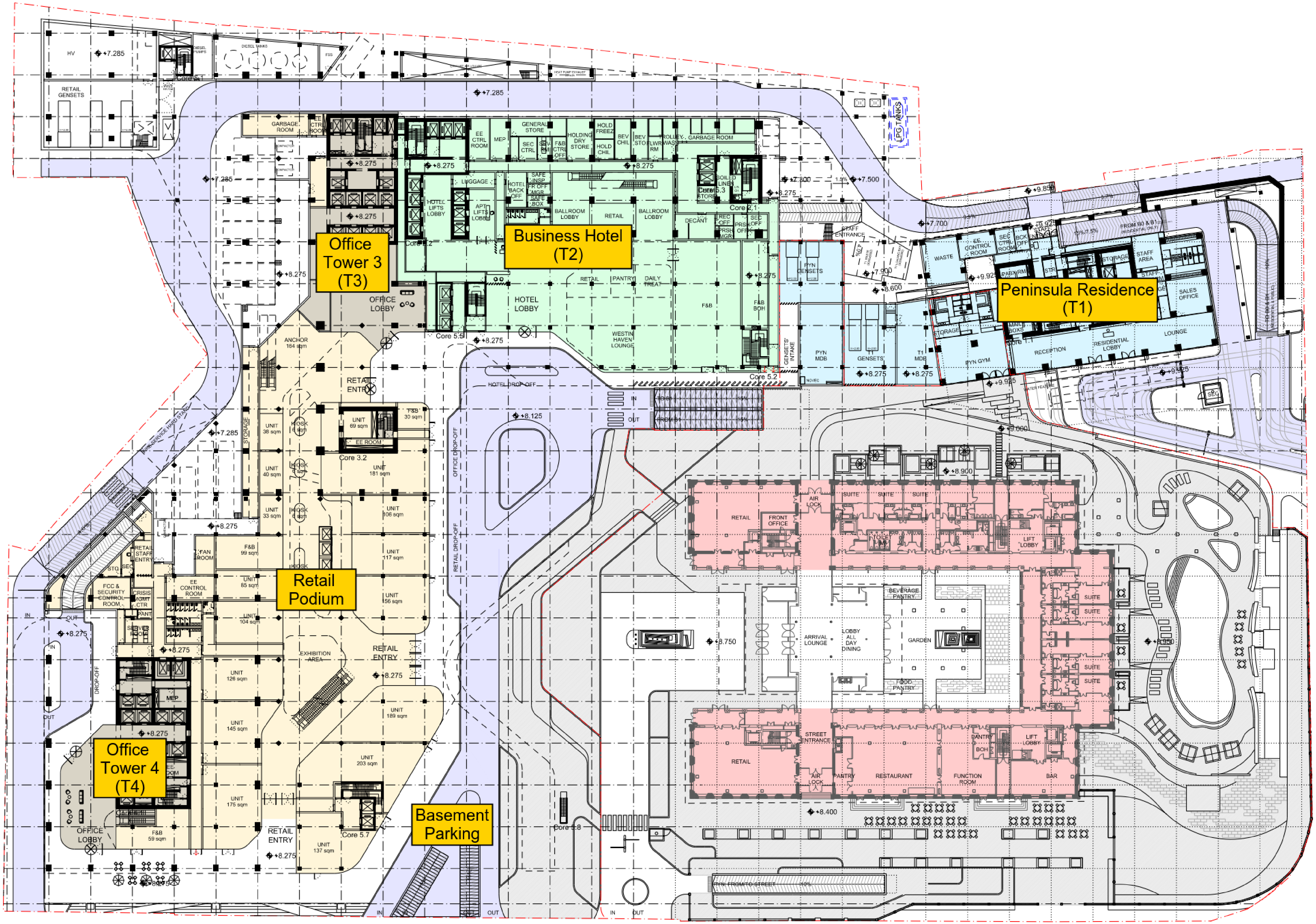

Figure 4.7: Proposed Development Layout

4.4.3 Residential Tower - Peninsula Residence (T1)

Serving as a luxury condominium, the Peninsula Residence Tower (referred as Tower 1 or T1) will be constructed on the north eastern corner of the Site. The tower will be a Peninsula branded luxury residence with apartments sold on a leasehold tenure and servicing agreement. The tower comprises 26-storeys of 98 luxury apartments and 3 apartments dedicated to managers. The units are equipped with public facilities including a function room, one children play area, gym, sauna and a pool terrace integrated within the project's podium roof design. The apartments have been designed to allow for discrete servicing performed by live-in staff through carefully studied segregated routes. The Peninsula Residence has a GFA of approximately 37,253 m^2. The proposed development components for T1 are presented in **Table 4.4**.

Table 4.4: Components of the Proposed Peninsula Residence (Tower 1)

Floor	Component	GFA (m^2)
L27	Machine room	178
L26	Roof terrace	435
L25	Two penthouse units	1,443
L5 – L24	Thirty-two units of 4-bedroom apartments, thirty-two units of 3-bedroom apartments, and thirty-two units of 2-bedroom apartments	30,248
L4	Pool deck and facilities	1,416
L3	Two 3-bedroom and one 2-bedroom manager's apartments, Apartment storage, Residents store, and Manager's Office	1,507
L2	Retail link	324
L1 (GF)	Entrance lobby, Lounge, Back-of-house	1,047
B0	Back-of-house (BOH)	326
B1	BOH	329
Total		**37,253**

4.4.4 Business Hotel and Serviced Apartments (T2)

The Business Hotel (referred as Tower 2 or T2) will be constructed centrally along the northern boundary of the Site, between the Peninsula Residence and the Tower 3 (T3) Office Tower. The Business Hotel has a GFA of approximately 49,778 m^2.

The tower benefits from a strategic position opposite the master plan central plaza. To the north, serviced apartments, rooms and public facilities enjoy views over the Shwedagon Pagoda monument. The hotel is designed to become a landmark with its unique sawtooth facade sweeping and merging with the podium roof.

The hotel will be developed as a 26-storey building (22 storeys above the retail podium) comprising 280 hotel rooms and 90 serviced apartments. This building also supports the roof facilities which include a fine dining restaurant with outdoor terrace, a function room / kids club, an exclusive rooftop bar and a pool deck with large outdoor pool bar. The hotel guestrooms will be located from L14 to L25 and the service apartments located from L6 to L13. Tower 2 podium levels (L1 – L5) include the main lobbies, pre-function, ballroom, Haven lounge, meeting facilities, beauty, spa and gym. An all-day dining restaurant will be located at L5 which opens out onto an outdoor terrace, designed for alfresco dining.

Other amenities such as shops, front office, administrative office, housekeeping office, business centre, employee support office, pantry and storage areas, kitchen, etc. are located within the podium levels and basement.

The proposed development components for Business Hotel are presented in **Table 4.5**.

Table 4.5: Components of the Proposed Business Hotel (Tower 2)

Floor	Component	GFA (m^2)
L27	Machine room	544
L26	Roof-top bar	1,494
L25	Fine dining, Hotel rooms	1,634
L14 – L24	Hotel rooms	17,881
L6-L13	Serviced apartments	12,854
L5	Alfresco dining, Executive lounge, Pool facilities	2,692
L4	Workout, Spa, Yoga, Beauty, Offices	2,200
L3	Meeting room, Function room, Board room, Ballroom, Banquet, Kitchen & storage	5,191
L2	Retail link	204
L1 and L1A	Main lobby, hotels lift lobby, serviced apartments lift lobby, ballroom lobby, retail, lounge, F&B (food and beverage), BOH	4,255
B1	BOH	829
TOTAL		**49,778**

4.4.5 Office Towers 3 & 4

The two 22-storey office towers (above ground) (referred as Tower 3 (T3) and Tower 4 (T4)) will be constructed along the north-western boundary of the Project site. The towers sit above the retail podium and office users are able to gain direct access to the shopping mall contributing to the activation of the space. The proposed development components for T3 and T4 are presented in **Table 4.6**.

Table 4.6: Components for the Proposed Office Tower 3 and Tower 4

Floor	Component	T3 GFA (m^2)	T4 GFA (m^2)
L23 and L24	Machine room	339	306
L5 - L22	Offices	43,343	38,314
L4	Retail link from Office Tower 3	124	36
L3	Retail link from Office Tower 4	34	129
L2	Retail Area	36	36
L1	Office lobby	560	469
B1	Office link or BOH	226	-
TOTAL GFA		**44,662**	**39,290**

4.4.6 Retail Podium

The four storeys shopping mall is located within the new development's four storey podium. It will be located below the Towers occupying levels B1 to L4 with a GFA of approximately 37,191 m^2. A supermarket with a footprint of approximately 2,500 m^2 combined with a retail lobby and drop-off area will be located at B1. Retail generally occupies the west side of the development podium with an exception on level 02 where the mall extends to the east allowing entry at Alan Pya Pagoda street level and providing direct access to Tower 1 residents.

The main entrance and drop-off/pick-up area will be located at L1 and this level will be occupied by exclusive international brands of fashion, watch and jewellery. Tenant mix is being advised by international retail consultancy specialist to create a new and exciting offer in Yangon.

The proposed development components for the Retail Podium are presented in **Table 4.7**.

Table 4.7: Components for the Retail Podium

Floor	Component	GFA (m^2)
L4	Food court, family dining, contemporary dining, department store	7,645
L3	Signature Myanmar bazaar, local boutiques, bookstore, casual fashion & sports, department store	7,664
L2	Mid-high and high-end fashion & accessories, department store, casual dining	12,865
L1	Main entrance, main drop-off/ pick up, luxury and accessible luxury fashion & accessories, watch & jewellery teahouse/ café, department store	4,408
B1	Supermarket, conveniences, retail lobby and drop-off	4,077
B2 – B5	Cark park link	532
TOTAL		**37,191**

4.4.7 Basement Car Parking

The basement car park has been arranged over five main floors located below ground i.e. one level of basement across the entire site with additional levels of deep basements under the central courtyard. This basement carpark is shared between the Project and the International Hotel Project (PYN) of Peninsula Yangon Limited (PYL).

Basement 1 extends to the site perimeter and has been elevated to sit clear of the surveyed water table. It contains multiple programmes in addition to the extensive parking and incorporates a local mezzanine at the base of the residential tower. The remaining car parking requirement is provided in a deep basement structure arranged over four floors of a similar footprint. The configuration of the lower basement levels is designed to facilitate vertical circulation and access to retail, commercial and hotel programmes above.

The lower level parking has also been developed to keep the construction of this element outside the footprint of the main towers and their associated temporary works. In doing so the lower basement construction timetable can potentially be constructed off the critical path of the four towers.

It has been designed to accommodate approximately 1,253 parking spaces.

4.4.8 Utilities

a) Electricity Supply

The total estimated demand for electricity for all the components is 70,953,600 kilowatt hour per year (kWh/ year). The breakdown of required electricity supply for each components of the proposed Project is presented in **Table 4.8**.

Table 4.8: Total Estimated Electricity Demand for Development Components

Development Components	Electricity Demand (kWh/year)
Retail Podium and central chiller	35,040,000
Peninsula Residence	12,264,000
Business Hotel	13,665,600
Officer Tower 3	4,992,000
Officer Tower 4	4,992,000
Total	**70,953,600**

The Project Team will coordinate closely with Yangon Electricity Supply Corporation (YESC) before carrying out any action items from the permit of New Main Power Supply Line Extension and New Electrical Service to the Site for both construction and operational phases which was granted on 18 May 2018. Dedicated contractor will be appointed and will be responsible for the whole process including obtaining necessary approvals. The Project Team will oversee the progress and activity that is carried out by the appointed contractor and provide support as necessary

In order to fulfil the energy demands for the development, electricity will be sourced primarily from the Thida Substation with the secondary source from the Railway Substation. Six (6) standby centralised generators with the back-up capacity of 100% will be installed as well to ensure undisrupted power.

b) Water Supply

The water requirement for the proposed Project is estimated to be 365,000 cubic meters per year (m^3/ year). The breakdown of required water demand for each components of the proposed Project is presented in **Table 4.9**.

Table 4.9: Total Estimated Water Demand for Development Components

Development Components	Water Demand (m^3/ day)
Retail Podium	205
Peninsula Residence	107
Business Hotel	248
Officer Tower 3	145
Officer Tower 4	130
PYN	165
Total	**1,000**

The primary source of water supply is groundwater with the secondary source obtained from the municipal supply. Provisions for future connection, as and when the City's infrastructure is upgraded, will be included. YCDC has agreed to negotiate to connect to the YCDC water supply network and the project has already put in place the connection point ready to connect once the infrastructure has upgraded in the project area.

Based on the current estimate, four (4) tube wells have been planned with a pumping capacity of 28 m^3/ hour. The water demand for the project is expected to be 365,000 m^3/ year where the total pumping rate is 28 x 4 (pumps) x 12 hr = 1,344 m^3/ day. Each borewell will only extract water for a maximum of 12 hours as per CQHP code. This is appropriate to allow sufficient time for the borewells to recharge. Locations of the four deep wells are shown in **Figure 4.8**.

The Groundwater Survey at Downtown Yangon, Myanmar conducted by GMT Corporation Ltd in November 2015 indicated that the available groundwater is sufficient to cater for long-term water supply demand for the proposed Project. Based on the study, the aquifers in the project area are extensive, productive and generally suitable for sustainably developing high amount of groundwater for various activities of the project area.

The groundwater will be pumped and stored within a raw water storage tank. The groundwater will then be subjected to treatment to meet the World Health Organization (WHO) Drinking Water Standards. The proposed raw water treatment system includes sand filters, activated carbon filters, softeners and settlement tank with pH control for iron removal. The water will also be disinfected using sodium hypochlorite. Treated water meant for domestic supply will

be stored separately from the water required for firefighting purposes. This is to prevent contamination of the domestic supply by the stagnant water in the fire-fighting system. Further, for potable use, the domestic supply will be subjected to UV (ultraviolet) treatment at the point of use. The domestic supply will also be used for the boilers as well as for other washing/cleaning purposes.

c) Sewage

Wastewater generated during the operational phase of the development includes sewage effluent from the sanitary facilities and sullage comprising wash waters from bathrooms, sinks, kitchen and showers. These wastewater streams will be treated within the proposed Wastewater Treatment Plant (WWTP) which is a Membrane BioReactor (MBR) with a design capacity of 1,200 m^3/day. Schematic drawings of the WWTP are presented in **Figure 4.9**. The WWTP will be designed to cater for wastewater arising from the main collection sump and the grease trap which removes oil and grease from the kitchen drainage from the buildings onsite. The design influent criteria is BOD > 400 mg/l (milligram per litre) for the sanitary facilities of the residential units, BOD < 1100 mg/l for the kitchen spent wash waters and BOD < 150 mg/l for grey waters entering the WWTP. The BOD and SS limits for the treated effluent will be < 20 mg/l and < 30 mg/l respectively. While the design accords with international standards, a discussion will be held with the relevant department within the YCDC to confirm the adequacy of these treatment limits as currently there are no specified regulatory limits for treated effluent discharge,

The wastewater from these sources will first undergo coarse screening before entering the equalization tank (350 m^3). From this tank, the wastewater will be pumped through a fine screen into an air-sparged aeration tank (80 m^3). The overflow from the aeration tank will then pass through two membrane tanks (150 m^3 each) which will operate in parallel. Sodium hypochlorite will be added into both the membrane tanks for disinfection purposes. The final treated effluent will be pumped into the treated water tank (100 m^3). The sludge formed at the bottom of the equalization tank and the aeration tank will be pumped into the slurry tank (30 m^3) for temporary storage before being pumped to a tanker for offsite discharge/disposal at YCDC registered disposal facility.

The treated effluent from the MBR is stored in the treated effluent tank. Treated effluent is polished and transferred to the cooling tower water make-up water tank. Make-up supply to cooling towers is further treated by dosing system. The MBR and recycling plants also have water storage tanks to account for fluctuations in water demand.

Access for maintenance and internal space for ongoing maintenance of the MBR system will be provided, including a high level gantry system to raise and lower the internal membrane panels for cleaning and maintenance. A ventilation system will also be provided to supply sufficient quantities of oxygen to the system via the MBR blowers, as this is integral to the biological processes. A mechanical extract system will remove the foul air resulting from the biological process.

A sludge holding tank will be provided to retain any sludge produced by the MBR system. This will be regularly emptied by tanker truck from the YCDC.

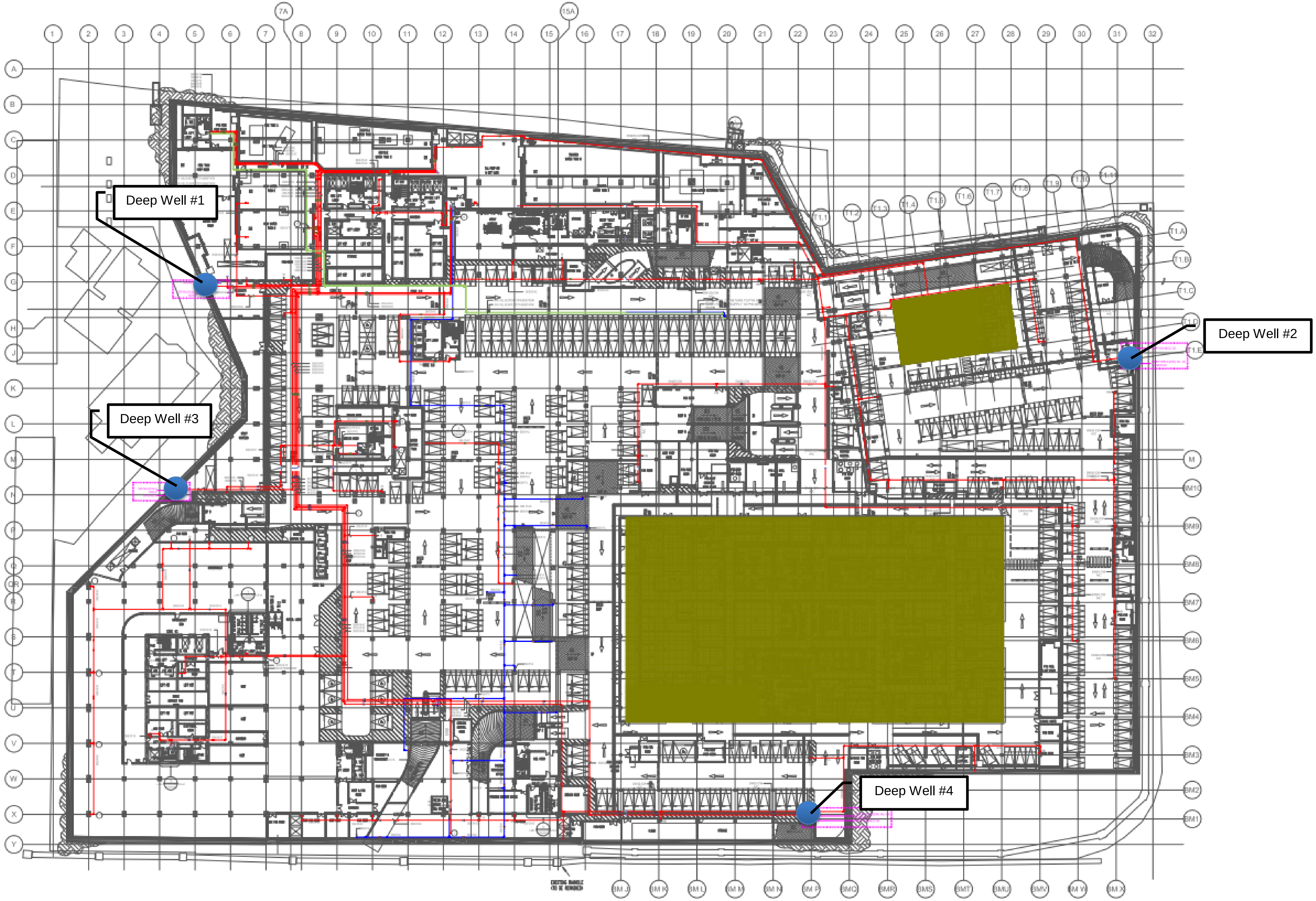

Figure 4.8: Locations of Deep Wells

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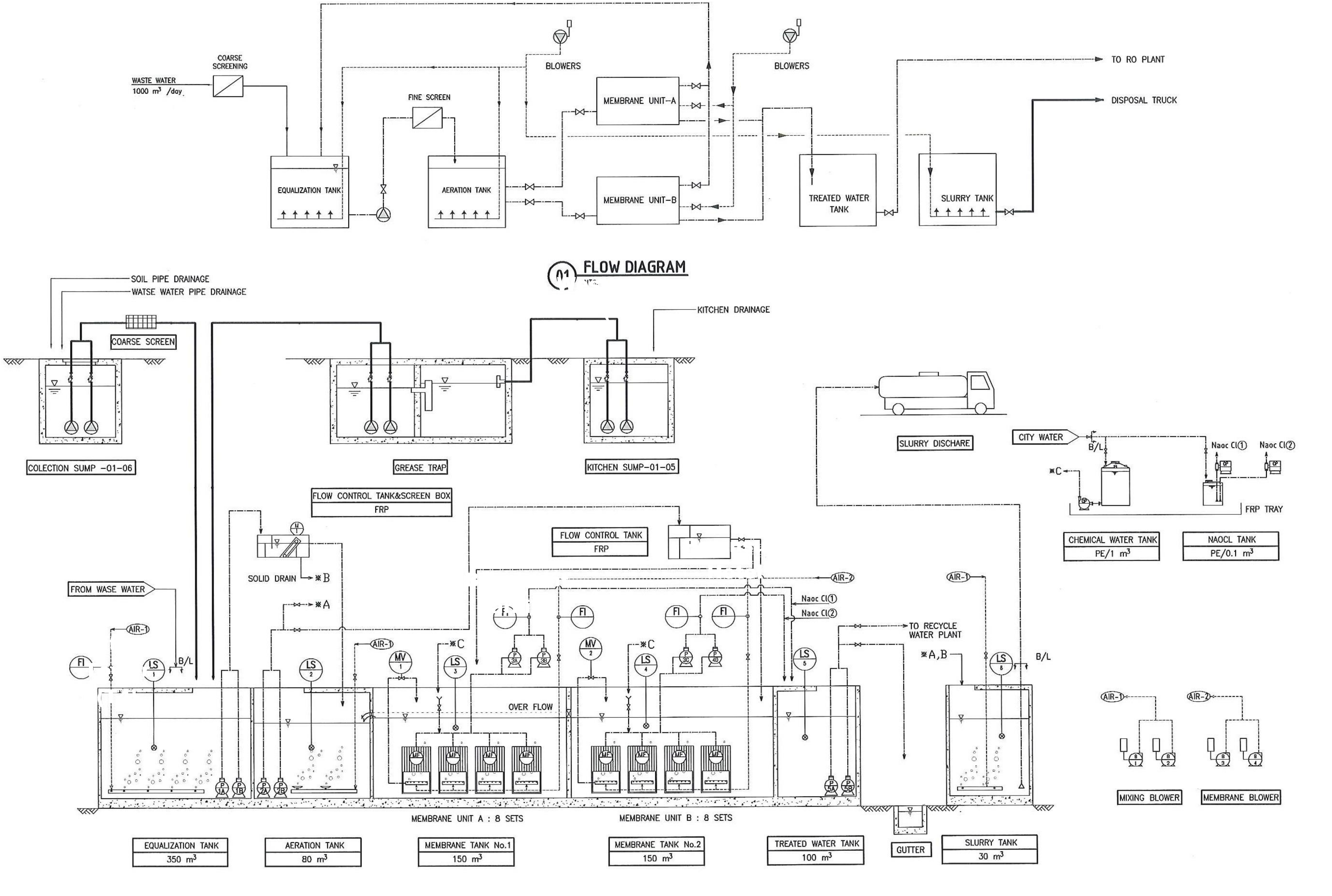

Figure 4.9: Schematic of the WWTP

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The MBR is an advanced activated sludge process, operated with higher biomass concentration and includes an integrated membrane filtration process. The MBR has been proposed for the following reasons:

- Smaller footprint than the conventional activated sludge system;
- Stable operation;
- Higher quality final effluent (to be recycled) regardless of fluctuating incoming waste water quality and quantity;
- Generates less sludge; and
- Modular and easily expandable.

d) Fuel

The sources of fuel for the proposed Project include diesel for the generators and the fire water pumps and Liquefied Petroleum Gas (LPG) for use in the kitchen at the hotel. There will be three (3) 20,000 litre storage tanks for the proposed Project for the storage of diesel located within the Diesel Fuel Storage Room which covers a footprint of 141 m^2 on the ground floor level. The room will be equipped with automatic water sprinklers for fire suppression.

There are two (2) 2,900 litre LPG storage tanks proposed. One tank has sufficient capacity to serve the proposed Project for approximately 5 days.

4.4.9 Fire Prevention System

The fire protection system comprises the following:

i. Sprinkler system will be provided for the whole development except T1 residential units. Sprinklers will only be provided in T1 at public areas, back of house areas and lift lobbies.

ii. Fire hose cabinets will be provided throughout the building. The travel distance to any part of the building will be no more than 30 m. Plus, a 9 m jet length. Each fire hose cabinet will have a nozzle, 25 mm. diameter hose and a 65 mm diameter quick coupling with cap and chain.

iii. Street fire hydrants (minimum 4, according to CQHP requirements) will be provided on the perimeter of all the buildings and along the access roads at ground floor. Each hydrant will have a 65 mm diameter quick coupling with cap and chain. The coupling will be compatible with Yangon Fire Department practice.

iv. An automatic fire detection and alarm system will be provided throughout. The T1 and T2 systems will be fully addressable, elsewhere will be semi addressable.

4.4.10 Ventilation Systems

4.4.10.1 Residential Tower (T1)

Variable refrigerant flow (VRF) type air cooled systems will supply the residential units. VRF units comprise a number of outdoor condensing units (CDUs), some with variable speed compressors, and multiple indoor fan coil units (FCUs). All units are connected to a common refrigerant pipe circuit per apartment.

Fresh air to the apartments will be entrained into individual rooms by natural ventilation and infiltration and the negative pressure created by the room and kitchen extract fans.

4.4.10.2 Hotel and Serviced Apartments (T2)

The guestrooms will be supplied by ceiling concealed FCUs. Other areas will be supplied by FCUs or re-circulating air handling units (AHUs). Air distribution system will generally be constant air volume type.

Pre-cooled fresh air AHUs will be provided at roof level to supply pre-cooled fresh air to FCUs in every guestroom and serviced apartment.

A central mechanical toilet extract system will be provided ducted to roof level extracting from the guestroom and serviced apartment toilets on each floor. The fresh air supply to guest rooms will be slightly higher than the exhaust air from the toilet in each room.

A central pantry and kitchen extract system will also be provided to supply the service apartment floors, extracting, via central extract fans, at roof level.

Pre-cooled AHUs will be provided to supply fresh air to the main lobby, function areas, restaurants, etc.

Cooking areas will be ventilated via kitchen hoods specified by the kitchen consultant. Hoods will extract to outside via fire rated stainless steel kitchen exhaust ducts and mechanical extract fans.

Kitchen hoods will include a grease trap system to minimize grease ingress into the exhaust duct. Exhaust air treatment systems will be provided, including stainless steel grease filter mesh with wash down facility for cleaning, pre-filters, UV filters and/or electro static precipitators for complete protection of the extract ductwork system. Carbon filters will be provided to remove kitchen odors, if required.

Make up air will be supplied to kitchens to prevent high negative pressures in kitchens and compensated by the suction of air-conditioned air from other areas. Make up air to kitchen extract hoods will be ducted to the hoods. The make-up air will be pre- cooled if the kitchen operating temperature is designed to be below 28°C.

4.4.10.3 Office Towers (T3 & T4)

Air conditioning will be provided in the office and public areas via variable air volume (VAV) type, system comprising central variable speed re-circulating AHUs which will deliver air to a series of supply diffusers located throughout the space via a number of zone VAV boxes, all connected by ceiling ductwork. The VAV boxes will automatically adjust the volume of air supplied to each zone to suit the actual load. The final ductwork and diffuser installation, downstream of the VAV boxes, is carried out by the tenant for fit-out by themselves to suit their own interior design.

Two AHUs will supply each floor, located in two AHU rooms in the central core, each AHU serving half the cooling load per floor.

Temperatures in the public toilets will not be controlled but will be tempered by conditioned air drawn in from other areas by the operation of the toilet extract air system.

A central mechanical toilet extract system will be provided, ducted to roof level from the toilets on each floor.

A central mechanical pantry extract system will be provided ducted to roof level. This will exhaust the pantry to the central core and has provision to be connected to up to 4 private tenant pantries on each floor.

Pre-cooled variable speed fresh air AHUs will be provided at roof level to supply pre-cooled fresh air to the back of re-circulating variable speed AHUs on each office floor for the tenant spaces.

4.4.11 Lightning Protection System

A conventional faraday cage lightning protection system comprising bare aluminium tape on roof with copper down conductors and ground rods will be provided to protect the public areas from lightning strike. If a zinc roof is employed, aluminium tape must be isolated to prevent corrosion. Down conductors will generally be in columns.

4.4.12 Internal Traffic Circulation

An internal circulation road will be constructed within the boundary of the Project (**Figure 4.10**). The circulation road will separate traffic from the main roads surrounding Landmark Project and provide vehicles with access and exit points. This measure is anticipated to alleviate traffic congestion along Bogyoke Aung San Road along the site boundary. Ingresses and egresses will be provided along Bogyoke Aung San Road and Alan Pya Pagoda Road. The proposed access will be designed and constructed to international standards.

4.4.13 Greening Plan

A number of green areas are located throughout the Project site as shown in **Figure 4.11**. These areas will be developed and landscaped to maintain the aesthetics of the Project site during and after construction. List of trees and shrubs that will be planted within the Project is presented in **Table 4.10** and **Table 4.11**, respectively.

Table 4.10: List of Trees to be Planted within the Project

No	Tree/Palm	Size (Height x Spread)	Quantity
1	Michelia Alba	EHS	24
2	Alsotonia scholaris	EHS	27
3	Alsotonia scholaris	HS	3
4	Agathis alba	ST (3500mm H)	6
5	Ficus religiosa	EHS	2
6	Delonix regia	EHS	1
7	Polyalthia longifolia	ST (3500mm H)	9
8	Arec catechu	4000mm Clear Stem Height x min. 6 Fronds	15
9	Bismarckia nobilis (Green)	2000mm Clear Stem Height x min. 6 Fronds	5
10	Bismarckia nobilis ‘Silver’ (Blue)	2000mm Clear Stem Height x min. 6 Fronds	8

No	Tree/Palm	Size (Height x Spread)	Quantity
11	Existing tree to be transplanted to the new location as indicated in the planting plan		1
12	Tabernaemotana corymbosa	1500 x 1500	3 nos
13	Cordia subcordata	HS	8 nos
14	Filicium decipiens (4500mm H)	HS	10 nos
15	Dypsis lutescens	1500mm x 10 stems	8 nos
16	Bauhinia purpurea	HS (4500mm H)	7 nos
17	Bauhinia purpurea	ST (3500 mm H)	7 nos
18	Mussaenda erythrophylla ‘Queen Sirkit’	1200 x 1500	8 nos
19	Tabernaemontana corymbosa	1500 x 1500	8 nos

Note:

EHS - Extra Heavy Standard Tree

HS – Heavy Standard Tree

ST – Standard Tree

Table 4.11: List of Shrubs to be Planted within the Project

No	Shrubs	Size Height x Spread (mm)	Quantity
1	Aglaia odorata	600 x 300	605 nos
2	Alpinia purpurata ‘Double red’	800 x 12 shoots	55 nos
3	Asparagus densiflorus ‘Sprengen’	300 x 300	155 nos
4	Asplenium nidus	600 x 15 fronds	590 nos
5	Asplenium nidus ‘Antiquum	600 x 15 fronds	1230 nos
6	Calathea rufibarba	500 x 10 leaves	200 nos
7	Calathea warscewiczii	500 x 10 leaves	200 nos
8	Carmona retusa ‘Hedge’	400 x 300	4075 nos
9	Clerodendrum thomsoniae	500 x 3 leaders	725 nos
10	Clitoria tematea	500 x 3 leaders	240 nos
11	Crinum amabile	500 x 12 leaves	90 nos
12	Cycas revolute ‘Thunb’	800 x 60	55 nos

No	Shrubs	Size Height x Spread (mm)	Quantity
13	Duranta erecta ‘Alba’	400 x 300	200 nos
14	Excoecaria cochinchinensis	500 x 300	1085 nos
15	Hedychium coronarium	600 x 12 leaves	250 nos
16	Heliconia Jamaican dwarf	600 x 12 leaves	250 nos
17	Hymenocallis speciosa	400 x 8 leaves	350 nos
18	Lxora ‘Super Queen’	600 x 300	785 nos
19	Murraya paniculata ‘Hedge’	400 x 300	325 nos
20	Nephrolepis exaltata	300 x 10 fronds	320 nos
21	Phyllanthus cochinchinensis (edging)	300 x 300	865 nos
22	Piper magnificum	500 x 12 leaves	110 nos
23	Spathiphyllum wallisii	300 x 8 leavers	210 nos
24	Tabernaemontana dwarf	300 x 300	1290 nos
25	Vernonia (Trailing Plant edge)	500 x 3 leaders	305 nos
26	Bauhinia kockiana	500 x 3 leaders	90 nos
27	Lonicera japonica	500 x 3 leaders	245 nos
28	Quisqualis indica	500 x 3 leaders	90 nos
29	Dissotis rotundifolia	100 x 200	100 nos
30	Acalypha reptans	300 x 300	280 nos
31	Alpinia rostrata	600 x 8 leaves	190 nos
32	Asplenium nidus	500 x 15 fronds	95 nos
33	Davallia denticulate	400 x 15 fronds	35 nos
34	Monstera oblique ‘dwarf’	300 x 8 leaves	35 nos
35	Petrea volubilis	500 x 3 leaders	2815 nos
36	Phyllanthus cochinchinensis	300 x 300	280 nos
37	Thomatococcus daniellii	600 x 8 leaves	70 nos
38	Vernonia elliptica	500 x 3 leaders	120 nos

No	Shrubs	Size Height x Spread (mm)	Quantity
39	Barringtonia asiatica	HS (4500 mm H.)	3 nos
40	Tabemaemotana divaricta	2000 H x 1500 spread	13 nos
41	Euterpe edulis	3000 x min 5 main stems	10 nos
42	Bauhinia kockiana	500 x 3 leaders	40 nos
43	Calathea loeseneri	300 x 8 leaves	60 nos
44	Calathea lutea	1000 x 10 leaves	260 nos
45	Clerodendrum thomsoniae	500 x 3 leaders	405 nos
46	Heliconia Rostrata	1000 x 8 leaves	110 nos
47	Hymenocallis speciosa	400 x 8 leaves	220 nos
48	Neomarica gracilis	300 x 10 leaves	820 nos
49	Pandanus amaryllifolius	500 x 12 leaves	125 nos
50	Phyllanthus cochinchinensis	300 x 300	975 nos
51	Pandanus kota ‘Tinggi’	300 x 12 leaves	760 nos
52	Tristellateia australasiae	500 x 3 leaders	255 nos
53	Rhoeo discolor	300 x 300	225 nos
54	Pandanus dubius (Accent)	1000 x 600	10 nos
55	Crinum amabile	800 x 600	30 nos
56	Chrysalidocarpus lutescens	1200 x 20 fronds	12 nos
57	Caesalpinia pulcherrima	800 x 600	80 nos
58	Clerodendrum bungei	500 x 300	330 nos
59	Costus curvibracteatus	400 x 300	180 nos
60	Cuphea hyssopifolia Pink	300 x 300	90 nos
61	Dissotis rotundifolia	100 x 200	595 nos
62	Excoecaria cochinchinensis	600 x 300	405 nos
63	Heliconia psittacorum ‘Strawberries and Cream)	800 x 12 leaves	250 nos
64	Ophiopogon jaburan	300 x 20 leaves	180 nos

No	Shrubs	Size Height x Spread (mm)	Quantity
65	Orthosiphon aristatus ‘White’	500 x 300	995 nos
66	Philodendron xanadu	400 x 300	135 nos
67	Phyllanthus cochinchinensis	300 x 300	20 nos
68	Rhapis multifida	1200 x 500	300 nos
69	Strophanthus gratus	300 x 300	145 nos
70	Xiphidium caeruleum	300 x 10 leaves	345 nos

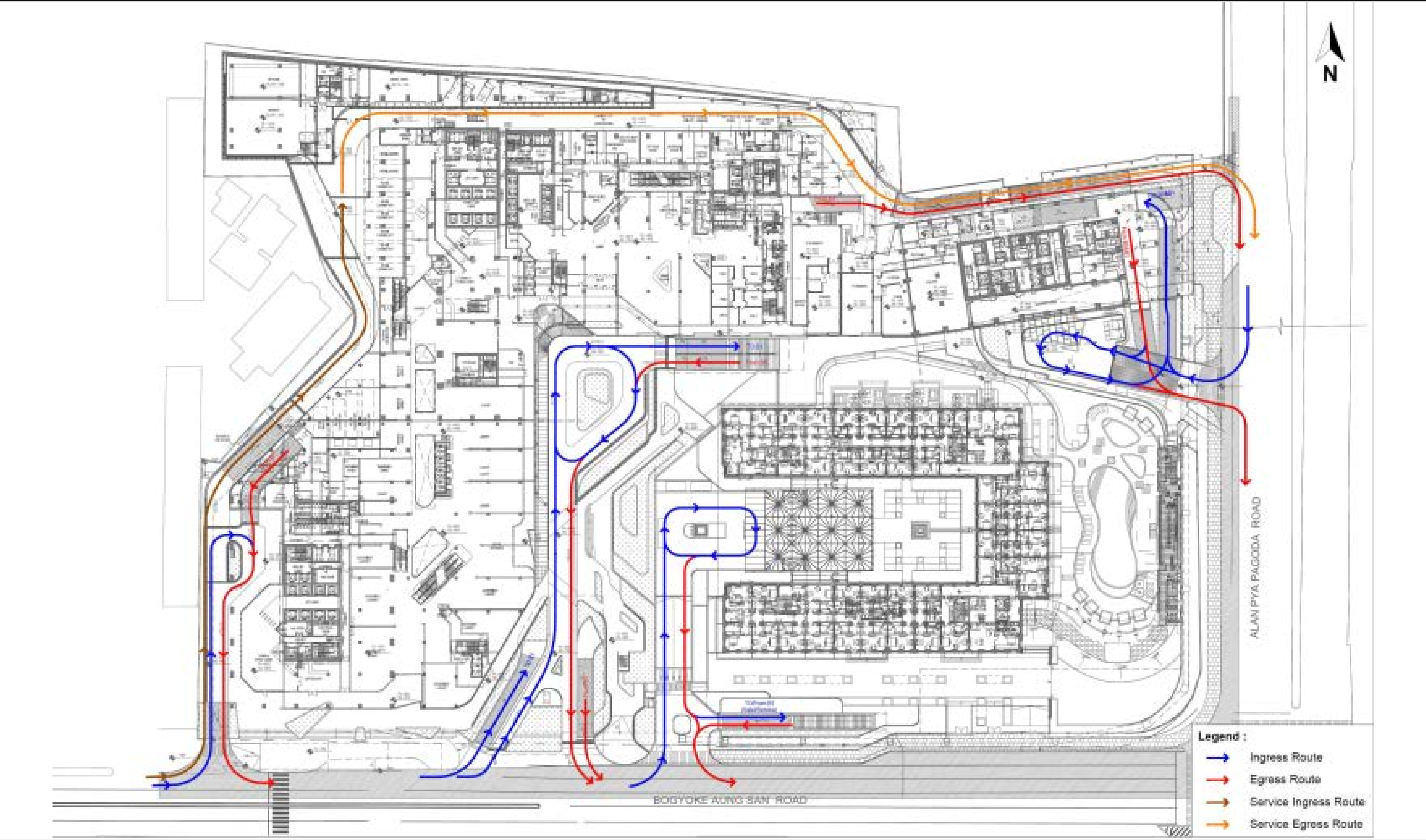

Figure 4.10: Traffic Circulation

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Figure 4.11: Greening Plan

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4.5 Sustainability in Design

The Project Proponent has engaged design consultant to implement sustainable design, construction and building operational measures. Passive design features considered include low E glazing on architectural windows to reduce solar heat gain and associated operational energy consumption by way of reduced air conditioning load, insulation of external walls, etc. Natural day lighting and ventilation will be utilised as much as possible.

Where mechanical cooling is required, high efficiency air-conditioning and mechanical ventilation systems will be selected. Variable speed drive pumps will be installed to cater to varying load demands across various periods of usages. The development will utilise only energy efficient lighting equipment and these will be controlled by motion sensors or timers to power off in the event of no occupancy.

Other energy efficient features that may be considered are energy efficient light fitting, bulbs, localised lighting controls, smart meters, CO_2 (carbon dioxide) sensors/ demand controlled, etc. These energy efficient features will contribute towards achieving more than 20% total energy savings for the development.

Landmark Project is also being designed to ensure that the development will not strain Yangon City's water resources. Strategies such as the extraction of groundwater, recycling of treated effluent as make-up water for cooling towers, low flow rate sanitary fittings, low water consumption water closets, water sub-metering and leak detection system, etc. will work together to allow Landmark Project to achieve significant water savings compared to a building of this nature and size.

The Project Proponent will aim to ensure that appointed contractors will implement environmentally sustainable construction measures such as monitoring energy usage, water usage and waste generation. Future building managers and users will be educated on sustainable building use and operation through a series of green awareness programs such as trainings, user guides, operation guides, green corners, events, etc. Recycling facilities will also be extensively provided and promoted for use.

In addition, Landmark Project is in the process of obtaining the IFC EDGE (Excellence in Design for Greater Efficiency) certification. In order to qualify for IFC EDGE certification, a building must achieve a 20% reduction in energy, water and embodied energy in materials compared to a conventional building. The EDGE works for a variety of residential and commercial buildings in nearly 100 countries, including homes and apartments, hotels and resorts, office buildings, health care facilities, and retail establishments. As of November 2017, the preliminary design of Landmark Project has generally achieved more than 20% reduction in energy, water and materials efficiency as shown below.

November 2017	Energy Efficiency	Water Efficiency	Materials Efficiency
Yoma Central Retail Mail	20.97%	36.12%	21.41%
Peninsula Branded Residence	35.86%	24.45%	41.07%
Yoma Central Business Hotel	28.31%	23.44%	27.96%
Yoma Central Offices	24.11%	36.56%	35.83%

This aims to not only demonstrate the Project Proponent's commitment in developing urban infrastructure in a responsible manner but to also address more urgent issues such as the shortages of power and water supply currently experienced in the Yangon.

4.6 Pre-Construction Surveys

Activities undertaken during this phase are focused primarily on obtaining physical data on the existing conditions at the Project area.

Key activities include:

- Hazardous Materials Assessment;
- Site Topographical Survey;
- Soil Investigation Work;
- Utilities Survey;
- Pile Load Test for constructions and testing;
- Traffic Study;
- Structural Dilapidation Survey; and
- Groundwater Pumping Test.

4.6.1 Hazardous Materials Assessment

A Hazardous Materials Assessment was carried out in February 2013 to identify any potential hazards to human health and the environment from the activity of demolition, removal and disposal of the materials. The assessment was also undertaken to ensure that the premises are free of hazardous materials as far as practicable once works are completed. The scope of the assessment included the inspection of representative areas of the property to identify hazardous materials, interview facility personnel and compile an up to date Hazardous Materials Register for the site. Based on the findings of the survey, a management plan was developed for the safe removal of the detected hazardous material.

The interior and exterior of the buildings were surveyed and hazardous materials assessed included Asbestos-Containing Materials (ACM), Synthetic Mineral Fibre (SMF), Polychlorinated Biphenyls (PCB), Lead Based Paints (LBP), Ozone Depleting Substances (ODS), radioactive smoke detectors, mercury containing materials, hazardous chemicals or waste, mold, biological hazards (pigeon and rodent droppings) and potential Chemicals of Concern (COC) in soil and groundwater.

Based on the assessment, 80 ACM and 21 LBP samples were sent for lab analysis while 14 soil and four groundwater samples were assessed for potential COC which could pose health risk to workers during demolition works. All other potentially hazardous materials on-site are reported to be manageable in its current condition.

4.6.2 Site Topographical Survey

A site topographical survey was carried out in September 2012. The data was used to determine the ground elevation and physical features of the Project site, and in earthworks preparation, infrastructure planning and determining the design platform level.

4.6.3 Soil Investigation Work

An extensive soil investigation program was conducted during the period of 18 October 2012 to 24 November 2012. The scope of work involved in this investigation includes the exploration of subsurface condition, Standard Penetration Test (SPT), collection of disturbed and undisturbed soil samples for laboratory analysis and to carry out pumping test. This program consists of drilling six boreholes, one pumping test, installation of four stand pipe piezometers (SPPs) and the monitoring of ground water level for six months. An additional 34 boreholes were established from September to November 2013.

4.6.4 Utilities Survey

A utilities survey was carried out to determine the existence and location of potential underground or aboveground facilities, pipeline and utilities in the vicinity of the Project site. This is to ensure the safety of the employees and to minimize the disruption to the site.

4.7 Construction Activities

The principal activities envisaged during the construction phase are as follows:

- Setting up and management of temporary facilities;
- Transportation of materials and machinery;
- Demolition and site clearing;
- Infrastructure and utility development;
- Construction of building structures;
- Offsite improvements per Traffic Impact Assessment (TIA); and
- Landscape and re-vegetation.

4.7.1 Setting Up and Management of Temporary Facilities

Upon commencement of the construction phase, the typical structures that will be erected at the Project site include a site office, laydown area (fabrication area, storage of machinery and building materials), sheds (storage of generators, etc.) and sanitary facilities. In most instances, the site office will be in the form of transportable cabins and the warehouse typically constructed as an enclosed wooden structure or shed.

Workers employed for the construction activities will be sourced primarily from the local community. There will be no requirement for onsite housing or worker camps. However, temporary facilities will be established for the workers with basic amenities, i.e. water supply, electricity and sanitation facilities provided. Sanitation facilities will be in the form of portable toilets with temporary septic tanks.

As part of the project developer's Environmental and Social Management System (ESMS), an overall labor and working condition assessment was taken against IFC Performance Standard 2 requirements. PS2 assessment had a strong focus on worker housing conditions, oversight of contractor and sub-contractor labor practices, workforce protection, and occupational health and safety. The assessment has verified, among other things, that there are contract provisions between the Project Developer and contractors and sub-contractors requiring: contractor compliance with PS2 provisions on child labor, working hour, and working conditions; and that all employees will be provided with housing of appropriate quality, as well as requiring submission of regular housing inspection reports and giving the Project Developer access to conduct random audits. Follow-up assessments will be performed when demolition and

construction activities commence. Results from the assessment will provide input into the Project Developer's ESMS development process.

4.7.2 Transportation of Materials and Machinery

Major plant and equipment for the construction activities are likely to include:

- Piling rigs;
- Bulldozer;
- Excavators;
- Cranes;
- Lorries/transport trucks, and
- Concrete batching plant.

Construction machinery and materials will be transported to the site in low loaders and heavy load bearing transport vehicles via the Bogyoke Aung San Road or Sule Pagoda Road into the main entrance of the project site. It is anticipated that the increased movement of heavy vehicles during the construction phase may cause traffic congestion especially during peak hours. Impedance to the normal traffic flow can be minimized by avoiding deliveries during the peak traffic hours.

4.7.3 Demolition and Site Clearing

A large amount of materials is proposed to be removed from the intended redevelopment zone. Standing structures namely the Grand Meeyahta Executive Residences, FMI Centre, Zawgyi house, the two two-storey brick auxiliary buildings and other associated structures will be demolished to make way for the redevelopment. Large amount of solid waste, mainly construction debris is expected to be generated during the site clearing process. As a best practice, the Project Proponent will ensure that the appointed Contractor will be responsible in minimizing the generation of such waste and to ensure proper disposal procedures.

There were 112 trees at the Project site and where possible, the existing trees will be retained. Some of the trees identified have been removed for transplantation. In cases where transplantation is not viable, compensatory planting is proposed. The remaining vegetation that will be cleared as part of the construction activities will be cut into manageable sizes and options for on-site composting will be considered. If such options are not feasible, these wastes will be disposed at the authorized disposal sites operated by the YCDC via the Pollution Control and Cleansing Department (PCCD).

Prior to site clearing activities, a temporary fencing will be erected around the PYN building for protection of the building and for security purposes.

4.7.4 Infrastructure and Utility Development

As the proposed Project site is located within a developed area, there is one existing storm drain which runs north-south through the centre of MRB – this will also be diverted to the outside of the D-Wall, inside the project boundary. The drains currently flow around the boundary of the existing building structures including the FMI Centre, Zaw Gyi House Restaurant, old staff building and the car park and convey surface run off into the YCDC main drain which traverses the site. This main drain then discharges via a box culvert located along the northern boundary of the site into a canal. The canal flows some 2.5 km before draining

into the Pazundaung River, a tributary of the Yangon River. Temporary earth drains will be provided to convey surface runoff from the construction work area into the existing drains.

Temporary access roads will be constructed for the entry/exit to the Project site and for the movement of construction machinery and vehicles within the site during the construction phase. The roads will be laid with crusher-run. All road exits which lead out of the site will be provided with a wheel washing trough to prevent carrying the mud and sediments onto public roads such as the Bogyoke Aung San Road.

Utilities will be sourced from the nearest supply points available. Utility works will involve trenching to lay the respective conduits for water supply, sewage, telecommunication cables, electricity cables; and construction of utility structures such as water storage tanks, pump houses, WWTP, generator shed and electrical sub-station. These structures will be suitably located to minimize interruption to traffic flow during the operational phase and adverse visual impacts during maintenance activities.

4.7.5 Building Construction

For safety purposes, hoarding will be erected around the periphery of the site to screen the temporary construction works from the local public. Earthworks involving excavation and foundation works by bore pilling will be conducted prior to the commencement of the foundation and superstructure works.

Specialized rigs, piles (either steel or more commonly, concrete) and a batching plant will be mobilized to the site. Building construction will involve the construction of sub-surface and foundation platforms by the construction of pile cap, erection of reinforced concrete frames followed by the construction of buildings/structures.

4.7.6 Roadwork, Landscape and Re-vegetation

Once the building activities are completed, construction of internal access roads, main access and restoration of any affected public roads (damaged in the course of Project implementation) will be carried out. Unpaved or bare ground areas of the site will be re-vegetated and landscaped to minimize soil erosion and also to aesthetically enhance the Project site. Landscaping efforts will be concentrated along the south and west boundaries of the site. Hardscape (landscaping) will play an important role across the whole project.

4.8 Description of Selected Alternatives

In the pre-planning stage, the Project considers various alternatives for many aspects of the project. In doing so, the possibility of the site without the Project is the option that the Project evaluated to predict potential pollutions. Aside from opportunity cost, leaving the site untouched will not escape future pollutions. With sound environmental management systems in place for the Project, environmental protection will be ensured.

4.8.1 Location Alternatives

As a consequence of rapid economic growth that came side by side with the opening up of the Country which was isolated from other countries for many decades, Myanmar land price has skyrocketed drastically. In addition to skyrocketing land cost, limited availability of vacant lands to develop in central Yangon restricted the Project from looking for other locations.

After evaluating several sites, the chosen location proved to meet the requirements of the Project, the selected site located in the commercial hub of Yangon with the existing necessary

infrastructures such as major roads, railways and nearby commercial structures offers the best advantages and options to the Project.

The new development will also prove to be economically and financially beneficial as compared to the current status of the site. Without the Project, the abandoned buildings and structures will be overgrown with shrubs and grass which will gradually fall into ruins.

In addition to economic advantages, the present location offers opportunities with minimal impacts as there is no environmentally sensitive receptors within the immediate area.

4.8.2 Design and Construction Alternatives

In order to curb adverse impacts on the environment, the proposed Project embraces modern designs, which accommodate energy efficiency, and innovative methods of construction that proactively address pollutions. Tender will be awarded to environmentally conscious and competent construction firms to reduce both construction and environmental impacts. Project designs have been developed to improve energy and water use efficiency. Moreover, contemporary architecture and structural strength to last and outstand environmental challenges distinctly feature the specific characteristics of the project designs.

On the contrary to abstaining as-built construction method, the project's structural development will primarily be based on as-planned method in sequence. To minimize the level of environmental degradation, mitigation measures will be implemented for each sequence of the project development. As-planned construction application will accommodate the project's management's plan to negate the project's impacts.

In addition to selection of as-planned approach, the project will strictly abide by the mitigation requirements set forth by the EMP from the ESIA for the proposed Project. Uncontrolled nature in as-built construction may lead to pollution contribution while the project's as-planned construction will provide well thought out procedures to combat pollutions ahead of the implementation activities. The main feature of the project's construction development is establishing environmental safeguards prior to the respective activities.

Precast flat panel system, 3D volumetric construction, and hybrid concrete construction were comparatively considered in the selection for construction systems. With relevancy to the local situation and availability, hybrid concrete construction, flat slabs application, and tunnel form systems will be employed as appropriate. Among the existing construction alternatives, these systems offer simplicity, rapid turnaround, consistent performance, and quality. Despite having the lack of building codes locally, the project plans to borrow other applicable building codes suitable to the environment.

4.8.3 Equipment and Material Alternatives

Despite adopting rigorous safeguards, the proposed Project plans to take conscious approach in the selection of materials and equipment. Environmentally friendly and least polluting materials from reliable suppliers will be prioritized for the Project. Newer equipment with better energy efficiency rating or the least emission will be utilized for the project use in every stage of the project development. Moreover, the project will adhere to follow regular maintenance schedule for all equipment and vehicles. In considering alternatives for equipment, the project makes sure to take into account the creation of employment opportunities as well.

The use of hydraulic breakers would be very noisy during demolition of existing buildings at the Project site which are close to the sensitive receivers. As mitigation measure, the use of hydraulic crusher is proposed as an alternative. Hydraulic crushers are typically 6 - 12 dB(A)

quieter when compared to conventional demolition with hydraulic breakers. It is, however, recognized that hydraulic crushers have their limitations and, hence, it is proposed that they will not be used in isolation but in tandem with hydraulic breakers to minimize the impacts. The hydraulic breakers can create holes on structural elements to facilitate ease of crushing by the jaws of hydraulic crushers and to deal with oversized ones that are not practically crushed.

In order to limit soil exposure and erosion potential, earthworks will be sequenced and timed. Duration of earthworks will be shortened by planned sequences. Temporary covers will be applied to ditch and excavation sites where appropriate.

In conclusion, the project's management has chosen attractive designs with energy efficient features, the most appropriate construction technologies with environmental focus and shortening construction period (as much as feasible), and the equipment and materials with the least pollution possibility. Together with these conscious choices, the project's environmental management plan may exceed its targets to minimize adverse impacts resulting from the project implementation.

5 DESCRIPTION OF THE ENVIRONMENT

5.1 Setting the Study Limits

The purpose of this ESIA is to predict how environmental and socio-economic conditions may change as a result of the implementation of the proposed Project. This requires a sound understanding of the current conditions at the Project site. The baseline condition at the Project Site and its immediate surroundings has been established through a combination of desk-based research, site survey and primary data collection. The methodology and objectives of the baseline data collection for surrounding environment are described under specific environment.

The Zone of Impact (ZoI) or Area of Influence (AoI) is a term used to describe the area most likely to be impacted by the implementation of a development or project. For the purpose of this ESIA the ZoI represents the area within a 1 km radius of the Project site. The predicted ZoI highlights the components of the environment concerns and establishes the baseline conditions prior to implementation of the proposed Project. The information provided within this chapter forms the basis of the impact assessment in **Chapter 6**.

It should be noted that the ZoI for a particular resource/ receptor may vary depending on the nature of the change caused by the Project activities and the type of effect being considered, but in each case, it is defined to include all the area within which it is likely that potentially significant impacts could result. For example, a 300 m ZoI may be considered sufficient for noise given the localised nature of noise impacts while the ZoI for air quality impacts due to is 500 m. As such, for a specific resource/ receptor / impact, the AOI will be discussed and refined as appropriate.

5.2 Physical Environment

5.2.1 Site Setting

The Project is located in the City of Yangon within the Yangon Region, Union of Myanmar. Located in the heart of Lower Myanmar, Yangon City lies at the convergence of the Yangon and Bago Rivers on the eastern margin of Ayeyarwady Delta and approximately 30 km away from the coastline bordering the Gulf of Martaban. The Yangon Region is bordered by the Bago Region in the north and east, the Gulf of Martaban in the south and Ayeyarwady Region in the west.

The Project is located at 380, Bogyoke Aung San Road, Pabedan Township, Yangon, Myanmar. The site is a L-shaped land parcel (16º46’ 50.84” N, 96º 09’31.58” E (northeast corner) and 16º 46’46.24” N, 96º09’26.78” E (south corner)) with an area of approximately 25,700 m^2 (6.35 acres). The site is a built-up area comprises a number of existing buildings, namely, the FMI Centre, Grand Meeyahta Executive Residence, Zawgyi House, two residential brick buildings, parking areas and a variety of smaller structures associated with the existing site.

5.2.2 Topography

Based on the data obtained from the topography survey, the site is relatively flat, with a gentle downward slope from the northeast boundary (10.97 m) to the southwest (7.75 m) as shown in **Figure 5.1**.

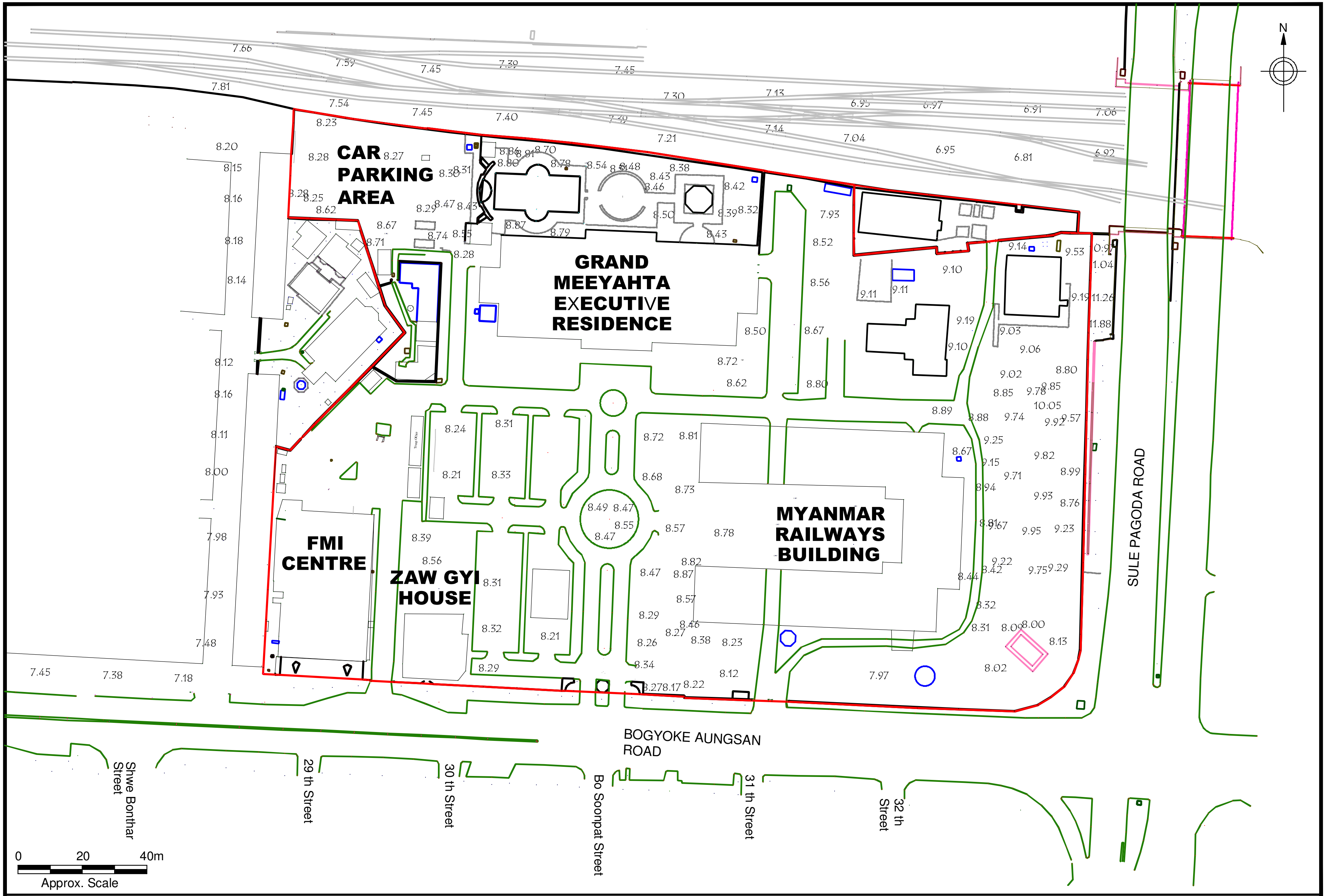

Figure 5.1: Survey Map of the Project Site

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5.2.3 Geology

Information regarding the general geology of the Project site and its surrounding areas was extracted from the following sources:

- Potential Seismicity of Yangon Region (Geological Approach), Hla Hla Aung, Advances in geosciences, Vol. 26: Solid Earth, 2010.
- Yangon River Geomorphology Identification and its Environmental Impacts Analysis by Optical and Radar Sensing Techniques, Aung Lwin and Myint Khaing, International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences, 2012.

The Yangon area is underlain by alluvial deposits (Pliestocene to Recent), the non-marine fluviatile sediments of Irrawaddy formation (Pliocene), and hard, massive sandstone of Pegu series (early-late Miocene). Alluvial deposits are composed of gravel, clay, silts, sands and laterite which lie upon the eroded surface of the Irrawaddy formation at 3 – 4.6 m above mean sea level (MSL). The rock type in Yangon is mainly soft rocks consisting of sandstone, shale, limestones and conglomerate. The Rock Map of Myanmar is presented in **Figure 5.2**.

Technically, Yangon is situated in the southern part of the Central Lowland, which is one of the three major tectonic provinces of Myanmar. The Taungnio Range of the Gyophyu catchments area of Taikkyi District, north of Yangon, through the Thanlyin Bridge, south of Yangon forming a series of isolated hill was probably caused by the progressive deformation of the Upper Miocene rocks (Aung Lwin 2012).

5.2.4 Soil

The underlying soil type at the Project site and its surroundings is characterized as the Meadow and Meadow Alluvial Soil. Meadow soil is soil which occurs near the river plains with occasional tidal floods, is non-carbonate and usually contain large amounts of salt. Both materials mainly comprise of silty clay loam and neutral soil where they are rich in available plant nutrient. **Figure 5.3** illustrates the soil types found in the Yangon Region.

Site-specific soil characteristics of the Project site were obtained from a soil investigation study which was conducted in October-November 2012 (Geolab (M) Sdn. Bhd). In particular, data from six boreholes which were installed within the Project site were reviewed. The location of the boreholes is presented in **Figure 5.4.** These boreholes were advanced by using the rotary drilling rig up to a depth of approximately 70 m.

In general, the upper layers (approximately 0 to 7 m) of the soil at the Project site comprise largely of cohesive layers with traces of sand and gravel, followed by the sand layers with low silt content and trace gravel from 7 to 35 m. The lower layers comprise denser silt layer with traces of sand and gravel from approximately 57 to 70 m. Standard Penetration Test (SPT) results indicated that the soil strength generally increases with depth.

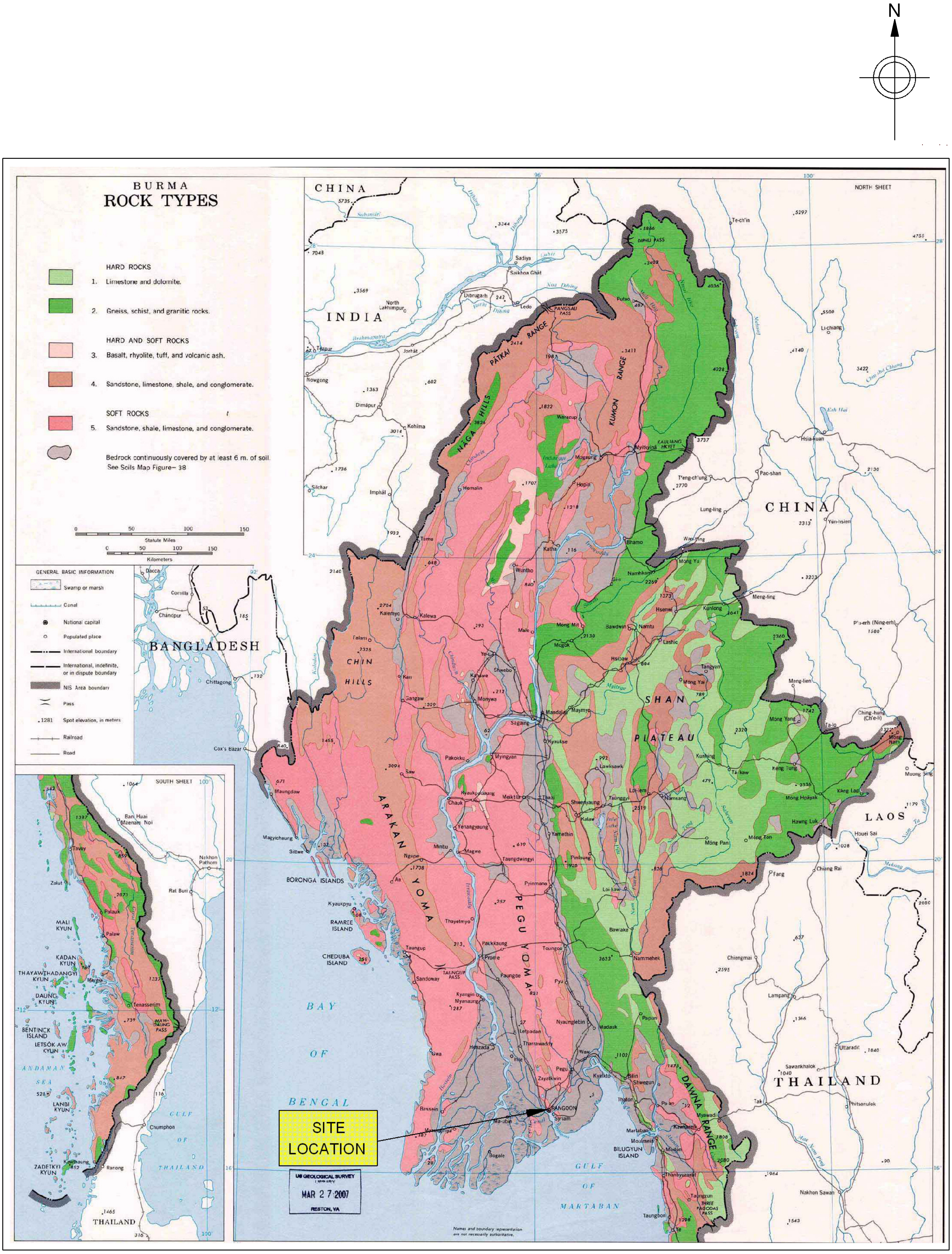

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Figure 5.2: Rock Map of Myanmar

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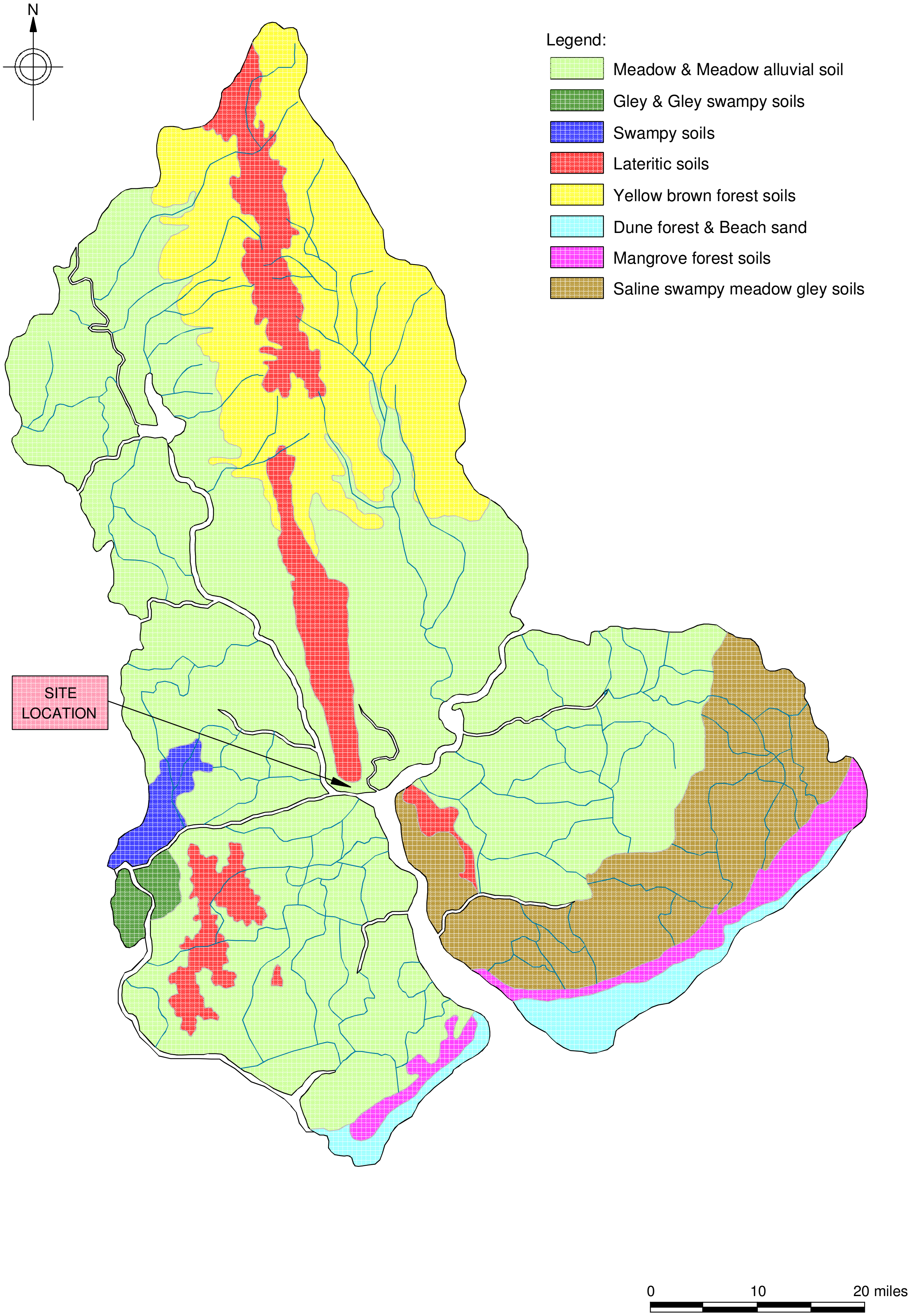

Source: Landuse Division, Myanmar Agriculture Service (Feb 11, 2002)

Figure 5.3: Soil Map of the Yangon Region

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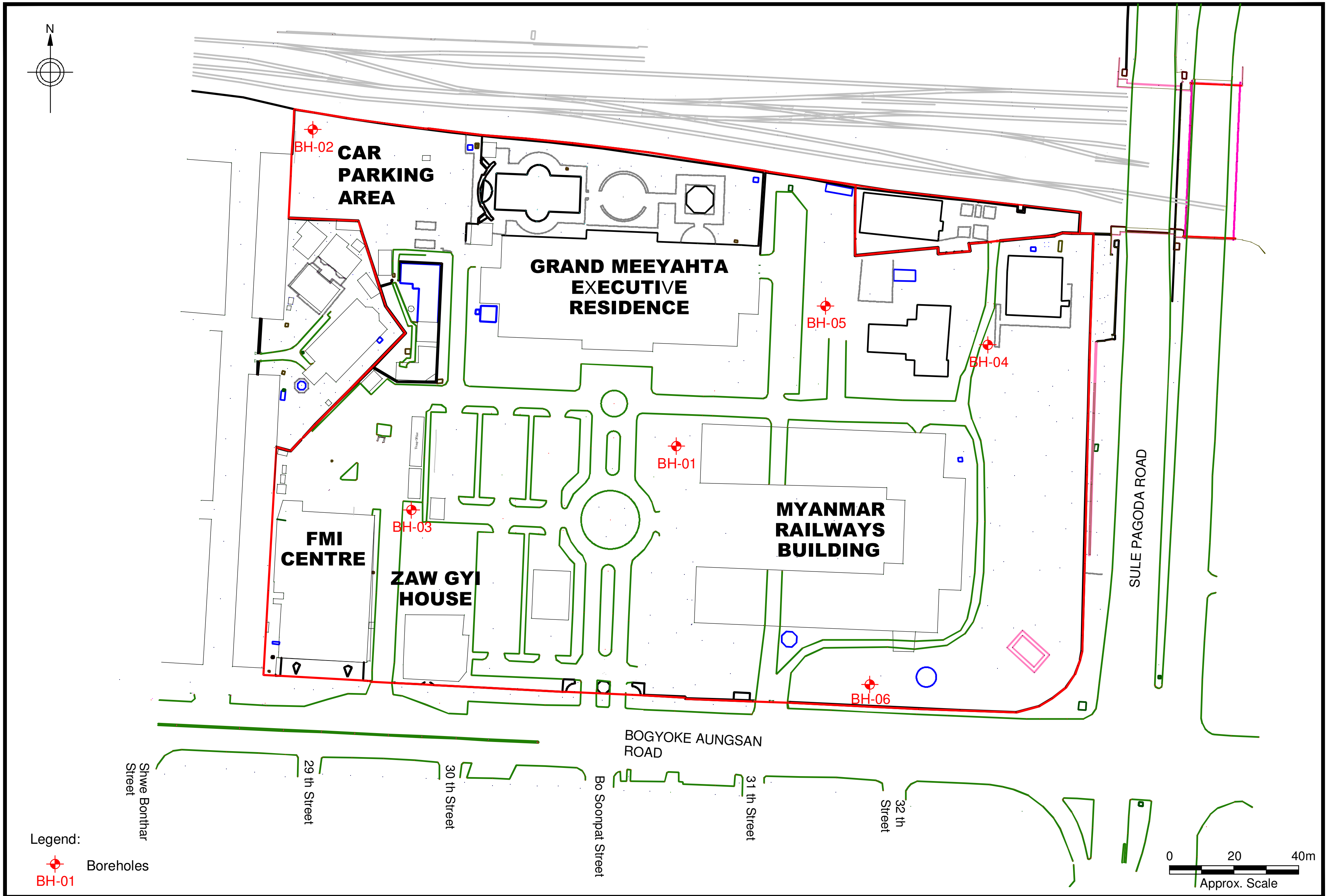

Figure 5.4: Location of Boreholes Installed During Soil Investigation

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5.2.5 Hydrogeology

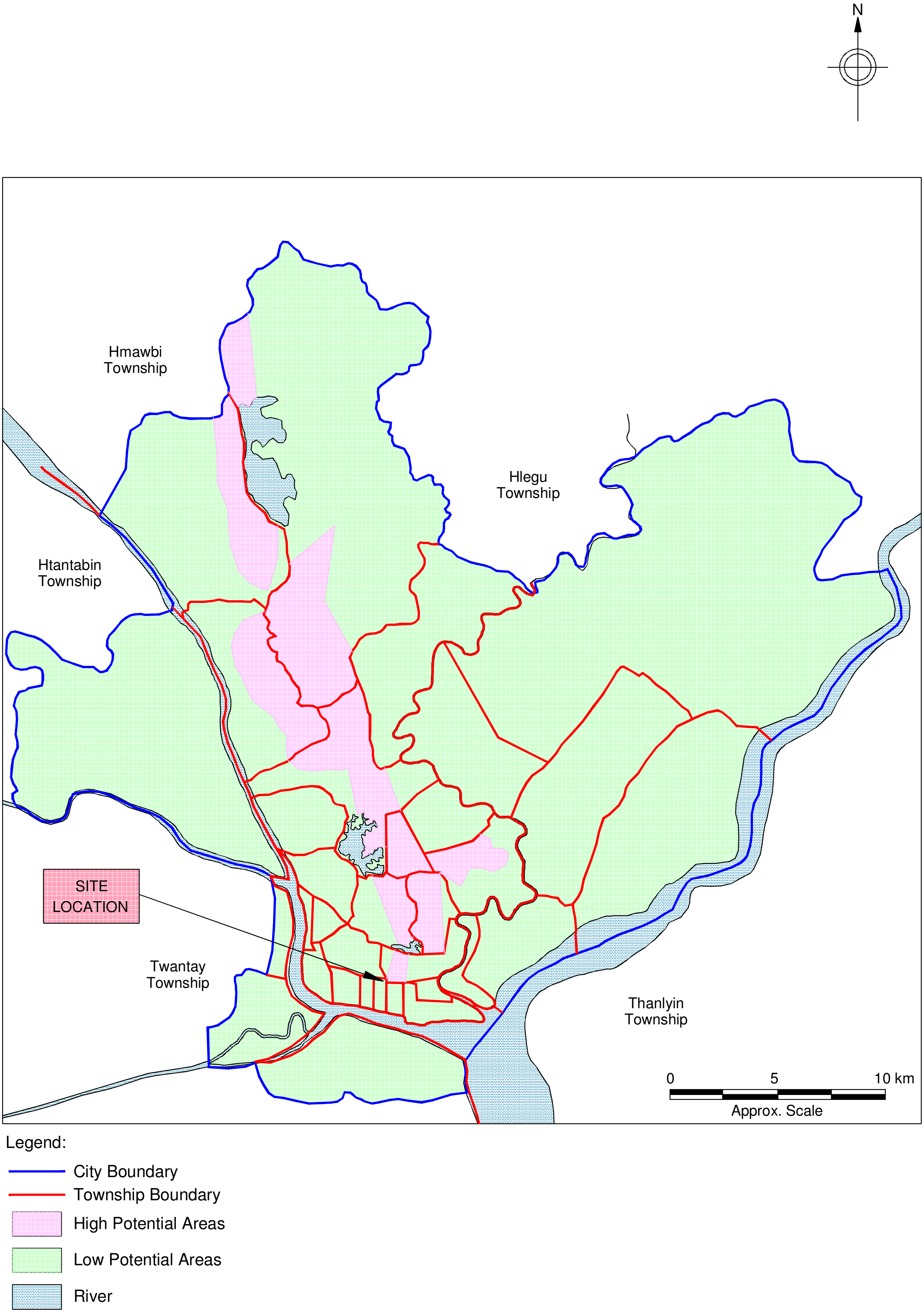
Yangon is rich in groundwater resources conserved by unconsolidated Tertiary-Quaternary deposits. In Yangon, groundwater is mostly extracted from valley filled deposits and Ayeyarwady sandstones. Groundwater availability is generally based on the distribution of permeable and relatively impermeable rocks. Based on local geological considerations, potential groundwater source of Yangon can be roughly divided into two sub regions, namely the low potential area and high potential area. The distribution of low and high potential areas is shown in **Figure 5.5**.

Low potential areas are areas with the rock units of Hlawga Shale, Thadugan Sandstones and Basepet Alternation of upper Pegu Group (Miocene epoch) and Danyingon Clays of Irrawaddy rocks. These rocks and formations are of a dense, massive and consolidated nature and have impervious characteristics. High potential areas are underlain by Pliocene Series and recent Formations. High potential area covers approximately 85% of the Yangon city, including Pabedan where the Project site is located. The township distribution with low and high potential areas of groundwater sources are tabulated in **Table 5.1.** The distribution of tube wells in Yangon is presented in **Figure 5.6**.

Table 5.1: Townshipwise High Potential and Low Potential Area of Groundwater Source

Township	Groundwater source		Township	Groundwater source	
	High Potential	Low Potential		High Potential	Low Potential
Ahlone	100%	0%	Mingalardon	50%	50%
Bahan	60%	40%	Mingalataungnyunt	90%	10%
Botataung	100%	0%	North Okkalapa	95%	5%
Dagon	100%	0%	Dagon Myothit (North)	100%	0%
Dala	100%	0%	Pabedan	100%	0%
Dagon Myothit (Seikkan)	100%	0%	Pazundaung	100%	0%
Dagon Myothit (East)	100%	0%	Seikkan	100%	0%
Hlaing	100%	0%	Sikkyikhanaungto	100%	0%
Hlaingtharyar	100%	0%	Dagon Myothit (South)	100%	0%
Insein	60%	40%	Sanchaung	100%	0%
Kamayut	80%	20%	Shwepyitha	80%	20%
Kyauktada	100%	0%	South Okkalpa	90%	10%
Kyeemyindine	100%	0%	Tamwe	10%	90%
Lanmadaw	100%	0%	Thaketa	100%	0%
Latha	100%	0%	Thingangyuan	60%	40%
Mayangon	30%	70%	Yankin	0%	0%

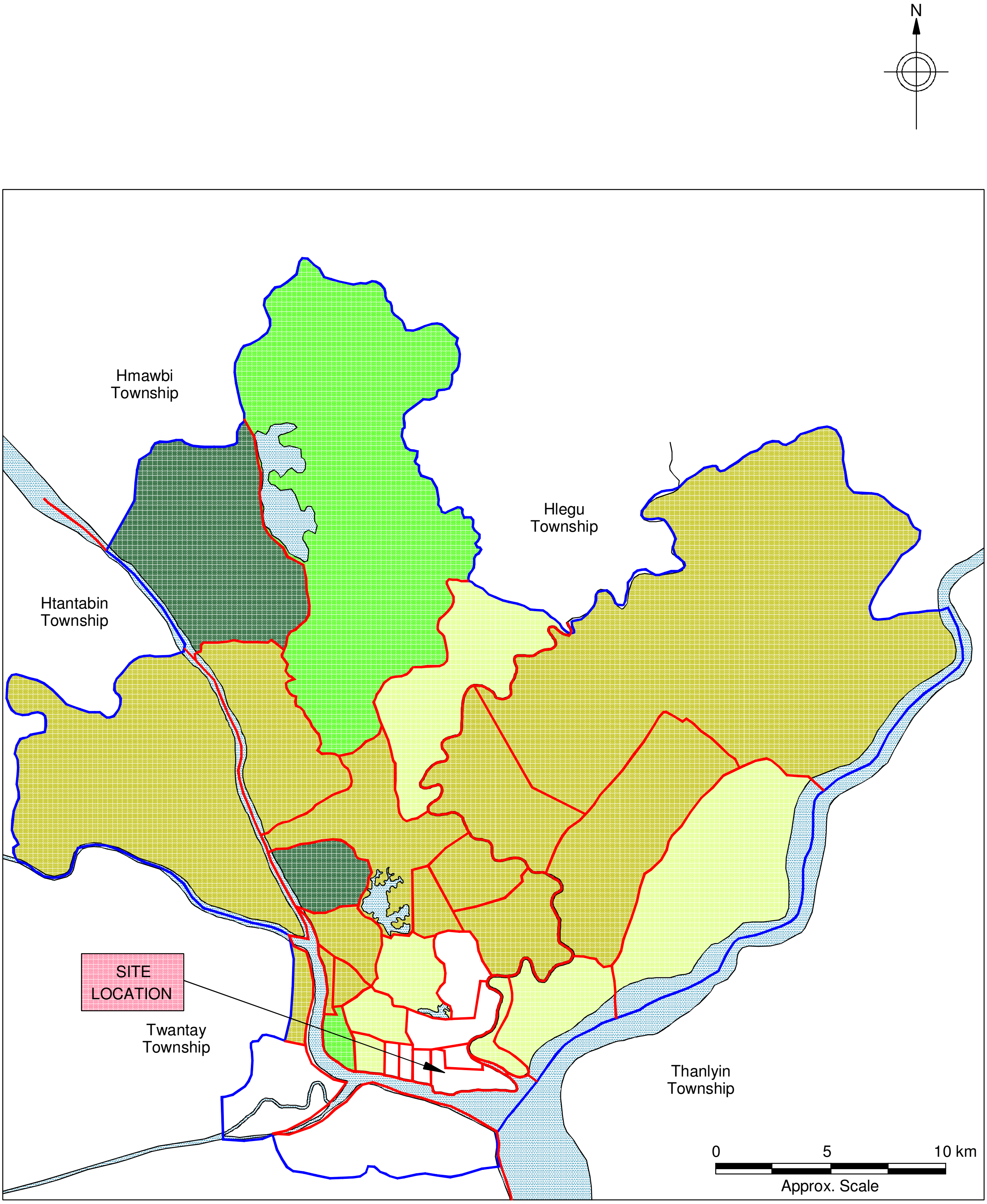
Source: Estimation based on lithology of Yangon city, Groundwater Utilization and Availability in Yangon City, Khin Kay Khaing, Universities Research Journal 2011, Vol. 4, No.5



Source: Lithology of Yangon City.

Figure 5.5: Low and High Potential Areas of Groundwater

ENVIRON



Legend:

Number of tube wells

- Below 50
- 51 - 500
- 501 - 1000
- 1001 - 10000
- 10000 - 15000

- City Boundary
- Township Boundary
- River

Source: Data from YCDC (2006)

Figure 5.6: Tube Wells in Yangon

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At the site, stand pipe piezometers were installed at BH-2, BH-3, BH-5 and BH-6 at a depth of up to 30 m from the existing ground level while a pumping well was installed at BH-1 upon completion of the soil investigation works. Based on the results recorded up to 8th December 2012, stabilized groundwater level observed at the boreholes ranged from - 0.49 m MSL (BH-1) to -1.81 m MSL (BH-5).

YCDC has an overall responsibility for management and distribution of water for Yangon City. At the moment, YCDC's water supply comes from two main sources: reservoir water from Hlawga, Gyobyu, Pugyi and Ngamoeyeik reservoirs and groundwater from YCDC's tube wells.

5.2.6 Hydrology

The Project site lies along the catchment of the Pazundaung River which flows east of the site in a southerly direction to converge into the Yangon River. The Yangon River (also known as the Rangoon River or Hlaing River) is formed by the confluence of the Pegu and Myitmaka rivers and flows into the Gulf of Martaban which is part of the larger Andaman Sea. The river flows along a 40 km stretch, flowing from southern Myanmar as an outlet of the Ayeyarwady River into the Ayeyarwady delta. A small portion of the Bago River (the estuary) lies within the Yangon Division. The Pazundaung Creek and Bago River join the Yangon River and from there, flow towards the southwestern direction into Andaman Sea (**Figure 5.7**).

5.2.7 Climate and Meteorology

Yangon has a tropical monsoon climate under the Koppen climate classification system. The city typically experiences a distinct rainy season from the month of May through to October where a substantial amount of precipitation occurs; and dry season which commences from November and ends in April.

a) Temperature

During the course of a year, average temperatures show some variance with average highs ranging from 26°C to 36°C and average lows occurring between 18^0C and 25^0C. The hottest period is between February and May, with little or no rain. At the end of this season, generally from March to April, the average monthly temperature reaches the upper 30os C. The average temperatures in Yangon range from 24°C to 36°C in April, during the hot season and ranges from 18°C to 32°C in January during the cooler season.

During the last twelve months, temperatures were highest during April with an average daily high temperature of 38°C while January was the coldest with an average daily low temperature of 20°C. Air temperature shows wide fluctuation from January to April 2013.

Based on the climate data for Yangon (1961 – 1990) provided by the World Weather Information Service, the average temperatures show little variance with average highs ranging from 29°C to 37°C and average lows ranging from 18°C to 25°C.

b) Rainfall and Relative Humidity

The climate of Myanmar follows a typical monsoon pattern. Yangon experiences the monsoon season from May to October where a substantial amount of rainfall is received. Historically, the average annual mean rainfall for Yangon was 2,681 mm with the annual average rainy days of 129.3 days. In 2013, the Department of Meteorology and Hydrology (Myanmar) has reported an annual precipitation of approximately 2,700 mm. The month with the most precipitation observations was July. It is observed that relative humidity was generally higher from May to October 2013.

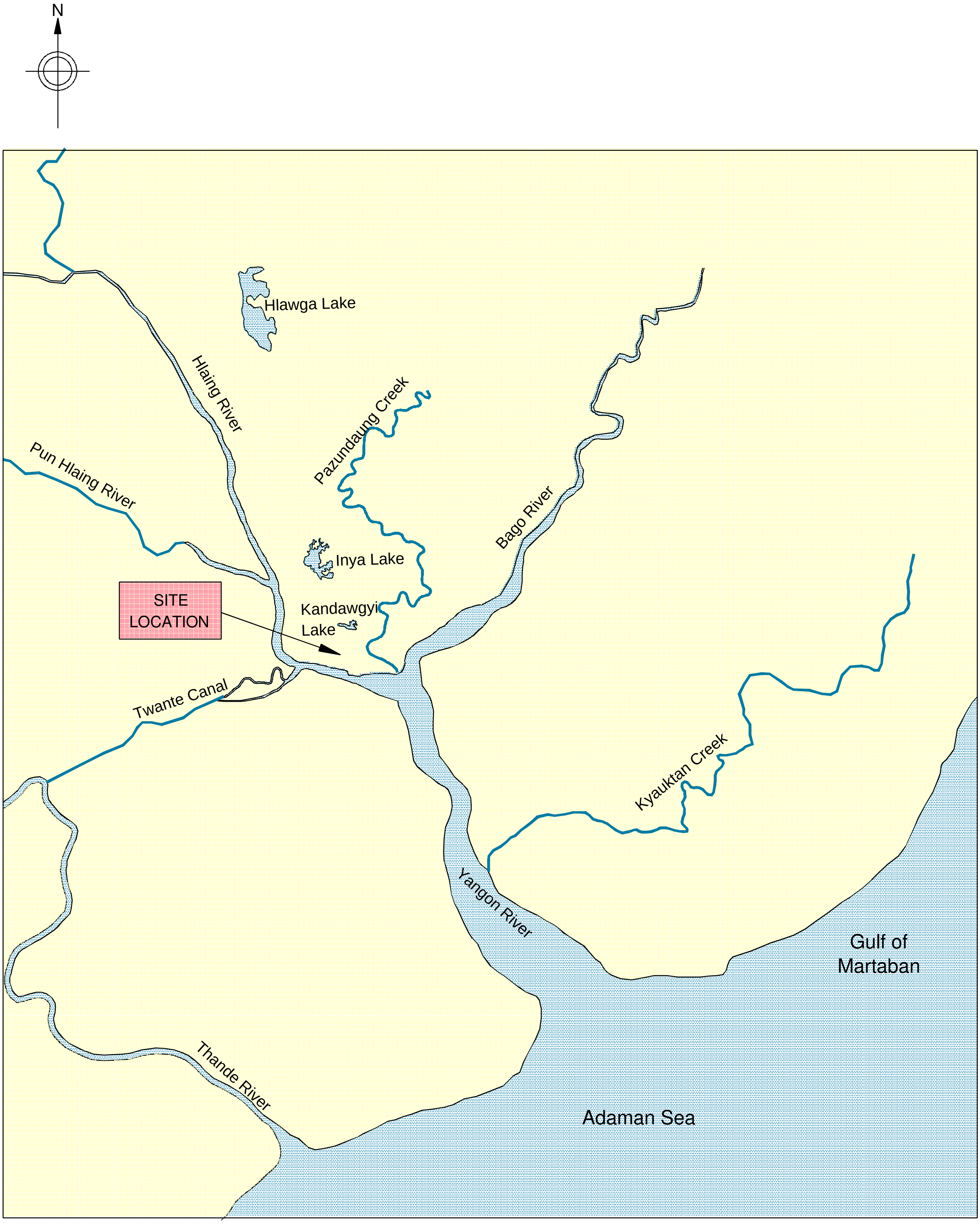

Figure 5.7: Hydrology Map

The dry season occurs from November to April. During this period, the country is less cloudy, with scant rainfall and mild temperatures with lower humidity. Based on the historical weather data for 2012 and 2013, no precipitation was observed in December 2012, February 2013 and March 2013. During this time, the least humid month was February 2013 with an average daily low humidity of 34%, and the most humid month was September with an average daily high humidity of 80%.

c) Wind Speed and Direction

For the period 2012 and 2013, the windiest month was April 2013, with an average wind speed of 3 m/s (metre per second) while the least windy month was December 2012 with an average wind speed of 1 m/s. The highest sustained wind speed was 54 m/s, occurring on 19 September 2013 and the highest daily mean wind speed was 4 m/s, occurred on 14 May 2013.

5.2.8 Natural Hazards

Myanmar is exposed to multiple natural hazards including cyclones, earthquakes, floods and fire. It has been periodically hit by natural disasters. Recent major disasters are as follows:

- Cyclones Nargis, 2008 which led to the loss of 84,537 human lives, 53,836 persons missing and damage to property up to approximately 4.1 billion USD;
- Cyclone Mala, 2006 led to the loss of 37 lives;
- Indian Ocean Tsunami, 2004 claimed 61 lives; and
- Taungdwingyi Earthquake (Magnitude: 6.8 Richter scale), 2003 led to the loss of seven lives.

a) Earthquakes

Yangon District is in the vicinity of the southern section of the Sagaing Fault which has not been active in the past 50 to 75 years. The Sagaing Fault is the most prominent active fault in Myanmar, trending roughly north to south. It has been an originator of large proportion of destructive earthquakes in Myanmar.

Five seismic zones are demarcated and named (from low to high) Zone I (Low Zone), Zone II (Moderate Zone), Zone III (Strong Zone), Zone IV (Severe Zone) and Zone V (Destructive Zone), mainly following the nomenclature of the European Macroseismic Scale 1992. Yangon straddles the boundary between Zone II and Zone III, with the old and new satellite towns in the eastern part in Zone III and the original city in Zone II. As the Project is located in an earthquake zone, incorporation the necessary safety features into building construction design and emergency response planning will be required.

b) Cyclones and Storm Surges

Myanmar is exposed to the threat of cyclones and associated storm surges from the Bay of Bengal. Previous frequency of cyclones that made landfalls at Myanmar coast was once in about three years. However, since the year 2000, cyclones crossed Myanmar's coast every year. Annually, there are approximately 10 tropical storms in the Bay of Bengal from April to December. Severe cyclones occur during the pre-monsoon period of April to May and post-monsoon period of October to December. The most recent significant cyclone was Cyclone Nargis in 2008, which tracked easterly from the Bay of Bengal, across the Yangon district. Cyclone Nargis caused a storm surge of seven meters, which resulted in extensive flooding

along the estuaries and rivers, including Yangon and caused the loss of more than 138,000 lives.

c) Flood

The monsoonal/rainy season in Myanmar is mostly from May to October during which time flooding and landslides are common in the country. The threat of flooding usually occurs in three waves each year: June, August and late September to October with significant flooding experienced during August.

5.3 Land Use within the ZoI

The 2 km study area or ZoI for the proposed Project covers the southern areas of Yangon. Overall, the primary landuse of the areas surrounding the site is a mix of commercial and residential purposes. A more detailed description is presented in **Table 5.2**. The ZoI is defined in **Figure 5.8**.

5.4 Landscape Character and Visual Amenity

The existing landscape character and visual amenity of the site are characterized by the FMI Centre, the two (2) old double storey buildings, the Zawgyi restaurant and landscaped green areas.

The architect's scheme developed for the proposed Project is characterized by seven (7) main elements: the retail podium, the Gateway Plaza, 2 office towers and 2 hotel and residential towers.

The visual and physical permeability of the site are key to the design of the proposed Project. Further, the Project design allows for easy pedestrian access from the surrounding streets which is characteristic of successful urban development schemes. The existing street level around the periphery of the Project site is currently busy with street vendors from the surrounding streets without a permanent designated space to conduct business. In addressing this issue, the Project design allows for a Retail Podium which will provide a public area for these businesses.

Table 5.2: Summary of Current Land Uses within the ZoI

Radial Distance from the Site	Land Use			
	West	North	East	South
0 km – 0.5 km	Bogyoke Aung San Market, formerly known as the Scott's Market located west of the Project site. Holy Trinity Anglican Church, located further west of the Project site.	A railway line which runs outside the northern boundary of the Project site. Hotel Imperial Jade located approximately 140 m across the railway line. Thamada Hotel and Hotel Park Royal Yangon located further south (approximately 320 m) from the site. Dagon (1) High School approximately 460 m south of the site. Mix of commercial and residential development interspersed with tourism related establishments.	Alan Pya Pagoda Street which runs along the east boundary of the site. Zoological Garden Road located adjacent to the Alan Pya Pagoda Road. Yangon Central Railway station located 400 m to the northeast	Directly adjacent to the south is the Bogyoke Aung San Road. Sule Shangri-La Hotel located further south across the Bogyoke Aung San Road. Sakura Tower located approximately 80 m southeast of the site. Mix of commercial and residential development interspersed with tourism related establishment.
0.5 km – 1 km	Universities and hospitals namely the University of Medicine 1, Yangon General Hospital and the New Yangon General Hospital located approximately 700 m southwest of the site. Mix of commercial and residential development including hotels (Olympic Hotel)	Mix of commercial and residential development interspersed with tourism related establishments.	Bogyoke Aung San Stadium St. Mary Church and a high school (Basic Education High School) Residential and commercial properties.	Tourist attraction locations including the Sule Pagoda, Maha Bandoola Garden and other residential and commercial development interspersed with tourism related establishment.
1 km – 2 km	Mix of commercial and residential development interspersed with tourism related establishment.	Mahavijaya Pagoda, located 1.8 km north of the site.	Mix of commercial and residential development interspersed with tourism related establishment.	Yangon River.

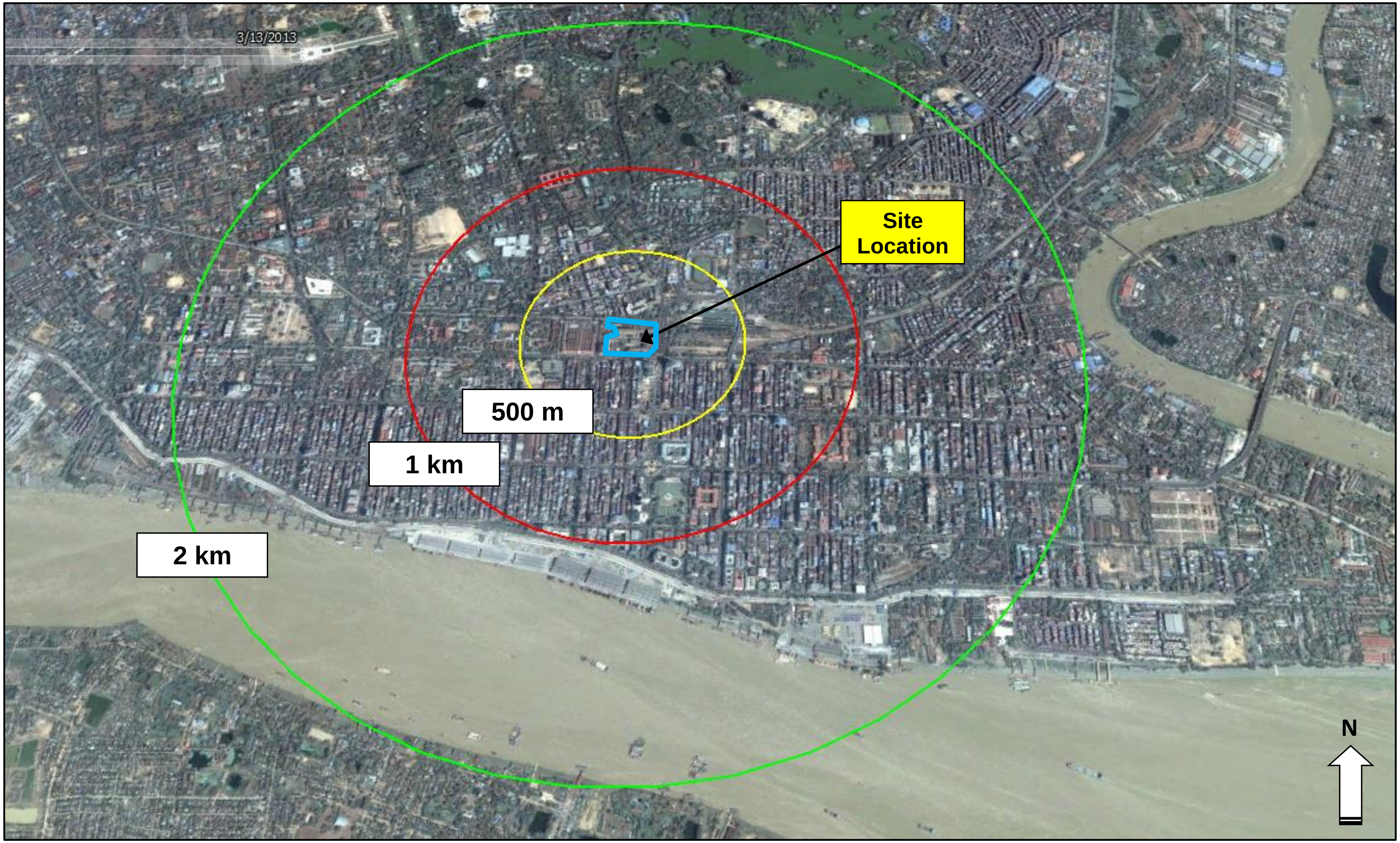

Figure 5.8: Land Use/ ZoI

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5.5 Air Quality

Yangon is the former capital and centre of commerce and trade in Myanmar. It is the Country's transport hub where motorways, railways, waterways and airways meet. The major source of air pollution in the City is vehicular emissions. Industrial emissions contribute to a lesser extent.

The Department of Meteorology and Hydrology obtains meteorological information from the Department's Kaba-Aye Station in Yangon. Based on the data obtained for the period October 2008 to September 2009, the annual mean wind speed is 3 km/h with the highest velocity of 3.38 km/h (kilometre per hour) south-west observed in July 2009. Wind direction is dominated by the southwest winds during the months of March to October and by the northeast winds from November to February.

The Ministry of Health's Occupational Health Department began measuring air pollution at three (3) selected locations within Yangon in 2009. Based on the data obtained, the air quality compares favorably with the USEPA (United States Environmental Protection Agency) NAAQS (National Ambient Air Quality Standards) and WHO Air Quality Guidelines (AQG) and the annual mean of particulate matter (PM), PM_{10}, SO_2 and NO_2 for the three monitoring sites (commercial, industrial and residential) are summarized in **Table 5.3**.

Table 5.3: Air Quality Measured at Three Monitoring Sites (Oct 2008 - Sept 2009)

Pollution Parameters	Commercial	Industrial	Residential	Area Average
	Annual Mean (µg/m^3)			
PM	58	65	91	71
PM_{10}	38	43	62	48
SO_2	1	3	1	2
NO_2	14	13	18	15

Source: Air Quality Assessment in Yangon City, Toe Aung, Air Pollution Management 2009 Advanced International Training Programme, Head of Office, Yangon City Development Committee, Union of Myanmar.

To supplement the data obtained from the desktop research was carried out to collect secondary data which is presented in **Table 5.4**. The data was obtained from a monitoring station located around the Sule Shangri-La Hotel in December 2008. The Sule Shangri-La Hotel is located across the Bogyoke Aung San Road from the Project site. The ambient air quality parameters were monitored over an averaging period of 24 hours included Total Suspended Particulate (TSP), PM_{10}, SO_2 and NO_2.

Table 5.4: Ambient Air Monitoring Results (December 2008)

Parameters	Results (μg/m^3), 24 hours averaging time		
	Commercial Area	WHO (2005)[1]	USEPA[2]
TSP	143.21	-	-
PM_{10}	71.75	50	150
SO_2	0.88	20	75 ppb^A
NO_2	22.23	200^A	100 ppb^A

Note: ^{A} – 1-hour mean

[1] - WHO AQG

[2] -- USEPA NAAQS

Source: Air Impact Assessment in Myanmar Development Projects: Sharing of Experiences and Needs to be improved during the Air-EIA, Dr. Ohnmar May Tin Hlaing, Environmental Consultant.

5.5.1 First Baseline Air Levels Data Collection in October 2013

The Project site is situated at the heart of the Yangon City where the predominant land uses are commercial and residential. The site is also abutting the heavily used Bogyoke Aung San Road which contributes significantly to the baseline ambient air quality.

The regulatory agencies have been routinely monitoring air quality in Yangon City since 2009 at representative monitoring stations based on the different land uses. Of relevance to this study are results obtained at stations representing commercial and residential areas. As shown in **Table 5.4,** the annual average PM (TSP) levels in 2008 - 2009 was recorded at 58 and 91 μg/m^3, respectively for commercial and residential areas.

For the purpose of assessing cumulative impacts, the baseline air quality was also measured at potential air sensitive receptors that may be affected by the Project. To this end, TSP was measured at three locations close to the northern, southern and western edges of the Project site on 22 October 2013 between 6 pm to 7:30 pm, which coincide with the rush hour of the area. The equipment used is the Dust Trak Aerosol Monitor (Model 8520) which operates based on the light scattering principle. The measured concentrations of TSP are shown in **Table 5.5**.

Despite shorter measurement durations compared to the long-term measurement results by the Government, the results obtained are location specific and representative of the local air quality, hence they were used in the calculation of cumulative impacts.

[1] WHO Air Quality Guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide, Global Update 2005, Summary of Risk Assessment.
[2] National Ambient Air Quality Standards (NAAQS) (40CFR part 50), USEPA.

Table 5.5: Ambient Air Quality Levels (22 October 2013)

Parameter	Location A	Location B	Location C
Nature of use	Residential building north of Site	Residential building south of Site	Shopping Mall west of Site
Time of measurement ending	18:38	19:02	19:32
Duration (minutes)	15	15	15
Likely sources of TSP	Mainly residential activities	Traffic emissions and commercial activities	Commercial activities
Measured TSP Levels ($\mu g/m^3$)	59	82	65

5.5.2 Second Baseline Air Levels Collection in February 2015

Due to the new requirement of MONREC for two-season baseline data, ENVIRON planned and conducted the air and noise quality baseline data collection in accordance with the IFC EHS Guidelines as detailed below.

5.5.2.1 Pollutants Investigated

The pollutants of concern for the project are those listed below:

- PM_{10};
- $PM_{2.5}$;
- NO_2; and
- SO_2.

Ozone is not included in the list as it is a secondary pollutant not emitted by any source and it is the product of many chemical and photochemical reactions occurring between the natural constituents of the atmosphere and nitrogen oxides and volatile organic compounds emitted by all sources present in the airshed.

5.5.2.2 Sampling Area

In this study, samples were collected at three sites, the church (LM1) to represent the project area, the northern residential area (LM2) next to the public railway lines and north-east of the Bogyoke Aung San Market and the southern residential area (LM3) near the Sule Shangri-La Hotel. **Figure 5.9** shows the locations for the sampling sites.

In Yangon, many of the roads are in poor maintenance condition and not wide enough to accommodate the increasing number of vehicles. The population of Yangon is over 7 million out of about 60 million people in Myanmar, being the Country's largest city. The major sources of pollutants in Yangon City are anthropogenic activities like industries, agriculture, and traffic.

Figure 5.9: Sampling Points around the Landmark Project

The Landmark Project is located in the Pabedan Township having an area of 0.65 km^2 (square kilometres), a population of 33,264 and population density equal to 53×10^3 per km^2. **Table 5.6** shows the GPS coordinates of the air quality and noise level monitoring points around project area.

The LM3 is at the intersection between Bogyoke Aung San Road and Alan Pya Pagoda Road where heavy traffic is observed. At LM1, the air quality and noise instruments were placed in the open space on the second floor of the church. LM2 and LM3 are located 200 m and 120 m away from the Project area, respectively. At LM2, the samplers were placed in open space on the second floor of the EPC building, approximately 6 m above the ground and 100 m away from the railway. There is no bus lane near the site and there are some villas around the LM2 site. At LM3, the samplers were placed in the open space platform near the project area and next to the Alan Pya Pagoda Road.

Photo 5.1, **Photo 5.2** and **Photo 5.3** show the air quality monitoring locations at LM1, LM2 and LM3.

Table 5.6: Coordinates of Air Quality and Noise Level Monitoring Points

Site	Description	Coordinates
LM1	St. Gabriel’s Church Union	16º46’49.63” N, 96º09’23.58” E
LM2	Intersection between Bogyoke Aung San Road and Alam Pya Pagoda Road, opposite Sule Shang-La Yangon	16º46’53º11” N, 96º09’28.80” E
LM3	Yaw Min Gyi Quarter	16º14’46.43” N, 96º09’31.50” E

5.5.2.3 Sampling Equipment

The E sampler, manufactured by MetOne, was used to collect particulate matters sample PM_{10} and $PM_{2.5}$. The E-Sampler is a nephelometer, hence, using a light scatter sensor.

Aeroqual S500, a portable gas sensor mounting gas sensitive semiconductors (GSS) with monitoring heads, was used to monitor NO_x and SO_2.

5.5.2.4 Sampling Plan

Ambient air samples were collected by E sampler and Aeroqual S500 at each monitoring point. E-sampler was used alternatively for $PM_{2.5}$ and PM_{10}. Ambient air sampling was conducted during the dry season (February 2015). The 24-hour sampling was carried out continuously. **Table 5.7** shows the monitoring schedule for Landmark project.

Table 5.7: Air Quality Sampling Period (February 2015)

Monitoring Points	PM_{10}	$PM_{2.5}$	SO_2	NO_2
LM1	3 Feb to 4 Feb	4 Feb to 5 Feb	3 Feb to 4 Feb	4 Feb to 5 Feb
LM2	5 Feb to 6 Feb	6 Feb to 7 Feb	5 Feb to 6 Feb	6 Feb to 7 Feb
LM3	7 Feb to 8 Feb	8 Feb to 9 Feb	7 Feb to 8 Feb	8 Feb to 9 Feb

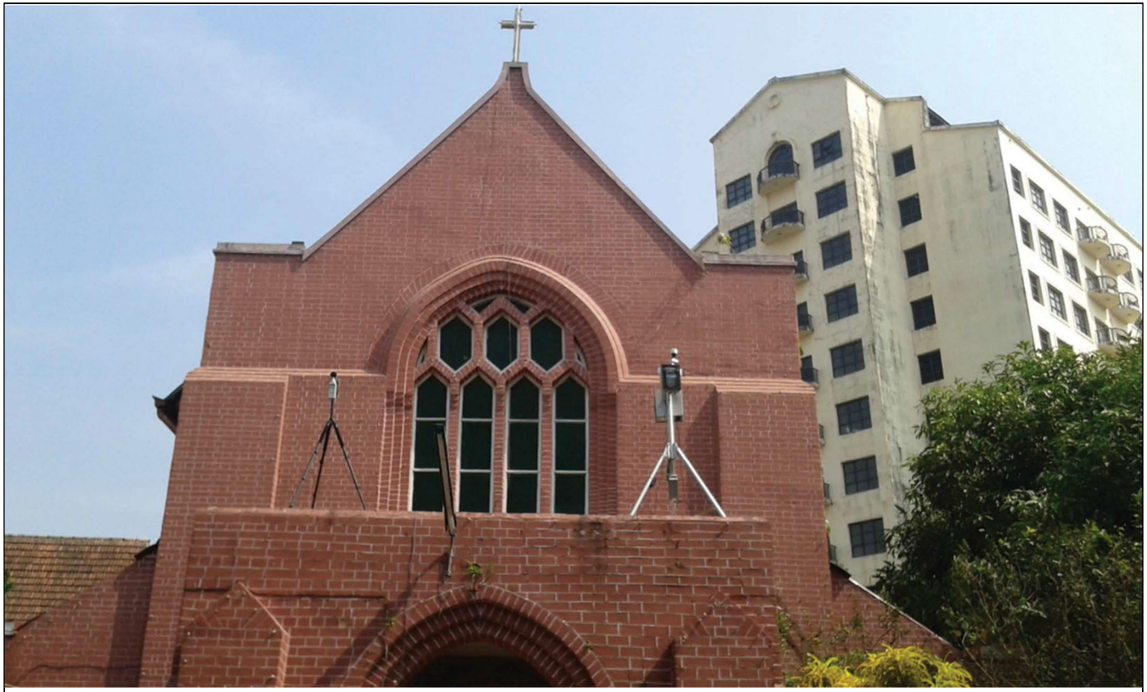


Photo 5.1: Sampling Site (LM1) Representing the Operation Area (Church)

Photo 5.2: Sampling Site (LM2) Representing the Northern Residential Area

Photo 5.3: Sampling Site (LM3) Representing the Southern Residential Area

5.5.2.5 Meteorological Data

The meteorological data for the sampling periods including air temperature, relative humidity, sea level atmospheric pressure, visibility, wind speed and rainfall were obtained from the website Wunderground (http://www.wunderground.com). A summary of the meteorological data is shown in **Table 5.8**.

Table 5.8: Weather Conditions during the Air Quality Sampling Period

2015	Temp. (ºC)	Relative Humidity (%)	Sea Level Pressure (in)	Visibility (ml)	Wind Speed (mph)	Rainfall (in)
Feb	**avg**	**avg**	**avg**	**avg**	**avg**	**sum**
1	27	66	30	4	3	0
2	27	65	30	4	2	0
3	27	57	30	4	4	0
4	27	61	30	4	3	0
5	27	60	30	4	4	0
6	27	61	30	4	5	0
7	27	57	30	4	4	0

2015	Temp. (ºC)	Relative Humidity (%)	Sea Level Pressure (in)	Visibility (ml)	Wind Speed (mph)	Rainfall (in)
8	27	55	30	4	4	0
9	26	55	30	4	4	0

5.5.3 Results and Discussion of Baseline Ambient Air Quality

Table 5.9 shows the comparison of PM_{10}, $PM_{2.5}$, NO_x and SO_2 concentrations with NEQEG 2015 at LM1, LM2 and LM3.

Table 5.9: Baseline Ambient Air Quality (February 2015)

Parameter (µg/m³)	Duration	LM1	LM2	LM3	NEQEG 2015 (µg/m³)
PM_{10}	24-hour Average	**63**	**58**	**64**	50
$PM_{2.5}$	24-hour Average	**59**	**38**	**51**	25
SO_2	24-hour Average	**42**	**94**	**75**	20
NO_2	1-hour Average	61	77	94	200

The daily average concentrations of PM_{10} were higher than NEQEG 2015 limits (50 µg/m³) at all receptors (LM1, LM2 and LM3), being 63 µg/m³, 58 µg/m³ and 64 µg/m³, respectively. For $PM_{2.5}$ concentration, the daily average values were also higher than NEQEG 2015 limits (25 µg/m³) at all sites (LM1, LM2 and LM3), being 59 µg/m³, 38 µg/m³ and 51 µg/m³, respectively. For SO_2 concentrations, all the monitoring findings were higher than NEQEG 2015 limits at 42 µg/m³, 94 µg/m³ and 75 µg/m³, respectively. Average hourly NO_x concentrations for LM1, LM2, and LM3 were 61 µg/m³, 77 µg/m³, and 94 µg/m³, respectively and these concentrations were lower than the NEQEG 2015 value of 200 µg/m³ at all monitoring sites but NO_x concentrations exceeding the NEQEG 2015 hourly standard were observed between 10 am and 12 pm.

It is important to note that findings from the baseline air quality monitoring showed higher levels of PM_{10}, $PM_{2.5}$, and SO_2 exceeding NEQEG 2015 guideline values even before the project construction activities commenced.

5.6 Noise Quality

5.6.1 Baseline Noise Levels Monitoring in February 2015

To establish the existing baseline condition, noise levels were measured at representative noise sensitive receivers near the project area.

5.6.1.1 Noise Sampling Area

The noise monitoring programme was conducted at representative noise sensitive receivers at and near the Landmark project. The monitoring points were located approximately at the same locations of the air receptors.

5.6.1.2 Noise Sampling Equipment

Extech sound level measurement instrument was used for 24 consecutive hours monitoring.

5.6.1.3 Noise Sampling Plan

Sampling plan for noise level monitoring at LM1, LM2 and LM3 are shown in the **Table 5.10**.

Table 5.10: Ambient Noise Levels Sampling Plan

Monitoring Point	Noise monitoring
LM1	3 Feb to 4 Feb 2015
LM2	5 Feb to 6 Feb 2015
LM3	7 Feb to 8 Feb 2015

5.6.2 Results and Discussion of Baseline Noise Levels

Two periods of twelve hours continuous monitoring of noise levels were investigated for comparison with the NEQEG limits for day and night. In this study, all ambient noise levels at all sites exceeded the noise level guidelines for residential, institutional and educational but is well below the allowable limits for industrial and commercial.

A summary of the noise levels recorded is presented in **Table 5.11**. LM3 appeared to be with high noise level because of its vicinity to a busy intersection and congested roads. In addition, it is also close to the Hindu Monastery where religious ritual with loud music was taking place during the monitoring period (7 to 8 February 2015).

Table 5.11: Summary of Noise Levels Monitored at Landmark Area (February 2015)

Duration	LM1 (dBA)	LM2 (dBA)	LM3 (dBA)	NEQEG 2015 (dBA)	
				Residential, Institutional, Educational	Industrial, Commercial
Day (7am-7pm)	**62**	**59**	**70**	55	70
Night (7pm-7am)	**49**	**53**	**62**	45	70

5.7 Soil and Groundwater

An intrusive soil and groundwater investigation was performed at the Project site to ascertain the baseline soil and groundwater conditions. The following sections describe the field activities and investigation methodology, and results of the investigation.

The location of the soil and groundwater sampling stations is presented in **Figure 5.10**.

The investigation was performed based on the American Standard for Testing Methodology (ASTM) Standard Practice for Environmental Site Assessments (ESA) E 1527-05 (Phase I ESA) and ASTM E 1903-11 (Phase II ESA), as applicable outside of the United States.

A total of four boreholes were drilled using a 150 mm-diameter auger and motorized drilling machine (BH-1 to BH-4) to a depth of up to 2 m below ground level (bgl), below the fill material and based on the actual depth of the water level at each borehole location. The remaining six shallow boreholes (BH-5 to BH-10) were advanced using hand auger to an average depth of 2 m bgl to a maximum depth of 4.2 m bgl, depending on the soil profile encountered during hand augering. At all locations, the boreholes were first hand augured to a maximum depth of 1.5 m bgl as an additional precautionary measure against drilling into underground services.

Soil samples were collected from the drill barrel and the lithology of the soil was visually logged in accordance with the Unified Soil Classification System (USCS).

Soil samples were collected from a total of ten boreholes based on the criteria below:

- One sub-surface soil sample (0.3 to 0.5 m bgl);
- One soil sample at 1.5 m bgl to 2.0 m bgl; and
- One soil sample every 2.0 m to 3.0 m bgl thereafter until the depth of termination.

One to two representative soil samples were selected at each borehole for chemical analysis based on visual and olfactory indications of contamination. Selected samples were placed in laboratory-provided sampling bottles. In addition, one sample was collected from an existing excavation area to determine the soil quality beneath the Grand Meeyahta building. This sample was labelled as TP-11.

A total of four boreholes were converted into groundwater monitoring wells (MW1 to MW4) to enable sampling of the underlying shallow groundwater. Following the completion of well installation activities, the monitoring wells were developed to remove fine particles that may have accumulated in the well during well installation activities. Well development entailed manually bailing out water from each well using a dedicated disposable PVC bailer. The monitoring wells were continuously developed until the purged water is visually clear or sediment-free. Static water level at each monitoring well was measured using a dip meter during borehole drilling and monitoring well installation. Groundwater sampling was performed using dedicated bailers. Onsite groundwater quality parameters measured during purging and sampling include temperature, pH, total dissolved solids (TDS) and electrical conductivity (EC).

5.7.1 Laboratory Analysis

A total of fifteen soil and seven groundwater samples, inclusive of one soil and one groundwater duplicates were subjected to chemical analysis. The relevant analytical methods based on USEPA and American Public Health Association (APHA) were used for testing of the soil and groundwater samples.

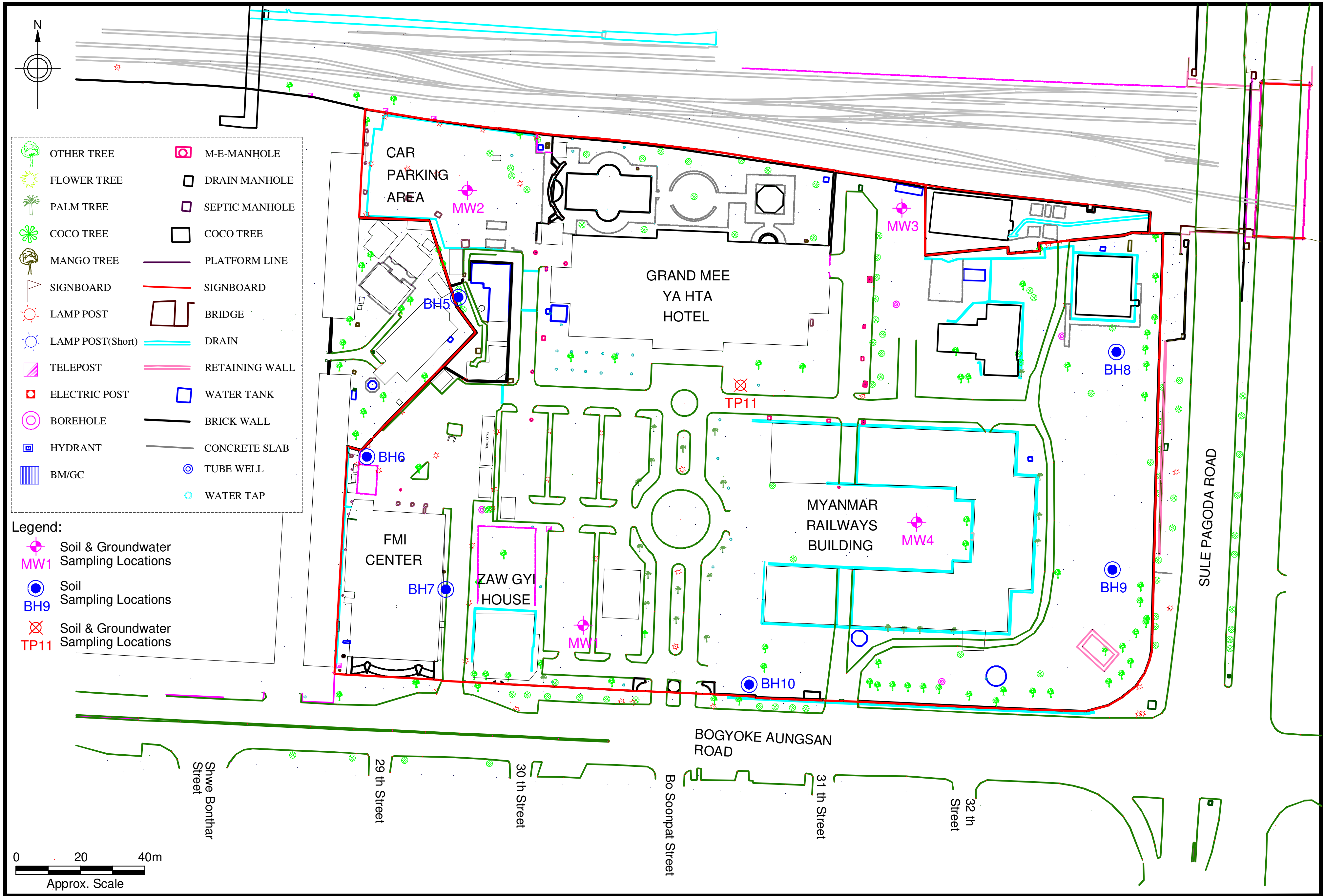


Figure 5.10: Soil and Groundwater Sampling Stations

In the absence of official standards in Myanmar, the samples were analyzed for parameters recommended by the Singapore Jurong Town Corporation (JTC) Environmental Baseline Study (EBS) Guidelines. These parameters include:

- Metals and metalloids;
- Volatile Organic Compounds (VOCs);
- Semi-Volatile Organic Compounds (SVOCs);
- Total Petroleum Hydrocarbons (TPH);
- Inorganic compounds;
- Conventional analytes;
- Organic matter and moisture;
- General groundwater quality;
- Total Coliform; and
- Asbestos-Containing Materials (ACM).

5.7.2 Assessment of Results

As there are currently no compound-specific reference standards for assessing the presence of soil and groundwater impact in Myanmar, the baseline analytical results were compared against the Dutch Standards 2009 (Rev 2012).

The Dutch standard specifies two sets of limits for heavy metals, inorganic compounds, aromatic compounds, hydrocarbons, pesticides and other pollutants for soil and groundwater as follows:

- Dutch Target Values (DTV): When the concentration level is below the DTV, the groundwater is considered as unpolluted. If the concentration level lies between the Dutch Intervention Value (DIV) and DTV, the site is considered contaminated but the contamination may not be serious enough to warrant a clean-up. Further investigation of the site including a risk assessment may be required to resolve uncertainties with respect to the possible pollution and its associated risks to determine the need to carry out a clean-up based on current and future land use requirements and its associated risks in the context of the project.
- Dutch Intervention Values (DIV): When the concentration level is above the intervention value, the soil/sediment/groundwater is considered as seriously contaminated and clean-up of the site is required. A case of serious contamination is deemed to exist if the average concentration measured of at least one substance in a soil volume of at least 25 m^3 in the case of soil contamination or a pore-saturated volume of at least 100 m^3 in the case of groundwater contamination, is higher than the DIV.

If the parameter is not listed in the Dutch Standards, alternative screening criteria were used. Any exceedances to the DIVs were compared to alternative standards for purposes of evaluating risk to human health and the environment. The Myanmar water quality standards were used where available.

5.7.3 Soil Sampling Analytical Results

A summary of detected constituents in soil and a comparison of the soil analytical results of DTV and DIV standards for soil are summarized in **Table 5.12**.

Table 5.12: Summary of Soil Analytical Results

Test Parameter	Dutch Standard (Rev 2012)		LOR[c]	MW1	MW2	MW3			MW4		BH5	BH6	BH7	BH8	BH9	BH10	TP11
				204001/2002[d]	207002/2002	201003/2001	201003/2003	201003/2006	202004/2001	202004/2008	206005/2001	209006/2003	209007/2001	201008/2002	202009/2001	203010/2002	206011/2001
	DTVs[a]	DIVs[b]		1.5 m[e]	1.0 m	0.5 m	3.0 m	9.0 m	0.5 m	13.0 m	0.5 m	4.0 m	0.6 m	2.0 m	0.5 m	2.0 m	1.1 m
Metals and Metalloids																	
Arsenic	29	76	0.5	3.98	5.40	3.18	4.33	0.55	7.68	1.86	4.61	3.02	4.96	6.21	21.6	6.00	65.4
Barium	160	-[f]	0.5	132	129	26.7	118	20.5	197	35.8	80.4	30.7	49.7	109.0	191	122	484
Cadmium	0.8	13	0.5	<0.5	0.77	<0.5	<0.5	<0.5	0.51	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.96
Chromium Total	100	-	0.5	26.9	51.4	24.4	26.5	10.7	43.7	24.6	35.2	32.8	29.5	47.9	60.2	41.2	39.6
Cobalt	9	190	0.5	9.35	10.4	7.89	12.6	2.86	13.6	7.69	9.49	5.20	10.1	37.3	8.41	12.0	21.9
Copper	36	190	0.5	39.8	102	6.75	40.9	4.11	125	2.99	61.6	9.72	18.0	15.8	75.6	50.4	600
Total Mercury	0.3	-	0.02	0.65	0.21	0.04	0.20	0.02	0.82	<0.02	0.30	0.22	0.39	0.07	0.40	0.65	0.17
Lead	85	530	0.5	76.7	195	13.9	44.2	6.25	13.6	7.65	73.5	15.1	40.9	38.0	7.28	89.1	154
Molybdenum	3.0	190	0.5	<0.5	0.73	<0.5	1.03	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel	35	100	0.5	19.6	23.5	36.9	18.2	18.5	22.8	33.0	23.1	11.0	21.3	19.9	22.3	23.7	12.0
Zinc	140	720	0.5	79.4	174	39.2	153	16.7	17.4	25.1	18.0	15.7	53.8	32.1	16.6	174	648
Antimony	3	22	0.5	1.20	4.00	0.65	1.26	<0.5	3.39	0.56	1.86	1.08	1.01	1.74	2.33	1.40	1.57
Inorganic Compounds																	
Total cyanide	1	20	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.4	<0.10	<0.10
PAHs																	
Anthracene	-	-	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.18	<0.1	<0.1	<0.1	<0.1
Phenanthrene	-	-	0.1	<0.1	0.58	<0.1	0.22	<0.1	<0.1	<0.1	<0.1	<0.1	1.19	<0.1	0.10	<0.1	<0.1
Fluoranthrene	-	-	0.1	0.24	0.36	<0.1	0.55	<0.1	<0.1	0.16	<0.1	<0.1	2.38	<0.1	0.26	0.51	<0.1
Benzo(a)anthracene	-	-	0.1	0.19	0.33	<0.1	0.40	<0.1	<0.1	0.12	<0.1	<0.1	1.47	<0.1	0.18	0.45	<0.1
Chrysene	-	-	0.1	0.22	0.44	<0.1	0.32	<0.1	<0.1	0.12	<0.1	<0.1	1.10	<0.1	0.18	0.34	<0.1
Benzo(a)pyrene	-	-	0.2	<0.2	<0.2	<0.2	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	0.58	<0.2	<0.2	0.32	<0.2
Benzo(k)fluoranthrene	-	-	0.2	0.29	0.24	<0.2	0.35	<0.2	<0.2	0.21	<0.2	<0.2	0.93	<0.2	0.26	0.49	<0.2
Sum PAH (soil with OM up to 10%)	1	40	0.2	0.94	1.95	<0.2	2.04	<0.2	<0.2	0.61	<0.2	<0.2	7.83	<0.2	0.98	2.11	<0.2
Other Pollutants																	
Mineral Oil	50	5000	50	55	83	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Conventional Analytes																	
Fluoranthrene	-	-	0.1	0.24	0.36	<0.1	0.55	<0.1	<0.1	0.16	<0.1	<0.1	2.38	<0.1	0.26	0.51	<0.1

Test Parameter	Dutch Standard (Rev 2012)		LOR[c]	MW1	MW2	MW3			MW4		BH5	BH6	BH7	BH8	BH9	BH10	TP11
				204001/2002[d]	207002/2002	201003/2001	201003/2003	201003/2006	202004/2001	202004/2008	206005/2001	209006/2003	209007/2001	201008/2002	202009/2001	203010/2002	206011/2001
	DTVs[a]	DIVs[b]		1.5 m[e]	1.0 m	0.5 m	3.0 m	9.0 m	0.5 m	13.0 m	0.5 m	4.0 m	0.6 m	2.0 m	0.5 m	2.0 m	1.1 m
Benzo(a)anthracene	-	-	0.1	0.19	0.33	<0.1	0.40	<0.1	<0.1	0.12	<0.1	<0.1	1.47	<0.1	0.18	0.45	<0.1
Chrysene	-	-	0.1	0.22	0.44	<0.1	0.32	<0.1	<0.1	0.12	<0.1	<0.1	1.10	<0.1	0.18	0.34	<0.1
Benzo(a)pyrene	-	-	0.2	<0.2	<0.2	<0.2	0.20	<0.2	<0.2	<0.2	<0.2	<0.2	0.58	<0.2	<0.2	0.32	<0.2
Benzo(k)fluoranthrene	-	-	0.2	0.29	0.24	<0.2	0.35	<0.2	<0.2	0.21	<0.2	<0.2	0.93	<0.2	0.26	0.49	<0.2
Sum PAH (soil with OM up to 10%)	1	40	0.2	**0.94**	**1.95**	<0.2	**2.04**	<0.2	<0.2	**0.61**	<0.2	<0.2	**7.83**	<0.2	**0.98**	**2.11**	<0.2
Other Pollutants																	
Mineral Oil	50	5000	50	**55**	**83**	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Conventional Analytes																	
Fluoranthrene	-	-	0.1	**0.24**	**0.36**	<0.1	**0.55**	<0.1	<0.1	**0.16**	<0.1	<0.1	**2.38**	<0.1	**0.26**	**0.51**	<0.1
Benzo(a)anthracene	-	-	0.1	**0.19**	**0.33**	<0.1	**0.40**	<0.1	<0.1	**0.12**	<0.1	<0.1	**1.47**	<0.1	**0.18**	**0.45**	<0.1
Chrysene	-	-	0.1	**0.22**	**0.44**	<0.1	**0.32**	<0.1	<0.1	**0.12**	<0.1	<0.1	**1.10**	<0.1	**0.18**	**0.34**	<0.1
Benzo(a)pyrene	-	-	0.2	<0.2	<0.2	<0.2	**0.20**	<0.2	<0.2	<0.2	<0.2	<0.2	**0.58**	<0.2	<0.2	**0.32**	<0.2
Benzo(k)fluoranthrene	-	-	0.2	**0.29**	**0.24**	<0.2	**0.35**	<0.2	<0.2	**0.21**	<0.2	<0.2	**0.93**	<0.2	**0.26**	**0.49**	<0.2
Sum PAH (soil with OM up to 10%)	1	40	0.2	**0.94**	**1.95**	<0.2	**2.04**	<0.2	<0.2	**0.61**	<0.2	<0.2	**7.83**	<0.2	**0.98**	**2.11**	<0.2
Other Pollutants																	
Organic matter, %	-	-	0.1	**2.9**	**10.5**	**0.5**	**6.8**	<0.1	**3.1**	<0.1	**3.1**	**0.3**	**0.8**	**0.4**	**5.6**	**1.2**	**12.4**
Moisture, %	-	-	0.1	**18.4**	**20.8**	**17.3**	**18.4**	**16.3**	**10.1**	**16.1**	**13.5**	**21.7**	**17.2**	**14.7**	**8.95**	**19.9**	**50.1**
Other Analytes																	
TPH C15-C28	-	-	10	**21**	**60**	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
TPH C29-C36	-	-	10	**34**	**23**	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Coliform Count, MPN/g sample	-	-	*	NA	NA	**>1,100**	**>1,100**	NA	**>1,100**	NA	**>1,100**	**>1,100**	NA	NA	**>1,100**	**>1,100**	**>1,100**
Pyrene	-	-	0.2	**0.23**	**0.39**	<0.2	**0.52**	<0.2	<0.2	<0.2	<0.2	<0.2	**2.08**	<0.2	**0.23**	**0.53**	<0.2

Notes:
a – NOBO 2008 for DTV as referenced in Dutch Standard 2009 (rev 2012)
b – Dutch Intervention Values 2009 (Rev 2012)
c – Limits of reporting
d – Row refers to sample identification marks
e – Row refers to depth the sample was taken
f – No Dutch standard
**No laboratory limit or reporting*
NA – Not Analyzed
Units are in mg/kg, unless otherwise indicated
Detected concentrations are in bold font; DTV exceedances are highlighted in yellow; DIV exceedances are highlighted in red.
Barium and total chromium were detected in the equipment wash blank at 87 µg/L respectively. As per EPA, if the blank concentration is greater than or equal to the limit of reporting or greater than a fifth the sample concentration, whoever is greater, the results may not be reported. In the case of barium and total chromium, the detected concentration in the equipment wash blank are less than the limit or reporting for the soil samples, as such, results are valid.

DTV exceedances in soil were reported for all metals and metalloids tested for except total chromium and molybdenum, selected sum PAHs (polycyclic aromatic hydrocarbons) and mineral oil. Among samples tested, TP11 has reported an exceedance of the DIV limit for copper (190 mg/kg) with a reading of 600 mg/kg. This maximum copper concentration was compared with the following alternative standards for combined direct exposure pathways in a commercial/ industrial setting (**Table 5.13**).

Table 5.13: Comparison of Maximum Copper Concentration at the Site and Alternative Criteria (mg/kg)

Sample ID and concentration	Hong Kong RBRG[a]	Florida DEP[b]	NZ[c]
208011/2001 (TP11-1.1 m) – 600 mg/kg	10,000	89,000	NL

Note:

a Hong Kong Risk-Based Remediation Goals (RBRGs) for Contaminated Land Industrial Land use

b Florida Department of Environment Soil Clean-up Target Levels (CTLs) for direct exposure in commercial/industrial land

c New Zealand Ministry for Environment Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health

NL = No limit. This is where the derived values exceed 10, 000 mg/kg

A comparison with alternative standards for combined exposure pathways (dermal contact and incidental ingestion) in commercial/ industrial soil indicates that the general population (including excavation workers) is not at risk at the current copper concentrations.

Further, Total Coliform was detected in the soil samples. This group includes faecal coliform (e.g., *Escherichia coli* (E. coli)), as well as other forms of naturally occurring coliform found in soil. Most coliforms are harmless in soil with no human health risk. To prevent any potential risks, the incidental ingestion of soil at the site should be prevented by the enforcement of appropriate personal protective equipment (PPE) and good hygiene practices, e.g. frequent washing of hands.

5.7.4 Groundwater Sampling Analytical Results

A summary of the detected constituents in groundwater and a comparison of groundwater analytical results to DTV, DIV are shown in **Table 5.14.**

Groundwater levels were measured at 10.1 m bgl (MW1), 6.73 m bgl (MW2), 7.71 m bgl (MW3) and 11.3 mbgl (MW4) during sampling and/ or purging. Barium in all four monitoring wells was found to exceed the DTV. The ammonia concentration at MW3 exceeded the DTV.

Total coliform was present in groundwater samples MW3 and MW4, recording at 30,000 colony forming unit CFU/100 ml and 500 CFU/100 ml, respectively. There are presently no limits for this parameter in surface water or groundwater quality. Only the Myanmar effluent standards stipulate limits for Total coliform at <400 MPN/100ml of coliform bacteria. The detected CFUs in MW3 and MW4 are above this limit and as such groundwater pumped from the site cannot be discharged to the public sewer system without prior treatment.

Based on the Guidelines on Canadian Drinking Water Quality, the CFUs in MW3 and MW4 exceed the limit of 10 CFU/100 ml. In the event groundwater from the site is proposed for consumption, the supply will be subjected to treatment to ensure safe consumption of the water.

Table 5.14: Summary of Groundwater Analytical Results

Test Parameter	Dutch Standard (Rev 2012)		LOR[c]	MW1	MW2	MW3	MW4
	DTV[a]	DIV[b]		207001/5001[d]	204002/5001	201003/5001	202004/5001
Metals and Metalloids							
Barium	50	625	<20	**87**	**109**	**166**	**80**
Nickel	15	75	<10	<10	14	11	14
Zinc	65	800	<10	<10	12	<10	<10
Total coliform Count (cfu/100 ml)	<400[e]		*	NA	NA	**30,000**	**500**
Conventional Analytes							
pH @ 25°C (pH Unit)	6.5 to 9.2[f]		0.1	7	6.4	7.1	**5.5**
BOD @ 20°C (mg/L)	50[e]		2	5	4	5	4
COD (mg/L)	250[e]		1	12	16	26	8
Total Organic Carbon (mg/L)	-		0.10	1.17	<0.10	0.63	0.67
Fluoride as F (mg/L)	20[e]		0.10	0.26	<0.10	0.29	<0.10
Chloride as Cl (mg/L)	600[f]		0.10	32.1	30	42.5	<0.10
Sulphate as SO_4 (mg/L)	400[f]		0.10	37.2	90.4	14.6	26.8
Ammonia as N (mg/L)	10[e]		0.01	0.64	2.1	**14.1**	2.50
Conductivity (µS/cm)	-		1.0	445	577	596	234

Notes:
a – Dutch Target Values 2009 (rev 2012)
b – Dutch Intervention Values 2009 (rev 2012)
c – Limits of reporting
d – Row refers to sample identification marks
e – Myanmar Effluent Quality Standard
f – Myanmar Effluent Quality Standard
- No available standard
**No laboratory limit or reporting*
NA – Not Analyzed
Units in µg/L, unless otherwise indicated
DTV exceedances are in bold font

Groundwater quality analysis results covered parameters such as Barium, Nickel, Zinc, Total Coliform Count, pH, BOD, COD, total organic carbon (TOC), Fluoride, Chloride, Sulphate as SO_4, Ammonia as N, and conductivity. Generally, Barium, Nickel, Zinc, and conductivity are measured in industrial wastewaters. Treated wastewater effluent parameters were not offered in the report.

IFC EHS Guidelines' Water and Ambient Water Quality uses pH, BOD, COD, Total nitrogen, Total phosphorus, oil and grease, total suspended solids, and total coliform bacteria as its fundamental parameters for treated sanitary sewage discharges. Hence, the report did not measure total nitrogen, total phosphorus, oil and grease, and total suspended solids. Total suspended solids and oil and grease are important parameters for food processing activities together with vehicles and human actions. Prior to discharging the effluent, temperature of wastewater should not increase greater than 3°C of ambient temperature at the edge of the mixing zone.

Table 5.15 shows a comparison with IFC EHS Guidelines for Water and Ambient Water Quality standards as well as USEPA and Canadian Groundwater Quality Standards.

Table 5.15: Comparison of Groundwater Analytical Results with IFC, USEPA and Canadian Groundwater Quality Standards

Test Parameter	LOR[c]	IFC Water and Ambient Water Quality	USEPA - DW	Canadian GW Quality	MW1	MW2	MW3	MW4
					207001/ 5001d	204002/ 5001	201003/ 5001	202004/ 5001
Metals and Metalloids								
Barium	<20	-	2	0.5	87	109	166	80
Nickel	<10	-	0.7	-	<10	**14**	**11**	**14**
Zinc	<10	-	5	0.01	<10	**12**	<10	<10
Total coliform count (cfu/100 ml)	*	400	0	0	NA	NA	**30,000**	**500**
Conventional Analytes								
pH @ 25°C (pH Unit)	0.1	6 – 9	6.5 – 8.5	6.5 – 8.7	7	6.4	7.1	**5.5**
BOD @ 20°C (mg/L)	2	30	-	-	5	4	5	4
COD (mg/L)	1	125	-	-	12	16	26	8
Total Organic Carbon (mg/L)	0.10	-	-	-	1.17	<0.10	0.63	0.67
Fluoride as F (mg/L)	0.10	-	2	0.12	**0.26**	<0.10	0.29	<0.10
Chloride as Cl (mg/L)	0.10	-	250	230	32.1	30	42.5	<0.10

Test Parameter	LOR[c]	IFC Water and Ambient Water Quality	USEPA - DW	Canadian GW Quality	MW1	MW2	MW3	MW4
					207001/ 5001d	204002/ 5001	201003/ 5001	202004/ 5001
Sulphate as SO_4 (mg/L)	0.10	-	250	100	37.2	90.4	14.6	26.8
Ammonia as N (mg/L)	0.01	10 as total N	30	-	0.64	2.1	**14.1**	2.50
Conductivity (µS/cm)	1.0	-	-	-	445	577	596	234

5.8 Biological Environment

As previously described, the Project site is a built-environment and the species of flora surveyed at the site are native species not uncommon to the Yangon area. There were no protected species or species of conservation value identified.

The existing flora within the Project site was identified by undertaking a preliminary survey.

Based on the survey data, 112 trees were identified. **Table 5.16**, **Table 5.17, Figure 5.11** and **Figure 5.12** present details of the survey including the species identified and their trunk diameter and height. It is noted that these species comprise common species which are native and largely distributed in Myanmar. No protected species or species of conservation value were identified.

The survey indicates that the majority of the trees (75%) are small with diameters less than 2 feet. Only 11 trees were recorded to have a diameter of 8 feet and this constituted 10% of the total number of trees.

Table 5.16: Trunk Diameter of Trees within the Project Site

Trunk Diameter (ft.-in)	Total of Trees
1'	30
1'6"	25
2'	29
2'6"	4
3'	3
3'6"	5
4'	2
5'	1
6"	1

Figure 5.11: Distribution of Tree Diameters in the Project Area

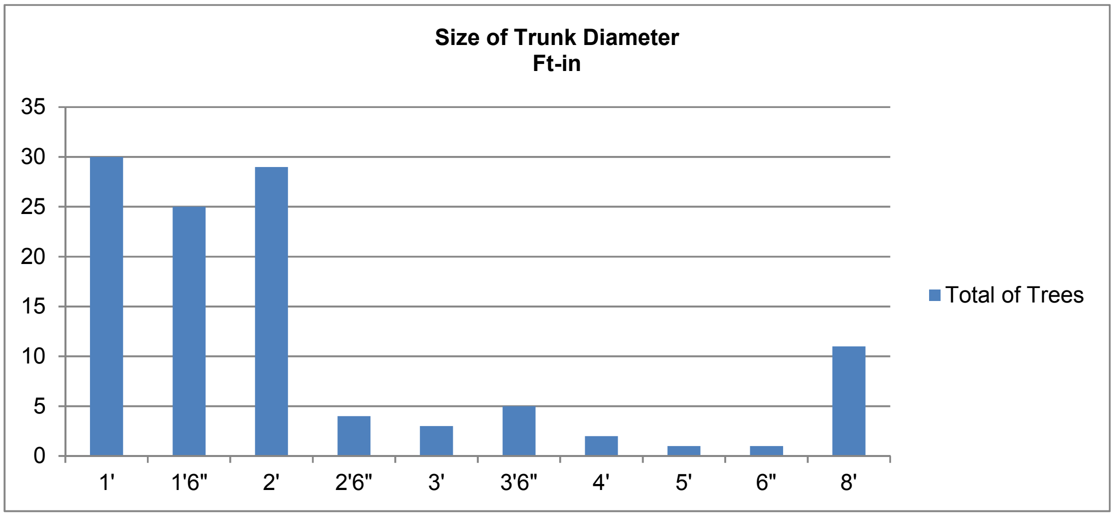
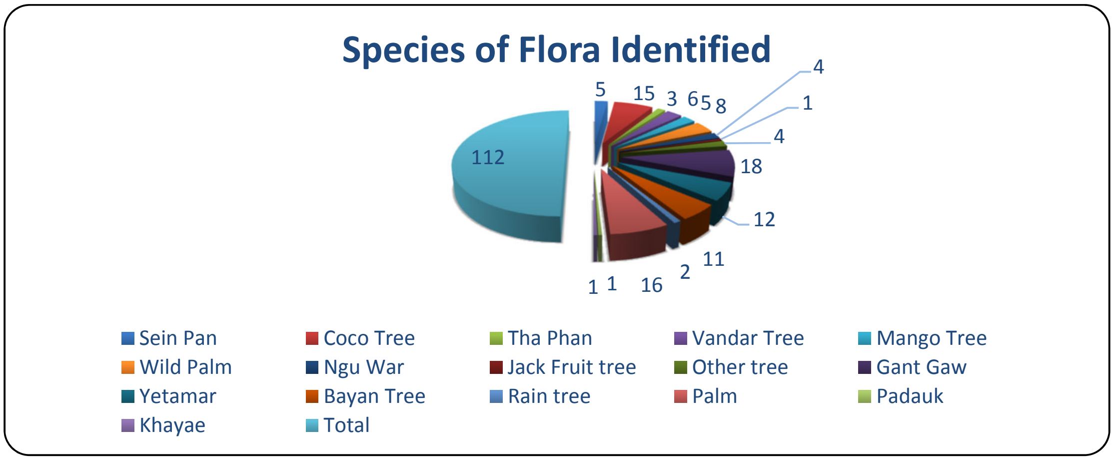


Table 5.17: Species of Flora Identified at the Project Site

Tree Name	Total
Sein Pan	5
Coco Tree	15
Tha Phan	3
Vandar Tree	6
Mango Tree	5
Wild Palm	8
Ngu War	4
Jack Fruit tree	1
Other tree	4
Gant Gaw	18
Yetamar	12
Bayan Tree	11
Rain tree	2
Palm	16
Padauk	1
Khayae	1
Total	**112**

Figure 5.12: Distribution of Plant Species in the Project Area



5.9 Socio-Economic Environment

The current population of Yangon is 5.14 million making it the largest city in Myanmar followed by Mandalay. The population of Yangon represents 12% of the national population and approximately 22% of the country's gross domestic product (GDP). Yangon was the capital of Myanmar until 2005.

Myanmar lacks comprehensive socio-economic information on the current population and land uses, with the last census completed in 1983, some 30 years ago. The description provided below is general information obtained from desktop research on secondary sources.

Yangon has a higher growth rate than the rest of the Country. Between 1998 and 2011, the rate was recorded at 2.58% per annum versus the national growth rate of 2% per annum for the 2000-2005 periods. This population growth is not homogeneous across the city of Yangon. The suburbs have high growth rates of 6-7%, as opposed to an almost zero or negative average population growth rates in the central business district and centre area. Around 10% of the population of Yangon is believed to live in slums.

Information obtained in 2011 shows that the ratio of the labour population to the total population in Yangon City was 50.8% (2.61 million) with nearly 70% of the working population (1.78 million) typically involved in tertiary industries.

5.9.1 Population Density, Population Growth and Distribution in Yangon

The Yangon Division is the smallest but the most densely populated area in Myanmar with population density of 635 persons per sq. km. (km^2) in 2005. The other divisions and states had densities far below this level almost less than half of Yangon. Secondary data (Ngah, 2005) on the socio-economic status within Yangon indicated that the City has a higher growth rate that the rest of the country.

In 2005, the total population of Yangon City was estimated to be about 4.35 million, with an average growth rate of 2.5% during 1983-2005 periods (**Table 5.18**). During the 1990's and early 2000's, the rate of population growth was due to the increase in migration from rural areas and from other states. It has increased from 2.11% during the 1983-1993 period to 2.87% during the 1993 - 2005 period.

Population growth differs across the townships. For example, townships located in or near the Inner-City Area (ICA) have experienced a low population growth of approximately less than 1% per annum. The population in the Pabedan Township was 41,913, 45,205 and 54,515 in 1983, 1993 and 2005, respectively. The Average Annual Growth Rate (AAGR) from 1983 - 1993 was 0.76% and from 1993 - 2005 was 1.57%.

The 2005 data indicated that 30% the population were under 15 years old, 65% between 15 and 64 years old and 6% were over 64 years old. The relatively low proportion of population below 15 years old was due to low fertility level and improvement in life expectancy. The migration of people within working age group (over 15 years old) also contributed to higher percentage of working age groups.

Table 5.18: Population of Yangon City and Yangon Division, 1983 – 2005

Area	Population			AAGR (%)	
	1983	1993	2005	1983-1993	1993-2005
Yangon City	**2,513,023**	**3,097,765**	**4,350,913**	**2.11**	**2.87**
Outside City	1,452,977	1,870,168	2,1111,066	2.56	1.00
Yangon Division	3,966,000	4,967,933	6,461,979	2.28	2.21
Myanmar	35,308,000	43,116,000	55,399,000	2.02	2.00

Source: Adapted from unpublished statistics, Department of Population, Union of Myanmar
Note : AAGR = Average Annual Growth Rate

A recent map of Yangon City published in July 2013 by the Myanmar Information Management Unit of the United Nations Development Programme (with the support of the Embassy of Switzerland in Myanmar) showed that the Pabedan Township has an urban population of 29,900. The projected population for the Pabedan Township for 2015 is 62,402 people and 67,575 people for 2020 based on a growth projection of 1.4 for 2010 - 2015 and 1.6 for 2015 - 2020.

5.9.2 Employment by Sector

The industrial structure in Yangon Region consists of the processing and manufacturing sector (37%), trade sector (25%) and services sector (24%).

Data on employment distribution by sectors was obtained from the Population Census of 1983 and the report of Myanmar Fertility and Reproductive Health Survey 2001 conducted by the Department of Population. Only broad category of industrial sectors were available from the survey. The primary sectors consist of agriculture, forestry, hunting and fishing. Secondary sectors include mining, quarrying, manufacturing and construction and the tertiary sectors are electricity, gas, water, transport, communication and other services.

Table 5.19 shows the total number of people employed in Yangon City increased from about 805,000 in 1983 to about 1.64 million in 2001. The key employment sector is the tertiary sector with a share of more than 70% of total employment. About one fifth of the total population employed were in secondary sector and about 5% in the primary sector, particularly agriculture. Tertiary sectors recorded highest growth of 4.3% during 1983-2001 period compared with 3.4% for secondary sector and 2.7% for primary sector.

The inner-city townships have high density and limited area for future expansion. The population of the townships located at the eastern and western fringes of the cities is expected to grow more than 4% per annum while the population of older townships located in and around the inner city is projected to increase much slower (less than 2.0%).

Table 5.19: Yangon City: Employment by Sector (1983 – 2001)

Sector	Number		Percentage		AAGR (%) 1983-2001
	1983	2001	1983	2001	
Primary	41,792	67,334	5.2	4.1	2.7
Secondary	192,051	348,167	23.8	21.2	3.4
Tertiary	571,402	1,226,797	71.0	74.7	4.3
Number Employed	**805,245**	**1,642,299**	**100.0**	**100.0**	**4.0**

Source: Adapted from Population Census 1983 and Myanmar Fertility and Reproductive Health Survey 2001
Note: AAGR = Average Annual Growth Rate

5.9.3 Labour Supply and Demand

The projected growth of the working age population (age over 15 years) and labour force is shown in **Table 5.20.** The number of people of working age is projected to rise from about 3.1 million in 2005 to 5.4 million in 2020 which corresponds to the increase in overall population during the same period.

The labour force participation rate is expected to increase by a rate of 0.5 % per annum from 59.2% in 2005 to 63.8% in 2020. The labour force is projected to increase from about 1.8 million in 2005 to about 3.5 million in 2020. The average growth of labour force is about 4.3% per annum, which is higher than the average growth of population (3.82%). This is due to the increase in labour force participation rate.

Table 5.20: Projected Labour Force, 2005 – 2020

	Number				AAGR (%) 2005-2020
	2005	2010	2015	2020	
Labour Force Part. Rate	59.2%	60.7%	62.2%	63.8%	0.50
Population Age 15+	3081447	3710240	4492275	5408043	3.82
Labour Force	1823253	2250736	2793954	3448445	4.34

Source: Yangon Strategic Development Plan, 2005

Table 5.21 shows a scenario of employment growth based on extrapolation of the past trend. If future employment continues to grow at an average of 4% per annum then the number of new jobs created will be about 1.6 million during the 2005-2020 period. Under this scenario the demand for labour will balance the supply and the jobs available will be sufficient to provide employment opportunities to the future labour force projected in Yangon City.

Tertiary sector is expected to remain dominant and its share to the total employment increase from 75.4% in 2005 to 78% in 2020 while the primary and secondary sectors are expected to decline in their share to the total employment.

The number of graduates according to field study specialization is shown in **Table 5.22**. There had been a significant increase in graduates from 7,024 in 1997/98 to 93,068 in 2002/03 with the majority graduating in the field of Arts and Science. These two areas of specialization accounted more than 80% of graduates produced in 2002/03.

Table 5.21: Projected Employment Growth by Sector, Yangon City 2005 – 2020

Sector	Number				Percentage				AAGR (%)
	2005	2010	2015	2020	2005	2010	2015	2020	2005-2020
Primary	74,906	85,579	97,773	111,705	3.9	3.6	3.4	3.2	2.7
Secondary	397,988	470,406	556,000	657,170	20.7	20.0	19.4	18.8	3.4
Tertiary	1,451,811	1,791,973	2,211,837	2,730,075	75.4	76.3	77.2	78.0	4.3
Total Employment	**1,924,704**	**2,347,958**	**2,865,610**	**3,498,950**	**100.0**	**100.0**	**100.0**	**100.0**	**4.1**

Table 5.22: Number of Graduates by Field of Study Specialization 1997/98 and 2002/03

Specialization	97/98	02/03	97/98	02/03
Buddhism	132	208	1.9	0.2
Engineering and Architecture	1199	2541	17.1	2.7
Computer Science & Computer Technology	256	2745	3.6	2.9
Economics	126	2673	1.8	2.9
Statistics	0	261	0.0	0.3
Commerce	0	1683	0.0	1.8
Education	1196	3497	17.0	3.8
Forestry	53	101	0.8	0.1
Veterinary	121	92	1.7	0.1
Arts *	1735	41035	24.7	44.1
Science**		35624		38.3
Foreign languages	241	336	3.4	0.4
Agriculture	7	440	0.1	0.5
Health	1958	1834	27.9	2.0
Total	**7024**	**93070**	**100.0**	**100.0**

**Arts include disciplines such as history, geography, law; etc.*
Science includes disciplines such as (zoology, botany, chemistry, mathematics, etc.
Source: Handbook on Human Resources Development Indicators, 2004

5.9.4 Socio-economic Survey Results of Household

The proposed Landmark Project is located within the commercial complex of the downtown Yangon and it is surrounded by Dagon, Pabedan, and Kyauktada Townships. There are seven Wards, namely Yawmin Gyi Ward in Dagon Township, Wards 1, 2 and 3 in Kyauktada Township, and Wards 5, 8 and 11 in Pabedan Township, are located within the immediate impact zone of the proposed Project. Therefore, the demographic information, the potential environmental and social impacts of the proposed Project to the surrounding townships are gathered by structured interview survey questionnaire. Based on the data from the local General Administration Departments (GAD) of three different townships, about 10% of the total households in each township were randomly selected. There is a total of 709 respondents from residents and local businesses, including 489 respondents from residents, 76 respondents from Bogyoke Market and 154 street shops/ vendors were randomly selected for the representative sample of the potential project affected population **Table 5.23**.

Table 5.23: Number of Respondents from Each Wards of the Three Townships

Township	Wards	Total No of Household	% of Household	Total Respondents
Dagon	Yaw Min Gyi	1343	7	91
Kyauktada	Ward No 1	541	7	38
	Ward No 2	509	11	57
	Ward No 3	628	9	55
	Sub total	1678	9	150
Pabedan	Ward No 5	534	13	69
	Ward No 8	1167	10	119
	Ward No 11	410	12	50
	Sub total	2111	12	238
Total Households		**6810**	**9.33**	**479**

a) Demographic information of Dagon Township

Yaw Min Gyi Ward with the total population of 1,343 households in Dagon Township is located at the northwest side of the proposed project area. 91 household or 7% of the total household are randomly selected for the representative sample. Among these, more than 68% of respondents are male and about 32% are female.

The age group of respondents range between under 20 to more than 50 years old. 52% of the total respondents are over 50 years old and almost 40% are in the middle group of 31 to 50 years old. Almost 8% of the respondents are in young age group 21 to 30 years old and only 1% is observed to be less than 21 years old.

All the respondents are Myanmar citizenship and almost 84% of respondents are Myanmar ethnic groups (majority is Burma, Shan, Kachin and Mon ethnic groups) and the rest 17% are

not Myanmar ethnic group. As majority of the respondents are Burma, 77% practice Buddhism, almost 18% are Muslims, only 4% are Christians and 1% of non-religious group are observed.

The educational backgrounds of the respondents range between informal/ primary levels to postgraduate degree. Almost equal in number 47% each are observed in high school level and graduate degree holder, however more than 5% of respondents only have primary to middle school level education. Almost 2% are postgraduate degree holders observed in this Ward.

The family sizes of the respondents range between 1 to 12 members. There are more than 60% of respondents who have 4 to 6 family members, while more than 30% have only 1 to 3 members. However, about 8% of respondents have a big family with 7 to 9 members and more than 1% of 10 to 12 family members are also observed in this study.

This study covers all levels of residents who have settled in this ward for several years. More than half or 55% of respondents have been living in this ward for more than 21 years, while more than 14 % have been living here for less than 5 years, 13% for 6 to 10 years and almost 18% of respondents have been living for 11 to 20 years in this ward.

The monthly income levels of respondents in this wards range between 1 to more than 9 lakh kyats. The majority, 54% of respondents earned 1 to 5 lakh kyats per month, meanwhile more than 23% have 5 to 7 lakh kyats and almost 8% of respondents earned more than 9 lakh kyats per month. However, during socio-economic survey more than 15% of respondents are not willing to provide the information on their income.

More than 68% of respondents conduct their own private business, while 20% of respondents are working as the staff for private companies and almost 7% are government employees. More than 1% are not willing to divulge their major livelihood, and almost 5% of the respondents who actively participated in this survey are pension holders or senior citizenship.

Almost 28 % of respondents are doing their private business near the proposed Land Mark project area while almost 70 % have no business inside the direct impact zone. There are various kinds of business observed in this area such as small-scale food shop to restaurant, apartments rental services, electronic devise shop, water pump motor shop, PVC pipe shops, workshop and mechanic services, selling commodities at Bogyoke Market, motor vehicle agent, Xerox services and private taxi drivers to Management company are also included.

With regard the prior information dissemination of proposed land mark project, more than 80% of respondents are partially informed and some of them want to know more about the proposed project, while almost 18% showed that they are familiar with the proposed project. Only 2% did not provide any response on this question.

On the perspective of the respondents on the proposed land mark project, more than 75 % showed they are in favour with almost 10% expressed very favourable response on it. However almost 7% of the respondents dislike on this Project and about 6% showed no interest on this Project, while about 2% are not willing to give any perspective on it.

Almost 90% of the respondents believed that the proposed Project will not have any negative impact on their livelihood, however, more than 5% of respondents think that some impacts will likely to affect their livelihood. About 3% of them cannot predict the potential impacts of the proposed Project. Among the respondents, more than 1% believed that there will be some impacts on their livelihood, while another 1% showed that they do not know about the potential impact of the Project.

b) Demographic information of Pabedan Township

There are three wards i.e. 5, 8 and 11 in the Pabedan Township, these wards located at the opposite side of the proposed Project. About 10% (238) households are randomly selected from the total households of 2,111. Most of the respondents are male and more than 33% are female respondents. The age groups of the respondents range between under 20 to over 50, but about 64% is in the middle age group of 21 to 50 years old and more than 31% are over 50 years old.

Although all the respondents are Myanmar citizens, more than 61% are Myanmar ethnic groups, among these majority are Burmese while almost 39% are Muslim and Hindu. As a quite populated downtown area, diverse religious belief was observed in these three wards, about 49% practice Buddhism, 42% Islam, more than 6% Hinduism, and almost 2% are Christianity.

The educational background of the respondents range between informal (monastery and primary) to postgraduate degree. More than 76% have high school to graduate degree, 17% in middle school level and the rest of them have primary to informal education including post graduate degree.

More than 54% of the respondents have 4 to 6 family members but about 33% have 1 to 3 members only. Half of the respondents have been living in this Township for more than 20 years, about 26% are residents for 6 to 20 years and almost 24 % have been living in this township for less than 5 years.

The income of the respondents range between 1 to more than 9 lakh kyats per month, but only about 7% of them have above 9 lakh kyats, 13% earned for 6 to 9 lakh and 48% earned 1 to 5 lakh kyats. Almost 32% of respondents are not willing to provide information on their monthly income.

The majority 78% of the respondents do private business, while only 5% in Government staff and 15% of private company staffs are also observed among the respondents. Very few numbers of pension holder and home-shop vendor are also included.

Almost 60% of respondents do not have any business near the proposed Project area but about 40% are doing their business near the proposed Landmark Project. There are various kind of businesses observed in these areas including small scale household shops, apartments, restaurants, clinic, optometry, bookstores and printing press shops to trading company.

During the structured interview survey, information dissemination and perspective of respondents on the proposed development project are recorded. Almost 20% of respondents knew very well about the project information, but more than 73% received information partially and some of them want to know more about the project design and responsible organizations. However, about 5% of the respondents showed no response concerning the project information dissemination system of the developer.

77% of the respondents are in favour of the proposed Project while 12% expressed favourable response as their property values will increase with the surrounding estate development. However, 5% of the respondents expressed dislike and neutral responses by their own concerns.

More than 90% of the respondents believe that their livelihood will not be affected by the proposed development Project; meanwhile, about 5% of respondents believe that their

livelihood will likely to be affected by the proposed Project and less than 5% of respondents cannot predict or do not know about the potential impact on their livelihood.

c) Demographic information of Kyauktada Township

There are three wards namely, Ward 1, 2 and 3 in the Kyauktada Township, which is located in the potential impact zone of the proposed Landmark Project. According to the local GAD of Kyauktada Township, the total population of household is 1,678, among these 9% (150 households) of the household are randomly selected for the representative sample of the study. The gender status of the study showed that 60% are male respondents and 40% of female respondents are also included.

The study covers all the age groups of the respondents, from under 20 to above 50 years old. Almost 20% of the respondents are in the age group under 20 to 30 years while 40% each are in middle age group (over 31 to 50 years old) and old age group (above 51 years old).

Like other townships, all the respondents are Myanmar citizens and almost 90% are Myanmar ethnic groups including Burma, Kayin, Shan and Rakhine races, while more than 10% are non-ethnic group.

Majority (85%) of the respondents in these three wards are Buddhist, followed by Muslims (11%), Christians (3%) and the rest 1% expressed that they do not have any religious belief.

As of the Kyauktada Township is located in the middle of down town Yangon, more than 57% of the respondents have graduate level education and almost 2% with postgraduate degree are also observed. The 33% of the respondents have high school level education while only 8% of them have primary and middle school levels education.

52% of the respondents have 4 to 6 dependent family members while almost 43% of them have only 1 to 3 family members. About 4% of the respondents have a big family size 7 to 10 family member are also observed in this township, while more than 1% are not willing to give information on their family members.

The study result indicated that majority (52%) have more than 21 years of residency in this Township, 16% settled in this Township for less than 5 years, about 15% of 6 to 10 years and more than 17% is within 11 to 20 years. Therefore, this study covers the perspective of the residents who have different years of settlement in this Township.

The residents of Kyauktada Township also have different income levels, about 42% of the respondents in this Township are not willing to provide information on their monthly income. Among the respondents, 32% earned 1 to 5 Lakh kyats only, while about 19% of respondents earned 5 to 9 lakh kyats. The highest level of income group of more than 9 lakh kyats was observed only in 7% of the respondents.

Almost 20% of the respondents have their own business near the proposed Landmark Project. Fortunately, majority of the respondents (78%) have no business near the Project affected area. The types of business vary, among these include the most widely observed businesses such as hardware shops, food shops, pharmacy, bookstores, computer showrooms and service centres, apartment agent, electronic gadget shops, sport equipment shops, computer design printing house and travel agencies. Some of the respondents have garment and textile shops in the Bogyoke Market.

In terms of project information dissemination, 16% have awareness on this development complex information, while more than half of the respondents partially know about the Project

and almost 21% of the respondents want to know more about the proposed Project especially in project detail design, potential impacts, developers, project duration and responsibility of developer on the environment. However, about 5% of respondents showed no interest on this Project and 4% showed that they have no knowledge.

The opinion of the respondents on the proposed Project was collected during a socio-economic survey. More than 79% of respondents in Kyauktada Township expressed their preference for the development of this Project and about 10% of respondents gave neutral to do not know on this Project. About 10% of respondents objected this project as the proposed Project.

The majority, 90% of the respondents predicted that the proposed Project will not have negative impacts on their livelihood. However more than 5 % of them expressed that there will be some impacts that will likely affect their livelihood in long term, while about 4% of respondents responded that they cannot predict the potential impacts of the proposed Landmark Project on their livelihood.

d) Demographic information of Bogyoke Market

The Bogyoke Market is located very close to the Landmark Project and the market sellers who sell their goods in this Market are considered as the project affected people. In order to get representative sample from the Bogyoke Market, the survey team randomly selected 76 respondents from the respective goods and respective buildings of the Bogyoke Market.

More than 60% of the respondents are female. There are five age groups of the respondents between under 20 to more than 51. The sample address more than 68% of the middle age groups (21 to 50 years old) and about 28% for old age groups. Therefore, the view and perspective of the respondents on the proposed project are reliable representative of different age groups.

75% of the respondents are Myanmar ethnic groups and all the rest are India and Chinese although all respondents are Myanmar citizens. More than 81% are Buddhist whereas Muslims and Christian are also observed to be 16 and 3%, respectively.

The educational background of the respondents are quite diverse with more than 67% have bachelor degree meanwhile almost 28% have high school level and only 4%of them have middle school level education. Besides, 1.3% of postgraduate level education was also observed among the respondents.

There are more than 63% of respondents who have four to six family members and about one third of the total respondents have one (single) to three members (father, mother and son/daughter). Only 8% of the respondents have a big family size (7 to 10) family members.

More than 82% of respondents owned their shops meanwhile about 17% rented from others. Among the respondents, almost 37% has been selling their goods in the Bogyoke Market for more than 21 years, about 35% for 11 to 20 years and almost 29% have been selling their commodities for one to ten years. Therefore, the survey result covered the different intervals of Bogyoke Market sellers.

Almost 40% of the respondents from Bogyoke Market refuse to provide information on their average daily income. Three average income levels per month was observed, among these almost 32% earned more than 9 lakh kyats, 17% earned between 6 to 9 kyats and about 12% earned between 1 to 5 lakh kyats a month. As the Bogyoke Market is an ancient famous market for tourist destination, almost 65% of shops for fine jewellery of gold and silver, colourful

gemstones shops and various kinds of souvenir shops are observed. About 33% of shops are selling clothes and textiles products while almost 3% for beauty and cosmetic shops.

The respondents were provided with information about the Landmark Project during the socio-economic survey and asked for their perspective on this Project. Almost 94% of respondents expressed that there will be no impact on their livelihood during the construction phase of Landmark Project, however more than 5% of respondents believed that there will be some impact on their livelihood while about 1.5% could not predict the potential impact of the project during the construction period as the project is large. Although 20% of the respondents expressed that the information provided about the Landmark Project is complete, about 50% of them stated that the information provided to them are incomplete while 20% want to know more about the Project. Meanwhile, more than 10% of the respondents showed no interest on this proposed Project. According to the survey results, the respondents would like to know more information on the detail construction designs of the Project, inclusiveness of public recreational areas, and project duration period and business opportunities for them.

20% of respondents showed their approval of the development of the Landmark Project while more than 73% also showed they like this Project. In spite the fact that more than 5% of the respondents are unwilling to share their clients with the proposed new retail podium, more than 92% of respondents generally accepted the proposed Landmark Project.

The proposed Landmark Project comprised of business complex and retail podiums, the operational phase impact on the surrounding environment especially on the Bogyoke Market retail shops also need to be considered. There are more than 78% of respondents who believed that there will be no impact on their livelihood during the operational phase of the Project. Almost 4% anticipated that there will be certain impacts on them while more than 5% also anticipated that there will be some impacts on their livelihood. However, more than 11% of respondents expressed that they could not predict the potential impacts of the Project on their livelihood.

e) Household Shops and Street Vendors

The proposed Landmark Project is located in the centre of downtown Yangon, the small scale business household shops and street vendors in the surrounding townships Dagon, Pabedan, Kyauktada and Mingalar Taung Nyunt are considered as the project affected people within the direct impact zone of the Project. The socio-economic information of randomly selected 154 shops were collected by structured interview survey.

More than 64% are male respondents while almost 36% are female respondents. The age groups of the respondents are ranging between under 20 to over 51 years old. More than 20% of respondents are in young age group of 16 to 30 years old, while more than 50% of respondents are in middle age group 31 to 50 years old and the rest 29% is in old age group over 51 years old.

The selected vendor sellers come from various townships of Yangon Region including North Oakalar, South Oakalar, Shwe Pyi Tha, Thin Gan Gyun, Pazundaung, Tharkayta, Thanlyin, Twantae and others. Some of them are existing household shops and some are street vendors along the streets of the highly populated downtown area. Most of the street vendor are selling their goods in the municipal area or public walkways along the main streets of Dagon, Pabedan, Kyauktada and Mingalar Taung Nyunt Townships. They are not directly related to the proposed Project area, but most of them are depending mainly on this livelihood which is located at the surrounding area of the Project.

Almost 88% of the respondents are Myanmar ethnic groups and majority are Burma followed by Mon, Kayin and Rakhine races. The rest of the 12% of the respondents are non-ethnic group and most of them are Muslim and Chinese hybrids although all are of Myanmar citizenship.

As the majority of the respondents are Burmese races, more than 80% of the respondents are Buddhist with 13% are Muslims, more than 3% are Hindu and almost 2% are of Christian faith.

The educational attainment of the vendor sellers varies, more than 87% of respondents have only informal/ primary to high school level education while almost 10% of graduate degree holders and almost 3% of post-graduate degree holders are also observed.

53% of respondents have 4 to 6 dependent family members while 35% have only 3 members and more than 11% of respondents have a big family size of 7 to 11 members. The street vendor shops life duration in current location varies, more than 22 % are under five years in their current shops location meanwhile more than 23% are 6 to 10 years in this area and about 20% are 11 to 20 years respectively. About 35% of the household shops and street vendor are selling goods in their respective areas for more than 20 years ago.

About 34% of the respondents own their shop places but more than 21% rented theirs from others and over 44% are temporary in nature. Majority (60%) of the respondents are from the low income level of about 1 to 3 lakh kyats per month. About 26% of respondents earn 3 to 7 lakh kyats monthly while almost 2% earn 7 to 9 lakh kyats and above 9 lakh kyats monthly.

The most common type of shops are fruits, flowers and vegetable vendors followed by food and snack shops, clothes and textile shops, sign board shops, book stores, coffee and tea shops, cosmetic and hard goods shops, hardware and television stores, shoes stores, art gallery and paint shops, betel leave shops, grocery and rice stores, optometry and service centres, construction accessory and pipe shops, electronic gadget shops, and hair dressing saloon.

As all of the household shops and street vendors are dependent on the proposed Project area, half of the respondents are concerned about the impacts of project construction on their daily life support system. However, the other half of them have no concern on their livelihood from the proposed project impacts.

In terms of the project related information, more than half of respondents want to get prior information and want to know more about the project schedule but some of them expressed don’t interest and the information provided is complete enough for them.

5.10 Existing Traffic Condition

5.10.1 Background Traffic in Yangon

The population of Yangon is estimated to be 7.36 million (2014 latest available data) with estimated annual growth of 3% per annum2. The expected Yongon population in 2016 is 7.81 million and the population for Myanmar is 53.93 million. However, Myanmar and particularly Yangon will undergo tremendous development in the coming years, and Landmark Yangon Project will be one of the first major commercial developments and is likely to instigate further investment in developing Yangon commercial center.

It is important to note that, before 2010, most vehicle imports were banned. The restrictions were lifted since 2010 which had resulted in worsened traffic conditions in Yangon.

5.10.2 Existing Traffic Condition Surrounding the Project Site

The existing access to the site is from Bogyoke Aung San Road with one entry and exit to serve the FMI building and one entry and exit to serve the Grand Meeyahta apartments. There are other kerb cuts and access points that are no longer in operation and were historically used to access the Myanmar Railways Headquarters.

Bogyoke Aung San Road is one way eastbound meaning that there is a cross-over between traffic entering and exiting the FMI or Grand Meeyahta. Access to the Landmark Project will aim to remove this conflict by proposing left in/ left out access at Bogyoke Aung San Road.

From existing junction geometry and traffic volume from surveyed, SIDRA analysis results for assessment hours (08:30 - 09:30 and 16:30 - 17:30) in the existing year 2015 and 2016 are as shown in **Table 5.24** and **Table 5.25**, respectively. The existing traffic analysis results for Bogyoke Aung San Road is tabulated in **Table 5.26**.

This is based on observed signal timings during the respective peak hours.

Table 5.24: Existing Traffic Analysis Result for 2015

Road	Movement	AM Peak 2015 (08:30 – 09:30)				PM Peak 2015 (16:30 – 17:30)			
		DOS (V/C)	Average Delay (s)	LOS	Queue (m)	DOS (V/C)	Average Delay (s)	LOS	Queue (m)
Sule Pagoda Rd.	Straight	0.168	27.2	LOS C	25.8	0.765	35.8	LOS D	152.9
	Right Turn	0.602	14.6	LOS B	123.3	0.467	13.1	LOS B	78.8
Approach		**0.602**	**18.8**	**LOS B**	**123.3**	**0.765**	**30.0**	**LOS C**	**152.9**
Alan Pya Pagoda St.	Left Turn	0.600	20.3	LOS C	85.3	0.760	33.5	LOS C	86.9
	Straight	0.451	14.1	LOS B	99.6	0.253	12.2	LOS B	48.6
Approach		**0.600**	**16.3**	**LOS B**	**99.6**	**0.760**	**22.0**	**LOS C**	**86.9**
Boyoke Aungsan Rd.	Left Turn	0.762	39.3	LOS D	155.7	0.762	39.3	LOS D	155.7
	Straight	0.772	33.9	LOS C	166.5	0.772	33.9	LOS C	166.5
	Right Turn	0.347	10.9	LOS B	49.2	0.282	7.0	LOS A	19.1
Approach		**0.772**	**33.4**	**LOS C**	**166.5**	**0.772**	**32.9**	**LOS C**	**166.5**
All Vehicles		**0.772**	**24.6**	**LOS C**	**166.5**	**0.772**	**29.4**	**LOS C**	**166.5**

Note: DOS: Degree of saturation LOS: Level of service

Table 5.25: Existing Traffic Analysis Result for 2016

Road	Movement	AM Peak 2016 (10:00 – 11:00)				PM Peak 2016 (18:00 – 19:00)			
		DOS (V/C)	Average Delay (s)	LOS	Queue (m)	DOS (V/C)	Average Delay (s)	LOS	Queue (m)
Boyoke Aung San & Alan Pya Junction									
Sule Pagoda Rd.	Straight	0.717	41.1	LOS D	149.9	0.623	39.7	LOS D	169.8
	Right Turn	0.480	14.7	LOS B	85.5	0.297	19.6	LOS B	70.8
Approach		**0.717**	**33.7**	**LOS C**	**149.9**	**0.623**	**35.5**	**LOS D**	**169.8**
Alan Pya Pagoda St.	Left Turn	0.790	40.6	LOS D	75.8	0.668	36.5	LOS D	93.5
	Straight	0.397	22.9	LOS C	95.1	0.272	13.6	LOS B	70.6
Approach		**0.790**	**28.7**	**LOS C**	**95.1**	**0.668**	**23.0**	**LOS C**	**93.5**
Boyoke Aung San Rd.	Left Turn	0.496	32.2	LOS C	119.9	0.815	57.2	LOS E	168.5
	Straight	0.581	25.5	LOS C	155.5	1.204	264.5	LOS F	802.7
	Right Turn	0.460	13.7	LOS B	108.6	0.484	10.7	LOS B	74.1
Approach		**0.581**	**25.4**	**LOS C**	**155.5**	**1.204**	**177.5**	**LOS F**	**802.7**
All Vehicles		**0.790**	**28.5**	**LOS C**	**155.5**	**1.204**	**105.6**	**LOS F**	**802.7**
Shwedagon Junction									
Shwedagon Pagoda Rd. (South)	Straight	0.754	40.4	LOS D	117.6	0.929	59.3	LOS E	185.3
	Right Turn	0.281	8.7	LOS A	12.7	0.305	8.7	LOS A	14.2
Approach		**0.754**	**27.9**	**LOS C**	**117.6**	**0.929**	**40.8**	**LOS D**	**185.3**
Shwedagon Pagoda Rd. (North)	Left Turn	1.166	220.1	LOS F	530.0	0.785	46.8	LOS D	141.7
	Straight	0.528	13.0	LOS B	122.2	0.374	11.4	LOS B	76.1
Approach		**1.166**	**152.6**	**LOS F**	**530.0**	**0.785**	**34.9**	**LOS C**	**141.7**
Boyoke Aung San Rd.	Left Turn	0.327	38.3	LOS D	47.4	0.241	37.5	LOS D	34.0
	Straight	0.968	69.8	LOS E	260.6	0.848	43.0	LOS D	173.4
	Right Turn	0.431	39.4	LOS D	64.7	0.379	38.8	LOS D	55.9
Approach		**0.968**	**63.6**	**LOS E**	**260.6**	**0.848**	**42.1**	**LOS D**	**173.4**
All Vehicles		**1.166**	**88.1**	**LOS F**	**530.0**	**0.929**	**39.6**	**LOS D**	**185.3**

Note: DOS: Degree of saturation LOS: Level of service

Table 5.26: Existing Traffic Analysis Results on Bogyoke Aung San Road (Mid-Block) for 2016

Road	AM Peak 2016 (10:00 – 11:00)				PM Peak 2016 (18:00 – 19:00)			
	Left		Right		Left		Right	
	DOS (V/C)	LOS	DOS (V/C)	LOS	DOS (V/C)	LOS	DOS (V/C)	LOS
Boyoke Aung San Rd.	0.757	LOS C	0.988	LOS E	0.764	LOS C	0.934	LOS E

As shown in the tables above, the junctions in base scenario (existing year 2016) are generally operating under capacity in terms of LOS and DOS, and there is reserve capacity for the traffic flows in the future. Some extended queuing may occur during peak flow periods but delay to vehicles is not excessive most of the time.

6 IMPACT AND RISK ASSESSMENT AND MITIGATION MEASURES

6.1 Introduction

This Chapter identifies and assesses the potential environmental impacts arising from the implementation of the Project in the City of Yangon. Based on the findings of the assessment, mitigation measures have been recommended to minimize and manage these impacts to meet prevailing regulatory requirements and in accordance with Good International Industry Practice (GIIP).

It is important to note that the Project site is a developed site (built environment) located within an urban setting. Much of the environmental impacts associated with the development of the site from its original state occurred more than 100 years ago.

The assessment of potential direct and indirect environmental and socio-economic adverse/beneficial impacts that may arise as result of the Project is divided into two sections, with each section representing a stage in the life-cycle of the project, i.e. construction phase and operational phase.

6.2 Impact and Risk Assessment Methodology

The ESIA process can be defined as a set of requirements, steps and stages to comply with, in order to conduct a preventive analysis following international standards where applicable.

A practical approach to the ESIA process responsive to international guidance will provide for:

Screening: An initial assessment to decide whether a project requires further investigation in an ESIA.

Scoping: To identify the key impacts identified during screening, requiring further investigation, and to establish terms of reference for the ESIA report.

Impact assessment: To identify and predict the likely environmental effects of the proposal.

Mitigation and impact management: To establish the measures that are necessary to avoid, minimize or offset predicted adverse impacts and, where appropriate, to incorporate these into an environmental management plan or system.

Residual Impacts: To determine the relative importance and acceptability of residual impacts (i.e., impacts that remain although mitigation measures have been incorporated).

Preparation of an Environmental and Social Impact Assessment report: To clearly document the potential impacts of the development, the proposed measures for mitigation, the significance of effects, and the concerns of the public, communities and other stakeholders affected by the proposal.

Public Involvement: The public is engaged typically during the scoping and reviewing phases of the ESIA but may also occur at any other stages of the ESIA process.

Based on the above, several tasks were proposed for this ESIA process. The initial task entailed a data gathering exercise. Available data (from secondary sources) concerning the existing buildings at Project site including the Grand Meeyahta Executive Residence, the FMI Centre and the immediate surroundings were assimilated and assessed. Upon completion of this task, the study team undertook the baseline environmental monitoring and related field

studies to supplement existing information and complete the gaps within the database obtained from secondary sources.

Technical studies which have contributed to this ESIA are described under **Section 2.5** of the preceding chapter. Concurrent with this work, relevant government agencies were also consulted to obtain additional information and guidance and to identify issues of public concern.

6.3 Assessment of Impacts and Proposed Mitigation

As part of the initial scoping exercise, ENVIRON developed a list of potential environmental and social issues relevant to the Project based on the Myanmar EIA rules and regulations, ESIAs for real estate projects previously conducted by the study team and the IFC PS and the IFC guidelines on Environment Health and Safety, where reasonable and appropriate to the Project.

Key environmental and social issues of concern associated with the implementation of the Project include the following:

- Air quality impacts due to generation of fugitive dust and vehicular emissions during the construction phase of the Project;
- Noise and vibration impacts arising during the construction of the Project related buildings/structures and the demolition of existing buildings;
- Soil erosion and sedimentation impacts during the construction of the buildings and structures and supporting facilities, and development of the infrastructure at the Project site;
- Water quality impacts due to discharge of wastewater and sewage during the construction and operation of the Project;
- Solid waste and hazardous waste management, especially during the demolition activities of the construction phase of the Project;
- Geotechnical impacts due to excavation and platform development for the construction of the buildings and supporting facilities associated to the Project; and
- Traffic impedance due to temporary street closures during construction as well as the increased movement of heavy vehicles during the construction phase. Increased vehicular movements should also be expected during the development phase of the Project.

6.4 Air Quality

This Section summarizes potential impacts on air sensitive receptors during the construction and operational phases of the Project and describes mitigation measures to be put in place to prevent and minimize these impacts. Dust generation from construction activities has been identified as a key issue and, therefore, assessed quantitatively whilst the air pollution during the operational phase has been assessed qualitatively. The air pollutants of main concern during the construction phase include PM_{10} and $PM_{2.5}$.

6.4.1 Assessment Area and Identification of Air Sensitive Receivers

The assessment area is generally defined as the area within a 500 m of the Project site boundary. **Figure 6.1** presents the demarcated assessment area and identifies the representative air sensitive receivers (ASRs) situated within this area.

A number of ASRs were identified based on a land use survey conducted in October 2013. The first tier of representative ASRs were selected based on their proximity to the Project Site,

nature of uses and the number of people that might be affected as indicated in **Table 6.1** and shown in **Figure 6.2**. These ASRs include existing residential and religious premises. **Figure 6.3** details the selected representative ASRs.

Table 6.1: Representative Air Quality Sensitive Receivers (Construction Phase)

ASR Label	Description	Easting	Northing	No. of storeys	Distance to Site Boundary (m)
A1	Northern Residential Building	96° 9'26.49"E	16°46'53.25"N	5	43
A2	Church	96° 9'24.22"E	16°46'49.67"N	2	12
A3	Mosque	96° 9'23.26"E	16°46'45.32"N	2	36
A4	Southern Residential Building	96° 9'26.92"E	16°46'45.24"N	8	25

6.4.2 Air Pollution Impact During Construction Phase

6.4.2.1 Potential Sources of Impacts

Potential sources of air quality impacts during the construction phase include fugitive dust arising from the following activities:

- Site preparation works such as excavation, levelling, compaction and trenching;
- Movement of heavy construction vehicles and machinery within the site and during transportation operations;
- Material handling (delivery, unloading and use of construction aggregates and structural fill);
- Demolition of existing building on-site;
- Operation of the batching plant; and
- Material/ soil tracked out of the site and deposited on local roads.

Figure 6.1: Assessment Areas of Air Quality and Noise

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Figure 6.2: **Ambient Air Quality and Noise Measurement Locations Near the Landmark Site**

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Figure 6.3: Representative ASRs

ENVIRON

The batching plant will be located to the east of the MRB. The specifications of the batching plant are as follows:

- Plant Concrete Output	: 60 m^3/h
- Model of Mixer	: DNA 1.5
- Type of Mixer	: Helical Twin Shaft
- Mixer Capacity	: 2250/1500 Liter
- Mixer Concrete Output	: 1.5 m^3/cycle
- Number of Aggregate Bins	: 4 Nos
- Aggregate Storage Capacity	: 45 m^3
- Cement Silo	: 1 Nos
- Aggregate Weighting System	: By Skip Bucket
- Cement & Water Dosing	: By Weight
- Aggregate Loading System	: Ramps
- Dimension for Transport (L x W x H, m)	: 14.3 x 2.5 x 3.3 m

The exhaust emissions emitted from vehicles and machinery engines will contain NO_x, SO_x, CO, VOC, particulates and smoke.

The main air quality parameter of concern is fugitive dust, represented by TSP and a small fraction of PM_{10}. Major activities that will contribute to fugitive dust impact include site clearance, demolition of buildings, excavation and operation of the batching plant.

6.4.2.2 Quantitative Impact Assessment

The evaluation of potential impacts on air quality was based on the assessment of the sensitivity of the receptor and the magnitude of the impact and then the assessment of the impact risk. For air quality, the definitions of sensitivity of the receptor and the magnitude of the impact are provided below.

a) Sensitivity of Receptors

The criteria for determining the sensitivity of air quality receptors takes account of a number of factors:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors;
- in the case of PM_{10}, the local background concentration; and
- site-specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

Two types of receptors are considered in this assessment:

- People and properties sensitive to soiling
- Human receptors sensitive to PM_{10}
- Habitat and plant communities.

The criteria to assess the sensitivity of each type of receptors to the dust emission are provided in **Table 6.2** and **Table 6.3**. The level of sensitivity is indicated in the tables by bold character and color shaded cells.

Table 6.2: Sensitivity of the Area to Dust Soiling Effects on People and Property

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)			
		< 20	< 50	< 100	< 350
High (dwellings, museums, culturally important collections, medium and long-term car park and car showrooms)	> 100	**High**	High	Medium	Low
	10 - 100	High	Medium	Low	Low
	1 - 10	Medium	Low	Low	Low
Medium (parks and places of work)	> 1	Medium	Low	Low	Low
Low (playing fields, farmland, footpaths, short term car parks and roads)	> 1	Low	Low	Low	Low
Note: The sensitivity of the area has to be determined for each activity					

Table 6.3: Sensitivity of the Area to Human Health Impacts (Annual Mean PM_{10} Concentration > 32 $\mu g/m^3$)

Receptor Sensitivity	Number of Receptors	Distance from the Source (m)				
		< 20	< 50	< 100	< 200	< 350
High (residential properties, hospitals, schools, residential care homes)	> 100	**High**	High	High	Medium	Low
	10 - 100	High	High	Medium	Low	Low
	1 - 10	High	Medium	Low	Low	Low
Medium receptors (offices, shop workers – not workers occupationally exposed to PM_{10})	> 10	High	Medium	Low	Low	Low
	1 - 10	Medium	Medium	Low	Low	Low
Low (public footpaths, playing fields, parks and shopping streets)	>= 1	Low	Low	Low	Low	Low

These criteria are drawn from the Institute of Air Quality Management (IAQM)'s Guidance on the Assessment of Dust from Demolition and Construction (Holman *et al* 2014). The guideline for PM_{10} was used as an indicator of particulate matter (dust).

b) Magnitude of Impact

The criteria for determining the magnitude of potential impacts on air quality are provided below.

Table 6.4: Magnitude of Impact Criteria for Air Quality

Magnitude of Impact	Typical Criteria (Air)	Magnitude of Impact
Demolition	▪ Total volume of existing structure to be demolished <20,000 m^3 ▪ On-site crushing and screening ▪ construction material with low potential for dust release (e.g. metal cladding or timber) ▪ Demolition activities <10 m above ground ▪ Demolition during wetter months ▪ Total site area <500 m^2	Small
	▪ Total volume of existing structure to be demolished 20,000 m^3 – 50,000 m^3 ▪ Potentially dusty construction material ▪ Demolition activities 10-20 m above ground level ▪ Total site area 500 m^2 to 2,500 m^2	Medium
	▪ Total volume of existing structure to be demolished >50,000 m^3 ▪ Potentially dusty construction material (e.g. concrete) ▪ Demolition activities >20 m above ground level	High
Earthworks	• Total site area <2 ,500 m^2 • Soil type with large grain size (e.g. sand) • <5 heavy earth moving vehicles active at any one time • Formation of bunds <4 m in height • Total material moved <20,000 tonnes • Earthworks during wetter months	Small
	▪ Total site area 2,500 m^2 – 10,000 m^2 ▪ Moderately dusty soil type (e.g. silt) ▪ 5 - 10 heavy earth moving vehicles active at any one time ▪ Formation of bunds 4 m - 8 m in height ▪ Total material moved 20,000 tonnes – 100,000 tonnes	Medium
	▪ Total site area >10,000 m^2 ▪ Potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size) ▪ >10 heavy earth moving vehicles active at any one time	High

Magnitude of Impact	Typical Criteria (Air)	Magnitude of Impact
	▪ Formation of bunds >8 m in height ▪ Total material moved >100,000 tonnes	
Construction	▪ Total building volume <25,000 m^3 ▪ Construction material with low potential for dust release (e.g. metal cladding or timber)	Small
	▪ Total building volume 25,000 m^3 – 100,000 m^3 ▪ Potentially dusty construction material (e.g. concrete) ▪ On site concrete batching	Medium
	▪ Total building volume >100,000 m^3 ▪ On site concrete batching, sandblasting	High
Trackout	▪ <10 High Duty Vehicles (>3.5t) outward movements in any one day ▪ Surface material with low potential for dust release ▪ Unpaved road length <50 m	Small
	▪ 10-50 High Duty Vehicles (>3.5t) outward movements in any one day ▪ Moderately dusty surface material (e.g. medium clay content) ▪ Unpaved road length 50 m – 100 m	Medium
	▪ >50 Heavy Duty Vehicles (>3.5t) outward movements in any one day ▪ Potentially dusty surface material (e.g. high clay content) ▪ Unpaved road length >100 m	High

c) Impact Risk

The dust emission magnitude determined according to the methodology described in **Section 6.4.2.2** are combined with the sensitivity of the area determined as per **Section 6.4.2.2** to determine the risk of impacts with no mitigation applied. The matrices in **Table 6.5**, **Table 6.6**, **Table 6.7** and **Table 6.8** provide the method applied to assign the level of risk for each activity. This is used to determining the level of mitigation that must be applied. Mitigation is discussed in **Section 6.4.2.5**. For those cases where the risk category is ‘negligible’, no mitigation measures beyond those required by legislation will be required.

Table 6.5: Risk of Dust Impact – Demolition

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Medium
Medium	High	Medium	Low
Low	Medium	Low	Negligible

Table 6.6: Risk of Dust Impact - Earthworks

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible

Table 6.7: Risk of Dust Impact - Construction

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Medium	Low
Low	Low	Low	Negligible

Table 6.8: Risk of Dust Impact - Trackout

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High	Medium	Low
Medium	Medium	Low	Negligible
Low	Low	Low	Negligible

6.4.2.3 Assessment of Impact Magnitude

Air pollutants will be generated by a variety of activities that are likely to take place during the construction period. The key activities likely to contribute to generate dust during the construction phase include: site clearance and land preparation, demolition of existing

structures, fugitive dust emissions from transportation activities, as well as windblown dust generated from exposed areas of the construction site. These activities produce a high concentration of particulate matter emission which is observed as construction dust.

A discussion of the air quality impact at various stages of construction and at discrete areas of the site is provided below.

a) Demolition

Demolition involves the existing FMI Centre, Grand Meeyahta Executive Residence, Zawgyi House, Two residential scale two-storey brick buildings and a variety of smaller supporting structures. This dusty demolition activity should be controlled with localised dust screens to prevent dust nuisance to the surroundings.

b) Earthworks

Exposed areas due to earthworks could lead to windblown dust. Strong winds blowing across exposed areas or surfaces where fine materials are found may generate dust. This problem will be more pronounced during the dry season and when wind speed increases during the down-draft of a thunderstorm. Most of the dust is expected to be carried over short distances due to the light weight and size of the particles, unless winds are strong and persistent. The latter usually occur during thunderstorms. Under normal conditions when winds are of short duration, soil particles will fall back to the ground when the wind losses its strength. For wind speed below 5 m/s, the problem of windblown dust is not expected to be significant. During periods of dry weather conditions and stronger winds, more significant windblown dust can occur.

Periods of high relative humidity coupled with high moisture content of the air is not conducive to dust generation. Frequent rains and condensation of moisture (mists) from the air keeps the ground area wet and is likely to be a factor to minimise fugitive dust dispersion. In contrast, dry periods can exacerbate windblown dust. Following site clearance, implementation of dust control measures are recommended to be implemented immediately to minimise the total exposed area at any one time.

The affected area at any one time is expected to be medium, between 2,500 m^2 and 10,000m^2.

c) Operation of Construction Machinery and Plant

Movement of construction vehicles, particularly during site preparation, can give rise to significant fugitive dust when these vehicles travel over unpaved surfaces especially when the surfaces are dry. Dust is generated due to the force of wheels on surfaces which causes pulverization of surface material/soil. Particles are lifted and dropped by the rolling wheels while at the same time the surface is exposed to strong air currents in turbulent shear within the surface. The turbulent wake behind the vehicles continues to act on the ground surface after the vehicle passes. Natural winds, particularly those that exceed 5 m/s may catch the dust particles and carry them away.

Materials may be whipped up by winds induced during transportation particularly for dry materials which are uncovered or spilled material. These may be carried by winds or taken in the wake of the moving vehicle and dispersed. Such materials are likely to drop back on the adjacent ground unless strong winds prevail. As discussed above, windblown materials are likely to be carried over short distances and affect nearby surrounding areas rather than carried

far away. The impacts due to dust from transportation of materials is not easily quantified in view of the variable factors that govern dust generation.

Dust emissions from the batching plant or blowover of materials such as cement being handled at the plant, would require careful management to minimise impacts on the surroundings.

Table 6.9: Estimated Magnitude of Dust Emission

Activity	Indicator	Indicator Level	Dust Emission Magnitude
Demolition	Total Building Volume >50,000 m^3	High	High
	Potentially dusty construction material, concrete	Medium	
	Demolition activities >20 m above ground	High	
Earthworks	Total earthworks area >10,000 m^2	High	High
	Potentially dusty soil type (clay, which will be prone to suspension when dry due to small particle size)	High	
	Number of heavy earth moving vehicles active at any one time >10	High	
	Formation of bunds > 8 m in height	High	
	Total material moved >100,000 tonnes	High	
Construction	Total building volume >100,000 m^3	High	High
	On site concrete batching	High	
Trackout	Number of High Duty Vehicles (>3.5t) outward movements in any one day >50	High	High
	Potentially dusty surface material	Medium	
	Unpaved road length > 100 m	High	

6.4.2.4 Assessment of Impact Risk

The assessment of dust impact risk for the construction phase has been conducted according to the methodology described in the above subsections. The risk levels are summarized in **Table 6.10**.

Taking the receptor sensitivity and magnitude of potential impacts into account, together with the baseline levels which were assessed to be exceeding the standards for particulate matter (PM), the overall significance of air quality impacts is considered *high* during all activities of demolition and construction. Impact can be controlled to minor levels through implementation of the recommended mitigation measures.

Receptor sensitivity was estimated to be *high* for both dust soiling and human health. The magnitude of unmitigated impact would be classified as *high*.

Table 6.10: Summary of Unmitigated Dust Impact Risk

Potential Impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust Soiling	High	High	High	High
Human Health	High	High	High	High

6.4.2.5 Modelling Assessment

Typical emission rates for fugitive dust (TSP) have been derived based on the emission factor given in the USEPA Compilation of Air Pollutant Emission Factors, 5th Edition (AP-42) (Section 13.2.3.3). The emission factor applied is 2.69 Mg/ha/month for all-inclusive heavy construction activities. The mitigated dust emission rates have been derived as 1.72×10^{-5} g/m^2/s by adjusting the above emission factor based on 30 working days per month, 12 working hours per day (07:00 - 19:00) and 100% active operating area. It is also assumed that hourly watering will be performed by default to reduce dust generation by 91.7%.

The air quality impact has been assessed quantitatively with the aid of an air quality model - the Industrial Source Complex Short Term (ISCST3) - an USEPA accepted software developed based on Gaussian dispersion.

Because of the lack of hourly meteorological data required for a complete year-round modelling, only the hourly average impacts have been computed under a directly downwind situation and worst surface meteorological conditions as follow:

- Wind speed: 1 m/s
- Mixing height: 500 m
- Stability class: D
- Directly downwind wind directions (southerly for A1, easterly for A2, north-easterly for A3 and northerly for A4)

The worst dust impact is expected to occur on at the human breathing zone at 1.5 m above ground.

The incremental air quality ground level concentrations due to heavy construction activities have been predicted conservatively by quantitative air modelling. Taking into account the baseline PM_{10} and $PM_{2.5}$ levels, the cumulative impact is predicted to be above the standards with higher values for the Church (denoted by A2) which is situated very close to the western boundary of the Project Site. Mitigation measures have to be implemented to reduce the dust impact in particular at the Church.

Through proper implementation of dust control measures recommended in the next section, construction fugitive dust will be able to be controlled at source. An EMAP will be implemented to verify the actual impacts and to provide the mechanism for adjustment of site activities to achieve acceptable TSP levels at relevant ASRs. This includes the worst-case of prohibiting dusty construction activities during Sunday services at the Church which is the nearest receptor and/or other sensitive use to be agreed amongst the affected stakeholders and the Project Proponent.

6.4.2.6 Mitigation Measures in Construction Phase

a) Fugitive Dust

Taking into account the baseline air quality monitoring finding which show levels of PM_{10}, $PM_{2.5}$, and SO_2 higher than NEQEG, necessary measures to suppress pollutant emissions from all potential sources will be considered.

The potential air quality impacts arising from the construction activities at the Project site will be mitigated by implementing standard dust suppression measures as described below.

- Routine water spray throughout the construction phase.
- Provide designate access way (demarcation) for site moving vehicles. This access way shall be concrete paved/ compacted/ sand layer where possible.
- Keep access area wet.
- Provide ceiling cover to batching plant to prevent spread of dust during concrete mixing process.
- Keep sprinkler system in the batching plant for routine spray of water during the mixing operation.
- Water spray during extraction of piling works.
- Cover materials with impervious sheeting.
- Install PVC strip curtains for batching plant stockpiles.
- Provide wheel washing facilities at the site entrance/ egress.
- Exposed earth shall be properly treated by compaction and keep the surface wet.
- All dusty materials shall be sprayed with water immediately prior to loading or unloading or transfer operation.
- Vehicle carrying a load of dusty materials shall be covered entirely with clean impervious sheet.
- Dusty materials shall not be loaded to a higher level than the side and tailboards and shall be covered by tarpaulin.

b) Vehicular/ Equipment Emission

The control of vehicular or equipment emission can be achieved by observing good construction practice procedures such as:

- Turning off equipment when not in use.
- Lorries/ trucks waiting for more than 10 minutes will turn off their engines.
- Carry out regular maintenance of all vehicles, plants and equipment.
- Install proper enclosures to the working areas to minimise the spread of fume and smoke.

6.4.3 Air Pollution Assessment during Operational Phase

During the operational phase of the Project, there will be no sources of significant air emissions.

The Project has committed to the use of clean gaseous fuel (LPG (3000 gallons), LNG, etc.) for heating or other purposes. Liquid fuel such as diesel will only be used for emergency generators. As such, air pollution will be a minor issue during the operational phase of the Project.

6.5 Noise

Construction noise impact is considered a key issue and hence has been addressed quantitatively while noise during the operational phase has been assessed qualitatively as it is not predicted to be significant.

6.5.1 Construction Related Noise

Construction of the proposed Project will comprise the following main tasks:

- Demolition;
- Main Buildings Early Works;
- Main Buildings Piling Works & D-Wall;
- Main Building Pile Caps, Basement Slabs & Podium; and
- Construction of Towers 1 – 4.

Table 4.2 shows the detailed construction program with breakdown of the sub-tasks, which construction equipment are assigned to enable assessment of construction noise. The nosiest tasks are identified to be associated with piling and demolition works.

6.5.1.1 Assessment Area

The noise assessment area is defined as the area within a 300 m radius of the Project site boundary as indicated in **Figure 6.4**.

A number of noise sensitive receivers (receptors) ("NSRs") were identified in a number of walk-over surveys conducted in February 2015. The first tier of representative NSRs has been selected in **Table 6.11** based on their proximity to the Project site, nature of uses and the number of people that might be affected. Details of the selected NSRs and their respective distances from the Project site are tabulated below. Among the all NSR, N2: Church will possibly experience more noise impact than the other receivers because the church is closer to the project area than the other receptors. However, the ambient baseline noise level in the church (62 + 4 = 66 dB(A)) is still lower than the NEQEG and IFC commercial allowable limit even with the addition of anticipated construction noise level (4 dB(A)). If there is any noise level exceedance that could warrant objection, A review of the construction equipment in use, effectiveness of existing mitigation measures in place, and better solutions to the issue will be considered.

Table 6.11: Representative Noise Sensitive Receivers (Construction Phase)

NSR Label	Description	Easting	Northing	No. of Storeys	Shortest Distance to Site Boundary (m)
N1	Northern Residential Building	96° 9'26.49"E	16°46'53.25"N	5	43
N2	Church	96° 9'24.22"E	16°46'49.67"N	2	12
N3	Mosque	96° 9'23.26"E	16°46'45.32"N	2	36
N4	Southern Residential Building	96° 9'26.92"E	16°46'45.24"N	8	25

Figure 6.4: Representative NSRs

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6.5.1.2 Assessment of Noise Impact

Noise impact during the demolition of the existing structure and the construction phase has been conservatively predicted based on the latest construction program and equipment inventory likely to be deployed.

As a worst case, without any noise mitigation measures, the maximum noise exceedance could reach 4 dB(A) above the noise criteria at the Church (N2) for a duration of 13 months within the 5-year long demolition and construction period.

In view of works that will be carried out at close proximity to the Church at N2, a number of alternative construction methodologies have been proposed to attenuate the noise impacts. These include the use of hydraulic crusher in tandem with hydraulic breaker in the demolition of buildings together with the use of noise insulation fabric on the scaffolding to reduce the noise impact.

6.5.1.3 Mitigation Measures

Overall, the noise impacts that will be generated during the project's construction of the Project will be minimised using appropriate mitigation measures, regular monitoring and auditing. These requirements will form part of the contractual requirements to be enforced in construction planning and at times of actually carrying out the works.

The Church (N2) identified at the western site boundary could be impacted at levels above the ambient noise level. In this case, the noise exceedance coincided with Sunday services at the church and nearby Hindu religious ritual with powerful music. The Project Proponent will discuss with the church management (the Affected Community) to explore various options to mitigate the project induced noise including the option to stop working during Sunday services as a last resort.

The Contractor will be reminded from time to time of the noise impacts on the surrounding NSRs, especially the Church through results of noise monitoring during the works so that adjustments could be made to control the construction noise levels. These requirements will be triggered by an Event and Action Plan as part of the EMAP, which will be incorporated into the works contract in order to make it enforceable.

The following measures are recommended to reduce nuisance due to construction related noise for both mobile and non-mobile sources on site.

a) Alternative Construction Methodologies

The use of hydraulic breakers would be very noisy during demolition of existing buildings at the Project site which are close to the sensitive receivers. In mitigation, the use of hydraulic crusher is proposed as an alternative. Hydraulic crushers are typically 6-12 dB(A) quieter when compared to conventional demolition with hydraulic breakers. It is, however, recognised that hydraulic crushers have their limitations and hence, it is proposed that they will not be used in isolation but in tandem with hydraulic breakers to minimise the impacts. The hydraulic breakers can create holes on structural elements to facilitate ease of crushing by the jaws of hydraulic crushers and to deal with oversize ones that are not practically crushed.

b) Use of Silencers & Enclosures

Noise Insulation Fabric (NIF) will be mounted on scaffolding erected over the buildings to be demolished to achieve a further reduction of noise in 5-10 dB(A).

c) Use of Movable Noise Barrier

Movable noise barriers can typically achieve 5 dB(A) reduction for movable construction equipment or 10 dB(A) for stationary ones. These noise barriers will be used to provide attenuation for high noise-generating equipment.

d) Good International Industry Practice

The following listed good site practice will be useful in minimising noise impact though the effects are not readily quantified in this assessment.

- Construct walled enclosures around especially noisy activities, or clusters of noisy equipment;
- The Contractor will submit the method statement to the Engineer Representative for comment on construction method, use of equipment and noise mitigation measures intended to be implemented on-site;
- The Contractor will devise and execute working methods to minimise the noise impact on the surrounding sensitive uses, and to provide experienced personnel with suitable training to ensure that those methods are implemented;
- Noisy equipment and noisy activities will be kept as far away from the NSRs as possible;
- Unused equipment will be turned off.
- Parallel use of noisy equipment/ machinery will be avoided;
- Queuing of dump trucks will be avoided. Their intermittent use will be avoided between loading cycles or may be throttled down to a minimum to reduce noise;
- Regular maintenance of all plant and equipment; and
- Material stockpiles and other structures will be effectively utilised as noise barriers, where practicable.

e) Noise Monitoring

- Noise meters will be installed at site boundaries to check the noise levels against the standards and adjust the control measures when needed.

6.5.2 Operational Phase

Noise impacts are not expected to be significant during the operational phase of the Project. The main sources of noise generation will be traffic noise from the increased vehicular movement by the employees of the office towers, the residents of the service apartments/ condominiums, and the guests staying at the hotels onsite. As these sources are mobile and intermittent, and the surrounding area is a highly commercialized environment with common exposure to traffic noise, it is concluded that the contribution will not be significant.

6.6 Vibration

This Section provides an assessment of the potential impacts on vibration sensitive uses that could be affected by construction and operation of the Project. It also recommends the corresponding mitigation measures, where necessary.

6.6.1 Review of Relevant Vibration Impact Standards

In the absence of Myanmar vibration standards, a number of vibration criteria have been reviewed for suitability to be adopted in this study. These include the following:

- Construction vibration damage criteria recommended by the High-Speed Ground Transportation Noise and Vibration Impact Assessment – US Department of Transport, September 2012 (**Table 6.12**);
- German Standard DIN 4150-3 1999 Structural Vibration – Part 3: Effects of vibration on structures (for structural damage) **(Table 6.13);** and
- Ground-borne Vibration (GBV) Impact Criteria (for annoyance assessment) for General Assessment suggested by High-Speed Ground Transportation Noise and Vibration Impact Assessment – USDOT, September 2012 (**Table 6.14**).

Table 6.12: Construction Vibration Damage Criteria

Building Category	PPV (in/s)	Approximate Lv#
Reinforced-concrete, steel or timber (no plaster)	0.5	102
Engineered concrete and masonry (no plaster)	0.3	98
Non-engineered timber and masonry buildings	0.2	94
Buildings extremely susceptible to vibration damage	0.12	90

Source: *Table 10-6 High-Speed Ground Transportation Noise and Vibration Impact Assessment – USDOT, Sep 2012. Based on research by Swiss Consultants for Road Construction Association. Effects of Vibration on Construction, VSS-SN640-312a, Zurich, Switzerland, April 1992*

 # RMS velocity in decibels (VdB) re 1 µin/s

Table 6.13: Guideline Values for Evaluating Short-term Vibration on Structures

Type of Structures	Guideline Values for Peak Particle Velocity (PPV) in mm/s			
	Vibration Frequency at the Foundation			Vibration at Horizontal Plane of Highest Floor at All Frequencies
	1 Hz to 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	
Residences and buildings of similar design and/ or occupancy	5	5 at 10 Hz to 15 at 50 Hz	15 at 50 Hz to 20 at 100 Hz	15
Buildings used for commercial, industrial purposes, and buildings of similar design	20	20 at 10 Hz to 40 at 50 Hz	40 at 50 Hz to 50 at 100 Hz	40
Structures that, because of their particular sensitivity to vibration, cannot be classified above and are of great intrinsic value (such as listed buildings under preservation order)	3	3 at 10 Hz to 8 at 50 Hz	8 at 50 Hz to 10 at 100 Hz	8

Source: *German Standard DIN 4150-3 1999 Structural Vibration – Part 3: Effects of vibration on structures*

Table 6.14: Ground-borne Vibration (GBV) Impact Criteria for Annoyance Assessment

Land Use Category	GBV Impact Levels (VdB re 1 µin/s)		
	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]
Category 1: Buildings where vibration would interfere with interior operations	65 VdB4	65 VdB4	65 VdB4
Category 2: Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB
Category 3: Institutional land uses with primarily daytime use	75 VdB	78 VdB	83 VdB

Source: *Table 7-1 of High-Speed Ground Transportation Noise and Vibration Impact Assessment – USDOT, Sep 2012*

Notes:

1. *Frequent Events is defined as more than 70 vibration events of the same kind per day*
2. *Occasional Events is defined as between 30 and 70 vibration events of the same kind per day*
3. *Infrequent Events is defined as fewer than 30 vibration events of the same kind per day*
4. *This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration-sensitive manufacturing or research will require detailed evaluation to define the acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the HVAC systems and stiffened floors*
5. *Vibration-sensitive equipment is not sensitive to ground-borne noise*

6.6.2 Assessment - Construction Phase

a) During Construction Phase

6.6.2.1 Vibration Sensitive Receivers

A number of vibration sensitive receivers (VSRs) were also identified in the walkover surveys conducted in October 2013 based on their proximity to the Project site, nature of uses and the number of people that might be affected. **Table 6.15** provides a description of the selected VSRs. The ZoI of the excavation with potential vibration impact is shown in **Figure 6.5.**

Table 6.15: Representative Vibration Sensitive Receivers (Construction Phase)

VSR Label	Description	No. of storeys	Reason of being selected
V1	Myanmar Railway Building (MRB)	3	Heritage building very susceptible to vibration/ structural damage
V2	Church	2	Masonry buildings closest to the FMI building and the Grand Meeyahta to be demolished.

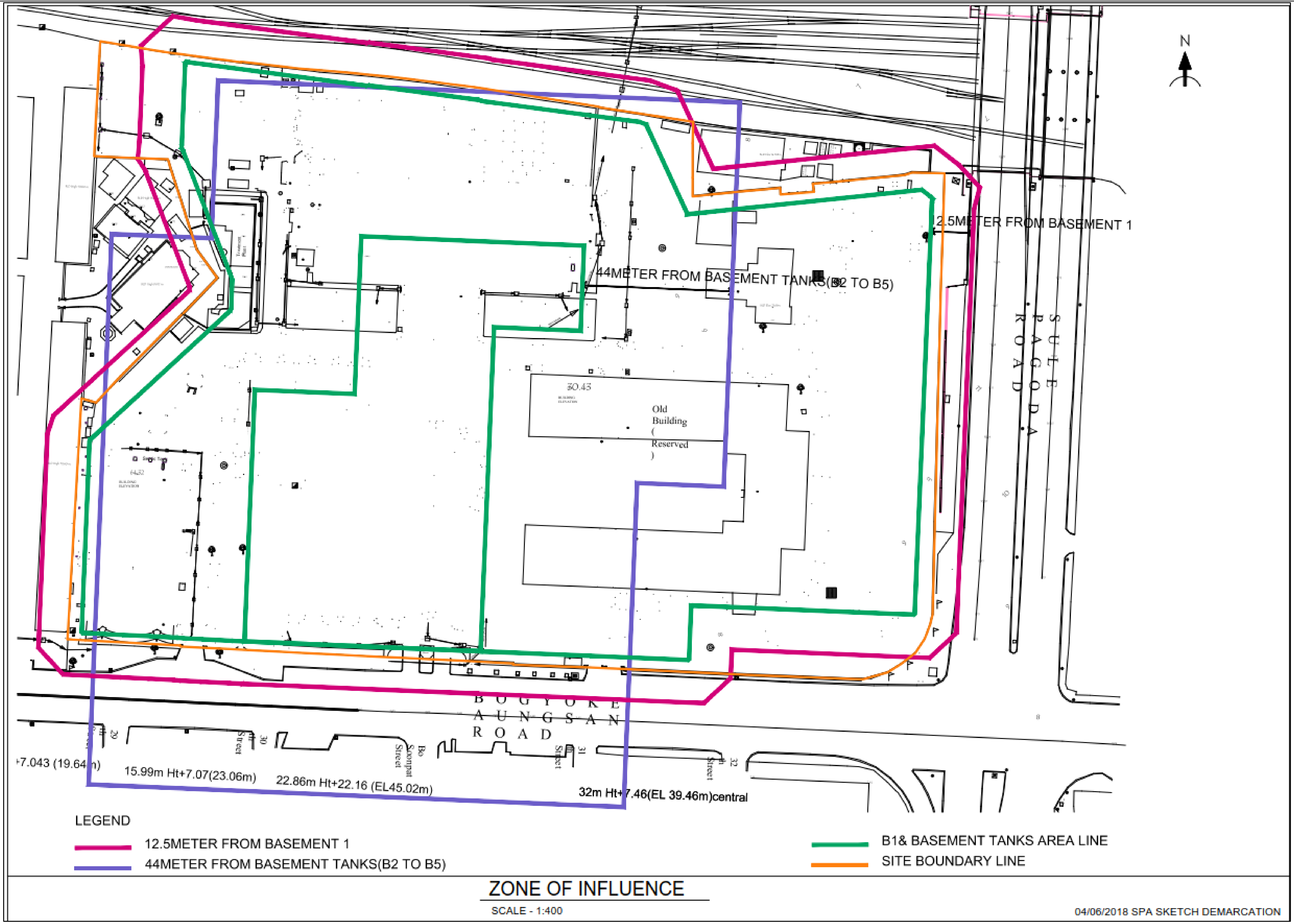

Figure 6.5: ZoI of the Excavation with Potential Vibration Impact

6.6.2.2 Reconciliation of Vibration Criteria

Based on the identified VSRs in **Table 6.15,** the vibration criteria have been assigned based on the most conservative/ appropriate vibration criteria selected from **Table 6.16**.

Table 6.16: Adopted Vibration Criteria (Construction Phase)

VSR label	Description	PPV (in/s) (for protection of structural damage)	Approximate L_v (for avoidance of annoyance)	Remarks
V1	Myanmar Railway Building (MRB)	0.12 (3 mm/s)	N.A. (Not occupied)	Same applicable criteria for heritage building in German Standard or Buildings extremely susceptible to vibration damage by United States Department of Transport (USDOT)
V2	Church	0.2 (5 mm/s)	75	Category 3 - Institutional land uses with primarily daytime use

6.6.2.3 Assessment Approach & Methodology

b) Vibration Impact Assessment

The assessment of vibration impact was referenced with the procedures given in Chapter 10: Noise and Vibration during Construction of Chapter 10 – Noise & Vibration during Construction in "High-Speed Ground Transportation Noise and Vibration Impact Assessment" published by the US Department of Transport, September 2012.

Construction vibration sources will be dominated by demolition activities associated with the Grand Meeyahta and the FMI Centre.

Vibration source levels of typical construction equipment are available and tabulated in **Table 6.17.**

Table 6.17: Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft (in/s)	Approx. Lv at 25 ft
Pile driver (impact)	Upper range	1.518	112
	Typical	0.644	104
Pile driver (vibratory)	Upper range	0.734	105
	Typical	0.170	93
Clam shovel drop (slurry wall)		0.202	94
Hydromill (slurry wall)	In soil	0.008	66
	In rock	0.017	75
Vibratory roller		0.210	94

Equipment		PPV at 25 ft (in/s)	Approx. Lv at 25 ft
Hoe ram		0.089	87
Large bulldozer		0.089	87
Caisson drilling		0.089	87
Loaded trucks		0.076	86
Jackhammer		0.035	79
Small bulldozer		0.003	58

Source:
Table 10-5 of the "High-Speed Ground Transportation Noise and Vibration Impact Assessment" – USDOT, Sep 2012

Based on:

1. *D. J. Martin. Ground Vibrations from Impact Pile Driving during Road Construction, Supplementary Report 544, United Kingdom Department of the Environment, Department of Transport, Transport and Road Research Laboratory, 1980.*
2. *J. F. Wiss. Vibrations during construction operations. Journal of Construction Division, Proc. American Society of Civil Engineers, 100(CO3), 239–246, September 1974.*
3. *J. F. Wiss. Damage Effects of Pile Driving Vibrations, Highway Research Record, No. 155, Highway Research Board, 1967*
4. *D. A. Towers. Ground-Borne Vibration from Slurry Wall Trench Excavation for the Central Artery/Tunnel Project Using Hydromill Technology, Proceedings of Inter-Noise 95, Newport Beach, CA, July 1995, pp. 227–232*

The hydraulic breaker will be the dominant source of vibration during the demolition of the Grand Meeyahta and the FMI Centre but it is not listed in **Table 6.17**, It has, therefore, been derived based on the *Transportation- and Construction-Induced Vibration Guidance Manual*[3]

$$PPV_{Hydraulic\ breaker} = PPV_{Ref} \times (25/D)^{n} \times (E_{equip}/E_{Ref})^{0.5}$$

Where:

PPV (ref) = 0.24 in/sec for a reference hydraulic breaker at 25 ft

D = distance (in feet) from the hydraulic breaker to the receiver

n = 1.1 (the value related to the attenuation rate through ground)

E_{Ref} = 5,000 ft-lbs. (rated energy of reference hydraulic breaker)

For a backhoe mounted hydraulic breaker of rated power at 67kW, the PPV has been calculated as 0.759 in/s and L_v value of 106 dB based on a crest factor of 4. The methodology used is summarised below:

c) Damage Assessment

- Select the equipment and associated vibration source levels at a reference distance of 25 ft. In this case, 0.759 in/s for backhoe mounted hydraulic breaker rated at 67kW
- Adjust for distance attenuation according to the following formula based on point sources with normal ground propagation conditions:

$$PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$$

[3] Transportation- and Construction-Induced Vibration Guidance Manual, pp 24, published by California Department of Transportation

Where:

PPV (equip) = peak particle velocity in inches per second of the equipment adjusted for distance

PPV (ref) = reference vibration level in inches per second at 25 feet

d) Annoyance Assessment

- Select the equipment and associated vibration source levels at a reference distance of 25 ft. In this case, 106 dB for backhoe mounted hydraulic breaker rated at 67kW.
- Adjust for distance attenuation according to the following formula based on point sources with normal ground propagation conditions:

$$L_v(D) = L_v(25\ ft) - 30\ log_{10}(D/25)$$

Where:

L_v = vibration level L_v at any distance D from the source

Lv (25 ft) = reference vibration level L_v at 25 feet

D = the distance (in feet) from the equipment to the receiver

6.6.2.4 Results of Prediction

a) Unmitigated Vibration Impact

The vibration impacts have been calculated based on the afore-mentioned methodology from both the structural damage and annoyance perspective as below. It has been demonstrated that there will be no unacceptable vibration impacts predicted at the VSRs.

Based on the vibration assessment conducted, the noisiest tasks are predicted to be associated with piling and demolition works.

b) Mitigation Measures

- Pre-condition dilapidation survey was conducted in 2014 on St. Gabriel's Church compound, Bogyoke Aung San Market Blocks 1 and 2 as well as other neighbouring buildings and pubic infrastructure. Information from the survey is used for damage risk assessment, establish a reference baseline and serve as a basis for post-construction repairs where required.
- Controlled demolition of the existing buildings.

Based on the vibration assessment conducted, the noisiest tasks are predicted to be associated with piling and demolition works.

a) Mitigation Measures

- Pre-condition dilapidation survey was conducted in 2014 on St. Gabriel's Church compound, Bogyoke Aung San Market Blocks 1 and 2 as well as other neighbouring buildings and pubic infrastructure. Information from the survey is used for damage risk assessment, establish a reference baseline and serve as a basis for post-construction repairs where required.
- Controlled demolition of the existing buildings.

Installation of vibration meters and crack gauges at the Project site to check the vibration impacts (**Photo 6.1**). 24-hours continuous monitoring is carried out to monitor the potential impact to the neighbours during construction phase.

Table 6.18: Unmitigated Vibration Impact

Construction Activities	No.	PPV (in/s) (at D)	Vibration criteria	Remark		
Demolition of Grand Mee Ya Hta						
Backhoe mounted hydraulic breaker (67 kW)	1	0.759		at D=	25 ft	Ref. distance
PPV_{church}		**0.031**	< 0.2 in/s	at D=	210 ft	Distance to Church
PPV_{MRB}		**0.048**	< 0.12 in/s	at D=	157 ft	Distance to MRB
Demolition of FMI Centre						
Backhoe mounted hydraulic breaker (67kW)	1	0.759		at D=	25 ft	Ref. distance
PPV_{church}		**0.016**	< 0.2 in/s	at D=	321 ft	Distance to Church
PPV_{MRB}		**0.006**	< 0.12 in/s	at D=	666 ft	Distance to MRB
Construction Activities	**No.**	**L_V (dB) (at D)**	**Vibration criteria**	**Remark**		
Demolition of Grand Mee Ya Hta						
Backhoe mounted hydraulic breaker (67 kW)	1	106		at D=	25 ft	Ref. distance
$L_{V\ church}$		78		at D=	210 ft	Distance to Church
Correction for building foundation		-10		assuming large masonry on piles or spread footing		
Corrections for amplification		6		due resonances of floors, walls and ceilings		
Resulting Lv		**74**	< 75 dB			
Demolition of FMI Centre						
Backhoe mounted hydraulic breaker (67kW)	1	106		at D=	25 ft	Ref. distance
$L_{V\ church}$		72		at D=	321 ft	Distance to Church
Correction for building foundation		-10		assuming large masonry on piles or spread footing		
Corrections for amplification		6		due resonances of floors, walls and ceilings		
Resulting Lv		**68**	< 75 dB			

Photo 6.1: Vibration Monitoring

6.7 Water Quality Impacts

This Section describes the potential water quality impacts arising from the construction and operational phases of the Project.

6.7.1 Construction Phase

6.7.1.1 Source of Impacts

Sources of water quality impacts predicted during the construction phase include:

- Soil erosion from the following key construction activities:
  - Demolition and site clearing;
  - Site preparation and site formation/earthworks;
  - Superstructure works; and
  - Infrastructure development including road works and landscaping activities;
- Potentially contaminated surface runoff arising from the site especially from material stockpile areas and hazardous materials (e.g. diesel, paints, lube oils) storage area; and
- Sewage from the sanitary facilities provided at the on-site temporary offices.

a) Soil Erosion

The primary source of water quality impact during the construction phase is soil erosion which results in the suspension of soil and particulate matter in the surface runoff from the site. Site

development activities including the removal of vegetation and excavation of paved surfaces will expose the underlying soil to erosive agents such as rain and runoff which accelerate soil erosion. The denuded soil will be subject to displacement of soil particles especially during heavy rainfall events. The susceptibility of any land surface to erosion, i.e. the erosion potential is related to a combination of factors including rainfall, runoff, soil erodibility, surface hydrology, surface slope and length, surface cover and condition, and land use.

At the Project site, soil erosion will be confined to the active construction phase which will involve demolition of existing structures, site clearing (including the removal of undergrowth and secondary vegetation which exist mainly along the north-eastern and eastern boundaries of the site), earthworks, grading, and excavation of drainage system, electrical cables and backfilling activities. It is anticipated that up to 400,000 m^3 of soil/ subsurface materials will be removed to allow for the foundation works and the establishment of the basement car parks for the office tower blocks. As this material is deemed unsuitable as backfill material or possible reuse on the site, the material will be transported offsite for disposal at a location approved by the YCDC.

The construction phase is expected to last for a period of about 3 years and during this period the activities will be carried out in phases. Upon completion of construction, the Project site area will be sealed (concrete or asphalt paved) and landscaped to minimize the erosion potential.

In preventing or minimising the impacts arising from soil erosion, the appointed Contractor must ensure that the phase approach is maintained. The impacts arising from the earthwork activities can be minimised with the implementation of appropriate mitigation measures and carried out by the appointed Contractor in accordance with the construction methodology proposed by the engineering team.

b) Contaminated Construction Runoff and Drainage

Surface runoff and drainage from material stockpiles areas, excavated areas and temporary drainage channels contain increased sediments and other water quality contaminants. Potential contaminations include:

- Grouting and other ‘wet’ building materials;
- Various types of lube oil, spent/waste oil and residues from construction equipment, vehicles and diesel generators;
- Residues and waste of industrial paints, pigments, lacquers, curing compounds, etc.;
- Debris and rubbish such as packaging material, plastics, reject construction materials and discarded containers;
- Excavated materials stockpile; and
- Spillages of fuel oil (diesel), liquid chemicals, paints and other liquid waste residues.

c) Sewage Effluent and Domestic Wastewaters

During the construction phase, temporary site offices will be established at the Project site. Wastewaters generated will be in the form of sewage effluent and domestic wastewater (e.g. kitchen wash waters from temporary canteens which may be established at the Project site.

6.7.1.2 Water Quality Impacts

During the construction phase, the sources water pollution are construction runoff and sewage effluent. The existing network of internal drains will be excavated and only the YCDC main drain will be retained in place for the conveyance of surface runoff from the site. To prevent the carry-over/washout of silt and sediment from the site, appropriately designed sediment retention structure will be installed at strategic locations within the Project site, namely at the active works area.

With these measures in place, the site preparatory works are not expected to result in adverse erosion rates. The impacts arising are transient in nature, occurring only during the site preparation stage of the construction phase, and with the effective implementation of these measures, this risk will be further reduced.

a) Construction Runoff and Drainage

Water quality impacts from site drainage will become significant in the event the runoff is uncontrolled and permitted to discharge directly into canal without any form of pre-treatment. Temporary and/or permanent drainage conveyance systems will be installed immediately following the site preparation works. Provided the construction runoff and drainage are effectively managed and controlled with the implementation of the recommended mitigation measures described under the potential impacts to the receiving canal is not predicted to be significant.

b) Sewage Effluent and Domestic Wastewaters

Untreated or inadequately treated sewage effluent and domestic wastewaters which are high in organic content will increase the BOD and Ammoniacal Nitrogen concentration in the receiving canal. These effluents will also have high counts of faecal coliform, E. coli and other disease carrying bacteria.

To eliminate this source of pollution, portable toilets will be recommended to prevent any release of untreated sewage into YCDC main drain which transects the site. These are discussed in the following sections.

6.7.1.3 Mitigation Measures

Major water quality impacts anticipated from the construction phase are related to soil erosion, sediment runoff and contaminated construction runoff. In mitigation, measures must be taken during the site clearing and excavation works to ensure that all losses of material to the receiving YCDC main drain and subsequently, the canal which flows along the northern boundary of the site are minimized.

Upon the onset of physical works, it is important that the nominated earthworks Contractor be guided in the approach and planning of site clearance and earthworks. Earthworks plan and phasing details complete with the relevant mitigating measures will be submitted to the YCDC for approval before the commencement of works. An Erosion and Sedimentation Control Plan (ESCP) will be integrated into the earthworks plan; and that the Contractor comply with the details of the plan.

An ESCP is a document that describes the measures to be carried out to control erosion and sedimentation during construction. Typically, an ESCP includes the following:

- Description of predominant soil type within the construction works area;

- Details of site topography including existing and proposed levels;
- Design details and locations for structural controls;
- Details of temporary and permanent stabilization measures; and
- Description of the sequence of construction.

Given below are general guidelines for non-structural and structural erosion control measures that will be incorporated in the ESCP and enforced during the construction phase. The effectiveness of the ESCP can be evaluated during the implementation of the EMP which includes regular monitoring and audits.

a) Earthworks

- All catch pits and trenches required during the earthworks will be located, designed and constructed in a manner that will minimise the potential threat of downstream flooding.
- Surface runoff from the site will be disposed of by temporary drainage or pumping systems of by other methods capable of keeping the site free of water and protected fro damage due to water.
- Any washout of construction or excavated materials will be diverted to the drainage system via sediment traps.
- Any disturbed earth caused by construction activities or fill operations will be firmly consolidated and compacted by earth moving vehicles and compactors to reduce the rate of possible erosion and release of loose soil particles.
- Denuded stretches will be re-vegetated or sealed immediately after the construction works. Suitable re-vegetation programmes will be planted as quickly as possible on exposed areas to reduce surface runoff and sediment loss.
- Uncovered stockpiles of excavated material or topsoil and fill material are prone to erosion and therefore will be protected. Small stockpiles can be covered with tarpaulin sheets and large stockpiles will be stabilised by erosion blankets and regularly damped.
- Wheel washing facilities at the ingress / egress point of the Project site to remove dirt/ soil from vehicles and machinery leaving the site. All surface discharge from the wheel washing facilities will be channelled into the temporary drainage system.
- Stockpiles of construction aggregate, spoil and excavated soil will be located at areas within the project site that do not permit direct run off into water courses and are generally flat. On site storage of excessive quantities of such materials will be avoided and where not possible the use of geotextile material or tarpaulin covers will be considered to minimize erosion.
- Stockpiles will be covered.
- Stockpiling of the excavated material shall be minimised by scheduling the construction programme in a way that one section of the alignment can be construction and completed before excavation works of the next section commence.
- Temporary sand bags will be installed when the site platform is higher to avoid runoff into public domain.

Earthwork details including cut and fill quantities, the road and drainage layout for the construction phase will be submitted to the YCDC prior to commencement of works at the Project site.

b) Sediment Retention Structures

Sediment retention structures such as silt traps or catch pits of adequate sizes will be provided at suitable locations within the active works area within the Project site to remove soil and sediment in the surface runoff prior to discharge into the receiving drainage channels.

The silt traps/catch pits will be regularly maintained and desilted to provide maximum silt removal efficiencies. Oil and grease removal facilities will also be provided to ensure the overflow from the silt trap does not have traces of oil and grease. Weekly inspection of silt trap will be carried out by the Contractor.

c) Sewage Discharge

The contractor will ensure that site management is optimised. The Project has installed six (6) 9 m^3 capacity septic tanks on-site. Sewage effluent generated from the workers' facilities will either be treated via temporary bioseptic treatment tanks which will be flushed out by YCDC approximately four (4) times a month and as and when required since it is accessible for inspection by the Contractor. The construction, operation and maintenance of these temporary systems will comply with the requirements concerning sewage disposal as stipulated by the YCDC. These systems will be maintained in a clean and sanitary condition. The capacity of these septic tanks is considered sufficient to meet the needs throughout the construction phase.

The temporary septic system will be installed only under the following circumstances

- Connection to an approved sewage disposal system is impractical or impossible;
- Water supply is not adequate;
- The installation of individual sewage disposal system or other approved method of sewage disposal is impractical or impossible; and
- The system will not create a public health hazard or a public health nuisance.

The temporary septic systems will be inspected and desludged regularly by YCDC. The facilities will be cleaned twice daily, in the morning and at the end of day. Discharge from the septic tanks will be channelled to the sedimentation tank.

d) Spillage of Oil, Fuel and Chemicals

- All vehicles and plant servicing, vehicle wash bays and lubricating bays shall be sheltered from rain and the drainage in these areas shall be connected to drains via a petrol interceptor.
- All generators, fuel and oil storage shall be within bunded areas. Drainage from the areas shall be connected to drains via a petrol interceptor.
- Drip collection devices will be provided.

6.7.2 Operational Phase

6.7.2.1 Sources of Impacts and Assessment of Impacts

During the operational phase of the Project, the main source of water quality impact domestic wastewater include sewage and sullage (also known as grey water which refers to wastewater sinks/wash basins, showers, and baths, but not (excluding) waste liquid or excreta from toilets). Stormwater from the Project site will be conveyed via a network of permanent drains which will discharge via the northern boundary of the site into the existing canal.

Untreated or inadequately treated sewage effluent and domestic wastewaters which are high in organic content has the potential to increase the BOD, COD and Ammoniacal Nitrogen concentrations in the receiving waterways. These effluents will also have high counts of faecal coliform, *E. coli* and other disease carrying bacteria.

6.7.2.2 Recommended Mitigation Measures

To treat the sewage effluent from the sanitary facilities located at the various development components of the Project and sullage from development components, a wastewater treatment plant (WWTP) will be constructed onsite. All soil and waste will discharge to a centralised WWTP. The wastewater treatment system will be a Membrane Bioreactor or MBR type system which is an advanced activated sludge process, operated with higher biomass concentration and an integrated membrane filtration process. The WWTP will be designed based on the peak water demand of 1,100 m^3/day as this rate is assumed to represent the wastewater generation at the site.

The treated effluent will be reused onsite as cooling water and any excess will be pumped into the city's storm water drainage system. Rain Water Harvesting System will be considered as an alternative source of water resource if required.

To ensure optimal efficiency of the WWTP, the system will be subject to periodic preventive maintenance.

6.8 Soil and Groundwater Contamination

6.8.1 Construction Phase

a) Impact Assessment

The potential impacts on soil and groundwater resources during the construction phase are likely to be attributed to improper management and handling of hazardous materials stored at the site. Potential sources of impacts anticipated during the construction activities of the Project include:

- Accidental spillage and leakage arising from the handling and storage of hazardous materials/chemicals in diesel skid tanks, chemical/fuel dispensers and storage drums, jerry cans or carboys that contain lube oil, hydraulic oil, paints and organic solvents and other chemicals used during the construction phase;
- Leakage arising from vehicle engine oil change, equipment and machinery, as well as refueling activities;
- Spills as a result of inappropriate hazardous waste storage and disposal practices;
- Improper discharge of untreated sewage; and
- Groundwater dewatering activity.

Soil and groundwater impacts arising from accidental spillage and leakage of hazardous chemicals and wastes during the construction phase are assessed to be not significant due to the limited quantities of chemicals used at any one time on-site during construction. Furthermore, construction activities are expected to be carried out in phases over a period of 36 months with each phase lasting over a relatively short period. Any potential soil and groundwater contamination is likely to be localised and surficial. These impacts can be readily addressed by implementing appropriate mitigation measures as recommended in the proceeding section.

Groundwater pumping may be required where foundation excavations extend below static water levels. However, the need for significant groundwater discharge is unlikely. In the unlikely event that some dewatering is required, the extracted water will be conveyed via the silt trap proposed for the construction works area and disinfected prior to discharge into the site's drainage system.

b) Recommended Mitigation Measures

The risks of soil and groundwater contamination during the construction phase will be appropriately managed and controlled by the following:

- A secured area (enclosed with hardstanding impervious base) will be provided for the storage of any hazardous materials and hazardous wastes;
- All temporary fuel tanks and drum storage areas are equipped with concrete or steel retention trays or temporary pit with plastic sheet and sand;
- All activities that may result in the potential release of hazardous materials to the ground such as changing of engine oils and lubrication oils from construction vehicles, equipment and generators on site are performed only on designated sealed areas or on drip trays and plastic sheet to reduce the risk of direct spill into the underlying soil and groundwater. Spent oil must be handled and disposed of as scheduled waste;
- Any accidental spills of fuel, oil or other hazardous chemicals will be cleaned up immediately. The recovered media (contaminated soil, absorbent pads, rags, etc.) will be disposed of as scheduled waste; and
- Disinfection of groundwater before offsite release is required as the baseline ground water investigation results indicates the presence of *E. coli* and coliforms in concentrations exceeding the standards for effluents discharge in Myanmar.

Appropriate sanitary facilities will be provided and properly maintained for construction workers throughout the construction stage. Direct discharge of untreated sewage into underlying soil, groundwater or surface water is prohibited. The number of temporary septic systems/chemical toilets installed at the site will be of sufficient numbers and will meet the requirements of YCDC.

6.8.2 Operational Phase

6.8.2.1 Potential Sources of Impacts and Impact Assessment

The areas of concern for the potential soil and groundwater contamination during the operational phase of the Project include:

- Diesel storage room covering a footprint of 135 m^2 which houses 3 metal skid tanks (each with a storage capacity of 20,000 litres) and 2 tanks (with a storage capacity of 10,000 m^3)
- Chemical store for the storage of chemical related to maintenance activities, the WWTP and the cooling towers (anti-fouling agents, corrosion inhibitors, biocides);
- The emergency firewater pumphouse;
- Standby generators (including their diesel day tanks); and
- Hazardous wastes store.

Accidental release of hazardous materials/chemicals has the potential to result in adverse impacts on soil and groundwater resources during the operational phase of the development. Both organic and inorganic contaminants in soil and groundwater have the potential to pose short term and long term threats to human health, safety and sensitive environmental

receptors. For example, the accumulation of volatile organic compounds (VOCs) as a result of petroleum hydrocarbon spills into the underlying soil and groundwater may reach levels in subsurface utility systems, or the concentrations of these vapours may cause acute health effects to facility and maintenance workers.

Groundwater contamination issues are long-term in nature. Certain contaminants are resistant to biodegradation and will persist in the environment for many years after the source of contamination has been removed. The presence of these residual contaminants in the soil and groundwater may pose an unacceptable risk particularly since groundwater is a valuable resource in Yangon and is currently the main source of water supply.

The impacts include:

- Changes in pH of the groundwater as a result of chemical spills have the potential to affect microorganisms in soil and groundwater and affect the natural soil processes such as biodegradation.
- Contaminants present in groundwater on-site have the propensity to migrate to down-gradient neighbouring properties and affect underlying aquifers or threaten sensitive habitats in receiving river systems, i.e. the Pazundaung Creek which subsequently flows into the Yangon River. Workers involved in excavation and construction workers may potentially be exposed to these contaminants via dermal contact, inhalation of vapours or accidental ingestion when carrying out sub-surface activities.

During the operational phase of the project, groundwater will be abstracted for use within the development for the sanitary facilities, landscaping, swimming pool general washing, and potable use.

Impacts to soil and groundwater resources associated with implementation of the Project can be minimised or prevented by implementing appropriate mitigation measures as discussed in the following subsection.

6.8.2.2 Recommended Mitigation Measures

The diesel and chemical storage facilities will be designed and operated to ensure that as far as practicable, leakage and accidental release of chemicals into the underlying soil and groundwater do not occur. Prevention and control measures include the following:

- The five diesel storage tanks within the Diesel Storage Room will be located within concrete-bunded enclosures capable of containing 110% of the contents of the largest tank within each enclosure. The floor of the bunded enclosures will be concrete-lined with an impermeable liner to prevent contaminant from permeating into the ground;
- Appropriate instrumentation and control/trigger alarm to warn of possible overfilling and to provide an alert mechanism in the event of significant fuel/chemical loss will be provided for the storage tanks;
- Operational control which includes regular/routine surveys, inspection and maintenance of the diesel fuel tanks and their ancillary facilities (pumps, valves and pipes) will be integrated into the Project’s environmental management practices so as to identify and rectify any significant fuel losses or ongoing spills/leakages which may be occurring;
- Areas where regular or periodic handling and dispensing of liquid hazardous material are undertaken, such as the diesel storage area and the building maintenance store will be concrete-paved with appropriate secondary containment (drip trays and bunded areas) provided.

- Any accidental spills will be assessed on a case by case basis and remedied, including excavation and disposal of any contaminated soil (classified as hazardous wastes) at a secure disposal facility approved by the YCDC.
- Procedures and work instructions on proper handling of diesel and maintenance chemicals as well as the disposal procedures for hazardous wastes will be developed and effectively communicated to all operations and maintenance personnel;
- Material Safety Data Sheets (MSDS) will be provided for the diesel and any other chemicals (e.g. chemicals used for the maintenance activities, used at the WWTP and for the cooling towers) stored within the Project site;
- Corrosion protection for steel tanks and their ancillary facilities (pumps, valves and pipes) will be provided to prevent leaks.

As part of continuous monitoring, the groundwater quality at the Project site will be monitored on a regular basis during the lifetime of the development as groundwater is a valuable and sensitive resource in Yangon. If the groundwater quality data indicate contaminants are present at concentrations above the groundwater quality screening levels such as the DIVs, further assessments will be necessary to determine the nature and extent of the contamination, as well as to remove the potential source(s) of contamination. A Human Health Risk Assessment (and/or an Ecological Risk Assessment, where appropriate) may be required to determine if the concentrations detected in the impacted media pose an unacceptable risk to human health and the environment.

6.9 Waste

6.9.1 Construction Phase

6.9.1.1 Assessment of Impacts

The main activities planned for the construction phase of the Project include:

- Demolition of the FMI Centre and Grand Meeyahta Executive Residence;
- Site preparation and formation works at the site;
- Superstructure works for the proposed new buildings; and
- Infrastructure establishment including roadworks and landscaping activities.

The types of solid wastes generated during the construction phase can be broadly categorised based on their nature and ultimate disposal method into the following:

- Non-hazardous waste; and
- Hazardous wastes.

6.9.1.2 Non-Hazardous Waste

- ***Demolition debris***: The development of the Project will involve the staged demolition of the buildings which currently occupy the site as described above. The non-hazardous demolition spoil is expected to comprise amongst others brick, concrete materials, iron, electrical wiring, wood based materials;
- ***Excavated unsuitable soil:*** During the site formation works, approximately 400,000 m^3 of material will be excavated, and removed offsite for disposed at YCDC's controlled dumping grounds.

- ***Construction spoil originating from the construction works***. These include materials such as crushed stones and gravel, rejected metal based materials, bricks, concrete slabs, steel frames, PVC pipes, cement/grouting mixes, etc.;
- ***General waste*** which includes non-inert and non-toxic waste such as plastics, packaging, paper, glass, metals, planks, putrescible food and other wastes generated from site office and temporary workers' canteen at the site; and
- Vehicle/ equipment parts such as tyres, metal components, etc.

6.9.1.3 Hazardous Waste

Wastes from the demolition of old structures potentially contain hazardous materials which require appropriate management and disposal. Older buildings are often painted with lead paint and paint containing mercury-based biocides; contain used leaded pipes, have asbestos insulation, mercury-containing fluorescent lamps and PCB ballasts and contain other hazardous materials. It is therefore critical to identify and quantify these wastes for proper removal, storage and disposal. To assess the presence of such hazardous materials in the structures to be demolished, an assessment was carried out for all existing buildings within the Project site in July 2013 (Golder Associates, 2013). The scope of the assessment included:

- Asbestos-containing material (ACM);
- Synthetic Mineral Fibre (SMF);
- Polychlorinated biphenyls (PCB);
- Lead based paints (LBP);
- Ozone depleting substances (ODS);
- Radioactive smoke detectors;
- Mercury containing materials;
- Hazardous chemicals/wastes;
- Mold; and
- Biological hazards (pigeon dropping and rat droppings).

The findings of the assessment and the recommended safe handling/ disposal measures are presented below:

- ACM across all buildings onsite[4];
- SMF at Grand Meeyahta Executive Residence, FMI Centre and Zawgyi House: The confirmed SMF materials will be maintained in good condition and removed under controlled conditions prior to any demolition works;
- Lead-based paints across all buildings onsite and the paint were observed to be peeling and weathered: It is recommended to remove the paint through techniques such as wire brushing or wet hand scraping with liquid paint removers or replacement of gas pipes should the pipe not be required in the future;

[4] This component of the assessment was carried out in accordance with HSG264 Asbestos: The Survey Guide and Golder Associates technical procedures on ACM Bulk sampling methods. Bulk samples of suspected asbestos containing material was collected during the survey and placed in plastic sealed bags. These samples were later analysed by Analytical Environmental Services Inc. (AES) in Atlanta who are certified by AIHA to analyse Industrial Hygiene Samples by Polarised Light Microscopy. Groundwater samples were assessed for ACM content by Transmission Electron Microscopy (TEM) –EPA Method 100.2.

- Ozone depleting substances at Grand Meeyahta Executive Residence, FMI Centre and Zawgyi House: During demolition all equipment containing refrigerants on site will be dismantled, handled with care and returned to supplier for disposal or recycling where possible;
- Radioactive smoke detectors at FMI Centre and Grand Meeyahta Executive Residence were of the Fire Dynamic Simulator (FDS) series and contain small amounts of Americium 241; a radioisotope: These smoke detectors will be separated during pre-demolition and may be returned to the supplier.
- Mercury containing materials e.g. fluorescent lights were found at the Grand Meeyahta Executive Residence. At various locations LG, GE and Osram brands of incandescent and fluorescent lighting were identified. No mercury is released when compact fluorescent lights bulbs or fluorescent tubes are intact (not broken) or in use. However, when fluorescent lamps are no longer usable, they will be disposed of safely or recycled if possible;
- Hazardous chemicals at FMI Centre and Grand Meeyahta Executive Residence: The appropriate hazard warning symbols and labelling will be put in place for chemicals required and stored on site;
- Mold at the Grand Meeyahta Executive Residence: All sources of moisture will be removed prior to cleaning. The affected area will be dried and workers involved in renovations works in the area will be provided with N95 masks. All other vents will be checked thoroughly for signs of mold growth prior to demolition to prevent any exposure to airborne diseases through mold spore exposure; and
- Biological hazards (pigeon dropping and rat droppings) at the FMI Centre and Grand Meeyahta Executive Residence: This waste will be removed prior to demolition so as to prevent disease transmission during demolition activities.

No PCBs were discovered within the onsite buildings.

Other forms of hazardous wastes generated from the construction activities include:

- Spent filter cartridges, mineral oils/ engine cleaning fluids from the construction machinery/equipment;
- Small quantities/ residues of waste of industrial paints from the painting activities; and
- Various types of spent/ waste oil and soil/rags contaminated with oily residues from construction equipment, vehicles and diesel generators.

The potential impacts arising from the improper management of both non-hazardous and hazardous waste categories include the following:

- Improperly managed wastes may enter public drainage system potentially obstructing the drainage flow;
- Grouting materials, oil & grease, paints, etc. may potentially contaminate the surface runoff arising from Project site;
- Improper disposal of putrescible municipal wastes onsite would attract disease carrying rodents and insects which are possible health risks to the employees within the Project site as well as create an odour nuisance within the site;
- Indiscriminate dumping of construction wastes (hazardous) at open areas within the Project site may potentially contribute to soil and groundwater contamination;
- Ineffective management of waste onsite including large stockpiles of excavated materials will also create aesthetic impacts as the Project site is located along one of the main streets within the city of Yangon; and

- Improperly managed construction wastes are also potential fire hazards within the site.

Overall, the impacts arising from the management of non-hazardous and hazardous wastes at the project site during the construction phase are predicted to be short-term and localized and can be effectively mitigated with the implementation of appropriate construction management practices.

6.9.1.4 Mitigation Measures

a) Non-Hazardous Solid Waste

The potential environmental impacts arising from the improper management of municipal wastes can be minimised with the implementation of the following practices:

- Good housekeeping practices are essential within the site;
- Segregation of waste for re-use and recycling;
- General construction spoil will be recycled on site as much as possible. For example, construction aggregate materials may be considered as possible backfill material;
- Domestic waste generated from the site offices will be stored in suitable covered receptacles or stored within enclosed areas and collected regularly by a YCDC-licensed contractor for disposal at approved disposal/ landfill sites; and
- Unsalvageable construction spoil will be stockpiled at a designated site and where practicable sold to salvage yard operators or other contractors interested in recycling the material.

MDL has obtained YCDC's approval for Soil Disposal Permit (**Annex 3**) and solid waste disposal at YCDC Landfill.

Open burning of any form of construction waste material within the Project site is strictly prohibited as apart from polluting the atmosphere and reducing the ambient air quality at the site, the activity poses a risk of fire spreading to the hazardous materials storage areas (example, diesel storage area).

b) Hazardous Wastes

The hazardous wastes generated during the construction phase as described above will require proper handling, storage and disposal.

- An Exposure Control Plan has been developed for removal of ACM and SMF as far as necessary to facilitate safe work area for demolition workers ahead.
- Chemical wastes will be properly packed, labelled and disposed of by licensed contractor.
- No products or substances including chemicals or fibrous materials are brought to the site without a current MSDS. All storage and use of hazardous substance and dangerous goods are in accordance with the MSDS and legislative requirements.
- All dangerous goods or combustible liquids are stored in accordance to MSDS requirements.
- Dangerous goods will be stored away from ignition sources and in non-hazardous area e.g. non-flammable cabinets, cages, non-corrosive containers, etc.
- All employees involved in the use of products classified as hazardous or dangerous are provided with information and training to allow safe completion of the required task.

Presently, in Yangon, there are is no collection system for hazardous wastes. The YCDC entrusts the PCCD to collect industrial wastes together with municipal and general wastes. The waste collection system at six townships within the Central Business District has been contracted to six different contractors as part of the department privatization efforts. The collected wastes are hauled to designated areas within the city limits as well as areas surrounding the city.

The PCCD also collects industrial wastes on request. In developing the contractual documents with the Main Contract, provisions are made to legally bind the Contractor to ensuring safe management and disposal of hazardous wastes. In deciding on the best disposal options, the project management team will meet with the PCCD to discuss available options.

6.9.2 Operational Phase

6.9.2.1 Impact Assessment

a) Hazardous and Non-hazardous Wastes

Non-hazardous wastes arising from the occupancy of the residential tower blocks and the hotel include kitchen wastes, office wastes from the administration offices of the hotel, wastes generated by the hotel guests, garden wastes and miscellaneous wastes which may include waste paper, plastic, cardboards etc.

Small quantities of hazardous wastes will be generated from the operation of the hotel largely from the periodic maintenance activities.

These include:

- Used fluorescent bulbs;
- Spent oils and solvents from the hotel maintenance department.
- Discarded or off-specification chemicals (paints, thinners, chemicals used for the disinfection of the swimming pool);
- Containers, bags or equipment contaminated with chemicals or mineral oil; and
- Rags, plastics, papers or filters contaminated with chemicals or oils.

The primary concern with regards to hazardous and municipal wastes management is improper disposal at unauthorised sites.

Improper disposal of these wastes will lead to potential surface water, groundwater and soil contamination. It will also contribute to unhealthy and unattractive surroundings.

6.9.2.2 Management Measures

Waste collection areas will be provided within the Project during the occupancy/operational stage. The specific location details were not available at the time of reporting. The hazardous and non-hazardous wastes will be hauled offsite by contractors licensed under one of the six waste collection companies appointed by the YCDC. Collection will be carried out once in every two days since accumulated wastes at the hotel premise will pose a health risk and nuisance to the occupants within the Project area as well as visitors/guests.

A waste separation system will be implemented within the Project site and options for waste recycling be considered in line with good practices for hotels and embassies in Yangon to minimise the volume of wastes to be disposed to the landfill.

6.10 Socio-economic Aspects

The magnitude and duration of the Project is likely to positively impact the overall socio-economic status of the City of Yangon. The Project will provide significant employment opportunities for the existing, local skilled and unskilled work force and will be a driver for economic growth in the City of Yangon. The type, nature and degree of benefits will vary according to the project phases (i.e. construction, operations, monitoring). This socio-economic assessment did not identify any significant adverse social impacts arising from the proposed project.

6.10.1 Construction Phase

The construction workforce comprising both skilled and unskilled labour will be sourced primarily from the local population, and foreign workers would mostly be hired if a post cannot be filled by a local. This is according to the company's internal human resource policy and to maximise the benefits of the Project to the local community and the nation as a whole. During construction, the project will create a lot of jobs for locals which are estimated as 86 jobs under direct employment by the project management company and 4,000 jobs under contractors' and sub-contractors' employment. Breakdown of workers' requirements during construction phase is as follows:

- 2018 > average 600 workers
- 2019 > average 1,200 workers
- 2020 > average 3,000 workers
- 2021 > average 1,800 workers

Many of the workers who will work during the construction stage of the project will be employed from Yangon Region, and the logistic services that have importance in the realisation of the project (such as fuel purchases, accommodation of the workers and necessities, construction material necessities among others) will be procured from the Yangon region. Similar necessities during the operation stage will be met from the Yangon region as far as possible. It is expected that the regional economy will be affected positively.

The contractor shall comply with all the relevant labour laws applicable to the contractor's personnel, including Laws relating to their employment (including wages and working hours), health, safety, welfare, immigration and emigration and shall allow them all their legal rights.

The contractor shall comply with all the relevant labour laws applicable to the contractor's personnel, including laws relating to their employment (including wages and working hours), health, safety, welfare, immigration and emigration and shall allow them all their legal rights.

The appointed main Contractor for the construction phase of the Project will ensure compliance to the following international practices with respect to the workforce:

- promote the fair treatment, non-discrimination and equal opportunity of workers;
- establish, maintain and improve the worker-management relationship;
- promote compliance with national labour and employment laws;
- protect the workforce, including vulnerable groups such as children or migrant workers, workers engaged by third parties, and workers in the project proponent's supply chain;
- promote safe and healthy working conditions and workforce health and well-being; and
- Prohibit any use of forced labour.

The contractor shall make arrangements for the engagement of all contractor's personnel including their wage, food, lodging, transport and welfare.

Recruitment for the construction phase is managed directly by the contractor through:

- Contractor's internal staff and worker who can be transferred to PYN Project
- The nearby community using recruitment campaign at the site recruitment office in front of Project
- By using local contact in Yangon with agency who can source a group of workers to be employed by BYMA Pte Ltd (BYMA)

The contractor shall pay rates of wages, and observe conditions of labour, which comply with all applicable laws and are not lower than those established for the trade or industry where the work is carried out. If no established rates or conditions are applicable, the contractor shall pay rates of wages and observe conditions which are not lower than the general level of wages and conditions observed locally by employers whose trade or industry is similar to that of the contractor.

6.10.2 Operational Phase

Only significant long-term positive socio-economic impacts are predicted as a result of the Project. No negative socioeconomic impacts are envisaged. The key benefits accrued by the Yangon Division and the neighbouring regions include the following:

- **Inflow of Foreign Direct Investment:** The implementation of the Project will entail a substantial capital investment which will have a multiplier effect on the country's economy. This is in line with the Government of Myanmar's efforts to encourage foreign investments to Myanmar to support the rapid growth and expansion of the economy;
- **Transfer of Technology/Training:** The Project will provide opportunities for training and professional development of the Myanmar employees to be hired to be part of the development, mainly in the hospitality and commercial sectors. The transfer of technology will take place at the point when employees are sent for training overseas in neighbouring countries and also, by way of regular visits by foreign specialists whose services may be engaged to provide onsite job training to the local staff;
- **Growth of Other Supporting Businesses:** The Project which will be located in the Yangon city centre is expected to create new business opportunities for the following sectors/ activities amongst others:
    - Transport/ logistics;
    - Housing;
    - Banking and Insurance;
    - Health care;
    - Education/professional training centres;
    - Chemicals;
    - Retail; and
    - Service providers e.g. telecommunication and waste disposal.
- **Increased Employment Opportunities:** The entire Project is expected to provide job opportunities for a significant number of employees across a wide range of levels. Expatriate employees where required will train locals until such time the locals attain

sufficient skills and technical knowledge to subsequently take over the responsibilities from the expatriates. For local employment alone, it is estimated that approximately 620 jobs will be created under direct employment by hotel operating companies, offices, retail and property management companies. Regarding indirect employment which is employed by office tenants and retail tenants, there will be approximately 6,000 of new jobs. Additionally, further job opportunities will become available for the local population as a result of the growth in the other supporting sectors identified above;

- **Economic Benefits:** The proposed Project is expected to bring about positive multiplier effects to the Myanmar economy. The total direct and indirect contributions to the Myanmar economy by the Project are expected to be significant. In addition, the Project is expected to generate significant tax revenue for the Myanmar Government over its lifetime.
- **Business for Local Suppliers:** Creation of demand for local supplies for the following sections including food and beverage and textile/garment.
- Improvement of pedestrian and traffic movement and provision for signalization and relocation of the pedestrian crossing at Bogyoke Aung San Road will benefit the local area and will ease traffic and pedestrian movement.

6.11 Landscape and Visual Impacts

6.11.1 Construction Phase

The development of the Project will result in temporary adverse landscape and visual impacts during the demolition and construction phase. A decorative hoarding will be erected around the periphery of the site to screen the temporary construction works from the local low level receivers, mainly pedestrians. The proposed hoarding would provide a unified edge treatment and interface between the construction site and its landscape context.

The construction of the Project will inevitably impact the existing trees within the site. Wherever possible the existing trees which contribute most to the landscape of the site will be retained.

It is anticipated that the 10 trees and 41 palms identified for transplantation can be relocated to a nursery area in Star City, one of the Yoma Strategic Holdings projects in Yangon (**Table 6.19**). The new Landmark project design doesn’t let many trees to be retained aside from two big trees in North-West corner. The Project landscape consultant has provided a standard outline specification that sets out procedures for the whole process of preparing plant stock for removal, transportation, storage and maintenance and replanting. A holding nursery site has been identified and preparation works will be considered for the setting up and establishment of such a nursery.

In cases where transplantation is not considered viable then compensatory planting is proposed. According to YCDC guidelines for every tree that is removed from the Project site, two more trees need to be replanted in Yangon area. To comply with this guideline, the Contractor will ensure that two trees are replanted in Yangon for every tree that is cut at the construction site.

Table 6.19: List of Flora that have been Transplanted to Star City Project Site

Existing Trees for Transplanting			
Item	**Botanic Name**	**Common Name**	**No.**
1.	Borassus flabellifer	Toddy Palm	15
2.	Cycas revoluta	Sago Palm	9
3.	Dypsis lutescens	Yellow Palm	6
4.	Cocos nucifera	Coconut Palm	3
5.	Livistona chinensis	Chinese Fan Palm	8
Palms (sub-total)			**41**
6.	Erythrina Variegata	Tiger Tree	3
7.	Plumeria spp	Temple Tree	3
8.	Delonix regia	Flame Tree	4
Trees (sub-total)			**10**

Some of the mitigation measures to be implemented during the construction phase are as follows:

- Trees to be transplanted will be retained at a proper nursery;
- Phased segmental root pruning for trees will be retained and transplanted over a few months period prior to lifting or site formation works which affect the existing rootball of trees identified for retention. The extent of the pruning will be equal to half of the spread of the canopy;
- Pruning of the branches of existing trees identified for transplantation and retention will be based on the principle of crown thinning maintaining their form and amenity value;
- All works affecting the trees identified for retention and transplantation will be carefully monitored. This includes the key stages in the preparation of trees, the implementation of protection measures and health monitoring throughout the construction period; and
- The tree transplanting and planting works will be implemented by approved Landscape Contractors and inspected and approved on site by a qualified Landscape Architect.

6.11.2 Operational Phase

A qualified landscape architect will be involved in the design, construction, supervision and monitoring and maintenance period to oversee the implementation of the recommended landscape and visual mitigation measures including the tree preservation and landscape works on site. Measures put in place to protect the landscape components and to create an aesthetic/ visual impact include the following:

- All landscape and visual mitigation works will be financed, and implemented by the project developer;

- To create the plaza to the West of the cultural heritage building to increase public access to the site and to open up views of the building façade;
- To restore the cultural heritage buildings and to create landscaped gardens in order to beneficially affect the landscape character and quality of the area; and
- To retain trees that have historic value and contribute most to the landscape and visual amenity of the site and its immediate environment.

6.12 Ecology

6.12.1 Construction and Operational Phase

As described in the preceding sections of this report, the Project site is located within a developed or built environment which houses numerous building/structures including the FMI Centre, the Grand Meeyahta Executive Residence and a variety of related smaller buildings within the demarcated site boundary. Prior to the establishment of these buildings/structures, historically, the site was a low-lying area most likely used for small scale farming as Yangon was originally established as a fishing village due to its proximity to the Yangon River and the Gulf of Martaban. The area was developed in phases over a period of 120 years with the onset of urbanisation in the Yangon Division. Any species of native flora which formed the original vegetation at the site were progressively removed over the years and replaced with ornamental species as part of the development of the city. Local native species of fauna that may have inhabited the area would have perished or migrated to other nearby habitats.

The existing vegetation around the FMI Centre (e.g. at the parking bay, along the access road) and the Grand Meeyahta (e.g. the courtyard, along the access road) comprise fruits trees, ornamental trees and common species of shrubs used for landscaping purposes. The areas along the northern and eastern boundaries of the site are overgrown with dense undergrowth, shrubs and scattered stands of fruits trees such as mango, jack fruit and coconut trees.

A list of the flora species found at the Project site is presented in **Section 5**. These include fruit trees such as mango, jackfruit, cocoa, coconut; ornamental species like the palm and two mature rain trees that have been preserved at the site. In developing the Project site, efforts have been made to preserve the mature trees, and to introduce other compatible species of flora as part of the development's greening/landscaping initiatives.

In terms of fauna, the vegetated areas within the Project site are expected to be a habitat for common species of small mammals (rats, squirrels), birds, reptiles (small snakes, lizards), amphibians (frogs) and insects that typically dominate green areas within cities and urban areas. It is expected that during the construction phase of the development the fauna will perish or move to adjoining areas where they can survive. Once the development is in operational phase, a new population of fauna is expected to recolonise the site within the new proposed green areas.

Overall, the impacts arising from the development of the Project on the existing terrestrial flora and fauna; and avifauna are not significant.

6.13 Traffic

6.13.1 Introduction

There are no official guidelines regarding the study of Traffic in Myanmar. The scope of the Traffic Impact Assessment (TIA) for The Landmark Project available in **Annex 4** has been established based on guidelines available in other countries such as Singapore, UK and

Thailand. The TIA report analyses (i) the existing traffic, pedestrian and public transport situation of the Project, (ii) highlights the key proposals for access, circulation and parking, (iii) calculates daily and hourly traffic demand and parking accumulation; (iv) the capacity of the road network and proposed improvement to the traffic, pedestrian and public transport network; and (v) the proposed routes and timings of construction vehicles.

SIDRA Intersection (Version 6) was used to analyze the capacity and traffic condition of the existing junctions. The key measurement of signalize intersection is Level of Service (LOS), LOS is the letter designation that describes a range of operating conditions. In the SIDRA Intersection software, LOS is determined from delay which is based on the HCM 2000 (Highway Capacity Manual). The LOS is ranged from A to F (A is the best, F is the worst). HCM 2000 is determined LOS indicator by control delay of traffic at **Table 6.20**.

Table 6.20: Level of Service Definitions

Level of Service	Control Delay per vehicle in seconds (d)
A	d < 10
B	10 < d < 20
C	20 < d < 35
D	35 < d < 55
E	55 < d < 80
F	80 < d

Source: Highway Capacity Manual 2000

Other key measurement of SIDRA Intersection is degree of saturation (DOS) which describe by following:

- DOS less than or equal to 0.9 is under capacity, reflecting satisfactory operating conditions;
- DOS of between 0.9 and 1.00 is considered to be at capacity; and

DOS of greater than 1.0 may be achievable, but it indicates that the junction is operating beyond its design capacity. DOS approaching about 1.2 would indicate overload of the junction, with likelihood of queuing and delays.

6.13.2 Future Base Year Analysis

To estimate the growth factor of background traffic, the study considers not only the growths of number of registered cars in Yangon, but also the increase of traffic surveyed in 2015 and 2016. It can be seen that the actual growth rates of AM and PM peak traffic are about 6% and 4%, respectively. This can ensure that the employed growth factor in this study, about 10%, is higher than the traffic growth observed from the field.

In additional, there is still a gap of growth rate, about 4% - 6%, which can cover the traffic generated by other developments. The 10% growth factor is employed to annually forecast the future traffics up to year 2021. These inform that the proposed study is a very conservative case study.

The Sidra analysis results for assessment hours (10:00 - 11:00 and 18:00 - 19:00) in the future base year 2021 without development as shown in **Table 6.21** and **Table 6.22**.

Table 6.21: Future Base Year Traffic Analysis Result at Junctions

Road	Movement	AM Peak 2021 (10:00 – 11:00)				PM Peak 2021 (18:00 – 19:00)			
		DOS (V/C)	Average Delay (s)	LOS	Queue (m)	DOS (V/C)	Average Delay (s)	LOS	Queue (m)
Bogyoke Aung San & Alan Pya Junction									
Sule Pagoda Rd.	Straight	1.209	260.2	LOS F	685.1	1.086	163.9	LOS F	636.1
	Right Turn	0.863	42.9	LOS D	240.4	0.478	21.4	LOS C	131.6
Approach		**1.209**	**199.8**	**LOS F**	**685.1**	**1.086**	**134.2**	**LOS F**	**636.1**
Alan Pya Pagoda St.	Left Turn	1.394	409.9	LOS F	471.9	1.190	232.7	LOS F	454.8
	Straight	0.480	24.0	LOS C	120.5	0.329	14.2	LOS B	89.1
Approach		**1.394**	**149.9**	**LOS F**	**471.9**	**1.190**	**103.8**	**LOS F**	**454.8**
Bogyoke Aung San Rd.	Left Turn	1.062	153.5	LOS F	510.7	1.479	528.1	LOS F	1,059.8
	Straight	1.039	115.5	LOS F	633.7	1.939	926.4	LOS F	2,343.2
	Right Turn	0.818	31.5	LOS C	221.1	0.938	75.1	LOS E	375.6
Approach		**1.062**	**112.0**	**LOS F**	**633.7**	**1.939**	**710.3**	**LOS F**	**2,343.2**
All Vehicles		**1.394**	**145.8**	**LOS F**	**685.1**	**1.939**	**423.3**	**LOS F**	**2,343.2**
Shwedagon Junction									
Shwedagon Pagoda Rd. (South)	Straight	1.215	254.4	LOS F	525.8	1.497	505.5	LOS F	943.6
	Right Turn	0.453	8.8	LOS A	25.7	0.491	8.9	LOS A	29.5
Approach		**1.215**	**157.5**	**LOS F**	**525.8**	**1.497**	**324.6**	**LOS F**	**943.6**
Shwedagon Pagoda Rd. (North)	Left Turn	1.878	857.6	LOS F	1,752.0	1.264	305.7	LOS F	693.6
	Straight	0.851	21.9	LOS C	296.0	0.602	13.9	LOS B	148.8
Approach		**1.878**	**585.0**	**LOS F**	**1,752.0**	**1.264**	**207.3**	**LOS F**	**693.6**
Bogyoke Aung San Rd.	Left Turn	0.525	40.5	LOS D	81.7	0.388	39.0	LOS D	57.5
	Straight	1.559	560.0	LOS F	1,256.3	1.366	386.8	LOS F	907.9
	Right Turn	0.694	42.7	LOS D	115.2	0.611	41.5	LOS D	97.9
Approach		**1.559**	**456.8**	**LOS F**	**1,256.3**	**1.366**	**321.6**	**LOS F**	**907.9**
All Vehicles		**1.878**	**435.2**	**LOS F**	**1,752.0**	**1.497**	**289.5**	**LOS F**	**943.6**

Note: DOS: Degree of saturation, LOS: Level of service

Table 6.22: Future Base Year Traffic Analysis Results on Bogyoke Aung San Road (Mid-Block)

Road	AM Peak 2021 (10:00 – 11:00)				PM Peak 2021 (18:00 – 19:00)			
	Left		Right		Left		Right	
	DOS (V/C)	LOS	DOS (V/C)	LOS	DOS (V/C)	LOS	DOS (V/C)	LOS
Bogyoke Aung San Rd.	1.219	LOS F	1.591	LOS F	1.231	LOS F	1.504	LOS F

As shown in **Table 6.22**, the junction will begin to experience more significant delay and queuing.

6.13.3 Future Year with Development

Analysis of the Sule Shangri-La Junction has been undertaken for 2021 with the proposed Project. The development traffic distribution is based on the existing percentage distribution at the junction. Although the traffic is shown to access from the south it is assumed that this traffic will also enter from north or west (only passing through the junction once on entering).

In the opening year, the total combined traffic from future base traffic with development traffic is shown in **Figure 6.6**.

Table 6.23 shows the 2021 with development SIDRA junctions capacity results and **Table 6.24** shows the volume capacity on mid-block of Bogyoke Aung San Road based on 10% annual traffic growth from 2016 to 2021 (5 years).

Table 6.23: Future Base Year with Development Traffic Analysis Results at Junctions

Road	Movement	AM Peak 2021 (10:00 – 11:00)				PM Peak 2021 (18:00 – 19:00)			
		DOS (V/C)	Average Delay (s)	LOS	Queue (m)	DOS (V/C)	Average Delay (s)	LOS	Queue (m)
Bogyoke Aung San & Alan Pya Junction									
Sule Pagoda Rd.	Straight	1.209	260.2	LOS F	685.1	1.086	163.9	LOS F	636.1
	Right Turn	0.863	42.9	LOS D	240.4	0.478	21.4	LOS C	131.6
Approach		**1.209**	**199.8**	**LOS F**	**685.1**	**1.086**	**134.2**	**LOS F**	**636.1**
Alan Pya Pagoda St.	Left Turn	1.425	438.4	LOS F	501.6	1.242	277.7	LOS F	526.3
	Straight	0.491	24.1	LOS C	124.1	0.343	14.3	LOS B	93.9
Approach		**1.425**	**159.3**	**LOS F**	**501.6**	**1.242**	**122.4**	**LOS F**	**526.3**
Bogyoke Aung San Rd.	Left Turn	1.086	172.0	LOS F	554.8	15.430	586.1	LOS F	1,163.5
	Straight	1.063	133.3	LOS F	693.5	2.021	1,000.6	LOS F	2,516.2
	Right Turn	0.842	35.3	LOS D	250.8	0.996	111.8	LOS F	505.0

Road	Movement	AM Peak 2021 (10:00 – 11:00)				PM Peak 2021 (18:00 – 19:00)			
		DOS (V/C)	Average Delay (s)	LOS	Queue (m)	DOS (V/C)	Average Delay (s)	LOS	Queue (m)
Approach		**1.086**	**127.6**	**LOS F**	**693.5**	**2.021**	**775.2**	**LOS F**	**2,516.2**
All Vehicles		**1.425**	**155.2**	**LOS F**	**693.5**	**2.021**	**464.6**	**LOS F**	**2,516.2**
Shwedagon Junction									
Shwedagon Pagoda Rd. (South)	Straight	1.215	254.4	LOS F	525.8	1.497	505.5	LOS F	943.6
	Right Turn	0.453	8.8	LOS A	25.7	0.491	8.9	LOS A	29.5
Approach		**1.215**	**157.5**	**LOS F**	**525.8**	**1.497**	**324.6**	**LOS F**	**943.6**
Shwedagon Pagoda Rd. (North)	Left Turn	1.916	892.0	LOS F	1,818.2	1.323	357.6	LOS F	792.8
	Straight	0.851	21.9	LOS C	296.0	0.602	13.9	LOS B	148.8
Approach		**1.916**	**612.1**	**LOS F**	**1,818.2**	**1.323**	**245.1**	**LOS F**	**792.8**
Bogyoke Aung San Rd.	Left Turn	0.525	40.5	LOS D	81.7	0.388	39.0	LOS D	57.5
	Straight	1.669	660.0	LOS F	1,457.7	1.535	538.7	LOS F	1,213.5
	Right Turn	0.694	42.7	LOS D	115.2	0.611	41.5	LOS D	97.9
Approach		**1.669**	**543.5**	**LOS F**	**1,457.7**	**1.535**	**453.4**	**LOS F**	**1,213.5**
All Vehicles		**1.916**	**482.1**	**LOS F**	**1,818.2**	**1.535**	**356.3**	**LOS F**	**1,213.5**

Table 6.24: Future Base Year with Development Traffic Analysis Results on Bogyoke Aung San Road (Mid-Block)

Road	AM Peak 2016 (10:00 – 11:00)				PM Peak 2016 (18:00 – 19:00)			
	Left		Right		Left		Right	
	DOS (V/C)	LOS	DOS (V/C)	LOS	DOS (V/C)	LOS	DOS (V/C)	LOS
Bogyoke Aung San Rd.	1.274	LOS F	1.663	LOS F	1.318	LOS F	1.611	LOS F

Table 6.25 and **Table 6.26** present the results of the comparison of future base year without and with development traffic.

As shown in **Table 6.25** and **Table 6.26**, after adding the with development traffic, the junction capacity is significantly impacted. In order to alleviate the impact, junction improvement measures should be implemented. Signal phasing optimization is used in this study as this measure is one of the most efficient and simplest measures and slight changes on shared lane configuration on eastbound and southbound directions as well.

Further to the proposed mitigation, the junction performance analysis results with improvements are shown in **Table 6.27** and the comparison of before and after improvements are presented in **Table 6.28**.

However, after implemented junction improvement measure by using optimized traffic signal, the junction performance is significantly improved especially in AM peak (**Table 6.28**). Hence, the traffic signal improvement is considered a good and viable measure.

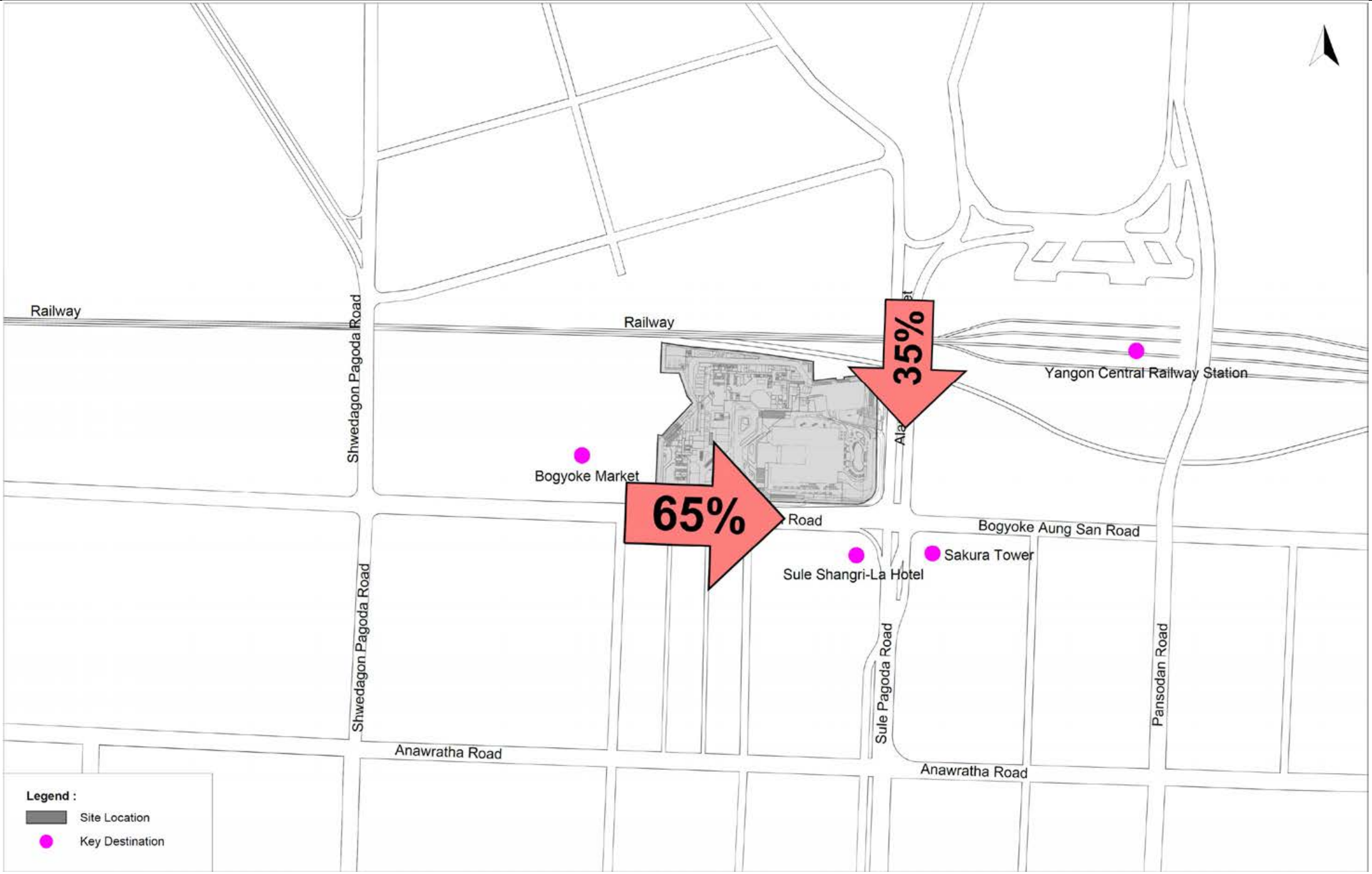

Figure 6.6: Distribution of Traffic at Bogyoke and Alan Pya Junction

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Table 6.25: Comparison of Future Base Year without and with Development Traffic at Junctions

Road	AM Peak						PM Peak					
	Without			With			Without			With		
	DOS (V/C)	Average Delay (s)	LOS	DOS (V/C)	Average Delay (s)	LOS	DOS (V/C)	Average Delay (s)	LOS	DOS (V/C)	Average Delay (s)	LOS
Bogyoke Aung San & Alan Pya Junction	1.394	145.8	LOS F	1.4	155.2	LOS F	1.9	423.3	LOS F	2.0	464.6	LOS F
Shwedagon Junction	1.878	435.2	LOS F	1.9	482.1	LOS F	1.5	289.5	LOS F	1.5	356.3	LOS F

Table 6.26: Comparison of Future Base Year Without and With Development Traffic on Bogyoke Aung San Road (Mid-Block)

Road	AM Peak								PM Peak							
	without				with				without				with			
	Left		Right		Left		Right		Left		Right		Left		Right	
	DOS (V/C)	LOS	DOS (V/C)	LOS	DOS (V/C)	LOS	DOS (V/C)	LOS	DOS (V/C)	LOS	DOS (V/C)	LOS	DOS (V/C)	LOS	DOS (V/C)	LOS
Bogyoke Aung San Rd.	1.219	LOS F	1.591	LOS F	1.274	LOS F	1.663	LOS F	1.231	LOS F	1.504	LOS F	1.318	LOS F	1.611	LOS F

Table 6.27: Future Base Year with Development Traffic and Improvements Traffic Analysis Results at Bogyoke Aung San – Alan Pya Junction

Road	Movement	AM Peak 2021 (10:00 – 11:00)				PM Peak 2021 (18:00 – 19:00)			
		DOS (V/C)	Average Delay (s)	LOS	Queue (m)	DOS (V/C)	Average Delay (s)	LOS	Queue (m)
Sule Pagoda Rd.	Straight	1.171	206.2	LOS F	508.9	1.414	418.2	LOS F	800.4
	Right Turn	0.864	34.8	LOS C	174.6	0.677	24.0	LOS C	100.8
Approach		**1.171**	**158.5**	**LOS F**	**508.9**	**1.414**	**336.1**	**LOS F**	**800.4**
Alan Pya Pagoda St.	Left Turn	0.995	65.6	LOS E	91.6	1.349	353.4	LOS F	361.0
	Straight	0.667	18.7	LOS B	126.1	0.671	19.4	LOS B	113.5
Approach		**0.995**	**34.0**	**LOS C**	**126.1**	**1.349**	**156.4**	**LOS F**	**361.0**
Boyoke Aung San Rd.	Left Turn	0.881	41.2	LOS D	214.9	0.884	39.1	LOS D	218.6
	Straight	1.076	126.2	LOS F	539.2	1.387	392.0	LOS F	1,380.4
	Right Turn	0.884	39.4	LOS D	222.0	0.789	24.4	LOS C	134.7
Approach		**1.076**	**86.5**	**LOS F**	**539.2**	**1.387**	**252.6**	**LOS F**	**1,380.4**
All Vehicles		**1.171**	**92.4**	**LOS F**	**539.2**	**1.414**	**248.7**	**LOS F**	**1,380.4**

Table 6.28:` Comparison of Before and After Improvements Analysis Results at Bogyoke Aung San – Alan Pya Junction

AM Peak						PM Peak					
without improvement			with improvement			without improvement			with improvement		
DOS (V/C)	Average Delay (s)	LOS	DOS (V/C)	Average Delay (s)	LOS	DOS (V/C)	Average Delay (s)	LOS	DOS (V/C)	Average Delay (s)	LOS
1.425	155.2	LOS F	1.171	92.4	LOS F	2.021	464.6	LOS F	1.414	248.7	LOS F

6.13.4 Traffic Management during Construction

The existing access to Grand Meeyahta on Bogyoke Aung San Road will be used during construction, and the construction is expected to take almost 5 years with majority of the vehicles entering and exiting the site during the basement excavation at the start of construction period.

Construction traffic will avoid peak traffic hours and adhere to YCDC limitations on vehicle size during specified hours of the day.

It is estimated that an average of 2,400 trucks will be required monthly to transport the excess soil to the YCDC approved disposal. These trucks will be using the routes designated by YCDC in their approvals.

Traffic management during the improvements to and access design connecting to the public road will be prepared by the contractor at a later date and agreed with YCDC Roads and Bridges Department.

6.13.5 Traffic and Pedestrian Improvement Measures

The proposed Project will include some improvements to the pedestrian and traffic in the vicinity of the site such as:

- Traffic signal optimization at Bogyoke Aung San – Alan Pya Junction
    - To adjust the traffic signal timing at Bogyoke & Alan Pya Junction to synchronize with the future traffic including development generated traffic.
    - Provide traffic warning signs and safety devices internally and externally for safety purpose of vehicles especially at the exit on Alan Pya Pagoda Road where situated at the foot of the bridge.
- Access management on Bogyoke Aung San Road:
    - The rejected route is proposed in order to accommodate the rejected vehicle smoothly without any obstacle on Bogyoke Aung San Road.
    - The security control can be operated with minimal effect out the obstruction on the main site access and Boygoke Aung San Road.
    - 20 m median is provided between the main accesses of Landmark and PYN to accommodate convenient and safe pedestrian crossing.
    - Staff will be hired to manage traffic and control safety of pedestrian at the main access and PYN access.
- Access management on Alan Pya Pagoda Road:
    - 3% downgrading slope for the sufficient distance for safe driving and stopping (minimum total stopping sight distance required is 65 m).
    - Provision of convex mirror at the median of Alan Pya Pagoda Road to increase safety for egress vehicles on service road.
    - Provision of security guard to control and manage in and out traffics at T1 access in order to provide smooth and safe traffic movements.
- Additional improvement measures to the pedestrian and traffic as follows:
    - Improvement and widen the footway surface along the boundary of the site.
    - Relocation of the existing pedestrian crossing with partial opening the fence at the median and propose a pedestrian signal at the crossing in front of the development.
    - Provision of a new taxi layby (4 spaces) on Bogyoke Aung San Road.
    - Pavement marking to clearly segregate entrance and exit from T4 drop-off to manage the traffic movements on Bogyoke Aung San Road efficiently and safe.
    - Removal of on street parking along Bogyoke Aung San Road (in front of the development site) is proposed to improve traffic flows.
    - The warning sign of crossing is recommended to be installed at all site accesses to inform drivers to drive carefully at entrances and exits.

6.14 Occupational Health and Safety

The IFC PS 4 recognizes that project activities, equipment, and infrastructure can increase community exposure to risks and impacts. In addition, communities that are already subjected to impacts from climate change may also experience an acceleration and/or intensification of impacts due to project activities. While acknowledging the public authorities' role in promoting the health, safety, and security of the public, this PS addresses the project proponent's responsibility to avoid or minimize the risks and impacts to community health, safety, and security that may arise from project related-activities, with particular attention to vulnerable groups.

The specific objectives of PS 4 are:

- to anticipate and avoid adverse impacts on the health and safety of the affected communities throughout project life, from both routine and non-routine circumstances; and
- to ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles, and in a manner that avoids or minimizes risks to the affected communities.

The management of potential impacts and the mitigation measures has been developed to achieve the objectives of PS 4, as applicable to the environmental and social setting of the Project.

6.14.1 Guidelines on Minimum Health & Safety Standards for Major Works

SPA Project Management (SPAPM), the company managing the proposed Project, has recently issued a Guidelines on Minimum Health & Safety Standards for Major Works and its compliance during the implementation of the Project is mandatory. The guideline is applicable to all contractors working at the Project site and in the event of non-compliance a penalty system has been put in place to deter any non-compliance and to encourage the management of workers' health and safety. The penalty, in terms of monetary fines, will be strictly imposed. Contractors working on the Project are required to prepare a Safety and Health Management Plan that needs to be submitted to SPAPM for approval before any commencement of works can start. The Safety and Health Management Plan must contain at a minimum the following:

- A safety policy;
- Safe work practices;
- Safety training (including local subcontractors);
- Group meetings;
- Incident investigation and analysis;
- In-house safety rules and regulations;
- Safety promotion;
- Evaluation, selection and control of sub-contractors;
- Safety inspections;
- Maintenance regime for machinery and equipment;
- Hazard analysis;
- Control of movement and use of hazardous substances;
- Emergency preparedness; and

- Occupational health programs.

An important preventive measure that the guideline covers is that all workers and supervisors working at the Project site must have receive health and safety training. A copy of the guideline is attached in **Annex 5**.

"SPA Minimum Health & Safety Standard for Major Work" is issued to contractors as part of the main works tender process, and it is mandatory for all the contractor/ sub-contractors to follow strictly.

The project procedure requires a monthly Health & Safety Report which covers:

- Monthly Incident/ Accident Return Summary Table (Project to date) and Accident Statistic Summary;
- Investigation and Analysis of the findings in site inspection; how the action was taken on findings immediately;
- Number of workers who participated in the safety induction and list of trainings that is conducted in the month (**Photo 6.2**);
- Topic of Tool Box Meetings and briefings and number of attendance in Tool Box Meetings (**Photo 6.3**);
- Number of site safety inspection done in the month and major findings of it;
- Monthly Plant/ Machinery and Equipment Inspection;
- Monthly Safety & Health Program carried out as a Safety Promotion Program; and
- Health and Safety Team Organization Chart (updated every month).

Health and Safety Team ensures that require signage and awareness are displayed and promoted on site such as warning signs, no smoking signage, pedestrian signage, assembly point signage and site clinic signage, etc. (**Photo 6.4**).

Daily visual inspection has been carried out by SPADS Health, Safety & Environment (HSE) Team on contractors to ensure proper PPE are used and activities are carried out according to method statement (**Photo 6.5**).

Photo 6.2: Health & Safety Training

Photo 6.3: Daily Toolbox Meetings

Photo 6.4: Signages Observed on-site

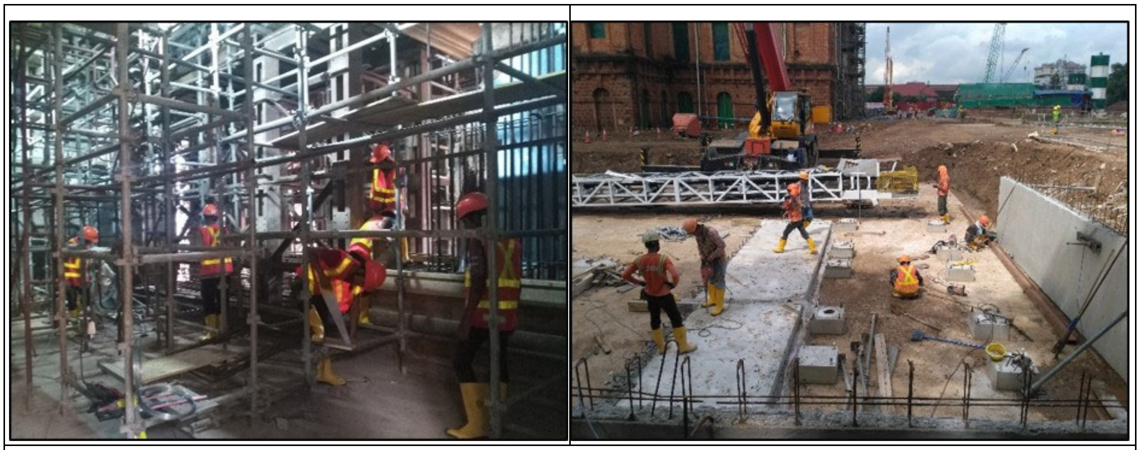

Photo 6.5: Usage of PPE on site

6.14.2 Construction Phase

The main construction activities to be carried out at the site are as follows:

- Setting up and management of temporary facilities;
- Transportation of materials and machinery;
- Demolition works and site clearance;
- Site clearance;
- Infrastructure and utility development;
- Construction of building structures; and
- Landscape and revegetation.

These activities will be carried out by numerous subcontractors operating under the main turnkey Contractor appointed for the Project in conformity with the approved construction and working designs.

It is expected that construction work will be performed by shifts; the working schedule and rest breaks will be organized with due consideration of natural and climatic conditions and the level of difficulty of a specific working process. It is expected that all workers, as much as possible, will be sourced locally. Hence, no temporary accommodations/ worker camps will be provided at the Project site.

The general amenities in the construction yards will comprise potable water supply (bottled water will be provided in the event such supply does not exist), temporary sanitary facilities, changing/ locker rooms and rest areas. To cater for minor cuts and bruises, and medical condition, adequate medical first-aid kits are to be provided.

Health check assessment will be conducted at the end of probation period of workers as part of the Occupational Health Programme.

Three (3) levels of surveillance health to be carried out are as follows:

- Normal health surveillance for all workers;
- Reinforced health surveillance for sensitive population such as those with previous health issues and disease, women, night shift workers, workers above 55 years old and workers with BMI (body mass index) below 19 or above 28; and
- Specific medical surveillance for equipment operator, welder and scaffolder.

6.14.3 Identification of Factors Affecting the Health and Safety of Personnel

The Project site will be organized in conformity with the civil-engineering and working designs. The site will be fenced, with signs and marking of detour for transport vehicles and passageways for pedestrians (railings, detour routes, road signs, etc.) along the main Bogyoke Aung San Road. The appointed Contractor and subcontractors will be responsible for the health and safety of their personnel. To this end, health and safety instructions will be developed for issuance to workers and for the more dangerous work (for example the demolition activities and, the removal, storage and handling of hazardous materials from the building prior to demolition), specific hazard-related training and briefing on the use of construction machinery, tools, appliances and personal protection equipment. Knowledge on the health and safety rules of these workers will also be checked periodically to ascertain their understanding.

6.14.3.1 Hazardous Working Areas/ Dangerous Zones

Prior to starting construction works, the more dangerous zones where hazardous factors exist within the Project site will be identified. These include the following areas:

- Areas in proximity to buildings/structures during demolition activities;
- Hazardous wastes storage/handling areas (removed from the buildings to be demolished) stockpile areas;
- Hazardous materials storage area (diesel, lube oil, paints, thinner, grouting chemicals);
- Areas where installation (or dismantling) of structural elements or heavy equipment is carried out;
- Displacement zones, where machinery, equipment or parts thereof are used;
- Areas, above which loads are handled by hoisting cranes; and
- Areas where concentrations of harmful substances in the ambient air in working zones exceed the regulatory maximum permissible levels) will be identified.

In the process of executing work at these areas, the workers may be impacted by the following:

- Increased dust in the ambient air in working zones;
- Increased temperature of equipment surfaces;
- Increased vibration levels;
- Moving machinery or its moving parts; and
- Common injuries likely to be encountered include over-exertion, dehydration especially during the hot season, minor cuts and bruises, ergonomic injuries and illnesses are among the most common causes of injuries in construction and decommissioning sites.

Management of workers' health and safety will be carried out by implementing the following:

- Protective fencing or tape will be provided at the boundaries of these zones and the appropriate warning signs, markings and safety signs;
- Areas where workers will stay temporarily (example, rest areas) will be located outside of any hazardous or dangerous zones;
- A work permit will be issued for any work to be carried out within these zones. The work permit will indicate the area where the work is to be carried out, a description of work in a hazardous/ dangerous zone, conditions for safe execution of work, the time of beginning and completion of the work, the list of team members and person responsible for safety in the process of the work;
- The persons entitled to issue work permits will determine the need for such work and a possibility for its safe execution; they will be responsible for the implementation of the precautionary measures mentioned in the work permit. A job description will be developed for each type of work; and
- Workers will be protected from over-exertion and ergonomic injuries and illnesses, slips and falls, and work at heights. Measures to be put in place include:
    - Training workers in lifting and materials handling techniques and setting weight limits;
    - Planning the layout of the work site to minimize the need for manual transfer of heavy loads;
    - Selecting tools that reduce force requirements and holding times;
    - Sorting and placing loose construction materials or demolition debris in established areas away from foot paths;
    - Cleaning up excessive waste debris and liquid spills regularly;
    - Training and use of temporary fall prevention devices as rails, and barriers;
    - Training and use of personal fall arrest systems, such as full body harnesses and energy absorbing lanyards able to support heavy loads.

It is also critical to protect the community and workers from physical, chemical and other hazards associated with the Project site during construction phase. Risks can arise from trespassing including potential contact with hazardous materials, buildings that are vacant or under construction or excavations and structures which may pose as fall and entrapment hazards. Restricting access to the Project site with the use of appropriate hoarding and posting 24-hour security personnel to monitor the boundaries will reduce such risks.

6.14.3.2 Communicable Disease and Vector-borne Diseases

Increased incidences of communicable diseases represent a potentially health threat to project personnel including the contractor, the workforce and residents of local communities. Prevention of the transmission of disease is also a key consideration. Workers will be trained to adopt basic requirements for personal hygiene, food preparation and handling, and recognition of the symptoms of communicable diseases. It is important as well to provide workers and the local community guidance on specific emergency actions to take in the event of a suspected disease outbreak. It will be noted that the baseline soil and groundwater investigation report prepared in 2013 indicates the presence *E. coli* and Total Coliform exceeding international limits (refer to Chapter 5). It will be important to ensure that the workers use proper personal protective equipment and practice good hygiene whilst working on site.

Infrequent or improper removal of construction debris including the vegetative biomass cleared from the Project site will contribute to unhealthy surroundings which provide an ideal habitat for disease-vectors such as mosquitoes, flies and rats which potentially cause health impacts to the workers and the neighbouring areas.

6.14.3.3 Hazardous Materials Management

Risks may arise from handling or being exposed to hazardous materials that will be used at the construction areas within the Project site, and these include:

- Diesel for the onsite generators, pumps, small engines; and
- Grouting chemicals, paints, solvents.

The following measures are planned to prevent the release or the spills of hazardous substances: To prevent accidental spills of petroleum products in the process of the filling of vehicles or machinery secondary containment measures will be provided in the form of containment

- trays and vehicle filling permitted to be carried out at designated areas provided with hardstanding and catch drains;
- Maintenance of construction machinery will be carried out only at designated areas where there is adequate protection to prevent the migration of spilled fuel or lubricants to the soil and groundwater;
- Durable waste receptacles will be installed at construction sites for the collection of oil contaminated waste materials and soil; all wastes will be disposed of separately as hazardous waste at a facility approved by the YCDC; and
- Use of trained personnel to identify and remove hazardous materials for example asbestos, PCB’s, electrical components containing mercury per the Hazardous Materials Management Plan prepared in the Hazardous Materials Assessment report.

6.14.3.4 Traffic Safety

A significant increase in movement of heavy vehicles for the transport of construction materials and equipment will increase the risk of traffic-related accidents and injuries to workers and the local community. The incidence of road accidents involving project vehicles during construction will be minimised through a combination of education and the raising of awareness amongst the local populace**.**

In managing these impacts, the following measures will be taken:

- Traffic safety awareness will be promoted;
- Safe transport practices will be adopted with an emphasis on safety aspects among drivers;
- The number of trips for each driver to be limited as far as practicable and rosters will be drawn up for drivers to avoid over fatigue;
- Dangerous routes will be avoided and transportation during night time reduced to minimize the risk of accidents; and
- Regular maintenance of vehicles and use of manufacturer approved parts to minimize serious accidents.

6.14.4 Operational Phase

During the operational phase of the Project, health and safety impacts will be significantly reduced and limited to maintenance activities and handling of hazardous materials (diesel, chemicals used for the WWTP, chemicals used for the treatment of groundwater and the treatment of the water used in the swimming pools at the hotels, chemicals used for the cooling towers (anti-fouling agents, corrosion inhibitors, biocides, etc.), paints, lube oils, grease and thinner. In ensuring safe handling of these materials, MSDS for each chemical will be obtained and the corresponding storage and handling measures will be implemented, including provision of appropriate personal protective equipment.

6.15 Community Health and Safety

Potential impacts on community health and safety may be caused by environmental impacts to air quality, noise, surface and ground water quality as well as natural resources and risk has been identified ahead and mitigations measures have been implemented. There is no physical and health impact to public community from the construction activities of the Project.

Contractors will be engaged for supply of labour, equipment or services. Contractors' activities could be a nuisance to the local community if not properly managed, for example, occupancy of public area for storage of construction wastes and staging areas.

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

6.15.1 Mitigation Measures

Impacts on community health and safety can be mitigated through good practices and close cooperation between the site managers, contractors, communities and local authorities, as below:

- Provision of pedestrian walk ways with shelter during FMI demolition with awareness signages and lightings for the walk ways during night time (**Photo 6.6**).
- A Traffic Management Plan has been established to indicate the traffic routes to be followed and speed limit to be complied with in order to reduce risk to the local communities.
- Enforcement of a speed limit for vehicles related to construction activities of the project.
- Establishment of a security team to monitor entrance to the construction site.

Photo 6.6: Pedestrian Walkways

6.16 Disaster Risk Reduction Measure

The prevention measures for natural disaster and emergency are included as part of the Emergency Response Plan.

Health & Safety team of both SPADPS and Contractor (BTJV) have conducted several drills for any emergency situations such as flood, earthquake fire and site accident etc. during construction period. All the drills are required to be conducted at least once a year.

6.16.1 Earthquake

The civil and structural design will be conducted in accordance with Myanmar building codes following the Committee of Quality-Control for High-rise Building Projects (CQHP) guidelines or alternative appropriate international standards.

6.16.1.1 Seismic Design

Yangon is subject to earthquake loading and as such seismic design is planned to be adopted on this project.

There are a number of guidelines for seismic design for Yangon. For the sake of consistency, the Engineer proposed that the design criteria be unified for all projects in Yangon as described below.

No.	Sources	Seismic Design Parameters
1	Seismic zone map that divides left & right sides of Yangon river into Zone 2 & 3	Peak ground acceleration (PGA) in range of 0.1-0.15g for zone 2 and 0.2-0.3g for zone 3, depending on our choice?
2	CQHP's recommendation letter	PGA = 0.2g at 475 yrs. (Uniform Building Code, 1997)
3	Draft of Myanmar code	Ss = 0.77 & S1 = 0.31 at 2475 yrs. (IBC or ASCE 7)
4	Comprehensive PSHA study**	Ss = 0.78 & S1 = 0.29 at 2475 yrs. (IBC or ASCE 7)

6.16.1.2 CQHP Requirements

The Landmark buildings' structures are designed to source no. 2 since it is an official government confirmation and according to Sources no. 3 and no. 4, sufficient confidence to use source no.2.

Letter no.	O-108/ CQHP/2012
Letter issue date :	10-Jul-2012
Description :	Revision on Seismic Zone, Seismic Zone Factor and Wind Speed

As per the agreement in the CQHP meeting held on 02-Jul-2012, the followings are revised to use in the Structural Design for high rise buildings and to be implemented for the development which submitted to YCDC after 01 August 2012.

UBC 97 Seismic Zone	-	2B
Seismic Zone Factor	-	0.2
Wind Speed	-	120 mph

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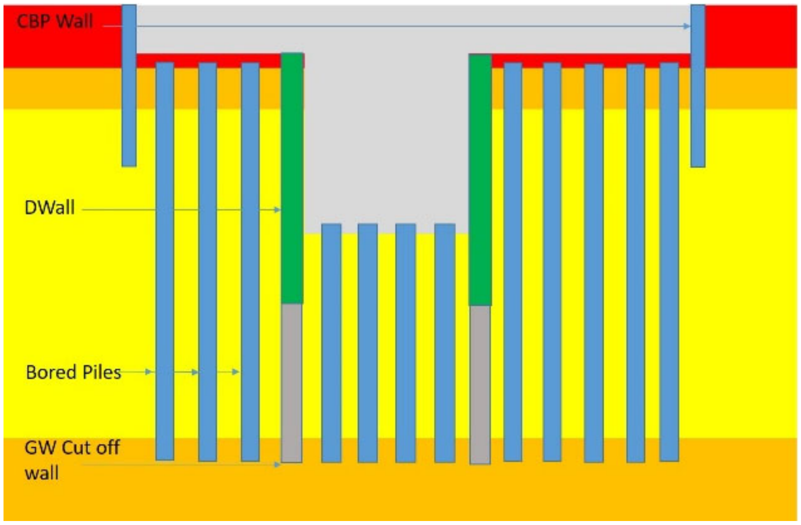
In terms of other safety measures, geotrchnical Design of Pile, Factor of Safety, Pile Load Test – ULT, Soil Capacity, Pile Load Test – WLT, Pile Capacity Utilisation Ratio and Structural Design of Bored Pile were considered and tested for safe working load (SWL).



6.16.2 Flood Risk

The drainage system has been designed taking into consideration the rainfall data and risk of flooding (**Annex 6**). The following drainage system has been constructed on-site with YCDC's permit and approval:

- Temporary Construction Drainage Plan
- Permanent Drainage Plan for both construction and operation phase

7 CUMULATIVE IMPACT ASSESSMENT

In this Section, the impacts associated with cumulative effects of the Project and other development are described. A cumulative impact assessment looks at the collective impacts posed by individual land use plans and projects. Cumulative impacts can result from individually minor but collectively substantial impacts taking place over a period of time.

7.1 Approach to Cumulative Impact Assessment

The cumulative analysis for the proposed project takes into consideration the other ongoing projects in the same geographic area as the proposed project, as well as planned land uses and transportation and circulation projections identified in city and county general plan and policy documents.

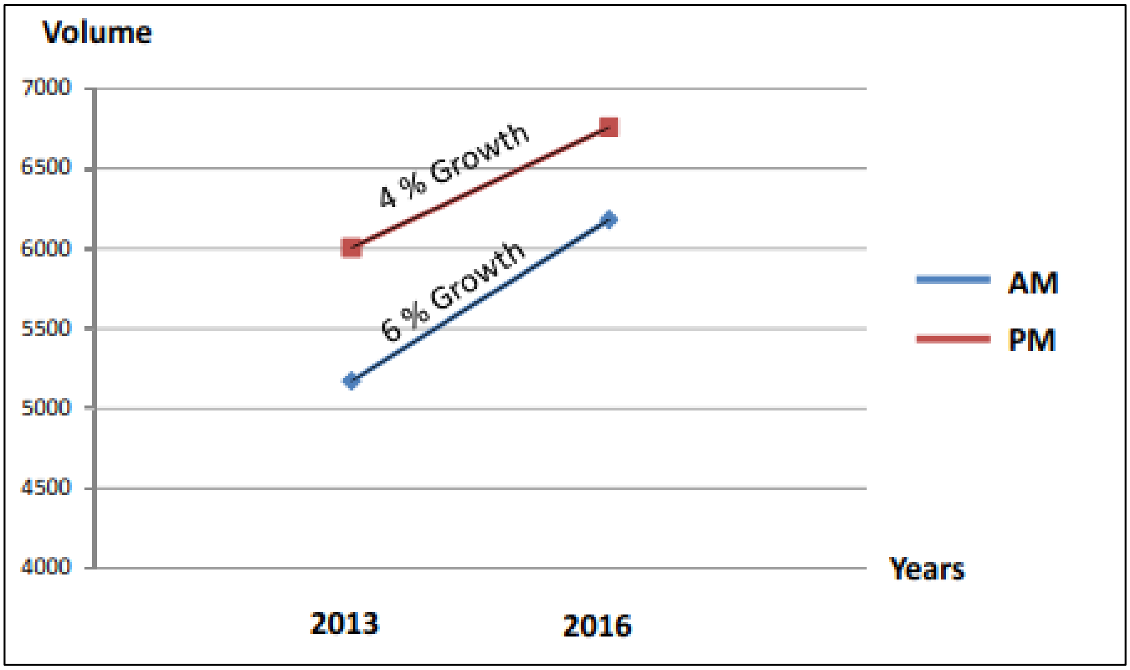
The existing and proposed projects including the PYN Project have been included in the analysis due to its proximity to the project area.

7.2 Cumulative Impact on Traffic

The Landmark Project is located in the commercial center of the developing city of Yangon. This mixed use development comprising office, business hotel, retail and residential will be a key major mixed use development in the commercial center of a city that is undergoing significant economic growth.

Traffic forecasts prepared for the year 2021 take into accounts the traffic generation from both the Landmark Project and PYN Project as well as 4% - 6% growth rate which cover the traffic generated by other developments (**Figure 7.1**). The 10% growth factor is employed to annually forecast the future traffic up to year 2021.

Figure 7.1: Actual Traffic Growth Rate



Traffic generated from the site in opening year (with special event) is shown in **Figure 7.2**. In the opening year, the total combined traffic from future base traffic with development traffic is shown in **Figure 7.3**.

As described in **Section 6.13**, the Bogyoke and Alan Pya Junction will be operated in overcapacity conditions in the future base year without and with development traffic in both AM and PM peaks. Having added the development traffic to the network will impact on the junction performance which is already in overcapacity stage in both peaks. However, after implemented junction improvement measure by using optimized traffic signal, the junction performance is significantly improved especially in AM peak.

Hence, altering the phasing and signal timing at the Bogyoke and Alan Pya Junction will improve safety and alleviate travel delays caused by the site traffics. In addition, some improvements to the pedestrian and traffic in the vicinity of the site have been proposed to manage traffic efficiently and beneficial to the local area.

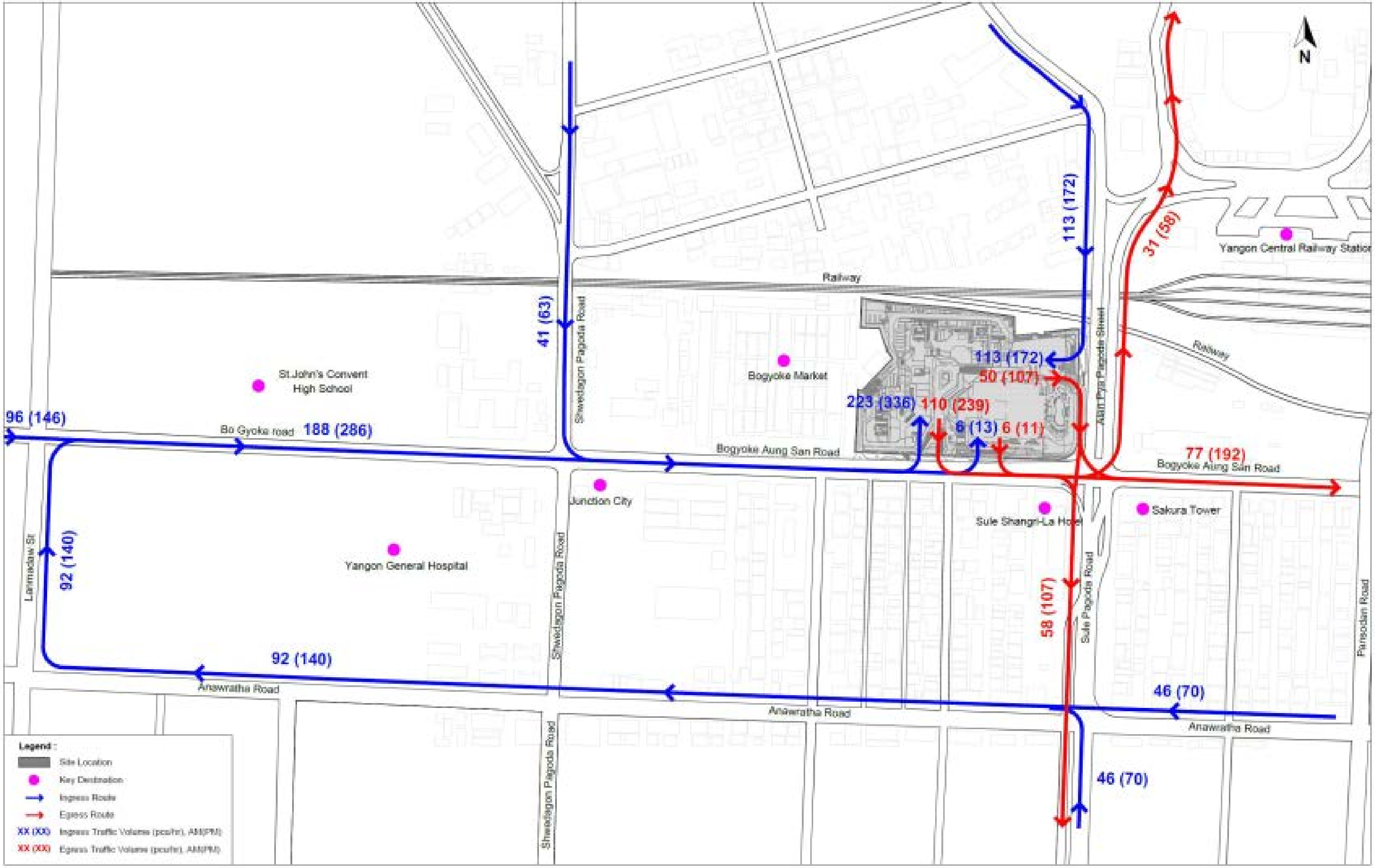


Figure 7.2: Development Traffic Volume

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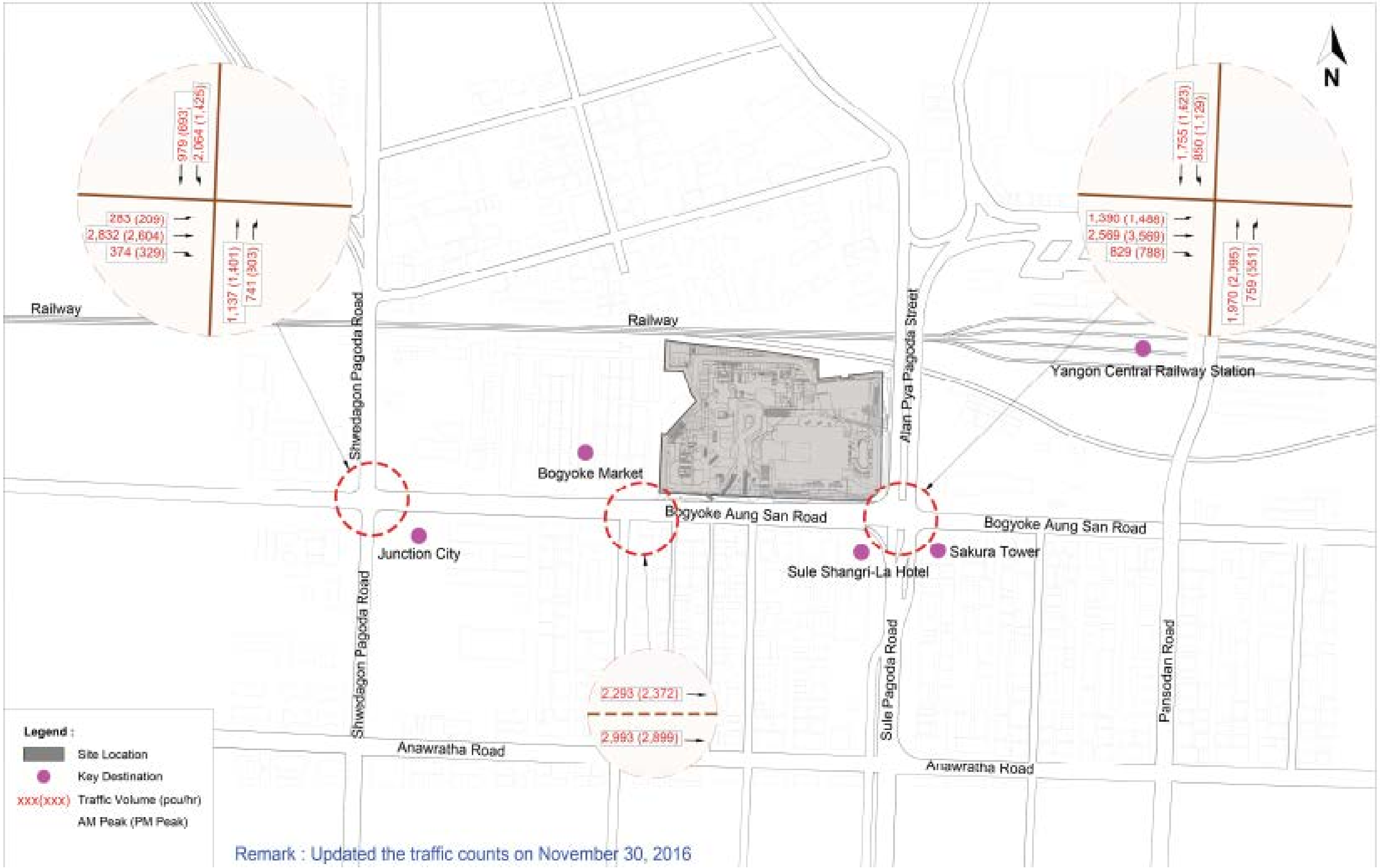

Figure 7.3: Combined Future Base with Development Traffic

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8 Environmental and Social Management Plan

8.1 Introduction

The Environmental and Social Management Plan (ESMP) described in this section forms an integral part of the ESIA prepared for the Project. It establishes the strategy for how environmental and social impacts will be managed throughout the stages of development, i.e. the construction and operational phases of the Project and provides a framework upon which MDL as the Project Developer will set environmental and social management requirements for the Project via its contractual documents with relevant parties amongst others, the Main Contractor appointed for the construction phase of the Project and the managing entities appointed to operate the various development components within the Project Site.

This ESMP prepared herein will be subject to revision upon receipt of feedback from the regulatory agencies, namely, the MONREC, YCDC and other technical departments, any ESIA approval conditions that may be imposed by the MONREC and completion of the detailed construction methodology and detailed engineering for the Project.

8.2 Objectives of the ESMP

The EMSP is a tool designed to aid MDL to meet the requirements of applicable environmental legislation and relevant authorities and achieve best practice environmental and social management for the Project. It contains a description of measures to be implemented in order to achieve and maintain acceptable levels of environmental and social impacts.

Broadly, the objectives of the ESMP are to:

- Provide practical and achievable plans for the management of the project that environmental requirements are complied with, by providing for the monitoring and control of the predicted impacts;
- Provide MDL and the regulatory authorities with a framework to confirm compliance with environmental policies and requirements; and
- Provide the community with evidence of the management of the project in an environmentally and socially acceptable manner.

8.3 Scope of This ESMP

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

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

8.4 Project Organisation Structure

MDL's environmental and social team structure is presented in **Figure 8.1**.

The Contractors are responsible to ensure environmental and safety compliance of overall activities on site as the Contract and EMP/E&S System.

- Ms Chaw Mon Tun, Compliance & Approvals Manager is responsible to review and monitor that Contractors do not breach any environmental and safety compliance.
- Mr. Ko Ko Win Swe Tun and Mr. Moe Win Htet, qualified construction managers and Mr. Khaing Lin Zaw Oo, qualified Safety Officer are in place to monitor that all the activities carried out in the site by the Contractors' are in compliance with ESMP.

8.5 Roles and Responsibilities

The relevant parties that will be involved in the implementation of the ESMP include:

- MDL as the Project Proponent;
- MONREC – Environmental Authority;
- The Project Engineer (PE) – to be employed by the Project Proponent;
- The Independent Environmental Consultant (IEC) – to be employed by the Project Proponent or the PE;
- The Environmental Team (ET) – to be employed by the PP, the PE or the Contractor; and
- The Contractor.

8.5.1 Project Proponent

The MDL as the Project Proponent will assume overall responsibility for the Project. The Project Proponent will:

- Ensure an ET is employed to undertake and manage the monitoring and audit, laboratory analysis and reporting of the environmental monitoring and audit programme; and
- Ensure an IEC is employed to audit the results of the environmental monitoring and audit (EM&A) works undertaken by the ET.

8.5.2 Ministry of Natural Resources and Environmental Conservation (MONREC)

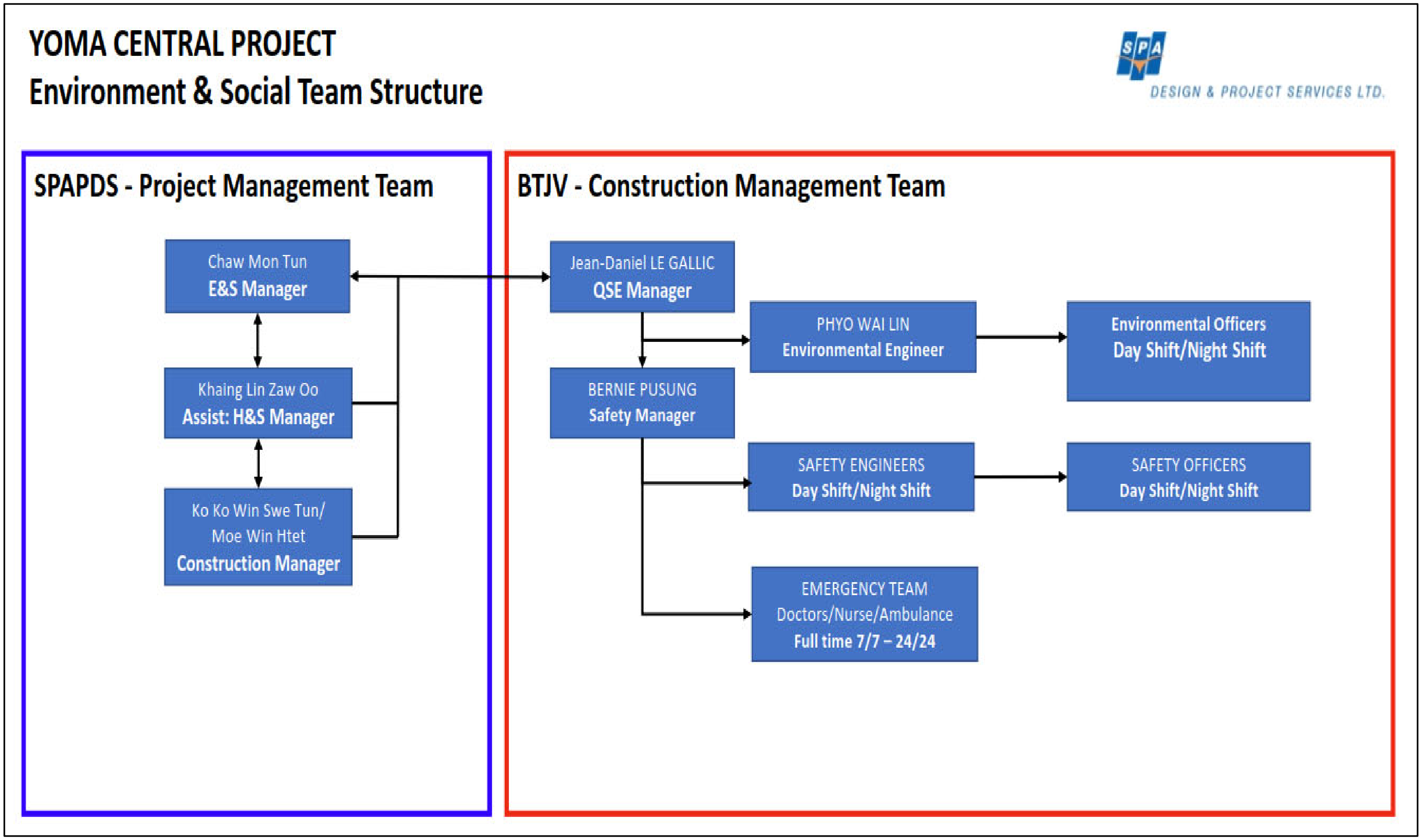
The MONREC is the governmental enforcement body for relevant environmental protection matters in Myanmar. The relevant departments which this ministry will be engaged with in all regulatory enforcement issues.

8.5.3 Project Engineer

The PE will be responsible for overseeing the construction of the Project and monitoring the works undertaken by the Contractor and the ET and to ensure the works undertaken are in accordance with the specification and contractual requirements. The PE will:

- Ensure the Contractor implements the environmental controls and mitigation measures committed in the ESIA as well as additional measures necessary for compliance with the relevant environmental standards;
- Advise, co-ordinate and give instruction to the Contractor when appropriate for effective implementation of any specific environmental mitigation measures identified, and/or outstanding environmental monitoring and audit works required to be carried out by ET in consultation with the IEC;

Figure 8.1: MDL's Environmental and Social Team Structure



- Ensure the Contractor is implementing and enforcing action plans to reduce impacts in the event of exceedance the prescribed limits or complaints;
- Provide assistance to the ET as necessary in the implementation of the environmental monitoring and audit programme;
- Participate in a joint site inspection undertaken by the ET and IEC as well as review the environmental monitoring and audit reports submitted by the ET and follow up the recommendations;
- Adhere to the procedures for undertaking the complaint investigation work;
- Ensure an ET is employed to undertake and manage the environmental monitoring and audit, laboratory analysis and reporting; and
- Ensure an IEC is employed to audit the results of the environmental monitoring and audit activities undertaken by the ET.

8.5.4 Independent Environmental Consultant

The IEC is preferably employed by the Project Proponent. The IEC will advise the PE on environmental issues related to the project. The IEC will not be in any way an associated body of the Engineer, the Contractor or the ET for the Project. The IEC will be empowered to carry out independent environmental performance audit of the Project. The IEC will have relevant qualification and experience in environmental monitoring and audit for environmental management works subject to the approval of the Project Proponent/ PE.

The responsibility of the IEC includes verifying the environmental acceptability of permanent and temporary works, relevant design plans, the project logbook and submissions under the ET, as well as arranging and conducting monthly general site inspections.

The main responsibilities of the IEC are to carry out independent environmental and social audit of the Project. This will include amongst others the following:

- Review and audit all aspects of the EM&A programme, including the implementation of all environmental mitigation measures, submissions relating to environmental monitoring and audits, as well as any other relevant submissions required under the ET;
- Validate and confirm the accuracy of monitoring results, monitoring equipment, monitoring locations, locations of the nearby sensitive receivers, and monitoring procedures;
- Carry out random sample check and audit on monitoring data and sampling procedures, etc.;
- Conduct random site inspection (at least once a month);
- Audit the ESIA recommendations against the status of implementation of environmental protection measures on site;
- Review the effectiveness of environmental mitigation measures and project environmental performance;
- On an as-need basis, audit the Contractor's construction methodology as well as verify and certify the environmental acceptability of permanent and temporary works, relevant design plans, contemporaneous logbook and submissions under the ET. Where necessary, the IEC shall agree the least impact alternative in consultation with the ET Leader and the Contractor;
- Check the investigation results of complaint cases and the effectiveness of corrective measures; and
- Review the monitoring and audit reports submitted by the ET leader.

8.5.5 Environmental Team (ET)

An ET managed by the ET leader will be employed by the Project Proponent or the Project Engineer to carry out the environmental and social monitoring programme including audits. The ET and ET leader will not be in any way an associated body of the IEC or the Contractor. The ET leader is the person who is responsible for and in charge of the ET to execute the environmental monitoring and audit requirements. The ET leader will have the relevant qualifications and experience in environmental and social monitoring and audits.

The ET leader will plan, organise and manage the implementation of the monitoring programme in accordance with the requirements as stipulated in the Final ESMP. Suitably qualified professional staff will be employed in the ET, and resources for the implementation of the monitoring programme will be allocated.

During the implementation of the monitoring programme, the ET's responsibilities include:

- Sampling, analysis and statistical evaluation of monitoring parameters with reference to the EIA study recommendations and requirements;
- Environmental site surveillance;
- Inspection and audit of compliance with environmental protection, and pollution prevention and control regulations;
- Monitor and assess the effectiveness of mitigation measures implemented;
- Monitor compliance with the environmental protection clauses/specifications in the Contract;
- Review the construction schedule and provide comments as necessary;
- Review construction methodologies and comment as necessary;
- Complaint investigation, evaluation and identification of corrective measures;
- Liaison with the IEC on all environmental performance matters and social issues, and timely submission of all relevant EM&A proforma for IEC's approval;
- Advice the Contractor on environmental improvement, awareness, enhancement matters, etc. on-site; and
- Timely submission of the monitoring and audit reports to the Project Proponent, MONREC, the IEC; the PE and the Contractor.

8.5.6 E&S Construction Management Team

The E&S Construction Management Team led by the Quality, Safety and Environment (QSE) Manager is responsible to:

- Ensure the environmental management system are correctly implemented to meet the requirements of the project and achieve the desired environmental outcomes;
- Ensure nonconforming environmental controls and practices are reported and remedial actions are implemented;
- Undertake and reviewing formal (weekly or monthly) and informal environmental monitoring and inspection reports and ensuring any actions required are carried out;
- Prepare and review environmental documentation, environmental procedures, project forms and checklists;
- Register and investigate environmental complaints;
- Liaise with the broader community, other stakeholders and interested parties;

- Assist in the auditing/assessment of the project, suppliers and subcontractors;
- Review and submit Project Monthly Environment Reports;
- Identify, develop and conduct environmental training initiatives for staff and subcontractors including inductions, toolbox talks and training courses;
- Ensure proper identification and follow up of legal requirement;
- Conduct daily site inspection to monitor environmental related issues, and to report any issue; and
- Continually insure implementation of environmental aspect by ‘coaching’ team on site.

8.5.7 Project Management E&S Team

E&S Team from the Project Management Team mainly monitor environmental compliance on Contractor activities in daily basis and take action as required focusing on:

- Managing documentation and reporting to ensure compliance with funding agreements (IFC/ ADB/ Mitsubishi) and authority requirements such as Contractor Requirements, Environmental & Social Management Plan, Annual Monitoring Reports, etc.;
- Conducts risk assessments, reviews and audits with focussing on Environmental, Social, Health and Safety and Labour to implement, improve and ensure compliance with these new policies and procedures across the Group by governing bodies, applicable rules, regulations and standards;
- Evaluate the environment, equipment and processes in working areas to ensure compliance with government safety regulations and industry standards;
- Analysis and reporting of potential risks and impacts for the project;
- Post-investment, work with investees to improve their E&S management systems, policies and procedures, including the implementation of E&S action plans (where relevant); and
- Work on ad hoc projects. For instance, external communications on E&S, such as an annual E&S report and case studies highlighting E&S value addition.

8.6 Summary of Impacts and Mitigation Measures

The potential environmental impacts and its corresponding mitigation measures for each phase of the Project are summarized in the following tables:

- Construction phase – **Table 8.1**
- Operational phase – **Table 8.2**

8.7 Overall Budget for EMP Implementation

Table 8.3 summarizes the budget allocated by the project developer to finance the environmental services and the mitigation measures and monitoring of the ESMP.

Table 8.1: Environmental and Social Management Plan during Construction Phase

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
Air Quality				
Potential sources include: • Site preparation works such as excavation, levelling, compaction and trenching • Movement of heavy construction vehicles and machinery within the site and during transportation operations; • Material handling (delivery, unloading and use of construction aggregates and structural fill); • Demolition of existing building on-site; • Operation of the batching plant; • Material/soil tracked out of the site and deposited on local roads; and • Exhaust emissions emitted from vehicle and machinery engine exhaust emissions will contain NOx, SOx, CO and VOCs.	Mitigation measures involving standard dust suppression measures include: • Carry out regular surface damping or wetting on general site areas, stockpiled fill and aggregates especially during dry ambient conditions; • Provide site enclosure and covering of any aggregates or stockpiles; • Ensure that all hardstanding areas and access roads within the site are wet twice a day; • Provide wheel-washing facilities or trough at the ingress/egress points. These facilities will be equipped with (1) a temporary hardstanding of sufficient size to accommodate a standard sized vehicle and equipped with a sump; and (2) high pressure water jets. • Vehicles operating within the Project site and especially within the construction works area will adhere to speed limits not exceeding 10 km/hr.	Ambient air quality monitoring to be carried out monthly at two locations along the Project site boundary and one location at the Church compound. The monitoring will be carried out by an independent environmental specialist. Parameters to be monitored include TSP, PM_{10} (particulate matter less than 10 micron), SO_2 and NO_2.	An independent environmental specialist appointed by ET	Submission of monthly air monitoring reports to the ET, IEC and PP.

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
	• Surface damping will be carried out on a 50 m road stretch on the public road outside the site's access point. • All construction vehicles transporting dusty materials will be secured with appropriate materials/sheets to prevent the escape of fugitive dust. • Open burning on the site premises is strictly prohibited. The control of vehicular emissions can be achieved by observing good construction practice procedures such as: • Turning of equipment when not in use; • Lorries/trucks waiting for more than 10 minutes will turn off their engines; and; • Regular maintenance of construction vehicles/equipment.			
Vibration				
The main construction activities that will generate vibration include: • Demolition of buildings, mainly with the use of backhoe mounted hydraulic breakers; • Main buildings early construction works;	• Pre-construction surveys will be conducted prior to commencement of major site works such as demolition, piling and foundation works. • Sequential work arrangement to avoid cumulative vibration impacts • Noise and vibration barrier will be erected	Identify monitoring points for vibration, and monitor vibration impacts with proper instrumentation.	Contractor	Submission of monthly vibration monitoring reports to the PP.

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
• Piling Works for the main buildings; • Main Building Pile Caps, Basement Slabs & Podium; and • Construction of the Towers				
Noise				
The main construction activities that will generate noise include: • Main buildings early construction works; • Piling Works for the main buildings; • Main Building Pile Caps, Basement Slabs & Podium; and • Construction of the Towers	Mitigation measures which will be implemented include: • Consideration for alternative construction methodologies: The use of hydraulic breakers should be avoided and hydraulic crushers should be used instead. There crushers are typically 6-12 dB(A) quieter. • Use of mobile barriers: Movable noise barriers will be used as necessary to achieve 5 dB(A) reduction for movable construction equipment or 10 dB(A) for stationary ones. Implement Good International Industry Practice (GIIP) as follows: • Construct walled enclosures around especially for noisy activities, or cluster of noisy equipment; • The Contractor will submit the method statement to the Engineer for comments on the construction methods, use of	Noise monitoring to be carried out monthly at two locations along the Project site boundary and one location at the Church compound. The monitoring will be carried out by an independent environmental specialist over a 24-hour period.	An independent environmental specialist appointed by ET.	Submission of monthly noise monitoring report to the PP.

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
	equipment, and noise mitigation measures intended to be implemented on-site; • The Contractor will submit the method statement to the Engineer for comments on the construction methods, use of equipment and noise mitigation measures intended to be implemented on-site; • The Contractor will devise and execute working methods to minimize the noise impact on the surrounding sensitive uses, and to provide experienced personnel with suitable training to ensure that those methods are implemented; • Noisy equipment and noisy activities will be kept as far away from the NSRs as possible; • Unused equipment will be turned off and the parallel use of noisy equipment/ machinery will be avoided; • Queuing of dump trucks will be avoided. Their intermittent use will be avoided between loading cycles or may be throttled down to a minimum to reduce noise; • Regular maintenance of all plant and equipment; and			

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
	• Material stockpiles and other structures will be effectively utilised as noise barriers, where practicable.			
Water Quality				
Soil erosion	• Sediment retention structures such as silt traps or catch pits of adequate sizes will be provided at suitable locations within the active works area within the Project site to remove soil and sediment in the surface runoff prior to discharge into the receiving drainage channels. The silt traps/catch pits will be regularly maintained and de-silted to provide maximum silt removal efficiencies. Oil and grease removal facilities will also be provided to ensure the overflows from the silt trap do not have traces of oil and grease. • These structures will be located, designed and constructed in a manner that will minimise the potential threat of downstream flooding. • Any disturbed earth caused by construction activities or fill operations will be firmly consolidated and compacted by earth moving vehicles and compactors to reduce the rate of possible erosion and release of loose soil particles.	Inspection of silt traps will be carried out by the Contractor as required. Based on the inspection, as required, silt traps/catch pits will be desludged to maximise silt removal efficiencies. The overflow from the silt traps will be monitored on a quarterly basis to ensure compliance to the following limit: • Total Suspended Solids (TSS): 50 mg/l Other parameters to be monitored on a quarterly basis include the following: • BOD: 30 mg/l • COD: 125 mg/l • Total Coliform: 400 MPN/100 ml • Oil and Grease: 10 mg/l	Earthworks Contractor	Development of an Erosion and Sedimentation Control Plan (ESCP) for integration into the Earthworks and Drainage Plan which will be submitted to the YCDC and related agencies.

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
	• Denuded stretches will be re-vegetated or sealed immediately after the construction works. Suitable re-vegetation programmes will be planted as quickly as possible on exposed areas to reduce surface runoff and sediment loss. • Uncovered stockpiles of excavated material or topsoil and fill material are prone to erosion and therefore will be protected. Small stockpiles can be covered with tarpaulin sheets and large stockpiles will be stabilised by erosion blankets and regularly damped. • Construction of a wash trough at the ingress/ egress point of the Project site to remove dirt/soil from vehicles and machinery leaving the site. The wash trough will have spray jet facilities and all surface discharge from the wash trough will be channelled into the temporary drainage system • Stockpiles of construction aggregate spoil and excavated soil will be located at areas within the project site that do not permit direct run off into water courses and are generally flat. On site storage of excessive quantities of such materials will be avoided and where not possible the use of geotextile material or tarpaulin covers will be considered to minimise erosion.	• pH: 6.0 – 9.0		

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
Construction runoff and drainage	Temporary and/ or permanent drainage systems will be installed immediately following the site preparation works to minimise downstream flooding.	Visual monitoring of the temporary and/or permanent drainage system will be carried out on a weekly basis and immediately after a heavy rainfall event. If these channels are obstructed, measures will be taken to prevent drainage impedance.	Contractor	Provision for proper management of sewage effluent from temporary sanitary facilities to be included in the Construction Method Statement.
Sewage Effluent and Domestic Wastewaters	• Appropriate sanitary facilities will be provided and properly maintained for construction workers throughout the construction stage. Direct discharge of untreated sewage into underlying soil, groundwater or surface water is prohibited. If portable toilets are used at the site, they must be of sufficient numbers and meet the requirements of Yangon City Development Council. • Temporary septic systems will be provided for use at the proposed site to prevent any release of untreated sewage into YCDC main drain. • These facilities will be maintained and cleaned on a daily basis.	Periodical desludging of the septic will be carried out by YCDC. The effluent will be monitored on a quarterly basis to ensure compliance to the following limit: • TSS: 50 mg/l Other parameters to be monitored on a quarterly basis include the following: • BOD: 30 mg/l • COD: 125 mg/l • Total Coliform: 400 MPN/100 ml • Oil and Grease: 10 mg/l • pH: 6.0 – 9.0	An independent environmental specialist appointed by ET	

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
Soil and Groundwater				
Accidental spills and leaks from handling and storage of hazardous materials	• A secured area (enclosed with hardstanding impervious base) will be provided for the storage of any hazardous materials and hazardous wastes. • All temporary fuel tanks and drum storage areas will be provided with drip collection devices and be sited on sealed areas (for example, concrete paved areas) with appropriate bunding for accidental spill containment. A valve will be installed at the discharge outlet of the bunded area. • Any accidental spills of fuel, oil or other hazardous chemicals will be cleaned up immediately. The recovered media (contaminated soil, absorbent pads, rags etc.) will be disposed of as hazardous waste.	Daily inspection of the hazardous materials storage area. Any spills observed, or any deterioration in the integrity of the storage containers (e.g. tanks, drums) will be addressed immediately.	Contractor	Submission of weekly inspection reports to the ET and the PE.
Leaks from vehicle engine and refuelling activities	• All activities that may result in the potential release of hazardous materials to the ground such as changing of engine oils and lubrication oils from construction vehicles, equipment and generators on site will be performed only on designated sealed areas or on drip trays to reduce the risk of direct spill into the underlying soil and groundwater. Spent oil must be	Daily inspection of the areas designated for refuelling. Any spills observed will be contained and removed with the use of sand, sawdust chemical absorbents	Contractor	Submission of weekly inspection reports to the ET and the PE.

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
	handled and disposed of as hazardous waste.			
Improper discharge of untreated sewage	• Appropriate sanitary facilities will be provided and properly maintained for construction workers throughout the construction stage. Direct discharge of untreated sewage into underlying soil, groundwater or surface water is prohibited. If portable toilets are procured to the site, they must be of sufficient numbers and meet the requirements of Yangon City Development Council. • Temporary septic systems will be provided for use at the proposed site to prevent any release of untreated sewage into YCDC main drain. • These facilities will be maintained and cleaned on a daily basis.	The sanitary facilities to be cleaned twice daily. The portable chemical toilets will be maintained per the manufacturer's requirements. If temporary septic systems are used, periodical desludging will be carried out. Provision for proper management of sewage effluent from temporary sanitary facilities to be included in the Construction Method Statement.	Contractor	
Non - Hazardous Waste Management				
Improper management of waste will potential result in the following: • Drainage impedance • Contamination of the surface runoff caused by the chemicals used at the Project site • Odour impacts	• Good housekeeping practices are essential within the site. Open burning of any form of construction waste material within the Project site is strictly prohibited as apart from polluting the atmosphere and reducing the ambient air quality at the site, the activity poses a risk of fire spreading to the hazardous materials	Daily inspection on housekeeping, storage and disposal of non-hazardous waste generation from the Project Site will be carried out. .	Contractor	Submission of weekly report on the quantity and type of waste generated and its disposal method. Copies of the receipts used in the sale and/or of the waste materials

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
• Possible health risks caused by disease vectors • Possibility of fires at the Project site	storage areas (example, diesel storage area). • General construction spoil will be recycled on site as much as possible. For example, construction aggregate materials may be considered as possible backfill material; • Domestic waste generated from the site offices and workers' temporary cabins will be stored in suitable covered receptacles or stored within enclosed areas and collected regularly by a YCDC-licensed contractor for disposal at an approved disposal/ landfill site; and • Unsalvageable construction spoil will be stockpiled at a designated site and sold to salvage yard operators or other contractors interested in recycling the material.			will also be appended in the report
Hazardous Waste Management				
Waste from demolition of old structures potentially containing hazardous materials such as ACM, SMF, PCB, LBP, ODS, radioactive smoke detectors, mercury containing materials, hazardous chemicals/wastes, mold and biological hazards. Other sources also include waste generated from construction activities	• As presently there is no collection system for hazardous waste in Yangon, the YCDC entrusts PCCD to collect industrial waste, together with municipal and general waste. • PCCD collects industrial waste on request.	Daily inspection on housekeeping, storage and disposal of hazardous waste generation from the Project Site will be carried out.	Contractor	Submission of weekly report on the quantity and type of hazardous waste generated and its disposal method. Copies of the receipts used in the sale and/or of the

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
including spent filter cartridges, small quantities of waste of industrial paints and various type of spent soil and soil/rags contaminated with oily residue.	• Project management team will meet with PCCD to discuss available options in deciding the best option in ensuring safe management and disposal of hazardous waste.			waste materials will also be appended in the report.
Landscape and Visual				
Temporary adverse landscape and visual impacts during the demolition and construction phase. Construction of Project will also impact the existing trees within the site.	A decorative hoarding will be erected around the periphery of the site to screen the temporary construction works from the local low level receivers, mainly pedestrians. The proposed hoarding would provide a unified edge treatment and interface between the construction site and its landscape context. Mitigation measure to retain existing trees include: • Phased segmental root pruning for tress; • Pruning of branches of existing trees; • Increase watering of existing vegetation; • All works affecting the tree identified for retention and transplantation will be carefully monitored; and • Tree transplanting and planting works will be implemented by approved Landscape Contractors, inspected and approved by qualified Landscape Architect.	Daily inspection of the hoarding to ensure there are no breaches or damaged areas.	Contractor	Submission of weekly reports to the PP and the PE.

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
Traffic and Transportation				
Increase in construction traffic.	• Construction traffic will avoid the peak traffic hours and adhere to YCDC limitations on vehicle size during specified hours of the day.	No monitoring programme required.	Not applicable	Not applicable
Health and Safety				
Factors affecting the health and safety of the workers: • Hazardous working areas/dangerous zones; • Communicable disease and vector borne disease; • Exposure to hazardous materials/ chemicals; and • Traffic safety	The Guidelines on Minimum Health & Safety Standards for Major Works developed by SPAPM will be adopted for the construction and operational phases of the project.	During the construction phase, provisions will be made for the appointment of a Health and Safety Officer at the Project site. Alternatively, one of the members of the ET can assume the role of managing the health and safety requirements at the Project site.	Project Health and Safety Officer/ET	Submission of weekly report on any issue regarding to safety and health issues on site to PP.

Table 8.2: Environmental and Social Management Plan during Operational Phase

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
Air Quality				
During the operational phase of the Project, there will be no significant sources of air emissions.	No mitigation measures required.	No monitoring programme required.	Not applicable	Not applicable
Vibration				
During the operation phase of the Project, no significant sources of vibration impacts are envisaged.	No mitigation measures required.	No monitoring programme required.	Not applicable	Not applicable
Noise				
Except for minor increase in traffic noise due to the occupancy of the various development components of the Project, no significant impacts are envisaged.	No mitigation measures required.	No monitoring programme required.	Not applicable	Not applicable
Water Quality				
Sewage and sullage	A wastewater treatment plant (WWTP) will be constructed onsite designed based on the peak water demand of 1,100 m^3/day.	Implementation of preventive maintenance programmes and performance monitoring programmes as stipulated under the manufacturer's specification. The treated effluent from the WWTP will be monitored once a week to	Company appointed for the operation and maintenance of the WWTP.	Submission of weekly monitoring report of the treated effluent from the WWTP.

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
		ensure compliance to the design specifications and to ensure compliance with the requirements of MONREC. The specific parameters to be monitored will be confirmed in conjunction with MONREC as presently there are no prescribed limits for treated effluent.		
Soil and Groundwater				
Contamination of soil and groundwater as a result of hazardous materials (diesel and chemicals) spillage.	• The five diesel storage tanks to be installed within the Diesel Storage Room will be located within concrete-bunded enclosures capable of containing 110% of the contents of the largest tank within each enclosure. The floor of the bunded enclosures will be concrete-lined with an impermeable liner to prevent contaminant from permeating into the ground; • Appropriate instrumentation and control/trigger alarm to warn of possible overfilling and to provide an alert mechanism in the event of significant fuel/chemical loss will be provided for the storage tanks; • Operational control which includes regular/routine surveys, inspection and maintenance of the diesel fuel tanks and their ancillary facilities (pumps, valves and pipes) will be integrated into the Project's	Daily inspection of the Diesel Storage Room including the piping, valves and related structures by the maintenance crew appointed during the operational phase of the Project. During the inspection, a checklist which addresses the management measures of the ESIA will be used. The groundwater quality at the Project site will be monitored every month during the lifetime of the development. The number of monitoring wells and the specific parameters to be monitored will be decided in conjunction with MONREC. At a minimum, three wells will be located to represent the groundwater quality up-gradient and down-gradient of the site.	Company appointed to carry out maintenance activities for the Project Site.	Submission of weekly inspection reports to the PP. Submission of monthly groundwater quality monitoring report to the ET and the PP

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
	environmental management practices so as to identify and rectify any significant product losses or ongoing spills/leakages which may be occurring; • Areas where regular or periodic handling and dispensing of liquid hazardous material are undertaken, such as the diesel storage area and the building maintenance store will be concrete-paved with appropriate secondary containment (drip trays and bunded areas) provided. • Any accidental spills will be assessed on a case by case basis and remedied, including excavation and disposal of any contaminated soil (classified as hazardous wastes) at a secure disposal facility approved by the YCDC. • Procedures and work instructions on proper handling of diesel and maintenance chemicals as well as the disposal procedures for hazardous wastes will be developed and effectively communicated to all operations and maintenance personnel; • Material Safety Data Sheets (MSDS) to be provided for the diesel and any other chemicals (e.g. chemicals used for the maintenance activities, used at the WWTP and for the cooling towers) stored within the Project site;	If contaminants are present at concentrations above the groundwater quality screening levels (example, the Dutch Intervention Values (DIVs), further assessments will be necessary to determine the nature and extent of the contamination, as well as to remove the potential source(s) of contamination.		

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
	• Corrosion protection for steel tanks and their ancillary facilities (pumps, valves and pipes) will be provided to prevent leaks.			
Non-Hazardous and Hazardous Waste Management				
Non-hazardous waste arising from occupancy of residential tower and hotel include: • Kitchen waste, • Office waste from administrative offices; • Hotel guests waste; • Garden waste; and • Miscellaneous waste.	Project management team will meet with PCCD to discuss available options in deciding the best option in ensuring safe management and disposal of the non-hazardous and hazardous waste.	Daily inspection on housekeeping, storage and disposal of hazardous waste generation from the Project Site will be carried out.	Contractor	
Hazardous waste will be generated in small quantities, largely from the operation of hotel's periodic maintenance activities including: • Used fluorescent bulbs; • Spent oils and solvents from hotel maintenance department; • Discarded or off-specification chemicals;				

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
• Containers, bags or equipment contaminated with chemicals or mineral oil; and • Rags, plastics, papers or filters contaminated with chemical or oils.				
Landscape and Visual				
Only positive impacts are envisaged.	A landscape management plan has been prepared for the Project site, including tree preservation and landscape work with measures are the followings: • To create plaza to the West of the cultural heritage building; • To restore the cultural heritage buildings; • To create landscaped garden; • To retain tress with historic values.	A qualified landscape architect will be employed to manage the landscape elements of the Project site.	PP	Submission of bi-yearly reports on the landscape management at the Project site.
Traffic and Transportation				
Increase in traffic and pedestrian volume around the vicinity.	• Improved footway surface along the boundary of the site • Left in/ left out access on Bogyoke Aung San Road (currently right in/ right out conflicting with traffic)	No monitoring programme required.	Not applicable	Not applicable

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
	• Relocation of pedestrian crossing on Bogyoke Aung San Road to align with the retail and office buildings • Signalization of the pedestrian crossing for improved pedestrian safety (traffic and pedestrian volumes will increase in future and so will conflicts so signalization would be required even without The Landmark project) • Removal of on street parking along the site boundary at Bogyoke Aung San Road to improve traffic flow and safety. • Improve lane markings and geometry of Bogyoke Aung San Road • Pedestrian connection / escalator in the north east corner of the site providing air conditioned and traffic free route through the retail podium from Alan Pya Pagoda Road towards Bogyoke Aung San Road. • Ensuring that access is designed with suitable gradients and visibility according to international standards (UK, Singapore). • At the main access car park ramp - providing car park ticket booths on Basement 1 level to avoid queuing back onto Bogyoke Aung San Road. Other booths within the development will be a minimum of 30m from the road (standard applied in Bangkok).			

Potential Sources of Impacts	Mitigation/ Management Measures	Monitoring Requirement and Frequency	Responsible Party	Monitoring and reporting requirements
Compliance with Labor Standards				
• Compliance of the Company and its Contractors and subcontractors with national labor laws and relevant ILO core labor standards • Payment of mandated minimum wages • Payment of mandated benefits of workers • Prohibited employment of child labor and forced labor • Non-discrimination, etc.	National labor law and measures to comply with relevant ILO labor standard conventions, including the following international practices with respect to the construction workforce: • promote the fair treatment, non-discrimination and equal opportunity of workers; • establish, maintain and improve the worker-management relationship; • promote compliance with national labor and employment laws; • protect the workforce, including vulnerable groups such as children or workers engaged by third parties, and workers in the project proponent’s supply chain; • promote safe and healthy working conditions and workforce health and well-being; and prohibit any use of forced labor.	No monitoring programme required as the ESMS carries out regular audits on labor standards.	ESMS Coordinator/ Director	Submission of yearly reports on the Labor Standards compliance at the Project site

Table 8.3: Budget Planned for Environmental and Social Management Measures

Items	Responsible Party	Construction Phase		Operational Phase	
		Cost Item	Budget (US$)	Cost Item	Budget (US$)
Monitoring • Air Quality • Vibration • Noise Quality • Water Quality • Non-Hazardous Waste Management Compliance with Labor Standards Health & Safety ** Cost for E&S training is included in the Management Compliance with Labour Standards*	Contractor's Environmental Control Measures	$ 421,736 $ 552,000 $ 3,680,000	4,653,736	Not Relevant	-
Air Quality		Air Monitoring Cost	48,000		
Noise Quality		Noise Monitoring Cost	16,000		
Water Quality		Stormwater detention system & diversion budget	331,345	Construction cost of wastewater treatment plant	908,710
Soil & Groundwater		Investigations	123,071		
Hazardous Waste Management		Haz-mat investigations & remediation	473,350		

Items	Responsible Party	Construction Phase		Operational Phase	
		Cost Item	Budget (US$)	Cost Item	Budget (US$)
Non-Hazardous & Hazardous Waste Management				Installation of waste handling bins, compactors	82,000
Landscape & Visual		Hoarding cost Trees transplantation cost	32,785 32,785	Landscaped garden budget; Landscape Architect	1,311,400
Traffic & Transportation		Traffic engineering studies	40,000	Offsite infrastructure budget; Pedestrian connection/escalator in the north east corner providing air conditioned and traffic free route; Car park ticket booths	473,350
Total			**5,751,072**		**2,775,460**

8.8 Environmental Monitoring Programme

Monitoring is a means verifying overall effectiveness of the management and mitigation measures contained within the management plans listed above.

Key objectives of the monitoring process are to:

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

8.8.1 Environmental Monitoring

a) Construction Phase

The objective of environmental monitoring is to demonstrate compliance with both regulatory and MDL's Project requirements (compliance monitoring), and also provide verification of the effectiveness of the implemented mitigation measures. An accredited laboratory will be engaged to carry out the environmental sampling and analysis.

The proposed environmental monitoring program for the Project, including the parameters to be monitored, sampling locations (**Figure 8.2**), frequency and duration as well as the applicable standards is presented in **Table 8.4**. The environmental monitoring results will be compared to the applicable national standards or other relevant standards in the absence of national standards.

During the excavation and construction of substructure, groundwater and vibration levels are monitored as presented in **Table 8.5**. For the construction phase, the contractor monitors the groundwater level weekly from 9 water standpipes as shown in **Figure 8.3**.

b) Operational Phase

In order to monitor the change in groundwater condition of the aquifers in the project area, some monitoring wells will be installed. The water level will be measured twice a month through the whole year in operation phase so that seasonal fluctuation of groundwater level can be observed. This data is useful for designing the depth of pump setting, observing the change in quantitative and qualitative groundwater potentials of the project area.

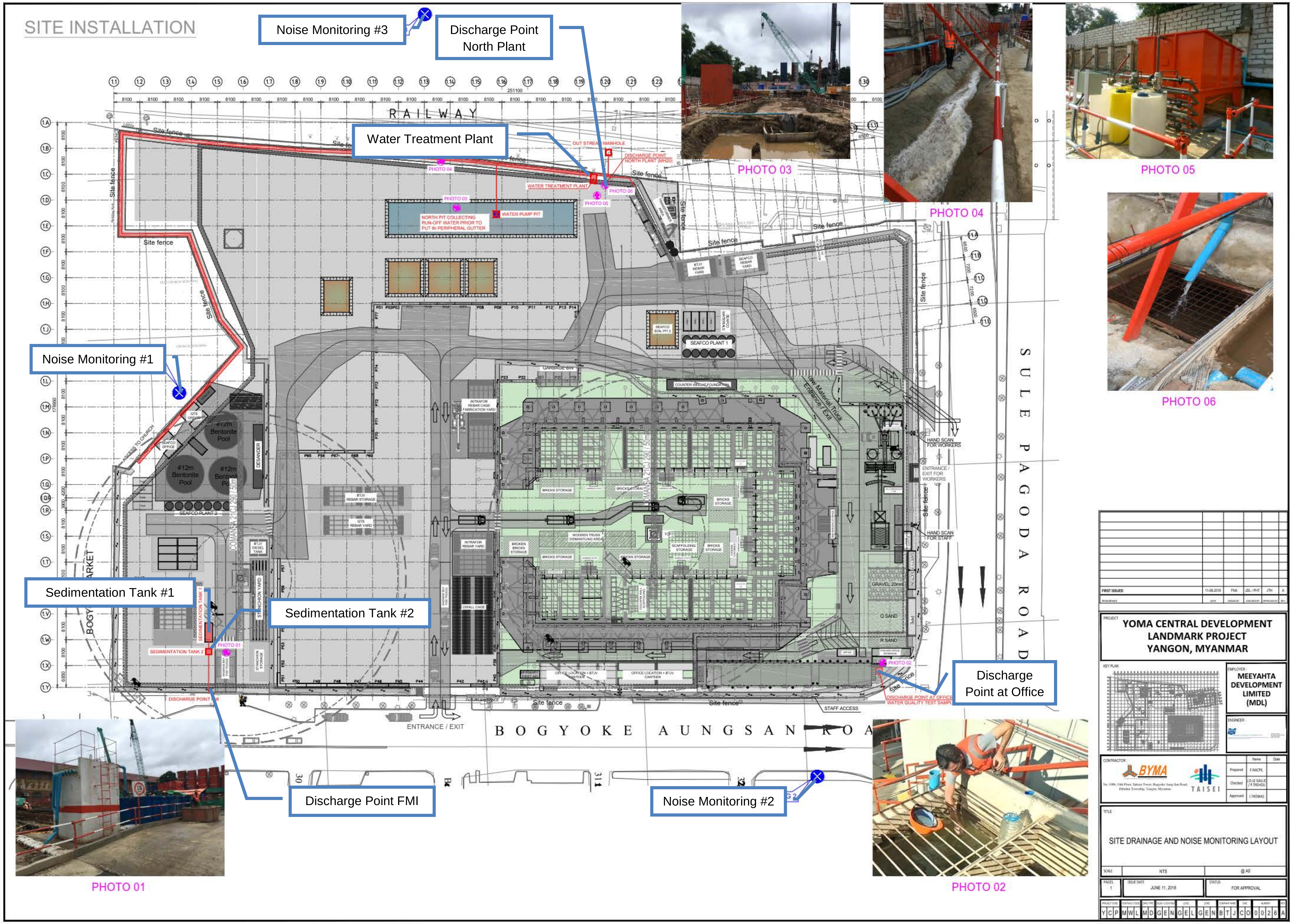


Figure 8.2: Noise and Water Quality Monitoring Points during Construction Phase

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Table 8.4: Environmental Monitoring Programme

Monitoring Components	Monitoring Parameters	Duration	Frequency	Standards
Construction Phase				
Site Run-off and Wastewater	• Biological oxygen demand (BOD) • Chemical oxygen demand (COD) • Oil and grease • pH • Total coliform bacteria • Total nitrogen • Total phosphorus • Total suspended solids	Grab sampling	Monthly	• 30 mg/l • 125 mg/l • 10 mg/l • 6 – 9 • 400 S.U.* • 10 mg/l • 2 mg/l • 50 mg/l
Air Quality	• Nitrogen oxide • Particulate matter PM_{10} • Particulate matter $PM_{2.5}$ • Sulfur dioxide	• 1 hour • 24-hour • 24-hour • 24-hour	Monthly	• 200 μg/ m^3 • 50 μg/ m^3 • 25 μg/ m^3 • 20 μg/ m^3
Noise Level	• Daytime • Nighttime	• 0700 – 2200 • 2200 - 0700	Monthly	• 55 dB(A) • 45 dB(A)
Operational Phase				
Wastewater	• Biological oxygen demand (BOD) • Chemical oxygen demand (COD) • Oil and grease • pH • Total coliform bacteria • Total nitrogen • Total phosphorus • Total suspended solids	Grab sampling	Monthly	• 30 mg/l • 125 mg/l • 10 mg/l • 6 – 9 • 400 S.U.* • 10 mg/l • 2 mg/l • 50 mg/l
Traffic survey	• Traffic condition of the surrounding areas		Annual	N/A

Table 8.5: Groundwater and Vibration Monitoring during Construction Phase

Measurement	Instrument	Minimum Monitoring Frequency				Trigger Level	
		Prior to Excavation/ Piling/ Diaphragm/ Walling/ Demolition	During Excavation/ Strut Installation & Back Filling	After Completion of Excavation & Back Filling	End of Monitoring	Alert Level	Work Suspended Level
Groundwater table	Standpipe/ observation well	Once a week	Twice a week	Twice a week	Upon completion of ground floor slab for podium and all floors slab for basement tank	--	--
Deformation of excavation lateral support wall	Inclinometer	Once a week	Daily	Once a week		5 mm/s	7 mm/s
Adjacent ground and building	In-ground settlement monitoring point	Once a week	Daily	Once a week			
	Building structure movement monitoring point	Once a week	Daily	Once a week			
	Crack gauges	Once a week	Daily	Once a week			
Reference datum level	Deep benchmark or equivalent	Monthly	Monthly	Monthly	Upon completion of work		

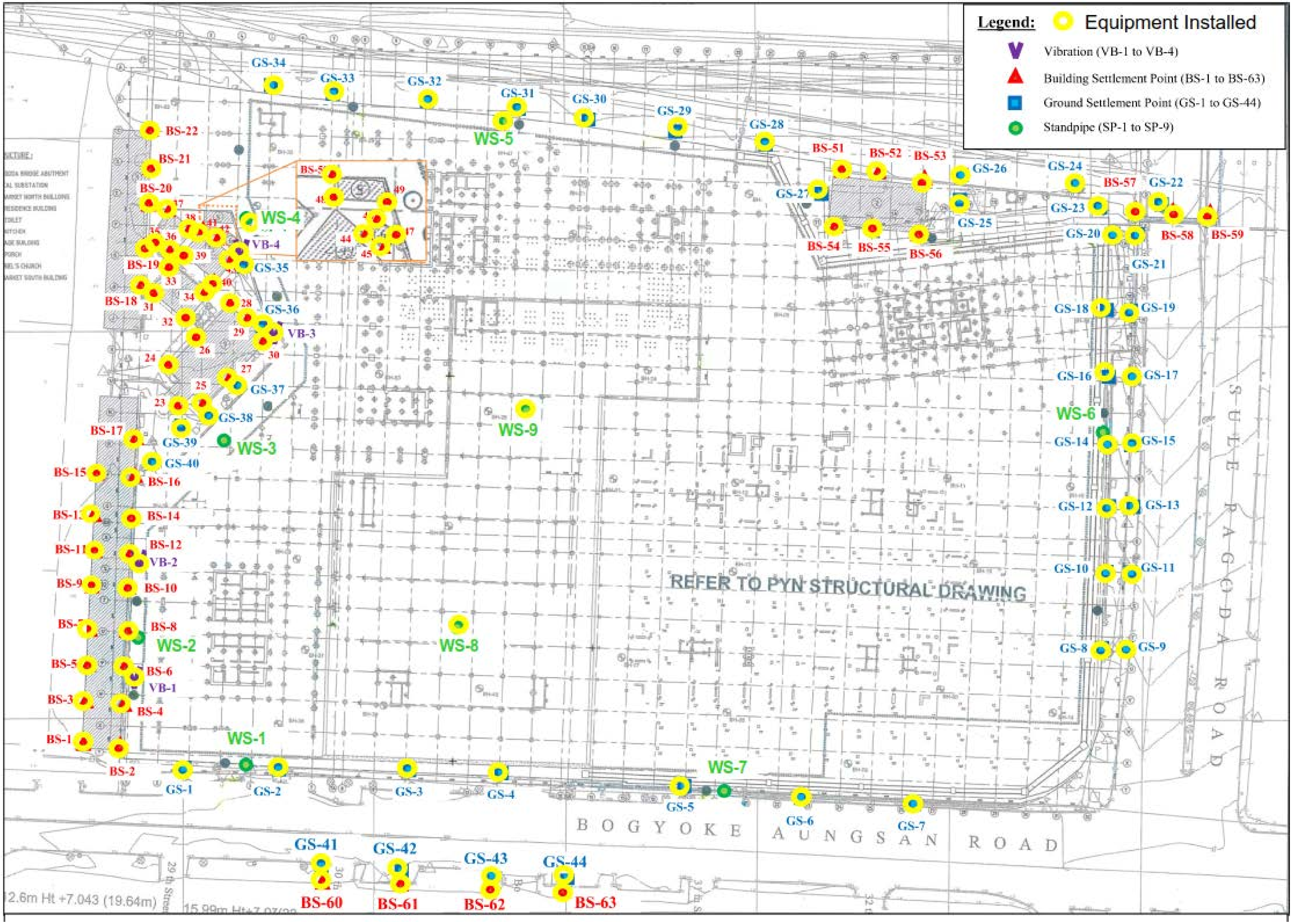


Figure 8.3: Locations of Standpipe, Vibration, Building and Ground Settlement Points

8.9.1.1 Monitoring Results Review

All monitoring results will be reviewed by the Environmental Officer with the respective phase managers:

- Pre-Construction/ Construction Phase: Project Manager/ Pre-Construction Manager/ Construction Manager; and
- Operational Phase: Operation Manager.

Where preventive/ corrective actions are deemed necessary, specific plans (with designated responsibility and timing) will need to be developed aimed at achieving continuous improvement in the environmental performance of the Project.

8.9.1.2 Reporting

Environmental Monitoring Reports will be prepared and submitted to MONREC on a six-monthly basis.

8.9 Training and Awareness

8.9.1 Environmental Training

In order for the measures outlined in the EMSP to be implemented effectively, Project employees, contractors and sub-contractors will be made aware of the ESMP and its requirements. The training shall include, but not limited to the following components:

- General environmental awareness;
- Environmental impacts and associated pollution prevention and mitigation measures for the Project;
- Awareness of the ESMP;
- Housekeeping in relation to the construction area;
- Construction activities;
- Work procedures; and
- Spill response training.

8.9.2 Relevant Training Programs

The Project has also put in place the in-house safety system which consist of different trainings program conducted for all the workers. All workers are required to attend the induction programs prior to entering the site. There is a briefing section every morning for all the workers highlighting safety issues and measures for the day as well as weekly toolbox meetings.

Following are the trainings currently provided in the Project:

- Safety induction course;
- Safety mass tool box meeting;
- Signal man/ rigger/ banksman training;
- Safe operation of plant and equipment;
- Firefighting/ safety training;
- Basic first aider training;

- Risk management training;
- Emergency response training;
- Traffic management/ man machine interface;
- Lifting operation (safe practices); and
- Safety leadership training.

All Safety Officers and Trainers engaged by the Contractor are qualified safety personnel holding the Certificate from Global Enchanting – Safety and Management Training Centre which is jointly organized with the Factory and General Labor Law Department (FGLLID) under Ministry of Labor. In addition, first aid trainings are provided by the Myanmar Red Cross Society (MRCS). Apart from the Contractor's safety team, MDL has their own Occupational Health & Safety team to oversee and making sure everything is operated in standard procedures in the site.

Yoma Central Project has the specific Health and Safety Plan implemented which contains detailed procedures for construction activities such as scaffolding, working at height, etc. The Contractor is in communication with FGLLID as required for any safety related instruction and advices and are now in discussion to invite over to the site to have safety talks for better awareness of the workers.

8.10 Management Plans

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

As identified with the summary of impacts and mitigation and management measures, the following management plans are considered necessary to effectively implement the outcomes of the ESIA throughout the life of the Project:

- Occupational Health and Safety Plan (**Annex 7a**);
- Emergency Response Plan (**Annex 7b**);
- Waste Management Plan (**Annex 7c**);
- Traffic Management Plan (**Annex 7d**);
- Energy Saving Plan (**Annex 7e**); and
- Water Use Management Plan (**Annex 7f**).

8.11 Project-Level Grievance Redress Mechanism Objectives and Scope

SPA Project Management Services Ltd. (the "Company") is providing project management services for Landmark Project (the "Project") which is developed by Yoma Strategic Holdings Ltd. (the "Group"). The Company has hereby established the project-level Grievance Redress Mechanism (GRM) for people in the communities who are directly affected by construction activities (the "Affected Communities") of the Project.

8.11.1 Objectives

The objectives of GRM are to:

- Provide a readily accessible means for communities to raise their concerns and issues.
- Develop transparent and efficient grievance redress process that will address the Affected Communities' concerns in a quick and direct manner and at no cost to complainants.
- Alleviate the tension of the Affected Communities before concerns are elevated to formal dispute resolution methods, such as courts.
- Build mutual understanding and trust between the Company and the Affected Communities.

8.11.2 Scope

This project-level GRM for Affected Communities will address following types of grievances:

- Health, safety, environmental & social (HSES);
- Accidental impacts associated with injury or death or damage claims;
- Misconduct of project personnel;
- Insufficient employment opportunities; and
- Misleading or lack of information.

In addition to the above complaints/ grievances types, the GRM will accommodate the Affected Communities' inquiries and concerns.

Corruption cases and criminal acts, however, will not be addressed within this GRM, and shall be responded properly and separately by the Group Risk Management and Assurance Unit.

The GRM is only available for those residing or working in the areas of immediate communities around the Project that will be directly affected by the Project development activities. The Affected Communities, who are identified as below, will be eligible to raise their grievances under this GRM.

8.11.2.1 Residents

- Residents in wards 5, 8 and 11 of Pabedan Township – located in South of the Project
- Residents in Yaw Min Gyi area at the other side of rail track – located in North of the Project

8.11.2.2 Organizations/Groups

- St. Gabriel's Church Union [Congregational] – located west of the Project
- Bogyoke Aung San Market – located west of the Project
- Holy Trinity Cathedral – located west of the Project
- Sri Kamichi Hindu Temple – located south of the Project
- Central Hotel – located south of the Project
- Shop/restaurant owners along Bogyoke Aung San Road – located south of the Project
- Chulia Dargah Mosque – located south-west of the Project
- Sule Shangri-La Hotel – located south-east of the Project
- Sakura Tower – located south-east of the Project

As this GRM is particularly designed to expedite the process of receiving and resolving the Affected Communities' grievances, the mechanism will not address complaints of other stakeholder groups such as employees, government agencies, non-governmental organisations (NGOs) and investment partners, etc. Instead, these complaints must be submitted to the management through the Group's "Procedures for Reporting Improprieties." This Policy also extends to employees of all companies throughout the Company's supply chain (which includes contractors, sub-contractors and suppliers) to voice their concerns.

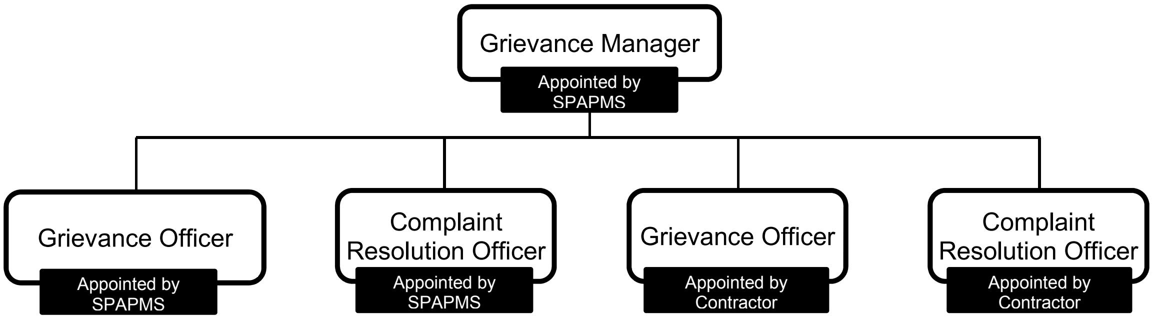
This project-level GRM is valid throughout demolition and construction phases of the Project and covers the actions of not only the Company but also its contractors, sub-contractors and suppliers.

8.11.3 Internal Grievance Committee

The GRM will be administered by the Internal Grievance Committee which will be formed as shown in **Figure 8.3**.

Having been classified as Category B project by IFC which means the Project will have only a limited number of reversible E&S impacts that can be readily addressed through mitigation measures, the Company does not expect a large number of complicated grievances to be regularly received, and hence it will not employ full-time employees for grievance handling. Instead, the Company will elect suitable existing employees to take on grievance redress as a concurrent responsibility. The Contractor shall also nominate two of its employees for this Committee and inform the Company of this nomination prior to the official appointment. It is crucial that nominees are selected based on their knowledge of the Project and understanding of the social and cultural environments of the communities. Employees with strong experience of environmental and social issues are recommended to be elected for Grievance Officers, and those who understand project operations and the full array of potential grievances induced by project activities, for e.g. Construction Manager or Health & Safety Manager, are recommended for Complaint Resolution Officers.

Figure 8.4: Internal Grievance Committee



Note* the grievance mechanism is proposed from developer not from consultant.

At any given time, at least one Grievance Officer must be available on site so as can be accessed by the Affected Communities.

Full information on name and contact details of members of the Internal Grievance Committee will be disclosed on the Company's website and at the security hut at the main gate of the Project. Whenever there is any change in the committee structure (person, no. of members, contact info, etc.), the Affected Communities will be informed as such.

8.11.4 Grievance Redress Procedures

The Internal Grievance Committee will handle grievances as a step-by-step process (see **Figure 2**), which encompasses four steps: receiving, recording and registering; screening; investigating; and resolving and responding.

8.11.4.1 Step 1: Receiving, Recording and Registering Grievances

a) Receiving Grievances

The Company will receive grievances from the Affected Communities through either one of the channels below:

- Third parties which can include government agencies, NGOs, residents ward committees or the Bogyoke Aung San Market management;
- Community Relations Officers where appointed by the Contractor; and
- Internal Grievance Committee formed by the Company.

Internal Grievance Committee will receive grievances via several methods in order to help the Affected Communities access the GRM regardless of their literacy levels or gender.

Notices and announcements for public grievance were posted at the project guardhouse (**Figure 8.4**). The public can lodge their grievances and complaints via the following methods:

- Telephone: 09-777 679919;
- E-mail: grievanceofficer_ycp@yomastrategic.com; and
- Complaint forms (**Figure 8.5)** are available at the project guardhouse at Bogyoke Aung San Road.

b) Recording Grievances

Whether the grievance is received in oral or written, the Community Relations Officer, or any member of the Internal Grievance Committee in the case of telephone complaints, will take a record as it comes in, using a standard format that basically requires the complainant to give:

- Name,
- Address in the community,
- Affiliation (if the complainant is a representative of an organization),
- Description of the complaint, and
- Contact information for further contact.

Only under special circumstances will the Company consider anonymous grievances. It is very important that the Affected Communities feel confident to give personal information, when raising their concerns, with no fear of threats, retaliation or any form of disadvantage whatsoever.

The Company is also committed to securing complainants' personal information and will not use it for any purpose other than further coordination to resolve issues. When the Company requires to share the identity with others for specific reason, the Company shall do so only after being acknowledged by the complainant.

Figure 8.5: Notices for Public Grievance

SPA Project Management Services Ltd.

အများပြည်သူသို့ အသိပေးအကြောင်းကြားခြင်း

ယခု တာဝန်ယူဆောင်ရွက်နေသော Yoma Central ဆောက်လုပ်ရေးစီမံကိန်းနှင့် ပတ်သက်၍ ဝေဖန်အကြံပြု ဆွေးနွေးလိုပါက (သို့) အဆင်မပြေမှု တစ်စုံတစ်ရာ တင်ပြလိုပါက စီမံကိန်း၏ သက်ဆိုင်ရာသို့ အောက်ဖော်ပြပါအတိုင်း ဆက်သွယ်နိုင်ပါသည်။

ဖုန်းနံပါတ်	၀၉ ၇၇၇ ၆၇၉၉၁၉
အီးမေးလ်	grievanceofficer_ycp@yomastrategic.com
လိပ်စာ	(၂) လွှာ၊ YCP Site ရုံး အမှတ် (၃၇၁-၃၈၀) ဗိုလ်ချုပ်အောင်ဆန်းလမ်း ပန်းဘဲတန်းမြို့နယ်၊ ရန်ကုန်

Site Notice to the Community

If you have any comment, question or complaint regarding Yoma Central Project, please contact the Project's responsible person as noted below.

Phone	09 777 679919
Email	grievanceofficer_ycp@yomastrategic.com
Address	Level-2, YCP Site Office No. (371-380) Bogyoke Aung San Road Pabedan Township, Yangon

Figure 8.6: Complaint Form

YOMA CENTRAL PROJECT

Room(801-805), 8th Floor, FMI Center
380 Bogyoke Aung San Road, Pabedan, Yangon, Myanmar

နစ်နာမှု တိုင်ကြားလွှာ

တိုင်ကြားသည့် ရက်စွဲ	
တိုင်ကြားသူ အမည်	
ကိုယ်စားပြု အဖွဲ့အစည်း/လူ	
ဆက်သွယ်ရန် ဖုန်း	
ဆက်သွယ်ရန် လိပ်စာ	
E-mail လိပ်စာ	

<u>တိုင်ကြားရသည့် အကြောင်းရင်း</u>

တိုင်ကြားသူ၏ လက်မှတ်		တိုင်ကြားချက် လက်ခံသူ အမည်	

c) Registering Grievances

After recording a grievance in the Company's form as mentioned earlier, the Grievance officer will register it in the centralized spreadsheet from which the unique grievance number will be retrieved for each complaint.

All grievances will be acknowledged by the Grievance Officer within 24 hours by giving complainants the registry number that they can follow up with later, either by hand-delivery, telephone, e-mail or post.

Grievances register will serve as a master document keeping records of grievances received in a chronological order so as to facilitate tracking, responding in a timely manner, and checking the status of grievances. The register includes the following, among other fields:

- Date on which the grievance is received;
- Grievance number (to be *unique* field);
- Date on which the grievance is acknowledged;
- Division(s) responsible for investigating and/or taking corrective actions;
- Date by which the grievance should be responded;
- Date on which the grievance is closed.

8.11.4.2 Step 2: Screening

All grievances received shall pass through the screening stage. The Grievance Officer will promptly screen the nature of the grievance, once it is logged into the Register, and determine if the grievance falls within the scope of the GRM. If the GRM is not authorized to address the grievance because it is out of its scope, the Grievance Officer will direct the case straight to Step 4 of Grievance Redress Procedures: Resolution and Response.

If the grievance is discovered to be in the scope, the Grievance Officer will continue doing a rapid assessment to identify the type (inquiries, concerns, complaints or claims) and degree of complexity of the grievance and communicate the findings to the Grievance Manager.

If the rapid assessment indicates the grievance is just an inquiry that can be readily resolved with an explanation, clarification or delivery of information, then the case can be pushed direct to Step 4: Resolution and Response. Any complex, problematic or repetitive grievances in which deeper underlying issues may exist, the Grievance Manager will assign responsible departments to investigate the case.

8.11.4.3 Step 3: Investigating

All grievances which cannot be readily resolved by the Grievance Officer shall undergo some extent of investigation, depending on the type of grievance and the level of impacts, especially when they require technical expertise to be resolved. The Grievance Manager will initially discuss the case internally with the Company's other managers who most of the time will be the Health, Safety and Environmental (HSE) Manager, the Construction Manager and/or the HR Manager. Usually, the head of the department to which the cause of the grievance is most related will lead the investigation process. In general, the HSE Manager or the Compliance Manager will be in charge of investigating HSES-related grievances or grievances with accidental impacts, while the Human Resource Manager will be the lead investigator for complaints about misconduct of Project Personnel or insufficient employment opportunities.

The lead investigator will then organize the investigating team with appropriate people both from the Company and from the Contractor. The investigator (or team) will review details of the grievance and its causes and will report investigation outcomes with a proposed company response to the Grievance Manager.

The investigation of certain grievances will tend to be more complicated, due to the need to seek independent third-parties' advice such as technical experts, insurance companies or the Group, especially when grievances are associated with damage claims or a person's death or injury.

Ideally, the grievance management team will be less involved in the investigation process to preserve neutrality. However, the Grievance Officer will keep following up with the investigator throughout investigation process to record the progress and update the status of it in the Grievances Register. Where necessary, the Community Relations Officer or the Grievance Officer will help the investigator (or team) to access the complainant; a direct conversation between these two parties and empathy listening to their complaints will calm down the situation and even speed up the resolution process.

8.11.4.4 Step 4: Resolving and Responding

As illustrated in **Figure 8.6**, there are three scenarios to reach the step of "Resolving and Responding": 1) when the grievance received is out of the scope of this GRM; 2) when the grievance is inquiry that can be readily responded; and 3) when the grievance requires to be investigated.

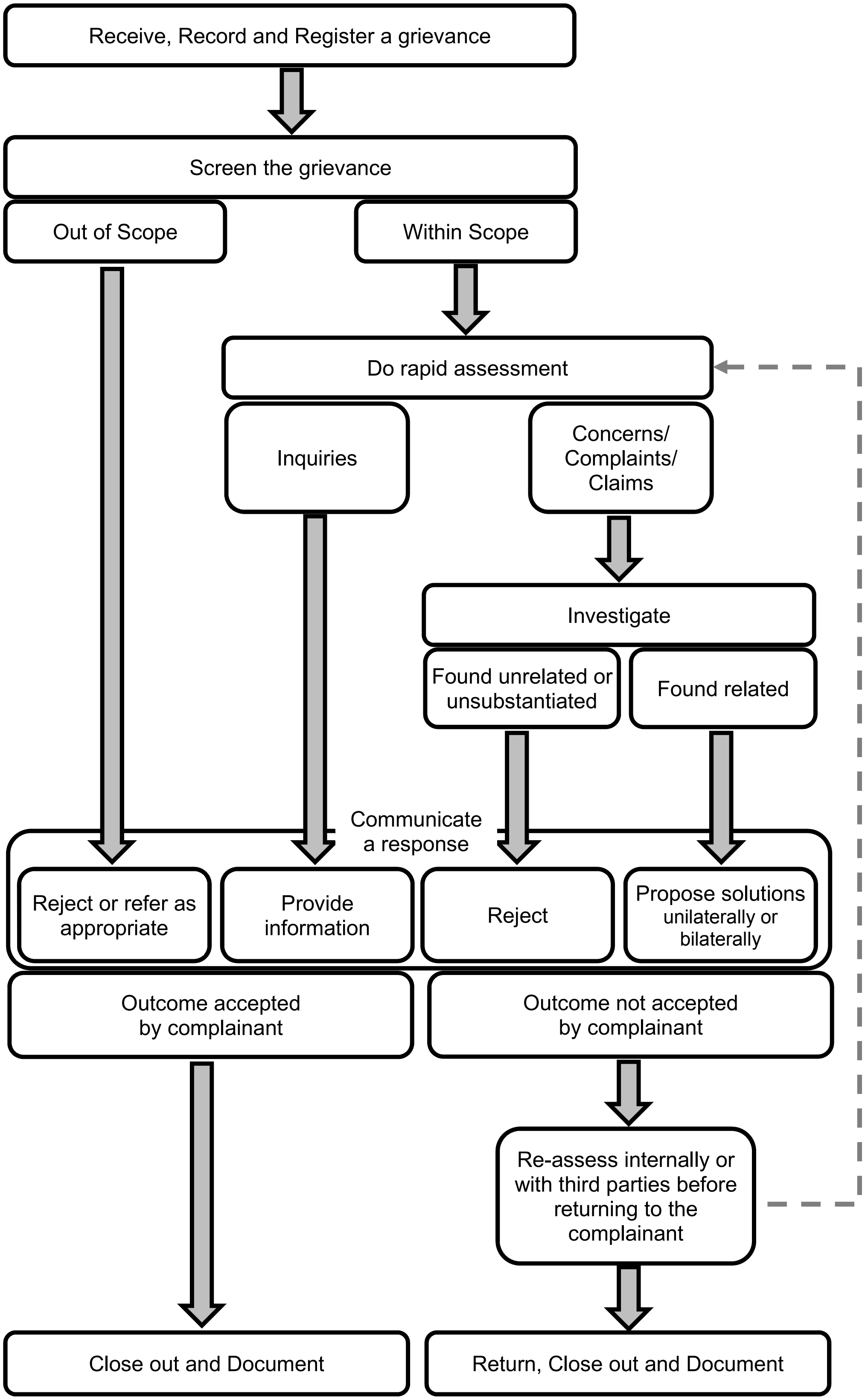
When the grievance is out of this GRM scope, the Internal Grievance Committee will reject the grievance. However, explanation for why the grievance is considered out of scope must be detailed and respectful. Where applicable, the Committee will refer to the correct mechanism that can resolve the grievance instead. When the grievance is actually the project inquiry, the Grievance Officer will gather the required information and prepare the response.

If the grievance is within the scope and cannot be readily resolved by simply providing information, it must have gone through investigation as mentioned in Step 3. Findings of investigation can lead to two different types of responses: reject or propose solutions. For grievances that are found unrelated to the Project or unsubstantiated for further investigation, the Committee will reject the grievance. The explanation must be detailed and respectful. If the grievance is discovered to be related to Project activities, solutions will be proposed either by the Committee or by discussion and negotiation between the Committee and the complainant.

In any case of responding grievances, the resolution must be at least agreed within the Internal Grievance Committee. The Community Relations Officer or the Grievance Officer will then communicate the response either in spoken or in written, depending on how the grievance was received. If the complainants are not satisfied with the proposed solution or the outcome of the agreed corrective actions, the Internal Grievance Committee 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 a dispute resolution mechanism outside of the Company grievance mechanism.

Figure 8.7: Grievance Redress Procedures



9 PUBLIC CONSULTATION AND DISCLOSURE

Public consultation and disclosure component of the environmental impact assessment allows the project proponent to adequately disclose information and creates opportunities to receive the public's inputs for the project. Social and environmental aspects are required to be taken into consideration for new projects in Myanmar.

Environmental Impact Assessment Procedure, promulgated in December 2015, by Environmental Conservation Department (ECD) under the MONREC states obligation for all EIA level projects to include public consultations and stakeholder engagements in the execution of EIA process. The project has staged a number of focused stakeholder engagements and public consultation meetings throughout from the beginning of the project planning stage. The suggestions, views, and comments from these meetings were incorporated in the design and planning of the project.

Due to the nature of the project and planned environmental safeguard measures, its potential Area of Influence (AoI) is minimal in the project's stages, which include construction phase involving demolition and operation phase. In consideration of the distance the AoI would potentially reach, the study limit will be set to within a 1 km radius of the project. The project identified that stakeholders to the proposed project are St. Gabriel Church management, the tenants, residents, guests, and employees of the buildings from the project, neighbourhood communities, Bogyoke Aung San Market management and the shopkeepers, Yangon Heritage Trust (YHT), relevant government authorities including Ministry of Transport, Ministry of Construction, YCDC, Myanmar Railways, and ECD from MONREC.

9.1 Methodology and Approach

In order to optimize inputs from various stakeholders, the project proponent applied focus groups, surveys, and public discussion methods for public consultation and disclosure. Opinions and comments related to cultural, technical, and regulatory matters were exchanged in individual focus group meetings with concerned government departments, YHT, YCDC, Myanmar Railways, and Ministry of Construction. Tenants currently occupying the site at the FMI Centre and Zawgyi House, customers and corporate clients of the Grand Meeyahta Executive Residences, employees of Grand Meeyahta Executive Residences, and the communities in the vicinity of the site including St. Gabriel's Church and Bogyoke Aung San Market were consulted in individual focus group meetings.

A survey in conjunction with a socio-economic survey was conducted to disclose information to the public and to collect public views on the project. Public consultation sections were held to inform the public and to receive the public's inputs.

9.2 Summary of Consultations and Activities Undertaken

The Project Proponent, since the initiation of the project development in 2011, has carried out separate consultations with individual stakeholder groups. In order to optimize mutual exchange and maximize the outcomes of the particular discussion, specific focused groups were met individually throughout the various stages of the Project.

In the early stage of the project planning, Grand Meeyahta Executive Residences employees, FMI Center employees, and business tenants from Grand Meeyahta Executive Residences and FMI Center were consulted in separate meetings.

The meeting with YCDC Engineering Department (Building) took place in August 2013 and building design and planning parameters were discussed in the meeting. Even though the project is still in design phase, a wide range of consultations have already been carried out between the Project Proponent and YCDC Pollution Control and Cleansing Department for asbestos disposal work, YCDC Playgrounds, Parks & Gardens Department for removal of trees on site, and CQHP for pile load test design and approval. YCDC Engineering Department (Roads and Bridges) was consulted in June 2016 about the storm drain diversion plan of the project. In addition, the Project Proponent consulted Myanmar Fire Services Department for fire safety design and approval.

Conservation measures were presented in the meeting with Yangon Heritage Trust in 2013. The PP also met with Department of Archaeology and National Museum on archaeological excavation on site matter. Issues related to Conservation Management Plan (CMP) were presented in another meeting with YHT in December 2014.

Members of St. Gabriel's Church Union expressed their concerns in a consultation section in May 2014. Again in June 2014, St. Gabriel's Church Union was consulted to register its concerns.

Meeting with Myanmar Railways took place in November 2015 and the conditions of the heritage items from MRB in the warehouse were discussed. Another meeting with Myanmar Railways took place in January 2016 as well.

In January 2016, Ministry of Construction was given a presentation to demonstrate that the project had taken safety measure to protect pedestrians and vehicles. Other construction related recommendations were relayed by the ministry in the meeting.

Individual public consultation meetings were conducted in August 2016 to inform the public near the project area and to receive their concerns. The residences who are located in the project impact area in Pabedan, Kyauktada, and Dagon, shopkeepers from Bogyoke Market, and the committee from St. Gabriel's Church Union were met to exchange views, concerns, and measures that the project has planned for the upcoming construction.

9.3 Results of Public Consultations

In the meeting with YCDC Engineering Department (Building), comments with regards to planning parameters (floor area ratio, building coverage ratio, setback, height) were discussed. The design parameters were checked by HIC to ensure compliance. CQHP reviewed and recommended the Project's pile load test design to YCDC for its approval. Asbestos disposal matters were exchanged with YCDC Pollution Control and Cleansing Department.

As a project developing high rise buildings in YCDC area, the approval in principle (AIP) has to be obtained from Yangon Region Government through HIC. In this regard, the Project Proponent has been working very closely with all seven departments under HIC. The Project Proponent met with YCDC Engineering Department (Roads and Bridges) in June 2016 regarding the storm drain diversion permit and submitted the newly proposed storm drain design to the department. The department referred to a third party organization for technical review. The project team has now engaged with the third party for the design technical review service.

YHT recommended to conduct Heritage Impact Assessment (HIA) in 2013. The first draft of HIA was prepared in Dec 2013 for Aedas scheme and submitted to local authorities in Dec 2014. The HIA (for new design) was updated in Dec 2015. It analyzed the impact of the new

development on the physical condition of the historic buildings within and adjacent to the site (MRB, St Gabriel's Church, Bogyoke Aung San Market) and also on the surrounding vistas. As part of HIA, archaeological evaluation was carried out between 9 and 17 November 2014 and follow up watching brief was carried out between 21 and 23 July 2015. A team from Department of Archaeology participated in the archaeological evaluations.

In December 2014 consultation with YHT, it recommended the PP to develop Conservation Management Plan (CMP). The CMP for Myanma Railways Building was submitted to YCDC in December 2015 and to Yangon Heritage Trust and Ministry of Construction in January 2016. Again, the PP met with YCDC, CQHP, Ministry of Construction, YHT and consultants of YCDC and presented CMP in March 2016. Comments were received from Ministry of Construction and YHT in March 2016. Comments were responded with an updated CMP to Ministry of Construction and YHT in April and May 2016.

In the meeting with Myanmar Railways in November 2015, humidity monitoring at the two warehouses storing the dismantled heritage items was discussed. Humidity and temperature monitoring devices were installed at the two warehouses in December 2015 and regular monitoring and documenting of humidity and temperature has been carried out ever since. In January 2016, Myanmar Railways indicated that present high-voltage cable installation through Sule Flyover is not appropriate for the new development. As a result of the meeting, a new proposal for laying 66 kV cable along the rail track underground was submitted to Myanma Railways in February 2016.

In January 2016, Ministry of Construction indicated that Bogyoke Aung San Road façade line of Tower 4 building should not project closer to Bogyoke Aung San Road than the Market façade line. The Project Proponent confirmed that Tower 4 (the podium and tower itself) is proposed to have 3,700 mm setback from the façade line of Bogyoke Market, and the ground floor has 8,700 mm setback. This illustrated that the new development will provide additional setback from Bogyoke Aung San Road and the façade line of Bogyoke Aung San Market (and especially when compared to the existing FMI Centre).

Ministry of Construction also raised concern for pedestrian and traffic safety in January 2016. The PP's technical team presented the project's plan for pedestrian and traffic safety issues to the Ministry of Construction in April 2016. The presentation included specialist consultant review for traffic and safety. This review analyzed in detail of the traffic generation estimates, security requirements, and future pedestrian and vehicular safety measures. It also looked at the option of combining the access driveways and found that the combined access prompts more potential for pedestrian and vehicle accidents.

The project has identified that currently working employees and business residence of the existing buildings are also stakeholder and the project affected peoples. Therefore, consultations with these groups were staged individually to find the most appropriate settlements. First, Grand Meeyahta Executive Residences employees were consulted and offered options. Grand Meeyahta Executive Residences closed down at the end of September 2013 in preparation for its demolition. Yoma arranged two job fairs during which each business within the Group interviewed Grand Meeyahta Executive Residences staff for potential re-employment. About 25% of 134 Grand Meeyahta Executive Residences staff have taken up offers with various Group entities while the rest decided to pursue other opportunities. For those who chose not to stay with the Group, full payment of salary was made until the end of the year 2013, and severance compensation was made in line with national labor regulations and with length of service.

Secondly, FMI Centre employees were consulted. FMI Centre is currently employing only 50-60 number of staff over which the Group has confidence in offering new jobs when the Group Headquarters is moved to Pun Hlaing Golf Estate. Similar to the Grand Meeyahta Executive Residences, employees who do not accept the new job offers will be compensated in line with national labor regulations.

Thirdly, the business tenants from Grand Meeyahta Executive Residences were consulted as early as the beginning of 2013. In line with contractual agreements, termination notice was given at least three months prior to the end of contract period. The business tenants from FMI Centre have been consulted since 2015. Depending on the time the lease agreement will come to an end, the team has mentioned suitable leasing options, ranging from monthly extension to six months extension, to allow tenants adequate amount of time to find a new office location.

Finally, the committee from St. Gabriel's Church Union (Congregational) was consulted in May 2014 and again in June 2014 to inform the project development and to receive its concerns.

The committee expressed concerns for inconvenience and potential damage resulting from the project's construction activities. The project appointed a qualified expert consultation firm to carry out a thorough dilapidation survey of all Church buildings. Dilapidation survey report was shared to the Church in July 2014. The project confirmed that appropriate devices will be installed to monitor any construction-related vibration impacts for Church buildings prior to the commencement of major site works. In addition, damage assessment was also carried out in January 2016 to examine damage potential as a result of project development activities. In the second consultation, the Church would not agree a pedestrian access to allow the public to go through the Church compound between Bogyoke Aung San Market and the Project. It wanted to maintain the gate as it is now. In response, the Project design was amended based on this comment by replacing open pedestrian access with the gate. Gate design options were proposed to the Church, and the final design was accepted by the Church in January 2016 after incorporating a number of their comments.

A socio-economic survey was undertaken for the project affected areas in late July 2016. The survey findings were incorporated in the earlier section of the report. Socio-economic survey targeted the stakeholders in the surrounding areas including Pabedan, Kyauktada, Dagon, and Bogyoke Market. Survey found that all in all majority of the respondents chose not to comment and showed no interest in learning more about the project despite overwhelming majority expressed favorable remark for the project. Repeated concerns for increase in traffic congestion, noise, vibration, and dust ranked top generally in Pabedan Township. For Kyauktada Township, noise, vibration, solid waste, and wastewater were viewed as important issues. Respondents from Dagon Township deemed that noise, vibration, and security were serious matters. All in all from the survey results, successive major concerns can be noted as noise, vibration, and traffic congestion respectively.

A series of public consultations for individual groups of residences from the projected affected areas were carried out in August 2016. Around 60 participants attended the consultation sessions.

The participants from the project affected people from Pabedan Township, Kyauktada Township, Yawmingyi Quarter and the committee from St. Gabriel Church raised several issues during public consultation meeting. The major issues raised include noise, dust pollution and vibration level from the construction, waste management, increasing traffics congestion due to the construction activities and damages on the roads. In addition, the participants also requested for information regarding the project's arrangement for the current employees,

demolition method and design about the basement parking lots, building strength for earthquake resistance, protection of the heritage building and impacts on the St. Gabriel Church building.

With regards to noise, dust pollution and vibration level resulting from the construction activities, the project team gave assurance that the level of noise and vibration will be strictly controlled to an acceptable state. The project will employ modern construction technologies with improved application to suppress noise and vibration as the task to conserve the heritage building is the major requirement for the project. Furthermore, all construction activities including loading and unloading operation will be conducted in line with YCDC's regulations and the project will place night restriction for operations that generate noise. Noise associated with piling work has been considered and the quietest method will be applied. In addition, the pile foundation activities are planned to take place during day time. Test pile foundation installation had already been carried out and the noise level did not exceed the common daily noise around the project site. Additional noise reducing measures will be introduced in the project as well. Dust suppression applications such as dampening the area before an activity and placing appropriate dust screens and covers around the working areas will be applied to minimize dust pollution. Demolition will maximize the use of mechanical pressure crushing method floor by floor. Mechanical pressure crushing method that generates very minimal noise and vibration is planned for sequential demolition with rigorous monitoring and inspection with the aim to protect the heritage building and the nearby infrastructures from noise and vibration impacts. With these measures, noise, dust pollution and vibration outside of the project compound will be reduced to the normal state. Noise, air quality, dust pollution and vibration from the construction activities are being monitored monthly using monitoring devices mounted on nearby buildings.

In relation to waste management, the project team indicated that as a project with the funding from IFC and the World Bank, it is important to minimize environmental and social impacts. All the wastewater will be treated to an acceptable level and recycled and use in air conditioning systems. Only compressed sludge will be hauled away for proper disposal by YCDC Pollution Control and Cleansing Department. Non-hazardous wastes will be placed in sanitary storage bins and transferred to the city's municipal department for proper disposal.

As for increasing traffic congestion and damages on the roads due to the project's construction, the project tasked Meinhardt (Thailand) to carry out traffic study and analysis. The project's traffic flows are planned and sequential construction stages are arranged to ease up the traffic congestion in the construction period. Ingress and egress will be properly established to prevent traffic being slow-down by construction vehicles. All construction vehicles will be properly parked within the compound and hauling operations will be arranged during off-peak hours. Occasionally when there is an urgent need to employ a number of construction vehicles, the public will be informed ahead in time. The project will employ strict safety regulations to minimize the risk factors. In terms of the damages to the road by the construction activities, all the project's vehicles will comply to the YCDC's weight limit and sequential operations will be arranged to reduce additional traffic congestion.

In response to the question of the project's arrangement for the current employees, the project team responded that all employees had been consulted earlier and were given options of either re-employment in a new place or appropriate severance compensation.

As the heritage building is located within the project compound, demolition application employing explosives would not be feasible. The project plans to employ mechanical pressure

crushing floor by floor in order to minimize generation of noise and vibration. One level of basement parking will be established under the footprint of the heritage building as described in the design. Reaction frames will be installed to support the heritage building before the excavation for basement parking commences. Reputable international contractors will be engaged to monitor, conserve and protect the heritage building from the construction related impacts. This method has been commonly used in Singapore and other countries for a long time. In response to the width of the pedestrian walkway, narrowing of the current walkway was not the due to the fencing the project compound but it was the result of road expansion by YCDC. After completion of the project, a much wider pedestrian walkway is guaranteed as illustrated in project 3D images.

Regarding to the building strength for earthquake resistance, the buildings' structural resistance to earthquakes is designed in compliance with CQHP design requirements for earthquake zone 2B where the Project site is located. As for accountability, the Project Proponent is solely responsible for the conservation of the heritage building. The Project has been carefully planning all its activities to prevent any mishaps. In response to geological survey question, geological and soil surveys were conducted prior to the design stage. Pile foundation is planned to reach up to 50 – 60 m in depth. With regards to the queries on protection of the heritage building from construction impacts of four other buildings in the compound, the project team responded that the diaphragm wall system will be employed. The heritage building will be first supported by reaction frame before the basement parking is construction. Noise and vibration will be closely monitored throughout the construction stage.

Participants from St. Gabriel Church were concerned about the impacts on its building. They believed that the previous construction activities had caused cracks in its building and, therefore, assurance for preventing further damages was requested. The project team responded that the technology has improved a great deal in 20 years and the project will employ modern technologies to prevent damages to both the heritage building and the church infrastructures. In addition, pre-condition surveys will be conducted to assess and register the existing state of infrastructures in the church compound and monitoring devices will be installed to regularly check the impacts. The church committee has been encouraged to immediately report any abnormalities observe in the infrastructures. The project will inform the church committee in advance of the pre-condition surveys so that the church committee can join the project team for the survey.

If there are any disruptions to the public during construction, the public can bring up the matters to the project management right away and the public's concerns will be addressed promptly. In response to public distrust of any project for not keeping their words, the project team has made the assurance that it will keep its promise and that it was the fundamental purpose of this public consultation to give the voice to the public and to address the public concerns transparently.

The mitigation measures for the noise and vibration, hazardous and non-hazardous waste management, traffic and transportation, health and safety, landscape and visual during construction phase and operational phase are stated in the table of environmental and social management plan based on the result from consultation.

9.4 Further Ongoing Consultations

The Project Proponent considers that further consultations with all stakeholders are necessary and the project proponent makes the commitment to consult frequently.

The project plans to inform the stakeholders after EIA is approved. Various departments from YCDC, Ministry of Construction, Myanmar Railways, ECD from MONREC, and other administrative bodies will be consulted frequently to seek their inputs in the development of the Project.

The general public will be informed regularly and consulted to seek their views, concerns, and inputs even if no complain is made for the project activities. Occasional meetings with St. Gabriel Church committee will be arranged to review the pre-condition survey results and the development progress. Random informal meeting with the other project affected people will be arranged to press further concerns.

All views, concerns, and inputs from further ongoing consultations will be registered and given due consideration for timely modification of the development plans.

9.5 Disclosure

At the corporate level, MDL has developed its corporate level ESMS, including the development of Standard Operating Procedures on stakeholder and community engagement (addressing grievance mechanisms) appropriate to the scale and complexity of the environmental and social risks/impacts associated with the Project. The ESMS has been in place since mid-2014.

In March 2014, a bilingual English and Burmese language advertisement was placed in a major local newspaper in Yangon to inform the public about the Project and that the Environmental and Social Review Summary and Action Plan prepared for the project are available for access and consultation (refer to **Figures 9.1** and **9.2**).

Following the official signing of master lease agreements, the announcements of investment through Landmark Development were made on 26 July 2016 in both English and Burmese languages on FMI website. Copies of this Myanmar announcement were distributed to the residences and shops in the nearby areas through the relevant administrative departments in July 2016. A news coverage for the project was observed in the Popular News on August 4, 2016. An editorial describing about the project was published by Pyithu Ayay on August 16, 2016.

The project management is committed to release timely and relevant information to the public.

SYDNEY

Chinese property investment faces Australia scrutiny

An increase in Chinese investments is being met with criticism from local buyers who claim they are losing out

FOREIGN investment in Australia's housing market will be examined by a national parliamentary committee, its chair said last week, following a study that said Chinese investors are squeezing out local buyers.

Kelly O'Dwyer said the House Standing Committee on Economics inquiry into affordable housing would probe the foreign investment framework to see whether it helps increase housing stock, and whether it is driving up prices.

"We know that the great Australian dream is to own your own home and we know that that's pretty difficult - even with two incomes and lots of years of savings and a large mortgage," Ms O'Dwyer told ABC radio.

"So we want to make sure that we're not making it even more difficult."

BILLION

$36

Credit Suisse's estimate of what Chinese investors could spend in Australia's residential property over the next seven years

Chinese investment is a sensitive issue in Australia, where rural politicians have argued against selling valuable farm and mineral land to foreigners, and there are indications of an influx in Chinese investors in housing.

Investment bank Credit Suisse this month estimated that Chinese investors could pour AU$40 billion (US$36 billion) into Australia's residential property over the next seven years and this could push up prices in what is already one of the world's most expensive housing markets.

In a report, Credit Suisse said Chinese buyers - who are restricted to buying only new homes - purchased 12 percent of new housing across Australia per year.

But they concentrated their buying in Sydney and Melbourne, acquiring 18 pc and 14 pc of new supply respectively, meaning they were a much more powerful force in those cities where home prices are climbing.

"The Reserve [central] Bank governor made some comments in the recent parliamentary oversight hearing of the Economics Committee, where he said all foreign investment does have an effect on prices," Ms O'Dwyer said.

"We want to know though whether or not the current laws and the current framework is being properly adhered to and whether it is a truly distorting impact."

– AFP

FRANKFURT

Heidelberg Cement is confident for 2014

HEIDELBERG cement, a leading producer of building materials, said last week it expects sales and earnings to grow this year as it benefits from the emerging recovery in key markets.

"The management board has set the goal of further increasing revenue, operating income and profit for the financial year in 2014 on a comparable basis," Heidelberg Cement said in a statement.

"In 2014, we will benefit from the economic development in the industrial countries, particularly in North America, the United Kingdom, Germany, and northern Europe," said chief executive Bernd Scheifele.

Those countries generated nearly half of the group's revenues.

"Furthermore, we are improving our market position in growth markets with the commissioning of modern production facilities. In view of these factors ... we consider ourselves well-equipped to benefit over-proportionally from the accelerating economic growth," Mr Scheifele said.

Last year, Heidelberg Cement posted its "best results since the financial crisis", the CEO said.

Net profit jumped 79 percent to 945 million euros (US$1.3 billion) and underlying or operating profit was unchanged at 1.607 billion euros ($2.23 billion), while sales slipped by 0.6 pc.

– AFP

Yoma Strategic Holdings Ltd. plans to develop and operate a mixed use complex in downtown Yangon. As part of its due diligence, the International Finance Corporation (IFC) has publicly disclosed the project's Environmental and Social Review Summary and Action Plan. Anyone interested in accessing these documents can contact the company as follows:

Business Development Department
Yoma Strategic Holdings Ltd. Tel: +951 240 363; 240 373
Fax: +95 1 246 881; 246 882

Israel approves 186 new east Jerusalem homes: councillor

ISRAEL granted final approval last week for plans to build another 186 new homes in annexed Arab east Jerusalem, a city councillor told AFP.

Yosef Pepe Alalu said the city's local planning council had granted "final approval" to plans to build 40 new homes in Pisgat Zeev and 146 in Har Homa.

Both are settlement neighbourhoods built on territory seized by Israel during the 1967 Six Day War and later annexed in a move never recognised by the international community.

The decision comes as US-led peace talks teeter on the brink of collapse ahead of an April 29 deadline, with Washington fighting an uphill battle to get the sides to agree to a framework proposal to extend the negotiations to the year's end.

So far, the Palestinians have flatly refused to countenance any extension, partly due to Israel's ongoing settlement construction which has shown no let-up since talks began in late July 2013.

Lior Amihai, a spokesperson for the settlement watchdog Peace Now, said, "This is a sad decision by the Jerusalem municipality, with the government's approval, to advance the construction of 186 new homes in east Jerusalem as the international community is trying to keep the negotiations alive." *– AFP*

Ultra-orthodox Jewish boys wearing costumes stand on the balcony of their house in Jerusalem during the Purim holiday March 17. The Israeli government is moving forward with its controversial plans to expand construction of new homes in disputed territories. Photo: AFP

FEATURE

Boosting Ethiopia's economic growth with building boom

ABOVE Addis Ababa's concrete skyline, cranes tower high amid blasts from nearby drills and diggers. At the feet of buildings shrouded in bamboo scaffolding, excavators dig up dirt tracks, to be replaced by paved roads and a modern railway.

It is a scene common to most neighbourhoods in the Ethiopian capital, which has turned into a giant building zone and a city in transformation.

"It looks like a construction site when we compare from the previous time," said Berhanu Kassa, manager of B.B. Construction in the Ethiopian capital.

"Especially in the past five years, it's a really big change," he added, speaking at the site of his latest project, a mixed-use commercial building on one of the city's main thoroughfares where workers unload concrete slabs from a delivery truck.

Addis Ababa's construction boom - funded both from private and public coffers - is being driven by the country's recent rapid economic growth.

But the government hopes it will attract further investment and help industrialise the economy in order to reach middle income status by 2025.

The public works projects, worth billions of dollars, include new roads, railways and massive power generation schemes across the country.

Meanwhile the majority of new buildings are owned by private investors, who by law must be Ethiopian citizens.

The development promises to boost Ethiopia's economic growth, officially 9.7 percent last year, though the International Monetary Fund (IMF) pegs it at closer to 7pc.

"The basic engine blocks of economic transformation are the infrastructure," said Zemedeneh Negatu, managing partner at Ernst & Young in Ethiopia.

"The Achilles heel of Africa is power, lack of power, lack of road networks, lack of the basic needs that you need to transform your economy."

But analysts point out that the boom in construction is also a symptom of the weakness of the financial system, which leaves the business community with few investment opportunities outside of the sector.

"This is the most attractive investment opportunity in the country for the time being since we do not have a financial market that is working properly," said the head of the IMF mission in Ethiopia, Jan Mikkelsen.

"There's no financial markets, no stock exchange, so real estate investments seem to be the most attractive from that point of view," he added.

The majority of the new buildings are hotels, apartments and offices.

Most are being built by Ethiopian-owned construction firms, though foreign-owned contractors from China or Turkey are cashing in too.

The government said the big push in the sector - which is bolstered by state-led incentives such as tax breaks and ready access to land - is driven by the need to create jobs for Ethiopia's 91 million people, about one in four of whom are unemployed.

"We are struggling to eradicate poverty and create jobs," said Desalegne Ambaw, state minister for urban development and construction.

Officials say 4 million jobs have been created in the last three years, including an increase in construction sector employment.

But Mr Mikkelsen warns that resources should not be pooled too heavily into infrastructure projects, no matter how crucial for development.

"There is a need for construction, but of course there's a limit to how much you can get out of that and these are potential resources that could have been used for other means and maybe more export-oriented businesses as well given that there is an urgent need for more foreign exchange," he said.

Imports outweigh exports by a factor of four, according to IMF data, which starves the country of foreign exchange.

The ambitious state-funded infrastructure projects also threaten to strain public finances in Ethiopia.

IMF forecasts see the public deficit possibly swelling to 44pc of gross domestic product within several years, nearly double the current level that means the country is borrowing a fifth of what it spends.

As it is, the financing shortfall for public works projects is already 10pc of GDP.

But for now, Mr Berhanu said he is grateful for the government's focus on the construction sector, since his business is booming.

"From a business perspective we are busy. Sometimes it is even beyond our capacity," he said, adding that his company has grown from three people to over 300 over the last 20 years.

Mr Berhanu said Ethiopia's economic growth is fuelling the expansion of his business by creating a demand for new infrastructure, and he in turn was contributing to this by creating employment and supporting local industries.

"I hire a lot of workers here, I use a lot of local materials, I use a lot of subcontractors, and because of that all we grow together and the country benefits," he said.

Mr Zemedeneh is confident it will continue to attract investors from abroad who witness the country's growth for themselves and said he only expects the city's transformation to continue.

"The bottom line is you will not recognise Addis if you come 10 years from now. It will be a completely, completely different city," he said.

– AFP

Figure 9.1: Public Announcement in English

ENVIRON

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Figure 9.2: Public Announcement in Burmese

ENVIRON

10 Conclusion

This ESIA study has assessed the potential environmental and social impacts arising from redevelopment of MDL's existing 6.35-acres plot in Yangon into a premium mixed development scheme comprising residential, commercial, retail and hotel components. Mitigation measures to manage and control the predicted impacts have also been recommended and are included in the ESMP.

The findings of this report indicate that the predicted impacts arising from the construction and operational phases of the Project can be effectively mitigated and minimised to meet regulatory limits with the implementation of appropriate mitigation measures. The recommended mitigation measures include technologically sound practices as well as the implementation of good international industry practice. The findings also show that there are no long-term detrimental or harmful impacts that cannot be mitigated.

To ensure the effectiveness of the mitigation measures, an ESMP, which includes requirements for periodical environmental monitoring and audits for the construction and operational phases of the project will be developed and implemented. This is to ensure that all recommendations of this ESIA and the requirements of the relevant government agencies upon approval of the ESIA will be executed by MDL as the Project Proponent.