

# Initial Environmental Examination

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April 2017

## Myanmar: Third GMS Corridor Town Development Project “Kayin State” (Part 3 of 3)

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The OHS Plan will address the following obligations:

- To identify health and safety hazards associated with construction activities (e.g., working at heights, work in confined space, permits to work, excavations and trenching, etc.), establishment and operation of construction/worker's camps, use of heavy equipment, transport and handling of materials and hazardous products (fuel);
- To ensure no UXO may remain on site prior to start excavation works (mine detection program);
- To propose for each potential risk appropriate and realistic prevention measures;
- To appoint an Environment, Health and Safety (EHS) Coordinator to look after implementation of required EHS measures, and to ensure the safety of the public in the vicinity of construction areas;
- To conduct awareness training for construction workers regarding occupational health and safety measures, hygiene, emergency response in case of accidents, fire, etc., and prevention of water related diseases;
- To provide first aid facilities in all working sites, particularly in those located outside the urban area: first aid kits in sufficient numbers with content complying with OSHA standard No. 1910.266 App.A, first aid officer present any time on site during working hours (at least 1 first aid officer per shift of 10-50 workers), first aid officer and stations clearly identifiable on sites;
- To provide fire-fighting equipment (extinguishers) on the work sites;
- To provide adequate accommodation for all workers living in a worker camp including building of acceptable quality, room size, sleeping equipment (bed, mattress, sets of bed sheets and blanket, mosquito net, storage area, light etc. ESHS specifications for bidding documents will elaborate in detail on all these requirements.. It is anticipated that the worker camps will accommodate only a limited number of workers as most of them should be resident either in Hpa-An or Myawaddy and should not require accommodation in camps;
- To provide reliable supply of potable water on work sites and in camps controlled at least on a weekly basis for residual chlorine and coliforms;
- To provide separate hygienic sanitation facilities/toilets and bathing areas with sufficient water supply for male and female workers.
- To establish clean canteen/rest area.
- To ensure proper collection and disposal of solid wastes produced within the construction and camp sites.
- To provide solid fencing on all areas of excavation greater than 1 m deep. For all worksite areas without excavation, provides movable barriers to prevent accident with surrounding residents.
- To provide personnel protection equipment (PPE) appropriate to the job: at least helmets and safety boots to all workers, and depending on job safety risk, to provide also gloves, protective clothes, goggles and ear protection where justified and ensure the equipment is effectively and adequately used.
- To ensure reversing signals are installed on all construction vehicles.
- To implement fall prevention and protection measures whenever a worker is exposed to the hazard of falling more than two meters, of falling into operating machinery or of falling through an opening in a work surface. Based on a case-

specific basis, fall prevention/protection measures may include installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area, proper use of ladders and scaffolds by trained employees, use of fall prevention devices, including safety belt and lanyard travel limiting devices to prevent access to fall hazard, fall protection devices such as full body harnesses, etc.

- To secure all construction sites inside urban areas from entering for the surrounding population and particularly for children.

#### **5.4.9 SUMMARY OF IMPACTS AND MITIGATION MEASURES**

Table [29] summarizes the impacts identified and the corrective measures proposed for the Third GMS Project Components during the construction period. For the meaning given to the evaluation of the impact, see Section 5.1 on Methodology for Impact Assessment.

**Table [29] POTENTIAL IMPACTS AND MITIGATION MEASURES RELATED TO PROJECT CONSTRUCTION**

Component or activity	Potential risks	Description of Potential Impact	Impact assessment			Corrective or support measure	Easiness of Implementation	Overall Risk after Correction
			Probability	Gravity	Overall Risk	Description of Measure		
Land preparation	Excessive destruction of trees	Limited impact for the whole project. Most of the project sites proposed in Hpa-An and Myawaddy is in forested areas. Mainly individual trees may be affected in urban area when rehabilitating and expanding the water supply network. Demolition of the Bar-Mae Hill reservoirs in Hpa-An followed by construction of new reservoir may impact, surrounding dense forest,	3	1	1	Monitoring of tree cutting by PIC, and maximization of conservation	1	1
			3	1	1	Mitigation greening program considering at least 2 trees planted for 1 mature tree cut. Consider plantation of a greenbelt around the landfills, at least 50 m width using fast growing trees as Eucalyptus or other appropriate local species, to create a buffer zone with surrounding development areas.  In Bar-Mae Hill, detailed design of reservoir to adapt to available area without tree cutting. Any request by Contractor for tree cutting shall be submitted to non-objection of PMO and Kayin State Forestry Dept. Monitoring by PMO & KSFD	1	1
	Destruction of protected tree species	Based on literature and direct observation, none of the species identified in Hpa-An or Myawaddy has a status of protected species (national or international)	1	2	1	Vigilance of the PIC during land preparation activities	1	1
	Interference with compensation & resettlement	Construction works start while land acquisition is not completed, raising conflicts with concerned owners. Risk limited but possible	1	3	2	Procedure with issuance of a land access certificate by PMO as a prerequisite for authorizing contractor to access the land.	2	1
						Monitoring by PIC of compensation progress and of issuance certificate	1	1

Component or activity	Potential risks	Description of Potential Impact	Impact assessment			Corrective or support measure	Ease of Implementation	Overall Risk after Correction
			Probability	Gravity	Overall Risk			
Workers' camps	Pollution of surface water and groundwater	Wastewater discharged into the environment	3	2	2	Wastewater receives treatment before being released outside premises in compliance with MONREC domestic effluent standards	2	1
						Contractor to monitor the quality of effluents released outside the bounds of the camps	2	1
	Zones of stagnant water	Proliferation of water-borne disease vectors as dengue fever or malaria	2	3	2	Create and maintain ditches to ensure efficient drainage and drain all stagnant water zones in camp	2	1
						Regular treatment of living areas with pesticide in compliance with authorised pesticides in Myanmar and EHS IFC guidelines	2	1
	Health risks	Development of diseases among workers because insufficient hygiene in camps and construction sites	2	2	2	Systematic awareness sessions for all new arrivals at the camp: meetings, posters in circulation areas, monitored by the camp chief	1	1
		Risk of epidemics in the camps	2	2	2	Prevention by automatic medical check-up at hiring	1	1
						Monitoring of hygiene conditions at the camps	2	1
						Anti-malarial prophylaxis, including mosquito netting	1	1
	Workers' living conditions	The most serious impact would be the contractor not providing acceptable housing and subsistence for workers.	2	3	3	Include detailed specifications on camp equipment and management in the tender documents. Enforce contractor obligations on site by regular site inspections (PMO)	1	1

Component or activity	Potential risks	Description of Potential Impact	Impact assessment			Corrective or support measure	Easiness of Implementation	Overall Risk after Correction
			Probability	Gravity	Overall Risk			
	Non-potable water supplied to workers.	Impact on public health, risk of epidemic. Main risk at the WTP and landfill sites where worker camps may be installed. Other project components located within urban areas, where camp facilities may not be required. However, water supplied on construction sites may also be of bad quality with impacts on worker's health	1	3	2	Tender documents to define obligations of contractors regarding supply of potable water in camps and on construction sites.	1	1
						Contractor and PMO to regularly monitor coliforms or residual chlorine (if not industrial drinking water bottles supplied) ) by reference to MONREC/WHO standards	2	1
Workshops and garages	Water and soil pollution	Such facilities should not be required in the urban area. One workshop may be installed near the landfill component considering extent of civil works. Storm water drainage contaminated by pollutants (mainly oil & grease)	3	2	2	Drains of workshops and garages equipped with oil separators	2	1
						Properly store hazardous products (including hydrocarbons). See activity "Use and storage of hazardous products"	1	1
						PMO to monitor and control used oil: Monitoring registers/logs and dedicated storage areas.	1	1
Excavations in urban area	Loss of cultural resources	Possible archaeological physical resource discovery during excavation work with the total loss of the relic if special measures are not taken.	1	2	2	Put in place a "Chance to Find" procedure aimed at halting work and warning the supervisors and the national authorities concerned for conservation measures to be taken to preserve the discovery and restart work as quickly as possible. Ensure personnel are aware of the procedure.	1	1
Hazardous waste management	Water and soil pollution	Located in urban area, most truck maintenance will be done in private garages. Only heavy machinery will	3	2	2	Require the contractor to prepare a hazardous waste management plan explaining where and how he will manage used oils	1	1

Component or activity	Potential risks	Description of Potential Impact	Impact assessment			Corrective or support measure	Easiness of Implementation	Overall Risk after Correction
			Probability	Gravity	Overall Risk			
		receive basic maintenance and refuelling on site.				Use storage sites that meet safety standards (with retention)	2	1
		Limited volumes of used engine oil and used hydraulic oil will be produced on site and will need appropriate storage to avoid soil and water pollution				Identify the existing used oil recycling facilities in Hpa-An and Myawaddy (none identified so far except re-use as paint for wood houses). Identify possibility of treatment in Thailand.	1	1
						Contractor to maintain a log of production/recycling of used oil	1	1
Production of non-hazardous solid waste	Water and soil pollution	By domestic waste: Possible impact if the waste is not managed in line with best practices in the worker camps and construction sites.	3	2	2	Contractor to submit a Solid Waste Management Plan including methods and procedures for (i) Awareness training of workers, (ii) collection and storage of waste on project sites, (iii) selective collection and recycling of waste (iv) eventual collection and disposal of waste, (v) coordination with Hpa-An and Myawaddy TDC/Development Affairs Committees/ Cleansing Departments	1	1
		By construction waste: Limited risk for inert products which may be associated to the fill required for other project components	2	1	2	Ensure recycling of metals, plastics and glass	2	1
Concrete production	Water pollution	Typical impact is water pollution by the alkaline wastewater from equipment and concrete trucks cleaning. This may concern the WTPs and the intakes in Hpa-An and Myawaddy.	2	2	2	Install a sedimentation pond with pH buffering before release of water in the natural drainage system	2	1
						Contractor (and PIC) to monitor the quality (SS, pH) of effluent released	1	1

Component or activity	Potential risks	Description of Potential Impact	Impact assessment			Corrective or support measure	Easiness of Implementation	Overall Risk after Correction
			Probability	Gravity	Overall Risk			
Spoil Disposal	Excessive use of productive land to dispose the spoil	Spoil expected particularly from the demolition of the Bar-Mae reservoirs and land excavation for WTP	3	1	1	Contractor to identify surrounding development projects involving land reclamation in low lying areas which could benefit the availability of spoil.	-	-
		Spoil from landfill construction to be disposed over productive land in Hpa-An and Myawaddy	2	2	2	Spoil could be stored on the landfill area for use as cover soil for waste during landfill operation or used as fill for extension of nearby IZ or TZ	1	1
Road Traffic	Public safety	Risk of road accidents related to truck traffic increase in urban zones for the transport of equipment and materials. Limited increase is anticipated as works will require limited quantities of materials/equipment (	2	3	2	Selected hauling routes and preventive/monitoring measures to be presented by the contractor in the Road Traffic and Access Plan	1	1
						Monitoring of driver behaviours in relation with Police Department	1	1
	Risk of traffic disruption in urban zones	Most sensitive areas in small streets concerned by rehabilitation of water supply network.	3	2	3	Road Traffic and Access Management Plan to be prepared by contractor shall detail procedures for traffic management: coordination with police, public information, signs and safety etc.	2	1
	Air pollution	Excessive exhaust gas emissions	3	2	2	Keep engines serviced	2	1
		Production of dust	3	2	2	Speed control, regular sprinkling of sensitive urban areas and on construction sites, cleaning of truck wheels when exiting muddy sites	2	1



Component or activity	Potential risks	Description of Potential Impact	Impact assessment			Corrective or support measure		Overall Risk after Correction
			Probability	Gravity	Overall Risk	Description of Measure	Easiness of Implementation	
Handling of hazardous products	Fire risk	Related to the storage of flammable products: hydrocarbons, paints, solvents. Potential risk on most sites involving heavy machinery	1	3	2	Provide fire equipment (extinguishers, fine sand) and safety posters displayed at each site.	1	1
						Set up a safety procedure and awareness/training for personnel concerned.	1	1
	Risk of accidents to personnel	Skin burning during handling operations, but risks quite limited for such type of project (few hazardous products only)	1	3	2	Provide training for personnel plus personal protective equipment and onsite safety data sheets for the products concerned	1	1
	Water pollution	Potential risk of accidental spillage: Leak in a storage tank, accidental spillage when handling or refuelling engines, road accident when transporting hydrocarbons.	2	3	2	Contractor to prepare hazardous products management plan, in particular: Store using containment trays, measures for preventing and detecting leaks and accidental spills, register/log of hazardous products and their use, antipollution equipment.	2	1
		Works on water intakes more sensitive as in Hpa-An and Myawaddy existing water intakes operate downstream project works.				Emergency response procedure in the case of accidental spillage	2	1
		Special safety procedures for refuelling engines onsite				1	1	

Component or activity	Potential risks	Description of Potential Impact	Impact assessment			Corrective or support measure	Easiness of Implementation	Overall Risk after Correction
			Probability	Gravity	Overall Risk	Description of Measure		
All Components and Activities	Occupational Accident of workers	As observed at on-going construction sites in Hpa-An or Myawaddy, occupational safety of workers is almost inexistent, with high risks of injuries and accidents during construction activities	3	3	3	Contractor to prepare and enforce a Health and Safety Plan to describe organisation, prevention and measures in case of accident. Particular attention dedicated to measures in urban areas (rehabilitation/extension of water supply network)	2	1
						Obligation of Personal Protective Equipment (PPE) for all workers on project sites, minimum being helmet and safety shoes	2	1
						Main contractors to designate a HSE Coordinator to ensure safety measures are enforced on sites	2	1
						Regular construction site inspections of PIC	1	1

## **5.5 Impacts during Operation stage**

### **5.5.1 IMPACTS ON/FROM FLOODING**

#### In Hpa-An

The water intake in Hpa-An is implemented along the Thanlwin river bank. The design takes already into consideration the fluctuation of river water level between dry and wet season and includes an additional safety board which covers for the potential sea level rise which will subsequently impact the Thanlwin level. All sensitive electro-mechanical equipment shall all be located above the maximum anticipated water level.

Impact of abstraction on the river regime is insignificant. Indeed, the project will pump 10 000 m<sup>3</sup>/day or 115 l/s. Other existing pumping systems on the river for the water supply of Hpa-An is estimated at 3 500 m<sup>3</sup>/day, or 40 l/s. Total abstraction after project implementation will be about 150-200 l/s, or only 0.01% of the Thanlwin low flow discharge (2 000 m<sup>3</sup>/s). There is no anticipated impact on other current river uses.

The water treatment plant site is located in an area located next to the city lake and regularly flooded when the water level of the lake rises during the wet season. The lake level can depends on the Thanlwin river level as a sluice gate is installed at its outlet. The dike road next to the site is reported by the authority as having never been flooded. This level, which is about 3.5 m above the site bottom level shall be considered as the minimum safety level for the plant and is already considered in the design.

#### In Myawaddy

In Myawaddy, the project does not intend to pum directly in the river but to pump from a draining gallery developed in the alluvial aquifer. There is no direct impact on the Thaungyin River. The design of the facility follows the same flood safety principles than anticipated for Hpa-An, in particular all sensitive electro-mechanical equipment shall be secured in a building well above the maximum anticipated water level.

The water treatment plant located in a wide agricultural area shall not be subject to flooding.

None of the project components in Hpa-An and Myawaddy is in a position to generate flooding or to increase flooding conditions. The improvement of solid waste collection in both towns will have direct beneficial impacts on urban drainage which is presently severely clogged by dumped waste, resulting in localised flooding during heavy rainfall events.

### **5.5.2 IMPACTS ON UNDERGROUND WATER RESOURCES**

The water supply components of the project in Hpa-An relies on surface water sources and does not exploit underground resources. The proposed infiltration gallery in Myawaddy will exploit sub-surface water from the Moei River baseflow. Extraction rate will be 9 000 m<sup>3</sup>/day (or 100 l/s) in addition to present water pumping in the alluvial aquifer of about 2 000 m<sup>3</sup>/day (or 23 l/s). With a total abstraction rate of about 125 l/s in the alluvial aquifer, it represents only around 2.5% of the river low flow estimated about 5 m<sup>3</sup>/s.

In the long term, the Project may have indirect beneficial impacts on the underground water resources:

- The water supply component will significantly increase the water supply of the population both in terms of duration of service, volumes and quality of water. Considering that presently people rely partly on low quality underground water (from shallow wells) and on septic tanks for their sanitation, the project will increase the volume of water released to the soil by septic tanks and eventually reduce the dependency on shallow wells, thus improving aquifer recharge;
- The solid waste component will drastically increase the quantity of waste collected and safely disposed in the landfill. At landfill site, leachates will be collected and treated. This component will definitely reduce the pollution load from solid waste which presently percolate into the soil and affects the underground water quality.

However, if leachates from waste piles is not appropriately collected and treated before being released in the environment it may have significant impacts on underground water quality with health threats for the surrounding population relying on shallow wells.

The project design as presented in the Project description Section of this report fully considers this risk and provide for a full collect, treatment and disposal process for the leachate:

- The landfill cell bottom and side slopes will be fully covered by an impervious liner made of high density polyethylene (HDPE) minimum 1.5 mm thick with sheets weltd together by a specialized company;
- A drainage system will cover the bottom of the cell including layers of gravels of various grain size with a network of drainage pipes to collect the leachate;
- The leachate will be transferred into an on-site treatment process including physical treatment (sedimentation, settling pond) and biological treatment (oxidation pond);
- Environmental monitoring includes 6 groundwater monitoring wells, 1 well up-gradient of the groundwater flow and 5 wells along the sides in down gradient direction, all wells 30 m away from landfill;

The organic load of the leachate shall be reduced as a part of the biodegradable waste will be diverted to the composting plant to be developed on the landfill site. The composting plant will have a design capacity of 65 t/day, for the treatment of 25% of the generated waste till 2025. In a second stage, the target is to compost 40% of the generated waste with a capacity of 120 t/day. Composting pad, maturing pad and storage pad will be covered, reducing the volume of leachate produced. Leachate produced by the composting plant will be drained and transferred to the leachate treatment facility.

Compost production is intended to be used for agriculture or green urban areas. To maximize the usability of end products (compost), waste should not be accepted that contains organics that are contaminated by potentially hazardous chemicals (e.g., PCBs, chlordane and other pesticides, heavy metals and metalloids) and/or pathogenic substances and micro-organisms (e.g., prions, viruses, bacteria, and parasites) that will not be rendered harmless by the process or may constitute a health or environmental risk. This may include certain clinical waste and other

related wastes of clinical origin, and diseased carcasses, or contaminants classified as hazardous or industrial wastes.

### 5.5.3 IMPACTS ON SURFACE WATER QUALITY

The solid waste component of the Project will have major impact on surface water which is, presently the main receiving body for most of the solid waste generated in Hpa-An or Myawaddy. At the existing dumping site in Hpa-An, leachates are presently released into surface water without any treatment. In Myawaddy, dumpsites are located on the banks of the Moei River, with direct discharge of leachate into the river during dry season and flooding of the dumpsites in wet season. The drastic improvement of solid waste collection and disposal will remove these present sources of pollution but also reduce the pollution load to the drains which eventually flow to the Thanlwin and the Moei rivers.

Waste will be weighted at entrance on the landfill site, then discharged on a platform for sorting and segregating the waste: organic waste to be directed to the compost plant, recyclable waste, hazardous waste (including infectious waste from hospital and clinics) and other dangerous items (gas containers, explosive products, etc.).

Water treatment plant will generate sludge from the treatment process, with potential but limited risk of pollution for water resources. The volume produced may be significant during the rainy season, when turbidity of the Thanlwin River is high. The project anticipates the installation of a thickener to reduce the volume of sludge on site before disposal. It may be considered the use of the thickened sludge as daily soil cover for the landfill. The sludge will consist mainly of mineral material and chemicals used for flocculation is not anticipated to concentrate harmful pollutants.

Treatment of water at WTP level will rely on liquid chlorine. Liquid chlorine may involve a risk of accidental spill. This risk shall be mitigated by a dedicated storage area with an active retention capacity of at least 110% of the largest container capacity stored on site. Dedicated safety training shall be organised for the workers in charge. No residents at risk in the immediate vicinity of the plant.

Measures for the protection of the resource shall also be implemented.

- Ensure no harmful industry discharge untreated and toxic effluents at short distance upstream the water intake/pumpage;
- Ensure that treatment capacity is adequate to meet anticipated demand;
- Construct, operate and maintain the water treatment facility in accordance with national requirements and internationally accepted standards to meet national water quality standards (equivalent to WHO Guidelines for Drinking Water Quality);
- Evaluate the vulnerability of the treatment and storage systems and implement appropriate security measures, such as background checks of employees, perimeter fencing and video surveillance, improve the electrical power feeds to the facilities by secondary stand-by equipment to reduce the vulnerability risk to essential operations.

### **5.5.4 IMPACTS ON URBAN ENVIRONMENT AND QUALITY OF LIFE**

The Project components will eventually contribute to a healthier and cleaner urban environment. Improvement of water supply capacity, rehabilitation/extension of networks and supply of treated water will reduce the population dependency to private or public shallow wells, most being significantly contaminated, and reduce population expenses related to the purchase of drinking water bottles. Improved collection of waste will contribute to reduce the risk for waterborne diseases among the population and will contribute to improve public health conditions of diseases transmitted through insects or rodents. Improvement of waste collection shall drastically improve the cleanliness of the city.

### **5.5.5 IMPACTS IN TERMS OF GHG EMISSIONS**

#### **Methodology**

Green House Gas (GHG) will be produced during construction and operation of the project components, water supply and solid waste management improvement. GHG production shall be limited during construction for both components, mainly related to exhaust fumes from trucks and other thermal machinery relying on diesel. During operation, the water supply component shall also release some quantities of GHG, mainly related to the use of electricity for pumps and treatment plant operation and to the transport of residual treatment sludge to the landfill. The amount released by such activities will be very limited.

However, GHG emissions from conventional solid waste management in Asian countries are considered to contribute significantly to global climate change: methane (CH<sub>4</sub>) emission from open dumping and landfilling is considered the third highest anthropogenic methane emission source (IPCC, 2006). These two processes are currently the most common waste treatment methods in Asian countries. In addition, GHG emissions (e.g. CO<sub>2</sub>, N<sub>2</sub>O) from waste handling, transportation and operation of machinery contribute also in GHG emission, but at a much modest level. Depending on the treatment processes considered, there is a possibility for important indirect GHG savings through materials and energy recovery from waste management which may even result in global GHG emission avoidance.

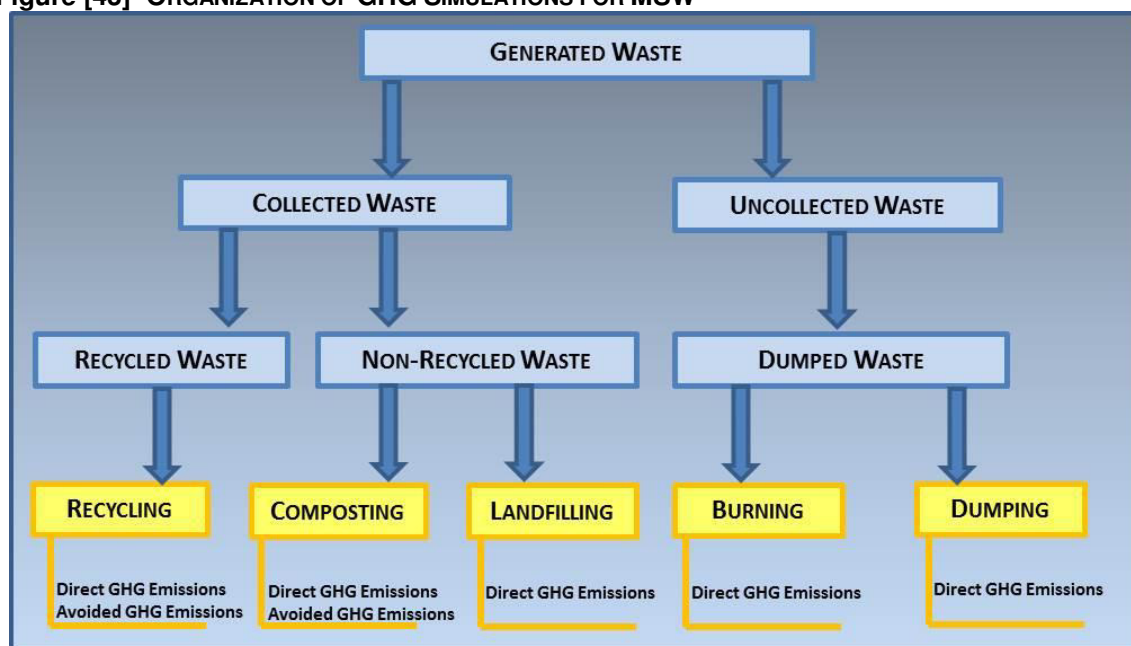
Thus, this section focuses mainly on GHG emissions from waste management components, as they shall provide most of the future emissions from Project components.

Simulations carried out by the PPTA Consultant to quantify GHG emissions from various waste management technologies rely on the IPCC 2006 guidelines from which the Institute for Global Environmental Strategies (IGES) simulation model was developed. The simulation calculates both the total GHG emissions and total GHG avoidance potentials of individual technologies. Based on the total GHG emissions and avoidance values, net GHG emissions are calculated from all the individual technologies considered in the Project.

The net GHG emission value reflects the overall climate impact/benefit of a particular technology taking into account the impact of all the possible resource and material recovery from the waste.

The simulation performed relies on the type of waste distribution in the municipal solid waste (MSW) and on the eventual treatment or disposal of the waste. The general waste processing organisation considered for simulations is presented in Figure 43.

**Figure [43] ORGANIZATION OF GHG SIMULATIONS FOR MSW**



Source: PPTA Consultant, 2015

In addition to these various processes for which GHG emissions and/or savings are estimated, an additional estimate is performed for waste collection and transport, mainly represented by the combustion of fossil fuel (diesel).

The main assumptions used for the estimate of waste types and quantities are those established by the PPTA Consultant in charge the waste management component and presented in the related Feasibility Study report. Assumptions regarding GHG production per unit of fossil fuel consumption and per unit of specific waste are those recommended by IPCC (2006) for the estimate of national GHG emissions. Decay equations are those recommended by IPCC (2006) and presented by the Institute for Global Environmental Strategies (IGES) from Japan in their Estimation Tool for Greenhouse Gas Emissions from Municipal Solid Waste Management in a Life Cycle perspective<sup>1</sup>.

**Table [30] MAIN SOURCES AND VALUES OF REFERENCES**

Topic	Source or Values of Reference
Waste Collection and Transportation	Diesel consumption estimated in FSR Diesel Energy content: 36,42 MJ/l diesel Diesel GHG emission factor: 0,074 kg CO <sub>2</sub> /MJ Uncollected waste is 53,17% of generated waste in 2015, 10% in 2020, 2% in 2040

<sup>1</sup>Tool developed by Nirmala Menikpura and Janya Sang-Arun under project « Measurement, Reporting and Verification for Low Carbon development in Asia » (2013)



Topic	Source or Values of Reference
Recycling	GHG emission based on recycling emissions from fossil fuel and electricity consumption from Thailand; Avoided emissions also based on energy required from related material production in Thailand (paper, aluminium, plastic, glass, metal) Recycling is 16% of generated waste in 2015 and 20% from 2020
Managed Landfill	Landfill gas: 60% methane and 40% CO <sub>2</sub> Equations regarding decay according to IPCC 2006 Waste Model Model considers emission without/with gas collection & flaring Waste disposed to landfill is equal to collected waste minus recycled and minus composted fractions
Composting	IPCC default emission factors: 4kg CH <sub>4</sub> and 0,3 kg N <sub>2</sub> O/ton organic waste (wet basis) Electricity: basis is Thailand grid emissions of 566 kg CO <sub>2</sub> eq/MWh Composted waste is 25% of generated waste in 2020 and 40% from 2025. 90% of the compost produced is re-used for agriculture or urban gardening as fertilizer substitute
Dumping	Similar to managed landfill but it considers more shallow deposits (<5m) and no collection of landfill gas. Fraction dumped in various locations of the city equivalent to uncollected waste, with 70% decaying as in shallow landfill (<5m)
Burning	Model considers only emission of CO <sub>2</sub> Quantity burnt is estimated as 30% of uncollected waste.

### Results

Results from the assessment are provided for Hpa-An and Myawaddy for years 2015, 2020 and 2040 in following table.

**Table [31] GHG EMISSIONS FROM MSW FOR HPA-AN AND MYAWADDY**

GHG Emissions (in tons CO <sub>2</sub> -eq/year)	Hpa-An			Myawaddy		
	2015	2020	2040	2015	2020	2040
Emissions from Collection & Transport of waste						
Direct Emissions from fossil fuel consumption	9	29	58	19	39	91
Net GHG Impact/Benefit	9	29	58	19	39	91
Emissions from Recycling of waste						
Direct Emissions from recycling	1725	7329	17364	4336	11334	29716
Avoided emissions from material production	-3194	-13567	-32144	-8028	-20982	-55011
Net GHG Impact/Benefit	-1468	-6238	-14780	-3691	-9648	-25295
Emissions from Composting of waste						
Direct Emissions from Plant Operation	N.A.	32	49	N.A.	36	97
Direct Emissions from waste degradation	N.A.	1050	3980	N.A.	1624	6811
Avoided emissions from fertilizer production	N.A.	-5231	-20918	N.A.	-7554	-36008
Avoided emissions from organic waste landfilling	N.A.	-2758	-10457	N.A.	-4266	-17896
Net GHG Impact/Benefit	N.A.	-6907	-27347	N.A.	-10161	-46996
Emissions from Landfilling of waste						



GHG Emissions (in tons CO <sub>2</sub> -eq/year)	Hpa-An			Myawaddy		
	2015	2020	2040	2015	2020	2040
Emissions of Methane Gas	64	345	592	225	534	1013
Emissions of Methane with gas flaring	N.A.	69	118	N.A.	107	203
Direct GHG emissions without gas flaring	1353	7264	12461	4726	11234	21326
Direct GHG emissions with gas flaring	N.A.	1451	2513	N.A.	2243	4300
Net GHG Impact/Benefit with flaring	N.A.	1451	2513	N.A.	2243	4300
Net Total GHG Emissions from Collected waste	-106	-11666	-39556	1054	-17527	-67900
Emissions from Uncollected Waste	-106	-11666	-39556			
Emissions from uncontrolled dumping	3640	801	413	3307	1239	708
Emissions from waste burning	796	45	4	723	70	7
Net GHG Impact/Benefit	4435	847	418	4030	1309	715
Net GHG Emissions from Generated Waste	4329	-10819	-39138	5084	-16217	-67185

Source: PPTA Consultant, 2015

At present (situation 2015), the highest contribution to GHG for Hpa-An is coming from uncontrolled dumping of waste (3 640 tons CO<sub>2</sub>eq in 2015) while in Myawaddy it is coming from collected waste disposed in the two dumpsites (4 726 t CO<sub>2</sub>eq/year). These figures are buffered in 2015 by the avoided emissions from the recycled waste, totalling 11 200 t CO<sub>2</sub>eq/year for the two cities. Present uncollected waste GHG emission is in a similar range for both towns, with about 4 400 t CO<sub>2</sub>eq/year for Hpa-An and 4 000 t CO<sub>2</sub>eq/year for Myawaddy in 2015. The annual net balance in 2015 is a GHG net emission of 9 410 t CO<sub>2</sub>eq/year for both cities.

With the project components, which intend to strongly reinforce waste collection, promote recycling and composting and develop a sanitary landfill with gas collection and flaring, the yearly balance shall be strongly beneficial, **with a GHG net benefit in 2020 of about 27 000 t CO<sub>2</sub>eq/year for both cities. In 2040, the net benefit expected shall reach 106 300 t CO<sub>2</sub>eq/year for both cities.** This beneficial situation results from major emissions avoidance related to recycling and mainly to composting. **Flaring of landfill gas (60% methane) provides also a major reduction of GHG emissions from the managed landfill with 80% abatement.**

### 5.5.6 IMPACTS ON AIR QUALITY AND NOISE

The project shall have beneficial impacts on Hpa-An and Myawaddy air quality. Indeed, the large volume of rotting organic solid waste dumped in any possible place around the urban area contributes to release unpleasant gas. The several collection points with only degraded containers (or without container) are also places generating smell nuisances to the surrounding population. The several points in the city, where such dumped waste is burnt, release smoke and unpleasant smells. The solid waste component will improve this situation: improving the waste collection will reduce the volume of waste dumped into the drains and open spaces of the city where it either rot or is burnt. The new transfer points proposed will be equipped and managed to reduce gas emission: shorter transit time for the waste, closed containers, closed trucks.

However, handling of solid waste during the collection and disposal process may generate nuisance dust but also bioaerosols (i.e., particles in the air consisting wholly or partially of microorganisms). Bioaerosols are of particular concern to the health of waste workers and have been shown to be the source of reduced pulmonary function and increased respiratory disease for those in immediate proximity to waste sweeping and collection activities. Recommended management strategies to minimize dust, bio-aerosols, and odours include:

- Establishing frequent waste collection schedules;
- Instituting a washing program for waste collection vehicles and for company-owned waste collection and transfer containers;
- Promoting the use of bags to reduce the odours from soiling of waste collection and transport equipment.
- Cover collection and transfer vehicles along the entire route of transport to avoid windblown litter;
- Clean vehicles used for waste hauling before transportation of any goods, including compost;
- Encourage residents to put waste out at designated times and locations;
- Where possible, blocking off access to dumping sites and fining illegal dumpers.

Specific measures to prevent, minimize and control vehicle air emissions during waste collection and transport include the following:

Optimize waste collection routes to minimize distance travelled and overall fuel use and emissions

Waste collection and transport vehicle owners and operators should implement the equipment manufacturers' recommended engine maintenance, along with the mechanical maintenance for the safe operation of the vehicle, including proper tire pressure.;

Drivers should also be instructed on the benefits of driving practices which reduce both the risk of accidents and fuel consumption, including measured acceleration and driving within safe speed limits (working with garbage truck drivers can save as much as 25% on fuel use and reduce maintenance by 15%).

Additional fleet management recommendations are presented in the General EHS Guidelines (IFC).

The following measures are recommended to prevent, minimize, and control vehicle emissions and emissions of dust, odours, and bioaerosols during waste receipt, unloading, processing, and storage:

- Select vehicles and containers that minimize air emissions during waste loading and unloading;
- Design drop-off points to minimize queuing of vehicles;
- Sweep waste management areas and roads frequently and use water spray for dust control where needed;
- Pre-treat wastes as needed (e.g., solidification, encapsulation, or wetting sufficient to reduce dust but without forming leachate);

- Use enclosed waste handling and storage areas for malodorous wastes or wastes that generate hazardous dust (e.g., asbestos). Enclosed waste storage and handling areas are preferred for all wastes;
- Use extraction system to remove dust from working areas, buildings, and storage vessels, and treat as needed to control particulate emissions (e.g., bag filter);
- Remove, treat, or dispose of all biological/malodorous wastes in an expeditious manner;
- Use odour-neutralizing sprays where necessary;
- Use negative pressure in processing buildings and appropriate air filtration (e.g., bio filter) to remove odour

In addition, annual medical check-up shall be organized for all waste workers involved in waste collection and in activities on the landfill. Principal sources of noise and vibration include truck traffic, loading equipment (e.g., cranes, wheeled loaders), stationary compactors, balers, grinders, and other treatment and conveyance systems.

Recommended noise management strategies include:

- Construct a buffer zone between the facility and the external environment or locate facilities away from sensitive receptors;
- Include noise and vibration considerations during design, including use of models to predict noise levels at specified noise-sensitive locations, using standardized sound power levels for construction plant;
- Maintain site roads in good condition to reduce noise and vibration from vehicle movements;
- Use acoustic screens around fixed/mobile plant and equipment;
- Select equipment that has low noise emission levels;
- Fit silencing equipment to plant, e.g. baffles/mufflers;
- Use buildings to contain inherently noisy fixed plant equipment (e.g., locate waste shredder in the tipping hall, and enclose tipping hall on all sides) and consider use of sound-insulating materials in construction.

Noise shall not be an issue when compared to the present situation. For waste, only the noise related to the carts and trucks transporting waste is expected. For the water supply component, no noise nuisance is expected as the distribution of water is by gravity and does not include the construction of any pumping station within the urbanized area. All facilities (WTP and landfill) both in Hpa-An and Myawaddy are located reasonably far from residential area (200 to 500m) and shall not create any noise nuisance at night for residents.

### **5.5.7 SUMMARY OF IMPACTS AND MITIGATION MEASURES**

Table 32 summarizes the potential operation impacts of the project components in Hpa-An and Myawaddy with proposed corrective measures.

**Table [32] SUMMARY OF IMPACTS AND MITIGATION MEASURES DURING OPERATION PHASE**

Table [02] SUMMARY OF IMPACTS AND MITIGATION MEASURES DURING OPERATION PHASE								
Component or activity	Potential Effect	Potential impact	Impact assessment			Corrective or support measure		Overall risk after correction
		Description of impact	Probability	Gravity	Overall Risk	Description of measure	Easiness of implementation	
Improved Water Supply Systems								
Operation of two WTP with disinfection stage	Quality of life and public health	Improved water supply security in Hpa-An and Myawaddy with improved public health	-	-	-	-	-	-
		Benefits from disinfection may be erased if disinfection not permanent or not strong enough to reach far points of network	2	3	3	Regular monitoring of residual chlorine and coliforms in the network, to confirm residual chlorine >0.5 mg/l. Operation ensures permanent and appropriate level of disinfection Monthly monitoring of general drinking water parameters	2	2
	Surface water pollution	Risk of pollution or accident for workers by accidental spill of chlorine if chlorine solution is used	1	2	2	Storage area of liquid chlorine to ensure retention capacity of 110% of the capacity of the largest container on site; Regular monitoring of storage and container conditions Training of workers in charge of handling chlorine on safety	1	1
		Pollution of surface water by inappropriate management of grid residues and sludge:	2	1	2	Ensure thickening and drying up of sludge and regular delivery with grid removals to the solid waste landfill	1	1
Operation new urban water storages	Quality of life and public health	Storages provide better water supply safety during peak demand hours; no particular impact or risk anticipated except the fast reduction of residual chlorine in water because of the high temperature in the region	2	3	2	Due to high temperature in the two cities, and 1 day capacity of storage, control of residual chlorine recommended at storage level with possibility of additional chlorination if required	2	1
		Risk of deliberate contamination of water before distribution	1	3	3	To avoid criminal action, ensure access to storage is restricted and sites guarded 24/7	1	1

Component or activity	Potential Effect	Potential impact	Impact assessment			Corrective or support measure		Overall risk after correction
		Description of impact	Probability	Gravity	Overall Risk	Description of measure	Easiness of implementation	
Operation of 2 new storages in Hpa An	Impact on landscape	New storage implemented on Kyar Inn Mountain in a former pond surrounded by woody vegetation will not be visible from outside. New storage built on the existing 3 storages of Bar Mae hill is also surrounded by dense forest and shall not be visible from outside	-	-	-	No particular measure required	-	-
New water intake in Thanlwin river in upstream section of Hpa-An city	Nuisance for surrounding population	Area isolated next to parking area for bus and next to an electric post. No residential property next to it. Limited noise from the pumps.	-	-	-	No particular measure required	-	-
New water pumping in Moei river aquifer to supply Myawaddy	Nuisance for surrounding population	Selected zone is upstream of the city far from residential zone. No nuisance expected.	-	-	-	No particular measure required	-	-
Network Rehabilitation and Extension in both towns	Quality of life and public health	Increase of population serviced will decrease number relying on polluted shallow wells; supply of potable water will reduce dependency to expensive water bottles	-	-	-	-	-	-
Climate Change	Affect water resources mobilised by the project	In Hpa-An, salinity of Thanlwin is anticipated to increase because of sea level rise and penetration of saline water. However, Hpa-An is located enough upstream to avoid salinity increase on the long term.	3	1	1	Long term monitoring of river salinity	-	-
		In Myawaddy, no risk of salinity. The river being of medium size, dry season discharge may follow a decreasing trend on the long	3	1	1	Implementation of a river gauge station and monitoring of river discharge; Identification of alternative water supply resources at medium term	2	1

Component or activity	Potential Effect	Potential impact	Impact assessment			Corrective or support measure		Overall risk after correction
		Description of impact	Probability	Gravity	Overall Risk	Description of measure	Easiness of implementation	
		term, as a consequence of dry season rainfall reduction						
	Increase of flooding risk	Water intakes in Hpa-An and Myawaddy and WTP in Hpa-An integrate CC forecast in their respective designs.	-	-	-	-	-	-
Improved Solid Waste Management								
Improving waste collection	Impact on Water Quality and Drainage	Reduced quantity of waste discharged into the local drainage system and in the surface water bodies Improvement of drainage discharge capacities and reduction of localised flood risk, but risk of solid waste dumping continues by surrounding population, wasting efforts	2	2	2	The achievement of all these positive impacts depends on a major awareness campaign and capacity building on waste management among population of Hpa-An and Myawaddy.	3	1
	Impacts on Quality of life and Public Health	General improvement of city image and quality of life of residents as a result of better waste collection rate	-	-	-			
		Risk of air nuisance if collection points not regularly cleaned	2	1	2	Cleaning procedure for collection and transfers points	2	1
	Impacts on Air quality	Reduction of waste presently dumped in the city shall reduce air pollution from gas, unpleasant smells and smoke from burnt waste	-	-	-	The achievement of all these positive impacts depends on a major awareness campaign and capacity building on waste management among population of Hpa-An and Myawaddy	-	-
	Reduction of pollution load	Collection point will improve waste segregation and management of hazardous waste	-	-	-	Organise and facilitate segregation on sites through public awareness campaigns	2	1

Component or activity	Potential Effect	Potential impact	Impact assessment			Corrective or support measure		Overall risk after correction
		Description of impact	Probability	Gravity	Overall Risk	Description of measure	Easiness of implementation	
Creation of a sanitary landfill with composting plant	Impacts from smells and insects on surrounding population	In Hpa-An, large area of scrub vegetation is available for landfill near industrial zone. Risk of nuisance does exist for the future building of the IZ located the nearest to the landfill  In Myawaddy, proposed landfill site is located next to the Trade Zone, with potential nuisances to nearest buildings in the future.	2	2	2	Ensure the presence of a buffer zone of at 250 m width between landfill and IZ or TZ, to be densely planted with trees (if natural vegetation is not sufficient)  Daily coverage of fresh waste by soil or WTP sludge to limit smells/insects/rodents  Daily cleaning of platforms and equipment	2	1
	Release of GHG by the landfill and composting plant	Landfill and composting process release methane gas. However, when compared with conditions of the present situation, the No project alternative releases much more GHG than with the proposed project.	-	-	-	No specific measure required	-	-

## 6 PROJECT ALTERNATIVES

### 6.1 “No Project” Alternative

For water supply, the “No Project” alternative shall maintain the urban population in a situation of the delivery of insufficient and unsafe domestic water. A significant number of wards shall continue to rely on underground water resources, more and more polluted and contaminated by the septic tanks servicing an increasing population, and oblige the population to rely on expensive water bottles for drinking purposes.

For the solid waste component, should no action being implemented and the present 2015 situation for MSW management being maintained on the long term, the cleanliness of the city shall continue to degrade with more solid waste dumped in the urban area creating unhealthy conditions and increasing the clogging of the drainage network, resulting in more frequent conditions of localised flooding during the wet season, with secondary impacts on the city activities and economy.

Furthermore, the “No Project” alternative should have much more detrimental impacts on GHG emissions as presented in following table.

**Table [33] COMPARISON OF GHG EMISSIONS WITH AND WITHOUT PROJECT**

Comparison of GHG Emissions with and without Project							
Situation	Year	Collected Waste				Uncollected	Total
		Collection	Recycling	Composting	Landfilling		
Hpa-An							
No Project	2020	11	-1 872	0	1 725	5 653	5 517
	2040	20	-4 434	0	4 087	13 392	13 064
With Project	2020	29	-6 238	-4 148	1 451	847	-8 060
	2040	58	-14 780	-16 890	2 513	418	-28 681
Difference	2020	18	-4 367	-4 148	-274	-4 806	-13 578
	2040	39	-10 346	-16 890	-1 574	-12 975	-41 746
Myawaddy							
No Project	2020	25	-4 824	0	6 176	5 266	6 644
	2040	66	-12 647	0	16 193	13 808	17 419
With Project	2020	39	-9 648	-5 895	2 243	1 309	-11 951
	2040	91	-25 295	-29 100	4 300	715	-49 289
Difference	2020	14	-4 824	-5 895	-3 933	-3 957	-18 595
	2040	24	-12 647	-29 100	-11 892	-13 093	-66 708
Total Kayin State							
No Project	2020	37	-6695	0	7901	10919	12161
	2040	86	-17081	0	20279	27200	30484
With Project	2020	68	-15886	-10044	3694	2156	-20012
	2040	149	-40075	-45990	6813	1133	-77970
Difference	2020	31	-9191	-10044	-4207	-8763	-32173
	2040	63	-22994	-45990	-13466	-26067	-108454



The results of the comparison shows that GHG emissions from solid waste in Hpa-An and Myawaddy could be reduced by 32,000 t CO<sub>2</sub>-eq/year in 2020 and even reach 108,000 t CO<sub>2</sub>-eq/year in 2040.

## 6.2 Intake Location & Design Hpa An

As part of the interim report, two options were studied consisting of providing water supply from a unique source for both the urban area and the HIZ and secondly from two different sources. As a result of the different technico-economic analysis undertaken it was shown that separate systems for each service area was the most economic option, given the large distance of the IZ from the urban area itself. In addition development trend of the Industrial zone, related water needs and time frame remain uncertain.

During the Interim and Final phases of the assignment further details of the other water supply projects, land availability in Hpa-An have been obtained, allowing to refine and adapt the Project consequently.

Given the latter project, the conclusion to consider separately the urban area and the HIZ was confirmed by the KSG during presentation of the Interim Report. It is understood that an independent water supply project for the Hpa-An Industrial Zone will be financed by the Union Government. However, no details have been obtained as of yet for this project. It was also decided given the relative small size of the JICA project, to ensure that the project proposed as part of the PPTA could be stand-alone and not linked to the former.

Further analysis of the proposed project during the final phase of this assignment focused on the identification of an appropriate site for the intake and treatment plant and the preliminary design of the network facilities (including storage). Three scenarios were considered for the location of the intake and treatment plant site:

Scenario 1: Intake and WTP near /on Bare Mae Hill (or replacing JICA project)

Scenario 2A: Intake to the south of the city with a WTP near Thanlwin bridge;

Scenario 2B: Intake located to the north of the city with a WTP near KanTarYar Lake (several locations have been proposed).

Of these different options, **Scenario 2B** was selected so as to enhance technical functioning, minimize land acquisition and resettlement costs, to be as far upstream as possible to avoid near bank pollutant discharges (existing and future) and finally to be completely separate from the proposed JICA project.

It is firstly proposed to create a new sustainable and robust intake structure to abstract water from the Thanlwin River in the best conditions. A site has been identified along the shore, north of the city and before the main waste water discharges to the river. The area belongs to HTDC and is currently used for water supply purpose with an existing small floating barge (see figure below). Consequently, intake will be replaced with a new main system, using existing building to be rehabilitated.

## 7 INFORMATION DISCLOSURE AND PUBLIC CONSULTATION

### 7.1 Consultation and Public Participation Process

Information disclosure and stakeholder consultations were conducted as part of the environmental assessment process. The consultations involved in-depth key informant interviews with relevant Government agencies and focus grouped discussions.

The consultations aimed on environmental issues and concerns affecting the community. Specifically, the objectives of the consultation meetings are the following:

- To present the proposed projects to the stakeholders;
- To solicit views of the stakeholders relative to the proposed project;
- To identify the most important project components for the locals;
- To identify possible environmental issues inherent on the proposed project and to identify mitigation measures to address these issues in the project design.

Preliminary consultations with relevant Government agencies were conducted as part of the IEE of the proposed project. The focus grouped consultations primarily focused on presenting the project components, identifying the most important issue for the locals, receiving inputs and suggestions from the participants regarding environmental concerns arising out of the project, obtain baseline environmental and cultural information for project sites as well as Government clearance requirements and discuss their opinions on the perceived environmental impacts of the project. Suggestions were sought on measures to consider to properly implementing the project and in avoiding any potential adverse impact.

The principles of information dissemination, information solicitation, integration, coordination, and engagement into dialogue were incorporated during the preliminary consultations.

### 7.2 Consultation Meetings

#### 7.2.1 SCHEDULE AND PARTICIPATION

Main consultation activities held during the PPTA are summarized below.

**Table [34] CONSULTATION ACTIVITIES FOR ENVIRONMENT COMPONENT**

Date	Activity	Persons met	Location	Purpose
Throughout the project since 27 April 2015	Meetings and interviews	Department heads of township and state Development Affairs	Township Development Affairs offices	To get better understanding of the project and the existing situations, and the requirements for the projects; to obtain perspectives and suggestions from the officers and representatives on the

Date	Activity	Persons met	Location	Purpose
				project
16 October 2015	In-depth key informant interviews	Deputy Director	Forest Department, Myawaddy, Ministry of Environmental Conservation and Forestry.	To gather the common flora and fauna species found in the region, and to discuss the concerns and suggestions regarding the existing environmental situation
30 September 2015, 14-17 October 2015	Public consultation with the ward administrators, stakeholders, solid waste contractor, and NGOs	Ward administrators, Regional officer, International Organization of Migration (Myawaddy), Regional officers of NGOs	Hpa-An, Myawaddy	To disclose the proposed project and gather information on the critical environmental problem in the society, and their concerns and suggestions on the proposed project.
18-20 October 2015	Focus Grouped discussions	Township and wards Development Committee members, Women household leaders, Local organizations	Myawaddy	To disclose the proposed project and gather information on the critical environmental problem in the society, and their concerns and suggestions on the proposed project.

### 7.2.2 SUMMARY OF FEEDBACK FROM PARTICIPANTS

From discussing with the public and the stakeholders, it was summarized that the necessity of good quality water supply, and the good solid waste management are important for both in Hpa-An and Myawaddy. Some main feedbacks from the discussions are as follow:

- Current water sources especially the private wells have very high concentration of calcium and effect on health negatively. The local people want to have the treated water access.
- In Myawaddy, the most important issue is the landfill site as the locals do not have specifically defined place to throw the solid waste. The existing landfills are along the River Thaungyin and all the rubbish reached into the city after flooding.
- There should be a proper facility to handle the medical wastes.
- There should be a monitoring body during project implementation.
- Public awareness and individual awareness are very crucial to keep the environment clean. More training programs on raising public awareness should be encouraged.

- To bring up the successful project and to avoid unwanted negative impacts on natural and social Environment, proper management along the whole project cycle are very crucial.

### **7.3 Future Consultations**

Information dissemination to, consultation with and participation of affected people and involved agencies reduce the potential for future conflicts and minimize the risk of project delays. Further information and consultations will be carried out before construction starts (during the first year of the project) and during the construction period.

Prior to the start of the construction, consultation will be carried out in all the areas where the proposed project activities area anticipated. The objective will be to provide the local population with accurate information on activities to be undertaken, on the schedule of these activities and on the potential nuisances for them during construction. This information stage, which concerns all the project sites, will be carried out jointly with the team in charge of RP preparation in those areas concerned by compensation and/or resettlement.

During construction stage, consultation will be carried out with local population in specific area where construction activities are expected to start within 1 month. This will be carried out through focus group discussion with residents and key stakeholders (police station, ward heads) on possible nuisances (noise, dust, traffic/access constraint, temporary suspension of public utility, etc.), on safety measures they will have to respect (regarding engines under activity, risks of fall in excavations, risks specific to children etc.) and on the detailed schedule of activities.

At the end of the construction activities in a dedicated site, inspection of site to ensure cleaning and rehabilitation has been done by the Contractor will include interview of residents to possibly identify non-compliance in the rehabilitation of the site.

### **7.4 Disclosure**

The Draft Final IEE will be submitted to the ADB for review and approval. It will then be transferred to the Hpa-An and Myawaddy Town Development Affairs for endorsement. Upon finalization, the final IEE will be disclosed on the ADB's website before the Board Approval, in compliance with ADB Public Communication Policy (2011).

## 8 GRIEVANCE AND REDRESS MECHANISM

A grievance redress mechanism (GRM) will be established in compliance with ADB's SPS (2009) requirement to prevent and address community concerns and assist the project to maximize environmental and social benefits. The grievance mechanism proposed for the environmental issues follows the same process than the one proposed for the compensation and resettlement issues.

The GRM will be accessible to diverse members of the community, including more vulnerable groups such as women and youth. Multiple points of entry, including face-to-face meetings, written complaints, telephone conversations, or e-mail, will be available. Opportunities for confidentiality and privacy for complainants will be honoured where this is seen as important.

### 8.1 Types of Grievance Expected and Eligibility Assessment

Public grievances addressed by the GRM will most likely relate to environmental issues during the construction phase, as consultations with potentially affected people conducted during project preparation confirmed their basic support to the project. Grievances will most likely include damage to public roads due to heavy vehicle operation and transportation of heavy equipment and materials; disturbance of traffic and increased traffic congestion; dust emissions; construction noise; inappropriate disposal of waste materials; damage to private houses; safety measures for the protection of the general public and construction workers; water quality deterioration, disruption of services (water supply, electricity), loss of access, etc.

During operation, grievances will most likely include nuisances related to unpleasant odours around waste collection points or around the landfill site. Possible grievances may also concern quality of distributed water during maintenance works on the network or pressure problems in some areas.

### 8.2 Proposed Mechanism

The overall purpose of the grievance redress mechanism (GRM) will be to reduce risk for the project, offer communities an effective platform for expressing concerns, and achieving solutions that will promote a constructive relationship between the government, project staff, and communities.

Specifically, the project GRM will be established to allow all persons affected by the urban infrastructure and services project to appeal any disagreeable decision, practice, or activity arising from the implementation of the Third Greater Mekong Subregion Corridor Town Development Project.

The design of the GRM should enable the mechanism to provide:

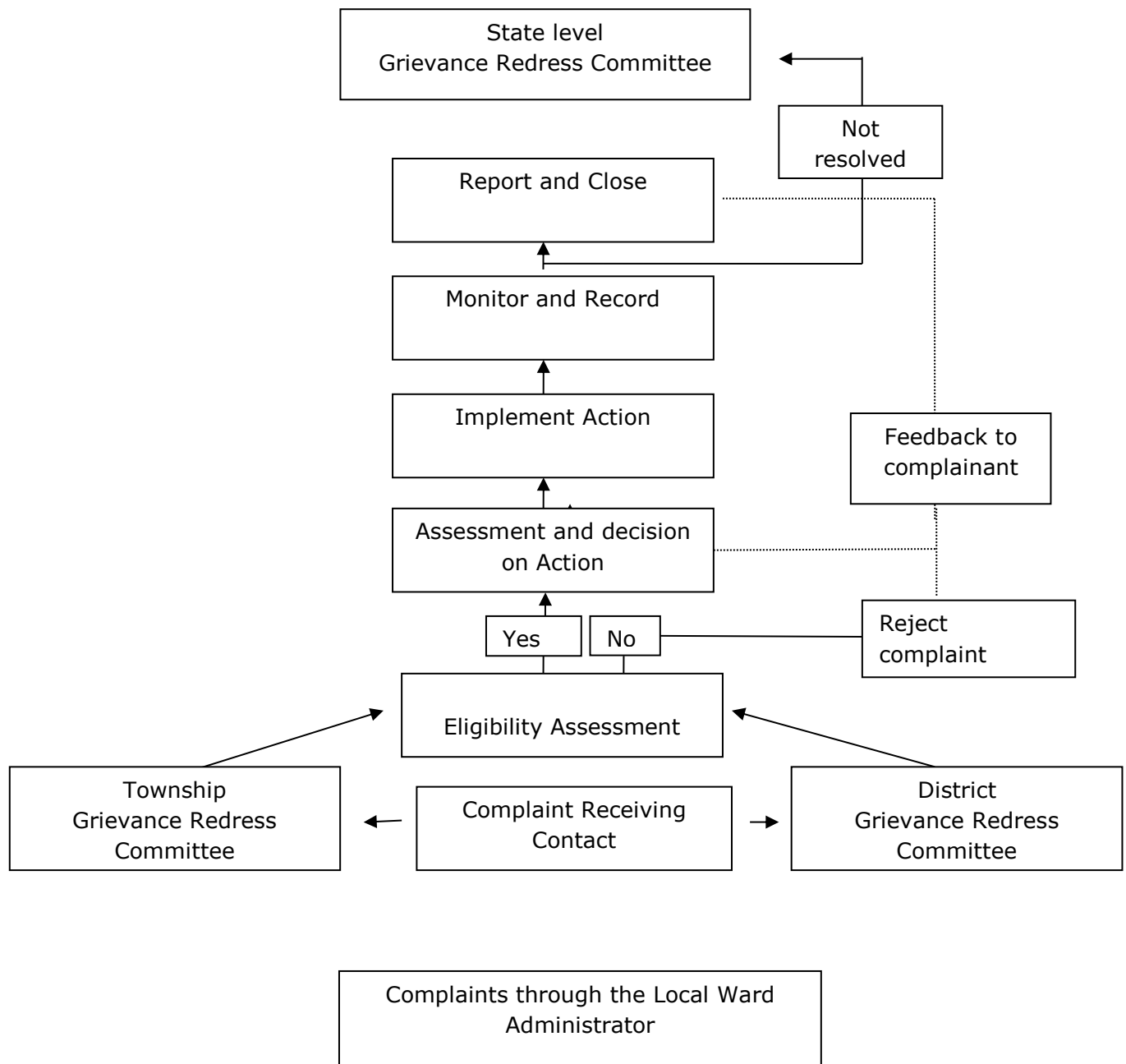
- a predictable, transparent, and credible process to all parties, resulting in outcomes that are seen as fair, effective, and lasting;
- builds trust as an integral component of broader community relations activities; and
- enables more systematic identification of issues or problems, facilitating corrective action, and pre-emptive engagement.

The GRM will include the following elements:

- a transparent grievance receipt and registration system to provide ways for community members to register complaints and confirm they have been received;
- grievance eligibility assessment to determine if the issues raised in the complaint fall within the mandate of the grievance mechanism and if the complainants are legitimate;
- grievance assessment and investigation to clarify concerns raised in the complaint, to gather information on the situation, and to identify how the issues might be resolved;
- several choices for solving problems are as follows:
  1. Internal decision-making processes, whereby issues are handled by designated members of the GRM, using set criteria to develop a response to the grievance and to allow for tracking complaints, monitoring and evaluation of the resolution and an appeals process.
  2. Joint problem-solving, in which the project and the complainant engage in a dialogue and action planning to resolve the problem.
  3. Third-party mediation to facilitate a solution when a voluntary agreement is not possible.
- grievance tracking, including maintenance of written records of grievances, monitoring, public information disclosure and reporting to the community; and
- grievance closure, including community feedback and confirmation of resolution of the problem.

All project stakeholders (Ministry of Construction [MOC], Project Management Office [PMO] and Project Implementation Unit [PIU] staff of the Kayin and Mon State Governments [M/KSG], district/township/ward officials, communities, civil society organizations (CSOs), and ADB staff) were involved in the design of the GRM—to outline the purpose, structure, and specifics about how the grievance mechanism will function.

Below is the structure of the GRM and its operational arrangements.



The GRM will be established in Hpa-An and Myawaddy. It involves the following process:

- Stage 1: Access to the GRM. If a concern arises, the complainant will make his/her complaint known to the Local Ward Administrator (LWA) of the concerned ward through verbal, phone, email, or written submission. CSOs may file complaints on behalf of affected persons through the LWA or directly to the Complaint Receiving Contact (CRC) with a copy to the LWA.



- **Stage 2: Submission and Registration.** The LWA or CSO will submit a written complaint to the Complaint Receiving Contact (CRC). The CRC will register the complaint and forward it to the township grievance redress committee (GRC) or district GRC depending on the nature of the complaint. The CRC will issue an acknowledgement of receipt of the complaint with information of which GRC will handle the complaint to the LWA. The LWA will inform the complainant and CSO if appropriate, and deliver the acknowledgement of receipt. The township level GRC will handle complaints or queries pertaining to construction activities (including road safety, and environmental issues), information about project activities, give general feedback. The district level GRC will handle complaints regarding environment and construction-related impacts, resettlement, compensation and livelihood improvement issues.
- **Stage 3: Determine Eligibility.** The township or district GRC will determine whether the complaint requires further action to address. A screening procedure based on simple eligibility criteria will be established for the GRCs. If the complaint is deemed ineligible, the complainant is informed of the decision and the reasons for ineligibility. Where appropriate, the GRC may refer the complainant to alternative options for resolution of the complaint.
- **Stage 4: Assessment and Decision on Action.** If the complaint is eligible, the appropriate GRC will conduct an assessment and gather information about the complaint and key issues and concerns to determine how the complaint might be resolved. The LWA and community members will participate in the assessment as necessary. If outside experts or technical information is needed, the GRC may seek such guidance and may request all parties concerned to participate in the GRM process. The GRM may offer a variety of grievance resolution approaches. The decision on the solution will be by the GRC. The GRC will develop an action plan and identifies responsibilities for the plan. This action plan will be reported to the complainant through the LWA.
- **Stage 5: Implementation of Actions.** Implementation of the action plan commences with close collaboration of relevant project stakeholders depending on the type of complaint.
- **Stage 6: Monitoring and Reporting on Implementation.** The GRC will monitor the implementation of actions and record findings which will be filed through the CRC. As part of the monitoring process, the GRC will consult the relevant project stakeholders, as needed. The monitoring time frame will be project-specific depending on the implementation of the actions.
- **Stage 7: Closure of the Complaint.** When the monitoring has been completed, the GRC will prepare a final report which is shared with the LWA and complainant, and filed with the CRC. The complainant will confirm completion of the actions and agree to the closure of the complaint. The grievance dossier is closed and filed in the project archive.
- **Stage 8: Appeal to the State GRC.** If the complainant is not satisfied with the solution suggested by the GRC during the assessment stage or after the implementation of actions, an appeal can be lodged at the state GRC through the LWA in writing, with a copy sent to the PMO/PIU of the M/KSG. The state GRC will serve as the second level authority for addressing grievances that were not resolved satisfactorily. It will also look into grievances regarding inconsistencies of grievance handling by the township and district GRCs. It may assign a second investigation of the grievance case to another expert or group of experts, depending on the required expertise for analysis and reporting, with final decision-making remaining with the State GRC.



If efforts to resolve complaints or disputes are still unresolved and unsatisfactory, the complainants have the right to send their concerns or problems directly to ADB's Southeast Asia Department (SERD) through ADB Myanmar Resident Mission. If the households are still not satisfied with the responses of SERD, they can directly contact the ADB's Office of the Special Project Facilitator as outlined in the Information Guide to the Consultation Phase of the ADB Accountability Mechanism.

GRM proceedings will entail one or more meetings for each complaint and may require field investigations by specific technical or valuation experts. Grievance cases shared by more than one complainant will be treated as a single case.

The GRC and the procedures for resolving complaints and grievances will be made public through an effective public information campaign. During the RP updating process when the detailed engineering design is available, the grievance redress procedure shall also be explained in the project's Public Information Booklet.

The mechanism proposed relies on the creation of a Grievance Redress Committee (GRC) integrated into the Department of Public Relations and Information (DPRI) of KSG and basically dealing with grievances related to resettlement and compensation. The GRC will additionally address those complaints related to construction activities when the grievance cannot be closed at the level of the contractor. The GRC, as defined in the RAP, will be headed by the Senior Officer of DPRI and would include representatives from townships, from civil society (Woman Association, Elder groups, Social Welfare groups) and Community representatives from the complainant's ward.

When construction starts, a sign will be erected at each construction site providing the public with updated project information and summarizing the grievance redress mechanism process including details of the GRM entry points. The contact persons for different GRM entry points, such as PMO, community leaders, contractors, and operators of project facilities, will be identified prior to construction. The contact details for the entry points (e.g. phone numbers, addresses, e-mail addresses, etc.) will be publicly disseminated on information boards at construction sites and on the website of the local government.

The GRC will establish a GRM tracking and documentation system. The system will include the following elements: (i) tracking forms and procedures for gathering information from project personnel and complainant(s); (ii) dedicated staff to update the database routinely; (iii) systems with the capacity to analyse information so as to recognize grievance patterns, identify any systemic causes of grievances, promote transparency, publicize how complaints are being handled, and periodically evaluate the overall functioning of the mechanism; (iv) processes for informing stakeholders about the status of a case; and (v) procedures to retrieve data for reporting purposes, including the periodic reports to the ADB.

## **9 ENVIRONMENTAL MANAGEMENT PLAN**

### **9.1 Purpose and Objectives**

The role of the Environmental Assessment process is to identify the impacts which may be caused by the project and to develop a series of attenuating or mitigating measures which will be technically appropriate, financially acceptable and easily applicable in the context of the project. These measures are identified in Section 6 of the present IEE.

The role of the EMP is to complement this analysis by defining the operational context in which these measures will be implemented. The present Section therefore sets out the principles, the approach, the procedures and methods which will be applied to monitor and reduce the environmental and social impacts resulting from the construction works and subsequent operation of the components projected in Hpa-An and Myawaddy.

All the measures proposed in this EMP are based on the results of the analysis of impacts and corrective measures outlined in previous Section 5 of the present EIA. These aspects will not therefore be repeated here.

### **9.2 Summary of Key Impacts**

The key impacts described in Chapter 5. Table 26 summarizes the key impacts related to project location. Table 29 summarizes the impacts during construction and Table 32 summarizes the key impacts during operation.

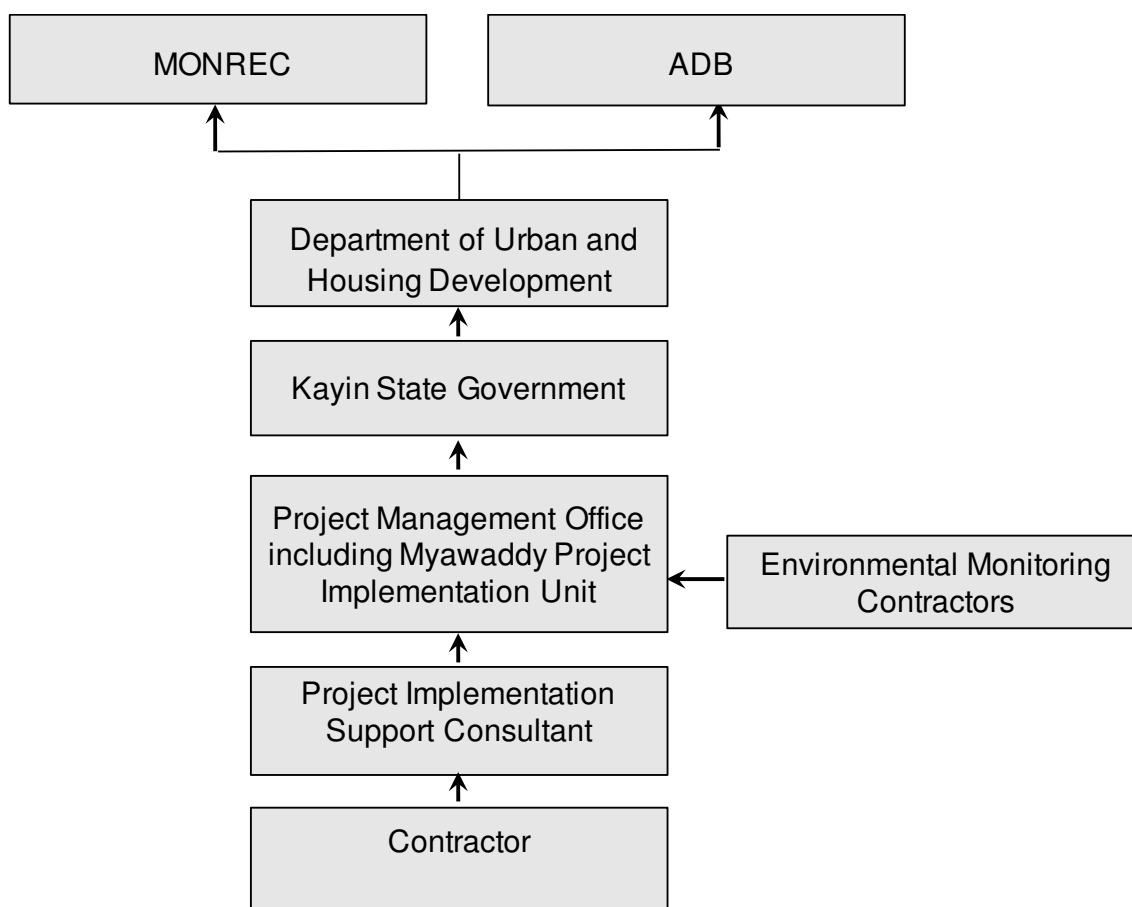
### **9.3 EMP Organisation and Responsibilities**

#### **9.3.1 OVERALL ORGANIZATION**

The Ministry of Construction and its Department of Urban and Housing Development do not have environmental and social management systems to guide project preparation, project construction, operation, and maintenance of roads. Overall responsibility for implementation of the environmental management plan falls to the Project Management Office (PMO) and Kayin State for this project.

There are eight agencies that are involved in the implementation, supervision, and monitoring of the environmental management plan: (i) the Department of Urban and Housing Development, (ii) the Kayin State Government, (iv) the Kayin State Government Project Management Office (including the Myawaddy Project Implementation Unit), (iv) the Project Implementation Support Consultant, (v) the Contractor; (vi) the Ministry of Natural Resources, and Environmental Conservation, (vii) ADB, and (viii) independent, third party Environmental Monitoring Contractors (see reporting relationships Figure 44).

**Figure 44: Proposed Organization for EMP Implementation**



**Department of Housing and Urban Development.** Department of Housing and Urban Development is the Project Executing Agency.

**Kayin State Government.** The Kayin State Government is the Project Implementation Agency. The Kayin State Government PMO is to establish the Kayin State Government Project Management Office including the hiring of environmental management staff. A Project Implementation Unit will be established the Myawaddy.

**Kayin State Government Project Management Office (KSG PMO) and Myawaddy Projection Implementation Unit (MPIU).** The KSG PMO and MPIU will have overall responsibility for:

- ensuring implementation of all mitigation measures;
- ensuring implementation of all monitoring programs;
- supervision and monitoring of the implementation of the environmental management plan (EMP);
- establishment and operation of the Grievance Redress Mechanism;
- training and capacity development of environmental staff of PMO

- meeting all the conditions of the Environmental Compliance Certificate (as issued by MONREC); and
- submitting semi-annual Monitoring Reports through the Kayin State Government and DUHD to the MONREC and to ADB.

**Construction Contractor.** The Construction Contractor will be responsible for:

- implementation of the environmental management plan mitigation measures; and
- frequent monitoring and reporting of environmental management plan implementation

**Project Implementation Support Consultant(PISC).** The PISC will be responsible for

- supervision and monitoring of and reporting the contractor implementation of the EMP on behalf of KSG PMO;
- supervision of third party environmental monitoring contractors;
- assisting KSG PMO in preparing of the environmental safeguard monitoring reports; and
- assisting KSG PMO in organization of training and capacity development

**Ministry of Natural Resources and Environmental Conservation (MONREC).** MONREC is responsible for:

- review of the periodic environmental safeguard monitoring reports submitted by KSG to ensure that adverse impacts and risks are mitigated as planned;
- as necessary, conduct monitoring and inspection of projects to determine compliance with all environmental and social requirements;
- as necessary, impose penalties and /or require Project Proponent to undertake corrective action; and
- where Projects are not in compliance or not likely to comply with its environmental and social requirements, take appropriate enforcement actions including: (i) suspension of project operation; and (ii) employing third parties to correct non-compliance.

**ADB.** ADB is responsible for:

- conducting periodic site visits for projects with adverse environmental impacts;
- conducting supervision missions for detailed review for projects with significant adverse environmental impacts; and
- reviewing the periodic environmental safeguard monitoring reports submitted to ensure that adverse impacts and risks are mitigated as planned

**Independent Third Party Environmental Monitoring Contractors.**

Environmental Monitoring Contractors will be responsible for conducting air quality, water quality, noise, and biological environmental monitoring programs on behalf of the KSG PMO.

### 9.3.2 ENVIRONMENTAL STAFFING REQUIREMENTS

Environmental staff are needed by the (i) Construction Contractor, (ii) Project Implementation Support Consultant, and (iii) the KSG PMO. It is the Kayin State Government's responsibility to ensure that qualified and trained staff are hired by all three agencies (Table 36).

Independent Third Party Environmental Monitoring Contractors need to be retained to conduct ambient environmental monitoring of air quality, water quality and noise.

**Table 36: Indicative Staffing and Outside Consultants**

Staff	Position	Level of Effort
Contractor	Environmental Engineer	Full time during construction
Project Implementation Support Consultants	Environmental Supervision Engineer	Half time during construction
	Environmental Safeguard Specialist	Full time during construction
KSG PMO	Environmental Safeguard Officer	Full time during Project
Outside Consultants to KSG PMO or through the Project Implementation Support Consultant	Environmental Management Capacity Development	\$40,000 Lump Sum Contract
	Independent Third Party Environmental Monitoring Contractors	To be estimated based on proposed environmental monitoring programs.

### 9.3.3 TRAINING AND CAPACITY DEVELOPMENT

The Kayin State Government needs to provide capacity development and/or training programs to ensure staff in all three agencies (i) fully understand the environmental management plan; (ii) understand their responsibilities; and (iii) are capable to undertake their responsibilities. As it does not have environmental and social management staff, Kayin State Government needs to hire a qualified contractor through the PMO or the PISC to conduct necessary training and capacity development programs.

## 9.4 Recommended Reporting Requirements.

Monitoring of the environmental management plan will have weekly reporting by the Contractor; and monthly reporting by the PISC.

The Kayin State Government is required prepare and submit, to the DUHD, MONREC, and ADB, semi-annual environmental monitoring reports. The reports will cover environment performance based on the implementation of the EMP and the environmental monitoring plan. The PISC will draft semi-annual environmental monitoring reports. The PMO will finalize the environmental monitoring reports and Kayin State Government will submit the reports to DUHD, ECD and ADB (see Table 37)

**Table 37: Recommending Reporting Requirements**

Responsibility	Reporting Requirement	Reporting to
Contractor	Weekly inspection and monitoring reports	PISC
Project Implementation Support Consultant (PISC)	Monthly inspection and monitoring reports	KSG PMO
	Draft semi-annual environmental monitoring reports	KSG PMO
Kayin State PMO	Final semi-annual environmental monitoring reports	Kayin State Government
Kayin State Government	Submission of Final semi-annual environmental monitoring reports	DUHD, ECD, ADB

## 9.5 Environmental Management Planning Prior to Construction

The main recommended actions for this pre-construction period are detailed in the following paragraphs. Revision of measures proposed during this pre-construction and construction periods will be considered as soon as the PISC will be recruited. Indeed, detailed design will start at this stage (for components not developed under DBO) and it is required (i) that design fully integrate mitigation measures identified in this IEE and (ii) that monitoring activities are adjusted in accordance with the selected design (particularly sampling points and parameters).

### **9.5.1 APPOINTMENT OF THE PMO- ENVIRONMENTAL AND SOCIAL OFFICERS**

The PMO will appoint its environmental and social officers before construction works start. The environment and social officers will be assisted at the beginning of his mandate by the Project Implementation Support Consultant (PISC) who will deliver training and assist with (i) the preparation of tenders regarding monitoring surveys, (ii) the selection of the Consultants, (iii) for the follow-up of the studies.

### **9.5.2 ENVIRONMENTAL CAPACITY BUILDING OF PMO**

The PISC will carry out training of the environmental and social officers and other PMO staff. Purpose is to have the staff fully operational at the start of the project construction activities. Training will focus on:

- Detailed review of impact analysis and mitigation from the Third GMS IEE
- Detailed review of EMP Program of Action
- Organization of KSG PMO for EMP implementation
- Basics for site inspection practices: organization of visits, frequency, control checklist;
- Basics for non-compliance procedures: reporting procedure and form, organization of follow-up, procedure for resolution approval;
- Data management for PMO: key information to be stored, data base organization, registers;
- Structure and content of weekly, monthly reports.

### **9.5.3 CAPACITY BUILDING ON HEALTH AND SAFETY**

When observing construction sites in Kayin State, the conclusion comes easily that health and safety considerations are still strongly ignored. Project construction sites must be compliant with international good practices regarding health and safety of workers on sites. This project may even be considered as a pilot project for introducing good EHS practices and for the concerned contractors.

The PISC shall organise safety training courses not only for the staff of PMO but also for all technical departments. The aim is to provide the basics of safety rules and organization of constructions sites and for the PMO staff, to clearly understand what must be required from the contractors on the sites.

### **9.5.4 PUBLIC CONSULTATION AND NOTIFICATION**

In support and follow up to the public consultations carried out within this PPTA, it is important to prepare the appropriate communication material rapidly, allowing KSG to present, before starting the works, clear information on the design of the project, on the phasing of construction work, on the recruitment procedures and on the environmental and social measures which will be implemented.

Preparation of proactive communication is essential to ensure the widest possible circulation of information at the most critical time, since it is during this period prior to the start of works, when important decisions and negotiations are in progress, that information on the Project must be available in a completely transparent manner. The communication tools to be developed include:



- Colour flyers and posters to be posted all along the various sub-components sites;
- Articles in the press and radio or TV messages;
- The technical EIA documentation available for consultation by any person, at KSG.

### **9.5.5 PREPARATION OF CONTRACTOR EHS SPECIFICATIONS FOR THE ENVIRONMENTAL MANAGEMENT PLAN**

Effective consideration of the EHS during construction activities pre-supposes the production of a clear, complete and detailed contractual document at the time the contract is awarded. This means including the specifications which will lay down all the EHS obligations to be imposed on contractors by PMO in the Tender Documents. These requirements dictated by the Project Owner will be presented in a document entitled "Environmental and Social Obligations of the Contractors", which will be prepared together with the Technical Specifications (General and Particular) of the Project. The PISC will assist PMO for the preparation of the Tenders.

The document will set out all the EHS obligations imposed to the contractors and the principles and measures required for complying with. These obligations will be articulated around the key fields of environmental and social management for all construction activities related to the Third GMS project components, including:

- general specifications for good environmental management which will be applicable to the contractor at any point within the work site and at all times, covering areas such as: training/awareness of employees on protection of the environment and safety, management of hazardous substances and waste, protection of biodiversity, prevention of water and air pollution, preservation of soils, rehabilitation of sites;
- minimum conditions to be established in the contractors' camps and installations, covering aspects related to housing, catering, waste management, drinking water, sewerage and conditions of public hygiene;
- minimum conditions to be observed by the contractor in the field of employees' health and safety;
- minimum conditions to be observed by the contractor with a view to protecting the environment of the sites as well as that of the areas contiguous, most densely urbanized;
- minimum conditions to be observed by the contractor in managing the social aspects of construction activity including applicable procedures for temporary land occupation or in case of damage to any private property.

## **9.6 Contractor Environmental Management Plan**

A Contractor Environmental Management Plan will be prepared for the undertaking of the mitigation measures described in Chapter 5 and summarized in Tables 26, 29, and 32.

**Contractor Management Plans.** Before the construction starts each Contractor will prepare a Contractor Environmental Management Plan (CEMP) consistent with



the EMP. The CEMP is to include all mitigation measures and monitoring requirements to be carried by the Contractor. The CEMP will be submitted to the CSC for review and approval. Approval will be required one month prior to the start of construction

Contract documents shall explicitly indicate the requirement for the CEMP. Construction cannot start until the CEMP is prepared. To ensure that the Contractor allocates sufficient funds to prepare and implement the CEMP, the Tender and Bid documents will require that the cost of implementing the EMP is included in the Contractor Bid price.

### **9.6.1 WASTE MANAGEMENT**

The CEMP include measure for domestic waste and hazardous waste. The first relates to domestic waste (mainly generated in worker camps) and other non-hazardous waste generated on the construction sites, while the second is related to hazardous wastes. Mitigation measures are designed:

- to minimize the generation of wastes by carefully considered use of raw materials;
- to sort and treat the wastes in order to limit their environmental impact;
- to raise awareness and train personnel in good waste management practices.

Measures include procedures, in accordance with local regulations or with international best practice, concerning the handling, transport, storage, treatment and elimination of wastes depending on their category:

- Non-hazardous wastes (Group A): putrescible wastes from the camps and canteens, paper, cardboard, plastics, wood and vegetation, inert wastes from construction or demolition (concrete, scrap iron, bricks, etc.);
- Hazardous wastes (Group B): wastes that are corrosive, explosive, toxic, representing a degree of danger for humans or for the ecosystem. In the context of the present project components considered, this will mainly include engine oils and used hydraulic fluids, the residues of paints, solvents and resins, first aid medical wastes, sludge from septic tanks and mobile toilets, various concrete additives (but with a lesser degree of danger for the latter).

#### **Non-hazardous Waste Management**

A system of waste segregation at source, ensuring separation of metal products (including drink cans or food cans), plastic products (bottles, cartons, wrapping, etc.), glass bottles, paper and cardboard, will be set up on the construction sites and in the camps. All these products will, as far as possible, be made available for collection by outside contractors responsible for recycling.

The workers' camp will be provided with two types of covered bins for selective collection of the various products listed above: putrescible in one, for recycling in the other. The contractor will carry out systematic awareness campaigns among residents of the camps to promote efficient use of these refuse bins.

On the construction sites, metal wastes that have not been polluted by hazardous substances (oils, acids, paints, etc.) will be collected in containers for recycling. The same applies to wood and cardboard and plastic packaging. It will be absolutely forbidden to burn plastic or lubricants.

Concrete and plaster debris that is not reused will be collected and dumped with other materials which may be usable for land filling or reclamation.

The Contractor will estimate the anticipated volumes of non-hazardous waste to be produced, the procedures for management, collection and disposal, the technical means implemented, the location and dimensions of the controlled landfill, the contact details of the companies involved in waste recycling, as well as the training programs to raise awareness among workers on this subject.

### **Hazardous Waste Management**

Should maintenance of heavy equipment happen on site, used engine lubricants from maintenance activities or floating oily residue from oil separators will be collected in 200 litre drums with a view to recycling. The drums will be stored in a dry and covered area, surrounded by a bund the height of which will ensure retention of a volume equal to at least 110% of that of the largest container stored in the area, and equipped with an oil separation system at its outlet. The contractor will identify an acceptable solution where the waste can be burned or recycled. A register will be maintained to record all handling of used lubricants, for the purpose of monitoring wastes. Machine and plant maintenance operations will be centralised in appropriate area allowing collection of the used oils and hydraulic liquids.

Should the use of chemical substances happen on sites, the following rules shall be followed: (i) give preference to substances with low toxicity values and minimize quantities to use, (ii) used chemical substances will be stored in containers or drums in the same storage areas as used oils, as long as these substances are compatible; (iii) otherwise, they will be stored in a safe area protected from inclement weather. The possibility of reuse in situ will be evaluated; failing this, the materials will be returned to the supplier or to appropriate waste treatment installations.

### **9.6.2 HAZARDOUS SUBSTANCES MANAGEMENT**

Mitigation measures will be applicable to all project activities involving the handling, storage and use of substances catalogued as hazardous. Measures will include:

- procedure for registering and monitoring any substance of a hazardous nature including in particular the drafting of a safety data sheet per substance;
- procedure for identification of alternative and less hazardous substances;
- handling and storage conditions, including details on compatibility of the substances;
- emergency procedures in case of a spill;
- condition for final treatment of residues or recycling.

Chemical substances will be stored in a locked container located on a watertight floor surrounded by a bund, capable of storing at least 110% of the volume of the largest receptacle placed there. Each storage site will be provided with a substance collection pit, absorbent products and extinguishers. Standard signs will warn of the presence of toxic substances.

The substances' safety data sheets will be available on the site and from the CC-EHSC of the contractor concerned. All chemical substances stores will be regularly inspected in order to detect any possible leakage or damage to the containers.

The largest volume of chemical substances anticipated under a project of this type may concern hydrocarbons (diesel, oil and grease). The programme will lay down the conditions to be respected for storage and refuelling of machinery.

Pollution control equipment to be installed by contractors at the storage sites (i.e., anti-pollution kits, extinguishers, substance description sheets) will be described

At each site, the employees in charge of handling chemical substances will be given special training relative to best practice and emergency measures in case of an incident.

### **9.6.3 ACCIDENTAL SPILL PREPAREDNESS AND RESPONSE PLAN**

An anti-pollution plan will be established to define the intervention procedures in case of leaks or accidental spills of liquid hazardous substances. This plan will include a description of the organisation planned for such situations and the work stations of key people. Specific training will be given for the activities to be performed in case of emergency intervention, for all staff and workers involved in any stage of the procedure. This plan will be required even if the Project doesn't imply the necessity for handling and storage of large quantities of hazardous material.

### **9.6.4 EROSION AND SEDIMENT CONTROL**

Erosion control measures will be applied to all land that is stripped or excavated, all embankments and temporary or permanent deposits of materials in order to minimise and control the resulting sediment loads before they reach surface water bodies. This protection will involve, on one hand, the implementation of methods for stabilising slopes where justified and, on the other, collection of surface water runoff.

Erosion control will include methods that are incorporated into construction practices, as the provision of temporary protection of a mechanical nature (geotextile covering sheets, sediment barriers).

Drainage of the entire area of any construction operations will be provided prior to the start of any other activity. Drained water will be channelled towards one or several sedimentation basins designed following accepted best practice and sized to contain the rainwater falling in 24 hours with a return period of two years.

For each site to be opened for construction activities, measures for drainage and anti-erosion measures will be prepared by the contractor and submitted to the PISC for non-objection at least three weeks before starting works on the site. The drainage channel and sedimentation basins will be built as a priority before any other activity is carried out.

### **9.6.5 MANAGEMENT OF CAMPS**

The following obligation will apply for any site sheltering workers on a 24 hrs. basis, including both permanent camps only dedicated for the residence of the workers and the temporary camps implemented on the construction sites where few workers may stay permanently (also to guard equipment and material at night).

A permanent and temporary camp management program will be prepared by each concerned contractor. The various aspects covered by such a program will include:

- choice of location for the camp, proposed organization, controlled entry;
- installations proposed for water supply and sewerage, waste management and drainage of storm water;
- equipment chosen for the sanitary facilities, collective equipment, bedrooms and dormitories;
- anticipated catering and food supply services, particularly canteens; means for monitoring the quality of foodstuffs stored and distributed in the camp;
- the policies implemented with regard to prevention of drug and alcohol abuse.

The specifications of the Tender Documents will lay down the requirements regarding water supply and sewerage. In order to eliminate the risks of development of disease vectors, rainwater drainage will be provided. The ratios to be respected in terms of sanitation (number of toilets, showers and wash-basins) will also be defined. The standards applicable to bedrooms and their furnishing and fittings will also be detailed in the Tender Documents. In particular, the minimum floor space per person, the supply of impregnated mosquito nets and mattresses, will be stipulated.

The procedures to ensure hygiene in all common facilities and in particular food hygiene procedures for storing and monitoring fresh products used by the canteens will be detailed by the contractor responsible.

In order to prevent possible abuse of drugs and alcohol, measures to raise the awareness of employees and specific control measures will be set up by the contractor responsible.

#### **9.6.6 PUBLIC HEALTH MANAGEMENT PROGRAM**

The program requirements will be described in detail in the Tender Documents and will cover the following main areas of action:

- First aid facilities established on the construction or camp site; hospital facilities available;
- emergency intervention procedures in case of an accident;
- employee surveillance measures: medical check-up on recruitment, annual medical check-up;
- regular cleaning of the sanitary facilities provided, in particular toilets and septic tanks;
- waste management and regular cleaning of refuse bins;
- systematic program to keep employees aware of good hygienic practices;
- monitoring hygiene in canteens

#### **9.6.7 MANAGEMENT OF AIR QUALITY, DUST AND NOISE**

Mitigation Measure to limit atmospheric and noise emissions will be put in place in all areas likely to be affected by construction of the Project. Emissions of exhaust gases and fumes will be limited by appropriate maintenance of equipment and trucks, and by banning the burning of waste on the sites.

Dust caused by road traffic on unpaved surfaces will be subject to reduction measures in residential areas, by requiring the contractor to water spray the

ground at regular intervals, i.e. at least two to four times per day during periods without daily rainfall. All loads of fine materials potentially causing dust to be spread during transport will be covered by a tarpaulin. In storage areas, watering will be recommended for all materials likely to generate dust. Wheels of trucks will be washed every time before leaving sites for dredging, to avoid deposition of sludge on public road and later production of dust.

Noise will be the subject of regular monitoring to ensure that the limits imposed for the site are respected or that the employees exposed to higher noise levels are appropriately equipped with PPE. Measures will be taken to reduce noise levels and the corresponding disturbance on the site and along the access roads: maintenance of plant and vehicles, use of soundproofed equipment, reduction of the hours of use of certain noisy activities.

### **9.6.8 MANAGEMENT OF ROAD TRAFFIC AND ACCESS**

Road traffic is a prime cause of accidents during the construction phase of infrastructure projects. It is therefore essential to regulate traffic both on site and outside. This is particularly important for the present project as (i) components are located in (or close to) dense urban area and (ii) the project shall involve the transport of significant quantities of materials and equipment which may generate heavy truck traffic. Various measures will be considered and adopted by the contractors:

- Awareness raising and training of drivers of trucks on elementary traffic safety rules and on the legal risks: driving under the influence of alcohol or drugs, excess speed, monitoring of tyre condition, load stability, etc.;
- visual acuity of all recruited drivers and their ability to drive;
- provision for parking trucks not encroaching on the roadway;
- respect of speed limitations;

Access to the construction sites will be indicated by appropriate road signals.

The Tender Documents will set out all these obligations as well as the penalties that will be applied to contractors and their sub-contractors in case of infringement.

### **9.6.9 PROTECTION OF CULTURAL RESOURCES**

The IEE confirms that the project components are not affecting any cultural site or building. However, as some components involve significant excavation (particularly for the rehabilitation of the water supply network, the chance to find any physical cultural resource does exist.

A chance to find procedure will adopted in case a discovery is made or an interaction is observed during the works. This procedure will include aspects such as:

- immediate measures to stop work at the site concerned and mark out the area to be protected;
- information procedure involving the contractor, PISC, and PMO
- approval of the measures decided by the PMO;
- organization of removal of the resource (if physical);
- closure of the incident and resumption of work.

### 9.6.10 EHS TRAINING

The objective of this training is to ensure effective implementation of the measures proposed under the EMP on the construction sites. General training programs (awareness training) are to be delivered to all personnel and the specialized training programs intended for the employees involved in particularly sensitive activities from the environmental standpoint (management and distribution of hydrocarbons, hazardous waste management, etc.). Each new recruit must participate in the awareness-raising program within 15 days following his recruitment. Each employee in charge of sensitive activities will follow a catch-up session every 6 months.

This training will be delivered by the CC-EHSC of the main Contractors or by a specialized consultant appointed by the contractors. All personnel shall be trained. The sessions shall be recorded in a register where the names and attendance signatures of all participants will be noted.

The environmental management awareness program on the sites will cover at least the following priority subjects:

- rules for waste management within the sites;
- rules for management of hazardous substances and wastes, particularly their storage authorized exclusively in specially adapted areas;
- pollution control, in particular the response required in case of an accidental pollutant spill;
- protection of sites against fire;
- protection of sites against erosion and sedimentation;
- procedure to follow in case of discovery of a physical cultural resource;
- rules for traffic safety on public roads and within the sites;
- principles for saving energy and other resources;
- applicable penalties in case of infringement against the established rules.

Complementary training sessions will be made relating to hygiene, health and safety including:

- Hygiene and basic public health issues;
- Safety rules on-site and off-site;
- Emergency response in case of accident;
- Personal and collective protective equipment and measures;
- Safety measures in public areas;
- Electricity hazards;
- Fire control and fire protection;
- Works in elevation and scaffolding safety.

### 9.6.11 SITE CLEANING AND REHABILITATION PROGRAM

By the end of the construction activities, each contractor has to decommission the sites where its activities for Project needs have been performed, which includes:



- The demolishing of all temporary structures/buildings developed for the purpose of Project construction.
- The removal from the sites of all equipment and remaining material and waste, the safe disposal or recycling of construction and demolition waste and of construction material;
- The restoration of the land in order to return it as close as possible from its initial state
- The official handover of the site to its owner, signed by parties.

In order to ensure that this Site Cleaning and Rehabilitation (SCR) operation is successfully implemented, the Contractor will be required to prepare a Site Cleaning and Rehabilitation Plan (SCRPlan) which provides operational methods for (i) site assessment and (ii) cleaning and rehabilitation in compliance with Contractual obligation and international good practices. The Plan will respect the following:

#### *Cleaning Stage*

- All construction materials, equipment, buildings, facilities and residual waste will be removed from all sites, except if a site-specific decision modifies this principle. This decision shall be commonly agreed on by the CC and the PMO.
- All waste collected on site will be treated in compliance with the requirements of the Tender Documents Environmental Obligations and the Waste Management Plan prepared by the CC at the start of the construction, depending on the classification of the waste product considered.
- Recycling of waste will be maximized.

The Plan will be submitted to the PISC not later than 1 month before the start of decommissioning and include the methods for carrying out the following activities:

- Evaluation of quantities regarding each group of materials/waste identified;
- Identification of registered companies for the recycling of materials and waste;
- Procedures for treatment and disposal of non-recycled material and waste;
- Schedule for cleaning operations;

#### *Rehabilitation Stage*

Rehabilitation will be carried out in immediate continuation or even in parallel with the cleaning stage, taking advantage of the presence of the manpower and the equipment. Consultation with concerned stakeholders will be carried out where necessary. The following principles will apply:

- Sites shall be rehabilitated in a way to restore, as much as feasible and reasonably possible, the original use of the land;
- All sites must be returned free of any buildings or infrastructures developed for the purpose of Project construction, except if specific request is made;
- All sites where structures were temporary removed (market stalls, shops, other) will be reinstalled at the end of the works, excepts if special request from the owner.
- All spoil disposal areas shall be rehabilitated according to the obligations of the Tender Documentation and the obligations of the Plan on Sediment and Spoil Management.

- Rehabilitation option will eventually be selected through consultation between CC, PISC, PMO and any private party if the land is privately owned.

After completion of SCR works, the CC will inform the PISC regarding the final site status. After acceptance by PISC of the site conditions, the PMO will be notified. To finalize the SCR process, a joint site visit with all concerned parties will be organized by the PISC to sign SCR Completion Certificates as follows:

- For public land, the SCR Completion Certificate will be signed by PISC, PMO and by the Town Development Committee Land Services as witness; and
- For private land, the SCR Completion Certificate will be signed by the land owner, CC, PISC and PMO.

## **9.7 Environmental Supervision during Construction**

The Project Implementation Support Consultant (PISC), through its Environment Health and Safety staff, is responsible for ensuring the Contractor complies with its CEMP. The PISC is the one that certifies payments to the contractor and as such, he can therefore 'negotiate' the deployment by the contractor of equipment or labour initially allocated to the works in favour of specific environmental measures.

### **9.7.1 MONITORING OF CONSTRUCTION ACTIVITIES**

Contractors' compliance with their environmental and social obligations will be the subject of a specific monitoring process, coordinated by the PISC. In order to ensure compliance with E&S requirements and efficient implementation of corrective measures an environmental monitoring program will be set up, including:

- EHS supervision of the contractors: Through regular site inspections the objective is to ensure that all EHS measures, set out in the obligations for Contractors and in the CEMP, are effectively and efficiently implemented;
- Environmental quality monitoring: monitoring of changes in the quality of the environment in order to evaluate the efficiency of the mitigation measures applied and, if necessary, to modify acceptability thresholds or methods;
- Environmental compliance control monitoring: ensuring that all discharges from all project sites are compliant with environmental legislation or with related specifications in the Tender Documents (under the responsibility of the Contractor. This monitoring will also confirm or not the validity of information supplied by the CCs on a monthly basis. Analysis will be performed on a limited number of parameters indicators of pollution from construction activities.

#### **Weekly Inspections**

Weekly inspection of the different work sites will be organised by the PISC and will be the subject of a report using a standard inspection sheet. This information sheet will cover all the environmental specifications imposed to the contractor, item by item, giving an immediate overview during each inspection, of potential situations of non-conformity.

Each environmental event (EE) will be the subject of a standard record sheet to be filled in by the observer (Inspector) and submitted to the PISC for action. The record sheet signed by the PISC is handed over to the Contractor who then completes the document by explaining the proposed corrective measure. If the solution is acceptable, the EE is closed after checking that the corrective measure has been effectively and successfully implemented.



**Coordination Meeting**

Regular (weekly or semi-monthly) coordination meetings will be held between the Contractors. (and their inspectors) and the PISC (and his inspectors), during which they discuss the EE in progress, the remedial measures taken and any other subject of current concern such as the Action Plans presented by the CC-EHSCs.

**9.7.2 WATER QUALITY MONITORING**

A water quality monitoring plan to appreciate the performance of the environmental management implemented on the sites. This monitoring will control the quality of liquid effluents (waste water, drainage water) leaving the limits of the work site concerned and their compliance with applicable norms or standards provided in the tender Documents.

Under the supervision of the PISC, a third party independent environmental monitoring consultant will be contracted for monitoring the quality of all discharges leaving its sites or subcontracting a competent consultant or local agency to do so. The parameters to monitor will be defined according to the type of discharge (grey water, storm water) and detailed in the Tender Documents.

Sampling sites and parameters may change in the course of construction in order to adapt to the areas of activity and the types of activity observed, some components being linear. The monitoring will be carried out on a monthly frequency.

Compliance monitoring will concern at least the following water quality indicators:

- organic pollution: BOD5, COD, nitrates, phosphates, coliforms, (particularly related to the camps areas);
- oils and grease, relating to drainage water from the areas used for mechanical activities, storage of hazardous substances (hydrocarbons) and wastewater from canteens;
- suspended solids in drainage water and used also as performance criteria for the dredging activities and for sedimentation basins.

**9.7.3 AIR QUALITY AND NOISE MONITORING**

The main anticipated impact will be caused by dust near the construction sites. No significant problem is seriously anticipated with exhaust emissions, except very locally along hauling routes.

Two types of sampling monitoring are under the responsibility of the PMO:

- ad-hoc controls for dust at the boundaries of construction sites near residential areas and along hauling routes used between the dredging sites and WWTP site to be filled. Action will be taken as soon as few complaints from residents have been collected for a particular location, or where visual inspection confirms that excessive dust is being generated. The PISC will make spot checks of noise levels on the various work sites and in certain residential areas during daytime and night, in order to check that applicable references at the boundaries of the work sites or in the surrounding residential areas are complied with.
- regular monitoring for air quality and noise carried out by an external registered laboratory on a semi-annual basis. Locations may vary according to progressive transfer of activities, particularly for the road works.

Proposed Monitoring Plan is detailed in **Table**.

**Table 38: Environmental Monitoring for Air and Noise**

Reference	Parameters	Locations	Frequency
Ambient air quality standards: Ministry of Health	CO, SO <sub>2</sub> , NO <sub>x</sub> , TSP, O <sub>3</sub> , lead dust (Pb), (PM10), (PM2.5),	Hpa-An <ul style="list-style-type: none"> <li>• WTP</li> <li>• Bar-Mae storage</li> <li>• Kyar-Inn storage</li> <li>• Water Intake</li> <li>• WS distribution network</li> <li>• SW Landfill/Compost plant</li> </ul>	Quarterly
Noise level standards: Ministry of Health	Day time and night time noise levels dB(A)	Myawaddy <ul style="list-style-type: none"> <li>• WTP</li> <li>• Water storage</li> <li>• Water Intake</li> <li>• WS distribution network</li> </ul>	

Monitoring will be conducted by a third party independent environmental monitoring contractors.

All results will be checked against MONREC Environmental Quality (Emissions) Standards, 2015. Any non-compliance detected will require immediate correction from the Contractor.

## 9.8 Environmental Management for Operation Stage

The implementation of environmental monitoring is necessary from the time the works are completed and commissioned, in order to ensure impacts and mitigation measures proposed have been efficiently implemented during the construction stage and show positive results as expected.

The start of the operation stage will vary depending on the project components considered. The total project construction is anticipated to last 5 years. Due to the type of sub-components concerned, only a water quality monitoring of the resources used to supply Hpa-An and Myawaddy is anticipated.

### 9.8.1 WATER QUALITY MONITORING OF RIVERS

Monitoring of Thanlwin and Thaungyin (Moei) rivers in order to ensure water quality remains stable on the long term and fully compatible for domestic water supply purpose.

Sampling will be carried out on a semi-annual basis (one sampling in wet and one in dry seasons) in 2 locations: in Hpa-An, close to water intake in Thanlwin River and in Myawaddy close to the intake in the Thaungyin (Moei) River.

- On site measurement: Temperature, EC, dissolved oxygen, pH, turbidity;
- Physical and chemical analysis: BOD, COD, Total Suspended Solids, Total Phosphorus, Phosphate, Total Nitrogen, Nitrates, Ammoniacal Nitrogen,

Ammonium, Sulphates, Chloride, Calcium, Magnesium, Sodium, Potassium, Alkalinity (Bicarbonate  $\text{HCO}_3^-$  and Carbonate  $\text{CO}_3^{2-}$ );

- Total and faecal coliforms;
- Heavy metals (during dry season sampling only): Iron, Lead, Cadmium, Chromium, Zinc, Copper.

PMO shall appoint a certified laboratory in Myanmar to carry out the monitoring program. Exact location of sampling sites shall be determined after the completion of the detailed design. Sampling of water resource will be complemented by the daily/monthly monitoring of distributed water carried out by the operator of the WTP.

### **9.8.2 MONITORING OF TREATED WATER SUPPLY QUALITY**

The Operators of the WTP in Hpa-An and in Myawaddy shall be requested to monitor on a daily basis the safety of the water supplied to the system. Sampling shall be done at the WTP reservoirs and at the main storages (Kyar Inn and Bare Mae reservoirs in Hpa-An and main storage in Myawaddy) before water enters the network and at tap level (4 random sites every day). Parameters controlled daily include residual chlorine for all sites and coliforms for any sample measured with residual chlorine lower than 0.5 mg/l.

### **9.8.3 MONITORING OF WTP SLUDGE**

The Operators of the WTP in Hpa-An and in Myawaddy shall be requested to monitor twice a year the quality of the sludge delivered to the landfill. Parameters to control include: pH, EC, N,  $\text{NH}_4$ ,  $\text{P}_2\text{O}_5$ ,  $\text{K}_2\text{O}$ , Ca, Mg, Al, Cu, Fe, Mn, Zn, Cd, Cu, NI, Hg, Pb, Helminth eggs, salmonella, odour.

### **9.8.4 MONITORING OF TUBEWELLS AROUND THE LANDFILL**

5 monitoring tube wells to control any contamination of underground water around the two landfills have been implemented at the start of the construction. These tube wells will continue to be monitored by the operators of each landfill during the operation and even during at least 5 years after its eventual closing.

Sampling shall be organized on a semi-annual basis including the control of the following parameters: pH, EC, BOD5, COD, TDS, Chlorides, Sulphates, Phosphates, Total N, Ammonia-N, Nitrate-N, Mn, Fe, Cu, Cd, Ni.

Should the results prove that no contamination is observed, sampling on an annual basis shall be sufficient.

### **9.8.5 MONITORING OF GAS EMISSION AT LANDFILL**

The owner/operator of each landfill will also be required, for health and safety concerns, to regularly monitor landfill gas (LFG). Monitoring is intended to detect unacceptable gas emissions resulting from landfill operations. Methane ( $\text{CH}_4$ ) and carbon dioxide ( $\text{CO}_2$ ) are the major constituents of landfill decomposition gas; other gases present in trace quantities include non-methane organic compounds (NMOCs), hydrogen sulfide ( $\text{H}_2\text{S}$ ), nitrogen ( $\text{N}_2$ ), hydrogen ( $\text{H}_2$ ) and oxygen ( $\text{O}_2$ ).

Gas will be controlled on a monthly basis the first year of operation, then reduced to quarterly control if results are below applicable limits. Any control detecting above standard value will re-activate monthly controls for at least 3 months.

Measures will concern the concentration and migration of methane, CO<sub>2</sub>, H<sub>2</sub>S, O<sub>2</sub> and percent lower explosive limit (%LEL, a concentration of 5% methane in the air). Hazardous conditions are not considered to be present on a landfill when methane concentrations are less than 25% of LEL in facility structures, and when the concentration of methane gas does not exceed the LEL (5% by volume) at the property boundary. Air sampling and analysis shall be carried out by a registered laboratory in Myanmar. Cost of monitoring will be supported by the owner/operator.

### **9.8.6 MONITORING DISCHARGES FROM LEACHATE TREATMENT PLANT**

Monitoring of Leachate Treatment Plant discharge water quality to ensure water quality remains in compliance with the national emissions standards of MONREC

Sampling will be carried out on a daily basis tracking the parameters included in the standard and including the following general parameters on at least a monthly basis. In addition, specific parameters related to new standards for municipal solid waste emissions will be monitored as agreed with MONREC prior to construction.

- On site measurement: Temperature, EC, dissolved oxygen, pH, turbidity;
- Physical and chemical analysis: BOD, COD, Total Suspended Solids, Total Phosphorus, Phosphate, Total Nitrogen, Nitrates, Ammoniacal Nitrogen, Ammonium, Sulphates, Chloride, Calcium, Magnesium, Sodium, Potassium,
- Total and faecal coliforms;
- Heavy metals (during dry season sampling only): Iron, Lead, Cadmium, Chromium, Zinc, Copper, Mercury.

This monitoring part of the conventional follow-up and maintenance to be carried out for this type of plant. The cost is not a part of the EMP budget.

## **9.9 Cost of Environmental Impact Prevention, Mitigation and Monitoring**

Table 39 sets out the estimated budgets required for implementation of the corrective measures and monitoring activities for implementation of the environmental management plan.

**Table 39: Tentative Budget for EMP Implementation in Kayin State**

Item	Cost (\$)	Comment
Mitigation Measures		Normally included in construction contracts. Indicative cost only.
Implementation of the CEMP	200,000	
Monitoring Programs		Contracted out by PMU to qualified environmental monitoring agencies.
Noise Monitoring	20,000	
Water Quality Monitoring	42,000	
Air Quality Monitoring	20,000	
Environmental Staff		
Contractor	72,000	36 person months
Project Implementation Support Consultant	150,000	Assumes 50% of PISC effort will be devoted to Kayin State subprojects 6 person months (International) 36 person months (national)
PMO Environmental and GRM Staff	36,000	72 person months
Capacity Development and Training	40,000	
Vehicles	30,000	
Subtotal	610,000	
Contingency (10% of subtotal cost)	61,000	
<b>TOTAL COSTS</b>	<b>671,000</b>	

## 10 CONCLUSIONS

The Third GMS Corridor Town Development Project focuses on the towns of Hpa-An and Myawaddy in Kayin State. The Project intends to significantly improve the environmental conditions in the two cities and the quality of life of its population through the improvement of water supply and solid waste facilities.

Water supply is presently insufficient in terms of serviced areas, service duration, quantities supplied and water quality. The Project beneficial impacts are the followings:

In Hpa-An:

- Improvement of the water supply efficiency by the mobilisation of new water intake in Thanlwin River;
- Improvement of water supply security by increasing the water supply storage capacity in Hpa-An through the construction (i) of a new 3,000 m<sup>3</sup> water storage on Bare Mae Hill in replacement of 3 old reservoirs and (ii) of a new 3,000 m<sup>3</sup> reservoir on Kyar Inn Mountain;
- Improvement of public safety through the construction of a water treatment plant with a capacity of 10,000 m<sup>3</sup>/day (and a possibility to extend to 18,000 m<sup>3</sup>/d in a second phase), based on rapid sand filtration process with disinfection by chlorine;
- Creation of transmission lines and distribution lines including 21.2 km of transmission lines and main networks (diameters from 200-400 mm) and 79.1 km of distribution system (including tertiary networks ≤ 200 mm). The project would also include a fund to finance over 10 000 new connections.

In Myawaddy:

- Improvement of the water supply efficiency by the mobilisation of new water intake by infiltration gallery along Thaungyin (Moei) River;
- Improvement of water supply security by increasing the water supply storage capacity in Myawaddy through the construction of a new 4,500 m<sup>3</sup> water storage;
- Improvement of public safety in Myawaddy through the construction of a water treatment plant, with a capacity of 9,000 m<sup>3</sup>/day, based on rapid sand filtration process with disinfection by chlorine;
- Rehabilitation and expansion of distribution network in wards 1,2,5 and a part of ward 4.

Solid waste management is a major environmental issue in Hpa-An and Myawaddy where only respectively 35% and 50% of the solid wastes are collected at present.

The remaining uncollected waste is dumped all over the cities where the waste either decays with unpleasant smells and proliferation of insects or is burnt by the residents with emission of unpleasant and dangerous smoke as materials like plastics are also burnt. The collected waste is disposed in Hpa-An in a dumping site where it is regularly burnt in the dry season and from where untreated leachates are discharged into the surface water bodies. In Myawaddy, collected waste is dumped in 3 sites. Two of them are located within the urban area on the Thaungyin River bank and a new dump site has been recently created west of the city. Large



quantities of waste are dumped into the storm drainage networks, clogging the drains and creating localised flooding during the rainy season.

The solid waste component beneficial impacts in Hpa-An and Myawaddy include:

- Improvement of quality of life and public health by (i) increasing the collection rate of solid waste in the city and (ii) improving collection points facilities;
- Improvement of storm drainage efficiency by reducing the amount of waste dumped into the drains and clogging the system;
- Reduction of water pollution load by improved collection rate and construction of sanitary landfills with leachate collection and treatment in each town;
- Reduction of air emissions and particularly GHG through (i) construction of a composting plant on the landfill site and (ii) collection of landfill gas and flaring;
- Improvement of waste recycling efficiency resulting in secondary beneficial environmental impacts through significant avoidance of GHG emission;

With the exception of Hpa-An new storage on Kyar-Inn mountain located on lands owned by monastery communities but presently unused and the WTP on floodable land privately owned, none of the other Project components requires land acquisition as they are all developed on Hpa-An or Myawaddy TDC land or on Kayin State Government land. Water distribution networks are located in public areas (roads and streets).

None of the Project components involves significant forest clearing or encroachment into valuable wetland or other conservation area. Only few urban trees may be cut depending on the detailed design of each component, but EMP shall limit the cutting and impose the plantation of 2 new trees per cut tree.

Following the principles of Green Cities, the project will support innovation with (i) the construction of the first composting plants in Myanmar, attached to the landfill of each city and (ii) the equipment of each proposed new landfill with a system of gas collection and flaring. When compared with the situation without project, the solid waste component of the Third GMS in Kayin State will reduce the annual emission of GHG from generated waste in 2020 by 13,500 tons CO<sub>2</sub>-eq/year for Hpa-An and by 18,500 tons CO<sub>2</sub>-eq/year for Myawaddy. GHG abatement shall reach in 2040 42,500 tons CO<sub>2</sub>-eq/year for Hpa-An and 66,700 tons CO<sub>2</sub>-eq/year for Myawaddy.

The IEE also considered climatic trends at the national, regional and local scale in Myanmar and more specifically in Hpa-An for which long term climatological data is available. Both temperature and rainfall show increasing trends in Hpa An along the last 50 years of observations, in line with the MONREC analysis for the Kayin State. Annual rainfall didn't change significantly over the last 50 years. Among the wet season months (May to October), only the months of June, July and September show an increasing trend, with July showing the highest raise during the 50 year period (about 120 mm, or 24 mm per decade).

Temperature rise was more significant during the same period. The average annual maximum temperature increased by 2,2°C over the last 48 years, or an increase of almost 0,5°C per decade, a value significantly higher than what is considered as an average increase in the Kayin State (0.32°C per decade). July and February increased by about 4°C during the period while the other dry season months increased by 2 to 3 °C. Wet season months increase was only about 1°C during the same period.



The results of AWARE model were considered in the preparation of the IEE Report. In this connection, climate change and natural hazards considerations had been incorporated in the IEE. AWARE was used by the ADB to undertake an initial climate risk screening exercise. The results had rated the project as MEDIUM RISK and have identified flooding and landslide as a high level risk factor as the project is located in a region which has experienced recurring flood events in the recent past. However, the effective risk level is dependent on local geographical factors. On this basis, due to the location of Hpa-An and Myawaddy in flat or smoothly undulating areas, the risk for landslide may be considered as low. Hpa-An experiences infrequent flooding mainly localized next to the Thanlwin River where the water intake is located and around the central lake (which level varies according to Thanlwin river level) near which the WTP is located. Both sub-components integrate flood level constraints into their design, including a safety board for climate change risk. Following such design principles, the Project components shall not be affected or put at risk by climate change.

A screening carried out during the Interim phase of the Project confirmed that environmental impacts raised by the project were either very beneficial or mainly related (i) to the risks of nuisances during the construction phase but easily controllable by appropriate construction site supervision and conventional mitigation measures and (ii) during operation, to typical risks in relation to WTP and landfill management but also easily avoidable considering the simple technology applied and the small size of the projects. Consequently, the proposed categorisation of the Project was B, involving the preparation of the present IEE. The conclusions of the present report confirm this initial categorization as category B Project.

Aside from the several and undisputable beneficial impacts of the Project in Hpa-An and Myawaddy, some potential but limited risks are still to be considered should the management program anticipated be deficient:

- Most of the anticipated environmental and social impacts are related to nuisances which may happen during the construction activities. Because of the project located in an urban environment, risk of nuisances is higher: traffic congestion, temporary alienation of access, temporary disruption of community facilities, noise and engine gas and dust release may temporarily disturb the nearby communities. However, recommendations formulated in the present EMP combined with a solid environmental contractual framework and an effective inspection and supervision of construction sites will definitely reduce these risks to acceptable levels.
- Impacts related to water treatment plant operation (pollution from sludge, contamination of water resource) can be also avoided by appropriate management measures already discussed in the IEE. Monitoring of rivers water quality and of treated water is considered to ensure compliance and reduce the risk of supplying contaminated water.
- Impacts related to landfill operation (gas emission and pollution by leachate) are unlikely to occur as design already consider gas collection and flaring and leachate collection and treatment. However, monitoring of gas emission, leachate and adjacent underground water table is considered to ensure compliance.

The EMP emphasizes (i) the need for EHS capacity building for Hpa-An and Myawaddy TDCs, the PMO and the PIU staff, (ii) the need for very strict and

detailed EHS specifications for the tender documents and (iii) the need for strict EHS enforcement through monitoring of construction activities.

**Conclusion.** Assuming that the mitigation measures and monitoring requirements described in the Environmental Management Plan are effectively implemented, the Project is not expected to have a significant adverse environmental impact

## **11 APPENDICES**

### **Appendix 1 Bibliography**

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