

MATRIX 1: ENVIRONMENTAL MANAGEMENT PLAN TO BE IMPLEMENTED DURING THE SITE PREPARATION AND CONSTRUCTION PHASES

Environmental / Social issue/ aspect/ activity	Anticipated negative impact	Management and mitigation	Performance indicator
Site preparation phase			
Establishment of site office:	Construction wastes generation.	<ul style="list-style-type: none"> • Landscape the area once construction is complete to incorporate as many/much trees /vegetation as possible; • Develop a waste management plan and implement it. 	Waste disposal records.
Earthworks, demolitions and excavations:	<ul style="list-style-type: none"> • Collection and stagnation of surface runoff; • Increase in susceptibility to soil erosion; • Production of spoil from excavated ground; • Reduction in aesthetic value of the area; • Risk of contamination to surface water; • Control dust and noise onsite • Provide workers with personal protective equipment 	<ul style="list-style-type: none"> • Excavation should be carried out such that drainage is controlled, and water is not allowed to accumulate; • Establish controls for surface runoff during excavation; • Control excavation activities to limit excavation to land which is required for construction; • Cordoning the site off using iron sheets or other appropriate materials to protect passersby and control noise. • Control any likelihood of occurrence of risks 	<p>Performance of erosion control measures.</p> <p>Noise and dust generation</p> <p>General due diligence practised</p>
Transportation of debris:	Fuel consumption and exhaust fumes; Increase in traffic flow	<ul style="list-style-type: none"> • Maintenance of equipment for efficiency, minimising noise production, emissions, spills and consumption; • Erect informative signs prior to commencing construction activities to warn 	<ul style="list-style-type: none"> • Fuel consumption; • Frequency of equipment

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	in the area.	residents; <ul style="list-style-type: none"> • Avoid transporting during periods of peak traffic activity. 	replacement and repair.
Levelling and laying of foundation:	Noise and dust.	<ul style="list-style-type: none"> • Water sprinkling and use of screens to control dust; • Maintenance of equipment for efficiency, minimising noise production, emissions and spills; • Cordoning the site off. 	<ul style="list-style-type: none"> • Daily spot checks; • Regular servicing of equipment.
Occupational health and safety:	Health hazard; Physical injury from slipping falling and handling equipment.	<ul style="list-style-type: none"> • Carefully plan for construction sanitary facilities • Provide personal protective equipment (PPE) appropriate to working area for staff and visitors to the site; • Regular site reporting on health, safety and environment (HSE) issues by an appointed HSE representative; • Develop a monitoring programme to assess noise performance in accordance with the revised Noise Prevention and Control Rules (April 2005); and NEMA Noise Control Regulations, 2009 • Assessment of HSE mitigation measures and recording of any matters arising as per Legal Notice No 40, The Factories (Building Operations and Works of Engineering Construction) Rules 	<ul style="list-style-type: none"> • Regularly check on performance of provided sanitary facilities; • Have regular spot checks on use and adequacy of PPE provided • Conduct regular internal assessments on environmental site performance and record findings.
Production of waste:	Soil degradation and surface water pollution.	<ul style="list-style-type: none"> • Develop a solid waste management plan prior to project commencing, identifying optimal waste re-use options and licensed disposal areas; • Waste should not be burned on site or dumped in undesignated waste disposal areas; • Minimise waste production by utilising best available techniques for site preparation; • Re-use construction waste to the maximum extent possible; • Excavation activities and dumping of spoil should be properly managed such that land which is not required for the project is left undisturbed. 	Report on all waste production and handling procedures.

Construction phase			
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Vegetation Clearance	<ul style="list-style-type: none"> • Loss of vegetation cover • Soil erosion 	<ul style="list-style-type: none"> • Areas with exposed soil should be replanted with grass as soon as possible after construction; to help mitigate against flash flood caused soil erosion. • Waste generated during the site clearance/construction phases of the project must be disposed of at an approved disposal site (Embu County dump site). • Suitable trees should be planted at the periphery of project site and near the River bank • No unnecessary removal of any vegetation shall be done 	<ul style="list-style-type: none"> • Spot checks • Number of trees planted or suitable vegetation
Loss of Water Quality and interference with riparian reserve	Pollution of nearby stream and sedimentation	<ul style="list-style-type: none"> • Runoff channels to be constructed to drain storm waters • Water quality tests at the river to be conducted quarterly • Maintain the riparian reserve of 10 meters • Replant the riparian zone with suitable trees 	<ul style="list-style-type: none"> • Spot checks • Water quality tests • Number of trees planted
Air Quality	Excessive generation of dust and other particulate matter	<ul style="list-style-type: none"> • Site access roads should be dampened every 4-6 hours or within reasonable time to prevent a dust nuisance and on hotter days, this frequency should be increased. • The access roads (unpaved sections) through to the site should also be wetted and the sections of the road monitored so that any material falling on it as a result of the construction activities be removed. • Minimize cleared areas to those that are needed to be used. • Cover or wet construction materials such as soil for backfill to prevent a dust nuisance. • Where unavoidable, construction workers working in dusty areas should be provided and fitted with respirators 	<ul style="list-style-type: none"> • Workers with respirators, nose masks, ear plugs • Wetted roads
Storage of Raw Material and Equipment	Stored materials becoming air, water or soil borne	<ul style="list-style-type: none"> • Raw materials that generate dust should be covered or wetted frequently to prevent them from becoming air or waterborne. • Raw material should be placed on hard stands surrounded by walls. • Equipment should be stored on impermeable hard stands surrounded by walls to contain any accidental surface runoff. • No storage of oils or fuels onsite 	<ul style="list-style-type: none"> • Impoundment walls constructed • Labeling of materials
Wastewater Generation	<ul style="list-style-type: none"> • Pollution of ground water 	Provide portable sanitary conveniences for the construction workers for control of sewage waste. A ratio of approximately 25 workers per toilet should be used	Sanitary facilities

and Disposal	<ul style="list-style-type: none"> • Pollution of local stream 	as a guide.	provided
Transportation of Raw Material and Equipment	Interference with traffic flow including pedestrians	<ul style="list-style-type: none"> • Adequate and appropriate road signs should be erected to warn road users of the construction activities. For example, reduced speed near the entrance roads. This should be done in conjunction with the Ministry of Transport • Raw materials such as sand, murram and cement should be adequately covered within the trucks to prevent any escaping into the air and along the route to the site. • The movement of equipment (trucks) during the construction of the system should be limited to the working hours, 8:00 am - 5:00 pm per day. • Equipment should be transported early morning (6 am – 7 am) with proper care being taken. • The use of flagmen should be employed to regulate when trucks have access to the main roads. 	Road signage erected
Traffic Obstruction	Obstruction caused by laying of sewer lines to persons and vehicles	<ul style="list-style-type: none"> • The laying of sewer pipes across any access road should be done when traffic volumes are lowest, for example, early morning or on weekends (specifically on Saturdays and Sunday). • Adequate notices should be placed along the route. • Adequate signs and flagmen should be put in place. 	<ul style="list-style-type: none"> • Signage posted • Flagmen posted appropriately along the route
Emergency Response plans	Occurrence Of accidental injuries	<ul style="list-style-type: none"> • A lead person should be identified and appointed to be responsible for emergencies occurring on the site. This person should be clearly identified to the construction workers. • Make prior arrangements with health care facilities such as a Health Centre in proximity, a private doctor or the Provincial Hospital to accommodate any eventualities. • Material Safety Data Sheets (MSDS) should be store onsite. 	<ul style="list-style-type: none"> • Availability of MSDS on site • Lead person to oversee health and safety issues appointed

Drainage management	Soil, surface and ground water pollution, work area health and safety	<ul style="list-style-type: none"> • Proper construction site drainage management i.e.: Control erosion • Avoid ponding water; • Proper waste and material handling, and storage to avoid flushing of wastes in to the neighbouring stream • Follow designs made for the system 	Daily auditing and spot checks
Waste management	Pollution, infestation by vermins, work area health and safety	<ul style="list-style-type: none"> • Waste bins should be strategically placed within the construction site. • The waste bins at the construction site should be adequately designed and covered to prevent access by vermin and minimize odour. • The bins at the construction site should be adequately covered to prevent a dust nuisance. • The bins at the construction site should be emptied regularly to prevent overfilling. • Disposal of the contents of the bins should be done at an approved disposal site. The Embu Town dump site is recommended. Appropriate permission should be sought (from the NEMA). • Controlled use of materials on site; • Waste minimization at the source • Safe waste storage and handling on site • Monitoring and reporting • Erect warning signs against poor waste disposal • Sensitization of workers on waste disposal methods • Encourage and practice reuse and recycling 	Daily auditing and spot checks
Soil erosion	Soil loss and sedimentation of the local stream	<ul style="list-style-type: none"> • Minimize vegetation disturbance; • Reinstate site immediately after construction • Put bunds to prevent soil and any material from getting to the local stream 	<ul style="list-style-type: none"> • Daily spot checks • Workers wearing protective gear • Monitoring of the stream nearby
Noise / vibration	Nuisance in the project area	<ul style="list-style-type: none"> • Use equipment that has low noise emissions as stated by the manufacturers. • Use equipment that is properly fitted with noise reduction devices such as mufflers. • Operate noise-generating equipment during regular working hours (e.g. 8 am – 6 pm) so as to reduce the potential of creating a noise nuisance during the night. • Construction workers operating equipment that generates noise should be 	Daily spot checks

		<p>equipped with noise protection. A guide is a worker operating equipment generating noise of ≥ 80 dBA (decibels) continuously for 8 hours or more should use ear muffs. Workers experiencing prolonged noise levels 70 - 80 dBA should wear earplugs.</p> <ul style="list-style-type: none"> • The working hours shall be regulated i.e. from 8 AM to 6PM • Workers shall wear earplugs during construction phase • Implement noise minimization measures; • Site screening; • Manage vibration, where it occurs • Monitoring, reporting and community liaison 	
Earthworks excavation	Wastes arising, safety, noise, vibration, surface contamination,	<ul style="list-style-type: none"> • Noise, dust, vibration minimization measures should be put into place • Minimize excavation and materials for disposal • Exclude water from excavation; • Properly support excavated areas as appropriate • Manage any contaminated materials found • Minimize risk of contaminating surface water • Safe material storage and disposal at appropriate sites. 	Daily auditing
Materials for construction	Destruction caused by mines and quarries, wastage.	<ul style="list-style-type: none"> • Document and report on all material sources • Control wastage of block, brick and stone work et al; • Utilize damaged materials elsewhere. 	Monthly reporting
Concrete works	Dust, noise, materials, oil contamination.	<ul style="list-style-type: none"> • Controlled batching; • Control dust and noise • Use re-usable shuttering; 	Daily, spot checks
Fire safety and general accidents	Working conditions, fire related incidents and accidents, pollution.	<ul style="list-style-type: none"> • Compliance with OHS laws and health and safety committee rules; • Provision of PPE (personal protective equipment) • Secure / screen hazardous areas; • Provision of fire suppression equipment; • "No smoking" signage Prominently displayed; • Provision of First Aid box facilities; • Training in fire response/ First Aid; • No burning of waste or material on site • Fencing the site with strong wire mesh material 	<ul style="list-style-type: none"> • Regular fire audit • Strict site supervision • A register of incidents and accidents should be kept