



Ghana Bridge Project ESMS

Environmental and Social Aspects and Impacts Register

**Early Power Limited
91 Osu Badu Street
West Airport
Accra**

Version Record – Record of Reviews and Amendments

Revision Number	Date of Issue	Planned Review Date	Reviewer	Details of Amendments	Approved by
1.0	10/05/2016	10/05/2017	Donna Fitzgerald, Jacobs	First issue	Martha McBarron
2.0	28/10/2016		JP Wale	Update	M McBarron
3.0	12/12/17	TBC	JP Wale	Update due to project change	JP Wale

Contents

1. Introduction	1-1
1.1 Updates	1-1
1.2 Scoring.....	1-1
2. Aspects and Impacts Registers	2-1
2.1 Construction Aspects and impacts Register	2-1
2.2 Operational Aspects and Impacts Register	2-15
2.3 Decommissioning Aspects and Impacts Register.....	2-27
2.3 Significant Risks (Aspects).....	2-36

1. Introduction

An aspects and impacts register developed in accordance with ISO 14001:2015 and IFC PS1 is central to the process of identifying and managing potential environmental and social impacts arising from project activities. It provides the mechanism to record potential impacts and their causes, data uncertainties and accountabilities for responding to identified impacts.

Reviews of the major project impacts have been conducted throughout the project to date using the Screening and Environmental and Social Impact Assessment (ESIA) processes. These reviews have informed this Environmental and Social Aspect and Impact Register.

Section 2 of this document presents matrices which summarise environmental aspects and impacts for each phase of the project, comprising:

- Construction;
- Operation; and
- Decommissioning.

This Aspects and Impacts Register has been developed with reference to the following documents:

- Ghana Bridge Project ESIA Volume 2: ESIA Study Report – updated August 2017;
- Ghana Bridge Project ESIA Volume 3: Environmental and Social Management Plan – updated August 2017; and
- Schedule to the Environmental Permit for the Ghana Bridge Project, Environmental Protection Agency, 25 January, 2016 (soon to be revised and re-issued).

1.1 Updates

This Aspects Register is a live document forming part of the Environmental and Social Management System (ESMS) documentation for the Ghana Bridge Power Project. It shall be updated on an as required basis, at least annually, or following a significant design change, or when the project is at the end of each significant project phase.

1.2 Scoring

For the purpose of categorizing risk, a scoring matrix has been developed in accordance with industry standards, which enables analysis of the severity and likelihood of each impact. The scores have been allocated based on the mitigated risk, following the application of both engineered mitigation and management controls which are already included in the design or are outlined within the ESIA. The relevant mitigation measures are detailed within the registers in Section 2.

Where adequate mitigation measures are not in place to reduce risk to an acceptable level, or where the design is not sufficiently mature to enable confirmation of mitigation, a conservative appraisal of risk has been applied.

Severity

All aspects and impacts have been scored for their environmental severity. Severity is categorized as A – I, with A being the most severe as described in Table 1 below. If the severity is rated as I (opportunity or beneficial impact) no further assessment of risk is required to be undertaken.

Likelihood

All aspects/impacts have been scored for their likelihood using the indicators provided in Table 2 below. This table enables the assignment of a score for likelihood based on the frequency of occurrence per year or probability of occurrence

Overall Risk

The residual risk score is calculated on the basis of severity and likelihood in line with the matrix provided in Table 2. The numbers in the matrix relate to the relative levels of risk (risk rating) with 1 being the lowest level of risk and 15 the highest.

Table 1: Severity Matrix

Rating	Severity
A	<p>Unintended release or impact with widespread damage to the environment which remains in an unsatisfactory state for more than 5 years or damage to a sensitive environment which can only be restored in a period of more than 5 years.</p> <p>Multiple fatalities or serious health disabilities.</p>
B	<p>Impact with widespread damage to the environment which can only be restored in a period of 1 to 5 years or damage to a sensitive environment which can be restored to an equivalent capability in a period of around 1 year.</p> <p>Fatality or serious health disability.</p> <p>Significant and widespread community concern at the national level, with associated significant reputational risk.</p>
C	<p>Impact with widespread damage to the environment which can only be restored in a period of up to 1 year or damage to a sensitive environment which can be restored to an equivalent capability in a period of months.</p> <p>Repeated failure to meet legal compliance requirements and implement actions required by regulators or lenders.</p>
D	<p>Impact with widespread damage to the environment which can only be restored in a period of months or localised damage to a sensitive environment which can be restored to an equivalent capability in a period of 1 year.</p> <p>Significant regulatory breach</p> <p>Lost time injury or short term health effects.</p> <p>Widespread local community concern.</p>
E	<p>Impact with localised damage to the environment which can only be restored in a period of 1 year or localized damage to a sensitive environment which can be restored to an equivalent capability in a period of months.</p> <p>Regulatory breach.</p> <p>Lost time injury or short term health effects.</p> <p>Widespread local community concern.</p>

Rating	Severity
F	<p>Impact with localised or immediate area damage to the environment which can only be restored in a period of months or localized damage to a sensitive environment which can be restored to an equivalent capability in a period of days or weeks.</p> <p>Minor regulatory breach</p> <p>Lost time injury or short term health effects.</p> <p>Widespread local community concern.</p>
G	<p>Impact with localised damage to the environment which can be restored in a period of days or weeks.</p> <p>Local/minor health effects requiring short-term treatment.</p> <p>Minor community opposition or complaints.</p>
H	<p>Impact with immediate area damage to the environment which can be restored in a period of days or weeks.</p> <p>Minor injuries requiring on-site one-off treatment.</p>
I	<p>Beneficial impact or opportunity on the local environment or community</p>

Table 2 Likelihood Matrix

	Likelihood of Risk Event							
	1	2	3	4	5	6	7	8
Severity Level	A similar event has not occurred and would only be a remote possibility	A similar event has not yet occurred within the industry	Similar event has occurred in the industry	A similar event has occurred at a similar facility	A similar event has occurred or is likely to occur within the lifetime of 10 similar facilities	Likely to occur once or twice within the facility lifetime	Likely to occur several times in the facility lifetime	Common occurrence at least annually at the facility
A	8	9	10	11	12	13	14	15
B	7	8	9	10	11	12	13	14
C	6	7	8	9	10	11	12	13
D	5	6	7	8	9	10	11	12
E	4	5	6	7	8	9	10	11
F	3	4	5	6	7	8	9	10
G	2	3	4	5	6	7	8	9
H	1	2	3	4	5	6	7	8
Frequency	10 ⁻⁶ /yr or lower	>10 ⁻⁶ to 10 ⁻⁵ /yr	>10 ⁻⁵ to 10 ⁻⁴ /yr	>10 ⁻⁴ to 10 ⁻³ /yr	>10 ⁻³ to 10 ⁻² /yr	>10 ⁻² to 10 ⁻¹ /yr	>10 ⁻¹ to 1/yr	>1/yr
Probability	10 ⁻⁶ or lower	>10 ⁻⁶ to 10 ⁻⁵	>10 ⁻⁵ to 10 ⁻⁴	>10 ⁻⁴ to 10 ⁻³	>10 ⁻³ to 10 ⁻²	>0.01 to 0.1	>0.1 to 0.25	>0.25

Table 3 below provides the definitions of risk in line with Table 2.

Table 3: Risk Definitions

Risk Category	Definition
Red	Highly significant Requires immediate action. Monitoring likely to be a legal requirement.
Orange	Significant Additional control and mitigation measures required beyond what may already be in place.
Yellow	Medium significance Mitigation measures are required.
Green	Not significant

2. Aspects and Impacts Registers

2.1 Construction Aspects and impacts Register

CONSTRUCTION: Including transportation / installation			Aspect / Impact Definition		Impact Category				Barriers		Applicable Legislation					
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Consequences (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk					
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability	Risk / Opportunity	Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines / Standards
C 1													Natural Resources			
C 1.1	Protected Areas	No protected areas are impacted by this project - see Protected or Endangered Species for details of ecological mitigation (C 1.3).														
C 1.2	Environmentally Sensitive Areas	No environmentally sensitive areas are impacted by this project - Ecological protection impacts and mitigation are detailed under Protected or Endangered Species (C 1.3).														
C 1.3	Protected and Endangered Species	Chaff flower, species of conservation importance; Neem tree invasive species	Construction ground works	1. Loss of chaff flower individuals. 2. Spread of Neem tree due to construction activities releasing and spreading seeds.	Y			Y	1. Begin construction activities during the dry season when a number of species will be absent	1. Construction Contractor shall monitor the population of the Chaff Flower and protect it wherever possible. 2. Construction Contractor shall develop a management plan to ensure control of the Neem tree. This should include careful disposal of trees and seeds, with the use of certain pesticides.	G	4	5	EPA, Act 490; Wildlife Conservation Regulations LI685.	Clause 7.3.5	IFC PS6
C 1.4	Ecosystems goods/ services	No Ecosystem goods or services will be impacted by this project.														

CONSTRUCTION: Including transportation / installation			Aspect / Impact Definition		Impact Category				Barriers		Applicable Legislation					
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Consequences (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk		Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines / Standards	
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability				Risk / Opportunity
C 1.5	Freshwater Resources	Potable water supplied by the GWC	Water consumption for hydrostatic testing and construction welfare	Reduction in supply detrimental to other water users	Y			Y	1. Contractor to consider feasibility of reuse of hydrostatic test water for different pipeline lengths 2. Use of efficient water fittings in welfare facilities	1. Monitor efficiency of water consumption 2. Establish water use monitoring programme 3. Develop a water management system for the project to allow resource optimization	F	5	7	Water Resources Commission Act, Act 52	Clause 7.3.5	IFC PS3
C 1.6	Construction Materials	Quarry resources	Construction materials, particularly quarried aggregate	Use of aggregate from unlicensed quarries with poor environmental controls	Y			Y		1. Audit of sustainable sourcing of construction materials	F	6	8	EPA, Act 490	Clause 7.3.5	IFC PS3
C 2 Emissions to Air																
C 2.1	Greenhouse Gas (GHG) Emissions	Regional and global sensitivities to Global Warming/ Potential regulatory changes	Combustion activities for construction works/ temporary accommodation/ vehicles/ emissions of GHGs including CO2)	Contribution to Climate Change/ Global Warming / non-compliance due to tightening of emission limits/	Y			Y	1. Vehicles to be well maintained to minimize exhaust emissions 2. Idling reduction awareness activities. 3. Minimisation of energy consumption by switching off equipment when not required.	1. Quantification of GHG emissions by desk-based calculations on an annual basis for reporting.	F	6	8	EPA, Act 490	N/A	IFC PS3 WHO air quality guidelines

CONSTRUCTION: Including transportation / installation			Aspect / Impact Definition		Impact Category				Barriers		Applicable Legislation					
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Consequences (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk					
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability	Risk / Opportunity	Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines / Standards
C 2.2	Air Quality	Local communities/ workforce	Dust generation from construction activities/ site preparation	Local air quality	Y			Y	1. Construct/ maintain roads to minimise dust (levelling etc.). Maintain speeds to prevent re-suspension of dust 2. Location, grading and management of stockpiles to prevent wind blow, or dusty materials removed from site promptly 3. Re-vegetation of completed earthworks as soon as practicable	1. Dust mitigation strategy shall be developed and implemented by contractors/subcontractors , including water spraying, vehicle speeds 2. Dampening of un-surfaced areas, soil and spoil to prevent dust re-suspension during hot, dry conditions 3. Lorries will be sheeted during transport of friable construction materials and wheel wash facilities made available during adverse weather conditions 4. Drop heights minimized during transfer of materials, i.e. loading and unloading of friable materials 5. Dust, dust suppression activities and dust in ambient air shall be monitored and logged throughout the construction period.	F	6	8	EP, Act 490, National Environmental Quality Guidelines	Clause 7.3.2, 7.3.5, 7.3.11 and 7.3.13	IFC PS3 WHO air quality guidelines

CONSTRUCTION: Including transportation / installation			Aspect / Impact Definition		Impact Category				Barriers		Applicable Legislation					
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Consequences (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk		Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines / Standards	
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability				Risk / Opportunity
C 2.3	Air Quality	Local communities/workforce	Combustion activities for construction/ temporary welfare accommodation/ vehicle emissions (CO, NOx, SOx VOCs, PM)	Local air quality	Y			Y	1. Use of low sulphur fuels. 2. Engines fitted with particulate filters 3. Vehicles to be well maintained to minimize exhaust emissions 4. Idling reduction awareness activities 5. Switch off vehicles and equipment when not in use.	1. Ambient air quality shall be monitored and recorded throughout construction period	F	6	8	EPA, Act 490	Clause 7.3.2, 7.3.5, 7.3.11	IFC PS3 WHO air quality guidelines
C 3 Waste Management																
C 3.1	Waste	Local communities/workforce	Poor waste management and incorrect disposal of waste	Soil/ groundwater/ visual contamination and local complaints	Y			Y	1. The feasibility of reusing spoil and other excavated materials on site shall be examined 2. Waste shall be stored on impermeable surfaces with adequate containment provided to prevent migration of wastes into the surrounding environment 3. Hazardous and non-hazardous wastes shall be segregated 4. Wastes shall not be stored adjacent to watercourses	1. A Site Waste Management Plan shall be developed outlining processes for the monitoring and management of waste 2. Staff shall be provided with training in waste management processes 3. Wastes shall be disposed of to properly licensed facilities with adequate capacity to manage the waste appropriately.	F	7	9	EPA. Act 490	Clause 7.3.3, 7.3.5, 7.3.10, 7.3.12 and 7.3.13	IFC PS3

CONSTRUCTION: Including transportation / installation			Aspect / Impact Definition		Impact Category				Barriers			Applicable Legislation				
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Consequences (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies			Environmental Risk				
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability	Risk / Opportunity	Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines / Standards
C 4 Liquid effluent discharges																
C 4.1	Wastewater Discharges	Local communities/ local water courses	Discharge of Hydro-test water	Contamination of local water courses	Y			Y	1. Pre-use tests will be undertaken to determine whether pH adjustment of the hydro-test water will be sufficient. This will enable the avoidance of the use of chemical additives such as corrosion inhibitors and biocides	1. Quality of used hydro-test water shall be tested prior to discharge. If the effluent does not meet the required discharge parameters, it will be removed from site via tanker to an appropriately licensed treatment facility	F	6	8	EPA, Act 490, National Environmental Quality Guidelines	Clause 7.3.5	IFC PS3 and 4
C 4.2	Wastewater Discharges	Local communities/ local water courses/ groundwater	Sewage from septic tanks	Contamination of ground or groundwater	Y			Y	1. Septic tank design to be in accordance with regulatory standards and guidelines and with adequate capacity	1. Septic tanks to be emptied regularly by an appropriately licensed contractor 2. Site rules will ensure that workers use the sanitary facilities provided	F	6	8	EPA, Act 490 Water and Sewerage Act, Act 310	N/A	IFC PS3 and 4
C 4.3	Storm water Discharges	Local communities / local watercourses	Discharge of dirty run-off water into storm water drainage system	Siltation of local watercourses.	Y			Y	1. Silt traps shall be located appropriately to ensure that silt laden storm water is not discharged to local water courses 2. Measures to eliminate dust generation as outlined in C 2.2 will also minimise sediment in storm water discharge	1. Routine monitoring of the turbidity of water prior to discharge`	F	7	9	EPA, Act 490	Clause 7.3.5	IFC PS3 and 4

CONSTRUCTION: Including transportation / installation			Aspect / Impact Definition		Impact Category				Barriers		Applicable Legislation					
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Consequences (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk					
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability	Risk / Opportunity	Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines / Standards
C 4.4	Unintended Releases	Sensitive habitats/ communities	Fuel and chemical transport/ storage	Release from vehicle / storage			Y	Y	<p>1. Road tankers/ storage vessels either transporting/ storing diesel/ chemical will use temporary secondary containment equipment when offloading diesel, with standby diesel oil spill response and clean-up facilities available</p> <p>2. In fuel/oil storage and handling areas, suitable secondary containment measures (110% of the volume of the largest tank) shall be provided.</p> <p>3. Shovels, plastic bags and absorbent material shall be kept near fuel and oil storage/handling areas to attend spills and leaks</p>	<p>1. Spill response process in place</p> <p>2. Staff provided with training in hazardous material handling and storage and spill response</p>	G	7	8	EPA, Act 490	Clause 7.3.5 7.3.3	IFC PS3 and 4

CONSTRUCTION: Including transportation / installation			Aspect / Impact Definition		Impact Category				Barriers		Applicable Legislation						
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Consequences (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk		Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines / Standards		
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability				Risk / Opportunity	
C 5 Land Quality																	
C 5.1	Land Condition – plant and tank farm sites	Local community/site workers/soil and groundwater	Existing contamination on Stage 2 site	Mobilisation of existing contamination including petroleum hydrocarbons due to groundworks such as piling and exposure of site workers and local community		Y		Y		1. Remediation of contamination	Final remediation solution to be proposed by EPC and agreed by EPL 1. Construction staff shall receive training in the requirements of the CEMP as part of their site induction 2. Monitoring of contamination encountered as appropriate throughout the construction phase 3. Procedure for dealing with unexpected contamination	F	7	9	EPA, Act 490	Clause 7.3.5, 7.3.8, 7.3.13	IFC PS3 and 4
C 5.2	Land Condition – pipeline route	Local community/site workers/soil and groundwater	Existing contamination	Mobilisation of existing contamination due to groundworks and exposure of site workers and local community		Y		Y		1. Implement good practice measures to minimise worker exposure to vapours and dust	1. Construction contractor to develop Safe Systems of Work for excavations along the pipeline route based on information obtained from existing ground investigations. 2. Provide training to construction workers relating to visual indicators of pollution and processes and management techniques to be implemented if contamination is encountered.	F	7	9	EPA, Act 490	Clause 7.3.5, 7.3.8, 7.3.13	IFC PS3 and 4

CONSTRUCTION: Including transportation / installation			Aspect / Impact Definition		Impact Category				Barriers		Applicable Legislation					
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Consequences (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk					
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability	Risk / Opportunity	Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines / Standards
C 5.3	Unintended Release	Local community/ site workers/soil and groundwater	Transport and storage of hazardous materials	Release from vehicle, storage			Y	Y	1. Road Tankers/ storage vessels either transporting/ storing diesel/ chemical will use temporary secondary containment equipment when offloading diesel, with standby diesel oil spill response and clean-up facilities available 2. Fuel/oil and hazardous materials storage and handling areas shall be located on impermeable surfaces and suitable secondary containment measures (110% of the volume of the largest tank) shall be provided 3. Compatibility of hazardous materials stored shall be assessed	1. Spill response process in place 2. Staff provided with training hazardous material handling and storage and in spill response 3. Shovels, plastic bags and absorbent material shall be kept near fuel and oil storage/handling areas to attend spills and leaks	G	7	8	EPA, Act 490	Clause 7.3.3 7.3.5	IFC PS3 and 4

CONSTRUCTION: Including transportation / installation			Aspect / Impact Definition		Impact Category				Barriers		Applicable Legislation					
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Consequences (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk					
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability	Risk / Opportunity	Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines / Standards
C 6													Noise			
C 6.1	Construction working hours	Local community, adjacent businesses and on-site workers	Noise generating construction activities including piling and excavation	Nuisance complaints	Y			Y	1. The development is located 2.2 km from the nearest residential receptor. 2. Adoption of industry good practice 3. Noise levels shall not exceed 70 dB(A) during the day 06:00 and 22:00 hours in accordance with EPA permissible noise levels for Industrial Areas. Compliance location to be defined in CEMP.	1. Restricted hours of working for noisy activities 2. Noise levels shall be periodically monitored and monitored during noisy activities at compliance location. 3. Consultation with the local community and nearby businesses shall be undertaken prior to any noisy works occurring or works outside normal working hours	H	8	8	EPA, Act 490, National Environmental Quality Guidelines, TEMA Metropolitan Assembly Bye Laws on Noise and Sanitation	Clause 7.3.2, 7.3.5, 7.3.7, 7.3.11 and 7.3.13	IFC PS4
C 6.2	Noise from Construction Traffic	Local community and site workers	Construction traffic movements	Nuisance impacts to sensitive receptors	Y			Y	1. Establishment of traffic routes which are away from sensitive receptors	1. Traffic Management Plan 2. Deliveries and other vehicle movements scheduled to avoid noise sensitive periods i.e. night time	H	8	8	EPA, Act 490	Clause 7.3.2, 7.3.4, 7.3.5, 7.3.11, 7.3.13	IFC PS4

CONSTRUCTION: Including transportation / installation			Aspect / Impact Definition		Impact Category				Barriers		Applicable Legislation					
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Consequences (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk					
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability	Risk / Opportunity	Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines / Standards
C 7													Traffic and Transport			
C 7.1	Construction Traffic	Local community	Construction traffic movements & parking	On-site and off-site congestion; road blockages; damage to verges	Y			Y	1. Provision shall be included within the construction area for parking for all HGVs and other vehicles associated with the construction phase to avoid congestion and parking on public roads	1. Develop a Traffic Management Plan or similar prior to works commencing which will ensure that HGV traffic movements will be managed and spread evenly through the day 2. All construction traffic shall be monitored and logged 3. Plan and schedule ship arrivals in consultation with Tema Port 4. An emergency response plan shall be developed for dealing with traffic accidents	H	8	8	EPA, Act 490	Clause 7.3.4 7.3.5 7.3.13	IFC PS4
C 8													Landscape and Visual Amenity			
C 8.1	Impacts on landscape and visual amenity are considered to be negligible. No mitigation is required.															

CONSTRUCTION: Including transportation / installation			Aspect / Impact Definition		Impact Category				Barriers		Applicable Legislation						
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Consequences (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk						
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability	Risk / Opportunity	Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines / Standards	
C 9													Socio Economic				
C 9.1	Physical and Economic Displacement	Kiosk owners, farmers and people living on the site and along the pipeline route.	Construction activities	Economic displacement of businesses or physical displacement of individuals	Y			Y		1. For both Stage 1 and Stage 2 Project Affected Persons, A Livelihood Restoration Plan/Abbreviated Resettlement Action Plan shall be developed prior to the start of construction, in consultation with the affected parties 2. For both Stage 1 and Stage 2 Project Affected Persons, provide training or livelihood assistance programmes as appropriate	F	8	10			Clause 7.3.5 7.3.6 7.3.13	IFC PS5
C 9.2	Indigenous People	No indigenous communities will be impacted by this project															
C 9.3	Cultural Heritage	No cultural assets will be impacted by this project															

CONSTRUCTION: Including transportation / installation			Aspect / Impact Definition		Impact Category				Barriers		Applicable Legislation				
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Consequences (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk		Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines / Standards
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability			
C 9.4	Community Health	Public health	Introduction of new health issues/ disease vectors or increased health risk from overseas workforce and construction activities such	Community and labour force health impacts	Y			Y		1. Development of an HIV/AIDS awareness and prevention programme providing tools and education materials 2. Development of a worker health screening programme 3. Work in collaboration with the Metropolitan Health Directorate of the Ministry of Health to increase education of workers on preventive health practices within the work site	F	7	9	Clause 7.3.5 7.3.9 7.3.13	IFC PS4
C 9.5	Employment & Economic Opportunity	Local community / workforce	Direct and indirect employment opportunities	Community disturbance due to migrant workers / Improvements in the economic opportunities available to the local workforce	Y					1. Ensure that a transparent hiring process is conducted enabling the local community to understand strategic hiring decisions 2. Produce a Workforce Development Strategy to maximize employment skills and opportunities for local people 3. Develop a training and skills programme to skill local people for construction and operational jobs	I			N/A	IFC PS4

CONSTRUCTION: Including transportation / installation			Aspect / Impact Definition		Impact Category				Barriers		Applicable Legislation				
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Consequences (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk		Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines / Standards
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability			
C 9.6	Human Rights	Local community / workforce	Applicable to all aspects of workforce employment	Discrimination and exploitation of workforce and contractors	Y					1. Develop a Worker Policy and Code of Behaviour which shall be communicated to all staff and contractors 2. Provide a grievance mechanism for workers to raise workplace concerns and ensure that all workers have access to it 3. Implement measures to ensure that contractors are legitimate businesses with appropriate Environmental and Social Management Practices	F	7	9	N/A	IFC PS2

CONSTRUCTION: Including transportation / installation			Aspect / Impact Definition		Impact Category				Barriers		Applicable Legislation				
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Consequences (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk		Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines / Standards
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability			
C 9.7	Labour and Welfare	Welfare of contractors/ workforce	Applicable across all aspects of workforce employment	Use of inappropriate child labour and exploitation of children	Y	Y								N/A	IFC PS2

2.2 Operational Aspects and Impacts Register

OPERATION			Aspect/ Impact Definition		Impact Category				Barriers		Applicable Legislation					
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Potential Hazard (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk		Process / Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines/ Standards	
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability				Risk / Opportunity
O 1 Natural Resources																
O 1.1	Freshwater Resources	Potable water supplied by the GWC	Water consumption for process cooling, NO _x scrubbing and sanitary uses.	Reduction in supply detrimental to other water users.	Y				1. Water use has been minimized within the design through the selection of an air cooled technology 2. Water consumption shall be metered	1. Monitoring of water consumption	H	6	6	Water Resources Commission Act, Act 52	N/A	IFC PS3
O 1.2	Flood Risk	Local communities and workforce	On site and off site flood risk due to fluvial and/or pluvial flooding.	Flooding of low lying areas within the site from overtopping of the adjacent storm drain during extreme rainfall events. Insufficient capacity within the site drainage system, or development of the site increasing the risk of onsite, downstream or adjacent site flooding. Potential exacerbation of		Y		Y	1. Raising of site and/or sensitive infrastructure to protect against fluvial flooding, as detailed in the ESIA/ESMP. 2. Perimeter and on-site drainage shall be designed to accommodate predicted wet season flows and any potential increase in flows due to future development in the catchment and climate-change 3. Drainage shall be designed to ensure that runoff from the site onto adjacent developed sites is not increased 4. Sufficient freeboard shall be allowed within the plant design to ensure that critical infrastructure does not flood during a storm event	1. Consider the case for refining the model used, with detailed topographic or LIDAR survey of the wider catchment. In the absence of further data and assessment, mitigation requirements will include the need to raise sensitive site infrastructure as indicated in the previous column. 2. Engage with local authorities regarding long term planning for catchment flood risk management, including consideration of implications of urbanisation.	E	7	10	EPA, Act 490	Clause 7.4.7	IFC PS4

OPERATION			Aspect/ Impact Definition		Impact Category				Barriers		Applicable Legislation					
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Potential Hazard (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk		Process / Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines/ Standards	
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability				Risk / Opportunity
				these risk due to increasing urbanisation of the catchment or impacts of climate change. Risks to project pipeline infrastructure at water crossings due to flooding of water courses.					5. At locations where the above-ground section of the pipeline crosses streams, directional drilling shall be used to pass beneath, or at least 0.6m freeboard be provided 6. Any above-ground pipelines used at watercourse crossings, should be resilient to the impact from debris in the event of high flows/flooding 7. Consideration shall be given to installation of formal roadside drainage for areas immediately adjacent to the site to manage overland flow.							
O 2	Energy Efficiency															
O 2.1	Energy Consumption	Air emissions	Consumption of energy by operational plant	Energy resource consumption	Y			Y	1. Utilise high efficiency lighting such as LEDs	1. Implement measures to encourage energy efficiency within the workforce and report the outcome in the Annual Environmental Report submitted to the EPA 2. Implement a planned maintenance programme for energy consuming equipment to ensure efficient operation	G	7	8	EPA, Act 490	Clause 7.4.2	IFC PS3

OPERATION			Aspect/ Impact Definition		Impact Category				Barriers		Applicable Legislation					
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Potential Hazard (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk		Process / Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines/ Standards	
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability				Risk / Opportunity
O 3 Emissions to Air																
O 3.1	Greenhouse Gas (GHG) Emissions	Regional and global sensitivities to Global Warming/ Potential regulatory changes	Direct emissions from plant operation including CO ₂	Contribution to Climate Change/ Global Warming / non-compliance due to tightening of emission limits	Y			Y	1. Emissions will be lowered when the plant moves to using NG from LPG after approximately 5 years of operation 2. Use of heat recovery improves fuel efficiency 3. Consideration will be given to further measures to improve efficiency where practicable through i.e. use of excess heat, motor load sensing for start/stop control, high efficiency motors and variable speed drives	1. Quantification of GHG emissions by desk-based calculations on an annual basis for reporting. 2. Targets shall be established for improvements in CO ₂ emissions within the operational ESMS	E	7	10	EPA, Act 490	Clause 7.4.8	IFC PS3
O 3.2	Greenhouse Gas (GHG) Emissions	Regional and global sensitivities to Global Warming/ Potential regulatory changes	Fugitive releases of greenhouse gases (refrigerant gases from air conditioning equipment)	Contribution to climate change			Y	Y	1. No CFC refrigerants shall be used	1. Regular maintenance of refrigerant-containing systems by appropriately qualified individuals. 2. Inventory of all refrigerant gases maintained. 3. Appropriate disposal of refrigerant-containing systems to a designated facility.	F	6	8	EPA, Act 490	Clause 7.4.8	IFC PS3

OPERATION			Aspect/ Impact Definition		Impact Category				Barriers		Applicable Legislation					
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Potential Hazard (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk					
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability	Risk / Opportunity	Process / Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines/ Standards
O 3.3	Air Quality	Local communities/workforce	Combustion emissions: NO _x and CO	Local air quality	Y			Y	<p>1. Use of modern combustion technology to minimise generation of NO_x and CO emissions and meet appropriate emission standards</p> <p>2. Water abatement has been incorporated into the design to reduce NO_x emissions from the turbines operating in open cycle mode</p> <p>3. Low sulphur fuel shall be used</p> <p>4. The height of the stack shall ensure adequate dispersion of emissions</p> <p>5. CEMS shall be installed at the exhaust stacks. Provision shall also be made for manual sampling points</p>	<p>1. Six-monthly monitoring and review of air emission measurement data which shall be submitted to the EPA in accordance with the Environmental Permit.</p> <p>2. Air emissions shall comply with the air quality guidelines reproduced within the Environmental Permit</p> <p>3. An extended monitoring programme shall be undertaken monthly in the locality, with diffusion tubes deployed on a continuous basis and analysis for NO_x and SO₂. and potentially and potentially particulate matter.</p>	F	7	9	EPA, Act 490	Clause 7.4.3 and 7.4.4	IFC PS3
O 3.4	Air Quality	Local communities/workforce	Fugitive VOC emissions from vehicle fuel storage	Local air quality				Y	<p>1. Use of vapour recovery systems for vehicle fuel storage, loading/off-loading and fuelling (if undertaken on site)</p>	<p>1. Periodic directed inspection and maintenance surveys using specialised equipment to detect and quantify leaks at hydrocarbon fuel tanks and piping, and prompt repair programme</p> <p>2. Loading/unloading of volatile materials will be limited during a poor air quality episode</p>	Source of impact not planned for implementation at present			EPA, Act 490	Clause 7.4.11	IFC PS3

OPERATION			Aspect/ Impact Definition		Impact Category				Barriers		Applicable Legislation					
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Potential Hazard (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk		Process / Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines/ Standards	
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability				Risk / Opportunity
O 4 Waste Management																
O 4.1	Waste	Local communities/ workforce	Poor waste management and incorrect disposal of waste	Soil/ groundwater/ visual contamination and local complaints	Y			Y	1. Permanent, segregated waste facilities will be included in the site design 2. Designated waste storage areas will be located on hard standing ground and covered to prevent ingress of rain or exposure to the sun 3. Hazardous and non-hazardous wastes, as well as non-compatible wastes, shall be segregated 4. Wastes shall be disposed of to properly licensed facilities with adequate capacity to manage the waste appropriately. 5. A continuous improvement programme shall implement the waste hierarchy and reduce waste generation	1. A designated individual shall be responsible for the implementation of waste management systems and processes 2. Detailed waste management processes shall be developed 3. Staff shall be trained in the correct handling, storage and disposal of waste. 4. Wastes shall be disposed of to properly licensed facilities with adequate capacity to manage the waste appropriately. 5. A continuous improvement programme shall implement the waste hierarchy and reduce waste generation	F	7	9	EPA, Act 490.	Clause 7.4.4 and 7.4.15	IFS PS3

OPERATION			Aspect/ Impact Definition		Impact Category				Barriers			Applicable Legislation				
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Potential Hazard (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk			Process / Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines/ Standards
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability	Risk / Opportunity			
O 4.2	Oily Waste	Local communities / workforce	Poor waste storage and control.	Contamination of the soil, water and groundwater environments	Y			Y	1. Waste oil shall be stored in an appropriately banded, impermeable area 2. For waste oily water, a treatment system shall be in place which enables the effluent to meet the EPA Guidelines. 3. Oily water shall be kept separate from sludge which shall be sent to a designated storage tank for disposal	1. Waste oil shall only be sold to EPA certified waste oil dealers	F	6	8	EPA, Act 490 EPA Sector Specific Effluent Quality Guidelines for the energy Sector	Clause 7.4.4, 7.4.9, 7.4.13, 7.4.18	IFC PS3
O 5	Liquid effluent discharges															
O 5.1	Wastewater Discharges	Local communities/ local water courses	Discharge of waste process effluent	Contamination of local water courses	Y			Y	The design of the wastewater treatment plant is to be confirmed. 1. Waste water from the water demineralization plant, NOx scrubber and steam/water circuit blowdown will be treated in the on-site wastewater treatment plant prior to discharge to the storm water system 2. Consideration should be given to whether the wastewater system is capable of being isolated to enable it to contain contaminated wastewater following an abnormal event or a failure of the wastewater treatment plant	1. Monitoring of the discharge from the storm water treatment plant shall be in place to ensure that the discharge meets required parameters	E	7	10	EPA, Act 490 EPA Sector Specific Effluent Quality Guidelines for the energy Sector	Clause 7.4.4 and 7.4.14	IFC PS3

OPERATION			Aspect/ Impact Definition		Impact Category				Barriers		Environmental Risk			Applicable Legislation		
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Potential Hazard (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Severity	Probability	Risk / Opportunity	Process / Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines/ Standards
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION						
O 5.2	Wastewater Discharges	Local communities/ local water courses	Sewage from septic tanks.	Contamination of ground or groundwater	Y			Y	1. Septic tank design to be in accordance with regulatory standards and guidelines and with adequate capacity	1. Septic tanks to be emptied regularly by an appropriately licensed contractor	F	6	8	EPA. Act 490 Water and Sewerage Act, Act 310 IFC PS3	Clause 7.4.14	
O 5.3	Unintended Release	Local water courses / soil and groundwater	Failure of on-site transformer	Release of transformer oil to local environment.		Y		Y	The design of the transformer is to be confirmed. 1. The transformer and its enclosure shall be designed to ensure that oil is contained following a catastrophic failure of the transformer 2. The transformer oil shall be PCB free 3. Consideration shall be given to utilization of biodegradable transformer oil.	1. The transformer shall be subject to regular preventative maintenance by appropriately quantified personnel 2. The integrity of the transformer bund shall be regularly checked through visual inspection	E	4	7	EPA, Act 490	Clause 7.4.18	IFC PS3

OPERATION			Aspect/ Impact Definition		Impact Category				Barriers		Applicable Legislation					
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Potential Hazard (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk					
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability	Risk / Opportunity	Process / Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines/ Standards
O 5.4	Unintended Release	Local water courses / soil and groundwater	Fuel transport/ storage	Release from vehicle / storage		Y		Y	<p>1. Road Tankers/ storage vessels either transporting/ storing diesel/ chemical will use temporary secondary containment equipment when offloading diesel, with standby diesel oil spill response and clean-up facilities available</p> <p>2. In fuel/oil storage and handling areas, suitable secondary containment measures (110% of the volume of the largest tank) shall be provided</p> <p>3. Integrity checks shall be undertaken on the fuel receiving pipelines and storage tanks every two years and the results submitted to the EPA</p> <p>4. Oil interceptors shall be incorporated into the site drainage system in areas where there is a risk of an oil spill. Drainage from such areas will be routed through the wastewater treatment plant.</p>	<p>1. Oil interceptors shall be subject to regular visual inspection and maintenance</p> <p>2. Develop an Oil Spill Risk Assessment Plan and an Oil Spill Contingency Plan</p> <p>3. Staff provided with training in hazardous material handling, storage and disposal and in spill response</p> <p>4. Shovels, plastic bags and absorbent material shall be kept near fuel and oil storage/handling areas to attend spills and leaks</p>	G	7	8	EPA, Act 490	Clause 7.4.4, 7.4.6, 7.4.14, 7.4.17, 7.4.18 and 7.4.21	IFC PS3

OPERATION			Aspect/ Impact Definition		Impact Category				Barriers		Applicable Legislation					
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Potential Hazard (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk		Process / Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines/ Standards	
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability				Risk / Opportunity
C 6 Land Quality																
O 6.1	Unintended Release	Local community/ site workers/soil and groundwater	Transport and storage of hazardous materials	Release from vehicle, storage	Y			Y	1. Road Tankers/ storage vessels either transporting/ storing diesel/ chemical will use temporary secondary containment equipment when offloading diesel, with standby diesel oil spill response and clean-up facilities available 2. In fuel/oil storage and handling areas, suitable secondary containment measures (110% of the volume of the largest tank) shall be provided.	1. Spill response processes in place 2. Staff provided with training in hazardous material handling, storage and disposal and in spill response 3. Shovels, plastic bags and absorbent material shall be kept near fuel and oil storage/handling areas to attend spills and leaks	G	7	8	EPA, Act 490	Clause 7.4.4, 7.4.6, 7.4.18 and 7.4.21	IFC PS3 and 4

OPERATION			Aspect/ Impact Definition		Impact Category				Barriers		Applicable Legislation					
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Potential Hazard (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk		Process / Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines/ Standards	
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability				Risk / Opportunity
O 7 Noise																
O 7.1	Ambient Noise Levels	Local community and on-site workers	Ambient noise levels generated by equipment including gas turbines, air inlet filters and air cooled condensers	Nuisance complaints	Y			Y	<p>1. The nearest residential receptor will be located 2 km from the operational site. The small number of kiosks and caretaker located nearby the power plant sites will be relocated as part of the project physical and economic resettlement planning activities.</p> <p>2. Silencers (attenuators) shall be fitted to all gas turbine air intakes</p> <p>3. Silencers (attenuators) shall be fitted on the bypass / HRSG system</p> <p>4. Steel turbine enclosures shall be included in the design</p> <p>5. Noise levels shall not exceed 70 dB(A) during the day 06:00 and 22:00 hours in accordance with EPA permissible noise levels for Industrial Areas.</p> <p>6. Use of noise barrier during stage 1a.</p>	<p>1. Routine monitoring and reporting of ambient noise levels.</p> <p>2. Night-time noise at a workers' residence in the commercial premises south of PPS1 will be minimised during Stage 1a, for example by the use of a temporary noise barrier comprising shipping containers.</p> <p>3. The solution to manage the temporary noise impacts during stage 1a needs to be agreed between EPL and the affected parties prior to operation of Stage 1a.</p> <p>4. Implementation of the Abbreviated Resettlement Action Plans for Stage 1 and Stage 2.</p>	G	4	5	EPA, Act 490, National Environmental Quality Guidelines, TEMA Metropolitan Assembly Bye Laws on Noise and Sanitation	Clause 7.4.4 and 7.4.12	IFC PS4

OPERATION			Aspect/ Impact Definition		Impact Category				Barriers		Applicable Legislation				
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Potential Hazard (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk		Process / Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines/ Standards
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability			
O 8 Traffic and Transport															
08.1	Impacts associated with traffic and transport during the operational phase of the project are considered to be negligible. No mitigation is required beyond preparation of an appropriate management plan or similar document, which should consider cumulative impacts as required based upon local baseline conditions at the time of construction.														
O 9 Socio Economic, including Community Health and Safety															
O 9.1	Community Health	Public health	Introduction of new health issues/ disease vectors or increased health risk from overseas workforce and construction activities such	Community and labour force health impacts	Y			Y		1. Development of an HIV/AIDS awareness and prevention programme providing tools and education materials 2. Development of a worker health screening programme 3. Work in collaboration with the Metropolitan Health Directorate of the Ministry of Health to increase education of workers on preventive health practices within the work site	F	7	9	Clause 7.4.4	IFC PS4
O 9.2	Occupational and community Safety	Public safety	Increased risk of accidents associated with the fuel supply pipelines	Risk of interference or accidents along overground sections of the fuel supply pipeline resulting in leaks or explosions		Y	Y			1. Installation of crash barriers adjacent to road crossings along the Tema Oil Refinery right of way. 1. Working with TOR to improve long term safety management for the Row, including review of existing management plans including emergency preparedness and response.	A	4	11		IFC PS2 and PS4

OPERATION			Aspect/ Impact Definition		Impact Category				Barriers		Applicable Legislation					
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Potential Hazard (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk					
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability	Risk / Opportunity	Process / Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines/ Standards
O 9.3	Employment & Economic Opportunity	Local community / workforce	Direct and indirect employment opportunities	Community disturbance due to migrant workers / Improvements in the economic opportunities available to the local workforce	Y					<ol style="list-style-type: none"> 1. Ensure that a transparent hiring process is conducted enabling the local community to understand strategic hiring decisions 2. Produce a Workforce Development Strategy to maximize employment and skills opportunities for local people 3. Develop a training and skills programme to skill local people for construction and operational jobs 	I					IFC PS4
O 9.4	Human Rights	Local community / workforce	Applicable to all aspects of workforce employment	Discrimination and exploitation of workforce and contractors	Y					<ol style="list-style-type: none"> 1. Develop a Worker Policy and Code of Behaviour which shall be communicated to all staff and contractors 2. Provide a grievance mechanism for workers to raise workplace concerns and ensure that all workers have access to it 3. Implement measures to ensure that contractors are legitimate businesses with appropriate Environmental and Social Management Practices 	F	7	9		N/A	IFC PS2

OPERATION			Aspect/ Impact Definition		Impact Category				Barriers		Applicable Legislation				
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Potential Hazard (Impact)	Planned / Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk		Process / Aspect Controlled by Legislation or EQS	Aspect Controlled by Environmental Permit CE0049560102	International Guidelines/ Standards
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability			
O 9.5	Labour and Welfare	Welfare of contractors / workforce	Applicable across all aspects workforce employment	Use of inappropriate child labour and exploitation of children.	Y					<p>1. All persons working on the site who are under the age of 18 shall be identified</p> <p>2. Appropriate risk assessment and regular monitoring of health, working conditions and hours of work for workers under the age of 18 shall be undertaken</p> <p>3. Children under the age of 18 are not to be employed in hazardous work</p> <p>4. Applicable national laws relating to child labour are to be adhered to</p>	F	7	9	N/A	IFC PS2

2.3 Decommissioning Aspects and Impacts Register

Note: There are no clauses within the Project Environmental Permit which are applicable to decommissioning at this time.

DECOMMISSIONING			Aspect / Impact Definition		Impact Category				Barriers				Applicable Legislation		
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Potential Hazard (Impact)	Planned/ Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk			Process / Aspect Controlled by Legislation or EQS	International Guidelines/ Standards
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability	Risk / Opportunity		
D 1 Natural Resources															
D 1.1	Freshwater Resources	Potable water supplied by the GWC	Water consumption for decontamination and cleaning	Reduction in supply detrimental to other water users.	Y			Y	1. Water consumption shall be metered	1. Monitor efficiency of water consumption 2. Establish water use monitoring programme 3. Develop a water management system for the project to allow resource optimization	H	6	6	Water Resources Commission Act, Act 52	IFC PS3
D 2 Emissions to Air															
D 2.1	Green House Gas (GHG) Emissions	Regional and global sensitivities to Global Warming/ Potential regulatory changes	Combustion activities for construction works/ temporary accommodation/ vehicles/ emissions of GHGs including CO2)	Contribution to Climate Change/ Global Warming / non-compliance due to tightening of emission limits/	Y			Y	1. Vehicles to be well maintained to minimize exhaust emissions 2. Idling reduction awareness activities. 3. Minimisation of energy consumption by switching off equipment when not required.	1. Quantification of GHG emissions by desk-based calculations on an annual basis for reporting.	F	6	8	EPA, Act 490	IFC PS3 WHO air quality guidelines
D 2.2	Air Quality	Local communities/ workforce	Dust production from construction activities/ site preparation	Local air quality	Y			Y	1. Maintain roads to minimise dust (levelling etc.) 2. Location, grading and management of stockpiles to prevent wind blow, or dusty materials removed from site promptly 3. Re-vegetation of completed earthworks as soon as practicable	1. Dust mitigation strategy shall be developed and implemented by contractors/ subcontractors, including water spraying, vehicle speeds, tree planting 2. Maintain speeds to prevent re-suspension of dust	F	6	8	EPA, Act 490	IFC PS3 WHO air quality guidelines

DECOMMISSIONING			Aspect / Impact Definition		Impact Category				Barriers		Environmental Risk			Applicable Legislation	
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Potential Hazard (Impact)	Planned/ Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Severity	Probability	Risk / Opportunity	Process / Aspect Controlled by Legislation or EQS	International Guidelines/ Standards
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION					
										3. Dampening of un-surfaced areas, soil and spoil to prevent dust re-suspension during hot, dry conditions 4. Lorries will be sheeted during transport of friable demolition materials and wheel wash facilities made available during adverse weather conditions. 5. Drop heights minimized during transfer of materials, i.e. loading and unloading of friable materials					
D 2.3	Air Quality	Local communities/workforce	Combustion activities for power generation for construction/ temporary welfare accommodation/ vehicles	Local air quality	Y			Y	1. Use of low sulphur fuels. 2. Engines fitted with particulate filters 3. Vehicles to be well maintained to minimize exhaust emissions 4. Idling reduction awareness activities	1. Ambient air quality shall be monitored and recorded throughout decommissioning period.	F	6	8	EPA, Act 490	IFC PS3 WHO air quality guidelines

DECOMMISSIONING			Aspect / Impact Definition		Impact Category				Barriers		Environmental Risk			Applicable Legislation	
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Potential Hazard (Impact)	Planned/ Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Severity	Probability	Risk / Opportunity	Process / Aspect Controlled by Legislation or EQS	International Guidelines/ Standards
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION					
D 3 Waste Management															
D 3.1	Waste	Local communities/ workforce	Poor waste management and incorrect disposal of waste	Soil/ groundwater/ visual contamination and local complaints	Y			Y	1. Waste shall be stored on impermeable surfaces with adequate containment provided to prevent migration of wastes into the surrounding environment 2. Hazardous and non-hazardous wastes shall be segregated 3. Wastes shall not be stored adjacent to watercourses	1. A Decommissioning Plan shall be developed during plant operation 2. A pre-demolition audit shall be undertaken and a bill of quantities developed to enable optimization of management arrangements and to minimize disposal requirements	F	7	9	EPA, Act 490.	
D 4 Liquid effluent discharges															
D 4.1	Not used														
D 4.2	Wastewater Discharges	Local communities/ local water courses / groundwater	Sewage from septic tanks	Contamination of ground or groundwater	Y			Y	1. Septic tank design to be in accordance with regulatory standards and guidelines and with adequate capacity	1. Septic tanks to be emptied regularly by an appropriately licensed contractor 2. Site rules will ensure that workers use the sanitary facilities provided	F	6	8	EPA, Act 490 Water and Sewerage Act, Act 310	IFC PS3 and 4

DECOMMISSIONING			Aspect / Impact Definition		Impact Category				Barriers		Environmental Risk			Applicable Legislation	
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Potential Hazard (Impact)	Planned/ Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Severity	Probability	Risk / Opportunity	Process / Aspect Controlled by Legislation or EQS	International Guidelines/ Standards
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION					
D 4.3	Storm water Discharges	Local communities / local water courses	Storm water drainage system	Siltation of local watercourses	Y			Y	1. Silt traps shall be located appropriately to ensure that silt laden storm water is not discharged to local water courses 2. Measures to eliminate dust generation as outlined in D 2.2 will also support the elimination of sediment from storm water discharge	1. Routine monitoring of the turbidity of water prior to discharge	F	7	9	EPA, Act 490	IFC PS3 and 4
D 4.4	Unintended Releases	Sensitive habitats/ communities	Fuel transport/ storage	Release from vehicle / storage				Y	1. Road Tankers/ storage vessels either transporting/ storing diesel/ chemical will use temporary secondary containment equipment when loading and offloading, with standby spill response and clean-up facilities available 2. In hazardous material and waste storage and handling areas, suitable secondary containment measures (110% of the volume of the largest tank) shall be provided 3. Shovels, plastic bags and absorbent material shall be kept near hazardous areas to attend spills and leaks	1. Spill response processes in place 2. Staff provided with training in hazardous material storage, handling and disposal and in spill response	G	7	8	EPA, Act 490	IFC PS3 and 4

DECOMMISSIONING			Aspect / Impact Definition		Impact Category				Barriers				Applicable Legislation		
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Potential Hazard (Impact)	Planned/ Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk			Process / Aspect Controlled by Legislation or EQS	International Guidelines/ Standards
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability	Risk / Opportunity		
D 5 Land Quality															
D 5.1	Land condition	Local community/ site workers/soil and groundwater	Contamination caused during site operation	Mobilisation of contamination due to groundworks and exposure of site workers and local community	Y			Y	1. Remediation of contamination if required following completion of the intrusive site investigation	1. Completion of intrusive site investigation prior to decommissioning beginning 2. Monitoring of contamination encountered throughout the decommissioning phase	G	6	7	EPA, Act 490	IFC PS3 and 4
D 5.2	Unintended Release	Local community/ site workers/soil and groundwater	Transport and storage of hazardous materials	Release from vehicle, storage		Y		Y	1. Road tankers/ storage vessels either transporting/ storing diesel/ chemical will use temporary secondary containment equipment when loading and offloading hazardous materials with standby spill response and clean-up facilities available 2. In hazardous materials storage and handling areas, suitable secondary containment measures shall be provided. 3. Shovels, plastic bags and absorbent material shall be kept near hazardous areas to attend spills and leaks	1. Hazardous materials shall be identified and scheduled for removal from site plant prior to demolition commencing 2. Spill response processes in place 3. Staff provided with training in hazardous material storage, handling and disposal and in spill response	G	7	8	EPA, Act 490	IFC PS3 and 4

DECOMMISSIONING			Aspect / Impact Definition		Impact Category				Barriers				Applicable Legislation		
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Potential Hazard (Impact)	Planned/ Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Environmental Risk			Process / Aspect Controlled by Legislation or EQS	International Guidelines/ Standards
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION	Severity	Probability	Risk / Opportunity		
O 6 Noise															
D 6.1	Construction Working Hours	Local community and on-site workers	Noise generating demolition activities including concrete breaking	Nuisance complaints	Y			Y	1. The site is located 2 km from the nearest residential receptor. 2. Adoption of industry good practice 3. Noise levels shall not exceed 70 dB(A) during the day 06:00 and 22:00 hours in accordance with EPA permissible noise levels for Industrial Areas	1. Restricted hours of working, particularly for noisy activities 2. Periodic monitoring of ambient noise levels, particularly during periods of noisy activity 3. Consultation with the local community shall be undertaken prior to any noisy works occurring or works outside normal working hours	H	8	8	EPA, Act 490, National Environmental Quality Guidelines, TEMA Metropolitan Assembly Bye Laws on Noise and Sanitation	IFC PS4
D 6.2	Demolition Traffic	Local community and site workers	Demolition traffic movements	Nuisance impacts to sensitive receptors	Y			Y	1. Establishment of traffic routes which are away from sensitive receptors	1. Traffic Management Plan. 2. HGV vehicle movements scheduled to avoid noise sensitive periods i.e., night time	H	8	8	EPA, Act 490	IFC PS4
D 7 Traffic and Transport															
D 7.1	Demolition Traffic	Local community	Demolition traffic movements	On-site and off-site congestion	Y			Y		1. Develop a Traffic Management Plan prior to demolition works commencing which will ensure that HGV traffic movements will be managed and spread evenly through the day 2. An emergency response plan shall be in place for dealing with traffic accidents	H	8	8	EPA, Act 490	IFC PS4

DECOMMISSIONING			Aspect / Impact Definition		Impact Category				Barriers		Environmental Risk			Applicable Legislation	
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Potential Hazard (Impact)	Planned/ Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Severity	Probability	Risk / Opportunity	Process / Aspect Controlled by Legislation or EQS	International Guidelines/ Standards
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION					
D 8 Socio Economic															
D 8.1	Community Health	Public health	Introduction of new health issues/ disease vectors or increased health risk from overseas demolition workforce	Community and labour force health impacts/	Y					1. Development of an HIV/AIDS awareness and prevention programme providing tools and education materials 2. Development of a worker health screening programme 3. Work in collaboration with the Metropolitan Health Directorate of the Ministry of Health to increase education of workers on preventive health practices within the work site	F	7	9		IFC PS4
D 8.2	Employment & Economic Opportunity	Local community / workforce	Direct and indirect employment opportunities	Community disturbance due to migrant workers / Improvements in the economic opportunities available to the local workforce	Y					1. Ensure that a transparent hiring process is conducted enabling the local community to understand strategic hiring decisions 2. Produce a Workforce Development Strategy to maximize employment and skills opportunities for local people 3. Develop a training and skills programme to skill local people for construction and operational jobs	I				IFC PS4

DECOMMISSIONING			Aspect / Impact Definition		Impact Category				Barriers		Environmental Risk			Applicable Legislation	
Ref	Aspect / Impact	Sensitivity Comments	Scenario (Aspect)	Potential Hazard (Impact)	Planned/ Enduring	Abnormal	Unplanned	Non-Compliance (with Regulations)	Controls & Contingencies		Severity	Probability	Risk / Opportunity	Process / Aspect Controlled by Legislation or EQS	International Guidelines/ Standards
									ELIMINATION / ENGINEERING	MANAGEMENT / MITIGATION					
D 8.3	Human Rights	Local community / workforce	Applicable to all aspects of workforce employment	Discrimination and exploitation of workforce and contractors	Y					1. Develop a Worker Policy and Code of Behaviour which shall be communicated to all staff and contractors 2. Provide a grievance mechanism for workers to raise workplace concerns and ensure that all workers have access to it 3. Implement measures to ensure that contractors are legitimate businesses with appropriate Environmental and Social Management Practices	F	7	9		IFC PS2
D 8.4	Labour and Welfare	Welfare of contractors/ workforce	Applicable across all aspects workforce employment	Use of inappropriate child labour and exploitation of children	Y					1. All persons working on the site who are under the age of 18 shall be identified 2. Appropriate risk assessment and regular monitoring of health, working conditions and hours of work for workers under the age of 18 shall be undertaken 3. Children under the age of 18 are not to be employed in hazardous work 4. Applicable national laws relating to child labour are to be adhered to	F	7	9		IFC PS2

2.3 Significant Risks (Aspects)

The analysis undertaken as part of this aspects and impacts register has identified that there are currently no highly significant risks associated with either the construction, operation or decommissioning phases of the Ghana Bridge Power Project.

Direct and indirect employment opportunities provided to the local workforce for this project are rated as being a beneficial impact at each project stage and a significant opportunity.

2.3.1 Construction phase aspects

A number of aspects assessed as being of medium significance for the project are associated with the construction phase, and hence require mitigation. The highest scoring risks during the construction phase are:

- C 3.1 Inappropriate waste management;
- C 4.3 Siltation of local watercourses due to storm water run-off from site;
- C 5.1 Existing contamination within the power plant and fuel tank sites;
- C 5.2 Existing contamination within the pipeline corridor;
- C 9.1 Economic displacement;
- C 9.4 Community health;
- C 9.6 Human rights; and
- C 9.7 Labour and welfare.

A detailed Construction Environmental Management Plan (CEMP) shall be drafted prior to commencement of construction. This will provide detail of mitigation as outlined within this Aspects Register, together with any management controls which shall be applied. The Aspects and Impacts Register will be reviewed against the CEMP at this time. A copy of the CEMP shall be provided to any sub-contractors employed within the project and shall also be submitted to the EPA in accordance with Environmental Permit requirements.

2.3.2 Operational phase aspects

A number of aspects associated with the operational phase of the project have been currently identified as being significant. In some cases, this is because either additional studies are required to assess the impact, or because the design is not sufficiently advanced to enable verification that sufficient mitigation is in place to reduce the risk to medium or low significance. The assessment has therefore adopted a precautionary approach until further information is available.

Aspects where further studies and/or information are required, or may be required, include:

- O 1.2 Flood risk; and
- O 3.1 Direct emissions of Greenhouse Gases.

Aspects where the design is not sufficiently advanced to enable verification of mitigation are:

- O 5.1 Discharge of contaminated wastewater to local watercourses; and

- O 5.3 Unintended release of transformer oil due to catastrophic equipment failure.

Other aspects which pose the highest scoring impact risks include:

- O 3.3 Combustion emissions impact on air quality;
- O 4.1 Poor waste management and incorrect disposal of waste;
- O 5.2 Sewage from septic tanks;
- O 9.1 Community health;
- O 9.3 Management of human rights; and
- O 9.4 Management of worker labour and welfare.

Mitigation measures that will reduce the risk associated with each significant aspect have been suggested within the register.

2.3.3 Decommissioning phase aspects

At this issue of the aspects register, the aspects identified for the decommissioning stage are very general and have been assumed to be similar or common to those associated with the construction phase. The decommissioning elements will be verified through audit and inspection and confirmed prior to decommissioning work commencing.

End of Aspects Register