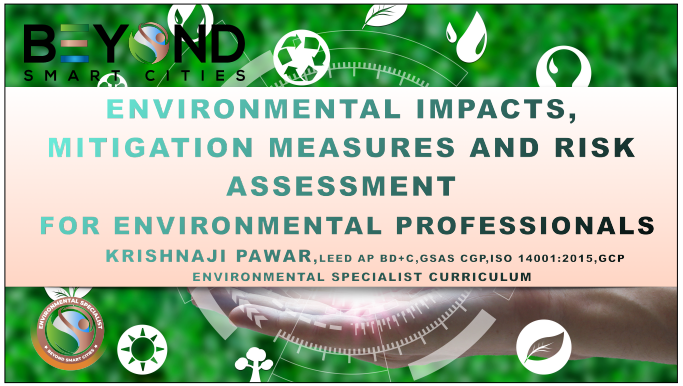
BEYOND
SMART CITIES
STRATEGIC ENVIRONMENTAL ASSESSMENT - SEA
KRISHNAJI PAWAR, LEED AP BD+C,GSAS CGP,ISO 14001:2015,GCP
ENVIRONMENTAL SPECIALIST COURSE

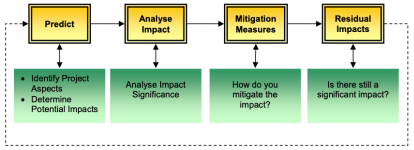

BEYOND
SMART CITIES
ENVIRONMENTAL IMPACTS, MITIGATION MEASURES AND RISK ASSESSMENT
FOR ENVIRONMENTAL PROFESSIONALS
KRISHNAJI PAWAR, LEED AP BD+C,GSAS CGP,ISO 14001:2015,GCP
ENVIRONMENTAL SPECIALIST CURRICULUM

WHAT SHOULD YOU LEARN
Strategy for Impact Prediction and Mitigation
Environmental Assessment Procedure
Environmental Impact Prediction and Mitigation
Mitigation measures
Risk Assessment
Identification of Accidental Environmental Hazards

STRATEGY FOR IMPACT PREDICTION AND MITIGATION

The Strategic Environmental Impact Assessment Procedure was followed for all development phases, construction, commissioning and operation, of Project in accordance with the Environmental Considerations specified by the MOE, the Abu Dhabi Guidelines, and the International Finance Corporation (IFC) standards.

The internationally recognized impact assessment and mitigation procedure is summarised in Figure .



STRATEGY FOR IMPACT PREDICTION AND MITIGATION +

The impact assessment procedure that was applied to Project is outlined as follows:

- ☑ Identification of all Project Master Plan activities, the Environmental Aspects, that could generate environmental and socioeconomic impacts
- ☑ Identification of the relevant environmental and social components, the Environmental Components (ECs)
- ☑ Determination of the potential environmental impact on each EC due to each Environmental Aspect of the Master Plan
- ☑ Evaluation of each impact
- ☑ Determination of the residual impacts that would remain after the application of necessary mitigation measures

A matrix methodology was used to correlate the Environmental Aspects with the Environmental Components as a means to identify the potential impacts during any of the development phases. The results were complemented by comparative scenarios and expert judgment.

ENVIRONMENTAL ASSESSMENT PROCEDURE

Table 5-1 Environmental Aspects Register

Development Component	Environmental Aspect
Construction	Earthworks, trenching and excavation
	Stockpiling
	Civil works (foundation, construction, concreting)
	Transport of equipment, personnel and materials
	Power generation (diesel generators)
	Waste and wastewater management (storage and transport)
	Staffing and purchasing of supplies and services
Operation	Physical presence of QEZ3 development
	Operation and maintenance of QEZ3 common areas
	a) Residential and commercial areas
	b) District cooling units
	c) Electricity substations
	d) Solid waste management
	e) Fire stations
	f) Storm water collection
	g) Forests
	h) Sewage collection and waste water treatment
	i) Potable water system
	j) Telecommunication network
	k) Public open spaces (irrigation)
	l) Common district transport
	Operation and maintenance of QEZ3 industries
	a) Metals
	b) Petrochemical
	c) Marine
	d) Transport and automotive
	e) Tools and machinery
	f) Building materials
	g) Logistics
	h) Food processing
	i) Industrial transport
	Industrial waste and wastewater management
	Staffing and purchasing of supplies and services
Decommissioning	Demolition, decommissioning and removal of infrastructures and equipment
	Site restoration
	Transport of equipment, personnel and materials
	Waste and wastewater management (storage and transport)
	Staffing and purchasing of supplies and services

The results of the receiving environment study, the baseline study, provide a description of the area and the main ecological, social and economic characteristics, the ECs, that could be affected by the proposed activities, the Environmental Aspects.

The list of Environmental Aspects that were considered for this impact assessment, based on the descriptions of the Project Master Plan activities, is provided in Table 5-1 which indicates how the combination of Development Components and Environmental Aspects are understood.

ENVIRONMENTAL ASSESSMENT PROCEDURE

Category	Environmental Component	Importance
Physical	Air Emission and Electromagnetic Fields	Impact on vegetation and wildlife Contribution to climate change Health implications for residences surrounding industrial sites
	Noise Levels and Vibration	Health implications for residences surrounding industrial sites Disturbance to animal populations (wildlife behaviour)
	Geomorphology	Land form changes Change to geomorphologic processes Drainage Patterns
	Soil	Edaphic horizons (flora sustenance) variation Chemical properties variation
	Surface water	Sustainability issues, local use and health implications for all users
	Groundwater	
	Marine water and sediments	
Biological	Marine Ecology	Biodiversity conservation Biodiversity value (International, National and Regional) Use to local community Component of desert and marine ecological system International, National and Community value
	Terrestrial/ Coastal Fauna	
	Terrestrial/ Coastal Flora	
	Terrestrial/Coastal Habitats	
Social	Population and Health	Living conditions Community welfare Health and Safety conditions
	Economic Activities	Regional population growth/decrease Diversification of activities
	Archaeological / Cultural Sites	International, national and community value
	Landscape	Visual quality
	Existing Infrastructures	Living conditions Human health implications Public nuisance

Environmental Components (ECs) are ecosystem and social components that are considered to be important or valuable and that merit detailed consideration in the SEA process. Once the Environmental Aspects were identified and defined, all of the ECs that could be impacted by any of the Master Plan activities were identified.

The ECs were segregated under categories of environmental and social resources based on the environmental baseline study of the area. These resources are: air and climate; land; water; ecology and biodiversity; and human environment. The importance of each EC was then determined, as listed in Table

ENVIRONMENTAL IMPACT PREDICTION AND MITIGATION

Environmental impacts that are anticipated to result from the environmental aspects of the proposed activities could affect one or more of the environmental components identified in Section 0.

Impacts can be avoided, minimized or mitigated by following a management system that includes proactive development and best practices.

These mitigation measures are described for the Construction Phase, for the Operational Phase, and for the Decommissioning Phase.

The combined, incremental effects of human activity, referred to as cumulative impacts, pose a threat to the environment.

RISK ASSESSMENT

The objective of this section is to address the risks associated with accidental impacts to the environment that could occur as a result of mishaps or failures during the construction, operation and decommissioning phases of the proposed Master Plan.The assessment serves for setting the general framework that the different industries will have to follow and the studies that will have to be taken into account during their particular environmental assessment.

The risk assessment identifies and provides a description of the following.

a. Environmental hazards that could be encountered during the construction, operational and decommissioning phases of the Master Plan.
b. A qualitative assessment of the level of risk associated with the identified hazards.
c. Preventive measures that will be implemented to minimize the risk of the occurrence and impact of each hazard.

RISK MATRIX

Risk Matrix

Likelihood		Consequence 1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
A	Almost Certain	H	H	E	E	E
B	Likely	M	H	H	E	E
C	Moderate	L	M	H	E	E
D	Unlikely	L	L	M	H	E
E	Rare	L	L	M	H	H

Table 5-59 Tolerability Criteria

Risk Severity Rating	Action Required
E – Extreme	Immediate attention
H – High	Immediate attention
M – Moderate	Action as soon as practicable
L – Low	Low priority, possibly no action required

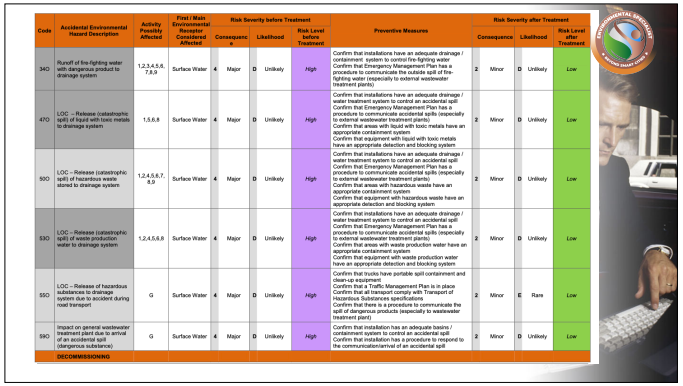
The Risk Matrix is used to define the tolerability of each of the hazards assessed before and after taking into account the proposed preventive measures. The matrix used to assess tolerability in this study is based on the Risk Likelihood & Consequence Guideline (CRP-0012) and was revised and accepted as appropriate for the scope and objectives of this SEA as provided in Table 5-58 with the Tolerability Criteria defined in Table.

IDENTIFICATION OF ACCIDENTAL ENVIRONMENTAL HAZARDS

A formal workshop that was conducted during several sessions was held, and the results were used to identify the accidental environmental hazards specific to the Project. The workshop was developed by Senior Environmental and Safety Risk Consultants.

This Risk Assessment found that most of the accidental hazard risks that were identified for the project will be reduced to a Tolerable Risk Level if the proposed preventive measures are implemented. In general, the risk levels before treatment are primarily Moderate or High, with two scenarios posing Extreme risk levels, which are related to chronic leaks of refined hydrocarbons or contaminated soils during decommissioning. After implementation of the preventive measures, these two would be reduced to Moderate Risk Levels.

Table 5-63 Main Hazards from the Risk Register

Code	Accidental Environmental Hazard Description	Activity Possibly Affected	First / Main Environmental Receptor Considered Affected	Risk Severity before Treatment					Preventive Measures	Risk Severity after Treatment				
				Consequence		Likelihood		Risk Level before Treatment		Consequence		Likelihood		Risk after Treatment
	CONSTRUCTION													
10C	LOC – Release of refined hydrocarbons / fuels from storage area to soil	G	Soil / Groundwater	4	Major	D	Unlikely	*High*	Provide adequate secondary containment for fuel storage Use impervious surfaces for transfer areas Provide portable spill containment and clean-up equipment	1	Insignificant	D	Unlikely	*Low*
14C	LOC – Release of refined hydrocarbons / fuels to soil in road transport accident	G	Soil / Groundwater	4	Major	D	Unlikely	*High*	Confirm that trucks have portable spill containment and clean-up equipment Confirm that a Traffic Management Plan is in place during the construction phase Confirm that all transport complies with Transport of Hazardous Substances specifications	2	Minor	E	Rare	*Low*
	OPERATIONS													
20O	LOC – Release (catastrophic spill) toxic liquid (aqueous phase) to drainage system	1,2,5,8,9	Surface Water	4	Major	D	Unlikely	*High*	Confirm that areas with toxic liquid have an appropriate containment system Confirm that equipment with toxic liquid have an appropriate detection and blocking system Confirm that areas with toxic liquid have drainage / water treatment system to control an accidental spill Confirm that Emergency Management Plan has a procedure to communicate accidental spills (especially to external wastewater treatment plants)	2	Minor	D	Unlikely	*Low*
21O	LOC – Release (chronic leak) of refined hydrocarbons / fuel to soil	1,2,3,4,5,6, 7,8,9	Soil / Groundwater	4	Major	C	Moderate	*Extreme*	Confirm that an adequate maintenance management plan is implemented for equipment that could chronically leak refined hydrocarbons / fuel Confirm that underground chronic leak detection system is in place for activities or equipment with higher risk	3	Moderate	D	Unlikely	*Moderate*
22O	LOC – Release (catastrophic spill) of refined hydrocarbons / fuel to soil	1,2,3,4,5,6, 7,8,9	Soil / Groundwater	4	Major	D	Unlikely	*High*	Confirm that areas with refined hydrocarbons / fuel have an appropriate waterproof pavement Confirm that areas with refined hydrocarbons / fuel have adequate drainage / containment system Confirm that equipment with refined hydrocarbons / fuel have and appropriate detection and blocking system Provide portable spill containment and clean-up equipment for refined hydrocarbons / fuel	2	Minor	D	Unlikely	*Low*
23O	LOC – Release (catastrophic spill) refined hydrocarbons / fuel to drainage system	1,2,3,4,5,6, 7,8,9	Surface Water	4	Major	D	Unlikely	*High*	Confirm that installations have an adequate drainage / containment system to control an accidental spill Confirm that Emergency Management Plans has a procedure to communicate accidental spills (especially to external wastewater treatment plants) Confirm that areas with refined hydrocarbons / fuel have an appropriate containment system Confirm that equipment with refined hydrocarbons / fuel have an appropriate detection and blocking system	2	Minor	D	Unlikely	*Low*

Code	Accidental Environmental Hazard Description	Activity Possibly Affected	First / Main Environmental Receptor Considered Affected	Risk Severity before Treatment					Preventive Measures	Risk Severity after Treatment				
				Consequence		Likelihood		Risk Level before Treatment		Consequence		Likelihood		Risk Level after Treatment
34O	Runoff of fire-fighting water with dangerous product to drainage system	1,2,3,4,5,6, 7,8,9	Surface Water	4	Major	D	Unlikely	*High*	Confirm that installations have an adequate drainage / containment system to control fire-fighting water Confirm that Emergency Management Plan has a procedure to communicate the outside spill of fire-fighting water (especially to external wastewater treatment plants)	2	Minor	D	Unlikely	*Low*
47O	LOC – Release (catastrophic spill) of liquid with toxic metals to drainage system	1,5,6,8	Surface Water	4	Major	D	Unlikely	*High*	Confirm that installations have an adequate drainage / water treatment system to control an accidental spill Confirm that Emergency Management Plan has a procedure to communicate accidental spills (especially to external wastewater treatment plants) Confirm that areas with liquid with toxic metals have an appropriate containment system Confirm that equipment with liquid with toxic metals have an appropriate detection and blocking system	2	Minor	D	Unlikely	*Low*
50O	LOC – Release (catastrophic spill) of hazardous waste stored to drainage system	1,2,4,5,6,7, 8,9	Surface Water	4	Major	D	Unlikely	*High*	Confirm that installations have an adequate drainage / water treatment system to control an accidental spill Confirm that Emergency Management Plan has a procedure to communicate accidental spills (especially to external wastewater treatment plants) Confirm that areas with hazardous waste have an appropriate containment system Confirm that equipment with hazardous waste have an appropriate detection and blocking system	2	Minor	D	Unlikely	*Low*
53O	LOC – Release (catastrophic spill) of waste production water to drainage system	1,2,4,5,6,8	Surface Water	4	Major	D	Unlikely	*High*	Confirm that installations have an adequate drainage / water treatment system to control an accidental spill Confirm that Emergency Management Plan has a procedure to communicate accidental spills (especially to external wastewater treatment plants) Confirm that areas with waste production water have an appropriate containment system Confirm that equipment with waste production water have an appropriate detection and blocking system	2	Minor	D	Unlikely	*Low*
55O	LOC – Release of hazardous substances to drainage system due to accident during road transport	G	Surface Water	4	Major	D	Unlikely	*High*	Confirm that trucks have portable spill containment and clean-up equipment Confirm that a Traffic Management Plan is in place Confirm that all transport comply with Transport of Hazardous Substances specifications Confirm that there is a procedure to communicate the spill of dangerous products (especially to wastewater treatment plant)	2	Minor	E	Rare	*Low*
59O	Impact on general wastewater treatment plant due to arrival of an accidental spill (dangerous substance)	G	Surface Water	4	Major	D	Unlikely	*High*	Confirm that installation has an adequate basins / containment system to control an accidental spill Confirm that installation has a procedure to respond to the communication/arrival of an accidental spill	2	Minor	D	Unlikely	*Low*
	DECOMMISSIONING