Lusail Real Estate Development Company

Health, Safety, Security, Environment, Logistics & Quality Department

Lusail Environmental Management Procedure - Overall Construction Environment Management Plan (OCEM

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COMPANY PROPRIETARY INFORMATION

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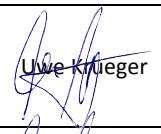
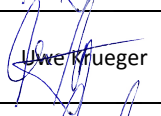
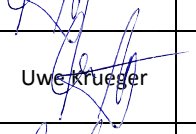
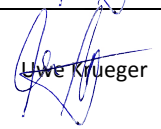
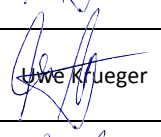
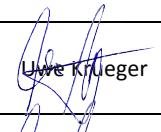
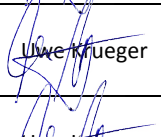
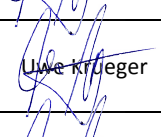
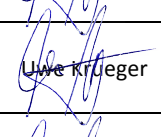
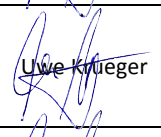
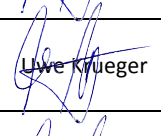
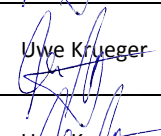
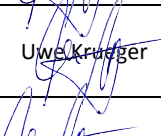
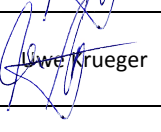
Amendment Record

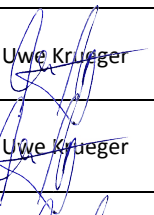
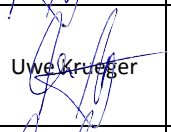
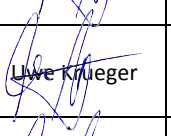
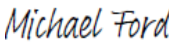
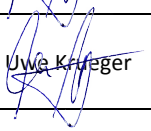
This document is reviewed to ensure its continuing relevance to the systems and process that it describes. A record of contextual additions or omissions is given below:

Rev. No	Description / Comments	Prepared By	Checked By	Approved By	Issue Date
1	(Pg. 8) Change of Abbrebiation – QSAS to GSAS	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 13) Reference to global sustainability assessment system (GSAS)	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 25) Reference to global sustainability assessment system (GSAS)	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 26) Inclusion of a revised payment deduction scheme	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 31) Inclusion of contractors requirement to recruit a full-time environmental representative	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 36) Reference to contractors weekly HSE Meetings	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 38) Reference to CEMP requirements for contractors carrying out a variation order	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 41) Reference to dewatering permits deleted	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 43) Reference to contractor' laydown area plans'	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 44) Reference to contractors responsibility regarding contaminated land during demobilization phase	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 46) Reference to ISO 14001 compliant checklist deleted Reference to contractor' laydown area plans'	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 48) Diesel spills changed a fuel spills	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 52) Clarification of contents of weekly environmental report	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 52) Correction of timeframe for submission of monthly environmental reports	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 54) Correction and cross referencing to section 20 for dewatering monitoring requirements	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	General Comments - References to turtles have been removed	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 66) Qatar sustainability assessment system changed to global sustainability assessment system	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 71) Inclusion of a wooden pallets and	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014

	car board as waste suitable for recycling				
1	(Pg. 72) Reference to a requirement that all waste must be stored in skips.	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 72) Section relating to 'waste piles' deleted	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 73) Inclusion of statement that all waste containers must be kept in a good state of repair.	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 73) Inclusion of statement that were skips are not feasible waste must be stored on an impervious concrete base.	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 74) Reference to contractor requirement to maintain a register of all waste shipments.	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pgs. 85-86) Text formatting – font change	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 88) Sec. 20.2 - clarification of process for dewatering discharge approval.	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 89) Sec. 20.3 - inclusion of requirements for contractor to remain schematics of dewatering networks	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 92) Creation of new section – 20.6 decommissioning of dewatering Wells	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 93) Clarification of reporting dewatering chemical analysis requirements via weekly environmental report	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 94) Extensive list of chemical analysis deleted – this section is redundant	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 95) Sec. 20.6 – new section included relating to decommissioning of dewatering wells	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 97) Inclusion of requirements for workshop perimeter to be bunded	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 102) Inclusion of requirements for a refuelling apron at bulk fuel transfer points.	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 107) Sec. 22.2 – details relating to concrete wash-out facilities on site has been deleted	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 110) Drawing for a typical concrete washout area has been deleted	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 112) The requirement for PMCM to pre-approved all hazardous chemicals introduced on site has been deleted	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 114) Inclusion of statement prohibiting sand to be placed within	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014

	secondary containment for absorption				
1	(Pg. 117) Inclusion of statement prohibiting sand to be placed within secondary containment for absorption	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 119) Inclusion of a requirement for spill kit checklist be completed on a monthly basis	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 126) Inclusion of a statement relating to the MOE marine moratorium	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
1	(Pg. 126) Inclusion of "marine trenching" as an activity which requires specific controls	HSE Working Group	Bernard Lim	Uwe Krueger	22nd May 2014
2	3.2.4 – Inclusion of Noise Monitoring Summary.	HSE Working Group	Michael Ford	Uwe Krueger	22nd March 2015
2	6.6.3 - Deleted reference to Lusail Waste Management Plan	HSE Working Group	Michael Ford	Uwe Krueger	22nd March 2015
2	5.5 - Clarify Supervising Consultants role in environmental inspections	HSE Working Group	Michael Ford	Uwe Krueger	22nd March 2015
2	5.6.2 - Clarify provision of extra contractor environmental staff at discretion of LREDC	HSE Working Group	Michael Ford	Uwe Krueger	22nd March 2015
2	8.1.2 - Table 8-1 – Contents of contractor CEMP to include environmental objectives and targets and project specific aspects and impacts register	HSE Working Group	Michael Ford	Uwe Krueger	22nd March 2015
2	8.2.2 - Clarification of Risk Assessment	HSE Working Group	Michael Ford	Uwe Krueger	22nd March 2015
2	8.2.3 - Permits to be prepared by contractor on behalf of LREDC unless otherwise specified	HSE Working Group	Michael Ford	Uwe Krueger	22nd March 2015
2	8.3 - Records to include plant and equipment daily inspection forms and resource consumption records	HSE Working Group	Michael Ford	Uwe Krueger	22nd March 2015
2	9.3.2 - Demobilization process clarified	HSE Working Group	Michael Ford	Uwe Krueger	22nd March 2015
2	10.2 - Supervisor consultant role clarified regarding site inspections	HSE Working Group	Michael Ford	Uwe Krueger	22nd March 2015
2	11.3.3 - Notification of environmental incidents clarified	HSE Working Group	Michael Ford	Uwe Krueger	22nd March 2015
2	12.1.2 - Accuracy of data in weekly reports specified	HSE Working Group	Michael Ford	Uwe Krueger	22nd March 2015
2	12.2.3 - Noise meter calibration certificate clarified	HSE Working Group	Michael Ford	Uwe Krueger	22nd March 2015
2	13.1 - Control and powdered materials specified	HSE Working Group	Michael Ford	Uwe Krueger	22nd March 2015
2	13.2 - Details of generator emissions / vehicle idling clarified	HSE Working Group	Michael Ford	Uwe Krueger	22nd March 2015

2	16.3 - Resource conservation programs to be documented and supported with documented evidence	HSE Working Group	Michael Ford		22nd March 2015
2	17 - Deleted reference to Lusail Waste Management Plan	HSE Working Group	Michael Ford		22nd March 2015
2	17.2 - Inclusion of section relating to waste bins / containers	HSE Working Group	Michael Ford		22nd March 2015
2	17.5 - Clarifications regarding details require on WTN's and frequency of waste disposal	HSE Working Group	Michael Ford		22nd March 2015
2	17.8 - Clarifications regarding storage and labeling of hazardous waste and period for storage of hazardous waste	HSE Working Group	Michael Ford		22nd March 2015
2	20.3 - Clarifications in details relating to dewatering networks – noise connections, standardized terminology relating to sediment tanks	HSE Working Group	Michael Ford		22nd March 2015
2	20.4 - Clarification of requirements relating to sediment lagoons	HSE Working Group	Michael Ford		22nd March 2015
2	20.4.3 - Clarification on requirements for anti-scouring and need to mitigate impact on receiving environment	HSE Working Group	Michael Ford		22nd March 2015
2	20.5 - Clarification of dewatering monitoring records to be held on file, laboratory reports attached to weekly reports and records of daily visual / odour monitoring	HSE Working Group	Michael Ford		22nd March 2015
2	21.1.1 - Clarification regarding daily inspection checks and checklists	HSE Working Group	Michael Ford		22nd March 2015
2	21.1.1 - Clarification of generator maintenance	HSE Working Group	Michael Ford		22nd March 2015
2	21.1.3 - Clarification of spill trays for field service vehicles	HSE Working Group	Michael Ford		22nd March 2015
2	21.1.4 - Clarification that all fuel tanks must be Woqod approved	HSE Working Group	Michael Ford		22nd March 2015
2	21.2 - Clarification regarding containment of waste wash water and disposal of sludge from wash bay interceptors	HSE Working Group	Michael Ford		22nd March 2015
2	21.3.2 - Clarification regarding use of automatic refueling nozzle	HSE Working Group	Michael Ford		22nd March 2015
2	21.3.2 - Clarification regarding refueling training	HSE Working Group	Michael Ford		22nd March 2015
2	21.3.4 - Clarification regarding use of Woqod approved vehicles	HSE Working Group	Michael Ford		22nd March 2015
2	21.3 - Clarification regarding Hazmat inventory, MSDS's, storage of POL in closed	HSE Working Group	Michael Ford		22nd March 2015

	containers, types of spill kits, storage of fuel container types				
2	23.2.3 - Clarification of spill trays requiring periodic checking and cleaning	HSE Working Group	Michael Ford	Uwe Krueger 	22nd March 2015
2	27.6 - Section included relating to generators in laydown areas	HSE Working Group	Michael Ford	Uwe Krueger	22nd March 2015
2	29 - List of appendices expanded to include additional environmental program documentation	HSE Working Group	Michael Ford	Uwe Krueger 	22nd March 2015
3	(Pg. 1) Company Propriety Information – Not controlled if printed has been added.	HSE Working Group	Michael Ford	Uwe Krueger 	1st April 2015
3	(Pg. 2) Revised Amendment Table	HSE Working Group	Michael Ford 	Uwe Krueger 	1st April 2015

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ABBREVIATIONS AND GLOSSARY

Abbreviations

Abbreviation	Definition
AC	Air Conditioning
BOD	Biological Oxygen Demand
CAD	Computer Aided Design
CAP	Corrective Action Plan
CCA	Copper chromium arsenate - an environmentally hazardous chemical used to treat timber
CEMP	Construction Environmental Management Plan
CFC	Chlorofluorocarbon
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
CP	Construction Package
dB	Decibels
dB(A)	Decibels (A-weighted)
DC	Design Consultant
EBS	Environmental Baseline Study
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
GPS	Global Positioning System
GRP	Glass Reinforced Plastic
HDD	Horizontal Directional Drilling
H_2S	Hydrogen Sulphide
HDPE	High-Density Polyethylene
HSE	Health, Safety and Environment
Hz	Hertz
ISO 14001:2004	International Standards Organisation 14001:2004 - environmental management system
km	Kilometre
L	Litre
LREDC	Lusail Real Estate and Development Company
m	metre
mm	millimetres
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
mg/m^3	milligrams per cubic metre
ml	millilitres
MLWM	Mean low water mark
MoE	Ministry of Environment
MPN/100ml	Most probable number per one hundred millilitres
MSDS	Material Safety Data Sheet
N	Nitrogen
NCR	Non-Conformance Report
NO_x	Nitrogen Oxides
NOC	No Objection Certificate
NSR	Noise Sensitive Receptor

Abbreviation	Definition
NTU	Nephelometric Turbidity Units
O_3	Ozone
OCEMP	Overall Construction Environment Management Plan
Pa	Pascals
Pb	Lead
PCB	Polychlorinated Biphenol
PM_{10}	Particulate Matter (less than 10 microns in diameter)
PMCM	Project Management / Construction Management
PPE	Personal Protective Equipment
QA/QC	Quality Assurance / Quality Control
QCS	QatarConstruction Specifications
QMA	Qatar Museum Authority
GSAS	Global Sustainability Assessment System
RO	Reverse Osmosis
SC	Supervising Consultant
SCENR	Supreme Council of Environment and Natural Reserves (now known as MoE)
SO_2	Sulphur dioxide
STP	Sewage treatment plant
SVR	Site Visit Report
TBT	Tributyl Tin - an environmentally hazardous chemical, used in marine anti-fouling paints
WMP	Waste Management Plan
WTN	Waste Transfer Note
°C	Degrees Celsius
%	Percentage
µg/m^3	Micro-grams per cubed metre
µm	Micro-metres (microns)

Glossary

Term	Definition
Bund	A structure designed to retain liquid around a primary liquid storage unit (a primary storage unit may be a tank or a drum). It is usually comprised of four (4) sealed walls and a sealed floor.
Construction contractor	Party employed by LREDC or a third party, who is carrying out construction activities at a construction site on LREDC land or on a LREDC Project.
Construction site	Any site where construction activities are being conducted within a LREDC project, or related sites, such as labour accommodation for a construction workforce supplied to a construction site within a LREDC project.
Construction Environmental Management Plan	A document that details the management measures (including controls, monitoring and other safeguards) to be implemented during construction of the Project.
Contractor's Environmental Representative	The person nominated by the contractor to take responsibility for the implementation of the environmental requirements listed by OCEMP.
Contractor's senior management	The role that is responsible for making financial and managerial decisions in the contractor's site management team. This could be the contractor's Project Director, Project Manager or Resident Engineer (if this is the most senior position on the site).
Developer	A third party organisation who has purchased a plot within the Lusail Development to construct their own development
Dutch Standards	Environmental pollutant reference values (e.g. concentration in the medium such as soil or groundwater) used in environmental remediation, investigation and cleanup
Government Regulator	The regulatory authority for LREDC land and LREDC projects is the Ministry of Environment (MoE)
Groundwater	Water located beneath the earth's surface in soil pore spaces and in the fractures of rock formations.
Material Safety Data Sheet	An internationally standardised way to document the hazardous properties of chemicals and other hazardous agents.
Sediment	Soils or other surficial materials transported by surface water as a product of erosion.
Soil	Naturally occurring surficial deposits overlying bedrock
Stockpile	A pile or storage location for bulk materials
Stormwater	Water that originates during rainfall events. Stormwater that does not soak into the ground becomes surface runoff, which flows directly into surface waterways or is channelled into storm sewers, eventually discharging to surface waters
Topsoil	The upper layer of soil.
Turbidity	A condition of water quality characterized by the presence of suspended solids and/or organic material.
Watercourse	Any natural or improved stream, river, creek, ditch, channel, canal, conduit, gutter, culvert, drain, gully, swale, or wash in which waters flow either continuously or intermittently

1. INTRODUCTION

1.1. General

Lusail Real Estate Development Company (LREDC) is undertaking the Lusail Development, which is a large infrastructure Project located on the east coast of Qatar; approximately 15 km north of the city centre of Doha (see Figure 1-1)

The Lusail Development will include residential housing for approximately 200,000 residents, with mixed use of retail, commercial centers, hotels, community facilities and recreational areas, bringing the total residential, business and visitor population to 450,000.

This Overall Construction Environmental Management Plan (OCEMP) provides practical mechanisms to manage the impacts of the construction upon its environment. These are based upon international best practices, designed to effectively address local practices, LREDC requirements and environmental conditions.

Figure 1-1 – Location of Lusail City

1.2. Requirement for the OCEMP

All projects within Qatar require an Environmental Permit from the Ministry of Environment (MoE) prior to construction and operation. Per MoE regulatory procedures, LREDC produced and submitted two Environmental Impact Assessments (EIA) for the Lusail Development (as discussed in OCEMP Section 3) for review before MoE granted a conditional Environmental Permit for the Lusail Development. This allowed it to proceed, provided a set of specified conditions are adhered to.

The MoE stipulated within the Environmental Permit that the strategic nature of the Lusail Development required the development of an Overall Construction Environmental Management Plan (OCEMP) for the Project in order to communicate the environmental requirements (including monitoring and mitigation measures) to all.

1.3. OCEMP Overview

This Overall Construction Environmental Management Plan (OCEMP) has been prepared to ensure construction works of the package projects associated with the development of Lusail Development Master Plan are managed to minimize and mitigate the significant environmental impacts. The OCEMP is intended to provide a framework for the Contactors who will be involved in the implementation of the Lusail Development Master Plan to maintain environmental compliance with the MoE requirements. It should be mentioned that such an OCEMP shall guide the preparation of single Construction Environmental Management Plans (CEMP) for the individual construction projects to be pursued by each major contractor. It is also one of the key requirements for approval of the related projects by MoE.

The OCEMP shall apply to the proposed construction projects outlined below and shall follow the guidelines recommended by MoE.

1.4. OCEMP Objectives

The objectives of this OCEMP are:

a) To ensure activities during site preparation and construction works have least impact on surrounding environment;

b) To present mitigation strategies and actions for control of pollution during the pursuit of construction related works;

c) To describe mitigation measures in order to minimize impact on surrounding eco-sensitive areas;

d) To establish a framework for environmental management to ensure implementation of mitigation measure;

e) To develop monitoring Program to ensure regulatory compliance and early detection of any significant environmental impacts;

f) To showcase good practice and sustainability in construction;

g) To present plans for implementing the recommendations of the EIA study; and

h) To demonstrate LREDC's commitment to comply with environmental laws and regulations of Qatar and MOE's requirements.

2. PROJECT DESCRIPTION

2.1. Project Background

By 2030 Qatar aims to be an advanced example of society living to a high standard in a sustainable way in the 21st century. As part of that vision, the creation of Lusail City establishes an iconic city providing all the convenience and amenity needed to support a community oriented lifestyle, whilst celebrating the special culture and geographic heritage of Qatar, through the layout and design of the city and its attractions.

Lusail City is comprised of 38 km2 of waterfront land that is sub-divided into 19 integrated and diverse mixed-use districts. The master plan consists of 11.5 km of developable land sub-divided into a total of 4,929 plots (see Figure 2-1).

Figure 2-1 - Lusail Development Master Plan

Lusail City will encompass not only new residential, commercial, hospitality, and retail facilities, but a full array of community needs, such as schools, medical facilities, sports venues, entertainment precincts, cultural facilities and

shopping centers. Its dynamic and innovatively built structures will be seamlessly integrated and shall incorporate an array of tranquil open spaces and pedestrian and cyclist networks.

Lusail City will accommodate approximately 200,000 residents. An estimated 170,000 are anticipated to work at the different districts, and tourist, recreational and cultural facilities are expected to attract a further 80,000 visitors.

The Lusail Development includes that part of Lusail City for which Lusail Real Estate Development Company (LREDC) is the responsible party and not third party developers. The Lusail Development is a multi-billion US$ undertaking, with mainly infrastructure and public transportation measures. It commenced in the year 2005 and it is divided into several projects with anticipated completion between 2011 and 2015. These projects are referred to as “Construction Packages” or “CPs” (see Figure 2-2).

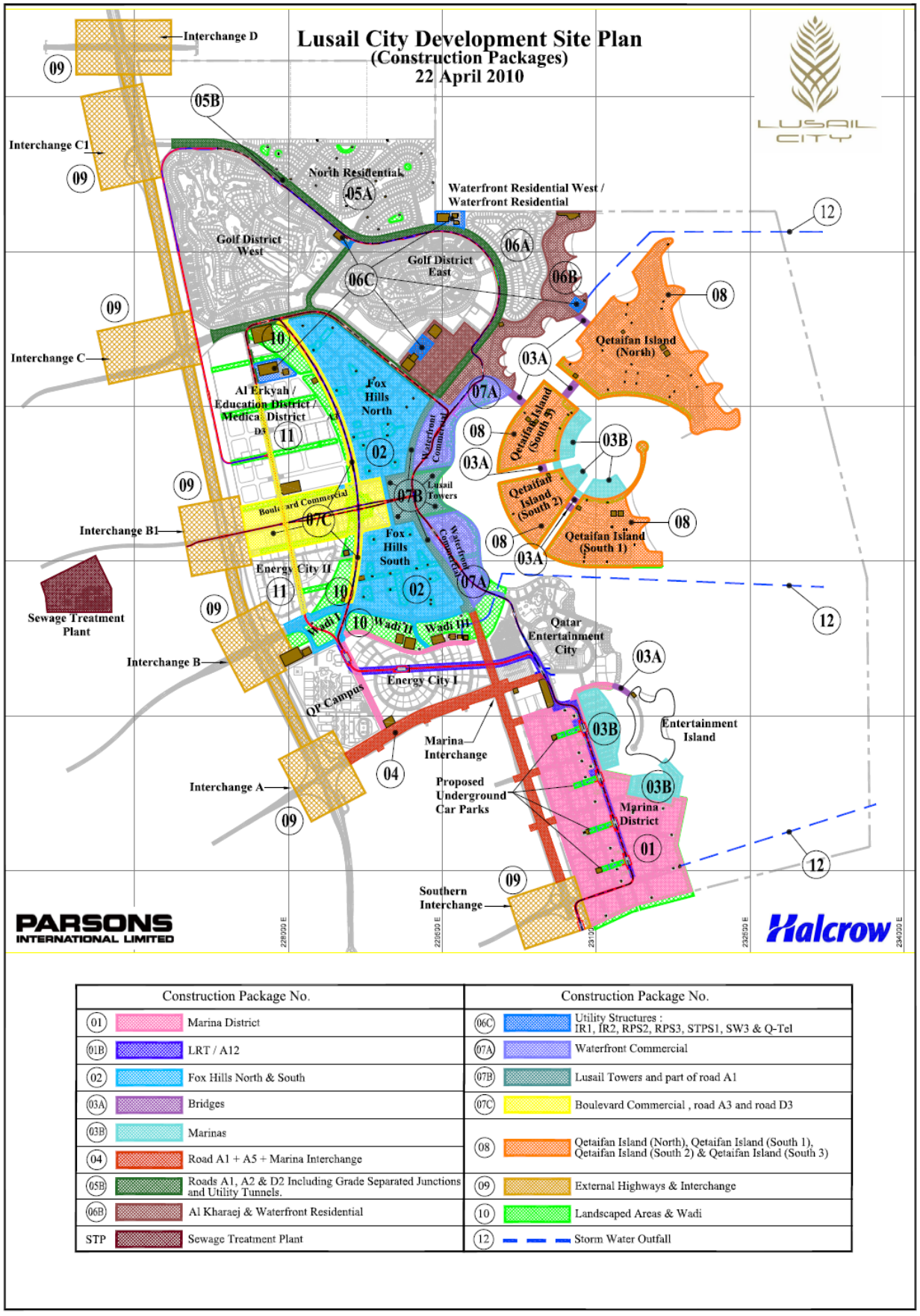
2.2. LREDC Environmental Commitment

Lusail Real Estate Development Company (LREDC) Management and Staff are committed to achieving high environmental standards, satisfying legal requirements and limiting the environmental impact of their activities. To achieve this commitment LREDC is putting special emphasis on Sustainability in all phases of the Project including design, construction methods, operations and subcontracts. For this purpose the GSAS (Global Sustainability Assessment System) in its newest revision has been made mandatory for all LREDC projects.

The Project’s Environmental Management Plans describe the Methods and Procedures to be adopted in order to meet state of the art requirements for the protection of our Environment and to fulfill LREDC's Environmental Policy.

The requirements are constantly reviewed by the Management to ensure that objective of continually improving the effectiveness of the Environmental Management System is met by, among other things, ensuring the best levels of appropriate communication internally as well as with the main Contractors, Developers, subcontractors and suppliers.

Being fully aware of LREDC’s various responsibilities concerning the natural Environment LREDC adopts a holistic approach which is conveyed to all staff in order to preserve the Environment and its biodiversity. This approach includes planning in the design stage to avoid impacts where ever possible as well as assessing and mitigating all unavoidable changes in the most advanced and sustainable manner that is technically feasible and economically viable.



Construction Package No.		Construction Package No.	
01	Marina District	06C	Utility Structures : IR1, IR2, RPS2, RPS3, STPS1, SW3 & Q-Tel
01B	LRT / A12	07A	Waterfront Commercial
02	Fox Hills North & South	07B	Lusail Towers and part of road A1
03A	Bridges	07C	Boulevard Commercial , road A3 and road D3
03B	Marinas	08	Qetaifan Island (North), Qetaifan Island (South 1), Qetaifan Island (South 2) & Qetaifan Island (South 3)
04	Road A1 + A5 + Marina Interchange		
05B	Roads A1, A2 & D2 Including Grade Separated Junctions and Utility Tunnels.	09	External Highways & Interchange
06B	Al Kharaej & Waterfront Residential	10	Landscaped Areas & Wadi
STP	Sewage Treatment Plant	12	Storm Water Outfall

Figure 2-2 - Lusail Development Site Plan (Construction Packages)

3. ENVIRONMENTAL BASELINE CONDITIONS

The purpose of this chapter is to describe the existing environment at the Project site for the intention of: determining the existing environmental conditions at the Lusail Development, which may have an influence over the construction works in terms of environmental impacts; and identifying potential environmental impacts which require particular environmental management actions to be implemented during the construction phase to maintain their integrity.

3.1. Environmental Impact Assessment

As part of the environmental permitting requirements of the Lusail Development, the Client commissioned COWI to undertake two separate environmental impact assessments (EIA) in order to understand the environmental sensitivity of the project area:

a) Lusail Development - North Beach Development Master Plan - Hydrology & Coastal Engineering and Geotechnical Consultancy Services - Environmental Impact Assessment (February 2005); and

b) Lusail Development - Primary Infrastructure - Environmental Impact Assessment (March 2007).

During the EIA, baseline surveys were carried out within the proposed projects development site itself. Full details of the baseline environmental conditions in the areas affected by the construction works related activities are contained in the EIA Reports, but are summarized below.

3.1.1. Scope of EIA

The scope of the two EIAs included the hydrology, coastal engineering and geotechnical aspects involved with developing the “North Beach” project (now known as the Lusail Development), as well as the construction and operation of the land-based infrastructure works of the Lusail Development which include: Roads, Bridge, and Utilities (potable water supply, wastewater collection system, storm water drainage, irrigation water supply, district cooling, electricity supply, telecommunications, solid waste).

For the purposes of the EIAs, the project has been divided into two phases - construction and operational.

a) Environmental impacts due to the construction activities are classified as "temporary" since the activities are limited in time. The environment normally recovers when the activities cease. One of the principal objectives of the EIA is to contribute to the definition of the construction methods so that the impacts are kept to a minimum and do not develop into permanent impacts.

b) Impacts during the operational phase of the project are classified as "permanent" since they are due to the permanent features of the project, e.g. new infrastructure locations and waste handling facilities. In this case the objective of the EIA is to interact with the designers to ensure that the impacts are kept at an acceptably low level, if necessary through the implementation of mitigating measures.

For each of the two phases, the environmental issues were organized in three groups dependent on the recipient medium: air; land/soil/groundwater; and surface/marine water, which may further relate to groundwater.

3.1.2. Summary of EIA Findings

The EIAs concluded that the negative impacts of the infrastructure construction and operation for the Lusail Development are expected to be concentrated around disposal of groundwater from dewatering, waste disposal, noise and emissions. The OCEMP therefore consists principally of conditions placed upon contractors to ensure compliance with environmental standards and implementation of mitigating measures where appropriate.

3.2. Existing Environmental Conditions

The existing environmental conditions were established through the EIAs. The following baseline conditions were determined to be in place at the time of the baseline studies (2005 and 2007), thus setting the agenda for the associated impacts identified.

3.2.1. Present Land Use

There were no villages in the project area. The only buildings were the Q-tel station, a cement plant and a partly abandoned farm with one family with some sheep and about 30 camels which roam freely. There were two other farms with property deeds, but no evidence that they are in use. The area was used extensively by young people for recreation in their 4WD vehicles.

Some of the sabkha areas were used as dumping grounds for construction waste.

3.2.2. Climate

Qatar is classified as a hot subtropical desert. Data received from the Doha Civil Aviation Authority (located approximately 19km south of the Lusail Development) for 2006-2011 indicates that:

a) Average monthly temperatures range from approximately 16°C in winter to approximately 37°C in summer months;

b) Humidity levels are highest over the winter months at approximately 82%. May and June experience the lowest levels of relative humidity at approximately 44%;

c) Rainfall is most likely within the winter months of November to February with some rainfall in March and April and none from May to October. Rainfall in Qatar is sporadic; however, large events can cause flooding and large amounts of surface water runoff; and

d) The predominant wind direction is from the northwest.

3.2.3. Air Quality

There are no baseline air quality measurements from within the Lusail Development area, though air quality monitoring is carried out at Ras Laffan and Mesaieed Industrial City (MIC). Measured nitrogen dioxide (NO2) levels in 2004 for these sites show results which are well below the allowable air quality standards. However, both the average and short-term emission levels of dust (particulate matter 10 microns across (PM10)) exceeded the allowable air quality standards on more than 4 occasions in 2004. This exceedance was probably due to the naturally occurring high levels of dust from the open areas and seasonal dust haze and storms.

The wind patterns place Lusail Development upwind of Doha for most of the year, and the lack of any significant existing emission sources upwind of Lusail Development would suggest that the present NO2 levels in the Lusail Development area would be less than those observed at the Industrial City MIC. Particulate concentrations are likely to be more dependent on the regional transport of dust and fine particulate matter, and it is likely that the PM10 levels observed at MIC would also be representative of the existing PM10 background levels at Lusail Development prior to the start of construction.

3.2.4. Noise and Vibration

Permanent noise monitoring equipment is installed by GHD at two locations within Lusail City. The noise monitoring equipment is installed at the following sensitive receptor locations:

- N-1 (northern station)
- N-2 (southern station)

Noise levels were continuously monitored at 20-minute LAeq intervals at both sites using a Svantek Sound Level Meter (SV 211) coupled with a Svantek Sound & Vibration Analyser (SV 979), and assessed against the Qatar Noise Standards.

Data obtained during the current Environmental Monitoring Program of the project shows that the baseline equivalent noise level typically is around 50 dB(A) during day time and 45 dB(A) during night time as measured at Shafallah, and around 45 dB(A) daytime and 40 dB(A) night time as measured at the Ritz Carlton. The noise levels vary slightly from day to day depending on the distance to the source and the type of activities taking place at the time. Generally, noise levels are below the Qatar Standards.

3.2.5. Soil Quality

Analysis of samples from 14 sites on land did not reveal any significant contamination by heavy metals or other pollutants.

3.2.6. Groundwater

Groundwater levels were measured in 55 boreholes and showed levels at the western edge of the project area of 1 m above mean sea level, thereby indicating a groundwater flow eastward through the site. The salinity of the groundwater varied from 18 ppt at the western side to over 40 ppt at the shoreline (equal to seawater). The water is too saline for domestic or agricultural use.

3.2.7. Terrestrial Ecology

The terrestrial vegetation consists with few exceptions of desert plants and salt tolerant species. Only 25 species of plants are found in the area, all are common in Qatar and none is rare or endangered. A map of vegetation zones is shown in Figure 3-1. (Blue hatch is low laying areas with sandy or silty sediment/soil. It includes true sabkha devoid of vegetation, and occasionally flooded salt marshes dominated by halophytes. Orange hatch represent rocky desert. The largest and most fertile depression is marked by green hatch and houses a now abandoned farm. Small artificial lakes in the southern part and a well/pit to the north are blue)

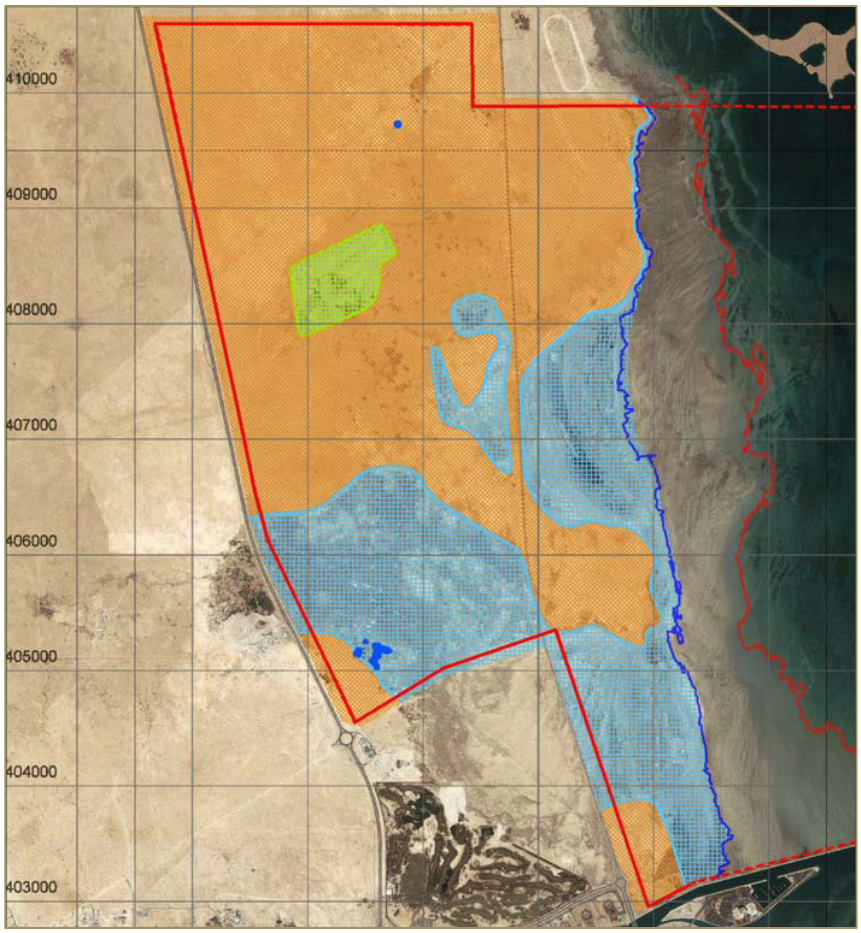


Figure 3-1 - Extent of different vegetation zones within the project area

Snakes and lizards are found in the project area, for example the Spiny-Tailed Lizard. No mammals were observed during field studies except for dogs and camels. However the area may be home to various species of jackals and foxes.

Only 6 species of birds were observed, and they were few in numbers. The intertidal and shallow sub tidal flats in the project area are frequented by migrating and wintering water birds such as cormorants, grebes, herons, flamingos, gulls and terns. A total of about 1,800 birds were observed along the 6.3 km coastline of the project area during the counting in

October 2004. This number included about 900 terns, 800 waders, and 100 others such as cormorants, gulls, herons and flamingos. The project area is not classified as an important bird site.

No rare or endangered species are found and the impacts on habitat and landscape has been considerable, but are assessed to be unimportant.

3.2.8. Bathymetry, coastal morphology and oceanography

The east coast of Qatar is a sedimentary coast with a wide, shallow tidal platform and a shoreline migrating slowly eastward. The tidal flats (depths up to 2 m) extend for 2 to 3 km from the shoreline where it is bounded by a channel of 5 - 6 m depth (Figure 3-2). The 10 m depth contour is about 20 km offshore.

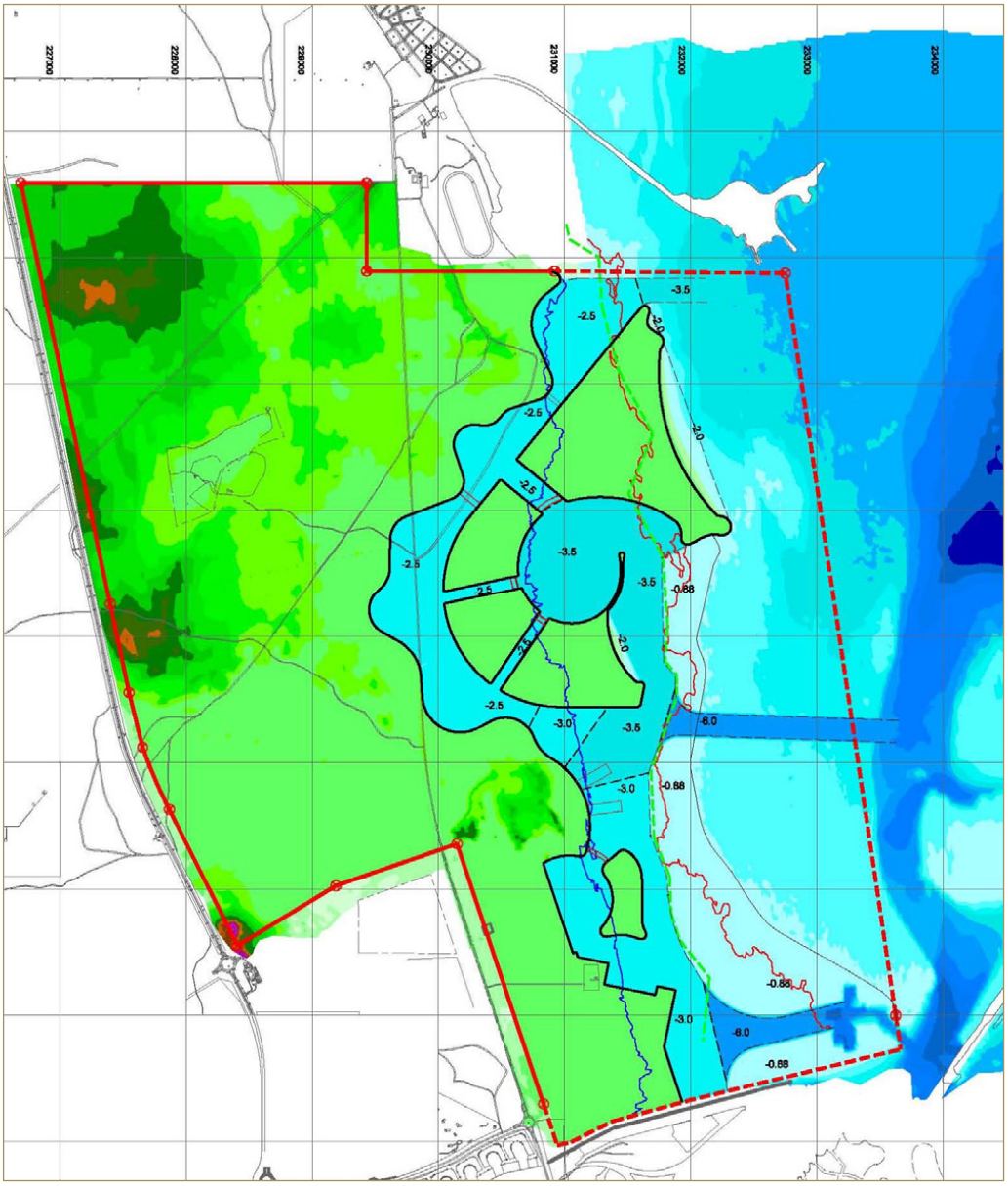


Figure 3-2 - Shoreline of the proposed Lusail development in relation to the existing topography

The sediments on the tidal flats consist of medium calcareous sands and fine material originating from desert dust. The calcareous sands originate almost entirely from crushed sea shells. Clean sand occurs towards the north while to the south there is a higher content of silt in the sand due to the lower wave action. The southern part is protected from waves by Al Aliyah Island. There is no evidence of significant littoral drift and the coastal morphology is therefore quite stable.

The tides at Lusail Development are similar to those at Doha, i.e. of the mixed diurnal-semidiurnal type with a maximum range of about 1.6 m. Current speeds over the tidal flats are very low, generally less than 0.1 m/s. Similarly, the daily

wave heights are very low, in the order of 0.1 to 0.2 m. Maximum wave heights during strong north-east winds are estimated at 1.0 m.

3.2.9. Marine Vegetation

Sea grass beds are the most widely distributed and important marine sub tidal habitat in the project area. The coverage is shown in Figure 0-3. The distribution of sea grass is patchy and within the project area the coverage is mostly less than 30%. Sea grass grows on sand with a low content of silt.

The upper limit of sea grass occurrence coincides closely with the Mean Lower Low Water (MLLW) line along most of the North Beach. The lower limit is usually set by the available light at the sea bed, and in the Gulf region it is reported that sea grass extends out to the 10 m depth contour.

There are three species of sea grass, Halodule uninervis, Halophila stipulacea, and Halophila ovalis, with the first dominating almost everywhere at Lusail Development.

The principal importance of the sea grass beds is that they provide a nursery area for juvenile fish and shrimps.

Benthic microalgae communities are ubiquitous but inconspicuous and are often just seen as a yellow-brownish tan of the sediment. They are best developed on sheltered sand and mudflats in shallow areas.

Benthic macro algae (seaweeds) usually grow attached to hard substrates like rocks, corals and shells. Small filamentous species grow attached to other algae or sea grass as epiphytes, a few species can grow in soft sediment, and still others are free floating. All these forms are found in the Lusail Development area, but red and brown macro algae attached to rocks and shells are the most prominent

Two patches of artificially planted mangroves are found on the site. They are not natural to the area.

3.2.10. Marine Fauna

A total of 62 species of benthic fauna were found during the field studies. On the intertidal flats they were dominated by snails and bristle worms and on the sub tidal flats by nematodes, crustaceans, mollusks and bristle worms. Pen mussels and pearl oysters were also found.

No live coral was found in the project area, and even on the reef-flat around Al Aliyah Island only one small colony was found. It is generally accepted that the high water temperatures in the summer of 1998 killed almost all coral in the area.

3.2.11. Water and Sediment Quality

Samples of sea water from 9 locations and bed sediments from 11 locations within the project area were analyzed for pollutants. Concentrations of heavy metals, petroleum compounds and polychlorinated biphenyl (PCB) were either far below critical limits or below the detection limits and do not pose any threat to users of the area.

3.2.12. Cultural and Archaeological

The detailed site inspection did not reveal any cultural or archaeological features of importance.

4. LEGAL AND REGULATORY REQUIREMENTS

This chapter details both the regulatory framework within which the OCEMP has been developed, and the environmental standards which will be adhered to. The chapter also outlines the legal obligations placed on the State of Qatar by international conventions.

4.1. Qatar Statutory Regulations

The Qatari constitution enshrines the protection of the environment, declaring that "the state shall preserve the environment and its natural balance in order to achieve comprehensive and sustainable development for all generations". Qatar has a dedicated Ministry of Environment (MoE), formerly known as the Supreme Council of Environment and Natural Reserves (SCENR), per Decree Law No. 11 of 2000.

The principal laws governing environmental protection in the State of Qatar are:

a) Decree Law No. 30, 2002: The Issuance law of Environmental Protection. The law charges MoE with overseeing and enforcing environmental protection and authorizes MoE to prevent hunting of scarce wildlife, and the destruction of trees and grass. It mandates that the planners of all public and private development projects must submit an environmental impact study before any relevant licenses can be issued, and obliges all industrial projects to establish waste treatment and recycling centres and calls for the establishment of emergency plans to respond to possible environmental disasters.

b) Executive Order (By-Law) for the Environmental Protection Law and its Annexes, 2005. The Annexes contain the environmental standards which require adherence.

c) Amiri Decree No. 16, 2009: Determining Ministries Specialties. Article 13 of the Decree is concerned with the responsibilities of the MoE. The Decree states that the MoE's duties include, amongst others, progressing and implementing general policies to: protect the environment, nature and control related activities; regulate licenses for environmental permits; control of chemicals; and disposal of wastes.

In addition the Qatar Construction Specifications (QCS, 2010) detail a number of environmental and sustainability practices to abide by, particularly Section 7 – Green Construction.

4.2. Qatar Environmental Emission Regulations

The majority of the emission limits are contained within the a) Decree Law No. 30, 2002: The Issuance law and the Environmental Protection Executive Order (By-Law) for the Environmental Protection Law and its Annexes (2005).

4.2.1. Air Quality

The Executive Order (By-Law) for the Environmental Protection Law and its Annexes (2005) provides maximum allowable ambient noise limits in Qatar, as presented in Table 4-1.

Pollutant	Limit	Averaging Period	Unit	Ambient Air Quality Criteria Attainment
Sulphur Dioxide	385	24 hours	µg/m^3	A
	80	Annual		A
Particulate Matter (<10 microns)	150	24 hours	µg/m^3	A
	50	Annual		B
Nitrogen Dioxide	400	1 hour	µg/m^3	D
	150	24 hours		A

Pollutant	Limit	Averaging Period	Unit	Ambient Air Quality Criteria Attainment
	100	Annual		B
Ozone	235	1 hour	µg/m^3	C
	120	8 hours		G
Carbon Monoxide	40	1 hour	mg/m^3	D
	10	8 hours		E
Lead	1.5	3 month average	µg/m^3	F

Key for Air Quality Criteria Attainment

A. 99.7% for all daily average throughout 1 year of evaluation
B. Average for all the daily measurements for 1 year of evaluation
C. 99.7% for all days in 1 year of evaluation, including readings for 1 hour or less than in the criteria
D. 99.9% of all the measurements for 1 hour throughout 1 year of evaluation
E. 99.8% for every maximum measures, averaged 8 hours for 1 calendar year
F. An average for all measurements per hour on a quarterly basis
G. 98% of all maximum daily measurements (8 hour average) throughout 1 year of evaluation

Table 4-1 – Air Quality Standards in Qatar

The maximum permissible limits for emissions from stationary sources subject to the type of facility include the following for cement industry facilities (such as concrete batching plants), see Table 4-2.

Parameter	Permissible Limits
Particulate Matter	50 mg/Nm^3
Sulphur Dioxide	35 mg/Nm^3
Nitrogen Oxides	240 mg/Nm^3

Table 4-2 – Cement Industry Air Quality Limits in Qatar

4.2.2. Noise Emissions

The Executive Order (By-Law) for the Environmental Protection Law and its Annexes (2005) provides maximum allowable ambient noise limits in Qatar, as presented in Table 4-3.

Area	Maximum limits of noise (average of 20mins)	
	Day Time	Night Time (22:00 – 04:00)
Residential areas and public corporations	55	45
Commercial Areas	65	55

Industrial Areas	75	75

Table 4-3 – Allowable Noise Limits in Qatar

4.2.3. Water Quality

The Executive Order (By-Law) for the Environmental Protection Law and its Annexes (2005) provides the standards for seawater quality in Qatar, as presented in Table 4-4.

Parameter	Maximum Permissible Limit	Unit
pH	6.5 – 8.3	
Salinity	33 - 45	
Dissolved Oxygen	More than 4	Parts per thousand (ppt)
Total Suspended Solids (TSS)	30	Mg/L
Phosphorus	30	Mg/L
Nitrates	100	Mg/L
Silica	900	Mg/L
Ammonia (Nitrogen)	15	Mg/L
Total Petroleum Hydrocarbons	5	Mg/L
Cadmium	0.7	Mg/L
Nickel	20	Mg/L
Mercury	Less than 0.4	Mg/L
Iron	90	Mg/L
Copper	15	Mg/L
Lead	12	Mg/L
Vanadium	10	Mg/L
Polychlorine phenyl	Not permissible	Mg/L
Chlorophyll	1	Mg/L

Table 4-4 – Standards for Seawater Quality

The Executive Order (By-Law) for the Environmental Protection Law and its Annexes (2005) provides standards for pollutants when discharged in the water environment in Qatar, as presented in Table 4-5.

It is prohibited to discharge pollutants in the marine environment. Sewage treated effluent can only be discharged at a distance not less than (4) nautical miles off the coast, unless prior agreement with MoE has been obtained. If the sewage effluent has not been treated, the distance should not be less than 12 nautical miles. It is also prohibited to discharge pollutants in the fisheries or in places of high economical, historical and aesthetic value including the natural reserves.

Parameter	Maximum Permissible Limit	Unit
1. Physical Tests		
Total Dissolved Solids (TDS)	1500	Mg/L
Total Suspended Solids (TSS)	50	Mg/L
pH	6-9	pH
Floating particulates	Nil	
Temperature	<3° above average level	Degrees Celsius
Turbidity (NTU)	50	NTU
Color	colorless	
2. Inorganic Matters		
Ammonia (NH^4)	3	Mg/L
Chlorine (Residual)	0.05	Mg/L
Cyanide	0.1	Mg/L
Fluorides	1	Mg/L
Phosphate (as P)	2	Mg/L
Sulphate	0.1	Mg/L
Biochemical Oxygen Demand (BOD)	50	Mg/L
Chemical Oxygen Demand	100	Mg/L
Urea	2	Mg/L
Total Nitrogen (TKN)	100	Mg/L
3. Trace Metals		
Aluminum	3	Mg/L
Arsenic	0.5	Mg/L
Barium	2	Mg/L
Boron	1.5	Mg/L
Cadmium	0.05	Mg/L
Chrome (Total)	0.2	Mg/L
Cobalt	2	Mg/L
Copper	0.5	Mg/L

Parameter	Maximum Permissible Limit	Unit
Iron	1	Mg/L
Lead	0.1	Mg/L
Manganese	0.2	Mg/L
Mercury	0.001	Mg/L
Nickel	0.5	Mg/L
Selenium	2	Mg/L
Silver	0.005	Mg/L
Zinc	0.02	Mg/L
4. Organic Matters		
Oil and Grease	15	Mg/L
Phenol (Total)	0.5	Mg/L
Halogenated Hydrocarbonates & pesticides of all types	0.1	Mg/L
Dioxin	1.34×10^{-7}	Mg/L
Trihalomethane	100	Mg/L
5. Biological Tests		
Total Coliform in $100cm^3$	100	MPN/100ml
Egg parasites	Nil	
Worm parasites	Nil	
Colon / stool bacteria	100	MPN/100ml

Table 4-5 – Standards for Pollutants When Discharged in the Water Environment

4.3. Client (LREDC) Requirements

4.3.1. Environmental Permit

All projects within Qatar require an Environmental Permit from the Ministry of Environment (MoE) prior to construction and operation.

The Lusail Development Project is entirely covered by the existing Environmental Permits obtained by Qatari Diar for the development. The individual developers and contractors will thus not be required to apply to MoE for individual environmental permits concerning their specific project parts (Though certain projects such as hospitals will require a special environmental permit to be separately applied for at the MoE), but they will be required to submit their own Environmental Management Plans and statement confirming their compliance with the master environmental permit rules and regulations to Lusail Real Estate Development Company (LREDC).

Since there are various elements and equipments within projects which request special environmental consents and/or permits from the MoE (e.g. for stone crushers, temporary sewage treatment plants on site etc.) each Developer or Contractor is requested to mandatorily consult LREDC for guidance.

4.3.2. LREDC Specific Requirements

The Client (LREDC) has developed the following environmental and sustainability requirements for the Lusail Development, which have subsequently been amalgamated within this OCEMP:

a) Lusail Environmental and Sustainability Requirements (as part of 'Construction HSE General Requirements on LREDC for Contractors'); and

b) Lusail Waste Management Plan (WMP) (Lusail/HSEMS/PRO/07/07).

In addition, Lusail has developed a number of permitting requirements, including dewatering, as discussed in OCEMP Section 20.

4.4. Sustainability Requirements

The Global Sustainability Assessment System (GSAS), is a sustainability rating system, which aims at creating a sustainable built environment that minimizes ecological impact while addressing specific regional needs and the environment of Qatar. This is discussed in detail within OCEMP Section 16.

4.5. International Conventions

Qatar is signatory to several international conventions. Most are related to the prevention of oil pollution, but some are more environmentally comprehensive, including:

a) Convention for the Protection of the World Cultural and National Heritage (World Heritage Convention) Paris, 1974 (Decreed 1984);

b) United Nations Convention on the Law of the Sea (UNCLOS) (Montego Bay, 1982);

c) Kuwait Regional Convention for Co-operation on the Protection of the Marine Environment from Pollution (Kuwait, 1978);

d) Agenda 21 and The Rio Declaration on Environment and Diversity (Rio de Janerio, 1992).

e) United Nations Framework Convention on Climate Change (UNFCC, 1992) and the Kyoto Protocol (Kyoto, 1997).

f) United Nations Conventions on Biological Diversity (United Nations, 1993).

g) Convention on the Conservation of Wildlife and Natural Habitats in the Countries of the Gulf Co-operation Council (GCC, 2003).

h) Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel Convention 1989) and it's Amendment (Basel Convention 1995).

i) Montreal Protocol (Montreal 1987), which calls for phasing out of chlorofluorocarbon (CFC) gases by 2010.

4.6 Legal Enforcement and Payment Deduction

4.6.1 General

The Contractor shall comply with these OCEMP Requirements as may be amended or supplemented from time to time, and all Qatari laws, codes, policies, procedures, regulations and requirements.

a) Contractor shall comply, and shall ensure that contractors/sub-contractors of any tier, consultants/ sub-consultants of any tier, personnel, material men, agents, vendors, and suppliers and permitted successors and assigns comply with these Requirements, as may be amended or supplemented from time to time by LREDC.

b) Should Contractor show disregard to these Requirements or fail to comply with, implement, impose, or is deemed to be in breach of any of these Requirements, LREDC shall be entitled to:

i. Provide to the Contractor notice identifying the discrepancy/ violation, required corrective action(s), and required completion date(s). LREDC Representative may conduct corrective action verification inspections following the report of corrective action completion by Contractor;

ii. Should Contractor not implement the required corrective action(s) prior to the due date as noticed by the LREDC Representative or if a repeat instance of similar discrepancy/ violation be identified, the Contractor will be issued a second notice informing Contractor of the violation;

iii. Impose the Payment Deductions outlined in Section 4.6.2 to these Requirements. Contractor should be aware, and are placed on notice in any event by these Requirements, that the LREDC may suffer costs, damages, losses and/or expenses arising from violation of these Requirements by Contractor and the Payment Deductions outlined in Section 4.6.2 may not be sufficient to fully compensate LREDC's costs, damages, losses and/or expenses. LREDC hereby reserves its right to seek and recover compensation for costs, damages, losses and/or expenses above those outlined in Section 4.6.2 of these Requirements. Furthermore, such compensation is in addition to any amounts prescribed under Qatar law or Qatari regulations which are collected for the competent authorities.

c) In situations where the failure by Contractor is deemed to be life threatening Contractor shall suspend any work affecting or affected by such life threatening situation.

d) Notwithstanding anything to the contrary in these Requirements: Contractor's failure to comply with these health, safety and environmental (HSE) and Sustainability General Requirements shall entitle LREDC and/or LREDC Representative to:

i. Suspend or terminate the Contractor's works and/or services. Traffic violation is deemed as an integral part of health and safety violation;

ii. Revoke the permits afforded to Contractor (including access to the site) at any time there is a violation of these Requirements and/or Qatari law; and/or

iii. Report the violation to local authorities; and/or

iv. Rectify at its own initiative any health or safety violations of the Contractor. Any costs, damages, losses and/or expenses arising from such rectification work shall be solely borne by the Contractor, and recoverable from the Contractor by LREDC. If Contractor fails to compensate LREDC for any rectification work, and/or to pay any penalties arising from our violations of these Requirements, within 3 days of the notice by LREDC to do so (or less if the urgent rectification is required), the LREDC shall be entitled, but not obligated, to deduct such costs, damages, losses, expenses and/or penalties from any amounts under its contract with the Contractor.

e) Any imposition of or failure by the LREDC Representative to issue notification of a health and safety breach or to impose a Payment Deduction shall not relieve Contractor of any of his obligations under the Contract.

f) In the event of the LREDC Representative taking action based on this Section 5.6, the Contractor shall not be entitled to any additional costs or extension to the time for completion of Contract.

g) Furthermore, LREDC and LREDC Representative (s) shall not be liable for, nor shall Contractor be entitled to, any damages, costs, expenses, losses, or compensations for any impacts to its work, project or reputation, following any Payment Deduction(s), suspension, stoppage of work, or permit revocations by LREDC or LREDC Representative (s).

4.6.2 Payment Deductions

If failures or violations of health, safety and environmental policies or procedures are not corrected within the schedule indicated by LREDC Representative, subsequent payment deductions of minimum QR 2,000 per day, post due date, may be imposed upon Contractor.

No.	Type of CONTRACTOR Violation	Performance Deduction (QAR)
1.	Failure to produce and submit to LREDC approved HSE Documentation e.g. HSE Plan, Method Statements, OH Plan, EMP Reports, etc.	**5000**
2.	Failure to implement a safe system of work and The Requirements of LREDC OCEMP.	**5000**
3.	Failure to conduct emergency drills as specified.	**2000**
4.	Failure to comply with LREDC with regard to Incident / Accident Notification, reporting and investigation requirements.	**2000**
5.	Failure to appoint competent HSE staff	**10000**
6.	Failure to report a potential high risk activity.	**10000**
7.	Failure to provide staff training in HSE and/or appropriate inductions	**5000**
8.	Failure to provide safe access and egress to LREDC Project sites.	**2000**

Table 4-1 – Table of Performance Deductions per Occurrence respectively per Day (in Qatari Riyals)

4.6.3 Waste Management Enforcement

With respect to any agreement between LREDC and any Contractor and/or Plant Operator, LREDC management will take all measures, impose penalties and/or levy fees against such Contractor and/or Plant Operator or its subcontractor(s) who breaches his waste disposal obligations under the agreement, in accordance with the terms and conditions of the agreement

a) Without prejudice to such contractual rights, this subcontractor may also be in breach of, and be subject to the penalties prescribed by, the Law No. 30 of the Year 2002 of the State of Qatar, which regulates waste management.

b) Article 68 of this Law deals with penalties associated with the incorrect disposal of waste. Transgressors shall be punished with a fine not less than QR. 5,000 and not more than QR. 50,000.

c) Article 70 of the Law deals with penalties associated with the incorrect disposal of hazardous waste. Transgressors shall be punished with imprisonment for a minimum period of one year or a maximum period of three years, and a fine of QR. 100,000 at the minimum and QR. 300,000 at the maximum, or with either of the two penalties.

d) Any Contractor and/or Plant Operator or its subcontractor(s) who contravenes the laws will be reported to the State authorities to enable such authorities to enforce the statutory penalties under the Law.

5. ROLES AND RESPONSIBILITIES

The purpose of this chapter is to identify the roles and responsibilities of the key parties involved in the implementation of the OCEMP and to define the environmental hierarchy on the project.

5.1. Government (Ministry of Environment)

The Ministry of Environment (MoE) roles and responsibilities will be:

a) Review and approve Project Environmental Impact Assessment(s);

b) Review and approve Project Environmental Permit(s);

c) Review and approve Project Dewatering Permit(s);

d) Review the Monthly Environmental Monitoring Reports (reviewed on quarterly basis);

e) Review and approve Contractor and Developer CEMPs; and

f) At their discretion, the MoE may carry out site inspections and audits to verify the Contractor and Developer compliance.

5.2. Client (LREDC)

The client and project proponent (LREDC) has overall responsibility for the Project:

a) Review, comment and approve Contractor CEMPs and Monthly Environmental Monitoring Reports prior to submission to MoE;

b) Appoint responsible contractors and consultants who commit to comply with all MoE and Project requirements;

c) Report any significant adverse environmental incidents to the MoE;

d) Primary source of liaison with Regulatory Authorities and other Government Organisations;

e) Approves contractor Permit Applications, Detailed Method Statements, Risk Assessments and similar unless LREDC delegated approval authority to another party;

f) Review and sign off Environmental Permit Applications to the MoE;

g) Manage long term non-conformance issues on site which require elevation within Lusail;

h) Communicate environmental and sustainability issues; and

i) Monitors contractor performance to inform pre qualification and procurement processes.

5.3. Project Management / Construction Management (PMCM)

The Project Management / Consultant Management (PMCM) represent Lusail on site and are responsible for overseeing the main contractor, design consultant and supervisory consultants during the project execution. Accordingly, the PMCM has the following responsibilities:

a) Review and provide comment on contractor and consultant documentation including CEMP, Method statement, Risk Assessments and Permit Applications prior to submission to Lusail;

b) Review and provide comment on contractor and consultant monitoring results and weekly and monthly reports prior to submission to Lusail;

c) Providing Environmental Induction ('train the trainer') for contractor HSE senior staff that can be disseminated to the rest of the employees.

d) Schedule and conduct project environmental meetings

e) Establish communication, reporting and authorization procedures for the project.

f) Carry out and record periodic site environmental inspections to monitor enforcement of environmental standards and ensure compliance with Lusail requirements

g) Undertake audits of contractors and consultants to ensure accuracy and completeness of records

5.4. Third Party Developers

The Third Party Developers have purchased their development site from LREDC and are thus operating differently to the LREDC Construction Package Contractors. However, there are still responsibilities beholden to the Developers in relation to LREDC as they are within the Lusail Development and adjacent to other LREDC projects which can be impacted by their own work

The Third Party Developers roles and responsibilities include:

a) Appoint a competent main Contractor;

b) Ensures that Contractor CEMP is signed off by a specialised third party Environmental Consultant;

c) Provide Contractor CEMP to Lusail for review and comment prior to submission to MoE;

d) Co-ordinate with LREDC and PMCM Logistics with regards access to and from site and waste management procedures;

e) Conduct project audits and regular site inspection; and

f) Take all necessary measures to protect the environment

5.5. Supervisory Consultants and Design Consultants

The Design Consultant roles and responsibilities during construction include:

a) Provide design clarification as needed; and

b) Review and response all requests for information raised by the Contractor regarding design issues.

The Supervisory Consultant roles and responsibilities during construction include:

c) Review Contractor variation order requests, construction phase submittals and submittals based on the tender documents;

d) Supervise and inspect Contractor construction activities for HSE and Quality compliance;

e) Monitor progress of work on site to verify that Contractor is executing works accordance with their contract;

f) Coordinate activities of the Contractor;

g) Carry out and record regular site environmental inspections to monitor enforcement of environmental standards and ensure compliance with Lusail requirements. LREDC will specify the periodicity of inspections. All inspections and reports shall follow client specified processes and templates.

h) Manage and coordinate long lead items;

i) Prepare weekly and monthly progress reports as stipulated in scope of work;

j) Conduct project audits;Review technical submissions, including: As-Built Drawings, Method Statements, CEMPs, Material Submittals, Shop Drawings and Plans; and

k) Monitor and perform inspection and testing of Contractor works.

5.6. Contractors

The Contractor will be fully responsible for implementing the CEMP and for ensuring that any Subcontractors are (where applicable) actively implementing the CEMP. The Contractor shall, throughout the execution and completion of the Works:

a) Establish and follow an Environmental and Sustainability Policy and to communicate this policy to the workforce.

b) Ensure that Contractor CEMP has either been produced by or elaborated and signed off by a specialised third party Environmental Consultant (as discussed in OCEMP Section 8.1);

c) Know and understand all laws governing his activities along with any site requirements and work site hazards. Such information shall be communicated by the Contractor to his personnel and Subcontractors;

d) Take all necessary measures to protect the environment; and

e) Conduct all operations throughout performance of the works in such a way so as to minimise impact on the natural environment and the local community.

f) Appoint a full-time Environmental Manager / Representative who will be responsible for implementing the project environmental requirements within their scope of work.

Specific roles and responsibilities within the Contractor's team are likely to be:

5.6.1. Project Manager

The Contractors Project Manager will be responsible directly, or by overseeing his project team, for compliance with the CEMP. They shall require all Subcontractors to adhere to these requirements and provide necessary resources, facilities and personnel. They will be responsible to:

a) Ensure resources are provided to prepare and implement the CEMP;

b) Approve the CEMP and any amendments to the CEMP;

c) Facilitate and provide necessary support for communication related to environmental protection raised by different parties; and

d) Approve monthly reports or other reports about environmental issues and non-conformances to the Client, in the regular reporting structure and when an issue arises.

5.6.2. Environmental Manager/Representative

The minimum staff requirements to be appointed by each contractor working on the site are: one (1) full-time Environmental Manager and one (1) full-time Environmental Representative. Additional Environmental staff may be required at the discretion of LREDC.Additional Environmental Representatives shall be provided as required to supervise high risk activities. Curriculum Vitae for the Environmental Manager must be submitted for LREDC review and acceptance.

The specified criteria for Contractors Environmental staff are contained in Lusail HSE General Requirements.

ENVIRONMENTAL MANAGER

- Hold a University Degree and/or professional Environmental Diploma or its equivalent in environmental engineering or a similar discipline, with a minimum of ten (10) years of construction environment management experience on projects of similar size and scope,

OR;

Hold a certification as a Chartered Environmentalist (CEnv) or equivalent (e.g. IEMA, CIWEM) from an internationally recognized professional institution and having a minimum of twelve (12) years of construction environment management experience on projects of similar size and scope.

ENVIRONMENTAL REPRESENTATIVE / OFFICER:

- A minimum of three (3) years of construction environment management experience on projects of similar size and scope

- Educated/ certified through internationally recognized schools/ agencies as having received comprehensive training in construction environment (e.g. NEBOSH Certificate in Environment management, ISO 14001:2004 internal auditor, or similar).

The Contractors Environmental Manager/Representative will be responsible to:

a) Prepare, review and update the CEMP;

b) Prepare weekly and monthly environmental reports to LREDC;

c) Attend LREDC Monthly Environmental Meeting;

d) Ensure any changes to the CEMP are made known to all staff and subcontractors;

e) Liaise with the Supervising Consultant, PMCM and LREDC Environmental Representatives to ensure variations to the scope or timing of the work that may impact on the environment are discussed, and be point of contact for all environmental issues and reporting;

f) Prepare information for environmental site training (toolbox talks);

g) Deliver or prepare information for environmental inductions;

h) Ensure materials being used on the site are environmentally friendly and safe;

i) Close-out all environmental non-conformances;

j) Conduct audits and inspections as required by the CEMP at work sites;

k) Review Subcontractors' environmental protection/mitigating measures – to verify compliance with the CEMP;

l) Undertake confirmation of staff observations regarding non conformances;

m) Maintain the environmental training register;

n) Maintain the incidents and complaints register; and

o) Be the one point of contact for discussing any changes to the scope of works, project boundary limits, reporting of incidents and non-conformances and other environmental issues.

5.6.3. Site Engineer

The Contractors Project Manager will be responsible to:

a) Control and monitor actions required by the CEMP;

b) Monitor subcontractor performance and commitment;

c) Report all environmental issues to the Contractor's Environmental Representative and Project Manager;

d) Maintain systems and records for waste management, sewage disposal, fuels and chemicals, and training;

e) Ensure documented procedures are followed, and records kept on site;

f) Ensure any complaints are passed onto the Client within 24 hours of receiving the complaint; and

g) The Site Engineer and/or the Contractor's Environmental Representative will confirm the information on site and then report the matter to the Project Manager.

5.6.4. Site Foreman

The Contractors Site Foreman will be responsible to:

a) Ensure the environmental controls in this CEMP are being implemented across the contract site;

b) Ensuring changes to the CEMP are communicated to staff;

c) Inform staff of environmental requirements;

d) Report all environmental issues to the Site Engineer and Contractor's Environmental Representative;

e) Monitor subcontractor performance on work sites;

f) Communicate instructions or information (from the CEMP or the Contractor's Environmental Representative) to staff on site;

g) Conduct tool box talks containing environmental information; and

h) Report information to the Site Engineer and the Contractor's Environmental Representative.

5.6.5. All Staff

All Contractors Staff will be responsible to:

a) Follow the requirements of this CEMP and those of the Site Foreman;

b) Follow requirements as directed by the Site Foreman;

c) Report any potential environmental issues to the Site Foreman, including but not limited to diesel or oil spillages, uncontrolled waste storage, excessive dust generation, sewage holding tank overflow;

d) Carry out work in accordance with the requirements of this CEMP;

e) Exercise due care, skill and judgment when carrying out tasks; and

f) Implement corrective actions which have been approved by the appointed site supervisor.

5.7. Sub-Contractors

Any company hired directly or indirectly by the Contractor to carry out the construction works is designated as a Subcontractor. The Contractor is solely responsible for the environmental performance of Subcontractors, suppliers and visitors at every tier and the Subcontractor's environmental performance will reflect directly on the Contractor.

a) It is the responsibility of the Contractor to ensure that those Subcontractors whose activities have at least one interface with identified key environmental aspects to be fully knowledgeable of the Contractor CEMP requirements and project environmental and sustainability requirements.

b) Before starting work the Contractor shall require all lower tier suppliers and Subcontractors to submit a written CEMP or method statement (as required) specific to the site and their scope of work. These plans must be reviewed and accepted by the Contractor before the Subcontractor can start work.

c) Subcontractors directly in charge of activities, such as laboratory sampling analyses or waste transportation and disposal, will be approved by MoE.

d) Subcontractors will be called to demonstrate a proactive behaviour towards environmental concerns. It will be their responsibility to provide any information requested by the Contractor, Supervising Consultant, PMCM, Client or MoE with regard to their construction activities, mitigation and compliance with applicable environmental requirements.

6. ENVIRONMENTAL AWARENESS AND TRAINING

The purpose of this chapter is to guide the Contractor and sub-contractors to establishing the environmental induction and training requirements for the activities associated with their works.

6.1. Induction and Orientation

The Contractor's Environmental Representative will present a site environmental induction to new staff within seven (7) days of their first day of work. This includes all site managers and relevant field staff.

The induction will include the following minimum content:

a) A definition of "environment" that includes air, sea, land, stormwater, groundwater, waste management, recycling, noise, plants and animals, and heritage items;

b) Duty of care (responsibilities) – a statement that every worker has a responsibility to carry out their duties in an environmentally responsible way, and to report environmental harm or incidents, and to carry out their work in accordance with the responsibilities outlined in the CEMP;

c) CEMP – purpose of the CEMP and any specific CEMP requirements. This may include some of the topics listed above;

d) Environmental incident response and reporting – requirement to report incidents, procedure for reporting incidents, incident response procedure;

e) Waste management practices – minimise waste generated; sort and store recyclable waste separately; location of waste recycling areas and skip bins; duty to report overflowing waste bins;

f) Fuel and chemical usage and storage practices – including location of spill clean-up kits, and general instructions on how to use;

g) Specific environmental impacts that may arise from activities at the construction site, and the appropriate controls – for example,

   i. Separating recycling waste from general waste;

   ii. Managing potential disturbance to nearby residential areas;

   iii. Covering truck loads of sand to limit dust;

   iv. Using drip trays under portable diesel generators;

   v. Protection zones around Ghaf trees; location of oil spill clean-up equipment;

   vi. Draining oil filters prior to disposal; and

   vii. Disciplinary action, outcomes and penalties for failing to comply with environmental requirements.

The employee's Functional Manager must follow up with their new employees to ensure they have received the orientation training and if they have any additional environmental questions or concerns.

6.2. Environmental Training

The Contractor CEMP will not be effectively implemented unless all staff is aware of their specific responsibilities and required actions. Provisions for training will be described in the Contractor CEMP and outline training sessions should be included as an appendix.

Subsequent training sessions will be held at regular intervals – to maintain awareness and also train any new staff.

Specialist environmental training may be required, based on the specific requirements of each role, and must be arranged by the contractor where relevant. For example:

a) Emergency Response Training - mandatory for staff involved in activities that have higher environmental risk, including the use of emergency response equipment; and

b) Spillage prevention and control training – mandatory for those maintaining fuel and chemical storage areas or undertaking maintenance or refuelling activities.

6.3. Tool Box Talks

Tool box talks for all laborer and supervisory staff will be held every week / fortnight, and will contain environmental updates or awareness. Topics that will be covered in toolbox talks are:

a) Specific issues / sections in CEMP;

b) Location of fuel spill clean-up materials, and procedures;

c) Environmental incidents or recurring non-conformances; and

d) Waste recycling.

Records will be kept of environmental information presented at toolbox talks, the date of training and the staff who received the training.

6.4. Training Records

Records of trainings will be maintained by the Environmental Representative and reviewed periodically. Sign-in sheets for each training session will be filled in by all attendees as well as the facilitator. The training attendance sheet will be completed for all training sessions and will include:

a) Description of training;

b) Date;

c) Location;

d) Facilitator name; and

e) Trainee's details: name, company, position and signature.

All information recorded on the training attendance form will be transferred into a training register, which records all information from the training attendance form, and date for refresher training, and results of any assessment.

7. COMMUNICATION

The purpose of this chapter is to guide the Contractor and sub-contractors on communication protocol and procedures both within their own organization, with second party organizations (such as PMCM and LREDC) and with third party external organizations (such as the MoE).

7.1. Contractor / Developer Internal Communication

The communication of relevant environmental related information internally among various levels and functions of Contractor and Developers may be done through inductions, bulletin boards, communication posters, behavior observations, suggestion boxes, newsletters, work team briefings, Project environmental meetings, milestone celebrations and feedback sheets.

7.1.1. Weekly Environmental Meetings

The Contractor shall hold weekly HSE meetings to provide instructions and receive feedback from site personnel on environmental and sustainability matters. The environmental meeting shall be chaired by the Environment Representative and attendees shall include representatives from all Subcontractors. Minutes shall be taken of the meeting and cover all relevant issues including actions to be taken. A copy of the minutes shall be given to the Supervising Consultant and be made available to the PMCM and LREDC.

The Environment Representative should attend the Contractor's weekly site meetings and tool box talks and "Environment and Sustainability" should be an item on the agenda.

7.1.2. Environmental Posters and Bulletin Boards

Each Contractor and Developer site office and work site should have a HSE bulletin board with a substantial portion dedicated to environment and sustainability, in order to display posters and informational materials. In addition, field operations use banners, signs, and whiteboards as part of the program.

HSE bulletin boards can be customized but must include monthly awareness materials, and procedures to report safety and environmental incidents and unsafe conditions. The bulletin boards can also contain industry environment news, HSE meeting minutes, training announcements, and performance measures.

7.2. Consultant / PMCM / LREDC Communication

Communication should be undertaken as per the hierarchal environmental reporting system, with entities communicating through the proper chain of reporting (e.g. only Client liaises with Government):

a) Government;
b) Client;
c) PMCM;
d) Third Party Developers;
e) Supervisory and Design Consultants; and
f) Contractors.

7.2.1. Project Wide Communication

Communication between different organizations should be only via the Aconex document Control system.

Any information that needs to be distributed project wide by LREDC or PMCM (such as environmental bulletins, monthly audit/inspection schedules and monthly environmental meeting minutes) will be undertaken via Aconex. It is therefore vital that all organizations on the Lusail Development project have access to Aconex, including the designated Environmental Representative.

7.2.2. Lusail Environmental Meetings / Forum

LREDC holds a monthly environmental meeting to promote dialogue between LREDC, PMCM, supervisory consultants, design consultants, third party developers and contractors on environmental issues which feature prominently across the project. Contractor attendance is mandatory.

Environmental training topics are also presented and provided to attendees so that they can be disseminated amongst contractor employees during weekly meetings or tool box talks.

7.3. External Communication

Should consultation with government bodies or any third party external organizations (such as Ministry of Environment, Karamaa, Ashgal and similar) be required, the Contractor Project Manager must first contact PMCM/LREDC, who will advise on the most appropriate lines of communication.

Submittal of environmental information (such as CEMPs or Dewatering Permits) to government bodies will also be undertaken by LREDC on behalf of the Contractor, unless an agreement with LREDC is in place that direct communication by the Contractor, Consultant or PMCM with certain entities is allowed.

Any communication received from such external organizations (including notifying said party of an external audit/inspection) shall be copied to the supervisory consultant, PMCM and LREDC for their information.

7.4. Complaints Management

Complaints are a principal indicator of nuisance and other community dissatisfaction with site activities. It is important that all complaints are properly and systematically recorded and acted upon.

Members of the public or other interested parties may make complaints or enquiries relating to the aspects of the Environmental risks, with the complaint mechanism defined as follows:

a) All complaints will be directed to the Environmental Representative, who will direct it to the Project Manager, Supervising Consultant, PMCM and LREDC immediately;

b) All complaints will be acknowledged within 48 hours of receipt by the Environmental Representative by contacting the complainant;

c) The Environmental Representative and the Project Manager will have the responsibility to check whether the complaint is valid, and will assign and dispatch an investigation team;

d) The investigation tasks will be agreed, delegated by the investigation team;

e) Remedial action recommended by the investigation team will be implemented and finalized;

f) Complainant will be contacted either by the Environmental Representative or the Project Manager and advised of the outcome on the investigation within one week, unless additional information or clarifications are needed; and

g) All complaints will be recorded using a Complaint Register that will list the following information:

   i. Date that complaint was received;

   ii. Complainant details (name, contact details, if appropriate);

   iii. Detailed description of the complaint the person has made;

   iv. Name of person who is or has responded to the complaint;

   v. Action taken to handle the complaint;

   vi. Outline of what has happened as a result of the complaint; and

   vii. Any action required as a result of the complaint. This may include a change to Contractor procedures and policies.

8. DOCUMENT AND RECORDS CONTROL

The purpose of this chapter is to guide the Contractor and sub-contractors in what documents are required for the project and the submittal procedure.

8.1. Construction Environmental Management Plan

8.1.1. CEMP Requirements

It is a mandatory requirement that every contractor working on a construction site within a LREDC project submits a Construction Environmental Management Plan, known as a "CEMP", to LREDC for review and approval. The purpose of the CEMP is to identify likely environmental impacts from the contract activities, and determine appropriate management measures to reduce the impacts to an acceptable level.

a) The Contractor is required to submit to the Supervising Consultant and PMCM a written CEMP within thirty (30) calendar days after contract award. This plan shall be specific to the site and works under this Contract.

b) Per the conditions of the MoE Environmental Permit, The CEMP has to be elaborated and endorsed by a specialised third party Environmental Consultant. It is recommended that the third party environmental consultant produce the CEMP on behalf of the Contractor;

c) The Contractor will have the sole responsibility for enforcing the CEMP;

d) The Contractor will not be allowed to start work on site until this document has been reviewed and approved by the LREDC Representative and the MoE; and

e) This plan shall be amended when conditions or operations require. Such amendments shall be submitted to the LREDC representative for review and acceptance.

f) Contractors who are granted additional work under a 'variation order' may be required to submit a separate CEMP for work under the scope of that variation order. This will be judged on a case by case basis by LREDC.

8.1.2. CEMP Content

There are mandatory issues that the CEMP must address, including:

a) Where a written plan is required in the Regulations the Contractor may satisfy this requirement with an appropriate section in the CEMP. Where a procedure or method statement is required the Contractor must supply separate and detailed instructions on that subject, specific to the task.

b) The Contractor's CEMP should set out the arrangements for minimising the potential negative environmental impacts of the construction work.

c) The CEMP shall illustrate; adherence to relevant laws and regulations, adherence to these Regulations, adequate resource allocation for implementing and enforcing these Regulations and implementation of mitigating measures identified in the EIA.

d) Information that must be included

i. Environmental legislation and approvals;

ii. Management structure and responsibilities;

iii. Lines of communication, both internal and external;

iv. Environmental inspections and audits;

v. Environmental awareness and training;

vi. Incidents, emergency response and complaints;

vii. Environmental performance reporting;

viii. Monthly and weekly environmental performance reports;

ix. Procedure for ensuring that all Subcontractors and suppliers are competent and will make adequate provision for environmental protection and sustainability;

x. Likely environmental impacts from the contractor's activities; and

xi. Control measures to reduce or eliminate the identified environmental impacts to acceptable levels.

A CEMP checklist has been provided for use by Contractors working on a construction site within a LREDC project, in Table 8-1. The aim of the checklist is to make preparation of a CEMP easier for contractors, whilst still addressing the minimum mandatory requirements.

Item	CEMP Elements
1	DOCUMENT
1.1	Project Name, Proponent
1.2	Proponent and Contractor details - Name, Address and Contact Numbers
1.3	List of abbreviations, definitions and glossary of terms used
2	PROJECT DESCRIPTION
2.1	Location - General overview map and specific site plan (indicating areas of work and location of site offices, workshops, stockpiles and storage areas)
2.2	Scope of Works
2.3	Planned Construction activities, including: Construction Project Description; Environmental baseline details; and Current condition of site and identified sensitive receptors.
2.4	Project schedule and Milestones
3	ENVIRONMENTAL MANAGEMENT
3.1	Environmental (or HSE) Policy statement
3.2	Environmental Objectives and Targets
3.3	Detail of Environmental Management System (EMS) and ISO 14001:2004 certification, if achieved
3.4	Roles and Responsibilities of Contractor, Consultant, PMCM and LREDC - names / contact details
3.5	Details of Regulations, laws and protocols
3.6	Project specific environmental aspect and impact register
3.7	Environment awareness procedures - Training, Tool Box Talks, Site induction, posters etc
3.8	Document Control and Review updates - CEMP revision etc
3.9	Internal and External Communication and Consultation
3.10	Environmental Inspections and Audits
3.11	Environmental Incident Investigation and Close Out Procedures

Item	CEMP Elements
3.12	Environmental Monitoring
3.13	Environmental Reporting – daily, weekly, monthly requirements
3.14	Emergency Response Procedures
4	ENVIRONMENTAL IMPACTS AND CONTROL MEASURES
4.1	Air Quality control plan - Dust, engine emissions, volatile organic compounds and odour
4.2	Noise and Vibration control plan
4.3	Light Pollution and Visual Impact
4.4	Resource Conservation and Sustainability in Construction
4.5	Waste management control plan – solid, liquid and hazardous waste and recycling
4.6	Erosion and Sediment control plan – stockpiles, storm water and erosion controls
4.7	Soil and Groundwater contamination control plan – dewatering and contamination
4.8	Vehicle Maintenance, Refuelling and Washing and Traffic control plan
4.9	Concrete Batching and Truck Management – concrete truck washout, waste management
4.10	Fuel, Chemical and Hazardous Material management
4.11	Spill Prevention and Control
4.12	Terrestrial Ecology control plan - land discharge, vegetation, animals
4.13	Water Quality and Marine ecology control plan - marine discharge, reclamation, ecology
4.14	Welfare facilities, Offices and Laydown Controls
4.15	Social Cultural and Archaeological Controls
5	APPENDICES
5.1	LREDC documents (e.g. Incident Forms, Reporting Forms)
5.2	Contractor documents (e.g. Inspection forms, Training register, Corrective Action report)

Table 8-1 – CEMP Review Checklist

8.1.3. CEMP Submittal

Contractors must plan for the cost and time required to develop and implement the requirements of a CEMP for their proposed activities. During the tender process, contractors may be asked to provide details of how they will provide for the cost and time required to develop and implement a CEMP for the proposed works, for example, budget allocation and/or engagement of suitably qualified and experienced professionals.

a) The contractor must submit the first draft of their CEMP at least 14 days prior to starting physical work and within thirty (30) calendar days after contract award ;

b) CEMPs must be submitted electronically (ideally via Aconex if the Contractor has access or on CD, or via email) and must be accompanied by a cover letter or document transmittal form with relevant details of the sender, including a telephone number of the sender for enquiries;

c) The Supervising Consultant and PMCM will review the draft CEMP for compliance with OCEMP requirements. Unsatisfactory draft CEMPs will be returned with comments to the Contractor, for subsequent revision and re-submission of a satisfactory draft document; and

d) When the PMCM Environmental Representative determines that the CEMP meets requirements, it will be forwarded to the LREDC Environmental Representative for approval. LREDC will subsequently forward the CEMP to the MoE for review and approval.

8.1.4. CEMP Updates

A formal review will be undertaken of the CEMP on at least an annual basis by the Environmental Representative in order to evaluate whether the CEMP still reflects the nature of the operations and activities. The review will also consider:

a) Changes to environmental or other relevant legislation and standards;

b) Relevant changes to organisational structure(s), including phone number changes;

c) Significant changes to operations, practices or facilities; and

d) Corrective actions resulting from reviews of incidents and similar.

The updated CEMP is submitted to the Supervising Consultant, PMCM and LREDC for review and comments.

8.2. Other Document Requirements

Additional documents that need to be submitted will follow a similar submittal procedure as described in Section 7.1.3 and include the following.

8.2.1. Operational Environmental Management Plan

A separate Operational Environmental Management Plan (OEMP) will be required for facilities that have been constructed and are at the commissioning stage (such as power stations or sewage treatment plants).

These will follow the same procedures for submittal and content as the CEMP, but be specific to operational and maintenance procedures and control measures.

8.2.2. Method Statements

Task specific procedures or method statements are to be submitted as the project progresses as required by the HSE Regulations Appendix A of the LREDC General Requirements.

a) These method statements should by specific to the Project site and task involved and include the measures to be taken to mitigate any risks to the environment and sensitive receptors;

b) The method statements should be submitted a minimum of 15 calendar days before the work is due to commence, and will be reviewed by the Consultant and PMCM for approval; and

c) Ideally, a list of expected method statements (and the schedule for when they will be required) should be included within the CEMP for information.

d) A Risk Assessment or Activity Hazard Analysis (AHA) identifies and assesses each of the hazards associated with a particular work activity, assigns a risk rating and an appropriate control measure to eliminate or reduce the risk. A Risk Assessment will be produced for each project activity to ensure that appropriate control measures are in place to eliminate or reduce the risk.

8.2.3. Permit Requirements

Unless otherwise indicated, applications for Permits from external agencies (such as the MoE) will be prepared by the respective Contractor on LREDC's behalf and the respective Permit shall be obtained by LREDC.

Records Control

Records management ensures that Contractors are able to demonstrate that they are implementing the OCEMP as designed. Records have value internally, but also allow Contractors to provide evidence of CEMP implementation to external parties (such as clients, auditors, etc).

Each Contractor and Developer must maintain the following documents and records in a central location and update them routinely to ensure that auditors, inspectors, and regulatory compliance officers have ready access to the information:

a) Construction Environment Management Plan (CEMP);
b) Employee orientation and safety training programs and attendance records;
c) Training Certification(s) (Competent Person/Qualified Person);
d) Near Miss and Incident/Accident Investigation Reports;
e) Emergency Action Plan(s);
f) Safety suggestions and documentation of management response;
g) Audit (internal and external) reports, findings and corrective actions;
h) HSE Committee/Toolbox/Safety Meeting minutes;
i) Environmental Inspections Reports (including close-out);
j) Permits/Certifications (Excavation, Dewatering, etc.);
k) Contractor Violation of Environmental Regulations;
l) Environmental Monitoring results;
m) Risk Assessments, Method Statements and similar documentation, as applicable;
n) Monthly Project Environment Reports;
o) Equipment Inspections/Certifications;
p) Plant and equipment daily inspection checklists
q) Resource consumption records (fuel / water) and
r) Environment Correspondence.

Where possible, all records should be stored electronically. If records/documents were not created or submitted in a digital format, then they should be scanned (ideally as pdf's) by the Document Controller for storage electronically on the Project server.

All records available on file (water consumption, fuel consumption) shall be substantiated against verifiable source data such as invoices, site delivery notes, etc. All data reported to PMCM as part of the weekly environmental report and the monthly environmental report shall accurately reflect records on file.

9. OPERATIONAL CONTROL

The purpose of this chapter is to guide the Contractor and sub-contractors to manage environmental control measures and procedures to protect sensitive receptors before, during and after the construction works.

9.1. Pre-mobilization

9.1.1. Pre-mobilization Meeting

A preconstruction (or kick-off) meeting should take place at the worksite on or before the first day of mobilization. Consultant and Contractor competent persons also attend these meetings. The meetings broadly review Contractor execution plans, site HSE issues, environmental compliance and regulatory requirements, and other concerns. The meeting serves as an opportunity to explain how LREDC manages safety, health, and protection of the environment on high-risk projects and tasks. The meeting will identify:

a) Contractor, Consultant, PMCM and LREDC main focal points;

b) Communication protocols;

c) Provision of HSE information from PMCM/LREDC;

d) Provision of HSE information from Contractor (such as CEMP); and

e) Contractor employees who require Project Environmental Induction.

9.1.2. Mobilization Site Inspection

PMCN/Client and Contractor should document and agree upon site conditions prior to mobilization. The agreed site conditions (i.e., original condition) can be used as a baseline to ensure that upon demobilization the site is returned to the client in its original condition, not requiring any remediation or removal of materials.

A 'laydown area plan' which details the proposed layout of the contractor temporary facilities shall be provided to LREDC for review and approval. The plan should include accurate coordinates of potentially polluting facilities such as bulk fuel storage areas, generators, Chemical Storage areas, workshop facilities, etc.

Contractor/Developer and the PMCM/LREDC will undertake a site walkover prior to mobilization/handover to ensure the condition of the site is approved by both parties. Note: Any modifications to be agreed by both parties.

a) PMCM/LREDC will maintain a record and photo log of the site recording the "as received" condition. Both Contractor/Developer and LREDC to agree and sign.

b) The use of existing on site infrastructure to be agreed upon with the client. By using previously installed infrastructure, the Contractor/Developer takes ownership and is, therefore, responsible for maintenance, removal, and any remediation if necessary.

c) Contractor/Developer is responsible for impacts beyond the site boundary where the source originates from the site and/or site activities.

9.2. During Construction Activities

Throughout the length of the construction activities, the Contractor/Developer will comply with the regulations within the OCEMP and ensure that the environmental standards that have been agreed within the contract are being adhered to with appropriate environmental control measures.

a) Environmental control measures, as required by the nature of the construction activities, in line with Sections 13 through 28 will be implemented by the Contractor; and

b) This will be monitored through regular meetings, inspections, audits and monitoring reports as discussed throughout this OCEMP.

9.3. Demobilization

9.3.1. Demobilization procedure

Contractors are obliged as part of their agreement with PMCM/LREDC to return the site(s) they have occupied to their original condition; not requiring any remediation or removal of materials. No final account settlement will be made until all issues highlighted within this document have been closed out and the document has been approved and signed off by PMCM/LREDC

Prior to the decommissioning and/or demolition of a site PMCM/Client requests that the Contractor submits the following Demobilization Plan documentation for review and approval;

a) Site plan, CAD format preferable;
b) Utilities/services plan, CAD format preferable;
c) Demobilization Method Statement: to include:
    i. Description of demobilization works;
    ii. Identification of environmental risks;
    iii. Mitigation of environmental impacts;
    iv. Removal of storage tanks and other site infrastructure;
    v. Management of wastes/materials;
    vi. Waste storage and disposal procedures;
    vii. Contaminated land remediation issues;
    viii. Environmental Closure Reports – if required by permit or regulation; and
    ix. Program/schedule of works.

9.3.2. Demobilization Site Inspection

The demobilization checklist is a tool for PMCM/SC to use to assess areas of potential environmental concern resulting from contractor's activities on site to ensure that the site operated is returned to Client in a clean state and not requiring any remediation. It also confirms that any outstanding actions from the final environmental site visit report have been closed out.

An initial demobilization inspection shall be conducted by PMCM/SC and the main contractor. During the inspection the checklist shall be completed and a demobilization report compiled highlighting environmental concerns. PMCM/LREDC/SC will advise on appropriate remediation required to ensure that contractors fulfil their environmental obligations. Upon receiving the report contractors shall be required to address any environmental concerns observed. Closure of any issues raised shall be verified by SC during this period. A final demobilization inspection shall be conducted by PMCM/SC/LREDC and the contractor to verify that all requirements as specified in the checklist have been completed.

The demobilizing party / main-contractor will be solely responsible for any contamination caused as a result of their presence on site. The costs and responsibility of any contamination investigation and subsequent remediation and/or disposal shall be borne by the demobilizing party / main-contractor, unless otherwise agreed by LREDC.

10. INSPECTIONS AND AUDITS

The purpose of this chapter is to guide the Contractor and sub-contractors on how the environmental compliance of the Project construction activities with respect to the CEMP will be periodically inspected.

10.1. Contractor Inspections and Audits

10.1.1. Contractor Internal Inspections

The following requirements are mandatory for all Contractors working on construction sites within the Lusail Development site:

a) The Environmental Officer, or representatives, shall make daily inspections of each area of the work site to monitor compliance of their own activities and site conditions against OCEMP and their CEMP, and document these inspections;

b) Contractors develop their own Environmental Inspection Checklist for their site and activities;

c) The routine inspections must be carried out by the contractor's environmental representative, who has undergone the mandatory training (refer to OCEMP Section 6);

d) Completed Environmental Inspection Checklists must be retained at the contractor's site office;

e) All non-conforming actions (non-compliance) observed during the routine environmental inspections must be recorded. A non-compliance can be, for example, an incorrectly stored fuel drum, over-full waste skips, or an environmental incident, such as an oil spill or leaking sewage holding tank. The following information about non-compliances must be recorded within the Environmental Inspection Checklist, or in an attached report:

   i. Description of each non-compliance, including location;

   ii. Corresponding corrective actions for eachnon-compliance. Corrective actions must include preventative measures, where necessary;

   iii. Due dates for completion of corrective actions; and

   iv. The responsible party to complete each corrective action;

f) The non-compliance must be checked during the next routine site inspection, or earlier. Progress must be noted, until the action has been satisfactorily completed;

g) If an environmental incident has been observed, the appropriate incident response actions must be taken (refer to OCEMP Section 11);

h) The contractor's senior management must receive a copy of the routine Environmental Inspection Checklists and any attached non-compliance reports, along with written and signed evidence of the completion of any corrective actions, such as a written and signed report attached to the Environmental Inspection Checklist, or notes regarding the remedy of the non-compliance in the subsequent signed routine Environmental Inspection Checklist; and

i) Contractor environmental inspection records are subject to audit by the Supervising Consultant, PMCM and/or LREDC, and must be produced upon request.

10.1.2. Contractor Internal Audits

The Contractor shall carry out regular environmental audits of the environmental records, processes and systems. The subject and work area of the audit shall be agreed with LREDC prior to notifying the relevant staff. The Contractor shall prepare an audit schedule prior to the audit and carry out a pre-audit briefing with the concerned parties. This briefing shall be completed not less than one week before the audit. The Contractor shall prepare an audit checklist based upon previous inspection reports. The following records will be audited:

a) Weekly site environmental inspections;

b) Environmental audits;

c) Waste collection and disposal record keeping;

d) Environmental training records;

e) Environmental incident and complaint records;

f) CEMP documentation; and

g) Any other relevant issue.

The audit will record:

a) Description of any non-conformances;

b) Corrective actions;

c) Due date for completion;

d) Party/person responsible for completing the corrective actions; and

e) Audit details, including the date and staff who participated in the audit.

Copies of the completed environmental audits will be reported to the Project Manager, with any supporting information, and signed report noting progress of completion of corrective actions.

All environmental audit records will be made available to the Supervising Consultant, PMCM and/or LREDC upon request and within 30 days of the audit taking place.

10.2. Consultancy and Developer Inspections

The supervising consultancy and third party developer may conduct regular environmental inspections or second party audits of the Main Contractor.

Carry out and record regular site environmental inspections to monitor enforcement of environmental standards and ensure compliance with Lusail requirements. LREDC will specify the periodicity of inspections. All inspections and reports shall follow client specified processes and templates.

The routine and procedures will be similar to as described in the OCEMP Section 9.1.

10.3. PMCM Inspections/Audits

Periodic compliance inspections and audits will be undertaken by PMCM (on behalf of LREDC) to monitor Contractors environmental activities and assess the Contractor environmental records, processes and systems using an audit checklist.

The Contractor's Environmental Representative shall participate in scheduled environmental audits to be conducted b. The Contractor shall allow free access to all documents and records pertaining to environmental protection as required, allowing the auditor to:

a) Validate and confirm accuracy of monitoring results, monitoring equipment, monitoring location, monitoring procedures and location of sensitive receptors

b) Review effectiveness of environmental mitigation measures and environmental performance

c) Provide an early indication and suggest appropriate additional or remedial measures should any of the environmental mitigation measures or controls fail to achieve compliance with relevant regulations/standards.

d) Verify if necessary, any additional mitigation measures or alternative measures to be undertaken by Contractors as corrective actions to prevent adverse environmental impacts arising from the works,

e) The Training Register is up-to-date, and staff induction records are complete;

f) Corrective actions arising from incident investigations or environmental inspections are complete;

g) All records relating to waste collection and disposal are retained and on file; and

h) Monthly Contractor Environmental Performance Reports are all up-to-date

The effectiveness of inspections can often be enhanced by the use of unannounced spot checks and involvement of the contractor's responsible supervisory personnel.

10.4. External Inspections/Audits

External audits of the Project or an individual Contractor may be undertaken by the Ministry of Environment (MoE) or other government agencies at any time to assess how effectively the CEMP is being implemented, to identify non-conformances and to recommend corrective actions to be taken.

a) To facilitate this, the Contractor will provide the MoE with all reasonable access to the site and to all relevant documentation and records;

b) The Contractor should ensure that its personnel are aware of and comply with the procedures to be taken in the event of a government inspection of any type;

c) The Contractor shall notify the LREDC Representative if a regulatory agency inspector requests entry onto the site; and

d) Following any regulatory agency inspection the Contractor shall submit a written report to the LREDC Representative which details all aspects of the inspection.

10.5. Corrective and Preventative Actions

All non-conforming actions (non-compliance) observed during the routine environmental inspections will be recorded as a non-compliance. This can be, for example, an incorrectly stored fuel drum, over-full waste skips, or an environmental incident, such as an oil spill or leaking sewage holding tank.

a) When a non-compliance with the OCEMP, CEMP or any relevant legislation is noted the relevant person should be instructed of the required corrective action and the time period within which it should be implemented. This communication shall be documented.

b) The Contractor shall immediately rectify any situation or condition that poses an immediate risk to the environment. If the situation or condition cannot be corrected immediately, the Contractor shall provide temporary measures as necessary for the protection of the environment.

c) The following information about non-compliances will be recorded within the Environmental Inspection Report, Audit Report, or Non-Conformance report (NCR):

   i. Description of each non-compliance, including location;

   ii. Corrective actions corresponding to each non-compliance. Corrective actions must include preventative measures, where necessary;

   iii. Due dates for completion of corrective actions; and

   iv. Responsible person/party for completion of each corrective action.

d) The non-compliance must be checked during the next routine site inspection, or earlier. Progress must be noted, until the action has been satisfactorily completed.

e) A copy of the close-out report shall be given to the Consultant, PMCM and LREDC Representatives.

11. ENVIRONMENTAL INCIDENTS AND EMERGENCY PREPAREDNESS

The purpose of this chapter is to guide the Contractor and sub-contractors to the procedure to report on and investigate environmental incidents during the construction works.

11.1. Environmental Incidents

An environmental incident is any event that causes (or is likely to cause) negative impacts on the environment, where that activity's environmental impact has not been previously identified and addressed through other approved environmental management measures (such as an EIA, CEMP or NOC).

Examples of environmental incidents include:

a) Fuel spills onto unsealed ground, during routine fuelling of trucks and vehicles;

b) Incorrect disposal of hazardous waste (such as chemical residues);

c) Covering contaminated soil with clean soil;

d) Causing injury or death to land or marine animals;

e) Oil spill to marine waters;

f) Dewatering discharge without an NOC; and

g) Discovery of heritage artefacts during earthworks.

In addition to the physical response to incidents, contractors are expected to report, investigate and document incidents, and maintain an incident register that can be readily audited.

All environmental incidents must be reported, investigated, remedied and documented.

Management of incidents is the responsibility of the party who caused the incident or was carrying out the activity associated with the incident; or where that party is not identified, then the party who has practical control over the area where the incident occurred.

11.2. Emergency Preparedness

Contractors must identify and be prepared for incidents that present a higher environmental risk (emergencies) at the construction site, to enable an effective response.

For long-term or complex construction activities, the contractor must carry out and document an environmental risk assessment to determine higher risk incidents or emergencies at the particular site location. The risk assessment must consider the likelihood of an incident occurring and the magnitude of the effect if it were to occur (for example, is the project site located adjacent to water bodies or other sensitive receivers?). The risk assessment should be included in the contractor's CEMP.

11.2.1. Emergency Response Plan

The planned response to higher risk incidents or emergencies must be documented in an Emergency Response Plan, which is integrated with other management areas such as security, site activities/control, and health and safety. The scope should consider the community, workers and the environment.

The following items must be included in the Emergency Response Plan:

a) Details of emergency services – Police, Fire, Ambulance/ Civil Defence, nearest hospital;

b) A communications strategy, including a list of contact details for other parties that should be notified or involved in emergency response. The information documented should include company name, contact person, telephone numbers including for after business hours, and fax number; and

c) Specific incident response procedures for activities that require specialised response, techniques or equipment, or activities that may pose an unlikely, but significant impact risk to the environment, workers or the community.

11.2.2. Emergency Requirements

To ensure that the site construction staff is prepared for incidents and emergencies, the following requirements are mandatory for construction contractors, and appropriate items should be included on the routine Environmental Inspection Checklist or as environmental management systems audit criteria:

a) Ensure copies of specific incident response procedures are posted in higher-risk areas;

b) Keep emergency response equipment in stock at the location where higher risk activities are being carried out. The emergency response equipment must be labelled, and have simple directions for usage;

c) Make available personal protective (safety) equipment required for responding to emergencies, as well as other emergency response equipment;

d) Materials Safety Data Sheets (MSDS) must be available for each chemical or fuel that is used, in an accessible location near the storage and usage areas;

e) Carry out emergency response training and awareness for staff involved in activities that have higher environmental risk, including the use of emergency response equipment. Training details must be recorded in the Training Register (refer OCEMP Section 6); and

f) Carry out emergency response drills as part of training.

11.3. Incident Response Procedure

The contractor must adopt the following generic approach for response to all environmental incidents, other than marine pollution incidents. Specific incident response procedures can be modeled from this generic approach, such as the Spill Response Procedure in Section 24.

11.3.1. Step 1 - Safety

Assess the safety hazards to the incident observer, other staff, other contractors and the public. Do not carry out any unsafe actions when responding to environmental incidents – safety considerations must take precedence. Safety considerations should include:

a) Identify specific safety hazards such as dangerous chemicals, fire, toxic smoke from chemical fires, or injured wildlife;

b) Close off areas to prevent traffic or public access;

c) Locate and use personal protective equipment (PPE) such as gloves, glasses, helmet, safety footwear, or a lifting device;

d) In case of fire or where fuel or chemical spills pose a significant risk to the community, call Civil Defence (Fire) on telephone 999;

e) Take other actions as necessary to create safe conditions (for example, stop all smoking and remove ignition sources); and

f) Consult the HSE representative for further advice.

11.3.2. Step 2 – Stop the Source

Where simple, ongoing incidents are continuing to cause environmental impacts, identify the cause, and if it is safe to do so, stop or limit the incident from occurring (for larger, dangerous or complex incidents go straight to Step 3), for example:

a) Turn off pumps or isolate lines if pipes are leaking;

b) Arrange for sewage holding tank pump-out if a sewage overflow has occurred;

c) Stop earthworks where injury or death to animals is occurring; and

d) Stop the use of excessively noisy equipment or noisy practices, particularly during the night time, if a noise complaint has been received.

11.3.3. Step 3 – Notify Relevant Parties

It is mandatory to notify the following parties immediately (after or as part of making the incident site safe):

a) Notification to site management, including as per any CEMP requirements. If the CEMP is not in place, notify the supervisor on duty and the Contractor's Environmental Representative (if this person did not observe or identify the incident);

b) Notify PMCM and LREDC Environment Department by telephone LREDC will determine whether the MoE or other authorities (for example, Civil Defence, Police) need to be notified;

c) Contractor shall follow up with documented notification to all aforementioned entities within twenty four (24) hours using the Lusail Environmental Incident Notification Form,; and

d) The Contractor shall be responsible for completing all statutory incident notifications and reports. Unless directed otherwise the Contractor shall take the lead in the investigation, documentation and instigation of corrective action. Copies of all statutory notifications and reports shall be passed to the LREDC Representative.

11.3.4. Step 4 – Control the Incident

Take immediate action (determine personnel, materials and equipment necessary) to prevent or limit environmental harm that has occurred or that may occur as a result of the incident. For example:

a) Where warranted due to the severity or nature of the incident, work shall be halted at incident scenes in order to begin the incident investigation in an un-tampered environment;

b) Contain free liquids, fuels or chemicals by draining into containers or pumping into mobile tanks or other containment vessels. Do not pump any waste water or chemicals into stormwater connections unless directed by civil services;

c) Deploy fuel spill clean-up materials (from spill kits), such as booms, absorbent particulate matter or absorbent mats;

d) Get extra waste skips delivered, for temporary storage of contaminated soil or other waste associated with the clean up; and

e) If required seek help from PMCM or LREDC to manage the incident's impacts and to implement control measures. For example, Fuel and chemical spills on public roads can present traffic hazards, call Civil Defence (Fire) on 999 for assistance in clean-up of spills on roads.

11.3.5. Step 5 – Reporting the Incident

When the incident is under control, and initial clean-up or prevention measures have been implemented, the contractor must complete the following:

a) Monitor any controls that have been put in place for the incident, for example, absorbent materials used in fuel spill clean-up will require changing when fully saturated;

b) Carry out an incident investigation and document it. The basic cause of the incident must be identified, and the corresponding preventative actions determined;

c) All incidents shall be thoroughly investigated by Contractor and relevant parties to determine all root and supporting cause(s). All witnesses to the incident shall provide statements and all data, monitoring records, medical reports, etc. pertinent to the incident or the suspected cause(s) shall be taken into account and included in the investigation report.

d) Submit a written incident report to PMCM and LREDC Environment Department with seventy two (72) hours of the incident occurring. The incident report must contain the following information:

   i. Date and time that the incident occurred, or when incident was first reported to the contractor;

ii. Who observed the incident (or reported the incident to the contractor);
iii. Description of the incident - what happened;
iv. Description of the activities that were taking place when the incident occurred;
v. Name and company details of those people involved in the incident;
vi. Details of the weather and other associated conditions (for example, tides) at the time of the incident;
vii. Location of the incident within the construction site/ labor accommodation site;
viii. Likely receivers (i.e. places/parties/facilities/environmental features that may be affected by the incident), and any sensitive receivers (for example, a school);
ix. Immediate actions taken in response to the incident;
x. Who the incident was reported to;
xi. Corrective and preventative actions proposed, and the due date and responsibility for these actions;
xii. Any additional information for the incident, such as samples or photos;
xiii. Who the incident report was prepared by on behalf of the contractor; and
xiv. Date of report preparation;

e) . Contractors must use the LREDC Enviromental Incident Investigation Report form to report incidents, Reports must be submitted to LREDC Environment Department.

11.3.6. Step 6 – Follow Up

When the incident has been investigated and the root cause identified, the Contractor should complete the following:

a) Monitor or re-inspect the area for any impacts. Sometimes environmental impacts from incidents may become more apparent over time (for example, vegetation dying in an area over time due to changes in groundwater height or quality);
b) Re-stock any materials used in incident response, such as personal protective equipment (PPE) or spill clean-up materials; and
c) Update the Incident Register with details of the incident, investigations and follow-up actions. The following information must be included in the Incident Register:
    i. Date and time of incident or when incident was first brought to the attention of the contractor,
    ii. Incident location,
    iii. Incident details – what happened,
    iv. Incident reported by an incident reported to,
    v. Immediate actions taken;
    vi. Environmental Incident Report submitted to LREDC Environment Department (yes/ no);
    vii. Corrective and preventative actions and who is responsible for these;
    viii. Due date for corrective/ preventative actions; and
    ix. Incident close-out date and sign-off.

12. MONITORING AND REPORTING

The purpose of this chapter is to guide the Contractor and sub-contractors on the mandatory environmental reporting and monitoring requirements during the construction works and to provide suggestions and forms to assist contractors carrying out monthly reporting

12.1. Reporting Requirements

LREDC expects to receive regular updates on Contractors' environmental performance. This allows LREDC to identify common problems across a project and direct assistance to overcome those problems. It also allows LREDC to fulfill its commitments to report on the environmental performance of its property development activities.

All documentation shall be in a format acceptable to the LREDC and shall be provided to the LREDC in a timely manner.

12.1.1. Daily Reporting

As discussed in OCEMP Section 10.1, the Contractor Environmental Officer, or representatives, shall make daily inspections of each area of the work site. Results of all inspections and all actions taken regarding the environment are to be documented and made available to the Consultant, PMCM, LREDC or external agencies upon request.

12.1.2. Weekly Reporting

In addition to the daily inspection reports and any other reporting required under the Contract, the Contractor shall submit weekly environmental reports.

a) Reports must be completed using the LREDC Weekly Contractor Environmental Report Form. A template of the report is in **Appendix 1.**

b) These reports shall include:

   i. Quantities of wastes generated on site

   ii. Quantities of fuel and water consumed on site, and

   iii. Incidents in the week covered and incident tracking for the project to date

c) These reports shall be submitted to the Consultant and the PMCM through Aconex on a weekly basis (by the following Sunday) and will be made available to the LREDC Environmental Representative.

d) Data contained in the weekly report shall be accurate, as verified against source documentation held on file by the Contractor.

12.1.3. Monthly Reporting

A Monthly Environmental Monitoring Report is to be produced by the Contractor on a monthly basis:

a) Reports must be completed using the LREDC Monthly Contractor Environmental Report Form. A template of the report is in **Appendix 2;**

b) Monthly reports must be approved by the contractor's senior management, prior to submission. If reports are submitted by email or other electronic means, a physical signature is not required on the completed report form, however, the report must still be approved by the contractor's senior management upon submission;

c) This Report has to be endorsed by a third party Environmental Consultant to endorse its validity and the level of the environmental content of the report ;

d) These reports shall be submitted via Aconex and received by the Consultant, PMCM and LREDC Environmental Representative within fifteen (15) days following the close of each calendar month;

e) The report must provide details on the following topics:

   i. Status of work;

   ii. Environmental monitoring results;

iii. Total quantity of waste sent for disposal;

iv. Quantity of mandatory waste recycling;

v. Quantity of fresh ("sweet") water usage;

vi. Quantity of diesel and chemicals usage;

vii. Incidents and complaints, including investigations and corrective actions;

viii. Inspections and audits, including investigations and corrective actions;

ix. Environmental training, including both induction and toolbox training; and

x. Other environmental initiatives or comments.

f) The monthly reporting requirements outlined here may be implemented as part of a Contractor's CEMP. The PMCM and LREDC Environmental Representative may ask for further information, or verification of reported data during site inspections and audits of the Contractor's management system.

12.1.4. Incident Reporting

As discussed in OCEMP Section 11, the Contractor shall be responsible for completing all statutory incident notifications and reports. Unless directed otherwise the Contractor shall take the lead in the investigation, documentation and instigation of corrective action. Copies of all statutory notifications and reports shall be passed to the LREDC Representative.

12.2. Monitoring

Environmental monitoring will only be undertaken where there is an actual requirement that has been identified by the Contractor, PMCM, LREDC or MoE, including:

a) If there are nearby sensitive receptors who will be impacted by the work activities (such as residential areas close to noise intensive works such as piling);

b) If an Environmental Permit (such as Dewatering Permit) is in place and the conditions stipulate ongoing monitoring requirements as part of the approval; and

c) If significant concerns have been raised by any parties about the impacts on the environment from the construction activities (such as earthworks close to a marine environment).

12.2.1. Air Quality Monitoring

Air sampling surveys are to be carried out periodically as described in the 'Construction HSE General Requirements on Lusail for Contractors' document.

a) In addition, a permanent automatic monitoring station, sampling the contaminants detailed in OCEMP Section 4.2, should be installed. Regular samples shall be taken with a minimum of 14% time coverage during the entire construction period. For sites covering an extensive area or located in a particularly environmentally sensitive area, more than one device may be required. In such sites the monitoring stations should be located at the extents of the Site and should record simultaneously in both samplers.

b) The Environmental Representatives shall carry out further air sampling as required by the PMCM and LREDC Environmental Representative.

c) The Contractor shall take immediate remedial action if the threshold levels as given in OCEMP Section 4.2. All such incidents and the remedial action taken shall be documented.

d) In addition to the minimum requirements given in OCEMP Section 4.2, the levels of airborne pollutants must comply with the process and plant specific requirements given in MoE requirements. If these requirements differ the most stringent requirement will take precedence.

12.2.2. Water Quality Monitoring

Water quality monitoring is required for those working on or near surface water (such as the sea or lagoons) or those undertaking dewatering activities.

a) Specific dewatering monitoring requirements are detailed in OCEMP Section 20 ;

b) The Contractor shall provide equipment for sampling and monitoring water quality. The Contractor shall ensure all equipment is calibrated per the manufacturer's recommendations;

c) All water discharged to the marine environment shall be monitored for pollutants and suspended solids. Water sampling shall be carried out daily at each discharge point;

d) The levels of waterborne pollutants must comply with the specific requirements given in OCEMP Section 4.2;

e) The Contractor shall take immediate remedial action if these threshold levels are exceeded. All such incidents and the remedial action taken shall be documented.

12.2.3. Noise Monitoring

The Contractor Environmental Representatives shall carry out noise sampling as required by the PMCM and LREDC Environmental Representative.

a) In addition to the safe limits as detailed in the 'Construction HSE General Requirements on Lusail for Contractors' document and relevant legislation, threshold limits of 65 dB in the daytime and 55 dB in the night-time shall be adopted within the Site; and

b) The Contractor shall take immediate remedial action if these threshold levels are exceeded. All such incidents and the remedial action taken shall be documented.

c) Noise monitoring instrumentation shall have a callibration certificate, which is updated as an when calibration is conducted. Callibration shall be conducted within manufacturers recommended frequency.

12.2.4. Additional Environmental Monitoring

Additional monitoring that may be required includes, but is not limited to:

a) Light Pollution (such as for night-time work close to residents); and

b) Marine Ecology (during dredging and reclamation activities).

The PMCM and LREDC Environmental Representative shall receive copies of all the monitoring results and shall carry out supplementary surveys and monitoring as required.

13. AIR QUALITY CONTROL

The purpose of this chapter is to guide the Contractor and sub-contractors to protect sensitive receptors in the vicinity of the Project area by complying with the allowable air emissions during the construction works. Permissible air quality levels are outlined in Section 4.2 of this OCEMP.

13.1. Dust Control

Fugitive dust is an ongoing air emission issue during construction. It is generated both by material handling and earth disturbance activities, as well as by wind and other weather conditions. Dust can be generated from natural sources (wind through a desert site or over an uncovered stockpile) and also through anthropogenic sources (vehicle movements over unconsolidated ground).

A number of mitigation and management measures can be instigated to reduce air quality impacts from dust. These control measures include:

a) Side enclosure and covering, by impervious sheeting where practicable, of any fill, aggregate or other dusty material stockpiles to stop dust generation and resource loss. Stockpiled material can also be dampened with water if it is regularly being worked;

b) Stockpiles will be placed in sheltered or covered areas, with temporary wind screens erected around stockpiles exposed to wind effects where necessary;

c) Stockpiled material will ideally only be handled when moist;

d) Trucks transporting bulk materials (e.g. dry earth) to, from and within the Project site shall be covered with a suitable tarpaulin sheet or similar when travelling on public roads and should not be overloaded;

e) Temporary access and haul roads will be dampened down with water to minimise dust from vehicular traffic where necessary;

f) Vehicle speeds will be regulated on all un-surfaced roads to 30km/h or less, as appropriate;

g) Work areas (particularly those for block cutters) should be fenced, with the fence lined with cloth or fabric (such as green garden type mesh) to minimise dust migration and generation off site;

h) Establishing a stand of trees or other suitable vegetation between the source and receptor to act as a buffer, aid dispersion and potentially remove dust particles through impingement on the foliage;

i) Land clearing will be kept to a minimum so as to keep vegetation cover that will stabilise the ground and reduce dusty environments;

j) Movement of vehicles should be restricted to defined access routes to minimise dust emissions;

k) Construction of access roads will be reduced by using existing tracks/easements wherever possible. Make use of the final road alignment so that area is only disturbed once;

l) Stabilise construction roads with gravel (or similar) immediately after grading;

m) External roads adjacent to the site should be cleaned at the end of each shift;

n) Consider the use of dust suppression materials where active construction has ceased. This could include concreting areas of the site that are not developed immediately or covering with sub-grade to stabilise the area. Landscaping of bare areas (including seeding and mulching) should be prioritised where it is unlikely to be damaged by later development;

o) Minimising the area of land to be disturbed at any one time by staging of construction activities and the progressive implementation of the works;

p) Construction activities (such as excavation and transfer of surface materials) to be minimised on windy days, particularly when blowing in the direction of sensitive receptors;

q) Powdered materials must be kept uin closed bags / sealed containers and covered to prevent particles becoming airborne when not in use.

r) Drop height of excavated materials (onto the ground or into vehicles) should be controlled to a minimum to limit fugitive dust generation from unloading as far as practicable;

s) Dust/mud transport onto the public highway will be minimised through use of lorry wheel washes at the exit from the work site;

t) Road sweeping equipment will be provided to clean up any public roadways affected by dust from the works;

u) Appropriately site the concrete batching plant out of prevailing high winds and at a considerable buffer distance of not less than 100 meters away from sensitive receivers;

v) Control dust generation from the concrete batching plant by installing filter bags at the vents of the silos and providing conveyors and discharge ends with dust-tight covers; and

w) Implementation of a construction phase dust-monitoring program on and adjacent to the Project site (incorporating use of a dust monitor such as a dust deposition gauge or volumetric air sampler) to monitor respirable dust and nuisance dust. This can provide trigger data to justify alteration of work practices during periods of high dust generation (such as strong winds).

13.2. Exhaust Emission and Gaseous Pollutants

Exhaust gas is emitted as a result of the combustion of fuels such as natural gas, gasoline/petrol, diesel fuel, fuel oil or coal. According to the type of engine, it is discharged into the atmosphere through an exhaust pipe, flue gas stack or propelling nozzle.

Exhaust emissions can be from a variety of sources, including vehicles, plant equipment, concrete batching plants, generators and similar. Exhaust emissions are likely to include pollutants such as: BTEX (petroleum derivatives such as fuel), nitrogen oxides (NOx), carbon monoxide (CO), sulphur oxides (SOx), hydrocarbons (HC), ozone (O3) and particulate matter (PM).

Emission standards focus on reducing pollutants contained in the exhaust gases from vehicles as well as from industrial flue gas stacks and other air pollution exhaust sources in various large-scale industrial facilities such as petroleum refineries, natural gas processing plants, petrochemical plants and chemical production plants.

A number of mitigation and management measures can be instigated to reduce air quality impacts from construction machinery, vessel and vehicle exhausts. These control measures include:

a) All vehicles and plant used during the works will be maintained in good working order to ensure optimum performance and no excess exhaust emissions are emitted. A record of maintenance shall be kept;

b) If equipment or vehicles are seen to have an excessive amount of emissions, they will be given defect notices and taken out of service until repaired and approved for re-deployment by site supervisor representative;

c) Emissions from stationary equipment (generators, etc) shall be visually inspected for the presence of black smoke and maintenance measures will be made to rectify burner efficiency issues as necessary;

d) Vehicles, plant and equipment that are idling or being used on an intermittent basis (such as a parked car) will be shut-off or throttled down when not in use;

e) Minimise unnecessary operation of construction machinery, including efficiency of trip times and reduction of double handling through appropriate placement of stockpiles, haul roads, works depots and work areas. This will also aid in fuel efficiency and will assist in reducing overall costs associated with unnecessary fuel consumption;

f) Use of modern machinery, with adequate pollution control devices (such as catalytic converters). A list of all machinery used on site (including date of manufacture, hours of operation, maintenance dates, fuel type and emissions control devices installed) should be kept on site by the site supervisor;

g) Vehicle and fuels will be compliant with manufacturer's instructions and specifications approved in the region – specifically in relation to low-sulphur content;

h) Proper and efficient use and operation of construction machinery and vehicles by qualified and skilled personnel (as per manufacturer's instructions); and

i) Encourage residents and commercial workers to use alternatives modes of transport to their own personal vehicles in when travelling to and from the Project site and within the Project site.

13.3. Odor Control

Unpleasant odors can arise from specific industrial processes, adversely affecting workers and even residents downwind of the industry. The most common sources of industrial odor arise from sewage treatment plants, refineries, animal rendering factories, and industries processing chemicals (such as sulphur) which have odorous characteristics. Sometimes industrial odor sources are the subject of community controversy and scientific analysis.

Odors from construction site activities will potentially include a number of sources, such as: inadequately maintained septic tanks or sewage networks; exhaust emissions from vehicles or equipment; and poor waste management (e.g. dumped food waste).

A number of mitigation and management measures can be instigated to reduce air quality impacts from odor. These control measures include:

a) Avoidance techniques will be implemented, with adequate separation distances between potential odour sources and potential receivers;

b) Proper staging of construction activities to minimise impact of construction odours (from painting, welding or grinding) on areas already occupied or neighbouring properties. This may involve proper timing of activities to avoid adjoining occupants' work hours or unfavourable wind conditions;

c) Proper timing of activities – this is a commonsense approach that can avoid potential odour impacts by controlling the timing of certain high-risk activities. Some examples include:

d) Stopping open air painting during high winds;

e) Cleaning commercial grease traps outside normal opening hours; and

f) Carrying out site sewage and maintenance works at appropriate low-use times;

g) Control of potential odours emissions at the source – this can be done through appropriate stack venting or filtration of odorous emissions from:

   i. Enclosed painting facilities;

   ii. Restaurant kitchens;

   iii. Sewage lines; and

   iv. Wastewater lines.

h) Organic waste (food) containers will keep a metal or hard plastic lid on at all times to ensure that odours do not emanate from the putrefying organic waste.

i) Long-term storage of wastes will not be permitted onsite. In addition, for short-term storage, no wastes are to be stored outside designated areas;

j) Septic tank lids will be kept tightly in place at all times to stop odours from emanating or rubbish from blowing into the septic tank;

k) Pipe networks and similar that transfer wastewater will be monitored for any leaks that could cause foul odour water to escape or the build up of a stagnant water pond;

l) Smoke generated by bonfires (often when burning waste) is a recognised problem on demolition and construction sites, and the practice is strictly prohibited;

m) Work areas should be well ventilated to avoid impacts on the employees;

n) Workers should be supplied with the appropriate personal protective equipment (PPE) when working with odours, dust and volatile emissions (such as respiratory equipment);

o) Provision of suitable workers' amenities, located within the construction area and, if possible, downwind from residential areas; and

p) Regular maintenance of workers' amenities, including emptying of effluent storage tanks.

13.4. Volatile Emissions

Strong toxic odors can additionally come from volatile emissions from chemical products used in construction works such as floor coverings, paints, adhesives and fillers, especially if left uncovered. Volatile emissions are also connected to refueling and maintenance activities

Odors and volatile emissions can cause nuisance and disturbance to onsite workers and to neighboring sites (e.g. residential areas). They can also cause an increase in allergy risks and respiratory disturbances to workers and close by residents.

The following mitigation measures will assist in controlling volatile emissions during the construction and operation phase (many of these measures will also be required from a safety viewpoint in regards to the use and storage of dangerous goods):

a) The number of fuel and chemical storage areas should be minimised and properly managed. Closed fuel and chemical storage areas will be adequately vented and confined;

b) Ensure proper on site storage of volatile fuels and chemicals in appropriately sealed containers, in cool, covered areas with adequate venting;

c) All containers used for the storage of volatile materials (e.g. fuels, solvents) shall be kept closed when not in use;

d) Leakage of gases from gas bottles should be controlled through proper dangerous goods storage.

e) A full list of all volatile fuels and chemicals stored on site should be kept by the site supervisor, including accompanying volumes, locations and Material Safety Data Sheets (MSDS);

f) Avoid on site storage of highly volatile fuels such as unleaded petrol and volatile chemicals such as solvents and oil-based paints;

g) Ensure all machinery is in good order and repair and not leaking fuel or volatile emissions from fuel tanks or fuel lines;

h) Vehicles are to go off-site for refuelling, with on-site refuelling limited to landscaping equipment (such as lawnmowers); and

i) Volatile emissions should also be controlled through minimising unnecessary leaks, spills and over-filling of fuel driven engines.

14. NOISE AND VIBRATION CONTROL

The purpose of this chapter is to guide the Contractor and sub-contractors to protect sensitive receptors in the vicinity of the Project area by complying with the allowable noise limits during the construction works.

14.1. Noise Control

Noise is inherent and generally unavoidable in most construction activities, with the most prominent noise emissions typically coming from heavy equipment, earthworks, vehicles or tasks (such as jack hammering). This elevates ambient noise levels in areas within a Project site for certain periods (especially as noises travelling further at night), which can affect wildlife and the public. Permissible noise levels are outlined in Section 4.2 of this OCEMP, with threshold limits of 65 dB (decibels) in the daytime and 55 dB in the night-time shall be adopted within the Site.

A number of mitigation and management measures can be instigated to reduce noise quality impacts. However, the disabling of audible reversing alarms on vehicles or plant is not considered as a method to reduce noise and is not permitted for vehicles and plant operating on the site. Therefore, engineering controls that eliminate noise at the source or establish a permanent barrier to noise are the preferred method of control. These control measures include:

a) Where practical, noise generating activities will be scheduled to avoid impacts on noise sensitive receivers (NSR). Schedule work carefully to:
    i. All works and ancillary activities (such as heavy vehicle movement and material deliveries) that are audible at the site boundary will be carried out during designated daytime hours only unless approval has been granted by the client and/or regulatory authority;
    ii. Noisy activities will be restricted to daytime and evening periods only, with no night time working permitted unless approval has been granted by the client and/or regulatory authority (e.g. 24-hour concrete pours);
    iii. Construction activities (such as piling and material deposition) to be minimised on windy days, particularly when blowing in the direction of sensitive receptors;
    iv. Phase construction activities to take into account potential impacts on visitors and employees in adjoining properties and adjacent areas;
    v. Avoid simultaneous use/operation of noisy equipment, if possible;
    vi. Require operators to shut down all plants and equipments in intermittent use between work periods or throttled down to minimum idling speed;
    vii. Retain existing features such as site office that act as noise barrier until the last phase of the project;
    viii. Erect noise source screening structures such as stores as early as possible to shield the noise sensitive receivers;
    ix. Remove stockpiles and perform excavation works at the side that is furthest away from the NSR to allow earth materials to shield NSRs from noise sources;
    x. Noise pollution will be minimized throughout animal nesting and hatching period (such as birds), as this may affect them. 24 hour operations to be scheduled outside this season, with no activity that causes noise levels greater than 55 dB (A) at the site boundary be carried out during this period.
b) Equipment and plant layout will be – as far as practical – located away from noise sensitive areas and the use of physical barriers, such as hoardings, stockpiles or site buildings will be employed to deflect or disperse noise. Locate facilities such that:
    i. Plant and equipment known to emit noise strongly in more than one direction is oriented to direct noise away from the noise sensitive receptors;
    ii. Noisy equipment and plant (generators and water pumps, etc) be sited as far away from noise sensitive receptors as practically possible;

iii. Nearby objects such as water cooling tanks, stockpiles, etc can be used to shield noise source against noise sensitive receptors as practically possible;

iv. Access roads to the site shall be positioned such that vehicular movements cause minimum disturbance to residential buildings;

v. Access to the site is designed so that the need for vehicles to reverse (and thus use their reversing alarm) is minimised;

vi. Layout of site precincts ensures minimum noise impacts for conflicting activities (especially between residential, commercial and recreational activities); and

vii. Consideration will be given to reducing noise by undertaking noisy assembly practices offsite where practicable.

c) Erect appropriate buffers (such as fencing, mounds, material stockpiles, site accommodation, building walls or a stand of trees or other suitable vegetation) between the source and receptor to absorb the noise;

d) Establish temporary acoustic barriers (semi-permanent or portable wooden or concrete barriers) to minimise noise impacts to on-site and off-site land uses, if required. These can be constructed from readily available building materials or commercially available sound absorbing panels, such that:

i. Surface mass of barrier material must be greater than 7kg/m^2;

ii. Avoid gaps and opening at joints of barrier material;

iii. Barrier located as close to noise source/NSR as possible;

iv. Minimum height of the barrier so that no part of noise source visible from NSR;

v. Length of the barrier must be at least 5 times its height; and

vi. All possible considerations to be given to the aesthetics of the barrier to blend with the existing surrounding.

e) Use portable noise barriers/enclosures with skid footing and a small cantilevered upper portion for noisy stationary/mobile plants:

i. Can be constructed from available building materials (plasterboard, plywood, chipboard) or purposely made acoustically isolative lining products;

ii. Noise reduction of up to 10dB possible for stationary plant (compressor, water pump, drilling rigs, generator, various hand tools and saw); and

iii. Noise reduction of up to 5dB possible for mobile plant (bulldozer, excavator, loader, truck mixer, mobile crane, vibrator and breaker).

f) Use at-source noise controls, so that any noisy equipment is suitably enclosed with an acoustic barrier or other noise reducing method, such as an exhaust muffler:

i. All equipment and machinery in use will be adequately silenced in accordance with the manufacturer's instructions, and all vehicles, compressors and mobile equipment will be equipped with effective silencers and noise reducing insulation;

ii. Make sure all plant, machinery and vehicles are fitted with appropriate mufflers, and that all mufflers and acoustic treatments are maintained in good working order;

iii. All generator sets and compressors should be housed in acoustically designed housing, which will be closed at all times when in use.

g) Select quiet equipment that produces the lowest noise level whenever possible:

i. Silenced/super-silenced compressors / electric compressor (if mains power used);

ii. Hydraulic concrete cutters and crushers, and rock drills (up to 20 dB noise reduction);

iii. Pneumatic breakers fitted with mufflers and damping collars (up to 21dB noise reduction); and

iv. Where possible, electrically powered equipment will be used in preference to diesel or gasoline powered equipment, as it is quieter;

h) Ensure communication with nearby sensitive receptors prior to and during works:

   i. Public billboards shall be erected at the construction sites, listing construction activities, contact persons and telephone numbers for receiving public concerns, complaints, and suggestions on a constant basis;

   ii. Prior to conducting any unavoidable noisy activities near to noise sensitive receivers, notify the receptors of the plans and keep them informed and updated with the work that is to be undertaken, including expected duration;

   iii. Public, particularly residents, in areas immediately adjacent to the construction sites shall be consulted prior to the start of night time construction, to alert them to the noisy activities during the night, to explain the reasoning for night construction to obtain public understanding, and to solicit specific public concerns and suggestions for mitigation; and

   iv. Ensure contingency plans are in place to deal with any noise complaints during construction and operation of the Project site. Investigate noise complaints and excesses of any agreed maximum acceptable levels immediately.

i) Managing traffic can sometimes reduce noise problems, including:

   i. Trucks can be prohibited from certain streets and roads around the site, or they can be permitted to use certain streets and roads only during daylight hours;

   ii. Traffic lights within and outside the site can be changed to smooth out the flow of traffic and to eliminate the need for frequent stops and starts;

   iii. Speeds will be regulated on all un-surfaced roads to 30km/h or less, as appropriate;

   iv. Speed limits can be reduced on permanent roads. However, about a 30km/h reduction in speed is necessary for a noticeable decrease in noise levels; and

   v. Stabilise site road with gravel (or similar) immediately after grading to reduce noise

j) Maintenance and servicing of equipment and vehicles in accordance to manufacturers recommendations, especially for noise mitigation components (e.g. retaining silencers / mufflers supplied with construction equipment and closing generator doors). Records kept;

k) Tyres and tyre pressures must be maintained to reduce friction between the wheel and surface. This will also ensure that the vehicle runs at optimum efficiency;

l) Make sure all plant, machinery and vehicles are regularly maintained and broken parts (such as mufflers) are replaced immediately;

m) Make sure all plant, machinery and vehicles are operated efficiently and according to the manufacturers specifications, by trained and qualified operators;

n) Practice extra caution in materials delivery particularly when dropping from a height. Construction materials should be properly handled so that the minimum noise is generated. Materials should be handled gently and, if possible, cushions should be provided to reduce impact of noise;

o) Loading and unloading of vehicles, dismantling of site equipment such as scaffolding or moving equipment or materials around site will be conducted in a manner as to minimize noise generation and where possible will be conducted away from noise sensitive areas;

p) Provide façade treatment to noise sensitive receivers within the noise affected areas of the Project site to ensure noise intrusion is minimised. Façade treatment can be the most effective measure to protect site buildings and structures from excessive noise intrusion. Insulating buildings can greatly reduce highway traffic noise, especially when windows are sealed and cracks and other openings are filled. Noise-absorbing material can be placed in the walls of new buildings during construction;

q) The Contractor shall submit a plan of activities with numbers of noise generating machines stating projected noise levels;

r) The normal operating noise levels for all vehicles, plant and machinery shall be ascertained and communicated to the users; and

s) Discourage raised voices or radios/music at high volumes, particularly at the start of shift or after normal business hours;

t) Site roads should be designed and constructed as level as possible. The elimination of steep inclines helps to reduce traffic noise because motor vehicle engines, especially multi-geared truck engines, do not have to work as hard; and

u) Incorporate the use of noise barriers (such as boards, walls, earth mounds and landscaping) along the road side of the Project site to mitigate noise from roads. Other options may include the incorporation of local noise barriers into the Project landscape designed to shield particularly sensitive areas in the Project site.

14.2. Vibration Control

In a construction and operation environment, vibrations usually occur from the movement of vehicles (e.g. heavy trucks, trains, plant) or from construction activities such as demolition or compaction of the soil by depth vibrators (vibro-compaction) during earthworks. Types of vibration on construction sites are:

a) Continuous Vibration - Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery);

b) Impulsive Vibration - Infrequent: Activities that create up to 3 distinct vibration events in an assessment period (daytime or night-time), for example, occasional dropping of heavy equipment, occasional loading and unloading; and

c) Intermittent Vibration - Frequent: Activities that create more than 3 distinct vibration events in an assessment period (daytime / night-time), e.g. nearby intermittent construction activity, passing heavy vehicles, forging machines, impact pile-driving, jack hammers.

A number of mitigation and management measures can be instigated to reduce vibration impacts from construction machinery, plant and vehicles. These control measures include:

a) In order to control the noise and vibration whilst driving piles, hammering technique shall not be used by the Contractor, with auguring the preferred piling method;

b) To reduce the potential for impacts from noise and vibration to sensitive receptors, earth compaction is suggested to be carried out mainly with the use of water, rather than via vibro-compaction technique;

c) If elevated noise / vibration levels are encountered, the source of noise or vibration is to be identified and alternative methods or additional control measures are to be implemented;

d) in the event of vibration becoming a concern, an assessment will be undertaken in accordance with local regulations and standards, if applicable;

e) If vibration monitoring is required, it should be undertaken inside rooms when assessing for nuisance and measured on the structure outside when assessing for damage. For sensitive structures, visual monitoring and the measurement of crack widths is the best way to determine whether damage is being caused;

f) Where reasonably practicable, vibrating equipment should be located as far from sensitive premises as possible, and if on a structure, not on one which is continuous with that of the sensitive premises;

g) In some instances it may be possible to reduce transmitted vibration by cutting a structure to separate site work from sensitive premises. Clearly, it is important to take account of safety and structural issues before carrying out any work of this nature;

h) All vehicles and plant used during the works will be maintained in good working order to ensure optimum performance. A record of maintenance shall be kept;

i) If equipment or vehicles are seen to have an excessive amount of vibration, they will be given defect notices and taken out of service until repaired and approved for re-deployment by site supervisor representative;

j) Plant and equipment that are idling or being used on an intermittent basis (such as a parked car) will be shut or throttled down when not in use to avoid vibrations;

k) Minimise unnecessary operation of construction machinery (which cause vibrations), including efficiency of trip times and reduction of double handling through appropriate placement of stockpiles, haul roads, works depots and work areas; and

l) Proper and efficient use and operation of construction machinery and vehicles by qualified and skilled personnel (as per manufacturer's instructions).

15. LIGHT POLLUTION AND VISUAL IMPACT CONTROL

The purpose of this chapter is to guide the Contractor and sub-contractors to protect sensitive receptors in the vicinity of the Project area by minimizing light pollution and negative visual impacts during the construction works.

15.1. Light Pollution

Light pollution refers to the impacts caused by the inefficient, excess or obtrusive use of artificial light. The major sources of artificial light include street lighting, security lamps, vehicle headlamps, advertising and display lighting, floodlights and building illumination. Light pollution competes with starlight in the night sky for urban residents, interferes with astronomical observatories and, like any other form of pollution, disrupts ecosystems and has adverse health effects.

Reducing light pollution implies many things, such as reducing sky glow, reducing glare, reducing light trespass, and reducing clutter. The method for best reducing light pollution, therefore, depends on exactly what the problem is in any given instance. In the event that construction activities are required at night, the following should be implemented to minimize light pollution:

a) Schedule works that would be light-intensive during day-time;

b) Position lighting (especially construction floodlights) properly and directing their light more efficiently towards where it is needed;

   i. Lights should be shielded and aimed so that they are not directly visible from the roads, alleys, adjoining “natural areas” and pathways (driver, cyclist and pedestrian safety), and so that they do not obscure traffic signs or cause confusion;

   ii. Lights should be spaced appropriately for maximum efficiency;

   iii. Design light fittings that reduce light emitted upwards. For instance, on advertising hoardings use top-mounted rather than ground-mounted floodlights;

   iv. Flat lens (full-cut off) fixtures ensure that light is only directed below the horizontal, which means less light is wasted through directing it outwards and upwards.

c) Use only the necessary amount of lighting to accomplish the light's purpose;

d) Install fencing, appropriate landscaping (such as trees or earth mounds) or similar measures to minimise escape of light from construction area.

e) Use energy efficient bulbs and lights in all public areas throughout the Project site;

f) Turn lights (particularly decorative floodlighting and advertising lighting) off using a timer or occupancy sensor or manually when not needed;

g) Evaluate existing lighting plans, and re-designing some or all of the plans depending on whether existing light is actually needed. For instance, light pollution can be reduced by turning off unneeded outdoor lights, and only lighting buildings when there are people inside. Timers are especially valuable for this purpose.

h) Temporary lighting of construction sites during the marine nesting season shall be restricted to the minimal amount necessary and shall incorporate all of the standards of this section

i) Several different types of light sources exist, each having different properties that affect their appropriateness for certain tasks, particularly efficiency and spectral power distribution. It is often the case that inappropriate light sources have been selected for a task, either due to ignorance or because more sophisticated light sources were unavailable at the time of installation.

15.2. Visual Impact

Visual impacts associated with the project will include the introduction of construction equipment and disruption of the landscape in association with construction operations into the project area. These impacts will be most noticeable to drivers travelling past, but may also be evident to residents living adjacent to the Project site. The following should be implemented to minimize visual impacts:

a) In general, construction activities would be contained within the Project site as much as practical;

b) Conspicuous and frequent small-vehicle traffic for worker access and frequent large-equipment (trucks, graders, excavators, and cranes) traffic for road construction and site preparation that could produce visible activity and dust in dry soils will be minimised;

c) Vehicles leaving site will not spread mud, soil or dirt onto public roads. Any mud, soil or dirt which has been spread onto public roads will be removed and cleaned promptly;

d) The choice of materials for boundary fencing will take into account the surrounding land use. For sites in or directly adjacent to residential areas - a solid fence providing security, safety, visual barrier, and partial acoustic attenuation will be used. For sites in more remote areas away from sensitive neighbours, or adjacent to other construction sites – a chain link or similar fencing may be sufficient);

e) The height of material stockpiles will be controlled so that they are not visually noticeable;

f) Loose material stockpiles will be covered or sprayed with water to minimise the amount of dust generated, especially on windy days when the wind is directed towards nearby residents;

g) Solid waste piles will be minimised in site, covered with netting or tarpaulin and bounded by hoardings to minimise their visual impact;

h) Invasive species that could colonize disturbed and stockpiled soils and compacted areas will be removed;

i) Soil scars and exposed slope faces that would result from excavation, levelling, and equipment movement will be minimised;

j) Ground disturbance and vegetation removal that could result in visual impacts that produce contrasts of colour, form, texture, and line will be minimised; and

k) Construction easements on parcels outside the Project site, where required, would be managed to minimize potential visual impact. Following construction, the use of ground cover, landscaping, or related materials would restore areas to pre-construction conditions or better.

16. SUSTAINABILITY IN CONSTRUCTION

The purpose of this chapter is to guide the Contractor and sub-contractors to resource conservation (energy, water, materials) within the office and construction site environment and to incorporating sustainable procedures into work practices.

16.1. Sustainability

Sustainability is the creation or enhancement of environmental, economic and socio-cultural balance, as realized through client deliverables, business activities, employee actions and community engagement. Sustainability addresses approaches, methods and practices that optimize the use of energy, water and materials, while reducing greenhouse gas emissions.

Sustainable Development can be defined as a “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (UN World Commission on Environment and Development 1983).

To manage Sustainable Development, there are many guiding and rating systems used worldwide, such as LEED, BREEAM, Estidama and similar. However, the GlobalSustainability Assessment System (GSAS) is a newly developed comprehensive rating system for Qatar covering commercial, schools and residential buildings, with Lusail being the first city implementing GSAS.

16.1.1. GlobalSustainability Assessment System

The GlobalSustainability Assessment System (GSAS) is a sustainability rating system, which aims at creating a sustainable built environment that minimizes ecological impact while addressing specific regional needs and the environment of Qatar.

The development of the GSAS rating system took advantage of a comprehensive review of combined best practices, while taking into consideration the needs that are specific to Qatar’s local environment, culture, and policies. The result is a performance-based sustainable building rating system customized to the unique conditions and requirement of Qatar. Lusail City will be the first development in Qatar where GSAS is applied.

GSAS criteria are designed to improve the efficiency of energy and water consumption and indoor environmental performance of buildings. The application of GSAS criteria to the building's design and construction improves the overall quality, maintenance requirements and life span of the building. The long term benefit to building owners is a real estate asset that is less costly to maintain, performs better for tenants/occupants and is more competitive in the real estate market than a building that is not GSAS certified.

In its current form, GSAS is only applicable to Residential, Commercial, and School buildings. However GSAS is a flexible assessment system which can be adapted in the future to assess the sustainability performance of other building types in Lusail City.

A set of criteria was put forward according to which buildings are ranked in Lusail City on the basis of five levels or five stars. Buildings which receive 3 stars or more will benefit from a package of incentives dedicated to development in Lusail City districts.

GSAS is based on 8 categories, which define possible environmental impacts of construction projects – each category assigned with a weighting:

a) Urban connectivity (8 %);
b) Site (9 %);
c) Energy (15 %);
d) Water (25%);

e) Materials (8 %);

f) Indoor environment (14 %);

g) Culture and economic value (13 %); and

h) Management and operation (8 %).

16.2. Energy Conservation

Energy conservation refers to efforts made to reduce energy consumption, which can be achieved through increased efficient energy use, in conjunction with decreased energy consumption and/or reduced consumption from conventional energy sources. Energy efficiency means using less energy to provide the same service.

A number of mitigation and management measures can be instigated to encourage energy conservation and efficiency. These control measures include:

a) Office - Energy Conservation

   i. Use alternatives to office lights (e.g. daylight) where ever possible.

   ii. Install occupancy sensors or luminosity sensors if possible

   iii. Lights, computers and air-conditioning (AC) units should be switched off at the end of day or if not in use

   iv. Use alternative sources of cooling instead of AC (e.g. open windows for ventilation & use blinds on windows)

   v. Set AC temperature at optimum human level (typically 22-24°C)

b) Office - Energy Efficiency

   i. Use energy-saving compact fluorescent bulbs or LED lights for lamps and other task lights;

   ii. Lights and light fittings should be adequately cleaned for optimum brightness;

   iii. Modern energy-efficient appliances, such as refrigerators, freezers, ovens, stoves, dishwashers, and clothes washers and dryers, use significantly less energy than older appliances;

   iv. Ensure that newly purchased appliances are energy efficient (e.g. 'Energy-star 'rated fridges, computers, etc); and

   v. Ensure the Facilities Management team calibrates, cleans, maintains, and services equipment regularly to ensure efficiency

c) Utilise or install solar-powered devices where practicable; and

d) Ensure that when practicable, vehicle engines should not be operated on idling mode.

16.3. Water Conservation

Water conservation refers to reducing the usage of water and recycling of waste water for different purposes such as cleaning, manufacturing, and agricultural irrigation. However, the key for water efficiency is reducing waste, not restricting use.

A number of mitigation and management measures can be instigated to encourage water conservation. These control measures include:

a) Office - Water Efficiency

   i. Ensure that taps, toilets, drinking station and other water units are leak free and not left to run water network;

   ii. Fit taps with flow reduction faucets to minimise water use and investigate installing waterless urinals;

   iii. Cooling water and other wastewater should be recycled if possible;

iv. Ensure that taps and pipes within toilet and kitchen areas do not have leaks and are turned off when not required;

v. Dripping taps can waste up to 15 litres of water a day. Replace worn tap washers for a quick and cheap way of saving water;

vi. Burst water pipes can cause serious damage as well as waste water. Ensure your water pipes and external taps are lagged in time for the cold winter months; and

vii. Faucet aerators, which break water flow into fine droplets to maintain "wetting effectiveness" while using less water. An additional benefit is that they reduce splashing while washing hands and dishes.

b) Landscaping – Water conservation

i. Place decorative fountains on a timer and use only during work or daylight hours. Periodically check for leaks if you have automatic refilling devices;

ii. Limit turf areas at office facilities. Instead, landscape using xeriscape (water-efficient landscape that's appropriate for your environment) principles to cut water use in half;

iii. Be sure the irrigation system is watering only the areas intended, with no water running onto walks, streets or down the gutter;

iv. Ensure that adaptive or native plants (which are more water efficient) are used in any landscaping to reduce the amount of water consumed;

v. Use waterbox devices to limit the amount of water and irrigation needed to sustain a tree within a desert environment;

vi. Mulch will slow evaporation of moisture while discouraging weed growth. Adding 2 - 4 inches of organic material such as compost or bark mulch will increase the ability of the soil to retain moisture. Press the mulch down around the drip line of each plant to form a slight depression which will prevent or minimize water runoff; and

vii. Employ drip irrigation rather than spray irrigation technology for landscaping

c) Water Recycling and Conservation

i. Where practicable use water recycling techniques (e.g. rainwater butts) and cost-effective water saving technologies such as waterless urinals, flow restrictor taps and dual-flush toilets;

ii. Collect wastewater from wheel-washing, hydro static testing of pipes (of water tightness), concrete curing, etc for treatment and potential re-use;

iii. Ensure water use for washing of tools, concrete curing, mixing of adhesive mortar, etc are not excessive; and

iv. When washing a car, fill a bucket with water and use a sponge. This can save about 300 litres of water.

v. Water conservation / efficiency programs undertaken by the Contractor shall be documented, implemented and a summary of improvement results available on file.

b) Water consumption records will be maintained on file. All records should be verifiable against source data such as invoices or delivery documents.

16.4. Material Conservation

Material conservation encompasses the reduction in wastage of materials through poor storage and over purchase of stocks which deteriorate with time. It also considers the sustainable purchase of material (locally sourced, of good quality and of high recycled content) which will reduce fuel costs associated with long-distance deliveries.

A number of mitigation and management measures can be instigated to encourage material conservation. These control measures include:

a) Stockpile Conservation

i. Stockpiles (sweet sand, backfill material) need to be suppressed to stop the material either blowing away or mixing with surrounding sand. Stockpile loss will cause you to buy more material;

ii. Suppress stockpile either with water sprinkling or (long-term) with a green shade-cloth covering; and

iii. Ensure that green netting is replaced or repaired as appropriate to control dust movement on the slope face

b) Material Conservation

i. Ensure that correct quantities of materials are ordered a number of times, more material (such as concrete) will have been ordered than is required.

ii. Ensure materials (such as paint) are not over-applied and thus wasted

iii. If the excess material cannot be used on another active project, then the first action should be to try and re-use the material in another form (e.g. make formwork concrete barriers);

iv. Ensure that material (e.g. fuel, paint) is handled carefully and is not spilt. If material is lost then time and money will need to be spent obtaining replacements;

c) Fuel Conservation

i. It is common to see vehicles which are not in use being left running. This wastes fuel resources as well as producing additional harmful engine emissions. Switch engines off when not in use;

ii. Establish the norms for fuel consumption, based on the manufacturer's recommendations, and get the operators to monitor fuel consumption;

iii. Consider whether materials can be purchased locally, thus saving on transport and time costs and reducing additional exhaust emissions;

iv. Reduce the amount of car journeys to site - investigate carpooling with colleagues where possible;

v. Use public transportation (buses, metro) if available and f possible, walk between locations rather than using a vehicle;

i. Regular maintenance of vehicles, equipment, generators and similar will prolong the life of the item as well as ensuring that it operates as it should; and

ii. A malfunctioning vehicle (e.g. damaged muffler, low tyre pressure) or a generator spewing black smoke will both require more fuel in order to do their job than a properly maintained version

d) Correct Material Storage

i. Make sure that the material is stored correctly (per manufacturer's instructions) until use. Correct storage of materials will prevent deterioration and wastage;

ii. Stack materials (e.g. fuel drums or scaffolding) in a safe manner so that they do not have the opportunity to fall over and damage themselves or other items or people;

iii. Ensure that materials are not left in the sun or a wet environment, if those physical conditions will degrade the materials and necessitate their replacement.

e) Office - Paper Reduction

i. Use scrap paper for memos, as over 45% of print outs are discarded that same day;

ii. Promote email and electronic documentation and print only when necessary, and do that double-sided; and

iii. Use forms and documents made and used electronically (e.g. proof read pdf's rather than printing paper drafts).

16.5. Green Purchasing Policy

The choice of building materials can make an important contribution to environmental performance during construction, and therefore LREDC and it Contractors have a responsibility to select environmentally-friendly materials.

The most common building materials used in Qatar, and therefore best targeted for sustainable construction activities, include: Concrete; Steel; Timber; Glass; and Plastic.

When selecting materials, consideration must be given to the following issues:

a) Usage of rapidly renewable materials – an example of a rapidly renewable resource is plantation hardwood timber, compared to timber logged from a rainforest;,

b) Hazardous components or residues – materials containing hazardous chemicals can emit harmful vapours (for example, paints and glues). Unused or left-over product may require disposal at hazardous waste disposal facilities;

c) Distance materials are transported – transportation consumes fuel, so locally supplied materials are usually a better option;

d) Recycled content – contractors must source products which have an identifiable recycled content;

e) Processing of raw materials to produce the building material –the manufacturing process for some materials will consume more energy than for others (for example, aluminium);

f) Product durability/ effectiveness – inferior materials require maintenance or replacement sooner, which increases waste and costs;

g) Amount and type of packaging – excess packaging increases waste generation, and may be made from non-renewable or non-recyclable raw materials; and

h) Quantity surveying – improve estimation, ordering and stock control. Purchasing the exact amount of building materials that you need reduces wastage and costs.

16.5.1. Purchasing

Where contractors have discretion in supplying materials, they should follow the material/ product selection criteria:

a) Recycled content – buy products made using some or all recycled materials. An example of this is buying plastic moulded products made from recycled (re-melted and moulded) plastic;

b) Natural, plentiful or renewable – use materials taken from sustainably-managed sources. For example, buy timber from Forest Stewardship Council (FSC) certified suppliers who offer 'chain-of-custody' certification;

c) Resource efficient manufacturing process – buy products manufactured with resource efficient processes. This means lower amounts of energy used in production, and/ or less wastage of materials. For example, a lot of energy is required to produce potable water from desalination plants, so a better option is to use potable water consumption only where needed (such as drinking, cooking, washing), and use dewatering discharge or treated sewage effluent elsewhere (such as landscape maintenance, toilet flushing, road dust suppression);

d) Locally available materials – source building materials and components locally or regionally, thus saving energy and resources in transportation to the project site. For example, landscaping compost can be made from vegetation cleared from the site, or neighbouring projects, instead of being brought in from neighbouring emirates or overseas;

e) Salvaged, refurbished or remanufactured – reuse materials such as glazing, pavers and roofing tiles to save costs as well as be environmentally beneficial. This includes saving a material from disposal and repairing, renovating or improving the appearance or value of it. This is subject to the salvaged product meeting the contract specifications, and may be difficult to practically achieve;

f) Reusable or recyclable – select materials that can be easily dismantled and reused for later jobs, or recycled when they reach the end of their useful life. An example of this is re-use of materials from temporary fences for later jobs; and

g) Avoid products and materials containing hazardous substances. For example, avoid using products containing asbestos, lead-based paint, copper chrome arsenate (CCA) treatments, and man-made mineral fibre.

16.5.2. Packaging

Packaging on materials should be reduced as much as possible:

a) Buy materials with minimal amounts of packaging. Left-over packaging requires storage, recycling or disposal by the contractor, and hence also contributes to costs;

b) Buy products where the packing is made from recycled content, or materials that are easily recyclable or reusable. Cardboard is an ideal example; and

c) Ask suppliers if they are willing to accept their packaging waste back. This is common practice in many other countries in Europe, hence suppliers who have worked in those areas may already be able to do this.

17. WASTE MANAGEMENT CONTROL

The purpose of this chapter is to guide the Contractor and sub-contractors to the management of wastes during the construction and operation works.

17.1. Waste Prevention

The primary effort should be to engage in waste prevention and reduce the amount of waste generated in the first place i.e. minimize the resources needed to do the job. Prevention is financially advantageous as it reduces the purchase of construction materials and obviates the need to remove waste from site. The contractor will be encouraged to reduce waste at source.

A number of mitigation and management measures can be instigated to encourage waste reduction. These control measures include:

a) Contractor shall maintain a tidy site by implementing good housekeeping, which can reduce waste generation;

b) Contractor shall store construction material at site in a safe and responsible manner to preserve the quality and in turn minimize waste;

c) Contractors will be expected where ever possible to use locally available material, as this reduces the impact associated with materials transportation, such as greenhouse gas emissions, and is therefore recommended;

d) Where possible, materials will be ordered in bulk – to reduce packaging.

e) Purchase materials with minimum of packaging waste to dispose of;

f) Where possible plastic drums, wooden pallets, cardboard, empty plastic bottles, scrap metal, batteries, waste paper and waste POL will be segregated on site and sent to recycling;

g) Contractor should re-use as much material on site if practicable, including:

   i. Bricks and concrete can be crushed by an onsite crusher or transported to an existing crusher. The resulting material can then be used as granular fill or aggregate either within the Project site or elsewhere;

   ii. Soil and rubble can be used as subsoil for landscaping. Rubble can be processed and used for a number of purposes including aggregate for roads. Leftover masonry material can be crushed on site and reused in driveways;

   iii. Reusing materials within a site conserves money and reduces transport costs, both for disposal and from transportation of new materials;

   iv. Excess concrete from pours can be re-used as formwork (e.g. paving slabs or new jersey concrete barriers) instead of being sent for recycling or disposal;

   v. Consider whether existing products (such as wooden pallets) can be reused instead of purchasing new products;

   vi. Salvage material from demolition sites, which may be reused at a later stage. Clean timber boards and formwork to facilitate reuse;

   vii. Have a management plan to help reduce surplus material;

   viii. Ensure that contracts for construction and demolition work require waste to be segregated and stockpiled for recycling; and

   ix. Influence subcontractors to take away and re-use surplus materials in the same or other projects.

17.2. Waste Collection

All waste on the project must be collected and stored in an appropriate metal skip or similar. A number of mitigation and management measures can be instigated to aid waste collection. These control measures include:

a) Waste Chutes - are often used to transfer waste from vertical constructions to the ground level.
   i. The Contractor shall provide enclosed chutes of wood or metal where materials are dropped more than 5 m. They usually consist of a plastic or metal tube (about 1 metre in diameter) through which waste is dropped.
   ii. The area onto which the material is dropped shall be provided with suitable enclosed protection barriers and warning signs of the hazard of falling materials;
   iii. Waste materials shall not be removed from the lower area until handling of materials above has ceased.
   iv. Waste chutes should deposit the waste directly into waste skips and not deposit them on to the ground where they are uncontrolled;
   v. Dust netting or similar should be placed around the skip and along the length of the chute to contain any dust clouds upon impact and also to stop any loose waste escaping; and
   vi. Measures installed to ensure that if there are multiple access points to the rubbish chute at different heights that no two workers can access the rubbish chute at the same time.

b) Liquid waste, such as greywater, sewage, slurry and other wastewater will be collected from source (typically a GRP tank or similar such as a septic tank) by a designated tanker and taken off-site for disposal at a Regulatory Authority-approved facility

c) Waste Bins / Containers
   i. Bins (wheely bins, Flexible IBC's or other suitable containers) shall be used for the storage of waste.
   ii. All bins shall be clearly labeled.
   iii. Bins shall be located in areas for ease of access to persons or activities where waste generation is reasonably expected.
   iv. Bins containing food waste, should be fitted with close-fitted lids.

17.3. Waste Segregation

Waste generated will be sorted and segregated at source to avoid mixing of incompatible waste materials, in accordance with Qatar regulations. Toxic and hazardous waste shall be collected separately and be disposed of in accordance with current regulations.

The Contractor shall establish a system for segregation for the recycling of construction and other waste on site as it is not permitted to send any mixed waste to governmental disposal grounds.

Whenever possible, clearly identify which waste should go in which skip, either with signs/pictures or by color-coding the skips. The main solid and hazardous segregation types are:

a) Food waste;
b) General waste (e.g. plastic, paper, card);
c) Hazardous waste (e.g. paint/fuel/oil cans, PCBs, oily rags, contaminated soil, etc);
d) Concrete waste (just dry concrete - breezeblocks or spilled concrete material);
e) Metal waste (e.g. rebar, girders or similar) has a good re-sale value, so should be segregated into separate skip or fenced off area;
f) Timber waste (e.g. from formwork or crates); and
g) Green waste (typically vegetation cuttings).

17.4. Waste Storage

A number of mitigation and management measures can be instigated to aid waste storage. These control measures include:

a) An adequate number of containers (skips, bins or similar) will be strategically placed throughout the construction areas and temporary facilities.

b) The waste containers will be regularly collected and taken to the main waste storage area;

c) The Contractor shall remove waste containers from site as soon as they are full. Waste containers shall not be allowed to overflow;

d) Containers will be regularly inspected. Waste receptacles will be kept securely closed during accumulation (except for open-topped trash skips) and storage, except when it is necessary to add waste, and will be tightly sealed prior to transportation from the generation area;

e) Containers should be in a good state of repair. Containers that are damaged beyond unreasonable wear and tear must be removed from the project and replaced with equivalent containers.

f) Containers will not be opened, handled or stored in a manner, which may rupture the container or cause it to leak.

g) Containers will be lifted using only the designated lifting points;

h) The storage containers will be of sufficient size and number to contain all solid wastes generated between collections.

i) The contractor will store waste appropriately, depending on the type of waste being stored, with a sufficient number of skips/storage areas for the different wastes:

j) All food waste will be properly stored in containers with closed metal or hard plastic tops to minimize the possibility of vermin infestation or odour emanating;

k) All light-weight waste skips (particularly those for plastic/cardboard) should have covers (tarpaulin/netting) in order to stop light weight waste being blown around site by the wind;

l) General waste storage on bare ground is not permitted. Where it is not feasible to store waste in a skip, waste must be stored on a reinforced impervious concrete base.

m) Place a bucket with sand near staff canteen or mess halls, for safe disposal of cigarette butts. Cigarette butts contain toxins and must not be left on the ground;

n) Timber should be stored separately (either in skip or fenced off area), but not allowed to grow into a large bonfire size, where it could have safety risks;

o) Inert construction waste will be segregated into combustible and non-combustible;

p) Combustible and flammable substances will be kept away from sources of ignition;

q) Old tyres are a fire hazard. Do not allow stockpiling of used tyres. Take them to a tyre recycling contractor or landfill for disposal;

r) Segregated, dedicated waste skip or fenced off area just for storing dry concrete (breezeblocks or spilled concrete material), ensuring that wet concrete sludge is not stored with it;

s) Remove any plastic from the concrete (e.g. plastic used to contain any drips when pouring) before placing within waste pile; and

t) Waste Sorting Area

   i. If the dumped waste is likely to contain food or hazardous waste, then the sorting area should have a base made of hardstand (e.g. impermeable concrete) to stop any potential contamination of the ground or groundwater

   ii. The sorting area should be contained tightly with hoardings and/or green netting to stop any wind-blown waste from escaping from the area and impacting other activities; and

   iii. The sorting area (as well as any skips, bins or waste piles) will be at least 30m away from any water bodies.

17.5. Waste Disposal

Contractor is reminded that they are ultimately responsible for all activities of their sub-consultants, including those who dispose of waste on their behalf. Contractor will dispose of waste appropriately:

a) The Contractor will arrange for the transfer and transportation of waste consignments with the Regulatory Authority approved / licensed Waste Management Contractor (WMC). Before the transportation takes place, the Contractor will check the contents, packing, labelling and documentation of the waste;

b) The contractor shall ensure that the waste transfetr note (WTN) is completed and jointly signed by representatives from the Contractor and the Waste Management Company,

c) Contractor shall ensure that waste materials are removed off site at a suitable frequency to prevent excessive waste accumulatuion, overflowing skips and waste being stored on bare ground

d) The Contractor will not release the waste if there is concern about the standard of transport or destination of the waste. No waste will be disposed of or removed from the construction site without the knowledge and approval of the Contractor Environmental Representative;

e) Waste will be transported to an Regulatory Authority-approved disposal facility;

f) Vehicles delivering waste to the disposal area will be covered where necessary, to prevent dropping, leaking, sifting or blowing of solid waste from the vehicle;

g) Any spillages or waste lost from disposal vehicle en route to the disposal site shall be promptly cleaned up;

h) Domestic and biodegradable waste from offices, canteens and welfare facilities shall be removed daily from the Site;

i) The Contractor shall not dump or bury waste on the Site;

j) No waste shall be burnt on site;

k) Waste generated during marine activities, must be fully contained, kept on board and disposed of appropriately once ashore. No waste is to be disposed overboard;

l) Marine vessels with toilet/ ablution facilities must include a holding tank on board for sewage. The holding tank must be pumped out only at a designated pump out facilities and by a Regulatory Authority approved facility, never into the sea; and

m) It is prohibited to discharge bilge or ballast water into marine waters. Bilge and ballast waters are contaminated with oil, grease, sewage and other chemicals, and are harmful to the marine environment. Bilge and ballast water must be stored securely on board the vessel, and then discharged into a port/ marina treatment facility.

n) Hazardous waste will be disposed of at aa Regulatory Authority approved facility. It will remain segregated and in the labelled storage containers; and

o) Incompatible hazardous wastes will not be transported together.

17.6. Waste Records

In order to ensure that we can be confident that waste generated throughout the Project is disposed of appropriately, some additional paperwork is required to assist in the tracking of waste.

a) Client requires proof material has been removed from site, but also that it has been disposed of appropriately at an approved location and facility;

b) Waste records are also required by GSAS as part of the accreditation process to confirm that amount of waste being recycled and re-used. A waste tracking system will be developed using a Waste Transfer Note (WTN) or similar;

c) In the WTN, a full description of the waste, the waste type, waste quantity shall be detailed. The Contractor will maintain a register of all waste shippments and disposal locations. The record of waste being disposed will include date, time, type of waste and approx. volume of waste. Safety Data Sheets will be consulted by the HSE Representative; and

d) These waste records will be audited on a regular basis to monitor the quantity and type of waste being produced in order to analyse where improvements can be made in either reducing the quantity of waste being produced or increasing the diversion of waste from the landfill towards re-use or recycling.

17.7. Waste Service Providers

Only waste contractors that have been approved by the regulatory body are used to transport waste.

a) The waste disposal contractors will provide details to confirm that they are on the Regulatory Authority-approved list; and

b) The waste disposal contractors will provide details to confirm that they are certified for the types of waste that they will be transporting.

17.8. Hazardous Waste requirements

Contractor will store hazardous waste appropriately:

a) Fire prevention systems and pollution control equipment will be provided for storage facilities where necessary, to prevent fires or the releases of hazardous materials to the environment;

b) Containers intended for hazardous waste disposal will not be used for other purposes unless they are specifically labelled for that purpose. Rusty, dented or defective containers for waste accumulation or storage will not be used;

c) Hazardous waste will be retained in a secure area with an impervious bunded base;

d) Different types of hazardous waste will be stored separately to avoid adverse chemical reactions and facilitate eventual treatment;

e) Drain used oil or fuel filters of the residual liquids by placing them on a mesh rack in a tray or drum. The drained filter can then be disposed of as scrap metal. The drained oil or fuel must be collected by a waste oil recycling contractor;

f) Unused liquid paints cannot be disposed of with general waste. Only completely dried-out paint residue tins/ drums may be disposed of with solid waste;

g) Store used batteries on a concreted surface or metal/ hard plastic tray. This is due to the acid content. Used batteries must be sent for recycling;

h) Ensure that bentonite fluid mixtures used during piling and other site works are contained. Use appropriate measures to prevent the slurry mixtures spreading to other parts of the site or adjacent works. This can be done using adequate temporary containment barriers placed around the piling bores to prevent lateral spreading of bentonite/ cement fluids;

i) There are specific requirements in Section 22 for managing the liquid waste and/ or slurry from concreting activities, for example, wash-out of concrete trucks and hand-mixers;

j) Liquid hazardous waste shall not be left in open containers. They shall be stored in sealed containers only.

k) Hazardous waste containers shall be clearly labelled indicating contents of containers, using suitable hazardous waste labels and hazardious classification placards

l) Empty hazardous waste containers (fuel/oil drums, chemical containers, etc) shall be stored within a bunded area or spill tray until disposal.

m) Expired hazardous materials shall be treated as hazardous waste

n) Hazardous waste will be stored separately from non-hazardous waste and away from sources of ignition;

o) Hazardous waste will be stored in tightly closed, leak-proof containers made of or lined with, materials that are compatible with the hazardous waste to be stored. Containers will be clearly marked with appropriate warning labels to accurately describe their contents and detailed safety precautions. Labels will be waterproof, securely attached, and written in Arabic and English. Wherever possible, chemicals will be kept in their original container;

p) Hazardous chemicals will be stored and handled in accordance with the manufacturers Material Safety Data Sheet (MSDS);

q) Hazardous waste shall be stored on site for a maximum period not exceeding 180 days

r) Spill prevention measures will be adhered to; and

s) The Contractor will maintain a register of all hazardous waste and disposal methods. MSDS will be consulted by the Contractor.

17.8.1. Hazardous Waste Classification

Table 17-1 below gives the classification of the hazardous waste following Qatari regulation.

Code	Description
Y1	Medical waste resulting from hospitals and medical clinics and centres
Y2	Waste resulting from producing and preparing pharmaceutical products
Y3	Pharmaceutical waste, drugs and medication
Y4	Waste resulting from producing, composing and using bio-toxics and pharmaceutical vegetal products
Y5	Waste resulting from producing, composing and using preservatives of timber
Y6	Waste resulting from producing, composing and using bio-solvents
Y7	Waste resulting from thermal treatment and mixing operations that contain cyanide
Y8	Waste of mineral oils that are consumed and may not be used for its designated purposes.
Y9	Waste of oils, water, mixtures of hydrocarbons with water and emulsions
Y10	Waste of substances and objects containing or polluted with PCBS and/or PBBS
Y11	Waste of tar residual resulting from the refining, distillation and thermal treatment operations
Y12	Waste resulting from producing, composing and using inks, tinctures, colors, paints and varnish.
Y13	Waste resulting from producing, composing and using resins, saps, substances with added plastics, glues and sticking substances.
Y14	Waste of chemical substances resulting from unknown and new researches, development and educational activities with unknown impacts on humans and the environment
Y15	Waste with explosive nature
Y16	Waste resulting from producing, composing and using photographic chemicals and substances used for developing films.
Y17	Waste resulting from treating metallic and plastic surfaces
Y18	Waste resulting from industrial waste disposal operations
Y19	Metallic carbonyl
Y20	Beryllium and its compounds
Y21	Chromium Hexavalent compounds
Y22	Copper compounds
Y23	Zink compounds
Y24	Arsine and its compounds
Y25	Selenium and its compounds
Y26	Cadmium and its compounds
Y27	Antimony and its components
Y28	Tellurium and its compounds
Y29	Mercury and its compounds
Y30	Thallium and its compounds

Code	Description
Y31	Lead and its compounds
Y32	Inorganic Fluorine compounds except the Calcium fluoride
Y33	Inorganic Cyanide
Y34	Acid bases and solid bases solutions
Y35	Alkaline solutions and solid alkaline bases
Y36	Asbestos (dust and fibers)
Y37	Organic phosphoric compounds
Y38	Organic cyanide
Y39	Phenol and its compounds including phenol chlorine

Table 17-1 - Classification of the Hazardous Waste

17.8.2. Hazardous Waste Treatment and Disposal Options

Table 17-2 lists operations that do not lead to the restoring of resources or recycling them, reclaiming land, direct re-utilization of these resources or other applications:

Code	Operations
D1	Placement on or under the ground (such as covering with soil, burying, etc.)
D2	Land treatment (biological wash-off to remove from soil any liquids, muddy waste, etc.)
D3	Deep injection (such as injecting liquid waste into wells, natural salty cavities constituting natural depositories, etc)
D4	Surface accumulation (such as placing liquid and muddy waste in shallow holes, ponds, lakes, etc.)
D5	Burying underground in a special geometrical manner (such as placing waste within special rooms lined up, covered and isolated from each other and from the surrounding environment etc…)
D6	Discharging into an aquatic environment except seas/ oceans
D7	Discharging into seas/oceans including discharge in the seabed
D8	Biological treatment that may finally create compounds or mixtures, which can be disposed of through any operation stated in Part (A)
D9	Physicochemical treatment (not determined in any part of this Appendix) that may finally create compounds or mixtures, which can be disposed of through any operation stated in Part (A) (such as vaporization, dehydration, burning, neutralization, sedimentation, etc.)
D10	Burning onshore
D11	Burning offshore
D12	Permanent storage (such as placing containers in mines, etc.)
D13	Mixing and blending before undertaking any of the operations stated in Part(A)
D14	Re-packing before undertaking any of the operations stated in Part (A)
D15	Storage until undertaking any of the operations stated in Part (A)

Table 17-2 – Part A - Hazardous Waste Treatment and Disposal Options

Table 17-3 lists operations for disposal and treatment of hazardous waste that can be re-used, restoring of resources, recycling them, reclaiming land or for any other applications.

This part includes all operations relative to substances distinguished by law as hazardous waste, unless disposed and moved to operations stated in Table 17-2, to be reused and recycled.

Code	Operation
R1	Reusing as fuel (except direct burning and other methods) to generate power
R2	Repairing and regenerating solvents
R3	Recycling and repairing organic substances that were not used as solvents
R4	Recycling and repairing mineral and mineral compounds
R5	Recycling and repairing other non-organic compounds
R6	Regenerating acids and bases
R7	Restoring compounds used to control pollution
R8	Restoring compounds from catalyzers
R9	Refining used oils or reusing used oils
R10	Land treating to for agriculture benefits and environmental development
R11	Using waste of substances resulting from any of the operations numbered R1 to R10
R12	Exchanging waste to undertake any of the operations numbered R1 to R11
R13	Collecting substances required for any of the operations stated in Part (B)

Table 17-3 - Part B - Hazardous Waste Treatment and Disposal Options

18. EROSION AND SEDIMENT CONTROL

The purpose of this chapter is to guide the Contractor and sub-contractors to minimize erosion, detain excess storm water run-off and prevent off-site sedimentation during the activities associated with the project construction works.

18.1. Erosion Control

The most environmentally dangerous period of development is the initial construction phase when land is cleared of vegetation and the topography is graded to create a proper surface for construction. The removal of natural vegetation and topsoil makes the exposed area particularly susceptible to erosion, causing transformation of existing drainage areas and disturbance of sensitive areas.

A number of mitigation and management measures can be instigated to reduce erosion impacts that destabilize the ground and generate dust. These control measures include:

a) Traffic Movements

i. Movement of vehicles should be restricted to defined and established access routes to minimise dust emissions and control soil compaction;

ii. Vehicle speeds will be regulated on all un-surfaced roads to 30km/h or less, as appropriate;

iii. Construction of access roads will be reduced by using existing tracks/easements wherever possible. Make use of the final road alignment so that area is only disturbed once;

iv. Tracked sediment must be removed from all off-site paved surfaces by street sweeping within 24 hours of discovery;

v. On sites with high traffic, measures such as stone pads, concrete or steel wash racks, or equivalent systems may be required to minimize vehicle tracking of sediment; and

vi. Temporary rock construction entrances must be installed and maintained wherever vehicles enter and exit a site.

b) Road Stabilisation

i. Stabilise construction roads with gravel (or similar) immediately after grading;

ii. If the road or work area is to carry only light to medium traffic flows and light vehicles then the road must be gravelled (i.e. gravel/railway ballast/crushed concrete) to suppress dust;

iii. If the road or work area is to carry heavy traffic flows or heavy machinery then a dust suppression regime must be implemented e.g. wetting down where required (i.e. water cart);

iv. Temporary access and haul roads will be dampened down with water to minimise dust from vehicular traffic where necessary;

v. Water used for dust suppression during earthworks should meet municipal health standards and should not exceed the salinity levels of the groundwater on site;

vi. Dust suppression of road and embankments will be applied in a manner that will not lead to water pooling or surface water flow that causes erosion;

vii. The surface to be sprayed will be compacted and swept at the appropriate moisture content prior to spraying to minimise wash out to the environment;

viii. Temporary construction access roads will be graded to a crown. Runoff from access roads will be directed to open unlined drains/soakaways.

ix. Sprayer will be positioned to avoid spraying beyond the area to be primed or primer sealed, where the bituminous material could be more readily washed out into the drainage system or sediment traps. The sprayer will be well maintained, operated by a trained crew and the spray nozzle will be checked for correct working so bituminous material is applied at the design rate of application uniformly across the surface; and

x. Where the surface of site roads becomes excessively compacted by heavy vehicle traffic the surface will be lightly rippled to encourage infiltration rather than runoff.

c) Landscape Stabilisation

i. Land clearing will be kept to a minimum so as to keep vegetation cover that will stabilise the ground and reduce dusty environments;

ii. Install fences, trees and shrubbery to minimise the visual impact of the Project and also to stabilise landscaped areas of soil; and

iii. Consider the use of dust suppression materials where active construction has ceased. This could include concreting areas of the site that are not developed immediately or covering with sub-grade to stabilise the area. Landscaping of bare areas (including seeding and mulching) should be prioritised where it is unlikely to be damaged by later development;

iv. Existing vegetation to be maintained whenever possible and the area of disturbance to be minimised. Trees to be retained and protected to enhance future landscaping efforts and reduce raindrop impact;

v. Appropriate erosion and sediment control structures (such as geotextile fabric and hay bales) will be provided where necessary;

vi. For on-going works or operations: installation of vegetation buffers i.e. turf stripping, down gradient of works or operations;

vii. A reinstatement plan will be implemented to minimise the potential for disturbed soil and sediments to leave the construction site. Immediate re-vegetation (wherever needed) following completion of works; and

viii. Progressively compact (stabilise) the ground to minimise the erosion of unconsolidated and un-vegetated material;

d) Limit earthworks and the extent of filling to the minimum required for the proposed facilities

i. Activities in sites and soils that are susceptible to erosion by wind will be minimised.

ii. Construction activities to be timed, as so far as is possible, so that the area of exposed soil is minimised during times of the year when the potential for erosion is high;

iii. Minimising the area of land to be disturbed at any one time by staging of construction activities and the progressive implementation of the works; and

iv. Backfilling activities will be undertaken in horizontal layers and soil will be previously dampened and immediately compacted in situ to minimise erosion.

e) The Contractor will be responsible for inspections and maintenance on the site, maintain documentation for review, and undertake inspections as follows:

i. Once every 7 days on exposed soil areas;

ii. Within 24 hours after a one-half inch rain event over 24 hours;

iii. Once every 30 days on stabilized areas; and

iv. As soon as runoff occurs or prior to resuming construction on frozen ground.

18.2. Stockpile Management

Stockpiled soil and other materials are common on construction sites and are a potential source of dust and sediment run-off. Soil stockpiles, like disturbed soil areas, are susceptible to erosion.

While requirements vary by type (material in stockpile), status (active or non-active) and season (rainy or non-rainy), the best ways to minimize or prevent runoff pollution from stockpiles are:

a) Where access to stockpiles is not required for a period longer than a day, the stockpile will be covered with netting or similar material to minimize wind erosion and storm water ingress into material;

b) Unstabilized stockpiles (and those being regularly worked) will be watered down (either by hand or temporary sprinklers) to suppress dust

c) Stockpiles will be placed in sheltered or covered areas, with temporary wind screens erected around stockpiles exposed to wind effects where necessary;

d) Locating stockpiles on flat areas, away from stormwater or dewatering drainage flow paths, with diversion of all up-gradient flows around stockpiled material;

e) Stockpile materials (temporary stockpiling of excavated soils) will be kept within designated areas at site, which is located at a sufficient distance from marine waters (minimum of 10m from high-tide mark);

f) If it is essential to stockpile materials close to the water, runoff control measures will be implemented, such as the excavation of a shallow water/sediment collection ditch around the stockpiles to contain run-off water for a sufficient length of time to allow the settlement of particulates;

g) A berm will be installed around the long-term stockpile to prevent runoff and entry of potential stormwater from other areas;

h) The boundaries of stockpiles or other storage compounds (e.g. construction materials) will be clearly marked with physical markers, such as posts, to limit the potential damage from vehicles knocking/pushing down earth to marine bodies;

i) Number and size of stockpiles to be kept to a minimum;

j) Topsoil to be kept separate from under burden when stockpiling soil;

k) Limiting the height and slope of stockpiles to minimise erosion of unconsolidated materials during rainfall events;

l) Stockpiles to be constructed with no slope greater than 2:1 (horizontal to vertical). A less steep slope may be required where the erosion risk is high;

m) All unstabilized stockpiles will be circled with silt fences or a drainage system that will collect and correctly dispose of contaminated water;

n) Erodible stockpiles will not be placed in surface waters, including storm water conveyances such as curb and gutter systems, conduits, and ditches;

o) All exposed soil areas will be stabilized if they have not been worked for 7 days on slopes greater than 3 feet horizontal to one foot vertical (3:1 slope); 14 days on sloped ranging from 3:1 to 10:1; and 21 days on flatter slopes; and

p) Stabilization measures include hydro-seeding, mulching, plastic sheeting, or similar measures to protect the stockpile from rain and wind erosion.

18.3. Stormwater Control

Stormwater resulting from a significant rainfall event during construction has the potential to be contaminated by these pollutants and infiltrate and contaminate groundwater, or to flow on to neighboring sites.

A number of mitigation and management measures can be instigated to control storm water and run-off. These control measures include:

a) Contractor to prepare a drainage management plan for their allocated area(s);

b) Investigate the existing site hydrology at the Project site, including the watercourses within the Project site, to confirm the need and location for culverts and other drainage structures;

c) When the surface of any access roads and vehicle turning areas has become excessively compacted by heavy vehicle traffic, it will be lightly ripped to encourage infiltration of stormwater rather than runoff;

d) To ensure minimal impact: construction activities should not be scheduled when there is significant potential for heavy rainfall; backfilling activities should be undertaken in horizontal layers with dampened soil; and in situ soil compaction undertaken immediately;

e) Diversion of overland flow around work areas / construction sites;

   i. Contractors who will be working closer to water bodies shall maintain a ditch, at least 10 m inland from the high tide water mark (suggested dimensions of 30cm deep × 30 cm wide) along the side of the water bodies as a minimum control measure to catch any runoff from reaching the water bodies;

ii. Storm water collection drains should be provided all along the stock piles and drained water will be allowed to pass through a pit/sump to collect the silt prior to disposing the storm water into the water bodies and/or flooded areas; and

iii. Storm water run-off controls (bunds) to be installed around soil stockpiles near the water body's shoreline.

f) Storm Drain Protection

i. Inlet protection will be placed prior to or concurrent with any up-gradient disturbance. Storm drain inlets will remain in place until stabilization of the site.

ii. Sediment deposits will be removed from these devices when the sediment has accumulated to between 1/3 and 1/2 of the design depth of the device, or when the device is no longer functioning as designed; and

iii. Manholes will always be adequately covered and temporarily sealed so as to prevent sand, construction materials or debris from entering the drainage system;

g) The Contractor shall provide sediment settling tanks or ponds for all storm water run-off within their contracted area.

i. Any runoff with heavy sediments and particulate matter, due to a potential incident of heavy rainfall, shall be prevented from reaching the water bodies;

ii. Possible use of sediment ponds (unused excavations) to collect storm water run-off containing excess sediment during construction, particularly in winter months. Any storm water discharges should also be monitored to assess compliance against adopted guidelines; and

iii. The size of the pit/sump is to be determined by Contractors engineer/Clients engineer based upon the size of the activity.

h) The traditional 'soak away' design of drainage systems could cause flooding in case of heavy rain events. The stormwater run-off system should consist of entry pits, underground pipes and soakaways. It is recommended to incorporate a treatment system consistent with the infrequent runoff nature of rainfall in the region consisting of stormwater quality improvement devices, sediment sumps and biological treatment devices.

i) Use of individual or centralised pollution controls upstream of the stormwater discharge/collection points to capture gross pollutants and sediments picked up in stormwater runoff prior to discharge from the Project site. These could include:

i. Gross Pollutant traps (GPTs) which require adequate access points and regular cleaning to collect and suitably dispose of matter collected;

ii. An oil-bypass interceptor tanks to remove any suspended contaminants;

iii. Stormwater collected in bunded areas may be contaminated. The treatment and/or disposal of storm water collected in bunded area should be determined in consultation with regulatory authority. Contractor shall obtain the necessary approval from regulatory authority before discharge to the sewer; and

iv. Collected storm water could be a potential source of irrigation water. Therefore, the storm water collection tank could be connected to the irrigation network and made use of after a rain event (only if water is acceptable and meets standards for use).

j) Fuel, mineral oils, soil stockpiles or hazardous material should not be stored within 50m of the water bodies shoreline;

k) The chemical application of pest control in any manmade islands or along marine water sources that cause runoff is strictly prohibited;

l) Regular inspections of all erosion and sedimentation controls during the construction period to ensure their continued effectiveness; and

m) Concrete Washouts must be designed to properly handle solids, wash water and rainfall to prevent overflow. Check all concrete washouts facilities daily to determine if they have been filled to 75 percent capacity, which is when materials need to be removed. Self-installed washouts must be inspected daily to ensure that plastic linings are intact and sidewalls have not been damaged by construction activities.

18.4. Sediment Control

A sediment control is a practice or device designed to keep eroded soil on a construction site, so that it does not wash off and cause water pollution to a nearby stream, river, lake, or sea. Often these practices intercept and slow or detain the flow of storm water to allow sediment to settle and be trapped. These control measures include:

a) Installation of linear sediment barriers (such as silt fence, sandbag barrier, and straw bale barrier), which are typically placed below the toe of exposed and erodible slopes, down-slope of exposed soil areas, around soil stockpiles, and at other appropriate locations along the site perimeter;

b) Provide fibre rolls, gravel bag berms, or check dams to break up slope length or flow;

c) Install buffer zone or vegetated filter strip to catch sediment and decrease velocity of runoff;

d) Temporary and permanent seeding and mulching to absorb stormwater run-off and retain some of the sediment-laden water;

e) Installation of earth dykes to contain sediment;

f) Diversion ditches to keep up-slope runoff from crossing areas of high erosion risk and direct runoff to temporary sediment trapping basins; and

g) Ensure that drain surface of drainage lines should be rock-lined to minimize erosion.

h) Installation of a sediment basin (temporary pond) to capture eroded or disturbed soil that is washed off during rain storms, and protect the water quality of a nearby river, sea or lake:

   i. Sediment detention basin is installed down-gradient of disturbed area;

   ii. Are installed before land disturbance (earth moving, grading) begins on a construction site;

   iii. The sediment-laden soil settles in the pond before the runoff is discharged;

   iv. On some construction projects, the sediment basin is cleaned out after the soil disturbance (earth-moving) phase of the project, and modified to function as a permanent storm water management system for the completed site, either as a detention basin or retention basin;

   v. If care is not taken when pumping a sediment basin, the sediment that was retained in the basin can be sucked downstream. A pump inlet should always be attached to a floating suction or a well-packed and placed well point. If using a floating suction, use one that has a plate on the bottom to guard against sediment being sucked off the bottom; and

   vi. Sediment basins can become ineffective in removing fine sediments such as fine silts and clays. As sediments settle into the basin, the retention time decreases. This decreases efficiency. They require a relatively large surface area.

   vii. On smaller construction sites where a basin is not practical (e.g. construction sites smaller than 5 acres in size), sediment traps may be used. A sediment trap is an embankment built along a waterway or low-lying area on the site and is typically installed at the perimeter of a site and above storm drain inlets, to keep sediment from entering the drainage system.

i) A silt fence is a temporary sediment control device used on construction sites to protect water quality in nearby streams, rivers, lakes and seas from sediment (loose soil) in stormwater runoff. Silt fences are perimeter controls, typically used in combination with sediment basins and sediment traps, as well as erosion controls, which are designed to retain sediment in place where soil is being disturbed by construction processes (i.e., land grading, reclamation and other earthworks).

   i. Silt fence will be installed along the perimeter of the area to be cleared and graded before any grading that takes place and placed around all soil and erodible materials stockpiles;

   ii. Silt fence will be properly installed by being trenched and buried at least six inches into the soil to stop the fence floating free when a strong flow or current strikes it;

   iii. All silt fences must be repaired, replaced, or supplemented when they become non-functional or the sediment reaches 1/3 of the height of the fence. These repairs must be made within 24 hours of discovery, or as soon as field conditions allow access;

iv. Less extensive silt fencing, limited to down-gradient contours, or alternate perimeter controls may be installed upon written approval by the LREDC Representative;

v. A typical fence consists of a piece of synthetic filter fabric (also called a geotextile) stretched between a series of wooden or metal fence stakes along a horizontal contour level. The stakes are installed on the downhill side of the fence, and the bottom edge of the fabric is trenched into the soil and backfilled on the uphill side;

vi. The storm water slowly passes through the fence while depositing its sediments on the uphill side of the fence. The fence is not designed to concentrate or channel storm water. The fence is installed on a site before soil disturbance begins, down-slope from the disturbance area;

vii. Sediment is captured by silt fences primarily through ponding of water and settling, rather than filtration by the fabric. Sand and silt tends to clog the fabric, and then the sediments settle in the temporary pond;

viii. Silt fences may perform poorly for a variety of reasons, including improper location (e.g. placing fence in an area with concentrated storm water flows), improper installation (e.g. failure to adequately embed and backfill the lower edge of fabric in the soil) and lack of maintenance. The fabric may become damaged with holes and tears if construction materials are stored next to or on top of the fence; and

ix. During various phases of construction at a site, a silt fence may be removed and relocated multiple times. It may be difficult to maintain effectiveness of a silt fence under such operating conditions. Location of fences in areas with high flows may lead to fence failures

j) Sediment-laden water that is being removed from construction site by pumping or trenching will be treated (typically by being retained within a gravity based settlement tank) to remove suspended solids prior to discharge for reuse or disposal.

i. Discharges from dewatering operations will be directed to settlement tanks or basins to reduce the potential impact to the marine environment. These will be designed to be adequately sized to allow sufficient retention time to permit suspended solids to settle;

ii. Sediment laden water is pumped into one end of the tank from a collection point, and the water travels over and under a series of weirs (baffles) before reaching the outlet at the other end of the tank. The weirs serve to maximize the distance the water must travel inside the tank. They also minimize water turbulence. Both of these factors greatly increase the settling efficiency of the weir tank over a standard tank;

iii. Settlement tanks will be visually checked daily by technicians to ensure the filters are not clogged and that there are no free floating sediments visible on water surface;

iv. Ensure that the settlement tank comes with a cleanout manway in each compartment as long term projects or flows with very high sediment loads may require regular cleanout during the project to remove the sediment build-up within the tank;

v. It is preferable to have a closed top or lids that can cover the tank to prevent workers or kids from falling into the tank. This is very important because these tanks are often placed in unsecured areas;

vi. Water quality will be monitored for turbidity by using turbidity meter (when required); and

vii. The water may then be reused as a dust suppressant, if it meets regulatory standards

k) Wastewater (such as groundwater from dewatering activities) may not be discharged in a manner that causes erosion to receiving channels or flooding of the discharge site:

i. Groundwater discharges to the marine environment or land will only commence once a Dewatering Permit has been received from the Regulatory Authority (if required) and the provisions of that permit have been met;

ii. Marine outfall discharge points will be at least 1m below the low tide level to prevent shore run off and to avoid risk of erosion to the seabed and soils; and

iii. Where ground water is discharged to the marine environment, discharge flows will be reduced to prevent scour and edge protection measures will be employed.

19. SOIL AND EARTHWORKS CONTROL

The purpose of this chapter is to guide the Contractor and sub-contractors to eliminating or minimizing impacts or pollution to soil and groundwater during the construction works.

19.1. Earthworks

Earthworks are engineering works created through the moving or processing of quantities of soil or unformed rock. Typical earthworks include constructing roads, railway beds, causeways, dams, levees, canals, and berms, as well as land grading to reconfigure the topography of a site, or to stabilize slopes.

a) General Earthworks Control Measures undertaken in order to minimise / mitigate potential soil and water contamination during earthwork activities:

i. Requirements for stockpiling of excavated materials (prior to use as a fill material) will be minimized – both in terms of time stockpiled and quantities – through reuse as soon as practicable.

ii. Excavated materials will be stockpiled for as short a time as possible.

iii. Ensure that dry stockpiled material are stored a minimum of 10m from water bodies (high-tide mark); and

iv. Ensure that stockpiles of reclaimed material are stored 30m away from water bodies (high-tide mark).

v. Handling of excavated materials will be minimized and the distances from the excavation site to the fill site will be kept as short as possible.

vi. Wherever possible, construction activities are not to be scheduled when there is significant potential for heavy rainfall, and work shall stop upon the occurrence of a storm event

vii. Backfilling activities shall be undertaken in horizontal layers with soil having previously been dampened. Soils will be immediately compacted in situ to minimise erosion.

viii. Vehicles used for transporting waste soil and rock shall not be used to transport any other type of waste, unless cleaned prior to reuse.

ix. An environmental evaluation will be completed for material disposal sites. The preferred site will be selected based on the following criteria:

a. Distance from sensitive receivers (residential/commercial activities, sites of ecological importance);

b. Habitat value;

c. Archaeological value; and

d. Potential impact on surrounding traffic flows.

x. Contractor's responsibility to perform whatever analyses are necessary to obtain SH&E Representative approval of the proposed disposal site prior to depositing materials off-site.

xi. Spoil will not be deposited:

a. In environmentally sensitive areas without the approval of (regulatory authority);

b. In watercourses or valley bottoms;

c. Where such material will potentially interrupt concentrated overland flow (wadis);

d. Mangrove areas;

e. Beach and dune areas; and

f. In such a way as to cause a landscape (visual) impact.

b) Re-profiling (Cut and Fill) is the process of constructing a railway, road or canal whereby the amount of material from cuts roughly matches the amount of fill needed to make nearby embankments, so minimizing the amount of construction labour.

i. The cut and fill requirements for the Project will be designed in a way to limit earthworks;

ii. Cutting will be minimized by locating the route in close proximity to existing developed areas and infrastructure, where feasible, and along valley floors in the large dune areas;

iii. In low lying areas, excess sand will be pushed on the either side of the alignment not more than 400m from the right of way;

iv. Excess dune sand material will be disposed to avoid damaging sensitive environments such as sections of sabkha containing sand roses;

v. The alignment of the route will avoid contaminated areas (known or suspected), i.e. such as the drill cuttings disposal sites.

vi. The Contractor will obtain the required permit from the regulatory authority when sourcing the materials from an existing borrow pit;

vii. In the event that the existing borrow pit is located in a protected area or a virgin land will be utilised to supply the materials for the Project, the Contractor will obtain approval from the regulatory authority in addition to the permit required from the municipality;

viii. Material used to backfill excavations, should be suitable for the intended purpose and should show no visual or olfactory evidence of contamination;

ix. Material obtained for earthworks from off-site sources, should be tested prior to placement to ensure compliance and suitability;

x. Where visual evidence of potential contamination is observed, this will be reported to the SH&E Representative, and works will cease until approval to continue is received; and

xi. When considering the instillation of underground utilities, the following will apply:

a. Install the utility as quickly as possible to avoid disrupting other works in the vicinity;

b. Minimise the length of open excavation prior to and following utility installation;

c. Complete backfill operation as soon as possible after installation; and

d. Records of position and placement (location) to be kept for the purposes of demobilisation.

xii. Wind-deposited sand bodies occur as sand sheets, ripples, and dunes. Sand dunes can have a negative impact on humans when they encroach on human habitats such as roads or railways.

a. Windblown sand will be deposited outside of the Right Of Way and down predominant wind direction from the road or railway embankment as far as it is possible.

b. Windblown sand will be deposited locally to avoid transporting it over long distances and to avoid large accumulations of deposited sand.

c) Horizontal Directional Drilling and Piling (HDD) is a steerable trenchless method of installing underground infrastructure such as telecommunications and power cable conduits, water lines, sewer lines, gas lines, oil lines and product pipelines, when trenching or excavating is not practical, especially in urban areas for developing subsurface utilities.

i. Ensure adequate sized earth berms are installed around the giving and receiving pits for the boring/piling works in order to contain the drilling fluid slurry when it exits, especially in the case of a ‘blow out’;

ii. Install a secondary earth berm around the boring/piling works if required;

iii. Monitor works to ensure no spillage of slurry into water, mangroves or land; and

iv. Monitor disposal of slurry material to ensure that it is removed in compliance with regulatory authority standards;

19.2. Existing Contamination

Construction activities may not always take place in 'greenfield' locations and may have some pre-existing contamination in place from prior industrial, construction, residential or military operations, known as 'brownfield' sites. Site contamination could arise due to industrial processes, introduced soil or fill, use of hazardous chemical or substance use, persistent chemicals such as pesticides and heavy metals, fuel storage, inappropriate waste disposal, excavation or mining activities or migration from neighboring activities.

a) Upon identification of potential contaminated soil or similar, a Contaminated Site Assessment may be required to determine whether or not the potential for contamination exists on a site and how significant it is. They are divided into Phase 1, 2 and 3 Assessments.

b) There are several options for remediation and clean-up of contaminated soil:

   i. Excavate soil and take it to a disposal site away from ready pathways for human or sensitive ecosystem contact. This technique also applies to dredging of bay mud's containing toxins;

   ii. Aeration of soils at the contaminated site (with attendant risk of creating air pollution);

   iii. Thermal remediation by introduction of heat to raise subsurface temperatures sufficiently high to volatize chemical contaminants out of the soil for vapour extraction. Technologies include ISTD, electrical resistance heating (ERH), and ET-DSPtm;

   iv. Bioremediation, involving microbial digestion of certain organic chemicals. Techniques used in bioremediation include land farming, biostimulation and bioaugmentating soil biota with commercially available microflora;

   v. Extraction of groundwater or soil vapor with an active electromechanical system, with subsequent stripping of the contaminants from the extract;

   vi. Containment of the soil contaminants (such as by capping or paving over in place); and

   vii. Phytoremediation, or using plants (such as willow) to extract heavy metals

c) Excavation and Removal of Contaminated Soil

   i. If cut works are required at potential areas of contamination, samples of the excavated material will be collected and will be analysed for required regulatory parameters, which typically involve the Dutch Standards for soil and groundwater contamination;

   ii. The excavated material will be stored over an impermeable base (such as a concrete bund or plastic sheet) and will be covered by a tarpaulin or similar to avoid the spread of contamination through infiltration or windblown sand;

   iii. If exceedance of target or intervention values of the Dutch standards is noted, the material will not be re-used and will be treated as hazardous waste and disposed appropriately.

   iv. Contaminated soil or waste water generated from cleaning of machinery and equipment will be treated as hazardous waste.

   v. All contaminated materials will be removed from the site by the Company appointed and approved hazardous waste contractor by transfer trucks as per Regulatory standards. Waste Transfer Note (WTN) shall accompany each shipment of hazardous waste and copy of such WTN shall be kept by the both the Contractor and the transporters.

d) During demolition activities, hazardous materials may be uncovered (such as asbestos containing materials or lead painting). The control measures for dealing with these forms of contamination have been addressed within the LREDC Health and Safety Procedures.

e) During earthworks, unexploded ordnance (UXO) may be uncovered if the site was a former military installation or similar. The control measures for dealing with these forms of contamination have been addressed within the LREDC Health and Safety Procedures.

20. GROUNDWATER AND DEWATERING CONTROL

The purpose of this chapter is to guide the Contractor and sub-contractors to eliminating or minimizing impacts or pollution to groundwater during the construction work.

In the construction industry, the installation of deep foundations or basement levels will often involve reaching and penetrating the water table where the groundwater resides, especially if the project site is close to the sea where the water table will be higher. In these instances, the water table must be artificially lowered in order to allow construction to take place in a dry environment. This is achieved by using pumps to remove the water from areas where construction work is taking place and discharging it to a new location – a process called 'dewatering'.

This water may be removed offsite by tanker, discharged via pipe system to another land or sea location, or stored onsite in lakes or tanks. The quality of the groundwater may vary significantly, and hence the impacts on receiving location for the dewatering discharge must also be considered.

20.1. General Dewatering Requirements

This section details recommended management techniques to avoid any adverse consequences as a result of dewatering and discharge activities.

a) Excavation below the groundwater table will be limited as far as it is possible;

b) Dewatering will be undertaken during the construction of structures, and will be localised at the foundation locations only. A ring of point wells will be bored around each site, well casisngs will be installed and then a dewatering system installed to draw down water around the foundation excavation site only;

c) Dewatering will only be required for pile head construction for foundations at the sites of major structures and will be kept to a minimum. The depth by which the water table will be lowered will be limited to 2.5 to 3m below the existing level and duration of dewatering will be limited as much as possible;

d) The preferred location for non-contaminated groundwater discharge is to land (in a constructed lagoon/basin or large tank), followed by discharge to stormwater network and finally discharge to a waterbody (such as the sea);

e) The following information must be displayed at the site legibly in English (and the local dialect), with a label containing the same information stuck to the pump as well.

   i. Name of the Company (Permit Number);

   ii. Contact person and phone number;

   iii. Principal contractor and project name; and

   iv. Completion date.

f) The contractor must have a contingency plan in place in the event of a halt to discharge works; e.g. as a result of a pollution event;

g) Storage of any materials, littering dumping of any wastes etc. is strictly prohibited. The site must be kept clean and tidy at all times; and

h) On completion of activities, the site will be to returned in the condition that it was received, not requiring any remediation. If remediation is required, this is done at contractor's cost.

20.2. Discharge Approval

LREDC approval is required for all discharges of groundwater and other water discharged as part of construction activities, regardless of their receiving medium; to land sea or other waters.

a) Any contractor that proposes to discharge groundwater or other liquids into the sea or onto land requires approval from LREDC Representative and/or Regulatory Authority. LREDC Approval is granted tacitly, on the approval of the contractors dewatering method statement.

b) The discharge of groundwater into the marine environment or on land is absolutely prohibited until approval for the Contractors Dewatering Methhod Statement has been issued via Aconex and the provisions of the method statement has been agreed. -The discharge rate should be stated in the method statement as this will determine the location and type of the discharge point and size of lagoon/pond or similar required;

c) Method statements must be submitted at least two weeks prior to when commencement of discharge is planned, so that work is not delayed by the permit approval process. Note that laboratory analysis usually takes a minimum of five (5) days to complete;

d) Applications are usually approved subject to conditions, which are stated on the advice from MoE/LREDC Representative;

e) Contractor should always keep a copy of the approved dewatering method statement at the project site;

f) Contractors who do not comply with dewatering approval conditions may have their approval withdrawn;

g) A discharge of water/wastewater from any source not detailed in the approved dewatering method statement is strictly prohibited.

h) Applications must be accompanied by a laboratory analysis report of a sample of the water that is intended for discharge;

   i. A sample point must provided in the discharge pipe work, to allow safe access during sampling of discharge waters;

   ii. Applications for dewatering must be supported by a recent laboratory analysis report of a sample of the water that is intended to be discharged. A duplicate sample must also be taken, for quality control;

   iii. The sampling parameters and the detection limits required may vary depending on whether the discharge is to land or to water;

   iv. If discharging to the marine environment, an additional sample must be taken in the receiving water 'up–current' from the discharge and tested for all required parameters;

   v. Sampling done for dewatering approval purposes must be conducted by an independent party, such as a commercial laboratory or environmental consultant. Contractors may not carry out sampling as part of the approval process;

   vi. The dewatering sample must be recent, and representative of the typical waters that are intended for discharge;

   vii. If the groundwater has a strong odour or is discoloured, then it may be necessary to test for extra contaminant parameters. In such cases contractors must seek advice from PMCM or LREDC Environmental Representative about the additional analytical parameters and the number of samples required; and

   viii. Any groundwater that is pumped during a short-term pumping trial must be collected into water tankers for appropriate disposal off the site, or stored temporarily in a holding tank or sealed retention pond.

20.3. Dewatering Network Set Up

The dewatering network may alter slightly based on the locality and form of discharge, but will typically involve a system of water pumps to remove the water from the ground, a series of hoses to transport it and a settlement tank to hold the water prior to discharge. Contractors must maintain an accurate schematic of the dewatering network which describes which hoses are connected to which pumps; which are connected to which sediment tanks; which are connected to which sediment lagoons and so on.

a) Dewatering Pump Requirements

   i. All pumps must be properly maintained, to prevent any leakages of oil, excessive noise levels and smoke emissions. Maintenance inspection record should be available;

   ii. Pumps and generators used for dewatering must be placed on a metal catch tray, to ensure diesel or oil does not contaminate the soil; and

   iii. Contractor should ensure that all the diesel engine dewatering pumps are provided with oil spill containment trays and oil spill cleanup kits.

b) Discharge Hoses and Pipe Network

i. Contractor should ensure that no leaks are observed from pipes and flanges;

ii. Hose connect ions and clamps used on flexible hoses should be periodically inspected and replaced as necessary to minimise the risk of connection failure

iii. All hoses must be clearly identified as connected to a particular pump or sediment tank. This is to allow for expeditious shutoff of pumps in the event of a hose / tank failure.

iv. Any leakage or unintended discharge from the dewatering network will be corrected and cleaned by the Contractor immediately on his becoming aware of leakage or discharge. The Contractor shall inform the PMCM and LREDC Environmental Representative of such incidents and report the corrective and preventive actions taken;

v. Where necessary take appropriate measures to protect dewatering hoses from damage by vehicles s (e.g. by installation of a ramp or burying hoses);

vi. The discharge pipe/hose must be laid in accordance with the best safety practices without affecting the aesthetic view of the area; and

vii. Permits and the construction or removal of discharge pipes/hoses across the foreshore reserve and beach will be determined on a case by case basis during any ecology nesting/hatching season.

c) Sediment Tank Requirements

i. A sediment tank may be required where discharge waters contain high levels of suspended solids or variable water quality. The purpose of a sediment tank is to improve the final water quality prior to discharge;

ii. The sediment tank should be located within approved locations;

iii. These will be adequately sized to allow sufficient residence time to permit suspended solids (down to 0.5 mm size fraction) to settle to the base of the tanks;

iv. During construction, when testing is required, sediment tanks will be used to hold dewatered water awaiting results of sampling;

v. Sediment tanks will be visually checked daily by technicians tContractors shall clean sediment tanks as required by observation made during inspection;

vi. Where there is a visible build of sediment in the tanks, sediment will be removed. If the dewatered water is contaminated, this will be disposed as a hazardous waste;

vii. Other forms of solids reduction, such as filtration may be used. Chemical coagulation or flocculation is not permitted, as these methods can lead to discharge of contaminants to the environment.

viii. Contractor shall conduct regular visual inspection of settlement tanks for corrosion/rust which may reduce the integrity of the tank. Corroded tanks shall be repaired as and when required

20.4. Discharge of Groundwater

20.4.1. Discharge of Groundwater to Sediment Lagoon

a) A plan must be provided identifying the area intended to receive the discharge waters. The land use of this area and surrounding areas must be clearly marked, noting any environmentally sensitive areas such as wetlands, lakes, schools or residences;

b) Contractors must implement drainage control measures to prevent dewatering material from entering low lying areas, which may cause flooding of adjoining land and vegetation;

c) Dewatering discharge must not cause soil erosion or sediment accumulation problems. The contractor is responsible for putting in place control measures, including sediment tanks / lagoons;

d) People and native animals can drown in temporary lakes, particularly with steep sides. All sediment laggoons and lakes must have a chain-mesh fence at least 1.6 metres high, and adequate signage stating that the water is not suitable for human consumption, and the maximum water depth;

e) Temporary lagoons must have a stepped or terraced slope up to the water surface, to allow people or animals to easily climb out if they fall in;

f) Standing water (lakes, ponds) has potential to breed mosquitoes and other insect pests. Measures must be taken to prevent this from occurring; and

g) On completion of dewatering works:

i. Any sediment lagoon, lake or basin will be returned to its previous condition'

ii. Any silt and contaminated sediments which have settled within lagoon areas will be removed by the contractor;

iii. Retaining walls of lagoons to be removed and any excavated areas to be back filled; and

iv. The liner from the lagoon must be disposed of properly, with a tracking certificate issued or similar evidence provided that the liner was removed and not buried on site.

20.4.2. Discharge of Groundwater to Stormwater Network

a) Discharge to stormwater network must not be done in any way that compromises the effectiveness of the existing stormwater system;

b) Hoses will typically discharge through manholes into the stormwater system; and

c) Alternative sources of discharge location may be required during heavy rain events which may overwhelm the stormwater system.

20.4.3. Discharge of Groundwater to Marine or Other Water Body

a) Groundwater should be discharged from the shoreline, into the deepest part of the channel/ water body (usually the centre);

b) The discharge location must be at least 1 meter below the lowest low tide level if discharged to the marine environment to allow adequate mixing of the discharged water with the seawater;

c) If the depth of the water column above the discharge pipe end is less than one (1) metres, then the discharge pipe must be extended a greater distance in the direction of deeper water until a water depth of one (1) metres is achieved;

d) The discharge point must be either embedded into a stone gabion of suitable size to prevent direct scouring of the seabed, or discharged onto an anti-scouring rock arrangement to de-energise water at the discharge point

e) The discharge flows will be reduced to prevent scour and, where necessary, edge protection measures will be employed;

f) A marker buoy must be used to indicate the location of the discharge pipe outlet;

g) The receiving environment should not be adversely affected by dewatering discharge water

h) Adding sediment to the receiving environment must be strictly prohibited

20.4.4. Alternative Discharge Options

Alternative uses or disposal options must be considered in addition to discharge to sea or land. This can result in significant cost savings (such as reduced transport costs for tankers bringing non-potable water onto site) as well as environmental benefits

a) Alternatives are aimed at preserving water resources and groundwater recharge;

b) The quality of discharge water is usually the limiting factor on how it may be used, and therefore water quality sampling is required.

c) Groundwater and other dewatering discharge must not be used for drinking water under any circumstances; and

d) Alternatives may be used in conjunction with sea/ land discharge, or on their own subject to meeting general requirements. Some options are listed below:

e) On-site uses such as: Dust suppression on roads; Wash-down water (such as for vehicles and equipment); Watering of landscaped areas; and Toilet flushing.

i. Contractors must confirm that the water quality is acceptable for the intended reuse by firstly contacting PMCM and LREDC Environmental Representative.

ii. Suitable onsite storage in temporary tanks or engineered low-infiltration lakes would be required (refer below – onsite evaporation lakes)

f) Groundwater recharge - water may be stored or immediately used to recharge groundwater on land-based projects. The following requirements apply:

i. Discharge water quality complies with relevant water quality criteria;

ii. There is sufficient aquifer storage capacity to recharge without risk to existing vegetation, wetlands, structures or services;

iii. Recharge will not degrade soil or water resource quality; and

iv. Recharge will not result in local flooding or adverse land surface impacts.

g) Off-site recycling - dewatering material may be useful to a neighbouring site for specific use. The following requirements apply:

i. The water quality is compliant with relevant, published criteria for the intended water use;

ii. The discharge water is provided under a written agreement between the owners of the two sites (discharge and receiving); and

iii. Approvals are obtained from the relevant authorities/parties, which have authority for the sites.

h) Onsite evaporation lakes - temporary lakes may be used to store water, to allow evaporation. The following requirements apply:

i. A water balance must be carried out to determine discharge inflow plus other potential inflows (rainfall, storm water) against outflows (evaporation and infiltration), and storage volume;

ii. The lake must be designed and built for low seepage rates;

iii. Lakes must be fully enclosed by a chain-mesh fence at least 1.6 metres high, and have signage stating that the water is not suitable for human consumption, and the maximum water depth;

iv. Temporary lakes must have a stepped or terraced slope up to the water surface, to allow people or animals to easily climb out if they fall in; and

v. Standing water (lakes, ponds) has potential to breed mosquitoes and other insect pests. Measures must be taken to prevent this from occurring

20.5. Monitoring Requirements

Groundwater being dewatered must be monitored on a regular basis. Discharge approval is usually granted subject to conditions (such as monitoring requirements), which are stated on the advice from LREDC/MoE;

Project dewatering monitoring requirements shall be available on file;

a) Testing of water must be for all required parameters and to minimum detection limits to allow comparison with the regulatory authority limits;

b) The parameters for water quality of discharged water before reaching the sea should not exceed the following limits prescribed by MoE:

Parameter	*Acceptable Limits*	*Frequency*
Turbidity	<5NTU	Daily
Total Suspended Solids (TSS)	30 mg/l	Daily
Odour	Not specified	Daily
Discolouration	Not specified	Daily
pH	6-9	Weekly
COD	50 mg/l	Weekly
BOD_5	25 mg/l	Weekly
Oil and Grease	5mg/l	Weekly
Total Coliform Bacteria	<23 MPN/100ml	Weekly
E Coli	<23 MPN/100ml	Weekly

c) Monitoring of water quality to be undertaken for visual parameters (odour, discolouration), turbidity and TSS on a daily basis and reported weekly to the PMCM and LREDC Environmental Representative while other parameters (listed in section 20.5c) are to be monitored weekly. All monitoring results shall be reported to the PMCM and LREDC Environmental Representative as part of the Weekly Environmental Report. Laboratory analysis reports (for the corresponding data being reported) shall be submitted with the Weekly Report;

d) Contractors shall maintained a document record of daily visual / odour inspections;

e) PMCM and LREDC Environmental Representative must be informed immediately where any Regulatory Authority limits are notably exceeded.

f) Water quality will be monitored for turbidity by using turbidity meter (when required) before reaching the receiving environment.;

g) Contractor should stop the pumping if any turbidity or oily material appeared in the discharged water and report the incident to the LREDC/MoE;

h) The contractor must notify PMCM and LREDC Environmental Representative of any changes to water colour and/or odours or contamination events that affect the dewatering process. In such cases, the following will apply:

   i. The contractor must notify PMCM and LREDC Environmental Representative, and stop or reduce groundwater discharge to a minimum flow rate, to allow sampling and investigation;

   ii. Subject to the analytical results, the dewatering discharge may require disposal by alternative means if critical changes in discharge water quality are confirmed; and

   iii. The contractor must seek advice from the PMCM and LREDC Environmental Representative to prevent contamination of the neighbouring land or water bodies.

i) Where visual evidence of potential contamination is observed this will be reported to the PMCM and works will cease until approval from PMCM and LREDC Environmental Representative received.

j) All monitoring reports are to be submitted to PMCM and LREDC Environmental Representative on a monthly basis with following.

   i. A Regulatory Authority-approved laboratory for sampling and analysis;

   ii. Contractor to ensure that the selected laboratory can accurately test the water quality parameters to the Regulatory Authority limits.

   iii. Ensure that laboratory-condition water sampling containers are used to collect the water samples;

   iv. Sample collection should be supervised by the Contractor's Environmental representative;

   v. Contractor to undertake a review of the water quality tests prior to submission of results to PMCM and LREDC Environmental Representative.

k) Laboratory test results should show:

   i. Material testing;

   ii. Date of Sampling;

   iii. Date of Delivery of sample to the lab;

   iv. Reporting date;

   v. Lab where analysis was achieved; and

   vi. QA/QC procedures of the used lab

l) Water produced during dewatering may be reused on site for dust suppression after confirmation of water quality complying with regulatory authority standards by laboratory analysis during pre-construction and construction phase monitoring

m) Where these guidelines are exceeded groundwater will not be reused for dust suppression but will be stored in temporary holding tanks before being removed by an approved provider. If groundwater is within the acceptable limits it will be reused but will be subject to regular screening.

20.6. Decommissioning of Dewatering Wells

On completion of dewatering activities, the main contractor is responsible for decommissioning of the dewatering wells that have been installed under their scope of work and within their project boundary.

a) All well casings must be removed and taken off site for re-use or appropriate disposal.

b) Wells must be backfilled with sand.

c) Wells must be 'capped' with 500mm of concrete which provides a 'lid' for the well – preventing a possible pathway for contaminants to enter groundwater strata below grade levels.

21. VEHICLE MAINTENANCE, WASHING AND REFUELLING CONTROL

The purpose of this chapter is to guide the Contractor and sub-contractors to managing vehicle, machinery and plant maintenance, refueling and washing so as to protect sensitive receptors during the construction works.

21.1. Vehicle and Equipment Maintenance

Maintenance and repair of machinery, including all types of vehicles, earthmoving equipment, generators and mobile plant, can cause environmental problems such as Contamination of land and waterways from oil and diesel; and Generation of hazardous waste, such as used oil, un-drained oil filters and used batteries.

All machinery maintenance and repair activities must aim to avoid or mitigate environmental problems. This section addresses the general requirements for all types of machinery maintenance and repair, including those carried out in workshops and field support for vehicles and equipment. It also suggests ways to achieve these objectives.

21.1.1. General Maintenance Control Measures

All vehicles, plant and equipment are to be regularly maintained in accordance with manufacturer's recommendations, and records of maintenance are to be kept on site. Vehicles, plant or equipment releasing visible emissions, or leaking POL or with damaged hydraulic hoses are to be removed from service immediately for maintenance and/ or repair. Daily inspection checklists, completed by equipment operators, should identify such issues.

a) Machinery maintenance or repair must be conducted at a commercial or approved workshop off-site, where practical. This will avoid project downtime and also the possibility of unscheduled servicing of machinery in undesignated areas;

b) Where it is not practical to conduct machinery maintenance and repairs at an off-site commercial or approved workshop, machinery maintenance and repair on-site must be done at a pre-approved workshop or approved designated repair area.

c) All mobile vehicles and equipment, including loaders (shovels), JCBs (back-hoes), bob cats (mini-scoop), and trucks, must be moved to an off-site workshop, or an approved on-site workshop for routine (i.e. scheduled) servicing and maintenance activities (for example, oil changes and addition of lubrication); and

d) Generators shall be periodically maintained as per manufacturers recommendations and records of maintenance are to be kept on site.

e) Very large and semi-fixed items of plant, such as piling rigs and large generators, may be serviced in-situ in the field, however, a written procedure should be submitted as part of the CEMP. The written procedure should address containment of all waste liquids, prevention of land contamination, waste disposal and training.

21.1.2. Maintenance Workshop

All workshops and designated repair areas proposed for the construction site must be approved by PMCM and LREDC Environmental Representative. The management and use of workshops and repair areas must comply with the following requirements.

a) All minor or emergency servicing that cannot be carried out offsite will be carried out at a dedicated sealed, impermeable, drained and kerbed concrete floor with wastewater and hydrocarbon / solvent collection and separation facilities.

b) Workshops must be built on a level, impervious concrete floor. Floors made from inter-lock paving are not permitted. The workshop shall be surrounded by a bund wall and three sides, with the concrete 'vehicle ramp' on the 'access' side, completing a full perimeter bund;

c) Vehicles/equipment shall be moved to a designated workshop for repair or mechanical servicing. Any repairs to vessels will only be carried out at a designated mooring;

d) Any equipment, vehicle or machinery that requires regular or emergency services shall be moved or towed to the designated area for carrying out the maintenance or repair activities. A plan must be in place to deal with, and removing of, vehicles that break down;

e) Vehicle/equipment service/maintenance locations will be clearly marked in the site layout;

f) The workshop floor must not discharge to stormwater, sewer, sewage holding tanks, soak-away trenches or to any other external connection. An exception may be made where wastewater pre-treatment equipment is specifically approved by the PMCM/LREDC Environmental Representative;

g) Stormwater runoff, rain water and other drainage sources from areas outside of the workshop must be prevented from entering the workshop. To achieve this, a small "roll-over" speed bump around the perimeter of the workshop may be required to prevent inflows, or the workshop may be located on an elevated area;

h) Workshops must not be built in areas below the high tide level or prone to inundation or flooding. All servicing areas will be located as far as possible from the water channels and wastewater channels to reduce potential for pollution via spillage or leakages

i) The workshop floor may drain to a collection sump, subject to complying with other drainage requirements. Where a sump is installed, it must have sufficient capacity for 110% of largest volume of liquid contained within the workshop, or 25% of the total capacity of liquids contained within the workshop, whichever is greater. The sump must be regularly inspected to check its capacity and condition, and emptied as required. The sump contents must be disposed of as hazardous waste at an approved facility; and

j) Hosing of the workshop floor is not permitted. Floors and concrete pads may only be cleaned using "dry" cleaning methods. Dry cleaning methods include:

   i. Hand sweeping;

   ii. Mechanical sweepers;

   iii. Industrial vacuum units;

   iv. Use of detergents on rags or in mop buckets; and

   v. Use of spill absorbent products;

k) Biodegradable and non-hazardous materials used during maintenance as far as it is possible; and

l) Maintenance waste to be disposed of as hazardous waste;

21.1.3. Field Repairs

Repair or service of any immobile plant, vehicle or equipment that cannot be towed to the maintenance area will be undertaken in the field using adequate metal drip trays beneath the section being repaired in all instances.

a) Repair work is differentiated from routine servicing (maintenance), which is largely predictable and able to be scheduled;

b) Repairs to vehicles and equipment, other than tyre changes or repairs to very large or semi-fixed equipment, are not permitted on construction roads or any open area of the construction site. The CEMP should provide a procedure for field repairs to the very large, semi-fixed items of equipment;

c) Broken-down vehicles and equipment must be moved (towed) for repair to an off-site workshop, or an approved on-site workshop or repair area;

d) Broken-down or damaged vehicles and equipment must not be abandoned on-site;

e) In the unlikely event that a vehicle or item of equipment cannot be moved to the approved workshop or repair area, contractors must use a combination of catch pans, drip trays, and ground protective sheets to prevent contamination of the surrounding environment by oil, lubricants, fuel or coolant, which may be spilled during the repair activities;

f) Use a metal spill tray or other impermeable container to intercept any oil or fuel leaked or lost during emergency servicing, repairs or recovery on site;

g) All wastes generated during field repairs must be collected by the contractor and properly disposed off. An example of this is when a hydraulic hose bursts, the hydraulic oil must be retrieved, absorbent used for

containing the spill must be collected, and any contaminated soil that has resulted must be stored and disposed of in accordance with regulatory standards.

h) All field repair and servicing support vehicles must be fitted with:

   i. All containers or tanks transported on field service vehicles shall be kept within metal spill trays or suitable secondary containment.

   i. Sealable containers, tanks or other means to store waste liquids for transportation back to an approved storage location, for recycling or disposal. These containers or tanks must be able to be securely fitted to the vehicle,

   ii. Metal spill trays, metal drip trays, funnels and/ or siphons for emptying catch pans and drips trays into containers or drums, and ground protective sheets. These items must be used to contain waste fluids and to protect the ground from spills or leaks, and

   iii. An appropriate spill clean-up kit with instructions for usage, and garbage bins/ bags for storing the used contents of the spill clean-up kit ; and

i) Field repair and servicing support vehicles must be periodically audited by contractors for compliance with these requirements, particularly prior to use on site.

21.1.4. Fuel and Chemical Storage

Fuel and chemical storage is covered within OCEMP Section 22. A number of mitigation and management measures can be instigated to reduce impacts, including:

a) All fuel and waste fuel storage must be in accordance with regulatory standards.Only Woqod approved bulk fuel storage tanks are permitted for fuel storage

b) All chemical storage and chemical waste storage must be in accordance with regulatory authority standards (chemicals include battery acids and coolant);

c) Where oil and/or fuel has the potential to enter a waterway (waterways include creeks, artificial and natural lakes, harbours and coastal waters) from the site, contractors must develop a spill response procedure;

d) A suitable oil/fuel spill clean-up kit must be located within or near the workshop. The spill clean-up kit must be labelled, contain instructions for usage, contain a monthly spill kit checklist and have a sign indicating its normal location when not in use; and

e) All workshop staff must be trained in use of the oil/ fuel spill clean-up kit.

21.1.5. Specific Requirements

a) Wastes generated from maintenance and repair activities, such as used fuel filters, oily rags and used coolant, must be managed in accordance with regulatory standards;

b) Mechanical maintenance and repair activities must be confined to the approved workshop building, and surrounding areas approved as part of the workshop if applicable;

c) Mechanical parts washing must be carried out within a drum or a specific item of equipment intended for this task, so that the washing fluid from all parts is contained.

   i. The container or equipment must be located within the workshop building; and

   ii. Used solvents/ mixtures from parts washing must not be poured onto unsealed ground or discharged to drains or waterways, instead it must be sent for recycling or disposal to a regulatory authority-approved facility;

d) Fuel and liquid chemical handling, such as paint mixing or oil changing, must only be completed within the workshop, in an adequately ventilated area;

e) Bodyworks including surface preparation of vehicle panels, minor amounts of spray-painting (“touch ups”) and panel beating of body parts must be done in an enclosed area with at least three walls, to prevent over-spray reaching the environment.

   i. The area must be adequately ventilated.; and

ii. Dedicated spray-painting and bodyworks repairers, or contractors carrying out spray-painting beyond minor amounts, must install an approved, fully enclosed spray-booth, with positive ventilation.

f) Washing of paint brushes, spray guns and other finishing equipment over unprotected ground is not permitted.

i. All such washing must be carried out in a location where the waste fluids are completely contained in a suitable container or tank; and

ii. Waste fluids which accumulate in the containment tanks must be regularly collected for appropriate off-site disposal by a regulatory authority-approved liquid waste transport contractor;

g) Abrasive blasting in all instances requires specific prior approval from the SH&E Representative). Consideration will be given to the type of abrasive media proposed for use, the location of the activity, containment of dust and grit, and disposal of used abrasive media;

h) Metal work including grinding, cutting, use of lathes, drilling and welding must be carried out over a sealed surface, so that all metal off-cuts, shavings and waste do not escape to unsealed ground or waterways, and can easily be collected for removal and recycling;

i) Wood work including sawing, grinding, drilling and lathing of timber must be carried out over a sealed surface, so that all wood off-cuts, shavings and waste do not escape to unsealed ground or waterways, and can easily be collected for removal.

21.2. Vehicle and Equipment Washing

It is important to contain and control vehicle and equipment wash water as it can both cause erosional damage to the ground surface if discharged in large quantities and at a high flow rate, as well as potentially contaminating the soil, groundwater or ecology through the harmful contaminants washed off the dirty vehicle/equipment and contained within the cleaning agent.

A number of mitigation and management measures can be instigated to reduce impacts from the washing and cleaning of vehicles and equipment. These control measures include:

a) Machinery will be washed / degreased prior to arrival at site. Wash downs of machinery in undesignated areas will be prohibited;

b) Vehicle and equipment wash-down shall only be undertaken at designated areas, which shall be subject to prior approval and will be indicted on the site compound plan.

c) The wash down area will be an impervious hardstand concreted, sloped surface with a soakaway to collect the wash water. The facility shall be adequate to prevent wash water splashes and shall be approved by PMCM and LREDC Environmental Representative;

d) Vehicle wash water contains grease, oil and other cleaning agents and is considered as wastewater. The effluent arising from this process be contained in a dedicated impervious tank (normaly a GRP tank) and shall be disposed in accordance with regulatory requirements;

e) Vehicle wash waters shall be directed to a triple interceptor designed in accordance with regulatory requirements. This will allow the grease, oil and other cleaning agents to be collected in separate tanks made of impervious material, and disposed of easily;

f) The interceptor trap shall be regularly cleaned and maintained so that there is no floating oil on the final compartment, and the Contractor shall regularly de-sludge triple interceptor to remove collected sediment;

g) Any sludge collected from washbay silt traps or triple interceptors shall be dried on an impervious surface prior to disposal. Dried sludge shall be treated as hazardous and disposed as contaminated soil.

h) Contained areas for washing out and cleaning of vehicles will be used and wash waters collected, using either settlement and / or re-circulation systems for water re-use or discharged to the foul sewer / STP for treatment.

Washwater shall be tested and if water meets the regulatory standard only then may the water bedischargedto the STP for treatment

i) If possible, make us of an eco-friendly cleaning agent to minimise any potential impacts;

j) Use only as much water as necessary to complete the task, thus conserving resources;

k) If possible, use just a dry or damp cloth to wipe the windscreens of a vehicle, rather than using a high-powered hose sprayer, which would require more water; and

l) Manual washing using buckets is the preferred method, as this minimises water usage

21.3. Vehicle and Equipment Refueling

Refueling of vehicles and equipment must be done in such a way that environmental harm does not occur, and is not likely to occur. Refueling by mobile delivery tanker, or "mobile refueling", to individual items of plant and equipment presents the most environmental risk, and hence it is only permitted where contractors can demonstrate they have considered other options.

21.3.1. General Control Measures

A number of mitigation and management measures can be instigated to control vehicle, plant and equipment refueling practices

a) Contractors must refuel vehicles at commercial petrol stations off-site, where practical. This applies in particular for light vehicles such as saloon cars, 4WDs, and light pick-up trucks. Refuelling at commercial off-site facilities is beneficial as it transfers any on-site environmental contamination risks to purpose-built, permanent facilities, which are able to manage problems more easily;

b) Where it is not practical to refuel at off-site commercial petrol station facilities, refuelling of vehicles and equipment on-site must be done at a dedicated area, over an impervious concrete pad, known as a refueling apron. Light vehicles, trucks and equipment such as loaders are considered easily mobile, and must return to the designated area for refuelling; and

c) Mobile refuelling of equipment may be carried out only after the above options have been considered and found to be impractical. This may apply for heavy and slow moving equipment, non-mobile equipment such as pumps and generators, and where the refuelling area is very far away.

21.3.2. Refueling practices

A number of mitigation and management measures can be instigated to control vehicle, plant and equipment refueling practices

a) All refueling muct be done using an automatic refuelling nozzle. Hoses connecting the nozzle to the fuel storage container must be intact and free from damage.

b) Ensure that vehicles or equipment being refuelled are supervised and not left unattended. E.g., do not connect a fuel hose and then walk away, even for a short period of time;

c) During bulk fuel tank filling, the Contractor Environmental Representative should be present to avoid any overfilling of the tanks. In such an event, an incident report shall be prepared;

d) While fuelling, the engine should be stopped and smoking should be prohibited;

e) The fuel nozzle must be clearly within the receiving tank, or the hose coupling connected to the receiving tank, before transfer of fuel starts;

f) The fuel nozzle or delivery hose must not be removed or disconnected unless fuel flow has completely stopped, that is, the delivery pump is no longer operating;

g) Fill nozzles, funnels and refuelling hoses shall be kept within an adequately bunded area when not in use;

h) Fuels and mineral oil canisters must not be stored on the ground, but placed in adequate bunded areas or metal trays

i) The oil tank must be filled via a screwed fitting or other fixed coupling which is in good condition. A drip tray must be provided at the time of fuel delivery to catch any oil that could be lost during the coupling and decoupling of the delivery hose;

j) Where a fill pipe is outside the secondary containment system, use a drip tray of an adequate capacity to contain the contents of the fill pipe and to catch any oil spilled during delivery. Contractor shall check the drip tray after each delivery and empty it if it contains any oil;

k) Sight gauges should be supported properly and fitted with a valve that will close automatically when not in use. The sight gauge should be situated within the secondary containment system;

l) An automatic overfill prevention device should be fitted if the tank and any vent pipe cannot be seen by the person controlling the delivery;

m) All staff handling fuel must be periodically trained in the refueling procedure as well as the proper use of the fuel spill clean-up kits; and

n) All fuel spills must be cleaned up promptly.

21.3.3. Refueling Areas

Refueling of mobile vehicles, plant and equipment will be carried out only in designated impermeable areas, not at machinery work locations, to reduce potential spillages. All designated refueling areas must comply with the following requirements:

a) Refuelling must be done over a level, reinforced impervious concrete pad (a 'refuelling apron'), which is able to withstand heavy vehicle traffic. Interlock paving is not permitted. The refueling apron shall be surrounded by a bund wall, with the concrete 'vehicle ramp' providing access for vehicle entry and exit, completing a full perimeter bund;

b) The size and layout of the concrete pad must take into consideration the size of the equipment that will be refuelled there, so that fuel spillage will be prevented from running off onto unsealed ground or into waterways;

c) The fuel dispensing hose must be stored over the concrete area at all times;

d) The concrete pad must not discharge to stormwater, sewer, sewage holding tanks, soakaways, trenches or to any other external connection. An exception may be made where wastewater pre-treatment equipment is specifically approved by PMCM / LREDC Environmental Representative;

e) Stormwater flow, rain water and other drainage sources from areas outside of the refuelling area must not be able to enter the refuelling area. To achieve this, a small "roll-over" speed bump around the perimeter of the concrete pad may be required to prevent inflows, or alternatively it may be located on an elevated area;

f) It is recommended that there be a concrete hump or lip on one or both of the access points into the bund so that wheeled vehicles can easily enter and exit;

g) Refuelling areas must be built in areas above the high tide level, and away from areas prone to inundation or flooding. All refuelling areas will be located as far as possible from the water channels and wastewater channels to reduce potential for pollution via spillage or leakages;

h) Refuelling areas must be communicated to all site personnel by signs and notice boards and clearly noted within the site plan;

i) The concrete floor may drain to a collection sump, subject to complying with other drainage requirements. The sump must be regularly inspected to check its capacity and condition, and emptied as required. The sump contents must be disposed of as hazardous waste at a facility approved by regulatory authority;

j) Hosing of floors at the refuelling area is not permitted. Floors and concrete pads may only be cleaned using "dry" cleaning methods. Dry cleaning methods include:

   i. Hand sweeping;

   ii. Mechanical sweepers;

   iii. Industrial vacuum units;

   iv. Use of detergents on rags or in mop buckets; and

   v. Use of spill absorbent products.

k) A suitable oil/ fuel spill clean-up kit must be located within or near the refuelling area; and

l) Fencing or other security measures must be provided to prevent unauthorised access to refuelling areas.

21.3.4. Mobile Refueling

Refueling in the field by mobile delivery tanker may be permitted, as described above, subject to the following requirements:

a) All refueling vehicles must be Woqod supplied and approved.

b) Equipment to be refuelled must be parked on level ground at least 20 metres from drains or waterways, before commencement of refuelling;

c) Where possible, delivery tankers and other fuel transfer equipment must use dry-break couplings, so residual fuel within the delivery hose is retained and cannot spill onto the ground;

d) All fuel hoses without hand-held trigger nozzles and automatic shut-off valves must have end caps, to seal the hose and prevent leakage of fuel which is left in the hose after it has been removed from the receiving vehicle/equipment. The end caps must always be kept in place when fuel is not being delivered;

e) Prior to starting pumping of fuel, a suitably-sized drip tray and ground protective sheet must be placed under the receiving vehicle's refuelling point. All drip trays and liners must be placed under the work area, so that they extend beyond the work area;

f) The contractor must be able to demonstrate how fuel captured within the drip tray/ container will be transferred into the storage container or otherwise removed, for correct disposal. This may be through use of absorbent mats and particulate, or a funnel and siphon arrangement;

g) The mobile delivery tanker must have on board:

   i. Metal Drip tray/s of sufficient capacity;

   ii. Ground protective sheet/s;

   iii. A labelled, sealable container for storing spilled fuel;

   iv. Any equipment required for transferring fuel captured in drip trays into the storage drum;

   v. A suitable spill clean-up kit; and

   vi. A shovel for use in spill clean-up; and

h) Mobile refuelling vehicles must be periodically audited by contractors for compliance with these requirements, particularly prior to use on site.

21.3.5. Marine Refueling

A number of mitigation and management measures can be instigated to control refueling of marine vessels to eliminate or reduce impacts. These control measures include:

a) When taking on fuel at a fuel dock slowly come along side the dock and securely tie up. Shut down all engines and electrical instrumentation, and close all hatches.

b) If the boat is equipped with portable tanks disconnect the fuel lines and move the tanks to the fuel dock to be filled.

   i. After filling and adding oil carefully wipe down the outside of the fuel tanks and dispose of the oily rags in the proper place on the fuel dock.

   ii. Place the fuel tanks back on the boat, reconnect the fuel lines, and pump up the primer bulbs to deliver fuel to the engines. Open all hatches for ventilation, start the engines, untie dock lines, stow them, and carefully manoeuvre away from the dock.

c) When fuelling a boat equipped with permanent tanks, carefully fill the tanks while holding a rag or absorbent material under the vent.

   i. When the tank is full replace the cap on the filler tube and clean up any spilled fuel and oil.

   ii. Dispose of oily rags on the fuel dock. On boats equipped with inboard engines, "Run The Engine Room Blower For Five Minutes And Sniff For Evidence Of Gas Fumes Prior To Engaging The Ignition Switch To Start The Engine". Untie the dock lines, stow them and carefully manoeuvre away from the dock.

d) A shutoff valve shall be installed at the fuel tank connection arrangement shall be made for operating this valve from outside the compartment in which the tank is located and from outside the engine compartment and outside the house bulkheads at or above the weather deck of the vessel.

e) A shutoff valve shall be installed at the engine end of the fuel line unless the length of the supply pipe is 1.8 m or less.

f) All carburettors, except down-draft type, shall be provided with a drip tray, with flame screen, that is continuously emptied by suction from the intake manifold or by a waste tank.

g) Fuel and lubricant containers and tanks shall be diked or curbed to contain the tank contents in case of leakage.

h) Fuel tanks must be stored and secured in proper out of the way locations.

i) Periodically visually inspect the portable fuel tanks for leaks, especially at the fuel line connections.

j) Engines shall not be started until the engine space and bilges have been ventilated to remove fuel vapour.

22. CONCRETE BATCHING AND TRUCK MANAGEMENT

The purpose of this chapter is to guide the Contractor and sub-contractors to managing concrete batching plant operations and concrete mixer and pumper truck movements on site during the construction works.

Concrete batching and its associated activities, including the storage and transport of aggregate, cement mixing, and cleaning of concrete mixing equipment, all have the potential to cause adverse environmental impacts.

22.1. Concrete Dust Control

Dust generation is a major concern at concrete batching plant due to the large amount of aggregates involved. This has been partially covered in OCEMP Section 13, but a number of mitigation and management measures can be implemented, including:

a) Dry cement powder must always be kept in closed bags or sealed containers, in such a way that dust nuisance does not result;
   i. All bagged and boxed materials shall be stored on pallets and covered to prevent loss or damage due to rain;
   ii. Fine material or aggregates 5 mm or smaller in size shall be stored in a totally enclosed area.

b) Open bulk storage bins shall be suitably contained and covered with netted tarpaulin enclosure to prevent dust emissions.
   i. Silos or other bulk storage bins shall be equipped with fabric or cartridge type filters capable of controlling 99% of particulate matter and vent filters will be maintained in operable condition;
   ii. Service hatches for silos or other bulk storage should be designed to prevent escape of dust;
   iii. Silos or other bulk storage should be equipped with visible and/ or audible alarms to warn operators that storage capacity is full.

c) Aggregate stockpiles must not create dust nuisance. Where stockpiles are generating dust nuisance, dust prevention measures must be implemented; and

d) Dust minimisation measures which may be applied to sand and aggregate stockpiles including:
   i. Store materials within a three-walled storage bunker. The bunkers must be oriented so that the stored aggregate is protected from the prevailing winds, and stockpiles kept at least 0.5 metres below the height of the walls;
   ii. Cover stockpiles with tarpaulins or canvas which are secured to the ground, or place a roof over the storage bunkers;
   iii. Spray uncovered stockpiles with water, in a way that drainage is controlled and does not cause nuisance or harm;
   iv. Stockpiles shall be covered and surrounded by a sediment barrier to prevent the escape of aggregate onto the site; and
   v. The angle of stockpile shall not exceed 40 degree maximum at any condition.

e) There should be no visible dusts emission from vents of silos, weigh hoppers or mixers during filling or refilling operation.
   i. The dust emission from any source after fixing control system shall be less than 100 mg/Nm^3;
   ii. All dry material transfer points should be ducted through a fabric or cartridge type filter unless there are no visible emissions from the transfer point;
   iii. Aggregate transfer points shall be equipped with a wet suppression system to control fugitive dust emissions; and
   iv. All conveyers shall be covered to prevent release of fugitive dust emissions.

f) Roads within the concrete batching plant and areas between stockpiles and conveyers shall be regularly dampened or paved maintained free of materials which may release fugitive dust emissions.

   i. All unpaved surfaces shall be kept wet either use a water tanker or fixing water sprinklers. The typical water requirement is at least up to 1 litre per square meter per hour. Untreated wastewater shall not be used for unpaved surface dampening;

   ii. The unpaved road surface shall be improved on regular basis through spreading of asphalt or gravel or aggregates;

   iii. The regular cleaning of paved surface shall be ensured by either use a mobile vacuum sweeper or a water flushing system;

   iv. Speed limit must be observed by all the drivers within concrete batching plant to reduce fugitive dust emission; and

   v. The Contractor shall install a wheel wash facility at the main entrance so that all vehicles leaving the plant shall be cleaned.

g) Cover all deliveries of sand or aggregate loads to prevent dust. Trucks must not be filled higher than 0.3 metres from the top of the tray walls.

h) Clean up spillages of dry cement powder, cement, fly-ash or aggregate promptly;

i) Where a concrete pump is to be used, temporary bunds should be placed across all drainage leaving the site to trap any spilt material. Spilled materials should be cleared from drainage lines and roadways before removing the bunds.

22.2. Concrete Mixing (Other than Batching Plant)

A number of mitigation and management measures can be instigated to control the use of concrete equipment (concrete ready mix trucks; concrete pumper trucks; concrete hand mixers and similar) so as to avoid any potential ground or soil contamination.

a) Mixing of concrete must always be performed over a sealed and impervious surface, to prevent drainage or spillage into the environment;

b) Concrete mixing areas must be a minimum of 20 metres from any waterways such as lakes or the ocean;

c) The mixing area should be located on level ground or in a contained area, to prevent concrete mix draining away from the mixing area;

d) Water use must be kept to a minimum during concrete mixing, for example, use buckets or hoses fitted with hand-trigger control and low-pressure spray nozzles;

e) Wastewater resulting from concrete batching must be contained, as the cement content of the wastewater can cause contamination of soil, groundwater and stormwater; and

f) Dry aggregate spillage must be collected using a shovel or broom, and returned for reuse.

g) Mix concrete over a large concrete pad, or a smaller concrete pad with a drainage collection sump, or a piece of plywood thick enough not to crack, to prevent runoff to the surrounding environment or soil contamination;

h) Adequately size the concrete mixing area to contain all mixing equipment, in addition to allowing mixing activities;

i) Minimise water used in concrete mixing by using:

   i. Brushes and rags, to remove excess solids, instead of high pressure hoses;

   ii. Buckets washing; and

   iii. Hoses with low volume, high pressure-spray nozzles and hand held trigger controls

j) Prepare a non-urgent list of jobs that require concrete, so that any excess concrete can be delivered for use there. For example, paving of unsealed areas in front of workshops, or making concrete blocks for use at a later date; and

k) For concrete mixer trucks and pumper trucks:

i. Ensure that concrete chute covers are in place whilst vehicle is in motion;

ii. Do not exceed approved speed limit for vehicle, especially whilst carrying a heavy liquid load and negotiating tight corners;

iii. Ensure that plastic sheeting or similar is placed beneath pumper truck upon start up so as to capture any oil leaks; and

iv. Ensure that plastic sheeting or similar is placed beneath concrete mixer truck and pumper truck whilst transferring concrete to other vehicles or receptacles

22.3. Concrete Waste

A number of mitigation and management measures can be instigated to control the amount of concrete waste produced and minimize the amount that is not re-used or recycled

a) Material procurement for concrete batching must be done in accordance with waste minimization principles. Materials must be ordered in minimum quantities, as required for the site activities;

b) When mixing concrete for use on-site, estimate the quantity required for each task and accurately mix only that quantity, to avoid wastage and disposal;

c) Any excess concrete mixture must be used where possible on other jobs;

d) Spilled and waste concrete shall be collected and sent to concrete breaking and recycling facilities wherever practicable. It can be used for construction purposes at the batching plant or project site (such as bunker blocks or paving unsealed areas).

e) Dumping of excess concrete on-site is not permitted;

f) Excess mixture that cannot be used elsewhere, that was mixed at a concrete batching plant, must be returned to that plant by the concrete delivery truck;

g) Excess mixture that cannot be used elsewhere, and that was mixed at the work site must be first dried out by discharging over a sealed surface, i.e. a concrete pad or plastic sheeting, and then completely removed and reused or disposed of appropriately

h) Once concrete wastes are washed into the designated areas and allowed to harden, the concrete shall be broken up, removed and disposed of regularly by a waste disposal contractor approved by the Regulatory Authority Any effluent arising shall be permitted to evaporate and resulting solids disposed as per other concrete wastes.

i) A designated storage area shall be allocated inside the plant's premises for collection of concrete waste. It shall not be stored beyond the boundary as a temporary storage.

j) Waste concrete stockpiles should be cleared from the site at least every 72 hours; and

k) Waste concrete slurry should be directed to the washout pit, where it will break down to gravel, sand and sludge, which can subsequently be collected and reused.

22.4. Concrete Washout

The washout of concrete equipment (concrete ready mix trucks; concrete pumper trucks; concrete hand mixers and similar) has the potential to release contamination into the soil, groundwater and waterways. All drainage from concreting activities must be controlled.

a) All concrete equipment including small mixers, shovels, wheelbarrows and trowels must be cleaned and washed within the concrete mixing facility, so that drainage is contained;

b) It is not permitted to discharge waste water from concrete washing to unsealed ground, drains or waterways.

c) Concrete mixer trucks should return to the batching plant where their load originated from, for full washing out;

d) Concrete trucks are to be washed only at an approved concrete truck washing facility, capable of retaining all excess water, residue and waste. Such facilities will be approved by the SH&E Representative prior to being installed and used on site. The washing of concrete trucks on-site and outside of an approved facility is strictly prohibited and offenders will be denied entry to the site.

i. The concrete washing facility will be a concrete bunded area with a slope leading to a soak away, where the wastewater will be detained.

ii. Washout areas shall be 100% skimmed with concrete and be of sufficient volume to completely contain all liquid and waste concrete materials generated during washout procedures.

iii. Wastewater from truck washing facilities, aggregate wetting, hardstand wash down and any other washing facility will be directed to the lined sedimentation basins located on the batching plant site.

iv. Wastewater will be detained in lined settling basins fitted with baffles to permit the settling of solids. There will be at least 3 chambers sedimentation tank of adequate capacity to accommodate wastewater generated within the batching plant.

e) Minimise water used in concrete cleaning by using:

i. Brushes and rags, to remove excess solids, instead of high pressure hoses;

ii. Buckets washing; and

iii. Hoses with low volume, high pressure-spray nozzles and hand held trigger controls.

f) The washwater treatment and chromium removal plant shall be installed before commissioning of a new batching plant. The treated wastewater quality must comply with regulatory authority standards.

i. A permit to re-use the treated wastewater shall be obtained from the regulatory authority if it is intended to use for irrigation, truck washing, dust suppression, or other batching plant purpose if it complies with regulatory authority standards;

ii. Wastewater should be tested every month for the following parameters at least: pH, TDS, total Chromium (Cr) and a summary report on the wastewater quality should be submitted to the PMCM and LREDC Environmental Representative; and

iii. The untreated or partially treated wastewater with quality exceeding the regulatory authority standards shall not be used for any purpose, but it should be disposed of as hazardous wastewater.

23. FUEL AND CHEMICAL STORAGE CONTROL

The purpose of this chapter is to guide the Contractor and sub-contractors on the correct way for storing fuels, chemicals and other hazardous materials both within designated areas and within the field.

Diesel, petrol and oil, or "fuels" and Liquid chemicals, such as thinners, solvents, paints, glues, acids, fertilizers and pesticides, must be stored in such a way that environmental harm does not result, nor is likely to result. The reference to "chemicals" here also includes unused chemicals, liquid mixtures made from dry chemicals and water or other liquids, and residues from chemical use (for example, the wash fluids resulting from cleaning of paint brushes). The reference to "fuels" here also includes waste fuels, such as waste oil, and waste emulsions (i.e. mixtures) of water and fuels.

The main environmental risks associated with fuel and chemical storage are:

a) Contamination of the ground (i.e. soil or sand);

b) Pollution of groundwater, through leaks and spills seeping into the ground;

c) Pollution of stormwater, lakes or other water bodies, either directly from leaks and spills, or indirectly through flow of contaminated groundwater; and

d) Harm to plants and animals, in particular from inappropriate pesticide handling; and

e) Generation of hazardous waste through incorrect handling.

23.1. Storage of Chemicals, Fuel and Hazardous Materials

A number of mitigation and management measures can be instigated to ensure proper storage of hazardous chemicals, liquids and materials. The following procedures shall be implemented:

a) All hazardous material, including chemicals and fuels, shall be stored at a designated site. A site plan, showing the layout of these areas shall be displayed in the site offices.

   i. Fuel, oil and chemical stores will be kept away from busy vehicle routes to minimise the likelihood of collision;

   ii. All construction material will be stored in designated areas away from drains;

   iii. Hazardous materials should not be stored in significant risk locations (e.g. within 50 metres of a water surface, waterway or 50 metres of a well, borehole or any drains that may ultimately drain into the sea or other surface water.);

   iv. Tanks shall be protected to minimise the potential for collision. Placement of cone or hard barrier delineators may be used to identify the tank position; and

   v. Fuel, oil and chemicals will only be stored on impermeable bases and within a bund to contain at least 110 % of the maximum capacity of the storage facility.

b) Hazardous materials to be handled only by operators trained in the relevant handling and spill response procedures. Hazardous materials are to be handled in accordance with Contractor's Project Instruction for Hazardous Materials Management.

   i. Chemicals associated with the plant shall be stored, handled and disposed of in accordance with Regulatory Authority standards and as per the Material Safety Data Sheet (MSDS) of each chemical;

   ii. All sub-contractors shall comply with all legislation with regards to the safe storage and handling of hazardous substances;

   iii. Spilled materials will be collected and treated as hazardous waste;

   iv. Hazardous materials will only be handled by trained personnel; and

   v. Relevant staff will be trained in spill response, containment procedures, material handling and storage procedures.

c) The quantities of fuel, oil and chemical that pose environmental hazards will be minimised;

d) Prior to any chemicals being brought to the site, alternatives will be sought, to ensure only those with the least potential to impact the environment are stored on site;

e) A list of all hazardous substances present on site (Hazmat Inventory) and the material safety data sheets (MSDS) for these substances shall be readily available at required locations/sites.

   i. All materials and chemicals will be stored in a manner that conforms to their MSDS requirements and manufacturer's instructions;

   ii. All MSDS's on file should be current – no older than 5 years.

   iii. All containers of oil, fuel or chemicals shall be labelled and identified with contents and capacity and stored appropriately;

   iv. Chemical containers should not be stacked above chest height or as recommended by the manufacturer

   v. Adequate signage will be put in place identifying hazardous materials and the nature of hazard;

   vi. Each receptacle containing dangerous goods shall be marked with the correct technical name of the substance it contains;

   vii. Inappropriate storage of incompatible materials will not be permitted;

   viii. Incompatible materials shall not be placed in common containment and different class of chemicals will be stored separately;

   ix. Combustible materials will be stored in fire proof containers;

   x. All flammable liquids shall be stored under cover and in well ventilated areas; and

   xi. All volatile chemicals and fuels to be stored in closed containers and properly stored to minimize VOC emissions.

   xii. All waste POL must be stored in closed topped containers.

f) If the Contractor stores liquid fuels and chemicals on site, it is necessary to maintain spill containment and clean-up kit including emergency booms and chemicals to soak up any accidental spillage.

   i. A spill response procedure will be implemented at the site;

   ii. Adequate spill response kits and fire prevention system will be situated throughout the site at high risk areas;

   iii. Appropriate emergency response equipment and medical equipment will be stored adjacent to hazardous materials;

   iv. Ensure there is adequate fire-fighting equipment at the fuel storage area; and

   v. All sub-contractors handling hazardous materials shall keep appropriate spill clean-up material adjacent to storage and maintenance areas.

   vi. Spill kit material should be suitable for the specific purposes they are assigned to – chemical spill kits should be used in chemical storage locations and fuel / oil spill kits used in fuel / oil storage / distribution areas

g) A secondary containment will be installed for storage tanks containing oil or fuel in accordance with MoE regulations and best international practices to accommodate spills.

   i. Contractor shall ensure that any fuel to be used on site (e.g. for generators) is stored in a container (tank or drum) which is of sufficient strength and structural integrity, and has been installed so as to ensure that it is unlikely to burst or leak in its ordinary use.

   ii. Fuels quantities in excess of 100 litres shall not be stored in plastic barrels. They should be stored in in WOQOD approved fuel tanks and bunded. Only WOQOD approved storage tanks shall be used with generators

   iii. All drums and barrels will be fitted with appropriate flow control devices and will be clearly labelled;

iv. All ancillary equipment such as valves and hoses will be contained securely within the bund when not in use; and

v. Bags and sacks of material shall be kept off the ground on pallets and covered or stored inside.

h) Any leaking drums or containers will be removed immediately and appropriately. In addition, should the leak have resulted in contamination of the underlying soils, these will be remediated;

i) Used or waste fuel or other waste chemicals shall be stored in an adequately bunded area onshore, or an impervious storeroom on dredging or other transport vessels until collected.

i. Empty drums and containers shall be kept in a designated area and within a bund or on a metal drip tray until disposed of;

ii. Empty containers will be removed from site and will be either recycled or disposed off as hazardous material;

iii. Damaged, leaking or empty drums will be removed from site and appropriately disposed of;

iv. Spilt materials will be collected and treated as hazardous waste;

v. Contaminated materials (soil and dewatered water) will be stored and disposed of as hazardous waste; and

vi. Waste material or water containing waste chemicals such as thinners, oil, and mineral spirits shall not be pumped or disposed of into storm water drains, sanitary sewers or onto the ground.

23.2. Secondary Containment Requirements

Secondary containment is an additional impermeable device (such as a metal tray or a concrete bund) to hold a hazardous material and contain any spillage from its receptacle in the instance of a failure.

23.2.1. Concrete Bunded Areas

Lubricants, fuels, waste oil and chemical storage area will be constructed on a concrete base. An impervious surface coating will be applied to the base and walls. The containment area will have the capacity to contain 110% of the total volume of stored materials.

a) The secondary containment system must be of sufficient capacity to contain at least 110% of the maximum contents of the container. Where more than one container is stored, the bund should be capable of storing at least 110% of the largest tank or 25% of the total storage capacity, whichever is the greater.

b) Where any drum(s) is used for the storage of the oil in conjunction with a drip tray as a secondary containment system, it is sufficient if the drip tray has a capacity of at least 25% of the drum(s) aggregate total storage capacity.

c) In most cases, the bund must be constructed of reinforced concrete or sealed reinforced block-work and meet the requirements of the appropriate construction standards. Bund walls must have sufficient structural strength to hold the weight of stored liquid, in the event of a tank failure when the tank is completely full;

d) The bunded area should consist of a level concrete or masonry hardstand base with a 150mm minimum high concrete wall to allow for containment of water and oil;

e) The base or wall of a bund must be impermeable in order to prevent water and oil escaping, and must not be penetrated by any valves, pipes or other openings which could be used for draining the bund, as shown in Figure 23-1;

f) The floor of the bund must be slightly graded to drain to one area of the bund, or contain a collection pit. Collection pits must not have drainage connections, except where the discharge is directed to a treatment system approved by PMCM and LREDC Environmental Representative;

g) Bunds which are covered by a roof must have a capacity to contain 110% of the capacity of the largest tank or container being stored in the bund;

h) Bunds without a roof must have a capacity to contain 110% of the capacity of the largest tank or container being stored in the bund, plus the capacity for rainwater according to the amount of rainfall that is collected following a one-in-twenty-year 24 hour storm;

i) The walls of the bund must be positioned a sufficient distance from the walls of the tank, so that spray/puncture leaks will be contained within the bund. Generally, walls must be positioned at least half the height of the tank away, as measured from the widest point of the tank in the same horizontal direction (the ratio of tank height : wall location = H : ½ H), per Figure 23-2;

j) It will be necessary to remove rainwater in order to preserve the integrity of the bund (the 110% rule) but this must be done by pumping the oil into containers for controlled, safe disposal.

k) If a fill pipe or draw-off pipe penetrates the base or wall of the bund the junction of the pipe must be adequately sealed to prevent oil escaping from the bund (steel fabricated puddle flanges are recommended for this use).

l) The bund walls, floor and any sealing finishes or jointing materials must be impervious to avoid fuel being absorbed by porous surfaces;

m) All materials used to construct the bund must not be corroded by the stored liquids;

n) The connection point for bulk refilling of a tank by fuel tankers must be located within the bunded area;

o) Fixed pipes carrying fuel to or from tanks must be positioned within the bund so far as they extend along or across the bund (instead of being attached to the outside of bund walls);

p) The general storage area must have the appropriate signage, specifying the type of fuel stored, the volume of the tank where it is 500 litres or more, oil response procedures and emergency contact details;

q) Hoses, hand-pumps and fittings used for fuel/chemical dispensing must be kept within the storage area or bund when not in active use;

r) If valves have been installed to allow bunds to be drained, they must be kept locked in the closed position when not in active use;

s) Do not drill, puncture or allow holes to be made in any bund walls for pipes and cables, unless effective sealing around the opening can be easily demonstrated;

t) Contractor shall ensure that, for security reasons, valves are made lockable and that stainless steel supply/return pipework is installed.

u) Contractor shall inspect all bunds, tanks and pipework regularly for signs of damage, corrosion or leakage and checked at least weekly. To ensure the bund retains its integrity, any defects in the bund wall or lining should be repaired promptly using the appropriate technique. Damage to the tank or pipework should be dealt with immediately.

v) Daily inspections will be undertaken by the Contractor Environmental Representative of all fuel and chemical storage areas to ensure adequate containment and bunding; and

w) Damage to any bunds must be reported immediately and fixed promptly.

x) It is prohibited for sand to be placed within a concrete bund to act as an absorbent. All secondary containment should be maintained free of sand at all times.

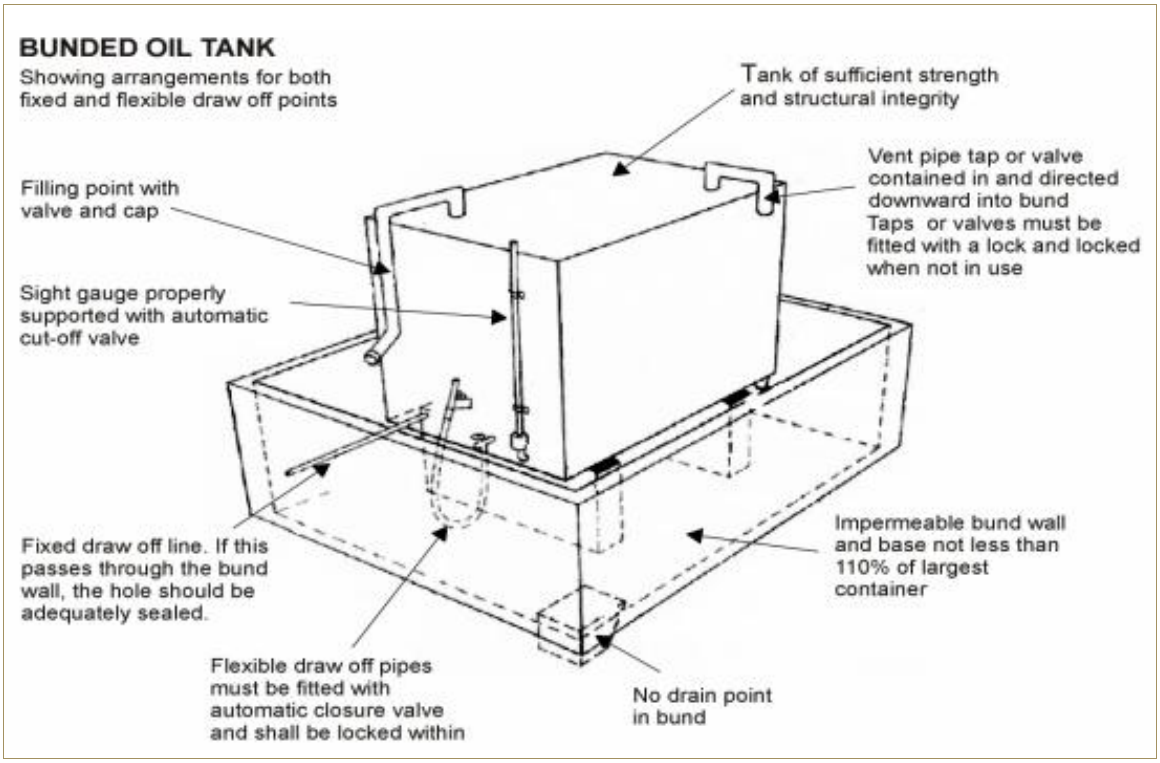


Figure 23-1 – Secondary Containment

23.2.2. Fuel Tanks

Contractor should ensure that fuel tanks are double-skinned. A double-skinned tank has a primary tank with another "skin" placed around it with a very small gap (interstitial space) between the two, thus allowing any leaked product (following a failure in the primary tank) to be contained in the outer tank.

a) Double-skinned tanks are required to have a sight gauge or view glass within the outer tank so that it can be easily ascertained if the primary tank has failed. A metal drip tray should also be provided

b) Contractor shall ensure that the container is not stored directly on the soil, and should be on a level, hardstanding surface.

c) Contractor shall ensure the container is positioned on a concrete plinth within a secondary containment system (bund or drip tray) to catch any oil leaking from the container or its ancillary pipework and equipment;

d) Bulk storage vessels should be check to ensure integrity before use.

   i. Bulk storage vessels will be integrity tested before use. A record of this test will be maintained on site; and

   ii. For steel tanks in open bunds, a minimum distance of 750 mm between the tank and the bund wall and 600 mm between the tank and the base is recommended to allow access for external inspection.

Figure 23-2 – Bund Wall Dimensions for WOQOD Storage Tanks

23.2.3. Metal Drip Trays and Catchment Trays

All stationary diesel and petrol operated construction equipment, including power generators, are to have impervious catchment trays or drip trays placed beneath them during operation.

a) These impervious drip trays (usually made of metal) that are of a sufficient size to contain any breach of primary containment. Trays are large enough to extend beyond the outline of the object;

b) Contractor shall place metal catchment trays under any static plant or equipment containing fuel or other hazardous liquids

c) Any spillages into the metal drip trays will be treated as hazardous waste and collected for safe disposal by an approved waste contractor.

d) Any debris (dust, rubbish, water) that falls in to the metal tray or any hazardous liquid that leaks will be treated as hazardous waste as well

e) If extensive dripping occurs, equipment shall be sent for maintenance;

f) Oil stored in mobile bowsers is also required to be bunded or in metal catchment trays;

g) Metal drip trays will be provided for smaller chemical and fuel storage areas

h) Drums, containers and tanks must be placed a sufficient distance in from the edge of the storage area, such that fuel will be prevented from leaking directly to unsealed surfaces or into waterways in the case of a puncture or drums/ containers falling over;

i) Contractor shall place any container holding hazardous liquids taken to a worksite for use within a catchment tray in order to prevent leaks, spills or overflow contaminating the surrounding area

j) On the construction site, refuelling will be undertaken using drip trays. This will prevent any release of materials from accidental spills into the underlying soil and groundwater

k) Metal impervious drip trays must be used during maintenance work or emergency servicing on site so as to catch any spills. They must be provided at the time of fuel delivery to catch any oil that could be lost during the coupling and decoupling of the delivery hose.

l) It is prohibited for sand to be placed within the drip tray to act as an absorbent. All secondary containment should be maintained free of sand at all times.

m) Spill trays shall be periodically inspected / maintained and kept free of accumulated sand / dust / litter / material.

23.2.4. Additional Measures

Additional control measures include:

a) All above ground pipework is properly supported to avoid damage and potential leaks;

b) The Contractor shall maintain integrity of site drainage system in order to reduce the possibility of land/ water contamination in case of accidental spillage. The Contractor shall provide a facility to block the outlet when required. Abandoned drains are to be blocked to minimise spread of spillage;

c) Hoses between generators and fuel tanks also need to be within secondary containment (such as a bunded area);

d) Ensure septic tanks, if buried below ground are within a GRP (glass reinforced plastic) double skinned tank and placed within an impermeable concrete bund;

e) Install protection (such as a concrete kerb in front of bund) to stop delivery/collection tankers from reversing into and breaking bunds and/or rupturing fuel tanks;

f) Any spillage or leakage and resultant contaminated soil (if any) will be removed and disposed of using approved waste management providers as soon as practicable; and

g) Ensure adequate primary and secondary bunds (earth berms) during Horizontal Direct Drilling (HDD) works in order to contain slurry that may overflow.

24. SPILLAGE PREVENTION AND CONTROL

The purpose of this chapter is to guide the Contractor and sub-contractors to protect sensitive receptors in the vicinity of the Project area by complying with spill prevention and containment practices during the construction works.

24.1. Spill Prevention

Contractor shall take all reasonable steps to prevent contamination of land and soils or pollution of water from spills of fuel or other hazardous liquid. This involves:

a) Maintaining absorbent materials and spill kits with all fuel transfer vehicles, maintenance vehicles, boats or vehicles designated for emergency response;

b) All personnel involved in fuel storage must be familiar with the response procedures in the event of a spill, including use of the spill clean-up kit;

c) Ensuring that once items from a spill kit have been used (and cannot be cleaned and re-used) they must be disposed of properly and replaced with like;

d) Regular monitoring of sewage/wastewater tank will be carried out to avoid overflow; and

e) Regular inspections of all refuelling, maintenance, washing and chemical storage areas to ensure that the secondary containment is adequate.

f) For concrete mixer trucks and pumper trucks spill prevention includes:

   i. Ensure that concrete chute covers are in place whilst vehicle is in motion;

   ii. Do not exceed approved speed limit for vehicle, especially whilst carrying a heavy liquid load and negotiating tight corners;

   iii. Ensure that plastic sheeting or similar is placed beneath pumper truck upon start up so as to capture any oil leaks; and

   iv. Ensure that plastic sheeting or similar is placed beneath concrete mixer truck and pumper truck whilst transferring concrete to other vehicles or receptacles

24.2. Spill Kits

Spill kits shall be made available at strategic locations across the site (including refueling locations, bulk storage areas and maintenance/repair workshops) and be present all fuel transfer vehicles, maintenance vehicles, boats or vehicles designated for emergency response.

a) The spill clean-up kit must be labelled and have appropriate signage indicating its normal location when not in use, and instructions for use must be kept within the kit;

b) The spill kit must be suitable for the volume and type of fuel being stored. Sand must not be used as an absorbent, as this directly causes further environmental contamination (i.e. the sand is part of the natural environment, and becomes contaminated);

c) The contents of the spill clean-up kit must be restocked after use, and contents must be checked for adequacy on a regular basis; and

d) A site plan, showing the locations of spill kits shall be displayed in the site office.

e) Spill kits often contain should contain inadequate equipment such as broken buckets, tissues and plastic bags. The following should be the minimum contents:

   i. Personal protective equipment (goggles, chemical resistant gloves; plastic, vinyl or rubber shoe covers; disposable lab coats, aprons, or coveralls);

   ii. Clean up Tools and materials (e.g. thick, heavy duty waste bags; shovel, sealing tape);

   iii. Metal drip trays and/or Quick deployment pools;

a. Metal drip tray should be used for: Leaking vehicle fuel tanks; Blown hydraulic lines; Leaking containers; and liquids used to decontaminate spill responders; and

b. A quick deployment pool is also an ideal and inexpensive option to place beneath a vehicle that is leaking as it can be cleaned and used again.

iv. Booms (or sand bags);

a. Booms are 'sausage' shaped items that are flexible enough to bend around and contain a spill and are placed downhill from the spill, flat against the ground, to stop spill leaking under or around; and

b. Booms are used to contain oil spills for recovery or to divert it to areas that are less sensitive where it can be collected.

v. Universal absorbents such as commercial spill pads, pillows, spill socks, and loose absorbents:

a. Sorbents are absorbent materials (pads or rolls) or pellets that attract and hold oils, like a sponge; and

b. Sorbents are placed on top of the spill (on land or in water) and soak it up. They are used once and then disposed of as hazardous materials.

vi. Marine floating booms (only required in marine environment)

a. Floating booms contain spills in the water and concentrate it into thicker surface layers, making recovery more effective by a combination of sorbents, vacuums or skimmers; and

b. The flotation blocks and vinyl-coated skirting of the booms create a non-absorbent barrier above and below the water line

vii. Watertight Containment tanks

a. Chemical-resistant container to hold the kit contents. It is recommended that container be on hand that has a sealable lid;

b. Will be used to contain: any waste oil/chemicals that are brought out of the water or collected from the ground; any contaminated soil or water; and any used spill kit equipment that cannot be reused (such as sorbents)until appropriate disposal can be arranged:

c. A spill kit checklist must be maintained with each spill kits on site. The spill kit checklist must be completed monthly. All checklists must be maintained as records.

24.3. Spill Response

Spillages or leakage resulting in soil/water contamination will be considered as an environmental incident and must be cleaned up immediately to prevent it from reaching the environment (including unsealed ground, drains, lakes, marine waters and other uncontained areas).

If a spill does occur, an orderly response procedure will be followed and a detailed contaminated land cleanup strategy will be implemented as follows:

a) Assess the risk (safety, severity and area of impact)

b) Call PMCM/LREDC Environmental Representative within 1-hour of incident:

i. Location of incident;

ii. Type of incident (Contamination or Pollution) and severity; and

iii. Whether Emergency Services needed.

c) Select appropriate PPE. If the spilled substance cannot be identified, treat it as highly toxic and utilise the most appropriate form of protective clothing

d) Contain the spill:
    i. Use booms or pool to contain spill and stop it spreading; and
    ii. Barricade incident with cones / new jersey barriers to control traffic movement until incident is cleared
e) Stop product flow;
f) Absorb contained fluids (with sorbents);
g) Dispose of contaminated materials (be it soil, water or spill kit materials) initially into containment tanks, and then off-site as per CEMP using the Company appointed and approved waste contractors (obtaining a Waste Transfer Note and any other receipts);
h) Complete final Incident Report and submit to LREDC / Regulatory Authority within 72 hours of the incident occurring
    i. Attach relevant photos and records; and
    ii. If desired, Contractor can attach own Incident Report as well (though not in place of the LREDC Incident Report)

The need for remedial work in any specific area will be determined on the basis of the observed contaminants, sampling and analysis to determine their concentrations and the risks that they may pose to local receptors (social and environmental). For instance, Lime powder is typically used for absorbing pesticides, and must be left in place after being applied to the spill, for at least 1 hour. Lime powder must be kept on site if pesticides are being stored. Use appropriate personal protective equipment when handling lime.

25. TERRESTRIAL ECOLOGY CONTROL

The purpose of this chapter is to guide the Contractor and sub-contractors on precautionary procedures to protect sensitive receptors during the construction works.

The following potential impacts may occur during construction:

a) Disturbance of wildlife as a result of construction personnel and lighting;

b) Disturbance of wildlife as a result of construction noise and vibration;

c) Excavation and earthworks;

d) Disturbance or loss of habitat; and

e) Movement of construction vehicle and machinery

25.1. Terrestrial Fauna

Although the EIA did not identify any rare or endangered terrestrial animal species within the site, there will still occasionally be animals, lizards, birds or similar within the project area. The following should be done:

a) Conduct a site check prior to starting surface clearing, to ensure animals are not present;

b) Plan the positioning of all fencing, to avoid trapping larger animals such as gazelles or camels in an area;

c) Fence temporary dewatering lakes that have steep slopes, to prevent animals such as gazelles drowning. The fences must be high enough so that they cannot jump over them;

d) If any animals are detected in an area, consult PMCM and LREDC Environmental Representative in the first instance to discuss how best to remove them. Workers are instructed not to approach the animals;

e) Clearly mark sensitive vegetation, such as Ghaf trees, on site maps and using GPS, if the vegetation is to be retained or relocated.

f) Contractor to ensure employees do not kill or harm any animal, bird or fish within the project site, including snakes, spiders and scorpions;

g) Nests of breeding birds, or similar and dens of animals are not to be disturbed;

h) Lighting at night will be angled so as not to impact nocturnal birds or animals;

i) Noise levels will be kept to a minimum so as not to impact birds or animals;

j) Contractor shall inform the PMCM and LREDC Environmental Representative immediately if there is any observation of a fish-kill incident in the sea, dead water birds (such as flamingos), or if rare or endangered flora or fauna is encountered on the work site

k) Although, bird flu has not been reported in Qatar so far, proper precautionary measures as per best international practice are to be followed. If any suspected bird flu incident occurs, Contractor should inform PMCM and LREDC Environmental Representative immediately, who will preserve the avian fauna's carcass in a plastic bag and transfer the same to the concerned authorities for further detailed investigation and analysis to reconfirm the possible causes.

l) Contractor to ensure employees do not swim or partake of fishing in the lagoons or sea; and

m) Contractor shall provide regularly emptied bins with around their site to prevent the propagation of unwanted fauna attracted to food waste (such as rats).

25.2. Terrestrial Flora

Although the EIA did not identify any rare or endangered terrestrial vegetation within the site, there are still plants and trees within the site. The following should be done:

a) Contractor to ensure employees do not do any damage to flora within the site;

b) Do not change soil levels around plants, for example do not add extra sand on top of the natural existing level within the root zone, as this reduces the roots ability to function. If this is unavoidable, minimise the area of the root zone affected;

c) Do not cut tree roots with a diameter of 50 mm or more, as roots of this size provide structural integrity to trees;

d) If works are required to be conducted within the root zones, such as laying of utilities, directional drilling or hand digging of the trench should be done, in preference to using digging equipment that exposes large areas of soil, such as bobcats (mini-scoops) or JCVs (backhoes);

e) If cutting plant roots cannot be avoided, make the cut with a clean sharp implement at the edge of the works, and do not apply any type of liquid or chemical to the newly-cut surface of the root;

f) If branches of trees need to be removed, ensure that the branches are removed to the branch collar; and

g) Do not discharge water near native vegetation on a permanent basis. Vegetation native to this region does not require large amounts of water and may be adversely affected.

h) Contractor should minimise chemical herbicides to control unwanted flora and fauna, due to risk of run-off into waterbodies, sea or groundwater;

i) Contractor shall aim to use indigenous or adaptive plant species in landscaped areas, as they are suited to the climate and less water intensive;

j) Where trees are to be retained, ensure that the roots and the immediate area that the roots have spread into (called “root zone”) is not impacted by machinery. Damage to the root zone, for example by cars driving over it, may kill the tree. The root zone can be estimated as follows:

   i. ROOT ZONE = TREE CIRCUMFERENCE (measured at 1.5m from ground) x 4

   ii. If a tree circumference at 1.5m above ground is 450 mm, then the Tree Protection Zone is 450mm X 4 = 1,800 mm from the base of the tree; and

   iii. Therefore, work must not be carried out closer than 1,800 mm from the base of the tree.

25.3. Pest Control

The Contractor shall be responsible for rodent, mosquito and pest control on their Site. A pest is any organism which may adversely affect public health, or attack food and buildings, and construction materials. The main types of pests which occur on construction sites in Qatar include:

a) Rodents (mice and rats);

b) Termites;

c) Feral cats;

d) Birds, such as pigeons; and

e) Other insect pests such as ants, mosquitoes, flies, cockroaches, and fleas.

Pests such as rats will seek shelter in stored materials, buildings and waste, which may also be a food source for them. Contractors are responsible to manage their sites in a way that:

a) On-site conditions that may lead to pest infestation are eliminated (limit food sources, shelter); and

b) Pest infestations are controlled through appropriate management responses.

25.3.1. Pest Control Management

The following management techniques provide assistance to the contractor to meet the above objectives and requirements.

a) Block off any potential hiding places for pests, such as gaps around septic tank covers;

b) Do not allow water to stagnate in shallow ponds or infiltrate into dark and covered areas. This will encourage fly and mosquito infestations at the construction site;

c) Pests seek places to live that satisfy basic needs for air, moisture, food and shelter. Prevent pest infestation by preventing pests from entering a site;

d) Feral cats can serve a useful role on site in keeping the number of rodents down. However, it is recommended that the cats on site should be de-sexed to stop uncontrolled breeding. Contact the PMCM and LREDC Environmental Representative

e) Contractors who wish for any feral cats to be removed from site must contact the PMCM and LREDC Environmental Representative, who can arrange for humane euthanasia. Contractors must not attempt to kill or traps feral cats themselves;

f) If evidence of termite activity is found, then all affected timbers should be appropriately disposed of away from site;

g) Consider biological methods for controlling mosquitoes. For example, a native fish species may be introduced to lakes to eat mosquito larvae. Contact PMCM and LREDC Environmental Representative; and

h) Waste Management requirements are covered in OCEMP Section 17:

   i. Waste must be kept in waste bins or skips, which have lids or other covers such as nets fitted;

   ii. Waste collection must be scheduled regularly, so that waste does not accumulate on site; and

   iii. All food waste must be removed and stored in metal waste bins with lids, until collection occurs.

i) Staff Facilities requirements are covered in OCEMP Section 27:

   i. Toilets, shower blocks and sanitary facilities must be well maintained, and septic tanks must be emptied regularly;

   ii. Mess halls, canteens, cafeterias and labourers' rest areas must be cleaned regularly; and

   iii. Ensure all labourers' accommodation has sufficient shower areas. Good human hygiene is important to prevent the spread of fleas.

j) Termites

   i. Termites feed on materials that contain cellulose. At a building site the main cellulose products are timber and wood-based products;

   ii. Do not store timber materials directly on the ground for long periods, and never bury timber in the ground;

   iii. Regularly inspect wood for any evidence of termite activity. Signs of termite activity may include a honeycombed appearance, or wood may give a hollow sound when tapped; and

   iv. Do not construct unnecessary expansion joints or other gaps in the concrete slab at the base of the construction. Such joints and gaps provide openings for termites to enter the building. Use non-organic expansion joint filling materials.

25.3.2. Pesticide Usage

Pesticides must only be applied by authorized persons, trained in the use and application of the chemicals they intend to use:

a) Refer to OCEMP Section 23 for pesticide chemical storage requirements;

b) Assess potential risks for harm before application and take steps to minimise risks;

c) Pesticide users must take all responsible precautions to avoid causing harm to people, property, the environment and non-target plants and animals;

d) Pesticides that are considered "broad spectrum", i.e. that act against a range of pests instead of a single type, or pesticides that have long residual effects in the environment must be avoided;

e) Chemicals and pesticides banned for use in Qatar must be abided by;

f) Spray pesticides in suitable weather conditions, i.e. calm, fine weather, so that sprayed pesticides do not drift or wash off outside the target area. Pesticides must not be sprayed or applied when wind speed exceed 2 m/s, or during fog or rain;

g) Ensure that spraying does not take place if people or non-target plants or animals are likely to be exposed to the spray;

h) Provide adequate buffer areas between the application area and dwellings or sensitive areas;

i) Provide adequate instructions and training to employees before application is carried out;

j) Notify staff of pesticide application, prior to pesticide usage; and

k) A register must be kept on site giving details of pesticides each time they are applied. The details must include the name of the pesticide, the date of application, start and end time of application, specific location of the area treated, and weather conditions.

26. WATER QUALITY AND MARINE ECOLOGY CONTROL

The purpose of this chapter is to guide the Contractor and sub-contractors to protect water quality and the marine ecology sensitive receptors in the vicinity of the Project area during the construction works.

26.1. Wastewater Management

A number of mitigation and management measures can be instigated to manage wastewater, which can include black water (sewage), greywater (washing machine water, shower water, etc), groundwater, vehicle wash water (see earlier) and concrete wash water (see OCEMP Section 22). These control measures include:

a) Contractor shall note that direct discharge to the ground or water is not permitted.

b) Wastewater quality shall conform to regulatory authority standards for the disposal on land, and monitoring records shall be included to PMCM and LREDC Environmental Representative;

c) Location of any storage of liquids, and the placement of any septic tanks, within the Contractors work area is to be agreed with the PMCM and LREDC Environmental Representative prior to occupying the site.

d) Waste water shall be disposed of to sewer either directly or via tanker. Companies must hold a permit for the disposal of such waste water issued in accordance with regulatory requirements;

e) Marine outfall discharge points will be at least 1m below the low tide level to prevent shore run off and to avoid risk of erosion to the seabed and soils;

f) Where wastewater is discharged to the marine environment, discharge flows will be reduced to prevent scour and, where necessary, edge protection measures will be employed;

26.1.1. Sewage Control Measures

A number of mitigation and management measures can be instigated to control sewage and greywater containment and disposal. These control measures include:

a) Contractor shall provide sufficient welfare facilities (both at the site offices and in the field) to cater for their employees;

b) Contractors and will instruct employees and Contractors not to urinate or defecate on the land or in the sea or any waterbody within the Project site;

c) Septic tanks will be GRP double skin tanks and located above ground or single skin and within an impermeable concrete bund below ground level. All associated pipework will be leak free;

d) Septic tanks will be inspected regularly and emptied as appropriate to prevent overfill.

e) It is prohibited to discharge sewage onto the open ground or into drains that discharge direct to the sea;

f) It is prohibited to discharge grey water into the sea. Sewage wastewater must be transferred and disposed of in an appropriate manner;

g) It is prohibited to use open ground for sanitary purposes including bathing;

h) Waste water from the wash basins, shower units, food container washing areas etc on site should be directed to a greywater storage tank. Consideration will be given to the re-use of grey water where possible (e.g. dust suppression);

i) All sewage waste from the temporary toilet blocks shall be routed to a septic tank. Septic waste shall be collected and removed by the Company appointed and approved waste contractor with a Waste Handling Form completed. Tanks will be housed when below ground in a secondary contained bund which is impervious;

j) Position of septic tanks are to be plotted on plan to aid in de-mobilisation;

k) Sewage disposal permits and NOCs to be obtained from regulatory authority prior to the system being commissioned and records to be maintained at site;

l) If on-site treatment is not possible then sewage shall be conveyed to an approved off-site treatment facility;

m) Grey water and sewage from construction site temporary facilities and office blocks must be discharged as per regulatory authority standards;

n) Contractors shall provide a complete description of the waste water treatment method proposed to the PMCM and LREDC Environmental to be approved before implementation;

o) The waste water or sewage generated by Contractors shall be conveyed to a central tank through a proper drainage system;

p) Contractor shall ensure the integrity of the drainage system to avoid escape of untreated wastewater and odour to environment;

q) Contractor will ideally install underground tanks for sewage collection, though septic tanks are acceptable;

r) Details of all existing temporary sewage holding tanks during installation and dismantling to be submitted to the PMCM and LREDC Environmental Representative;

s) Contractor shall ensure that there will be a minimum separation distance of 100m between any sewage collection system or septic tank and standing water bodies; and

t) The sewage shall be treated in treatment systems where the disinfecting method will be defined by the PMCM and LREDC Environmental and the outflow used for irrigation in the development area or transferred to the central system.

26.2. Reclamation and Dredging Activities

Planning of dredging, marine trenching and reclamation, assessment of alternatives, development of monitoring programs and implementation of management measures must be done in consideration of surrounding developments and operational facilities as well as the marine ecology. The Lusail project is subject to an MoE enforced marine works moratorium which spans the spawning of hatching season of juvenile shrimp and fish. The moratorium is effective from 1st April to 30th June each calendar year. During this time, any activity which is expected to result in sediment loading of the water column is strictly prohibited. The aim is to protect sensitive marine ecosystems during the spawning season.

26.2.1. General Controls

The reclamation, marine trenching and dredging methods must be identified in the contractors' CEMP, including equipment used for reclamation, and any adjustments and fittings that can be applied to or installed on the reclamation equipment to minimize disturbance to water quality and identified sensitive receptors;

a) The contractor must consider alternatives to the dredging and reclamation plan that could minimize any potential adverse impacts on the marine environment;

b) When dredging, fit the hopper with an environmental valve to reduce overflow of dredged material;

c) When dredging, use low-turbidity dredging machinery near sensitive areas;

d) When doing reclamation, spread dredge material by controlled (barge) hopper release;

e) Implement Environmental Impact Assessment recommendations relating to reducing environmental impacts;

f) Schedule dredging or reclamation works with consideration to:

   i. Avoid seasonal weather impacts and plume migration near sensitive areas,

   ii. Avoid work near sensitive areas during periods of high public exposure (such as during holiday period when there is more recreational beach/marine activity),

   iii. Avoid disruption of major, public, maritime activities, for example - sailing regattas, speed boat races, abra and ferry operations,

   iv. Avoid work during hatching period, coral spawning period, or migratory bird roosting grounds at relevant times, and

   v. With respect to breakwater construction to maximize opportunities for plume containment;

g) Staged configuration and orientation of reclaimed land masses to enclose and limit turbidity plumes.

h) Most dredging equipment has one or more control measures to limit sediment release during collection and transport, and spills during loading and unloading, for example covers, plates, gate seals, splash aprons;

i) Sediment loss prevention/minimisation measures must be used when working near environmentally sensitive areas. Use of these measures must be included in the CEMP;

j) Transport equipment shall be tested for leaks and breaks prior to material transportation and shall be frequently monitored during operation for leaks and blockages;

k) Pipeline sections must be quick and easy to assemble, maintain and dismantle, because it may be periodically necessary to halt dredging operations to add or remove sections of the pipeline to repair leaks or reroute the line;

l) Extra pipe sections must be readily available onsite to replace both land and water-based pipeline sections that are clogged or leaking;

m) Barge hulls must be inspected regularly to ensure that they are completely sealed; and

n) Sediment spillage can result from overfilling the barge or a leaking hull. Overfilling can be prevented by filling the barge only to the bottom of the barge coaming, and spillage while in tow can be prevented by placing removable covers over the barge coaming. In cases where overfilling is required (for example, hydraulic filling), contractors must avoid using such dredging methods close to sensitive environmental receptors.

26.2.2. Silt Curtains

Silt curtains are a type of containment barrier used to control suspended sediments in the water column, that maybe generated by dredging marine trenching and reclamation. Silt curtains reduce water movement in the area contained by the curtain, which then allows suspended sediment within the contained area to settle out of suspension, before the water disperses more broadly. Silt curtains do not indefinitely contain turbid water, but control the dispersion of turbid water by diverting the flow under the curtain, thereby minimizing the turbidity in the water column outside the silt curtain.

a) Ensure that silt curtain is approved by PMCM and LREDC Representative as installed correctly prior to works starting adjacent to or within the water

b) Ensure that silt screen is complete with a scum boom as well.

c) Ensure that the size and gauge of the silt curtain is appropriate

d) Ensure that the silt curtain will be secured, with no gaps within the protection

e) It is not acceptable to have the floating solid silt screen with a screen that does not reach the sea floor at all times, as the sediment-laden water can pass beneath it, thus negating the purpose of a silt curtain

f) Weights will be added to the bottom of the silt screen from the outset, as this will prevent the screen from floating. Therefore there will be no need for a boat.

g) Any scum that develops within the fenced off area will be removed with a net or similar and stored on land within containment to dry out prior to disposal

h) Monitoring regime of the silt curtains to confirm that it is being effective, includes:

   i. Confirming that base of solid silt screen remains on the sea floor at all times when in operation;

   ii. Confirming that silt curtain has not been damaged;

   iii. Confirming that water quality (particularly turbidity) past the silt screen is not exceeding the MoE parameters;

i) Silt curtains must be left in place at least for five (5) days after dredging or reclamation activities have been completed, to allow for more complete settling of sediment.

j) For large projects, it may be necessary to relocate the barriers as the dredge moves to new areas. Ensure that the barriers do not impede navigation traffic.

26.2.3. Water Quality Monitoring

The contractor must plan and implement a water quality monitoring plan. The plan must be approved by PMCM and LREDC Environment Department, and included in the CEMP:

a) The purpose of the monitoring plan is to identify impacts on water quality which may affect the environment and in particular sensitive receivers;

b) The water quality monitoring plan must address the location of monitoring stations, the frequency of data collection, the duration of activities, the expected weather conditions during the activities and the type of dredging and reclamation machinery used; and

c) The turbidity limits indicate the amount of sediment suspended in water and must be adhered to at all times during all dredging and reclamation activities that are being carried out in and around sensitive receivers.

26.3. Marine Ecology

Contractors must identify significant ecological or community events that are likely to occur during their planned activities adjacent to or within the marine environment (e.g. dredging/reclamation activity).

a) Contractor to ensure employees do not kill or harm any animal, bird or fish within the project site, including jelly fish, sharks and sea snakes;

b) Nests of breeding birds, or similar and dens of animals are not to be disturbed;

c) Lighting at night will be angled so as not to impact animals whilst nesting or hatching;

d) Noise levels will be kept to a minimum so as not to impact animals whilst nesting or hatching;

e) Contractor shall inform the PMCM and LREDC Environmental Representative immediately if there is any observation of a fish-kill incident in the sea, dead water birds (such as flamingos), or if rare or endangered flora or fauna is encountered on the work site

f) Contractor to ensure employees do not swim or partake of fishing in the lagoons or sea;

g) Dredging/ marine trenching / reclamation must not be carried out during these times, that is, an “environmental window” period must be applied. Significant ecological events may include:

   i. Coral spawning;

   ii. Growth periods for aquatic vegetation such as sea grass;

   iii. Nesting season for local and migratory birds;

   iv. Migration periods for birds;

   v. Habitat and/or food source destruction of migrating or seasonal species; and

   vi. Impediments to seasonal recreational activities.

h) For marine activities, install silt curtains to protect significant marine areas such as coral reefs from construction sediment; and

i) Works near permanent and seasonal waterways must ensure sediment does not enter waterways.

27. WELFARE FACILITIES, OFFICES AND LAYDOWN CONTROL

The purpose of this chapter is to guide the Contractor and sub-contractors on setting up offices, lay down areas, work sites and welfare facilities during the construction works.

27.1. Boundary Management

A boundary fence must be constructed around a contractor's work site and/ or compound. The type of fencing will be determined by the neighboring land use and type of activities taking place:

a) Sites in high visibility areas such as adjacent to residential land or near high-traffic public roads must have a solid fence that acts as a visual and noise barrier, as well as providing security and safety,

b) Sites in remote areas, away from sensitive receivers, may have a chain mesh fence or other fence which provides security and safety;

c) Further consideration to the type of fencing will be required for sites where camels, gazelles and other native animals (animals) may live or roam. Fencing should not entrap animals or cut them off from their normal access to food, water and habitat. Consult PMCM or LREDC Environmental Representative for further advice;

d) Contractors must confine all their activities and storage to within their fenced site compound or work site;

e) Ensure that hoardings have covers at the base of the hoarding (soil/sand, wood or netting) to stop waste escaping beneath them;

f) Fencing materials from previous jobs must be re-used where possible. Timber hoardings, fencing chain mesh and steel fence posts are re-useable, so they may be sourced from previous sites; and

g) In cases where logistical constraints prevent a contractor from confining all activities, structures and materials within the agreed boundary, then contractors must acknowledge that they may share responsibility for the clean-up of any contamination and/or any issues of non-compliance across the affected parts of the project site.

27.2. Site Layout

The precise location and limits of a contractor's work site (including offices, workshops, lay down areas and actual work sites) within the overall project site must be approved by the Project Management Team before mobilization. This is covered further in OCEMP Section 9.

a) Site establishment must take into account overland flows (run-off) and drainage requirements sufficient to prevent flooding in the event of significant rains;

b) Site establishment on coastal projects must also take into account sea water levels, in particular, king tides and storm surge. Inundation of areas used for fuel and chemical storage may result in significant marine pollution, for example;

c) Prior to mobilisation, it is the responsibility of the contractor to bring to the attention of PMCM and LREDC any suspected or existing contamination on the area of the proposed work site, compound, workshop or site offices. Failure to do so may result in the contractor being held liable for the contamination during the contracted work or upon later demobilisation; and

d) A layout plan of the proposed work site must be submitted to the Project Management Team for approval. The plan must show:

   i. Physical limits of the work site and boundary fence,

   ii. Location of buildings and their use,

   iii. Access and egress roads,

   iv. Sewage holding tanks,

   v. Water tanks,

vi. Workshop and repair areas,

vii. Storage areas - hazard materials storage, fuel storage, waste storage including provision for separate storage of recycling waste,

viii. Concrete washout bays, and

ix. The emergency marshalling point.

27.3. Welfare Facilities

Welfare facilities include food, shelter and water areas for the workers and staff. Control measures include:

a) Outdoor cooking fires are prohibited;

b) All food preparation and cooking areas must drain to a correctly installed and maintained plumbing system (sealed pipes), which drains to a fully enclosed holding tank/s;

c) All food and other cooking waste must be disposed of in dedicated metal bins with lids. These waste bins must be checked routinely and emptied frequently to avoid overfilling, odour problems and pest infestations;

d) Water drinking stations must not be allowed to overflow as the ponding water can become stagnant and attract mosquitos and other pests; and

e) Water drinking stations must be maintained so that water resources are conserved.

27.4. Toilet Facilities

Toilets must be provided in appropriate locations and in sufficient numbers for all site office and construction site workers (one toilet per every 20 construction workers):

a) It is prohibited to use a beach, open ground or unfinished buildings for toilet purposes;

b) Defecating or urinating outdoors is not permitted;

c) Kitchens, toilets and ablution facilities must drain through sealed pipes to fully enclosed sewage holding tanks;

d) Sewage holding tanks are not permitted to discharge to a soakage trench. Sewage holding tanks must be designed for emptying by tanker. Where a contractor seeks to treat sewage or wastewater on site, for example, through composting toilets, approval from PMCM and LREDC must be obtained prior to installation of any such facilities. Approval may be subject to conditions;

e) Sewage holding tanks must be pre-fabricated fibre-glass tanks or concrete tanks. Excavated pits lined with concrete block bricks (not skimmed), or with boards covering the open (top) face are not permitted;

f) Sewage holding tanks must have close fitting, heavy duty lids. The lids must be in good condition and in-place at all times, except during pump-out of tanks;

g) Toilets must not be washed out on to the floor. Either use a kerb at the front of the toilet entrance or a mop and bucket to collect the wastewater or divert it to the drainage hole;

h) Prior to installation, sewage holding tanks must be inspected by the Project Management Team, who will verify that all tanks are free of cracks or damage. Tanks that do not pass this inspection must be replaced. Replacement tanks may be installed only after they are inspected and certified by the Project Management Team as being suitable;

i) Temporary toilet facilities are to be constructed on a concrete pad that is designed and built to drain to the sewage holding tank;

j) Sewage tankers and other vehicles are not permitted to drive or park over sewage holding tanks. Provisions must be made for sewage tankers to access sewage holding tanks without driving or parking over them. A concrete kerb is installed to stop drivers hitting the tank or bund;

k) A barrier must be placed around underground sewage holding tank locations, so that vehicles and people cannot drive or walk over the sewage holding tanks, and a sign must indicate the location of the sewage holding tanks with a warning about the potential presence of raw sewage on the ground surface (hazard); and

l) The connection point for sewage tankers pumping out sewage holding tanks must be over a concrete pad, which drains back to the sewage holding tank or into a contained sump, to prevent raw sewage spilling onto unsealed ground during pump-outs.

27.5. Housekeeping

Housekeeping is covered within the waste management section (OCEMP Section 17), and includes:

a) All waste must be sorted (for reuse and recycling purposes) and stored in appropriate waste receptacles, in a designated area prior to collection by an approved waste transport contractor;

b) Waste must not be stockpiled directly on unsealed ground;

c) Space must be allocated for waste collection vehicles to access waste and recycling storage areas;

d) Rain and other water flows must not be permitted to enter waste storage containers or waste storage areas;

e) All unsorted (mixed) waste must be stored in containers, such as skips, bins or drums, and covered so that wind cannot blow waste out of the skips/ bins;

f) Waste intended for reuse or recycling must be stored separately in clearly marked areas, with signs indicating the type of waste to be stored there;

g) Waste storage containers must be available for each type of waste;

h) Food waste must be stored in bins and have close-fitting lids;

i) There must be a sufficient number of litter bins placed around compounds, labour camps and work sites to discourage littering; and

j) Hazardous waste must be must be labelled clearly, and stored separately according to the requirements for the type of hazard presented (refer to the MSDS) and in accordance with other regulatory requirements.

27.6. Generators

Secondary containment requirements for generators are discussed in section 23.0.

Other control measures include:

a. Generators must be located away from potential noise-sensitive areas such as offices, rest shelters, and eating areas;
b. The area around the generator must be clean and free of clutter and any combustible material;
c. Fuel / oil / POL spills around the generator, either within the concrete bund or on the ground adjacent to the bund, must be cleaned promptly and the cause of such spills investigated with a view to implementing appropriate corrective action.
d. Provide shelter for generator for protection against adverse weather conditions. Shelters are beneficial in providing shade to generators, reducing ambient air temperature around the generator unit.

28. SOCIO-CULTURAL AND ARCHAEOLOGY CONTROL

The purpose of this chapter is to guide the Contractor and sub-contractors to protect any archaeological or heritage sites discovered during the construction works and to minimize any negative socio-cultural impacts.

28.1. Archaeological Sites

The Project Environmental Impact Assessments (2005 and 2007) did not identify any areas of archaeological importance within the Lusail Development, but heritage or archaeological items or relics may still be uncovered during the construction activities. Control measures to implement include:

a) Specific conditions related to the protection of cultural heritage items from the Environmental Impact Assessment and Environmental Baseline Study will be implemented as directed under the contract;

b) When work is conducted near identified heritage items, the items will be clearly marked with temporary flagging or fencing prior to the commencement of works;

c) When work is conducted near identified heritage items, an exclusion zone will be created around the items to prevent damage by excavation, vehicle movement and vibration, resulting from vehicles and equipment;

d) The possible or confirmed existence of heritage objects or places, and the responsibility to report any suspected heritage discoveries, will be communicated to all staff including machinery operators;

e) The discovery of any potential heritage items will be reported through the Project Manager, PMCM and LREDC's Environmental Representative for further instructions; and

f) It is noted that potential heritage items or relics can include:

   i. Evidence of historical occupation (such as aged building remains), fishing or pearling artefacts, ship wrecks, pottery, flint and other tools;

   ii. Evidence of early industrial heritage;

   iii. Articles of religious heritage value; and

   iv. Items or places of importance to the early Bedouin peoples.

28.2. Socio-Cultural Interaction

It is imperative that the construction activities have a minimum of negative impact on the surrounding land users or on people who are still entering the site for non-Lusail Development activities (such as members of the public at the Marina District or the concrete batching plants not supplying Lusail Development).

29. APPENDICES

The following forms have been developed for specific use within the Lusail Development, alongside the Contractor's own forms and procedures

Appendix 1 – Weekly Environmental Report

Appendix 2 – Monthly Environmental Report

Appendix 3 – Environmental Incident Notification Report

Appendix 4 – Environmental Incident Investigation Report

Appendix 5 – Environmental Inspection and Audit Procedure

Appendix 6 – Environmental Inspection Checklist

Appendix 7 – Environmental Inspection Report

Appendix 8 – Environmental Management System (EMS) Audit Checklist

Appendix 9 - Environmental Aspects and Impacts Procedure and Register

Appendix 10 - Environmental Risk Assessment Form

Appendix 11 – Demobilisation Checklist

Please contact the Lusail Project Environmental Team for documents listed above.

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