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الدقم

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Special Economic Zone Authority



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*CONSULTANCY SERVICES FOR
DESIGN AND SUPERVISION OF THE DUQM
DEVELOPMENT DRAINAGE NETWORK AND
PROTECTION SCHEMES – PHASE I
SAAY DAM, JURF CHANNEL, SAY CHANNEL AND
CHANNEL JUNCTION*

*ENVIRONMENTAL IMPACT
ASSESSMENT REPORT*

RENARDET S.A. & PARTNERS
CONSULTING ENGINEERS L.L.C.



 **bonifica** GROUP

JULY 2015

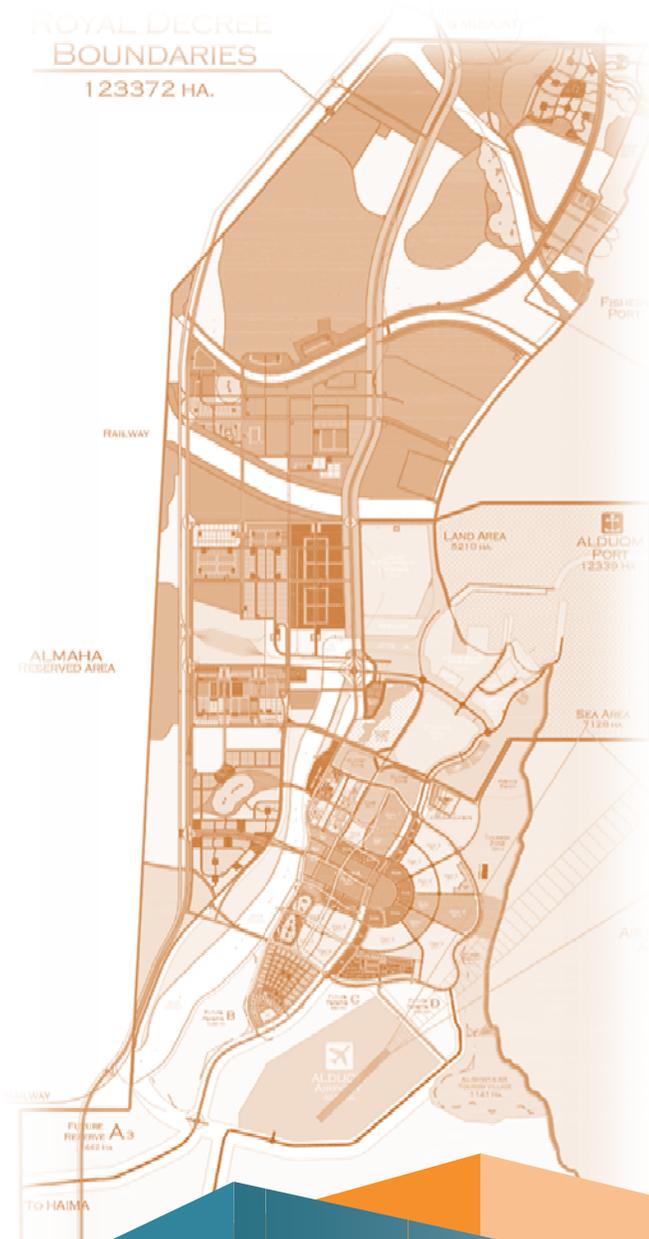


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LIST OF ABBREVIATIONS

AE	: Apparent endemic
BOQ	: Bill of Quantities
BOD	: Biological Oxygen Demand
CCEPP	: Council for the Conservation of Environment and Prevention of Pollution
CO	: Air Pollution by Carbon Monoxide Concentrations
COD	: Chemical Oxygen Demand
DC	: Diversion Channel
DDF	: Dam Design Flood - Subject to Client approval and discussions
DE	: Design Engineer
DGEA	: Directorate General of Environmental Affairs
EIA	: Environmental Impact Assessment
EIS	: Environmental Impact Statement
EMP	: Environmental Management Plan
EMC	: Environmental Management Cell
EMS	: Environmental Management System
ES	: Environmental specifications
E&SU	: Environmental and Social Unit
FR	: Fragmented Population
FSL	: (Full Supply Level): Subject to Client approval and discussions
SEL	: Safety Evaluation Flood
SDF	: Spillway Design Flood
PMF	: flood - Subject to Client approval and discussions
GDP	: Gross Domestic Product
HC	: Air Pollution by Hydrocarbons Concentrations
H ₂ S	: Hydrogen Sulphide
IEE	: Initial Environmental Evaluation
IDF	: Intensity Duration Frequency
MDs	: Ministerial Decisions
MECA	: Ministry for Environment and Climate Affairs
MWL	: Maximum water level in reservoir
mamsl	: meters above mean sea level
MOCI	: Ministry of Commerce and Industry
MOH	: Ministry of Housing
MRM&WR	: Ministry of Regional Municipalities and Water Resources
NAAQS	: National Ambient Air Quality standards
NO _x	: Air Pollution by Nitrogen Components Concentrations

NRs	: Nature Reserves
PMF	: Probable maximum flood
PM ₁₀	: Air Pollution Index
OR	: Omani Rial
QA/QC	: Quality Assurance and Quality Control Checks
RD	: Royal Decree
RE	: Resident Engineer
RGO	: Regional Offices, Diwan's Offices
SEZAD	: Duqm Authority
SC	: Special Concern
SCTP	: Supreme Committee for Town Planning
SOx	: Air Pollution by Sulfur Components Concentrations
SRS	: Standard Review Sheet
TA	: Technical Assistant
TE	: Trace Elements
TOR	: Terms of Reference

1. INTRODUCTION

1.1 Background

The Special Economic Zone Authority for Duqm Project (SEZAD) appointed Renardet SA & Partners for the Consultancy services for feasibility and detailed design study of the Duqm Development Drainage Network and Protection Schemes for the free zone of Duqm located in Al Wusta Governorate of the Sultanate of Oman.

Duqm development undertakes the future construction of Modern Port & Dry Dock, International Airport, New Town complex, Industrial Areas, Fishing Harbor & Industry, Transport System, Power & Utilities and Tourism Zones (Hotels & Resorts).

The project encompasses a very large area at the north of Duqm in the Al Wusta Governorate. A royal decree defined the boundaries of the foreseen development. This area is situated in a bay where several wadis draining the higher plateaus, located inland, enters the sea.

Previous studies were performed over this area in order to establish a Master plan for the development. The area will be developed in accordance with this Masterplan with industrial, commercial and residential areas demarcated and joined with arterial roads. The previous Masterplan foresaw at least two dams and three channels over the studied area to provide safe conveyance of stormwater.

Within this Masterplan, preliminary calculations were done to obtain sizes of the dams and the channels. For the purpose of this environmental impact assessment (EIA) study the project comprehends the Saay dam design and 3 channels (Saay channel, Jurf Channel and the junction of both channels till the sea outlet) positioned in the three main wadis, Wadi Saay, Wadi Jurf and Dangert.

For the Inception phase, some initial information were gathered and made available. The documents received relates largely to the Master plan carried by Sering Consultancy. In addition, several reports relating to the geological aspects of the development area and geotechnical interpretation reports were made available to us.

As mentioned before, the study area is located within the Wadi Jurf, Wadi Say and on both sea outlets in the Duqm city in Al Wusta Governorate.

The aim of the project is to provide a significant degree of flood protection to the free zone area under development. The construction of attenuation dams and flood conveyance channels is likely to form the principal components of such flood protection measures. Dams will be situated upstream of the target area and channels shall be designed to convey the remaining water safely through the development area. The following figure shows the approximate location of the project.

Within the feasibility phase and hydrological assessment was carried out over the complete area and two dimensional models were established to show the effect of dam and channel implementation. Particular attention was paid to the land occupation within the SEZAD boundary. The hydrological model was adapted with right curve number in order to place our design on the safest side

Slopes encountered are shallow and resulted in wide channels especially at the downstream end even for the return period considered.

In addition, the alignment of preliminary the channel was actually selected according to the wishes of the Client and due a possible interaction with services and bridges.

Alternative channel routes were considered during design phase. Eventually it was decided to select the channel alignment based on hydraulic considerations resulting in the alignment following the natural wadi bed to a large extent.

The Consultant undertook a site investigation of the proposed dam site area as well as the surrounding environment to determine both the impacts of the dam and the channels on the surrounding area until the sea outlet, environment and foreseen future developments.

The general principle is to use the natural wadi channels as far as practically possible, bearing in mind the development plan. This minimise adverse environmental impacts in the first instance and reduce excavation quantities and associated costs.

Dam provided upstream of the development area reduces the flood peaks and volumes thereby reducing the need for wide channels. Optimisation of the entire project is required to ensure a balance exist between the cost of channels and the sizes of the respective dams.

The scope of works includes:

- Wadi Say Dam
- Wadi Jurf Channel
- Wadi Say Channel
- Collecting secondary channels
- Sea outlet.



No base-flow is present in wadis; therefore its construction won't provide any impact on the absent surface water.

Few livestock (camel, goats and sheep) are presently grazing the project area, since the wadi provides protection and food for some of these animals.



The natural habitats present in and around the project area are the below mentioned. These habitats will be preserved in the most possible way and mitigation measures are considered.

The habitats present in and around the Al Duqm town area can be broadly grouped into three main types:

- **Coastal habitats** and Sabkha (salt flats): these areas contain a mixture of wetlands (e.g. lagoons), very saline areas with little vegetation, and less saline areas with some vegetation. These habitats support internationally important species and, of the three main habitats, are the least common in the region
- **Wadis and gravel plains:** the water provided by wadis supports a diverse range of vegetation, typified locally by open acacia woodlands, low shrubs and ephemeral grasses. Wadis act as wildlife corridors, along which mammals and birds travel; and
- **Hills, slopes and escarpments:** these habitat types support the least vegetation and wildlife, although where water is retained in fissures and depressions, there is likely to be a higher density of vegetation.



These habitats shelter important protected species, such as the Arabian Oryx reserve, the bird area and the turtle nest area. Although, the project doesn't cross these areas, mitigation measures are contemplated, in order to not disturb the natural habitat in the surrounding area of these important fauna nests.



- An Arabian Oryx reserve lies approximately 5km west of the proposed town. The reserve contains a diverse range of habitat types and supports

numerous internationally/regionally important and rare species, including the Arabian Oryx. The site was included on UNESCO's World Heritage List in 1994 but became the first site to be deleted from this list in 2007, due to Oman's decision to reduce the area of the protected site by 90% and because of a decline in Oryx numbers due to poaching and habitat degradation; and

- Duqm Important Bird Area, designated in 2001, comprises the coastal and sabkha habitat immediately north of the proposed town, which has been recognized as an internationally important site for migratory birds. Unfortunately, completion of Al Duqm port development will destroy this site.
- Turtle Area, nesting aggregations of the endangered green and loggerhead turtles in the world. Sea turtles are among the oldest and most important marine animals in Omani waters.



By the Preliminary design stage, several meetings and site visits were held, resulting in some optimization of the Saay Channel design with interesting findings and channel adjustments due environmental concerns.

A site visit to wadi Saay Channel a small community of trees was found to be on the exact alignment of the channel. This small community of trees is presented in the bellow images, along with its identified location.





The encountered community of trees are mostly Acacia spread in an approximated 2 km² area of the project and its destruction would arise not only the construction costs but the environmental impacts of the project due the lack of biodiversity and air quality lost. Therefore, the client agreed on adjusting the wadi Saay Channel design alignment and not to destroying this small Acacia community.

The project doesn't predict the need of occupation of private residential areas, since there are no houses to be relocated from the dam axis, reservoir or from the wadi bed were the channels will be built.

Nevertheless, there are a few small animal shelters that may be relocated, mainly because the owners often move the shelters according to their needs and they may move some onto the channel alignment before construction starts. At the moment, the project does not consider the relocation of the animal shelters, but should be consider such relocation in the BoQ.

Due the extension of the projects it is possible to encounter some power lines that need to be relocated. These medium voltage lines will be relocated without long interruption of the service.

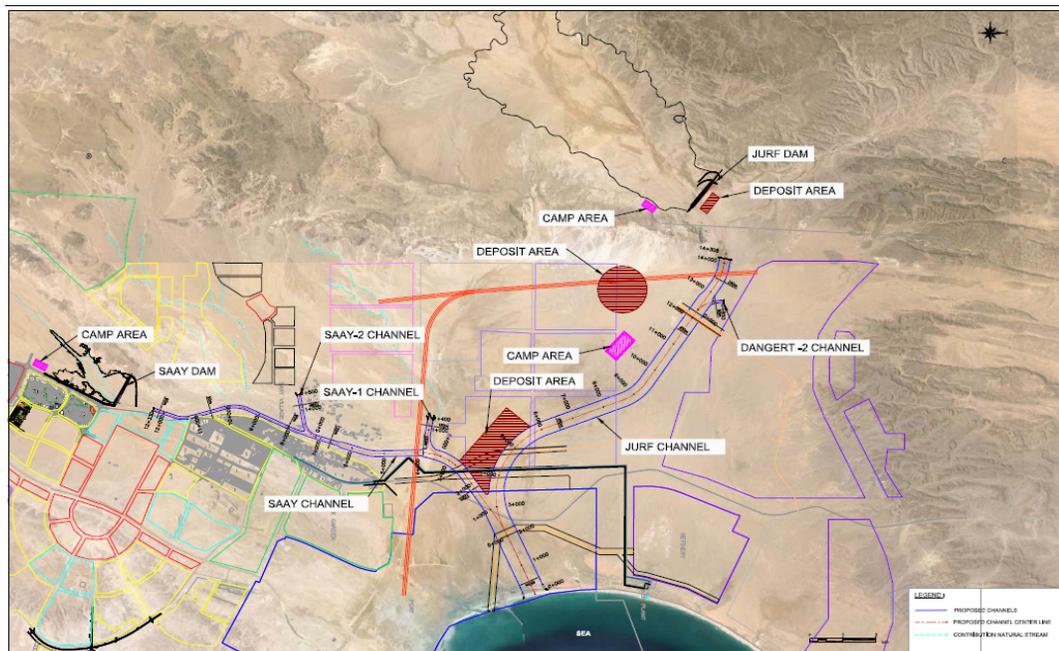
During construction, some temporary areas will be affected to establish campsites, deposit areas and even borrow areas. The contractor will settle 2 areas to establish the campsites where the construction material and logistic will take place. It is suggested this campsite to be upstream each dam and close to the main road to serve the channels, in a flat area, avoiding the occupation of other areas with no access built and improving response in case of any emergency situation.

Also during construction phase, the excavation activities may generate surplus of soil that will have no use for the construction of dam and the channels. This excavation material will be stockpiled on a temporary area near the project in a flat area, avoiding being run off from water or wind. This temporary stockpiled area is allocated to the stock material that SEZAD may use for their future projects needs.

At this stage of the project it is not possible to assume the exact amount of material to stockpile or to borrow as the size of the dams are still under approval of SEZAD, but the predictable quantities for deposit area are 200 000 m² at the channel junction. Once approved the dimension of the dams, the volume and the exact location of these areas can be confirmed for the borrow areas, quarries and the deposit, but the contractor will need permission/ approval from SEZAD.

Within the project, particular attention was paid in order to minimise the impacts of the projected features over the existing and foreseen features. Despite this effort some features will be affected due to the selected channel route. Some PAEW gravity and under pressurised pipes will be affected. Protection and relocation of these will be essential.

The channels are crossing several roads alignment. Preliminary Channel alignment was retained to minimise these impacts and resulted in a adverse bend at the downstream end. The Consultant believed this shall be replaced by a different solution despite the increase effect on these features. Protection of the crossing is required and was taken into consideration at preliminary stage.



There is no major air quality problem located in the project area as per the time being, since the study area is wide open, with natural habitats and absence of major air pollution sources, such as industry or big traffic roads.

Also, during construction, there would be temporary impact on the noise environment along the proposed channel due to excavation and material transport.

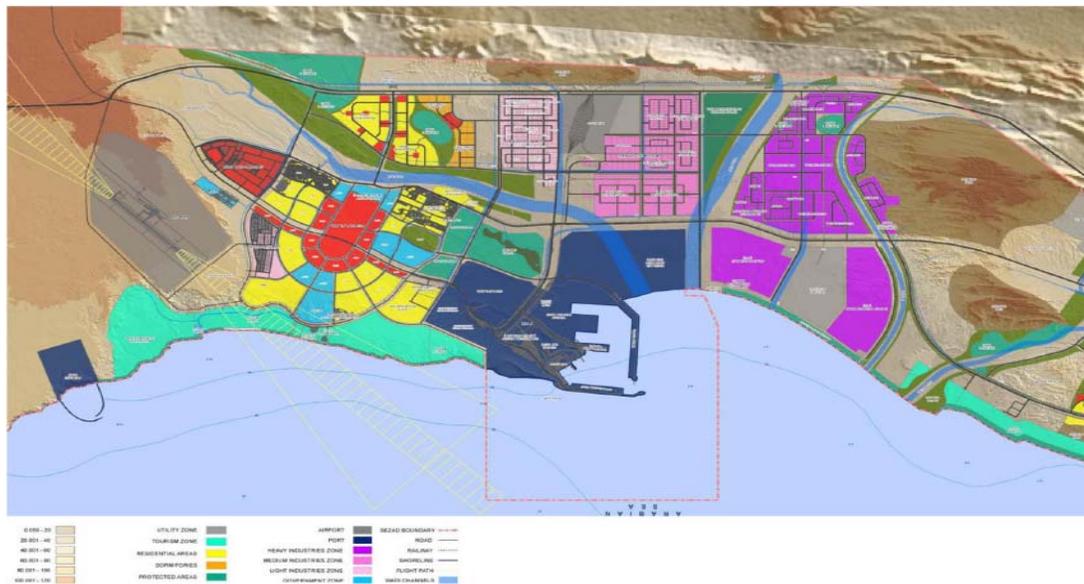
It is not anticipated that very toxic or hazardous materials will be used during this project. Fuel storage areas, if required, will be contained as required by law and solvents, paints and construction additives that may be toxic will be controlled in contained stores.

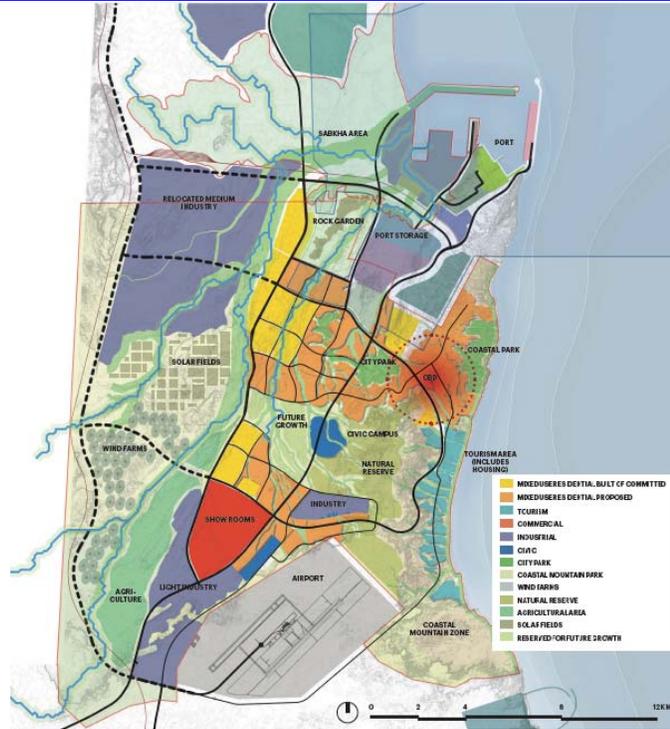
For the channels, most of the required construction materials are generally available from within the wadi bed, except for embankments that are to be in rip rap material (preferably, but not demanding from the wadi bed).

For the dam construction there are no borrow areas or quarries yet defined as the project studies don't allow at this stage to take any conclusion in this regard. Nevertheless, all the borrow areas to this project have to be requested and approved by SEZAD.

The current land use map shown below, indicates the developed within Duqm city. For the actual time, the area where the project of the proposed project is to be developed (Wadi Say, Wadi Jurf and the Junction area of the Channel sea outlets) has no major occupation in terms of land use terminology. Some construction activities are in the on-going stage in the vicinity of the area and some small farms are visible along the channels on a small scale.

The below figure represents the adopted land use zoning for the entire Duqm Royal decree area as of September 2013.





Although the project area is almost untouched in terms of construction activities, major projects are to be developed, with the development of Duqm Town, the airport area and the medium and light industrial area in the vicinity of the proposed project. The SEZAD Masterplan predicts innovative developments, namely, wind farms, solar fields, commercial area & showrooms, along with the implementation of the industrial areas, in the surroundings of the wadi Saay and Wadi Jurf dams and channels. As a sort term strategy for the project area, Duqm will see the rising of a road system at national and local scale serving the abovementioned areas in Duqm.

The project area will be subject to drastic changes within the future developments, highlighting the importance of building an adequate channel capable of providing flood protection and natural drainage of the existing wadis.

The development location has a rich archaeological legacy with a number of findings on or within the vicinity of the site including burial mounds, shell midden sites, ceramic artifacts that hint at Bronze Age settlements, burial structures and pre-historic tombs.

Among the COPS identified archeological sites, some remain in right flank zone and others in an area upstream of the Wadi Say Dam, along the wadi Say Channel. During the site visits, no archeological particulars, such ceramic artifacts, burial structures or tombs, were identified.



Other Geological Heritage – Echinoids, Nummulites and Geodes

Further sites visits allowed the investigation to be expanded to the Damman Formation (Edm1-2). This formation consists on a succession of sequences of alternating bioclastic limestone and white chalky marl and the top of the sequence is very rich in large inner shelf fossil fauna with echinoids and molluscs.



These natural sites were considered during the design stage of the wadi Say dam and the dam axis was relocated downstream so that the natural heritage can be preserved from any construction activity.



Another geological wonder in the Sultanate of Oman and identified during site visits in an upstream area of the Say dam is the geodes.

According to the Geological society of Oman, geodes can be found in the region of Dhofar, Yemen and in the Huqf area, within the Arabian Oryx sanctuary.



Geodes are small hollow rocks lined with crystals. They are common in active volcanic areas of the world. These geodes are found as hard round balls of rock lying loose in stony desert areas and somewhat surprisingly around the strand lines of dry lakes. Many of the geodes are hollow with thin airtight hard silica shells (quartz). When broken open they have interiors lined with elegantly shaped quartz crystals and are objects of surprising beauty.

These natural geological heritage beauties have been noted at the surface and it will not be affected by the reservoir at full supply level. Nevertheless, it's important to highlight these findings to promote preservation of these areas in case of need to expand the project, such as need for quarries, future deposite areas or even vandalisme by casual/ project staff collectors.

The project area where it is proposed the Say Dam and Say Channel seems to be an archeological and geological heritage key and there is a need to preserve as many of these sites from any potential damage, casual collection of fossil, rock and mineral specimens.

On approval of the final design report the Consultant will prepare Tender Documents for the construction of the Say dam, Jurf Channel, Say Chanel and the junction of both channels to the sea outlet. The Consultant will analyse the tenders, submit a tender report and based on the analysis recommend award of the tender. The appointment includes supervision of construction.

The overall assessment obtained from the investigation indicated that the project is environmentally feasible and substantial benefits are very likely to affect majority of the project environment in case of mitigation measures will be considered.

Adopted technology and design criteria ensure that no long-term negative impacts are to result from the development. Nevertheless, unavoidable minor negative impacts that are often associated with construction works should be expected and they are likely to result from excavation, transport and deposition of construction material. Such undesirable impacts are limited, and should be cleared upon the commissioning of the dams scheme.

The contractors will follow wide ranges of management and construction techniques and procedures to minimize and/or eliminate the pollution hazard; minimize visual intrusion and noise and air monitoring during construction by following the national recommendations; provide sanitation facilities and safeguard health of labourers and conduct environmental monitoring during and after construction for the concerned ecological element.

The satellite images below depict firstly the project area in relation to Duqm and secondly the general layout of the project works.



Figure 1-1: Project Area - Special Economic Zone at Duqm

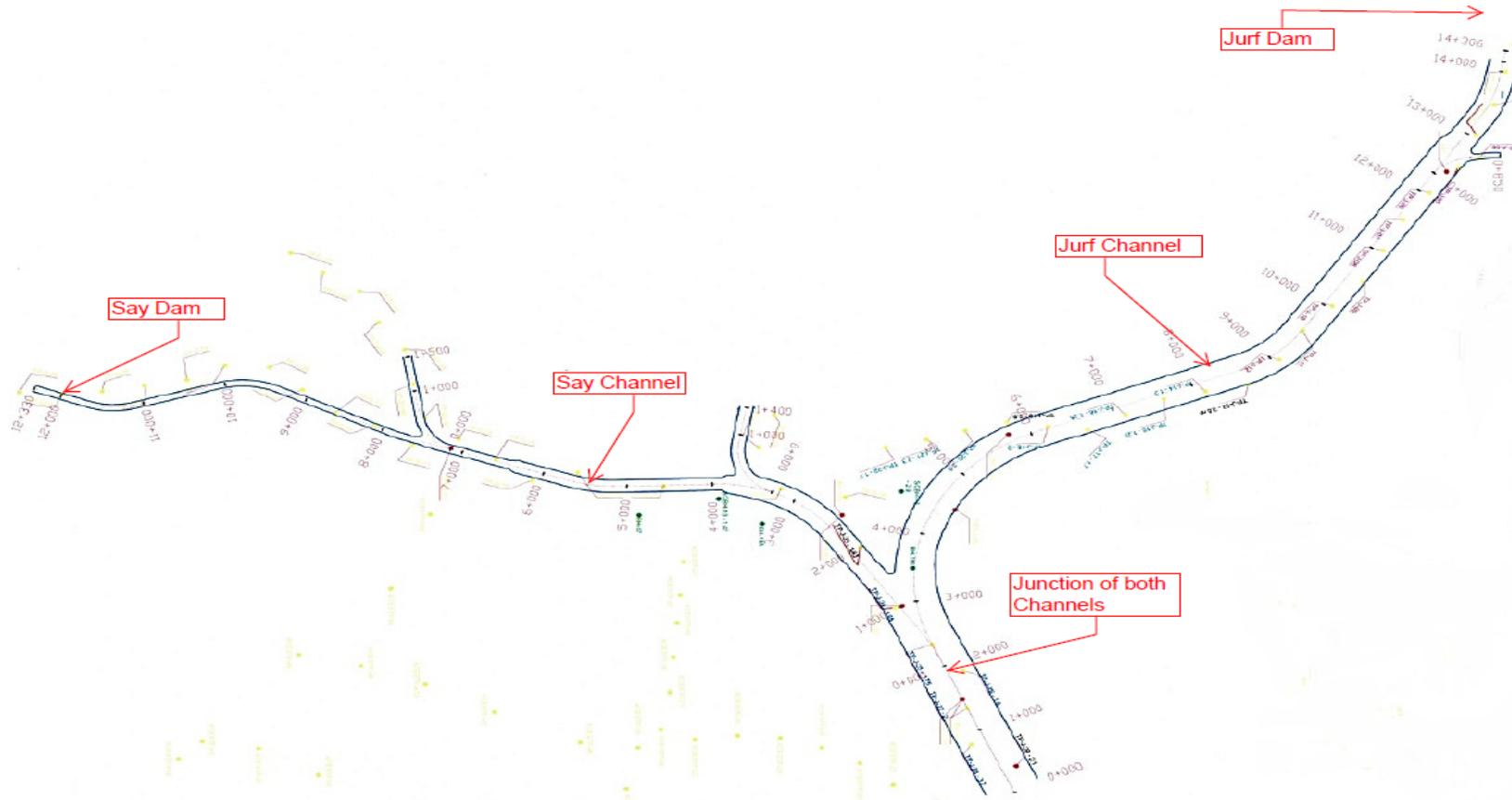


Figure 1-2: General Project Location

1.2 Environmental Impact Assessment Study Objective

The main objective of this environmental study is to furnish the appropriate information about the outcome and environmental impacts of this project so that decision-makers can take proper actions. Furthermore, the decision maker will want to know if the proposed project is likely to produce the stated results. A review of the natural process operating in the region is necessitated so that the project objectives are not in conflict with prevailing environmental scenario. The following objectives are to be considered:

1. Detailed statement of the significant both positive and negative environmental impacts during construction and operation of the proposed project that can affect the quality of life.
2. Suggestion of mitigation measures to enhance positive impacts and reduce negative impacts through compensation plans for the impacted areas, careful design, construction and operation of the project features.

1.3 Justification for Environmental Impact Assessment

EIA has become generally accepted worldwide as an essential procedure in initiating development projects and implementation of policies. The Environmental Impact Assessment (EIA) is an activity designed to identify and predict the impacts on the biogeochemical environment and on human health and well-being, of legislative proposals, policies, programs, projects, and operational procedures and to interpret and communicate information about impacts. An Environmental Impact Statement (EIS) is a public document written in a format specified by authorized national agencies (Ministry for Environment and Climate Affairs. In recognition of this, the Ministry for Environment and Climate Affairs (MECA) gives a list of all projects, which require EIA before they are implemented. Listed under flood protection and recharge dam project, the Interim Guideline on Environmental Impact Assessment draft version No.2 (6-6 -1999), are classified as Group 2 projects and require a detailed EIA study.

2 SCOPE OF METHODOLOGY AND ACTIVITIES

2.1 General Methodology

The study shall retain the basic premise of the TOR of the Duqm Development Drainage Network and Protection Schemes - Phase 1 and significantly expand the wide range of activities to be undertaken by the project technical team. The aim is to produce an Environmental Impact Assessment study incorporating environmental issues in conjunction with the project activities through three main elements as defined in the following Figure.

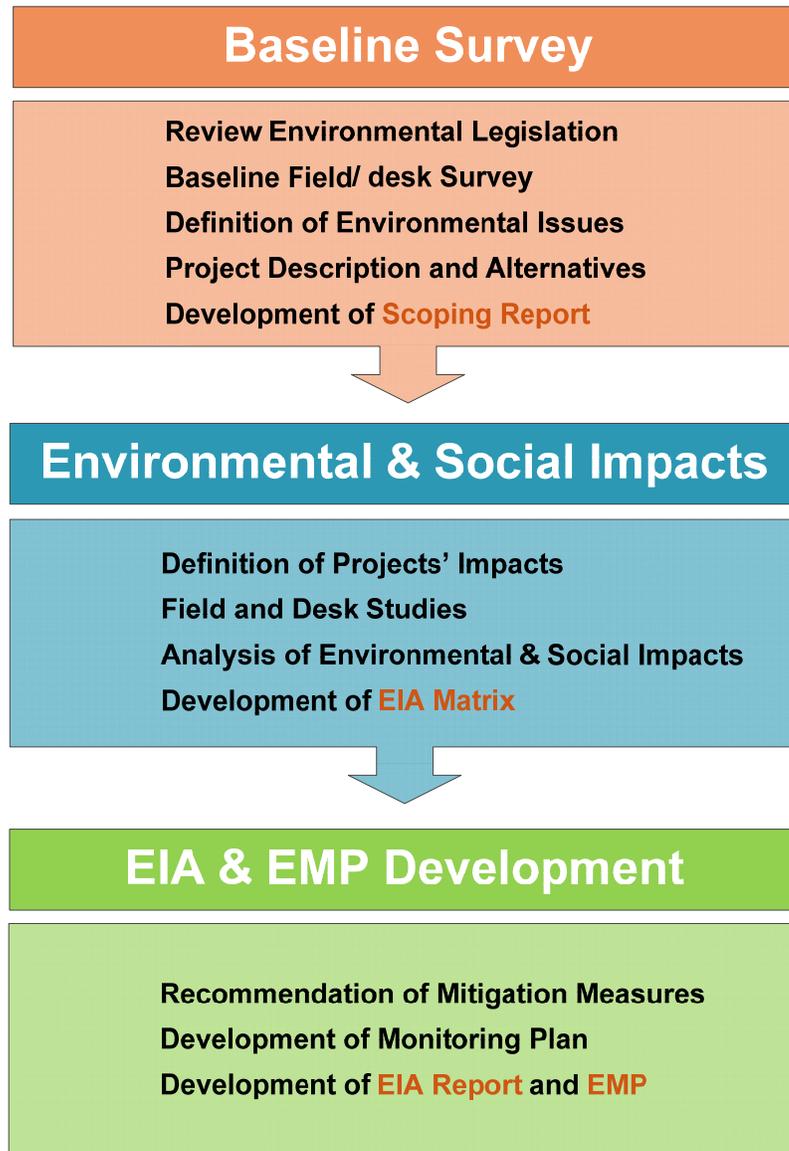


Figure 2-1: EIA main elements for the Project

The environmental study will aim to:

- Identify and predict in detail the positive and negative impacts of the development of the project on the environment;
- Make recommendations of appropriate solutions to minimize any undesirable effects resulting from the project to the developed schemes.
- Develop environmental monitoring and management schemes.

2.2 Scope of Achievements

Generally, a number of methods are applied either singly or in combination in order to adequately address all issues in the scope of this study. All steps (methodology) consistent with the Guidelines (Guidelines on Environmental Impact Assessment Planning and Approval, and Environmental Permit Application Review Process) have been followed and will be applied. In summary these methods (tasks) include:

2.2.1 Literature Review & Desk Studies

All available maps, aerial photos, reports, data, and notes taken during site visits utilized in this task to propose and study alternative routes.

2.2.2 Expert Consultations

Expert consultation through relevant persons conducted to solicit their views and comments on the projects' alternatives and the surrounding environment.

2.2.3 Field Visits

Several field visits were paid to the study area in 2013 and 2014 to have better understanding and knowledge, define the environmental issues of project area and conduct on-the-spot assessment.

2.2.4 Define the Environmental Issues

There are several environmental issues related to the dam project development and operation to be considered during the environmental studies. Examples of those issues are including but not limited to the followings:

- Socio – Economic
 - Developed schemes, land and infrastructure;
 - Future development schemes;
 - Resettlement and relocation works
- Hydrology and Wadis Flow Control
 - Flood protection
 - Water resources; Groundwater and Aflaj
- Sedimentation and Erosion

- Ecology
 - The historical and cultural heritage
 - The ecology and landscape
 - Fauna and flora
- Air Pollution and Noise generated during construction
- Risk Assessment
 - Hydraulic design
 - Reservoir flood
 - Dam safety factors
 - Dam break analysis

2.2.5 EIA Matrix Development

The environmental checklist shall comply with the level of details required to complete the EIA of the significant issues. This process enables the development of an EIA matrix to define the negative, positive and over all impacts of the environmental related issues. The EIA matrix for this project will be presented in Chapter 7. The EIA matrix is developed according to project area physical, environmental consideration and national policy required.

3 LEGISLATIVE AND REGULATORY FRAMEWORK

3.1 ENVIRONMENTAL LEGISLATION IN OMAN

3.1.1 Overview

The Omani law on environmental protection, control and management is covered under the basic law viz., the ‘Law for the Conservation of the Environment and Prevention of Pollution’ first promulgated in 1982 as RD 10/82 and superseded in November 2001 as RD 114/2001. The responsibility for the implementation of the environmental laws and regulations rests with MECA, which issues regulations, standards and guidelines through MDs. Within MECA, the Directorate General for Environmental Affairs (DGEA) is the authority responsible for environmental permitting, inspection and control in the Sultanate of Oman. Recently, MECA has established DGCA (Directorate General for Climate Affairs), which is the authority to assess the potential aspects of the project with regard to climate change. The Omani environmental laws and regulations with regard to air emissions, noise, wastewater, solid and hazardous wastes, hazardous materials and chemicals etc., potentially applicable for the present project are listed in Table 3-1.

Table 3-1 Applicable Omani Environmental Laws and Regulations

Law / Regulation	Description
General	
RD 90/2007	Establishing the Ministry of Environment and Climate Affairs
RD 114/2001	Law on Conservation of the Environment and Prevention of Pollution
Permit / License	
MD 16/210	Regulations on environmental requirements for industrial and service activities
RD 187/2001	Regulations for the issuance of Environmental Approvals and the Final Environmental Permit
MD 68/2004	Amendment of RD 187/2011
MD 199/2001	Issuance of municipal license for establishment, companies and factories

Law / Regulation	Description
MD 209/95	Obligating industrial and commercial organizations and others to apply environmental regulations as stated in environmental permits
Water and Wastewater	
MD 3/2009	Regulations on wells and springs
MD 159/2005	Discharge of Liquid Waste in the Marine Environment
MD 39/2004	Marine environmental management permits
RD 115/2001	Law on Protection of Sources of Potable Water from Pollution
MD 192/2000	Determination of the Dhahira Region Water Supply Wellfield Protection Zones
RD 29/2000	Promulgating the Water Wealth Conservation Law
MD 241/98	Regulations for septic tanks, soak-away pits and holding tanks
MD 342/1997	Regulations for organizing the use of water desalination units in wells
MD 263/2000	
MD 145/93	Wastewater discharge and re-use
MD 55/2002	Amendment of MD 145/93
RD 90/91	Protocol Protection of Marine Environment from Pollution from Land-based Sources
MD 8/84	Standards for the disposal of trade effluents

Law / Regulation	Description
RD 26/81	Approving the accession of Oman to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and other Matter
MD 2/90	Regulations for registration of existing wells and new well permits
RD 76/77	Issuing the Water Resources Development Law
RD 34/74	Law on Marine Pollution Control
Air Emissions	
MD 243/2005	Regulations for the Control and Management of Ozone Depleting Substances
MD 118/2004	Regulations for Air Pollution Control from Stationary Sources
Environmental Noise	
MD 79/94	Noise Pollution Control in the Public Environment
Waste	
RD 88/2002	Sanctioning Resolution 3/1 Adopted by the COP to Basel Convention on the Control of the Transboundary Movement of Hazardous Wastes and their Disposal
MD 17/93	Regulations for the Management of Solid Non-Hazardous Waste
MD 57/2002	Amendment MD 17/93
MD 18/93	Regulations for the Management of Hazardous Waste
MD 56/2002	Amendment of MD 18/93
Chemicals and Radioactive Materials	
MD 317/2001	Regulations for Packaging and Labeling of Hazardous Chemicals

Law / Regulation	Description
MD 326/2001	Regulation regarding barring of circulation and usage of some hazardous chemical substances including PCBs, brown asbestos and blue asbestos
MD 281/2003 MD 249/97	Regulation for the control and management of radioactive materials
RD 46/95	Law on Handling and Use of Chemicals
RD 81/99	Accession of the Sultanate of Oman to the Rotterdam Convention Related to Application of Prior informed Consent to Certain Hazardous Chemicals and Pesticides in International Trade
MD 248/97	Registration of Chemicals Substances and the Relevant Permits
MD 68/2000	Amendment MD 248/97
Cultural Heritage	
RD 6/1980	Protection of National Heritage
Land and Resource Use	
MD 81/2004	Gathering and transportation of wood
MD 200/2000	Crushers, quarries and the transport of sand from coasts, beaches and wadis
RD 5/96	Relating to the international Convention to Combat Desertification
MD 20/90	Rules Regulating and Specifying Coastal Setbacks
RD 8/2003	Law of Grazing Lands and Animal Resources
MD 4/87	Issuance of Quarries and Mines Licenses

Law / Regulation	Description
Ecology and Nature Reserves	
MD 110/2007	Regulations of the Law on Nature Reserves and Wildlife Conservation
RD 6/2003	Law on Nature Reserves and Wildlife Conservation
MD 4/2001	Providing Rules for the Jebel Samhan Nature Reserve
MD 3/2002	Providing Rules for the Coves Reserves (Khawrs) on the Salalah Coast
RD 67/2002	Conservation of Wildlife and Their Habitats
MD 101/2002	Killing, Hunting and Catching of Wild Animals and Birds
MD 113/2000	Regulating the Management of the Turtles Nature Reserve
MD 55/2006	Amendment MD 113/2000
MD 112/2000	Regulating the Management of the Dimaniyat Island Reserve
MD 56/2006	Amendment MD 112/2000
MD 111/2000	Regulating the Management of the Arabian Oryx Reserve
MD 56/2006	Amendment MD 112/2000
RD 50/97	Establishing the Al Saleel National Park in the Kaamil Wo Wafi Wilaya
RD 48/97	Establishing Reserves in Some Coves (Khawrs) on the Salalah Coast

Law / Regulation	Description
RD 25/96	Establishing the Jabal Samhan Reserve
RD 23/96	Establishing the Dimaniyat Islands Nature Reserve
RD 11/2007	Concerning the Arabian Oryx Sanctuary
Social and Health and Safety	
RD 35/2003	Labour Law
RD 74/2006	Amendments RD 35/2003
RD 112/2006	
RD 113/2011	
MD 286/2008	Regulation of Occupational Safety and Health for Establishment Governed by Labour Law
MD 80/94	Noise Pollution Control in the Working Environment
MD 19/82	Occupational Health & Industrial Safety Precautions
RD 119/94	Sanctioning the Accession of the Sultanate of Oman to Basel Convention on the Control of the Transboundary Movement of Hazardous Wastes and their Disposal, the United Nations Framework Convention on Climate Change and Convention on Biological Diversity
Climate Change	
Climate Change	Guidelines on information to be provided towards evaluation of Climate Change Impacts of the Project

3.1.2 Environmental Protection and Prevention of Pollution

RD 114/2001 provides the framework for environmental protection and prevention of pollution in Oman. Applicable requirements of the above RD are listed below:

- Article 7 imposes a general prohibition on disposal of pollutants to the environment unless permitted by a regulation or MD;
- Article 9 requires all establishments to possess requisite permits prior to commencing work;
- Article 10 requires the use of best available technology to prevent pollution and protect natural resources;
- Article 11 requires all establishments to comply with emissions/discharge limits specified in relevant MDs;
- Article 19 and 22 restrict dumping /disposal of hazardous and non hazardous wastes into the environment without any permit; and
- Article 41 states that in the event of any violation, the violator must undertake the removal of pollution at his own expense in addition to payment of the specified compensation.

3.1.3 Protection of potable Water sources from Pollution

RD 115/2001 provides the framework for protection of potable water sources from pollution. Listed below are applicable Articles from this RD:

- Article 8 states that non-household effluents shall not be discharged in sewage networks unless they are treated to specifications stated in Appendix No. 3 of the RD;
- Article 9 requires that solid non-hazardous waste shall only be disposed off in sanitary landfills (sites licensed by the Ministry for disposal of non-hazardous solid wastes) licensed by the Ministry. Solid non-hazardous waste shall not be mixed with any category of hazardous waste at any stage;
- Article 13 requires any person causing pollution to water to remove the pollution at his own expense in addition to payment of the specified compensation;
- Article 16 prohibits discharge of hazardous wastes or substances into aflaj and their channels, surface watercourses, wadis or places of groundwater recharge; and
- The RD further specifies conditions for treatment, discharge, and re-use of

wastewater

3.1.4 Wastewater Reuse and Discharge

The Omani standards for wastewater discharge and re-use on land are issued under MD 145/93 and RD 115/2001. There are two types of standards, based on the crops grown on the land where the wastewater is applied, as described in Table 3-2.

Table 3-2 Wastewater Discharge and Reuse Standards - Categories

Specification	Standard A-1	Standard A-2
Crops	Vegetables and fruits likely to be eaten within 2 weeks of irrigation	<ul style="list-style-type: none"> ▪ Vegetables to be cooked or processed ▪ Fruits if no irrigated within 2weeks of cropping ▪ Fodder, cereal and seed crops
Grass and ornamental areas	<ul style="list-style-type: none"> ▪ Public parks, hotel lawns, recreational areas ▪ Areas and lakes accessed by public 	Pastures and areas with no public access
Aquifer recharge	All aquifer recharge controlled and monitored by the Ministry	
Methods of irrigation	Spray on any other method of aerial irrigation is not permitted in areas with public access unless with timing control	
Any other reuse applications	Subject to the approval of the Ministry	

The maximum permissible concentrations of various pollutants in the treated wastewater are as presented in Table 3-3.

Table 3-3 Wastewater Discharge and Reuse Standards

Parameter	Units	Standard A-1	Standard A-2
Aluminum (Al)	mg/l	5	5
Arsenic (As)	mg/l	0.10	0.10
Barium (Ba)	mg/l	1	2
Beryllium (Be)	mg/l	0.10	0.30
Biochemical oxygen demand	mg/l	15	20

Parameter	Units	Standard A-1	Standard A-2
(BOD) – days @ 20°C			
Boron (B0)	mg/l	0.50	1.00
Cadmium (Ca)	mg/l	0.01	0.01
Chemical oxygen demand	mg/l	150	200
Chloride (Cl)	mg/l	650	650
Chromium (Cr)	mg/l	0.05	0.05
Cobalt (Co)	mg/l	0.05	0.05
Copper (Cu)	mg/l	0.50	1.00
Cyanic (CN)	mg/l	0.05	0.10
Electrical conductivity (EC)	mg/l	2000	2700
Faccal coliform bacteria	Number per 100 mL	200	1000
Flouride (F)	mg/l	1	2
Iron (Fe)	mg/l	1	5
Lead (Pb)	mg/l	0.10	0.20
Lithium (Li)	mg/l	0.07	0.07
Magnesium (Mn)	mg/l	150	150
Manganese (Mg)	mg/l	0.10	0.05
Mercury (Hg)	mg/l	0.001	0.001
Molybdenum (Mo)	mg/l	0.01	0.05
Nickel (Ni)	mg/l	0.10	0.10
Nitrogen:			
Ammoniacal (N)	mg/l	5	10
Nitrate (NO ₃)		50	50
Organic (Kjeldahl as N)		5	10
Oil and grease (total extractable)	mg/l	0.50	0.50
pH	mg/l	6 – 9	6 – 9
Phenols (Total)	mg/l	0.001	0.002
Phosphorus (P)	mg/l	30	30

Parameter	Units	Standard A-1	Standard A-2
Selenium (Se)	mg/l	0.02	0.02
Silver (Ag)	mg/l	0.01	0.01
Sodium (Na)	mg/l	200	300
Sodium absorption ratio (SAR)	--	10	10
Sulfate (SO ₄)	mg/l	400	400
Sulfide (S)	mg/l	0.10	0.10
Suspended solids (SS)	mg/l	15	30
Total dissolved solids (TDS)	mg/l	1500	2000
Vanadium (V)	mg/l	0.10	0.10
Viable nematode ova	Number per L	<1	<1
Zinc (Zn)	mg/l	5	5

The following are Omani standards for reuse and disposal of sludge resulting from wastewater treatment. The sludge generated from the wastewater treatment may be applied on land for agricultural use (after obtaining permit from MECA) for the same), subject to the conditions given in Table 3-4.

Table 3-4 Wastewater Treatment Sludge Reuse Standards

Metal	Maximum Concentration (mg/kg of dry solid)	Maximum Applicable Rate (kg/ha)*	Maximum permitted concentration in soil (mg/kg of dry solids)
Cadmium	20	0.15	3
Chromium	1000	10.00	400
Copper	1000	10.00	150
Lead	1000	15.00	150
Mercury	10	0.10	1
Molybdenum	20	0.10	3
Nickel	300	3.00	75
Selenium	50	0.15	5
Zinc	3000	15.00	300

Note: * Based on a ten-year average and a soil pH>7.0

After the spreading of the sludge, there must be at least three weeks period before grazing or harvesting of forage crops. Sludge use is prohibited in the following cases:

- On soils whilst fruits or vegetable crops, other than fruit trees, are growing or being harvested;
- For six months preceding the harvesting of fruit or vegetables, which grow in contact with the soil and which are normally eaten raw; and
- On soils with a pH < 7.0.

3.1.5 Air Emission from Stationary Sources

Omani standards for air emissions from stationary sources are specified under MD 118/2004. Applicable limits for emissions from stationary point sources in the present project are provided in Table 3-5. The key provisions of this regulation applicable for the project are presented below:

- Article (2) – Emission controls have to be provided to emission sources from the facility in order to prevent noxious or offensive emissions;
- Articles (3) – The emission standards specified by this regulation are to be complied with. Further, the monitoring of emissions from sources within the facility is to be conducted and reported to the Ministry. The Ministry has the right to request to improve the monitoring method and equipment used in such monitoring;
- Article (4) – Necessary action shall be taken by the operator of the facility to eliminate any harmful effects to public health, nuisance or emission of noxious odours arising from the work area;
- Article (5) – Dark smoke shall not be emitted from chimneys unless specially permitted by the Ministry for specific reasons and periods. The smoke shall not be as dark as or darker than shade one on the Ringelmann scale (20% opacity);
- Article (6) – The facility shall submit an application for an environmental permit and shall not commission or operate the plant unless the height of the chimney serving the plant has been approved by the Ministry that it is sufficient enough to prevent the smoke, grit, dust and toxic gases from becoming prejudicial to health or nuisance. The minimum stack heights for power plants, from ground level shall be as follows:

Power plants (Natural gas fired) - 26 m

Power plants (Diesel fired) - 35 m

Boiler plants (Natural gas fired) - 15 m

Boiler plants (Diesel fired) - 20 m

In other cases, the chimney height shall be calculated as “2.5 times multiplied by the height of the highest building (in meters) in the concerned establishment complex”.

- Article (7) – The permit to operate shall be issued for a period of three years, renewable for a same period within one month from the date of expiry;
- Article (8) – Concerned inspectors from the Ministry may enter the facility to inspect any processes causing emission of any noxious or offensive substances, to ensure efficiency of emission controls and to ascertain the quantity and quality of emissions and suggest requirements for further controls or measurements;
- Article (9) – The facility shall provide access and assistance to the concerned environmental inspectors from the Ministry to perform their duties for inspection and monitoring of the sources at the facility;
- Article (10) – Any change of ownership or production process of the facility shall be communicated to DGEA; and

Article (11) – Failure to comply with any provisions of this regulation will result in penalties and the Ministry may close down the establishment if there is prejudice harm to the public health or environmental damage.

Table 3-5 Emission Standards as per MD 118/2004

Pollutants	Maximum permissible limits
General	
Grit dust	0.050 g/m ³
Dark some products of combustion shall not emit smoke as dark as or darker than shade one on the Ringelmann scale (20% opacity)	
Power Plants – Natural Gas Fired	
Nitrogen dioxide	0.150 g/m ³
Particulates	0.050 g/m ³
Unburnt hydrocarbons	0.010 g/m ³
Carbon dioxide	5 g/m ³
Power Plants – Diesel Oil-Fired (less than 0.5% Sulfur)	
Sulfur dioxide	0.035 g/m ³
Carbon monoxide	0.050 g/m ³
Nitrogen dioxide	0.150 g/m ³
Particulates	0.100 g/m ³
Unburnt hydrocarbons	0.010 g/m ³
Combustion Sources – Diesel Oil-Fired*	
Sulfur dioxide	0.035 g/m ³
Carbon monoxide	0.050 g/m ³
Nitrogen dioxide	0.150 g/m ³
Particulates	0.100 g/m ³
Unburnt hydrocarbons	0.010 g/m ³
Combustion Sources – Natural Gas-Fired	
Carbon dioxide	5 g/m ³
Nitrogen dioxide	0.150 g/m ³
Particulates	0.050 g/m ³
Unburnt hydrocarbons	0.010 g/m ³

Note: * industrial boilers, furnaces, industrial ovens

3.1.6 Noise

The regulations for noise control are applicable to workplace noise levels and ambient noise levels. The ambient noise standards are issued under MD 79/94 and the limits for ambient noise levels from industrial sources are summarized in Table 3-6.

MD 80/94 specifies the regulations for noise pollution control in working environment. These regulations state that no employee shall be exposed to noise levels exceeding 85 dB(A). If the workplace noise level exceeds 85 dB(A), suitable ear protection devices shall be provided. The attenuation of such protection devices shall reduce the noise level to 80 dB(A) or lower.

Table 3-6 Ambient Noise Standards

Type of District	Day Time (7 AM – 6 PM) workdays	Evening Time (6 PM – 11 PM) workdays	Night Time (11 PM – 7 AM) workdays and all times on holidays
Rural residential and recreational	45	40	35
Sub-urban residential	50	45	40
Urban residential	55	50	45
Urban residential with some workshops or business city hub	60	55	50
Industrial and commercial	70	70	70

3.1.7 Hazardous Waste

MD 18/93 specifies the Omani regulations on hazardous waste management. Hazardous waste is defined as “any liquid or solid waste, which because of its quantity, physical, chemical or infectious characteristics can result in hazards to human health or the environment when improperly handled, stored, transported, treated or disposed off”. The relevant articles in the regulation are listed below:

- Article (4) – No hazardous waste shall be mixed with any other category of waste nor shall it be discharged to a common or other internal or external sewerage or other drainage system without a licence from the Ministry;
- Article (5) – Every hazardous waste generator shall complete a Consignment Note for each category of hazardous waste before the hazardous waste leaves his land or premises;
- Article (6) – All hazardous waste shall be labelled and packed according to the

Ministerial Decision issued in this respect;

- Article (7) – A hazardous waste or any components of a hazardous waste may be recycled at the point of generation or elsewhere only within the conditions of these Regulations. In case recycling is limited only to the point of generation, hazardous waste generator shall not be committed to complete a consignment note;
- Article (8) – Every hazardous waste generator shall store hazardous waste in approved storage facilities on his land or at his premises until its removal in accordance with the terms of the licence issued by the Ministry;
- Article (9) – Hazardous waste shall be transported by transporters licensed by the Ministry to collect, handle, store and dispose hazardous waste outside the waste generator's premises. This licence will be issued with conditions after the approval of Royal Oman Police (ROP);
- Article (10) – Every owner of any site where hazardous waste is to be stored, shall apply for a licence from the Ministry and shall operate the site only in accordance with the terms of the issued licence which shall include a requirement that all hazardous waste received at the site shall be accompanied by appropriate Consignment Note(s) in accordance with Article (5); and
- Article (11) – Every owner of a storage facility shall only release hazardous waste from that facility if it is accompanied by a Consignment Note in accordance with Article (5).

3.1.8 Solid Non Hazardous Waste

MD 17/93 specifies the Omani regulations for non-hazardous solid waste management (the relevant articles of RD 115/2001 are also to be referred to). The relevant articles in the regulation are listed below:

- Article (2) – Occupants of the premises (including industries which generate any solid or semi solid non-hazardous waste) shall store and dispose of solid non-hazardous waste in accordance with the provisions of these regulations and decision of the concerned authorities to this effect, such that there is no nuisance or hazard to the public health;
- Article (5) – The occupants of the premises shall collect these wastes and transport it in a safe manner to a site designated by the concerned authority; and
- Article (13) – No solid non-hazardous waste should be mixed with any category of

hazardous waste at any time.

3.1.9 Establishment of Septic Tanks, Holding Tanks and Soak Away Pits

MD 421/98 specifies requirements for designing, locations, and constructing septic tanks, soak away pits, and holding tanks. Important Articles of this MD are listed below:

- Article 3 of the MD allows the use of septic tanks in institutions where the population equivalent is not greater than 150;
- Article 4 and 11 states requirement of consent of local municipality prior to establishment of septic and holding tanks; and
- Article 10 and 13 present the minimum setback distances for construction of septic tanks, soak away pits, and holding tanks.

3.1.10 Ambient Air Quality

Presently, there are no Omani standards for ambient air quality. Therefore, MECA recommends the use of U.S. EPA's National Ambient Air Quality (NAAQ) standards. The NAAQ standards are presented in Table 3-7.

Table 3-7 Ambient Air Quality Standards

Pollutant	Averaging Period	Maximum Permissible Limit
Particulate (PM ₁₀)	24-hour average	150 µg/m ³
Particulates (PM ₂₅)	24-hour average	35 µg/m ³
	Annual arithmetic mean	15 µg/m ³
Sulfur dioxide (SO ₂)	3-hour average	0.5 ppm (1300 µg/m ³)
	24-hour average	0.14 ppm
	Annual arithmetic mean	0.03
Nitrogen dioxide (NO ₂)	Annual arithmetic mean	0.053 ppm (100 µg/m ³)
	1-hour average	0.100 ppm
Carbon monoxide (CO)	1-hour average	35 ppm (40 mg/m ³)
	8-hour average	9 ppm (10 mg/m ³)
Ozone (O ₃)	1-hour average	0.12 ppm

Pollutant	Averaging Period	Maximum Permissible Limit
	8-hour average	0.075 ppm
Lead (Pb)	Rolling 3-month average	0.15 µg/m ³
	Quarterly average	1.5 µg/m ³

MECA however is currently in the process of developing Omani Ambient Air Quality (AAQ) Standards. Although the standards have not yet been promulgated, the provisional standards are provided as presented in Table 3-8.

Table 3-8 Omani AAQ Standards (Provisional)

Parameters	Averaging Period	Standard Limits (µg/m ³)
NO ₂	24-hour average	112
SO ₂	24-hour average	125
CO	8-hour average	6000
H ₂ S	24-hour average	40
O ₃	8-hour average	120
HCNM	3-hour average	160
PM ₁₀	24-hour average	125

There are no Omani standards for work place air quality as of this writing. Therefore, United States Occupational Safety and Health Administration (OSHA) 8-hour Time Weighted Average (TWA) can be used. The maximum permissible limit specified by OSHA¹ for respirable particulate matter (PM₁₀) within the workplace is 5,000 µg/m³.

3.1.11 National Heritage Protection

RD 6/80 states the requirement for the protection of areas of cultural importance. These include the following:

- All types of monuments and antiquities; and
- Chattels of cultural properties including archaeological fossils and fragments of monuments / ancient ruins or sites and ancient building blocks.

¹ OSHA Regulations Standards – 29 CFR

3.1.12 Protected Areas in Oman

Fourteen protection areas designated as the nature conservation by Royal Decree are shown in the next table. These areas are highly regulated and controlled by Ministry for Environment and Climate Affairs (MECA). On the marine environment, the Regulation for Conservation of Marine and Coastal Environment as MD20/90 and Decision no: 19/90 of the Supreme Committee for Town Planning (SCTP), which was instituted in 1990, is established control zone of development being within 50 to 300 meters from natural coastal line.

Table 3-9: Protection areas in Oman

<i>Name of area</i>	<i>Location (Region)</i>	<i>Reserve resources (Biological, others)</i>
The Arabian Oryx Sanctuary	Al Wusta	<i>Arabian oryx, Nubian ibex, etc., conserving biodiversity</i>
As Saleel natural Park	Ash Sharqiyah	<i>Simr, Arabian gazelle, Gordon's wild cat, protecting wildlife</i>
Ra's al Hadd Turtle Reserve	Ash Sharqiyah	<i>Turtles, Coral reefs, mangroves, Prosopis cineraria wildlife</i>
Jebel Samhan Nature Reserve	Dhofar Governorate	<i>Leopard, Ibex, Arabian wolf, Gazelle, Blandford's fox, protecting wildlife</i>
Dimaniyan Islands nature Reserve	North of Muscat	<i>Coral reefs, fish, birds and turtles, conserving wildlife</i>
The Khawrs Reserve of Dhofar Coast	Dhofar Governorate	<i>Khawrs, springs, and archaeological sites, Mangroves, sustainable use of the resources</i>
Wadi Al Sarin	South of Muscat	<i>Arabian tahr and mountain goat</i>

3.2 Environmental Impact Assessment Interim Guidelines

The Interim Guideline on Environmental Impact Assessment was issued in 2001. The legislative authority of the guideline is based on the Royal Decree 114/2001 and its amendments “Amending some provisions of the law on Conservation of The Environment and Prevention of Pollution (Royal Decree 10/82)”. However, this Interim Guideline on Environmental Impact Assessment has been replaced with EIA Guideline called “Guidelines for Obtaining Environmental Permits for year 2001”. The Interim Guideline lists the projects, which are subject to a detailed EIA study. At the initial of the project stage, the Ministry for Environment and Climate Affairs conducts an environmental screening to ensure the proposed project is subject to an appropriate environmental assessment. Based on the screening results, the projects are classified into projects that in the proposed location have negligible environmental impacts, and projects that likely to have significant environmental impacts. The Guideline lists the key features of EIA, such as scoping, developing EIA, and data and information to be included (kindly consider below Figure 3-1: EIA Procedures in Oman Figure 3-1).

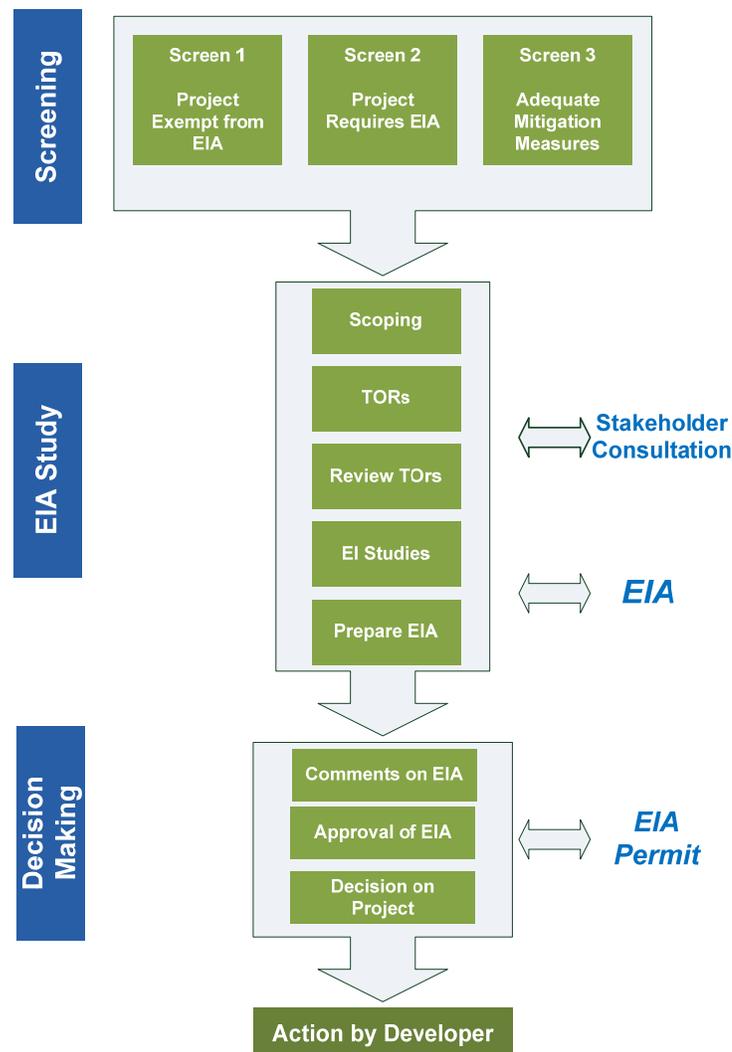


Figure 3-1: EIA Procedures in Oman

3.2.1 Overview

The Regulation for the issuance of the Environmental Approvals and the Final Environmental Permit (Ministerial Decision No. 187/2001, 16 June 2001) is composed of six (6) articles and two (2) annexes. The following are highlights of the regulation applicable to the proposed Project:

- Article 1: The establishments subject to this Regulation are classified into categories according to the materials used in production, production capacity and the degree of their impact on the environment as indicated in Annex 1.
- Article 2: The owner of an establishment shall present an application to the Ministry and enclose an EIA, if required by the Ministry.
- Article 3: The owner of the establishment shall abide by all environmental requirements and conditions before obtaining the Environmental Approval or Final Environmental Permit
- Article 4: The establishments shall abide by carrying out an Environmental Audit by a specialized company approved by the Ministry.
- Article 5: Dividing the Establishment into categories.
- Annex I: Desalination stations are included in category two and water supply networks as category three.
- Annex II: Fees for the Environmental Approvals and for the Final Environmental Permit.
- Ministerial Decision 68/2004 amends the Ministerial Decision No. 187/2001, referring that the Ministry (MECA) can add any new project or any projects resembling the projects stated in the annex of Division of Establishments into Categories after the approval of the Ministry of Finance (MoF) and modify the categories stated in the annex of MD 187/2001.

3.2.2 Preliminary Consultation

Before submitting the application for permit, the proponent (or its appointed consultant) should contact MECA to discuss details of the required documentation. The proponent is encouraged to discuss the proposed projects informally with staff of the Ministry at an early stage before detailed studies or plans are drawn up. A feasibility study, complete with its environmental chapter, maybe utilized during the preliminary consultation.

3.2.3 Application Review Process

The procedure for processing of an application for an Environmental Permit from MECA can be divided into three (3) stages:

Stage 1: Application Submission Stage

This stage begins the application review process and consists of submitting a completed Environmental Permit Application Form, to MECA supporting technical documents, and permits from other Ministries (if necessary).

Stage 2: Technical Stage Appraisal (Screening and Scoping)

At this stage, technical staff of the Ministry conducts a screening followed by a detailed review of the application to determine the type of environmental analysis that is required for the project.

There is no fixed list of specific industries, developments or their sizes, which would trigger a detailed EIA. Instead the Ministry's procedure relies on screening, identifying significant impacts on sensitive areas, and discussion between MECA and the applicant to identify any critical issues and to establish the scope of the EIA. However, certain types of projects or their elements fall into categories of projects usually requiring a detailed EIA, including desalination plants. The final decision rests with MECA.

A formal EIA should include but not limited to the following:

- Project description
- Baseline data
- Comparison of alternatives and their impacts (negative or positive) on all aspects of the environment
- Proposed mitigation measures
- Risk assessment
- Evaluation of the net effects of the development
- Proposed monitoring and follow-up activities
- Inter-agency coordination
- Consultation with affected communities
- Clear and complete Environmental Impact Statement document