

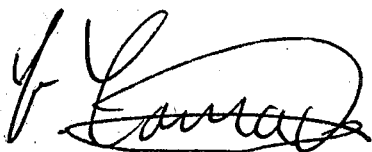
**MINUTES OF MEETINGS BETWEEN  
THE JAPANESE IMPLEMENTATION STUDY TEAM AND  
THE AUTHORITIES CONCERNED OF  
THE GOVERNMENT OF THE SULTANATE OF OMAN  
ON JAPANESE TECHNICAL COOPERATION  
ON THE QURM ENVIRONMENTAL INFORMATION CENTER PROJECT  
IN THE SULTANATE OF OMAN**

The Japanese Implementation Study Team (hereinafter referred to as 'the Team') organised by the Japan International Cooperation Agency (hereinafter referred to as 'JICA'), headed by Mr. Yoshiharu Yamada, visited Oman from 5<sup>th</sup> June to 21<sup>st</sup> June, 2005, for the purpose of working out the details of the technical cooperation program concerning the Qurm Environmental Information Center Project (hereinafter referred to as 'the Project').

During its stay in Oman, the Team exchanged views and had a series of discussion with the Omani authorities concerned with respect to desirable measures to be taken by both Governments for the successful implementation of the above mentioned Project.

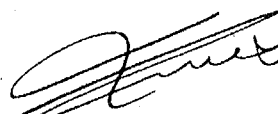
As a result of discussions, the Team and the Omani authorities concerned agreed to recommend to their respective Governments the matters referred to in the documents attached hereto as supplement to the Record of Discussions.

Muscat, Oman, 20<sup>th</sup> June, 2005



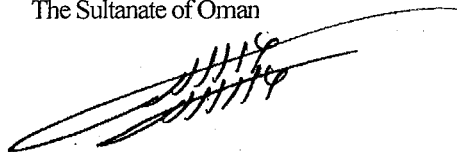

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Mr. Yoshiharu Yamada  
Leader  
Japanese Implementation Study Team  
Japan International Cooperation Agency,  
JAPAN




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Mr. Mohamed Bin Abdullah Al Muharrami  
Director General for Environmental Affairs  
Directorate General of Environmental Affairs  
Ministry of Regional Municipalities, Environment and  
Water Resources  
The Sultanate of Oman




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Mr. Ali Amer Al-Kiyumi  
Director General of Nature Conservation  
Ministry of Regional Municipalities, Environment and  
Water Resources  
The Sultanate of Oman

## ATTACHED DOCUMENT

1. Project Document  
The both sides agreed the contents of Project Document attached in ANNEX I.  
"Plan of Operation" might be revised based on the progress of the Project.
2. Training Program  
The both sides agreed to training programs as listed in ANNEX II.
3. List of Machinery and Equipment  
The both sides agreed that the machinery and equipment will be provided for the implementation of the Project by JICA based on the List of Machinery and Equipment as listed in ANNEX III.  
Some of the machinery and equipment will be installed in Qurm Environmental Information Center (QEIC) to be constructed by the Omani Government.
4. Utilization of local resources  
The both sides agreed that it is important for the effective and efficient implementation, and sustainability of the Project to utilize local resources, not only those in relevant offices and centers of the Ministry of Regional Municipalities, Environment and Water Resources (hereinafter referred to as "MRMEWR") but also external ones.  
MRMEWR will make necessary arrangements to secure the collaboration with such offices, organizations and centers before the initiation of the Project:
  - 1) Human Resources Development Center, MRMEWR
  - 2) Awareness and Information Department, MRMEWR
  - 3) Food and Environmental Monitoring Center, MRMEWR
  - 4) Regional Offices, MRMEWR
  - 5) Sultan Qaboos University
  - 6) Local GovernmentsIn addition, necessary arrangements will be made by MRMEWR to secure timely involvement of local communities and NGOs.
5. Target of Training  
For a better implementation of the Project, the Team requested that MRMEWR timely identify the participants to each training course in accordance with the Training Program as listed in ANNEX II.
6. Environmental Assessment  
Regarding the construction of QEIC and its surrounding area, which is at the design stage, the Omani side prepared the screening format for environmental categorization in accordance with Guidelines for Environmental and Social Considerations (JICA, April 2004). It is agreed that Omani side would provide JICA with additional information including a copy of the environmental assessment statement when necessary in accordance with the JICA Guidelines.

7. Project Progress Report

The Japanese experts and the Omani counterparts shall jointly review the achievements of the Project referring to the PDM as in Appendix 1 of Project Document, compile those in the Project Progress Report and submit it to JICA in every six (6) months during the project period. The format of the Project Progress Report is shown in ANNEX IV.

8. Request Forms

Omani Side will submit Form A1, Form A2A3 and Form A4 to request dispatch of experts, training in Japan, and provision of machinery and equipment, respectively to JICA through the Embassy of Japan. The format of A1, A2A3 and A4 forms are shown in ANNEX V.

9. Further Schedule

The both sides agreed the further schedule as follows;

	Action	Schedule expected
1	Omani authorities concerned will submit request form (Form A-1) for Japanese expert(s) to the Embassy of Japan.	By the end of September, 2005
2	MRMEWR will timely submit a notification letter to JICA through the Embassy of Japan on the information related to QEIC construction, such as evaluation/permission by Muscat Municipality, tendering and budget allocation.	At the earliest opportunity
3	JICA will send a letter to notify the date of the Project initiation to MRMEWR through the Embassy of Japan.	Within 1 month after the reception of the necessary information.
4	The cooperation period will start.	To be determined.

The tentative construction schedule and plans of the QEIC is attached as Appendix 7 of Project Document. The both sides agreed to make an effort for earlier initiation of the cooperation period.

ANNEX I Project Document

- Appendix 1 Project Design Matrix (PDM)
- Appendix 2 Plan of Operation (PO)
- Appendix 3 Organization Chart of the MRMEWR
- Appendix 4 Proposed Organizational Chart of the QEIC
- Appendix 5 Proposed List of Members of the JCC
- Appendix 6 Tentative Schedule of Implementation (TSI)
- Appendix 7 Tentative Construction Schedule and Plans of QEIC

ANNEX II Training Program

ANNEX III List of Machinery and Equipment

ANNEX IV Format of Project Progress Report

ANNEX V Format of A1, A2A3 and A4 forms

**Technical Cooperation Project  
on  
Qurm Environmental Information Center  
in  
The Sultanate of Oman**

**Project Document**

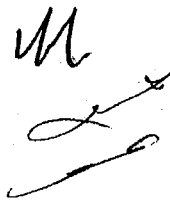
20 June 2005

**Technical Cooperation  
Between  
The Government of Sultanate of Oman  
And  
Japan International Cooperation Agency**

A handwritten signature in black ink, consisting of a stylized 'H' followed by a flourish and a checkmark.

## Abbreviations

DAC	Development Assistance Committee
EIA	Environment Impact Assessment
GCC	Gulf Cooperation Council
GOJ	Government of Japan
GOO	Government of Oman
ICAM	Integrated Coastal Area Management
IUCN	International Union of Conservation of Nature
JICA	Japan International Cooperation Agency
M/P	Master Plan
MAF	Ministry of Agriculture and Fisheries
MD	Ministerial Decree
MPCZM	Marine Pollution and Coastal Zone Management
MRME	Ministry of Regional Municipalities and Environment
MRMEWR	Ministry of Regional Municipalities, Environment and Water Resources
NGOs	Non-governmental Organizations
ODA	Official Development Assistance
OECD	Organization of Economic Cooperation and Development
OJT	On-the-Job Training
PCM	Project Cycle Management
PDM	Project Design Matrix
PLA	Participatory Learning and Action
PO	Plan of Operation
QEIC	Qurm Environmental Information Center
R.O.	Omani Rial
R/D	Record of Discussions
RD	Royal Decree
SQU	Sultan Qaboos University
UNESCO	United Nations Education and Cultural Organization
US\$	United States Dollar



**Sultanate of Oman**  
**Mangrove (Qurm) Environment Information Center (QEIC) Project**  
**Project Document**

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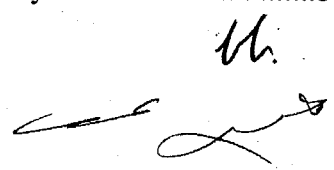
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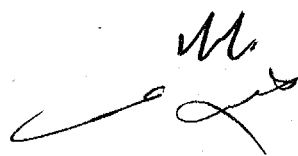
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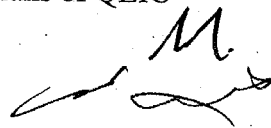
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**The Sultanate of Oman**  
**Mangrove (Qurm) Environmental Information Center (QEIC) Project**  
**Project Document**

**1. Introduction**

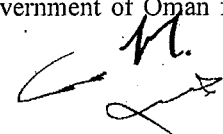
This appraisal document is prepared for the proposed technical cooperation project entitled “Mangrove (Qurm<sup>1</sup>) Environmental Information Center (QEIC) project in the Sultanate of Oman (hereinafter referred to as the Project). Purpose of this document is to review and study feasibility of the project prior to the inauguration in the project document format, a standardized format for project appraisal. Joint efforts of Japan International Cooperation Agency and Ministry of Regional Municipalities, Environment and Water Resources (MRMEWR) of Oman carry out the project.

Recent economic development and rapid expansion of cross-border trade and investment have put pressures on natural resources. Conservation of natural environment and cultural/historical heritage are national development goals stated in the National Development Plan of Oman. The MRMEWR has made serious efforts to conserve natural resources of the country. Mangrove ecosystems in Oman, in particular, are recognized as important heritage, not same as mangroves in tropical rainforests.

In April 2000, JICA dispatched an expert in mangrove afforestation to the MRMEWR in response to the request from Omani government. Technical transfer of *Avicennia marina* (grey mangrove) and its afforestation was implemented in order to strengthen capacity of Omani government staff. In June 2002, JICA dispatched a study team to prepare the “Master Plan Study on Restoration, Conservation and Management of Mangrove (Master Plan Study)”. The study was completed in August 2004.

The study recommended that conservation of natural environment is critical while restoration and plantation of mangrove ecosystems in costal zone should be implemented by mobilizing various levels of the administration, organizations and people of Oman. In order to attain concrete outcomes, participation and coordination of all relevant agencies and people are essential. In this context, the study proposed the establishment of QEIC to coordinate conservation efforts of people of all level and organizations. The Study Team prepared a feasibility study for the QEIC to help the MRMEWR of Oman request Japanese Government to implement a technical cooperation project to establish the QEIC in August 2003.

The main areas of technical cooperation requested by the government of Oman for the QEIC include the following:



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<sup>1</sup> “Qurm” means “Mangrove” in Arabic.

- Management of the QEIC
- Environmental monitoring and data management/analysis
- Training and educational programs on mangrove ecosystem conservation
- Public awareness programs and public relations for mangrove conservation

All the listed items here include preparation of manuals and materials together with the QEIC staff training.

## 2. Background

### 2-1. Socio-economic Conditions of Oman

#### 2-1-1 Population

Statistical data is limited in Oman. There are two different census data available. The first one was conducted in 1993 and the latest was in December 2003. Population in selected regions is shown in Table 1.

**Table 1 Population by Governorate/Region and Wilayat of Survey Site in 1993 and 2001**

Governorate/ Region/Wilayat	Total (persons)		Share of Omani in Total Region/Wilayat (%)		Share of Wilayat in Region (%)		Share of Region in Oman Total (%)	
	1993	2001	1993	2001	1993	2001	1993	2001
Al Batinah	564,677	686,284	83.6	83.5	100.0	100.0	28.0	27.7
Shinas	44,313	53,851	84.8	84.7	7.8	7.8		
Liwa	22,667	27,544	85.8	85.7	4.0	4.0		
Barka	64,526	78,468	75.3	75.1	11.4	11.4		
Muscat	549,273	685,676	53.8	48.7	100.0	100.0	27.2	27.7
Mutrah	173,908	215,092	35.2	36.3	31.7	31.4		
Muscat	40,856	51,580	75.7	75.3	7.4	7.5		
Qurayyat	34,405	43,047	88.5	88.9	6.3	6.3		
Ash Sharqiyah	258,665	315,584	84.9	84.9	100.0	100.0	12.8	12.7
Sur	53,381	65,368	80.3	80.3	20.6	20.7		
Masirah	8,299	10,139	74.3	74.3	3.2	3.2		
Al Wusta	16,623	21,019	79.5	80.0	100.0	100.0	0.8	0.8
Muhut	7,369	9,622	92.6	92.9	44.3	45.8		
Dhofar	189,094	232,563	66.4	66.7	100.0	100.0	9.4	9.4
Salalah	131,813	162,021	86.0	86.1	69.7	69.7		
Taqah	15,677	19,321	84.9	85.0	8.3	8.3		
Mirbat	11,280	13,905	61.4	61.7	6.0	6.0		
Musandam	28,727	35,945	78.2	78.3	n/a	n/a	1.4	1.4
Adh Dhahirah	181,224	221,687	74.6	74.7	n/a	n/a	9.0	8.9
Ad Dakhliyah	229,791	279,829	86.8	86.7	n/a	n/a	11.4	11.3
Sultanate of Oman	2,018,074	2,477,687	73.5	73.7	n/a	n/a	100.0	100.0

Source: Socio-economic Atlas, November 1996 (based on the 1993 national Census), Ministry of Development Statistical Year Book, August 2001, Ministry of National Economy (quoted from JICA M/P Study)

The population center is located in Al Batinah Region, which constitutes about 28% of the total population in Oman, followed by Muscat Governorate, with almost the same share of the total population. Although Al Wusta Region is very large in terms of area, it has the lowest population percentage, which amounts to less than 1% of the total population, as shown in the table.

In terms of ethnicity, Omanis constitute 74% of the total population of the Sultanate. With each region/governorate the percentages of Non-Omani show a vast degree of variation. Generally, with the exception of Muscat and Dhofar Governorates, the percentage of Non-Omanis is lower than the general average for the Sultanate in all other governorates and regions.

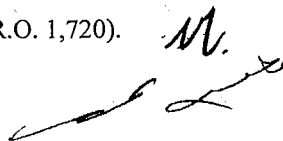
The population by age group indicates that the Omani society is very young one. The percentage of Omani population who are younger than 15 years old has almost reached 42% of the total Omani population. Distribution of young population enforces the idea that education and awareness building campaign targeting to younger population is a key factor for development programs.

#### 2-1-2 National Development Plan

The Sixth Five-Year Development Plan (2001-2005) states that the most prominent regional consideration required is to benefit from the diverse resources and ecological variation and to utilize them for the best interest of the development process. The Plan aims to minimize regional disparity through adopting specific policies and mechanisms package. The key issue is equitable distribution of the investments of the "Plan Investment Program" through a set of criteria. The package above includes provision of basic services of education, health, and safe drinking water for remote and least developed regions. Improved access to remote areas by paved roads, industry development promotion would help upgrade the overall condition of least developed areas, and provide employment opportunities to the residents of the regions. Tourism services including making of handicrafts and fishing may be of target for further development.

According to the Ministry of National Economy, total approved investment in the Sixth Five-Year Development Plan investment program is about R.O. 2,724.9 million, representing about 40.7% of the total investments (Table-2). The relative shares varied for each region. The highest investment is allocated to Al Batinah Region, representing 48.5% of total investment in the plan.

The top of the regions arranged according to the per capita investment is Al Wusta region (R.O. 2,905), which is the least developed, followed by Al Batinah where the per capita is expected to reach about R.O. 1,982 and Ash Sharqiyah (about R.O. 1,720).



**Table 2 Regional Distribution of the Investment Program in the Sixth Five-Year Development Plan**

Governorate/Region	Planned Investment (Mn. R.O.)	Region's Share in Total Investment (%)	Region's Share in Regionally Allocated Investment (%)	Per Capita Investment (R.O.)
Muscat	277.9	4.2	10.2	420.4
Al Batinah	1,322.1	19.8	48.5	1,982.2
Ash Sharqiyah	528.2	7.9	19.4	1,720.4
Al Wusta	58.1	0.9	2.1	2,905.0
Dhofar	251.1	3.8	9.2	1,116.2
Musandam	30.4	0.5	1.1	894.1
Adh Dhaira	76.2	1.1	2.8	354.4
Ad Dakhliyah	180.9	2.7	6.7	665.1
Total Approved Investments for the Regions	2,724.9	40.7	100.0	1,134.4
National Projects	3,962.8	59.3	n/a	n/a
Total Investment	6,687.7	100.0	n/a	n/a

Source: The General Framework of the Sixth Five-Year Development Plan 2001-2005, Ministry of National Economy, February 2002 (quoted from JICA M/P Study)

## 2-2 Issues and Problems Addressed

### 2-2-1 Threats to Mangrove Forest

The recent economic expansion puts significant pressures on environment and ecosystems in Oman. Mangrove ecosystem is exposed to negative effects of rapid development. The following is some examples of threats to mangrove ecosystems.

#### (1) Coastal development

Port and harbor construction introduce solid structures along the coastlines. For example, harbor wall and breakwaters can affect the natural movement and deposition of sand along the coastlines. Such physical change to coastal conditions caused by the development has a big impact on the mangrove ecosystems.

Another threat to the ecosystem is road construction. Direct impacts from new road construction include the loss of natural habitat; the damage to Oman's dramatic landscape; and air pollution and noise. Coastal dune visitation is lost and wading bird species were disturbed by a large number of tourists to the beach.

#### (2) Tourism and recreational development

Poorly managed tourism development affects mangrove ecosystems both directly and indirectly. Mangrove tree areas have been disturbed by un-managed development and un-controlled pressures from visitors.

### (3) Solid waste and water pollution

Modernization of Omani society produces non-degradable solid waste such as plastics, metals and concrete. Nutrient levels of wastewater harms water quality of enclosed lagoons in the vicinity of urban areas, agriculture and other development sites. Water pollution caused by untreated sewage leads to increasing nitrate and phosphate levels and spread of algae. Increased algae covers mud surfaces and young seedlings of mangroves. When the algae mat eventually dies, they decompose and use up oxygen in the water killing many animal species.

### (4) Overgrazing by domestic animals

There are several forests endangered by overgrazing by domestic animals. It is observed that mainly goats are browsing mangroves at the fringe of the Quriyat Forest. In Salalah, camels are browsing and almost destroying tiny patches of mangrove vegetations in channels. Recently the Ministry of Agriculture and Fishery (MAF) has started a project to reduce the number of domestic animals, camels, cattle and goats in Salalah by subsidy. The overgrazing in Salalah was started in the mountain areas and eventually hungry domestic animals, mostly camels, are coming down from the mountain to the coastal areas to look for food and to browse mangroves. Thus, deterioration of mangrove vegetation in the coastal areas is closely linked to the on-going desertification in the mountain areas in Salalah. In parallel with the endeavors by the MAF, the Directorate General of Nature Conservation has started a project to encircle proclaimed channels (khawrs in Arabic) as Nature Reserves with fences.

## 2-3 Environmental Legislation

### 2-3-1 General Environmental Protection

Oman is the first country in the Gulf region to establish Ministry of Environment. While the degradation of environment is gradually recognized as a threat to the coastal ecosystem, the government also recognizes increased needs of efficient use of natural resources and environmental protection. In order to harmonize development of priority sectors and natural resources, the government of Oman reformed legal systems concerning environmental protection.

The following Royal Decrees (RD), Ministerial Decisions (MD), and regulations are relevant to coastal issues.

- RD 6/2003. Law on Nature Reserves and Wildlife Conservation (replaces RD 26/79 Law on National Parks and Protected Areas). See 2.2.2 further details.
- RD114/2001. The Law on Conservation of the Environment and Prevention of Pollution (replaces RD 10/1982).
- RD 53/81. Law of Sea Fishing and the Protection of Marine Biological Wealth.
- RD 26/79. Law on National Parks and Protected Areas (now replaced by RD 6/2003).
- MD187/2001. This regulates issuance of Environmental Approvals and the Final Environmental Permits.

- MD 200/2001. This regulates permits for crushers, quarries and mining sand from wadis and beaches.
- MD 207/93. Bans hunting, trapping or shooting animals or birds in the Sultanate.
- MD 128/93. Bans cutting green trees.
- MD 20/90. Establishes a System for Coastal Setbacks for new construction along the coastline. Natural coastline setback 300m, sandy beach around khawrs 150m, sandy beaches 50m.
- MD 40/81. Building Code for Oman. Defines buildings, permanent buildings, temporary buildings, requirement for building permits, setback, and inspections and violations.
- RD 114/2001 Enables the Minister of Regional Municipalities, Environment and Water Resources to set regulations to protect the environment and control pollution. Any development that may impact on the environment must obtain a permit from the Ministry. Before issuing a permit, the MRMEWR may require that an environmental impact assessment study be conducted.

An environmental impact assessment (EIA) must be applied as early as the planning of a project is launched so that irrevocable decisions harmful to environment are avoided. Disclosure of information to concerned public is critical for ensuring the open and the balanced process of the EIA procedures. The guidelines stipulate that the following classes of projects are required to obtain environmental permits prior to implementation:

- (1) Industrial;
- (2) Mining;
- (3) Agricultural;
- (4) Food;
- (5) Tourism; and
- (6) Light industries.

In addition, public works such as road construction crossing wadis<sup>2</sup> and tributaries must seek the Ministry for approval. Marine and coastal projects must pay special attentions to protect vulnerable areas such as mangroves, khawrs and coral reefs.

Provisions of above laws relevant to mangroves prohibit the following acts considered harmful to environment:

- (1) Cutting down or damaging trees in public forests without obtaining a permit;
- (2) Removing stones, soil, sand, or uproot trees, shrubs or grass from watercourses, beaches, wadis, ponds without a permit; and
- (3) Dumping waste materials into the marine environment without a permit;

All of them are considered offence to damage nature conservations areas or wildlife, particularly species listed in appendix 1 and 2 of RD 114/2001 (this includes sea turtles, flamingo, pelican, gull and tern species, and all wild mammal species).





Oman is a signatory to the Convention on Biological Diversity, ratified by RD 119/94. The objectives of the convention are conservation of biodiversity and the sustainable use of biological resources. In 2001, the Ministry of Regional Municipalities, Environment and Water Resources published the National Biodiversity Strategy and Action Plan which is prepared through counseling input from relevant government and private institutions.

### 2-3-2 Protected Areas

Further to earlier laws listed in 2.3.1, the following stipulates wildlife protections:

- MD 207/93 Bans hunting, trapping or shooting of animals or birds in the Sultanate (in effect superseded by RD 114/2001);
- MD 128/93 Bans cutting green trees, the following law enables specific habitats and species to be protected;
- RD 6/2003. The Law on Nature Reserves and Wildlife Conservation (which replaced RD 26/79, the Law on National Parks and Protected Areas)
- This law allows for Nature Reserves to be established by Royal Decree according to proposals from a committee with representatives of certain Ministries. Making any alteration to the reserve's boundaries, classification or buffer zone is not permitted, except by Royal Decree. An important new article in this law is the provision for the Minister of Regional Municipalities, Environment and Water Resources, after approval by cabinet, to establish a Temporary Protected Area or an Area of Special Significance. This should allow the more rapid legal protection of a sensitive area until only a Royal Decree establishes a full Nature Reserve status. Under the original RD 26/79 several protected areas have been declared;
- RD 04/94 Proclaims the Arabian Oryx Sanctuary. The boundary at present recognized by the MRMEWR covers 24,785 km<sup>2</sup> of the central plateau, which is home to the reintroduced Arabian Oryx and other mammals, as well as having important geological and archaeological sites. The sanctuary was listed as a UNESCO World Heritage Site in 1994;
- RD 23/96 Proclaims Dimaniyat Islands Nature Reserve. The reserve covers 203 km<sup>2</sup> distributed over 9 islands, 16-18 km from the coast. The conservation objectives are to protect turtle nesting beaches, coral reefs, birds and plants and to promote ecotourism. A permit is required to visit the islands;
- RD 25/96 Proclaims Ra's al Had Turtle Reserve. The reserve covers 120 km<sup>2</sup> of beaches, coastal lands, seabed and Khawrs al Hajar (including Quq) and Khawr Jaramah. Conservation of turtles and their nesting beaches are given first priority under the management plan while it ensures the needs of the fishermen. Various options for tourism, which benefit the local people, without causing damage to the biological resources, are addressed. A permit is required to visit the nesting beaches;
- RD 48/97 Proclaims Jebel Samhan Nature Reserve. The reserve covers 4,500 km<sup>2</sup> of barren mountain peaks and deep canyons. It includes the escarpment overlooking the foothills and coastal plain, as well as an escarpment towards the east, which reaches the shore. One of the aims is to conserve the coastal environment and to utilize sustainably;

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<sup>2</sup> The Arabic term 'wadi' means "ephemeral stream bed" in English.

RD 49/97

Proclaims The Khawrs Reserve of Dhofar Coast. The areas of the khawrs vary from a few hectares to a hundred hectares. The main conservation objective is the sustainable use of the resources. Several khawrs have been fenced to protect against overgrazing, while controlled harvesting is allowed. The eradication of invasive exotic plant species is also planned. Excavation and restoration of the main archeological sites is planned. Khawrs mentioned specifically include: Mughsayl, Dahariz, Balid, Awqad, Qurm as Saghir and Qurm al Kabir, Sawli, Taqah and Rowri. Khawr Rowri is the largest of the proclaimed khawrs. It has been proposed that the area be fenced and, as soon as there is a recovery in vegetation, that some indigenous wild animals could be introduced. Limited visitor facilities including an information centre at the archaeological site are proposed; and

RD 50/97

Proclaims As Saleel National Park. It covers 220km<sup>2</sup> of alluvial plain and protects a variety of wildlife.

The MRMEWR has proposed that Royal Decree establishes the coastal area of Barr al Hikman and the shallow water surrounding Mahawt Island as a Nature Reserve. As of early 2004, decisions were made that the proposed boundaries and zones should be reviewed and clarified and that there should be consultations with the local people regarding the proposal. It is expected that management plans for this area would include the protection of fishery resources and wildlife, particularly turtles and birds.

**Table 3 List of Selected Protected Areas**

No.	Name of Protected Area	Category	Satellite Image	Scene No.	Image Date
1	The Arabian Oryx Sanctuary	Reserve	LandSat TM	158/046	28/01/1985
				158/047	02/11/1993
2	As Saleed Natural Park	National Park	LandSat TM	157/044	14/04/1992
				157/045	14/04/1992
3	Ra's al Had Turtle Reserve	Reserve	LandSat TM	157/044	14/04/1992
				157/045	14/04/1992
4	Jebel Samhan Nature Reserve	Reserve	LandSat TM	159/048	04/08/2001
5	Dimaniyat Islands Nature Reserve	Reserve	LandSat TM	158/044	08/07/2000
6	Barr Al Hikman Reserve	Reserve	LandSat TM	157/046	10/03/1985
7	Khawr Taqah Reserve	Reserve	LandSat TM	159/048	04/08/2001
8	Khawr Sawli Reserve	Reserve	LandSat TM	159/048	04/08/2001
9	Khawr Rowri Reserve	Reserve	LandSat TM	159/048	04/08/2001
10	Khawr Mughsayl Reserve	Reserve	LandSat TM	159/048	04/08/2001
11	Khawr Dahareez Reserve	Reserve	Ikonos	----	--/12/2000
12	Khawr Balid Reserve	Reserve	Ikonos	----	--/12/2000
13	Khawr Awqad Reserve	Reserve	Ikonos	----	--/12/2000
14	Khawr Saghir Reserve	Reserve	Ikonos	----	--/12/2000
15	Khawr Kabir Reserve	Reserve	Ikonos	----	--/12/2000

Several study sites chosen by the Master Plan Study by JICA fall into the boundaries of declared protected areas. The Master Plan Study took account of existing management plans for these areas. These study sites include: Al Qurm – originally designated as a Protected Area in 1975 (and now managed as such with the agreement of Muscat Municipality), Khawr Quq, Khawr Hajar, Film shoreline, Mahawt Island, Khawr RawriRowri, Khawr Dahariz, Khawr Balid, Qurm Kabir and Qurm Saghir. Table 3 indicates a list of the selected protected areas in Oman.

The Master Plan Study conducted a socio-economic survey in selected mangrove ecosystems in Oman. Based on the survey, the value of the mangrove ecosystems is evaluated. The characteristics of mangrove ecosystem is summarized as follows:

- (1) Consumptive use value such as timber and firewood, fodder, and medicine is considered low in Oman while very limited use of mangrove tree as fodder is observed in Salalah and Sharqiyah. This is a unique characteristic of Omani mangrove ecosystem while the value of mangrove ecosystems in Southeast Asia is mostly recognized in this category. In particular, use of mangrove as firewood and timber is very common in Southeast Asia.

**Table 4 Valuation of Mangrove Ecosystem in Oman by Zone**

Value of Mangrove Ecosystem			Zone						
			Batinah	Muscat	Qurm	Sharqiyah	Wusta	Dhofar	
1. Use Value	1.1 Direct Use Value	1.1.1 Consumptive Use	1.1.1.1 Timber, Firewood	N	N	N	N	N	N
			1.1.1.2 Agriculture resources	N	C	N	C	N	N
			1.1.1.3 Medicine	N	N	N	N	N	N
	1.1.2 Non-consumptive Use	1.1.2.1 Tourism and Recreation	B	A	A	A	A	A	
		1.1.2.2 Educational, Historic and Scientific Information	B	A	A	B	B	A	
		1.1.2.3 Genetic Resource	C	C	C	C	C	C	
	1.2 Indirect Use Value	1.2.1 Storage and Recycling of Human Waste and Pollutants	N	N	N	N	N	N	
		1.2.2 Shoreline/ Riverbank	C	C	C	C	C	C	
		1.2.3 Maintenance of Biodiversity	A	A	A	A	A	A	
		1.2.4 Provision of Nursery and Breeding Grounds for Fish	N	C	N	C	B	N	
1.3 Option value	1.3 Future Direct and Indirect Use Value	N	N	N	N	N	N		
2. Non-use value			2.1 Cultural and Aesthetics (landscape)	C	A	A	B	A	C
			2.2 Spiritual and Religious	C	C	C	C	C	C

Legend A: High potential, B: Medium potential, C: Low potential, N: No potential

- (2) Non-consumptive use value, for example tourism, recreation and education, are considered significant in Omani mangrove ecosystem. Unique vegetation and aesthetic of the mangrove forest is attractive for general public to visit.
- (3) Non-use value, such as site of cultural and aesthetic (landscape) value is recognized for the scenery of mangrove forest itself gives unique experience for those who observe it.

Additional evaluation in Oman by zone is summarized in Table 4.

## 2-4 Initiatives to Improve Mangrove Protection

### 2-4-1 Coastal zone management by Omani Government

The mangrove ecosystem has some important functions such as protection against erosion of banks inside channels (khawrs), cultivation of fishery resources, preservation of biodiversity, and tourism resources. The government of Oman identifies the protection of coastal marine ecosystems as one of the major priority areas in the environmental protection.

The mangrove ecosystems of Oman are one of the important elements of the coastal zone. The socio-economic importance and vulnerability of the mangrove ecosystems are described in the Coastal Zone Management Plan<sup>3</sup> in Oman (1991), in which the management system for mangroves is described. Ministry of Regional Municipalities, Environment and Water Resources (MRMEWR), and the Sultan Qaboos University (SQU) have carried out various researches on mangrove ecosystems. In the past, including the technical cooperation from JICA, the ministry accumulated the techniques and methodologies to plant a mangroves species *Avicennia marina* were planted in Oman twice, however this did not bring concrete results because of the lack of accumulated experiences on technical knowledge and skills for mangrove afforestation.

Coastal Zone Management in Oman is implemented through the process of Integrated Coastal Area Management (ICAM). ICAM Studies in the Sultanate of Oman started with the International Union for Conservation of Nature (IUCN) Study (Clarke et al., 1986), in which preliminary areas, including 12 coastal and marine areas covering areas from Musandam in the north to Dhofar in the south were identified as priority areas for conservation. Various biological communities were also highlighted for protection such as all marine turtles, wading and migratory birds, and coral reefs.

The Clark study was followed by the IUCN Coastal Zone Management Study (IUCN, 1986, 1988, 1989a,b, 1991a,b,c). Salm (1989), in a review of the Arabian Sea coasts of Oman, emphasizing the importance of Barr Al Hikman for migratory birds and the largest true coral reefs of cabbage coral *Montipora foliosa* found along the southern edge of Barr Al Hikman. Masirah Island has the world's largest nesting population (30,000) of the loggerhead turtle *Caretta caretta*.

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<sup>3</sup> International Union for Conservation of Natural Resources. 1986-1991. Oman Coastal Zone Management Plan. Ministry of Commerce and Industry

Salm (1991) further discussed management issues for turtles in Oman. Within Ghubbat Hashish the significance of the mangrove *Avicennia marina* at Mahawt Island, the mud flats and flamingo feeding grounds west of Mahawt Island and sea grass beds were highlighted in this report. Further south, the importance of the Al Hallaniyat Islands and khawrs in Dhofar were emphasized as were the abalone and associated algal communities of the southern region.

The management recommendations from the IUCN Coastal Zone Management Study were taken further by the study of wildlife and conservation areas of Barr Al Hikman and Masirah Island by Wiedleplan (1992). This study defined four zones with priority given to environmental protection versus economic development.

Of great importance was the protection of the Daymaniyat Islands for nesting turtles (the hawksbill *Eretmochelys imbricata* and green turtle *Chelonia mydas*) and nesting seabirds. The area was declared the Daymaniyat Islands Nature Reserve in 1996 (Royal Decree No. 23/96)

The Marine Pollution and Coastal Zone Management Section (MPCZM) of the Ministry of Regional Municipalities, Environment and Water Resources (MRMEWR) presently coordinates implementation of ICAM. The Section works closely with the Directorate General of Nature Protectorates which actively manages the coastal and marine protectorates Damaniyat Islands, Ras al Hadd, and Khawr reserve areas in Dhofar including Khawr Mughsayl, Qurum alsaghir, Qurum alkabir, Awqad, Baleed, Dahareez, Sawli, Taah and Ruri.

Previous, on-going and proposed projects by the MRMEWR in the field of ICAM include:

- (1) The Coastal Zone Management Study (IUCN, 1986 - 1991), summarized by Salm (1993)
- (2) Coastal erosion studies (Dobbin, J, Ass. Inc., 1992).
- (3) National Conservation Strategy. MRME (1993).
- (4) Coral reef management plans (Mouchel, L.G. & Partners Ltd., 1996).
- (5) Damaniyat Islands Management Plan, 36pp., with attachments (MRME, 2000)
- (6) Marine Pollution Monitoring Studies ongoing (MRMEWR, 2001)
- (7) Extension of Special Area under Annex I and V, MARPOL 73/78, (MRMEWR, 2001).
- (8) Studies on the Conservation and Management of Mangroves in the Sultanate of Oman (MRMEWR/JICA (2000 - 2002).
- (9) The MRMEWR (2001, in prep.). Oman National Coral Reef Management Plan, Implementation - Phase I. Tender Document.
- (10) The MRMEWR (2001, in prep.). Environment Database Project: Marine Pollution & Coastal Zone Management Section.

In addition the MRMEWR has sponsored various studies for supporting implementation of ICAM including:

- (1) Artificial reef studies;
- (2) Crown-of-thorns starfish predation studies; and
- (3) Coral growth studies.

## 2-4-2 Mangrove planting activities in Oman

Mangrove planting has been implemented in Oman since 1983 up until now as shown in the Table 5. In April 2000, JICA dispatched expert in mangrove afforestation to the MRMEWR. Working closely with the JICA experts, tangible outcomes of developing the most appropriate transplanting methodologies suitable for Omani environment using *Avicennia marina* have been attained by the MRMEWR staff. Presently, several sites, such as Sawadi, Shinas and Salalah are identified as suitable for mangrove planting by the MRMEWR. Transplanting is initiated regularly.

**Table 5 Planting/ Transplanting Activities in Oman**

Year	Species	Plantation Method	Area	Scale	Implementing Agency	Results
1983	<i>Rhizophora stylosa</i> or <i>Rhizophora mucronata</i> / <i>Lumnitzera racemosa</i> / <i>Conocarpus erectus</i>	Direct sowing	Balid		Oman/ Japan	Produced concrete results on a limited basis
1983	<i>Rhizophora stylosa</i>	Direct sowing	Qurm		Oman/ Japan	Did not produce concrete results
1983	<i>Rhizophora stylosa</i> / <i>Bruguiera gymnorrhiza</i>	Direct sowing	Salalah		Oman/ Japan	Did not produce concrete results
1984 Sep.	<i>Avicennia marina</i>	Using seedlings taken from Qurm	Barka	1,200 seedlings	Oman/ Japan	Did not produce concrete results
1985	<i>Rhizophora stylosa</i>	Direct sowing	Qurm		Oman/ Japan	Did not produce concrete results
1985	<i>Rhizophora stylosa</i> / <i>Bruguiera gymnorrhiza</i>	Direct sowing	Salalah		Oman/ Japan	Did not produce concrete results
2001 Feb.- Mar.	<i>Avicennia marina</i>	Transplanting using pot seedlings prepared at Qurm mangrove nursery	Sawadi (1.15 ha)	11,500 seedlings	Oman/ JICA	Successful
2001 Nov.	<i>Avicennia marina</i>	Transplanting using pot seedlings prepared at Qurm mangrove nursery	Sur (1.2 ha)	12,000 seedlings	Oman/ JICA	Poor
2002 Feb.	<i>Avicennia marina</i>	Transplanting using pot seedlings prepared at Sur mangrove nursery	Sur		Oman/ JICA	Poor
2003 Jan.	<i>Avicennia marina</i>	Transplanting using pot seedlings prepared at Salalah mangrove nursery	Salalah		Oman/ JICA	Successful
2003 Feb.	<i>Avicennia marina</i>	Transplanting using pot seedlings prepared at Qurm mangrove	Sawadi		Oman/ JICA	Fair

Year	Species	Plantation Method	Area	Scale	Implementing Agency	Results
		nursery				
2003 Feb.	<i>Avicennia marina</i>	Transplanting using pots seedlings prepared at Sur mangrove nursery	Sur	12,000 seedlings	Oman/JICA	Poor
2003 Mar.	<i>Avicennia marina</i>	Transplanting using pot seedlings prepared at Salalah mangrove nursery	Salalah	7,200 seedlings	Oman/JICA	Successful
2003 May	<i>Avicennia marina</i>	Transplanting using pot seedlings prepared at Qurm mangrove nursery	Musanaa	10,000 seedlings	Oman/JICA	Poor
2004 Jan.	<i>Avicennia marina</i>	Transplanting using pot seedlings prepared at Qurm mangrove nursery	Sawadi	12,000 seedlings	Oman/JICA	Successful
2004 Jan.	<i>Avicennia marina</i>	Transplanting using pot seedlings prepared at Salalah mangrove nursery	Salalah	4,800 seedlings	Oman/JICA	Successful
2004 Jan.	<i>Avicennia marina</i>	Transplanting using pot seedlings prepared at Qurm mangrove nursery	Shinas	9,750 seedlings	Oman/JICA	Successful
2004 Feb.	<i>Avicennia marina</i>	Transplanting using pot seedlings prepared at Qurm mangrove nursery	Musanaa	3,250 seedlings	Oman/JICA	Poor
2004 Feb.	<i>Avicennia marina</i>	Transplanting using pot seedlings prepared at Sur mangrove nursery	Sur	12,000 seedlings	Oman/JICA	Poor
2004 Feb.	<i>Avicennia marina</i>	Transplanting using pot seedlings prepared at Salalah mangrove nursery	Salalah	2,100 seedlings	Oman/JICA	Successful

The MRMEWR built mangrove nurseries in Qurm, Sur and Salalah as shown in Table 2.2.2. The nurseries have been operated successfully and produce approximately 54,000 pots annually.

#### 2-4-3 Technical cooperation by Japanese Government

JICA has no office in Oman at the present, embassy of Japan plays an important role in technical cooperation. While the basic country development policy related to economic assistance to Oman is not yet prepared, a country project finding mission dispatched in April 2002 by JICA has identified environment and human resources development higher priority. Currently, three JICA

experts are dispatched to Oman.

**Table 6 Mangrove Nurseries Built in Oman**

Year	Species	Irrigation System	Area	Capacity	Implementing Agency	Remarks
2000	<i>Avicennia marina</i>	Pump-up	Qurm	18,000 pots	the MRMEWR	Renovated in 2001
2001	<i>Avicennia marina</i>	Tidal	Qurm	12,000 pots	the MRMEWR	
2001	<i>Avicennia marina</i>	Tidal	Sur	12,000 pots	the MRMEWR	
2001	<i>Avicennia marina</i>	Pump-up	Salalah	12,000 pots	the MRMEWR	

The Government of Japan (GOJ) dispatched an expert to the MRMEWR in April 2000, to assist with technical transfer of mangrove afforestation using *Avicennia marina*, a common mangrove species in Oman, to the MRMEWR staff members. Responding to an additional request from the Government of Oman (GOO), GOJ dispatched a preparatory study team through JICA in February 2002 to negotiate about the scope of work for technical cooperation aiming to prepare the "Master Plan Study on Restoration, Conservation and Management of Mangrove".

The result of the technical cooperation on mangrove conservation is described in the previous section. Tabl-6 summarizes the previous technical cooperation to the MRMEWR.

**Table 7 JICA's technical cooperation to the MRMEWR**

Duration	Description	Purpose and Activities
2000 – 2004	Dispatch of mangrove afforestation expert	(1) Supervision and management of on-going mangrove afforestation project and its extension program for transplanting; (2) Establishment and implementation of a routine training program for the staff of the MRMEWR on mangrove projects; and (3) Coordination of JICA training program suitable for the staff in the MRMEWR.
2002 – 2004	Preparation of master plan study on restoration, conservation and management of mangrove	(1) Formulation of a master plan comprising of site-specific plans in the priority sites as well as public awareness programs. (2) Technology transfer to assigned counterpart personnel through on-the-job training (OJT).



2004 - present	Dispatch of environmental advisor	<ol style="list-style-type: none"><li>(1) Advising on environmental strategy and policy on global issues and on human resources development on a sustainable basis;</li><li>(2) Supervision and advising on on-going programs and strategic policies by the MRMEWR and by JICA; and</li><li>(3) Coordination between the MRMEWR and authorities concerned.</li></ol>
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### 3. Problems to be Addressed and the Current Situation

#### 3-1 Institutional Framework for the Sector

##### 3-1-1 Ministry of Regional Municipality, Environment, and Water Resources

Ministry of Regional Municipality, Environment and Water Resources is one of the ministries of the administrative branch of the Sultanate of Oman. As its name indicates, the ministry has vast areas of responsibilities including, environmental regulations and enforcement, nature and environmental conservation, health control and public health, infrastructure development, water resources development, awareness building and information related to its activities, and human resources development.

##### 3-1-2 Organizational arrangement of the QEIC

For the implementation of mangrove restoration, conservation and management, it is necessary to establish an appropriate institutional arrangement in the MRMEWR. The Marine Pollution and Coastal Zone Management (MPCZM) section in the MRMEWR, which is the primary responsible section of mangrove protection and management, will continue to play a leading role. The establishment of the QEIC is one of the important issues for the institutional arrangement for the MRMEWR to implement the Master Plan Study by JICA. The proposed QEIC will have a key position in protection and management of mangrove ecosystems in Oman.

Appendix 3 shows proposed organizational arrangement of the QEIC within the MRMEWR. Proposed organizational chart of the QEIC is shown in Appendix 4.

#### 3-2 Analysis of the Current Situation and Problem of the Project Site


##### 3-2-1 Project site

Among many mangrove ecosystems in Oman, the MRMEWR has proposed to locate the technical cooperation at Khawr Qurm, in Muscat area. The site is currently designated as the Nature Reserve and is one of the most popular beachside recreational areas in Muscat. Total area of the proposed site is approximately 100 hectares, of which 60 hectares are covered by natural mangrove forest.

##### 3-2-2 Current situation in the Qurm Nature Reserve area

###### (1) Natural Condition

The QNR is located in capital city of Muscat. Its general terrain is categorized as flat plain. Khawr Qurm lies on the alluvial deposits at the mouth of Wadi Aday. Surface soils under mangrove vegetation along two water channels are basically silty and clayey with humus accumulation under anaerobic condition (See detail in the vol 2. Specification 5 of the Master Plan).



Fauna of Khawar Qurm has been studied by Fouda and Al-Muharrami (1996) who listed 194 species of birds, 27 species of crustaceans, 48 species of molluscs and 40 species of fish. Further studies have recorded more species of invertebrates and their zonation (Hywel-Davies 1994) (See detail in the vol 2. Specification 5 of the Master Plan).

For the Flora, Kurschner, (1986) and Al-Maamary, (1994, M. Sc. Thesis from Sultan Qaboos University) described and mapped the different vegetation zones of the Nature Reserve (See detail in the vol 2. Specification 5 of the Master Plan).

## (2) Existing mangrove areas

Banks of the lagoons along western and eastern water channels at Khawar Qurm are covered by mangrove. Total area of the mangrove vegetation is approximately 74 ha. The areas covered by mangrove species have extended during the last 20 years. Healthy mangroves forests with tall trees are spreading on shores along eastern and western water channels. Some natural seedlings are developing on shore near the mouth of the western water channel. Tall trees reach to approximately 7-8m in height. Trees on shore of the western water channel are taller and have bigger stems than in eastern channel. There are no additional accreting areas. Many seeds are observed after flowering season.

## (3) Impact from the surrounding areas

The site of the QNR is not, as such, immune to several threats as listed in 2.2. Changes in the watershed in Wadi<sup>4</sup> Adai where the expanded road will reduce the capacity of the sediment to carry water. This means that a steady supply of freshwater to the mangrove ecosystems may be reduced and the likelihood of quick floods will increase. The footbridge at the Crowne Plaza Hotel restricts the channel affecting the sediment movements. Accumulation of dumping materials and garbage placed on upper area can damage trees. The fishing facility and nearby housing may cause pollution to the water of the site.

The new road along the foreshore acts like a dyke, and during a flood or typhoon water cannot be released across the beach, which may lead to erosion. The new road built very close to the sea detracts from the natural scenic quality of the QNR. Ministerial Decision 20/90 specifies setbacks for development from the high tide as follows: 300 m for natural and scenic coasts; 150 m for sandy coasts and khawrs; and 50 m for urban areas. Further developments within the boundaries of the QNR may lead to damage from trampling (car parks and visitors) and pollution (toilets and garbage). Ideally, development using permanent structures should be kept outside the boundaries of the QNR. Nature trails with wooden boardwalks and hides are appropriate inside the boundaries. Salm (1986) recommended a marine extension to the boundaries of al-Qurm to include Fahal Island to protect the diverse coral communities and nesting birds.

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<sup>4</sup> Wadi: A drainage channel which is usually no water.

### 3-2-3 Objectives

Mangrove forests in Oman provide economic, cultural and social benefit to the people of Oman and those who visit the country. Protecting mangrove ecosystems in Oman is one of the national agendas addressed in Oman because the significance of the ecosystems is fully acknowledged. Therefore, the Overall Goal of the QEIC is defined as:

“Dissemination of sustainable mangrove ecosystems management in Oman and in the region”.

In order to achieve this goal, the objective of the proposed technical cooperation is as defined in the Project Purpose:

“The QEIC is established as the center for promoting sustainable mangrove ecosystems management in Oman”.

Formulating a wide range of network based on personnel exchange, knowledge sharing, and building partnerships regarding mangrove ecosystem conservation through utilizing the QEIC's facility is one of the key elements of the QEIC activities. Long-term cooperation through networks development ensures human resources development in the region.

## 4. Qurm Environmental Information Center Project

### 4-1 General Description of the Project

Among programs and projects proposed in the Master Plan Study prepared by JICA Study Team, establishment of the QEIC in Khawr Qurm in Muscat Municipality is recommended. The center will be administered by the Ministry of Regional Municipalities, Environment and Water Resources (MRMEWR) and act as a contact point to promote conservation of mangrove ecosystem in Oman. It will serve as the site for training and education, technical development, technical exchange, and human resources development on mangrove ecosystem conservation for various parties concerned. In addition, It should be noted that the MRMEWR will assume the role of the secretariat of the mangroves protection for the section of the Regional Organization for the Protection of the Marine Environment (ROPME) of which the nine member states are, the GCC (Gulf Cooperation Council) countries (namely, Oman, UAE, Qatar, Bahrain, Saudi Arabia and Kuwait) plus Iran and Iraq.

### 4-2 Project Strategy

The project strategy of the QEIC is described as follows:

#### 4-2-1 Emphasis on training and education

Because the proposed site of the QEIC is located at the center of the capital city, Muscat, educational value to promote natural resource conservation is extremely high. Potentials to provide education/training programs to general public by utilizing the mangrove ecosystem of the QNR are enormous. At the moment such educational opportunities focusing on raising awareness in environmental conservation is limited in Oman. It is an ideal vehicle for this purpose.

#### 4-2-2 Stakeholder participation

In order to develop network, the QEIC will actively seek participation of various stakeholders in its activities. Other governmental ministries and agencies, such as the Ministry and Agriculture and Fishery, and the Muscat Municipality are important key stakeholders to be involved in the QEIC activities. Other organizations include universities, local and international NGOs, the private sector, primary and secondary schools, and community leaders.

These stakeholders should play active role in the QEIC within their own capacity. For instance, research organizations such as university and international NGOs may bring their own resources to conduct mangrove related researches at the planning sites implemented by the MRMEWR. Community leaders may be trained and educated for coastal zone management by local NGOs or the QEIC personnel. Such stakeholders may utilize the QEIC facility for transmitting their findings for sharing. In order to do so, the QEIC will play an active role in coordinating mangrove ecosystems conservation in Oman as required by its mandate.

#### 4-2-3 Emphasis on practical training

As the QEIC is required to promote sustainable mangrove ecosystems management to Oman and beyond, field-based training will be emphasized. Existing mangrove-planting technologies jointly developed and practiced in Oman through the past technical cooperation should be extended and promoted. Because the technology developed was a compilation of empirical knowledge, emphasis is to promote the technology in the field, not in the laboratory for the sake of mere theoretical research.


#### 4-2-4 Development alternatives to protect the fragile natural mangrove ecosystems

As described in 3.2.2, existing pressures associated with urbanization are major threats to the state of the QNR. If no protective measures are taken in immediate future, overall environmental conditions of the QNR will continue to deteriorate and the value of natural mangrove ecosystems will be lost.

In order to minimize the threats associated with urbanization, the QEIC is proposed as a development alternative. Restoration of the reserve, including construction of the proposed facility and the artificial lagoon, will provide a buffer zone to protect natural forest areas of the QNR. Afforestation of the lagoon through education and training program will increase the number and density of the mangrove species in the site.

#### 4-2-5 Monitoring of mangrove ecosystems

Strengthening of monitoring function is identified as one of the priority areas in the Master Plan Study. Various parameters associated with the mangrove monitoring, such as growth, number, density, biodiversity, soil and water quality are covered. In addition, monitoring of soil and water in and around mangrove vegetation, fauna and flora are necessary. As pollution resulting from uncontrolled dumping of garbage and waste is becoming a serious threat to the ecosystem,



monitoring of pollution is also of high priority. Also land ownership should be monitored in order to ensure management of the ecosystem. Such monitoring is implemented on a regular-basis with an user-friendly format for public use.

#### 4-3 Implementation of Technical Cooperation Project by JICA

The proposed project will be implemented as the Technical Cooperation Project, one of the JICA's schematics of technical cooperation. The project consists of the following elements:

- (1) Dispatch of experts;
- (2) Provision of machinery and equipment; and
- (3) Training in Japan.

#### 4-4 Justification of the Project

The justification of the proposed technical cooperation is summarized as follows:

##### 4-4-1 Localization of technology provided by Japanese experts

Japanese experts dispatched will work closely with the assigned officers of the MRMEWR in the course of the technical cooperation. The Japanese experts will provide mainly on-the-job training for the initial technology transfer. Working closely with the Japanese experts, Omani side will interpret the acquired capacity to fit to the local contexts and to develop the technology suitable for Oman. In order to do so, the proposed Technical Cooperation Project is justified.

##### 4-4-2 Practical training

As described in 2.4.2, the MRMEWR and JICA have jointly developed the technology in mangrove protection and management suitable in Oman. The proposed QEIC project will continue to develop and disseminate the technology in Oman. In order to do this, the proposed technical cooperation will pay specific attentions to practical training to maximize outcomes of the technical cooperation. The Master Plan Study identified the development of training methodology for mangrove protection as one of the important fields of the training in order to develop the capacity of local officers and community leaders who carry out mangrove ecosystems management in the field. Trainer training is another area of importance.

#### 4-5 Areas of technology transfer

##### 4-5-1 Education and training

Education and Training of the personnel who are engaged in the activities of mangrove ecosystem conservation is one of the main areas of the technical transfer by the technical cooperation. Starting from the staff training of the QEIC, various stakeholders including officers of other than the MRMEWR departments, including other ministries and agencies, research organizations and NGOs, the private sector personnel and community leaders are the target groups. Such training and education will provide opportunities to strengthen the capacity in mangrove protection and management of the stakeholders. Personnel other than the QEIC are included because the training

course related to mangrove protection and management will provide opportunities to acquire skills, knowledge and attitude to protect coastal environment in a holistic manner. Various levels of training courses will be developed and provided in order to meet the target groups' respective learning goals and objectives.

#### 4-5-2 Monitoring

Strengthening the monitoring functions for protecting and managing mangrove ecosystems have been recommended by the Master Plan Study by JICA. Through the technical cooperation, the QEIC will have reliable capacity in collecting and compiling necessary information and data related to protection and management of the mangrove forests in Oman. Regular monitoring of socio-economic conditions of the designated mangrove forest areas is the most fundamental activity for the protection and management of mangrove forest.

In addition to data collection and compilation, specific attentions will be paid to develop data analysis capacity within the QEIC. Stakeholders and decision-makers will consult the QEIC regarding policy and technical matters related to the protection and management of the mangrove ecosystems. Such recommendation should be based on evidences collected through the monitoring.

#### 4-5-3 Enhancement of sustainable protection and management of mangrove ecosystems

The technology of transplanting mangrove has been developed through previous technical cooperation as indicated in 2.4.2. The developed technology has produced some tangible outcomes in several plantation sites in Oman. Although the recovery of biological diversity in afforested areas comparable to natural mangrove ecosystems may take 20 to 30 years, plantation of mangrove seedling needs to be continued and extended. In order to do so, the QEIC needs to continue its efforts of technology development. In addition, extension methodology to promote sustainable mangrove ecosystems management is necessary. The proposed site for the QEIC will have an artificial lagoon to be used as an experimental site. Maintenance and possible expansion of the existing nurseries may be implemented.

#### 4-5-4 Exhibition and community outreach

Regular exhibitions and public outreach programs specifically tailored to match cultural contexts of Oman will raise public awareness of mangrove ecosystem protection and management. Unlike the Education and Training above, it aims at a much broader audience, therefore methodology and approach of the technology transfer may be different.

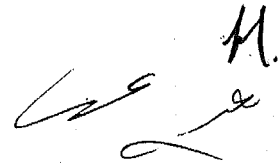
Technology transfer of exhibition, for example, will be practical and experimental with hands-on training focused on actual production of attractive exhibition displays and materials, and marketing and organization of topical exhibitions, seminars and workshops for a variety of audiences. Among other topics included may be are trainer training for the nature game and interpreters. Experimental plantation utilizing the artificial lagoon would be of good opportunity for students to participate in

the conservation activities. In addition, field trips are another effective approach for building public awareness.

Community outreach program focuses on the training for acquiring the skill, knowledge and attitude to mobilize community to protection and management of their near-by mangrove ecosystems. Possible training may include: field works of basic social survey techniques such as participatory learning and action (PLA) and communication. Other technology transfer areas may include social marketing to increase participation of the private sectors, volunteers and citizens.

#### 4-5-5 Administration/organizational management

Because the proposed QEIC is a newly established institution, additional training in administration and management may be necessary. Examples might be included case studies of similar institutions elsewhere and management seminars targeting senior staff and managers of the MRMEWR. Similar JICA technical cooperation projects can provide the QEIC lessons learned through the course of implementation as a effective training resources for the Omani project.

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## 5. Basic Plan of Implementation

All elements of the proposed project are summarized in the Project Design Matrix (PDM) shown in Appendix 1.

### 5-1. Project Purpose

According to the Development Assistance Committee (DAC) of the Organization for Economic Cooperation and Development (OECD), purpose of the project is defined as: The intended physical, financial, institutional, social, environmental, or other development results to which a project or program is expected to contribute. It is usually, stated publicly. The project purpose of the QEIC project is defined as:

“The QEIC is established as the center for promoting sustainable mangrove ecosystems management in Oman.”

Specific indicators of the Project Purpose to measure the achievement at the time of the end of the project in 2007 are summarized as follows:

- (1) The QEIC is developed into the center for knowledge sharing by professionals, practitioners and scholars specialized in coastal environmental management;
- (2) The QEIC is able to provide counsel on policy and technical issues related to management of mangrove ecosystems to private and public sectors concerned;
- (3) The QEIC completes mangrove plantation at the proposed artificial lagoon built in the Qurm Nature Reserve as scheduled; and
- (4) Training on mangrove ecosystem management provided to professionals in Oman and beyond

### 5-2. Overall Goal

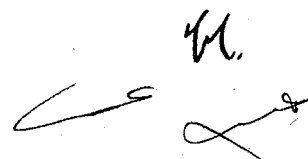
Overall Goal is the direction that the project should take next when it is successfully completed.

It is stated as:

“Dissemination of sustainable mangrove ecosystems management in Oman and in the region”

Indicators of the Overall Goal to measure the achievement in long term are summarized as follows:

- (1) Number of mangrove sites managed through partnership programs with local communities increased by five (5);
- (2) Number of new plantation sites increased by seven (7); and
- (3) Country experience on mangrove ecosystems management is presented in ROPME regional meetings and other international conference.



5-3. Outputs and Activities

5-3-1 Output 0 and Activities

“The project operation unit in the QEIC is established”.

- 0.1 Prepare and review the plan of operation (PO);
- 0.2 Prepare the budget plan;
- 0.3 Establish the Joint Coordinating Committee;
- 0.4 Prepare monitoring plan;
- 0.5 Allocate the budget, personnel and facility;
- 0.6 Prepared the Job description; and
- 0.7 Machinery and equipment provided are properly installed and maintained.

5-3-2 Output 1 and Activities

1 Education and Training program targeting various stakeholders is carried out

- 1.1 Identify the target groups for education and training program;
- 1.2 Define the goals and the objectives according to the target groups and choose the methodologies;
- 1.3 Develop a set of lesson plans for respective target groups and topics;
- 1.4 Prepare educational/training materials;
- 1.5 Deliver the lessons according to the lesson plan;
- 1.6 Evaluate the individual education and training program by target groups;
- 1.7 Modify the lesson plan as necessary; and
- 1.8 Modify the staff training as necessary

5-3-3 Output 2 and Activities

2 Monitoring functions aiming at protecting mangrove ecosystems is strengthened.

- 2.1 Define and finalize the necessary parameters of fauna/flora/socio-economy to monitor in the monitoring function of the QEIC activities base on the PO;
- 2.2 Furnish the monitoring plan accordingly;
- 2.3 Carry out monitoring and gather the information;
- 2.4 Compile and store in an appropriate format;
- 2.5 Analyze the data and information as necessary; and
- 2.6 Publish the results for public use.

5-3-4 Output 3 and Activities

3 Sustainable measures for protection and management of mangrove ecosystems in Oman are enhanced.

- 3.1 Prepare seedlings;
- 3.2 Select the restoration/afforestation sites;
- 3.3 Transfer the seedling to the sites;
- 3.4 Maintain and monitor the plants;
- 3.5 Evaluate the survival rate of planted seedling and provide feedback for the planting methodology; and
- 3.6 Modify the training as necessary.

5-3-5 Output 4 and Activities

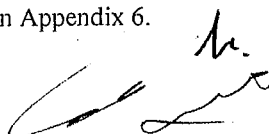
4. Exhibitions and community outreach programs to mobilize national efforts for mangrove ecosystems conservation and restoration are organized.

- 4.1 Identify the target group for exhibition and public outreach;
- 4.2 Define the goals and objectives according to the target group and choose the methodologies;
- 4.3 Present outcomes of training and education activities;
- 4.4 Present the results of on-going monitoring of mangrove ecosystems;
- 4.5 Present the outcomes of mangrove conservation activities;
- 4.6 Provide training in techniques in participatory social survey and how to mobilize communities;
- 4.7 Provide training for trainers and for "Interpreters" in interactive education such as games and displays ("Nature Game");
- 4.8 Organize and market topical mangrove exhibitions in the QEIC targeting general public; and
- 4.9 Modify the activities as necessary

5-4 Implementation of Activities

5.4.1 Implementation schedule of the project

Tentative Plan of Operation (PO) is shown in Appendix 2. Tentative Schedule of Implementation (TSI) which shows detailed schedule of implementation including all activities and other related elements of the Project is shown in Appendix 6.



#### 5.4.2 Financial arrangement

##### (1) Cost of the Project

Itemized cost incurred during the 2 years of technical cooperation includes but are not limited to:

- Dispatch of experts from Japan,
- Training provided,
- Materials and equipment
- Transportation and installation of equipment,
- Construction of the facilities and other fixtures,
- Salary and benefits for those who are assigned to the project,
- Cost for administrative support,
- Cost for office spaces and utilities, and
- Travel expenses and per diem.

##### (2) Construction of the QEIC facility

Prior to the technical cooperation, construction of the QEIC facility must be assured. There are several phases of development during the course of the design and construction work to implement the QEIC project. Examples include:

- (a) Preliminary land use plan including site and lagoon design
- (b) Preliminary design of the facilities
- (c) Detailed design of the facility
- (d) Preparation of tender document
- (e) Tender and procurement
- (f) Contracting
- (g) Construction work

Planning, design and construction (items (b) to (g), (j) and (k) are in-kind contribution from Oman, while the items (a) is expected to be financed by the Japanese side.

The Muscat Municipality has a plan for the development the neighboring area. It is located between the beach and the QNR. The plan includes a parking lot, two restaurants/coffee shop buildings along the highway. The plan is already in progress and it may attract tourists for recreation in the QNR area.

In the initial phase of the item (g) Construction Work above, land preparation for the construction site including excavation work is necessary. The proposed site for the QEIC building, parking lot, and the artificial lagoon would be the areas for the excavation. Extensive grading work including cutting, moving and filling of materials are necessary. Careful attentions to the surrounding environment throughout implementation of the construction are required to minimize the impact on the QNR. (The current Master Plan Study only showed the indicative location of the QEIC site. Balance of grading work (balance between filling and cutting), buffer zones from the



construction work and treatment of run off water are among issues that need detailed considerations.)

5-5 Commitment from Omani Government

5.5.1 Commitment from Omani Side

Omani side provided tentative construction schedule and plans of QEIC as Appendix 7. Based on the confirmation of construction schedule and plan, the Project will be implemented.

5-6 Input

Project inputs are summarized in Table 8. Quantity and specification of machinery, equipment and materials required for the project will be provided based on the List of Machinery and Equipment.

**Table 8 Inputs required for Project Implementation**

Japanese Side	Omani Side
<p>Experts in the field of:</p> <ul style="list-style-type: none"> <li>● Chief Advisor / Training Plan &amp; Implementation</li> <li>● Environmental Monitoring</li> <li>● Analysis and Database Development</li> <li>● Exhibition Planning and Design</li> <li>● Community Outreach and Extension</li> </ul> <p>Training of Omani Project Personnel in Japan</p> <p>Machinery, Equipment and Materials</p>	<p>Personnel</p> <ul style="list-style-type: none"> <li>● Project Director</li> <li>● Project Manager</li> <li>● Counterparts in the field of; <ul style="list-style-type: none"> <li>Monitoring and Information</li> <li>Training and Education</li> <li>Mangrove Plantation</li> <li>Exhibition and Public Relations</li> <li>Environmental Education</li> </ul> </li> <li>● Administrative Personnel</li> </ul> <p>Local Cost</p> <p>Land, buildings and facilities</p> <p>Procurement of Goods and Consumables</p>

5-7 Important Assumption

The following is a list of assumption in the project design:

- a. Other ministry and agencies bring and share their resources and expertise in coastal environment management to the QEIC;
- b. Similar initiatives in mangrove ecosystem management are carried out by other ROPME countries;
- c. Public – private sector partnership in GCC strengthened;
- d. Participants in the education and training program secure their own funding to attend the courses; and
- e. Unexpected weather related adversely effects to the planting sites are minimal.

5-8. Implementation Arrangement

5-8-1 Ministry of Regional Municipalities, Environment, and Water Resources

For the implementation of the mangrove ecosystems protection and management, the MRMEWR requires an institutional arrangements in the ministry. Currently the Marine Pollution and Coastal Zone Management Section (MPCZM) of the MRMEWR is a leading department in charge of the mangrove ecosystem protection and management. MPCZM will need to play a leading role. While The QEIC will be a separate institution, it will be a part of MPCZM in the Directorate General of Environmental Affairs, in the MRMEWR. Such arrangement will provide the QEIC enough authorities and capabilities to perform its responsibilities by holding a key position in the MRMEWR. Also, the MRMEWR has expertise and experience relevant to the Project implementation in Human Resources Development Center, Awareness and Information Department, and Food and Environmental Monitoring Center, which are expected to play important roles in the Project. In addition, regional offices will play important roles in dissemination of knowledge and methods for conservation of mangrove ecosystems. It is essential for a successful implementation of the Project to secure participation of these offices and centers. Appendix 3 shows the organizational chart of the MRMEWR.

5-8-2 The QEIC: implementing organization

The organizational arrangement of the proposed QEIC is summarized as follows:

- Name of Organization: The Qurm Environmental Information Center (QEIC)
- Management Body: the MRMEWR
- Sections in the Center:
- Training and Education
  - Monitoring and Information
  - Mangrove Plantation
  - Exhibition/ Community Outreach
- Personnel: Total of ten (10) persons will be allocated for operation and management
- Director (one manager of the Center)
  - Clerical staffs (2 persons)
  - Section Heads (4 persons)
  - Assistants (3 persons)
  - Technical Advisors (2 persons: assistance to the director.)

The organizational chart of the proposed QEIC is shown in Appendix 4.

5-9. Preconditions and other factors

5-9-1 Preconditions in the PDM

In addition to the above important assumptions in the PDM, precondition is identified as:

- f. Schedule of the project is negotiated and agreed;
- g. Construction schedule of the QEIC is finalized; and
- h. the MRMEWR puts construction of the QEIC facility tender prior to the project.

#### 5-9-2 Target groups and learning goals

There are 7 different target groups namely, QEIC staff, Officers in MRMEWR, Officers in other ministries, agencies and the private sectors, research organizations, students of higher education, community members and ROPME professionals, for the proposed training programs implemented at QEIC. Fields of training and learning goals for each target groups are defined in Training Program.

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## 6. Review of Project Validities

### 6-1 Summary of Project Validities

The validities of the project are high for the significance of mangrove ecosystems in Oman. The following are the summary of ex-ante evaluation on the Project employing the evaluation criteria defined by the Development Assistance Committee (DAC) of the Organization for Economic Cooperation and Development (OECD), which is commonly used among major donor agencies. Detailed discussions on each category are followed by 6-2 through 6-6.

#### 6-1-1 Relevancy

Because the proposed QEIC project is situated in the scarce natural forest in hyper arid climate, establishment of QEIC and its facility with a function of protecting and managing mangrove ecosystems is in line with the environmental policy of Oman. Various environmental benefits may include transfer of technology in mangrove protection and management to Oman and beyond, strengthening Oman's capacity in education and training in the related field, and finally, fulfilling the mandate of promoting sustainable mangrove ecosystem protection and management requested by ROPME.

#### 6-1-2 Effectiveness

Designate activities are well coordinated and the logical structure of the project is well designed. The process of objective setting was an outcome through a series of dialogue with the stakeholders of the project. In addition, the objectives are based on the results of the two-year-long Master Plan Study implemented by JICA. Therefore, the probability of achieving the objectives is considered high.

#### 6-1-3 Efficiency

The inputs listed in section 5-6 are necessary and sufficient for achieving the Project Purpose. These inputs are utilized for various and comprehensive activities under the Project, and synergetic effect among the activities in the Project are expected to produce the outputs with high efficiency.

#### 6-1-4 Impact

Various areas of impact, such as improvement of environmental policy; overall quality and institutional arrangement of management of coastal zone environment; and technological development and extension, are expected to be significant as the result of the project. When the proposed technical cooperation is completed in 2007, QEIC will be counseled about various policy and technical issues related to mangrove ecosystems and provide solid advises to decision-makers.

#### 6-1-5 Sustainability

In order to assure long-term sustainability of the proposed QEIC project, the primary focus of the project is on capacity development in protection and management of mangrove ecosystems as



identified in the Master Plan Study. The QEIC is designated as a place of sharing knowledge and information brought by various stakeholders related to mangrove ecosystems protection and management. Multiple effects of the project, resulting from the combined effect of education and training, exhibition and community outreach, is expected to produce fruitful outcomes after the project is completed.

## 6-2. Relevancy

According to JICA's guideline, overall qualification as an ODA project is judged by whether or not the project has common goods and equity. In the light of such criteria, the relevancy of the project is reviewed as follows:

### 6-2-1 Qualification as an ODA project

The QEIC project will transfer some key technologies to protect and manage mangrove ecosystems in Oman. Therefore, relevance of the project is considered high.

#### (1) The project has high level of public interests;

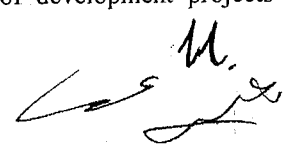
Because Oman is situated in hyper arid climate, broadleaf trees are extremely rare. *Avicennia marina* (grey mangrove) is considered a scarce natural resource since only approximately 1,000 ha of land are covered in the country. Because the limitation of natural forest ecosystems found in Oman, rehabilitation of mangrove ecosystems has significant impact on the environment if such initiatives are carried out in long-term. The MRMEWR is cautious in avoiding introducing non-indigenous species to Oman since such attempts may harm existing ecosystems in Oman.

Though it may need at least twenty to thirty years to rehabilitate the same level of bio-diversity, on-going afforestation will increase the biodiversity in the afforested areas. Given the high level of bio-diversity in the mangrove ecosystems, the needs of the project are high. Although the relationship between the ecosystems and human being in Oman is different from what is found in the Southeast Asia, raising public awareness by providing general public through wider dissemination of conservation strategies is necessary in Oman.

Various environmental benefits are expected as a short-term outcome of the proposed technology transfer. The most immediate one may be significant improvement in education and training of broad audience not only in Oman but also in the ROPME region. In the long run, it is expected that overall quality of coastal shore environment should be improved. Therefore, the proposed project has high level of public interest and relevancy.

#### (2) Relevancy as official development assistance

In general, environmental conservation project of this kind has a common challenge of estimating direct and indirect economic benefits from the project. Investments usually produce very limited tangible benefit in a short period of time. But long-term benefits and magnitude of the impact from it are considered significant. Such difficulty in realizing immediate direct benefits eventually prohibits the private sector to implement the similar kind of development projects to attain



financial benefit. Therefore, the proposed support from the public sector through the form of official development aid is justifiable. If the private sector is involved, there may not be any financial support provided from the market. It may be difficult for the private sector to implement similar projects because availability of finance through the market, and risk managements because project finance are still less developed in the respected area.

#### 6-2-2 Consistency with the master plan

##### (1) Compliance with the priority sectors and guidelines

The environmental sector is identified as one of the priority areas for Japan's technical cooperation. The challenge is how to effectively maximize the impacts of the technical cooperation focusing on the environmental issues expanding to entire nation and neighboring countries. Considering the vast coastal ecosystem zones, and the magnitude of threats facing the mangrove ecosystems in Oman, technical cooperation by Japan has its limitation. It is almost impossible for Japan alone if it were to single handedly impact effectively all considerable measures to eliminate loss and disturbance of mangrove trees in Oman. The basic strategy of the project is to assist the QEIC as a technology center to improve mangrove management, to support their efforts to promote environmental conservation technologies in the region. In light of such a strategy, it is effective to promote technologies to improve public awareness, reforestation technology as well as education and training in Oman.

##### (2) Harmonization with environmental policy of the Government of Oman


Overall goal as described in 5.2 is in line with various environmental laws in Oman. In particular, Integrated Coastal Zone Management Plan formulated by International Union for Conservation of Nature is the basis of mangrove ecosystems protection and management in Oman. Therefore, the project is in line with other environmental policies and laws.

#### 6-2-3 Participatory project planning

The process for formulating the project has relied upon the efforts of long-term experts who were assigned in the MRMEWR since 2000. The experts and the MRMEWR have had several meeting and dialogues to discuss details and arrangements to implement the QEIC projects. In such a process, both sides incorporate their comments, recommendations and inputs from the field workers (if available) to furnish the project design. Project employed Project Cycle Management (PCM) method in order to encourage inputs from stakeholders to the basic project design and participation from a wide range of stakeholders. It is further expected that the project will include more variety of people in its selection of theme of educational projects, monitoring and evaluation.

#### 6-2-4 Establishment of operational arrangement

The Technical Cooperation Project, one of schematics of JICA projects is considered relevant. In the previous technical cooperation, basic technology to be disseminated is developed and tested. Through the newly proposed QEIC, the technology should disseminate throughout the country and



beyond. In order to do so, the proposed schematics combining (1) dispatch of experts (2) provision of machinery and equipment, and (3) training in Japan is suitable for initiating Omani initiatives to achieve the goal. Through the schematic, both Japan and Oman will contribute their resources to carry out the project. It is expected that the four areas of technical transfer listed in 4-4 is accomplished through the technical cooperation.

#### 6-2-5 Technical advantages of Japan

As described in 2.3.4, the technology in mangrove ecosystems protection and management has been jointly developed through technical cooperation of the two countries. The Japanese side has carried out a similar technical cooperation in Indonesia. In addition, Japan has a training program on mangrove ecosystem protection. Therefore, Japan is in the right position to carry out the proposed QEIC project as a technical cooperation by JICA.

### 6-3. Effectiveness

According to JICA's guidelines, effectiveness of the project is evaluated by whether the project provides benefit to designated target groups. Logical structures of the project, appropriateness of objective-setting, and important assumptions are reviewed. For the project document preparation, these items are reviewed using project design matrix (PDM) as the project is not yet started.

#### 6-3-1 Logical structure of the project

##### (1) Logic between activities and output

There are 5 outputs listed in the PDM of the proposed project. In order to achieve these outputs, total of 36 activities are identified and listed in the PDM. All are necessary and logically constructed in accordance with assumptions.

There are no assumptions in activity-level while three are listed as precondition. All assumptions listed here are out of hand but still are all necessary to implement the project. For example, "Unexpected weather related adversely effects to the planting sites are minimal" is one of the key elements for success of intended technology transfer. Because if it fails, successful example may not be available for other areas of possible plantation of mangrove trees to be promoted to the prospective communities.

##### (2) Logic between Outputs to purpose

Five outputs are linked to one purpose. All five outputs will have assumptions associated with them. The output 0, "The project operation unit in QEIC established" is a "cross-cutting" issue of which prerequisites of all other outputs are listed. While considerable conditions are out of hand of the project, the project needs to find some mechanism to internalize these assumptions so the risk factor of the project may be minimized.

##### (3) Logics between purpose and overall goals

The overall goal of the project is defined as 'Dissemination of sustainable mangrove ecosystems



management in Oman and in the region'. The most significant condition to reach to this goal is how the project and other concerned bodies put the plan on the ground to promote the new technologies amongst of all level of community members in Oman and beyond. Within the project's scope, the QEIC is charged with promotion of technology for protecting and managing mangrove ecosystems through monitoring, education and training and other means to facilitate knowledge transfer to broader audiences. In order to achieve such a goal, support from the government as well as local communities are indispensable. In addition, careful monitoring of assumptions listed in PDM is necessary.

#### 6-3-2 Objectives-setting

The indicators were developed through discussions with concerned officials in the MRMEWR who will operate the QEIC. In addition, the objectives listed are based on the results of the two-year-long Master Plan Study implemented by JICA. Therefore, the probability of achieving the objectives is considered high.

#### 6-3-3 Extension of new technology in Oman and the region.

In order to disseminate and extend the technology in the given period of time, the capacity of personnel of all target districts needs to be strengthened. The proposed Training and Education modules of the PDM are planning to train 18 trainers, at least, within the initial two-year period. Thus the rules and procedures may be improved for those actively supporting the initiative may be rewarded.

In addition, there is a need for policy dialogues with concerned branches of government jointly ensure achievement of Overall goal of the project. Both Japanese and Omani sides must share the importance of the issues for the success of the project.

#### 6-4. Efficiency

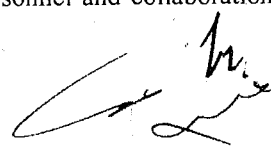
According to the guideline, the efficiency of the project is judged by (1) Cost-benefit/Output analysis and (2) whether or not the equipment provided is efficiently operational.

##### 6-4-1 Efficiency of inputs

##### (1) Efficiency of Inputs to Outputs and Project Purpose

The inputs listed in section 5-6 are necessary and sufficient for achieving the Project Purpose. In this project, the inputs, for example, machinery and technology transferred will be utilized for achieving plural outputs, such as "Training and Education" and "Monitoring of Mangrove Ecosystem". And some Training Programs are aimed to train trainers. Each newly trained trainers will disseminate knowledge and necessary technologies for mangrove conservation, which efficiently increase the number of total trainees in a sustainable way.

In addition, Oman has some experience and knowledge in mangrove conservation and some in relevant activities to the Project, such as environmental awareness raising, human resources development and chemical analysis. Involvement of relevant Omani personnel and collaboration



with relevant authorities / institutions will provide the Project with high efficiency.

#### (2) Efficient utilization of equipment provided

The equipment will be provided based on the List of Machinery and Equipment. The Equipment to be provided will be used for the Project activities, such as training, monitoring and exhibition, and appropriate utilization and daily maintenance method would be transferred through the Project Activities. Efficient utilization of equipment is expected to be high.

#### 6-4-2 Cost-benefit analysis

Some of the inputs are expected to contribute to two or more outputs, for example, equipments for monitoring will also be utilized to the purpose of the training. The efficiency of the Project will be raised and collaboration among the sections promoted by utilization of one input to achieve two or more outputs.

#### 6-5. Impact

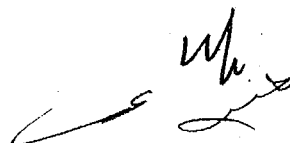
According to the guideline, impacts resulting from the project are judged by long-term and possible indirect ripple effects. Based on the PDM, the following items are reviewed, as the project is not yet implemented.

##### 6-5-1 Probability of achieving the overall goal

Based on the previous discussion in section 6-2-1 and 6-2-3, probability of reaching overall goal is considered as high. The following are the reasons for the judgment:

- (1) The technologies expected to transfer match with needs of Omani side. It is expected that incentives for adopting such technologies are high.
- (2) Realistic number of trainers with specific technical requirements are training within the given timeframe. The proposed number of 18 trainers is realistic yet challenging within the given timeframe of the technical cooperation.
- (3) While the MRMEWR and the proposed QEIC has high level of credentials in the protection and management of mangrove ecosystem in Oman, their initiatives for structural adjustments, network of highly trained experts and technical expertise has been always respected. These credentials will support promotion of the technologies developed.
- (4) The MRMEWR is expected to assign the highest level of qualified staff members to the project.
- (5) Omani experts from the MRMEWR have a successful record of localizing technologies introduced from foreign countries in the previous technical cooperation. The project can utilize the past experiences. Therefore, probability of success is high in this project.

According to the set of objectively verifiable indicators on PDM, the impact of the project would be significant. It is, however, visible impact including increase in number of catch may be realized only after 20 to 30 years from the termination of the project.



## 6-5-2 Estimated impact by the Project

The following are description of socio-economic impact by the proposed project:

### (1) Policy implications and impacts

Given the high credentials the MRMEWR holds, the technologies transferred and improved management and conservation technologies of mangrove, raised public awareness through training and education programs developed in the QEIC would become a de facto standard in Oman as well as the ROPME region when they are promoted successfully. In addition, extension technologies in particular has vast application itself, the QEIC's development could be utilized in other topics and purposes related to natural resources management and conservation.

### (2) Institutional impact

If proposed QEIC becomes the center of knowledge sharing, as envisioned in the PDM, all technical expertise related to the mangrove protection and management will be accumulated in the QEIC. When the technical cooperation is terminated in 2007, QEIC will be counseled about various policy and technical issues related to mangrove ecosystems and provide solid counsel to decision-makers.

### (3) Technical impact

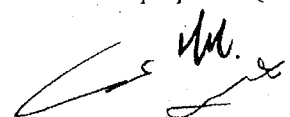
It is expected that the project will have significant technical impacts on the Omani mangrove conservation as a whole.

For monitoring capacity through hands-on practice at the QEIC and nearby mangrove areas, it is considered as a fundamental technology necessary for implementation of the project because it has broad applications. Therefore, the technological impact on Omani environmental conservation in general is considered significant. If proposed technology transfer is successfully implemented, the impact on Oman's environment-related technology is significant. These technologies are not only considered as a basis of environmental protection, but also as applicable technologies to various areas within the environmental sector. Trickle effects by technologies development at the QEIC will be significant.

In addition, for the mangrove technology related to mangrove ecosystems management, the technology is mostly within the hand of the MRMEWR personnel who have directly received the technology in the course technical cooperation by JICA. The proposed QEIC project will extend the technology to other related ministries and beyond. Further the QEIC would continue to develop the related technology in its own which would be also extended to other part of the region. Therefore, the proposed QEIC project has potentially significant technical impacts.

### (4) Economic impacts

It is very difficult to estimate direct economic impacts resulting from the proposed project. In particular the short-term benefit is very difficult to estimate. However, because the proposed QEIC



project's primary focus is capacity development, direct economic benefit of having such institution focusing on human resources development may be economically feasible when QEIC's training and education function is fully developed and implemented as planned. Various cost saving may be realized in the long run if the QEIC training and education program is available to public.

#### 6-6. Sustainability of the Project

##### 6-6-1 Institutional capacity

The proposed QEIC will be established, as the newly established institution for the focal point of mangrove ecosystems protection and management. The MRMEWR is to allocate the necessary resources including personnel, expertise as well as authority.

The implementation agency, the MRMEWR, has sole authorities in protecting coastal environmental zones. Personnel and other resources as well as technology in mangrove ecosystems protection and management are available in the ministry. Establishment of the QEIC is in line with the mandate from ROPME to be a leading country to disseminate mangrove protection and management among the member countries. Some ROPME countries have already expressed interest in transferring the mangrove ecosystems protection and management technology developed in the past technical cooperation with Oman. Investment in the QEIC will eventually materialize also from the proposed dissemination of the technology to the neighboring countries in the region.

Within the scope of the work of the QEIC, strengthening of the existing institutional capacity is one of the aims for the technical cooperation. In addition, partnership with the private sector is one of the key elements of the technical cooperation. In particular oil industry in Oman has expressed their interest in supporting the mangrove transplanting activities implemented by the ministry. When the QEIC is established, the partnership with the private sector may play a vital role to disseminate the technology in Oman and beyond.

##### 6-6-2 Technical support from other departments within the ministries and other agencies in Oman

As described in the 2.3.1, the Omani Government identified that the mangrove ecosystem protection as one of the top priority areas within environmental sector. The proposed QEIC project has received a support from the government. The government will allocate necessary personnel and expertise along with the resources to the QEIC in order to establish it as the national center for mangrove protection and management in Oman and the region. The institutional arrangements of QEIC are summarized in the organizational chart shown in Appendix 3: Organizational Chart of the MRMEWR and Appendix 4: Organizational Chart of the QEIC.

The Joint Coordinating Committee (JCC) is established to oversee the progress of the technical cooperation during the course of technical cooperation. The JCC functions as a supreme decision-making and coordinating body to discuss the issues raised by two countries in the course of implementation. JCC, comprising various stakeholders concerned and the members of the



committee, is listed in Appendix 5.

#### 6-6-3 Financial arrangements

The MRMEWR has expressed their strong concerns that selection of procured machinery and equipments should be based on availability of parts and maintenance in Oman.

The MRMEWR has pledged to provide necessary funding to implement the technical cooperation and to repair and replace the equipment based on the estimated maintenance and replacement cost.

#### 6-6-4 Social, environmental and technical adoptability

The technical cooperation at the QEIC is in line with the previous supports provided by JICA. The technology developed in Oman is fully adopted in Oman. Therefore, the adoptability of the technology within the country and the region is considered high. The counterpart personnel trained and collaborators are the core members of disseminating the technology in Oman and beyond. When the QEIC project is started, the same members are expected to work with the organization.

In order to maximize the outcomes from the QEIC project, the MRMEWR is inviting other ministries and agencies. The QEIC may be used to bring other stakeholders expertise and the knowledge developed in the QEIC would be shared. For example the SQU may bring their capacity in academic research in biology to the QEIC. The center may provide research sites to the university so that the SQU may conduct thematic research on mangrove ecosystems. Such interaction will eventually make QEIC as the center of mangrove ecosystems protection and management.

The QEIC will also work closely with various international agencies and research institutions in the area of mangrove ecosystems protection and management. For example, because the ROPME nominated the Sultanate of Oman to develop and disseminate the technology in mangrove ecosystems protection and management, QEIC will become the regional center to train professionals from the ROPME countries. Cooperation with other JICA projects related to the coastal zone environmental management would be considered in the formulation of JICA's third country training program schematic.

