

Table 4.1.2 Distribution of Water Consumption in 1992

Source	(MCM/year)			
	Irrigation (MCM)	Water supply (MCM)	Industry (MCM)	Total (MCM)
Renewable groundwater	306	158	36	500
Treated water	40	0	0	40
Surface water	329	31	0	360
Total	675	189	36	900
	(75%)	(21%)	(4%)	(100%)

Source: Water Authority of Jordan (WAJ), 1992

The total quantity of water consumed for all purposes in 1992 reached 900 MCM, 500 MCM of which came from groundwater sources, and 360 MCM from surface water; treated water was estimated at 40 MCM in 1992, 90% of which flows from the Khirbet Samra treatment plant. Total discharge for all treatment plants is estimated to reach 60 MCM annually by 1995. An estimated 97% of the population is served by water supply networks, and 54% of the total population is served by trunk sewerage systems.

Water is primarily used for irrigation, domestic and industrial purposes as detailed below.

Irrigation: This includes all water used for irrigating plants (trees, vegetables, crops, forage and cattle watering). The quantity of water used for irrigation purposes from all water sources was estimated at 675 MCM in 1992 of which 306 MCM came from groundwater and 329 MCM from surface water sources. Most of the surface water used for irrigation is consumed in the north and central Ghor areas. Most of the groundwater use is consumed in desert areas.

Domestic supply and industrial uses: This represents all water used in houses, gardens and all types of industries. Quantities of water used for this purpose were estimated at 225 MCM in 1992, 194 MCM of which came from groundwater and 31 MCM from springs. Most of this water is consumed in the centers of population, i.e., Amman, Irbid, Zarqa, Karak and Aqaba, where per capita consumption is also higher than in the more rural areas.

4.1.6 Present Situation

(1) Water Supply

There are two seasons in Jordan: a dry hot summer season when there is almost no

rain and a wet cool winter season when the majority of the rainfall occurs. The amount of rainfall is low with a maximum of 400 to 500 mm annually in the northern highland, 300 mm in Amman, 50 to 200 mm in the south and less than 100 mm in the desert to the east.

The current water supply situation in Jordan is very serious because of the imbalance between water demand and supply. The supply is inadequate because of insufficient rainfall, minimum recharging of groundwater and over abstraction. Demand is satisfied only up to the supply limit. The imbalance has been worsened by the increase in population.

The various sources of water resources and the consumption is shown below.

Table 4.1.3 Water Resources and Consumption in 1992

Resource (MCM/year)		Consumption (MCM/year)	
Groundwater	500	Irrigation	675
Surface water	360	Domestic water	189
Treated water	40	Industry	36
Total	900		900

Source: Water Authority of Jordan (WAJ), 1992

(2) Sewerage

The sewerage system is thought to serve approximately 54% of the population, which is comparable to other developing countries.

The importance of an adequate sewerage system is not only for human health but in Jordan to protect ground water from contamination. In the ten tourism areas, Petra (Wadi Musa) and Wadi Ram have no conventional waste water treatment plant.

There are 14 waste water treatment plants in Jordan. The oldest one commenced operations in 1981, the remainder have been constructed since 1987. The effluent in these plants is low compared with design loads. The reason seems to be low per capita water supply quantity.

The present conditions and major problems for water supply and waste water treatment plant facilities observed during the site investigation are summarized in Table 4.1.4. Newly completed and under construction projects are listed in Table 4.1.5 and Table 4.1.6.

Table 4.1.4 Existing Conditions and Major Problems of Water Supply and Waste Water Treatment Facilities
(As of 1992)

Population	Water Supply	Waste Water (Sewerage System)
IRBID 775,650	Location of pumping station: Near Wadi Arab dam Pumping capacity: 2,300 m ³ /day Water loss due to leakage from pipes: 30-40%	Location of treatment plant: 3km of center of Irbid Design load: 11,023 m ³ /day Actual load: 6,777 m ³ /day Groundwater will be contaminated due to cesspools
JERASH 219,000	Location and name: Center of city, Ein Al-Quawan Pumping capacity: 2,400 m ³ /day Water loss: 30-40%	Location: about 4km south of center of Jerash Design load: 5,000 m ³ /day Actual load: 1,399 m ³ /day Necessary of care for groundwater from contamination
AMMAN & ZARQA 2,200,000		Location: 20km northeast of Zarqa, Al-Sanra Design load: 68,000 m ³ /day Actual load: 124,263 m ³ /day Foul odor in surrounding area Necessary of care for groundwater contamination Necessary of urgent improvement for facility
BALQA 248,000		Location: 23km north of Amman beside of King's Highway Design load: 6,000 m ³ /day Actual load: 5,168 m ³ /day Plastic media of trickling filter have been broken due to over load Much foul odor on the King's Highway Necessary of urgent improvement for facility
MADABA 106,000	Location: 30km south-west of Amman on the Kings' Highway Pumping capacity: 2,000 m ³ /day Water loss due to leakage from pipes: 30-40%	Location: 3km south of Madaba Design load: 2,000 m ³ /day Actual load: 2,069 m ³ /day Necessary improvement for lagoon from over topping Foul odor has been stunk around lagoon Necessary of care for groundwater from contamination
KARAK 170,000	Location and name: 120km south of Amman, Ain Sara Pumping capacity: 4,080 m ³ /day Water loss due to leakage from pipes: 30-40%	Location: 5km north of Karak Design load: 786 m ³ /day Actual load: 827 m ³ /day Necessary of care for groundwater from contamination
TAFLA 65,000	Location: 200km south of Amman Pumping capacity: 6,000 m ³ /day Water loss due to leakage from pipes: 30-40%	Location: 5km northwest of Tafila Design load: 754 m ³ /day Actual load: 878 m ³ /day Necessary of care for groundwater from contamination
WADI MUSA (PETRA) 65,900	Location: Hilltop in Wadi Musa	Treatment plant is not installed yet. Most of houses are used to cesspools except big hotels. Necessary of care for groundwater from contamination Some sewers have been leaked from houses in the town
WADI RAM 5,900	Location: Dissi Pumping station: 1,920 m ³ /day Water loss due to leakage from pipes: 20-30%	Treatment plant is not installed yet. Most of houses are used to cesspools Necessary of care for groundwater from contamination
AQABA 80,000	Location: Dissi Pumping capacity: 4,000 m ³ /day Water loss due to leakage from pipes: 30-40%	Location: 5km northwest of city center Design capacity: 9,000 m ³ /day Actual load: 4,925 m ³ /day Foul odor at substation on the way to the terminal plant

Source: JICA Study Team

Table 4.1.5 Newly Completed Water Supply and Sewerage Projects

No	Health	Project Name	Outline of Project	Project Area	Execution Period	Aid System	Cost (1,000 JD)
1	Improvement and Extension of Water Supply	Completion of Wala Hidan Water Project	Study on Adding of Water Supply Quantity for Amman & Madaba, Well Excavation and Installation of Pond, Pumping Station and Management Office Construction for Conveyance Water of 41,000m ³ /day.	Amman	1992-'94	SDP-48% (1) Jordan Government 52%	11,720
2	Rehabilitation of Water Supply	Rehabilitation Zarqa Water House-Connection System	Removal of existing Embedded Pipes in order of Leakage Water	Zarqa	1991-'93	IBRD-60% Jordan Government-40%	5,570
3	Improvement and Extension of Water Supply	Marhab Water Wells	Conveyance Water from 4 Wells from Marhab to Zarqa district. Installation of Pumping Station, 2 Ponds of 1,000m ³ /day, and Conveyance Pipes 25 km	Zarqa	1992-'92	Jordan Government-100%	1,869
4	ditto	Partial Investment for Ain Alqum Water	Making channels to avoid water Storage in Rural Area. Installation of Pond of 1,950m ³ /day, Pumping Station, and Conveyance Pipes 27 km.	Zarqa	1992-'93	Jordan Government-100%	748
5	ditto	Ain Urna Quern Water	Water Supply for Rural Area of Ain Urna Quern Village. Installation of Pond, Pumping Station and Conveyance Pipes of 5 km.	Irbid	1993	S.Korea-50% Jordan Government-50%	400
6	Improvement and Extension of Water Supply	Zakur Water	Installation of Pond, Pumping Station and Conveyance Pipes of 12 km for Several Rural Areas in Irbid district.	Irbid	1993-'94	S.Korea-50% Jordan Government-50%	1,250
7	ditto	Rehabilitation Irbid Water Supply System	Improvement and Rehabilitation of Water Supply Network and installation of P.V.C. Pipes of 140 km and installation of P.V.C. Pipes of 460 km.	Irbid	1992-'95	EIB, Jordan Government	6,800
8	Improvement and Extension of Water Supply	Smahar and Sebra Walls	Planning of Water Supply for Central Part of Jordan Valley from New Water Resources.	Irbid	1993	Jordan Government-100%	300
9	Improvement and Extension of Sewerage System	Amman Sewerage Project	Improvement of Sewerage pipes in Housing Area to be newly constructed	Amman	1993-'94	EIB, (2)	
10	ditto	Jorash WWTP Extension	Capacity up to Treatment Plant for Increase of Sewer and Loads due to population increase. Installation of Additional Plant for Capacity up from 2,300 to 5,000m ³ /day.	Irbid	1991-'93	IBRD-60% Jordan Government-40%	2,794
11	ditto	Salt WWTP Extension	Capacity up to Treatment Plant for Increase of Sewer and Loads due to population increase. Installation of Additional Plant for Capacity up from 2,300 to 5,000m ³ /day. Installation of Additional Plant for Capacity up from 2,500 to 7,500m ³ /day.	Hakeq	1991-'93	IBRD-60%	3,608
12	ditto	Barzun Sewerage Project	To avoid of pollution of Groundwater due to extension of Sewerage Area, and Improvement of Sanitary Environment. Installation of concrete pipes of 69 km.	Zarqa	1992-'93	EIB-57% Jordan Government-43%	3,528
13	Improvement and Extension of Sewerage System	Jabal Faisal Al Muhterich and Al Jabal Shamsi Sewerage Project	To avoid of pollution of Groundwater due to extension of Sewerage Area, and Improvement of Sanitary Environment. Installation of concrete pipes of 69 km. Installation of D.I. Pipes and Concrete Pipes of 89 km.	Zarqa	1991-'93	EIB-57% Jordan Government-43%	4,752

Note : (1) Saudi Development Fund, (2) European Investment Bank.

Table 4.1.6 Under Construction Water Supply and Sewerage Projects (1/2)

No	Title	Project Name	Outline of Project	Project Area	Execution Period	Fin System	Cost (1,000 JD)
1	Waste Water Treatment Plant	Expansion of Salt W.W.T.P.	Expansion of Salt W.W.T.P. to handle waste of Salt town up to 2010.	Balqa	1991-95	UNID-60%	4,400
2	Waste Water Network and Treatment Plant	Serving towns of Fuhes and Madha town with waste water collection system and treatment.	Serving towns of Fuhes and Madha town with waste water collection system and treatment.	Balqa	1994-95	Jordan Government-100%	10,000
3	ditto	Waste Water Treatment Plant	Serving Wash Jar town with waste water (sewer) including construction of waste treatment plant.	Amman	1994-95	S. Korea EADB Bank-47% Jordan Government-53%	12,200
4	Waste Water Network Expansion	Salt Waste Water Project	Expanding the waste water network to serve new areas.	Balqa	1995-96	EB-50% (1)	1,000
5	ditto	Amman Waste Water Project	Expanding the waste water collection system to serve new areas.	Amman	1995-96	EB-50%	1,500
6	ditto	Zarqa Waste Water Project	ditto	Zarqa	1995-96	Under awarding	900
7	ditto	Aqaba Waste Water Project	ditto	Aqaba	1995-96	Under awarding	450
8	Food Waste Water and Treatment Project	Serving Towns in Irbid Governorate and Construction of Q. Treatment Plants	Expansion of network of the city of Irbid and serving towns in Irbid Governorate and construction of Q.T. plants and a reuse project.	Irbid	Planned to start in 1996-98	GTZ-100% (2)	42,000
9	Rehabilitation of Waste Water and Treatment Project	Balqa and Abu-Naser W.W.T.P	Detailed design for the expansion and upgrading of Balqa and Abu-Naser treatment plants.	Balqa	1996 Extended to 1995	Jordan Government-100%	42,000
10	Improvement and Expansion of Waste Water Services	Free Zone and Zarqa Waste Water Project	Expanding the service of waste water in Zarqa and the free zone.	Zarqa	1995	Jordan Government-100%	630
11	ditto	Design of The Commerce System (Siphon) to As-Sabra	Design of a new siphon from Ain Ghazal plant to As Sabra plant and inlet structure of Ain Ghazal.	Amman Zarqa	1995-96	GTZ-100%	
12	Improvement and Expansion of Waste Water Treatment	Al-Sabra Short Term Efficiency Improvement Program	Expansion and upgrading of Al-Sabra plant and odor treatment and installation of mechanical ventilators.	Zarqa	1995-97	UNID-90% Jordan Government-10%	12,000 (US\$)
13	Improvement and Expansion of Waste Water Service	Ramtha and Madaba Treatment Plants Upgrading and Expansion	Design and feasibility study of the two treatment plants to improve the effluent quality.	Ramtha Madaba	1995-96	S. Korea-100%	900
14	Serving Wash-Jar and Petra with Waste Water Facilities	Wash-Jar Water and Waste Water Project	Feas and final engineering design for waste water facilities for Petra and Wash-Jar.	Wash-Jar Petra	1995-96	UNID-100%	2,000 (US\$)
15	Serving Towns and Villages in South Amman	South Amman Waste Water Project	Feas and final engineering design for waste water scheme and T. plants for south Amman towns and villages.	Amman	1995	EB-100%	675
16	Serving Near with Waste Water Facilities	Near Waste Water Project	ditto	Amman	1995-96	Jordan Government-40%	3.5
17	Serving Al-Ahwar Area with Waste Water Facilities	Al-Ahwar Waste Water Study	Feas and preliminary engineering design for the Jordan Valley area (Waste Water)	Jordan Valley	1995-96	CIDA (3)	

Note: (1) European Investment Bank
(2) German Cooperation Agency
(3) Canadian International Development Agency

Table 4.1.6 Under Construction Water Supply and Sewerage Projects (2/2)

Sl. No.	Fields	Project Name	Outline of Project	Project Area	Execution Periods	Aid System	Cost (1,000 JD)
18	Improvement and Expansion of Water Service	Rehabilitation and Expansion of Madfraq, Karak, Mafraq and Ajlun W.W.T.P	FE and final engineering design for the expansion and upgrading of the 4 plants.	Ajlun, Karak, Madfraq, Mafraq	Not started		
19	Rehabilitation and Expansion of Water Service	Ammann, Zarqa Dam Waste Water Master Plan	FE's preliminary engineering design for the waste water scheme and treatment for Amman and Zarqa area.	Ammann, Zarqa	1995-97	USAID-100%	3,000 (US\$)
20	Reuse of Treated Wastewater	Reuse of Treated Water Ajlun, Karak, Madfraq, Mafraq, Ajlun, Zarqa	Design of reuse systems of the effluent in agriculture and choice of crops.	Ajlun, Karak, Madfraq, Mafraq	1995	EB	1,000
21	Improvement and Expansion of Water Supply	Ammann Water Project	Replacement and installation of water pumps to external service and reduce water losses.	Ammann	1994-95	W.B.	3,860
22	- ditto -	Salt Water Project	Construction of reservoir, installation of water main, pumping station and new network to expand service and reduce losses.	Balqa	1995-97	LIB-50%	15,000
23	- ditto -	Karaba Water Project	- ditto -	Irbid	1995-99	EB	3,630
24	- ditto -	Ammann Water Project, Wadi Al-Qhar Project, Al-Hattar Project, Subab, Sweiq, Madaba Water Project	Installation of new trapezium pipes in different areas in the country.	Whole Jordan	1991-95	Jordan Government	2,500
25	Improvement of Irrigation Water Supply	North Ghora Diversion Project	Diversion of Water for irrigation purposes in north valley	North Valley	1991-99	OLET	23,780
26	- ditto -	Al-Kara Main Dam	Construction of Al-Kara Main Dam.	South of Jordan	1994-97		80,668
27	Improvement and Expansion of Water Supply	Ona ground Water Study and Trial Damqah	Final engineering design for the transmission pipes and pumping stations and wells.	Mafraq	1995-97		
28	- ditto -	Mammad Sirhan Ground Water Study	Survey of availability of water in quantity, quality, and building wash ponds.	Mafraq, Irbid	1991-95	USC	3,600
29	- ditto -	Strengthening of National Capacity in Water Resources Management	Assess of MW's policy framework concerning water supply and provide up for ability of planning.	Whole Jordan	1993-99	UNDP-100%	
30	- ditto -	Water Master Plan Upgrading	Updating the 1982 water master plan.	Whole Jordan	1993-95	GIZ-100%	
31	- ditto -	Water Quality Improvement and Conservation Project	Industrial waste water discharge prevention in farm irrigation methods, Building GIS and NIS for the water sector and training, Laboratory upgrading artificial recharge and surface water monitoring.	Whole Jordan	1994-98	USAID	12,000 (US\$)
32	- ditto -	Institutional Reconstructing Study	Strengthening of organization and service system.	Whole Jordan	1991-95	CIDA	

Figure 4.1.1 Organization of the Headquarters of Ministry of Water and Irrigation

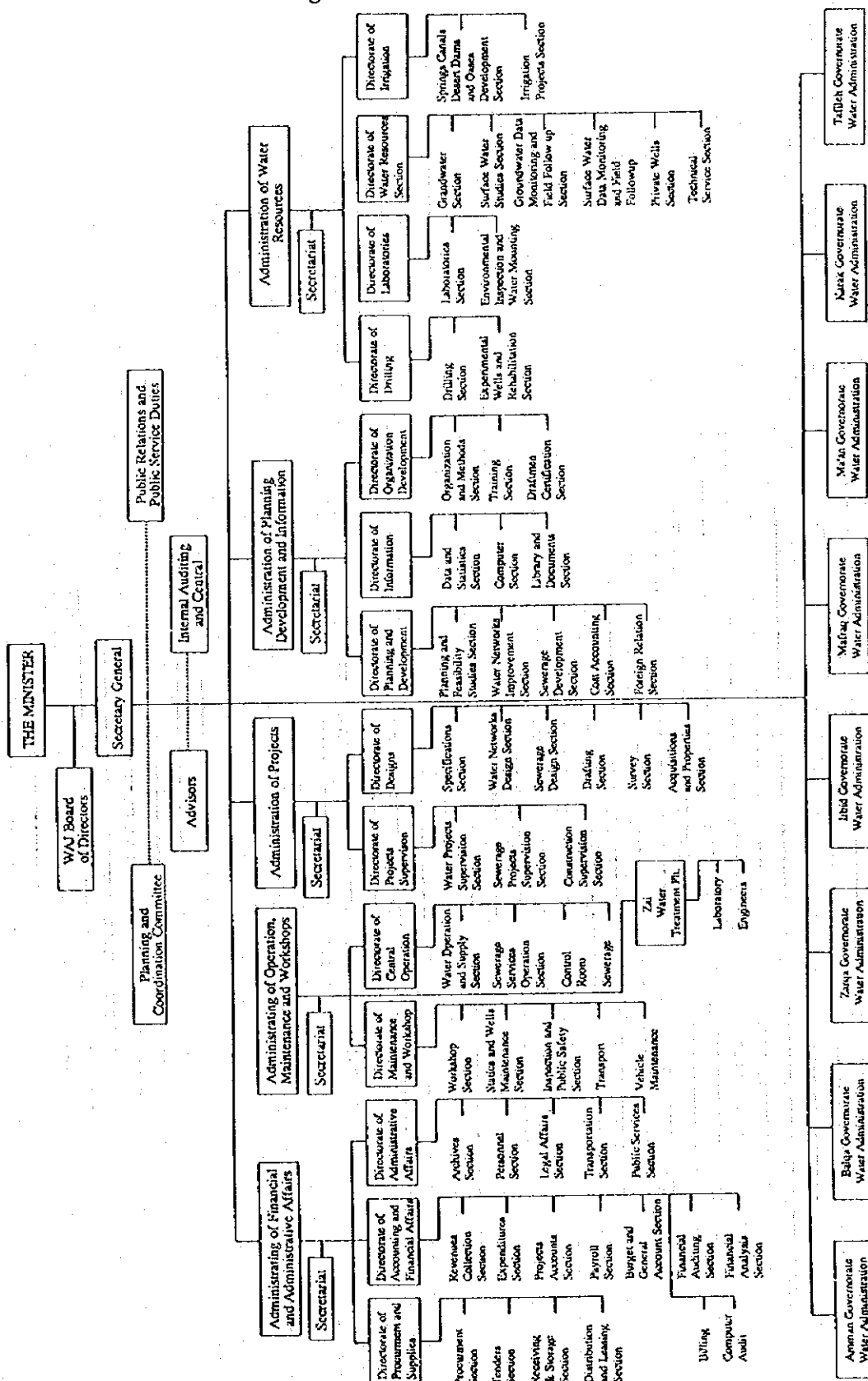


Figure 4.1.2 Organization of Governorate Water Administration of Ministry of Water and Irrigation

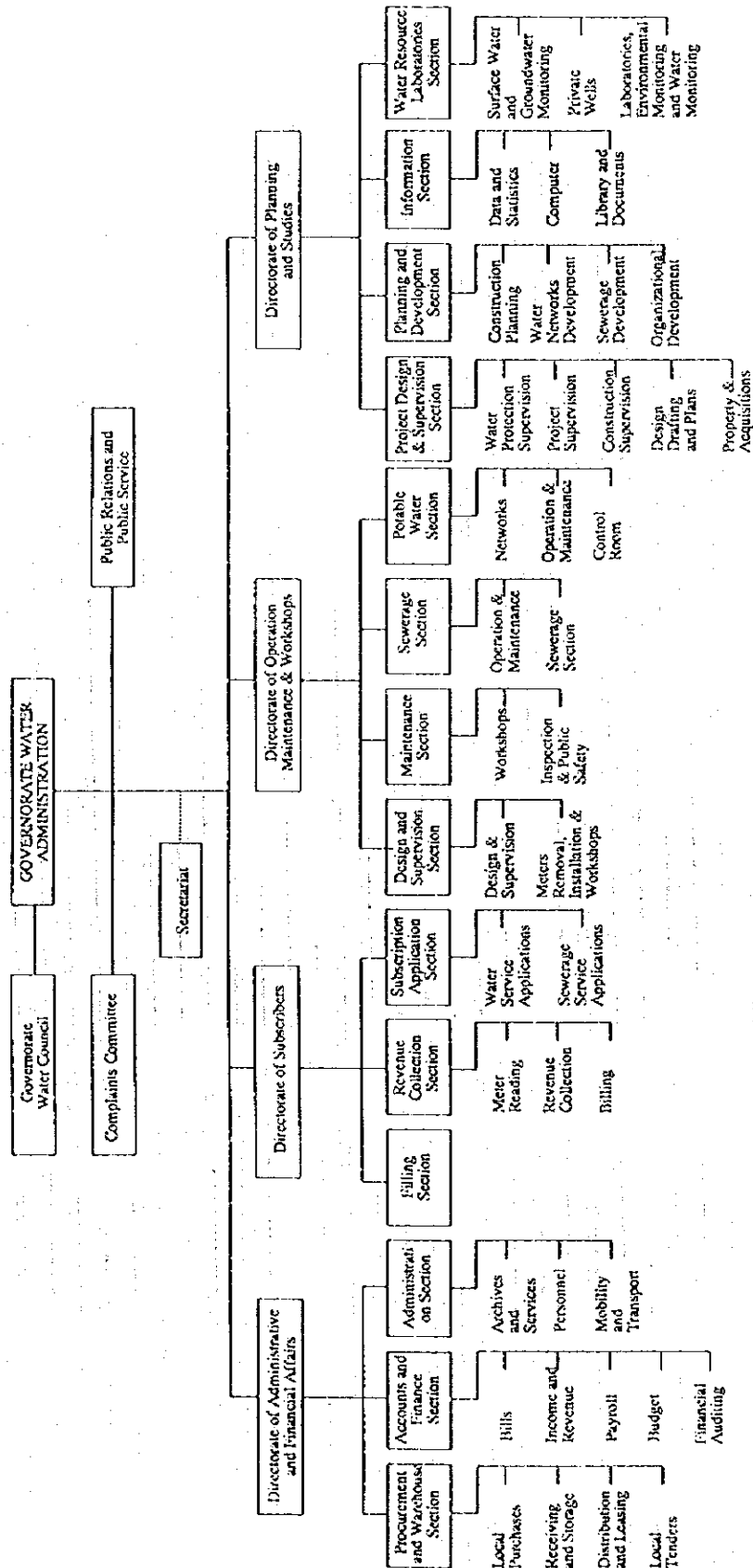
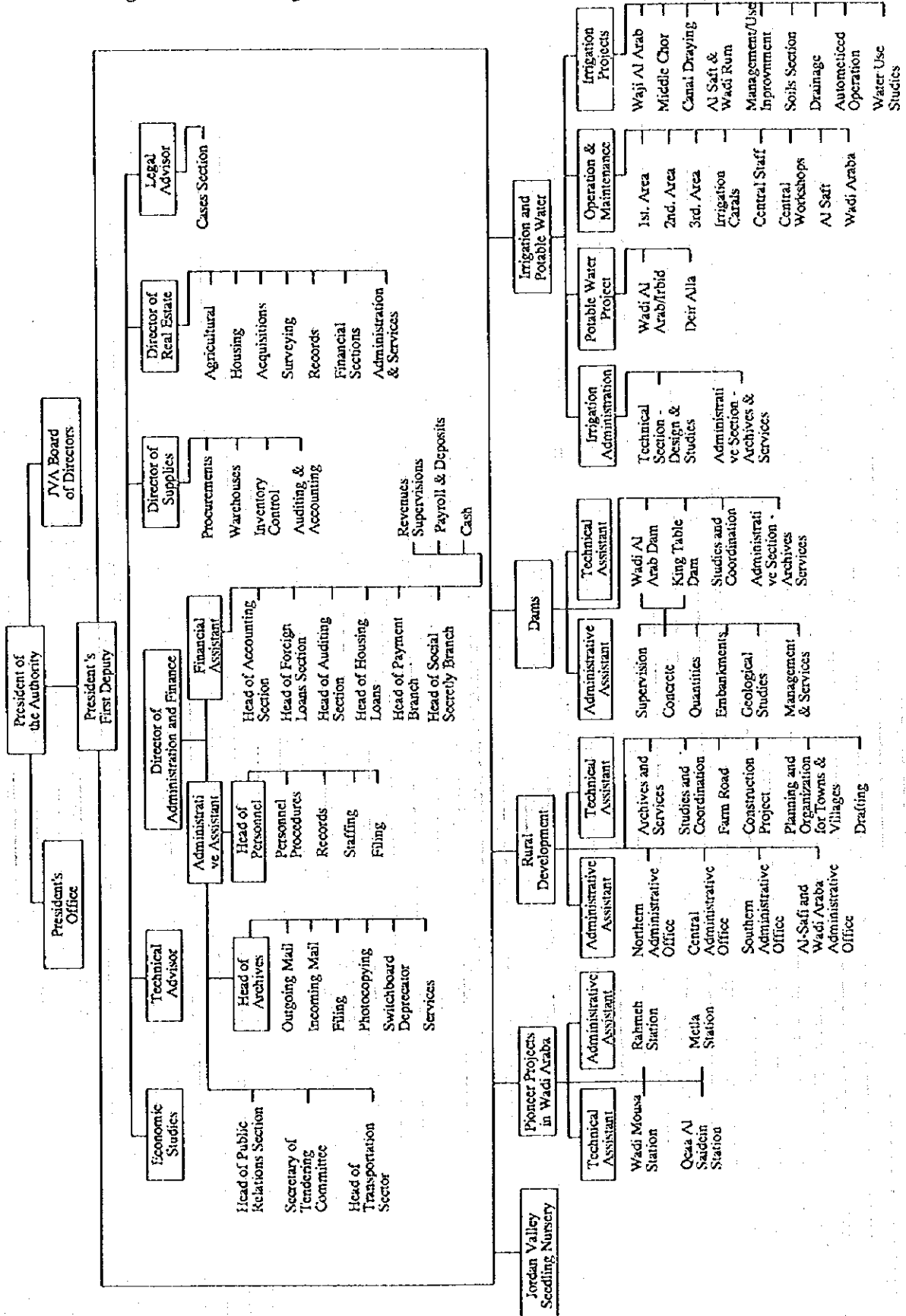


Figure 4.1.3 Organization of Jordan Valley Authority



4.2 Demand Forecast and Development Strategy

4.2.1 Demand Forecast

(1) Water Supply

Water Demand

The national demand for water has been calculated from the average per capita consumption related to the projected population. It has been assumed that the per capita consumption will increase to that currently assumed to be used by tourists (Table 4.2.1) and that the population will continue to grow at an underlying rate of 3.2% (Table 4.2.2). This provides a more reasonable estimate than that currently adopted by the water authority of Jordan (Table 4.2.3) which envisages a 9.4% increase in demand between 1990 and 2000 (Table 4.2.4).

Table 4.2.1 Per Capita Net Water Demand

Unit: liters per capita per day (l/c/d)

Year	Local Population	Tourists	Remark
1995	139	-	
2000	160	400*	*The demand could be 600 l/c/d
2010	200	400)	for tourists in Aqaba due to high temperature

Source: JICA Study Team

Table 4.2.2 Forecast of Population, Foreign Tourists and Stay Overnight

Year	Forecast Population (1)	Foreign Tourists (number) (2)	Stay Overnight (days) (2)
1995	4,500,000	1,155,000	5,198,000
2000	5,280,000	1,546,000	6,957,000
2010	7,230,000	2,400,000	10,800,000

Source: (1) WAJ (2) JICA Study Team

Table 4.2.3 Projected National Water Demand (JICA Study Team)

Unit: MCM

Purposes	Year		
	1992	2000	2010
Irrigation	742 (75%)	764 (67%)	836 (57%)
Water Supply	208 (21%)	308 (27%)	528 (36%)
Industry	40 (4%)	68 (6%)	103 (7%)
Total	990	1,140	1,467

Source: JICA Study Team

Table 4.2.4 Projected National Water Demand (WAJ)

Unit: MCM

Purposes	Year				
	1990	(1992)	2000	(2010)	2015
Irrigation	675 (75%)	742 (75%)	1,088 (67%)	1,088 (57%)	1,088 (53%)
Water Supply	189 (21%)	208 (21%)	442 (27%)	700 (36%)	819 (40%)
Industry	36 (4%)	40 (4%)	101 (6%)	142 (7%)	150 (7%)
Total	900	990	1,631	1,930	2,057

Source: WAJ, 1992, (1992) and (2010) have been interpreted the JICA by Study Team from WAJ figures

The per capita demand varies considerably throughout Jordan; from a minimum of 87 l/c/d in Irbid to 235 l/c/d in Mafraq presumably reflecting the abundance of the water supply. It is therefore reasonable to assume that demand would expand to a level far exceeding the current average consumption of 139 l/c/d if there was sufficient supply (Table 4.2.5).

Table 4.2.5 Per Capita Water Demand According to Region (1992)

Districts	Full Population (pers.)	Per capita Consumed Water Quantity (l/c/d)	Annual Water Consumption (MCM)
Amman (2)	1,672,099 (41%)	161	84.2
Zarqa	634,055 (15%)	98	32.2
Irbid (3)	994,650 (24%)	87	50.5
Mafraq	165,823 (4%)	235	8.4
Balqa	248,082 (6%)	172	12.6
Karak	170,335 (4%)	113	8.6
Tafila	65,410 (2%)	100	3.3
Ma'an	151,776 (4%)	298	7.7
Total	4,102,230 (100%)	139	208.1 MCM (1)

Source: WAJ (1992)

(1) : $4,102,235 \times 0.139 \times 365 \text{ days} = 208 \text{ MCM}$

(2) : Includes Madaba

(3) : Includes Ajlun and Jerash

Water Supply

There is considerable discrepancy between estimates of the volume of water currently supplied and that potentially available. However, a comparison between Table 4.2.3 and 4.2.6 demonstrates that demand is only just being met at the present and that, even if all internal potential sources are exploited, these will only be sufficient to meet demand until 2000. Any increase in demand after that date, whether by the national population or by tourists, will not be met under the present circumstances.

Table 4.2.6 Existing and Potential Water Resources

Resource	Existing (1)	Potential (2)
Renewable Groundwater	360	280
Non Renewable Groundwater	-	118
Surface Water	500	755
Treated Water	40	32
Total	900	1,185

Source: (1) Water Authority of Jordan

(2) National Environmental Strategy for Jordan (1991)

Table 4.2.7 Daily Recharging Groundwater in Jordan

No.	District	Recharging Quantity (MCM)	Area (square km)	Daily Recharging (mm/day)
1	Irbid, Mafraq, etc.	40	1,730	0.063
2	Ajlun, etc.	15	1,560	0.026
3	Adasiya, etc.	21	870	0.066
4	Amman, Zarqa, etc.	87.5	3,850	0.062
5	Madaba, Karak, Potash, etc.	57	12,610	0.012
6	Tafila, Shawbak, etc.	3.5	5,500	0.002
7	Wadi Ram, Aqaba, etc.	5.5	5,860	0.003
8	Ma'an, etc.	27	14,470	0.005
9	Mudawara, etc.	125	4,450	0.077 (*1)
10	Azraq, etc.	24	19,472	0.003
11	Bayir, etc.	5	17,819	0.001
12	As Satawi, etc.	8	21,960	0.001
	Total	418.5 (*2)	90,200	0.013 (average)

Source: JICA Study Team

Note : (*1) This area is fossil groundwater.

(*2) Refer to Figure 4.2.1

Table 4.2.8 Demand for Water from Resident Jordanians and Tourists

Year	Total Annual Water Consumption (MCM)		
	Resident Jordanian	Tourist	Tourist as % of residents
1992	208	N/A	N/A
2000	308	3.03	0.98%
2010	528	4.70	0.89%

Source: JICA Study Team

Implications for Tourism

Using the above analysis the development of tourism is not viable unless significant steps are taken before that date to improve the water supply situation.

However, tourists form only a small proportion of the population. Even considering their greater per capita demand and projected increased numbers they will consume less than 10% of the total water consumption by regional inhabitants except Aqaba-Wadi Ram of southern tourism region (Table 4.2.9). This proportion

varies according to the region being greatest in the southern region where the tourists attractions are concentrated, e.g., Petra and Wadi Ram where the population density is least.

As the special attention to be referred to the above, since the southern tourism region, especially Aqaba, is located at the most southern area in Jordan, water consumption by tourists at hotels could be approximately 600 l/c/d due to increased frequencies for taking a bath. In care of the comparison of water consumption ratio between tourists and local inhabitants for the year 2000 and 2010 are 11.6% and 10.3% respectively. So that, to avoid such problem due to water shortage, recycled water from sewerage through the high-tech device should be reused for irrigation, industry and toilet flushing thus, more water supply will be available.

Water Quality

Very little data is available as to the quality of either surface or groundwater. What information there is suggest that water treatment plants, and by implication areas where there is no formal sewerage system, are significant polluters.

Tourists will expect the highest water quality standards, equivalent to those existing in their own country.

(2) Sewerage

Demand

Only slightly more than 50% of the population is currently served by a sewerage system (Table 4.2.10). These are in the main towns; in the rural areas sewage is disposed of via cesspools and informal systems.

Table 4.2.10 Percentage of Population Served by a Sewerage System

	District	1995
Calculated	Amman	72%
	Zarqa	52%
	Irbid	13%
	Mafraq	11%
	Bakqa	42%
	Karak	9%
	Tafilah	14%
	Ma'an	29%
	Average	56%
Estimated (1)	Jerash	43%
	Madaba	41%
	Wadi Musa, Wadi Ram	9%
	Aqaba	52%

Source: JICA Study Team

(1) Estimated from comparison with other Jordanian towns of similar size

Treatment Capacity

The existing treatment capacity is insufficient to meet demand. The projected shortfall in capacity versus generation are significant. As would be expected the shortfalls are greatest in the main centers of population especially Amman, which suffered the brunt of the unplanned development to accommodate the rapid influx of refugees (Table 4.2.11). It will require considerable capital investment even to keep pace with the growth in the indigenous population.

At this study, the Study Team expects and assumed that treatment ability for the years 2000 and 2010 are 60% and 70% respectively, applying the advanced high-tech treatment method. Also, most of the treated water should be reused for irrigation, industry and toilet flushing water, etc.

Table 4.2.11 Projected Waste Water Treatment

(Unit : 10^6 m³/year)

Tourism Region	1992			2000			2010		
	A. Generated	B. Treated	Shortfall	A. Generated	B. Treated	Shortfall	A. Generated	B. Treated	Shortfall
Northern	50.5	3.5	47.0	74.8	41.8	30.0	128.0	89.6	38.4
Eastern and Central	40.6 79.5	40.6	90.5	177.8	111.9	65.9	304.5	222.6	81.9
Western	18.0	3.0	15.0	26.6	11.2	15.4	45.6	22.3	23.3
Southern	19.7	1.5	18.2	29.1	17.2	11.9	49.9	34.9	15.0
Total	A. 208.3	B. 48.6	159.7	A. 308.3	B. 185.1	123.2	A. 528.0	B. 369.4	158.6
	B/A = 23%			B/A = 60%			B/A = 70%		

Source: JICA Study Team

Implications for Tourism

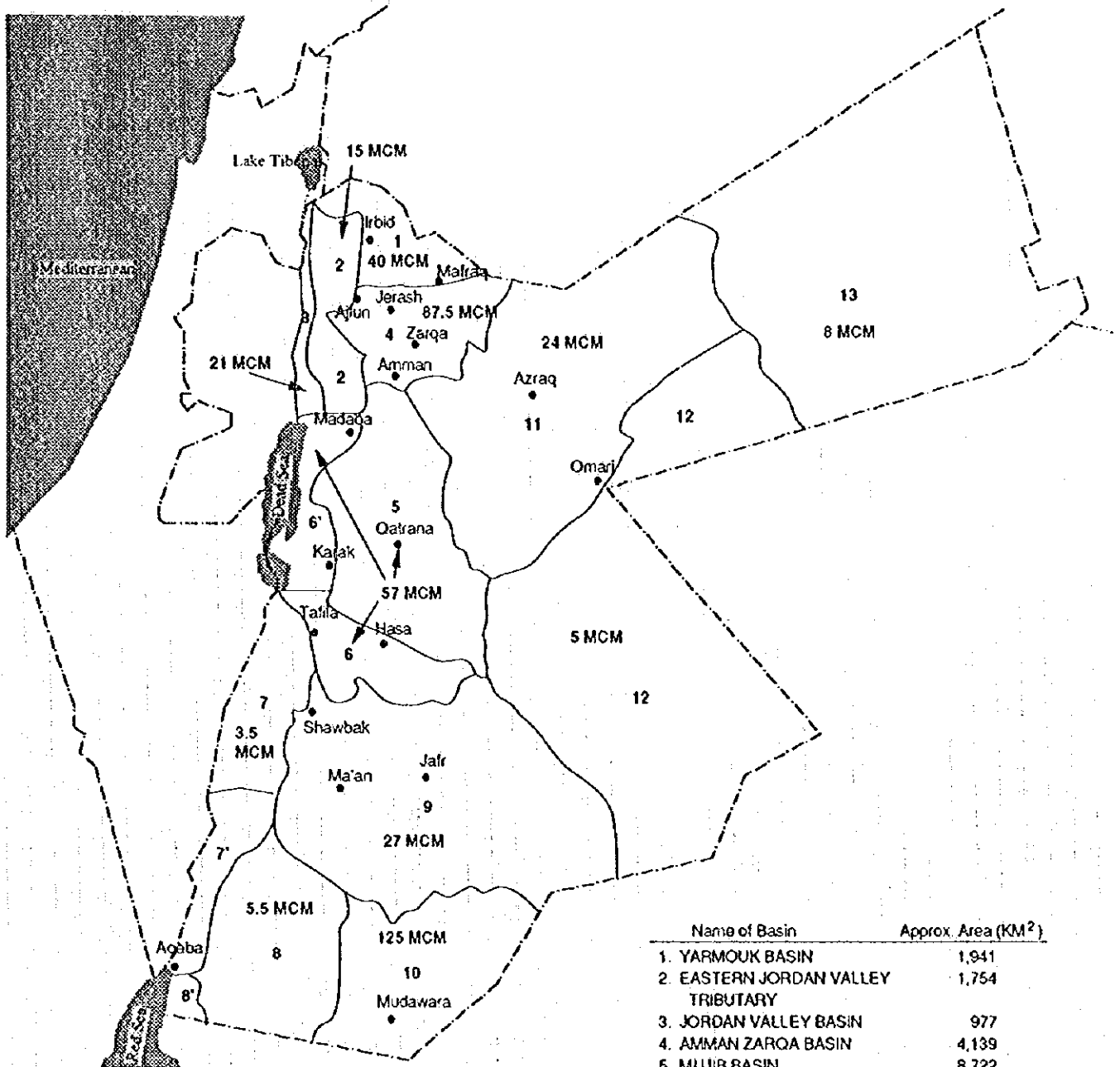
Since the generation of waste water is related to the supply of water, the significance of the waste water generated by tourists will be similar to their water demand. Thus the proportion attributable to tourism is an insignificant proportion compared to that of the national population.

Table 4.2.9 Projected Water Consumption between Tourists and Jordanian Inhabitants per Region

Tourism Region	Project Area	(A) No. of Tourist Nights per year (10 ⁷)		(B) No. of Tourists per year (10 ³)		(C) No. of Stay Overnight (A)/(B)		(D) Per Capita Net Water Demands (lit/d)		(E) Water Consumption of Tourists per year (B) x (C) x (D) (MCM)		(F) Water Consumption of Regional Inhabitants (MCM)		(E)/(F) (%)	
		2000	2010	2000	2010	2000	2010	2000	2010	2000	2010	2000	2010	2000	2010
Northern Region	Irbid	70	86	70	86	1	1	400	400	0.028	0.034	58.30	99.82	0.048	0.034
	Ajlun-Jerash	139	130	139	130	1	1	400	400	0.056	0.052	16.45	28.18	0.338	0.185
	Zarga-Mafraq	70	54	70	54	1	1	400	400	0.028	0.022	60.10	102.94	0.047	0.021
Eastern Region	Amman	3,737	5,562	1,252	1,854	3	3	400	400	1.502	2.225	117.67	201.55	1.277	1.104
	Balqa	35	108	35	108	1	1	400	400	0.014	0.043	18.04	31.93	0.075	0.135
Western Region	Madaba-Dead Sea	348	972	232	486	1.5	2	400	400	0.139	0.389	7.96	13.64	1.749	2.850
	Karak	104	184	104	92	1	2	400	400	0.042	0.074	12.80	21.92	0.325	0.336
	Tafila	35	32	35	32	1	1	400	400	0.014	0.013	4.91	8.92	0.285	0.143
Southern Region	Petra-Shawbak	1,148	1,782	574	891	2	2	400	400	0.459	0.713	4.95	8.48	9.277	3.406
	Aqaba-Wadi Ram	1,252	1,890	626	945	2	2	600	600	0.751	1.134	6.45	11.06	11.647	10.255
	Total	6,938	10,800							3.033	4.698	308.25	528.48	0.984	0.889
Project Area		Population (pers.)		Water Consumption (MCM)		Water Consumption (MCM)		Water Consumption (MCM)		Water Consumption (MCM)		Water Consumption (MCM)		Water Consumption (MCM)	
		1992	2000	2010	1992	2000	2010	2000	2000	2000	2010	2000	2010	2000	2010
IRBID		775,650	997,938	1,367,415	775,650	997,938	1,367,415	997,938	997,938	58.28	1,367,415	1,367,415	1,367,415	1,367,415	99.82
AJLUN-JERASH		219,000	281,762	386,081	219,000	281,762	386,081	281,762	281,762	16.45	386,081	386,081	386,081	386,081	28.18
MAFRAQ		165,823	213,345	292,334	165,823	213,345	292,334	213,345	213,345	12.46	292,334	292,334	292,334	292,334	21.34
ZARQA		634,055	815,764	1,117,793	634,055	815,764	1,117,793	815,764	815,764	47.64	1,117,793	1,117,793	1,117,793	1,117,793	81.60
AMMAN		1,566,099	2,014,915	2,760,920	1,566,099	2,014,915	2,760,920	2,014,915	2,014,915	117.67	2,760,920	2,760,920	2,760,920	2,760,920	201.55
BALQA		248,082	319,178	437,351	248,082	319,178	437,351	319,178	319,178	18.64	437,351	437,351	437,351	437,351	31.93
MADABA		106,000	136,378	186,870	106,000	136,378	186,870	136,378	136,378	7.96	186,870	186,870	186,870	186,870	13.64
KARAK		170,335	219,150	300,288	170,335	219,150	300,288	219,150	219,150	12.80	300,288	300,288	300,288	300,288	21.92
TAFILA		65,410	84,155	115,313	65,410	84,155	115,313	84,155	84,155	4.91	115,313	115,313	115,313	115,313	8.42
PETRA (1)		65,876	84,755	116,135	65,876	84,755	116,135	84,755	84,755	4.95	116,135	116,135	116,135	116,135	8.48
WADI RAM		5,900	7,591	10,401	5,900	7,591	10,401	7,591	7,591	0.44	10,401	10,401	10,401	10,401	0.76
AQABA		80,000	102,927	141,034	80,000	102,927	141,034	102,927	102,927	6.01	141,034	141,034	141,034	141,034	10.30
Total		4,102,230	5,277,858	7,231,935	4,102,230	5,277,858	7,231,935	308.13	308.13	308.25	528.48	528.48	528.48	528.48	527.93
								#208	#208	#208	#208	#208	#208	#208	#208

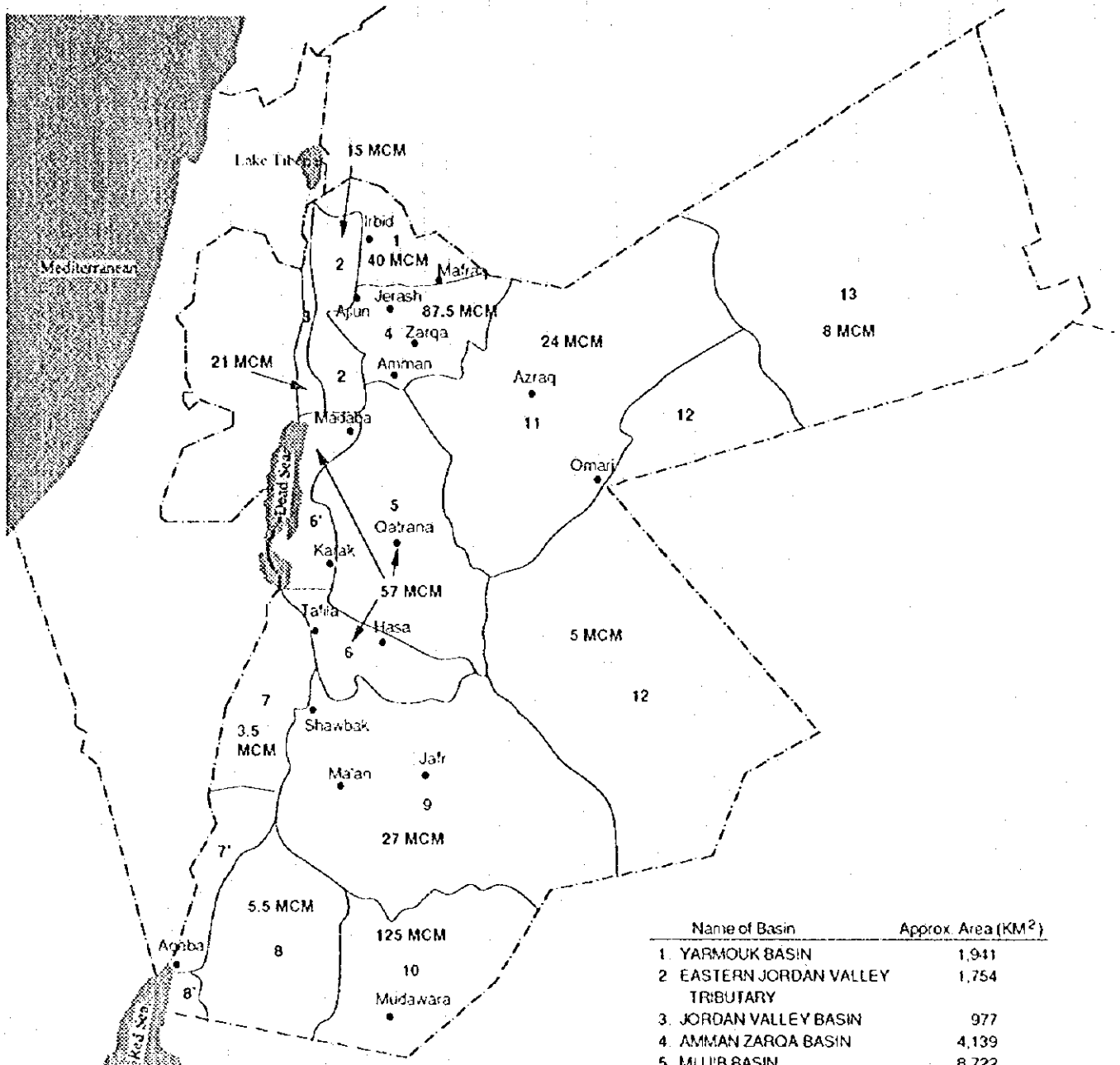
Note: (1) Includes Wadi Musa and Aqaba

Figure 4.2.1 Available Ground Water Basins in Jordan



Name of Basin	Approx. Area (KM ²)
1. YARMOUK BASIN	1,941
2. EASTERN JORDAN VALLEY TRIBUTARY	1,754
3. JORDAN VALLEY BASIN	977
4. AMMAN ZARQA BASIN	4,139
5. MUJIB BASIN	8,722
6. HASA BASIN	3,530
7. WADI ARABA NORTH BASIN	4,185
8. WADI ARABA SOUTH & WADI YUTUM BASINS	6,193
9. JAFR BASIN	16,244
10. SOUTHER DESERT BASIN	4,990
11. AZRAQ BASIN	19,472
12. SARHAN BASIN	17,819
13. HAMMAD BASIN	24,666

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4.2.2 Development Strategy

(1) Water Supply

a. National Supply

The shortage of a national water supply is the most serious problem together with that of water quality. National measures are required to:

- increase the supply of raw water;
- stress the need for conservation of water use;
- ensure adequate and appropriate water quality; and
- ensure a wider and more appropriate distribution.

A scenario has been developed that will meet the projected water demand until 2010 from internal resources (Figure 4.2.2 to 4.2.4). No account has been taken of external resources, which may become further available as a result of the peace process. The achievement of internal self sufficiency requires the adoption of the following approach:

- the use of only renewable groundwater sources. Non renewable groundwater resources are by definition not sustainable and in addition are likely to be brackish and require treatment before supply;
- surface water is not used to its fullest extent so that a sufficient quantity is available for the natural recharge of groundwater;
- the treatment of brackish water remains at current rates of approximately 50 MCM; and
- the proportion of water treated to a high standard i.e. tertiary treatment is increased to 60% in 2000 and 70% for 2010. At present there are no tertiary treatment plants in Jordan.

It is considered these are unrealistic assumptions because of the necessary restructuring of the distribution of water which will inevitably meet with opposition from powerful lobbyists and because of the significant capital costs.

An alternative strategy is therefore to supply water to the tourism sector while limiting its availability to the resident population. This may not be as unacceptable as might first appear. The existing demand per capita from the public clearly varies enormously and overall demand may be kept at present levels through a suite of measures including the following:

- increasing the overall cost of water particularly to commerce, industry and

agriculture;

- discounting the price of lower quality, recycled water; and
- increased metering especially for commercial, industrial and agricultural users.

Significant savings in water usage may be made as follows:

- hotels:
 - separation and low-level treatment of wash water (sludge) for non potable uses e.g. of toilet flushing;
 - the use of treated sewage for irrigation of landscaped areas; and
 - water metering of high consumption activities e.g. food preparation.
- domestic:
 - dual flush toilets with a reduced flush for liquids only; and
 - the watering of gardens by hand and not with the use of a sprinkler.
- industry:
 - re use of slightly contaminated water for less sensitive uses; and
 - condensation of cooling water.

b. Services for the Tourism Sector

The nature of the supply to tourist facilities will depend on their location.

Urban Location: Tourist facilities in urban areas may be supplied by the existing service provided that there is sufficient capacity. This may require internal reallocation of supplies in order to accommodate the projected demand. The availability of supplies should be incorporated in urban development plans and facilities not be permitted to develop outside of the areas where sufficient capacity is available.

Rural Location: Tourism facilities developed in rural areas will not normally be able to depend on the existing service and will have to develop their own dedicated supplies either jointly funded with other planned tourism facilities or with the Jordan Water Authority. Demand and supply forecasts would be an essential element of the Environmental Impact Assessment required before the facility is permitted to be constructed.

(2) Sewerage

a. National Demand

As with the supply of water it is not possible to remedy the country's under-provision of treatment plants just to service the tourism sector.

However, the total load may be reduced through the raising of charges to commercial and industrial properties based on quantity as well as the quality of the water sent for treatment. This would have the benefit of increasing income to the service provider but would essentially encourage improved housekeeping by commerce and industry in order to reduce discharges and therefore the cost to individual premises.

Good housekeeping could include the following:

- improved operation to reduce the use of water;
- reclamation of contaminants for reuse and the reuse of the "treated" water;
- minor pretreatment of discharges; and
- complete treatment before discharge.

The potential for such savings in Jordan have already been identified (Cowi Consult and Royal Scientific Society, 1994). However, experience elsewhere suggests that companies are unwilling to implement such schemes when direct disposal is cheaper because of the low treatment charges. The raising of charges often provides the impetus for implementation.

b. Services for the Tourism Sector

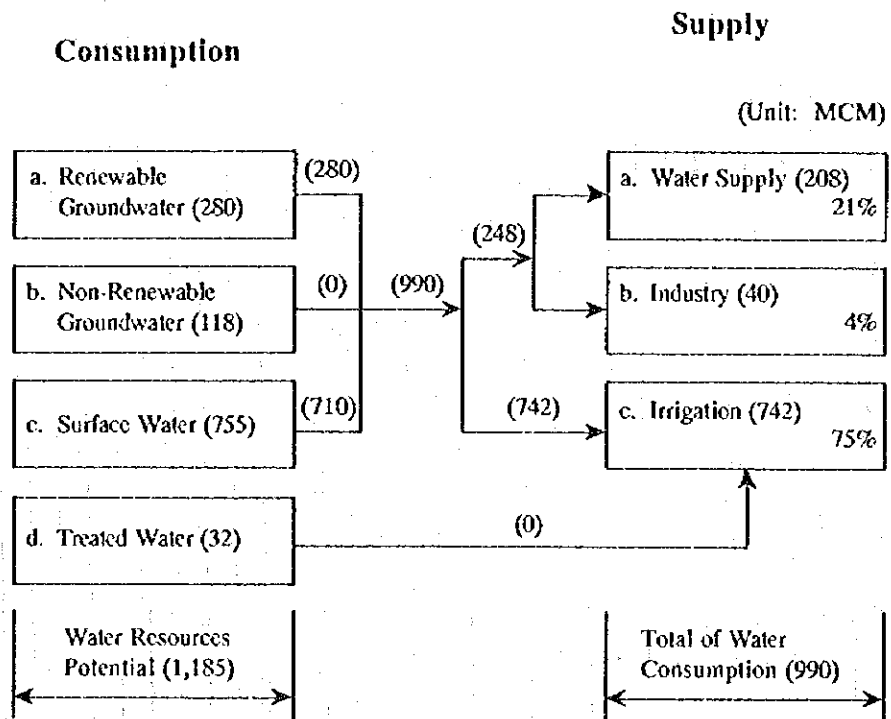
The service available for each new tourism facility will again be related to its location.

Urban Location: Large facilities should be able to connect directly to the sewage system and will only have a minor impact on the volume of sewage to be treated. Increased charges will contribute to the increased volumes requiring treatment.

Rural Location: Again, rural tourism is likely to place a significant load on sewerage systems where these exist. New tourism facilities should therefore be required to install and operate their own treatment facilities as part of the development cost and to include their demand and treatment forecasts within the EIA prepared for each new development. However, treatment plants should be operated to a high standard if foul odors are to be avoided. Large international hotels and developers are

familiar with the design and operation of such plants.

Figure 4.2.2 Water Supply Strategy - 1992 Situation

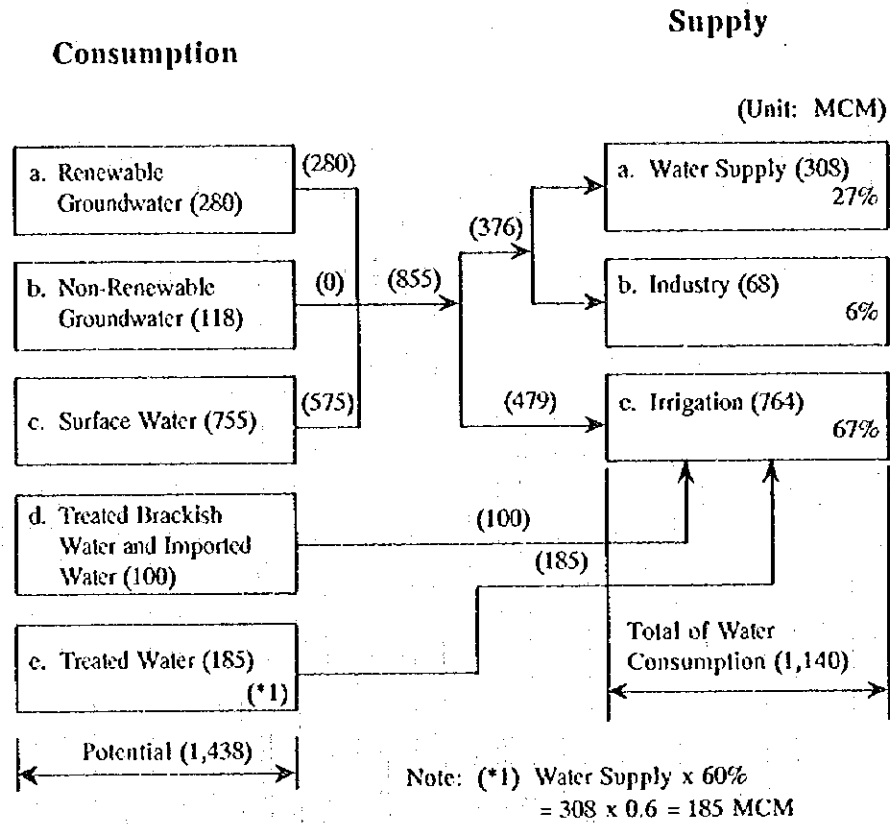


Source: JICA Study Team

Note: (*1) Refer to Tables 4.1.4 and 4.2.6

(*2) Refer to Table 4.2.3 on the year 1992

Figure 4.2.3 Water Supply Strategy - Projected Situation 2000



Source: JICA Study Team

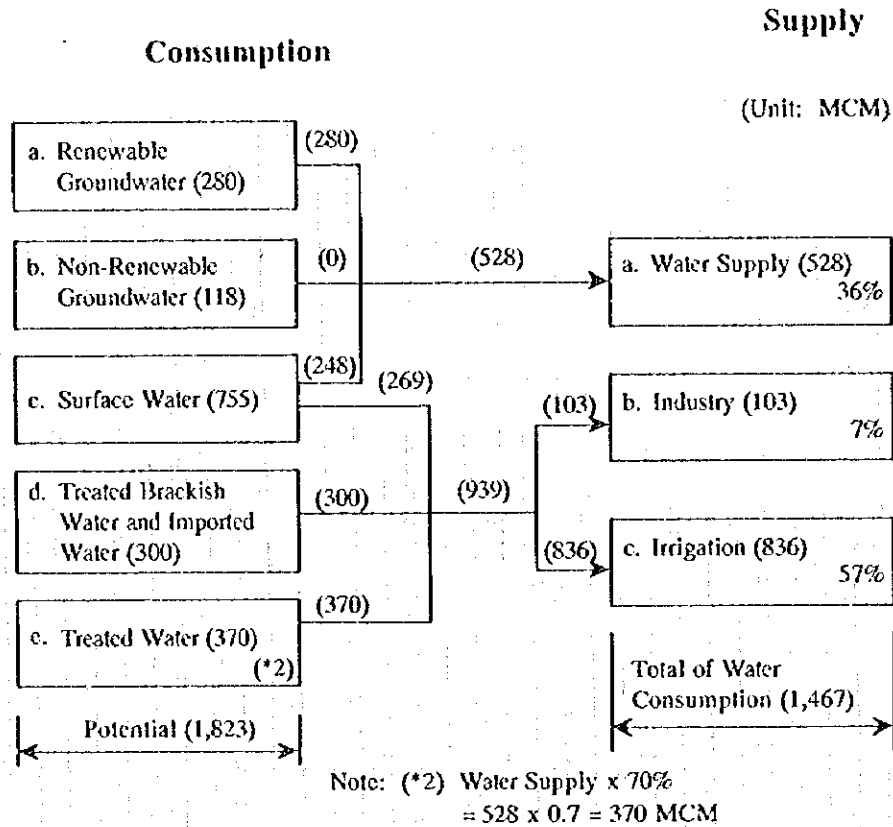
As for the above figure, the water supply volume (W.S.V.) for 2000 is estimated as follows.

$$W.S.V. (2000) = 208 \text{ MCM} \times \frac{160}{139} \times (1,032)^8 \approx 308 \text{ MCM}$$

- where,
- 208 MCM : total water supply consumption for 1992
 - 139 l/c/d : average percapita net water demands for 1992
 - 160 l/c/d : average percapita net water demand for 2000
 - 3.2 % : assumed average annual population increased ratio from 1992 to 2000

By the way, projected water volume for the industry and irrigation in 2000 is estimated using the ratio of consumption referring to the data from the Water Authority of Jordan.

Figure 4.2.4 Water Supply Strategy - Projected Situation 2010



Source: JICA Study Team

As for the above figure, the water supply volume for the year 2010 is estimated as follows.

$$W.S.V. (2010) = 308 \text{ MCM} \times \frac{200}{160} \times (1,032)^{10} \approx 528 \text{ MCM}$$

- where,
- 308 MCM : projected total water supply consumption for 2000
 - 160 l/c/d : average percapita net water demands for 2000
 - 200 l/c/d : average percapita net water demand for 000
 - 3.2 % : assumed average annual population increased ratio from 2000 to 2010

PART I (VOLUME 2)
NATIONAL TOURISM DEVELOPMENT STRATEGY AND POLICY
(SECTORAL DEVELOPMENT)

Chapter 5.

Hygiene and Waste Management

69

THE UNIVERSITY OF CHICAGO

PHYSICS DEPARTMENT

PHYSICS 354

Chapter 5. Hygiene and Waste Management

5.1 Existing Situation and Issues

5.1.1 Food Hygiene

The health of the visitor is critical to his enjoyment of the country and of this, food hygiene is an important contributor.

(1) Regulation

Food production, processing and serving is controlled through licensing, and the monitoring of compliance with the conditions of the licence and with established Jordanian standards. This is almost exclusively undertaken by the Ministry of Health (MOH) although the Ministry of Agriculture (MOA) and the Ministry of Tourism (MOTA) are also involved in crop quality and the licensing of tourist facilities respectively (Table 5.1.1).

The MOH operates two analytical laboratories and can call on the expertise of the MOA or the Royal Scientific Society for more specialist analysis. It works to Jordanian standards which have been compiled from existing standards world-wide and are compatible with those of FAO and WHO. Regular inspections are carried out on all premises to ensure compliance with license conditions and existing standards.

The MOH prefers to advise and persuade, although it has power to refuse to licence, prohibit continued operation and to prosecute with the courts empowered to fine and/or imprison.

At present the co-operation it receives from other ministries is mixed; that from the MMRAE being particularly poor in responding, let alone in taking appropriate action.

(2) Training

Both the Hotel Training College, the management of which has recently been transferred to MOTA and the Vocational Training Corp. include general hygiene and food hygiene in their courses. The MOH also operates 2 training colleges offering 2 year, full time Diploma on a range of health related topics. The courses are regularly upgraded to meet the changing needs in Jordan.

Table 5.1.1 Institutional Distribution of Main Food Hygiene Functions

Food Aspect	Ministry Issuing Licence	Ministry Monitoring Conditions / Standards.
Crop quality	-	MOA
Ablation	MOA	MOH
Safety	MOH	MOH
Import/Export	MOH	MOH
Storage	MOH	MOH
Manufacturing	MOTA	MOH
Preparation e.g.	MOH	MOH
Bottled water	MOH	MOH
Mains water	-	MOW/MOH

Source: JICA Study Team

5.1.2 Waste Management

(1) Background

Waste is a factor in tourism development as it is generated by the tourism industry by its own consumption but or, more important, its visual impact largely affects the level of enjoyment of the sites being visited.

However, waste management is also part of a country's infrastructure services. An assessment of the impact of waste generated by tourism cannot be divorced from an assessment of the efficiency and methods by which waste from residents is managed. Thus tourists effectively increase the resident population. The addition of further waste on an already inadequate system will only serve to overburden it still further.

Previous studies on waste management are almost non-existent and there is a significant absence of data and an understanding of waste management issues. Data for this report have therefore been gathered from published and unpublished reports, municipal budgets and personal interviews. However, it has not been possible to validate the data so acquired and its accuracy is suspect.

(2) Legal Setting

The Hashemite Kingdom of Jordan is committed to a significant improvement in waste management practices (five year plan 1993-1997, Ministry of Planning). However, the reality within Jordan is somewhat different. After 14 years the Jordan Environment Act (JEA) has just been passed by both houses of the Jordanian

Parliament and is awaiting the Assent of His Majesty the King. Enforcement continues to be through the Ministry of Health and the application of laws relating to health.

Al-Omary (Status of environmental Law in Jordan in International Environmental Law, Environmental Research and Studies 5, Olman My (ED), 1994) has therefore concluded that "it is still safe to say that there is no environmental law in Jordan."

The sector of waste management is perhaps more under-regulated than other environmental sectors. Waste management is mentioned in only two laws and there are no guidelines or advice on recommended practices.

The Pride Project (USAID, 1992) has therefore concluded that "no regulatory activities are occurring at the national level."

Even when it is enacted it will have very little effect on waste management. Because, whilst (October 1992) conferring a number of necessary activities (setting of standards, monitoring regulation, enforcement prosecution) these do not specifically apply to waste management. The location for the responsibility for waste management is therefore unclear. However, the Royal Scientific Society in its Recommendations for the Implementation of the Jordan Environment Act sees waste management firmly within the remit of JEA and receiving over 10% of all resources required to implement the Act.

(3) Institutions Involved in Waste Management

Numerous institutions are involved in the control of waste management (Table 5.1.2). There is little co-ordination between the individual organizations and most have had their responsibilities thrust on them without the resources to implement the necessary activities. The manner in which these institutions affect tourists and other generators of waste is identified in Tables 5.1.3 and 5.1.4 respectively.

Department of Municipal and Rural Affairs and Environment

The Department of the Environment within MMRAE amongst its many responsibilities, oversees waste management as follows:

- a centralized function consisting of data gathering, policy, technical expertise
- direct advice to municipalities and through the permissioning process via a system of inspectors based at the governorate level. The inspectors are responsible for all environmental matters not just waste disposal. They report not to the DOE but to a separate body (the Directorate of Municipal and Rural Affairs and Environment) within the MMRAE.

The considerable criticisms of the DOE's effectiveness, of having no legal power, no clear assignments, responsibilities that overlap with other ministries are equally applicable to the unit responsible for waste management. The unit is under researched, under staffed, and has little expertise in the subject.

Table 5.1.2. Institutional Distribution of Main Environmental Functions

Function	National	Governorate	Municipality
Policy	- National Government by enactment of the Environment Act (JEA) - MMRAE DOE have prepared some draft guidelines		GAM
Regulation	- MMRAE (DOE) have will not make any regulations until JEA is enacted. Department of Traffic for litter from Vehicles		
Permitting of Waste Management Activities		ARA as part of Environmental Impact Assessment procedure	
Permitting of Waste Disposal Sites	- MMRAE after consultation with, MOH, MOP, MOW	MMRAE, Directorate	
Inspection		MMRAE, Directorate	GAM
Sampling and Analysis	ad hoc reports by the RSS Environmental Resources Center		GAM
Enforcement	- Any MMRAE enforcement has to be through MOH and MOH legislation - The Traffic Department for litter from vehicles as from 1994	MMRAE, Directorate. Advice only as MMRAE has no enforcement powers. Monthly report to MMRAE Directorate	
Maintenance of Statistics	- MMRAE annual report by DOE - ad hoc information from MMRAE (Directorate)	GAM	

Source: JICA Study Team

Abbreviations:

ARA	Aqaba Regional Authority
GAM	Greater Amman Municipality
MOH	Ministry of Health
MOP	Ministry of Planning
MOW	Ministry of Water
MMRAE	Ministry of Municipal and Rural Affairs and Environment
RSS	Royal Scientific Society

Table 5.1.3 Sectional Distribution of Waste Management Responsibilities for Municipal Waste

Sector	Line Ministry Responsible	Operating Government Organization	Private Organization NGO
Antiquities			
Principal Sites	MOTA, Dept of Tourism	Collection, transportation and disposal by local municipality	
Manned, less important sites	MOTA Dept of Antiquities	Guardians responsible but often take no action because facilities are not provided	
Unmanned sites	MOTA, Dept of Antiquities	Inadequate peripatetic work force visit site infrequently. Collected waste is often disposed of in the nearest wadi	
Privately owned sites	MOTA, Dept of Antiquities	No action	Depends on owners. Religious owners maintain high standards whilst individuals generally take no action
Current Excavations	MOTA, Dept of Antiquities	Transportation and disposal by local municipality	Collection by excavating organization
Cultural			
Mosques, shrines, churches, tombs	MOTA Dept of Antiquities for shrines over 30 yrs	When waste collected transported and disposed of by local municipality	Effective collection by relevant religious organization.
Health Facilities			
Hammamat Ma'in			Effective collection and disposal (incineration) by the owners
Seaside			
Aqaba	Aqaba Municipality	Collection, transportation and disposal	
National Parks			
	Ministries of Agriculture, Social Security Dept	Occasional and inadequate collection transportation and disposal	
Recreational Areas			
	Relevant Municipality or local council	Rarely if ever collected	

Source: JICA Study Team

Table 5.1.4 Sectional Distribution of Responsibilities for Management of Non Municipal Wastes

Sector/ Location	Line Ministry Responsible	Operating Government Organization	Other Organizations
Commercial - shops - offices	MMRAE, GAM, MA	MMRAE, GAM, MA collected as municipal waste	
Institutions - government - schools - universities - police	MMRAE, GAM, MA	MMRAE, GAM, MA collect waste from urban institutions	Waste from rural institutions dump on their own or adjacent land
Industry non hazardous -tyres	MMRAE, GAM, MA	MMRAE, GAM, MA Smaller industries collected as municipal waste	Larger industries make their own arrangements often burning on site or storing for later disposal (1)
Industry hazardous	MMRAE, GAM, MA	MMRAE, GAM, MA Smaller industries probably collected as municipal waste	Larger industries use their own dumps. 3 of the 13 known sites require immediate action and at least 50% of Jordan's annual production is stored awaiting eventual disposal (1)
Hospitals - hospitals - clinics - vets	M of Health	MMRAE, GAM, MA Clinics and smaller industries collected as municipal waste. Larger hospitals dispose of non clinical waste and incinerator waste including 'sharps' as municipal waste	Large hospitals may incinerate but with old and inefficient equipment.
Sewage -treatment sludge, cess pits emptying night soil	MOW	MMRAE, GAM, MA Some disposed of to waste dumps	Probably unofficial dumping by private operators

Sources: JICA Study Team

(1) Cowi Consult and Royal Scientific Society 1994. Industrial Pollution control Project in Jordan.

Other Ministries

Although responsible for different aspects of waste management the various ministries generally give it a low priority, unless political pressure is brought to bear. e.g. a ministerial visit to a particular site.

The municipalities are responsible for street sweeping and the collection and disposal of municipal waste. Their effectiveness is dependent on the availability of resources which are greater in Amman and significantly less in the other municipalities.

Greater Amman Municipality (GAM)

The operation of waste management in Amman, being the capital and being by far the largest single center of population, differs in many significant respects from operations in other municipalities.

- it is the only municipality whose waste management system has been specifically studied by consultants;
- it has appreciable resources in terms of equipment and manpower; and
- it employs the largest number of streets sweepers who maintain a high standard of street cleanliness.

Aqaba Regional Authority (ARA)

Although the ARA has the authority to undertake waste management, this function is carried out by the municipality of Aqaba.

(4) Non-Municipal Waste

There appears to be little concern and no control over the destination of non-municipal waste. Small volumes of commercial and industrial waste no doubt enter the municipal waste collections or are dumped local to the place of generation e.g. the railway operated by Jordan Potash Company.

As far as can be ascertained the only study of hazardous waste arising and disposal was undertaken for the Department of Planning (Cowi Consult and Royal Scientific society, 1994, Industrial Pollution Control Project in Jordan).

(5) Municipal Waste Characteristics

The only national statistics on waste characteristics are waste by the DOE. They are incomplete and their accuracy somewhat suspect. Strategies cannot be developed without reliable statistics. Accurate records are urgently required.

The composition of the waste generated in Amman is similar to that of other Arab states (Table 5.1.5) having a high organic content i.e. vegetable and animal waste and a low packaging content i.e. paper and plastic. As would be suspected with increasing affluence the organic content is progressively decreasing and the packaging content i.e. paper and plastics is increasing. Data from elsewhere in Jordan are not available but are suspected to be closer to that for Amman in 1976, especially in the rural areas.

Table 5.1.5 Comparison of Waste Composition (% by weight)

Materials	UK (1) 1984	Middle East City	Amman (2) 1976	Amman (2) 1979	Amman (3) 1992
Organic	28	50	45	66.4	52.09
Paper	37	16	15	14.7	23.25
Metals	9	5	5	2.1	1.98
Glass	9	2	5	1.8	1.59
	3	3	8	6	2.86
Plastic	2	1	4	4.4	10.83
Other	12	23	23	1	7.38
Total	100%	100%	100%	100%	100%
Weight/kg/p/day	0.84	1.06	-	-	0.76
Density kg/m ³	150 (4)	-	-	43- 187	-
Moisture	25 (5)	-	-	-	56.85

- Sources: (1) Holmes, 1984. *Solid Waste Management: Decisions in Developing Countries in Holmes Managing Solid Waste in Developing Countries.*
 (2) Watson Hauksley - ERL, 1980. *Solid Waste Management and Disposal System for the Greater Amman Region.*
 (3) Bani Hani, 1992. *Solid Waste Management in Jordan.*
 (4) Constream S.J. 1984. *Solid Waste Collection Practice and Planning in Developing Countries.*
 (5) This Study.

The rate of waste generation (Table 5.1.6) varies throughout Jordan but is approximately 0.8 kg/person/day. This is less than other Arab states for which figures are available (Table 5.1.5).

(6) Solid Waste Collection

The methods of collection and disposal of municipal solid waste are described in Table 5.1.7.

(7) Solid Waste Disposal

Waste is disposed at 21 dumps distributed throughout the country reflecting the population distribution (Table 5.1.6, Figure 5.1.1). The majority of waste is deposited within the northern and central study regions. The Russayfa site is by far the largest in the Kingdom. Amman also contains the only liquid waste disposal site.

The capacity of the existing sites is not known. Although a few new sites have been identified these are inadequate to provide a land bank of future capacity.

Waste Reuse, Recycling, and Minimization

The potential for the reduction and recycling of the principal components of litter and of other waste is shown in Table 5.1.8.

At present most elements of litter are recycled by the informal sector through a hierarchical system of scavengers traders and raw materials purchasers. It is unlikely that the efficiency of this system could be significantly increased under current conditions.

(8) Financial Aspects

The total spending of the municipalities is very low by international standards being only 5.5% of total spending compared to 20% - 30% in developing countries (World Bank, 1994). This reflects the centralized decision making and revenue generating structure. The municipalities have no independent source of revenue other than rents from properties etc. All revenues are tightly controlled from the center and effectively prevent any independent raising of funds to meet particular local needs such as tourism (World Bank, 1994).

Table 5.1.6 Distribution of Dump Sites

Study Region	Governorate	Dump Name (1)	Area Dunnums 1,000 m ²		Total Waste Dumped (1) t/day		Population Served (Estimated) (4)	Generation Rate kg/p/day			
			(1)	(2)	(1)	(2)					
North	Irbid Ajlun Jerash	1. Ekaeder*	606	606	571	700	1,015,000	0.90	0.87		
		2. Hartha*	50	50	24	13					
		3. Kufr Awan	25	55	57	25					
		4. Kufrinja*	71	71	80	40					
		5. Nuamat*	250	250	14	30					
		6. Surouk (Malka)	55	55	25	25					
		7. Shuma (N)	67	67	60	20					
		8. Tayyiba	60	60	13	13					
	Total	1,184	1,214	844	866						
East	Mafraq	9. Mafraq*	180	180	100	100	167,000	0.75	0.67		
		10. Unm Qutain	400	400	26	12					
		Total	580	580	126	112					
	Zarqa	11. Dulayl	30	-	25	25				0.04	(0.65)
	Total	30	-	25	25						
Central	Amman	12. Russayfa (3)	300	-	1,500	-	1,582,600	0.89+	(0.65)		
West	Madaba	13. Madaba	52	52	70	70	97,400	0.72			
		Total	52	52	70	70					
	Balqa	14. Hunra*	270	270	136	200	255,000	0.73	0.78		
		15. Middle Ghour	25	25	50	-					
		Total	295	295	186	200					
	Karak	17. Karak	1,000	1,000	125	150	174,000	0.88	1.09		
		18. Tayyiba*	29	29	29	29					
Total	1,029	1,029	154	179							
South	Tafila	19. Shawbak	20	20	9	9	66,000	0.98	1.81		
		20. Tafila	500	500	56	120					
		Total	520	520	65	129					
	Ma'an	21. Ma'an	500	500	56	80	74,800	0.75	1.03		
		Total	500	500	56	80					
	Aqaba*	22. Aqaba	60	-	60	80	79,200	0.76	1.0		
Total		60	-	60	80						
Total	22	4,550	4,086	3,086	1,441						

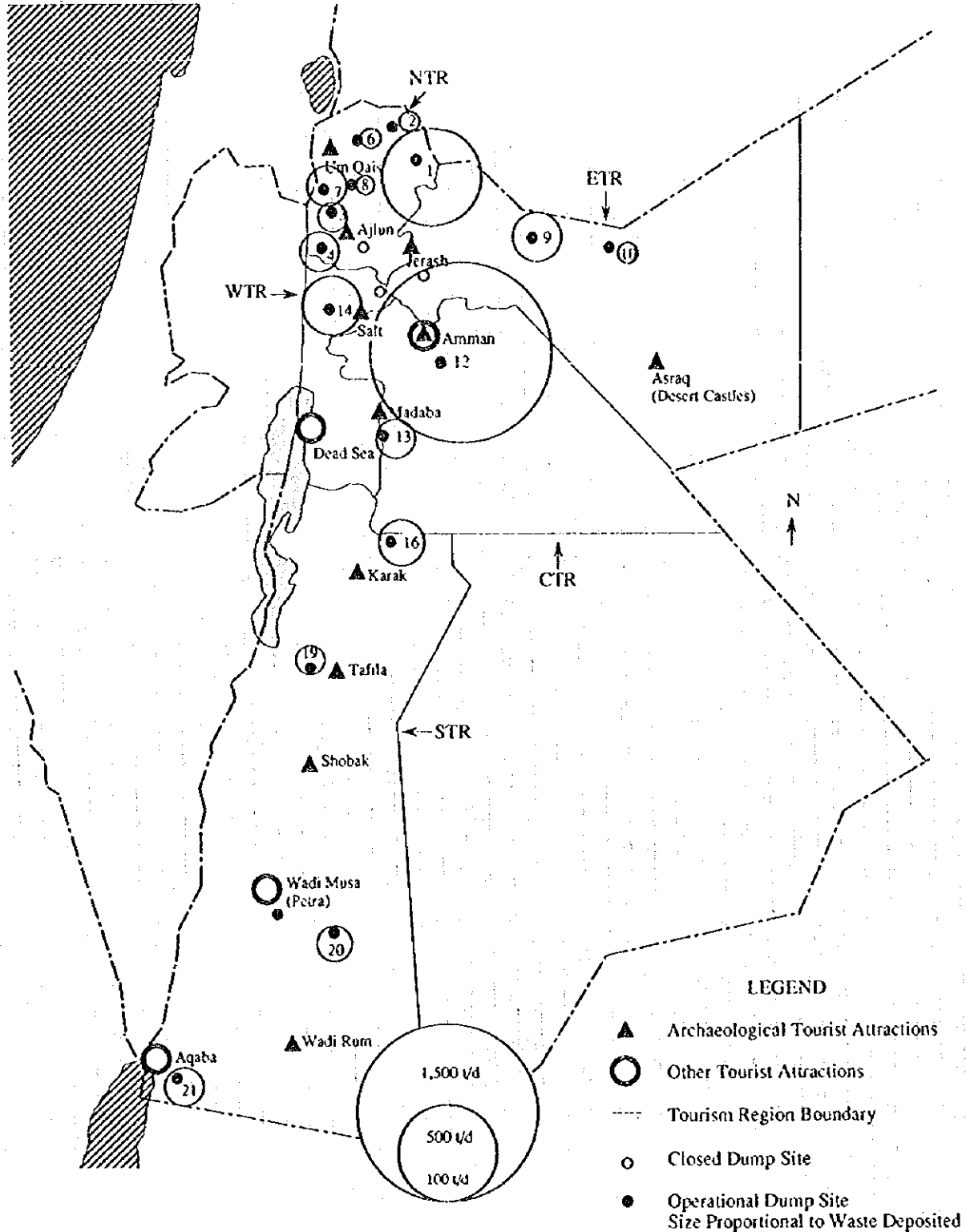
- Sources: (1) MMRAE, DOE. Solid Waste in Jordan 1994. Internal handwritten Report. The Report excludes the Russayfa site which is the responsibility of the Greater Amman Municipality.
- (2) MMRAE, DOE. Tables understood to have been submitted to JICA as part of a request for funding. The Report excludes the Russayfa site which is the responsibility of the Greater Amman Municipality.
- * Sites have been identified by MMRAE as requiring funding first.
- (3) JICA 1994. The Project for the Improvement of Solid Waste Management in the Greater Amman
- (4) Department of Statistics 1994. Hashemite Kingdom of Jordan: Statistical Year Book 1993.
- + Waste from parts of Zarqa is deposited at the Russayfa, dump. The generation rate () is calculated from the combined population of Amman and Zarqa governments.

Table 5.1.7 Collection, Transportation and Disposal of Municipal Waste

Location	Operational Organization	Container (Capacity in liters)	Collection Vehicles (Capacity in m3)	Disposal Method
Amman	Greater Amman Municipality	<ul style="list-style-type: none"> - 120/240 l plastic wheelie bins made by Schaefer, Sulo etc. supplied by residents. Many are split as a result of exposure to sunlight and rough handling - 1100 l galvanized steel continental bins made by Schaefer and Sulo and a local manufacturer. - 250 l steel drums 	<ul style="list-style-type: none"> - Emptied daily mechanically into a screw compaction, 15 m3 Rotopress body mounted on a variety of chassis e.g. Mercedes. - Three of the refugee camps to be supplied in 1995 with small 4 m3 compaction truck and 30 m3 trash trailer. 	Landfill at Russayfa
Towns including Aqaba	Municipality	<ul style="list-style-type: none"> - 1100 l galvanized steel continental bins made by Schaefer and local Jordanian company supplied by the municipality - 2000 l bins made by a local Jordanian company supplied by the municipality (these require a different loading mechanism to the continental containers and are being phased out) 	<ul style="list-style-type: none"> - Bins emptied mechanically daily/every other day by a screw compaction 15 m3 Rotopress body mounted on a variety of chassis. - Drums are emptied manually onto tipper trucks. 	<ul style="list-style-type: none"> - Mostly by open burning. - The dumps usually isolated and a significant distance from the point of collection.
Rural Villages	Local municipality via the Regional Cooperative Council	<ul style="list-style-type: none"> - 250 l used steel drums 	<ul style="list-style-type: none"> - Drums are emptied manually onto tipper trucks. 	Burnt at the dumps provided by the nearest municipality.

Source: JICA Study Team

Figure 5.1.1 Location of Dump Sites in Jordan (1994)



Fees and charges are collected by the municipalities. Generally there seems to be little attempt to link these to the cost of providing services. Some municipalities stated that waste management fees (itemized as "cleansing" in the municipal budget) are a fixed 20% of the property tax indicating at least some linkage between revenue and service demand. However, the charges for waste management are unable to fund that service. The revenue from Wadi Musa is 4.4% and for Madaba 9.9% of the total revenue (excluding loans) whilst the expenditure on waste management ranges from 45%, 54% respectively of total expenditure.

An increase in fees of 50 to 500%, depending on the requirements of the individual municipality would be required just to cover operational costs. There is a strong impression that the standard of service is controlled by fiscal rather than environmental or health considerations

No provision appears to be made for capital replacement which is accommodated by loans from the Cities and Villages Development Bank in Jordan or by aid from external governments. When required these loans significantly distort the budget.

Two of the municipalities examined contract out the waste management service to the private sector (Aqaba and Jerash) without appearing to increase costs above those which undertake the work by direct labor.

(9) Problems and Constraints

The problems and constraints pertaining the management of waste from the viewpoints of tourism are as follows:

- the waste management is under-regulated as a result of insufficient legislation and inadequate controls by the government;
- there is little interest or expertise in waste management;
- the collection and disposal of waste in order are unrealistically resourced by the government;
- responsibility for waste collection and disposal is spread throughout a wide range of organizations; and
- because of the lack of resources the majority of effort is concentrated on the collection and disposal of domestic waste to the detriment of that which is generated by tourists or which might affect tourist enjoyment.

(10) Issues

The issues relating to waste management are identified in Table 5.1.9.

Table 5.1.8 Recycling Status of Other Wastes

Material	Occurrence	Current Recycling Status	Potential Methods For Increasing
Textiles	Informal recycling and scavenging at the dumps	Only complete garments collected for cleaning and resale e.g. Irbid and the souk in Amman	Significant local demand. 10,410 t imported. Nil exported (1). Probably little scope for increased recycling.
Oil	Significant where vehicle workshop are concentrated	<ul style="list-style-type: none"> - Not systematically collected but disposed of to the ground. - Some industries use it as a boiler fuel with resulting air pollutions. 	<ul style="list-style-type: none"> - Reprocessing facilities not available in Jordan. - Feasibility study by RSS yet to be acted on (2).
Tyres	Significant work where vehicle shops are concentrated e.g. Aqaba which acts as a trucking center for the region	<ul style="list-style-type: none"> - Only truck tyres are retreaded in Jordan. Car tyres are imported part worn and require frequent replacement. - Most used tyres are dumped in the desert. Some are reused as irrigation water retainers for plants and in repairing shoes. <p>Estimated generation per year commercial 20,000 cars 175000</p>	<p>An international problem. Potential for use as an additive for road surfaces.</p> <p>Jordan has now prohibited the import of part worn tyres (1995). This should increase car safety, extend car tyre life and reduce generation to 50,000 tyres per year.</p>
Olive Oil Residue	Significant where olive oil is manufactured	Disposed of to ad hoc lagoons in Zirqa. In other places it is probably disposed to ground.	<ul style="list-style-type: none"> - Possible fuel
Municipal Waste	In litter bins containers and at dumps	Some recyclable material is removed from the waste stream before it enters a container, some while it is in a container and some when deposited at the dump.	<ul style="list-style-type: none"> - GAM plan a 400-600 t/day composting plant at Russayfa landfill - UNDP are proposing a 50-80 t/day biogas plant and a gas extraction system for the Russayfa Landfill
Scrap Metal	Scrap cars machinery etc.	Currently collected in Amman	RSS has undertaken R & D studies but these have yet to be reported on (2)

Sources: (1) Derived from Department of Statistics, 1994. Statistical Year Book 1993.

(2) Royal Scientific Society, 1994. Annual Report 1993.

Table 5.1.9 Principal Waste Management Issues

Issue	Occurrence	Cause	Impact
Litter			
Tourist sites - Antiquities - Museums	<ul style="list-style-type: none"> - generally present - hidden in obscure but visible locations - unmanned sites used as a dumping ground 	<ul style="list-style-type: none"> - confused responsibilities 	<ul style="list-style-type: none"> - detracts from tourist experience at site
Urban urban areas outside of Amman and Aqaba	<ul style="list-style-type: none"> - along streets, on undeveloped plots, spillage from containers and litter bins 	<ul style="list-style-type: none"> - insufficient funding of municipalities etc. - lack of awareness - low priority by residents 	<ul style="list-style-type: none"> - detracts from experience of short stay tourist wishing to see the area around his hotel
Rural all rural areas	<ul style="list-style-type: none"> - road side litter from cars - unofficial dumps - construction debris - institutional debris from over supply on infra structure projects 	<ul style="list-style-type: none"> - insufficient funding of municipalities etc. - lack of awareness - low priority by residents 	<ul style="list-style-type: none"> - detracts from experience when approaching more remote sites
Recreational areas - National Parks - informal recreation areas - roadside view points	<ul style="list-style-type: none"> - food litter - remains of picnic fires 	<ul style="list-style-type: none"> - confused responsibilities - insufficient funding of municipalities - lack of awareness 	<ul style="list-style-type: none"> - detracts from tourist experience of long stay or independent tourist
Containers			
Tourist Sites - Antiquities - Museums	<ul style="list-style-type: none"> - inadequate number or none present results in widespread litter - poorly maintained 	<ul style="list-style-type: none"> - confused responsibilities - insufficient funding of municipalities 	<ul style="list-style-type: none"> - detracts from tourist experience at site
Urban urban areas outside of Amman and Aqaba	<ul style="list-style-type: none"> - inadequate number results in spillage - poorly maintained containers many with wheels missing - unsightly, rusty 55 gallon drums 	<ul style="list-style-type: none"> - insufficient funding of responsible ministries and municipalities 	<ul style="list-style-type: none"> - detracts from experience of short stay tourist wishing to see the area around his hotel
Rural all rural areas	<ul style="list-style-type: none"> - inadequate number results in spillage - unsightly, rusty 55 gallon drums 	<ul style="list-style-type: none"> - insufficient funding of municipalities 	<ul style="list-style-type: none"> - detracts from experience when approaching more remote sites
Recreational Areas	absence of containers results in general distribution of litter	<ul style="list-style-type: none"> - insufficient funding of responsible ministries and municipalities 	<ul style="list-style-type: none"> - detracts from tourist experience of long stay or independent tourist
Dumps (Landfill)			
Urban Areas Zirqa	<ul style="list-style-type: none"> - smell, odor, vermin, smoke, noise 	<ul style="list-style-type: none"> - inadequate siting - poor ground preparation - poor operation - absence of monitoring - proximity of dump to habitation - burning of waste - acceptance of unsuitable waste 	<ul style="list-style-type: none"> - minimal impact on tourists - significant impact on residence - significant potential impact on ground water supplies
Rural	<ul style="list-style-type: none"> - smell, odor, vermin, smoke, noise 	<ul style="list-style-type: none"> - inadequate siting - poor ground preparation - poor operation - absence of monitoring - proximity of dump to habitation - burning of waste - acceptance of unsuitable waste- 	<ul style="list-style-type: none"> - minimal impact on tourist as they are remotely located - significant potential impact on ground water supplies

Source: JICA Study Team

5.2 Development Strategy

5.2.1 Food Hygiene.

The increasing number of tourist-related facilities that will be constructed will place a significant burden on both the capabilities of individuals and also on the MOH. In order to keep pace with the developments it is recommended that:

- preference should be initially given to developments by, or in association with, international hotel chains that already achieve high standards because of their need to maintain their international reputation;
- the lecturers at the Hotel school and the MOH Schools should be trained overseas on aspects of their discipline relating to tourism;
- the courses should be thoroughly reviewed by an international organization for their appropriateness to the international tourism market;
- the MOH Diploma should be made available to students of other approved courses
- liaison between MOH and MOTA, especially at the regional and local planning level should be improved so that MOH is aware of its liable future responsibilities;
- the level of fines for breach of licence conditions or standards which are currently enshrined in the Law of Jordan should be made subject to regulation and the level substantially increased so as to act as an effective deterrent; and
- procedures are developed to ensure co-operation by all GOJ Ministries.

5.2.2 Waste Management

(1) Strategy

The development strategy for waste is an integral component of the National tourism Plan. Waste management therefore requires consideration at every stage of the implementation of that plan.

a. Objectives

The objective of the waste component of the tourism strategy is to accommodate the waste generated by tourists themselves and to meet their needs. Poor management of waste either generated by tourism or the local inhabitants may become a significant detraction for the tourists enjoyment and effectively deter any development of the sector.

The objectives of a waste management strategy within the Tourism Development Plan should therefore be as follows:

- to reduce the existing widespread distribution of litter on the routes to and within the individual tourist sites; and
- to allow the development of the management of waste within Jordan to accommodate the increased number of tourist envisaged by this Tourism Development Plan.

Other wastes indirectly generated by the tourism industry e.g. from the production of goods purchased and manufactured in Jordan, especially hazardous wastes which are regarded as being too remote from the tourist and have therefore not been examined.

b. Street Sweeping and Litter Collection

Impact on Tourism

Poorly swept urban streets, litter strewn along urban roads and informally deposited in unauthorized areas have an adverse impact not only on the visitor but on the local economy.

However, local residents may not be aware of this litter, having become accustomed to its presence.

c. Collection of Municipal Solid Waste

Impact on Tourism

The manner of collection can generate litter and give a poor visual image to the visit through poorly maintained and unsightly waste recepticals and vehicles and impolite and poorly dressed workers. High standards are achieved in the richer urban areas e.g. Amman whilst those in the under resources urban and rural areas are totally inadequate.

However, the volumes that result directly from tourism are minimal compared to those generated by both the urban and rural populations. Comparison of the additional waste generated by tourists, including immigrant workers, indicates that by 2010 the waste from tourism will increase by only 2.2% of the total waste generated by the population in 1995 and that the total waste from tourism will be only 2.6% of that generated by the local population (Table 5.2.1 and 5.2.2). Waste generation by the residents is therefore a significantly greater problem than that generated by tourism. There is also little difference in the percentage growth of the individual tourism regions.

However, the location of the point of generation may have a significant local impact on the type of waste. The strategy will therefore have to be appropriate to the location of the source of generation.

Table 5.2.1 Waste Generated by Tourism Compared to that Generated by the Resident Population

Year	Population (1)	Waste generated t/day	Additional Tourists Nights	Guest Workers	Waste Generated t/day	Increase in waste from tourism %
1995	4,500,000	3,600	14,241	748	71.9	2.0
2000	5,280,000	4,224	19,060	1,001	96.3	2.3
2010	7,230,000	5,784	29,589	1,553	149.5	2.6

Source: Ministry of Water and Irrigation (1) and JICA Study Team

Table 5.2.2 Additional Waste Generated by Tourism

Year	Population 1995 (1)	Waste generated t/day	Additional Tourists 1995	Additional Guest Workers 1995	Additional Waste Generated t/day	Percentage increase in waste %
1995	4,500,000	3,600	14,241	748	-	-
2000	-	-	4,819	253	24.4	0.7
2010	-	-	15,348	805	77.6	2.2

Source: Ministry of Water and Irrigation (1) and JICA Study Team

d. Disposal of Municipal Solid Waste

Impact on Tourism

At present the disposal sites have a minimal effect on the tourist because of their remoteness and distance from the main tourist routes. However, this is unlikely to remain the case with increasing numbers of tourist and the opening of new tourist

sites. Of more immediate concern is the effect of unsuitably located sites on groundwater quality and its impact on the health of consumers, including tourists.

Table 5.2.3 demonstrates the considerable restrictions placed on locating new landfill sites and the poor location of many of the existing sites.

Virtually all of Jordan's waste is disposed of to dumps which, in some instances, pose a significant threat to water quality. Landfilling is the scientific approach to the disposal of waste to the ground. While it is more expensive than dumping it still remains comparatively low cost and low technology. If operated effectively, the threat to water resource is small (Table 5.2.3)

Table 5.2.3 The Geographical Distribution of Potential Landfill Sites According to Tourism Region

Tourism Region	Description of Area	Rift Valley	Escarpment	Plateau
		Low lying and flat	deeply dissected side of the Rift Valley	Undulating highland mostly desert to the east
Northern Region	Pollution potential	<ul style="list-style-type: none"> - River Jordan and irrigation canals throughout - small rural settlements 	<ul style="list-style-type: none"> - many springs, outcrop of major national aquifers 	<ul style="list-style-type: none"> - many springs, outcrop of major national aquifers - industrial and commercial urban developments throughout
	Landfill availability	limited number of available sites because of competition with agriculture and risk of pollution of surface waters	limited number of available sites because of the risk of pollution of springs and outcropping national aquifers	limited number of available sites because of the risk of pollution of springs and outcropping national aquifers
Eastern Region	Pollution potential			entire region forms the outcrop of major national aquifer
	Landfill availability			limited number of available sites because of the risk of pollution of springs and outcropping national aquifers
Central Region	Pollution potential			outcrop of major national aquifer along eastern and western boundary
	Landfill availability			availability of sites because of isolation and lack of aquifers. Site of proposed national hazardous waste disposal site
Western Region	Pollution potential	<ul style="list-style-type: none"> - intensive agriculture - limited seaside resort but with potential for development 	<ul style="list-style-type: none"> - many springs, outcrop of major national aquifers - mixed urban and rural settlements 	entire region forms the outcrop of major national aquifer
	Landfill availability	limited number of available sites because of competition with agriculture, risk of pollution of surface water and visual impact on recreational facilities	limited number of available sites because of the risk of pollution of springs and outcropping national aquifers	limited number of available sites because of the risk of pollution of springs and outcropping national aquifers
Southern Region	Pollution potential	<ul style="list-style-type: none"> - minimal risk to the Dead Sea - isolated rural and nomadic settlements 	<ul style="list-style-type: none"> - many springs, outcrop of major national aquifers in most of the area - isolated rural and nomadic settlements 	outcrop of major national aquifers in the northern and southern parts of the region
	Landfill availability	availability of sites because of isolation and lack of aquifers however may have visual impact from escarpment	limited number of available sites because of the risk of pollution of springs and outcropping national aquifers	availability of sites because of isolation and absence of aquifers in the center of the area near Ma'an

Source: JICA Study Team

The development strategy for waste management arising from the tourism industry consists of the following interrelated elements:

- educational;
- technical;
- institutional; and
- financial.

(2) Technical Resources

a. Educational

There is currently a low awareness of the impact of litter and waste on the health and amenity of both the community and the individual.

Awareness campaigns by the Jordan Environment Society on other issues, do not appear to have been significantly successful. The positive message taught to school children appears to be negated by the parents. If awareness campaigns are to succeed in any measure they need to meet the following criteria:

- impart the message to all sections of the community; and
- demonstrate direct linkage between careless littering with health and financial well being i.e. litter deters tourists who generate income.

This message is particularly important in the rural areas where litter abounds and waste collection or disposal is a significant expenditure by the municipality.

b. Street Sweeping and Litter Collection

A complete refurbishment of the existing facilities in all areas should be undertaken, especially in the major towns and those which contain tourist attractions or are identified in this report as cores. Full advantage should be taken of the benefits of standardization e.g. economies of bulk purchase, the encouragement of local manufacture and ready recognition by foreigners.

In order to improve the visual appearance of both the street sweepers and their vehicles it is recommended that the following are provided:

- a workers uniform with brightly colored strips to aid visibility; and,
- a double compartment, two wheeled cart made of durable material.

c. Collection of Municipal Solid Waste

The technical requirements are site specific and require examination by each municipality in order to provide the most cost efficient and effective service. Typical specifications should be developed by the government. The use of rusting, steel drums is unsightly because the waste collected in them is often burnt. This may be a response to infrequent or inadequate collection. Therefore municipalities should:

- ensure regular and frequent collection;
- replaced the drums with containers, plastic drums or improve the drums by painting; and,
- where appropriate, the bins should be hidden behind a wooden screen constructed by the local residents of local materials.

d. Disposal of Municipal Solid Waste

Municipal Solid Waste should be disposed of as follows:

- small-scale incineration operated by the private sector for isolated tourist facilities including hotels and national parks; and
- landfilling with municipal waste for urban sites and those generating considerable quantities of organic waste.

(3) Institutions

a. Government

Government, through its own operations and actions can encourage a responsible approach to waste management through the following range of measures:

- an Environmental Impact Assessment should be submitted for all large scale developments or those in sensitive areas. This will particularly apply to new hotels in remote locations. The EIA should contain proposals for waste collection and disposal by the operator of the facility;
- licensing should include an assessment of existing or proposed waste management techniques and a condition of continued compliance with present conditions;
- those accepted on to the approved contractor list should submit for approval an approved waste management policy and evidence of previous of compliance;
- products and services should be purchased by the government from organizations that have previously submitted, and had approved, a waste

-
- management policy; and
 - waste management issues are a specific criteria in awarding all Government contracts.

This approach may also be extended to include other government requirements such as waste and energy conservation and efficiency, local and global, environmental performance etc.

b. General Corporation of the Environment (GCOE)

The central government should remain in control of national policies, techniques and standards. To this end a separate department should be established staffed by waste management professionals and with specific responsibilities according to the following:

- to devise a national waste management plan;
- to publish mandatory guidelines on street sweeping;
- to establish specific performance targets;
- to monitor compliance with the guidelines and targets;
- to gather statistics from all waste disposal operators;
- to initiate a database to contain information which has been internally verified as accurate;
- to determine waste management strategy which it is able to implement through its own and other ministries;
- to act as a point of contact for all national and international finance;
- to provide a peripatetic street sweeping task force to clean the major tourism routes on a regular basis to prevent the deterioration below a minimum acceptable level;
- to consider the desirability of a similar task force for vehicle maintenance; and
- to use inspectors to ensure satisfactory standards.

Many of these functions are already the responsibility of the DOE of the MMRAE. However, the DOE has manifestly been unable to satisfactorily fulfill these roles. This has partly resulted from uncertainty surrounding the Jordan Environmental Act for the past years. Until this act is implemented there is little hope of any effective management of the environmental let alone of waste management issues.

A separate waste management department (WMD) would overage the operation of the local level of the MMRAE's own inspectorate which would be responsible for the providing advice and guidance to individual municipalities and for monitoring waste management and environmental issues.

Quality Monitoring and Control

In order to ensure efficient management it is essential that the performance of all services are monitored against predetermined standards. The advantage of the private sector is that such performance requirements may be written into the contract. However this should not preclude the same approach to services through the application of work schedules, appropriate standards, assessment criteria evaluation, setting of performance objectives, monitoring of achievements etc. Many of these approaches are partially operated by departments but absent from others especially those related to waste collection and disposal; these techniques assist in evaluating value for money and should therefore be of intense interest to the Prime Ministers Office and the Ministry of Finance.

It is therefore recommended that:

- the MMRAE/GCOE should undertake all the above activities and apply them to all waste management activities undertaken by the municipalities; and,
- the government require all ministries to undertake similar evaluation; the unit for contract management (see above) is trained in the application of such techniques to enable it to offer similar training to all ministries requesting it.

c. Other Ministries

Various ministries are already responsible for the management of the existing tourist facilities. these responsibilities would be relinquished to the new WMD except where they have exclusive control within a defined boundary e.g. the DOA or the proposed Royal Parks Service. In such cases the ministry would remain responsible for all waste management functions within its boundary of operation.

d. Municipalities

The municipalities would remain responsible for all operations except at archaeological sites and the National Parks where it will be the responsibility of the DOA and RPS respectively.

e. Private Sector

At least one authority (Aqaba Municipality) has contracted out its waste management function to the private sector. While this does not appear to have resulted in financial savings, a qualitative examination indicates the achievement of above-average operational standards. The private sector should be encouraged to enter waste management as national private companies.

It is currently government policy to reduce the extent of government bureaucracy. The involvement of the private sector has the following advantages:

- a reduction in the financial liabilities placed on government;
- a reduction in the number of government employees;
- greater ease with which a private company can raise capital;
- greater ease with which government ministries can enforce relevant regulations;
- the ability to include performance standards into a contract;
- the greater degree of motivation to achieve and maintain higher standards. (Low standards will be reflected in decreased profitability.);
- the greater freedom to exploit the considerable commercial opportunities free of the financial and procedural constraints of government or quasi government organizations;
- the ease of negotiating with other private-sector companies;
- the greater freedom to negotiate contracts and wage rates; and
- the potential to diversify Jordan's commercial base through the development of an additional sector.

The objective, which is in line with government policy, should be to encourage private-sector involvement through the following methods:

- contracting out: the performance by the private sector of a specific task, to a specific standard for a fixed fee e.g. waste collection; and
- concessions: allowing the private sector operators to provide service from which they generate income in exchange for a flat or variable fee. Such concessions should include the responsibility to collect and dispose of the waste generated as a condition of the concession.

In order to assist all government departments to implement and operate such contracts concessions etc. it is recommended that a dedicated unit should be established with an appropriate ministry to advise on the preparation of all contractual procedures from the preparation of contract documents to performance monitoring and the enforcement of penalty conditions. Specifically, the unit would have the following responsibilities:

- prepare generic contract documents under the guidance of the relevant technical ministry e.g. for waste collection;
- identify performance standards again under the guidance of the relevant technical ministry;
- maintain an approved list of suppliers, contractors etc. and a record of their

- performance;
- evaluate the overall performance of each contract. However, contract monitoring would remain that of the responsibility of the contracting organization e.g. the municipality; and
- report annually to the prime minister's office on the progress of individual ministries in encouraging the private-sector involvement.

A number of ministries are suitable to house such a body however, that which has the greatest experience in contracting is the Department of Public Works.

At DOA franchised sites the franchisee would be responsible for the installation, operation and maintenance of all tourist facilities including waste management.

f. Non Governmental Organizations (NGOs)

The Royal Parks Society (RPS) would have the same responsibilities as the municipalities for the litter collection, waste collection and disposal. These services could be contracted out to the private sector thus providing an additional source of income to rural communities. National standards would have to be complied with and all sites would be inspected as part of the national system.

(4) Finance

The present system of returning much of the revenue to the central treasury would appear to discourage both increasing revenue and the improving facilities. Thus benefit to both the relevant authority and to the MOF is minimized. Allowing the retention of part, or all, of the revenue generated either directly or by non submission to the MOF, or by its return from the MOF, would encourage increasing revenue and improving the standards of services.

It is recommend that the burden of additional fees and taxation for the improvements are not levied on the domestic payer because not only is there a perception among Jordanians that they already suffer from too great a burden of tax but it is these inhabitants who are the most likely to be inconvenienced by the arrival of more tourists e.g. increased congestion, noise etc. The potential improvement in local service may act by way of compensation.

a. Revenue Generation

Direct revenues to fund the waste management sector might include the following:

- charging other government departments and organization for the use of waste

-
- disposal sites;
 - acting as a contractor for other Ministries;
 - offering recycling concessions at selected dumps e.g. Rusyfa. While this may be considered to affect the poorest members of the community, flexibility of operations may be able to enhance their productivity and hence their income. Such a flexible approach could include segregating particularly profitable loads for scavenging;
 - cross subsidizing low revenue or non charging tourist sites by high revenue sites;
 - transferring an agreed percentage of tourist receipts from a particular site or sites to the relevant municipality undertaking its waste management;
 - increasing the property tax and/or annual licence fee on commercial properties; and
 - charging for the collection of waste from commercial properties likely to benefit from tourism.

b. Savings

Savings in waste management costs may also be achieved through the following mechanisms:

- contracting all certain waste management services;
- the formation of a co-operative purchasing or maintenance organization (this already exist in embryo form: many municipalities draw on the technical expertise of the greater Amman Metropolitan Authority);
- transferring the waste management responsibilities for a particular site with the concession to operate the tourist facilities at the site; and
- the allocation of the responsibility of individual developments e.g. hotel complexes to their operators.

c. Other Financial Measures

The present government accounting should be revised:

- to enable depreciation of equipment to be incorporated within municipal and governmental budgets;
- to remove the requirement for all revenues to be diverted to the MOF before redistribution;
- to enable the identification of the expenditure on waste management. This will facilitate monitoring by the new Waste Management Division; and
- to determine expenditure on waste management based on a minimum per capita expenditure on waste. This will incorporate a factor for increasing this

amount for those municipalities with a number of attractions. This system will prevent waste management falling below a predetermined standard in other municipalities.

Table 5.2.4 Waste Management Strategy for Tourism Development

Proposed Facility	Description of Location	Type of Waste	Proportion of Waste	Strategy for Litter	Strategy for Collection	Strategy for Disposal
Urban Developments eg Urban Heritage Areas, Museums etc	central urban area well served by infra-structural services	mostly tourist and commercial	insignificant compared to that generated by urban population	<ul style="list-style-type: none"> - increase litter bins - retailers sponsor bins 	<ul style="list-style-type: none"> - municipality incorporate within existing arrangements - ensure regular collection - improve standard of street bins - replace and steel drums behind wooden screen 	<ul style="list-style-type: none"> - municipality incorporate within existing arrangements to landfill
Small Rural Developments National Parks	individual isolated development in rural area with small villages limited infra-structural services	mostly tourist with some commercial	significant compared to that generated by local rural population	<ul style="list-style-type: none"> - provide sufficient litter bins 	<ul style="list-style-type: none"> - incorporate within existing arrangements - incineration may be practical 	
Large Rural Development eg Hotel complexes, country clubs etc	isolated in rural area with small villages limited infra-structural services	mostly domestic, tourist and commercial	largest local generator of waste	<ul style="list-style-type: none"> - private sector responsible 	<ul style="list-style-type: none"> - private sector responsible 	<ul style="list-style-type: none"> - private sector responsible - incineration individually or cooperatively may prove practical
Long distance Tourist Routes eg the Desert Highway and the Kings' Highway	isolated in rural area with small villages limited infra-structural services	mostly tourist with some road waste eg tires	small but significant visual impact on traveling tourist	<ul style="list-style-type: none"> - RPS responsible for National Parks - Municipality responsible for non Park picnic areas and view points - MOT responsible for Highway - Police responsible for potential driving hazards 	<ul style="list-style-type: none"> - RPS - Municipality, incorporate within existing arrangements - MOT - Police 	<ul style="list-style-type: none"> - RPS incineration may be practical - Municipality incorporate within existing arrangements - municipal landfills - municipal landfills

Source: JICA Study Team

PART I (VOLUME 2)
NATIONAL TOURISM DEVELOPMENT STRATEGY AND POLICY
(SECTORAL DEVELOPMENT)

Chapter 6.

Environmental Management

THE UNIVERSITY OF CHICAGO

Chapter 6. Environmental Management

6.1 State of Environment

6.1.1 Natural Environment

(1) Geomorphology

From west to east, topographical units are the Jordan rift valley (Ghor area), the escarpment and/or highlands, the highland plateau, and the desert, which is called the "Badia" region. The following morphological features are important elements of the Jordanian landscape:

- Basaltic plateau;
- Limestone plateau;
- Endoreic depressions of the arid area;
- Rift valley depression (below sea level);
- Escarpment and deep wadis along the rift valley;
- Highlands.

(2) Climate

The climate is dominated by Mediterranean and arid tropical conditions. Four climatic types have been identified according to the temperatures and rainfall characteristics: Mediterranean, Irano-Turanian, Saharo-Arabian, and Sudanian (Figure 2.1.1). Main climatic regions can be summarized as follows:

- Jordan Valley (Ghor): Very hot in summer and warm in winter. Daily average temperature is 31°C (mean) and 39°C (maximum). Rainfall decreases from north to south with an average of more than 300 mm/year in north, and less than 70 mm/year in south. The morphological depression of Ghor makes this region similar to a greenhouse.
- Badia: Continental arid climate, with important diurnal and seasonal variation of temperature. The daily average temperature is between 34°C and 37°C in summer, and 3°C in winter. Rainfall is less than 100 mm/year.
- Escarpment area with highlands and plateau: The average daily temperature is about 25°C in August, and 6°C to 8°C in winter. The mean annual rainfall ranges from more than 500 mm/year in north to about 300 mm/year in south.

(3) Physiographic/Biogeographic Areas

The geographical distribution of the physiographic and biogeographic areas is described below.

- The Jordan rift valley (Ghor, 15 to 30km wide) and the Dead Sea are below sea level (-197m at Baqoura in the north, and -400m at the Dead Sea). The area has been newly opened after the Peace Treaty but is still almost without human activities. Northern Ghor is the core of irrigated agriculture in Jordan, and natural vegetation has been replaced by agro-ecological species.
- The rift Wadi Araba region extends at elevations from -200m to +300m, and drains into the Gulf of Aqaba. This area is mainly composed of arid landscapes: Stony outwash plains, sand dunes, and saline mud flats (sabkha). Precipitation is between 40 and 80 mm/year. Human activity is represented mostly by nomadic pastoralism. Natural vegetation is an open vegetation of isolated trees and dwarf-shrub, of tropical sudanian type: Acacia, Balanites, Tamarix, Calotropis, etc.
- The Gulf of Aqaba area is part of the precedent unit but is characterized by the coastal and marine environment. The gulf is a branch of the Red Sea, and is known for its rich marine biodiversity. However, pressure of human activities on the littoral environment is a potential source of damage. The gulf is shared by 4 countries. The Jordanian coastline does not exceed 27km in length.
- The escarpment area stretches along the rift valley and is the contact area between rift depression and high plateau. The escarpment area presents a variety of physiogeographic characters, including uplands, mountains, highlands, and deep wadi valleys like Wadi Mujib and Wadi Zarqa Ma'in. The highland area is classified as a separate type (see below).
- The highlands are bordering the rift valley to south. It consists of rugged relief stretching from the bottom of the rift valley to altitudes ranging between 1100m and 1500m. Wadi Ram lies at the extreme south of these highlands at the Saudi Arabia border.
- The steppe area makes the transition between the Mediterranean escarpment area and the eastern arid desert. Natural vegetation has been replaced by agro-ecological species due to agriculture and pastoralism.
- The eastern desert plateau ("Badia") is part of the Arabian Desert. This area is typical of arid areas, with closed drainage basins which are temporarily flooded.

There are 2 major closed basins: Qa al Azraq in the north, and Jafr in the south. Azraq oasis is a natural permanent wetland. The "Badia" area covers 90% of Jordan's area.

(4) Main Habitats

Jordan is a transitional habitat between several biogeographic regions. This has resulted in a rich diversity of species, including regionally endemic species (Middle East). The main important wildlife habitats are as follows:

- **Forest:**
Forest covers less than 1% of the country (about 75,000ha), of which more than half is natural (about 40,000ha). Forests with extremely low canopy cover approximately 150,000ha, in rocky regions. The forests are located mainly in the escarpment areas, including the mountains and the highlands, in the north (60%) and in the south (40%). This forest is managed by the Forestry Department. Natural forest includes evergreen broad leaved forest, wild olive forest, deciduous forest, coniferous forest, and mixed forest.
- **Dead Sea:**
The ecology of the Dead Sea is not well known. Surface runoff that ends up in the Dead Sea is about $1600 \times 10^6 \text{ m}^3/\text{year}$. Evaporation would be about 1% of the Dead Sea permanent water amount. Maximum depth is -400m. Salt content is about 31.5%. The environmental fragility of this area is due to its low topographic level, akin to a "sink" for residual waters.
- **Range lands:**
The term "range lands" is used by the Forestry Department to designate lands used for grazing. They are generally state owned, and have grazing management problems. Corresponding habitats are the steppe rangelands, and the "Badia" arid range lands.
- **Wetlands:**
Wetlands are part of the endoreic drainage of arid desert, and generally include seasonal lakes and desert wadis. The Azraq Project has identified a total of 15 wetlands, including those natural and those artificial. However, there is no large wetland apart from the Azraq oasis. Several small wetland areas, generally located in the desert, are important habitats for migrating waterfowl. Due to the degradation of the Azraq oasis, migrating waterfowl are actually dispersed among various water bodies, especially in the Jordan valley.

- **Desert:**

Sand desert can be found locally in Wadi Araba, in the Badia area, and in Wadi Ram. There are also rocky steep lands and gravel or stony flat lands. Desert wildlife is rich but vulnerable to human activities (pastoralism, hunting), excepted in the marginal land of Wadi Araba. The rift area is characterized by scattered acacia grassland at the bottom of the wadi and in the depression, and by scattered *Ziziphus* grassland, which is confined to the shores of the Dead Sea.

- **Sea and Seashore:**

The marine coastal ecosystems of the Gulf of Aqaba include sands and mud, sometimes with sea grass beds, rocky outcrops, coastal lagoons and coral reefs. The specificity of the Gulf of Aqaba is the high diversity of species and its significant endemism (fishes, corals, mollusks and algae).

(5) Description of Natural Areas

Natural areas of Jordan were described earlier in Table 2.1.1 and Figure 2.1.2. Identification of these natural areas with corresponding tourism areas has been made in Table 6.1.1. In this table, the tourism areas of Jordan as described in another section are referred to.

(6) Main Wildlife Species

The following numbers of wildlife species have been estimated for Jordan: Species and sub-species of mammals (77), birds (350), reptiles (73), marine fishes (268), fresh water fishes (18 to 20), and vascular plants (2,300). However there is not yet a systematic inventory of wildlife in Jordan. At the exception of the Dana survey described below, the existing inventories are the result of disseminated observations and ad hoc surveys.

- **Birds:**

A schedule of important bird areas has been compiled for Jordan and the Middle East. This list has reported 17 important sites, of which 5 are actually protected sites (nature reserves). The highest diversity of birds is found in the Highlands and the rift valley margins. The rift valley is recognized as an important migration route for certain species of water birds and for passerine migrants. Site classification and related location map is given in Figure 6.1.1. Important species are classified in Table 6.1.2.

- **Mammals:**

Main mammal species that are found in Jordan include the Red Fox, Ruppell's Fox, Wild Cat, Porcupine, Wolf, and Eurasian Ibex. Locally or globally extinct

species include: Brown bear, Asiatic lion, Arabian Oryx, Persian Fallow Deer, Syrian Wild Ass, Syrian desert ostrich. Important species are classified in Table 6.1.2.

- Fishes:

Habitat suitable for fish are found only in the Azraq Oasis, Jordan River and main tributaries of the Dead Sea, and the Gulf of Aqaba. Endemic species of surface waters are *Tilapia gallilae* and *Aphanius Serhani*. Fishes of the tributaries of the Dead Sea, like the Mujib river for example, are supposed to be endemic, but no survey has been done by now. In the Gulf of Aqaba, 268 species of fish have been recorded, of which 7 are endemic.

- Natural vegetation:

Natural vegetation is concentrated in temporary rivers called wadi, and is considered to be composed of secondary species in most cases. Remaining areas of natural woodland lie between Amman and Irbid. This forest is a mixed composition of evergreen/deciduous oak trees (*Quercus calliprinos*, *Q. ithaburensis*). Woodland above 700m is dominated by Pine trees (*Pinus Halepensis*). In "Badia" area, main species are Iranian shrub and bush species such as *Artemisia*, *Retama*, *Anabasis*, and *Ziziphus*.

(7) Wildlife Inventories

RSCN has started a program of wildlife surveys with support of the UNDP and World Bank (Global Environment Facility Project for the Conservation of Nature). These surveys are known as the Dana Nature Reserve Baseline Wildlife Surveys, and have been performed for the Dana reserve site, including the Wadi Araba region. The inventory at Dana has for example resulted in the recent discovery of Blanford's Fox and Small-spotted Genet, which were unknown in Jordan, and the discovery of Caracal, which was unknown in this area. Already available surveys are the following:

- Wadi Araba gazelle;
- Carnivora; Canidae, Hyeenidae and Felidae;
- Mustelids, Viverrids, Porcupine and Rock Hyrax;
- Ibex;
- Rodents;
- Birds;
- Baseline ecological survey (flora and fauna).

A new survey program is going to be implemented for the Wadi Mujib reserve, and for the Burq's proposed biosphere reserve with UNESCO, taking the Dana survey as a model.

Apart from the above mentioned regional surveys, there is also a national inventory of important bird species, which has been performed as part of the Inventory of Bird Species in the Middle East (Birdlife International). Results of this survey have been summarized in Table 6.1.3, together with Figure 6.1.1.

(8) Biodiversity

Due to climatic conditions and/or traditional land use pressure, primary productivity and biodiversity in Jordan terrestrial habitats is low. However, the transition status of Jordan in the biogeography of the Middle East is a factor of diversity for this type of habitats. For example, there are more fox species in Jordan than in Western Europe. With specific local conditions, which are the presence of water, topography, climate, and low pressures from society, biodiversity may be important in restricted areas. The "wadi" and oasis can be considered as such natural cluster.

(9) Sensitivity to Pressure

Wildlife is very sensitive in Jordan because extensive habitat is needed for predators in the context of low biomass. In addition, open area of desert is a factor of vulnerability (gazelles for example). Main pressures are hunting, grazing, and conversion of land use. In the Gulf of Aqaba, coastal land use is a potential pressure on coral reef ecosystem.

Discarded litter, specially farming plastics, tins and food supplies, which are common along roads, are hazardous compounds once they enter the digestive tract of goats or gazelles (in Wadi Araba) through accidental consumption. They are also a major cause of degradation of the visual landscape.

Overgrazing is a serious factor of degradation of wildlife. Tourism development has also resulted to some extent in the degradation of valuable resources like wildlife and landscape (litter, wood cutting, hunting).

6.1.2 Social Environment

(1) Background

60% of the total population, which was close to 4.2 million persons in 1994, are living in urban areas. Population growth is 3.4% a year, of which 2.9% is natural growth. About 53% of this population is residing in the core area (Amman area). Average family size is about 6 persons per family. More than 42% of the population

is under 15 years old. Unemployment rate is high (about 18%) and the number of people below poverty limit is considered to be increasing. The participation of women in the development process is low (about 13% of labor).

Total land area of Jordan is close to 9 million ha, of which only 5% is arable, according to the UNEP Environmental Data Report in 1992 (4% cropland and pasture land and 1% forest and woodland). Scarcity of water resources is a major issue, with only 200m³ per capita in 1993, and 121m³ per capita predicted for 2025.

(2) The Bedouin Population

The Bedouin population actually represents no more than 2% of the total population. Those who have kept a nomadic way of life are supposed to represent less than 10% of the total Bedouin population. They almost depend on grazing resources, completed with modern fodder resources and land cultivation. Land and landscape conservation in Jordan is closely intertwined with appropriate integration of the Bedouin population in development projects.

Life style, income and living standards are different from one group to the other. In the Dana - Wadi Araba area, the poor Bedouin communities are stressing the lack of regular income, lack of good infrastructure, education and health care, forcing them into a subsistence life based on nomadic pastoralism and livestock farming. Nature conservation would not be possible without including a socio-economic component to provide alternative employment (farming, artisan crafts, ranger service, visitor service). However, illiteracy is a serious limiting factor to such alternatives. Bedouin themselves admitted that they would resettle if employment opportunities were given to them (according to the Dana survey).

(3) Conflicting Uses of Land

Arable land and pasture land are scarce resources in Jordan. Protection of land is conflicting with pastoralism activity and with land reclamation for cultivation purpose. Pastoralism is generally still conflicting with cultivation and irrigation uses. Settlement uses may also conflict one another, like it is in Aqaba between industrial and tourism purposes.

(4) Pressures on Land and Landscape

Modernization is a source of various pressures on land and traditional uses of land. Bedouins' herds are fed by artificial fodder resources, which are transported from Amman in plastic bags. This results in the scattering of plastic bags which are not

disposed of correctly after use, and overgrazing of pasture land, since existing herds are now largely beyond the natural capacity of fodder resources. Settlement programs of Bedouins and land reclamation for cultivation are also modern sources of pressures on land and landscape. As a whole, the effects are the degradation of scenery, loss of vegetal cover, erosion, loss of wildlife habitats and species (desertification).

(5) Use of Renewable Resources

Collection of wild plants and fuelwood is not an important activity, but could have serious consequences on wildlife in the context of scarcity. Illegal hunting of valuable or rare wildlife species is a permanent threat on conservation of nature.

6.1.3 Urban Environment

(1) Settlements

The average number of persons per room is 3.7 in large cities, while 6 to 10% of households have more than 7 persons per room. Non availability of approved national land use plans is a factor of conflicting uses between housing, agriculture, and industry. Main environmental problems are the non-organized expansion of the city, congestion of roads, and exposure to air pollution from traffic and industry.

(2) Environmental Services

Municipal solid and liquid waste disposal sites are often not properly designed and located. Waste collection and disposal are not correctly managed, and can be sources of water, soil and air pollution. Water and solid waste related problems are discussed in different sections of this report.

(3) Amenities

Traffic density, lack of public transportation system, limited availability of public parks, and absence of pedestrian accesses are sources of disamenities in Amman.

6.1.4 Environmental Quality Issues

(1) Countrywide Issues

Population growth, urbanization and economic development are increasingly causing stress upon arable land, water resources, and wildlife. These resources are however scarce:

- Only 5% of the country is arable, partly for climatic reasons, and partly for cultural/historical reasons.
- Water resources are being progressively depleted and Jordan is already classified as having a water shortage. Water shortage is defined by the World Resources Institute as below 1000m³ per capita per year, compared to Jordan's supply of 255m³ per capita per year (1990).
- Overgrazing and deforestation have been traditional and have induced the loss of biodiversity, change of landscape, loss of productivity of pasture land, and soil erosion.

The principle^{al} environmental problems country wide are summarized in Table 6.1.4, with an indication of the main pollution or degradation sources, and the affected areas.

(2) Wildlife Issues

Environmental quality is determined by the historical pressure of agriculture on land and by the urbanization of land. However, there are marginal lands like desert and escarpments, specially those restricted as army territories, which have been largely outside human influence for a long time, before the Peace Treaty. Inaccessibility of land and existence of mined areas in the Wadi Araba and Dead Sea region have kept the area free of habitat encroachment and hunting activity. However, since the signing of the Peace Treaty, illegal hunting has started and this refuge for wildlife is no more effective.

Diversity of wildlife is still high in the rift valley, specially in the Wadi Araba region, and in the tributary wadis. The plateau area with natural steppe vegetation is almost influenced by agriculture, industry and housing. East marginal lands of "Badia" have been degraded due to overgrazing and illegal hunting.

(3) Main Factors of Environmental Degradation

a. Institutional/Legal Factors

The main factors of environmental degradation and pollution result from institutional and legal inadequacies. Regulations are inappropriate or lacking; existing plural jurisdictions are overlapping or conflicting; and legal enforcement of existing rules is almost non existent.

b. Social Factors

Main social factors of degradation of wildlife are urbanization, water use, use of firewood, desertification of villages, overgrazing, illegal hunting, and industrial pollution. There are specific factors like the clannish organization of society in desert area, modern management of pasture land, and subsidies provided to the Bedouin population, that can be important causes in the process of overgrazing for example. Low awareness of sound and visual landscape, spreading of litter and plastic bags, and unsalubrity conditions (e.g., Zara near Dead Sea and litter in Dibbin) are factors of degradation of the environment and tourism resource.

c. Economic Factors

Main economic factors of degradation of the environment are: Unemployment level, lack of human resources and financial resources to manage environmental issues, particularly those regarding nature and wildlife conservation, scarcity of water and expensive cost of water resources development.

Table 6.1.1 Geographical Correlations Between Main Ecological Areas and Main Tourism Areas

Tourism Area Ecological Area	Irbid	Ajlun- Jerash	Mafraq- Zarqa	Amman	Balqa	Madaba- Dead Sea	Karak	Tafila	Petra- Shawbak	Aqaba- Wadi Ran
Jordan valley (Upper Ghor)	x	x			x					
Dead Sea basin					x	x	x	x		
Wadi Araba								x	x	x
Northern escarpment	x	x			x					
Southern escarpment						x	x			
Irbid Madaba	x	x		x	x	x				
Ajlun Highlands		x								
Karak plateau							x			
Southern Highlands		x						x	x	
Northern steppe			x	x			x			
Southern steppe								x	x	
Burqu Hammada / Badia Plateau			x							
Azraq oasis			x	x						
Hisma										x
Gulf of Aqaba										x

Source: JICA Study Team

Table 6.1.2 Important Animal Species

	Worldwide threatened species	Regionally threatened species (Middle East)	Species of great biogeographic interest (1)	Species reintroduced after local extinction
Birds	<p>BREEDING: Marbled Teal Lesser Kestrel Houbara Bustard</p> <p>MIGRATING: Imperial Eagle Cormorant</p>	<p>Black Francolin Lappet-faced Vulture Lammergeier Brown Fish Owl</p>	<p>Dead Sea Sparrow Syrian Serin</p>	<p>Blue necked Ostrich</p>
Mammals	<p>Leopard, Caracal, Hyrax, Arabian Oryx, Nubian Ibex, Sand or Goitered) gazelle, Asian Wild Ass, Persian Deer, Blandford's Fox;</p>	<p>Wolf, Hyrax, Striped Hyaena, Caracal, Leopard, Cheetah, Mountain gazelle, Dorcas gazelle, Goitered gazelle, Indian Crested Porcupine, Otter, Arabian Gazelle, Nubian Ibex</p>	<p>same as regionally threatened species;</p>	<p>Arabian Oryx, Mountain gazelle, Dorcas gazelle, Goitered gazelle, Persian Wild Ass (or Onager); Ibex; Roe Deer Planned reintroduction of Fallow deer ;</p>

Note: (1) This includes species that may be numerous in Jordan but limited worldwide, and species limited to specific local habitats.

Source: Birdlife International and RSCN

Table 6.1.3 Summarized Geographical Review of the National Inventory of Important Bird Species in Jordan

	General specifications for key species (described in right columns)	Worldwide threatened species (IUCN Red List)	Regionally threatened or declining species (Middle East)	Species restricted to the Middle East
Zubiya	Valuable passage migrants	- Lesser Kestrel	- European Honey Buzzard - Lesser spotted Eagle	- Striated Scops Owl - White throated Robin - Syrian serin
Azraq oasis	Mainly species of great biogeographic interest: - Common Shelduck - Common Crane - Black winged Stilt - Pied Avocet - Collared Pratincole - Kentish Plover - Little Stint - Ruff - White-winged Black Tern	- Marbled Teal - Imperial Eagle - Houbara Boustard	- Great Bittern (very rare) - Great Snipe	- Black-winged Pratincole - Finsch's Wheatear - Upcher's Warbler
Shawmar	Species of great biogeographic interest: - White Stork	- Imperial Eagle - Lesser Kestrel - Houbara Boustard	- Lappet-faced Vulture - Levant Sparrowhawk	- Finsch's Wheatear - Syrian Serin
Wadi Mujib (nature reserve)	Rich breeding birds area	- Lesser Kestrel	- Lammergeier - Egyptian Vulture - Eurasian Griffon Vulture - Levant Sparrowhawk - Sooty Falcon - Sinai Rosefinch	- Sand Partridge - Finsch's Wheatear - Hume's Tawny Owl - Hooded Wheatear - Arabian Babbler - Tristram's Grackle - Dead Sea Sparrow
Dana-Finan	Rich breeding birds area	- Imperial Eagle - Lesser Kestrel	- Lammergeier - Egyptian Vulture - Eurasian Griffon Vulture - Lappet-faced Vulture - Sinai Rosefinch	- Hume's Tawny Owl - Hooded Wheatear - Upcher's Warbler - Arabian Warbler - Arabian Babbler - Tristram's Grackle - Dead Sea Sparrow - Syrian Serin
Hisma basin (Wadi Rum)	Rich variety of desert and mountain birds	- Imperial Eagle - Lesser Kestrel	- Lammergeier - Egyptian Vulture - Eurasian Griffon Vulture - Lanner - Saker - Sinai Rosefinch	- Sand Partridge - Hume's Tawny Owl - Hooded Wheatear - Arabian Babbler - Tristram's Grackle - Hooded Wheatear - Pale Rock Sparrow
Dibbin (National park)	Only rare migrants	- Imperial Eagle	none	- Syrian Serin

Table 6.1.3 Summarized Geographical Review of the National Inventory of Important Bird Species in Jordan (continued)

	General specifications for key species (described in right columns)	Worldwide threatened species (IUCN Red List)	Regionally threatened or declining species (Middle East)	Species restricted to the Middle East
Petra (national park)	Rich breeding birds area	- Imperial Eagle - Lesser Kestrel	- European Honey Buzzard - Egyptian Vulture - Eurasian Griffon Vulture - Sooty Falcon - Sinai Rosefinch	- Sand Partridge - Hume's Tawny Owl - Arabian Babbler - Tristram's Grackle - Syrian Serin
Jordan valley (unprotected)	Resident and migrant / visitor species; breeding species; Species of great biogeographic interest: - White Stork - Cattle Egret	- Marbled Teal - Corncrake	- Great Bittern - European Honey Buzzard - Egyptian Vulture - Levant Sparrowhawk - Black francolin - Great Snipe	- Sand Partridge - Dead Sea Sparrow - Syrian Serin
Burqu (proposed reserve)	Resident and migrant species; breeding species;	- Imperial Eagle - Houbara Boustard	- Lanner - Saker	- Sand Partridge - Pale Rock Sparrow
Irbid Mafraq Plain (unprotected)	Mainly migrants / visitors; breeding species	- Lesser Kestrel - Imperial Eagle - Corncrake - Sociable Plover	- Eurasian Griffon Vulture	- Finsch's Wheatear - Syrian Serin
Khirba as Samra (unprotected)	Man made wetland; only migrants; Species of great biogeographic interest: - White Stork	none	- Ferruginous Duck	none
Qa Hanna (unprotected)	No key species; mainly Common Crane	none	none	none
Hisban - Madaba Plain (unprotected)	Rainfed culture plain; migrants / visitors	- Cinereous Vulture - Imperial Eagle - Corncrake - Houbara Boustard	none	none
Wadi Araba (unprotected)	Migrants and residents	- Houbara Boustard	- Egyptian Vulture - Eurasian Griffon Vulture - Lappet-faced Vulture	- Sand Partridge - Arabian Warbler - Arabian Babbler - Tristram's Grackle - Sinai Rosefinch
Aqaba mountains (unprotected)	Migratory bottleneck site; breeding bird community of Rift Valley	- White-eyed Gull	- Lammergeier - Levant Sparrowhawk - Sooty Falcon - Sinai Rosefinch - Lanner	- White-checked Tern - Hume's Tawny Owl - Hooded Wheatear - Arabian Babbler - Tristram's Grackle - Arabian Warbler

Note: Species of great biogeographic interest are those that concentrate in sites in relatively large number although they are relatively in small number in world ranges. The criteria is that migrants represent more than 1% of total population size of the site or of the Middle East for one species, or that the site is a migratory bottleneck. These species are particularly subject to human disturbance.

Source: Birdlife International

Table 6.1.4 Principal Environmental Problems in Jordan

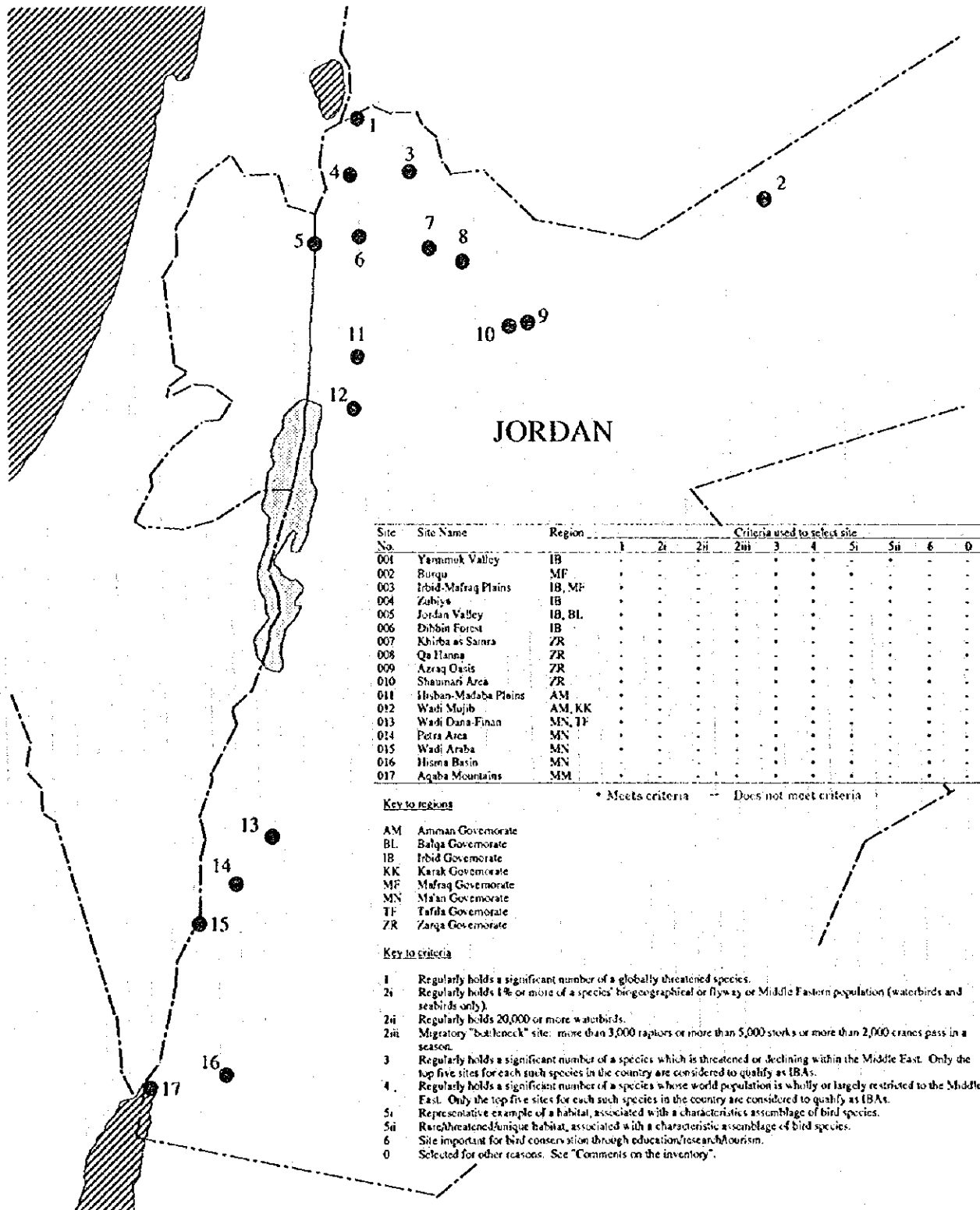
	Occurrence	Causes	Gravity
Water quality	Given the scarcity of water resources, water quality is a very sensitive issue; groundwater could be affected in the Zarqa - Amman region;	Industrial, urban, agricultural wastewater emissions;	The Amman Zarqa region is the most affected. King Talal Dam is the general collector;
Air quality	Increasingly an important issue because population growth has led to urbanization around industrial air pollution sources; dust pollution is locally important; traffic pollution seems to be less important;	Population growth, urbanization, industrialization; main pollution sources are industrial, municipal (including waste and wastewater treatment plants), and quarrying / mining sites;	Problems are located in Zarqa (industry), Amman (traffic) and Aqaba (phosphate handling dust)
Soil quality	Mainly agricultural soil contamination; there is no evaluation for soil in urban areas; salinization of soil in arid areas;	Plastic bags used for handling of agro-chemicals, or for greenhouse agriculture; non sanitary waste dumping sites, and industrial sites; use of agro-chemicals;	Contamination by plastic bags seems very serious (consumed by cattle) everywhere, and more specifically in Jordan valley; contamination by agro-chemicals (Jordan valley); salinization of soil in Jordan valley and Hadia;
Erosion	Wind and water erosion; desertification	Overgrazing, with loss of vegetation;	Mainly in steppe areas and mountain areas;
Noise/foul odor	Noise is not perceived as a major concern; foul odor are however an important problem of increasingly locally concern (complaints);	Industry, waste disposal plants, wastewater treatment plants	Foul odors are the source of few complaints to DOE; Although it is quite limited in area, it might have serious impact on future tourism activity if not addressed now;
Natural habitats Wildlife	Several valuable species have been made extinct in recent decades; habitat is preserved in Aqaba Gulf, but under pressure; decreasing of the Dead Sea level, with possible consequences on the equilibrium of regional groundwater;	Overpumping of aquifers and degradation of wetlands, use of pesticides, urbanization, and land use; loss of forest by fires; cutting of bushes for fuelwood, and collection of plants (limited effect); overgrazing; tourism activity; Dead Sea is affected by diversion of water sources;	Loss of biodiversity is a grave issue; However, the reintroduction program of species has been initiated with success; Quality and quantity degradation of the Dead Sea is a major concern for the future; most famous ecological disaster: Azraq oasis (under rehabilitation);

Table 6.1.4 Principal Environmental Problems in Jordan (continued)

	Occurrence	Causes	Gravity
Landscape	Landscape is well preserved and still constitutes one of the most valuable resources of Jordan; Plastic litter of agricultural origin is actually the major source of degradation; litter in recreation zones;	Main existing or possible sources of degradation are urbanization and tourism development; plastic bags used for agriculture agrochemicals are not collected; spreading by wind; tourism activity;	Dead Sea shore and Jordan rift valley, "wadi" valleys along the escarpment of the rift valley and in mountainous areas, Wadi Rum in the arid desert, gulf of Aqaba
Social disruption	Local communities, including bedouins are generally not consulted / educated in development projects;	Land use development; settlement of bedouins; tourism development;	The effects of development on local communities is certainly a major issue, particularly in tourism development;

Source: DOE

Figure 6.1.1 Location of Birds Areas in Jordan, with Review of Criteria's Selection of Inventory Sites (Source: Birdlife International)



6.2 Protection of Nature and Natural Resources

6.2.1 Protection of Wildlife by Legislation

All mammals and birds are protected in Jordan by the hunting law as established under the Agricultural Law n°20, 1973. According to this hunting law, hunting is prohibited in the hunting area lying at east of the Hijaz Railway, at the exception of the Azraq area. The hunting committee permanently updates a list of species that can be hunted in certain places, at certain periods, and with a defined quota. The hunting committee is headed by the MOA, and includes MOTA as one of the members. There are 4 inspectors to control the application of hunting rules. Since the staff of nature reserves is involved in hunting control as well, the total staff, country wide, is about 40 persons.

6.2.2 Protection of Wildlife by the Establishment of Nature Reserves

Nature reserves (list in Table 6.2.1) are established and managed by RSCN, with the following general objectives:

- Protection/retoration of flora and fauna and their habitat;
- Protection of endangered species;
- Reintroduction of local extinct species;
- Raising public awareness on wildlife conservation; and
- Promotion of tourism and improving socio-economic conditions.

6.2.3 Concept of Nature Reserves in Jordan

The concept of nature conservation in Jordan has basically involved fencing and strict prohibition of any activity. The reserve may be a set of small pieces of land, as in Shawmar reserve. This strict protection approach is now changing toward a more integrated approach of conservation, including social development (Dana reserve), and opening to tourism under certain conditions (Dana, Shawmar, Wadi Mujib, planned Burq reserve). A nature reserve is established by declaration by the Prime Minister, providing that RSCN is the protection and management agency, on behalf of the Forestry Department (MOA). The Forestry Department is the land owner. The exception is Dana reserve, where property has been transferred from the Forestry department to the RSCN. Since there is no specific law for the protection of nature reserves, protection rules are derived from sectoral laws, particularly agricultural laws. In the case of Dana, protection rules are those enforced by RSCN. Existing and planned reserves are described in Table 6.2.2. Their geographical location is given in Figure 6.2.1.

6.2.4 Protection of Natural Resources

Grazing reserves and national parks are parts of the natural resources protection system. Their objectives are not protection of wildlife itself but protection of natural resources for use by people. Grazing reserves (22 sites) provide fodder resources for cattle. National parks (3 sites, 25,100ha) provide leisure resources, and do not correspond to the international definition of the concept of national park. However, both grazing reserves and national parks have a landscape value. Dibbin Forest and Zai national parks have been both established by cooperation between Forestry Department and Department of Tourism. The Amman national park, which is managed by Greater Amman Municipality, includes facilities like golf. Two national parks are being established. These are designed to comply with the national park concept as recommended by IUCN.

Planned national parks are the following:

- Petra National Park, managed by MOTA, and including the Petra World Heritage Site (Petra Trust Fund): The management plan is now being implemented;
- Washi Fall and Falluz Forest, which are managed by the Forestry Department; and
- A further national park is planned for Wadi Ram, but planning has not yet been carried out.

6.2.5 International Conventions for the Protection of Wildlife and their Habitats

Several international conventions which are significant for the protection of wildlife and their habitats have been signed and/or ratified by Jordan. DOE directly manages the Ramsar Convention, the Ozone Convention, the Basel Convention, and the Biodiversity Convention.

Main conventions signed and sometimes ratified by Jordan for the protection of wildlife and habitats are:

- Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matters: Signed and ratified by Jordan in 1973;
- Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment: Jordan has signed the Protocol Concerning Regional Cooperation in Combating Oil and Other Harmful Substances in Cases of Emergency;
- International Convention for the Prevention of Pollution from Ships: Jordan signed the convention in 1973, but did not join the protocol;
- International Convention for the Prevention of Pollution of the Sea by Oil;
- Convention of Wetlands of International Importance Especially as Waterfowl Habitat;

-
- Convention on International Trade in Endangered Species of Wild Fauna and Flora; and
 - Biodiversity Convention.

Other selected conventions signed or ratified by Jordan for the protection of the environment are:

- Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer;
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal;
- Convention on the Early Notification of A Nuclear Accident;
- Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons;
- Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space and Under Water; and
- Climate Change Convention.

6.2.6 Environmental Issues in Wildlife Reserves: The Example of Dana

(1) Background

The Dana reserve is remarkable for the diversity of its habitats, covering the following types of vegetation:

- Sand dune desert;
- Acacia subtropical vegetation;
- Irano-Turanian mid altitude steppe; and
- Mediterranean semi-arid vegetation.

The total number of plant species recorded in the reserve is 555. It is 37 for mammals, 111 for birds, 36 for reptiles.

(2) Problems

The problem of involvement of people in the nature conservation purpose has been studied by RSCN in the case of Dana (Rangeland and Livestock Management Study). A total of 52 Bedouin families, which represents 524 persons and 8,638 livestock animals (about 80% are goats) are regularly using the forage resources inside the reserve. Bedouins are organized in different groups, with different economic patterns as regards to habitat, cultivation of land, grazing.

Overgrazing of most available pastures of the reserve is one of the major problems. Overgrazing is one major cause of decline of the Ibex and Rock Hyrax populations.

Hunting for Ibex meat and trophy, and for Badger and Porcupine meat is however still an essential cause of decline. Transmission of diseases from livestock to Ibex population is an additional threat.

In the Wadi Araba area, the main problem is about the conservation of the Dorcas Gazelles, which population has been identified by the RSCN survey in 1995, and is estimated to reach 180 to 260. These gazelles are threatened by habitat encroachment (livestock grazing and road landscaping), wood cutting, and illegal hunting. Without conservation measures taken, they might disappear within 5 to 10 years.

(3) RSCN's Recommendations

Recommendations of RSCN to deal with the overgrazing problem have been about grazing regulation according to defined ecological areas. Such regulations would be from total banning in very sensitive cases to restrictions in grazing period, number of grazing animals, and permitted owner families. Permits would be granted by RSCN.

In the case of Wadi Araba, the proposed measures are:

- Creation of a gazelle rehabilitation center, focusing on captive breeding before release, and later developed into a research center and a visitor center;
- Extension of the Dana nature reserve to create a corridor for gazelles;
- Upgrading of wildlife species protection, since current law enforcement regulations are inadequate.

The RSCN has also recommended that a community association with local Bedouin should be established in order to promote their participation in wildlife conservation and to resolve possible conflicts arising from officially designating the area as a nature reserve. Job creation in tourism, ranger service, artisan crafts, and other activities, is also recommended.

(4) Ecotourism Project

The Dana nature reserve is actually investigated to develop ecotourism (GBF/World Bank funding). This project includes the Dana village visitor center (funded by JICA), development of nature trails and campsite, and job opportunities for the local population.

Socio-economic surveys were carried out by RSCN in 1992/93 regarding the tribal groups using the Dana reserve and the views of this community to the reserve as part of their means of subsistence.

The basic approach of RSCN could be summarized as follows:

- Wildlife surveys to identify the ecological value;
- Social surveys to identify the land use pattern and its effects on nature;
- Priorities for nature conservation, with ecological zoning;
- Discussion with local communities to find out the best solutions;
- Establishment of land use plan, with ecotourism development zones; and
- Development of control and monitoring systems.

Table 6.2.1 List of Established and Proposed Reserves in Jordan

Established reserves	Proposed reserves	Reserves with international protection status
Azraq Oasis (Zarqa, 1,255ha); Zubiya (Irbid, 1,300ha); Shawmar (Zarqa, 34,200ha - also grazing reserve) Wadi Mujib (Amman, Karak, 21,200ha) Wadi Dana - Finan (Ma'an, Tafila, 15,000ha)	Hisma Basin (or Wadi Rum); Burqu (Mafraq, 95,000ha) Bayir (-, 44,000ha) Wadi Rajil (-, 86,000ha) Jarba (-, 40,000ha) Abu Rukbah (-, 41,000ha) Jebel Masada (-, 46,000ha) Jafer	Azraq oasis (Zarqa, 7,372ha - Ramsar site) Burq (proposed for Biosphere Reserve)

Source: RSCN

Table 6.2.2 Existing and Selected Planned Nature Reserves in Jordan

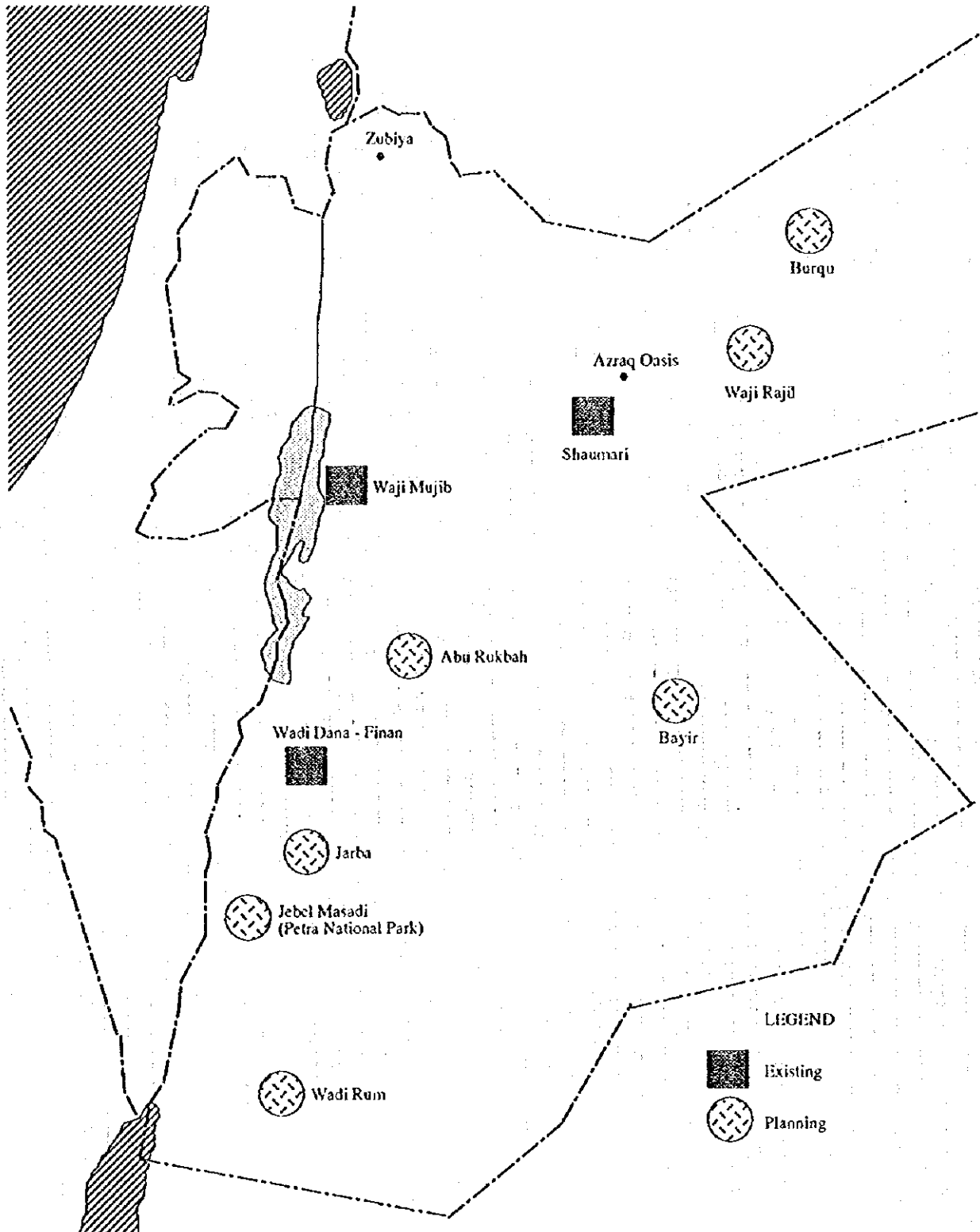
	Type of ecosystem; characteristics	Main objectives of protection	Status of protection implementation tools	General comments
Shawmar	Scrub steppe with rich plant communities in the desert wadi;	Breeding of extinct species and reintroduction in nature reserves; educational center (visit of school students);	Strict protection by fencing; tourism not permitted inside the fenced area; after completion of the Dana project, Shawmar will be a first priority for ecotourism;	Small pieces of land for ostrich and onager; fenced area for oryx
Azraq Oasis	Wetland area in desert endoreic basin; the site is a major water resource for Amman; Overpumping has dried the wetland, now under rehabilitation;	The reserve is core of the Ramsar site; protection of waterfowl and aquatic species;	Strict protection by fencing, but no maintenance of fences; opening for ecotourism is planned, with visitor/education center and access to wetland;	Rehabilitation and management of the oasis by the Azraq Project;
Zubiya	Oak trees forest:	Conservation of oak forest habitat; reintroduction of local species;	Strict protection by fencing;	Very small reserve; preparation of comprehensive management plan;
Wadi Mujib	Reserve established all along the Jordan rift escarpment, including part of the "wadi" Mujib;	Conservation of a set of natural habitats from Dead sea valley to upstream; possibilities are: geology, spa, hiking, eco-interpretation;	Promotion of tourism will be a first priority after Dana and Shawmar;	Visiting / access facilities still lacking; the reserve is threatened by a dam project;
Wadi Dana - Finan	Reserve established all along the wadi oriented E-W, and including a large area in north; 5 types of ecosystems are represented between +1200m (mediterranean) to -150m (sand desert).	Conservation of a set of natural habitats from Dead sea valley to upstream; conservation of the old village and revitalization of local community;	Dana is the only reserve for which RSCN has got land ownership; RSCN applies strict protection but is carrying out a comprehensive management plan, including social development.	Integrated project of Dana: restoration of Dana village, conservation of nature, development of eco-tourism; Visitor, research and handicraft center in the Dana village;

Table 6.2.2 Existing and Selected Planned Nature Reserves in Jordan (continued)

	Type of ecosystem; characteristics	Main objectives of protection	Status of protection implementation tools	General comments
Wadi Rum	Arid desert ecosystem, with spectacular scenery; archeological remains;	Project of establishment of national park for nature conservation and ecotourism; wildlife reserve would be the core of the area;	Wadi Rum is a proposed reserve and has no any protection status;	Actually under pressure of non organized tourism development; also disputed by several agencies: MOTA, MOA (RSCN) and DOE, and ARA;
Burqu	Desert with temporary lake and archeological remains	Protection of habitats and wildlife, including eco-tourism;	Actually no protection status; Project of biosphere reserve;	This area is under survey in order to establish a biosphere reserve;

Source: RSCN

Figure 6.2.1 Schematic Location of Existing or Planned Nature Reserves in Jordan (Source: RSCN)



6.3 Environment and Tourism in Jordan

6.3.1 Synergy: Tourism and Environment

The tourism development sector has a special link with the natural environment. It is likely to have some adverse impacts through the use of resources, but the magnitude of these impacts is small compared with other sectors. More important is the direct effect of tourism on the landscape resource, which is defined here as including the nature and culture diversity. Since diversity (landscape) is the resource of tourism sector, protection and conservation of this resource are the basic requirements of tourism development. In that sense, tourism should be considered as a good opportunity for environmental protection and conservation.

Environment as regards to the tourism sector includes the following aspects:

- Conditions as tourism resources (diversity, patrimony, landscape);
- Constraints on tourism development (carrying capacity; water, soil); and
- Quality requirements for receiving visitors (living environment; amenities).

The expected role of tourism in environmental protection and conservation in Jordan can be summarized as follows:

- Increase the environmental quality of sites which are degraded by existing pressures (non organized tourism activity, uncontrolled grazing);
- Promote the use of new technologies through pilot projects;
- Generate revenues for the conservation of nature and culture;
- Develop the mentality of natural and cultural patrimony to be preserved; and
- Identify and protect the nature tourism potential.

6.3.2 Environment as a Resource for Tourism Development (Table 6.3.1)

(1) Nature Tourism Potential

The tourism potential of existing/proposed wildlife reserves remains almost unused, at the difference of historical sites development. However, it is clear that there are several places where the tourism potential of natural resources is outweighing that of the cultural resources. Such natural areas are in priority nature reserves, the Gulf of Aqaba, the Dead Sea, and Wadi Ram, which are already visited by domestic or international tourists.

Wildlife in Jordan cannot be considered as a tourism resource to the same extent that it is in Africa, because it is not abundant and not easy to observe.

(2) Review of Natural Habitats in Relation with Nature Tourism Potential

Table 6.3.2 is a presentation of main habitats in terms of nature tourism potential according to physical factors. The importance of the rift escarpment and highlands is underlined. Each type of habitat is discussed below.

- **Dead Sea:**

The Dead Sea shore can be considered as having a high ecological value in the north and northeast, where shoreline vegetation is preserved. Landscape value is more evident but could certainly be improved by careful land use and landscaping. The landscape of the east and southeast part of the Dead Sea is already seriously degraded by quarries. Settlements in the north part and traffic will increasingly put pressure on this area.

- **Rift Escarpment and Highlands:**

This area presents the highest potential in terms of landscapes and panoramic sites, wildlife diversity, natural, cultural, and historical heritage. This potential is threatened by desertification of villages, conflicting use of land between conservation and grazing.

- **Plateau:**

There is perceived to be no potential for nature tourism promotion in these areas.

- **Wadi:**

Presents the highest potential for tourism because of scenery, availability of surface water, presence of trees and vegetation, and wildlife. Their specificity is high diversity of wildlife compared with surroundings, due to the wide range of biogeographical zones.

- **Desert:**

There could be some potential in relation with cultural heritage and oasis/wetland areas, which are rich in migrating birds. The Azraq oasis, where habitat and wildlife have been lost after mismanagement of water, is a good example of degradation of the environment together with nature tourism potential.

- **Forests:**

Forest are already the main attraction of leisure parks around Amman. The potential of this habitat is almost limited to picnic activity. Behavior of people and mismanagement of these sites are causes of severe degradation, specially as regards to the litter problem.

- **Red Sea:**

Scenery and rich marine corals tourism together with a mild climate are the environmental elements of good nature tourism potential. Better integration with local culture and history, and a comprehensive environmental management are however necessary.

6.3.3 Environment as a Limiting Factor for Tourism Development

(1) Carrying Capacity of Tourism Sites

Carrying capacity is determined by physical, ecological, and social factors: accommodation capacity, capacity of facilities, quality of environment and landscape, public acceptability of tourists by the host community, and acceptability of tourists among themselves.

Carrying capacity of the natural and social environment mainly concerns items like:

- Water scarcity;
- Water quality;
- Habitat and wildlife;
- Waste management capacity;
- Volume capacity to accept tourist activity;
- Bedouin population and villages; and
- Domestic tourism (picnickers).

(2) Impacts of Tourism Development Projects

Sources of impacts of tourism projects are siting and design of facilities, tourists volume, and road traffic. Induced sources are garbage deposits, crowds, use of resources, and contact with local populations, influx of income, behavior of tourists. Main types of effects on the natural and social environment are resources scarcity, degradation of the landscape and environmental media, loss of wildlife, social change and social conflicts (gap rich/poor), change in the lifestyle and cultural values of local people, and moral corruption for behavior reasons or economic reasons.

(3) Environmental Sensitivity to Tourism Development in Jordan

Tourism development may be an important factor of degradation or improvement of the visual/sound landscape. Degradation of landscape occurs at micro level (loss of vegetation), and meso level (loss of harmony, loss of wilderness). For example, the use of camels to visit Wadi Ram desert preserves both visual and sound landscape, and maintains the desert wilderness atmosphere and scenery.

From the ecological point of view, conservation of nature and culture diversity is important. From the tourism resources point of view, conservation of wilderness and landscape is essential. Conservation of the tourism resource is conditioned by the conservation of the ecological conditions. For example, at a threshold of motorized traffic in such environment as Wadi Ram, first effect is loss of vegetation, loss of harmony between view and sound, loss of wilderness, and loss of the site as a tourism resource.

Rift escarpment together with wadi is a very sensitive zone because of the concentration of wildlife, old settlements, outstanding landscapes, ecological value, and availability of various resources. Steep slopes in the escarpment are however rocky land with almost no ecological value but still positive landscape value. The ecology of the Dead Sea shore is not well known. However, natural vegetation has been preserved in the northern part of the Dead Sea and is subject to degradation in case of development. The eastern coastline could be developed for tourism with good improvement of the landscape, if good integration was made.

In the arid and semi-arid area (under 200 mm/year), the natural environment is not sensitive in degraded zones (rocky slopes, overgrazed plateau), and is sensitive when natural conditions have been preserved (ex. Wadi Ram, Wadi Araba). Landscape harmony is sensitive anywhere.

6.3.4 Environmental Issues in Relation with Tourism Development

(1) Environmental Issues in Tourism Areas

- Pressure on water resources, with possible loss of resources, but more probably new resources development and generation of conflicts for use;
- Disturbance of wild animals, due to obstacles on their moving, or due to disturbance in and around water sources;
- Uncontrolled expansion of the village and spread of commercial activities, which contribute to the degradation of landscape; for example, tourism development has led to uncontrolled development of the Wadi Musa village in Petra, and of the Bedouin village in Wadi Ram;
- Excessive pressure on municipal services and infrastructure;
- Disorganized encroachment of the catchment area with possible effects on water resources availability;
- Degradation of the wildlife and landscape, garbage, graffiti, risk of accelerated erosion, degradation of the historical remains (inscriptions in Wadi Ram, illegal excavation in the antiquities site of Petra);

- The case of Aqaba presents specific major issues like the degradation of coral reef due to tourism pressure, the risk of oil spill accident in the bay, and the land use conflicts between tourism development, environmental protection, and industrial activity development.

Environmental issues in main tourism sites are summarized in Table 6.3.3.

(2) Environmental Issues in Natural Areas

Since natural areas might have potential for the development of nature tourism, this section proposes a review of tourism and environment problems for each natural area of Jordan. This review is summarized in Table 6.3.4.

Table 6.3.1 Matrix of Physical and Cultural Factors of Tourism Potential

	Remoteness wilderness unspoiled nature	Morphology land use geology	Diversity of species	Antiquities and nature	Settlements traditions	Water; air amenities (trails, facilities)	Nature landscape
Scenic beauty	x	x		x	x		x
Mystery	x			x			x
Observation discovery	x	x	x	x	x		
Recreation leisure			x			x	
Medicinal therapeutic						x	
Adventure; wilderness	x			x			x
Aesthetic art		x		x	x		
Patrimony heritage			x	x	x		x

Table 6.3.2 Physical Factors of Nature Tourism Potential in Main Natural Habitats

	Remoteness wilderness unspoiled nature	Morphology land use geology	Diversity of species	Antiquities and nature	Settlements traditions	Water; air amenities (trails, facilities)	Nature landscape
Dead Sea shore		x				x	x
Rift Escarpment	x	x	x				x
Highlands	x	x	x	x	x		x
Plateau					x		
Wadi						x	x
Desert	x						
Forest							x
Red Sea			x				x

Table 6.3.3 Environmental Issues in Main Tourism Sites

	Actual conditions/ Existing pressures and change in local society (social issues)	Effects on the environment and landscape	Present institutional status, and existing projects
Dana	Old villages, historical remains, forested land and deep wadi constitute a big landscape potential; Dana village and its land use are under rehabilitation; number of visitors to Dana village and to camp site is still reduced	There is no effects of the local settlements on the nature reserve; the effect of tourism is actually positive because it is well integrated into the wildlife conservation purpose; actual negative effects could be: 1) social economic gap between villagers and visitors; 2) limited possibility of economic expansion in the future for villagers; 2 limits: land and sustainable use of local resources	Reserve management plan, including local community development, and wildlife protection; wildlife surveys are on-going
Wadi Ram Disi	Increasing number of visitors (more than 30,000 in 1993); rapid growth of the village (800pers. 130 cars); major problems will be waste and water sanitation related; In Disi village, fossil aquifer is pumped for irrigation	1) Effects of increased frequentation of desert by tourists: loss of vegetative cover; loss of wildlife species; spreading of litter; graffiting on rocks; surface scarring by vehicles, which are all degrading landscape value; 2) Effects of growing settlement: direct encroachment on desert; disorganization of bedouins communities; leakage of engine oil affecting soil; overuse of fuelwood; overgrazing; illegal hunting	The area is included in the Environmental Action Plan for the Gulf of Aqaba; Project of transboundary biosphere reserve has been proposed, but is actually abandoned; The area is considered for natural reserve or national park
Azraq	Overpumping of groundwater for Amman water supply has resulted in environmental disaster; the oasis is now under rehabilitation of its natural conditions; Azraq city has no sanitation facility	The area has been affected by successive steps: loss of unique species in the 1960s, complete drying of wetland in 1993, return to wetland conditions in 1994/95; Degraded conditions of the oasis has certainly degraded the attractivity of this site for tourism	The Azraq oasis is classified as Ramsar site; the Azraq Project works on the integrated rehabilitation and management of the site, since 1994; rehabilitation is made by artificial recharge of water in the wetland, and cleaning of the natural water sources; results are encouraging, although they might be largely related to favorable meteo conditions

Table 6.3.3 Environmental Issues in Main Tourism Sites (continued)

	Actual conditions/ Existing pressures and change in local society (social issues)	Effects on the environment and landscape	Present institutional status, and existing projects
Petra area	Growth of Wadi Musa population and increased number of visitors; this exerts pressures on sanitation capacities; natural conditions of the area are already degraded due to the loss of vegetation, and loss of big mammals	Impact is actually concentrated in the Petra sanctuary, due to high concentration of people (noise, dust, degradation of walls), and in Wadi Musa (non organized growth, degradation of landscape; land use pressure)	Petra is classified as World Cultural heritage, and is being to be integrated in a natural national park; Management Plan (UNESCO) under way; Petra National Trust
Dead Sea area	This area is with very few settlements; Shore line of the Dead Sea is generally well preserved; however, Dead Sea level is decreasing due to regional water withdrawal; human pressure is very high on holiday time, due to domestic tourism; The geographical situation of the Dead Sea (-400m) makes it very sensitive to water contamination; Biological diversity is low	Decreasing of the Dead Sea level could affect the groundwater balance; Tourism activity is of picnic type, having as main impact spreading of litter; encroachment of tourism facilities is still limited	There are several projects for the development of the rift valley and the Dead Sea; Jordan Valley Authority is in charge of water related issues; JVA has carried out a master plan for tourism development of the eastern coast, which resulted in the implementation of 2 projects
Gulf of Aqaba	Coastal zone is limited to 26km line in Gulf of Aqaba, shared by city settlements, industry, shipping, and tourism activity. There is increasing pressure on water and waste sanitation issues; Coral reef habitat is unique because of the exceptional number of corals, and the diversity of marine wildlife	Coral reef habitat has not been affected until now; however, there are an increasing number of conflicting activities, which constitute a potential risk of environmental degradation; Tourism has induced shore line encroachment, spreading of litter on beach, direct degradation of corals; future sustainability of water resources use is doubtful	Gulf of Aqaba's environment has received increased attention; Master Plan for Development of Tourism; Environmental Action Plan; project of national marine park, including marine nature reserves; planning and permitting agency is ARA

Source: MOTA, DOE, RSCN, ARA, Azraq Project

Table 6.3.4 Expected Future Trends and Environmental Issues According to Natural Areas Units

	Environmental quality and problems	Existing tourism sites, and development plans/projects	Tourism trends in future	Expected general impacts
Jordan valley (Upper Ghor)	Water pollution due to intensive irrigated agriculture; wildlife still surviving along Jordan river	none	Increase of domestic tourism and rural tourism	Litter, degradation of landscape, traffic jam and traffic related nuisances; loss of wildlife species which are confined to the river habitat
Dead Sea basin	Ecology affected by water use of tributaries; Settlements in north and road on east have increased pressure; water quality is sensitive due to topography under sea level	Dead Sea shore is still almost free of tourism facilities; Ma'in spa in the Zarqa Ma'in tributary; Severe pressure of picnickers after opening of new road because non organized	Sharp increase in domestic and international mass tourism; JVA tourism development plan; in 1995, 4 new hotels have been authorized in north east part of Dead Sea shore	Wastewater, solid waste, litter, heavy traffic, degradation of water quality; water resources scarcity; risk of landscape degradation is very high with development of tourism facilities
Wadi Araba	Marginal land newly opened to people; overgrazing and illegal hunting by Bedouins, and opening of roads are threatening a rich heritage of wildlife; Wadi Araba is a necessary pathway between Israel and Jordan's habitats for important species	RSCN plans a gazelle rehabilitation center, to be converted into a visitors center in the future, as a western entrance to the Dana reserve; this reserve could be extended to Wadi Araba	Risk of illegal hunters	Wildlife is very sensitive because of the open landscape; without conservation measures, main effect will be loss of wildlife; degradation of landscape by litter
Northern escarpment	Cultivated land and pasture; wildlife seems to be relatively important	Umm Qays Pella	Moderate increase of visitors to the existing archeological sites	Major on local villages society, with however positive aspects; traffic; litter; water resources scarcity

Table 6.3.4 Expected Future Trends and Environmental Issues According to Natural Areas Units (continued)

	Environmental quality and problems	Existing tourism sites, and development plans/projects	Tourism trends in future	Expected general impacts
Southern escarpment	Escarpment along the Dead Sea with outstanding landscape; rich wildlife, specially in Wadi Mujib reserve; wadi with permanent water are the core of this natural heritage	Ma'in Mukawir	Sharp increase of visitors, including picnickers and international tourism	Wastewater, solid waste, litter, heavy traffic, traffic related nuisances; degradation of water quality; water resources scarcity; risk of landscape degradation; landslide risk is important
Irbid Madaba	This area includes reserves (Zubiya) and parks (Dibbin) in forest habitats; but urban environment and cropland are dominant features	Amman Madaba	Sharp increase of visitors	Social impact on local communities; pressure on water resources availability however, large beneficial effects can be expected
Ajlun Highlands	Wildlife; cropland and pasture	Jerash Dibbin forest Zai forest	Increase of visitors	Litter, traffic related nuisances
Karak plateau	Cropland; old settlements; Wadi Mujib reserve on the border of this area	Karak	Sharp increase of visitors	Litter; capacity of environmental infrastructure; tourists behavior is a source of problems for acceptability by local people; but positive effects expected
Southern Highlands	Outstanding sceneries with old settlements and historical heritage; desertification of villages, overgrazing and hunting by Bedouins; tourism pressure on land	Shawbak Petra Dara	Sharp increase of visitors	Petra reception capacity is already crowded; uncontrolled land use, scarcity of resources; capacity of treatment; social change; traffic related nuisances
Northern steppe	Cropland and pasture	none	none	none

Table 6.3.4 Expected Future Trends and Environmental Issues According to Natural Areas Units (continued)

	Environmental quality and problems	Existing tourism sites, and development plans/projects	Tourism trends in future	Expected general impacts
Southern steppe	cropland and pasture	none	none	none
Burqu Hammada/ Badia Plateau	Overgrazing is the major problem	None, but project of biosphere reserve; Badia development project	Limited increase	Could be beneficial for development of the desert
Azraq oasis	Wildlife, and important passage of migrating waterfowl; Ramsar site; ecological disaster due to overpumping of water for Amman supply; actually under rehabilitation	Azraq oasis desert castles	Moderate increase of visitors;	Impact will be positive since tourism development is interlinked with rehabilitation of the site
Bayir Hammada	Arid desert with Bedouins pastoralism	none	none	none
Hisma	Landscape and wildlife value; illegal hunting; loss of wildlife species; litter; graffiting; surface scaring by vehicles; growth of village and social change; litter; degradation of landscape	Wadi Ram	sharp increase of visitors	Severe new pressure on already degraded area, leading to loss of the tourism resource if no action is taken; scarcity of water resources
Gulf of Aqaba	Landscape value; high diversity and endemism of marine wildlife; conflicting uses of land; high pressure on marine life	Aqaba	sharp increase of visitors;	Pressure on marine environment, water resources, and landscape; increased risks of environmental degradation

6.4 Areas of Natural Interest

6.4.1 Method of Evaluation and Objectives

This geographical analysis consists of a review of areas that are important for wildlife and biodiversity resources, natural habitats, and landscape resources. Such areas are those for nature tourism potential from the viewpoint of their environmental resources exclusively. The analysis provides a first step approach in the evaluation of priority action areas, which is performed later.

Areas of natural interest are defined according to:

- Areas of ecological importance;
- Areas with environmental uniqueness (Figure 6.4.1).

6.4.2 Areas of Ecological Importance

Areas of ecological importance are determined by the presence of at least one nature reserve and a rich birds population area, or a nature reserve and a rich mammals population area, or a rich birds and mammals populations area all together. The relevance of nature reserves and wildlife importance should however be considered.

In the case of mammals fauna, the area is considered as ecologically important in presence of a threatened/endemic fauna. However, the evaluation of important mammals areas remains relatively imprecise. Table 6.4.1 provides a description of each area according to factors of ecological importance.

6.4.3 Areas with Environmental Uniqueness

(1) Uniqueness of the Highlands Wadi

Wadis are geomorphological forms that might designate very wide valleys like the rift Wadi Araba, deep incisions in the plateau or mountains, as well as small water courses in the arid and semi-arid desert. The wadis of the highland areas have absolutely unique features because of their geographical situation:

- They are deeply incised, and connect different climatic and physiographic areas, from the Jordan rift valley on west toward the high plateau on east;
- They concentrate, within a very compact geographical space, a succession of natural habitats, which provide a unique biodiversity, including endemic species, from elevation below sea level to elevations sometimes higher than 1,000 m;
- The habitat has been relatively well protected because of the isolation between the usual north-south communication axes (King's way in the east, and the Rift Valley in the west); and