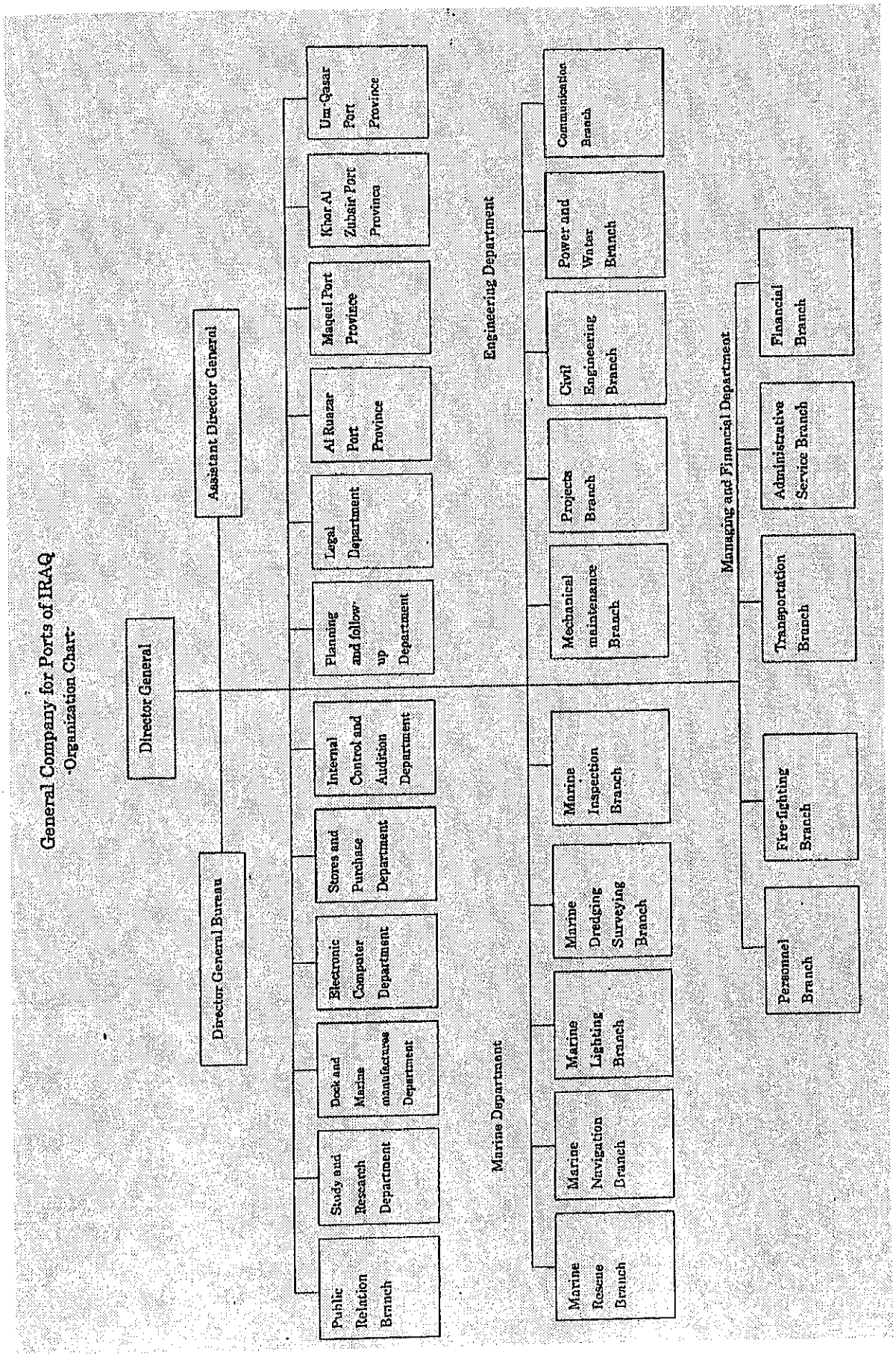


Figure 5.1.2 (6) Organization of GCPI

Figure 5.1.2 (7) Significant Implementation Program of Urgent and Short Term Projects

Prospective Projects Name	Priority	2004	2005	2006	2007- 09
1 Port Sector 1.1 Supply equipment spare parts	Urgent				
1.2 Channel Restoration between Um Qasr and Khor Al Zubair					
Phase 1 1) Site survey basic design 2) Dredging works	Urgent				
Phase 2 1) Basic design 2) Dredging, removal wrecks 3) Training of employees	Short Term				
1.3 Port development study (M/P) 1) TOR finalize with GCPI. 2) Study in field	Study				
1.4 Short /Middle Term Projects. 1) Requests from GOI 2) Detailed design 3) Construction	Short Middle term				
2. Air Port Sector					
2.1 Supply instruments for air freight assistance 、 landing guide 1) Request from GOI 2) Basic design 3) Supply Installation works 4) Training of employees	Short term				
2.2 Air port development study 1) TOR finalize with MOT 2) Study in field	Study				

Table 5.1.4 (1) Conditions of Navigation Aids to all Ports

Sl. No.	Name of Port	Kinds of Sailing Signs	Extra Floating Vessels	Prices
1	Um Qasr	Hardened Plastic on floating vessels work on Eyala's system, (5) whole units of buoys (3 meter in diameter)	8 units/Eyala's system	According to offers
2	Kur Zubair	20 whole units buoys required repairs with lightning and fixing sinker, 3 meter in diameter of buoy, Eyala's system	5 units/hardened plastic	
3	Al Bakr	18 whole units, hardened plastic, Eyala's system, 3.5 meter in diameter	1 cardinal entry, 2 greef	
4	Al Ameeq	15 whole units, hardened plastic, Eyala's system, 3.5 meter in diameter	1 cardinal entry	
5	Al Fao	30 whole units, hardened plastic, 3	15 lighthouses	
6	Al Maqal			
7	Abu Flous (Al Nasr Port)			
8	Abi Alkahaseeb			

Source: Marine Affairs Department under the General Company of Ports of Iraq

(Navigation Facility Control Department)

Note: Whole units means that this floating vessels (navigation buoys) is fully equipped with lightening and fixing tools sinkers.

Table 5.1.4 (2) Um Qasr Port Facilities as of 2001

Wharf Facilities of Um Qasr Port for the year 2001

Berth No.	Purpose /	Capacity	Dimension (m)	Cargo Handling	Depth(m) along Berth	Sink Objects	Equipment available	Quntity
1	General Cargo	250,000	285x25	3x8 ton	10		Container Cranes 40 ton	4
2	General Cargo	250,000	200x25	2x3 ton	10		Container crane	2
3	Sulf Export	1,500,000	200x25	Belt	10		Lifter Crane	61
4	Sulf Export	1,500,000	200x25	Belt	10		Forklift 40 ton	2
5		500,000	250x40	2x40 t/hr	9		Forklift 10 ton	2
6	Various Cargo	250,000	185x25	2x15 ton, 4x 3ton	9		Forklift 7 ton	4
7	Various Cargo	250,000	185x25	2x8 t, 1x15 t, 3x3 ton	9		Fire Rescue cars	2
8	Various Cargo	250,000	185x25	1x8 t, 1x5 t, 4x3 t	8		Ambulance cars	1
9	Various Cargo	250,000	168x25		7	Lightenning Vessel (Buoys)	Mafeez Heads (Truck head)	5
10	Seeds	2,000,000	280x30		11		Seed Suckers	6
11	Vegetable oil	500,000			9		Portable Cable Lift	6
12	Various Cargo	250,000	188x25	1x8t, 1x15 t, 2x3 t	7		Container Yard crane	2
13	Various Cargo	250,000	200x25	1x8t, 1x15 t, 3x3 t	7	Anchor		
14	Various Cargo	250,000	200x25	1x15 t, 2x3 t, 1x8 t	5			
15	Various Cargo	250,000	200x25	1x15 t, 3x3 t		Alsorrah/Shark , 2 Tug boats		
16	Various Cargo	250,000	240x25	1x8t, 1x15 t, 2x3 t	9			
17	Various Cargo	250,000	200x25	1x8t, 1x15 t, 2x3 t	9	Korean dredger		
18	Various Cargo	250,000	200x25	1x8t, 1x15 t, 2x3 t		Alnaffa base, Oil Tanker		
19	Various Cargo	250,000	210x25	2x8t, 1x15 t, 1x3 t	10			
20		500,000	180x25	2x40 ton	10			
21	Roll-Roll		200x25	Passengers Wharf	10			

Table 5.1.4 (3) Sheds and Yards of Um Qasr Port and Al Nasr Port

Shed and Storage Facilities of Um Qasr Port

Old Port

No Berth	Shed No	Shed Dimension (m)	Shed Capacity	Store No	Store Dimension(m)	Store Capacity (ton)	Yard No.	Yard Dimension (m)	Yard Capacity (ton)
1	Nothing	Nothing	Nothing	2	120x36	18,144	2	120x100 / 173x120	25,200 to 42,840
10	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing
11	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing
2	1	35x98	4,733 ton	1	145x35	10,657	1	132x58	16,078
3	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing
4	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing
5									
6	1	33x135	9,355 ton	1	150x33	10,476	1	165x93	32,224
7	1	33x135	9,355 ton	1	150x33	10,476	1	175x93	34,177
8	1	33x135	9,355 ton	1	150x33	10,476	1	170x93	33,210
9	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing

New Port

12	1	140x33	9,702 ton	1	170x33	11,781	1	170x80	28,560
13	1	140x33	9,703 ton	1	170x33	11,781	1	170x80	28,560
14	1	140x33	9,704 ton	1	170x33	11,781	1	170x80	28,560
15	1	140x33	9,705 ton	1	170x33	11,781	1	170x80	28,560
16	1	140x33	9,706 ton	1	170x33	11,781	1	170x80	28,560
17	1	140x33	9,707 ton	1	170x33	11,781	1	170x80	28,560
18	1	140x33	9,708 ton	1	170x33	11,781	1	170x80	28,560
19	1	140x33	9,709 ton	1	170x33	11,781	1	170x80	28,560
20	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing
21	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing

Al Nasr Port Facility

No Berth	Storing Purpose	Capacity (x1000Ton)	Dimension (m)	Lift &Capacit	Remarks
1	Various Cargo	250	198x18	5x2 ton	1 lift good /1lift
2	Various Cargo	250	198x18	5x3 ton	1lift good / 1 lift damaged
3	Various Cargo	250	198x18	5x2 ton	2 lifts damaged

Table 5.1.4 (4) Port Facilities of Khor Al Zubair Port as of 2001

Wharf Facilities of Khur Al Zubair Port for the Year 2001

Berth No.	Purpose/Cargo	Capacity	Dimension (m)	Cargo	Depth(m) along Berth	Wreck	Equipment Available	Quntity
1	General Cargo	100,000	100x30	Nothing	7	Military boat	Forklift 3 ton	2
2	General Cargo	250,000	180x30	4x8 ton	4		Forklift 5-7ton	3
3	General Cargo	250,000	180x30	4x8 ton	4		Cable lift 6-10 ton	6
4	General Cargo	250,000	180x30	4x8 ton	4	Al Baheth Vessel	Cable lift 30 ton & more	1
5	Phosphets & Fertilizer export	350,000	250x30	1x600 t/hr	4	Korean Banton	Trucks	2
6	Phosphets & Fertilizer export	350,000	250x30	2x300 t/hr	8		Field Trucks	6
7	Phosphets & Fertilizer export	350,000	250x30	1x150 t/hr 2x 150t/hr	5		Basin Cars	2
8	Phetrochemicals Export	250,000	250x30	2x5 ton	7		Rescue Cars	1
9	Phetrochemicals Export	250,000	250x30	2x6 ton, 15 x 2 ton, 10 x 2 ton		Sink facing wharf	Dumps Car	1
10	Iron Scrap	250,000	240x24	2x15 ton	5	Damaged in		
11	Iron Raw Materials	450,000	320x26	2x1500 t/hr, 1x1500 t/hr	7	Petrol base		

Table 5.1.4 (5) Sheds and Warehouse of Khor Al Zubair Port

Shed and Storage Facilities of Khur Al Zubair Port

Facility	Number	Storing Purpose	Capacity (x 1000 ton)	Dimension (m)	Remarks
Store	1	Fertilizer of Urea Store	48	300x50	Not Suitable for storing
Store	2	Fertilizer of Urea Store	48	300x50	Not Suitable for storing
Store	3	Phosphate Store	85	500x50	Suitable for storing
Store	4	Phosphate Store	85	500x50	Suitable for storing
Store	5	Phosphate Store	85	500x50	Suitable for storing
Store	1	Petrochemicals Store	11,000 tons bags, 4,000 tons barells	180x35	Suitable for storing
Store	2	Petrochemicals Store	11,000 tons bags, 4,000 tons barells	180x35	Suitable for storing
Store	3	General Goods Store	25	120x35	Suitable for storing
Store	4	General Goods Store	25	120x35	Suitable for storing
Store	5	General Goods Store	25	120x35	Suitable for storing
Shed	2	General Goods Store	Used temporary for storage	180x35	Suitable for storing
Shed	1	General Goods Store	Used temporary for storage	180x35	Suitable for storing
Store Yards	1			19,631 m2	Suitable for storing
Store Yards	2			64,600 m2	Suitable for storing
Store Yards	3			22,000 m2	Suitable for storing
Store Yards	4			70,100 m2	Suitable for storing
Store Yards	5			2,619 m2	Suitable for storing
Store Yards	6			14,000 m2	Suitable for storing
Store Yards	7			4,800 m2	Suitable /with slopes

Table 5.1.4 (6) Port Facilities of Maqal Port as of 2001

Wharf Facilities of Khur Al Zubair Port for the year 2001

Berth No.	Purpose/Cargo	Capacity (ton)/Year	Dimension (m)	Cargo Handling Lift Capacity (ton)	Depth(m) along Berth
1	Various Cargo	250,000	204x25	1x15 t, 1x8 t, 2x3 t	2.6
2	Construction Material	250,000	125x15	1x8 t, 1x5 t	3.5
6	Various Cargo	250,000	168x25	1x15 t, 1x3 t, 3x8 t	5.4
7	Various Cargo	250,000	134x25	1x15 t, 1x8 t, 1x3 t	6.3
8	Various Cargo	250,000	180x25	4x8 t, 1x3 t	5.8
9	Various Cargo	250,000	144x25	2x15 t, 2x3 t	5.9
10	Various Cargo	250,000	180x25	1x8 t, 2x5 t	6.8
11	Various Cargo	250,000	180x25	1x15 t, 2x8 t, 1x3 t	6
12	Various Cargo	250,000	152x25	1x3 t, 2x8 t	6
13	Various Cargo	250,000	137x25	1x8 t, 2x3 t	9.5
Al Janaeb	Construction Material	250,000	505x25	2x5 t, 3x4 t	

Table 5.1.4 (7) Shed and Yards of the Al Maqal Port

Shed and Storage Facilities of Al Maqal Port (Basrah)

Location	Wharf No	Qty of Shed	Area (m2)	Shed Capacity (x 1000 ton)	Stores	Area (m2)	Store Capacity	Remarks
Al Maqal Port	Dangerous Material	Nothing	Nothing	Nothing	2	1,785/850	3,200 / 1,600	
Al Maqal Port	1	1	3,740	10,860	2	5,642/1,956	16,500 /5,508	
Al Maqal Port	2	Nothing	Nothing	Nothing	2	2,736/990	8,100/2,874	
Al Maqal Port	6	1	3,344	9,660	3	1,242/1,080/621	3,168 /1,800 / 3,600	
Al Maqal Port	7	1	2,706	7,800	1	1,638	4,842	Suitable for storing
Al Maqal Port	8	1	2,944	8,712	1	2,700	8,004	Suitable for storing
Al Maqal Port	9	1	1,908	5,532	1	3,198	9,234	Suitable for storing
Al Maqal Port	10	1	2,394	6,990	1	1,656	2,872	Suitable for storing
Al Maqal Port	11	1	2,700	7,803	1	2,205	6,489	
Al Maqal Port	12	1	4,726	138,181	1	4,059	12,021	
Al Maqal Port	13	Nothing	Nothing	Nothing		Nothing	Nothing	Suitable for storing

5.2 Road, Railway and Urban Transport Sectors

5.2.1 Highways, Roads and Bridges

(1) Current Situation and the Problems

Most of Iraq's 40,690 km road network was developed during the 1970s and 1980s. The road type is categorized into 5 ranks including an expressway system of 1,061

km connecting Basrah in the south with the Jordanian border in the west via Baghdad. An Iraqi road network map is shown in Figure 5.2.1. Roads accommodate 70 percent of all traffic volume in Iraq and the expressway network accounts for 30 percent of the road traffic. The present condition of the road network is shown in Table 5.2.1. Approximately 85 percent of the overall network is paved. Most of the unpaved network consists of secondary and village roads.

Table 5.2.1 Roads, Length, and Condition

Classification		Length (km)	Condition of Roads (%)		
			Good	Fair	Poor
Expressway	- Grade separation - Six lane with divider	1,061	50	40	10
Primary Roads	- Four lane mainly - Linking Baghdad with each state capital.	10,917	30	65	5
Secondary Roads	- Linking state capitals with local cities.	14,193	20	70	10
Rural Roads	- Connecting with secondary roads.	3,704	10	30	60
Military/Border Roads	- Logistics for border guards.	10,815	-	-	-
Total:		40,690			

Source: IRAQ United Nations/World Bank Joint Needs Assessment

The existing roads have a significant lack of maintenance because there has been limited maintenance budget, consistent overloading of freight trucks, and excessive use by heavy military vehicles. The expressway and part of the primary road network could support loads of 16.3 tons per axle. However, prevailing permissible load limits are 13.2 tons per axle due to little or no maintenance for several years. These roads are at the end of their design lives because of pavement deterioration, increasing roughness, and damage to structures.

The topography of Iraq, with two major river systems along which most cities are located, makes bridges a vital part of the road network. There are 1,156 bridges throughout the country, and they are classified as follows.

Main	- More than 180 meters in length. - Spanning rivers or tributaries.
Secondary	- Less than 180 meters in length. - Built over tributaries or interchanges.

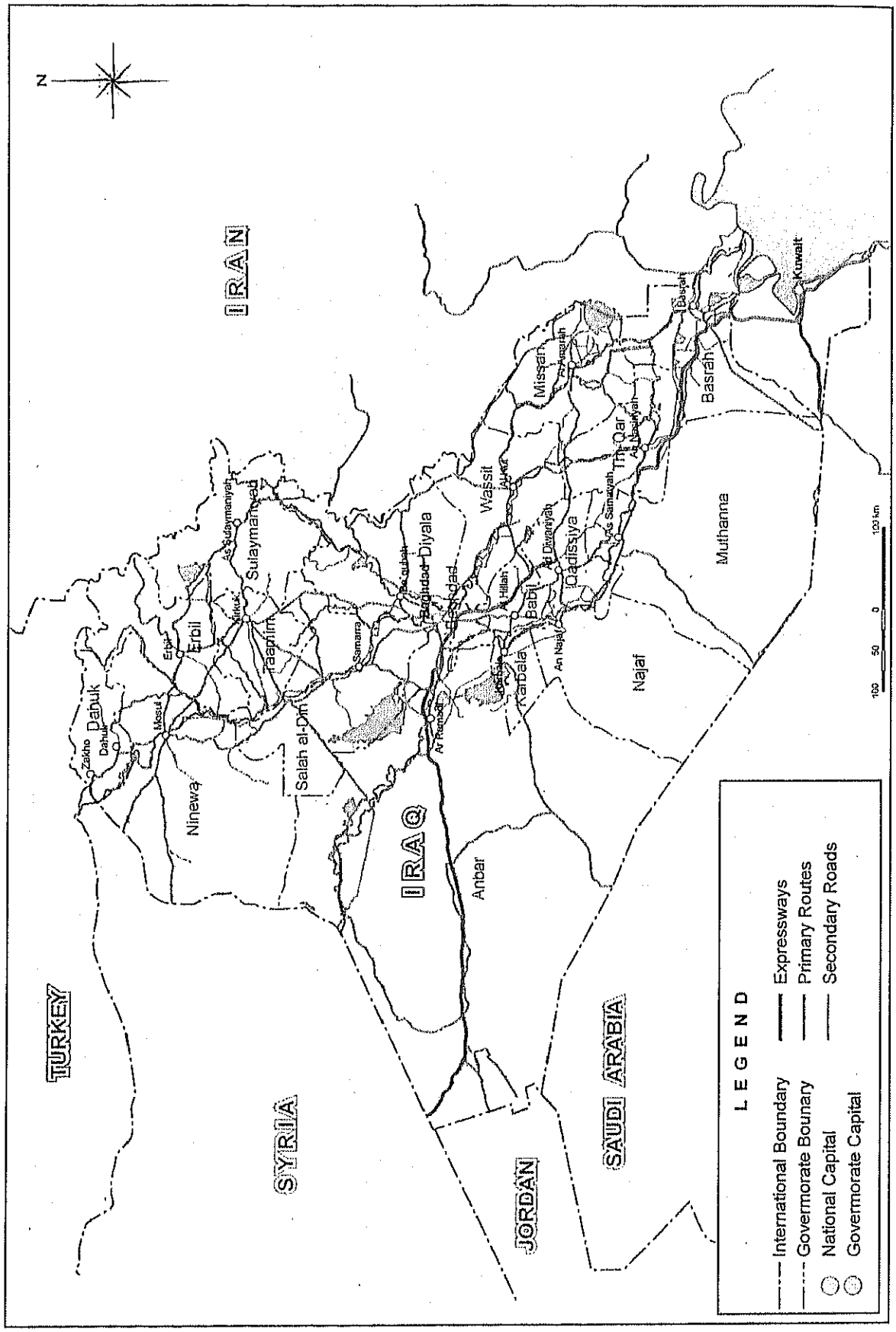


Figure 5.2.1 Iraqi Road Network Map

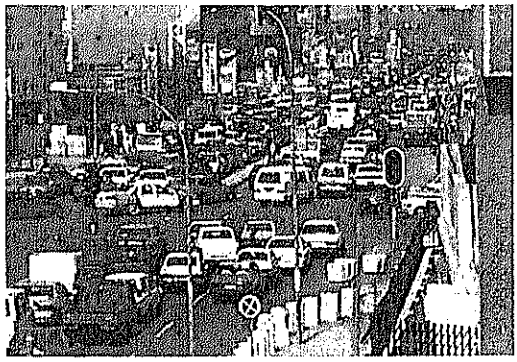
As a result of the first Gulf War, many bridges were damaged. Following the economic sanctions, most rehabilitative works were stopped and only maintenance activities undertaken. Consequently, of the 148 main bridges and 1,008 secondary bridges, most are in fair to poor condition. In addition, a number of key crossings are missing.

After the Iraq War, the UN conducted a damaged bridges survey and the result is on the web site of the United Nations Joint Logistics Centre (refer to Figure 5.2.2). According to the result, 38 bridges on the truck route are listed in the category of bridges which need any rehabilitation. They are classified as "Destroyed beyond repair" (7 bridges), "Partially destroyed needing major repair" (12 bridges), "Damaged needing repair" (17 bridges), "Deteriorating" (1 bridge), and "Unknown" (1 bridge). According to the Ministry of Housing & Construction, the UNJLC's data is almost realistic though there are a few misunderstandings.

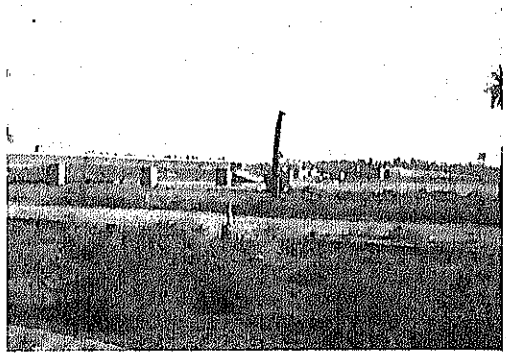
There is some information that some of these damaged bridges have already been rehabilitated using the Iraqi government fund, however, the detail is unknown.

The above deteriorating condition of Iraqi roads and bridges has contributed to an increase in road accidents. Other factors include: (i) an aging vehicle fleet; (ii) a lack of signage and traffic furniture; and (iii) poor driver behavior. Nearly 70 percent of all accidents occur within cities, and the vast majority of accidents outside municipal limits occur on two-lane roads. Enforcement of traffic laws and installation of dividers for dangerous sections of the road system are needed.

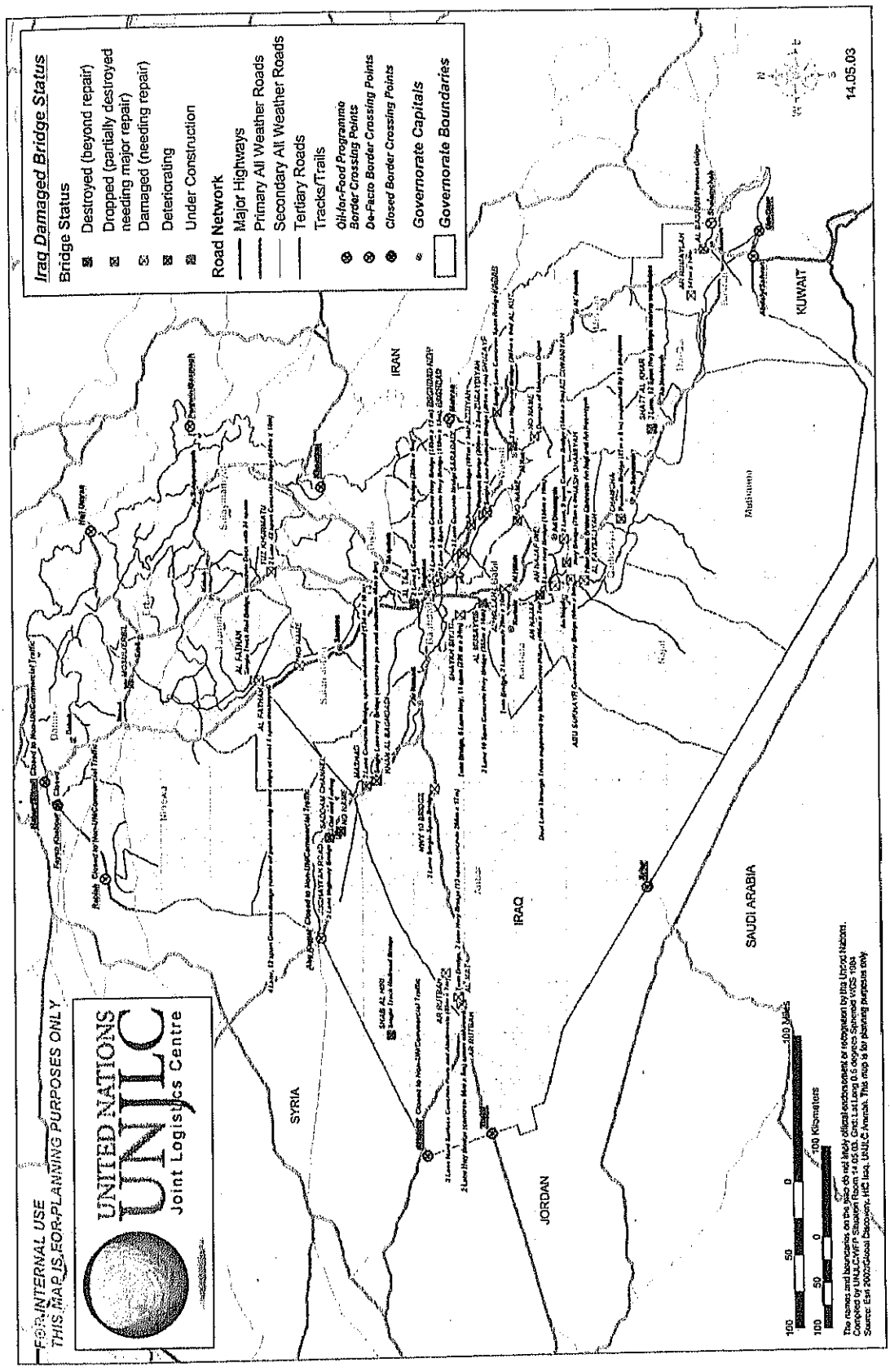
Iraq has one of the lowest vehicle ownership rates in the region, with approximately 55 vehicles per thousand inhabitants. But, in the future, with demand that has been suppressed for a number of years, it is expected that the size of Iraq's vehicle fleet will increase remarkably. It was reported that since May 2003, more than 100,000 used vehicles have been imported to Iraq. Additional road capacity in major urban areas may be necessary.



Traffic jam in Baghdad



Fallen bridge in Basrah



Source: UNJLC (United Nations Joint Logistics Centre)

Figure 5.2.2 Iraq Damaged Bridge Status

(2) Activity of Other Donors and NGOs

USAID is now conducting a bridge rehabilitation program for three bridges on the trunk road. Al Mat Bridge, one of the three bridges, was opened on 10th February, 2004 and the other two were to open in March, 2004.

Bridge	Site	Note
Khariz Bridge	Between Mosul and Arbil	Pair of dual-lane bridges
Al Mat Bridge	Around Ar Rutbah	Pair of dual-lane bridges
Tikrit Bridge	On the Kirkuk road	Two-lane bridge

USAID has committed to invest a total of 240 million USD in the rehabilitation program for roads and bridges in 2004 and 2005. Table 5.2.2 shows the detailed investment plan.

Table 5.2.2 USAID Investment Plan for Roads and Bridges in 2004-2005

(Unit: $ million)

No.	Title	Estimated Cost
1	Dora-Yousifia Freeway (84 km)	76.7
2	Construct Village Roads (800 km)	42.0
3	Al Sharqat Bridge and Approaches	12.3
4	Kufa Third Bridge	8.7
5	Qandil Bridge	2.3
6	2nd Carriageway: Diwaniyah – Samawah	10.0
7	Sheik Sa'ad Bridge	13.3
8	Hillah-Keesh Freeway (13 km)	8.0
9	2nd Carriageway: Baghdad – Kirkuk	36.0
10	Zuba Oilfield Bridge	0.7
11	2nd Carriageway: Amarah – Maymunna	3.3
12	Dair Bridge	16.7
	Total	240.0

No other detailed assistance programs by other organizations have been found out up to now.

(3) Reconstruction Plan of Iraqi Government

United Nations and the World Bank made a Joint Needs Assessment in October 2003. Table 5.2.3 shows the priority needs and funding requirements for roads and bridges found by them.

Table 5.2.3 Road and Bridges – Priority Needs Budget (US$ million)

	2004	2005-2007
Gross Expenditure		
Asset Maintenance (Roads and Bridges Routine and Periodic Maintenance)	**70.24**	**288.07**
Rehabilitation/Reconstruction (Required to Bring Sector Back to March 2003 Level)	**7.00**	**10.00**
Investment (Base Case)	**80.70**	**578.80**
Total Expenditures	**157.94**	**876.87**
Investment Requirements (Base Case)		
Priority 1		
- Equipment and Technical Assistance to Develop a Road and Bridge Management System	0.50	1.50
- Road and Expressway Master Plan; Prepare SCRB Restructuring (Highway Authority)	0.50	1.50
- Replacement of 4 Floating Bridges	3.50	3.50
- Completion of Expressway No.1 (About 150 km)	30.00	189.00
- Road Rehabilitation Program (100 km Expressway, 750 km Primary Roads, 650 km Secondary Roads, and 250 km Village Roads)	29.05	178.45
Total Priority 1 Capital Costs	**63.55**	**373.95**
Priority 2		
- Replacement of 5 Floating Bridges	0.00	18.00
- Rehabilitation of 10 Bridges	5.40	12.60
- Construction of New Links to Expressway No.1	5.00	45.00
- Dualization of Selected Primary Roads (A Program of About 400 km)	3.00	67.00
- Village Roads (400 km New Village Roads)	3.75	26.25
Total Priority 2 Capital Costs	**17.15**	**168.85**
Priority 3		
- Urban Freeways, Bypasses and Ring Roads in Major Urban Areas	**0.00**	**36.00**
Total Investment Requirements (Base Case)	**80.70**	**578.80**
Additional Investment Requirements (High Case)		
- Construction of New Links to Improve Network Connection (About 250 km of Primary and Secondary Roads)	3.00	122.00
- Construction of 12 New Bridges	0.00	25.00
Total Additional Investment Requirements (High Case)	**3.00**	**147.00**

Source : IRAQ United Nations/World Bank Joint Needs Assessment

Based on the information from the Ministry of Housing and Construction, the Iraqi Government plans to implement 14 road and bridge projects as shown in Table 5.2.4 in 2004 from their own budget.

Table 5.2.4 (Investment or Reconstruction) Projects

New Project of 2004 Projects funded by Ministry of Finance

No.	Project Name	Length (km)	Governorate
1	Floating Bridges replacement construction of 6 permanent		Several
2	Second carriageway of expressway No. 1 (Dywania – Samawa – Nasiria	146	Several
3	Fathah bridge		Salah Al Deen
4	Falluja Third bridge		Al Anbar
5	Expressway No. 1 R/10 Rutba bridge		Al Anbar
6	Al Faiha'a bridge in Hilla		Babil
7	Al Musayyib bridge		Babil
8	Reconstruction of Abbasiat second bridge		Najaf
9	Kiffel bridge		Najaf
10	Suwaira bridge		Wasit
11	Al Hafar bridge		Dywaniya
12	Construction of two permanent bridges in Amara and Qala'at Salih		Missan
13	Reconstruction of Navigation bridge on Shat Al Basrsa		Basrsa
14	Reconstruction of Qarna bridge (second carriageway)		Basrsa

(4) Organization of the Execution Agency

The State Commission for Roads and Bridges (SCRB), which is a Department within the Ministry of Housing and Construction (MOHC), is responsible for all national roads and bridges, including segments of the expressway network located within municipal limits. Table 5.2.5 shows the outline of the SCRB and Figure 3 shows the organization chart of the MOHC. Much of the work is contracted out to state-owned construction companies, including two prominent ones. The involvement of private sector firms has been limited to some highway design and construction activities that require specialized expertise. Although staff at SCRB have effectively carried out their functions, economic sanctions have prevented them from keeping pace with technological advances, and the migration of qualified staff to other countries has reduced their capacity.

Table 5.2.5 Outline of SCRB

Office	Main Office - Baghdad Branch Offices – 18 Governorates (including the northern Governorates)
Staff	Total 1,307 staff (including 217 engineers) 25% of staff located at Baghdad main office
Activities	- Supervision - Road Maintenance - Emergency Works (SCRB has the equipment)

Policy formulation and planning are centralized at the Ministry of Planning (MOP), while the SCRB and other entities in the sector act more as implementing agencies. A master plan of the road network for nationwide and urban transport will be

required in the near future.

Government road laboratories and technical centers, which played a central role in controlling the quality of road construction and maintenance activities throughout the country have been decimated by looting, and all equipment and supplies have been stolen. While there are one or two private sector laboratories in Baghdad, they cannot replace the lost capacity of the country's central and regional road laboratories.

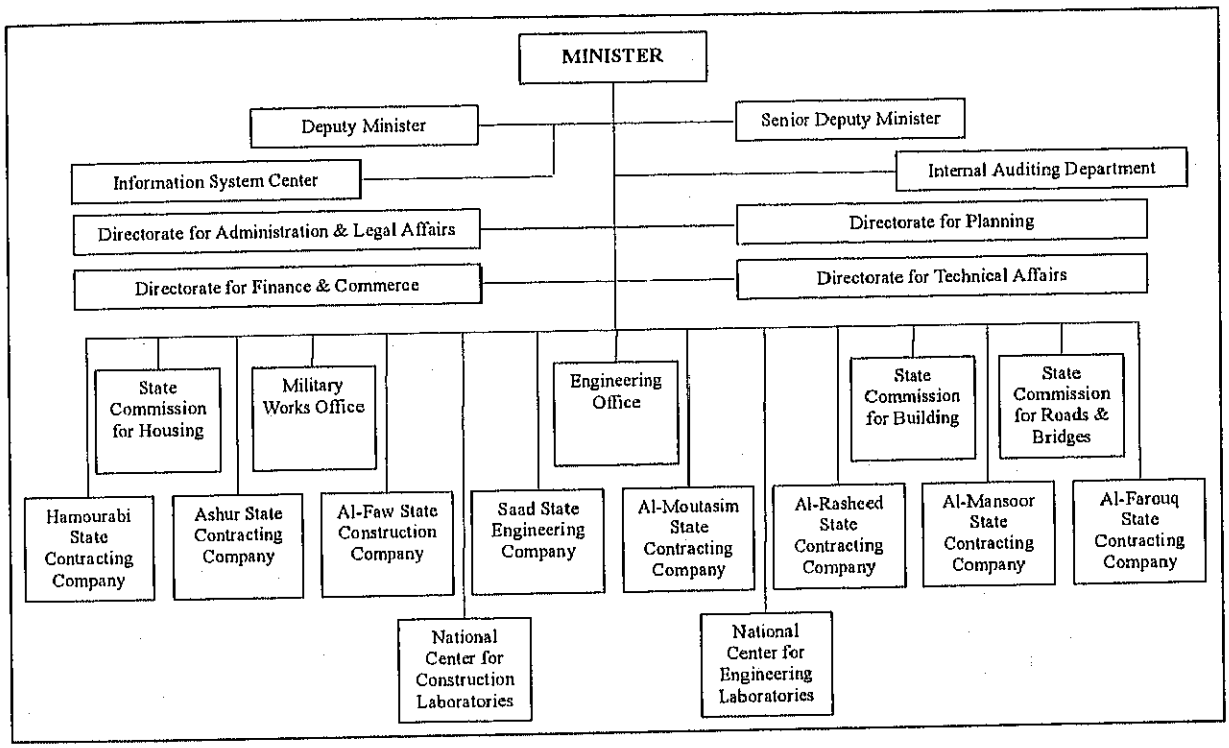


Figure 5.2.3 MOHC Organization Chart

There are 18 Governorates, including Baghdad, and each Governorate is responsible for its inner city roads. Baghdad Governorate is overwhelmingly huge compared with the others and is treated as the same level as the Central Government. The northern three Governorates comprise the Self-Government of the Kurds.

Figure 5.2.4 shows the Organization Chart of Basrah Governorate.

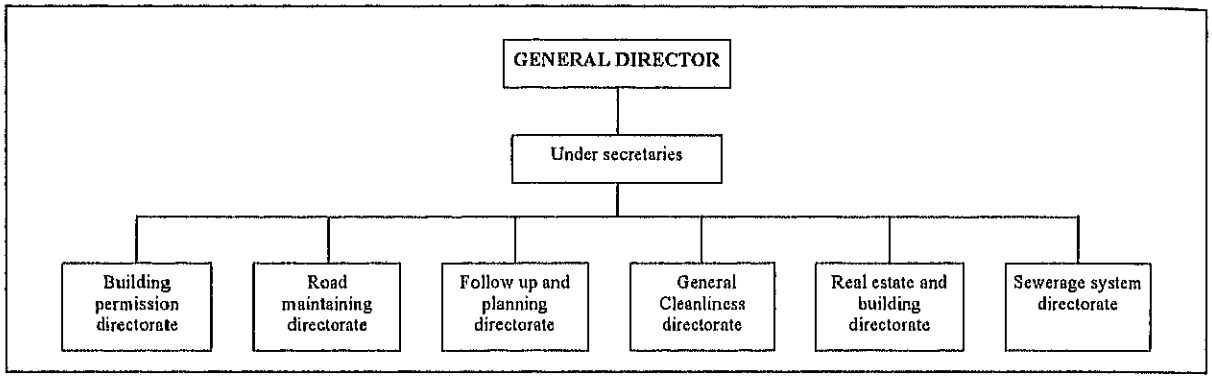


Figure 5.2.4 Basrah Governorate Organization Chart

(5) Proposed Projects for an Urgent Iraqi Reconstruction Program

The Ministry of Housing and Construction made a request to Japan for the implementation of the seven projects shown below with the priority order.

1. Construction of Al Samawa Bridge
2. Rehabilitation of Shindbad Bridge in Basrah
3. Rehabilitation of Shatt Al-Basrah Bridge on Expressway No.1
4. Construction of Al Mussayib Bridge
5. Construction of Dair Bridge near Basrah
6. Construction of Second Kut Bridge
7. Construction of Expressway No.2

Figure 5.2.5 shows these seven project sites.

The Ministry of Housing and Construction has also made a request to Japan for the Construction Equipment Center Projects. Outline of these eight projects are shown in Annex (Potential Project List, Project Sheet).

The Minister of Housing and Construction strongly requested the early implementation of the highest priority project; the Construction of Al Samawa Bridge.

The Iraqi Government mainly requested that Japan undertakes new infrastructure construction projects and not rehabilitation of existing infrastructure, while the result of the People's Needs Survey shows that the Iraqi people desire the

rehabilitation of inner city roads which they frequently use.

The criteria for the selection of a project for the Urgent Infrastructure Rehabilitation Program are set as below:

1) So called "Face to Face Cooperation" so local people can easily get its benefit.
2) A project with obvious needs which does not require F/S.
3) A project for which the construction period is relatively short.
4) A project which doesn't need highly specialized techniques, both in design and construction, where it is easy to keep good quality without a long assignment for a Japanese expert.

Based on these criteria, five projects were selected as projects for the Urgent Infrastructure Rehabilitation Program.

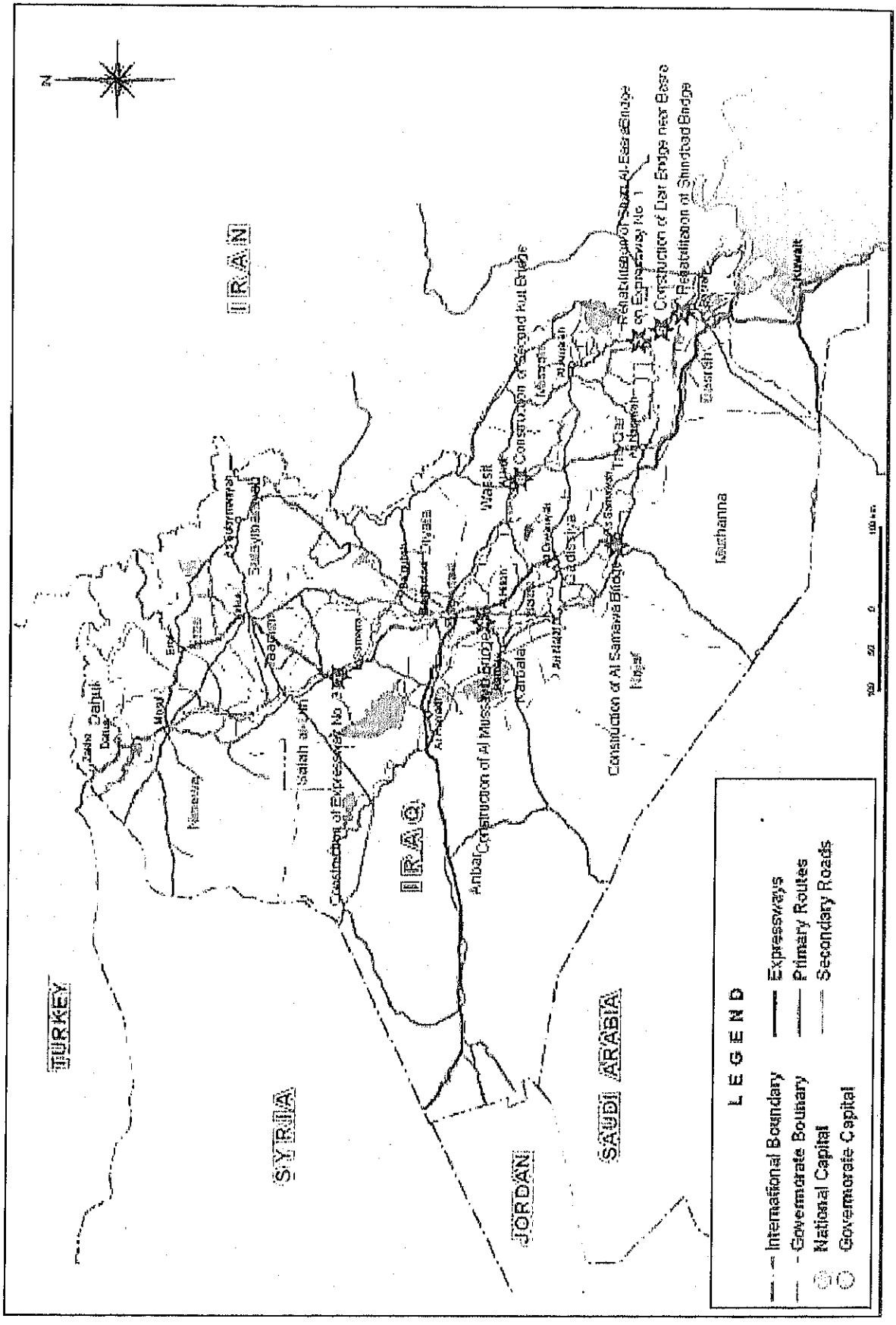


Figure 5.2.5 Project Site Expected to Implement with Japanese Assistance

(a) Construction of Al-Samawa Bridge in Samawa

This project was requested by the Ministry of Housing and Construction as the No.1 priority project. This bridge crosses the Euphrates River which segments Samawa city into northern and southern parts and was eagerly requested by the people in Samawa. The Ministry of Housing and Construction explained that the expectation of Japanese assistance is increasing in Samawa because of the stationing of the Japanese Self-Defence Army there. The planned bridge is 300 m long and 12 m wide with 2 lanes. The estimated construction cost is 900 million yen (Iraqi estimation).

(b) Rehabilitation of Khalid Bin Al-Waleed in Basrah

This project was requested by the Ministry of Housing and Construction as the No.3 priority project. This bridge is the only one that crosses Shatt Al Arab river in Basrah City. The span over the first three headwaters was completely destroyed in the First Gulf War in 1991. There is a temporary floating bridge with pontoons beside the main bridge but for some hours every day, this floating bridge is closed because of the movement of the tide level. Early rehabilitation of the main bridge was eagerly requested by citizens in Samawa. The estimated cost is about 700 million yen.

(c) Improvement of Inner City Road and Channel in Southern 3 Cities

The aim of this project is to improve the city roads and their channels in the high density districts in Baghdad, Samawa and Basrah which have road and drainage systems in a bad condition. It is better to implement waterworks and sewage projects at the same time with this project.

This improvement project directly effects the local people's lives. There isn't any difficulty in design and construction from the viewpoint of technical aspects and the project period is relatively short.

(d) Construction of Construction Machine Center

This project is to construct the maintenance center for the construction machines of the Ministry of Housing and Construction, including the supply of the equipment and spare parts. There are considerable numbers of machines of the Ministry of Housing and Construction that don't work any more because of the lack of maintenance. Construction of this center and rehabilitation of these construction machines would make it possible for the Ministry of Housing and

Construction to rehabilitate and construct roads and bridges by themselves.

It is relatively easy to maintain security in the construction stage because access to the project site is limited.

(e) Master Plan Study for Integrated Transport in Iraq

It is difficult to implement the requested big projects like the construction of bypass roads, huge bridges and expressway No.2 because these big projects require verification of feasibility and priority. If the recovery of Iraq progresses smoothly, these big projects may be necessary from the national economic point of view.

It is necessary to carry out an integrated transport master plan study to achieve the implementation of prioritized road and bridge projects with certainty.

5.2.2 Railway

(1) Present Situation and Problems to be Solved

The railway network of Iraq consists of three major lines radiating from Baghdad, the capital, and one bypass line:

1) towards the southeast through Basrah to Umm Qasr, the most important port of the country located on the coast of the Arabian Sea,

2) towards the north to Rabiya, located on the border of Syria, linking with Turkey,

3) towards the west through Al Qaim, near the border of Syria to Akashat, where phosphate quarries are located, and

4) the bypass line from the northwest to the northeast from Haditha to Kirkuk.

The total length of the railway network is 2,456 km, including 1,905 km of the four lines of above, and 551 km of spur lines. Table 5.2.7 provides an outline of the railway lines, and figure 5.2.6 presents the location of the railways.

The railway lines from Baghdad to Umm Qasr and from Baghdad to Rabiya were constructed in the 1910s, and other lines were opened in the 1980s. All lines are

built at standard gauge and are not electrified.

Table 5.2.6 Railway Network of Iraq

Line	Length (km)	Number of Stations	Single/Double Track	Signaling System
Baghdad - Basrah - Umm Qasr	609	43	Single	Semi-automatic
Baghdad - Baiji - Mosul - Rabiya	524	20	Single	Manual
Baghdad - Ramadi - Al Qaim	376	24	Single/Double	Semi-automatic
Al Qaim - Akashat	144	6	Single	(Unconfirmed)
Kirkuk - Baiji - Haditha	252	14	Single	CTC
Subtotal (above 5 lines)	1,905	101	-	-
Branch Lines	551			
Total	**2,456**	**107**		

The infrastructure of the railway has been heavily damaged by the war and post-war looting. In particular, the signalling and telecommunication systems are mostly defunct. Facilities undamaged by the war are in poor condition due to difficulty of procurement of spare parts during the economic sanctions. Approximately half of the sections are heavily deteriorated, allowing a scheduled speed of no more than thirty kilometers per hour. The rolling stock fleet is also in poor condition. Only a few units are operable.

In the early 1990s, during the peak year, as much as 770 million passengers and 770 million tons of freight were transported by rail.

Prior to the war in 2003, thirty trains per day were operating. At present, as regular services, there are only one round trip train between Baghdad and Basrah , one round trip train between Baiji and Mosul, and one round trip train between Baghdad and Baiji.

Unconfirmed sources of information report that unscheduled trains, under speed restriction, operate between Baghdad and Umm Qasr, and Baghdad and stations near the borders of Syria. The line towards Kirkuk is interrupted at a bridge over the Euphrates, to the east of Saiji, which was destroyed by bombing during the recent war.

In April 2003, immediately after the declared end of the recent war, the Coalition Provisional Authority (CPA) and USAID started the reconstruction of the infrastructures, including the railways. The first task was to rapidly assess the

condition of the tracks, rolling stock and workshops, including the assessment of the capacity of the facilities and railway workers. The result of the assessment was that the damage to railway infrastructure and rolling stock was mainly due destruction brought about by the previous war, and the progression of deterioration of the facility during the economic sanctions following the previous war, and looting after the recent war, rather than by military attacks in the latest war.

Fifty (50) Chinese diesel locomotives, imported in 2002, are assumed to be the main traction of the train operation.

Construction works of additional tracks and new lines, such as double-tracking of the route from Umm Qasr through Baghdad to Rabiya (bordering Syria), were in progress just before the start of the recent war. The resumption of those suspended projects together with the reconstruction projects are also expected by the Iraqi people.

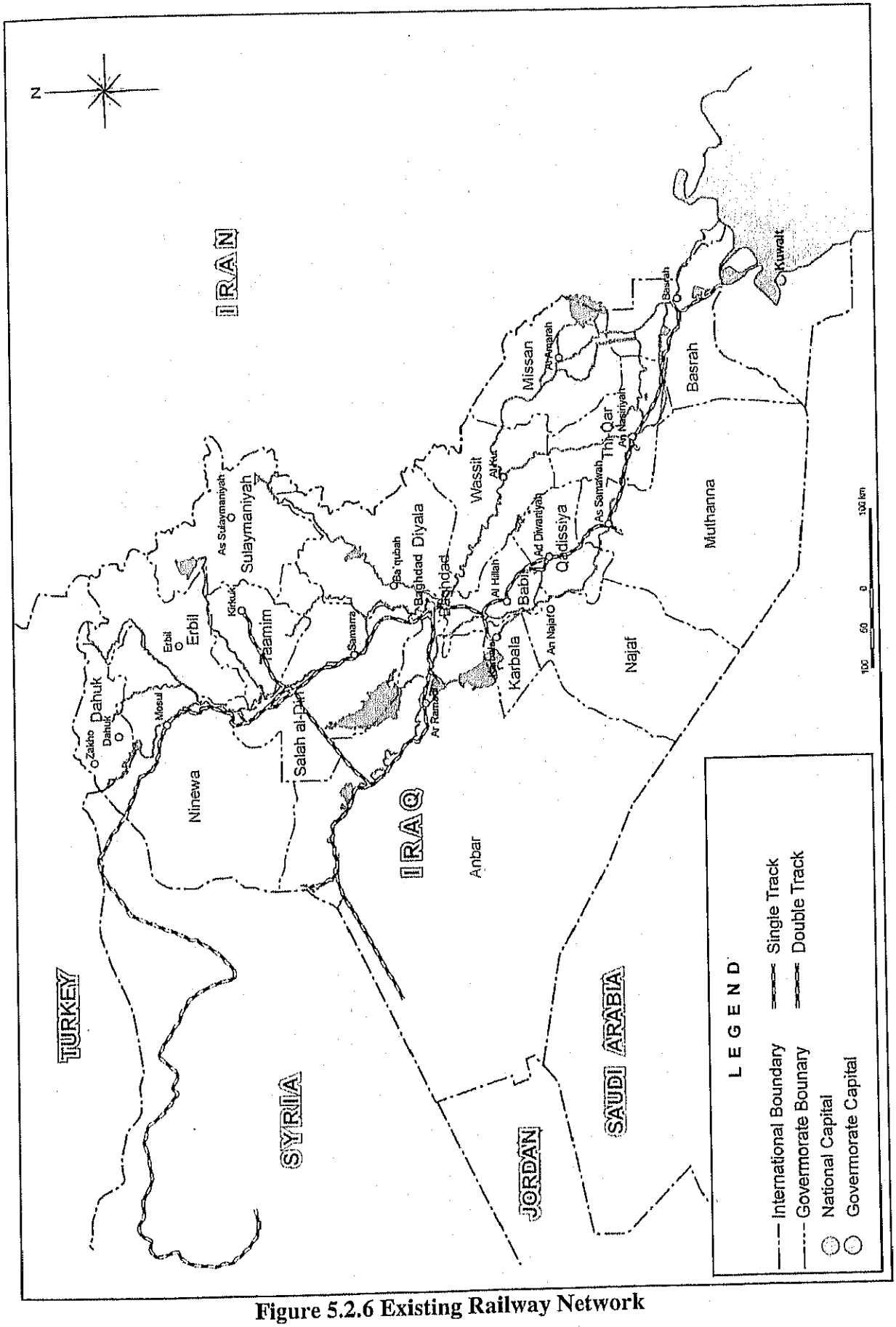


Figure 5.2.6 Existing Railway Network

The railway network of Iraq links Umm Qasr Port with the Baghdad Metropolitan Area. Umm Qasr Port is the only deep seaport leading to the Arabian Sea and is the gateway of the Country. The Baghdad Metropolitan area is the area where population and industries mostly concentrate. The railway network also connects to the western and northern areas which produce natural resources, and further lead to neighboring countries along the Mediterranean Sea and further into European countries. Thus, it plays an important role as a major transportation means across the country.

In particular, the railway has an advantage in transportation of containers, heavy goods, and bulk commodities. Since it has significant advantage in heavy goods, it is important that the railways are utilized for transportation to/from Umm Qasr Port for the reconstruction of Iraq.

The pre-war Iraq was economically affluent and had put priority on construction of a trunk road network including a six-lane expressway, and the development of the railway network was put at a relatively lower priority. However, the two Gulf wars and the economic sanctions between the two wars have heavily damaged the road as well as the railway. Not only the poor condition of the road infrastructure but also the lack of operable automobiles is serious. Transportation of goods necessary for the reconstruction cannot be borne by road transport alone. A transportation system that is inclined to roads includes problems of frequent occurrence: traffic accidents, damage caused by transportation of heavy goods, environmental deterioration along roads, etc.

Two great rivers, the Tigris and Euphrates, flow in from Turkey and Syria, penetrate the national land from the northwest area to the Arabian Sea. In the 1980s, five to seven percent of all freight in Iraq was carried along the rivers using barges and pushers. Several problems such as the construction of thirteen pontoon bridges, heavy siltation of the rivers, insufficient infrastructure and navigation signage, significantly decreased water level due to the construction of dams in Turkey, etc., have taken away the movement of freight along the main inland waterways. This has drastically reduced the volume of freight transport. Therefore, large volume long distance transportation of heavy goods, including marine containers, cannot be sufficiently borne by inland waterways. Railways are expected to take over that role. Even though the railway is heavily damaged, much of the facilities and rolling stock is thought to be repairable. The railways can be made use of for

transportation of long-haul and heavy goods accompanying reconstruction undertakings, with phased rehabilitation work on the railway. It is indispensable to make good use of the existing railway infrastructure, and rehabilitation, reconstruction, dredging, pier repairing, repairing of loading/unloading facilities, etc., of Umm Qasr Port and Khor Al Zubair Port must be carried out simultaneously.

The railway will play an important role in pressing ahead with the reconstruction of Iraq as well as its role in sustainable development of the Iraqi economy. Rehabilitation followed by strengthening and improvement of the railways is urgently required.

(2) Trend of Assistance of Other Donors / Programs of Reconstruction of Iraq Government

Immediately following the declared end of the recent war, an examination for reconstruction was carried out by the CPA (Coalition Provisional Authority) and other administrations. Concerning the transportation sector, in October 2003 the United Nations and the World Bank jointly worked out an execution plan ("Working Paper, Iraq United Nations/Word Bank Joint Needs Assessment, Transportation & Telecommunications, October 2003"). The plan consists of the urgent program to be carried out within 2004 and the program to be executed from 2005 to 2007.

The purpose of the first one year (2004) program is to bring the sector back to pre-war (March 2003) levels. The program after 2005 aims to reinforce and improve the facilities reinstated in 2004 for further development and growth of the Iraqi economy. The implementation of these programs should be executed based on an elaborate integrated transportation master plan.

The summary of the program is shown in the following table 5.2.8, each item requiring financial assistance.

Table 5.2.7 Railways - Priority Needs Budget (US$ million)

Items	2004年	2005 - 2007
Total expenditure	**145.00**	**588.50**
Asset maintenance	**8.00**	**30.00**
Track maintenance	4.00	17.00
Rolling stock maintenance	3.00	10.00
Station facility maintenance	1.00	3.00
Rehabilitation/Reconstruction (Required to bring sector back to March 2003 level)	**6.00**	**3.00**
Railway stations	2.00	
Rolling stock and maintenance equipment	3.00	3.00
Reconstruction of 2 damaged bridges (Al Datha Bridge near Baiji and Akashat)	1.00	
Investment amount (**Base case**)	**131.00**	**555.50**

Investment (Base Case) (US $ million)

Items	2004年	2005 - 2007
Total investment (Base case)	**131.00**	**555.50**
Priority 1	**58.00**	**127.50**
1. Railway reconstruction study	0.50	
2. Modernization of the railway training center	1.50	4.50
3. Construction of Baghdad Container Terminal including procurement of container loading/unloading equipment (fork-lift/crane)	4.00	6.00
4. Restoration and upgrading of the railway system	52.00	117.00
- Studies for reconstruction/repair/upgrading of track, rolling stock, signaling, and telecommunication systems	*1.00*	*3.00*
- Reconstruction of Baghdad Central Station and all station buildings	*7.00*	*13.00*
- Overhauling of rolling stock (Locomotives, coaches and wagons)	*10.00*	*30.00*
- Reinstatement of signaling and line blocking system between Baghdad - Basrah - Umm Qasr	*10.00*	*20.00*
- Reinstatement of signaling and token-less radio blocking system between: (a) Baghdad - Mosul - Rabiya; (b) Baghdad - Al Qaim - Akashat; (c) Kirkuk - Baiji - Haditha	*17.00*	*33.00*
- Reconstruction of depot workshop at Shalachia (Baghdad) at Samawa, Bajai, Al Qaim and Kirkuk, etc.	*7.00*	*18.00*
Priority 2	**38.00**	**218.00**
5. Restoration and upgrading of the railway system	38.00	218.00
- Replacement of tracks between Baghdad - Basrah - Umm Qasr line (536 km) to a higher technical standard	*35.00*	*210.00*
- Reconstruction of concrete sleeper factory at Abughaarib	*1.00*	*4.00*
- Installation pf optical fiber network on all railway lines	*2.00*	*4.00*
Priority 3	**35.00**	**210.00**
6. Restoration and upgrading of the railway system	35.00	210.00
- Replacement of tracks between Baghdad - Mosul - Rabiya (near the Syrian border) (524 km) and double tracking the existing line	*35.00*	*210.00*

Additional Investment Requirement (Higher Case)

Additional investment	**3.00**	**159.00**
Construction of a new railway line between Mosul and Zakho (connection to Turkey) (150 km)	2.00	150.00
Construction of approximately 10 bridges over roads	1.00	9.00

At present, reconstruction work on the railway at Umm Qasr Port, and the railway line between Umm Qasr Port and the outskirt of Basrah (72 km) are being implemented by USAID.

USAID has budgeted US$210 million for the reconstruction of the following railway facilities in 2004. No donor other than USAID has expressed a plan for reconstruction of the railways.

- Introduction of a communications-based train control system
- Procurement of track maintenance equipment and supplies
- Reconstruction of selected locomotive and wagon repair workshops, repair and replacement of damaged tools and machines, and replenishment of spare parts
- Restoration of station buildings and offices
- Procurement of minimum numbers of rolling stock, including tank wagons for transporting LPG, passenger coaches, modern container wagons, as well as several items of container-handling equipment
- Installation of fiber-optic cable network
- Implementation of local signal project

(3) Present Situation of the Organization and Human Resources of the Executive Agency

The railway of Iraq is managed by Iraqi Republic Railway (IRR) under the control of the Ministry of Transport and Communication (MOTC). Preliminary assessment by the JICA mission concluded that the executing agency is capable of working out railway reconstruction plans. There are about 13,300 employees in IRR, and the employees are manned at similar numbers per km of line as with the case of the railways in Syria and Morocco. Although, the organization requires strengthening of management techniques, the staff are technically skilled.

The recovery of railway transportation capacity is urgently required. Securing staff

having the ability to determine priorities for reconstruction of railway facilities and procurement of rolling stock, and balancing those requirements with the available funds and material, is indispensable. Cooperation between the CPA or Provisional Administration, and donor countries and organizations is needed.

(4) Obstacles to Reconstruction and Development Issues

Factors hindering the reconstruction activities are listed as follows.

- Security and safety issues: For reinstatement of the Iraqi socio-economy, reconstruction works should be implemented at the earliest possible time. However, restoration of law and order is not yet sufficient, and investigation and disposal of land mines and ordinances is considered to be incomplete. The volatile security situation making it difficult to assure the safety of aid workers is considered to be the obstacle to implementing immediate reconstruction activities.
- Industrial Standard: Since Iraq adopts different industrial standards from that applied in Japan, the reconstruction plan for the railways and procurement of major construction materials, equipment, and rolling stock from Japan, require careful planning. In particular, spare parts for rolling stock and equipment are perceived as requiring manufacture by the original manufacturer.
- Positioning of the project: The aim of the project is to reinstate railways that will contribute to the early reconstruction of Iraq. Thus the improvement or strengthening of the entire railway network to a standard level, as is the case with ordinary railway projects, is not expected. Since the railway system would become defunct due to a single missing link, determination of the order of priority is essential. However, since donors consist of many countries and organizations there is a danger that a conflict of interest will arise and hinder the smooth and effective implementation of projects.

It should be recognized that reconstruction comes in advance of any development. A master plan needs to be established prior to the implementation of any development projects. Double tracking and construction of a new line were already in progress before the war and some railway lines have had the design work completed. Such incomplete projects should be reviewed in line with the development policy of the new administration and utilized effectively.

(5) Assistance Program for Urgent Reconstruction (Draft)

In order of priority, the MOTC has shown their expectation of the following projects being implemented with assistance from Japan:

1. Rehabilitation of the concrete sleeper factory in Abu-Ghareeb

2. New line construction of Baghdad - Kirkuk - Mosul
3. New line construction of Baghdad - Kut - Basrah , Kut - Nasiriya
4. New line construction of Mosul - Zako

The locations of the projects are shown in Figure 5.2.4. An outline of the conceived projects is presented in Annex (Potential Project List, Project Sheet).

Construction of new railway lines was requested together with the reconstruction of the concrete sleeper factory. The MOTC explained that reconstruction of the widely dispersed existing lines is planned for implementation with the Iraqi Government budget and USAID, and that construction of new lines in limited areas where security issues are minimal be implemented with assistance from Japan.

The Study Team recommends the following projects constituting an urgent railway infrastructure reconstruction project:

(a) Reconstruction of concrete sleeper factory

This project aims to reconstruct the concrete sleeper factory, owned by the Iraqi Republic Railways. The factory and its part of the equipment were destroyed during the post-war confusion in 2003.

IRR can commence with the replacement of deteriorated sleepers and reconstruction of the railway network once the stable production of pre-stressed concrete sleepers is reinstated. Therefore, this project is considered to have a significant return on investment.

The project cost is estimated at approximately 1,000 million yen, if all equipment is replaced (production capacity: 400 pieces per day), and excluding the reconstruction of the building.

The advantages of this project are as follows:

- As the project site subject to study and the construction site are limited within the parameters of the factory, there are a minimum of security issues.
- The reinstatement of factory operation will create jobs for the production of sleepers, track reconstruction works, new line construction works, and double-tracking works.

- The duration of the study and installation work is relatively short and results will show quickly.
- The subject of the assistance may only be the reinstatement of the pre-stressed concrete sleeper factory. However, the produce of the factory will be utilized across the nation for the reconstruction and development of the railways. This project is considered to have significant economic impact.

(b) Nationwide integrated transportation master plan study in Iraq

It is difficult to execute the construction of new lines in such a short period as the MOTC has requested. At first, technical/economical feasibility, and priority should be verified. As mentioned previously, Iraq Republic Railways (IRR) is expected to play a significant role in long-haul and large volume freight transport. From the view point of medium and long term planning, the requested construction of new lines will be necessary for national economic development.

In order to ensure the implementation of prioritized railway projects, there is a pressing need to work out an integrated transportation master plan including other modes of transport.

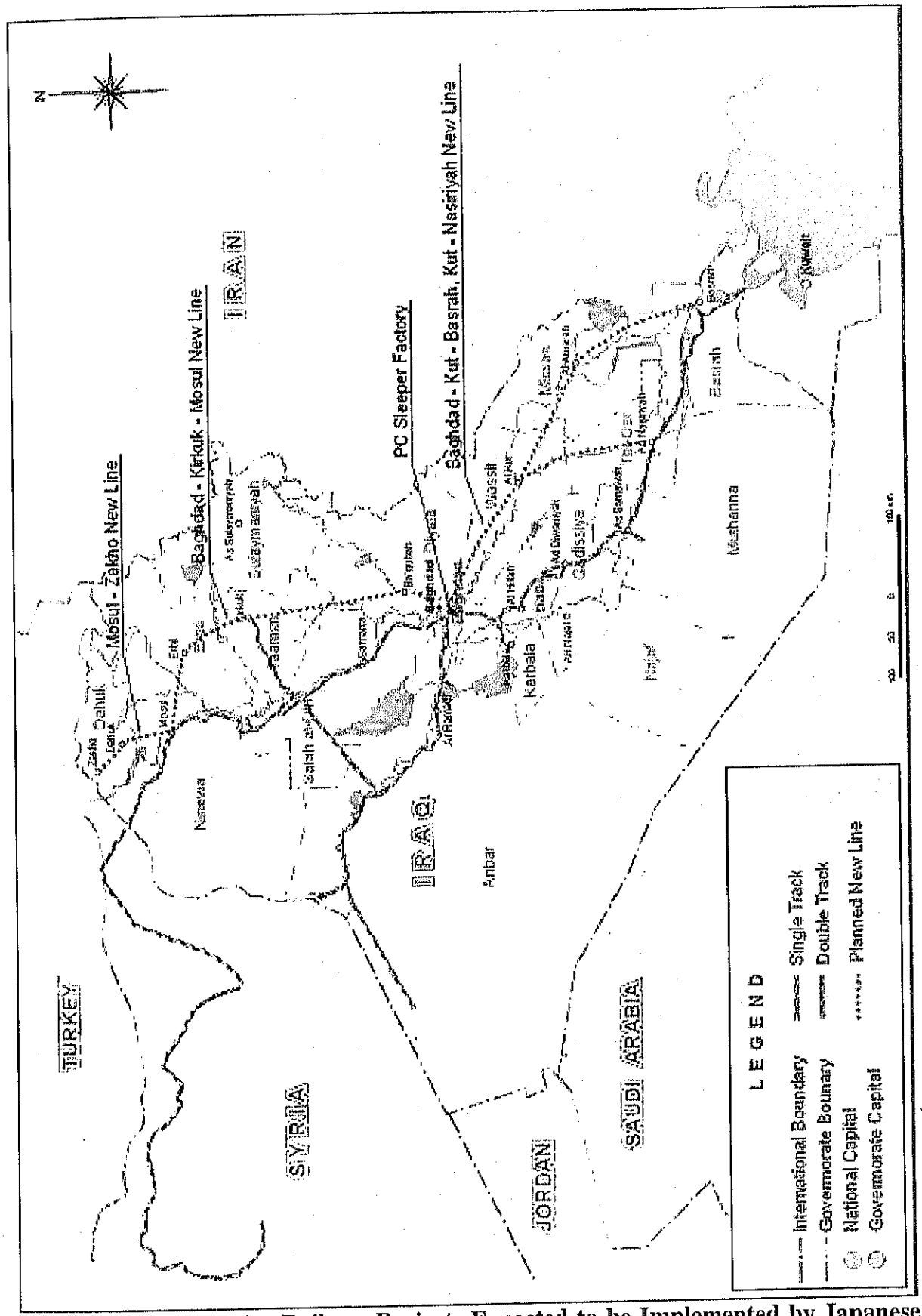


Figure 5.2.7 Prospective Railway Projects Expected to be Implemented by Japanese ODA

5.2.3 Urban Transport

(1) Current Situation and Problems

The traffic condition in Baghdad has been aggravated after the latest Iraqi War. Currently citizens of Baghdad are facing serious traffic congestion. The causes of the aggravated traffic situation are considered to be as follows:

1) Rapid increase of car ownership after the war
2) Unworkable condition of traffic signals due to lack of power supply
3) Lack of public mass-transit system (urban railway and public bus system)

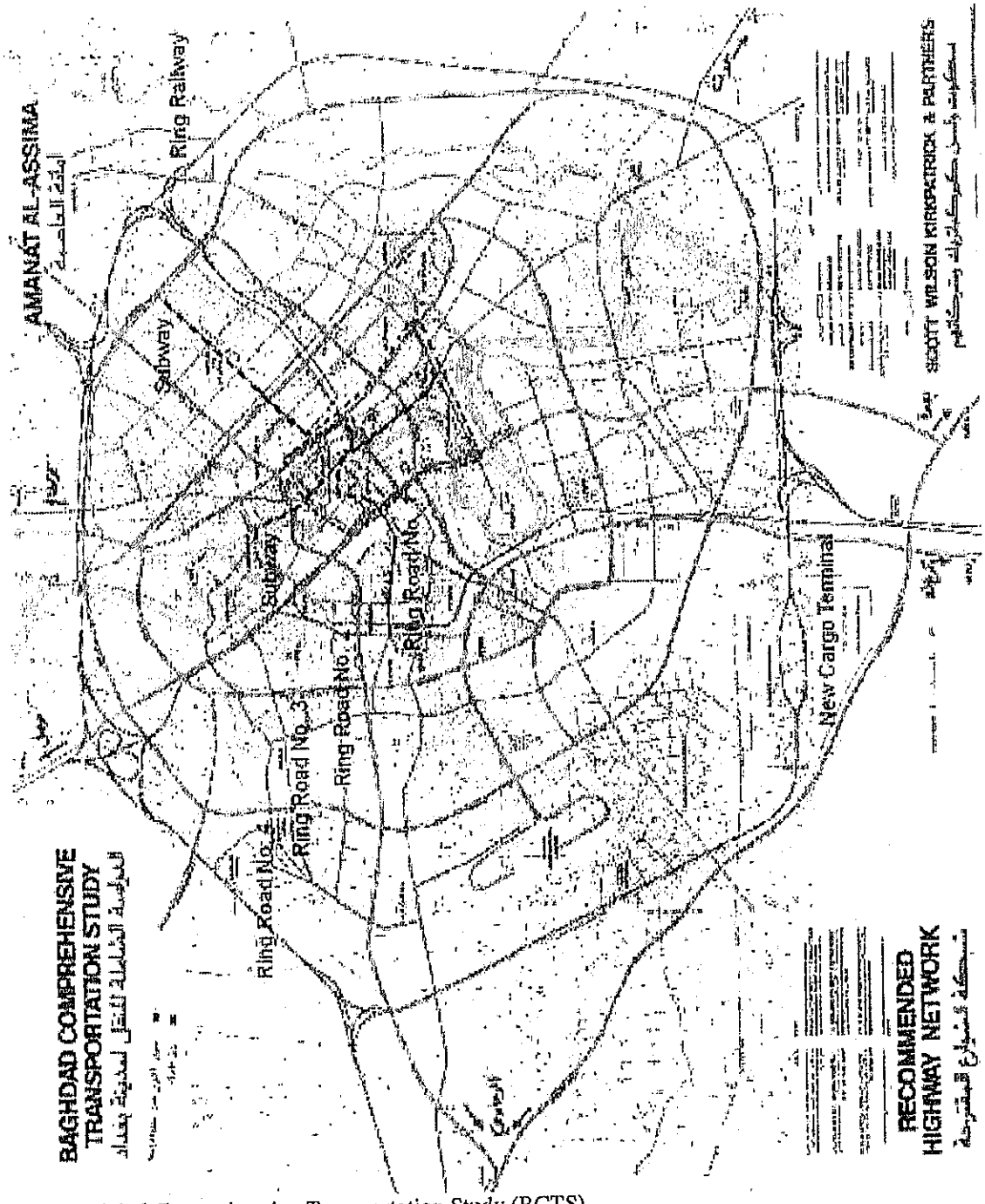
Besides the above issues, Baghdad has a basic problem that the necessary development of the transport infrastructure to accommodate the big traffic demand of the city with 5 million population has been suspended since the 1980s because of a series of wars during this period.

The Transport Master Plan of Baghdad was prepared in 1982 by the "Baghdad Comprehensive Transport Study (BCTS)". The Figure 5.2.8 shows the BCTS Master Plan. The Master plan recommended the following major urban transport projects.

i) Construction of four (4) Ring Roads
ii) Construction of two (2) lines of subways (Baghdad Metro)
iii) Construction of a Ring Railway
iv) Relocation of Baghdad central railway station
v) Grade separation of major intersections

According to the master plan, the "Baghdad Rapid Transit Authority (BRTA)" was established as the executing agency for the Baghdad Metro Project and a detailed design of the project was completed in 1985. The Metro project, however, was suspended in 1986 because of the economic impoverishment caused by the Iran-Iraq War. Technical investigation for the project was re-started in 2002, but it was suspended again due to the latest Iraq War. Currently the detail design of the Metro project has been completed but no construction work has been performed.

Regarding the urban highway development, about 25% progress was obtained with construction of one part of the 2nd Ring Road. Therefore, development of the Ring Road and grade separated interchanges is urgently required.



Source: Baghdad Comprehensive Transportation Study (BCTS)

Figure 5.2.8 The BCTS Master Plan (1979－1982)

Baghdad has not had an urban railway system and bus services have been limited to a sole public transport service available for the city people. The important public bus service, however, was seriously damaged by looting during the post war chaos period and an adequate service is not available at present. Baghdad Passenger Transport & Cargos St. (BPTCS) has been operating the public bus. The number of buses currently owned by BPTCS is only about ten instead of about 400 buses as before the war. The lack of the public bus system induced an increase of illegal bus

operators, which has caused serious traffic congestion.

(2) Activity of Other Donors and Reconstruction Plan of the Iraqi Government

According to the information from the Ministry of Housing and Construction (MOHC), it was decided to implement the following projects in FY2004.

a) Al-Zuhur Interchange

b) July 14 Bridge (Suspension Bridge)

c) New Diyala Bridge

d) Al-Furat Bridge

In addition, USAID decided to implement the following projects in Baghdad in FY 2004.

a) Dora Yousifiay Freeway (approach to Expressway No.1 from Baghdad city)

b) Al-Madaen Bridge (New bridge and approach roads)

Besides the above projects, a total of 48 transport related projects have been announced by the Iraqi Government as those which need foreign financial assistance. Among the projects, the following one in Baghdad is included.

- Second Madaen Road (1.3 km in length)

(3) Organization of the Executing Agency

The following agencies are involved in urban transport in Baghdad City.

- Baghdad Municipality for city roads
- Ministry of Transport and Communication for Railway, Subway and Bus service
- Ministry of Housing and Construction for National Roads

Figure 5.2.9 shows the organization chart of the Baghdad Municipality.

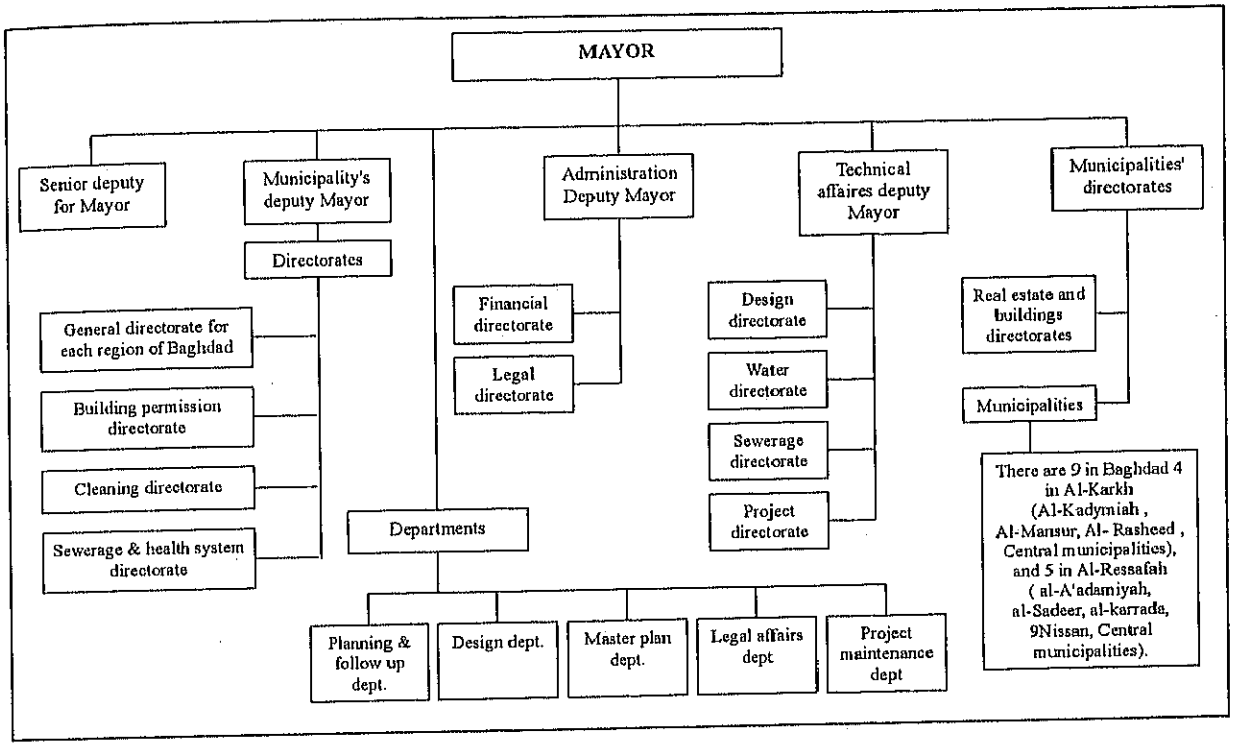


Figure 5.2.9 Organization Chart of the Baghdad Municipality

(4) Proposed Projects for Urgent Iraqi Reconstruction Program

According to the interview survey by the Local Consultant, the following projects were requested for Japanese financial assistance by the Baghdad Municipality.

A-1) East Part of Ring Road No. 4 in Baghdad City

A-2) West Part of Ring Road No. 2 in Baghdad City

A-3) A Bridge connecting Abo Al-Kasim Al-Shabi Street and Al-Bakir University Street, crossing the army canal in Baghdad City

A-4) Connection of (Mohammed Al-Kasim – Army canal road intersection with Ring Road No. 4, in Baghdad City

A-5) Traffic Signals at intersection, in Baghdad

A-6) Baghdad Metro

A-7) Rehabilitation of city road

A-8) Multi-story parking garages, in Baghdad

Among the projects list prepared by the Ministry of Transport and Communications for foreign financial assistance, the following three (3) projects, which related to Baghdad urban transport, are included (Table 5.2.10)

Table 5.2.8 Projects Requested by MOTC (Related to Baghdad Urban Transport)

	Project Name	Approx. cost (Mil. US$)	Cost for FY2004 (Mil. US$)	Period (months)
B-1	Baghdad Ring Railway	550	100	36
B-2 (=A-6)	Baghdad Metro	3,150	200	72
B-3	Procurement of Buses (300 vehicles)	45	45	12

Besides the above projects, an official request for the following project was issued to the JICA Jordan office from the Baghdad Municipality.

- Supply of Construction Machines for Rehabilitation of City Roads

According to a Japanese company's information, the Baghdad Municipality made a request for the projects shown in Table 5.2.11 to the Japanese Government.

Table 5.2.9 Major Intersection Improvement Projects

	Project Name	Approx. cost (Mil. US$)	Remarks
C-1	Viaduct Bridge crossing Army Canal and Ring Road No. 3	10	· possible link to ring road No.3 · No obstruction in site · Length of bridge : approx. 500m
C-2	Viaduct Bridge Crossing Railway and Ring Road No.1	5	· possible link to ring road no.1 · Length of bridge : approx. 200m
C-3	Viaduct Bridge of Ring Road No.1 crossing a major road.	15	· Elevation of ring road No.1 · Grade separation of an intersection only · Length of bridge : approx. 1,000m

As introduced above, not only restoration projects but also new construction projects are included in the project list for Japanese financial assistance.

On the other hand, according to the people's interview survey, the residential people wish for such projects as those which have direct effects to improve their lives and can be completed in a short time.

A location map of the requested projects is shown in Figure 5.2.10.

Taking into consideration the above requests from the Iraqi Government agencies and residential people, the Study Team selected candidate projects for the Iraqi Urgent Reconstruction Program based on placing priority on the projects that satisfy the following conditions.

a) to bless the people with direct effects from the project

b) to be justified as a necessity without a further feasibility study

c) to be completed in a short period

d) to be constructed without any special technology, with limited involvement of Japanese experts and with minimum required quality control.

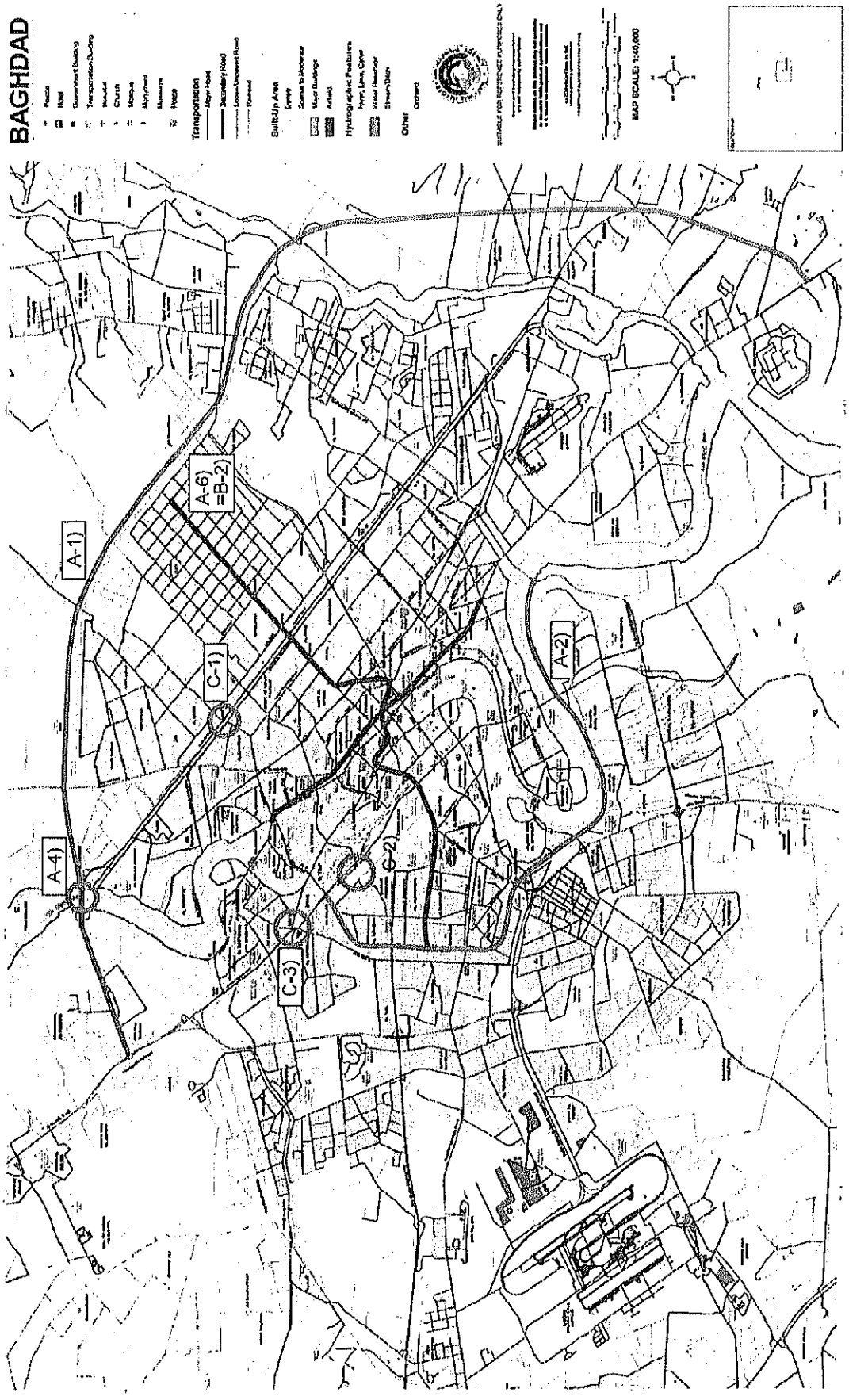


Figure 5.2.10 Location Map

Based on the above considerations, the following projects have been recommended as candidate projects for the Iraqi Reconstruction Program.

(a) City Road and Drainage Improvement Projects in Major Cities in Iraq's Southern Region.

It is a common problem in urban areas in Iraq that city roads and the drainage system are in extremely poor condition in highly populated areas and hinder the daily lives of the people. The project aims to improve these city roads and drainage system in some of the selected highly populated areas in Baghdad, Samawa and Basrah cities.

The Ministry of Housing and Construction placed highest priority on the new housing construction in Sanawa city as a Japanese assistance project. This kind of project requires no special technology and can be implemented easily.

(b) Construction of Viaduct Bridge crossing Army Canal.

This is the project that the Planning Department of the Baghdad Municipality requested with highest priority. The project aims to construct a viaduct bridge crossing Army canal to connect to the ring road No.3.

(c) Construction of Viaduct Bridge No.2

The project requested with 2nd priority by the Baghdad Municipality was the project to construct a viaduct bridge crossing the railway to connect with Ring Road No.1 in the South-west of the city.

(d) Construction of Viaduct Bridge No.3

The project requested with 3rd priority by the Baghdad Municipality was the project to modify a part of the western part of the Ring Road No.1 by the viaduct structure.

(e) Supply of Construction Machine for City Road Maintenance

Supply of construction machine to Baghdad municipality for the sake of rehabilitation and maintenance of city roads. A list of necessary machines and equipment is available from the Baghdad Municipality.

(f) Public Bus Transport Improvement Project

This project is included in the project list prepared by the Ministry of Transport and Communications. The Project includes supply of buses (vehicles) and spare

parts to Baghdad Passenger Transport and Cargos St., who is operating the public bus service in Baghdad.

(g) Baghdad Integrated Urban Transport Master Plan Study

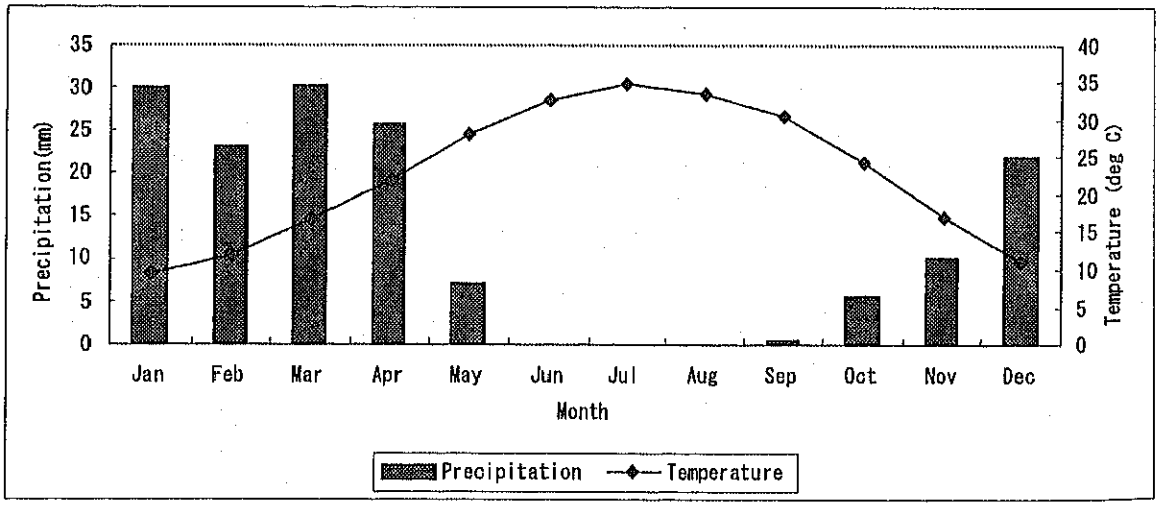
Preparation of an integrated urban transport master plan in Baghdad to justify such medium and long term projects as Baghdad Metro, Baghdad Ring Roads, Baghdad Ring Railway projects and so on. The project shall examine the best modal-mix of road and railway transport.

5.3 Water Resources / Irrigation / Agriculture / Mesopotamian Marsh

5.3.1 Water Resources

(1) Current Condition and Issues

Climate: The climate in Iraq mainly consists of Semi-arid tropical climate in the central, western and southern parts and Mediterranean Sea climate in the north and north-eastern parts of Iraq. The rainy season is generally observed from December to February in the major parts of Iraq, and from November to April in the north and north-eastern parts. Figure 5.3.1 shows monthly mean temperature and precipitation in Baghdad (1962-1980)



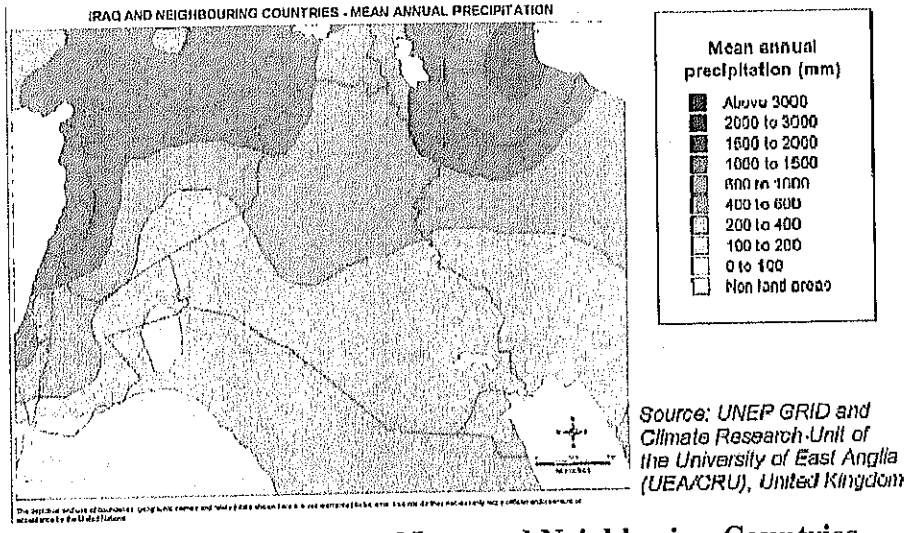
Source: Japanese Science Annual Statistic 2001

Figure 5.3.1 Monthly Mean Precipitation and Temperature in Baghdad (1962-80)

Average annual precipitation was 150mm, and average annual mean temperature was 23 C° in Baghdad from 1962 to 1980. July was the highest temperature of 34.7 C° and January is the lowest of 9.4 C°.

Precipitation (rainfall) in Iraq is dependent on the location. The southern area has

less than 100mm per year of precipitation. On the other hand, the north-eastern mountainous part of Iraq within the Tigris River Basin has plentiful rainfall of 1,200 mm/year, more or less.



Source: UNEP GRID and Climate Research Unit of the University of East Anglia (UEA/CRU), United Kingdom

Figure 5.3.2 Isohyetal Map of Iraq and Neighboring Countries

Water Resources: The Tigris (Catchment Area: 370,000km^2) and the Euphrates (Catchment Area: 580,000km^2) are the major water resources in Iraq. They originate from Turkey and flow through Syria and Iraq toward the south-west and finally discharge into the Persian Gulf. Iraq occupies about 40% of the watershed of the Tigris river basin and 50% of the Euphrates river basin. Figure 5.3.3 shows the basin map of the Tigris and Euphrates river basins.

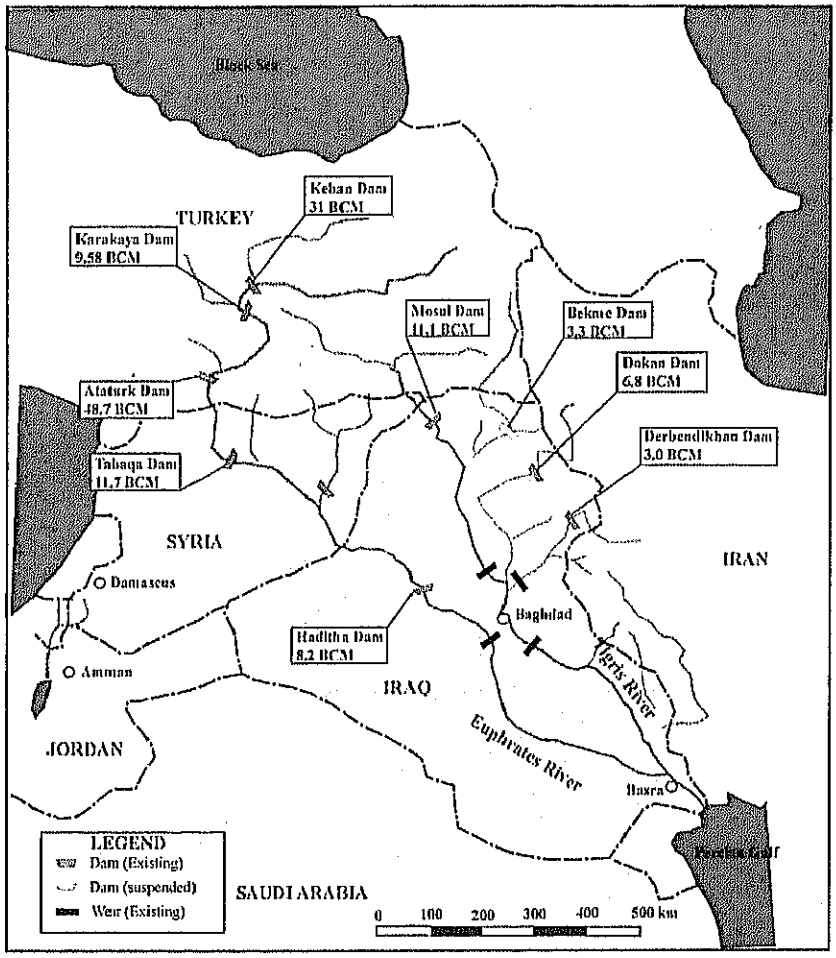


Figure 5.3.3 Basin Map of Tigris and Euphrates River Basins

Table 5.3.1 Catchment Area Distribution by Countries of Tigris and Euphrates Rivers

Country	C.A. of Euphrates River Basin (km^2)	%	C.A. of Tigris River Basin (km^2)	%
Iran	-	-	175,386	47.2%
Iraq	282,539	48.8%	142,175	38.0%
Saudi Arabia	77,090	13.3%	-	-
Syria	95,405	16.5%	948	0.3%
Turkey	121,787	21.0%	533,052	14.0%
Total	579,314	100.0%	371,562	100.0%

Source : Basic Information Collection and Analysis in IRAQ, JICA May 2003

The annual mean inflow volume into Iraq through the Euphrates River is estimated at 26.8 Billion Cubic Meters (BCM) based on the monthly observation record from 1932 to 1993 at Haditha Dam site, which is located on the upstream end of the Euphrates River in Iraq. There is almost no inflow into the tributaries in Iraq as they are located in the western desert area of the Euphrates river basin. Accordingly, the

water resources in the Euphrates River in Iraq are highly affected by the upstream water resource development and management in Turkey and Syria.

Table 5.3.2 shows the list of major dams and weirs along the Euphrates River. In 1975, the Keban Dam, with the gross storage of 31 BCM, was constructed in Turkey and water impounding in the reservoir commenced. Since then many large dams and reservoirs have been constructed in Turkey, Syria and Iraq along the Euphrates River, which changed the flow condition dramatically, particularly in the downstream stretch in Iraq.

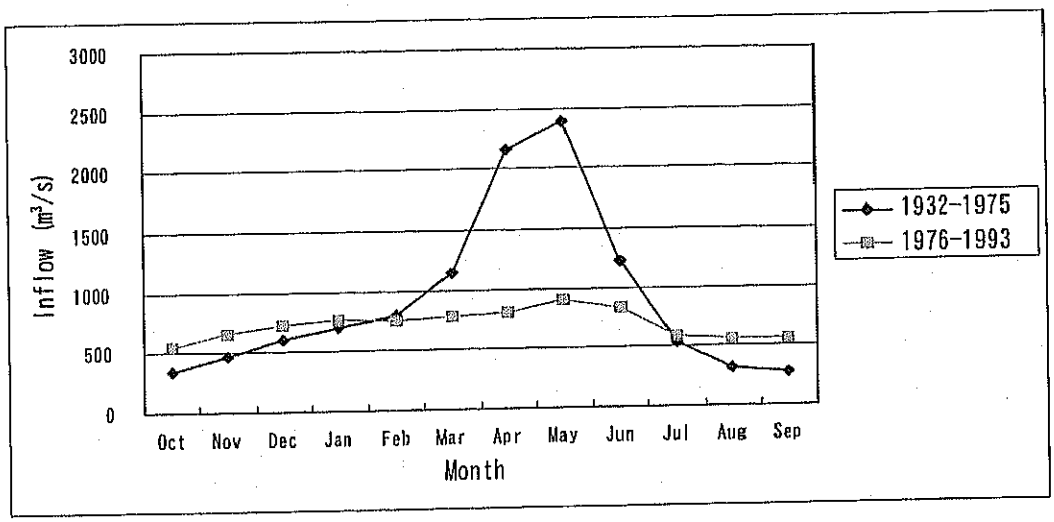
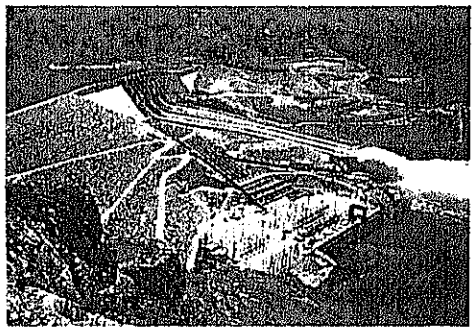
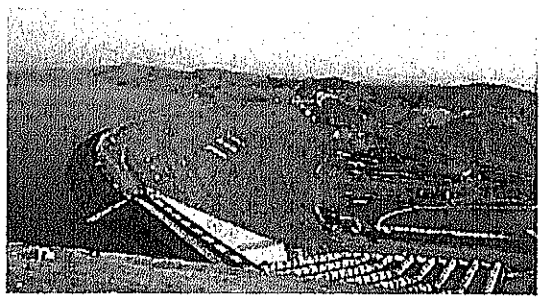


Figure 5.3.4 Change in Monthly Inflow into Haditha Dam before and after 1975

Figure 5.3.4 shows the changes in monthly inflow into Haditha Dam before and after 1975. The annual inflow volume decreases from 28.6 BCM to 22.2 BCM after 1975. Almost all the flood water is stored by the upstream reservoirs and no natural flood has been observed in the downstream after 1975, which is the main reason for the decrease of annual inflow volume in Iraq. Instead, the river flow during the dry season from July to February has increased due to the regulation effect of the dams and reservoirs, and this seems to have a positive effect by firming up a dependable flow for water resource management.

However, the water supply to the downstream swamp area might be significantly decreased as flooding is now regulated upstream. The UNEP and other international agencies warn that the recent condition of the natural environment, such as the marshland vanishing, may be destroying the eco-system in the downstream marsh. The details about the marsh land environmental condition is described in the later sub-section 5.3.4.





Large Dams in Turkey, Keban Dam (Left), and Ataturk Dam (Right)

Table 5.3.2 Major Dam and Reservoir List in Euphrates River Basin

No.	Country	Name of Dam	Purpose(*1)	River	Completion (Year)	Gross Storag (MCM)	Surface Area (km2)	Ins. Capacity (MW)	Dam height (m)
Tu-E1	Turkey	Adiyaman	HP	Goksu	Planned	1,887	60	75	90
Tu-E2	Turkey	Ataturk	HP, IR	Euphrates	1992	48,700	817	2,400	166
Tu-E3	Turkey	Birecik	HP, IR	Euphrates	2000	1,220	56.25	672	53
Tu-E4	Turkey	Camgazi	IR	Euphrates	1998	56	5.55		39
Tu-E5	Turkey	Derik-Dumulca	IR	Euphrates	1991	22	2.23		24
Tu-E6	Turkey	Hacihidir	IR	Euphrates	1989	62	4.4		32
Tu-E7	Turkey	Hancagiz	IR	Euphrates	1988	100	7.5		45
Tu-E8	Turkey	Kahta	HP	Kahta	Planned	1,887	100		125
Tu-E9	Turkey	Karakaya	HP	Euphrates	1987	9,580	268	1,800	158
Tu-E10	Turkey	Karkamis	HP,FC	Euphrates	1999	157	28.4	189	21.2
Tu-E11	Turkey	Kayacik	IR	Euphrates	under const.	116	2.91		45
Tu-E12	Turkey	Keban	HP	Euphrates	1975	31,000	675	1,330	163
Sy-E1	Syria	Baath	HP,IR,FR	Euphrates	1988	90	27.15	75	
Sy E2	Syria	Tabaqa	HP, IR	Euphrates	1975	11,700	610	800	60
Sy-E3	Syria	Tishrine	HP	Euphrates	1999	1,900	166	630	40
Sy-E4	Syria	Upper Khabur	IR	Khabur	1992	988	1.37		
Sy-E5	Iraq	Al Hindiyaha Barrage	FD	Euphrates	1989				
Iq-E1	Iraq	Al Qadishiyah (Hadith	HP, IR	Euphrates	1984	8,200	500	660	57
Iq-E2	Iraq	Fallujah Barrage	IR	Euphrates	1985				
Iq-E3	Iraq	Baghdadi	FR	Euphrates	Planned				
Iq-E4	Iraq	Ramadi-Habbaniyah	FC	Euphrates	1948				

Table 5.3.3 List of Major Dams and Reservoirs in Tigris River Basin

No.	Country	Name of Dam	Purpose(*1)	River	Completion (Year)	Gross Storag (MCM)	Surface Area (km2)	Ins. Capacity (MW)	Dam height (m)
Tu-T1	Turkey	Batman	HP,IR	Tigris	1998	1,175	49.25	198	71.5
Tu-T2	Turkey	Cag-Cag	HP	Tigris					
Tu-T3	Turkey	Cizre	HP, IR	Tigris	Planned	360	21	240	51.4
Tu-T4	Turkey	Devegecidi	IR	Tigris	1972	202	32.14		32.8
Tu-T5	Turkey	Dicle	HP, IR	Tigris	1997	595	24	110	75
Tu-T5	Turkey	Dipni		Tigris		1,020	46		90
Tu-T6	Turkey	Dilimi	IR	Greater Zab	under const.	59	2.41		70
Tu-T7	Turkey	Garzan	HP, IR	Tigris	Planned	983	46	80	113
Tu-T8	Turkey	Ilisu	HP	Tigris	Planned	10,410	299.5	1,200	138
Tu-T9	Turkey	Goksu	IR	Tigris	1991	62	3.9		46
Tu-T10	Turkey	Kralkizi	HP	Tigris	1997	1,919	57.5	90	113
Tu-T11	Turkey	Silvan	HP,IR	Tigris	Planned	820	164	150	165
Iq-T1	Iraq	Al-Adheem	HP, IR	Al-Adheem	1999	1,500			
Iq-T2	Iraq	Al Amarah Barrage	FR	Tigris	under const.				
Iq-T3	Iraq	Al Faris (Bekme)	HP,IR	Greater Zab	Not complete	3,300	56	1,600	200
Iq-T4	Iraq	Al Kut Barrage	FD	Tigris	1939				
Iq-T5	Iraq	Derbendikhan	IR	Diyala	1962	3,000	121		128
Iq-T6	Iraq	Dibbis	IR	Little Zab	1965	3,000	32		15
Iq-T7	Iraq	Diyala Barrage	IR	Diyala	1969				
Iq-T8	Iraq	Dokan	IR	Little Zab	1961	6,800	270		116
Iq-T9	Iraq	Hamrin	IR	Diyala	1980	3,950	440		40
Iq-T10	Iraq	Saddam	HP, IR	Tigris	1985	11,100	371	320	126
Iq-T11	Iraq	Sammarra-Tharthar	FD	Tigris	1954	72,800	2170		
Iq-T12	Iraq	Sennacherib	FR	Tigris		500			
Ir-T1	Iran	Bazoft		Bazoft	under design				
Ir-T2	Iran	Dez	HP, IR	Dez	1962	3,460		520	203
Ir-T3	Iran	Garm-ab		Karkheh	under design				
Ir-T4	Iran	Karkheh	HP, IR, FC	Karkheh	2001	7,795		400	128
Ir-T5	Iran	Karun-1	HP, IR	Karun	1977	3,139	54.8	1,000	200
Ir-T6	Iran	Karun-2	HP	Karun	uc-2005			1,000	
Ir-T7	Iran	Karun-3	HP, FC	Karun	2001	2,750		2,000	205
Ir-T8	Iran	Karun-4	HP, FC	Karun	uc-2006	2,190		1,000	222
Ir-T9	Iran	Khersan I	HP	Khersan	under design	520		750	180
Ir-T10	Iran	Khersan II	HP	Khersan	under design	500		500	180
Ir-T11	Iran	Khersan III	HP	Khersan	under design	730		750	165
Ir-T12	Iran	Marun	IR, HP	Marun	1998	1,200	25	145	165
Ir-T13	Iran	Masdjied-e-Soleiman	HP, IR	Karun	2001	228		1,000	177
Ir-T14	Iran	Saz-e-bon		Karkheh	2004			500	
Ir-T15	Iran	Shushtat	HP	Karun	uc-2005	4,530		2,000	180
Ir-T16	Iran	Simareh	HP	Karkheh	2004			500	
Ir-T17	Iran	Tang-e-mashoreh		Karkheh	under design				
Ir-T18	Iran	Upper Gtvand	HP	Karun				1,000	
	Turkey					17,605		2,068	
	Iraq					105,950		1,920	
	Iran					27,042		13,065	
	Total					150,597		17,053	

Notes: (*1) HP:Hydropower, IR:Irrigation, FC:Flood Control, FR:Flow Regulation, FD:Flow Diversion
Source: UNEP, The Mesopotamian Marshlands

Annual inflow into Iraq along the Tigris River basin is estimated at 48 BCM, which is about 1.8 times bigger than that from the Euphrates River basin. Out of the 48 BCM, 21 BCM is from the mainstream flowing from Turkey, and the remaining 27 BCM is from the tributaries of the Tigris River, which originate from the north-eastern part of Iraq. The annual available water volume at Baghdad is estimated at 35.7 BCM based on the on-going USAID study.

Since the major water resource in the Tigris River basin in Iraq is its tributaries, the Iraqi government has put them as the top priority area for water resource

development since the 1960's.

Three large dams have been constructed in the Tigris River basin in Iraq. They are the Mosul Dam on the Tigris mainstream, the Dokan Dam on the Lesser Zab River and Derbendikhan Dam on the Diyala river. The total storage volume of the three dams is estimated at 21 BCM, which is almost the same volume as the annual inflow of the Tigris River from Turkey to Iraq. In addition, the Bekma Dam on the Greater Zab River had its construction suspended due to the economic sanctions from 1991 and the recent Iraq war (30% completed as of February 2004). The Bekma dam would be the largest capacity with 33 BCM when it is completed.

There is so far no large scale dam constructed in the Tigris river basin in Turkey. Figure 5.3.5 indicates no big differences in flow condition before and after 1975, which is different from the Euphrates river basin.

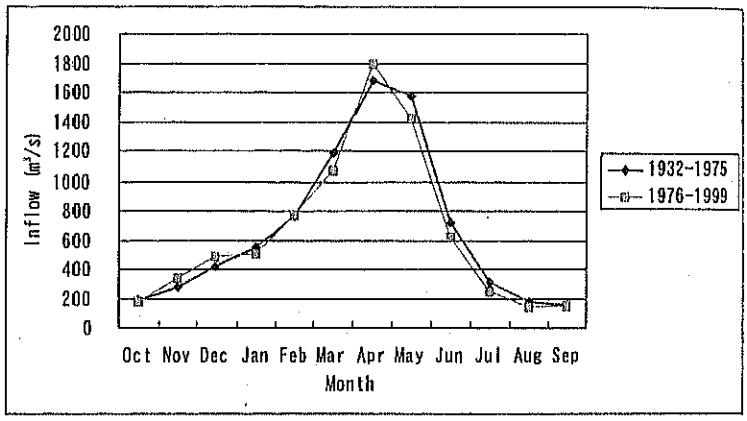


Figure 5.3.5 Change in Monthly Discharge at Mosul Dam

It is concluded that Iraq is a relatively rich country in water resources in the middle east, because of the Tigris and Euphrates Rivers even though it has only 200mm in annual rainfall. The water resource development activities have also been vital since the 1960's. As a result, six (6) large dams and reservoirs in the Euphrates river basin with total storage capacity of 37.5 BCM, and twelve (12) large dams and reservoirs in the Tigris river basin with 150.6 BCM have been developed up to the year 2004.

Figure 5.3.6 shows the conceptual water balance in Iraq. The effective usage of these water resource structures and facilities should be assessed based on the detailed water balance analysis by means of water management and distribution technologies.

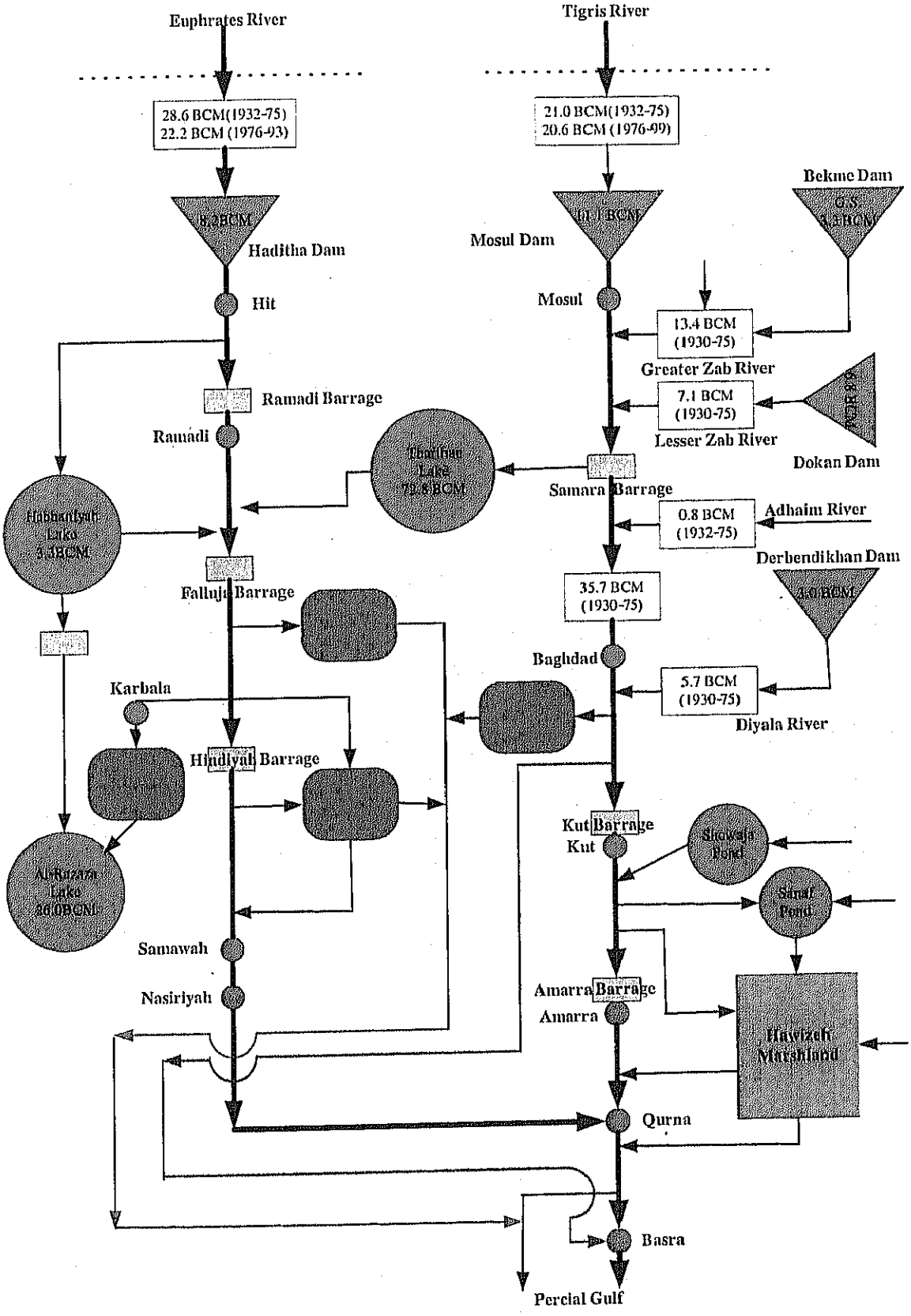


Figure 5.3.6 Conceptual Water Balance in IRAQ

(2) Activities of Other Donors

UN Agencies: FAO and WFP are the key players under Cluster 5 (Agriculture, Water Resources and Environment) of the UN group for re-building and rehabilitation assistance to Iraq. In cluster 5, the following four (4) issues have been raised as the priority matters to be tackled within the year 2004: improvement of food security and activation of agricultural villages through increasing agriculture production, construction of an integrated and efficient agricultural administration system, assistance to policy making for integrated water and irrigation management and international water treaties, construction of an environmental management and water management system, which would enable sustainable development.

On the other hand, no particular re-building and rehabilitation activities under the water resources and irrigation sector have so far been observed in Iraq as of February 2004 according to the Ministry of Water Resources (MOWR).

CPA and USA group: USAID commenced re-building and rehabilitation assistance immediately in 2003. The current major activities under the water resources sectors are as follows:

(a) Rehabilitation of sewerage treatment plants in the whole of Iraq
- Rehabilitation and re-building of water supply system in Baghdad, central and south Iraq,
- Rehabilitation of various water supply pipe networks

(b) Extension of water treatment plant (1 location) and sewerage treatment plants (3 locations) in Baghdad
- Rehabilitating and adding 45% capacity to Baghdad's Saba Nissan water plant, adding an additional 225,000 cubic meters a day to the water supply by May 2004 mostly in the overpopulated eastern sections,
- Installing back-up electrical generators at 39 Baghdad water facilities and pumping stations to ensure continuous water supply,
- Rehabilitating Baghdad's sewage treatment plants; Rustimiyah North, Rustimiyah South and Kerkh to benefit 3.8 million people by October 2004,
- Rehabilitating 70 of Baghdad's non-functioning waste pumping stations.

(c) South Central Iraq: Rehabilitating one water plant and four sewage plants
- Rehabilitating Najaf municipal water treatment plant. The project will

be completed by June 2004,

- Rehabilitating Ad Diwaniyah and Karbara sewage treatment plants, which serve 200,000 residents and currently discharge untreated waste into the Euphrates River. These projects are expected to be completed by May 2004 and October 2004 respectively,
- Rehabilitating Al Najaf and Al Hillah sewage treatment plants to serve 194,000 residents. These projects are expected to be completed by December 2004 and April 2004 respectively.

(d) South Iraq: Rehabilitating the entire Sweet Water Canal system, including the canal, its reservoirs, 14 water treatment plants and pumping stations and the Safwan water system.

- The system provides drinking water to 1.75 million residents of Basrah City. It had been operating at less than half capacity.
- Rehabilitated and removed 34,000 cubic meters of sand and silt from the west settling-reservoir of the Canal, allowing it to be refilled with clean water,
- Began work on Sweet Water's 14 water treatment plants in January 2004. By summer 2004, water quality and volume will surpass prewar levels.

(e) North Iraq: Rehabilitating two water plants and one solid waste collection system

- Constructing 400 solid waste collection points in Kirkuk (in the Tamin Governorate) to improve sanitation.
- Rehabilitating Mosul and Kirkuk water treatment facilities.

Assistance by USAID in the water sector is mainly for water supply and sewerage projects as mentioned above. At the same time, USAID is activating for restoration of the Mesopotamian marshland with a budget of 4 million US$. A nationwide hydraulic modeling and reservoir simulation study is being conducted under the program of marshland restoration, which is expected to figure out the water demand in major demand centers for irrigation and water supply. The details are described in the later sub-section 5.3.4 in this report.

Also, safety assessment inspections of major dam and water resource structures were conducted by USACE (United States Army Corps of Engineers). As a result, it was concluded that urgent needs for rehabilitation have been identified in the 16 major dams and regulating facilities with a total cost of 100 million US$.

The study reported that there is no proper recording system for the operation and

rehabilitation as well as maintenance, which is essential and needed for the safety assessment of the main structures. To improve the safety condition of dam structures, it would be necessary to facilitate the supply of various items of monitoring equipment and the strengthening of the safety monitoring and maintenance system for dams in Iraq.

The urgent rehabilitation needs for Mosul Dam were identified by the USACE inspection. The dam was constructed in 1985 with a dam height of 126 m and a reservoir storage volume of 11.1 BCM. The dam was ordered to be constructed on a known layer of soluble gypsum. As a result, a continuous grouting operation must be performed to prevent the dam from failing. The supplementary work will provide for a final solution to be developed and implemented to secure the safety of the dam. Completion of this work is necessary to ensure the overall safety and reliability for the operation of the water control infrastructure in Iraq.

(3) Reconstruction and Rehabilitation Plan of the Iraqi Government

The plan of the Ministry of Water Resources of Iraq was officially announced at the donor meeting in Madrid in October 2003 regarding the priority issues to be considered in the water resources sector. The followings are the priority issues:

a) Formulation of a nationwide water resources master plan which includes water balance, distribution, pricing and quality,

b) Solving the matter of an international water treaty among Turkey, Syria and Iraq,

c) Urgent rehabilitation of pump stations and irrigation schemes,

d) Immediate completion of suspended projects of dam construction, intake facilities and water regulating facilities,

e) Introducing an integrated approach for land use, water use and eco-system reservation from the view of sustainable resource management,

f) Restoration of the Mesopotamian marshland.

In the course of the study, a needs assessment for the MOWR was conducted through the Environmental Department of Baghdad University. At that time, 20 MOWR staff in different departments were interviewed for the needs assessment with Japanese reconstruction and rehabilitation assistance. The following activities were raised as urgent needs for assistance:

a) Rehabilitation of irrigation facilities and modernization of irrigation systems in the middle reach of the Euphrates River basin,

b) Development of seasonal water regulating structures on the dry rivers and the desert tributaries of the Euphrates River,

c) Rehabilitation of major water resource structures such as the Mosul Dam, Haditha Dam, Tharthar Lake and so on,

d) Resumption of construction activities of the suspended Bekma Dam construction (only 30% completed as of February 2004),

e) Provision of construction equipment for dredging/cleaning the irrigation canal network and intake facilities,

There were opportunities to discuss with the staff of the state commission of irrigation and reclamation, the state commission of the Tigris River basin, and the state commission of the Euphrates River basin during the field investigation and data collection period in Jordan. The MOWR staff provided a list of projects consisting of 256 projects which require assistance.

Among them, 47 projects are related to water resources development and management sectors, including dam and weir rehabilitation, resumption of suspended dam construction projects and so on. The list of 47 water resource projects is shown in Table 5.3.4.

In February 2004, the second donor meeting was held in Abudabi, UAE. At this time, the Ministry of Planning and International Cooperation in Iraq presented the revised list of projects which need urgent assistance in various sectors. There are 21 projects related to the water resource sector in the list as shown in Table 5.3.5.

According to the revised list, there are almost no specific projects identifying the name of the dam and facilities. The priority issues to be assisted are provision of equipment to rehabilitate the headquarters of the MOWR, provision of construction equipment for maintenance of existing irrigation and drainage systems, provision of water gauging equipment, provision of spare parts for pump facilities and capacity building for MOWR staff and the whole administration. Based on the above, the MOWR is still not ready for commencement of various rehabilitation activities, and it is highly desirable to set up the basis for operation and maintenance activities prior to implementing the various rehabilitation activities.

Table 5.3.4 List of Projects for Dam and Weir Rehabilitation submitted by MOWR

Priority	Project Name	Type of Project	Location		Funding Condition
			District	City / Town	
1	Rehabilitation of Diyala Weir	Barrage	Diyala	Bakuba	Fully Funded
2	Sammara Barrage Complex Maintenance	Barrage	Salah al-Din	Sammara	Fully Funded
3	Ramadi Barrage Complex-Various Projects	Barrage	Anbar	Ramadi	Fully Funded
4	Mosul Dam Rehabilitation (needs $1.1 million annually for grouting)	Dam	Ninewa	Mosul	Fully Funded
5	Mandali Dam Construction	Dam	Diyala	Mandali	Fully Funded
6	Horan 1/2 Dam Construction	Dam	Anbar	Horan	Fully Funded
7	Badoosh Dam (Phase-1)Rehabilitation	Dam	Ninewa	Badoosh	Fully Funded
8	Adhaim Dam Maintenance	Dam	Diyala	Adhaim	Fully Funded
9	Kazania Dam Construction	Dam	Diyala	Kazania	Fully Funded
10	Tubal Dam Construction	Dam	Anbar	Tubal	Fully Funded
11	Arar Dam Construction	Dam	Anbar	Arrar	Fully Funded
12	Hussub Dam Construction	Dam	Najaf	Hussub	Fully Funded
13	Shamiya Barrage Rehabilitation	Barrage	Najaf	Shamiya	Un-funded
14	Al Hindiyah Barrage	Barrage	Babylon	Hindiyah	Un-funded
15	Al Kut Barrage Complex	Barrage	Kut	Kut	Un-funded
16	Barrage Falluja Barrage Rehabilitation	Barrage	Ambar	Falluja	Un-funded
17	Amara Barrage Construction of Dyke	Barrage	Missan	Amara	Un-funded
18	Dibbis Barrage Rehabilitation	Barrage	Tameem	Kirkuk	Un-funded
19	Al Shallalla Weir Rehabilitation	Barrage	Ambar	Shallalla	Un-funded
20	Establish Dam Safety Program	Dam	Nationwide	Nationwide	Un-funded
21	Dam Maintenance Program	Dam	Nationwide	Nationwide	Un-funded
22	Dam Project Sraffing Restoration	Dam	Nationwide	Nationwide	Un-funded
23	Dam Program Project Documentation Implementation	Dam	Nationwide	Nationwide	Un-funded
24	Tharthar Outlet Works Rehabilitation	Dam	Salah al-Din	Sammara	Un-funded
25	Haditha Dam Rehabilitation	Dam	Anbar	Haditha	Un-funded
26	Badoosh Dam (Phase-2)-Mechanical works	Dam	Ninewa		Un-funded
27	Bekma Dam Construction (suspended at	Dam	Arbil	Arbil	Un-funded
28	Bekman-Khalekan Dam-various projects	Dam	Duhuk		Un-funded
29	Wadi Al Nafat Dam Construction	Dam	DIyala	Nafat	Un-funded
30	Hemereen Dam Rehabilitation	Dam	Diyala	Hemreen	Un-funded
31	Derbendikhan Dam Rehabilitation	Dam	Suliamaniyah	Derbendikahn	Un-funded
32	Dahok Dam Rehabilitation	Dam	Ninewa	Dahok	Un-funded
33	Dokan Dam Rehabilitation	Dam	Suliamaniyah	Dokan	Un-funded
34	Tak Tak Dam Construction	Dam	Arbil		Un-funded
35	Construction of Basora Dam	Dam	Suliamaniyah		Un-funded
36	Construction of Komospan Dam	Dam	Duhuk		Un-funded
37	Rhauda Dam Construction	Dam	Anbar	Rauda	Un-funded
38	Rutba Dam Maintenance	Dam	Anbar	Rutba	Un-funded
39	Construction of Mandawa Dam	Dam	Arbil		Un-funded
40	Gaara 1/4 Dam Construction	Dam	Anbar	Faara	Un-funded
41	Horan 1/4 Dam Construction	Dam	Anbar	HOran	Un-funded
42	Construction of Kolos-Dola Soor Dam	Dam	Suliamaniyah		Un-funded
43	Al Kadif Dam	Dam	Anbar		Un-funded
44	Dam ProgramProject Security	Dam	Nationwide	Nationwide	Un-funded
45	Water Resources Master Plan Phase-1	Water Resources	Nationwide	Naitionwide	Un-funded
46	Establishment of Gauging stations for water quantity & quality observation	Water Resources	Nationwide	Nationwide	Un-funded
47	Construction of 40 communication networks	Dam / Barrage	Nationwide	Nationwide	Un-funded

Source: Ministry of Water Resources, Iraq

Table 5.3.5 List of Projects related to Water Resources submitted in Abudabi Donor Meeting (Feb. 2004)

Seq.	Project No.	Project Title	Project Cost (US$)	Governorate	Classification
1	447	Connection of Ramadi main drain	2,036,300	Anbar	Drainage
2	448	Eshqi-Mosul road main drain	1,776,000	Salah al-Di	Drainage
3	449	Water resources masterplan - Phase 1	5,000,000	Various	Technical assist.
4	450	Provision of Euphrates pumping station spare parts	5,000,000	Various	Spare parts
5	451	Provision of Tigris pumping station spare parts	5,000,000	Various	Spare parts
6	452	Procurement of laboratory equipment	350,000	Baghdad	Equipment
7	453	Establish gauging stations for water quality & quality observation	10,000,000	Various	Equipment
8	454	Supply of printing and map production from aerial	2,000	Baghdad	Equipment
9	455	Construction of 40 communication networks	250,000	Various	Equipment
10	456	Modernization of surveying	600,000	Various	Capacity building
11	457	Suppying of modem computers, printers, plotters, scanners,etc.	3,000,000	Baghdad	Equipment
12	458	Professional training in weed control	36,000	Various	Capacity building
13	459	External assistance for ministry's administrative	100,000	Various	Capacity building
14	460	Training of minstry employees and professional	850,000	Various	Capacity building
15	461	Land reclamation equipment	101,945,000	Various	Equipment
16	462	Canal cleaning equipment	133,000,000	Various	Equipment
17	463	Establish dam safety program	100,000	Various	Technical assist.
18	464	Dam maintenance program	100,000	Various	Technical assist.
19	465	Dam project staffing restoration	100,000	Various	Capacity building
20	466	Dam program project documentation	100,000	Various	Technical assist.
21	467	Provide pumps for sab albore draining pumping station	1,265,000	Various	Equipment
		TOTAL	270,610,300		

Source: Ministry of Planning and International Coordination

(4) Institution of MOWR and Human Resources

Figure 5.3.7 shows the institutional arrangement of the MOWR.

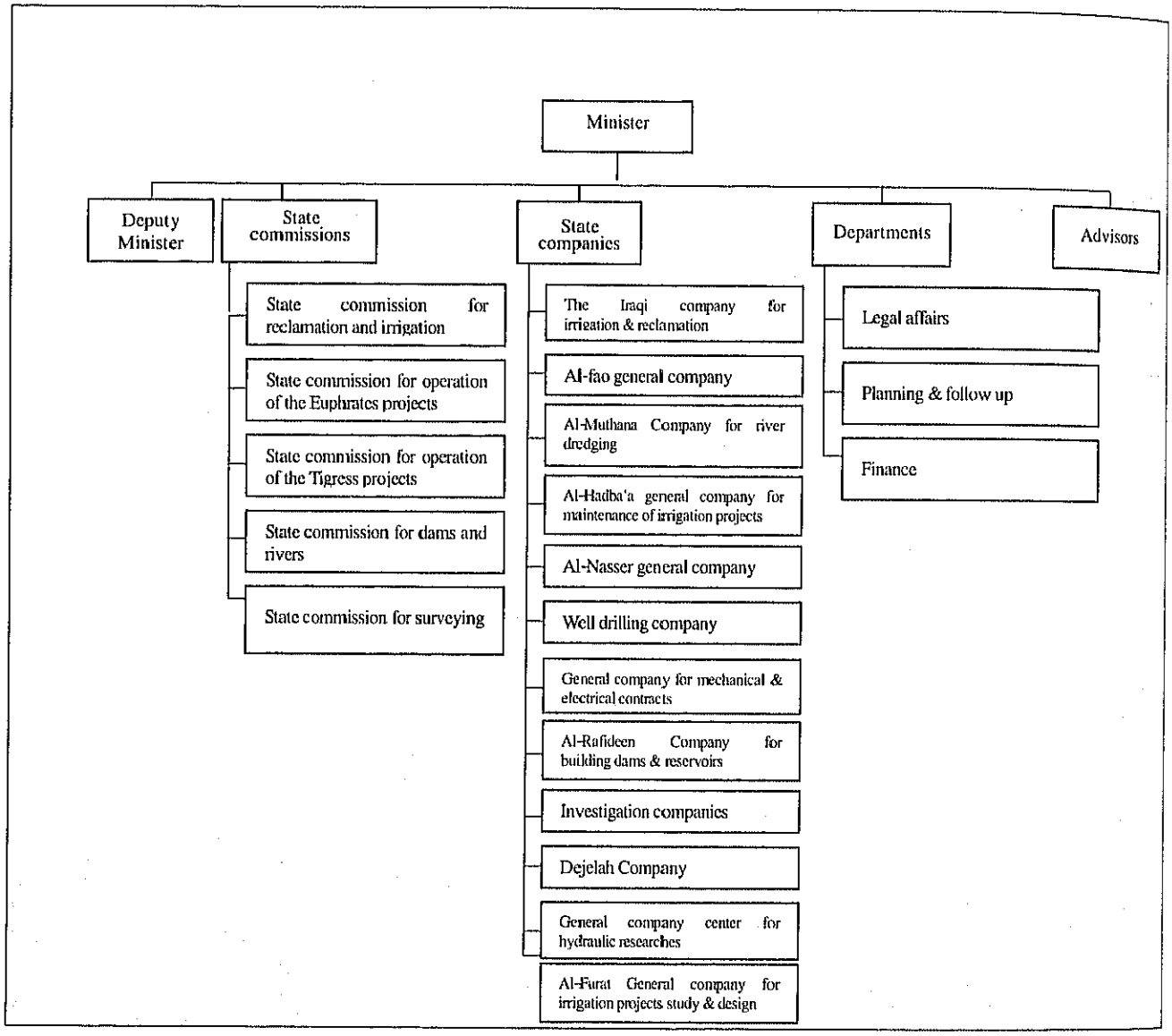


Figure 5.3.7 Institutional Set-up of the MOWR

The Ministry of Water Resources was formed by integration of the former Ministry of Water Resources and Ministry of Irrigation after the Iraq War of May 2003. The Ministry consists of three departments, five state commissions and twelve state companies under the minister and deputy minister. Advisors are appointed for special issues such as the Mesopotamian marshland and so on. Total number of staff is 18,000.

The three departments are legal, finance and planning. The five state commissions are responsible for operation of the existing facilities. They are irrigation and

reclamation, dams and reservoirs, Tigris River basin, Euphrates River basin, and survey administration.

The twelve state companies are responsible for construction, rehabilitation and maintenance activities. They are irrigation and reclamation, dredging, irrigation maintenance, boring, mechanical and electrical, investigation, hydrology and hydraulic, and general civil engineering. Each respective company has its own specific technology related to water resource administration.

The planning and follow-up department is a key department for international cooperation. This department has a function of coordinating among the other departments, state commissions and state companies. The needs for assistance with reconstruction and rehabilitation were collected by the planning and follow-up department from various fields in the MOWR and priority ranking for assistance projects is made in this department. They are also responsible to coordinate with other ministries such as the Ministry of Planning and International Cooperation, Ministry of Agriculture, Ministry of Environment and so on.

During the study period, there were opportunities to discuss with some MOWR staff, such as the advisor to the minister (Mesopotamian marsh task force), planning and follow-up department, state commission of irrigation and reclamation, Tigris River basin and Euphrates River basin and so on.

Based on the discussion and information from the staff, it was found that capacity development of MOWR engineers is an urgent issue as they are not familiar with the recent technologies for planning, design, construction, operation and maintenance of water resource structures and facilities in spite of the fact that many of the engineers are highly educated from the universities in Iraq.

In fact, the technology development in the last twenty years has been remarkable in the water resources sector in the world. Together with the development of computer and GIS technologies, the new ways of water management and integrated operation of water resource facilities have developed rapidly. Also, the policies for water resource management have changed dramatically from the development oriented to demand side management, which might not be easily accepted by Iraqi engineers in the MOWR.

It seems that the major aspects for further water resource management in Iraq are as

follows:

(i) Strengthening facility maintenance and management capability for improvement of security and effective operation of existing water resource structures,

(ii) Formulation of optimum water distribution plans through water use monitoring activities,

(iii)Enhancing water saving consciousness and transferring water saving agricultural technologies.

It is important to note that the human resources development and technology transfer in the above three items are urgent and highly desirable for further water administration in Iraq. Training for integrated dam operation systems and watershed management systems in Japan and Iraq's neighboring countries would be effective for transfer of the above technologies.

(5) Constraints on Reconstruction and Development Issues

As mentioned in (4) above, the major constraint for reconstruction in the water resources sector seems to be pre-maturity of the institution of the MOWR, which would not be ready for activation of a full swing into reconstruction activities. In addition, the technical block of 20 years is seriously affecting the capability of management of existing structures and facilities. Almost all the existing structures and facilities are faced with the serious condition of their lack of maintenance work. As a result, there are so many structures / facilities which urgently require rehabilitation. It is quite difficult to determine priorities among various projects for urgent reconstruction and rehabilitation.

Taking into account the above conditions, it is recommended that urgent reconstruction assistance should be parallel to the capacity building activities, by which rebuilding of structures and human resources can be progressed at the same time.

Regarding the development issues, the rehabilitation of existing dams, reservoirs and water transport structures and facilities should be considered initially. Vital water resource development activities were undertaken in the 1960's and there is enough capacity in the existing water resource structures in Iraq. The full capacity rehabilitation of the existing structures is the most effective and quick solution to manage water resources in Iraq.

It is also important to note that resumption of the suspended activities for dams, intakes, and reservoirs would be effective to restore the water resource management system in Iraq. Many of the projects would require relatively little investment as some parts of the works have already been done, but prior to the resumption of activities, a review of water demand would be highly desirable.

After urgent rehabilitation of the existing structures and facilities, a review of the nationwide water resources master plan would be required. The master plan will then provide the updated water demand with appropriate water saving technologies, demand side management technologies and required further development of water resources. The basin-wide (nation-wide) water management system for effective utilization of existing water resource structures should be also taken into account together with the new water resource development.

An international water treaty for the Tigris and Euphrates River basins is essential and a very important issue in Iraq for further water resource management. In this issue, discussion among the directly affected countries is the only way to solve the problems that arise. Considering the merit and de-merit of claims by each respective country is a key issue to lead to an agreement.

(6) Proposed Support Program for Reconstruction and Rehabilitation

1) Water Management System for Tigris and Euphrates River Basins in Iraq

This project is to install telemeter water level gauges at major water resource and diversion facilities in the Tigris and Euphrates River basins. The objectives are to monitor real time inflow, outflow and reservoir storage. The real time water level information is to be transmitted through a telemeter communication system to a Water Management Center in Baghdad. The data is to be automatically saved in computers in the center. The accumulated information would be utilized to review the existing operational methods at the respective water resource structures and facilities, and to formulate optimum operation rules for an integrated water management system.

A training program is also to be implemented in parallel with the project implementation. The Japanese integrated dam operation system and river information system would provide quite effective learning for capacity building in water management technology for Iraqi engineers.

This project is judged as an effective and urgently required project to improve the safety operation of dams and effective use of the existing water resources. In fact, the MOWR raised the same project in their priority list for international assistance.

The followings are the proposed procedures for the project implementation:

a) **Training for Water Management in Jordan and Japan** A training program would initially be conducted for the core engineers in the state company center for hydraulic research, and the state commission of dams and reservoirs operation. The training would be conducted in the Jordan Valley Authority (JVA) and in Japan. In the JVA, the water management system in the Jordan Valley consists of two dams, a 90 km long distribution canal (King Abdura Canal), Tiberias Lake in Israel and 38 check gates for distribution of irrigation water. Water saving agricultural technologies would also be experienced in the training. In Japan, an integrated dam operation / management system in the river basin can be observed and various lectures for the SCADA system, a water allocation system, information management system and water right allocation system in Japan, would be provided. The training period would be 3 to 6 months, more or less. (Urgent project: Training, Project Cost approximately 200 million Japanese Yen).

b) **Installation of dam and weir operation monitoring system:** As the first stage of introduction of a water management system, a dam operation monitoring system for Mosul and Haditha Dams is to be installed. The two dams are located at the upstream end of the Tigris and Euphrates Rivers in Iraq, and all the inflow from the mainstream can be monitored by the two dams. In these dams, inflow into the reservoir, reservoir storage volume and outflow from the reservoir will be monitored through a real time telemetering system. Based on the accumulated information from the two dams, a tentative water distribution plan for the downstream water demand centers would be possible, and the required water resource development from the Tigris tributaries can be assessed. It would be much better if some additional monitoring stations were provided at the major structures, such as Samarra barrage, Ramadi barrage, Tharthar lake, Dokan dam and Derbendikan dam and so on, but this would be dependent on the budget availability. (Urgent, Grant-aid scheme, Project Cost 100~200 million Japanese Yen)

c) **Development of Basinwide Water Management System for Tigris and Euphrates in Iraq** The second stage of the water management system proposed is a nation-wide basin water management system, which covers all the major dams, reservoirs, barrages and intakes, particularly for irrigation, and the water supplies for major cities are included. The water demand for all the major intakes should be

estimated with the monthly/seasonal variation. The water distribution is based on the demand and the available water resources. The priority for water allocation to the demand side would be provided in case a shortage in the water resource occurs. The entire system would be operated in the National Water Management Center in Baghdad. By using this system, effective water management with a saving in water consumption would be realized. (Middle / Long term, Study/Loan Scheme, Project Cost approximately 5~ 10 billion Japanese Yen).

2) Major Dams Rehabilitation Project

There are currently 18 large scale dams and weirs existing in the Tigris and the Euphrates River basins in Iraq. Most of them are currently not able to function as they were originally expected to. Some are in a rather serious situation regarding their safety aspects.

The major dams rehabilitation project is therefore recommended and it is identified as the most urgent and effective project for water resource management.

The following are the proposed stages for the implementation:

a) **Study on Improvement of Safety Aspects and Function of Major Dams** The objective of the study is to identify the current condition of the existing major dams in Iraq. The alternative measures for each respective issue would be proposed in the study for each dam. A comparative study for the alternatives would be carried out and the optimum solution recommended with cost/benefit analysis. A priority action plan for dam rehabilitation will be proposed together with a financial arrangement plan. The counterpart agency for the study is the state commission of dams and reservoirs operation, MOWR. In conducting the study, close coordination with USAID would be required as they are also planning to conduct dam rehabilitation to some extent. In the course of the study, it is better that Japanese experts enter into Iraq for detailed investigation of major dams even though there is a limited time period. The study is, therefore, to be implemented as a basic study by hiring well experienced consultants in middle east countries, who can enter into Iraq, and high quality satellite images are to be used for the study of each dam condition until the security situation in Iraq is improved. (Basic study: Urgent, F/S: middle and long term, Study Cost: about 500 million Japanese Yen).

b) **Implementation of Dam Rehabilitation Project** Based on the results of the feasibility study, the priority project for dam rehabilitation would be selected with its optimum solutions. The project implementation for

dam rehabilitation would then be carried out. Throughout the project implementation, capacity building measures for Iraqi counterparts should be conducted in parallel. This would include system development for dam operation, monitoring and maintenance. It is expected that Tharthar lake rehabilitation, Hindia barrage, Haditha dam, Sweet water canal, Kut barrage and so on, might be selected as the priority scheme for Japanese assistance. (Rehabilitation of existing structures, middle/long term, project cost: approximately more or less 5 billion Japanese yen).

5.3.2 Irrigation

(1) Current Condition and Issues

The downstream delta area between the Tigris and the Euphrates is the place where irrigation originated in the world during the era of the Mesopotamian civilization. Mesopotamia means the area between two rivers.

In 4000 BC, migrants who had come to the Mesopotamia delta from the northern mountains had begun agriculture activity utilizing the fertile soil of the Mesopotamian delta for food production. However, the crops frequently died before harvesting. The people learned to dig ditches along the farm land and lead the water from the Euphrates River. This is the earliest known example of irrigation agriculture of mankind.

Since then, irrigation technology has gradually improved and food production has increased based on the development of irrigation technologies. About 200 years ago, modern irrigation technology was developed and large scale irrigation development became possible. At the same time, food production dramatically increased.

In Iraq, development of water resources for irrigation became vital from 1960s by diverting the river water to large scale lakes in the plains. As a result, the total irrigated area in Iraq is now 3.25 million hectare with a 61% irrigation ratio; this is the 12th biggest irrigation country in the world as shown below:

Table 5.3.6 Top 20 Countries for Large Scale Irrigation Development in the World

Rank	Country	Irrigation Area (million hectares)	Irrigation Ratio (%)
1	India	50.1	29
2	China	49.8	52
3	U.S.A.	21.4	11
4	Pakistan	17.2	80
5	Iran	7.3	39
6	Mexico	6.1	22
7	Russia	5.4	4
8	Thailand	5.0	24
9	Indonesia	4.6	15
10	Turkey	4.2	15
11	Uzbekistan	4.0	89
12	Spain	3.5	17
12	Iraq	3.5	61
14	Egypt	3.3.	100
15	Bangladesh	3.2	37
16	Brazil	3.2	5
17	Romania	3.1	31
18	Afghanistan	2.8	35
19	Italy	2.7	25
19	Japan	2.7	62
	World	52.4	17

(Source : FAO, Production Yearbook 1997)

Gravity irrigation systems are difficult to apply in Iraq due to the flat topography at the delta area. The river gradient is just 1/20,000 for the downstream 700 km stretch between Basra and Baghdad. The elevation in Baghdad is 36 m asl. Pumping stations are essential to force river water into irrigation canals, which are generally more than 100 km in length. There are many pumping stations connecting the irrigation canal networks in the middle and downstream areas of the Mesopotamian delta area.

It is reported that the actual irrigation area is estimated at 1.93 million hectares as of 1993, which is only 59% of the total irrigation area. The low rate of actual irrigation is due to lack of maintenance of irrigation canals and frequent breakdown of pumping stations. Cereals such as wheat and barley are the major crops in Iraq and occupy 75% of the farmland. According to WFP, the cereal production does not meet domestic demand with a deficit of 4 to 5 million tons as of 1993. The gap between production and demand is getting bigger year by year. Actual irrigation area also decreased seriously after 1993 with the continuous economic sanctions to Iraq. In fact, no spare parts for pumps and equipments could be imported for a long time. As a result, cereal production dramatically decreased over the 5 years from

1997 to 2002, during which time production halved.

Another issue of the irrigation sector is the high salinity in the irrigated farm land. The river water quality is not really suitable for irrigation because of high chloride concentration, particularly in water from the Euphrates River. The river flow in the Euphrates River is heavily used for irrigation in the upstream area in Turkey and Syria. Drainage water returns to the same river with higher salinity than when it was extracted. It is reported that the chloride concentration at Ramadi barrage on the Euphrates River was about 500–600 ppm, and water from this barrage is mainly used for irrigation in the middle Euphrates River basin. Soil salinity increases when the salty irrigation water is supplied, so soil salinization is a serious problem because of the continuous irrigation using drainage water from upstream countries.

As a countermeasure, the Iraqi government constructed a 500-km long drainage canal, which is called the Main Outlet Drain (MOD). All the drainage water from irrigation areas is collected in the MOD to prevent downstream degradation of water quality. The MOD flows from the south of Baghdad through the Mesopotamian irrigation area towards the Persian Gulf.

The priority issues for the irrigation sector are therefore summarized as: i) urgent rehabilitation of pumping stations, and ii) improvement of soil quality on irrigated farm land. Increased food production is an urgent requirement to stabilizing living conditions in Iraq. In addition, water resources development in the north-eastern region and seasonal water reservoir on the desert area would also be effective to activate the irrigation sector and increase food production. Introduction of water saving irrigation technologies and more efficient water management systems will have synergetic effects to mitigate the degradation of soil condition and improve river water quality.

(2) Reconstruction support program recommended by Iraqi Government

Rehabilitation of existing irrigation facilities is identified as the most urgent and important issue in the irrigation sector. Particularly, rehabilitation of pump stations connecting irrigation/drainage canal networks is essential to resume irrigation activities in southern Iraq. Many pump stations do not function due to lack of maintenance, spare parts, and electricity. Urgent rehabilitation or emergency provision of pump units would be highly effective to resume irrigation activities in a short time.

Another urgent issue is to clean up the irrigation canal network. The canals are clogged by floating and submerged weeds and siltation. The lack of canal maintenance is basically due to the shortage of equipment for dredging and weed removal. Provision of canal excavating and dredging equipment and weed removal unit would be highly effective to improve the canal condition to increase flow capacity.

The above projects are also regarded by the government of Iraq as having a high priority. The following six (6) projects were proposed by the Ministry of Planning and International Cooperation in the Abudabi donor meeting:

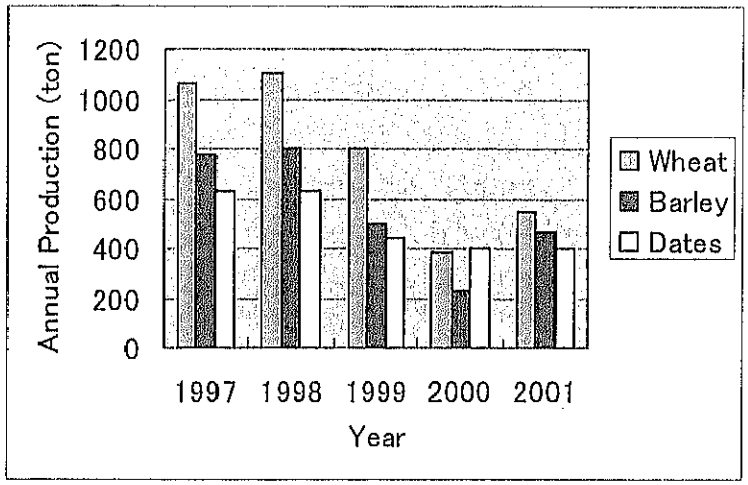
Table 5.3.7 List of Priority Projects for Irrigation Sector proposed by MOP

Project No.	Project Title	Project Cost (mil.US$)	Governorate
450	Provision of spare parts for the Euphrates pumping station	5.0	Various
451	Provision of spare parts for the Tigris pumping station	5.0	Various
458	Professional training in weed control	0.036	Various
461	Land reclamation equipment	102.0	Various
462	Canal cleaning equipment	133.0	Various
467	Provision of pumps for Sab albore draining pumping station	1.265	Baghdad

Rehabilitation of pumping stations, weed control, and canal cleaning are included in the six priority projects.

(3) Constraints for Reconstruction and Development Issues

As mentioned above, salinity is a serious problem in the of the irrigation area of the Mesopotamian plain in southern Iraq. The potential farm land in southern Iraq is estimated at 8 million hectares, but the actual irrigation area would be only half that. The agriculture production has decreased and is becoming more serious year by year. Improvement of drainage condition and water use efficiency will directly contribute to the restoration of agriculture production.



Source: FAO

Figure 5.3.8 Annual Production of Major Crops

The present irrigation methods need to be reviewed, particularly in the Mesopotamian plain, to avoid further declines in agricultural productivity through accumulating soil salinity. Water saving technology such as drip and sprinkler irrigation systems are much more efficient at delivering water than gravity irrigation and thus could reduce salinity accumulation as less water needs to be applied. This method is, however, not well known by Iraqi farmers, and the government of Iraq is not very interested to apply water saving irrigation technologies.

One of the main reasons why the farmers and government are not interested in water saving irrigation is that there is no water pricing system in the Iraqi irrigation system. If the water for irrigation is free, the farmers only wish to apply gravity irrigation because it is simpler to operate than drip and sprinkler systems. But if water pricing is applied for the irrigation sector, water saving technology would be more likely to be adopted by farmers and the government.

Water saving irrigation systems could also be expected to relieve the country's water shortage problems, particularly for the Euphrates River basin. It is proposed that integrated improvement of irrigation systems for the middle Euphrates Area should be implemented. As a first step, the existing canals should be maintained to increase their flow capacity and recover production on existing irrigation areas. Provision of canal excavation equipment and weed removal dredgers would be effective to achieve this aim. At the same time, immediate supply of horizontal pumps is recommended as an urgent remedial measure.

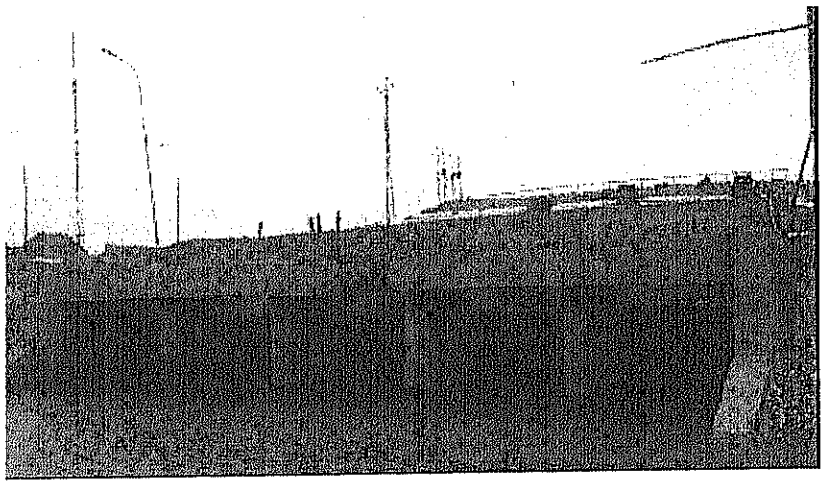
The second stage would be to prepare a master plan study of integrated irrigation management for the middle Euphrates River. The master plan would propose long-term development plans for solving the issues of water shortage, soil salinity, drainage conditions and so on. A priority pilot project would be recommended for immediate implementation after the master plan. The pilot project would include measures for effective water use for irrigation, diversification of crops to meet market needs, introduction of food processing industry, strengthening farmers' cooperation and so on. Throughout the project, capacity building by means of training schemes and assistance to irrigation policy making would be included.

(4) Proposed Reconstruction Support Program

1) Provision of fixed type horizontal pumps

It is essential to replace the irrigation and drainage pumps of irrigation systems located in the middle Euphrates River basin. The Iraqi government purchased 1,000 East German made pumps in 1980 (capacity: 1 m3/s, Head 6~7m). These pumps have been installed in irrigation systems throughout Iraq.

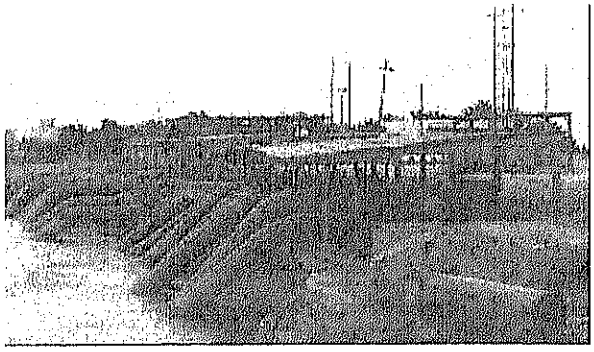
Generally, the scale of irrigation of drainage pump stations is somewhat larger than 1 m3/s, but as an urgent restoration measure, it is recommended that the same type of pumps be installed to increase the number of pumps to meet the required capacity. Pumps of 1 m3/s capacity are easy to transport and install, and this can be managed by Iraqi engineers with appropriate training in neighboring countries.



Severely Damaged Pump Station (East Garaf)

Since 1990, there have been few opportunities for maintenance of pumps due to economic sanctions. Because of this, almost all the pumps installed in 1980 have completely broken or are severely damaged. They need to be replaced immediately to recover the function of irrigation and drainage.

In 1997, the Iraqi government was provided with 500 horizontal pumps (made in Tunisia/Egypt) through the Oil for Food program. All the pumps provided in this scheme were 1 m3/s capacity horizontal type. These pumps were used to replace the broken pumps in the whole country. After that, another 1,000 pumps of Chinese make were again procured through the Oil for Food program. Even after provision of 1,500 pumps, there are still many places that require replacement of pumping equipment immediately.



Urgent Installation of Pumps at Irrigation Canal

Provision of the same type of pumps would be quite effective as the Iraqi government is well experienced at installing them. This scheme would directly effect the restoration of the irrigation area and would result in an increase in cereals production.

At this time, 50 horizontal type pumps with a capacity of 1 m3/s should be provided to the Ministry of Water Resources. The pumps are proposed to be installed at East Garaf in Nasiriyah, Al Suweer in Samawah, and Al Muhadad in Samawah. (Urgent, Grant-aid, Project Cost: 2 billion Japanese yen).

2) Provision of Equipment for Irrigation Canal Cleaning

Canal conditions urgently need to be improved to restore the irrigation system. Lack of canal maintenance is mainly due to lack of equipment for canal excavation and silt/weed removal. It is recommended that equipment for canal maintenance be provided as an urgent reconstruction support program under the irrigation sector.

The equipment would be supplied to state companies for irrigation and reclamation, which are responsible for maintenance of the existing irrigation

system. The equipment required for canal maintenance is as follows:

a) Normal backhoe
b) Long arm backhoe,
c) Floating weed remover,
d) Dump truck,
e) Wheel loader

The number of machines can be adjusted based on the budget. The equipment supply should be parallel to the training and supply of spare parts. (Urgent, Grant-aid, Project cost 1~2 billion Japanese yen)

3) Modernization of Irrigation System on Middle Euphrates River Basin

This project covers the whole Mesopotamian plain downstream from Ramadi barrage on the Euphrates River and downstream from Kut barrage on the Tigris River basins, which includes the following 14 irrigation schemes.

The project aims to formulate an integrated modernization plan for the existing irrigation system of the whole irrigation area of 480,000 ha, including rehabilitation of existing irrigation facilities, review of cropping pattern, strengthening farmers' organizations, introduction of food processing industry, assessment of water pricing system, technical assessment for soil improvement and water saving irrigation methods, and so on.

A master plan will be formulated consisting of urgent, short term, mid-term and long-term action plans for modernization of the irrigation system. At the same time, capacity building and technology transfer to farmer's organizations and government engineers will be performed throughout the study and implementation period. The special training program will also be formulated for sustainable improvement of the irrigation system. Enlightment on water saving and management is the most important issue for modernization of irrigation systems in Iraq.

The following is an outline of the implementation program:

a) **Training on Water Saving Technologies in Jordan** : Water resources availability in Jordan is amongst the most limited of all countries in the Middle East, and the country's per capita water availability is only

one-fifth of Iraq's. Reflecting the severe lack of water availability, various water saving irrigation technologies are employed in Jordan, such as drip irrigation, sprinklers, vinyl house farming, evaporation protection sheeting, treated water utilization, demand side management system, SCADA system and so on. Some of these technologies would be quite effective in Iraq for promotion of water saving irrigation system. The target group for training is the engineers of the state commissions of the Tigris and Euphrates river basins, Irrigation and Reclamation division of the Ministry of Water Resources, and the Ministry of Agriculture. The host agent for the training would be the Jordan Valley Authority undertaken by the Ministry of Water Resources in Jordan. (Urgent, Training scheme, 100 million Japanese yen).

b) **Master plan on Integrated Modernization of Irrigation System on Middle Euphrates River Basin :** Master plan formulation is essential to begin the modernization of the irrigation system. The area covered is the southern part of the Mesopotamian plain downstream of Ramadi barrage on the Euphrates River and Kut barrage on the Tigris River. The total irrigation area to be covered is 480,000 ha consisting of 14 major irrigation systems.

The study period will be more or less 1 year including mapping through satellite imagery, field investigation by local consultants, master plan formulation, preliminary design for modernization of the irrigation system, cost and benefit analysis, and project implementation program formulation. (Sort / Mid Term, Study, Cost: about 500 million yen)

c) **Pilot Project for Implementation of Integrated Modern Irrigation System :** Pilot project sites for modernization of the irrigation system will be selected under the study in b) above. Implementation of the pilot projects will be carried out immediate after completion of the study. More or less five areas will be selected with the budget of about 1 billion Japanese yen each. The pilot scheme would be integrated agriculture development, which includes rehabilitation of existing irrigation/drainage facilities, market oriented cropping pattern, water saving irrigation demonstration farming, trial application of a water pricing system, and strengthening of farmers' cooperation. (Short/mid term, Japanese yen credit, Total project cost: about 5 billion yen)

d) **Permanent Restoration of Pumping Stations :** In the master plan study mentioned in b) above, a prioritization study for the permanent restoration of existing pumping stations will be carried out. The project will be implemented in parallel with the pilot project for integrated modernization of irrigation system. The scope for permanent restoration of pumping stations is a) restoration of pumping stations, b) lining of existing irrigation canals, leveling of existing irrigated farm land, and so on. (Short/mid term, Japanese Yen loan, about 5 billion yen).