(8) A Regional Medical Centre with an Advanced Nursing School will be established by expansion of the existing public hospital (3 ha).

(9) The existing sports ground will be enlarged and improved as a sports park not only for football, but also for tennis, swimming, cycling, aerobics and probably *Karate*, *Judo*, (10 ha).

(10) A People's Hall will be established with an auditorium, a hall for ceremonies and a children's library (2 ha).

(11) Neighbourhood parks will be located at some places (totaled 10 ha).

5.4 Mu'tah Industrial Estate Programme

(1) Site Selection: An area located north to the existing campus of Mu'tah University is thought to be the most suitable for the Estate in view of the following site conditions (see Fig 5-3):

(A) Proximity to Mu'tah University
(B) Unurbanized flat land
(C) Good access to Mu'tah, Mazar and Karak
(D) Availability of the existing and planned infrastructures
(E) Good road network such as the University Road
(F) The site is located to the east of the Urban Centre, that is the downward direction of the dominating west wind

On the other hand, there are some disadvantages of this site such as the rather high land price (JD 4 to 5/m^2) and the present landuse for agriculture.

The following two alternative sites were also identified in addition to the above site: (1) One is a site south of Karak College, which is located at a crossroads of the University Road and the Karak-Qatrana road (Route 80). But the land is used for agriculture and rather far from Mu'tah-Mazar Urban Centre and Mu'tah University. (2) The other is a site along Route 80 between Karak and Lajjun. This site has such favourable conditions as low land price (less than JD 1/m^2) and less

affect on agricultural land. However the site has, at the same time, such disadvantage as less good access to urbanized areas and comparatively poor infrastructure and service levels.

Although these two alternatives are regarded as second bests, they should be included in a further study on the location.

(2) Proposed landuse composition and major facilities

(A) Expected employment and landuse: The Estate would provide job opportunities for about 2,500 persons. With a gross density of 75 persons per hectare, the Estate will require about 33 ha in total. A preliminary layout plan is shown in Fig. 5-4.

(B) Factory land consists of standard factory areas and custom-built factory areas. Various types of equipped factories (industrial apartments) and warehouses will be built to help establish small and medium scale industries at a low initial cost. Various sizes and types land for custom-built factories will also be prepared.

(C) Administrative and Supporting Centre: The main facilities of the Centre will be an office, meeting rooms, an information centre, a copy and printing centre, a restaurant and cafeteria, a multi-purpose hall, a mosque, a products display area, a petrol station, and training facilities. General urban facilities will be shared with urban centre as far as possible to have active and open relationships with the city centre.

(D) Incubation functions will include supporting activities for marketing, research and development, financial services, coordination with the University and other research institutes, computer services, provision of meeting rooms and a hall, clerical services, information services, and management consultation. These incubation functions will be carried out by the staff members of the Centre.

(E) Utilities: Utility facilities are water supply, sewerage, electricity and telecommunications. Water demand is preliminarily estimated at about 1,500 - 2,500 m^3/day.

(F) Green areas, parks and open spaces: In addition to the boundary green buffer, two parks will be arranged to provide an agreeable

environment and recreational space. Sufficient green areas should be attached to buildings so that the total green area accounts for not less than 25 per cent of the total land area.

5.5 Costs

(1) Mu'tah-Mazar Urban Development Programme: The total cost is roughly estimated at JD 22.88 million. The details are shown in Table 5-4.

(2) Mu'tah Industrial Estate: The investment cost for the Estate is estimated at about JD 8.00 million, of which land acquisition costs will be JD 0.33 to JD 1.65 million and construction costs JD 5.70 million. The rest represents the cost of the study, planning, design and contingencies.

5.6 Implementation Schedule and Project Management

The proposed implementation schedule for the Mu'tah-Mazar Urban Development Project is shown in Fig. 5-5. A feasibility study on the Mu'tah Industrial Estate should be started first for early implementation of Phase 1 of the Estate. A study on the Urban Development Programme should follow for implementation in the long-term.

As for overall urban development, Mu'tah-Mazar Urban development Council would be established for management and coordination between Mu'tah and Mazar Municipalities, Mu'tah University, Karak Governorate and other ministries and agencies involved. Also, the representation of Tafila Governorate may need to be examined because the development of the Mu'tah and Mazar area will have influence on Tafila's own development projects.

The Industrial Estate, however, would be managed by Jordan Industrial Estate Cooperation taking advantage of its experiences and institutional capability.

5.7 Conclusions and Recommendations

(1) Conclusions: It is proposed that Mu'tah and Mazar be developed as an education and industry oriented urban centre of the King's Highway

Corridor which will extend from Karak to Tafila. Mu'tah University should lead the development with its research functions in industrial technology and in the supply of qualified manpower for incubating and promoting small and medium scale industries.

Mu'tah Industrial Estate Programme: this will have a land area of 33 ha and new job opportunities of 2,500, and will be an essential component of the Project. The Estate should put special emphasis on incubation and development of small and medium scale industries which will take root in the local industrial linkage and local communities.

Mu'tah-Mazar Urban Development Programme: the planned area is 710 ha, and projected population and job opportunities in 2005 30,000 and 9,000 respectively. With implementation of the proposed infrastructures, urban facilities and the Pilgrim Park surrounding the Muslim martyrs' tomb, the Mu'tah-Mazar Urban Centre would become a unique growth point in harmony with agriculture, technology research and manufacturing industry, and pilgrimage.

The construction cost of the Project is estimated at JD 30.88 million (equivalent to US$ 90.8 million), consisting of JD 8.00 million for the Mu'tah Industrial Estate and JD 22.88 million for the Mu'tah-Mazar Urban Development.

(2) Recommendations: The Study Team recommends that Jordan Industrial Estate Corporation should make a feasibility study of the proposed Mu'tah Industrial Estate. In parallel with this, a detailed study should be made of the proposed Urban Development Programme for early implementation.

Also, the Study Team recommends the establishment of a joint committee between both councils for urban development because the coordination between Mu'tah-Mazar and Karak Urban Development is important in terms of their combined effects.

Table 5-1 LAND AREA AND POPULATION IN MU'TAH-MAZAR

District	Area (ha)	Population	Density per ha
Mu'tah	488.0	3,500	7.2
Mazar	461.4	5,000	10.8
Total	949.4	8,500	9.0

Source: MMRAE Regional Planning Department, MOP
Note: The planning area is equal to the municipal area.

Table 5-2 PRESENT LANDUSE

(ha)

	Classification	Mu'tah	Mazar	Total
1.	Commercial	3.4	3.7	7.1
2.	Religious	0.3	0.5	0.8
3.	Residential	73.6	62.0	135.6
4.	Administrative	0.4	2.2	2.6
5.	Industrial	0.3	-	0.3
6.	Educational	3.8	3.4	7.2
7.	Green	14.0	7.6	21.6
8.	Ruinous	6.2	-	6.2
9.	Terminal	-	-	-
10.	Power supply	-	-	-
11.	Agriculture	306.7	301.2	607.9
12.	Unspecified	79.3	80.8	160.1
	Total	488.0	461.4	949.4

Sources: Regional Planning Department, MMRAE
The Study Team
Note: Road and street is included.

Table 5-3 FUTURE LANDUSE PLAN OF MU'TAH-MAZAR

(ha)

Classification	Mu'tah - Mazar
1. Central Commercial	7.3
2. Neighborhood Commercial	7.0
3. Governmental Building	1.7
4. Community Centre	3.2
5. Religious	0.7
6. Terminal/Distribution	-
7. Supply/Treatment	-
8. Residential - A	38.8
9. Residential - B	116.0
10. Residential - C	114.5
11. Residential - D/E	74.7
12. School/Laboratory	19.1
13. Hospital/Health	4.0
14. Plaza/Garden	8.4
15. Park/Forest/Green	87.5
16. Recreation/Sports	11.5
17. Industrial	2.0
18. Agricultural	117.9
19. Car Parking	6.7
20. Road/Street	88.8
Total	709.8

Source: The Study Team

Table 5-4 CONSTRUCTION COSTS OF MU'TAH-MAZAR URBAN DEVELOPMENT

Sub-Project	Item	Unit cost (JD)	Scale	Total amount (JD 1000)
1. Road	Excavation	3.0/m^3	237,000 m^3	711
	Pavement	2.5/m^2	474,000 m^2	1,185
2. Water Supply	piping	6.0/m	133,200 m	799.2
3. Sewerage	piping	22.0/m	204,800 m	4,505.6
4. Parco Mu'tah	demolition	6.0/m^2	62,000 m^2	372
	excavation	3.0/m^3	62,000 m^3	186
	pavement	2.5/m^2	31,000 m^3	77.5
	gardening	6.0/m^2	15,000 m^2	90
	building	80.0/m^2	16,000 m^2	1,280
5. School Sites	Excavation	3.0/m^3	30,000 m^3	90
	reclamation	3.0/m^3	30,000 m^3	90
6. Residential lots	Excavation	3.0/m^3	500,000 m^3	1,500
	reclamation	3.0/m^3	500,000 m^3	1,500
7. Modernization of streetside commercial	pavement	2.5/m^2	25,000 m^2	62.5
	gardening	6.0/m^2	25,000 m^2	150
8. Hotel	building	80.0/m^2	7,200 m^2	576
9. Medical centre	building	80.0/m^2	36,000 m^2	2,880
10 Sports Park	gardening	6.0/m^2	50,000 m^2	300
	building	80.0/m^2	50,000 m^2	4,000
11 People's hall	building	80.0/m^2	24,000 m^2	1,920
12 Neighborhood park	gardening	6.0/m^2	100,000 m^2	600
Total				22,874.8

Source: The Study Team

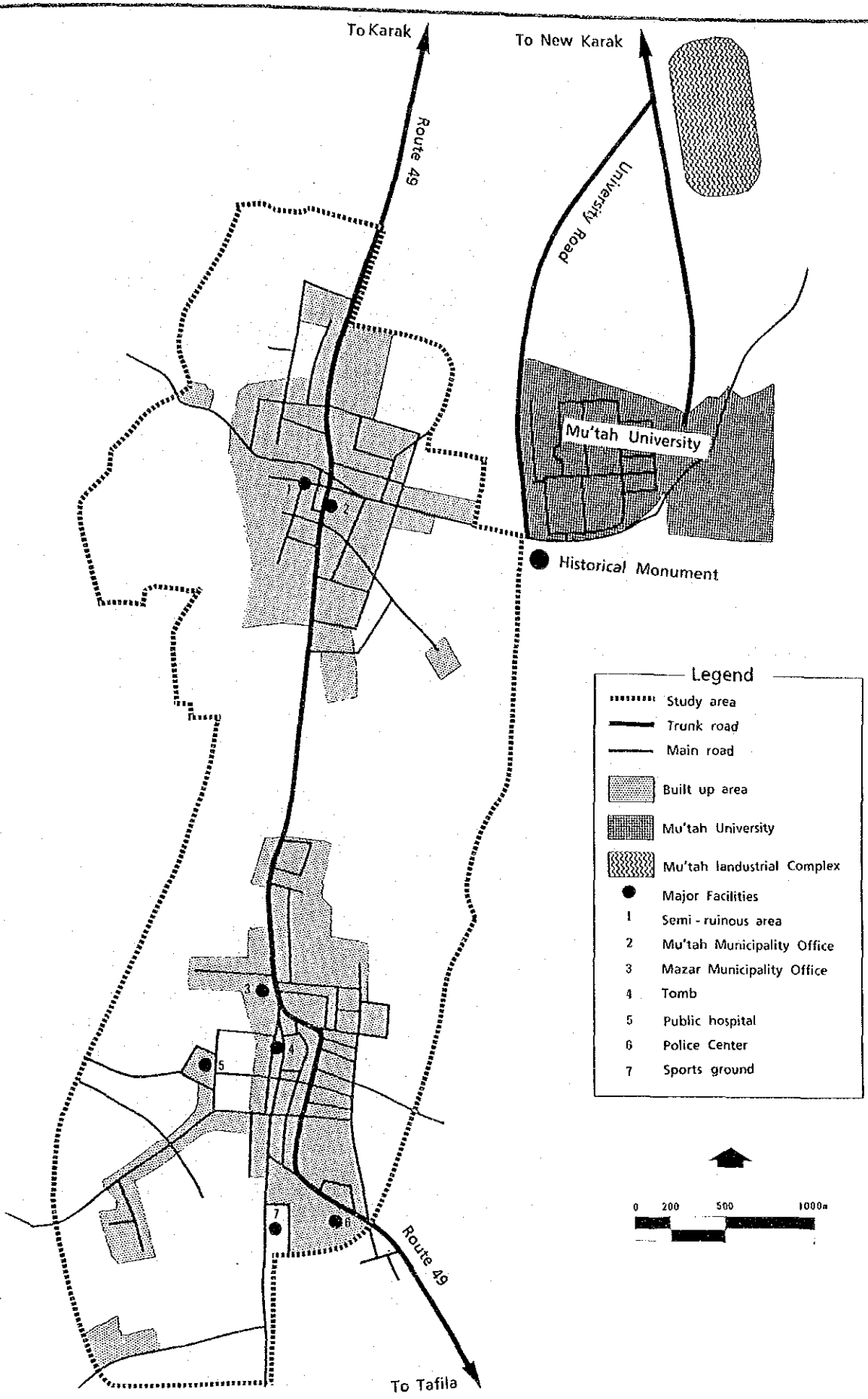

Fig. 5-1 Location Map of the Mu'tah-Mazar Urban Development Project

THE HASHEMITE KINGDOM OF JORDAN
THE STUDY ON INTEGRATED REGIONAL DEVELOPMENT MASTER PLAN FOR THE KARAK - TAFILA DEVELOPMENT REGION

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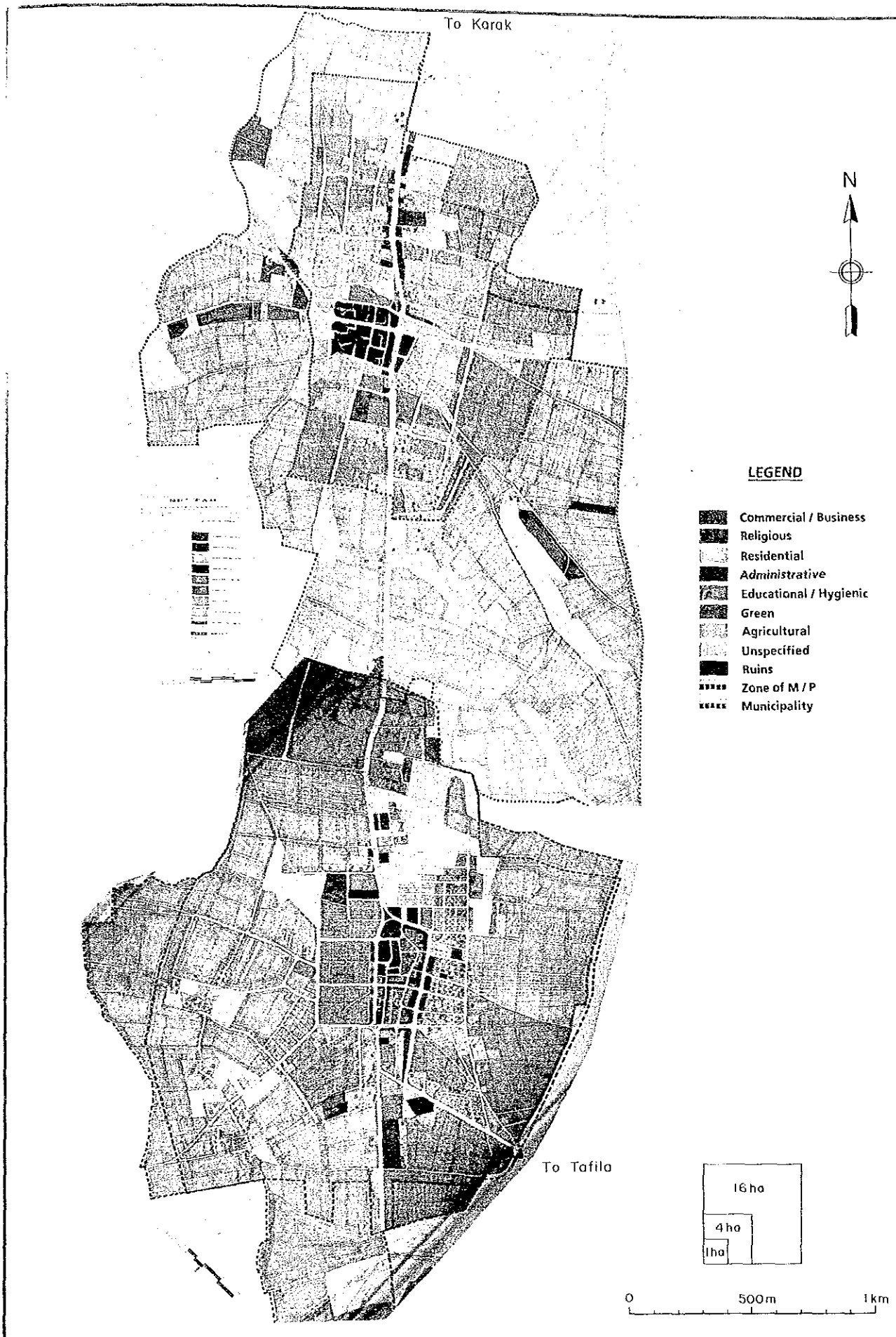

Fig. 5-2 Present Landuse of Mu'tah-Mazar

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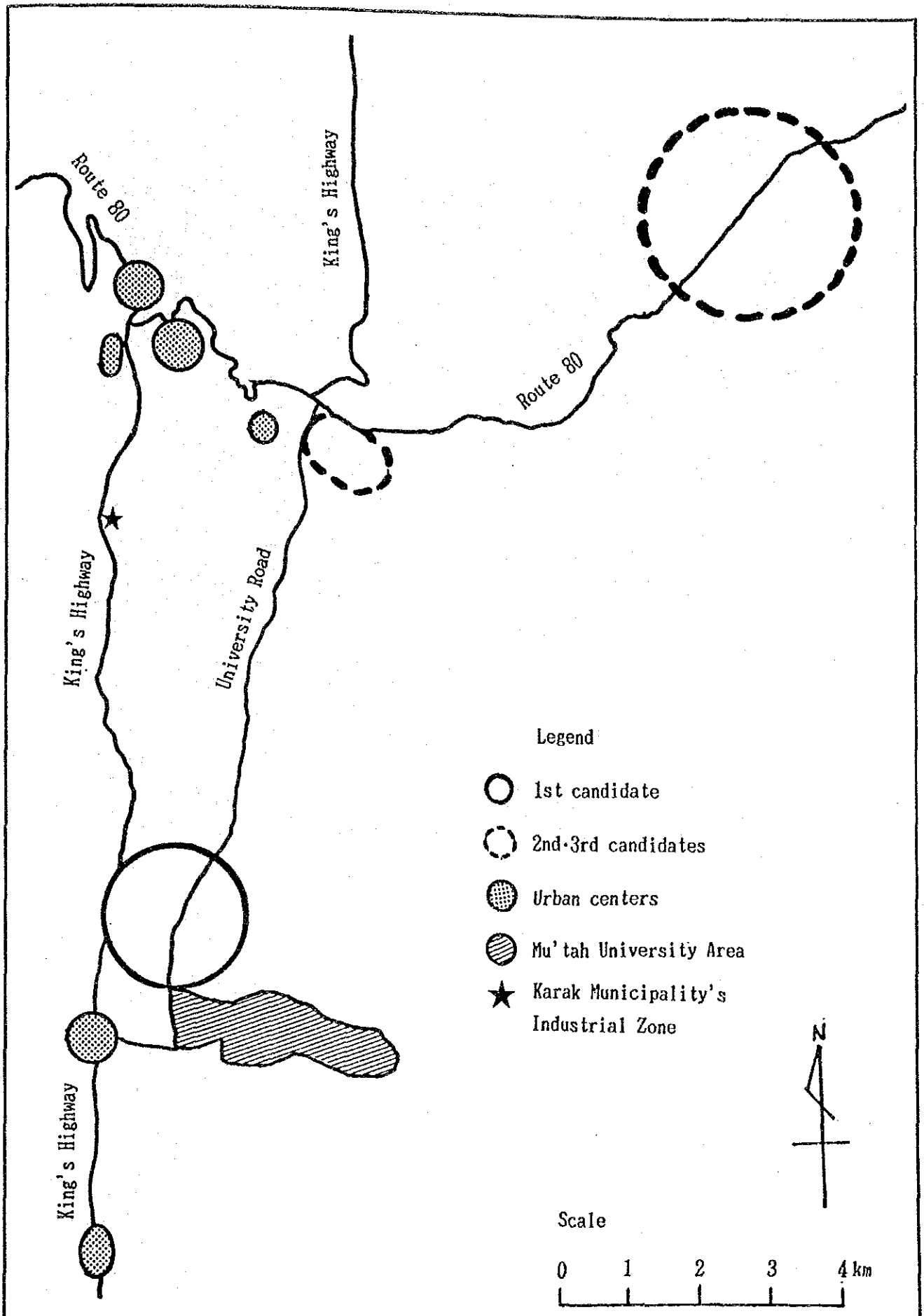

Fig. 5-3 Candidate Sites for Mu'tah Industrial Estate

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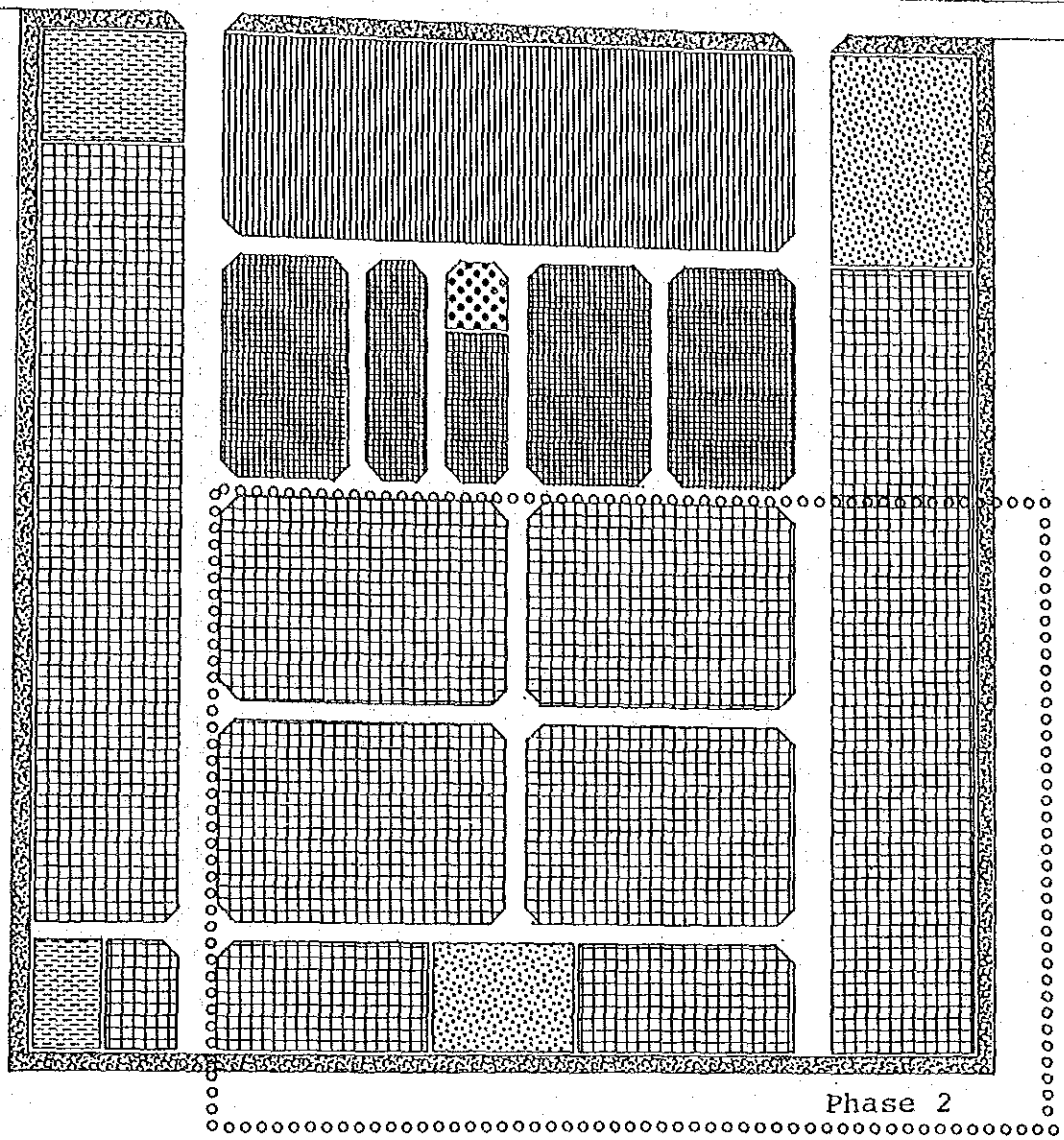

SCALE

0 10 20 50 100 200 300m

LEGEND

- Administrative and supporting facility land
- Standard factory land
- Custom built factory land
- Park
- Green boundary zone
- Warehouse
- Utilities

Fig. 5-4 Layout Plan of Mu'tah Industrial Estate

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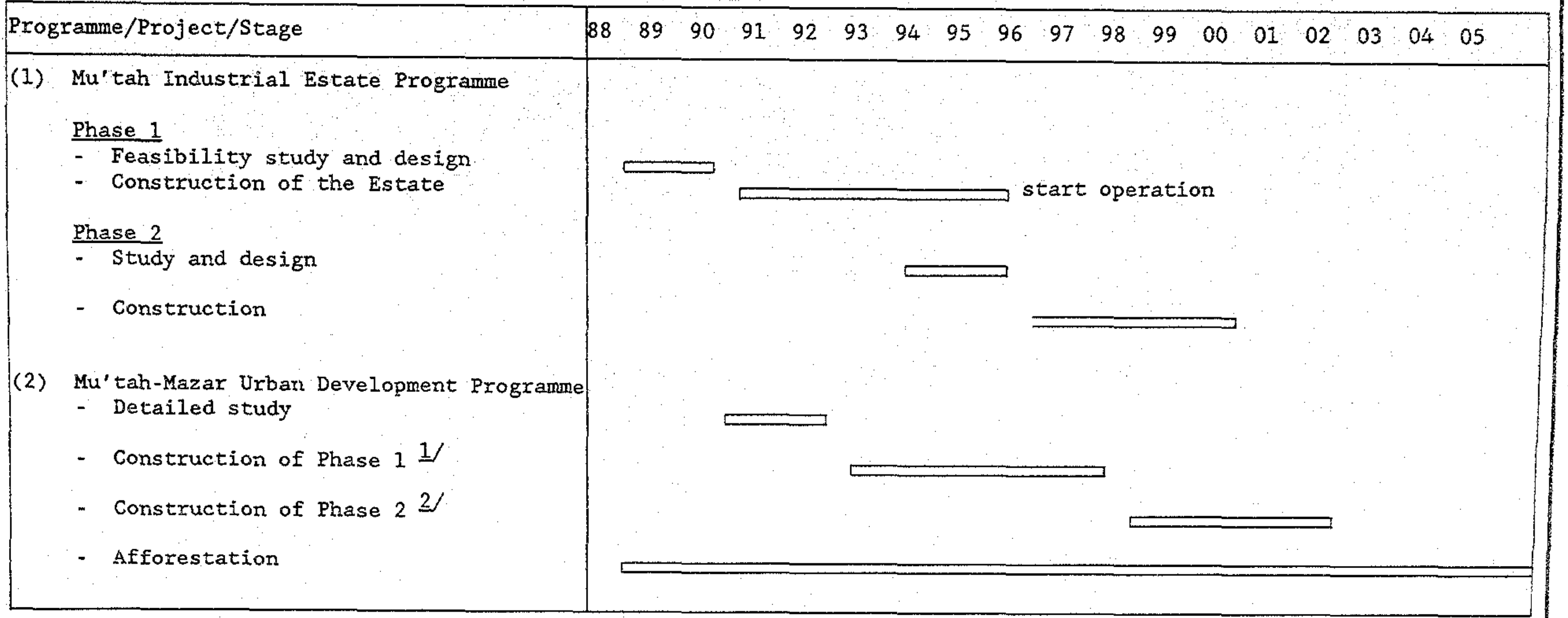

1/: Phase 1 includes expansion of infrastructures; establishment of Parco Mu'tah; improvement of school buildings; modernization of street commercial activities; improvement of residential lots; construction of a hotel

2/: Phase 2 includes construction of sports garden; establishment of Regional Medical Centre with Advanced Nursing School; peoples hall

Fig. 5-5 Preliminary Implementation Schedule for the Mu'tah Mazar Urban Development Project

Fig. 5-5 Preliminary Implementation Schedule for the Mu'tah-Mazar Urban Development Project

THE HASHEMITE KINGDOM OF JORDAN
THE STUDY ON INTEGRATED REGIONAL DEVELOPMENT MASTER PLAN FOR THE KARAK - TAFILA DEVELOPMENT REGION

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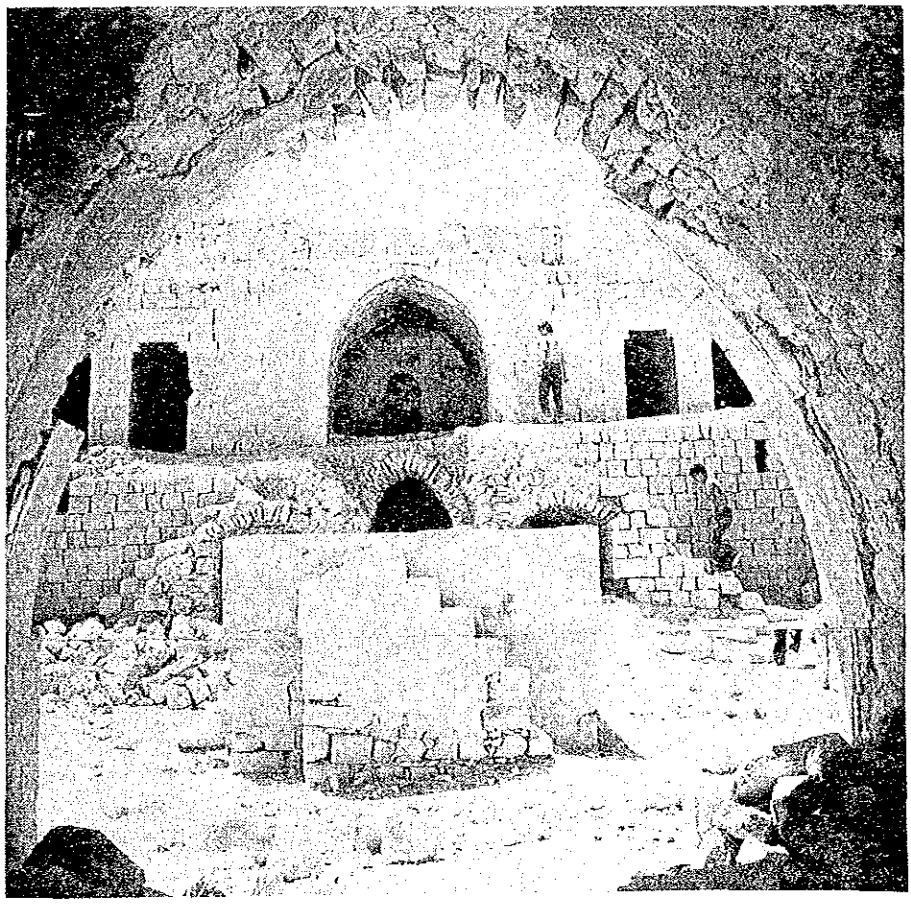
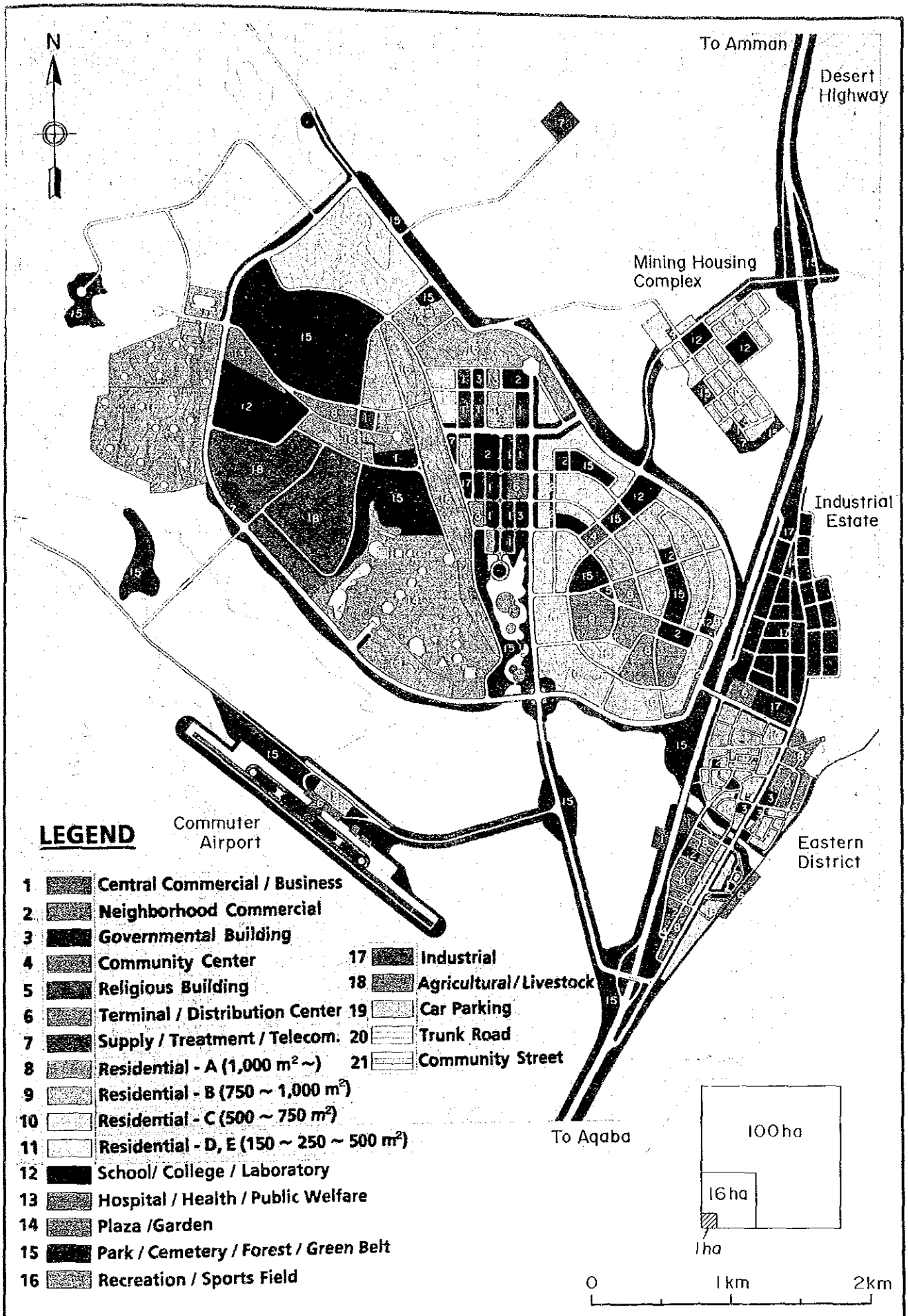
CHAPTER 6 GREEN BADIA PROJECT



Hasa Castle



Future Landuse Plan of Hasa

THE HASHEMITE KINGDOM OF JORDAN
THE STUDY ON INTEGRATED REGIONAL DEVELOPMENT MASTER PLAN FOR THE KARAK - TAFILA DEVELOPMENT REGION

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6. GREEN BADIA PROJECT

6.1 Introduction

The necessity for the Badia development has been discussed and realized by the Government. Recently in 1987, the Badia development was taken up as a priority project of the Kingdom under the leadership of H.R.H. Crown Prince Hassan with most of the ministries and the related governmental agencies involved.

The Arabic term Badia historically means managed semidesert. The Green Badia Project has been selected as one of the six priority projects in the Master Plan. This Project is planned with the target year 2005, and is proposed with Water Programme, Environment and Tourism Programmes, Hasa New Town Programme, and New Energy Programme.

A draft master plan for this Project was prepared in this study, including frameworks, a plan of infrastructure and necessary urban facilities, and a future landuse plan. Within the scope of this draft master plan, the other three programmes were prepared.

6.2 Project Background

6.2.1 The Project Area and Landuse

(1) Project area: The project area is located some 50 km southeast of Karak, and 130 km south of Amman in a direct line. The area covers the existing town of Old Hasa and surroundings as shown in Fig. 6-1. The land area and population of the project area are shown in Table 6-1.

(2) Landuse: Topographical features of the Project Area can be summarized as follows:

(A) The urbanized area in Old Hasa is flat land at an altitude of about 820 m AMSL, where Wadi Hasa flows from east to west.

(B) The candidate site for New Hasa is a continuation of gently undulated hills with altitudes from 820 to 900 m AMSL.

The present landuse is shown in Table 6-2 and Fig. 6-2, and may be summarized as follows:

(A) An agglomeration of buildings has been formed from south to north along the old Desert Highway, which is the present main street of Old Hasa.

(B) More than 47 per cent of the municipal area is used for residential purposes, and the green area is limited.

(C) The candidate site of New Hasa is unused governmental land.

6.2.2 Socio-economy

The population of the Badia Development Sub-area was estimated to have been 7,200 in 1985. Hasa (4,000 people) and Qatrana (2,200 people) are the two largest towns along Route 15 (the Desert Highway), which is a primary road connecting Amman and Aqaba. In 1985 the traffic volume of vehicles was between 4,000 and 5,000 a day in the neighbourhood of the Qatrana junction. At present, the Badia along the Highway is only a commodity-transit and phosphate-mining area in terms of socio-economy.

6.2.3 Infrastructures

(1) Roads: There are two trunk roads in Old Hasa, the Desert Highway (Route 15) and the old Desert Highway. Streets in the City are mostly paved, but roadside trees and pedestrian walks are not well provided.

(2) Water supply system: This serves most of the municipal area from wells.

(3) Electricity: The electrification ratio in the city is 100 per cent.

(4) Sewerage system: This has not yet been developed except in the housing complex of the Jordan Phosphate Mines Company (JPMC).

(5) Social infrastructure: As major urban facilities, there are a health centre, two secondary schools, and two primary schools in Old Hasa.

6.2.4 Phosphate Mining

Two large phosphate mines of JPMC are located at Hasa and Abiad. About 90 per cent of domestic phosphate production in 1985 came from these mines. The production contributes to acquisition of foreign cur-

rency in the context of the national economy. However, the two factories have no significant economic effect on activities in the project area except in provision of some local employment.

6.3 Draft Master Plan for Green Badia Development

6.3.1 Development Objectives

The Green Badia Project has three principal objectives:

(1) to rehabilitate the green environment of the Badia for socio-economic development

(2) to enhance the local economy both in the number of job opportunities and in income levels by promoting strategic tourism industries

(3) to provide citizens with improved accommodation in a comfortable environment with greenery

6.3.2 Basic Concepts

The Project aims at the establishment of a growth point in the South Badia for full-swing development in the 21st century, by harnessing the abundant sunshine and extensive land resources. During the plan period, the population in the Badia Development Sub-area is targeted to increase from 7,200 at present to 30,000 in 2005, thereby contributing to rectifying the present imbalanced spatial structure of the socio-economy in the region.

One of the main motivations for this Project is the availability of the water resources in the project area. These consist of groundwater, flood flow and wastewater from the phosphate mines.

The Study Team proposes a start with afforestation works in the Badia to rehabilitate the environment. In parallel with this, tourism should be promoted as the main income generating sector as well as to provide job opportunities for people who are going to settle in the Badia.

Since the water resources are limited both in the Badia as well as in the Kingdom, it is proposed that this limited amount of water be used

for a large scale tourism development and afforestation works rather than for small scale irrigated agriculture. The potential productivity of tourism industries in terms of unit water consumption is much higher than irrigated agriculture, although the tourism development requires a capital investment on a large scale.

Also, since the water cannot be manufactured in a practical sense except by desalinization of sea water, it is a prerequisite for the nationwide water resources development in the Kingdom to reuse the wastewater from the phosphate mines. This water should be recognized as the common property of the Kingdom or the people, and be reused to the maximum possible extent.

An application of solar and wind energy is becoming a potentially strong tool for development of the Badia for power and hot water supply using innovative technology.

The proposed Hasa New Town will be the key to the successful development of the Green Badia Project. The Study Team proposes the designation of Hasa as the strategic growth point for the South Badia in view of its availability of water, extensive unutilized governmental land, and good access for transportation. In the future, Hasa New Town will contribute to balanced development of national socioeconomic activities by leading the Badia development.

6.3.3 Development Strategies

(1) Water Programme: El Hassa Phosphate Mine, which is using about 6.9 MCM/yr of the total groundwater development potential of 13.4 MCM/yr in the Hasa basin, is discharging about 3.8 MCM/yr of wastewater with solids of about 0.9 million t/yr as slimes. These are at present left for natural evaporation and infiltration on the flood plain to the east of the Desert Highway. This wastewater has a TDS concentration of about 3,600 ppm and is, therefore, not suitable for ordinary agricultural use. Furthermore, El Abiad Phosphate Mine is discharging about 2.3 MCM/yr of wastewater with solids of about 0.6 million t/yr. The TDS concentration was about 1,800 ppm when measured by the Study Team. Reuse of these

wastewater is proposed as a start.

A flood flow of 1.8 MCM/yr could be developed by the proposed Hasa Dam on the main stream of Wadi Hasa about 10 km downstream from the Desert Highway (see Fig. 6-1). In addition, there is the potential rainwater which would be impounded in Qa El Hasa after a storm, most of which now evaporates without flowing downstream because of its flat topography like a swamp (see Fig. 6-4). In the future, after making a study on its potential and a development plan, this water can be developed.

As basic resources of the Project, the water resources should be developed by the following ways:

(A) recovery of wastewater by constructing tailings dams for desilting and storing solids

(B) development of flood flow by the Hasa Dam, and in the long run development of the rainwater in Qa El Hasa

(C) mixing of this wastewater and flood flow to supply the Project for green works

(D) development of groundwater in the proposed Darawish well field to supply fresh water to the Project as well as to Tafila and for other uses

(2) Environment and Tourism Programmes: The tourism development targets will be to attract both domestic and foreign tourists from the region, Greater Amman, Aqaba as well as from the Gulf countries. The foreign residents in Greater Amman are also a principal target.

For attracting tourists, rehabilitation of the environment with greenery is essential. The water resources will be mainly used for these greenery projects.

The main tourism resources of the Project will be artificially created with the water resources to be developed under the proposed Water Programme. An open water surface and a wide green area will be the sales points of this park. The principal facilities and event pro-

grammes are proposed as follows:

(A) Water related facilities to offer the pleasure to play with water such as a boating lake, fishing pond and water park.

(B) Green facilities including a picnic garden, a botanic garden, productive greenery, forests, greenbelts, a polo ground, and a golf course. A family picnic is the favorite style of recreation in Jordan. The golf course will yield high value-added, and will create many job opportunities, and there is a potential demand for this facility.

(C) Tourist facilities including a hotel with restaurants, coffee shops, conference halls, banquet rooms and so forth. A small scale zoo, a Desert Science Museum, and a Children's Amusement Centre would also be built.

(D) Event programmes would include conferences, lectures, symposia, star observation, desert life experience in the Bedou style tent, camel riding, etc.

(E) Restoration of Hasa Castle is proposed to provide tourists with a chance to think about the old life style in the Badia. The Castle, bridge, and the old stone-paved pilgrim way of the Umayad period will also be restored.

(F) A service area is also proposed for drivers, who are driving on the Desert Highway, to take rest in a green environment with an open water surface.

(3) Hasa New Town Programme: The future functions of the two districts are proposed as follows:

(A) Eastern District (Old Hasa): Residential and administrative district

(B) New Hasa: Core and symbolic zone of the long-term Green Badia Development Plan

Basic strategies for the programme will be as follows:

(A) General

- to establish the development identity for the urban vista
- to develop green land to the maximum extent possible
- to develop the potential for the inter-regional traffic as a

traffic terminal

- to interrelate the development effects between the Eastern District, New Hasa, the Housing Complex of El Hassa Mine and the proposed Commuter Airport
- to exclude transit traffic and to release streets to pedestrians
- to secure school sites
- to establish a sewerage system, and a solid waste management system

(B) Eastern District (Old Hasa)

- to improve the square in front of the Hasa railway station as one of the gateways to Hasa

(C) New Hasa

- to develop large scale tourism and urban facilities
- to divide New Hasa into functional zones

(4) New Energy Programme: Jordan, especially the Badia is blessed with abundant sunshine and wind energy, which is referred to as the soft energy or new energy. The technology is being developed throughout the world, and in Jordan the Royal Scientific Society (RSS) has ongoing trials with pilot plants.

One of the advantage of the new energy is its availability on the site of demand. No long distance transmission lines are necessary even for electrification of an isolated village. Another advantage is that the new energy application systems do not require any special operation and frequent maintenance: *Operation is Free* and *Maintenance is Free*.

However, its practical utilization is not widely spread in the world mainly due to its high equipment costs. The cost of the new energy system will progressively decrease in future owing to continuing technological innovation especially for solar batteries, while the cost of the conventional energy systems will progressively increase along with price escalation of fossil fuel in the international market which will only partially be offset by increasing thermal efficiency.

If electrification of a small village is planned with the conventional power supply system, construction of a distribution line will be required inevitably, and the distribution line will cost about JD 10,000/km regardless of the scale of the load. In such a case, the new energy application becomes competitive.

Solar and wind energy potential: The project area has excellent solar radiation and wind power as follows:

(A) Annual mean solar radiation of 5.44 kWh/m^2/day at Hasa

(B) Theoretical wind power of 247 W/m^2 on an annual mean basis at Hasa. This wind energy varies in a wide range between seasons, being high in summer and low in winter.

Conceivable applications: In the case of a solar battery system, some provision is required to supplement the shortage of power in winter. A hybrid system consisting of a solar battery system and wind energy system can, in general, supplement this shortage. For the electrification of an isolated small village which requires constant power supply through the year, the hybrid system can be applied. Numbers of non-electrified villages in Karak and Tafila were 43 and 22 respectively in 1986. Most of them could be applied with the electrification by the hybrid system (*Solar Village System*).

The Watering Station is proposed for supplying drinking water to the Bedou and their livestock. One Watering Station is assumed to cover the Bedou camps of not more than 10 groups, each consisting of 6 persons, 200 sheep and 20 camels.

The required power for the Watering Station would decrease in the winter compared with the power required in the summer, because in the winter water for livestock could be obtained from wadis, and some Bedou will go out of the planned area of the Watering Station to other places or to their settlements. Therefore, a Watering Station could be installed even at such places where available power decreases in winter compared to summer.

For siting the Watering Stations, the land to the west of the Desert Highway is considered to be suitable because the area has a higher potential as grazing land than the land to the east of the Desert Highway, and is isolated from existing electrified areas.

Consequently, the following applications of new energy are proposed:

(A) Electrification of small isolated villages which have, for example, households of around 30 in number and isolated from the nearest electrified area by more than 8 km

(B) Watering Stations for Bedou camps which are, for example, isolated from the nearest electrified area by more than 5 km

6.3.4 Development Frameworks

(1) The planned area is set at about 1,170 ha in total including roads:

District	Planned area	Total
- Eastern Districts	174.6 ha	
- New Hasa	998.3 ha	1,172.9 ha
(Airport)	(86.6 ha)	

Note: El Hassa mining plant site and its housing complex are excluded.

(2) The planned population is as follows:

District	1985 (existing)	1995	2005
Eastern District	4,000	4,000	4,000
New Hasa	-	2,000	21,000
Total	4,000	6,000	25,000

Note: Population in 1985 is estimated based on the data of MOP and Hasa Municipality.

(3) The planned employment in the year of 2005 is as follows:

1. Commercial Services	2. Public Sector Administration O / M	3. Agriculture Manufacture Construction	Total
1,100	2,500	3,900	7,500

Note: (A) All the planned employees of the Hasa Industrial Estate of 3,000 are included.

(B) Employees for the Hasa Mine are excluded.

6.3.5 Draft Landuse Plan

Based on the development strategies and frameworks, a future land-use plan is proposed as shown in the figure on the first page of this Chapter and Table 6-3.

6.3.6 Planned Infrastructures

The principal infrastructures to be developed are considered to be as follows:

(1) East District: A sewerage system will be constructed for approximately 600 households.

(2) New Hasa

(A) A trunk road and street network will be constructed (84 ha).

(B) A water supply system will be developed (for approximately 3,000 households and other facilities).

(C) A sewerage system will be constructed (for approximately 3,000 households and other facilities).

(D) The power distribution system will be provided (for approximately 3,000 households and other facilities).

(E) A final disposal site and collecting system of solid waste will be established (10 ha).

6.3.7 Planned Urban Facilities

(1) East District

(A) The square in front of Hasa station should be improved to receive foreign tourists coming by train (1.0 ha).

(B) Parking and service areas will be established both the sides of the Desert Highway (2.0 ha).

(2) New Hasa

(A) Residential lots and housings will be constructed (227.2 ha). The residential area by classification will be as follows:

Classification	A	B	C	D/E	Total
area (ha)	33.7	53.3	48.2	92.0	227.2

Note: Classification is set by the minimum lot area of residence. A: 1,000 m^2, B: 750 m^2, C: 500 m^2, D: 250 m^2, E:150 m^2

(B) School sites will be secured (20 ha).

(C) The Badia development laboratory will be established (21.4 ha).

(D) A public hospital and clinic will be established (10.2 ha).

(E) A community centre will be constructed at the centre of the residential area (2.0 ha).

(F) Religious sites will be secured in the residential area (0.5 ha).

(G) A distribution centre will be located near the Desert Highway (3.0 ha).

(H) A hotel, shopping centre and central commercial area will be developed (17.1 ha).

(I) A productive green tract will be secured as a symbol of this Project (72.3 ha).

(J) A forest and water park with ponds will be developed as the core of the tourism program (total 50 ha, pond: 15.3 ha including islands).

(K) *A Badia Wonderland* such as amusement park like Disney Land should be set up as a strategic facility for economic activation of the project area (87.5 ha).

(L) *A Badia Country Club* with a golf course of 18 holes and a polo stadium will be developed for the adult recreation (Golf courses: 80 ha, Polo stadium: 2.0 ha).

(3) Others

(A) A Commuter Airport will be constructed as another strategic facility in the Badia development (86.6 ha).

(B) An Industrial Estate will be developed along the Desert Highway on the north side of the Eastern District (55 ha).

(C) A green belt from Qatrana via Hasa to Darawish along both the side of Desert Highway will be raised as the magnificent monument of this Project (50 meters of width each, 70 km).

6.4 Water Programme

(1) Tailings Dams for El Hassa Phosphate Mine: For recovering 50 per cent of the water contained in the slimes, the reservoir surface area needs to be less than 30 ha. A large reservoir with a surface area of more than 100 ha would recover no water at all and all the water would be evaporated and infiltrated.

An optimization study was made for the surface area of the reservoir and for the life time of one reservoir. It is concluded that the yearly construction of a tailings dam having a surface area of 25 ha (500 m x 500 m) and a dam height of 3.4 m is the cheapest solution (Table 6-5 and Fig. 6-3). The reservoir will store the solids contained in the slimes and will yield about 2.1 MCM/yr of desilted wastewater.

For El Abiad Mine the cheapest solution will be a tailings dam having a surface area of 15 ha and a dam height of 3.7 m. The reservoir will yield about 1.2 MCM/yr of desilted wastewater.

(2) Hasa Dam: The catchment area is 1,435 km^2 with a mean basin rainfall of 88 mm/yr. Mean runoff is estimated at 2.3 MCM/yr. With a gross reservoir capacity of 4.2 MCM equivalent to a 5-year probable annual flood volume, a mean yield of 1.8 MCM/yr would be expected. In every two years, a yield of 1.4 MCM/yr could be expected (see Fig. 6-5 for site characteristics).

The dam height will be about 25 m above the riverbed. The dam will be of a concrete gravity type, having dam volume of about 50,000 m^3. The stored water will be transmitted to the project site by a pipeline. The unit water cost would be about 180 fils/m^3 (See Table 2-4 of Chapter 2).

(3) Drainage Improvement Works in Qa El Hasa: The catchment area of the whole Qa El Hassa is 1,019 km^2 and the mean basin rainfall is about 89 mm/yr. According to a villager of Old Hasa, Qa El Hasa is sometimes flooded during winter over an extensive area.

As proposed for Qa El Hafira in the JICA Mujib study, drainage improvement works could yield a considerable amount of water for use downstream. This water could be stored in the proposed Hasa Dam.

(4) Groundwater: The new development potential of the proposed Darawish well field is assessed to be about 5.5 MCM/yr (see Annex-A for details). A standard well is assumed to be 300 mm in diameter, 60 m^3/hr in pumping yield, 16 hr/day in operation time. The pumping drawdown is estimated at 8.75 m. The depth of a standard well is proposed at 150 m. The standard well spacing may be not less than 1.0 km following the practice of WAJ. A standard pumping yield of one well is estimated at 960 m^3/day or 0.32 MCM/yr. The total number of wells required will exceed 18.

For transmitting the necessary amount of groundwater to the project site, the well field could be located closer to the project site, since the groundwater is flowing towards it.

(5) Pipelines: Two pipelines will be needed to distribute the groundwater from the proposed Darawish well field: Darawish-Hasa Pipeline, and Darawish-Tafila Pipeline. Although the scale of these pipeline projects will depend on the water allocation, for present purposes they were studied on the basis of Water Allocation Plan 1 and topographic maps at a scale of 1/50,000. The approximate route and profile are shown in Figs. 6-7 to 6-10. Their principal features are shown in Table 6-6.

The Darawish-Hasa Pipeline will have only one pumping station which will pump up water to a discharge sump located about 3 km to the north. From the discharge sump, water can be transmitted by gravity flow up to Hasa Terminal Reservoir if the flow velocity is limited to 0.75 m/s.

The Darawish-Tafila Pipeline will have two pumping stations and one discharge sump. After the discharge sump which will be located 17.8 km from the No. 1 Pump Station, the water can be transmitted to the Tafila Terminal Reservoir by gravity flow.

6.5 Environment and Tourism Programmes

(1) Environmental rehabilitation

The environment in the project area will be rehabilitated through establishment of the productive green tract of 72.3 ha, afforestation around the water park (50 ha in total), and greenbelts along the Desert Highway and principal roads (see also Sub-section 6.3.7). For promoting growth of these greenery especially after transplanting with limited water, not only ordinary irrigation but also Water Harvesting measures should be examined to seek an optimum way. For the greenbelts, road microcatchments could be applied as shown in Fig. 6-6 and Table 6-4. For afforestation, pitcher irrigation should also be considered in conjunction with proposed water basins which could be made from phosphate slimes.

Water for these environmental rehabilitation would be supplied from the discharge of the water pond. Fresh water, if required for nursery, could be supplied from the proposed Hasa dam or groundwater from the proposed Darawish well field.

(2) Tourism development

The proposed tourism facilities other than lodging facilities and event programmes are given in Sub-section 6.3.7 and shown in the figure on the first page of this Chapter.

Lodging facilities

(A) A Rest House is proposed to provide lodging as well restaurants, coffee shops, souvenir shops and so forth. The restaurants may be used as banquet rooms. A conference room will be included in the Rest House, which will be used for lectures, symposia, exhibitions, etc.

(B) Bungalows will be prepared for the people who wish to stay overnight with their families. Individual bathrooms, toilets and a kitchenette will be provided for the convenience of visitors. Twenty bungalows will be built in the green garden. Each bungalow will have a floor area of about 60 m^2.

(C) A camping area will be prepared for visitors who wish to stay overnight in an individual tent. Some Bedou style tents will be provided for family visitors and group tourists. Hygienic toilet and shower facilities will be provided for the campers. Some of the Bedou tents will be used for public facilities such as a rest house, a restaurant, a coffee shop, and also as a performance place for the visitors to enjoy the traditional life of the Bedou. It would contribute to friendly communication between visitors.

Event Programmes should be examined and provided including:

(A) Cultural : Music, dance, exhibition, parade
(B) Physical : Boat race, swimming competition, sports festival
(C) Scientific: Star observation, desert science
(D) Amusement : Camel racing, horse racing, film theatre, shows
(E) Others : Conferences, symposia and lectures

6.6 New Energy Programme

Preceding implementation of the new energy application projects, trials are needed with pilot plants. One Mini Pilot Plant and three Prototype Watering Stations are proposed. The Mini Pilot Plant would include a mini Watering Station for sheep, goats and camels and a mini Solar Village System.

(1) Hasa Mini Pilot Plant is proposed to be established in the Hasa Oasis Park together with other demonstration facilities such as solar street lights and a solar driven fountain. The Mini Pilot Plant would include:

(A) Mini Solar Village

- Model house with lighting (40 W), television (100 W), ceiling fan (60 W), refrigerator for clinic (200 W) ..... 1 house
- Windmill with 1.0 kW DC generator ..... 1 set
- Solar battery 1.0 kWp ..... 1 set
- Others ..... 1 lot

(B) Mini Watering Station

- Pump house ..... 1 house
  - . pump and windmill with 1.0 kW AC generator ..... 1 set
  - . pump and solar battery of 0.7 kWp ..... 1 set
  - . pump and windmill (0.3 kW) + solar battery (0.5 kWp) ..... 1 set
- Groundwater production well ..... 1 well
- Watering facility for livestock ..... 1 set
- Others ..... 1 lot

(2) Prototype Watering Stations of the following three types are also proposed to be installed one each at different locations:

Type-A: Windmill

- Pump house (windmill with 4.5 kW AC generator) ... 1 house
- Groundwater production well ..... 1 well
- Watering facility for livestock ..... 1 set
- Others ..... 1 lot

Type-B: Solar battery

- Pump house (solar battery of 3.0 kWp) ..... 1 house
- Groundwater production well ..... 1 well
- Watering facility for livestock ..... 1 set
- Others ..... 1 lot

Type-C: Hybrid

- Pump house (windmill with 1.0 kW DC generator + solar battery of 2.5 kWp) ..... 1 house
- Groundwater production well ..... 1 well
- Watering facility for livestock ..... 1 set
- Others ..... 1 lot

6.7 Costs

The total construction cost of the Project is estimated at JD 82.28 million (equivalent to US$ 242 million) as shown below:

(1)	Water Programme	
(A)	the tailings dam for El Hassa Mine	JD 440,000/yr
(B)	Hasa Dam	JD 3,300,000
(C)	Groundwater wells	870,000
(D)	Darawish-Hasa Pipeline	2,270,000
(E)	Darawish-Tafila Pipeline	2,200.000
	Sub-total	JD 9,080,000
(2)	Environment and Tourism Programmes (See Table 6-7 for breakdown)	JD 35,300,000
(3)	Hasa New Town Programme (See Table 6-7 for breakdown)	JD 37,500,000
(4)	New Energy Pilot Plants	
(A)	Hasa Mini Pilot Plant	JD 110,000
(B)	Three Prototype Watering Stations	JD 230,000
(C)	Guidance service	JD 60,000
	Sub-total	JD 400,000
	Grand Total	JD 82,280,000

6.8 Implementation Schedule and Project Management

(1) Implementation schedule

(A) Overall project implementation: Since the scale of the Project is rather large, the proposed master plan for the Project should first be reviewed and examined by the Government. After the Plan is basically approved, a detailed study should be carried out on each of the four Programmes. However, such environmental works as for the greenbelt and afforestation could be started at once. Details are shown in Fig. 6-11.

(B) Water Programme: Detailed study and design will be required for the proposed tailings dams for the two phosphate mines, the Hasa Dam,

and for the potential of and siting of production wells in the proposed Darawish well field, and the two pipelines.

(C) Environment and Tourism Programmes: Afforestation and greenbelt works should first be commenced and continued through the plan period. A feasibility study on the Tourism Programme should also be commenced so that restoration works of Hasa Castle and construction of basic facilities would be undertaken in the 1990's, including the water park, family garden, picnic garden, rest house, golf course and so forth.

(D) Hasa New Town Programme: A detailed study should first be made for implementation in the long-term.

(E) New Energy Programme: It will take 13 months to start operation of the proposed pilot plants from the commencement of the works. Trials should then be carried out for at least one year to obtain actual meteorological data and so forth.

(2) Project-management

(A) Overall project management: It is proposed to establish the New Hasa Development Board under the Badia Development Council, which is presently under consideration by the Government. The Board would be constituted by the related agencies including Mu'tah University, municipality and the private sector to manage and supervise the development activities of the Project.

(B) Water Programme: This should be studied, planned and implemented by WAJ except for the tailings dams, which it is proposed, would be undertaken jointly by JPMC and the Board under the supervision of WAJ.

(C) Environment and Tourism Programmes: It is recommended that the financial costs and work forces be shared between the public and private sectors as follows:

(a) Planning by MCTA

(b) Investment by SSC and private sector

(c) Operation and management by the private sector, SSC and MCTA with an associated managing body

(D) Hasa New Town Programme: The proposed New Hasa Development Board should manage and coordinate this Programme in association with

MMRAE and other concerned ministries.

(E) New Energy Programme: This should be supervised by the governmental organization in cooperation with MOP, MMRAE, RSS, JEA, JMD, NRA and Mu'tah University. The assistance of RSS will be required especially in the design and operation stages including measurements of data in the pilot plants.

6.9 Conclusions and Recommendations

(1) Conclusions: The Study Team proposes that Hasa be developed as a strategic growth point in the Badia on account of its proximity to water resources, its geographic location in the centre of the South Badia, extensive unutilized governmental land, good access to transportation, and Hasa Castle as a tourism resource.

Water Programme: in the proposed Project area around Hasa, wastewater from the phosphate mines can be recovered at about 2.1 MCM/yr by constructing tailings dams. Flood water of 1.8 MCM/yr can also be developed by constructing the proposed Hasa Dam, and groundwater of 5.5 MCM/yr can be developed in the proposed Darawish well field. In addition, a further flood flow of more than 1.0 MCM/yr can be developed by drainage improvement works in Qa El Hasa.

Environment and Tourism Programmes: as an income generating sector, tourism development is proposed by constructing an *Artificial Oasis Park* with the *Badia Country Club* surrounded by a *Productive Green Park*, exploiting the water resources mentioned above. In the long term, establishment of an Amusement Centre and a Badia Country Club is also proposed to attract tourists not only from the Kingdom but also from elsewhere in the Middle East.

Hasa New Town Programme: with implementation of the proposed infrastructures and urban facilities, Hasa New Town having a planned population of 25,000 by the year 2005 would become a unique growth point in the South Badia to accommodate people who will engage in development of the Badia.

New Energy Programme: both of the proposed new energy applications, the *Solar Village* and the *Watering Station*, are feasible under certain conditions of application even at present levels of equipment cost. These do not need any fuel transportation and would be essentially maintenance free. It is proposed that the proposed pilot plants be established to investigate economic viability, technical suitability, and social acceptability of the actual applications.

The total construction cost of the Project is provisionally estimated at about JD 82.28 million (equivalent to US$ 242 million), consisting of JD 9.08 million for the Water Programme, JD 35.30 million for the Environment and Tourism Programmes, JD 37.50 million for the Hasa New Town Programme, and JD 0.40 million for the New Energy Pilot Plants.

(2) Recommendations: The Study Team recommends the establishment of a New Hasa Development Board under the proposed Badia Development Council, which is presently under consideration by the Government. The Board would be constituted by related agencies, municipality and the private sector to manage and supervise the development activities of the Project.

Upon approval of the basic development plan by the Council, it is recommended that the detailed study of the Water Programme and the basic design of the New Energy Pilot Plants be started first, followed by a feasibility study of the Environment and Tourism Programmes. It is recommended that a certain part of the water resources available around the project area be allocated to the Project as a basic input. Some environmental works such as for the greenbelt and afforestation could be started in parallel with the feasibility study. A detailed study for the Hasa New Town Programme should be started immediately after completion of the feasibility study so that the infrastructures can be constructed in a pre-arranged manner without duplication or replacement.

Table 6-1 LAND AREA AND POPULATION IN HASA

District	Area (ha)	Population	Density per ha
Eastern	76.9	4,000	52.0
New Hasa	998.3	0	0
Total	1,075.2	4,000	3.7

Note: (A) The housing complex area of El Hassa Mine is not included in the above.
(B) The area of New Hasa includes approach roads, an airport and rocky slopes
Source: The Study Team

Table 6-2 PRESENT LANDUSE

(ha)

	Classification	Eastern	New Hasa	Total
1.	Commercial	3.2	-	3.2
2.	Religious	0.8	-	0.8
3.	Residential	36.4	-	36.4
4.	Administrative	2.5	-	2.5
5.	Industrial	-	-	-
6.	Educational	6.6	-	6.6
7.	Green	1.0	-	1.0
8.	Ruins	-	0.2	0.2
9.	Terminal	-	-	-
10.	Power supply	-	-	-
11.	Agriculture	26.4	998.1	160.1
13.	Wadi	0.4	-	0.4
	Total	76.9	998.3	1,075.2

Note: Roads and streets are included.
Source: The Study Team

Table 6-3 FUTURE LANDUSE PLAN OF HASA

(ha)

	Classification	Eastern	New Hasa	Total
1.	Central Commercial	4.5	17.1	21.6
2.	Neighborhood Commercial	-	2.9	2.9
3.	Governmental Building	3.2	1.8	5.0
4.	Community Centre	0.5	2.0	2.5
5.	Religious	0.2	0.5	0.7
6.	Terminal/Distribution	0.5	3.0	9.5
7.	Supply/Treatment	-	3.0	3.0
8.	Residential - A	36.4	33.7	70.1
9.	Residential - B	10.7	53.3	64.0
10.	Residential - C	19.7	48.2	67.9
11.	Residential - D/E	4.0	92.0	96.0
12.	School/Laboratory	1.5	41.4	45.9
13.	Hospital/Health	0.4	10.2	10.6
14.	Plaza/Garden	1.8	87.5	89.3
15.	Park/Forest/Green (pond)	30.2	247.5 (15.3)	277.7
16.	Recreation/Sports	-	175.0	175.0
17.	Industrial	54.7	2.1	56.8
18.	Agricultural	-	72.3	72.3
19.	Car Parking	0.3	18.2	18.5
20.	Airport	-	86.6	86.6
	Total	174.6	998.3	1,172.9

Note: Area of roads is included in relevant landuses.
Source: The Study Team

Table 6-4 ANNUAL RUNOFF VOLUME FROM ROAD SURFACE

Annual Mean Rainfall (mm)	Runoff Depth (mm/yr)	Runoff Volume per m of Road (m^3/yr/m)		
		B = 3.0m	B = 5.0m	B = 10.0m
0 - 100	30	0.09	0.15	0.30
100 - 200	90	0.27	0.45	0.90
200 - 300	150	0.45	0.75	1.50
300 -	180	0.54	0.90	1.80

Note: Mean runoff coefficient is assumed at 60 %.
Source: The Study Team

Table 6-5 SUMMARY OF PRELIMINARY STUDY OF TAILINGS DAMS FOR PHOSPHATE MINES

Area of Unit (ha)	Life time (year)	Height of Levee (m)	Length of Levee m 1st	Length of Levee m Nth	Volume of Levee 10^3 m^3 1st	Volume of Levee 10^3 m^3 Nth	Construction Cost 1/ JD10^3 1st	Construction Cost 1/ JD10^3 Nth	Present Value 1/ 10^3 JD	Construction Cost 2/ 10^3 JD 1st	Construction Cost 2/ 10^3 JD Nth	Present Value 2/ 10^3 JD	Available Water MCM/yr	Unit Cost 1/ JD/m^3	Unit Cost 2/ JD/m^3
Hasa															
50	1	2.2	2840	2130	65.8	49.5	322.4	178.2	2088	697.4	553.2	6177	1.3	0.16	0.48
	2	3.4	2840	2130	133.3	100.1	653.2	360.4	2352	1028	735.4	4494	1.3	0.18	0.35
	3	4.6	2840	2130	223.2	167.6	1094	603.4	2898	1469	978.4	4394	1.3	0.22	0.34
25	1	3.4	2000	1500	93.5	70.2	458.2	252.7	2961	645.7	440.2	5006	2.1	0.14	0.24
	2	5.8	2000	1500	236.1	177.1	1157	637.6	4162	1344	825.1	5233	2.1	0.20	0.25
	3	8.2	2000	1500	442.0	331.5	2166	1193	5734	2353	1381	6482	2.1	0.27	0.31
20	1	4.0	1800	1350	110.9	83.2	543.4	299.7	3512	693.4	449.7	5148	2.2	0.16	0.23
	2	7.0	1800	1350	298.0	223.5	1460	804.6	5252	1610	954.6	6109	2.2	0.24	0.28
	3	10.0	1800	1350	574.2	430.7	2814	1551	7450	2964	1701	8050	2.2	0.34	0.37
15	1	5.0	1560	1170	141.6	106.2	693.8	382.3	4481	806.3	494.8	5708	2.3	0.19	0.25
	2	9.0	1560	1170	409.3	306.9	2006	1105	7213	2118	1217	7854	2.3	0.31	0.34
	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	1	7.0	1280	960	211.9	159.0	1038	572.4	6708	1113	647.4	7526	2.5	0.27	0.30
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Abiad															
30	1	2.3	2200	1650	54.3	40.7	266.1	146.5	1717	491.1	371.5	4171	0.8	0.21	0.52
	2	3.7	2200	1650	118.6	89.0	581.1	320.4	2091	806.1	545.4	3377	0.8	0.26	0.42
	3	5.0	2200	1650	200.0	149.7	980.0	538.9	2591	1205	763.9	3489	0.8	0.32	0.44
15	1	3.7	1560	1170	84.0	63.0	411.6	226.8	2658	524.1	339.3	3885	1.2	0.22	0.32
	2	6.3	1560	1170	213.5	160.2	1046	576.7	3764	1159	689.2	4407	1.2	0.31	0.37
	3	9.0	1560	1170	409.3	306.9	2006	1105	5309	2118	1217	5847	1.2	0.44	0.49
10	1	5.0	1280	960	116.2	87.1	569.4	313.6	3676	644.4	388.6	4494	1.4	0.26	0.32
	2	9.0	1280	960	335.8	251.9	1645	906.8	5919	1720	981.8	6347	1.4	0.42	0.45
	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	1	9.0	900	675	236.2	177.1	1157	637.6	7473	1195	675.1	7883	1.5	0.50	0.53
	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1/: Excluding a land acquisition cost 2/: Including a land acquisition cost, which is assumed at 0.5 JD/m^2

Source: The Study Team

Table 6-6 SUMMARY OF PIPELINE PROJECTS

Description	Unit	Darawish -Hasa	Darawish -Tafila	Lajjun -Karak
1. Annual water	MCM/yr	3.24	1.22	4.36
2. Design discharge	lit/min	14.7	5.6	19.7
3. Pipe diameter	mm	500	300	500
4. Length	km	18.5	28.8	15.1
5. Max. static head	m	19	316	401
6. No. 1 pump station	kW x nos. 1/	40 x 3	90 x 3	380 x 3
7. No. 2 pump station	kW x nos. 1/	-	90 x 3	380 x 3
8. Terminal reservoir	m^3	3,000	2,000	4,000
9. Electricity	MWh/yr	300	1,900	8,000
10. Construction cost	JD 10^3	2,270	2,198	2,297
11. O & M cost 2/	JD 10^3/yr	14.3	19.9	27.9
12. Electric charge	JD 10^3/yr	6.9	43.7	184
13. Unit cost at reservoir site 3/	fils/m^3	113	285	141

1/: Including one set for standby
2/: O&M cost is assumed at 0.5 % for pipeline, reservoir and discharge sump; and 4 % for pump station
3/: Discount rate is assumed at 10.6 % for pipeline; 16.3 % for pump station and 10 % for reservoir and discharge sump . A production cost of the ground including well digging and pumping is estimated at 31 fils/m^3, and is added to the unit cost.
Source: The Study Team

Table 6-7 CONSTRUCTION COSTS OF HASA URBAN DEVELOPMENT (1/2)

Sub-project	Item	Unit Cost (JD)	Scale	Total Amount (JD1000)
1. Road	excavation	3.0/m^3	420,000 m^3	1,260
	pavement	2.5/m^2	840,000 m^2	2,100
2. Water supply	piping	6.0/m	126,000 m	756
3. Sewerage	piping	22.0/m	150,000 m	3,300
4. Final disposal site	excavation	3.0/m^3	30,000 m^3	90
	pavement	2.0/m^2	100,000 m^2	200
5. Parking/rest house	reclamation	3.0/m^3	30,000 m^3	90
	building	80.0/m^2	2,400 m^2	192 *
6. Station square	gardening	6.0/m^2	10,000 m^2	60
7. Residential lots	excavation	3.0/m^3	681,600 m^3	2,045
	reclamation	3.0/m^3	454,400 m^3	1,363
8. School sites	excavation	3.0/m^3	48,000 m^3	144
	reclamation	3.0/m^3	32,000 m^3	96
9. Badia development laboratory	building	80.0/m^2	1,200 m^2	96
10. Hospital	building	80.0/m^2	38,250 m^2	3,060
11. Community centre	building	80.0/m^2	8,000 m^2	640
12. Distribution centre	building	80.0/m^2	10,500 m^2	840
13. Hotel/S.C.	building	80.0/m^2	136,800 m^2	10,944 *
14. Green tract	excavation	3.0/m^3	289,200 m^3	868 *
15. Forest & water park	excavation	3.0/m^3	306,000 m^3	918 *
	gardening	6.0/m^2	347,000 m^2	2,082 *
16. Badia Wonderland	gardening	6.0/m^2	294,000 m^2	1,764 *
	building	80.0/m^2	147,000 m^2	11,760 *
	pavement	2.5/m^2	280,000 m^2	700 *
17. Badia country club	excavation	3.0/m^3	20,000 m^3	60 *
	reclamation	3.0/m^3	200,000 m^3	600 *
	gardening	6.0/m^2	550,000 m^2	3,300 *

Table 6-7 CONSTRUCTION COSTS OF HASA URBAN DEVELOPMENT (2/2)

Sub-project	Item	Unit Cost (JD)	Scale	Total Amount (JD1000)
18. Commuter airport	reclamation	3.0/m^3	433,000 m^3	1,299
	pavement	2.5/m^2	259,800 m^2	650
	gardening	6.0/m^2	86,600 m^2	520
	building	80.0/m^2	40,000 m^2	3,200
19. Industrial complex	excavation	3.0/m^3	99,000 m^3	297
	building	80.0/m^2	192,500 m^2	15,400
20. Green belt	afforesta-tion	3.0/m^2	700,000 m^2	2,100 *
Total				72,794

Note: The mark * shows components of the Environment and Tourism Programmes, while others are of the Hasa New Town Programme. The total cost of the Environment and Tourism Programmes amounts to JD 35,288,000.

Source: The Study Team

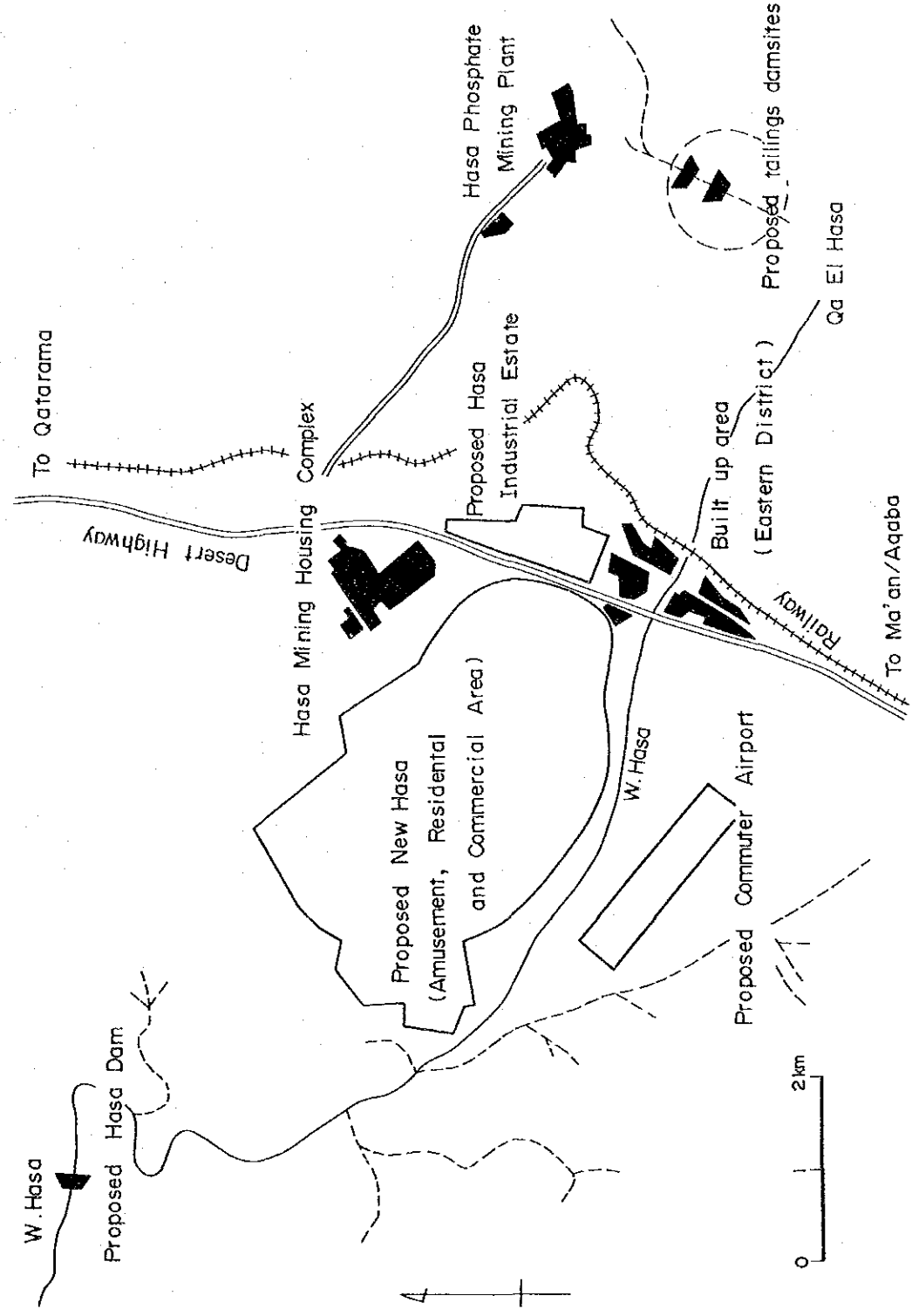

Fig. 6-1 Location Map of the Green Badia Project

THE HASHEMITE KINGDOM OF JORDAN
THE STUDY ON INTEGRATED REGIONAL DEVELOPMENT MASTER PLAN FOR THE KARAK - TAFILA DEVELOPMENT REGION
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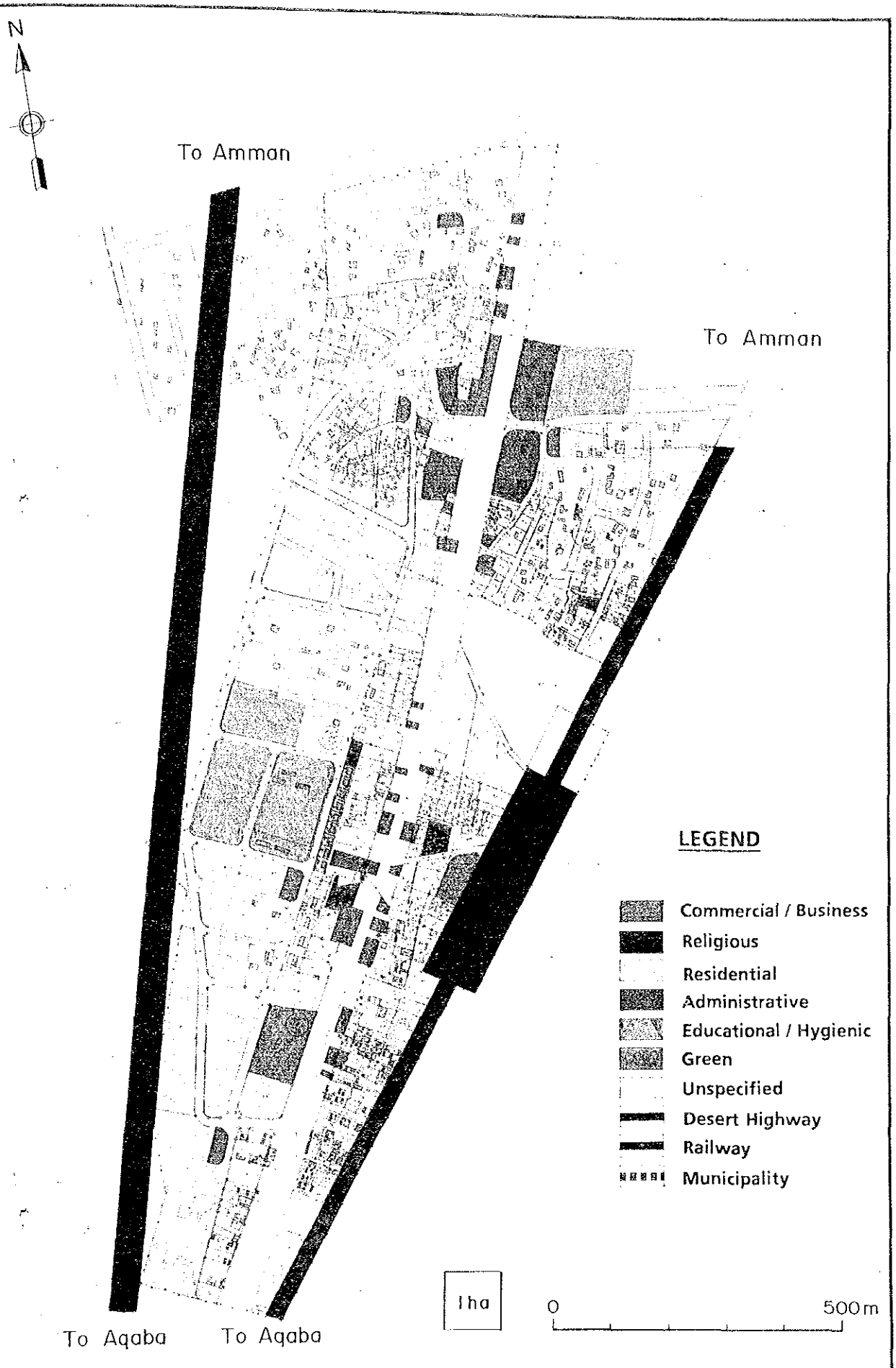

Fig. 6-2 Present Landuse of Hasa

THE HASHEMITE KINGDOM OF JORDAN
THE STUDY ON INTEGRATED REGIONAL DEVELOPMENT MASTER PLAN FOR THE KARAK - TAFILA DEVELOPMENT REGION

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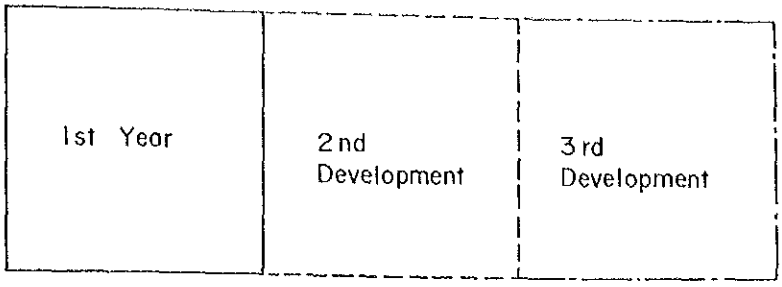

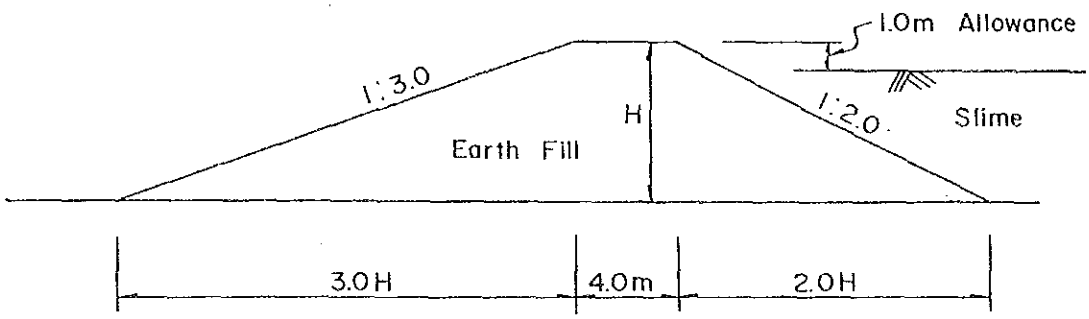

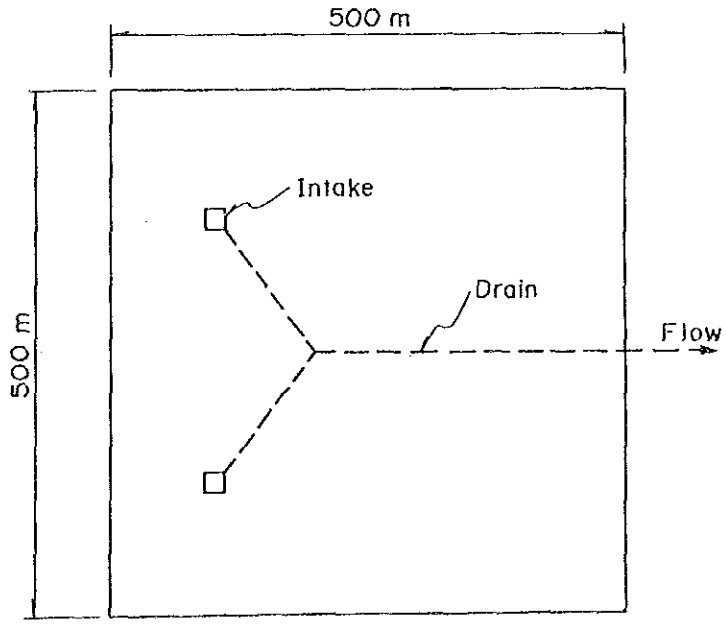

Fig. 6-3 Proposed Tailings Dam for Phosphate Mines

THE HASHEMITE KINGDOM OF JORDAN
THE STUDY ON INTEGRATED REGIONAL DEVELOPMENT MASTER PLAN FOR THE KARAK - TAFILA DEVELOPMENT REGION
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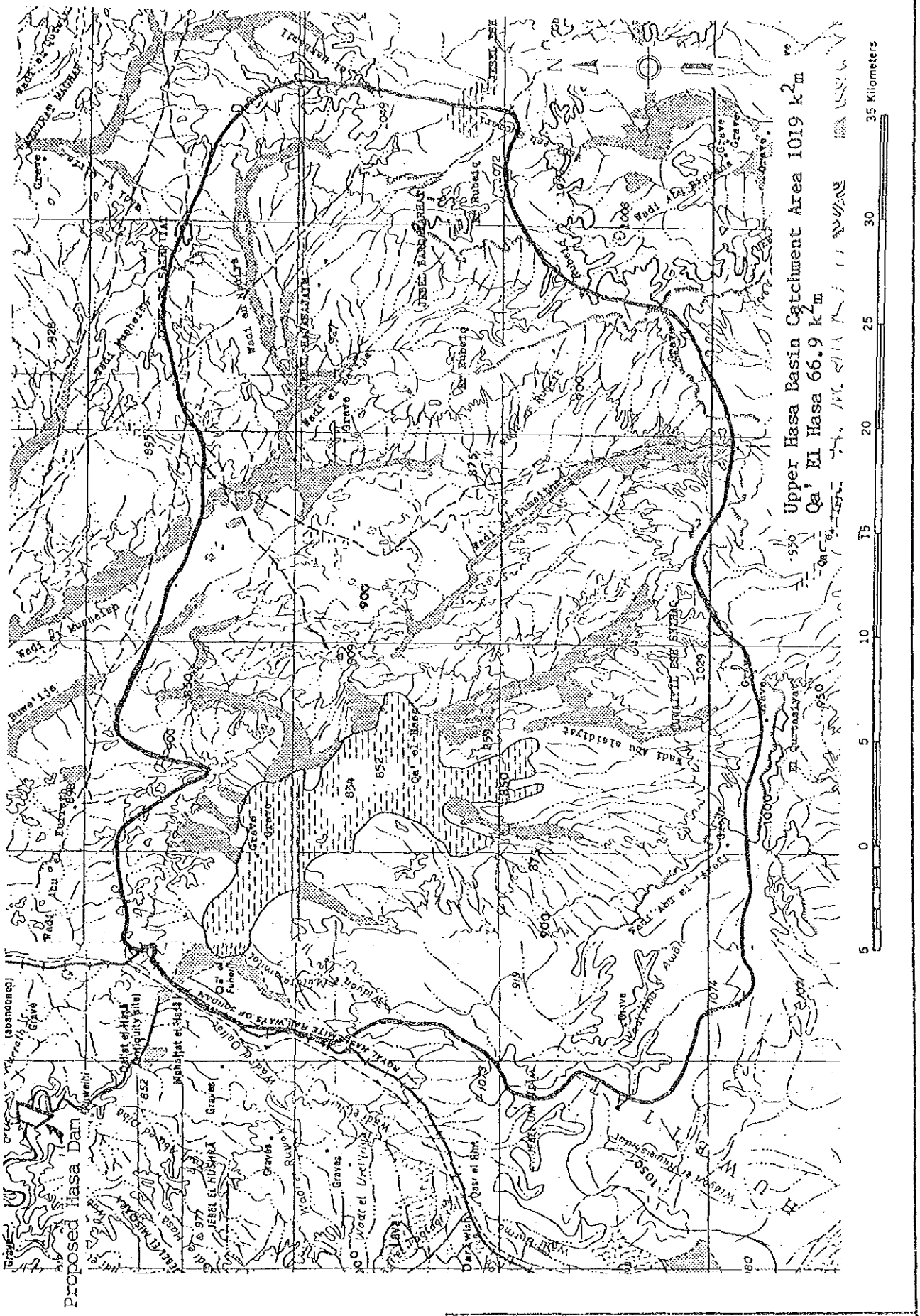

Fig. 6-4 Location Map of Proposed Hasa Dam and Qa El Hasa

THE HASHEMITE KINGDOM OF JORDAN
THE STUDY ON INTEGRATED REGIONAL DEVELOPMENT MASTER PLAN FOR THE KARAK - TAFILA DEVELOPMENT REGION

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Dam No.	Dam Name	Wadi	Dam type	Location				Hydrological condition				
				Governorate	Latitude	Longitude	Altitude m	C. A. Km²	Rm mm	Qm × 10³ m³	H / Lw m / Km	R. B. S. m / Km
M - 1	Hasa	Hasa	Concrete gravity	Hasa	30°52.8′	35°55.0′	760	1435.0	88	2290	400/45.5	8.8
Features of dam				Features of reservoir				Features water use		Other features		
Crest El. m	Hd m	Crest L. m	Vd × 10³ m³	HWL m	R. A. × 10³ m²	Vs × 10³ m³	Ve × 10³ m³	Yield × 10³ m³	I. A. ha	C ×10³ JD(×US$)	F1	F2
780	25	248	50.5	777	500	4200	1440	1850		3300 (9706)	83.2	0.79

Hasa Damsite: Alternation of chart and limestone with N35°W strike and 5°NE dip, ranging in thickness from 2 to 13 m exposes on the entire slope of left bank and upper slope of right bank with N35°E and 6°NW dip. Limestone at foot of left bank is hard, massive and crystalline, whilst limestones of upper horizon are moderately hard, massive and coquinal or silicified. Lower slope of right bank is covered by debris of 3 to 4 m thick. Wadi floor consists of terrace and water channel. Terrace is 2 m higher than river channel floor and is composed of very fine-grained mudflat deposits which are estimated at 5 to 6 m thick. Water channel beds consist of gravels which are 2 m or more thick.

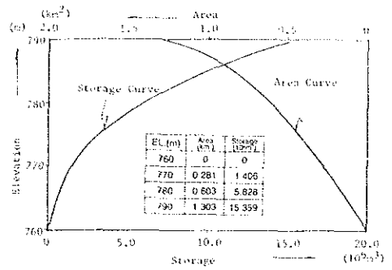
Features of irrigable area

M-1: There are no farmlands which can be irrigated by gravity flow. Flat land to the west of M-1 site or land around the existing town of Hasa can be irrigated by pumping. However, leaching and drainage channel would be required to prevent accumulation of salt.

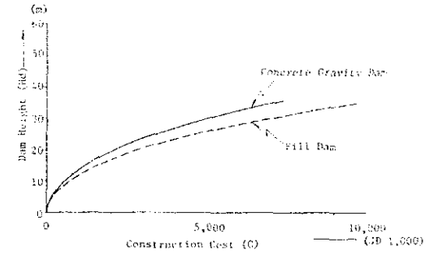
Features of submerged area

M-1: Soil at Qa el Fuheili has a high salt content.

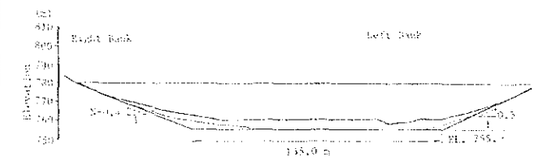
Curve of El. - R. A. and El. - Vs



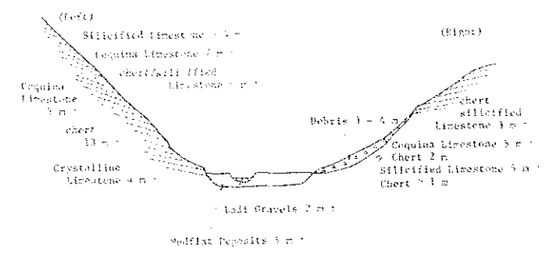
Curve of Hd - C



Longitudinal profile of dam



Sketch of site geology (not to scale)



Calculation table

Crest El. m	Hd m	Crest L. m	Vd × 10³ m³	HWL m	R. A. × 10³ m²	Vs × 10³ m³	Ve × 10³ m³	Yield × 10³ m³	I. A. ha	C ×10³JD(×10³US$)	F1	F2 JD / m³
765	10	180	8.3	762	60	250	–			543 (1597)	30.1	2.17
770	15	203	17.7	767	200	900	–			1158 (3406)	50.8	1.29
780	25	248	50.7	777	500	4200	1440			3316 (9753)	82.8	0.79
790	35	293	105.9	787	1000	12000	9240			6926 (20371)	113.3	0.58

Note

C. A. ; Catchment area
Rm ; Annual average rainfall
Qm ; Annual average runoff
Lw ; Water course length
R. B. S. ; River bed slope
Crest El. ; Crest elevation
Hd ; Height above lowest foundation dam
Crest L. ; Crest length
Vd ; Dam volume
HWL ; Elevation of reservoir surface
R. A. ; Reservoir area
Vs ; Initial storge capacity
Ve ; Ultimate storage capacity
I. A. ; Irrigable area
C ; Construction cost
F1 ; Initial storge capacity / Dam volume
F2 ; Construction cost / Initial storge capacity

Fig. 6 - 5 Site Characteristics of Proposed Hasa Dam

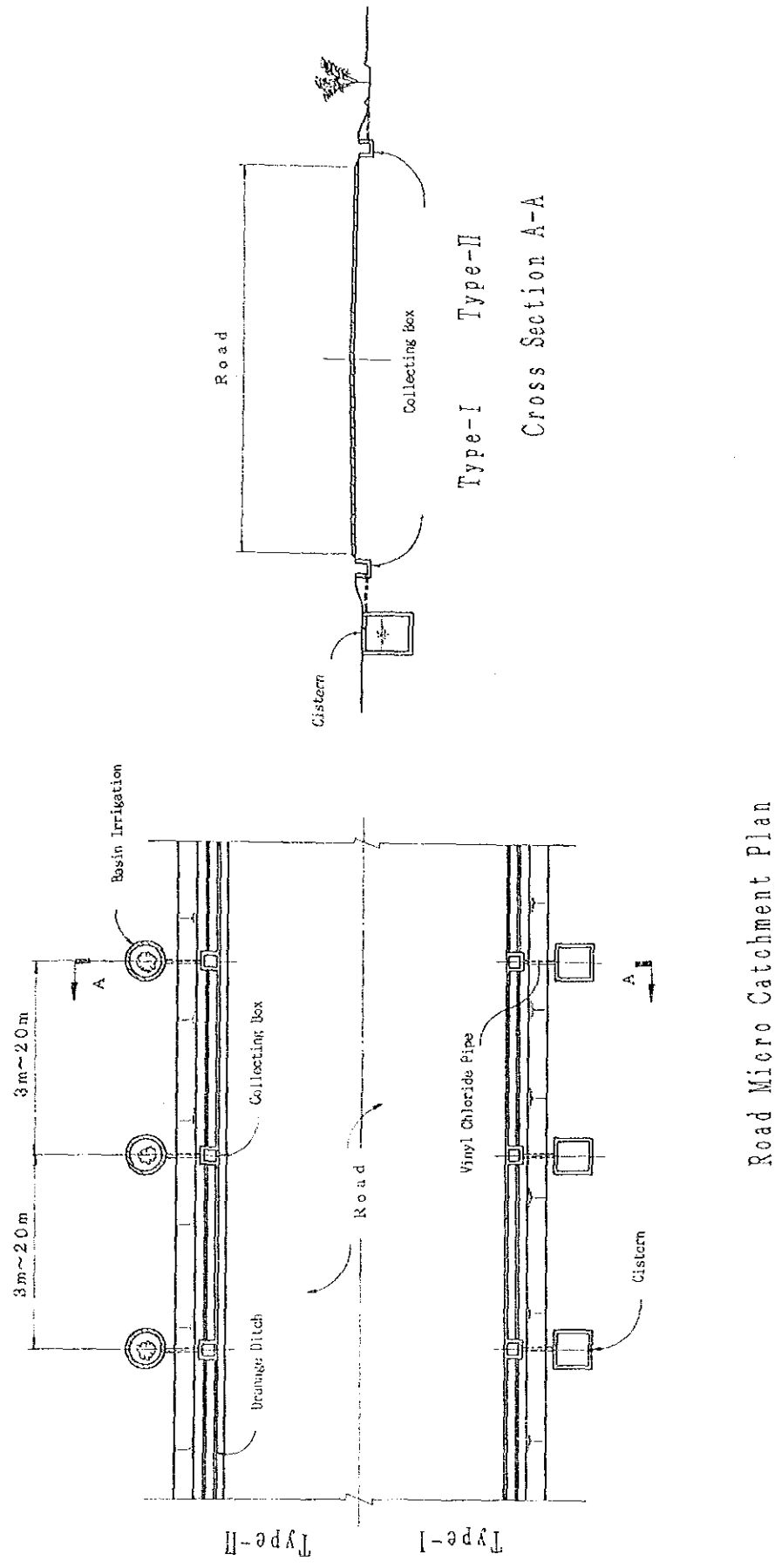


Fig. 6-6 Illustration of Road Microcatchments for Greenbelts

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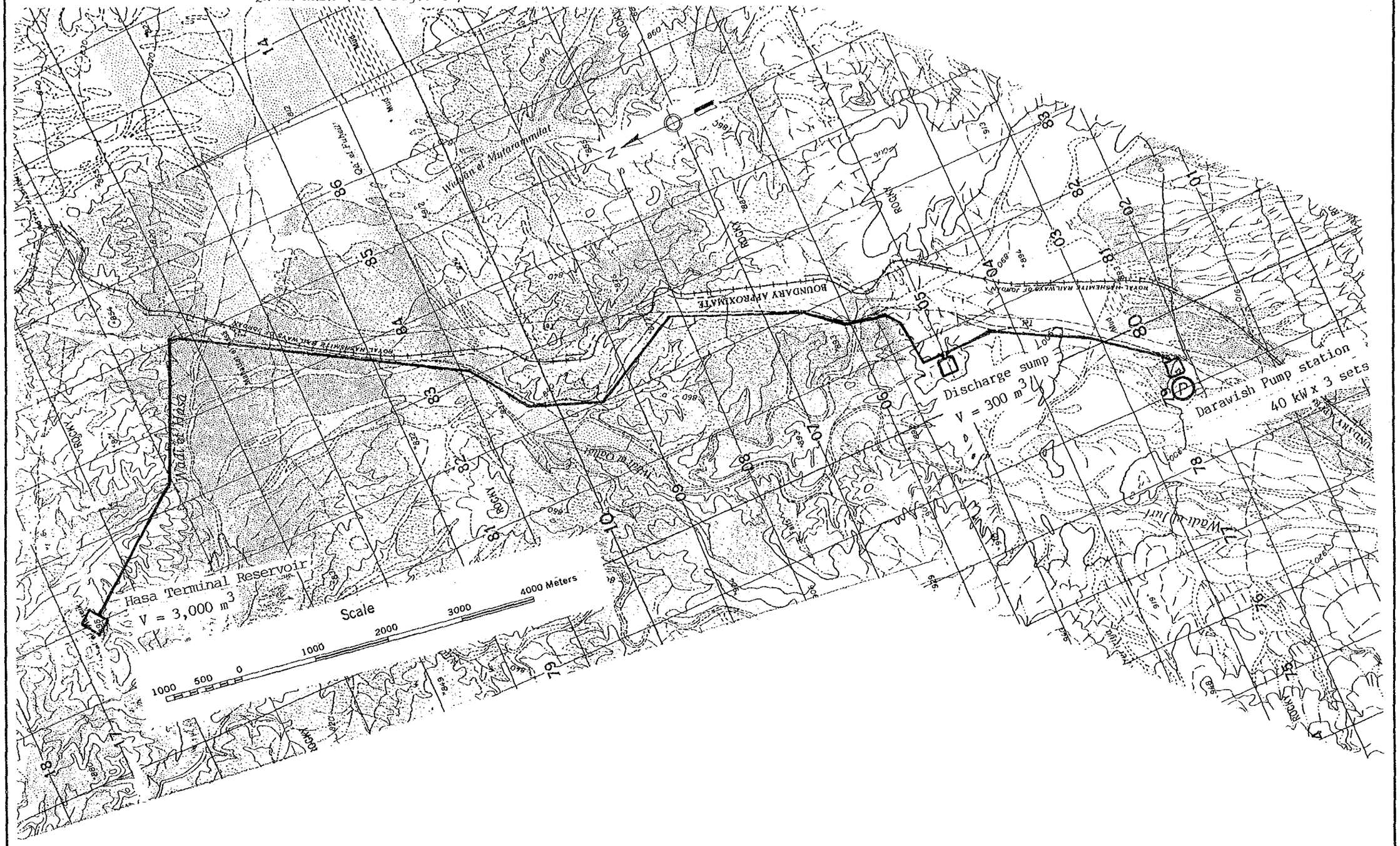

Fig. 6-7 General Layout of Proposed Darawish-Hasa Pipeline

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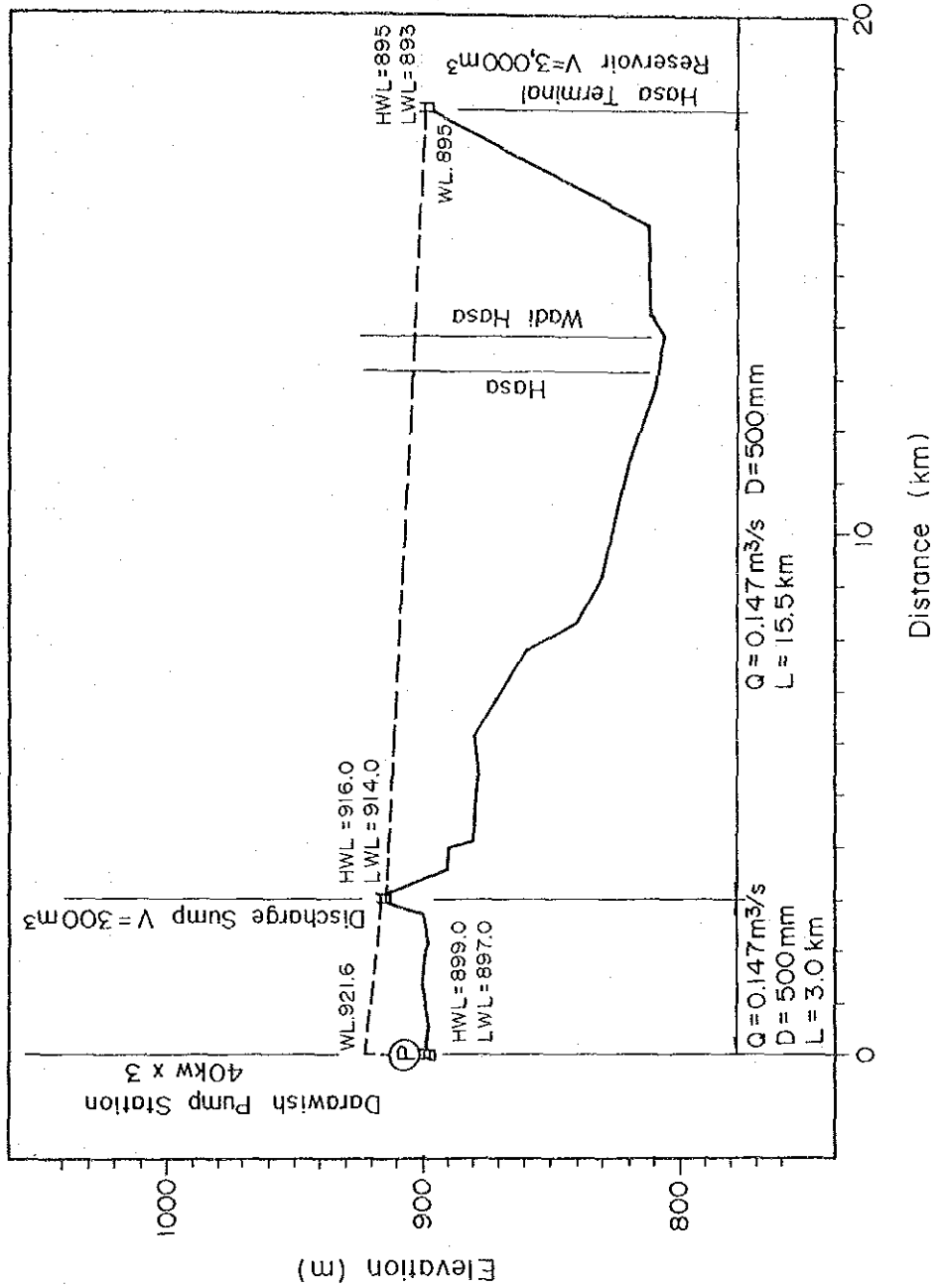

Fig. 6-8 Profile of Proposed Darawish-Hasa Pipeline

THE HASHEMITE KINGDOM OF JORDAN
THE STUDY ON INTEGRATED REGIONAL DEVELOPMENT MASTER PLAN FOR THE KARAK - TAFILA DEVELOPMENT REGION

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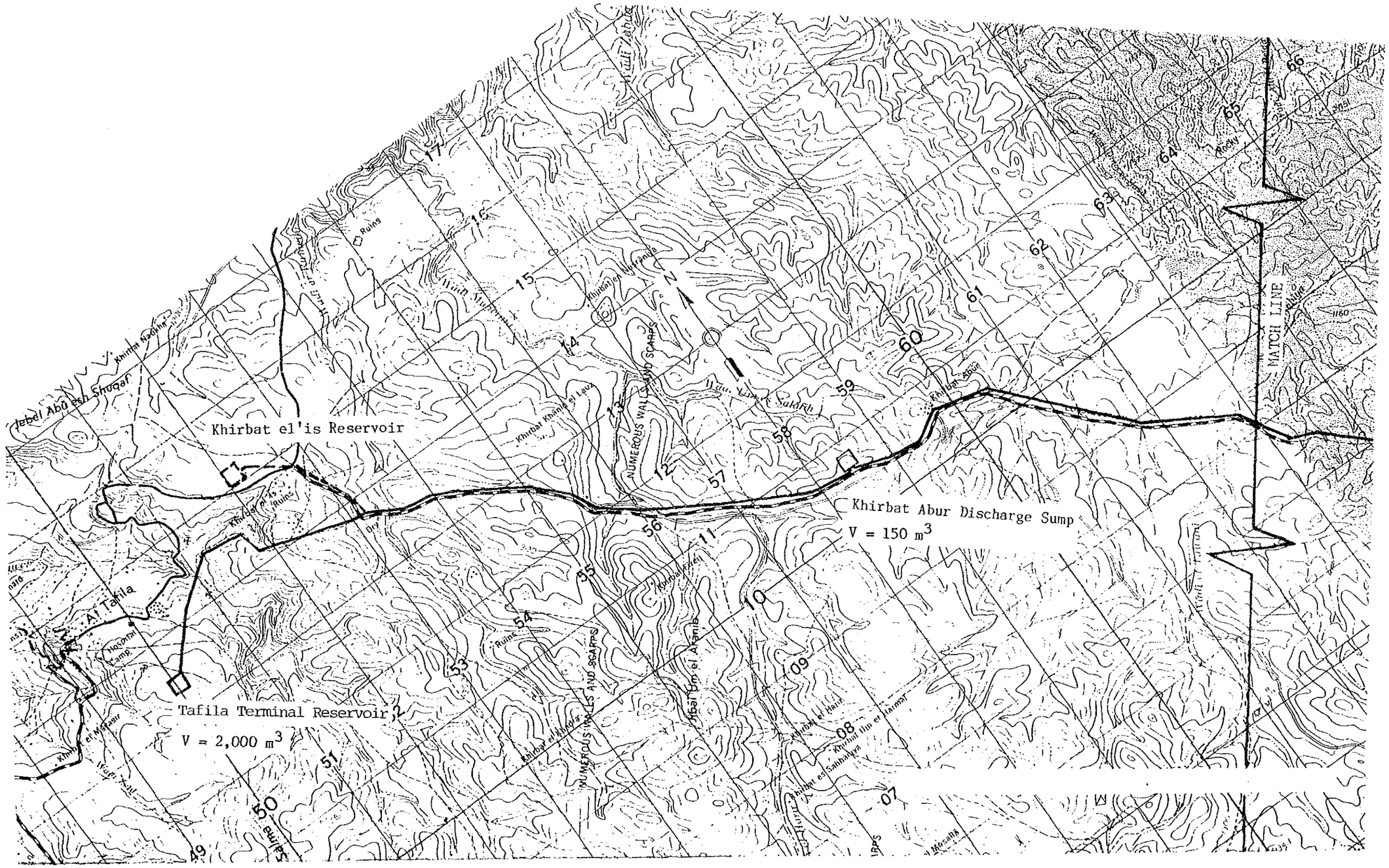

Fig. 6-9 General Layout of Proposed Darawish-Tafila Pipeline (1/2)

THE HASHEMITE KINGDOM OF JORDAN
THE STUDY ON INTEGRATED REGIONAL DEVELOPMENT MASTER PLAN FOR THE KARAK - TAFILA DEVELOPMENT REGION
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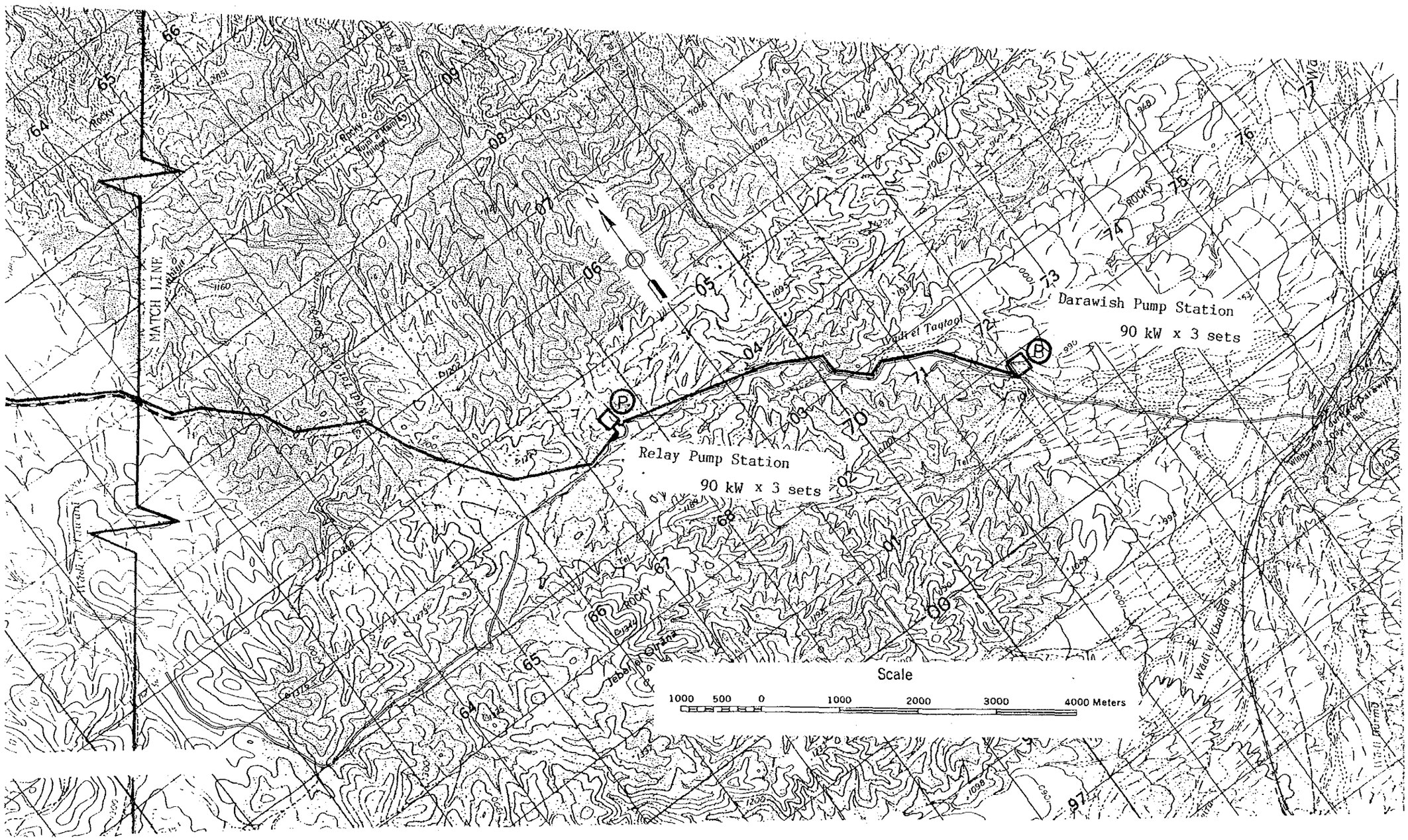

Fig. 6-9 General Layout of Proposed Darawish-Tafila Pipeline(2/2)

THE HASHEMITE KINGDOM OF JORDAN
THE STUDY ON INTEGRATED REGIONAL DEVELOPMENT MASTER PLAN FOR THE KARAK-TAFILA DEVELOPMENT REGION
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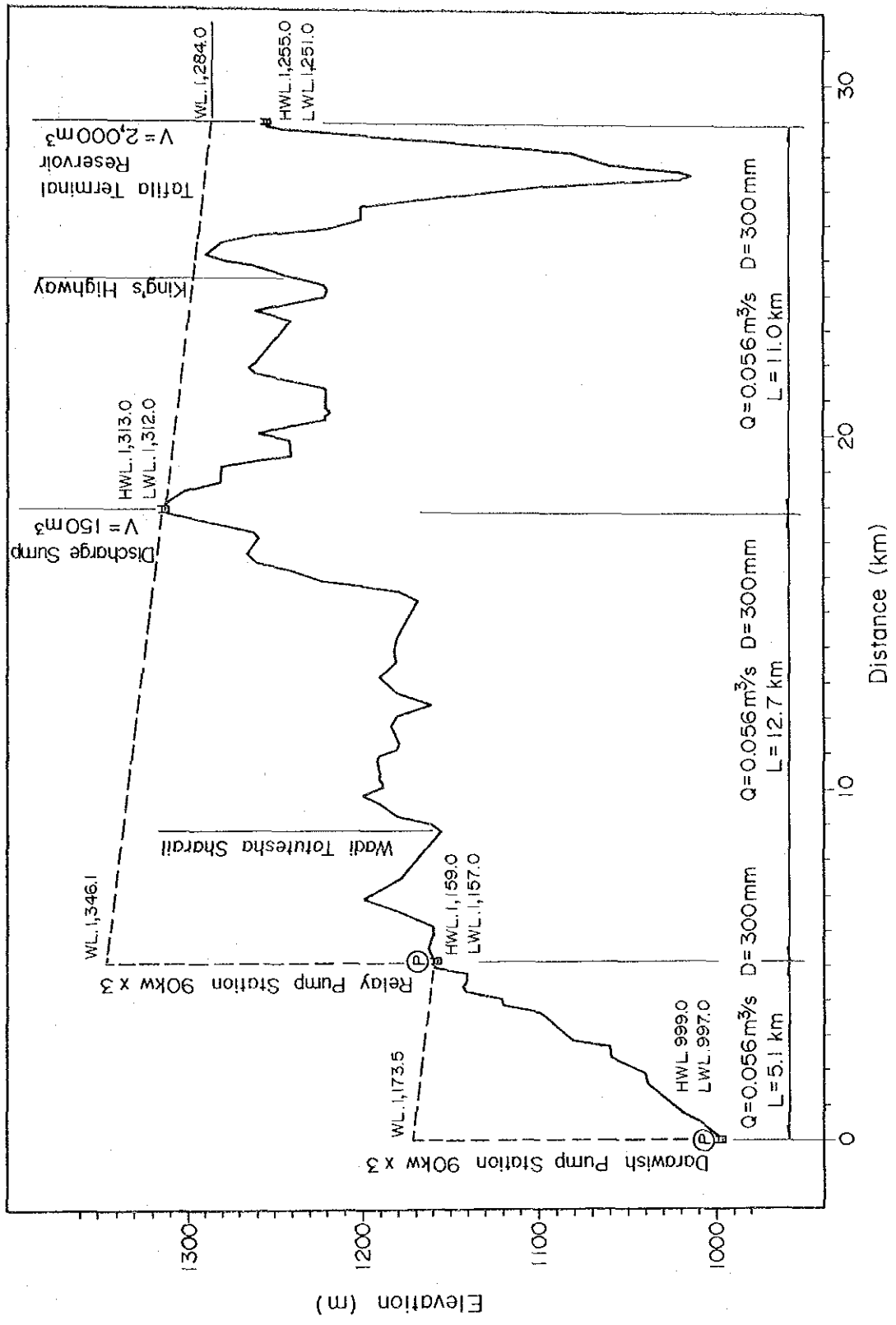

Fig. 6-10 Profile of Proposed Darawish-Tafila Pipeline

THE HASHEMITE KINGDOM OF JORDAN
THE STUDY ON INTEGRATED REGIONAL DEVELOPMENT MASTER PLAN FOR THE KARAK - TAFILA DEVELOPMENT REGION
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Fig. 6-11
Preliminary Implementation Schedule
for the Green Badia Project

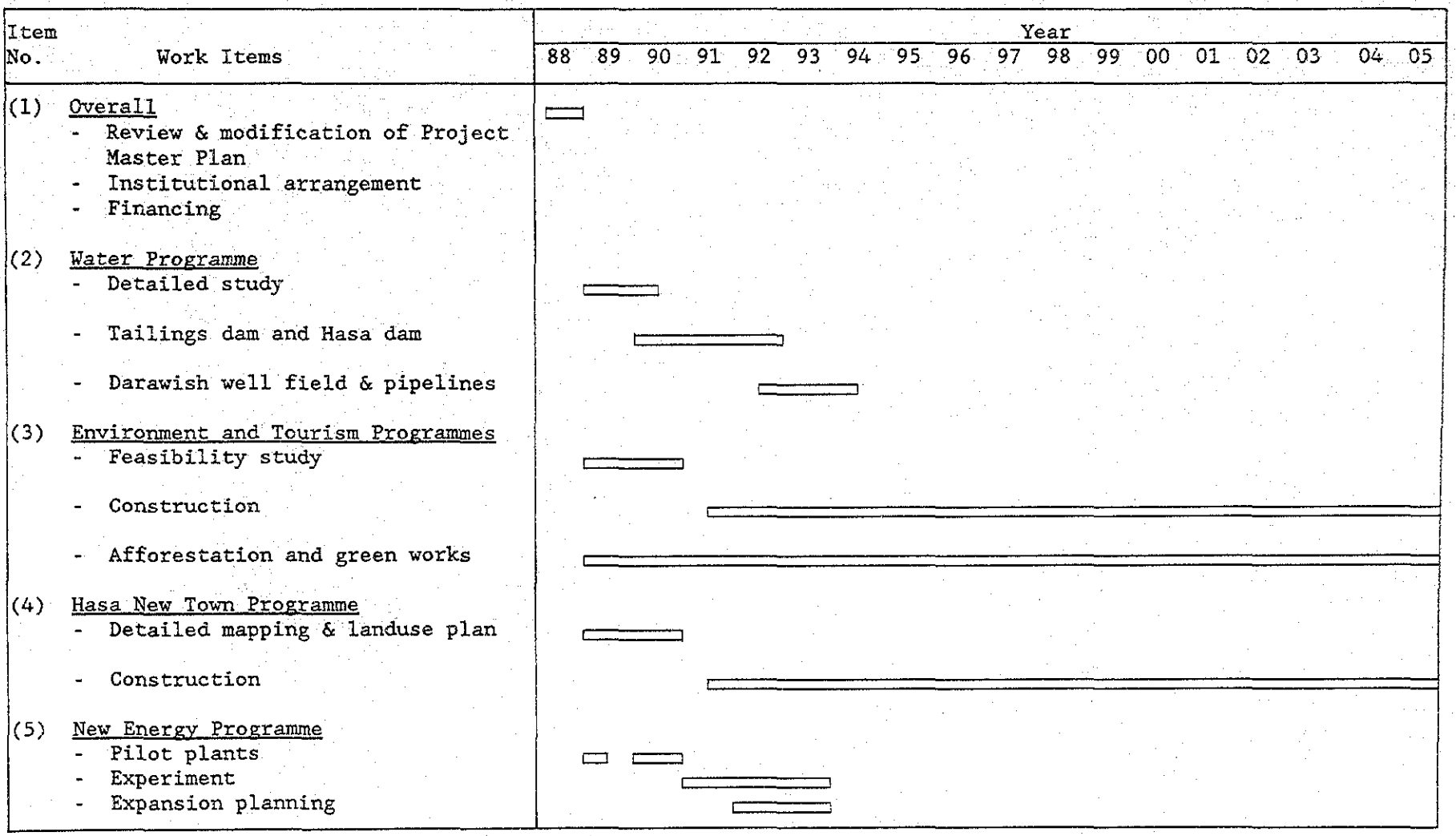

Fig. 6-11 Preliminary Implementation Schedule for the Green Badia Project

THE HASHEMITE KINGDOM OF JORDAN
THE STUDY ON INTEGRATED REGIONAL DEVELOPMENT MASTER PLAN FOR THE KARAK - TAFILA DEVELOPMENT REGION
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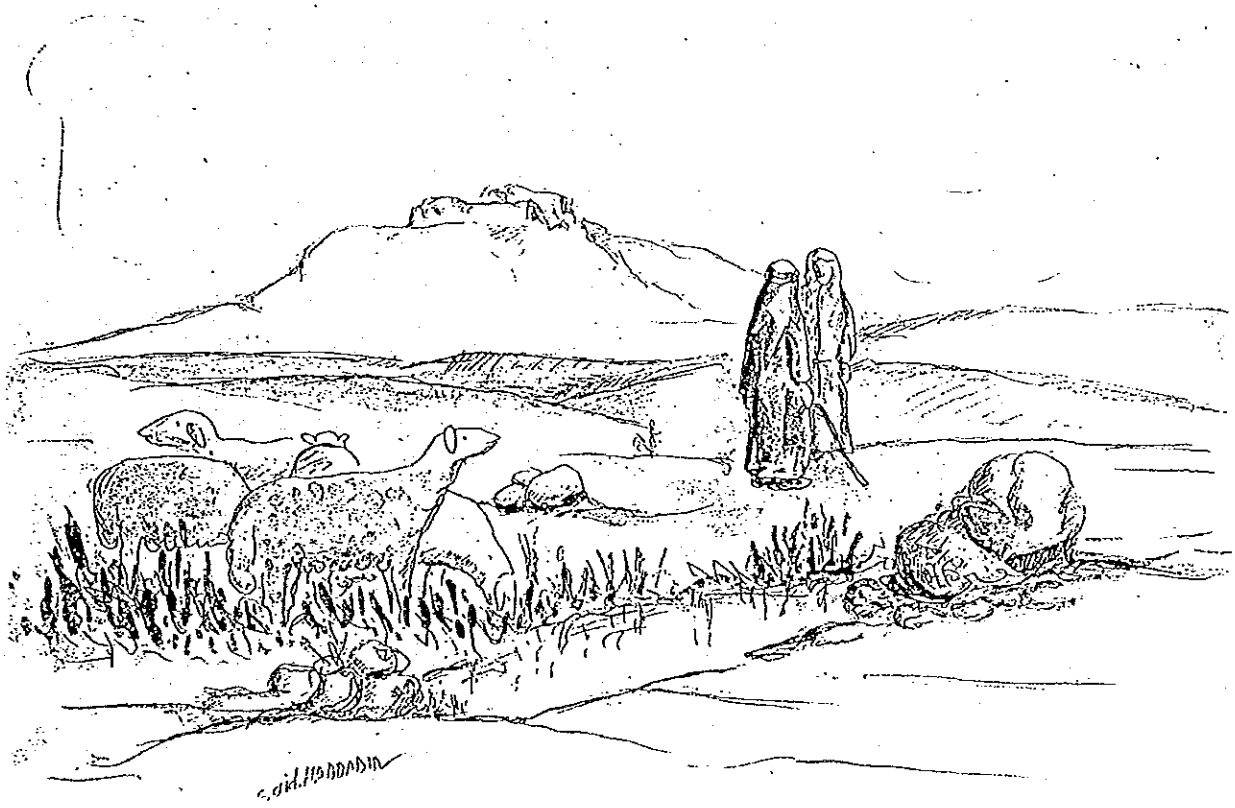
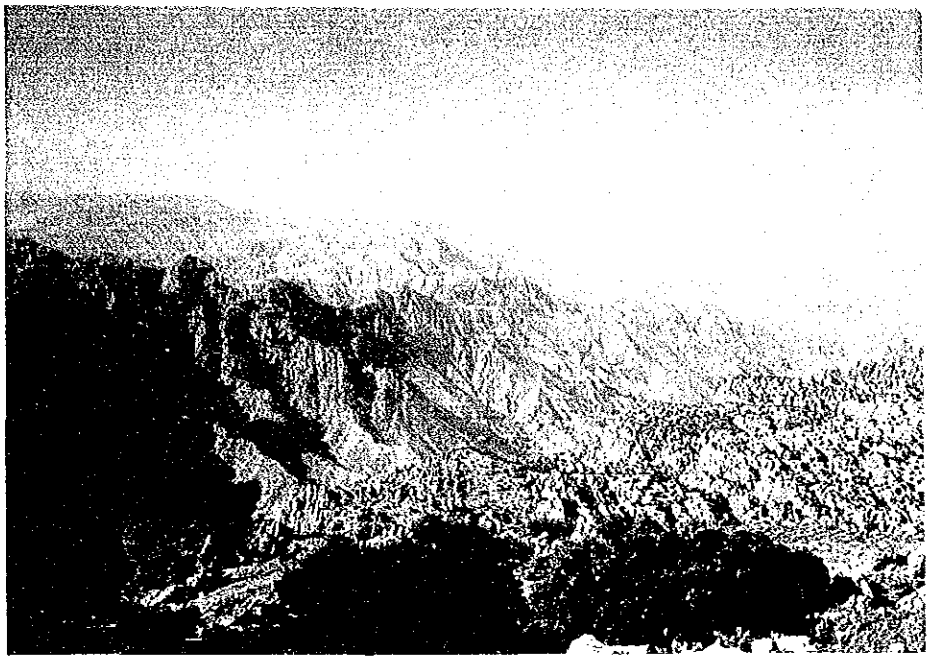
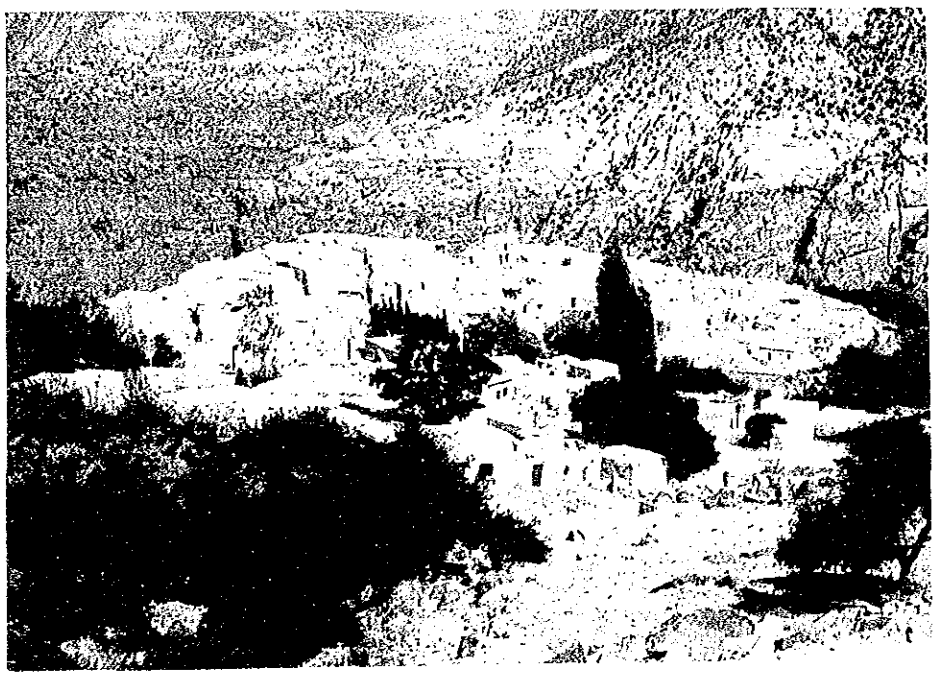
CHAPTER 7 DHANA VALLEY TOURISM DEVELOPMENT PROJECT





View of Dhana Valley from Jabal Sarab



Stone Houses at Old Dhana Village
(to be restored)

7. DHANA VALLEY TOURISM DEVELOPMENT PROJECT

7.1 Introduction

Since this Dhana Valley tourism development has been selected as the sixth priority project, the Study Team conducted a preparatory study on this Project at a master plan level.

7.2 Dhana Valley Tourism Development

7.2.1 Development Objectives

The objectives of this Project are set out as follows:

(1) to give an impact on start of the tourism development in the region
(2) to create job opportunities and to promote tourism-related industries by establishing a resort at Dhana
(3) to provide visitors to Tafila with suitable lodging facilities

7.2.2 Basic Concepts

The Project is planned to develop a resort of a long-stay type in the Dhana Valley taking advantage of such tourism resources as the natural environment blessed with greenery and fresh air, a row of old stone houses in Old Dhana, a view of the Dhana Valley and Wadi Araba, the ruin of a copper smelter from King Solomon's time, and so forth (see Fig. 7-1 for the project location).

It is proposed that a resort hotel be built as a base for various recreational activities in the surrounding areas; sports, picnics, observation of geology and fauna, etc. Trekking, hiking, rock climbing and mountaineering will also be tourist attractions of this Project.

Possible visitors to the Dhana Resort are Jordanians and foreign residents mainly from Amman and Aqaba. Foreign visitors from the Gulf countries are also expected in summer. The hotel facilities will function also as a business hotel for visitors to Tafila City, since the site is close to Tafila (half an hour by car).

This Project will contribute to prolonging the regional tourism axis of Karak and Tafila to the south of the region by connecting with tourism spots in South Jordan such as Petra, Wadi Rum and Aqaba, which are famous tourist places of Jordan. Promotion of tourism activities will also contribute to the local economy especially in creation of job opportunities and in the incubation of tourism related industries.

7.2.3 Tourist Attractions

(1) Green area: A wide green area with abundant grass and Mediterranean oak trees spreads to the south of Old Dhana. Olive trees are planted widely on the valley slope. The Ministry of Agriculture (MOA) is constructing a new agricultural station in this area, while the Social Security Corporation (SSC) has a plan to build a rest house at Old Dhana.

(2) A gorgeous view of the Dhana Valley: The Dhana Valley presents a unique topography of rocks, cliffs and hills. The Valley descends for 1,600 m from the peak at 1,400 m above sea level to Wadi Araba at about 200 m below sea level. The north bank of the Valley forms huge rock wall cliffs, and the south bank forms rolling hills with rich green. The upstream end of the Valley ascends to the plateau of Rashadiya. Old Dhana is located at the uppermost end of the Valley. The bottom of the Valley is covered by sandstone outcrops.

The top of the north bank forms a plateau of moderate slope and is a suitable site for the proposed resort hotel and trekking course.

(3) Old Village of Dhana: The village still has a row of old-fashioned stone houses. Many houses are abandoned but remaining in good condition. The old village will offer a chance to the visitors to savour traditional community life.

(4) Fresh air: Owing to the high altitude the air is fresh and the temperature is about 3 to 4°C lower than in Amman. This is an advantageous resource for a long-stay summer resort to attract visitors from other parts of Jordan as well as from the Gulf countries.

(5) Ruin of a copper smelter in Wadi Araba: This was founded in the time of King Solomon and is considered to be an interesting archaeological resource for tourists.

7.2.4 Overall Plan

This Project includes construction of the following facilities:

- a resort hotel, bungalows and pensions
- restaurants, coffee shops
- souvenir shops, daily shops
- sports facilities: tennis courts, trekking and hiking courses
- public facilities: a police office, a fire station, a post office
- a bus and taxi station
- a heliport
- utilities: water, sewerage, power, telecommunications

A resort hotel should be built as the core of the Project. It should be of a level comfortable enough for long-stay tourists.

Cultural programmes should be arranged such as pottery, painting, hand weaving and lectures. These activities will leave good memories of the Resort with the visitors who will come again.

The houses in Old Dhana should be restored for reuse as tourism facilities such as restaurants, coffee shops, souvenir shops, pensions, etc. Old Dhana will become a charming traditional village for tourists, and will attract tourists especially architects, urban planners and foreigners. The restoration works would be relatively easy and not costly.

Tourism facilities in Old Dhana and the resort hotel should be linked by shuttle bus service.

7.2.5 Facilities

The principal features of each facility required for the Project are outlined below:

(1) The Resort Hotel should have 100 rooms, restaurants, a coffee shop, a lounge, a shopping arcade and a convention hall. Bungalows and pensions will also be built reusing the restored stone houses in Old Dhana.

(2) Recreational Facilities: Tennis courts, trekking and hiking courses should be built. A swimming pool should be attached to the Resort Hotel for summer visitors.

7.2.6 Recreational Programmes

Recreation programmes such as sports and cultural activities are essential to enrich the resort life of visitors.

(1) Sports Programme: The fresh and cool highland climate is suitable for sports activities of individuals and groups of visitors for recreation and physical training. Service facilities and field athletic equipment should be prepared too.

(2) Cultural Programme: It is important to draw on traditional culture and to create an active resort life.

(A) Handicrafts such as pottery, painting, hand weaving, etc.
(B) Archaeological surveys of pre-historic relics such as the copper smelter of King Solomon's time
(C) Natural observation of astronomy, geology and fauna
(D) Lectures and symposia
(E) Excursions to surrounding areas to visit Karak Castle, Afra-Burbeita hot springs, Hasa Oasis Park, Tafila, Petra, Wadi Rum, Aqaba, etc.

7.3 Implementation Schedule and Project Management

(1) Implementation schedule

(A) 1988-1990: A branch office of MCTA will be established in Tafila. A study should be made to prepare a development plan for the Resort.
(B) 1991-1995: Planning and designing should be completed in this period and finance should be arranged for implementation of the Project. Partial implementation of the Project would be started.

(C) 1996-2000: Construction of the resort hotel and restoration of Old Dhana would be undertaken during this period.

(D) 2001-2005: Further development of the resort will be undertaken in this period.

(2) Project management: It is assumed that the necessary access roads and related public utility systems for this Project will be constructed by MPW.

Restoration of the old stone houses in Old Dhana by the public sector should cover the exterior works which will include planting, installation of street furnitures and lighting. Interior restoration works should be undertaken by private investors. Coordination of both sectors is required to plan the reuse of the old quarter for tourism.

7.4 Costs

(1)	Resort Hotel	JD 1,000,000
(2)	Restoration of Old Village	JD 550,000
	Sub-Total	JD 1,550,000
	Contingency	780,000
	Total	JD 2,330,000

7.5 Conclusions and Recommendations

(1) Conclusions: A resort development project is proposed in the Dhana Valley targeting long-stay tourists. It would include a resort hotel with 100 bedrooms and recreational facilities, restoration of stone houses in Old Dhana, and sports and culture programmes.

To attain a bed occupancy rate of 60 per cent in the proposed resort hotel, a total of about 3,000 visitors staying one week or more will be required in a year. The most important factor to ensure success of this Project will be marketing since the site is rather far from large population centres and the number of tourists would become almost nil in winter except business visitors to Tafila Municipalities etc.

The construction cost of the Project is estimated at JD 2.33 million (equivalent to US$ 6.8 million).

(2) Recommendations: The Rashadiya Cement Factory owns a wide concession in Jabal Sarab on the north bank of the Dhana Valley. After extraction of limestone from quarry, the site should be rehabilitated with greenery to recover the original environment. With this rehabilitation work, the mining, which contributes to the national economy, can be in favourable harmony with the excellent natural environment and with the proposed tourism activities as well.

Social education should be given to local inhabitants to avoid the friction with visitors who may have different religious and cultural backgrounds.

To invite investment from private sector, the following preparatory measures should be undertaken by public sector:

(A) Preparation of the utility and transportation systems to the project area
(B) Institutional arrangements for encouraging private investment
(C) Promotion of resort activities and marketing by MCTA
(D) Investment by SSC

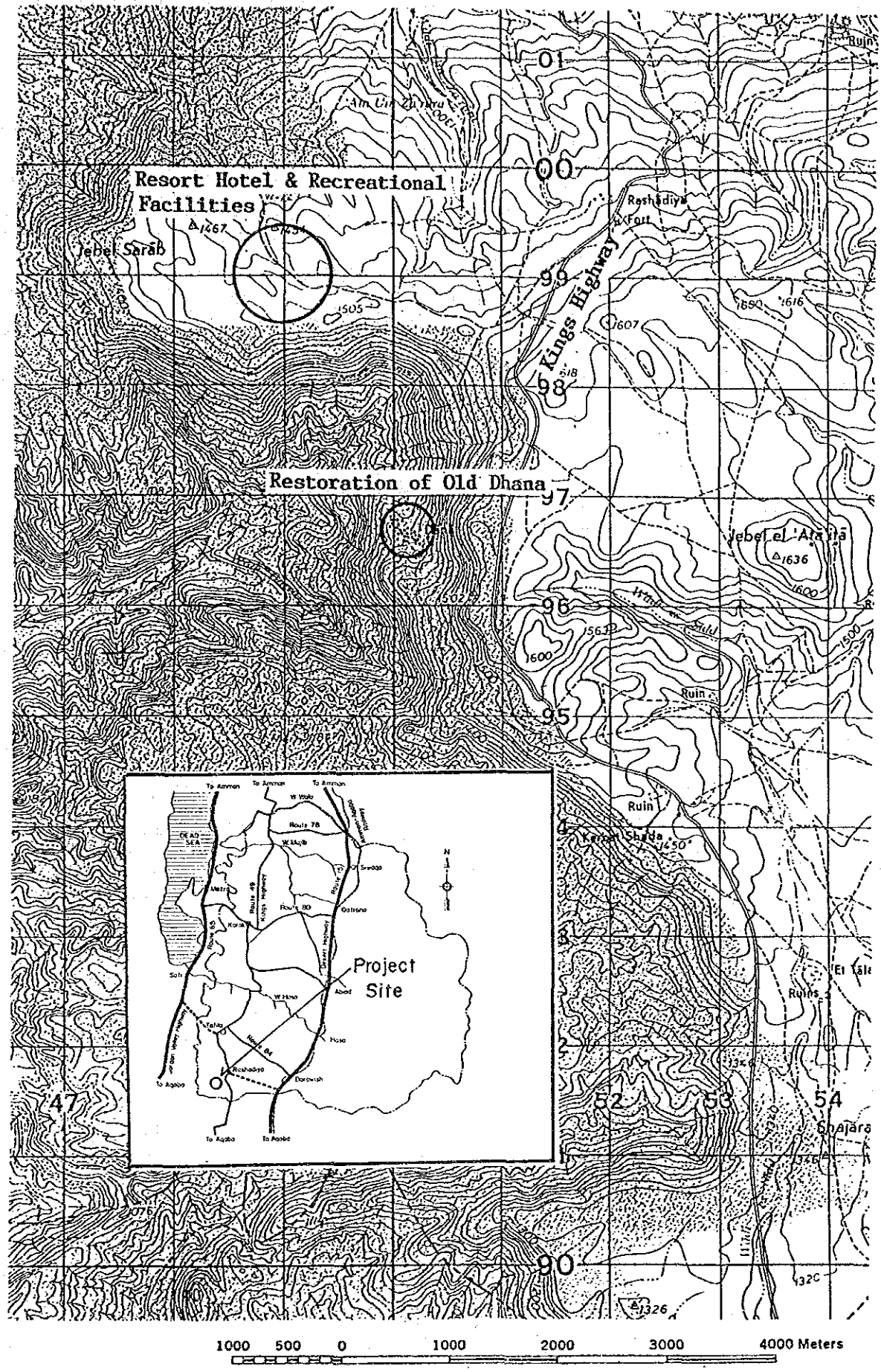


Fig. 7-1 Location Map of the Dhana Valley Tourism Development Project

THE HASHEMITE KINGDOM OF JORDAN
THE STUDY ON INTEGRATED REGIONAL DEVELOPMENT MASTER PLAN FOR THE KARAK - TAFILA DEVELOPMENT REGION

JAPAN INTERNATIONAL COOPERATION AGENCY