

Fig. B-4 Isohyetal Map

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

JAPAN INTERNATIONAL COOPERATION AGENCY

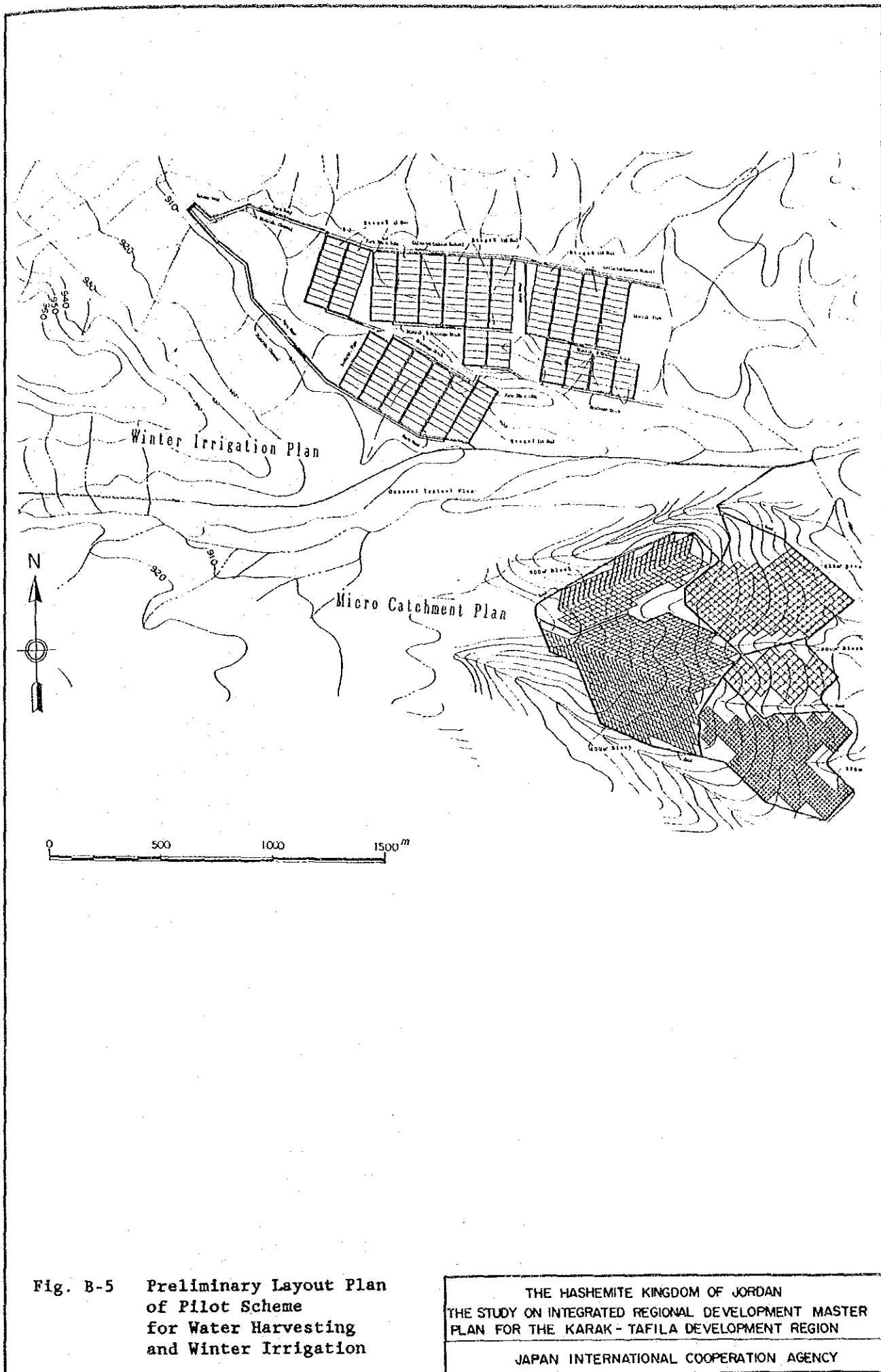


Fig. B-5 Preliminary Layout Plan of Pilot Scheme for Water Harvesting and Winter Irrigation

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**ANNEX C: MINERAL RESOURCES**



THE STUDY ON  
INTEGRATED DEVELOPMENT MASTER PLAN  
FOR THE KARAK - TAFILA DEVELOPMENT REGION

VOLUME 4: SUPPORTING REPORTS

ANNEX C: MINERAL RESOURCES

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## 1. INTRODUCTION

Many authors have contributed in geological investigations of Jordan since the end of last century. The Geological Survey and Bureau of Mines was established in 1965 and renamed the Natural Resources Authority in the next year. The Ministry of Energy and Mineral Resources was created in 1984.

Thanks to efforts at the government and industrial company levels, valuable information on mineral resources is becoming available. With a review of the background, recent activities and moves on mineral resources are briefly described.

## 2. GEOLOGICAL SETTING

### 2.1 Stratigraphical Nomenclature

The lithostratigraphical nomenclature on the stratigraphy of the whole country was published in 1968 by F. Bender, the head of the West German Geological Mission which carried out a detailed survey in collaboration with Jordanian geologists during the period of 1961 to 1966 (Refs. C-1 and C-5).

Concurrently with this, formation names with geographical prefixes are widely used as a prevailing practice and also the letter nomination has been introduced as the derivatives of conventional usage. For example, an aquifer system A7-B2 means one of the Upper Cretaceous hydraulic complex, in which A stands for Ajlun series of Upper Cretaceous and B stands for Belqa series of Santonian to Eocene in age, formerly named by A.M. Quennell in 1951 (Ref. C-2).

Under the present 1:50,000 Geological Mapping Series, the project introduces a system which combines a lithographical formation name with a geographical prefix. Many of geographical names have been derived from formation names used in aquifer projects since 1963 (Refs. C-6 to C-10).

### 2.2 Stratigraphy

Stratigraphy in Jordan and its correlation table are shown in Tables C-1 and C-2.

The Basement Complex refers to igneous rocks and metamorphic rocks of Precambrian age which are exposed along the eastern side of Wadi Araba. Saramuj Conglomerates at the south-eastern end of the Dead Sea and Slate-Greywacke series near Gharandal are of Precambrian in age.

The Cambrian System comprises the Basal Conglomerates, Bedded Arkose Sandstone, Dolomite-Limestone-Shale, Variegated Sandstone and Massive Brownish Weathered Sandstone Units. These rocks are exposed in

the eastern side of Wadi Araba to the east of the Dead Sea. The Variegated Sandstone Unit corresponds to the copper-bearing White Fine Sandstone Unit in the Feinan area which contains in some layers scattered fragments of quartz porphyry.

The Ordovician rocks crop out mainly in the Qa'Disi area of South Jordan and consist of a sequence of sandstones. The Silurian sandstones occur along the Hejaz Railway and to the east in South Jordan.

The Upper Paleozoic sequence has not been defined but Carboniferous clastics were penetrated in an oil exploration well about 42 km ESE of Amman.

The Triassic sediments crop out along the north-eastern shore of the Dead Sea and are formed of sandstone, sandy shale, shale, marl and dolomite. In Wadi Huni of Zarqa River area, gypsum deposits occur within a group of yellowish to greenish shales and marls.

The Jurassic system is distributed at the north of the Dead Sea and embraces a series of alternating sandstones, shales, marls, dolomites and limestones.

The Massive White Sandstone and the Marine Varicoloured Sandstone Units of Lower Cretaceous age are equivalent to Quennell's Kurnub Sandstone which is exposed along the eastern side of Wadi Araba and the Dead Sea, in the area between Ras En Naqb and Mudawara of South Jordan and in the Zarqa River area of North Jordan.

The succeeding Nodular Limestone Unit of Cenomanian in age is well exposed in the mountainous area east of the Rift Valley and comprises dolomitic limestone, marly limestone, reddish and greenish shale and gypsum. The overlying Echinoid Limestone Unit is composed of limestones, dolomitic and marly limestones with gypsum in places. These units are correlated with Ajlun Series.

The lowermost of Belqa Series is called the Wadi Ghudran Formation (B1), comprising chalk, marl, chert and sandstone. This is followed by the Amman Silicified Limestone (B2a), Al Hasa Phosphorite (B2b), Muwaqqar Chalk-Marl (B3) and Um Rijim Chert-Limestone (B4) Formations.

The most persistent beds of phosphorite are in the Al Hasa Phosphorite Formation. Oil shale has been detected in the upper member of this formation and the lower part of overlying Muwaqqar Chalk-Marl Formation. The Chert-Limestone Formation of Eocene is widely distributed in Central Jordan and unconformably overlain by Oligocene to Miocene sediments.

During the late Neogene and Pleistocene, basaltic volcanism was widespread. The Shagur Formation of lacustrine and fluviatile rocks of the earliest Pleistocene occurs in the eastern side of the Jordan Valley (Refs. C-1 to C-10).

### 2.3 Igneous Activity

Although the Basement Complex is dominated by igneous rocks, post-Proterozoic igneous activities are limited in number of times.

Plug-shaped masses, dikes and sills of quartz porphyries intruded or intercalated the lower part of the Cambrian sandstones.

Acidic dikes and sills in the Triassic limestones have been reported in Wadi Hisban at the northeast of the Dead Sea. Trachyte sills and lenses of volcanic ashes in the Triassic beds have been recorded in Wadi Ain Musa at the south of Wadi Hisban.

A dolerite dike can be traceable for several kilometers along a fault zone trending toward southeast in the Upper Cretaceous limestones of Wadi Karak, but this may be assigned to the Pleistocene.

The basalt extrusions are all of Plio-Pleistocene in age (Ref. C-5).

## 2.4 Geological Structure

Three structural provinces have been proposed in Jordan (Ref. C-5). They are;

- (1) The Nubo-Arabian Shield of South Jordan
- (2) The block-faulted Platform of Jordan, east of the Rift, and
- (3) The Wadi Araba-Jordan Rift

The Nubo-Arabian Shield of southern Jordan forms a northern rim of the Shield. Paleozoic sediments are regionally tilted and dip gently to the east-northeast.

The Jordan Platform is of a regional monocline in the eastern side of the Rift Valley. Some major faults trend in a NW-SE direction. The most prominent fault zone runs from Karak south-easterly, dividing El Jafr Basin of the southwest from the Bayir-Sirhan Plateau of the northeast and extends to Saudi Arabia.

Fault zones trending in an E-W direction are also remarkable. The Zarqa Fault zone, Zarqa Ma'in Graben and Siwaqa Fault zone are of this system. Faults of a N-S direction are observed in areas adjacent to the Rift Valley. Grabens of Qatrana and Lajjun are of this trend.

The most significant feature of Jordan is the Rift Valley which forms a part of Western Arabia Rift System. The graben strikes N15°E from the Gulf of Aqaba along Wadi Araba and turns northerly from the Dead Sea to the Lake of Tiberias (Ref. C-5). Two hypotheses, one being of vertical tectonics and another being of horizontal tectonics, have been discussed by many authors. The separation of Nubia (Africa) and Arabia plates in two stage motions since the Oligocene has been suggested in recent years.

## 2.5 Mineragenetic Province

Due to the limited orogenic movements and igneous activities, distribution of magmatic deposits is rather restricted within narrow areas.

Copper mineralization has been encountered in the Basement Complex and Cambrian sediments and manganese mineralization occurs also in the Cambrian sandstones. Consequently, the Basement Complex and Cambrian System form a metallogenic ore field in the east of Wadi Araba.

Iron deposits at Warda in the southern part of Ajlun district have been indicated to be of hydrothermal origin within the Grey Thick Bedded Limestone Unit of Upper Cenomanian age.

Feldspars in alkali granites of the Precambrian have been investigated as a source of raw materials for ceramic and glass industries. The granites occur in Wadi Yutum area northeast of Aqaba.

Sulphur impregnation is widespread in Lisan Marl beds of Pleistocene in age.

In contrast with the above, mineral deposits of precipitation and sedimentation in origin are widespread in areas of sedimentary rocks.

Huge quantities of glass sand occur within the Lower Ordovician and the Lower Cretaceous sandstone units. Gypsum deposits occur within the group of Lower Triassic sediments in the Zarqa River area and in the Ajlun Series of Cenomanian to Turonian age in the Wadi Mujib-Tafila area. Kaolin clay is being mined from the lower part of the Kurnub Sandstone Unit of the Lower Cretaceous in the west of Amman.

Marble in the Hebron area occurs within the upper part of the Nodular Limestone Unit. In the Daba area, 50 km south of Amman, marble is being mined from the upper part of the Chalk-Marl Unit or Muwaqqar Chalk-Marl Formation of upper Paleocene. Tripoli has been investigated at the south and southwest of Karak in the lowermost portion of the Silicified Limestone Unit of Campanian age.

Sedimentary phosphate deposits have been exploited in the Al Hasa Phosphorite Formation of late Campanian to Maestrichtian in age. The upper member of the formation and the lower part of the overlying

Muwaqqar Chalk-Mark Formation are bituminous.

The Lisan Peninsula is underlain by a thick succession of marl and chalk with rock salt and potash salt of Pleistocene age. Potash is being recovered from Dead Sea brines. Salt is also being obtained from underground brine in the Azraq area.

Several deposits of travertine occur in the east of Jordan Valley. These deposits are of Holocene age (Refs. C-1 to C-10).



### 3. MINERAL OCCURRENCES

At present, phosphate rocks are being mined at two sites in the Study Area and there is one Portland cement factory. Gypsum is being mined as one of raw materials for cement production (Fig. C-1). Construction of roads and housing facilities is extensively carried on in the region, which requires concrete aggregates and sand.

Detailed studies for utilization of oil shale resources are in progress within the area. The phosphate rocks and oil shales in the region are radioactive. Two localities of tripoli have been subjected to detailed exploration in the vicinities of Karak. Manganese deposits have been investigated in the southwest of the Study Area.

Exploration of mineral resources is being intensively carried out in the area and also in its immediate vicinity. Mineral occurrences in Jordan which may have direct impact on the Study Area can be summarized as follows.

#### 3.1 Phosphate

Phosphate deposits were first discovered in 1908 and a private company started production at Rusaifa to the northeast of Amman in 1934. The Jordan Phosphate Mines Co. (JPMC) was formed in 1953 to exploit the Rusaifa area. El Hassa mine started its production in 1962 and El Abiad in 1979. The former is situated in Tafila Governorate, 136 km south of Amman and the latter is located in Karak Governorate, 115 km south of Amman. Shidiya deposits were discovered at about 120 km northeast of Aqaba by the Natural Resources Authority during its 1969 to 1974 exploration program.

Phosphate-bearing horizons occur in the Maestrichtian of Upper Cretaceous age and cover a wide belt of about 20,000 square kilometers. The phosphate at El Hassa and El Abiad is found in two horizons and the deposits occur mostly in the upper horizon, in one bed of two layers separated by a thin band of marl. The upper layer is 0.4 to 0.8 m thick

and contains 55 to 62% TGP (Tricalcium Phosphate). The lower layer ranges from 1.5 to 2.5 m in thickness and contains 66 to 70% TGP or 30 to 32%  $P_2O_5$ .

### 3.2 Brines

Water of the Dead Sea is known to have an average salinity of 300 grams of salt per liter. Estimated total amounts of salts are over 40 billion tons. A typical composition of the water is given as follows (after APC):

MgCl <sub>2</sub>	13.76%
NaCl	7.65
CaCl <sub>2</sub>	3.80
KCl	1.03
MgBr <sub>2</sub>	0.48
Water	73.28

Potash is being recovered from the Dead Sea.

At the Azraq area, the natural underground brine is pumped into surface pans and is subjected to solar evaporation. Residuals are crushed and bagged without and treatment (p.48 of Ref. C-4 ).

### 3.3 Solid Potash Minerals

In 1960, the Phillips Petroleum Company sunk a deep well at the central part of the Lisan Peninsula to a depth of 3,672 m, without penetrating the bottom of the evaporite series of Tertiary age.

In 1967, three carnallite-sylvite seams were identified in the first well drilled by NRA for the purpose of oil exploration. Additional subsurface data were obtained by seismic surveys carried out in 1967 and 1985. The maximum thickness of this evaporite body is approximately 4,000 m. It is bounded by a N-S fault at the east of the deposit. An exploration program involving two or three wells to a depth of 1,500 m has been proposed by NRA to delineate the occurrence of solid potassium-bearing salts (Refs. C-13 and C-18).

### 3.4 Limestone

Limestones for Portland cement industry are widely distributed and two Portland cement factories are in operation at Fuheis and Rashadiya.

Limestones suitable for white cement industry exist in Salt and Khalidiya, and the Jordanian-Syrian Industrial Company's white cement works at Khalidiya came into operation in 1985 at an annual rate of 10,000 t/yr.

Several travertine deposits of Holocene age occur in the Rift Valley and the largest deposits are located at 9 km south of Deir Alla, 45 km north of the Dead Sea.

### 3.5 Silica Minerals

Huge quantities of glass sand have been known in the Lower Ordovician sandstone units and also Lower Cretaceous sandstone unit in the Ras Naqb area. The Jordan Glass Manufacturing Company has been established to utilize the raw materials and commenced its production.

Two localities of tripoli have been subjected to detailed exploration programs, one being at Ainun, 13 km south of Karak and another at El-Shahabiyeh, 4 km southwest of Karak. These deposits occur in the lowermost portion of the Silicified Limestone Unit of Campanian age and the average content of silica is about 92% (Ref. C-4).

### 3.6 Aluminous Minerals

In exploration studies of clay and feldspar, and existence of small lenticular bodies of pegmatite was indicated in the Aqaba granite area. Alternatively, appreciable quantities of alkali granites occur in the Wadi Yutum area, northeast of Aqaba. As an annual requirement of feldspar in Jordan seems small, beneficiation practice has been assumed infeasible (Ref. C-4).

Due to a limited number of igneous activities in post-Paleozoic, rocks are not rich in feldspar minerals and thus occurrences of aluminous clays are also restricted. Kaoline clays occur at Mahis and

Ghor Kabid in the lower part of Kurnub Sandstone Unit of Lower Cretaceous age. In the Mahis area, clays are extracted for the Jordan Ceramic Factory and for export. Montmorillonite and illite clays are sporadically distributed in the Azraq basin (Ref. C-4).

### 3.7 Sulphate Minerals

Several occurrences of barite have been reported but are said to be of no economic importance.

Gypsum of lower Triassic sediments is being extracted at the Zarqa River area in the north of Amman.

Gypsum forms several layers in the upper part of the Nodular Limestone Unit and the lower part of the Echinoid Limestone Unit of Cenomanian to Turonian in age and crops out mainly on the western side of the Karak and Tafila region. The gypsum in the area is embedded in a greenish and reddish group of shales and marls. Previously, it had been mined at Wadi Mujib and Wadi El La'ban, the latter being a tributary of Wadi Hasa. A new mine has been opened at the north of Jabal Muleyh in the north of Aima to supply its products to Rashadiya cement works. Alabaster had been sought in an area some 10 km southwest of El Hasa.

### 3.8 Sulphur

Sulphur impregnations are widespread mainly in Lisan Marl beds of the Pleistocene and reconnaissance exploration activities over the areas of Lisan Peninsula and Ed Dhira are in progress (Refs. C-4 and C-14).

On the other hand, extraction of sulphur from gases at the hydrocracking unit of the petroleum refinery is being investigated. Daily capacity will be in the region of 15 tons (Ref. C-11).

The tar sand deposit in Ed Dhira contains 4% sulphur and 18% oil (Refs. C-14 and C-15). The oil shale of El Lajjun contains 4% sulphur and shale oil would have a content of 10% sulphur (Ref. C-3).

### 3.9 Petroleum

Several oil and gas showings were reported from petroleum exploration wells drilled by foreign companies since 1957, and also from stratigraphic or water wells sunk by NRA.

During the period of the Five Year Plan 1981-1985, NRA conducted seismic surveys and commenced drilling for petroleum exploration. In 1983, oil was encountered in the Azraq basin. Some wells of Hamzeh field started oil production in 1984.

Traps are structural closures controlled by antithetic faults and source rocks are marls of Cenomanian and Turonian in age, although an additional contribution to the hydrocarbon accumulation is suggested from rocks of Triassic and possibly of Paleozoic age. All wells in the Azraq basin have penetrated a 30m section of Maestrichtian containing asphaltine oil at a depth between 900 and 1,000 m (Ref. C-12).

In the Study Area at the southeast of the Dead Sea, Cenomanian sediments are widely exposed on the western slope of the central plateau, unconformably overlying Cambrian sandstones. Although the petroleum potential in the east of the plateau remains as a subject of the future study, a huge amount of organic substances exists as kerogen, without being converted into oil, in oil shale deposits of Maestrichtian to Paleocene in age.

### 3.10 Tar Sand

Occurrence of tar sand has been known within the Kurnub Sandstone Group of Lower Cretaceous age at the entrance of Wadi Isal, which is located in the south of the root of Lisan Peninsula, and also within the Cambrian sandstone at a few kilometers eastward along the same wadi (Ref. C-4).

Newly observed outcrops are along a fault which runs north-easterly from Wadi Isal. Ed Dhira deposit is within the Cambrian sandstone and ranges from a few meters to some 50 meters in thickness. Another deposit has been reported at Wadi Aheimir but details are not available.

The initial investigation program of Ed Dhira deposit has been proposed, comprising detailed geological mapping, trenching and/or pitting, and drilling (Ref. C-14).

### 3.11 Oil Shale

Bituminous rocks mainly in the Chalk-marl Unit of upper Maestrichtian to Paleocene. Many localities were reported in the Kingdom, but detailed studies have been concentrated to the El-Lajjun area which lies between Karak and Qatrana.

The El-Lajjun area is a small graben bounded by two parallel faults striking approximately N-S. Oil shales are poorly laminated, rather massive and dark brownish in color. Specific gravity of oil shales ranges from 2.04 to 2.35 gr/cm<sup>3</sup>. Inorganic components comprise mainly calcite with concomitant quartz and dolomite.

Seventy four holes were drilled and sixty nine holes penetrated oil shale bed over an area of 20.4 million square meters. About 1.3 billion tons of oil shale have been estimated with an average thickness of 31.2 m. A ratio of overburden against ore has been estimated at 0.9 with an average thickness of 29.2 m. Oil yield averages 10 per cent by weight, which is equivalent to 103 liters per ton or 24.7 gallons per short ton at a specific gravity of 0.968 (Ref. C-3).

In the Sultani area, another 0.9 billion tons of oil shale with an average oil yield of 9.7% have been revealed by drilling (Ref. C-19).

### 3.12 Copper

Copper showings have been reported from sediments of Lower to Middle Cambrian and dikes in the Basement Complex which extends along the eastern side of Wadi Araba and of the Dead Sea.

An entrance of Ain Fidan road is situated some 55 km south of Wadi Hasa. Following this road and Wadi Feidan towards east, the government camp of mineral prospect is accessible in a distance of some 30 km. Feinan copper prospects are located at the northeast of the camp on

cliffs at the northern side of Wadi Dhana. Manganese prospect can be reached some 5 km to the east of the camp.

Copper mineralization occurs on the top of Dolomite Limestone Unit of Cambrian in age, which underlies the coarse-grained, cross-bedded Variegated Sandstone Unit. Mineralization is mainly confined within a phyllitic facies of 2 m thick, which exhibits intraformational foldings in places. Manganiferous compact ore is contained in a form of thin layers of about 5 cm thick. Chrysocolla is most abundant in copper minerals.

About 3 km northwest of the Feinan prospect, an ancient shaft is found in coarse-grained sandstones at Wadi Khalid. Malachite-chrysocolla concentration of 30 to 55 cm thick is observed on the top of phyllitic facies of 2 m thick. Overlying coarse-grained sandstones are also mineralized sporadically with chrysocolla. This upper horizon of mineralization does not exceed 30 cm in thickness.

The Natural Resources Authority estimates a potential of 60 million tons of ore at an average grade of 1.36% Cu, with an average thickness of 2 m. A recovery rate of copper in a leaching process has been indicated at 70 to 80 per cent (Ref. C-4).

A techno-economic feasibility study was carried out on copper-extraction pilot plant with a 3,000 ton annual capacity in the Wadi Araba region. Trials were conducted on 680 tons of sample ores, but results were not encouraging in view of the lower price of copper on world markets (Ref. C-11). A difficulty in supply of treatment water is also predicted.

### 3.13 Manganese

Manganese deposits of Jordan occur mainly in the Feinan district on the top of the Dolomite Limestone Shale Unit of uppermost Lower to Middle Cambrian. A prospect called Wadi Dhana was subjected to detailed studies and sampling programmes in 1950's to 1960's. Several adits were opened in these days.

Dhana village is accessible with a four-wheel-drive car from Bier Ata'etah or Kadiesyyeh, a village some three kilometers south of Rashadiya cement works. From Dhana, a very steep graded road reaches to upper streams of Wadi Dhana. Manganese prospects are located about four kilometers west of the junction of Wadi Barra and Wadi Dhana, on the northern side of the valley.

Mineralization has a form of bedded deposits, and ranges from 0.2 to 4 m in thickness. Massive ore is dense, compact and very fine-grained, and shifts laterally into phyllitic facies of low metal content, although the ore horizon can be traceable over a distance of about 2 km.

The German Geological Mission (1965) estimated the indicated ore to be in the order of 64,000 tons. From exploratory works done so far, 1.5 million tons of ore with 38% Mn and 1.4% Cu have been indicated by the Natural Resources Authority. Metallurgical studies came out with the conclusions that a leaching or reduction method would be applicable to separate manganese from copper, which might involve expensive costs (Refs. C-1 and C-4).

The deposits are erratic and small in scale. Underground mining will be necessitated due to a rugged topography.

### 3.14 Iron

A hematite and limonite deposit has been known at Warda in the southern part of Ajlun district. The deposit is found within the Upper Cenomanian limestones of the Ajlun Group and has been estimated to be of 60,000 tons with 67.9%  $Fe_2O_3$ . The iron deposit is said to be hydrothermal in origin (Ref. C-4).

### 3.15 Radioactive Minerals

Thorium has been detected in the Paleozoic sandstones in the southeastern desert and assumed to be contained in zircon and monazite minerals.



Uranium minerals are known to be associated with the Phosphorite Formation of Maestrichtian in age. The content in the phosphorite section ranges from 24 to 204 ppm  $U_3O_8$ . Oil shales are also slightly radioactive (Ref. C-4).

### 3.16 Building Materials

Building limestones are cut and polished mainly in Ma'an Governorate.

Marble in the Daba'a area at 50 km south of Amman occurs in the upper few meters of marl and chalky limestone of the Muwaqqar Chalk Marl Formation and is used to be of multicolored chips in terrazzo plaster tiles (Ref. C-8).

Aggregates are usually made up of hard limestone. Many quarries are in operation and limestone is blasted in the quarries and crushed into different sizes.

Natural sand is being quarried for construction purposes particularly in the Amman area.

Tuff at the northeast of Jordan is used in cement industry.

Granitic rocks of Precambrian shield are said to be suitable for decoration (Ref. C-4).

#### 4. PRESENT CONDITIONS OF MINING INDUSTRY

##### 4.1 Position of Mining Industry in National Economy

Mining industry has been well established in Jordan and plays an important role in the national economy. Even if some sectors are running with financial deficits, they still maintain inflows of foreign currencies.

The Third Five-Year Plan aims to increase real income generated by the mining and quarrying sector at an annual rate of 7.8 per cent. The value added from phosphate and potash will constitute 71% and 18% respectively of the value added in the sector. Growth is expected to create 1,600 new employment opportunities by the last year of the planned period.

In 1985, the national production of mining industry amounted to JD 57 million, which shared 4.2% of GDP. The mineral export was JD 97 million, comprising JD 66 million of phosphate and JD 31 million of potash. The mineral export contributed 31.2% of the total commodity export of Jordan. A number of persons engaged in the mining sector was some 8,000 being 1.3% of the country's total job opportunities.

Jordan's industrial strategy has been mainly concentrated on large capital-intensive industries. In the field of mineral utilization, the Jordan Fertilizer Industry Company and the Arab Potash Company started production in 1982, the South Cement Company and the Jordan Glass Manufacturing Company in 1984, and the Jordanian-Syrian Industrial Company commenced white cement production in 1985.

Jordan is the third largest phosphate exporter in the world after Morocco and USA. Some 6.25 million tons were exported in 1986. Extraction of potassium chloride from Dead Sea brine is on a way of full rate production of 1.2 million tons which is expected to be achieved in 1987. Production, trade and domestic consumption of main mineral commodities are shown in Table C-3.

The potash refinery is located at the Ghor district of Karak Governorate in the immediate vicinity to the west of the Study Area. The Arab Potash Company expressed its intention to bring the capacity up to 1.4 million tons of potash per year. This will be followed by installations of a potassium sulphate plant and a sodium carbonate plant. Investment on the company consists of 26% of the total investment in the mining and industry sector in the Third Five-Year Plan and of an 80% of the allotment to Karak and Tafila Governorates in the sector (Ref. C-11).

In order to meet the needs of regional planning and domestic industries, the Natural Resources Authority commenced publishing geological maps of 1:50,000 since 1985. In addition of existing 8 stations, construction of 28 seismological stations is being planned. Great efforts have been extended in the fields of petroleum exploration, oil shale studies and investigation of geothermal energy as well as general prospecting for mineral ores and industrial rocks. Participation in the petroleum exploration has been registered by a number of foreign companies.

In early 1986, the Jordan Industrial Consortium Engineering Company was formed by the Jordan Phosphate Mines Company, Jordan Fertilizer Industry Company, Arab Potash Company, Royal Scientific Society, Social Security Fund and Pension Fund to carry out the studies, design and construction management of industrial projects belonging to its shareholders.

The Jordan Fertilizer Industry Company's di-ammonium phosphate (DAP) plant of 0.74 million tons capacity is located 17 km south of Aqaba. The plant utilizes 1.3 million tons per year of rock phosphate. Export of DAP stood at 509,000 tons in 1985 and at 559,000 tons in 1986. The company also started shipments of aluminum fluoride. By a technical reason, the company was merged with the Jordan Phosphate Mines Co., Ltd. in 1986 (Ref. C-16).

Export of raw materials was affected by continued economic slowdown and the drop in international commodity prices as well as the depreciation of dollar, in spite of the increase in volume of export.

The Government of Jordan has recently decided to take a leading role in development of Dead Sea brine, rock phosphate and other natural resources and has formed the Chemical Industries Commission, chaired by the Minister of Industry and Trade (Ref. C-15).

#### 4.2 Mining Industry in the Study Area

An establishment of the industry provides infrastructures, offers job and training opportunities and contributes in various forms to the area. Remarkable increases in number of inhabitants have been recorded at mine-sites. An estimated number of persons engaged in the major industries including contractors in the Study Area stands at about 4,000 (Table C-4).

##### 4.2.1 Phosphate

The domestic phosphate production in 1985 amounted to 5.92 million tons, of which a 55.2 per cent came from El Hassa Mines in Tafila Governorate and a 36.8 per cent from El Abiad Mines in Karak Governorate. Out of production, 4.61 million tons were exported and the remaining 0.84 million tons were delivered to the fertilizer plant in Aqaba.

Open cast mining is being used. Overburden is drilled, blasted and broken materials are transported by dumptrucks. At El Hassa mine where the overburden is thick and the stripping ratio is of more than 11:1, an electric dragline has been introduced to strip the overburden with a capacity of about 25,000 cubic metre per day.

The uncovered phosphate bench is usually loosened by ripping and the raw phosphate is hauled to the processing plant. Phosphate ore of 70-72% TCP is fed directly to rotary driers. Ore of 66-68% TCP is fed to beneficiation plants to produce phosphate cakes of 73-75% TCP. The high grade concentrate requires a complex treatment involving a washing

stage that eliminates clay waste and lowers some of soluble impurity elements, most of which are notably chlorides. A method of beneficiation at El Hassa and El Abiad is shown in Fig. C-2.

Water consumption is in the order of 1.5 to 2.0 cubic meters per ton of ore recovered. Annual requirement of water in these mines stands at 2.8 million cubic meters in El Abiad and 6.5 million cubic meters in El Hassa. Water is recycled in the beneficiation plants but when it becomes rich in chlorine content, the water can not be re-used and discharged.

Mining of phosphate at Rusaifa has been suspended temporarily until a calcination plant is constructed at the southern end of the Dead Sea, to upgrade phosphate content and to supply by-products from the calcination process to the Dead Sea Chemical Complex (Ref. C-15).

The Jordan Phosphate Mines Company produced 6.25 million tons of phosphate in 1986, all of which came from two mines in the Study Area. Of the produced rock phosphate, 5.20 million tons were exported and 0.94 million tons were processed at the fertilizer plant. Two berths are operating at Aqaba with a capacity of 6 million tons of phosphate per annum.

#### 4.2.2 Cement Raw Materials

Limestone reserves of Rashadiya cement works will meet 50 years operation at a full capacity production of 2 million tons per annum. The works of the South Cement Company came into production in 1984 as an export-oriented factory, but due to a limited size of accessible markets in the neighbouring countries, the company was merged with the Jordan Cement Factories in 1985. The Rashadiya factory is now supplying ordinary Portland cement to the domestic market in addition to the export.

The factory is equipped with two lines of one million tons per annum each. Limestone and shaly clay are being quarried by company's crew to constitute 60% and 30% of raw materials required for cement production. Out of remaining 10%, a 6% comes from silica clays which

are purchased at a local market to control a silica content and a 4% comprises gypsum which is supplied from areas on the southern banks of Wadi Hasa.

The cement factory was being operated by some 600 persons at a rate of less than 25% of the capacity in 1986. New sales contracts with the neighbouring countries are expected to improve the rate of production in 1987 up to more than 50% of the designed capacity.

Gypsum was mined at Wadi El La'ban, but new mines are being opened 15 km NNW of Tafila at the north of Jabal Muleyh on the southern bank of Wadi Hasa. About 75,000 tons of gypsum will be trucked annually to the Rashadiya cement factory (Source: NRA).

#### 4.2.3 Construction Materials

Activities for building and construction materials in the Karak-Tafila region are summarized as follows:

	Karak	Tafila	Total
<u>Number of Quarries</u>			
Aggregates	11	7	18
Natural Sand	2	5	7
Marble	-	1	1
<u>Number of Workers</u>	89	56	145
<u>Annual Production (1,000 cubic meters)</u>			
Aggregates	810	540	1,350
Natural Sand	120	180	300
Marble	-	7.5	7.5

in 1986 (after NRA)

As being located between Amman and Aqaba, construction and upgrading of road are active and housing projects of Al Mu'tah University, phosphate mine and cement factory are in progress. Further improvement of transportation facilities will be necessitated within the Study Area and this may require large amounts of aggregates. Gravels of Pleistocene in age can provide a limited source of graded gravels and

the coquina members of El Hasa and Amman Formations are considered to be exploitable for crushed rock aggregate (Refs. C-6 to C-10).

## 5. FUTURE PROSPECTS OF MINING INDUSTRY

### 5.1 Phosphate

Phosphate-bearing horizons of Upper Cretaceous to Eocene are widespread from Jordan in the east to Morocco in the west. Many deposits have been exploited in the region and new discoveries of large deposits have been reported from Egypt and Saudi Arabia.

Output of phosphate rock in Egypt exceeded 1 million tons annually but most of the output was used domestically. About 988 million tons of ore averaging 25%  $P_2O_5$  have been delineated in Abu Tartur and marketable output of some 2 million tons is being envisaged.

A discovery of 1 billion tons of phosphate rock at Al Jalamid in northern Saudi Arabia was announced but this relatively low-grade rock would require upgrading. The ultimate goal would be a phosphoric acid and fertilizer industry using locally available sulphuric acid. The required potash is said to have been sought along the Red Sea coast.

JPMC plans to increase its production from the existing mines to reach about 7.5 million tons per year during the Five Year Plan (1986-1990). Ore reserves of mines are given in Table C-5. Jordan is ideally situated to serve the growth markets of Asia and East Europe.

Es Shidiya mine in Ma'an Governorate is now under construction and is scheduled to start at a relatively low production rate in 1989. It is expected to increase gradually to about 5 million tons in 1995.

The Chemical Industries Commission expects that the production capacity of existing mines will be maintained till about 1995 and will start decreasing gradually thereafter. It is probable that some work forces will be transferred to Es Shidiya mine but JPMC will maintain the production from the existing mines as much as possible.



The Aqaba Fertilizer Complex aims to increase the production capacity of the fertilizer plant from 415,000 tons of  $P_2O_5$  to 830,000 tons in 1995. This will be followed by processing phosphoric and fluosilicic acids, and aluminum and calcium fluorides into various chemical compounds (Ref. C-15).

## 5.2 Dead Sea Brines

To recover potash from the Dead Sea brines, the Arab Potash plant was completed in 1982. The plant was to produce 1.2 million tons of potash annually but modifications are being made to increase its capacity to 1.4 million tons per year. The modifications are scheduled to be completed in 1988. The Arab Potash Company (APC) produced a total of 1.1 million tons of potash in 1986, all of which were exported.

The Chemical Industries Commission has developed a long term plan for the development of Dead Sea brines as well as rock phosphate. The industrial projects cover the Dead Sea Complex which is expected to consist of the expanded potash plant with a capacity of 2.3 million tons by the year 1993, and other plants necessary to process potash and by-products into related marketable products. The Complex aims to produce not only potassium compounds but also magnesium, sodium compounds and various bromides (Ref. C-15).

## 5.3 Cement

The Jordan Cement Factories Company, Ltd. was incorporated in 1951. The company expanded its production capacity of Pozzolana Portland cement at the Fuhais factory to a level of 2.0 million tons per year to meet a domestic consumption. Although import of cement was ceased in 1984, the domestic consumption declined from a level of 1.9 million tons in 1983 to 1.7 million in 1984, 1.6 million in 1985, and also 1.6 million tons in 1986 (Table C-3).

Saudi Arabia is exporting cement to Iraq and Qatar, and the Saudi-Kuwait Cement Manufacturing Company based in Ras Al Khafi has signed a contract to supply the Kuwait Cement Company with 1 million tons of clinker annually starting 1987. But Saudi Arabia itself is unable to

satisfy domestic needs for cement from its own production of existing plants. Egypt also have to import cement in addition to its own production and both countries are increasing the production capacities of their cement factories.

Thanks to efforts made by the government and company, the gloomy day has passed its bottom. With an increase of foreign and domestic demands, the production of Rashadiya factory is expected to attain a level of 1.1 million tons in 1987. When the full production is accomplished, additional job opportunities ranging from 200 to 250 are expected to be created.

Export of cement largely depends on political and economical conditions of neighbouring countries. Huge quantities of demand will arise when a cease-fire is achieved.

#### 5.4 Oil Shale

Oil shale had been widely utilized in many countries. Since the nineteenth century, retorting of shale oil was conducted in France, Germany, Great Britain, USA, Canada, Australia, Spain, Estonia, China, South Africa and test plants were operated in Brazil, Sweden and USA, but most plants were closed after increased production of Middle East petroleum. Only USSR and China remained as oil shale users at the end of 1966.

In Jordan, brownish-black bituminous marls and limestones at the Jericho-Jerusalem road were quarried and used for manufacturing vases, bowls, decorative plates, ash-trays, etc. for a long time. At the Yarmouk River area, the bituminous limestones were used on a small scale in primitive fire places to produce quick-lime. During the First World War, a small shale oil plant was erected by German engineers (Ref. C-1).

On the other hand, exploration works are still in progress and huge quantities of oil shale have been reported from USA, USSR, Morocco, Thailand and other countries. Among these, Union Oil's Parachute Creek Project on the Green River deposits has entered into the first stage

production of jet fuels.

The Government of Jordan is implementing an extensive study on utilization of oil shale resources, which are widely distributed in many parts of the country. Detailed studies have been concentrated to the El Lajjun area and also a large quantity of oil shale has been penetrated in exploratory wells in Qatrana and Sultani areas. Recent exploration works delineated an existence of oil shale in Jurf Ed Darawish, Attarat Um Ghudran and Wadi El Maghar. Also, indication has been recorded in Siwaqa and Khan Ez Zabib (Source: NRA).

The study strategically aims to secure the domestic energy sources, to reduce the foreign exchange expenditure for imported energy and to utilize not only as a source of energy but also as a source of sulphur, carbon, nitrogen and lime, which will be necessitated in the Dead Sea and Aqaba chemical complexes.

With cooperation of West Germany, a feasibility study of retorting the shale with a capacity of 50,000 bbl/day of shale oil is in progress. If the result of this study shows that the shale can be easily and economically retorted, the project will proceed to the next stage, which involves design and construction of a pilot plant of 5,000 bbl/day.

When the pilot plant is installed, about 795 m<sup>3</sup> or 770 tons of shale oil are recovered from 7,700 tons of oil shale with stripping of some 7,000 tons of overburden and discharging 7,000 tons of used shale a day. An average of 21,700 tons must be handled per day. The project is assumed to create new job opportunities of more than 2,000.

In addition to this study, an investigation of retorting the oil shale is also being conducted with cooperation of China. In conjunction with the studies of retorting process, the Ministry of Energy and Mineral Resources is spending a great effort to utilize oil shale by direct combustion for generating electric power.

Jordan is of advantage having an established infrastructure to utilize the resources. The viability of the oil shale projects largely depends on the Government Policy. The Natural Resources Authority expects the installation of the pilot plant be completed by the year 1996.

### 5.5 Other Minerals

Jordan has established the foundation for export of rock phosphate and potash. But markets for raw materials are not always developed or accessible and many minerals are not necessarily able to bear a transportation cost. And also, an export-oriented industry is easily affected by a rise in global production or by economic recession. It is essential first to consider utilization of domestic resources for home market.

For example, a large amount of tripoli is known in the vicinities of Karak. The market of the material seems to be small and no marketing standard is available because specifications differ for each use. Many of physical properties are not susceptible to measurement and consumers are not willing to change their source of supply. Chief uses of tripoli are of an abrasive, a filler and an admixture in cement and concrete product. The pulverized product can be used as an abrasive element in scouring soaps and powders. Utilization of this material would have to be discussed with personnels of existing detergent company.

Although gypsum is gradually being replaced by synthetic products, such as a by-product of phosphoric acid production, most of the gypsum consumed is used as a retardant for cement. In Jordan, natural gypsum is being mined in two areas mainly to supply raw materials for cement works. The yield is largely related with the output of cement production. Gypsum of the new mine at the north of Jabal Muleyh in the north of Aima seems to be rich in salin spar and can be used as raw materials for various plasters. An approach is said to have been made by a user in Amman.

An establishment of mineral-utilizing industry is essential and approaches and cooperation from industrial sectors are necessitated for

**utilization of local industrial minerals.**

## 6. CONCLUSIONS AND RECOMMENDATIONS

Industries related with mineral resources are often affected by political and economical conditions and by an increase in global production. Exporters have to compete to get market to maintain inflows of foreign currencies and to retain the maximum number of jobs.

Jordan has demonstrated in the last few years that it can expand sales even in the time of depressed demand and it has firmly established the position of the third largest phosphate exporters in the world.

Phosphate rocks are being produced from the two mines in the Study Area and the production capacity will be increased gradually through improvements of processing units and equipments.

A new mine is now under construction in Ma'an Governorate and when it comes into operation, it is likely that some work forces will be transferred to the new mine and the production from the existing mines will commence decreasing gradually. But modification and improvement of facilities and equipments and also exploration works at these mines are still in progress. JPMC is expected to maintain the production from existing mines as much as possible.

The production of the cement factory in the Study Area is expected to attain a level of more than 50% of the designed capacity in 1987. When the factory comes into full operation, additional job opportunities ranging from 200 to 250 can be created.

Demand for building and construction materials depends largely on the amounts of public investments which are closely being envisaged by the Governments.

In order to meet the needs of domestic industries, NRA commenced publication of the geological maps at a scale of 1:50,000. Maps of most parts of the Study Area are under processing and are expected to provide

with information of economic minerals. Utilization researches on unused minerals should be conducted with cooperation of the industrial sector and relevant institutes. Participation from these fields is highly invited.

The Government of Jordan is implementing an extensive study on utilization of oil shale resources. An economic evaluation of the projects should be made not only on the basis of import substitute for fuels but also with a viewpoint of utilization of indigenous resources for energy, sulphur, carbon, nitrogen and lime, etc. The viability of the projects would be substantially affected by international oil prices and depends largely on the Government policy, but when a test plant is established in the Study Area, it is expected to create numbers of job opportunities.

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**T A B L E S**



Table C-1 STRATIGRAPHY IN JORDAN

Holocene	Holocene deposits	
Earliest Pleistocene	Basaltic rocks Shagur Formation	
Oligo-Miocene	Basaltic Rocks Syntectonical Conglomerates and Glauconitic Sandstones	TS3
Eocene	Chert-Limestone Unit	TS1-2
Danian-Paleocene	Chalk-Marl Unit	
Maestrichtian	Phosphorite Unit	
Campanian	Silicified Limestone Unit	
Santonian	Massive/Sandy Limestone Unit	
Cenomanian-Turonian	Echinoid Limestone Unit	
Cenomanian	Nodular Limestone Unit	
Lower Cretaceous	Varicoloured Sandstone Unit Massive White Sandstone Unit	
Jurassic	Sandstone-Calc. Sandstone-Shale Limestone	
Triassic	Fine Sandstone-Marls-Dolomite Shale and Sandstone Coarse SS with Sandy Shale	
Lower Silurian	Worm Burrow Sandstone Unit Red Brown Argillaceous SS Unit Nautiloid Sandstone Unit	
Upper Ordo-Lower Sil.	Conularia Sandstone	
Middle Ordovician	Sabellarifex Sandstone	OS4
	Craptolite Sandstone	OS3
Lower Ordovician	Bedded Brownish Weathered SS	OS2
	Massive Whitish Weathered SS	OS1
Middle to Upper Camb.	Massive Brownish Weathered SS	
Lower to Mid. Camb.	Variegated Sandstone Unit Dolomite-Limestone-Shale Unit	
Lower Cambrian	Bedded Arkose Sandstone Unit	
Precambrian	Saramuj Conglomerates / Slate-Greywacke Series Basement Complex	

after SUNNA(1984)

Table C-2 CORRELATION TABLE OF STRATIGRAPHY

	Sumna (1984)	Sandstone Aquifer Project (1971)	National Mapping Project (1985)	
Pleistocene	Volcanic Rocks	Volcanics		Ja/Az
Pliocene	Volcanic Rocks	Volcanics		Ba
Oligocene	Chert Limestone Unit			Si/Da
Eocene	Chalk-Marl Unit			Ba
Danian-Paleoc.	Phosphorite Unit	Belqa Group		B5
Maestrichtian	Silicified Limestone Unit			B4
Campanian	Massive/Sandy Limestone Unit			B3
Santonian	Echinoid Limestone Unit			B2b
Turonian	Nodular Limestone Unit	Ajlun Group		B2a
/	Varicoloured Sandstone Unit	Kurnub Group		B1
Cenomanian	Massive White Sandstone Unit	Zarqa Group		A7
Albian	Limestone, Shale, Sandstone			A5-6
Aptian	SS, Sh, Marl, Dolomite Units			A4
Neocomian	Sandstone Units			A3
Jurassic	Sandstone Units			A1-2
Triassic	SS & Dolomite, Lst, Shale Units			K2
Permian	Saramuj Conglomerates			K1
Carboniferous	Basement Complex			Z2
Devonian				Z1
Silurian				Cb
Ordovician				Kh
Cambrian				D
Late Precambrian				S
Early Precambrian				BC

Table C-3 PRODUCTION, TRADE & DOMESTIC CONSUMPTION  
OF MAIN MINERAL COMMODITIES

	(million tons)				
	1982	1983	1984	1985	1986
<u>Phosphate</u>					
Rusaifa	0.64	0.65	0.81	0.47	-
El Abiad	1.42	1.54	2.16	2.18	2.55
El Hassa	2.33	2.56	3.29	3.27	3.70
Total	4.39	4.75	6.26	5.92	6.25
Export	3.56	3.70	4.69	4.61	5.20
Domestic	0.24	0.62	0.98	0.84	0.94
<u>Potash</u>					
Safi	0.02	0.28	0.49	0.91	1.10
<u>Cement</u>					
Fuhais	0.78	1.27	1.62	1.53	1.32
Rashadiya	-	-	0.33	0.54	0.47
Total	0.78	1.27	1.95	2.07	1.79
Import	1.03	0.64	-	-	-
Export	-	-	0.19	0.38	0.16
Domestic	1.81	1.91	1.69	1.60	1.58

Source: Companies' Information

Table C-4 NUMBER OF EMPLOYEES OF MAJOR INDUSTRIES  
IN THE STUDY AREA

	(1986) in thousand
El Abiad Mine	0.7
ditto, contractors	0.3
El Hassa Mine	1.7
ditto, contractors	0.5
Rashadiya Cement Factory	0.6
Quarries	0.2
Total	4.0

Source: JPMC

Table C-5 ORE RESERVES OF PHOSPHATE MINES

on 1st Jan. 1987  
(million tons)

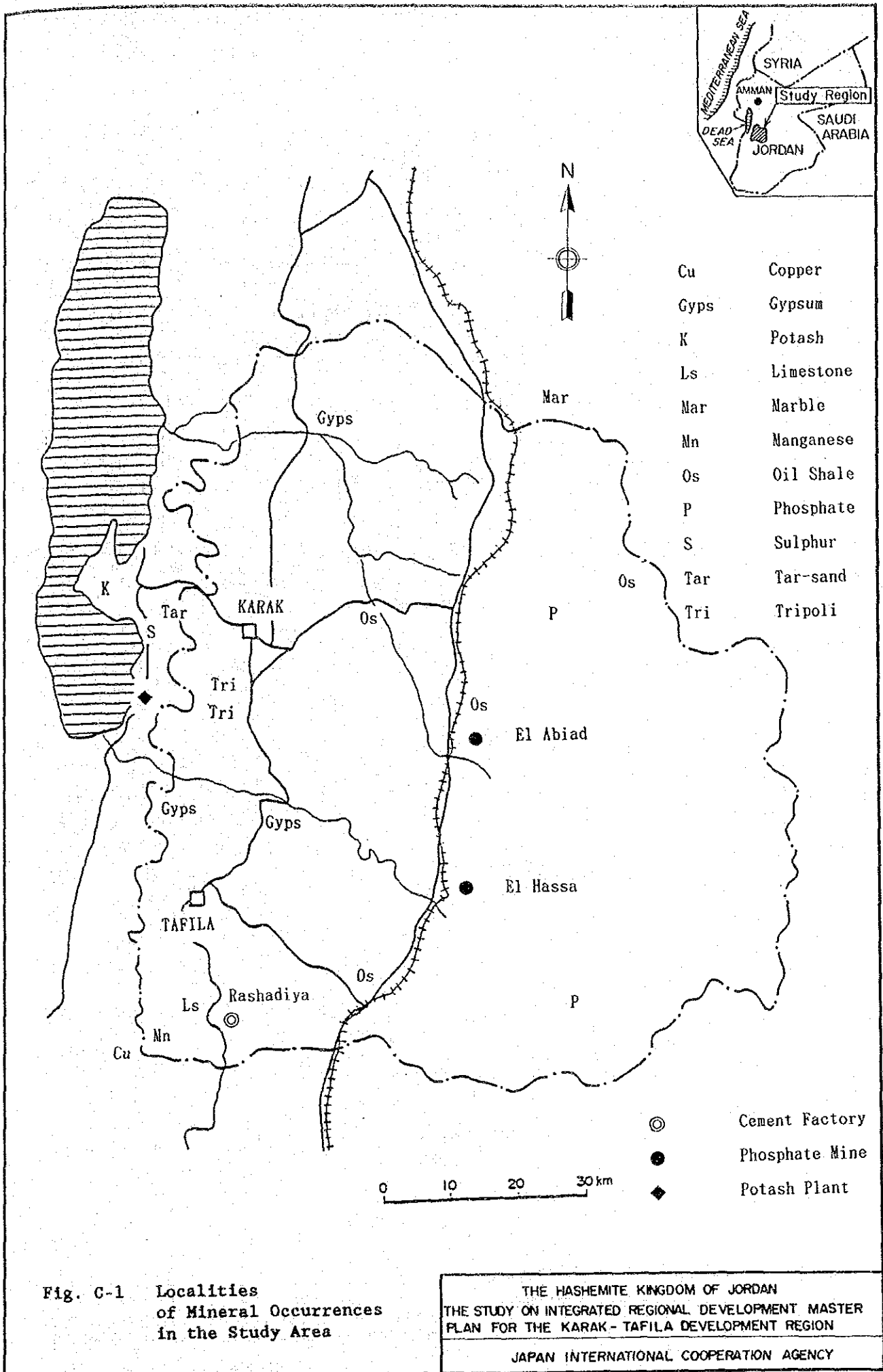
	Proved	Indicated	Inferred	Total
Rusaifa	65	3	-	68
El Abiad	62	24	73	159
El Hassa	105	9	11	125
Es Shidiya	790	246	150	1,186
<b>Total</b>	<b>1,022</b>	<b>282</b>	<b>234</b>	<b>1,538</b>

Source: JPMC

**F I G U R E S**







- Cu      Copper
- Gyps    Gypsum
- K        Potash
- Ls       Limestone
- Mar      Marble
- Mn       Manganese
- Os       Oil Shale
- P        Phosphate
- S        Sulphur
- Tar      Tar-sand
- Tri      Tripoli

- ⊙        Cement Factory
- Phosphate Mine
- ◆        Potash Plant

0      10      20      30 km

**Fig. C-1** Localities of Mineral Occurrences in the Study Area

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

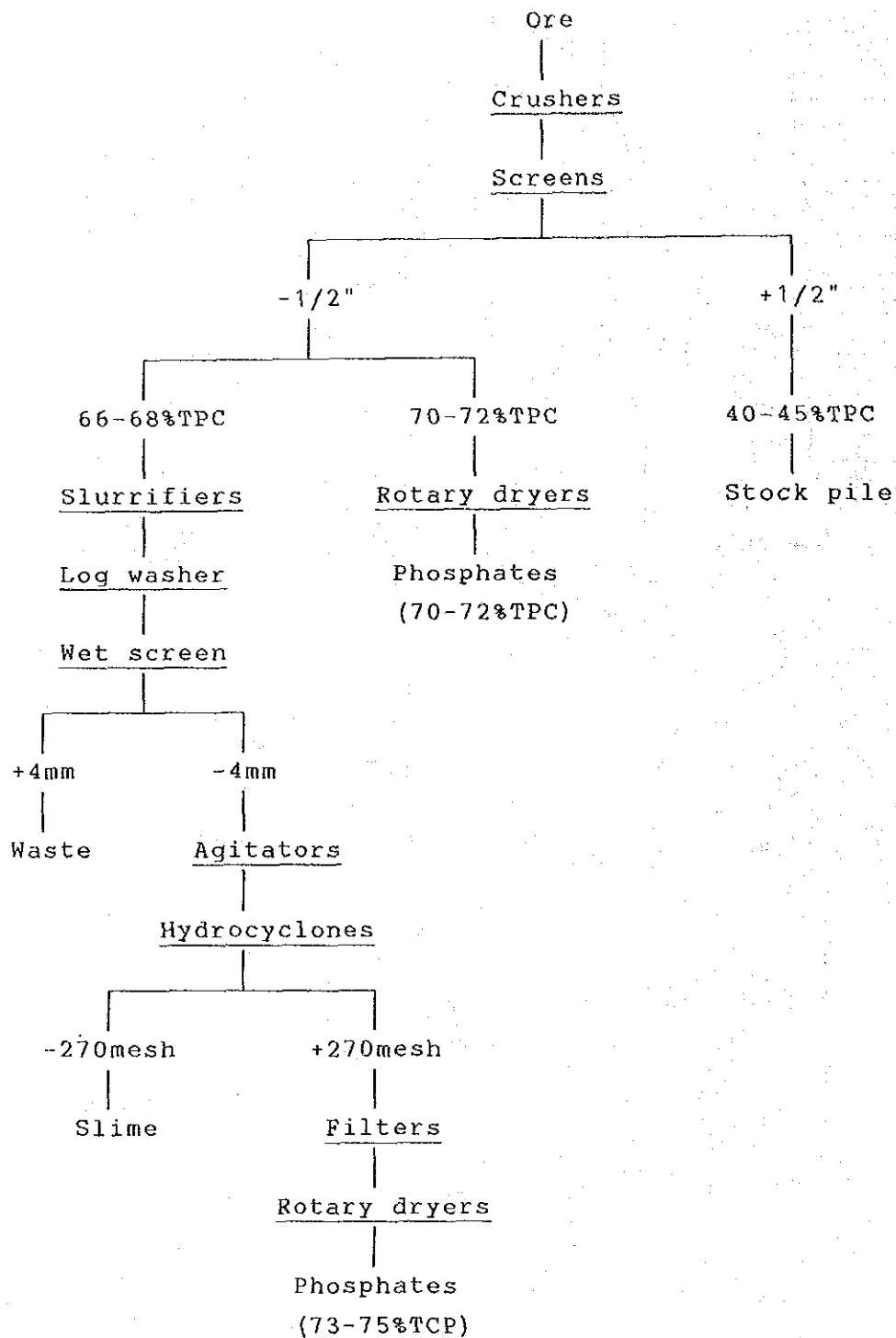


Fig. C-2 Simplified Flow-sheet of  
Ore Processing in El Hassa  
and El Abiad Mines

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

JAPAN INTERNATIONAL COOPERATION AGENCY

ANNEX-D SMALL AND MEDIUM SCALE INDUSTRIES



THE STUDY ON  
INTEGRATED DEVELOPMENT MASTER PLAN  
FOR THE KARAK - TAFILA DEVELOPMENT REGION

VOLUME 4: SUPPORTING REPORTS

ANNEX-D SMALL AND MEDIUM SCALE INDUSTRIES

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## 1. INTRODUCTION

This supporting report analyzes the situation of small and medium scale industries in the Study Area. It formulates a development plan and two priority projects are recommended in it; Old Karak Handicraft Centre and Mu'tah Industrial Estate.

It is noted that the two projects are not the only projects recommended in this report. They have to be complemented by other projects for the purpose to develop local small scale industries.

The sectoral plan is an integral part of the overall regional development study towards the target year 2005. Therefore the industrial development plan should be understood within its total framework.

## 2. INDUSTRY IN JORDAN

### 2.1 Position of Industry in National Economy

The manufacturing industry accounts for the largest share in the the gross domestic product (GDP) of the commodity sector. In 1984, GDP of the manufacturing industry was JD 166.4 million, which was 11.2 per cent of the total GDP of the nation. In recent years, however, it showed a sluggish trend with decreasing share in the total GDP.

The domestic export of the manufacturing industry in 1985 was JD 113 million. The manufacturing industry accounted for more than 30 per cent of the total domestic export in recent years.

The manufacturing industry is estimated to provide approximately 52,000 job opportunities in Jordan, which are about 9 per cent of the total employment.

### 2.2 Characteristics of Industry in Jordan

According to the 1983 industrial survey, major types of industries were non-metallic mineral products, mining and quarrying, and tobacco in terms of products; industrial service, non-electrical machinery and furniture and wood in terms of number of establishments; and industrial service, non-metallic mineral products, and mining and quarrying in terms of number of workers (Table D-1). Mining related industries and agro-industries held some of the high ranks.

Among 8,533 industrial establishments in the Kingdom in 1985, small establishments with less than 5 employees accounted for 80.2 per cent in number of establishments, and 16.0 per cent in number of employees.

The average wage of an employee of small establishments is JD 910 per year, and is approximately 50 per cent of that of larger establishments with 5 employees or more. There is a noticeable gap between them even though income of owners of small establishments may not be counted as wage.

Neither value added per employee nor gross income per employee of small establishments does reach half the level of larger establishments. And the gaps have been widened since 1979.

Among the manufacturing establishments with 5 employees or more in principal cities in the Kingdom (Amman, Zarqa, Irbid, Salt, Karak, Ma'an and Aqaba), the establishments with less than 25 employees account for 77.6 per cent and the number of employees of these establishments accounts for 24.4 per cent.

Non-Jordanian employees account for 8.9 per cent of the total employed by the establishments with 5 employees or more in the principal cities. Among the non-Jordanians, male Egyptians are the majority being 6.3 per cent of the total employees. The share of male Egyptians is thought to be the same level as establishments with less than 5 employees.

### 2.3 Investment Climate and Goals of National Industrial Development

(1) In addition to the rich mineral resources endowment, the Kingdom has the following advantage for industrial development, although some conditions are less relevant outside Amman and its environs (Ref. D-1):

- (A) Political stability
- (B) Central location in the Middle East
- (C) Access to the Arab Common Market and the Arab Middle East Region as well as the domestic market
- (D) Special trade link with Arab Middle East Region through human relations.
- (E) Quality labor force
- (F) Set-up of educational and technical training
- (G) Monetary stability and full financial services
- (H) Good infrastructure and utilities
- (I) Pleasant climate
- (J) Good living conditions
- (K) Investment guarantees and incentives

(L) Rich heritage of traditional handicrafts such as embroidery, weaving, pottery, wood work, leather products, brass copper and glass items.

(2) Among the various measures for industrial development taken by the Government of Jordan, the following are noted:

(A) The Encouragement of Investment Law provides for exemptions from income and other taxes. It covers projects of industry and mining, agriculture and livestock, tourism and hotel industry, marine transport, hospitals and education. In order to achieve a balanced development among regions, the law classifies the Kingdom into 3 zones according to the economic development needs in such a way:

Zone A = Amman and its environs, Aqaba and its environs, and Jordan Valley to the north of the Dead Sea

Zone B = Irbid - Salt - Madaba belt

Zone C = The remaining areas

It provides less developed zones with more generous exemption. The law grants equal treatment and opportunities to foreign and domestic investments to facilitate foreign participation.

(B) The Small Scale Industry and Handicraft Fund was established within the Industrial Development Bank (IDB) in 1975 to alleviate the adverse conditions of these industries by extending credit of low interest rates and easy terms. The loans during 1981-1985 period were 1,277 totaling JD 3,770,000 (Ref. D-2).

IDB delegates its staff at the Housing Bank branches in Irbid and Karak to acquaint with small scale industries owners in the regions and to grant them loans at their sites. IDB also contributed to establish a handicraft training centre in Jerash for training girls in the region.

(C) Jordan Industrial Estate Corporation has established an industrial estate at Sahab. Occupancy of the first phase blocks of the estate is approximately 75 per cent. When the second and third phases are completed, the total area will be 258 ha.

The corporation is starting to construct another industrial estate of approximately 40 ha in Ramtha. It also plans industrial estates in Aqaba and Salt.

- (D) Free Zones exist in Aqaba and Zarqa. The Free Zone Corporation is planning to establish new ones near the Syrian border and at the Queen Alia International Airport.
- (3) The Third Five-Year Plan sets up the following development goals in the mining and industrial sector and allocates the total investment of about JD 393.2 million of which 52.4 per cent is for the public investment:
- (A) To increase employment opportunities in the sector by about 12,600 jobs
  - (B) To increase Jordan's foreign currency holdings through encouraging exports and reducing imports
  - (C) To increase the value added in order to expand the share of the industrial sector in GDP. The target growth rate of manufacturing industry is 6.9 per cent per annum.
  - (D) To encourage the transfer and application of advanced technology wherever necessary or feasible
  - (E) To coordinate among the existing industries
  - (F) To encourage the establishment of export-oriented industries, and to provide incentives for import-substitution industries. It is aimed to increase exports of goods at the annual rate of 7 per cent and to restrict imports of goods to the annual growth rate of 2.7 per cent.
  - (G) To regulate imports of goods which are similar to domestic products, and to protect domestic products through all possible means
  - (H) To strengthen Arab commercial ties, to encourage joint Arab projects, and to expand the scope of Arab and foreign investments in Jordan
  - (I) To upgrade the quality of domestic products and strive in every possible way to reduce industrial costs through proper utilization of available resources
  - (J) To increase the marketing efficiency of domestic industries, locally and abroad
  - (K) To encourage the establishment of small, medium-scale and cottage industries suited to local conditions in the various regions

### 3. PRESENT CONDITIONS OF INDUSTRY IN THE STUDY AREA

#### 3.1 Characteristics of Local Industries

(1) According to the Industries Survey in 1985, there are 212 establishments in the industrial sector including mining and quarrying in the old Karak Governorate. Among them, 30 establishments (14.2 per cent) have 5 employees or more, which include very large factories of Jordan Phosphate Mines Co. (JPMC), Arab Potash Company, and Jordan Cement Factories Company Ltd.

(2) In the old Karak Governorate, there are 182 establishments with less than 5 employees and they employ 187 employees producing JD 491,000 of value added in total. Regarding these small establishments, shares of the old Karak Governorate to the Kingdom are 2.1 per cent in number of establishments, 2.5 per cent in number of employees, and 2.3 per cent in value added. These figures are less than 5.8 per cent, which is the population share of the old Governorate.

The average number of employees of these small enterprises of the old Governorate is 1.03 being the least in the Kingdom, while the national average is 1.11. The average yearly wage per employee is JD 866, which is 95.2 per cent of the national average of JD 910.

The number of the establishments, employees, value added, the average number of employees of an establishment and average wage of an employee of the old Governorate have all increased since 1979. But the shares to the national total of both number of establishments and average wage per employee decreased.

(3) On the other hand, the 30 establishments with 5 employees or more in the old Governorate employ 4,504 workers producing about JD 47 million of value added, which is 96 times the total value added of the 182 establishments with less than 5 employees of the same area.

Regarding the establishments with 5 employees or more, the share of the old Governorate to the national total is as low as 0.4 per cent in number. But the number of employees accounts for 11.3 per cent and the value added accounts for 17.5 per cent, both of which exceed the population share by far.

The average annual wage per employee is JD 2,969, which are as high as 162 per cent of the national average. These results reflect the dominance of the very large mining factories in the Study Area.

(4) In Karak Municipality, no industrial or construction establishment with 5 employees or more was reported by the Employment Survey in 1984.

(5) According to the survey conducted by the Ministry of Planning, there are 228 industrial establishments including construction companies in the Study Area. The major types of industry are as given in Table D-2. The above industries are mainly for consumer goods and housing related industries to meet the local daily needs.

(6) The establishments in the Study Area are mainly distributed to Karak Sub-region (102 establishments, 44.7 per cent), Mazar Sub-region (54 establishments, 23.7 per cent), and Tafila Sub-region (37 establishments, 16.2 per cent) (Table D-3, Fig D-1).

These 3 sub-regions account for 84.6 per cent of the total establishments in the Study Area.

Among them, concentration of 95 establishments or 41.7 per cent of the Study Area in Karak Municipality is prominent.

### 3.2 Present Situation of Local Establishments

The following are the summary of the results of interviews with 11 typical establishments in Karak, Tafila and Qasr Municipalities.

#### (1) Identification of establishments

(A) Category and place of industry: (see Table D-4).



- (B) Type of organization: 8/11 are single proprietorship and 3/11 are partnership.
- (C) Year of establishment: 5/11 were established in 1983 or after.
- (D) Owners' other business: 9/11 have no other business.

(2) Capital investment

- (A) Land and building: 8/11 are rented.
- (B) Floor area: 46m<sup>2</sup> on an average (including a cement tile factory).
- (C) Rental: JD 45/month or JD 1.0/m<sup>2</sup>/month on an average.
- (D) Cost of machines: varies from JD 200 to JD 37,000.
- (E) Place of purchase of machines: over 90 per cent are from Amman.
- (F) Maintenance of machines: 80 per cent are by themselves, 20 per cent depend on Amman.
- (G) Telephone: 6/11 have telephones.

(3) Manpower

- (A) Number of total workers: 3.9 on an average
- (B) Number of Egyptian workers: 35 per cent on an average
- (C) Number of dependents of the owner: 8.2 on an average

(4) Raw material requirements

- (A) Raw materials: 60 per cent are from Amman, 40 per cent are from Karak or Tafila Municipality.
- (B) Payment for raw materials: 70 per cent are in cash, 30 per cent are on credit.

(5) Utility requirements

- (A) Water: 8/11 do not consume water, only a cement tile factory and bakeries consume a considerable amount of water.
- (B) Electricity: varies from minimum charge to JD 35/month and JD 350/month for a cement tile factory.
- (C) Fuel: Only bakeries require fuel for factories, others consume fuel only for cars.

- (6) Production
- (A) Products
- 1/11 is car maintenance  
4/11 are consumer goods  
6/11 are housing, building materials.
- (B) To order or ready-made: Majority are order-made.
- (C) Payment: Credit in some cases
- (7) Market: Municipality, surrounding villages or Governorate wide.
- (8) Industrial waste and environmental problems: No problems were reported.
- (9) Locational matters
- (A) Reasons for selecting the place of factory: 9/11 owners come from the area.
- (B) Commuting distance: 6/11 do not commute, some commute several kilometers.
- (C) Problems: (See the next section)
- (10) Loans
- 4/11 borrowed money from their acquaintances,  
6/11 borrowed money from banks.
- (11) Vocational training
- No formal training is being done, most of them think formal training is irrelevant.

#### 4. RESOURCES AND CONSTRAINTS FOR INDUSTRIALIZATION

##### 4.1 Problems for Industrial Development

- (1) The following are major problems reported in the interviews
  - (A) Keen competition among local establishments (excess number of local enterprises for the small market)
  - (B) Penetration of the enterprises of Amman to the market (difficulties for local establishments to participate in big projects)
  - (C) Unavailability of raw materials, spareparts and big machines (heavy dependence on Amman)
  - (D) Difficulties for Jordanians to find employment due to Egyptians' hard-working at low wages and a comparatively high turn-over of Egyptian workers
  - (E) Shortage of money due to delay of payment
  - (F) Higher rental of about JD 100/month per workshop of the Karak Industrial Zone which is under construction
  - (G) Lack of space
- (2) The problem structure of small and medium scale industries in the Study Area can be summarized as shown in Fig. D-2.

The diagram presents how the "regional background" is related to "dominance of Amman" and to "international background". These conditions result in "conditions for industry", "characteristics of industry" and "competition problems".

"Labor problems" are also related to "regional background", "characteristics of industry" and "competition problems", which in turn result in "financial problems" interacting with "physical problems". In reality, all these conditions and problems are interacting each other.

Here are the key issues.

- (A) One of the causes for excess number of local enterprises for small market is due to their production system based on manual labour which can be easily opened without large capital investment.

- (B) Penetration of enterprises of Amman is mainly due to the low level of technology and productivity, and limited production capacity of the local enterprises.
- (C) These characteristics of the local enterprises make it very difficult for them to participate in any work for the big mining factories in the region.
- (D) Insufficient utilization of vocational training systems by local enterprises interrelate with lack of chances of higher standard job opportunities.
- (E) Limited job opportunities lead to population drain to Amman and result in low local market potential for the industries.
- (F) In spite of the fact that access to the Small Scale Industries and Handicraft Fund of Industrial Development Bank (IDB) is available to the owners of local establishment, some are not well aware of the system and some do not think it useful.

#### 4.2 Industrial Development Potential in the Study Area

##### 4.2.1 Manpower

Increase of population during the plan period of approximately 130,000 and development of educational and training facilities are enriching the region's manpower resources.

##### 4.2.2 Raw materials

Prominent raw materials available to the region are agricultural produce not only in the region but also from the Ghor area and mineral resources.

Cement from Rashadiya is utilized for construction industry, while phosphate in the Badia area and potash in the Jordan Valley are not consumed in the area.

Some other mineral resources may be exploited in future.

#### 4.2.3 Infrastructure

Basic infrastructure such as roads, water supply and electricity have been in service in major towns.

Sewerage projects are progressing in Karak and Tafila municipalities. The Mu'tah-Mazar area also has sewerage development plans. From an industrial development point of view, completion of the Jordan Valley Highway will have considerable impacts, for it will provide the region with another channel of access to Amman, but at the same time, it may lower comparative importance of the region as a transportation node.

#### 4.2.4 Finance

Major financial resources for small and medium scale industries are government budgets, self-finance of corporations, foreign loans and assistance, private sector capital and domestic banks. In the Third Five Year Plan, the total budget of industry and the related projects except mining projects amounted to approximately JD 5,500,000 for the Study Area (Table D-5).

As a financial resource, the Industrial Development Bank is expected to raise the level of disbursement. In 1985, 5 loans of the small scale industries and handicraft fund that amounted to JD 16,500 were approved by the bank in the Karak area.

The City and Village Development Bank can also play an important role for the sector.

#### 4.2.5 Market

Expansion of the local market by increase of population, income level and various development activities is expected to stimulate industrial development. Regarding the domestic market, items for import substitution should be noted as potential market as the Ministry of Industry and Trade suggests (See Table D-6, D-7).

Export should also be promoted taking use of the local advantage.

#### 4.2.6 Industrial Development Potential and Suggested Industries

Industrial development potentials in the Study Area are found in these types of industries as listed below which are interrelated to development projects of other sectors:

(1) Industries related to new regional development projects based on water resources development such as manufacture of fabricated metal products, machinery and equipment, and also manufacture of structural clay products and cement products

(2) Industries related to agriculture and livestock development in the Highlands and Ghor area such as food manufacturing, manufacture of prepared animal feeds, slaughter house, grain milling, olive soap, leather and weaving, yellow board, etc.

(3) Industries related to tourism development such as manufacture of handicrafts

(4) Industries related to Mu'tah University such as research and development oriented industries. At ultimate capacity, the University's population will be approximately 8,300, with faculty of arts and sciences, faculty of engineering, faculty of economics, management and law, academy of military sciences, and academy of police (Ref. D-3).

(5) Industries utilizing manpower from technical institutes such as polytechnic and vocational schools

(6) Industries related to mineral resources development such as bottling of mineral water, manufacture of pottery, stoneware and industries to support development of mining

(7) Industries making the best use of people with skill, entrepreneurship and capital, who return from Amman and the Gulf countries.

#### 4.2.7 Industrial Development Potential along the Two Highways

(1) King's Highway Belt has potential of development of medium and small scale industries taking advantage of existing natural and social stock in coordination with development of other sectors such as agriculture and tourism (comparatively short-term target).

(2) Desert Highway Belt has development potential of large industrial estate taking advantage of availability of groundwater, comparatively easy access to the sea and airport, and land availability (comparatively long-term target).

## 5. INDUSTRIAL DEVELOPMENT PLAN

### 5.1 Development Objectives

- (1) To increase employment and income
- (2) To upgrade small scale industries, and expand the market
- (3) To substitute import and promote export in coordination with other Arab countries
- (4) To fully utilize local resources and potential and strengthen other sectors
- (5) To develop manpower, technology and management capability
- (6) To develop new industrial agglomerations and lead new regional development

### 5.2 Development Framework

As an integral part of the overall framework of the Study Area, the manufacturing sector sets the following framework for the year 2005:

Items	1984/1985 (Ref. D-4)	2005
- Employment	519	10,000 <sup>1/</sup>
- Share in total employment of Study Area (%)	1.8	16
- Value added (JD 1000)	668	63,000
- Share in total value added of Study Area (%)	0.7	25
- Value added per worker (JD)	1,287	6,300 <sup>2/</sup>

<sup>1/</sup>: In order to sustain the target population of the Study Area, employment of the industrial sector has to attain a level of 10,000.

<sup>2/</sup>: Value added per worker in the industrial sector of Jordan in 1984 was JD 5,673. That of establishments with 5 employees or more was JD 6,294 while that of establishments with 4 employees or less was JD 2,813. The value added per worker of the Study Area in 2005 was expected to be the present level of the larger industrial establishments.



### 5.3 Development Concepts

#### 5.3.1 Basic Concepts of Industrial Development

##### (1) Basic policies for industrial development

To reach the target mentioned above, the basic development policies should be set as follows:

- (A) To invite local, national, Arab and other international investors to initiate industrialization mainly based on export market oriented type of industries through creation of favorable and competitive investment climate
- (B) To guide to locate new industrial investment towards the King's Highway urban corridor in the first decade in such a manner as industry and urban may mutually interact to promote maximum benefits of development and to gradually shift the locational weight to the growth pole along the Desert Highway from the start of the second decade
- (C) To help modernize the existing small industries and promote satellite industries including handicraft into the rural areas to be linked with the mother industries located in the urban areas

##### (2) Specific policies

In line with the basic policies above, the following specific measures should be considered:

- (A) Promotion of new investments
  - Incentives in taxes and duties in the Study Area
  - Additional incentives for location in industrial estates and zones within the Study Area
  - Provision of fully serviced industrial estates in the strategic urban areas
  - Provision of industrial apartments which are ready-made workshops furnished with machines and equipment
  - Enhancement of industrial coordination with the other Arab countries
  - Attractive credit facilities from the governmental and commercial financial institutions
  - Easy industrial licensing and import/export procedures

- Special encouragement to those who left the Study Area and are now successful in business in Amman, Arab and other international markets
- Sales promotion activities of local products by such means as advertisements and exhibitions in Amman
- Easy access to governmental research facilities
- Easy access to major highways, airport and seaport
- Availability of trained and easily trainable manpower

(B) Industrial location strategy

New industrial areas should be developed to ensure better production conditions and to realize overall regional development of the areas.

Relocation of certain industries causing nuisance in urban areas should also be considered to improve urban environment. On the other hand, conservation of agricultural land needs due consideration.

Conceptually the following 5 types of industrial locations can be considered related to the development stages, and type 2 to type 5 are to be promoted:

Type 1: Small scale urban industry within towns presenting mixed land use

Type 2: Small or medium scale industry at peripheries of mother towns relying on the towns

Type 3: Small or medium (or large) scale industry outside towns (which may form industrial agglomerations)

Type 4: Industrial estates located in the desert areas to form substantial new towns

Type 5: Tourism related handicraft industry within towns

A concept of future industrial agglomeration is shown in Fig. D-3. Two strategic industrial areas are proposed; the King's Highway Belt, and the Desert Highway Belt.

In the King's Highway Belt, small and medium scale light industries can be developed by making the best use of available resources such as natural resources, social capital and historic assets, and by integrating these.

Mu'tah area (Type 3): Industrial development making use of Mu'tah University, one of the Kingdom's four universities, which is ready to contribute to the regional development, geographical features, climate, the central location of the Study Area, and existing accumulation of population.

New Karak area (Type 2): Industrial development of the Karak Industrial Zone.

Old Karak area (Type 5): Development of tourism related handicraft centre as an integral part of the Old Karak tourism promotion and urban restoration, taking advantage of relocation of some industries to the Karak Industrial Zone

Outer Tafila area (Type 3): Industrial development making use of the Polytechnic, geographic conditions considering access to the Desert Highway and to the Jordan Valley.

Tafila Industrial Zone (Type 2): Industrial development of the Tafila Industrial Zone to support urban activities and to help improve urban environment of Tafila Town.

Tafila Town (Type 5): Development of tourism related handicraft centre in coordination with other tourism, culture, handicraft, and training promotion facilities and activities.

In the Desert Highway Belt (Type 4), modern medium and large scale industries located in industrial estates can be planned as an integral part of the front base for the Badia development utilizing groundwater, land, transportation conditions such as rather easy access to Queen Alia International Airport and the sea port at Aqaba, and the central location in the Kingdom. Functions of a goods circulation centre and a free zone need to be attached to the estate. To facilitate settlement of the employees and their families, high standards of living environment with urban amenities have also to be provided. The following are the candidate locations of the Desert Highway Belt (Table D-8): Qatrana, Abiad, Hasa, and Darawish

(C) Modernization and promotion of small scale industries

In order for the presently under-developed local manufacturers to catch up with the national average level in terms of productivity

and income and to compete with those in Amman Region, the following further support measures should be considered:

- Incentives for organizing cooperatives of local establishments and for joint work such as sharing common space and equipment, joint purchase of materials, joint efforts for information collection, training, marketing, welfare of workers, and also joint contract
- Giving priority to local establishments for supply of products to local projects
- Industrial extension services to the rural areas to promote handicraft in material supply, production and marketing

### 5.3.2 Prospective Types of Industries

(1) Industries to be promoted in the Study Area are expected to satisfy the following conditions, though not necessarily all the conditions:

- (A) Less water and energy consuming industries
- (B) Industries to utilize local resources and potential:
  - Agro-industry
  - Mineral resources based industry
  - Tourism related handicraft industry
- (C) Labour intensive small and medium scale industries
- (D) Industries for import substitution and export promotion
- (E) Industries to support housing, infrastructure, urban and regional development
- (F) Research and development oriented advanced industries

Types of industries to be considered are listed in Table D-9.

(2) Examples of earlier development stages of typical existing industries in the Study Area are as follows:

<u>Present</u>	<u>Future</u>
Fabricated metal products (except machinery)	<ul style="list-style-type: none"> <li>-&gt; Metallic tools, instruments and machinery</li> <li>-&gt; Metallic ornaments</li> </ul>
Wearing apparel	<ul style="list-style-type: none"> <li>-&gt; Mechanized production</li> <li>-&gt; Artistic/traditional garments</li> </ul>
Carpentry and wood-working	<ul style="list-style-type: none"> <li>-&gt; Mechanized production</li> <li>-&gt; Artistic/traditional handicraft</li> </ul>
Non-metallic mineral products	<ul style="list-style-type: none"> <li>-&gt; More mechanized larger scale production</li> <li>-&gt; Tourism related mineral products (e.g. pottery stonework)</li> </ul>
Bakery	-> More processed products in larger scale utilizing local products and development of local food
Grain milling	-> More processed products in larger scale
Maintenance	-> Higher standard of technology (e.g. electric equipment) and simple manufacture.

(3) Examples of the advanced industrial technology are biotechnology for new agro-industry and engineering technology for electronics, chemical products, mechatronics, new ceramics, new materials, new usage of mineral products and waste materials, and local energy development.

## 5.4 Development Plan

### 5.4.1 The Five-Year Plan Projects and Improvement of Local Industries

The Five-Year Plans of Karak and Tafila Governorates set forth industrial development projects such as:

- Industrial zone development
- Agro-industry factories and facilities
- Promotion of handicraft
- Construction-related industries (see Table D-5)

The planned projects are based on locally available resources and technology, and expected to be developed by the private sector's contribution.

In addition to these, improvement of existing establishments by measures presented in the previous section is needed. Decentralized local industrial development such as processing of local agricultural produce or production of rather simple parts as subcontracting workshops of the larger scale factories in the major industrial centres are also needed. These local industries can fully utilize the labour force of local village households. Actions to be taken to enhance these include extension services of vocational training, joint work such as share of common space, joint purchase of materials, joint sales of products, and organization of the subcontracting system networking the core factories and the decentralized workshops.

More extensive public relations and services of the Industrial Development Bank especially the Small Scale Industries and Handicraft Fund are also recommended. In rural centres, housing and construction related industries are promising, to meet the demand of increasing population.

### 5.4.2 Strategic Development Projects

To meet the expected population increase and the increasing demand for employment, considering also constraints on other sectors, the Five-Year Plan projects and improvement of the local industries are not

sufficient, and the following industrial development projects attracting investment not only from the Study Area but also from other areas in the Kingdom, the Gulf countries and other foreign countries are recommended:

- (1) Mu'tah Industrial Estate
- (2) New Karak Industrial Zone
- (3) Karak Handicraft Centre
- (4) Outer Tafila Industrial Estate
- (5) Tafila Industrial Zone
- (6) Tafila Handicraft Centre
- (7) Hasa Industrial Estate along the Desert Highway

#### 5.5 Implementation Schedule

During the whole plan period up to 2005, the King's Highway Belt is given higher priority at an earlier period, while the Desert Highway Belt is given higher priority at a later period.

- (1) Key development efforts in 1987-1990 period
  - Implementation of ongoing projects
  - Implementation of the 5 year plan projects
  - Study for the strategic projects
- (2) Key development efforts in 1991-1995 periods
  - Implementation of selected strategic projects in the King's Highway Belt.
  - Further study for strategic projects in the Desert Highway Belt.
- (3) Key development efforts in 1996-2000 period
  - Implementation of selected strategic projects in the Desert Highway Belt
- (4) Key development efforts in 2000-2005 periods
  - Continuation and expansion of the strategic projects

According to the stage development strategy, a conceptual stage development plan is set as shown in Fig D-4.

## 5.6 Priority Projects

Indications of priority to industrial projects are shown by a qualitative comparison table (Table D-11).

The Industrial Estate project along the Desert Highway is dropped due to the delayed development schedule of the area, though the project is expected to produce the greatest benefit.

Regarding the Mu'tah Industrial Estate and the Outer Tafila Industrial Estate, both of which aim to be appropriate and advanced industrial estates, the Mu'tah Industrial Estate is regarded to have higher priority for its locational conditions and the possibility to utilize the University's potential.

Comparing the two handicraft centres, the Karak Handicraft Centre has higher priority for the town's tourism potential and for necessity to restore the urban area.

It is therefore concluded that the Mu'tah Industrial Estate and the Karak Handicraft Centre be nominated as priority projects of the sector in the study.

## 5.7 Organization

Since there has been marked shift in weight of industrial policy from mineral resources oriented and capital intensive industries to small and medium scale industries which are basically developed by initiative of the private sector, a new administrative set up would be required to respond more effectively and efficiently to the needs of a large number of local and foreign investors.

In the public sector, the the Ministry of Industry and Trade should participate actively in the industrial development especially in small and medium scale industries in the region in cooperation with related ministries in charge of agriculture, mining, labour, social development, education as well as the Ministry of Municipal and Rural Affairs and the Environment, and the Ministry of Planning.



Local governments and authorities also have to cooperate by fully utilizing functions of development councils.

As an inter-ministerial coordinating and central decision making body for industrial investment, establishment of such organization as a Board of Investment would be attractive to investors. The Board should provide all the necessary services and information to investors at one-step concerning the permit for foreign investment, work permit, industrial license, building permit, etc. required for actual investment. The Board can also assist the local investors through the regional industrial extension centre to be attached to MOIT.

## 6. REQUIREMENTS FOR INDUSTRIALIZATION

### 6.1 Labour

By the year 2005, a total of approximately 10,000 manpower will be required for realization of the planned industrial development. Fostering of skilled manpower should be given priority (Table D-12).

### 6.2 Water

By the year 2005, the maximum of approximately 9,000 m<sup>3</sup>/day will be needed (Table D-13).

### 6.3 Land

By the year of 2005, approximately 150 ha of industrial land will be required. Selection and development of industrial land has to give due consideration to agricultural land use from socioeconomic and environmental points of view (Table D-14).

### 6.4 Capital investment

The total investment in the industrial sector during the plan period will be approximately JD 62 million, of which public investment is JD 27 million or 44 per cent, and private investment is JD 35 million or 56 per cent (Table D-15).

## 7. PREPARATORY STUDY ON PRIORITY PROJECTS

### 7.1 Karak Handicraft Centre

#### 7.1.1 Project Concept

Objectives of the project are:

- to promote local handicrafts
- to promote tourism and commercial activities
- generate income of local people and households in and around Karak Municipality
- provide skills and knowledge to local people and contribute to social development

In order to achieve the objectives, the centre is planned as an integral part of the "Museum City" to have the following major functions:

- Manufacture and sales of tourism related handicrafts
- Display and demonstration in an indoor pocket park atmosphere
- Training and improvement of local handicrafts
- To act as a cooperative of local people for manufacture and sales of their handicrafts

#### 7.1.2 Conditions for Location

The following preferable conditions are identified in the Old Karak area for location of the handicraft centre:

(1) Availability of local handicrafts

The following are the examples:

- (A) Carpets and rugs
- (B) Daggers
- (C) Straw baskets and saucers
- (D) Pottery
- (E) Embroideries and laces
- (F) Local clothes
- (G) Leather products such as bags and decorations

(H) Local jam and sweet made from grapes, peaches, figs, dates, plums, cherries, local apricots and so on

(I) Olive pickles

(J) Dry yogurt

(2) Availability of manpower: Karak is the primary population centre in the region and there is certain concentration of skilled manpower which can participate in development of local handicrafts. On the other hand, population concentration also means large demand for generation of household income. Especially income generation of women and of farmers by engaging in handicrafts is sought for.

(3) Marketability in accordance with tourism development: By the year 2005, 68,000 visitors to Karak are forecasted, that is, a daily average of 186 visitors. So the corresponding market for handicrafts is expected. In addition to the visitors to Karak, marketing in Amman should be planned. Moreover the local market in Karak Governorate is not negligible.

(4) Availability of raw materials: Raw materials which may be utilized by the centre are wool, olive, leather, other agricultural produce, and mineral resources such as clay, stone, marble, oil shale, etc.

(5) Supporting facilities: In addition to the tourist attractions and facilities located in the "Museum City", the centre and the following facilities are expected to support each other:

(A) Technical vocational schools

(B) Social development organizations for women

(C) Agricultural facilities such as a slaughter house and a vegetable canning factory

(6) Transportation network: The centre can take advantage of the transportation network crossing at Karak consisting of the King's Highway and Route 80 (Road to the Jordan Valley Highway and the Desert Highway).

### 7.1.3 Plan of the Centre

#### (1) Site selection

The following three candidate Sites are identified (Fig. D-5):

- (A) In front of the castle: This area is largely occupied by the administrative centre facilities such as the Governorate office, the police and civil defense facilities, the court, the telecommunications office, etc. This is a potential centre for tourism development after relocating these to New Karak. Therefore, the candidate site can be found in the area although demolishing and relocation of existing facilities are needed.
- (B) Along the east street: There is a concentration of small scale workshops along this street and these are expected to relocate to the new industrial zone after its completion in November 1987. Considering the relocation and also the dominance of old buildings there, restoration of the street is given priority. Therefore, a location midway along the street can be the candidate site, considering also good access to and from the bus terminal. The centre can have a good view to the east
- (C) At the northern end of the central street: The central street is the busiest commercial street in Karak at present. Taking advantage of it and to further promote the flow of people on the street, establishment of an attraction at the northern end can be considered. In this case, attention should be paid to the special features of the site on a cliff, that is, consideration of building structure and utilization of extra space created due to the site conditions. The centre would have a good view to the north.

Taking into consideration the urban development plan and the implementation schedule of Old Karak and also cost aspects, the second candidate site is regarded most suitable, because:

- (A) In the first alternative, implementation of the centre has to wait for the relocation of the existing government offices. Moreover this alternative tends to confine the visitors at the area and hinders spread of them to other areas in Old Karak.
- (B) The third candidate site is rather far from the castle, which is the most attractive place for tourists. In addition to it, this

alternative necessitates extra cost for building a large scale structure due to the sloped land.

(2) Functions of the Centre

(A) Manufacture and sales of tourism related handicrafts. Candidate items of handicrafts are:

- Embroideries and laces
- Carpets and rugs
- Local clothes
- Woodworks
- Basketry such as straw baskets and saucers
- Stoneware including marble and oil shale
- Metalworks and accessories including daggers
- Leather products such as bags, jackets and decorations
- Pottery and earthenware (at a later stage and/or at a separate site)
- Semi-processed agro-products such as jam, sweet, pickles, etc. (at a later stage and/or at a separate site)

Sales promotion activities will be done utilizing various tourist facilities in Karak and Amman.

- (B) Display and demonstration: The handicrafts will be displayed in a space like an indoor pocket park, where visitors enter freely and may have a rest. The manufacturing processes will be demonstrated.
- (C) Training and improvement of local handicrafts: A trainer for each type of handicraft will be assigned. The trainers and permanent staff will participate in training of local people and in marketing and improvement of local handicrafts.
- (D) To act as a cooperative of local people for manufacture and sales of their handicrafts.

Local individuals and households can be provided with training, instructions, materials, equipment and financial support by the centre and, in turn, they can supply the products to the centre by organizing a cooperative.

Other related facilities for training and education, social development and agriculture are expected to cooperate with the centre to form a production linkage.

(3) Requirements for the Centre

(A) Manpower requirements

In order to attract a daily average of nearly 200 visitors and to train local people, 40 members of the staff will be required (Table D-16).

(B) Requirement of major facilities and spaces

To accommodate visitors, trainees and the permanent staff, approximately 700 m<sup>2</sup> of land will be acquired for workshops, a hall, offices and the indoor pocket park (Figs. D-6 and D-7). In addition to this, car parking space on the basement or store and space for outdoor work such as drying works on the roof can be considered.

In the case of the site at the northern end of the central street, other facilities should be built together to fully utilize the site conditions. Examples of the facilities are extra car parking space, restaurant, offices, store, space for extension, etc.

(C) Expected water demand

The water demand is estimated at approximately 30 m<sup>3</sup> per day, based on the following calculation. :

$$0.2 \text{ m}^3/\text{day worker} \times 40 + 0.05 \text{ m}^3/\text{day visitor or trainee} \times 300 \\ + \text{miscellaneous}$$

$$= 30 \text{ m}^3/\text{day}$$

7.1.4 Implementation Schedule and Organization

(1) Implementation schedule

1988-1990: Study, plan and design

(A) Study of local traditional handicrafts

(B) Marketing study

(C) Identification of types of industry

(D) Assignment and training of the core staff

(E) Organizational set-up and establishment of a cooperative

- (F) Financial set-up
- (G) Building design
- (H) Coordination with the urban development project of Karak
  - 1991-1992: Construction
  - 1993-.: Operation
  - 1996-.: Fully-fledged operation

(2) Organization: The internal organization of the Centre is as described Paragraph (3)-(A) of Sub-section 7.1.3.

The Centre is expected to be managed by an independent semi-public organization to be established for the centre under a supervisory committee comprising the Ministry of Social Development, the Ministry of Industry and Trade, the Ministry of Tourism, the Ministry of Labour, Industrial Development Bank, Karak Governorate and Karak Municipality.

The Centre should organize a cooperative of people in and around Karak Municipality for manufacturing and sales of handicrafts to increase their income.

#### 7.1.5 Preliminary Estimation of the Project Cost

(1) Preliminary estimation of the investment cost: The investment cost mainly consists of land acquisition, construction of the building, procurement of the equipment, study, plan, design and training of the staff.

The cost varies with the land price, specifications of the building, types and number of the installed equipment, cost of the preparatory study to identify the potential and market, and methods of training for the trainers.

Assuming the conditions shown in Table D-18, the total investment cost will amount to approximately JD 240,000.

In the case of the site at the northern end of the central street, additional cost for building and land will be needed.



(2) Preliminary estimation of the operation cost and sales income

The total annual operation cost including salaries of all the staff, materials, utilities, equipment and payment to the cooperative members was estimated at JD 200,000 on the basis of the assumption set in Table D-19.

If salaries of the trainers are excluded, the total will be reduced to approximately JD 170,000.

On the other hand, the sales income is estimated to exceed JD 180,000. Therefore, the centre can gain while generating income of the cooperative members, if the trainers are paid from separate budgets.

(3) Financial arrangement: Based on the preliminary estimation of the project cost and income, it is recommended that the centre should be self-financed except that the cost for training should be paid by separate budgets such as the Ministry of labour and the Ministry of Social Development.

Karak Municipality is expected to build the building and rent it to the centre because the centre is an integral part of the Museum City and provides an indoor pocket park.

Support from voluntary societies and foreign cooperation are also expected.

## 7.2 Mu'tah Industrial Estate

### 7.2.1 Project Concept

Mu'tah Industrial Estate is an essential component of the Mu'tah Urban Development Project proposed in the Master Plan.

Industrial, academic and urban development should be promoted in concert materializing the high standard of working and living environments in order to attract entrepreneurs from not only the region but also outside the region and abroad, and to create a new urban centre

in the region.

The estate should lay special emphasis on incubation and development of small and medium scale industries which take root in the local industrial linkage and local communities.

Thus the estate is expected to be centre of the local industries in the region and to contribute to the balanced development of the Kingdom.

#### 7.2.2 Macroscopic Conditions for Industrial Location

The industrial estate should be planned considering the following conditions:

(1) Human resources: The total population of Karak, Mazar and Ayy Sub-Regions in 2005 is projected at 135,000. The increase from 1985 will be approximately 60,000. In addition to the population size, there are a number of high educational and training facilities in the region and these grow qualified manpower.

(2) Urban development: In parallel with the expected population growth, Mu'tah-Mazar urban development is planned. Development of urban infrastructure, services and amenities will raise industrial development potential.

(3) Raw materials: The region has rich agricultural resources as well as agricultural produce from the Jordan Valley.

(4) Harmony with agricultural development: Special consideration should be given to agricultural development in promoting agriculture by developing agro-industries and in generating employment for extra workforce of farmhouses. Transformation of agricultural land to industrial land needs discretion.

(5) Market conditions: Local market, domestic market including import substitution, and foreign market especially Arab market should be

covered by the estate.

### 7.2.3 Plan for the Estate

#### (1) Site Selection

In the light of industrial development and integrated urban development, the area north of the present campus of Mu'tah University is thought to be most suitable for the estate due to the following site conditions (Fig D-8):

- (A) Unurbanized flat land
- (B) Good access to Mu'tah, Mazar and Karak including future expansion of the urban areas
- (C) Good access to Mu'tah University
- (D) Good access to existing and planned infrastructure and possibility to share infrastructure and services with Mu'tah University
- (E) Good road network such as the university road and the linked roads
- (F) Only few scattered villages on the east side of the site, that is, down the dominating west wind of the site

While it is to be noted that considering the disadvantages of the site such as the rather high land price (JD 4/m<sup>2</sup> - JD 5/m<sup>2</sup>) and the present landuse for agriculture, the following two candidate sites could be identified as the supplementary minor alternatives:

One is a site south of the present campus of Karak College and the civilian department of Mu'tah University, and is located at a cross-roads. But it is an agricultural land and rather far from Mu'tah-Mazar and also from Mu'tah University's main campus.

The other is a site along Route 80 between Karak and Lajjun with such favorable conditions as:

- (A) Low land price (less than JD 1/m<sup>2</sup>)
- (B) Less effect on agricultural land

However the site has such disadvantages as:

- (A) Less good access to urbanized areas
- (B) Comparatively poor infrastructure and service levels

Therefore these two alternatives should be regarded as second bests, but for contingencies they should be included in a further study.

(2) Network for industrial development

The estate will be the hub of the network for the regional industrial development (Fig. D-9).

The network covers other industrial facilities, research, technical education and vocational training facilities, governmental agencies concerned, banks, and other urban facilities.

Factories inside and outside the estate should cooperate through sub-contracting and industrial linkages.

The University can take place in the following ways:

- (A) The students of the University can have training in the estate.
- (B) Some graduates of the University can become the workforce of the estate.
- (C) The University can conduct practical research and development activities for appropriate technology to be applied by the factories, or the two can conduct joint research and development work.
- (D) The University and the estate can share sophisticated equipment such as computers.
- (E) The factories can manufacture equipment needed by the University including tools for experiment and printing related products.

(3) Major functions of the estate

- (A) Incubation and development of small and medium scale industries and non-manufacturing business activities. Planned types of industries and their features are shown in Table D-22.
- (B) Administration, overall management and supporting functions for the industries in the estate
- (C) Provision of utilities and comfortable environments including parks and other greenery
- (D) Promotion of decentralized local industries in the region

(4) Proposed landuse composition and major facilities

(A) Expected employment and landuse: In order to contribute to generation of employment, the industrial estate is expected to employ approximately 2,500 persons. Considering the gross density of 75 persons per hectare, the total land area is planned approximately to be 33 ha. The preliminary landuse composition and the landuse plan are shown in Table D-20 and Fig. D-10.

(B) Factory land: Factory land areas consist of standard factory areas and custom-built factory areas. Various types of fully equipped standard factories, that is, INDUSTRIAL APARTMENTS together with warehouse will be built to help establish small and medium scale industries at a low initial cost of entrepreneurs. They will be located next to the administration and incubation centre to have good access to the services. Also, various sizes and types of custom-built factory land will be provided.

(C) Administrative and supporting centre: Major facilities to be accommodated by the centre are:

- Offices of the staff members
- Meeting rooms
- Information centre
- Post office
- Shops
- Banks
- Clinic
- Copy/printing centre
- Restaurant and cafeteria
- Multi-purpose hall(s)
- Mosque
- Products display area
- Fire Station
- Police station
- Petrol station and maintenance facilities
- Warehouse facilities
- Training facilities to provide practical training to the workers and candidate workers in and outside the industrial estate

Incubation functions should include the following supports:

- Marketing support
- Research and development support
- Support for financial arrangement
- Coordination with universities and other research institutes
- Computer service
- Use of rooms/halls
- Clerical service support
- Information services
- Management consultation

The above incubation functions will be carried out by the staff members of the centre. The centre will also accommodate offices for companies such as computer software firms and other service industries.

- (D) Utilities: Utility facilities are water supply, sewerage, electricity and telephone. Water demand is preliminarily estimated at approximately 1,500 - 2,500 m<sup>3</sup>/day.
- (E) Green areas, parks and open space: In addition to the boundary green zone, a couple of parks will be arranged to provide comfortable environments and recreational spaces. Sufficient green areas should be attached to buildings so that the total green area accounts for not less than 25% of the total area.
- (F) Roads: Sufficient road network should be established to cater for the traffic with the minimum area for road and for pedestrians.

#### 7.2.4 Implementation Schedule and Organization

(1) Implementation schedule is shown in Fig. D-11. The most immediate actions are the feasibility study and land acquisition. It is expected that the fully-fledged operations of the phase 1 would start in 1996.

(2) Organization: It is recommended that the estate should be managed by Jordan Industrial Estate Corporation taking advantage of its experiences and institutional capability.

#### 7.2.5 Preliminary Estimation of the Project Cost

The investment cost for the estate is estimated at approximately JD 8.0 million, of which land acquisition costs JD 0.33 to JD 1.65 million and construction costs JD 5.7 million (Table D-21). The rest is for study, plan, design and contingencies at 1987 prices. Domestic cost is estimated at JD 3.8 to JD 5.8 million, while foreign cost JD 3.5 million equivalent. By the year 1995, JD 7.0 million will have to be invested.

## 8. CONCLUSIONS AND RECOMMENDATIONS

(1) Conclusion: Seven strategic development projects have been formulated for promoting industrialization in the Karak and Tafila regions. Of the seven, two are integrated, in the Master Plan, into the parts of the priority projects. They are the Karak Handicraft Centre Project and the Mu'tah Industrial Estate Project.

(2) Recommendations: It is recommended that both of the Government and the Regional Development Councils review and examine these projects and take necessary actions for their early implementation.

Immediate actions to be taken for the priority projects are the following:

Karak Handicraft Centre: Organizing a study group under supervision of the governor for a preparatory study of the handicraft centre. Cooperation of the Ministry of Industry and Trade, the Ministry of Social Development, the Ministry of Tourism, and Industrial Development Bank is necessary for the study.

Mu'tah Industrial Estate: Conducting a feasibility study by Jordan Industrial Estates Corporation



## REFERENCES

- D-1 Jordan (Pamphlet for Investment Promotion),  
Jordan Industrial Estates Corporation
- D-2 Industrial Development Bank (Annual Report), 1985
- D-3 Mu'tah University, Dar Al-Handashah Consultant
- D-4 Industrial census, Department of statistics, 1984

**T A B L E S**



Table D-1 RESULTS OF INDUSTRIAL SURVEY 1983

Type of Industry	Domestic Product 1000 JD (%)	Number of Establishments (%)	Number of Workers (%)
Mining and quarrying	37966 (14.9)	192 ( 2.9)	5869 (11.6)
Food manufacturing	13047 ( 5.1)	620 ( 9.2)	4404 ( 8.7)
Beverages	7994 ( 3.2)	16 ( 0.2)	931 ( 1.8)
Tobacco	29406 (11.6)	4 ( 0.0)	642 ( 1.3)
Textiles	3095 ( 1.2)	77 ( 1.2)	1161 ( 2.3)
Clothing	4123 ( 1.6)	389 ( 5.8)	2630 ( 5.2)
Leather & Leather products	655 ( 0.3)	20 ( 0.3)	243 ( 0.5)
Foot wear	3182 ( 1.3)	102 ( 1.5)	752 ( 1.5)
Furniture and wood	6478 ( 2.5)	720 (10.7)	2484 ( 4.9)
Paper & paper products	4122 ( 1.6)	16 ( 0.2)	1178 ( 2.3)
Printing and publishing	3721 ( 1.5)	146 ( 2.2)	1346 ( 2.7)
Chemical & chemical Products	17865 ( 7.0)	46 ( 0.7)	3212 ( 6.4)
Petroleum refinery	26327 (10.4)	1 ( 0.0)	2456 ( 4.9)
Rubber & rubber products	52 ( 0.0)	3 ( 0.1)	24 ( 0.0)
Plastic & plastic products	5364 ( 2.1)	49 ( 0.7)	1117 ( 2.2)
Non-metallic mineral Products	41972 (16.5)	539 ( 8.0)	6050 (12.0)
Basic metal Products	5984 ( 2.4)	13 ( 0.2)	857 ( 1.7)
Nonelectrical machinery	13822 ( 5.4)	805 (12.0)	4095 ( 8.1)
Electrical machinery	562 ( 0.2)	6 ( 0.1)	256 ( 0.5)
Transport equipment	374 ( 0.1)	14 ( 0.2)	177 ( 0.4)
Miscellaneous	-	-	-
Energy electrical Products	16177 ( 6.4)	3 ( 0.0)	3844 ( 7.6)
Industrial services	12042 ( 4.7)	2943 (43.8)	6789 (13.4)
Total	254330 (100.0)	6724 (100.0)	50,517 (100.0)

Source: Statistical Yearbook 1985

Table D-2 TYPE OF INDUSTRY IN THE STUDY AREA

Order Types of Industry	Number of Establishments	Share in the Study Area(%)
1. Fabricated metal products (except machinery) - Blacksmiths	52	22.8
2. Construction (including general contractors, plumbers, electricians, etc.)	38	16.7
3. Wearing apparel (including tailors and dressmakers)	32	14.1
4. Carpentry and wood-working (including furniture)	25	11.0
5. Non-metallic mineral products (including tile and brick manufacturing and stone cutting, excluding petroleum, pottery, cement, lime and plaster)	24	10.5
6. Bakery	19	8.3
7. Grain milling (including cereals, coffee and salt)	19	8.3
8. Others	19	8.3
Study Area Total	228	100.0

Source: Ministry of Planning

Table D-3 DISTRIBUTION OF INDUSTRIAL ESTABLISHMENTS IN THE STUDY AREA (1/2)

Type of Industry Sub-Region	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	Total
Karak	-	-	6	3	1	2	27	-	15	1	1	6	27	-	13	102 (44.7)
Qasr	-	3	1	-	-	-	-	-	2	-	-	3	6	-	-	15 (6.6)
Mazar	-	6	4	-	2	-	1	-	6	-	-	8	8	1	18	54 (23.7)
Ayy	2	1	2	-	-	-	-	-	-	-	-	2	1	-	-	8 (3.5)
Desert	-	-	1	-	-	-	-	-	-	-	-	-	2	-	-	3
Karak Gov.	2	10	14	3	3	2	28	0	23	1	1	19	44	1	31	182 (79.8)
Tafila	2	7	4	3	-	-	3	1	1	-	-	2	2	-	6	37 (16.2)
Bsaira	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0 (0)
Hasa	-	-	1	-	-	-	1	-	1	-	-	-	-	-	1	4 (1.8)
Tafila Gov.	2	7	5	3	-	-	4	1	1	-	-	2	8	-	7	41 (1.8)
Dhiban	-	2	-	-	-	-	-	-	-	-	-	3	-	-	-	5 (2.2)
Jizeh	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0

Table D-3 DISTRIBUTION OF INDUSTRIAL ESTABLISHMENTS IN THE STUDY AREA (2/2)

Type of Industry Sub-Region	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	Total
Amman Gov.	0	2	0	0	0	0	0	0	0	0	0	3	-	-	-	5
Total	4	19	19	6	3	2	32	1	25	1	1	24	52	1	38	228
	(1.8)	(8.3)	(8.3)	(2.7)	(1.3)	(0.9)	(14.1)	(0.4)	(11.0)	(0.4)	(0.4)	(10.5)	(22.8)	(0.4)	(16.7)	(100.0)

- |   |  |
|---|--|
| 1. Agriculture, forestry, and fishing                                 | 9. Carpentry and wood-working (including furniture)  |
| 2. Grain milling (including: cereals, coffee, & salt)                 | 10. Printing and publishing  |
| 3. Bakery   | 11. Cement, lime, and plaster production   |
| 4. Sweetshop (chocolate and sugar confectionery, ice cream)           | 12. Other non-metallic mineral products (including tile and brick manufacturing and stone cutting) |
| 5. Other food processing or manufacturing (including olive processes) | 13. Fabricated metal products (except machinery)   |
| 6. Beverages manufacturing  | 14. Other manufacturing  |
| 7. Wearing apparel (including tailors and dressmakers)                | 15. Construction (including general contractors, plumbers, electricians, etc.)                     |
| 8. Shoe and leather manufacturing                                     |  |

Table D-4 INTERVIEWED ENTERPRISES AND NUMBER OF ENTERPRISES  
BY SUB-REGION AND TYPE OF INDUSTRY

(Number of interviewed enterprises)/(Number of enterprises)

Type of Industry	Sub-region			
	Karak	Tafila	Qasr	Total
Fabricated metal products (Blacksmith)	1/27	1/8	0/6	2/41
Wearing apparel (Tailor)	1/27	0/3	0/0	1/30
Carpentry and Wood-working	1/15	1/1	1/2	3/18
Non-metallic mineral products	1/6	0/2	0/3	1/11
Bakery	1/6	1/4	0/1	2/11
Grain milling	0/0	1/7	0/3	1/10
Maintenance *	1/34	0/7	0/3	1/44
Total	6/115	4/32	1/18	11/165

\* A car maintenance workshop was specially included for the strong link of the industrial development.

Number of Enterprises: after Ministry of Planning



Table D-5 INDUSTRIAL PROJECTS IN THE THIRD FIVE-YEAR PLAN

No.	Project name	Implementation year	Sector in Charge	Investment (1000 JD)	Location
<b>KARAK GOVERNORATE</b>					
1.	Upgrading of traditional and handicraft industries	1987 -	Social development	30	Karak
2.	Vegetable canning	1987 -	Social development	15	Karak
3.	Professional workshop	1986 - 1990	Women	100	Karak
4.	Traditional and handicraft centre	1990 -	Women	50	Karak
5.	Handicraft industrial areas	1989 -	Municipal and rural affairs	37	Mazar
6.	Traditional industrial areas	1987 -	Municipal and rural affairs	37	Mu'tah
7.	Traditional industrial areas	1987 -	Municipal and rural affairs	55	Qatrana
8.	Slaughter house	1987 -	Agriculture	2600	Karak
9.	Olive squeezers	1987 -	Agriculture	120	
10.	Animal slaughter house	1987 -	Agriculture	50	Qasr
11.	Rural and home industries	1986 -	Industry and mining	208	Karak Gov.
12.	Cement block factory	1987 -	Industry and mining	30	Qasr
13.	Carpet weaving factory	1988 -	Industry and mining	50	Mazar
<b>TAFILA GOVERNORATE</b>					
14.	Small technical workshop	1986 -	Women	65	Tafila
15.	Traditional trade and handicraft centre	1986 -	Women	50	Tafila
16.	Development of traditional trades and handicrafts	1987 -	Social development	30	Tafila Gov.
17.	Women counseling and training centre	1987 -	Women	30	Tafila Gov.
18.	Manual knitting workshop	1987 -	Women	25	Ain Al Baida
19.	Manual knitting workshop	1987 -	Women	25	Bsaira
20.	Construction of a soap factory	1987 -	Industry and mining	150	Tafila Gov.
21.	Marble factory	1988 -	Industry and mining	500	Hasa
22.	Fruit canning factory	1989 -	Industry and mining	550	Ain Al Baida
23.	Mineral water bottling factory	1989 -	Industry and mining	650	Gharandal

Table D-6 SUGGESTED INDUSTRIES

(Mainly for small and medium scale industries)

- (1) Animal food
- (2) Spray and additives for washing machine
- (3) Toys
- (4) Brushes
- (5) Button, zipper
- (6) Socks
- (7) Ink for writing
- (8) Ink for typing
- (9) Frozen food
- (10) Umbrella
- (11) Cast for cake
- (12) Jewels
- (13) Traditional
- (14) Aluminium plat/sheet
- (15) Rubber products
- (16) Light reflectors
- (17) Paper for wall & decoration
- (18) Pottery
- (19) Carbon paper
- (20) Cast material excluding iron material, machine parts
- (21) Tools
- (22) Cutters
- (23) Agricultural machinery and construction machinery
- (24) Kitchen equipment
- (25) Screws and nuts
- (26) Air compressors
- (27) Rollers for road construction
- (28) Fire extinguisher equipment
- (29) Agricultural spray machine
- (30) Jack (for vehicles) & garage equipment
- (31) Vehicle spare parts
- (32) Kitchen Hotel and cafeteria equipment
- (33) Ambulances, fire brigade cars and garbage collection cars
- (34) Conveyer belts, cylinders
- (35) Cutting tools & spare parts for digging machines etc.
- (36) Control valves
- (37) Electric & water meters measurement equipment
- (38) Machines & equipment for processing grain & vegetables
- (39) Medical tools drills

Source: Ministry of Industry and Trade

Table D-7 ENGINEERING AND CAPITAL INDUSTRIES RECOMMENDED  
BY A PRIMARY STUDY FOR IMPLEMENTATION STUDY

1. Non-iron metal casting, aluminium, zinc, brass etc.
2. Hand utensils & equipment (pincettes, screw drivers, etc.)
3. Digging tools, cutting tools & sharp tools (cutlery)
4. Imitative jewels
5. Agricultural and construction equipment, and various other equipment
6. Kitchen utensils & steel, brass & aluminium pans
7. Fixtures, screws, nuts & engine fans, etc.
8. Aluminium foils
9. Agricultural, industrial pumps & others
10. Hand electrical utensils
11. House utensils with an automotor
12. Air compressors
13. Road rollers
14. Equipment of extinguishers and agricultural spray powders and others
15. Cars and small garages, jacks, lubrication pumps, and garages equipment
16. Car spare parts including tyres metal parts, distributor parts, combustion coil, spark plugs, platinum, other small parts like glass vipers, fuses, carbon brushes & carburetor parts & gaskets and bearings
17. Equipment for kitchens hotels & cafeterias
18. Electrical supplies for protection from explosive matters
19. Bodies of vehicle extinguishers, ambulances, garbage collecting cars, road cleaners, etc.
20. Moving belts, belt-rollers & belts
21. Wires, ploughs and cutting-tools for earth moving and roads, annexed to heavy structural and agricultural equipment
22. Control-valves
23. Electric meters, water meters, and other similar measuring instruments
24. Pharmaceutical machines
25. Machines and instruments for mills and the treatment of corn and grains
26. Equipment for manufacture of common foodstuff (washing, drying, chipping, packing)
27. Machines tools: lathes punchers, mechanical compressors, compression breaks & accessories, carpentry machines & accessories, etc.
28. Rubber products: Gloves, children toys, balloons, rubber container, etc.
29. Reflectors & plastic light signals for roads & cars.
30. Walls & decor-paper
31. Ceramics except sanitary wares & tiles: dish-basins, utensils for table, electrical insulators
32. Mirrors industry
33. Optical lenses & crystal glass industry

Source: Ministry of Industry and Trade  
1985-Abstract from "ECUA" Study

Table D-8 LOCATIONAL CONDITIONS FOR INDUSTRY ALONG THE DESERT HIGHWAY

Viewpoint	Qatrana/ Karak	Abiad/ Karak	Hasa/ Tafila	Darawish/ Tafila
<b>(1) Accessibility (km)</b>				
- to Amman	85	110	135	155
- to QAIA airport	65	90	115	135
- to Aqaba seaport	250	225	200	180
- to the Valley	60	55	80	60
- to King's Highway	40	25	50-55	35
- to Iraq	1st	2nd	3rd	4th
- to Saudi	4th	3rd	2nd	1st
- Railway availability	Station	Station at Manzil	Station	Station
- to other industrial area (km)	15 to Lajjun	25 to Mu'tah	50 to Mu'tah 55 to Tafila	35 to Tafila
- Nearest town and distance (km)	Karak 40	Karak 35	Tafila 55	Tafila 35
<b>(2) Infrastructure</b>				
- Power				
- Water availability		Slime	Slime	
- Communication	1st	4th	2nd	3rd
<b>(3) Land</b>				
- Land availability	OK	OK	OK	OK
- Land ownership				
<b>(4) Others</b>				
- Potential for amenity/ living environment				
- Raw material		Phosphate	Phosphate marble oil shale alabaster	
- Existing industry	3 establishments (planned industrial area)		4 establishments (planned marble factory)	
- Existing industry related facilities	Research centre of energy and electricity			
- Access to research/ education/training institute (km)	Mu'tah Univ. 50	Mu'tah Univ. 25	50 to Mu'tah 55 to polytech	Polytech 35
- Decentralization trend	4th	3rd	2nd	1st

Source: The Study Team

Table D-9 TYPES OF INDUSTRIES TO BE CONSIDERED (1/2)

- (1) Manufacture of food and beverages
  - Slaughtering
  - Canning and preserving of fruit and vegetables
  - Manufacture of vegetable and animal oils and fats
  - Grain mill products
  - Manufacture of bakery products including biscuits and similar dry bakery products
  - Manufacture of prepared animal feeds
  - Wine industries
  - Bottling of mineral water
- (2) Textile, wearing apparel and leather industries
  - Spinning, weaving and finishing textiles of wool
  - Manufactories of made-up textile goods such as curtains, sheets and textile bags
  - Knitting mills
  - Manufacture of carpets and rugs
  - Manufacture of wearing apparel including uniforms, caps, hats, underwear, and also traditional/local clothes
  - Manufacture of leather products
  - Manufacture of footwear
- (3) Manufacture of wood products including furniture
  - Manufacture of wooden containers
  - Manufacture of furniture and fixtures and woodworking
- (4) Manufacture of paper products and printing
  - Manufacture of paperboard
  - Manufacture of containers and boxes of paper and paperboard
  - Printing and allied industries

Table D-9 TYPES OF INDUSTRIES TO BE CONSIDERED (2/2)

- (5) Manufacture of chemicals, rubber and plastic products
  - Manufacture of soap
  - Tire industries including reclaimed tires
  - Manufacture of plastic products
- (6) Manufacture of non-metallic mineral products
  - Manufacture of pottery, china and earthenware
  - Manufacture of structural clay products
  - Manufacture of cement, lime, plaster, their products, and abrasives
- (7) Manufacture of fabricated metal products, machinery and equipment
  - Manufacture of cutlery, hand tools and general hardware
  - Manufacture of furniture and fixtures primarily of metal and metal ornaments
  - Manufacture of structural metal products
  - Manufacture of machinery and equipment
  - Manufacture of electrical machinery, apparatus, appliances and supplies
  - Manufacture of transport equipment including motor vehicle parts and accessories
  - Manufacture of professional and scientific, and measuring and controlling equipment
- (8) Other manufacturing industries
  - Manufacture of sporting and athletic goods
  - Software and information technology

Source: The Study Team

Table D-10 STRATEGIC INDUSTRIAL PROJECTS (1/3)

Project/Location	No. of Employees	Conditions/ Characteristics	Examples of Typical Industries to be introduced
Mu'tah Industrial Estate/Mu'tah	2,500	<ul style="list-style-type: none"> <li>- High standard industrial estate composed of:                             <ul style="list-style-type: none"> <li>- Industrial estate with industrial apartments</li> <li>- University &amp; research institute</li> <li>- Industrial incubation and development centre</li> <li>- Park, sports stadium, housing &amp; amenities</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- Bakery products (biscuits, dry products)</li> <li>- Wearing apparel (uniforms, caps, underwear)</li> <li>- Printing &amp; allied industries (binding, ink)</li> <li>- Cement, lime, plaster products &amp; abrasives</li> <li>- Electrical/electronic machinery</li> <li>- Professional, scientific, measuring, controlling equipment</li> <li>- Sporting &amp; athletic goods</li> <li>- Software &amp; information technology</li> <li>- Research &amp; commercialization (high technology products including ceramics, new materials, utilization of mineral products/waste, local energy biotechnology &amp; new agro-industry)</li> </ul>
New Karak Industrial Zone/South of New Karak	1,000	<ul style="list-style-type: none"> <li>- Industrial zone for relocated establishments from Old Karak to stop urban problems &amp; to lead new area development</li> </ul>	<ul style="list-style-type: none"> <li>- Car repair &amp; maintenance</li> <li>- Blacksmiths/fabricated metal products</li> <li>- Carpentry &amp; woodworking</li> <li>- Electrical maintenance</li> </ul>
Karak Handicraft Centre/Old Karak	40	<ul style="list-style-type: none"> <li>- The centre being an integral part of the historic quarter of the town with such functions as                             <ul style="list-style-type: none"> <li>- Manufacture &amp; sales of tourism related handicrafts</li> <li>- Training, promotion of traditional handicraft &amp; art, &amp; improvement</li> <li>- Display &amp; demonstration</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- Embroideries &amp; laces</li> <li>- Weaving of carpets &amp; rugs</li> <li>- Traditional/local clothes</li> <li>- Leather products</li> <li>- Woodworking</li> <li>- Pottery &amp; earthenware</li> <li>- Stoneware including marble &amp; oil shale</li> <li>- Metalwork &amp; accessories</li> <li>- Semi-processed agro-products</li> </ul>

Table D-10 STRATEGIC INDUSTRIAL PROJECTS (2/3)

Project/Location	No. of Employees	Conditions/Characteristics	Examples of Typical Industries to be introduced
Outer Tafila Industrial Estate/East of Tafila	1,000	Industrial estate with support facilities & amenities, cooperating with Polytechnic Institute	<ul style="list-style-type: none"> <li>- Grain mill products</li> <li>- Wine industry</li> <li>- Made-up textile goods</li> <li>- Leather products</li> <li>- Footwear</li> <li>- Plastic products</li> <li>- Cement, lime, plaster products</li> <li>- Furniture &amp; fixtures of metal</li> <li>- Machinery &amp; equipment</li> <li>- Electrical/electronic machinery</li> </ul>
Tafila Industrial Zone/periphery of Tafila Town	1,000	Industrial zone for relocated establishments from Tafila Town	<ul style="list-style-type: none"> <li>- Car repair</li> <li>- Blacksmiths/fabricated metal products</li> <li>- Carpentry &amp; woodworking</li> <li>- Electrical maintenance</li> <li>- Olive soap</li> <li>- Tourism related handicrafts</li> </ul>
Tafila Handicraft Centre/Tafila Town	20	The centre, forming a network with other tourism, culture & handicraft facilities, has functions such as: <ul style="list-style-type: none"> <li>- Manufacture &amp; sales of tourism related handicrafts</li> <li>- Training, promotion of traditional handicraft &amp; art &amp; improvement</li> <li>- Display &amp; demonstration</li> </ul>	<ul style="list-style-type: none"> <li>- Embroideries &amp; laces</li> <li>- Weaving of carpets &amp; rugs</li> <li>- Traditional/local clothes</li> <li>- Leather products</li> <li>- Wood working</li> <li>- Pottery &amp; earthenware</li> <li>- Stoneware including marble &amp; oil shale</li> <li>- Metal work &amp; accessories</li> <li>- Semi-processed agro-products</li> </ul>



Table D-10 STRATEGIC INDUSTRIAL PROJECTS (3/3)

Project/Location	No. of Employees	Conditions/Characteristics	Examples of Typical Industries to be introduced
Hasa Industrial Estate/Hasa along Desert Highway	3,000	Industrial estate, a goods circulation centre, a free zone with housing & amenities, being a core of desert development, utilizing underground water	<ul style="list-style-type: none"> <li>- Prepared animal feeds</li> <li>- Leather products</li> <li>- Paperboard</li> <li>- Structural clay products</li> <li>- Cement, lime, plaster products</li> <li>- Founding &amp; casting</li> <li>- Structural metal products</li> <li>- Machinery &amp; equipment</li> <li>- Electrical/electronic machinery</li> <li>- Transport equipment (motor) (vehicle parts &amp; accessories)</li> <li>- New energy-related products</li> <li>- Bedou handicraft</li> <li>- Pottery using phosphate slimes</li> </ul>

Source: The Study Team

Table D-11. EVALUATION OF STRATEGIC INDUSTRIAL PROJECTS

No.	Viewpoint	Mu'tah Industrial Estate	Karak Handicraft Centre	Outer Tafila Industrial Estate	Tafila Handicraft Centre	Industrial Estate along Desert Highway
1.	Employment	A	C	B	D	A
2.	Production	A	C	B	D	A
3.	Participation of small/medium industries	B	A	B	A	C
4.	Expansion of market	A	C	B	C	A
5.	Utilization of local resources	B	A	B	A	B
6.	Strengthening other sectors	A	A	A	A	A
7.	Conflict with agricultural landuse	C	A	C	A	A
8.	Development of manpower/technology	A	B	A	B	B
9.	Impact on regional/urban development	B	C	B	D	A
10.	Water consumption	D	A	C	A	D
	Indicative figure	42	41	40	38	43

Note: (1) The 5-year plan projects (New Karak Industrial Zone and Tafila Industrial Zone) are not included.  
 (2) A to E are in descending order of evaluation results.  
 (3) Indicative figures are total marks, given that A = 5, B = 4, C = 3, D = 2, E = 1

Source: The Study Team

Table D-12 PROJECTED EMPLOYMENT IN INDUSTRIAL SECTOR

Project	(job opportunity)			
	1990	1995	2000	2005
Mu'tah Industrial Estate (77 workers/ha)	0	1,400	2,000	2,500
New Karak Industrial Zone (270 workshops x 3 to 5 workers + others)	1,000	1,000	1,000	1,000
Karak Handicraft Centre (Assumption)	0	40	40	40
Outer Tafila Industrial Estate (70 workers/ha)	0	500	1,000	1,000
Tafila Industrial Zone (270 workshops x 3 to 5 workers + others)	1,000	1,000	1,000	1,000
Tafila Handicraft Centre (Assumption)	0	20	20	20
Industrial Estate along Desert Highway (50 workers/ha)	0	0	1,500	3,000
Sub-total	<u>2,000</u>	<u>3,960</u>	<u>7,060</u>	<u>8,560</u>
Other-small/medium Industrial development	250	500	1,000	1,500
Total increase	2,250	4,460	8,060	10,060
Accumulative total <sup>1/</sup> (519 in 1984)	2,450	4,460	8,260	10,260

<sup>1/</sup>: Present + total increase + relocation

Source: The Study Team

Table D-13 PROJECTED INDUSTRIAL WATER DEMAND

Project	(m <sup>3</sup> /day)			
	-1990	-1995	-2000	-2005
Mu'tah Industrial Estate (0.6-1.0 m <sup>3</sup> /day/worker x workers)	0	840- 1,400	1,500- 2,500	1,500- 2,500
New Karak Industrial Zone (1 m <sup>3</sup> /day/ workshop x 270 + Others)	300	300	300	300
Karak Handicraft Centre (0.2 m <sup>3</sup> /day/worker x 40 workers + 0.05 m <sup>3</sup> /day/visitor x 300 visitors + miscellaneous)	0	30	30	30
Outer Tafila Industrial Estate (0.6-1.0 m <sup>3</sup> /day/worker x workers)	0	300- 500	600- 1,000	600- 1,000
Tafila Industrial Zone (1 m <sup>3</sup> /day/ workshop x 270 + Others)	300	300	300	300
Tafila Handicraft Centre (0.2 m <sup>3</sup> /day/worker x 20 workers + 0.05 m <sup>3</sup> /day/visitor x 150 visitors + miscellaneous)	0	15	15	15
Industrial Estate along Desert Highway (50 m <sup>3</sup> /day/ ha x Area or 1 m <sup>3</sup> /day/ worker x workers)	0	0	1,500	3,000
Sub-total	<u>600</u>	<u>1,785-</u> <u>2,545</u>	<u>4,245-</u> <u>5,645</u>	<u>5,745-</u> <u>7,145</u>
Other small/medium industrial development (1 m <sup>3</sup> /worker)	250	500	1,000	1,500
Total increase	850	2,285- 3,045	5,245- 6,645	7,245- 8,645

Source: The Study Team

Table D-14 LAND REQUIREMENT

(ha)

Project	1990	1995	2000	2005
Mu'tah Industrial Estate (77 workers/ha)	0	19	33	33
New Karak Industrial Zone (Given)	5	5	5	5
Karak Handicraft Centre (Assumption)	0	0.07	0.07	0.07
Outer Tafila Industrial Estate (70 workers/ha)	0	7	14	14
Tafila Industrial Zone (Given)	6	6	6	6
Tafila Handicraft Centre (Assumption)	0	0.03	0.03	0.03
Industrial Estate along Desert Highway (50 workers/ha)	0	0	30	60
Sub-total	<u>11</u>	<u>37.1</u>	<u>88.1</u>	<u>118.1</u>
Other small/medium industrial development (50 workers/ha)	5	10	20	30
Total increase	16	47.1	108.1	148.1

Source: The Study Team

Table D-15 PRELIMINARY ESTIMATION OF INVESTMENT COST BY SECTOR

Item	Amount (JD 1000)	Remark
1. Public sector		
(1) Mu'tah Industrial Estate	8,000	Section 7.2
(2) New Karak Industrial Zone	339	Given
(3) Karak Handicraft Centre	240	Section 7.1
(4) Outer Tafila Industrial Estate	3,000	JD 240 million x 14 ha
(5) Tafila Industrial Zone	140	Given
(6) Tafila Handicraft Centre	100	JD 330 x 300 m2
(7) Industrial Estate Along Desert Highway	14,400	JD 240 million x 60 ha
(8) Other small/Medium Industrial Development	576	JD 144,000 x 4 (5 year plan)
<u>Public sector total</u>	<u>26,795</u>	
2. Private Sector		
(1) Mu'tah Industrial Estate	26,219	Equal to the corresponding public sector amount
(2) New Karak Industrial Zone		
(3) Karak Handicraft Centre		
(4) Outer Tafila Industrial Estate		
(5) Tafila Industrial Zone		
(6) Tafila Handicraft Centre		
(7) Industrial Estate Along Desert Highway		
(8) Other small/Medium Industrial Development	8,552	JD 2,138,000 x 4 (5 year plan)
<u>Private sector total</u>	<u>34,771</u>	
<b>Grand Total</b>	<b>61,566</b>	

Source: The Study Team

Table D-16 EXPECTED NUMBER OF STAFF, TRAINEES AND VISITORS

Item	Number
Staff	40
- Manager	1
- Trainers cum senior staff	7
- Assistant	1
- Craftman	30
- Shopgirl/boy	1 (Other workers help sales on a part-time basis)
Trainees	50 (Maximum at a time)
Visitors	186 (Daily average)

Source: The Study Team

Table D-17 RECOMMENDED MAIN ROLES OF SUPERVISORY COMMITTEE MEMBERS OF KARAK HANDICRAFT CENTRE

Organization	Main roles
Ministry of social development	Supervision of training and Cooperative
Ministry of Industry and Commerce	Supervision of Manufacture and Sales
Ministry of Tourism	Supervision of marketing, public relations, sales promotion
Ministry of Labour	Supervision of training
Industrial Development Bank	Supervision of feasibility study and financial aspects
Karak Governorate	Overall coordination
Karak Municipality	Provision of land and building

Source: The Study Team

Table D-18 PRELIMINARY ESTIMATION OF PROJECT COST  
FOR KARAK HANDICRAFT CENTRE

Item	Amount (JD)	Remarks
Land acquisition	72,000	JD 100/m <sup>2</sup> x 720m <sup>2</sup>
Construction	115,200	JD 80/m <sup>2</sup> x 720m <sup>2</sup>
Equipment	4,000	JD 100/staff x 40 staff
Study, plan & design	7,200	JD 300/man-month x 24 man-months
Training for Staff	24,000	JD 250/man-month x 8 staff x 12 months
Contingencies	22,240	10% of the above total
<b>Total</b>	<b>244,640</b>	

Source: The Study Team

Table D-19 PRELIMINARY ESTIMATION OF OPERATION COST AND SALES INCOME  
OF KARAK HANDICRAFT CENTRE

Item	Amount (JD)	Remarks
Salaries of all staff	144,000	Average annual income=JD 3,600 (A trainer's average annual income = JD 4,000)
Materials	20,000	
Utilities	1,000	
Supply of equipment	1,000	
Payment to cooperative members	11,250	JD 3 x 75 days x 50 members
Others	22,750	
<b>Total</b>	<b>200,000</b>	
Total except payment to trainers	172,000	JD 200,000 JD 200,000-JD 4,000 x 7 staff
<b>Sales income</b>	<b>183,600</b>	Average price = JD 3 Buyers at the centre = 68,000 visitors x 0.75 Buyers outside the centre= Buyers at the centre x 0.2 - JD 3x (68,000 x 0.75) x (1+0.2)

Source: The Study Team



Table D-20 PRELIMINARY LANDUSE COMPOSITION  
OF MU'TAH INDUSTRIAL ESTATE

Landuse	Land area in m <sup>2</sup> (%)	Remarks
1. Factory land	197,280 (59.2)	Total 138 factories, average lot size 1,430m <sup>2</sup>
1.1 Standard factories	32,640 (9.8)	
Type A	6,936	204 m <sup>2</sup> x 34
Type B	8,160	510 m <sup>2</sup> x 16
Type C	8,160	1,020 m <sup>2</sup> x 8
Type D	8,160	2,040 m <sup>2</sup> x 4
Warehouses	1,224	
1.2 Custom built factories	164,640 (49.4)	
Type E	31,200	1,200 m <sup>2</sup> x 26
Type F	3,360	1,680 m <sup>2</sup> x 2
Type G	43,200	2,400 m <sup>2</sup> x 18
Type H	63,360	2,640 m <sup>2</sup> x 24
Type I	5,760	2,880 m <sup>2</sup> x 2
Type J	8,160	4,080 m <sup>2</sup> x 2
Type K	9,600	4,800 m <sup>2</sup> x 2
2. Administrative	28,800 (8.6)	Including offices for firms, training space and incubation facilities
Built-up area	14,400	
Parking	5,000	
Green and open space	9,400	
3. Supporting facilities	9,600 (2.9)	
Built-up area	2,700	
Parking loading and unloading	6,900	
4. Utilities	7,200 (2.2)	4,800 m <sup>2</sup> + 2,400 m <sup>2</sup>
5. Green area	36,640 (11.0)	
Boundary zone	22,240	10 m x 2,224 m
Parks	14,400	9,600 m <sup>2</sup> + 4,800 m <sup>2</sup>
6. Roads	53,664 (16.1)	
24 m wide	28,704	L = 1,196 m
12 m wide	24,960	L = 2,080 m
<b>Total</b>	<b>333,184 (100.0)</b>	

Source: The Study team

Table D-21: PRELIMINARY ESTIMATION OF PROJECT COST  
FOR MU'TAH INDUSTRIAL ESTATE

(unit: 1000 JD at 1987 prices)

Item	Domestic Cost	Foreign Cost	Total Cost	Remarks
1. Land acquisition	330- 1650	0	330- 1650	Land price = (1 JD/m <sup>2</sup> -5 JD/m <sup>2</sup> ) x 33 ha
2. Construction	2873	2873	5746	15.8 JD/m <sup>2</sup>
Infrastructure	1294	1294	2588	7.84 JD/m <sup>2</sup> x 33ha
Administrative and supporting facilities	795	795	1590	41.4 JD/m <sup>2</sup> x 3.84 ha
Standard factories	784	784	1568	48.1 JD/m <sup>2</sup> x 3.26 ha
3. Study, plan and design	287	287	574	10% of construction cost
4. Contingencies	349 481	316	665 797	10% of land acquisition construction, study plan and design
5. Total	3839 5291	3476	7315 8767	

Note: Domestic cost: Foreign cost = 50%: 50% for construction, study,  
plan and design

Source: The Study Team

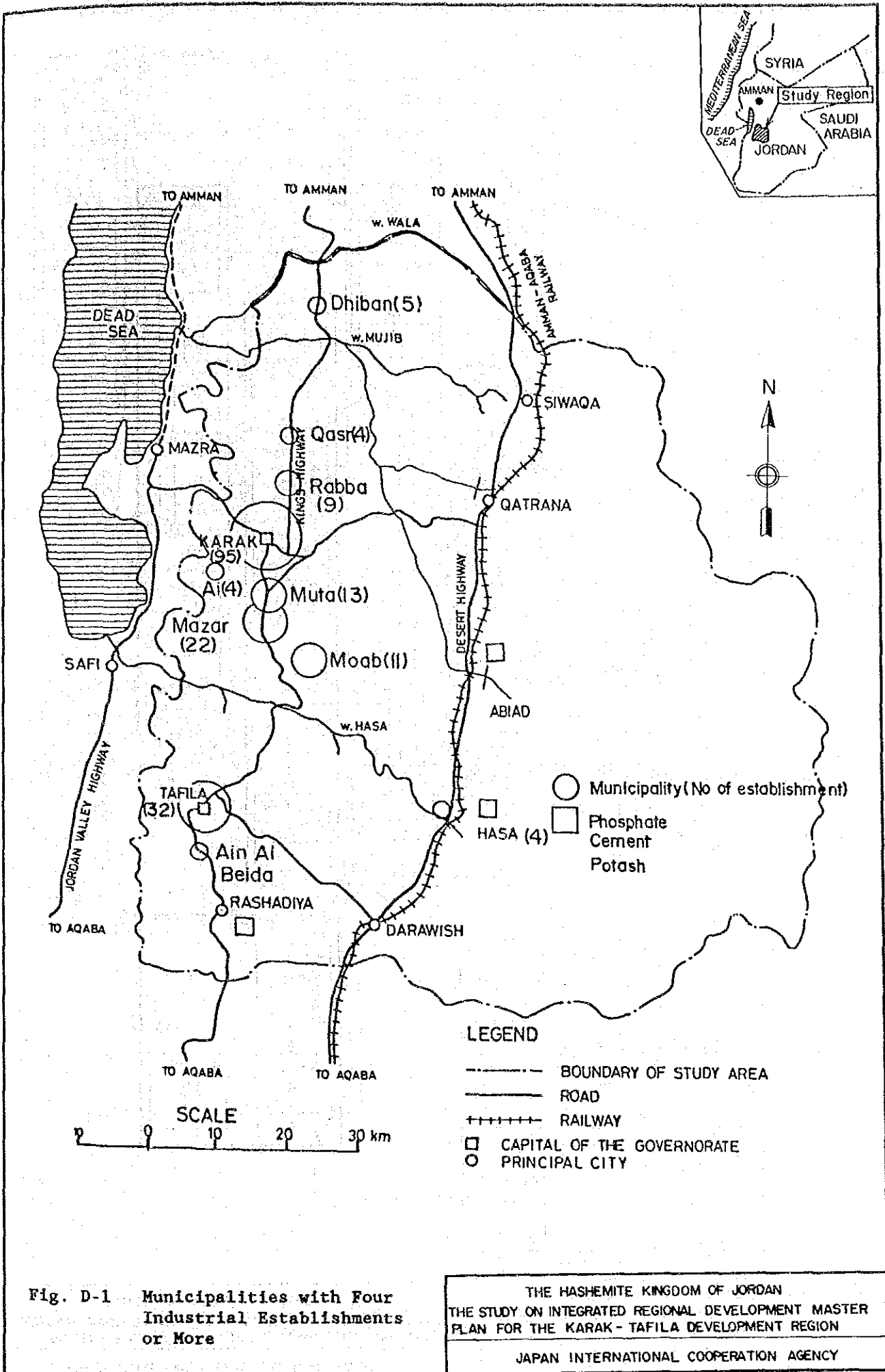
Table D-22 PLANNED TYPES OF INDUSTRIES OF MU'TAH INDUSTRIAL ESTATE

Features/ Types of industries (Examples)	Utilization of local resources	School University related	Local Market	Domestic/ Import Sub- stitution	Export Promotion
Car repair & maintenance *			x		
Furniture *			x		
Metalworks *			x		
Agro-products (biscuits, dry products)	x		x	x	x
Construction related industries (cement, lime, plaster products)			x		
Wearing apparel (uniforms, caps underwear, shoes)		x	x	x	x
Sporting goods		x	x	x	x
School and univer- sity equipment (professional, scientific, measuring, controlling equipment)		x	x	x	x
Paper products printing & allied industries (binding, ink, paperboard)		x	x	x	x
Assembly of electric/ electronic machinery		x	x	x	x
Software and information technology		x	x	x	x
Research, development & commercialization (joint efforts with Mu'tah Univ.)		x	x	x	x

\* Coordination with municipalities industrial zones is needed.  
Source: The Study Team

**FIGURES**





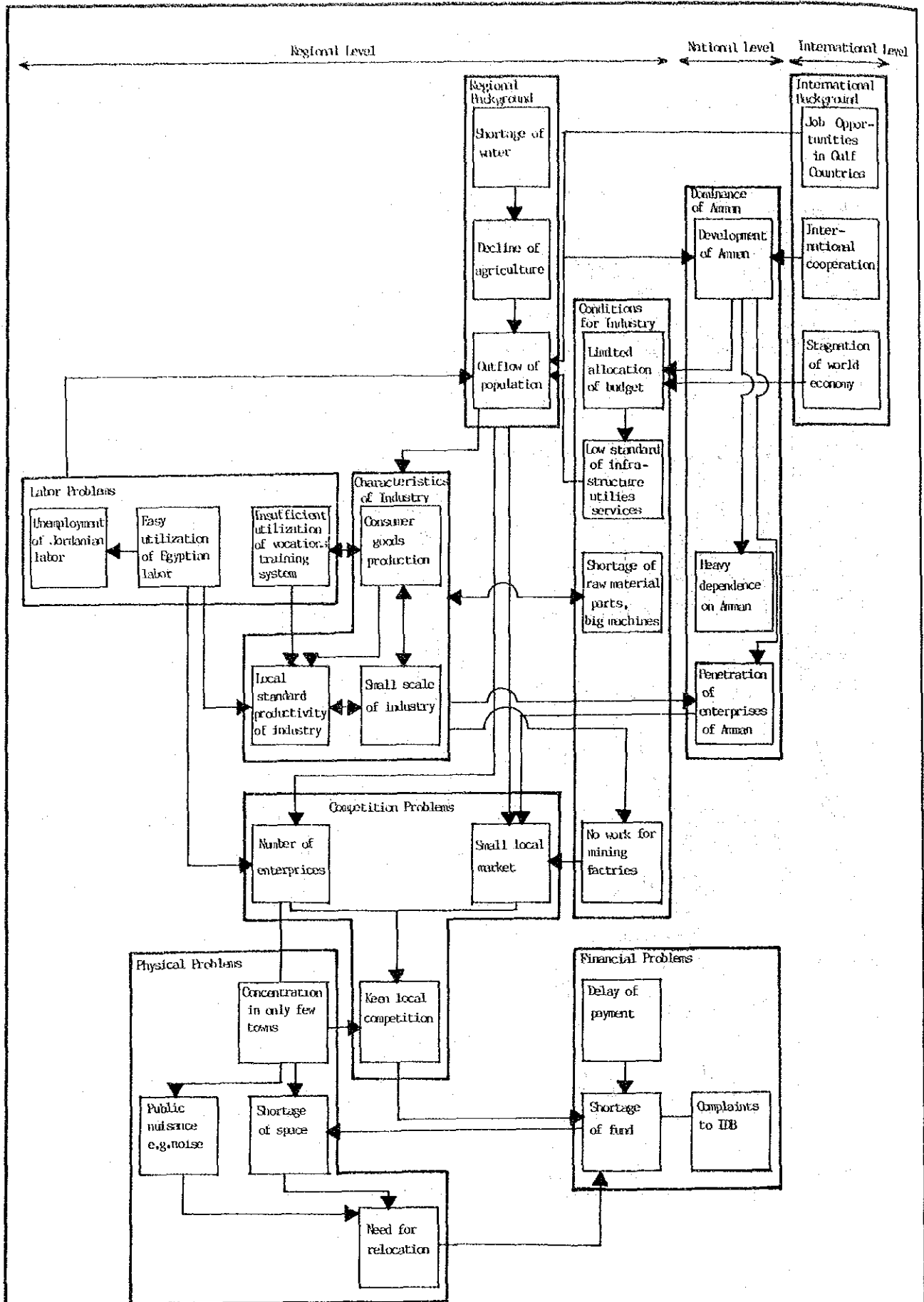


Fig. D-2 Problem Structure of Small and Medium Scale Industries in the Study Area

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

JAPAN INTERNATIONAL COOPERATION AGENCY

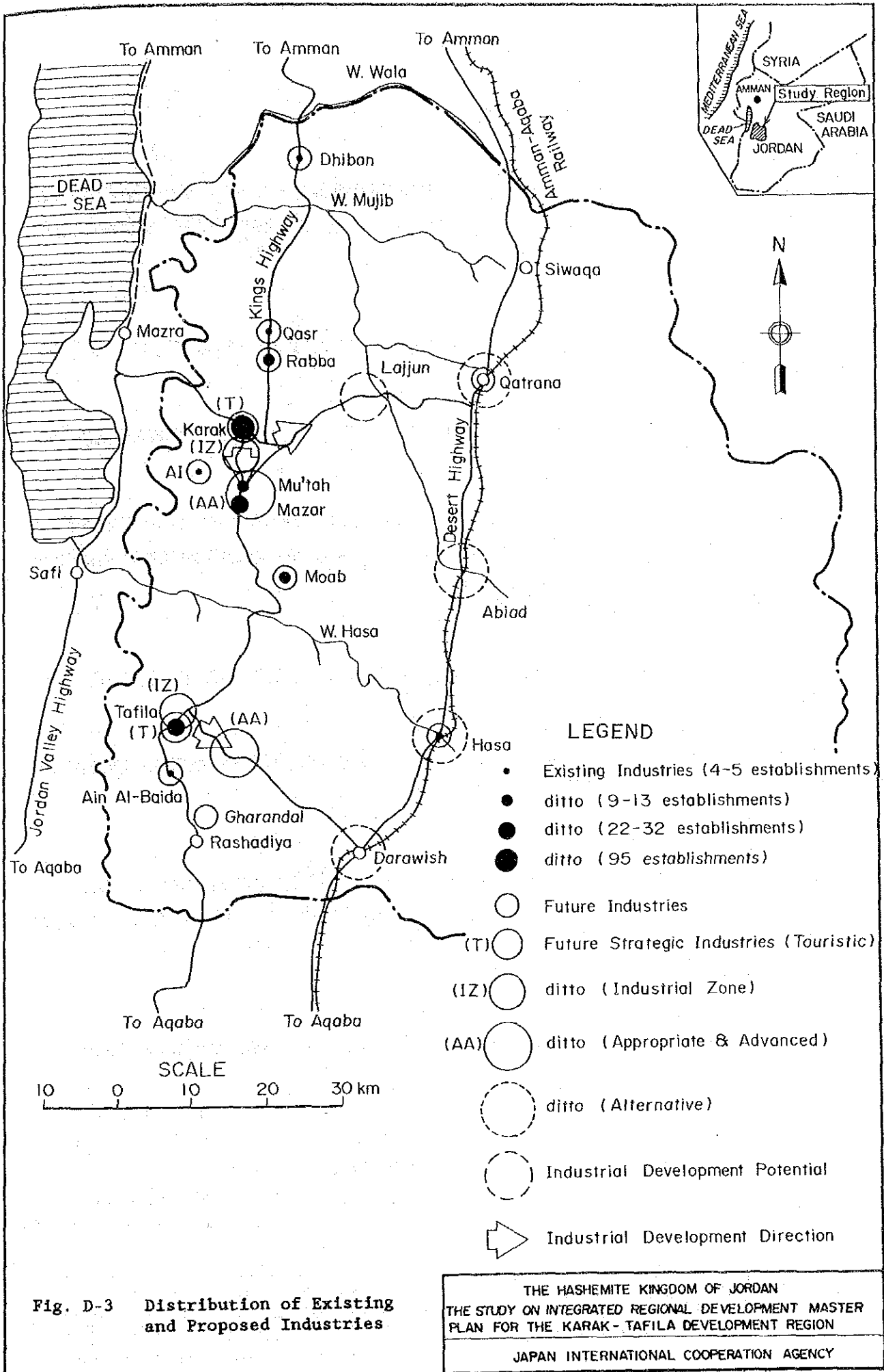


Fig. D-3 Distribution of Existing and Proposed Industries



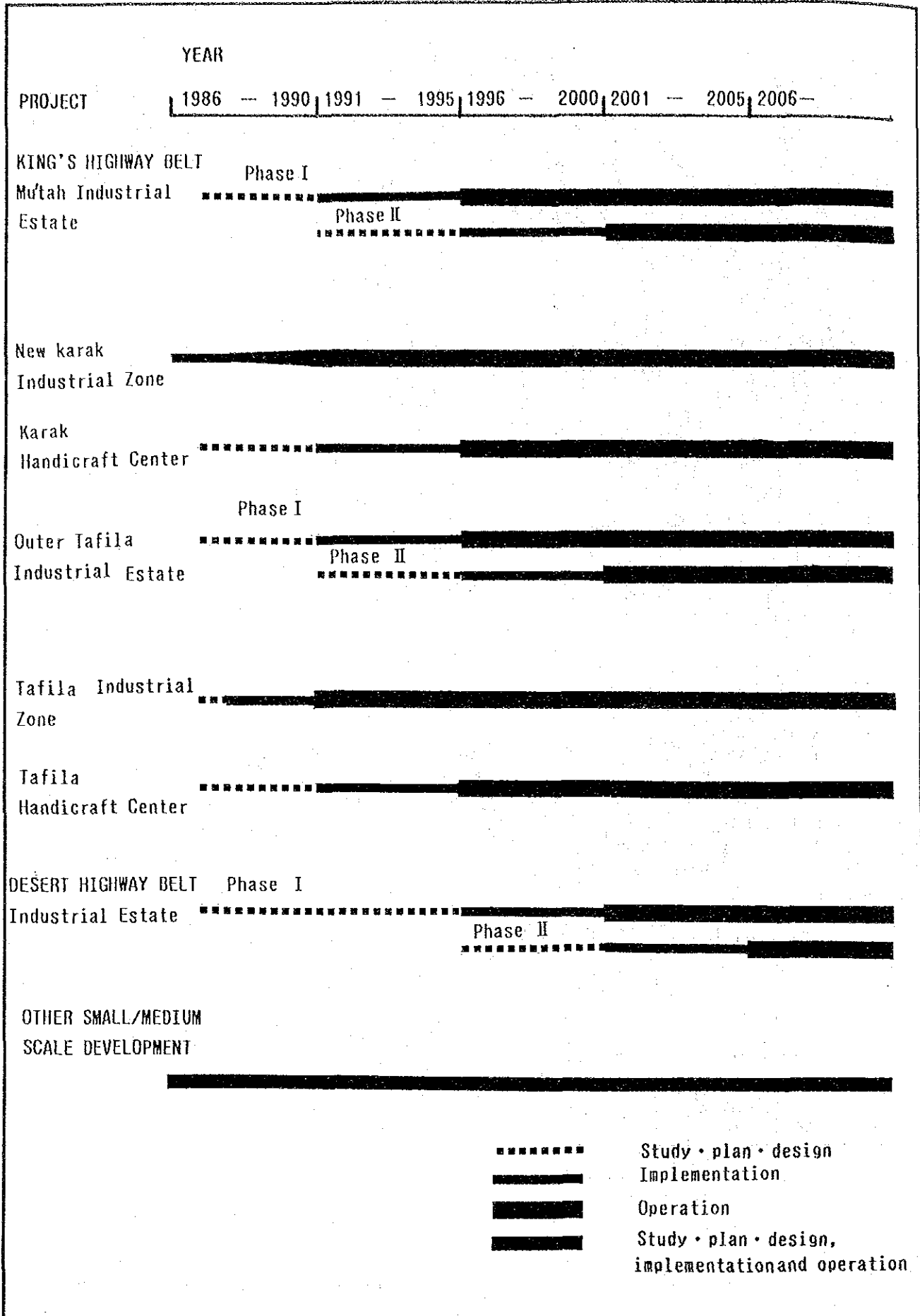


Fig. D-4 Proposed Implementation Schedule of Industrial Projects

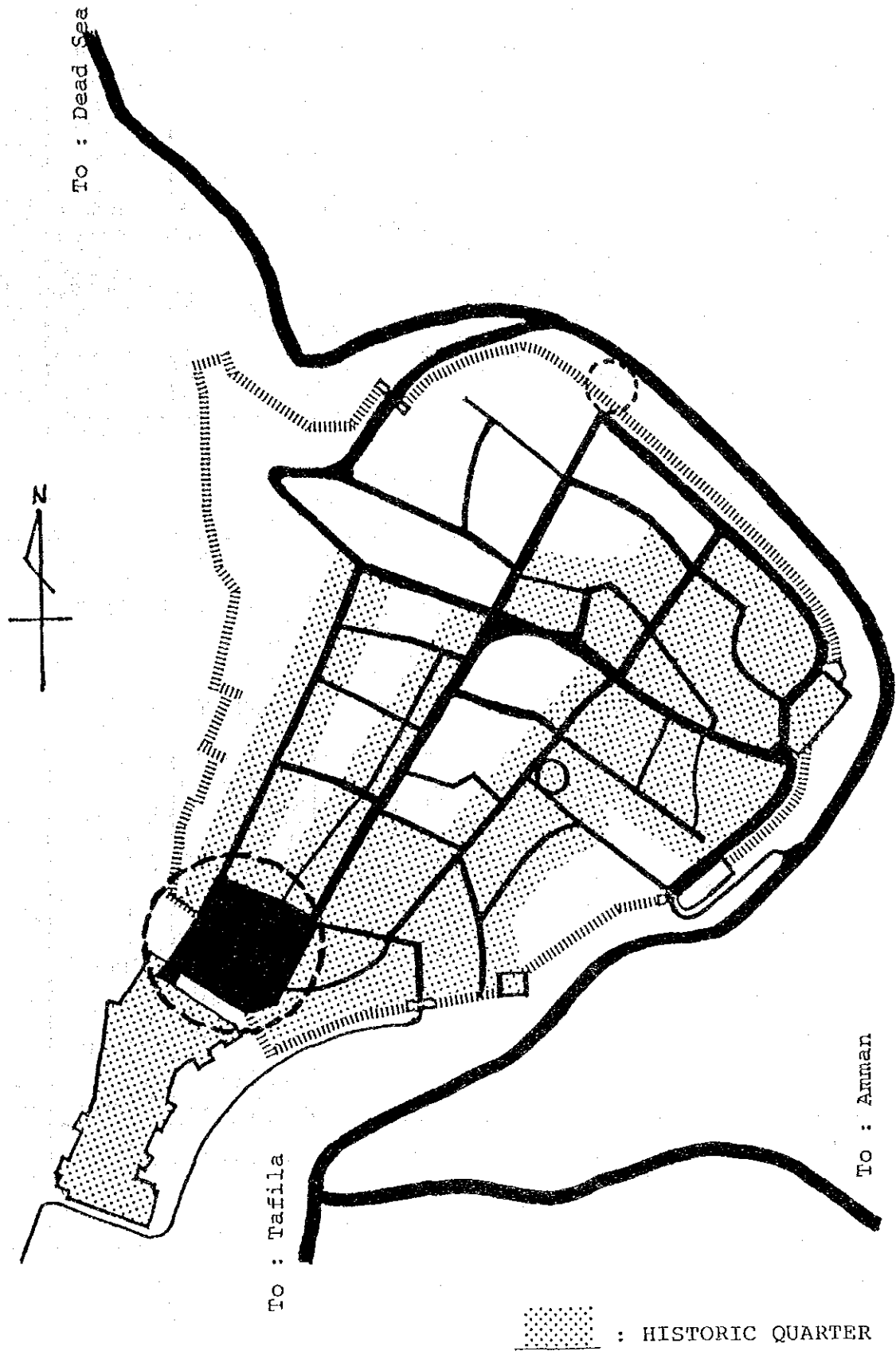


Fig. D-5 Candidate Sites  
for Karak Handicraft Centre

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

