336 Twenty-three industries are listed in Table 3.19 according to the International Standard of Industrial Classification (ISIC) and to the products in each ISIC code. During the screening process in the Prefeasibility Study, it was suggested that some of the proposed industries would have difficulty to be introduced into IIE. For example, glass and glass products (3620) and cement, lime and plaster (3692) were said to be almost infeasible by industrial experts in Jordan. Another example was fertilizers and pesticides (3512). The reason was that expansion plans of these existing industries were set at that time. For instance, Jordan Glass Manufacturing Company built a large scale glass factory with a production capacity of 12,000 to 18,000 tons/year in 1980 and the existing cement factory set a expansion programme to cope with the growing demand for cement.

337 It should be noted, however, that the industries proposed in the Prefeasibility Study of IIE need to be examined at the level of product breakdown in the ISIC code rather than at the level of ISIC code itself. From this point of view, industries such as glass ware, glass products, construction materials made of cement and preparation of pesticides are some of industries which need further examination.

3.4.2 Industries Proposed by the Industrial Programming Study

338 Industrial Programming Study conducted by National Planning Council is aimed at identifying industrial projects which are possibly established in Jordan with particular emphasis on medium to large scale and export-oriented industrial establishments. The entire country of Jordan is covered. This study is different from the Feasibility Study for IIE in important respects. The Feasibility Study is limited in spatial terms to Irbid Municipality and its surrounding areas, and in terms of scale to small and medium scale industries most of which would depend on local market.

339 The Industrial Programming Study proposed 40 priority projects which would be medium or large in scale. Besides, 11 other small scale projects have been identified as possible projects as shown in Table 3.20. Among these 51 projectes, more than half (31 projects) have been included in the list of industries selected in the Prefeasibility Study for IIE as shown in Table 3.21. The Prefeasibility Study recommended 23 kinds of industries, six of which were deleted from the list of proposed projects by the Industrial Programming Study. Those deleted industries mainly belong to the food and beverage sector, and most of them depend on local markets. With regards to around 20 projects which were not included in the proposed list of the Prefeasibility Study, 10 of those are chemical industries which are based on domestic resources. These raw material-oriented industries would be impossible to be located in the northern region because the region lacks relevant raw materials. Other ten projects which belong to such kind of industries as made-up textile goods, wearing apparel, printing and publishing, and machinery are worth thorough investigation.

Table 3.19 Industries and Products Proposed by the Prefeasibility Study of IIE

I.S.I.C. Code	Industries	Products
3115	Vegetable Oil, Fruits Oil and Animal Fats	Cooking Oil, Vegetable Oil, Fruits Oil, Soap, Shampoo and Margarine
3117	Backery (Integrated)	Biscuits, Cake, Pastry and Confectionary
3121	Mayonnaise and Icemaking	Mayonnaise, Egg Oil, Egg White and Egg Yolks
3122	Animal Feeds	Animal Feeds
3215	Cardage and Rope	Packaging Rope
3233	Leather Products	Leather Products (Bags and Suits)
3240	Leather Footwear	Footwear, Slippers and Shoes
3311	Sawmill	Sawn Timber and Related Products
3312	Wooden Boxes, Cases, Containers and Cabinets	Wooden Packing Cases, Boxes, Drums, Containers, Cabinets and Trunks
3319	Other Wooden Products	Shoelasts, Agricultural Implements, Fancy Kitchen Utencils, Figurines, Flower Bases, Wooden Shoes, Tool Handles, Fuels and Charcoal
3320	Furniture and Fixtures	Furniture and Parts, Table and Chairs, Bookshelves, Benches, Beds and Room Units
3412	Paper Boxes and Containers	Cartons, Boxes, Cases and Containers
3512	Fertilizer and Pesticides	Inspecticides, Hydrated Lime, Farm Chemicals
3560	Plastic Products	Egg Trays, Boxes, Cases, Containers and Cartons
3610	Pottery, China and Earthenware	Ceramics, Sanitaryware, Tableware, Insulators and Tiles
3620	Glass Products	Glassware, Tableware, Ashtray and Folkcraft
3691	Structural Clay Products	Bricks
3692	Cement, Lime and Plaster	Mixed Concrete, Lime
3699	Non-metallic Mineral Products	Mortar, Plaster, Tiles, Chalks, Immitation Jewelry and Stone Cutting
3811	Cutlery, Hand Tools and General Hardware of Metal	Houseware, Kitchenware, Knives, Cutting Blades, Spoons, Forks and Related Items
3813	Metal Products	Curtain Rail, Fixtures
3819	Fabricated Metal Products	Locks, Padlocks, Tubes, Pipes, Cocks, Taps, Valves, Bolts, Nuts, Nails, Springs, Angles, Shapes, Cartons and Fixtures
3822	Agricultural Machinery	Engines, Pumps, Generators, Pipes, Portable Sprayers, Sprinklers, Valves, Nozzles, Cultivators, Tractors and Weeders

Source: The Prefeasibility Study Report of IIE by JICA.

Table 3.20 Industries Proposed by the Industrial Programming Study of Jordan

Code	Medium or Large Scale Industries
1	Garments
2	Kitchen, Office and School Furniture
3	Living and Bedroom Furniture
4	Printing Plant
5	Packaging Plant
6	Wallpaper Plant
7	Sodium Tri-polyphosphate, Sodium Phosphate and Potassium Phosphate
8	Sodium Phosphate
9	Potassium Silicate
10	Nitric Acid, Ammonium Nitrate and Compound Fertilizer
11	Carboxy-methyl Cellulose
12	Aspirin, Acetic Acid and Paracetamol
13	PVC Tiles
14	Plastic Furniture, Sanitary and Kitchenware
15	Travel Goods
16	PVC Leather Cloth
17	Tableware
18	Concrete Spun Pipes
19	Foundry for Pumps and Valves
20	Drills
21	Hand Tools
22	Saw Manufacture
23	Pumps and Valves (Machining and Assembly)
24	Locks, Keys and Window Fittings
25	Wire Cables
26	Hinges
27	Nuts and Bolts
28	Sheet Metal Plant/Press Shop
29	Welding Electrodes
30	Steel Fabrication
31	Tool and Die Manufacturing
32	Die Casting
33	Non-ferrous Foundry
34	Spades, Hoes, etc.
35	Welding Machines
36	Electric Motors
37	Electric Transformers/Current Stabilizers
38	Vehicle Trailers
39	Machine Tools
40	Room Fans

Code	Small Scale Industries
a	Granite
b	Clays
c	Barium Sulphate
d	Potassium Hydroxide
e	Metal Chlorides
f	Putty, Mastics and Alhensives
g	Bituminous Paints
h	Plating
i	Cement Mixture
j	Water Meters
k	Compressors

Source: Industrial Programming Study and Project Identification by NPC and Dar. Al-Handasah Consultants.

Table 3.21 Comparison of Industries Proposed by the Prefeasibility Study of IIE and Industrial Programming Study

Industries Proposed by the Prefeasibility Study of IIE[1/]

Industries Proposed by the Industrial Programming Study[2/]	3115 *	3117 *	3121 *	3122 *	3215	3233	3240 *	3311 *	3312	3319	3320	3412	3512	3560	3610	3620	3691	3692	3699	3811	3813	3819	3822
* 1											0												
2											0												
3																							
* 4																							
5					0				0			0											
* 6																							
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10																							
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27																					0	0	
28																							
29																				0	0	0	0
30																				0	0	0	0
31																				0	0	0	0
32																							
* 33																							0
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f																	0						
* g																					0		
h																		0					
i																							
* j																							
* k																							

Source: Study Team.

Notes: 1/ For industries, refer to the ISIC code in Table 3.20.
2/ For industries, refer to the code in Table 3.21.
3/ 0 indicates an industry overlapping in both studies.
4/ * indicates an industry not overlapping.

340 Among these proposed industries, followings are added to a list on Table 3.19 as new candidate industries which will be investigated in section 3.5.

Industries added to the candidate list from Industrial Programming Study

Industry Code in Table 3.20	Industries
1	Garments (Made-up textile goods, Wearing apparel)
4	Printing and Publishing
14	Plastic Furniture, Sanitary and Kitchenware
18	Concrete Spun Pipes
32	Die Casting
40	Room Funs
j	Water meters
k	Compressors

3.4.3 Industries Proposed by the Master Plan of Amman Industrial Estate

341 The Amman Industrial Estate (AIE) at Sahab is now under construction by the Jordan Industrial Estate Corporation. For the development of AIE, 115 candidates industries and products were proposed as shown in Table 3.22. Among these, 32 products are covered by the list of industries proposed in the Prefeasibility Study of IIE.

342 In the list of products proposed for AIE, there are many products whidh are dependent on local market and possibly located in IIE. Among these, followings are added to a list on Table 3.19 as new candidate industries which will be further investigated in section 3.5.

1. Printing and publishing for local use
2. Heat boilers
3. Aluminium extrusion
4. Die casting for brassware fittings and for builder's hardware
5. Oil and gas barners
6. Central heating equipment
7. Building accessories (scaffolding, hoists, winch, and wheelbarrows)

8. Gas welding, cutting torches and regulators
9. Automotive parts and components
10. Bus and truck bodies
11. Air compressors
12. Switchboards and switchgears
13. Electric funs
14. Thermoforming of plastics (advertisement signs, decorative ceiling and wall panel and lamp diffuses)
15. Fibreglass moulding (roofings, tank panels, moulded seets and portable houses)
16. PVC hoses
17. Poultly processing
18. Fibro-cement sheets and pipes
19. Garments
20. Camping equipments (tents)
21. Helmets of metal and plastics

Table 3.22 Industries Proposed for Amman Industrial Estate

Type of Industry	Products[1/]
Printing and Publishing	Publications of educational(o), reference texts and children's books; High quality multicolour printing and packaging materials(*); Magazines, cartons(*), brochures and calendars; Printing of security documents
Educational Equipments Metal and Metal Transforming	Teaching aids(*); School laboratory equipment; Steel frame building system and components(*); Light gauge sections for construction industries(*); Irrigation system and equipment(*); Containers(*); Steel furniture and cabinets(*); Window louvers and doors; Pipes and fittings; Heat exchangers and boilers(o); Kitchen equipment(*); Refrigeration cabinets(*); Aluminium extrusion(o); Die casting for builder's hardware(o); Electroforming and plating; Tool and dies(*); Link chairs and wire mesh(*); Upholstery coil springs and mattress(*); Oil and gas barners(o); Central heating equipment(o); Building accessories(o) (scaffolding, hoists, winch, wheelbarrows, vibrator and concrete mixer); High quality locks(*); Gas welding,

Table 3.22 (cont'd)

Type of Industry	Products[1/]
Educational Equipments	cutting torches and regulators(o);
Metal and Metal Transforming	Agricultural implements and machinery(*); Automotive parts and components(o); Metal fabrication for industrial plants; Bus and truck bodies(o); Fork lifts; Typewriters and other office machines; Air compressors(o); Sheet metal working machines; Gravity-casting for brassware fittings
Electric Industries	Electric wires, cables and telephone cables; Circuit breakers; Switchboards and switch gears(o); Electric motors; Electric irons; Heaters; Hair dryers; Electric funs(o); Washing machines; Electric kettles and hot plates; Electric brankets
Electronic Industries	Radios and televisions; Digital clock and timers; Cassettes; Sound equipments; Electronic watches; Electronic calculators; Liquid crystal; Light emitting diode; Computer peripherals; Computer terminals; Electronic cash registers; Electronic musical instruments; Electronic detecting equipment; Medical electronics; Micro processor; Integrated circuits; Micro computers; Telephone PABX and exchange equipments
Plastic Industries	Injection molding (high quality household wares)(*); Injection molding (industrial and engineering parts)(*); Extrusion (polyethylene film, wire coating, tubing, sheetings and filaments)(*); Compression molding (melamine tablewares, electrical accessories)(*); Blow moulding (PVC products and polyethylene bottles)(*); Calendering (leather cloth, laminated sheets); Thermoforming (cash acrylic sheets, advertisement signs, decorative ceiling and wall panel and lamp diffusers)(o); Expanded polystyrene products; Polyurethane foam products(*); Fibreglass moulding (roofings, tank panels, moulded seats, portable houses)(o); Plastic for building industries (piping, plumbing, insulation and ducting)(*); PVC flexible hoses, duct hoses, braided hoses(o)

Table 3.22 (cont'd)

Type of Industry	Products[1/]
Food and Pharmaceutical Industries	Confectionary(*); Glucose; Convenience food and frozen foods; Poultry processing and freezing(o); Animal feed(*); High quality biscuits(*); Vitamins, antacides, analgesics, cough and cold medicaments, sterile injectables; Antibiotics; Vaccine manufacturing; Disposable hypodermic needles, syringes and other related products
Non-Metallic Mineral Products	Glass fibres and glass wool for insulation use; Fibro-cement sheets and pipes(o); Sandlime bricks(*); China wares manufacture(*); Pottery products and garden decorations(*)
Woodworking Industries	High quality furniture and carpentry(*); Panel furniture for kitchen and bedroom applications(*); Windows and door frames(*)
Toy Industries	Toys; Games
Textile and Garment	Garments(o); Travel bags and suitcases(*)
Aircraft Services	Maintenance, overhaul and repair of aircrafts; Avionics
Chemical Industries	Printing inks; Industrial gas; PVC; High quality paints, varnishes and lacquers; Fire extinguishers
Defence Industries	Barked wire; Camping equipment (tents, spades)(o); Helmets(o); Gunsight (optical); Communication equipment (radio receivers and transmitters); Night viewing devices; Laser equipment; Investment casting; Army rations

Source: Master Plan and Preliminary Engineering Study of Amman Industrial Estate and the Study Team

Note: o within parentheses indicates a product covered by the Prefeasibility Study of IIE and * within parentheses indicates a product newly included in this Study.

343 Industrial Development Bank also undertook a survey of small scale factories in Amman and Zarqa region, asking whether they were willing to move into AIE. There were 47 factories which answered "yes" as compiled in Annex 3.4. Industrial composition of these 47 factories is summarized in Table 3.23. In terms of floor area demanded, the largest share of 37.9 percent was occupied by metal works followed by construction materials and auto-repairing of 16.7 percent respectively. It should be noted that the result of IDB's survey is quite similar to that of Factory Interview Surveys conducted by the Study Team.

Table 3.23 Industrial Composition Derived from the Survey Conducted by IDB

Types of Industry	Number of Factories		Floor Area Demanded (m^2)	
1. Metal Works	15	(31.9%)	8,850	(37.9%)
2. Furniture and Room Units	5	(10.7%)	2,360	(10.1%)
3. Food and Beverages	3	(6.4%)	1,850	(7.9%)
4. Garments and Clothes	1	(2.2%)	400	(1.7%)
5. Plastics and Chemicals	3	(6.3%)	1,450	(6.2%)
6. Construction Materials	2	(4.3%)	3,900	(16.8%)
7. Auto-repairing Shops	16	(34.0%)	3,906	(16.8%)
8. Trading	2	(4.2%)	610	(2.6%)
9. Paper and Paper Products	-		-	
Total	47	(100.0%)	23,326	(100.0%)

Source: Annex 3.4.

3.5 Industries to be Developed in IIE

3.5.1 Comprehensive List of Industries for Screening

344 Based on the review of industries proposed in various previous studies including the Prefeasibility Study of IIE, a comprehensive list of candidate industries and products for screening was compiled as shown in Table 3.24. This list includes 107 products and the Japanese Standard of Industrial Classification (JSIC) was introduced in addition to ISIC code. Since there are aboundant data of industrial activity which are classified by JSIC code, it could be utilized to identify a standard size of production and to indicate adaptability of industries to small and medium market.

Table 3.24 A List of Candidate Industries for Screening

Product Code	Candidate Products	I.S.I.C. Code	J.S.I.C. Code
001	Poultry	3111	1819
002	Organic Fertilizer	3115	1893
003	Vegetable Oil	"	1911
004	Fruits Oil	"	"
005	Cooking Oil	"	1913
006	Margarine	"	"
007	Cake	3117	1872
008	Pastry	"	"
009	Biscuits	"	1873
010	Confectionary	"	1879
011	Seasonings	3121	1844
012	Eggs and by-products	"	1849
013	Animal feed	3122	189
014	Canvas (tents and covers)	3212	2193
015	Textile bags	"	2194
016	Packaging rope	3215	2071
017	Work, sports and sanitary clothing	3220	2113
018	School uniform	"	2114
019	Skirts	"	2122
020	Suits (made of leather)	3233	2159
021	Footwear (made of leather)	"	2941
022	Bags (made of leather)	"	2961
023	Structural wood products	3311	2221
024	Packaging cases (wooden)	3312	2233
025	Drums and barrels (wooden)	"	"
026	Shoelasts, wooden shoes	3319	2292
027	Agricultural implements and tool handles	"	2299
028	Fancy kitchen utencils and figurines	"	"

Table 3.24 (cont'd)

Product Code	Candidate Products	I.S.I.C. Code	J.S.I.C. Code
029	Fuels and charcoal (waste of wood)	3319	2299
030	Boxes and cabinets	3320	2311
031	Tables, chairs, benches for school	"	"
032	Bookshelves	"	"
033	Beds and bedrooms	"	"
034	Office and store fixtures	"	"
035	Kitchen units (made of wood)	"	"
036	Doors and windows	"	2331
037	Plastic furniture	"	2399
038	Cartons (made of paper)	3412	2453
039	Boxes and cases (made of paper)	"	"
040	Containers (made of paper)	"	"
041	Calendering (laminated sheet)	3419	2431
042	Publishing (educational texts)	3420	2521
043	Printing (for local use)	"	2531
044	Compounded fertilizers	3512	2612
045	Soap	3523	2652
046	Shampoo	"	2695
047	PVC tubes, pipes, hoses and tiles	3560	3961
048	Industrial and engineering parts	"	3965
049	Boxes containers and cartons (plastics)	"	3969
050	Thermoforming of plastics	"	"
051	Travel goods and sports goods	"	"
052	Sanitary ware (pottary)	3610	3041
053	Table and kitchenware (pottary)	"	3042
054	Insulators	"	3044
055	Tableware and kitchenware (made of glass)	3620	3016
056	Fibre glass moulding	"	3017
057	Glass fibre products	"	"
058	Ashtray and accessories	"	3019
059	Tiles (made of clay)	3691	3046
060	Mixed concrete (and its products)	3692	3022
061	Fibro-cement sheet and pipes	"	"
062	Concrete piles and pipes	3699	3023
063	Mortar and plaster	"	3029
064	Tiles (concrete products)	"	"
065	Structural bricks and accessories	"	3083
066	Chalks	"	3099
067	Stone cutting and shaping	"	"
068	Foundry	"	3171
069	Houseware and kitchenware (made of metal)	3811	3321
070	Knives, forks and spoons	"	"
071	Cutting brades	"	3322
072	Hand tools	"	3327
073	Locks and padlocks	"	3329
074	Metal furniture	3812	2312
075	Scaffoldings (for construction works)	3813	3341

Table 3.24 (cont'd)

Product Code	Candidate Products	I.S.I.C. Code	J.S.I.C. Code
076	Curtain rail and architectural metal products	3813	3342
077	Tubes and pipes (made of metal)	3813	3343
078	Angles and shapes (made of metal)	"	"
079	Cartons, tanks, containers and cabinets (of metal)	"	"
080	Wire meshes	"	3369
081	Boilers	"	3411
082	Cocks and taps (water system)	3819	3331
083	Equipment for solar heating	"	"
084	Oil and gas barners, hot plates and ovens	"	3339
085	Press shops	"	3352
086	Die casting and gravity casting	"	3359
087	Die manufacturing and hand tools	"	"
088	Nails and springs	"	3361
089	Bolts, nuts and screws	"	3371
090	Casting of brassware fittings	"	"
091	Helmets	"	3399
092	Valves	"	3492
093	Irrigation system and equipment*	3822	3421
094	Portable sprayers	"	"
095	Weeders	"	"
096	Water motors	3825	3712
097	Compressors	3829	3472
098	Hoists	"	3474
099	Airconditioning equipment	"	3484
100	Machine shop (parts and repairing)	"	3499
101	Electric fans	3833	3521
102	Switchboards and switchgears	3839	3514
103	Truck bodies	3843	3612
104	Motor vehicle parts	"	3613
105	Bicycles and its parts	3844	3631
106	Pumps and equipments	3851	3471
107	Childrens vehicles	3909	3933

Source: Study Team.

Note: * Pumps, Sprinklers, Valves, Nozzles, and Pipes

3.5.2 The Criteria for Screening Industries

345 Examination of industries and products listed in Table 3.24 was carried out against four criteria such as adequate technology, market demand, availability of materials and linkage to domestic and local industries. These four criteria are explained below;

i) Adequate Technology

Advanced technology does usually require a large scale economy which depends on the size of market. Such type of industries will be difficult to be developed in Jordan because of small size of its market. On the other hand, some kind of industries are competitive in a small and medium size of production. They can be operated efficiently and sufficient profits can be obtained. Such type of industries are called as "intermediate technology oriented". Therefore, intermediate technology oriented industries are put high priority in the screening process.

ii) Market Demand

In the previous chapter, market demand of selected industries has been evaluated in terms of domestic and foreign market. It should be an important factor for screening out possible industries. In addition, a market evaluation in the "Industrial Programming Study (Interim Report, Task 2.2)" is also used for screening out industries for which demand projections were not made in Chapter II.

iii) Availability of Materials

Availability of materials is basically classified as "local", "domestic" and "foreign". Every product requires several materials, and it is difficult to evaluate exactly the availability of materials. At the general screening stage, the most important material alone shall be considered.

iv) Linkage to Domestic and Local Industries

One of major objectives of industrialization is to promote the efficient integration of industrial structure at the national and regional level. Therefore, the degree of linkage to existing or planned industries is a major factor for screening out possible industries.

These four major factors shall be extensively used for the general screening of industries.

3.5.3 Screening of Candidate Industries

a. Evaluation of Intermediate Technology Oriented Industries

346 In order to identify intermediate technology oriented industries, the standard size of industries and the index of productivity are used. Since it is hard to obtain these data for each candidate industries in Jordan, statistics available in Japan ought to be applied. For this purpose, candidate products are classified into JSIC code, and thereafter the average number of employee per establishmenet and value added by one employee (data by Industry Census of Japan in 1977) are employed for evaluation;

E/N = Average Number of Employee per Establishment
V/E = Productivity

where E = Number of Employee
N = Number of Establishment
V = Value Added

347 Average number of employee per establishment (E/N) and productivity (V/E) were computed for each industry by using the data of establishment of more than 30 employees and shown in Table 3.25. The average value of [E/N] for 80 candidate industries in Table 3.25 is 102 and standard deviation is 57, while the average value of [V/E] is 561.50 and standard deviation is 361.22. Therefore, 80 industries were divided into five categories, and each industry was assigned a weight according to the values of [E/N] and [V/E] as shown below.

Category	Range in the Value of E/N	Weight	No. of Industry
1	less than 70	(+2)	22
2	more than 70 and less than 100	(+1)	27
3	more than 100 and less than 130	(0)	13
4	more than 130 and less than 160	(-1)	9
5	more than 160	(-2)	9

Category	Range in the Value of V/E	Weight	No. of Industry
1	more than 600	(+2)	19
2	more than 500 and less than 600	(+1)	18
3	more than 400 and less than 500	(0)	23
4	more than 300 and less than 400	(-1)	11
5	less than 300	(-2)	9

348 Intermediate technology oriented industries could be evaluated by an combined score of [E/N] and [V/E]. Industries which possess a score below zero (0) should be eliminated from further evaluation. These eliminated industries at this stage are 12 out of 80. Remaining 68 industries which include 95 products are further evaluated against the criterion of marked demand.

Table 3.25 Data for Evaluation of Intermediate Technology

I.S.I.C. Code	(J.S.I.C.) Code	Product Code	No. of Employee per Establishment (E/N)	Value Added by One Employee (10,000 Yen/Employee) (V/E)
3111	(1819)	01	84	274.68
3115	(1893)	02	37	253.64
	(1911)	03, 04	126	2,013.45
	(1913)	05, 06	185	877.97
3117	(1872)	07, 08	86	431.12
	(1873)	09	128	562.21
	(1879)	10	127	769.68
3121	(1844)	11	140	1,442.10
	(1849)	12	106	949.31
3122	(189)	13	64	1,195.74
3212	(2193)	14	60	307.28
	(2194)	15	61	187.57
3215	(2071)	16	65	413.14
3220	(2113)	17	62	247.73
	(2114)	18	83	407.06
	(2122)	19	74	200.38
3233	(2159)	20	75	187.64
	(2941)	21	90	395.77
	(2961)	22	55	342.86
3311	(2221)	23	67	424.71
3312	(2233)	24, 25	54	328.75
3319	(2292)	26	49	407.55
	(2299)	27 - 29	56	266.57
3320	(2311)	30 - 35	74	361.74
	(2331)	36	51	352.71
	(2399)	37	52	425.34
3412	(2453)	38 - 40	65	508.36
3419	(2431)	41	102	624.64
3420	(2521)	42	123	1,533.16
	(2531)	43	79	501.46

Table 3.25 (cont'd)

I.S.I.C. Code	(J.S.I.C.) Code	Product Code	No. of Employee for One Establishment	Value Added by One Employee (10,000 Yen/employee)
3512	(2612)	44	119	932.52
3523	(2652)	45	167	1,253.77
	(2695)	46	156	2,341.29
3560	(3961)	47	186	629.11
	(3965)	48	82	467.51
	(3969)	49 - 51	82	512.75
3610	(3041)	52	172	687.64
	(3042)	53	102	355.65
	(3044)	54	210	401.04
3620	(3016)	55	89	501.09
	(3017)	56, 57	148	638.41
	(3019)	58	65	332.54
3691	(3046)	59	109	387.08
3692	(3022)	60, 61	43	479.42
3699	(3023)	62	65	421.70
	(3029)	63, 64	76	504.76
	(3083)	65	68	418.05
	(3099)	66, 67	78	516.79
	(3171)	68	76	453.19
3811	(3321)	69, 70	63	526.47
	(3322)	71	88	551.14
	(3327)	72	51	225.35
	(3329)	73	82	495.43
3812	(2312)	74	101	588.47
3813	(3341)	75	98	612.74
	(3342)	76	81	547.00
	(3343)	77 - 79	70	463.81
	(3369)	80	63	547.77
	(3411)	81	421	547.99
3819	(3331)	82, 83	85	491.95
	(3339)	84	71	484.28
	(3352)	85	64	412.36
	(3359)	86, 87	63	385.36
	(3361)	88	134	152.32
	(3371)	89, 90	84	527.71
	(3399)	91	81	436.54
	(3392)	92	95	531.59
3822	(3421)	93 - 95	140	735.47
3825	(3721)	96	106	438.26
3829	(3472)	97	139	464.84
	(3474)	98	134	625.78
	(3484)	99	148	481.90
	(3499)	100	70	558.36
3833	(3521)	101	178	728.12
3839	(3514)	102	102	432.20

Table 3.25 (cont'd)

I.S.I.C. Code	(J.S.I.C.) Code	Product Code	No. of Employee for One Establishment	Value Added by One Employee (10,000 Yen/employee)
3843	(3612)	103	280	468.79
	(3613)	104	180	502.87
3844	(3631)	105	100	569.45
3851	(3471)	106	153	624.33
3909	(3933)	107	70	332.99

Source: Industry Census of Japan.

b. Evaluation of Market Demand

349 In Chapter II, future market demand of 21 industries and four products were projected and the result indicated that the annual average growth rate of these industries and products will be 21.5 percent in volume term. The market potentials of these industries and products were broken down into five categories and a weight was put on each industry according to the projected annual growth rate as below.

Category	Projected Growth Rate	Weight
1	more than 25 percent	+2
2	more than 20 percent less than 25 percent	+1
3	more than 15 percent less than 20 percent	0
4	more than 10 percent less than 15 percent	-1
5	less than 10 percent	-2

350 For industries which were not covered by the demand projection in Chapter II, market data given by the Industrial Programming Study (Interim Report, Task 2.2) were employed to evaluate market potentials. The Study contains the data on the total volume of imports of 22 neighboring countries including Jordan[1/] from the rest of the world and the share of imports from within these 22 countries to the rest of the world. These data are available for 123 products. As to the total volume of imports, 101 out of 123 products recorded less than 100,000 tons per year during 1975 and 1978. Therefore, industries were divided into five categories according to the absolute volume of imports which seems to reflect one aspect of market demand.

1/ These 22 countries are; Jordan, Baharain, Iraq, Kuwait, Lebanon, Oman, Qatar, Saudi A., Syria, USE, Algeria, Egypt, Libya, Morocco, Sudan, Yamen A.R., India, Iran, Kenya, Pakistan, Somalia and Turkey.

Category	Annual Volume of Imports
1	more than 100,000 tonnes
2	more than 40,000 tonnes and less than 100,000 tonnes
3	more than 10,000 tonnes and less than 40,000 tonnes
4	more than 2,000 tonnes and less than 10,000 tonnes
5	less than 2,000 tonnes

The shares of imports were also divided into three categories. The less the share of imports, the more the market potential within 22 countries by import substitution or, in general, industrialization.

Category	Share of Imports
a	less than 10 percent
b	more than 10 and less than 40 percent
c	more than 40 percent

Therefore, these two criteria were combined and weights for evaluating market potential were determined as follows;

Weight for Evaluation of Market Potential

Category	Share of Import a	b	c
Annual Volume of Imports			
1	+3	+2	+1
2	+2	+1	0
3	+1	0	-1
4	0	-1	-2
5	-1	-2	-3

c. Evaluation of Availability of Materials

351 It is a hard task to identify the availability of every raw materials for each industry within the limited time and resources at hand. However, a major item for each industry could be idnetified by its origin where it is supplied. Therefore, three categories were used to evaluate the availability of materials, i.e., local origin, domestic origin and foreign origin. Weights were assigned as follwos;

Category	Origin	Weight
1	Local Origin	+2
2	Domestic Origin	+1
3	Foreign Origin	0

d. Evaluation of Linkage Effects

352 For the promotion of industries, especially, pioneering industries, linkage effects to the existing and/or potential industries are one of the most important criteria among others. The stronger the

linkage effects to other industries, the more the stimuli for the national economy. In order to evaluate the degree of linkage effects, industries were divided into four groups, i.e., agricutlure related industries, manufacturing related industries, construction and public works related industries and distribution related industries including trading.

353 Since agricultural sector is the most important sector in the northern region of Jordan, industries related to agricultural sector could be evaluated highly from the point of view of regional development. Second priority could be put on industries related to manufacturing sector for Jordan needs an intensive effort to develop a modern and stable industrial structure. In summary, weights for the evaluation of linkage effects were put as follows.

Category	Industry Group	Weight
1	Agriculture	+2
2	Manufacturing	+1
3	Construction and Public Works	0
4	Distribution including Trading	0

e. Results of Screening Industries

354 Four different criteria and weights were assigned on 80 industries including 107 products and summarized in Table 3.26. In Table 3.26, two different methods were applied for accumulating four kinds of weights. In the first method, four kinds of weights were simply accumulated. In the second method, weights on the market demand were doubled, since market demand is the most important factor for establishing industries. As a result, industries were arranged in the order of total score derived by the second method and shown in Table 3.27. Thirty-eight out of 80 industries gain the total score of more than 5 points, while there are 17 industries which gain the score between one and four. Given the result of this general screening, comparative advantage of these candidate industries will be evaluated in the next section.

Table 3.26 Evaluation of Candidate Industries

Industry Code			CRITERIA												
			[I] Intermediate Technology			[II] Market Demand				[III] Material Availability			[IV] Linkage Effects		[V] Total Score	
ISIC	JSIC	Product Code	E/N	V/E	Score [A]	Projected Growth Rate of Demand	Import 1,000 ton	Share of Import	Score [B]	Major Input Material	Origin	Score [C]	Related Industries	Score [D]	Simple A+B+C+D	Market Weighted A+2B+C+D
3111	(1819)	01	1	-2	-1	-	-	-	-	-	-	-	-	-	-	-
3115	(1893)	02	2	-2	0	7.1	-	-	-2	Crops, vegetables and wastes	Local	2	Agriculture	2	2	0
	(1911)	03.04	0	2	2	7.1	-	-	-2	Fruits and vegetables	"	2	"	2	4	2
	(1913)	05.06	-2	2	0	7.1	-	-	-2	Crops, seeds and vegetables	"	2	"	2	2	0
3117	(1872)	07.08	1	0	1	24.5	-	-	1	Flour	"	2	"	2	6	7
	(1873)	09	0	1	1	24.5	-	-	1	"	"	2	"	2	6	7
	(1879)	10	0	2	2	24.5	-	-	1	"	"	2	"	2	7	8
3121	(1844)	11	-1	2	1	-	4	a	0	Fruits and vegetables	"	2	"	2	5	5
	(1849)	12	0	2	2	-	3	b	0	Eggs	"	2	"	2	6	6
3122	(189)	13	2	2	4	6.8	-	-	-2	Crops, vegetables, fruits, bone, wastes	"	2	"	2	6	4
3212	(2193)	14	2	-1	1	-	3	c	1	Coarse yarn	Foreign	0	Distribution	0	0	-1
	(2194)	15	2	-2	0	-	3	b	0	Fabrics	Domestic	1	Manufacturing	1	2	2
3215	(2071)	16	2	0	2	-	3	c	-1	Hemp	Foreign	0	Distribution	0	1	0
3220	(2113)	17	2	-2	0	-	2	b	1	Fabrics	Domestic	1	Manufacturing	1	3	4
	(2114)	18	1	0	1	-	3	b	0	"	"	1	"	1	3	3
	(2122)	19	1	-2	-1	-	-	-	-	-	-	-	-	-	-	-
3233	(2159)	20	1	-2	-1	-	-	-	-	-	-	-	-	-	-	-
	(2941)	21	1	-1	0	21.8	-	-	1	Leather	Domestic	1	Agriculture and Manufacturing	1	3	4
	(2961)	22	2	-1	1	21.8	-	-	1	"	"	1	"	1	4	5
3311	(2221)	23	1	0	1	19.4	-	-	0	Wood	Foreign	0	Construction	0	1	1
3312	(2233)	24.25	2	-1	2	19.4	-	-	0	"	"	0	Agriculture and Distribution	1	2	2
3319	(2292)	26	2	0	2	19.4	-	-	0	"	"	0	"	1	3	3
	(2299)	27~29	2	-2	0	19.4	-	-	0	"	"	0	Agriculture and Construction	2	2	2
3320	(2311)	30~35	1	-1	0	19.8	-	-	0	"	"	0	Construction	0	0	0
	(2331)	36	2	-1	1	19.8	-	-	0	"	"	0	"	0	1	1
	(2399)	37	2	0	2	19.8	-	-	0	Plastics	"	0	"	0	2	2
3412	(2453)	38~40	2	1	3	26.1	-	-	2	Paper and paperboard	Foreign	0	Distribution	0	5	7
3419	(2431)	41	0	2	2	-	1	a	3	"	"	0	Manufacturing	1	6	9
3420	(2521)	42	0	2	2	6.5	-	-	-2	"	"	0	"	1	1	-1
	(2531)	43	1	1	2	6.5	-	-	-2	"	"	0	"	1	1	-1

(cont'd)

Table 3.26 (cont'd)

Industry Code			[I] Intermediate Technology			[II] Market Demand				[III] Material Availability			[IV] Linkage Effects		[V] Total Score	
ISIC	JSIC	Product Code	E/N	V/E	Score [A]	Projected Growth Rate of Demand	Import 1,000 ton	Share of Import	Score [B]	Major Input Material	Origin	Score [C]	Related Industries	Score [D]	Simple A+B+C+D	Market Weighted A+2B+C+D
3512	(2612)	44	0	2	2	5.7	-	-	-2	Chemical and organic fertilizers	Local and Domestic	1	Agriculture	2	3	1
3523	(2652)	45	-2	2	0	-	2	b	1	Fats and oil	Local	2	"	2	5	6
	(2695)	46	1	2	1	-	2	b	1	"	"	2	"	2	6	7
3560	(3961)	47	-2	2	1	41.0	-	-	2	PVC	Foreign	0	Construction	0	3	5
	(3965)	48	1	0	1	41.0	-	-	2	"	"	0	Manufacturing	1	4	6
	(3969)	49~51	1	1	2	41.0	-	-	2	Plastics	"	0	Distribution and Manufacturing	1	5	7
3610	(3041)	52	-2	2	0	34.5	-	-	2	Clay and quortz	Domestic	1	Construction	0	3	5
	(3042)	53	0	-1	-1	-	-	-	-	-	-	-	-	-	-	-
	(3044)	54	2	0	-2	-	-	-	-	-	-	-	-	-	-	-
3620	(3016)	55	1	1	2	24.1	-	-	1	Glass	Domestic	1	Construction	0	4	5
	(3017)	56.57	-1	2	1	24.1	-	-	1	"	"	1	"	0	3	4
	(3019)	58	2	-1	1	24.1	-	-	1	"	"	1	Construction and Manufacturing	1	4	5
3691	(3046)	59	0	-1	-1	-	-	-	-	-	-	-	-	-	-	-
3692	(3022)	60.61	2	0	2	21.4	-	-	1	Cement	Domestic	1	Construction	0	4	5
3699	(3023)	62	2	0	2	5.9	-	-	-2	"	"	1	"	0	1	-1
	(3029)	63.64	1	1	2	5.9	-	-	-2	Cray and cilica	"	1	"	0	1	-1
	(3083)	65	2	0	2	5.9	-	-	-2	Cement	"	1	"	0	1	-1
	(3099)	66.67	1	1	2	5.9	-	-	-2	Carcium carbonate, stones	Domestic and Local	2	Construction and Education	0	2	0
	(3171)	68	1	0	1	5.9	-	-	-2	Pig iron	Foreign	0	Manufacturing	1	0	-2
3811	(3321)	69.70	2	1	3	25.2	-	-	2	Iron, steel and alminium	"	0	Construction	0	5	7
	(3322)	71	1	1	2	25.2	-	-	2	Steel	"	0	Manufacturing	1	5	7
	(3327)	72	2	-2	0	25.2	-	-	2	Iron and steel	Foreign and Domestic	1	Agriculture and Manufacturing	2	5	7
	(3329)	73	1	0	1	25.2	-	-	2	Iron, steel and aluminium	Foreign	0	Construction	0	3	5
3812	(2312)	74	0	1	1	25.2	-	-	2	Steel and aluminium	"	0	"	0	3	5
3813	(3341)	75	1	2	3	25.2	-	-	2	Iron, steel and aluminium	"	0	"	0	5	7
	(3342)	76	1	1	2	25.2	-	-	2	"	"	0	"	0	4	6
	(3343)	77~79	1	0	1	25.2	-	-	2	"	"	0	Construction and Distribution	0	3	5
	(3369)	80	2	1	3	25.2	-	-	2	Iron wire	"	0	Construction	0	5	7
	(3411)	81	-2	1	-1	-	-	-	-	-	-	-	-	-	-	-

Table 3.26 (cont'd)

Industry Code			[I] Intermediate Technology			[II] Market Demand				[III] Material Availability			[IV] Linkage Effects		[V] Total Score	
ISIC	JSIC	Product Code	E/N	V/E	Score [A]	Projected Growth Rate of Demand	Import 1,000 ton	Share of Import	Score [B]	Major Inpute Material	Origin	Score [D]	Related Industries	Score [D]	Simple A+B+C+D	Market Weighted A+2B+C+D
3819	(3331)	82.83	1	0	1	25.2	-	-	2	Iron and steel	Foreign	0	Construction and Public Works	0	3	5
	(3339)	84	1	0	1	25.2	-	-	2	"	"	0	Services	0	3	5
	(3352)	85	2	0	2	25.2	-	-	2	Parts and accessories	Foreign and Domestic	1	Manufacturing	1	7	9
	(3359)	86.87	2	-1	1	25.2	-	-	2	Pig iron	Foreign	0	Construction and Manufacturing	1	4	6
	(3361)	88	-1	-2	-3	-	-	-	-	-	-	-	-	-	-	-
	(3371)	89.90	1	1	2	25.2	-	-	2	Iron steel and metal	Foreign	0	Construction and Manufacturing	1	5	7
	(3399)	91	1	0	1	25.2	-	-	2	"	"	0	Construction and Services	0	3	5
	(3392)	92	1	1	2	15.2	-	-	2	"	"	0	Construction	0	4	6
3822	(3421)	93~95	-1	2	1	28.7	-	-	2	"	"	0	Agriculture	2	5	7
3825	(3721)	96	0	0	0	-	3	a	1	"	"	0	Construction and Public Works	0	1	2
3829	(3472)	97	-1	0	-1	-	-	-	-	-	-	-	-	-	-	-
	(3474)	98	-1	2	1	-	2	a	2	Iron and steel	Foreign or Domestic	1	Agriculture and Construction	2	6	8
	(3484)	99	-1	0	-1	-	-	-	-	-	-	-	-	-	-	-
	(3499)	100	1	1	2	-	3	b	0	Parts and accessories	Foreign or Domestic	1	Agriculture, Manufacturing and Construction	2	5	5
3833	(3521)	101	-2	2	0	-	2	b	1	Steel alminium and plastics	"	1	Construction and Manufacturing	1	3	4
3839	(3514)	102	0	0	0	-	2	a	2	Parts	"	1	"	1	4	6
3843	(3612)	103	-2	0	-2	-	-	-	-	-	-	-	-	-	-	-
	(3613)	104	-2	1	-1	-	-	-	-	-	-	-	-	-	-	-
3844	(3631)	105	0	1	1	-	5	a	-1	Steel, iron and parts	Foreign or Domestic	1	Manufacturing	1	2	1
3851	(3471)	106	-1	2	1	-	2	b	1	"	"	1	"	1	4	5
3909	(3933)	107	1	-1	0	-	5	a	-1	"	"	1	"	1	1	0

Table 3.27 Candidate Industries Ordered by Total Score

Industry Code			Industries and Products	Total Score
ISIC	JSIC	Product Code		
3419	(2431)	41	Calendering of laminated sheet	9
3819	(3352)	85	Press shops	8
3117	(1879)	10	Confectionary	
3829	(3474)	98	Hoists	7
3117	(1872)	07.08	Cake, Pastry	
	(1873)	09	Biscuits	
3412	(2453)	38∿40	Cartons, Boxes and Cases (made of paper and paperboard)	
3523	(2695)	46	Shampoo	
3560	(3969)	40∿51	Plastic products (Boxes, Containers, Cartons, Thermoforming, Travel goods and Sports goods	
3811	(3321)	69.70	Houseware and Kitchenware of metal, Knives, Forks and Spoons	
	(3322)	71	Cutting blades	
	(3327)	72	Hand tools (made of metal)	
3813	(3341)	75	Scaffoldings for construction (made of metal)	
	(3369)	80	Wire meshes	
3819	(3371)	89.90	Bolts, Nuts and Screws	
3822	(3421)	93∿95	Irrigation system and equipment	
3121	(1849)	12	Eggs and by-products	6
3523	(2652)	45	Soap	
3560	(3965)	48	Industrial and engineering parts of plastics	
3813	(3342)	76	Curtain rail and architectural metal products	
3819	(3359)	86.87	Diecasting and gravity casting	
	(3392)	92	Valves	
3839	(3514)	102	Switchboard and switchgears	
3121	(1844)	11	Seasonings	5
3233	(2961)	22	Bags (made of leather)	
3560	(3961)	47	PVC tubes, pipes, hoses and tiles	
3610	(3041)	52	Sanitary ware	
3620	(3016)	55	Tableware and kitchenware made of glass	
	(3019)	58	Ashtray and accessories (made of ceramics)	
3692	(3022)	60.61	Mixed concrete	
3811	(3329)	73	Locks and padlocks	5
3812	(2312)	74	Metal furniture	
3813	(3343)	77∿79	Tubes and pipes (made of metal)	
3819	(3331)	82.83	Cocks and taps for water system, Equipment for solar system	
	(3339)	84	Oil and gas barners, hot plates and ovens	
	(3399)	91	Helmets	

Table 3.27 (cont'd)

Industry Code			Industries and Products	Total Score
ISIC	JSIC	Product Code		
3829	(3499)	100	Machine shops (parts and repairing)	
3851	(3471)	106	Pumps and equipments	4
3122	(189)	13	Animal feeds	
3220	(2113)	17	Clothing for work, sports and sanitary	
3233	(2941)	21	Footwear (made of leather)	
3620	(3017)	56.57	Fibre glass moulding	
3833	(3521)	101	Electric fans	
3220	(2114)	18	School uniform	3
3319	(2292)	26	Shoelasts and wooden shoes	
3115	(1911)	03.04	Vegetable oil and fruits oil	2
3212	(2194)	15	Textile bags	
3312	(2233)	24.25	Packaging cases, drums and barrels (made of wood)	
3319	(2299)	27~29	Agricultural implements and tool handles (made of metal)	
3320	(2399)	37	Plastic furniture	
3825	(3721)	96	Water meters	
3311	(2221)	23	Structural wood products	1
3320	(2331)	36	Doors and windows (made of wood)	
3512	(2612)	44	Compounded fertilizers	
3844	(3631)	105	Bicycles and its parts	
3115	(1893)	02	Organic fertilizers	0
	(1913)	05.06	Cooking oil and margarine	
3215	(2071)	16	Packaging Rope	
3320	(2311)	30~35	Boxes, cabinets, tables, chairs, benches (made of wood)	
3699	(3099)	66.67	Chalks, Stone cutting and shapings	
3909	(3933)	107	Children's vehicles	
3212	(2193)	14	Canvas (Tents and covers)	-1
3420	(2521)	42	Publishing of educational texts	
	(2531)	43	Printings	
3699	(3023)	62	Concrete piles and pipes	
	(3029)	63.64	Mortar and plaster	
	(3083)	65	Structural bricks and accessories	
	(3171)	68	Foundry	-2

f. Comparative Advantages of Northern Region

355 Northern region of Jordan, especially Irbid area, has several comparative advantages as compared to other regions of Jordan. Such comparative advantages can be classified into (1) natural resources endowment which is capitalized in agricultural sector and (2) locational proximity to other Arab countries and Europe as described in section 2.2.4 of this report.

356 As it was mentioned in section 2.1.2, Northern region itself has been characterized as a major agricultural region and the region is, in addition, close to the agricultural area of Jordan Valley. As shown in the distribution of agricultural production by Governorates in Annex 3.5, Irbid produces not only a wide variety of agricultural products in field crops, vegetables and fruit, but also the highest amount of production volume. Therefore, industries which utilize these various agricultural products as raw materials have comparative advantage in locating in Irbid as compared to other regions. On the other hand, industries which produce input materials and equipment such as fertilizer, animal feeds, insecticides, tools, machines, etc., have tight linkages to the agricultural sector. These industries are called as agro-industries and should play a key role in the development of IIE.

357 An analysis of imported goods in Jordan indicates that major materials imported through Ramtha Customs Office are wood, textiles and chemicals. As mentioned in section 2.2.4, these materials are transported by trucks and its tariff is 1.1 JD/ton between Amman and Irbid, industries which use these materials have locational advantage in locating in Irbid. Therefore, priority should be put on these industries. Although some materials such as iron and steel are currently imported through Aqaba port, imports of variety of materials through Beirut could be improved once the political stability is recovered. In such a case, locational advantage in Irbid could be effectively enhanced.

358 Besides these comparative advantages, large scale on-going and planned development projects in the northern region should be taken into consideration. These includes construction of new campus of Yarmouk University, Yarmouk Dam, irrigation projects in Jordan Valley, housing construction in the northern region and turism development projects. Industries which have linkage to construction works should capture this construction boom by providing construction materials and equipment.

359 These considerations lead to the breakdown of comparative advantages into five factors from the availability of raw material and into five factors from the demand for their products. Comparative advantages of Irbid region for each candidate industry are evaluated by the combination of these factors as shown in Table 3.28 in which weights of each combination of factors are also shown.

Table 3.28 Evaluation of Comparative Advantages of Candidate Industries and Products[1/]

Demand for Products Related Factors / Raw Materials Related Factors	Agriculture	Construction	Manufacturing	Distribution and Trade	Consumer and Services
Agricultural Products	SCORE 5 02,13		SCORE 4		SCORE 3 03,04,05,06, 07,08,09,10, 11,12,21,22, 45,46
Wooden Products and Fibres		14,17,23,31, 32,33,34,35, 36		16,24,25,30	15,18,26
Metalic (Iron and Steel, Aluminium)	27,28,29,93 94,95,100, 106	73,74,75,76, 77,78,79,80 82,83,84,90, 91,92,96,98, 102	68,72,85,86 87,89,92	79	69,70,71,101, 105,107
Non-metalic Minerals	SCORE 3	52,56,57,60, 61,62,63,64, 65,67	SCORE 2		SCORE 1 55,58,66
Chemicals and Plastics (including paper and paperboard)	44,47	37	48	38,39,40,41	37,42,43,49 50,51

Source: Study Team.

Note: 1/ Numbers indicate product code used in this Study.

3.5.4 Suggested Industries and Products for the Development of IIE

360 The weights of comparative advantages of candidate industries are added up to the total score of each industry derived in Table 3.27. Industries are then classified into four groups according to the points of final score. The first group consists of industries in which the final scores are more than ten, and there are 23 industries and products in this group. The second consists of those in which the final scores are between eight and ten, and there are 28 industries and products in this group. In the third group, 25 industries and products which have

scores between eight and five are included. The final group consists of industries in which the scores are less than five. Industries in the first three groups are listed in the order of the final score in Table 3.29. Altogether, these 76 industries and products are suggested for the development of IIE.

Table 3.29 List of Suggested Industries for IIE

Group A. Products in the Highest Priority (23 products)

85	Press Shop (Pressed metal products)
98	Hoists
10	Confectionary
72	Hand tools (made of metal)
75	Scaffoldings for construction (made of metal)
80	Wire meshes
89	Bolts, nuts and screws
90	Casting of brassware fittings
93	Irrigation systems and equipment
94	Portable sprayers
95	Weeders
41	Calendering of laminated sheet
07	Cake
08	Pastry
46	Shampoo
69	Houseware and kitchenware (made of metal)
70	Knives, forks and spoons
71	Cutting blades
76	Curtain rail and architectural metal products
86	Die casting and gravity casting
87	Die manufacturing and hand tools
92	Valves
102	Switchboard and switchgears

Group B. Products in Higher Priority (28 products)

12	Eggs and by-products
45	Soap
73	Locks and padlocks
74	Metal furniture
77	Tubes and pipes (made of metal)
78	Angles and shapes (made of metal)
79	Cartons, tanks, containers and cabinet (made of metal)
82	Cocks and taps (for water system)
83	Equipment for solar heating
84	Oil and gas barners, hot plates and ovens
91	Helmets
100	Machine shop (parts and repairing)
106	Pumps and equipments
13	Animal feed
17	Clothing for work, sports and sanitary wear

38	Cartons (made of paper)
39	Boxes and cases (made of paper)
40	Containers (made of paper)
49	Boxes, containers and cartons (made of plastics)
50	Thermoforming of plastics
51	Travel goods and sports goods (made of leather)
48	Industrial and engineering parts (made of plastics)
11	Seasonings
22	Bags (made of leather)
47	PVC tubes, pipes, hoses and tiles
52	Sanitary ware
60	Mixed concrete (and its products)
61	Fibro-cement sheet and pipes

Group C. Other Possible Products (25 products)

21	Footwear (made of leather)
56	Fibre glass moulding
57	Glass fibre products
101	Electric fans
55	Tableware and kitchenware (made of glass)
58	Ashtray and accessories (ceramics)
18	School uniform
26	Shoelasts and wooden shoes
24	Packaging cases (wooden)
25	Drums and barrels (wooden)
27	Agricultural implements and tool handles
28	Fancy kitchen utensiles and figurines (wooden)
29	Fuels and charcoal
96	Water meters
23	Structural wood products
36	Doors and windows
03	Vegetable oil
04	Fruits oil
37	Plastic furniture
02	Organic fertilizers
31	Tables, chairs and benches for school
32	Bookshelves
33	Beds and bedrooms
34	Office and store fixtures (made of wood)
35	Kitchen units (wooden furniture)

Source: Study Team.

3.5.5 Comments on Suggested Industries and Products

361 Industries and products suggested in the previous section are reasonably classified into such major areas as agro-industries, products related to construction works, products based on linkages to the manufacturing sector and distribution industries, and other industries and products. Comments on these industries and products shall be provided according to these areas in the following.

a. Agro-industries

362 In general, agro-industries consists of two different types. One is such industries that use agricultural products as raw materials. The other is industries which support agricultural production by providing tools, equipment, machines, animal feeds, fertilizers and insecticides. Packaging, transportation and preserving of agricultural products are also included in this category. Most of the processed food for domestic consumption are currently imported which contributes Jordan's trade defficits. This situation can be reversed by promoting adequate food processing industries which utilize abundant agricultural products produced in the northern region and the Jordan Valley. On the other hand, there are several on-going irrigation projects in the Jordan Valley. Machines and equipments for the irrigation system including pipes, tubes, pumps and valves, portable sprayers, weeders, hoists, cocks, taps, and hand tools are indispensable for the development of these projects. The processing plants of animal feeds and fertilizers made of organic materials have also excellent potential to be exploited. These industries utilize wastes of agricultural products, wastes of food processing factories, disposals from kitchen and treatment plant and bone meal with the combination of barley, wheat, maize and soya beans. Repairing and spare parts producing plants for agricultural machines and equipment should also be noted. Cartons, boxes, containers made of wood, plastics and paperboard are another potential products to be developed, and they improve the distribution and preserving of agricultural products. In addition, production of eggs and its by-products is expected to grow in a reasonable scale. Oils and fats processing industries will be developed based on stable supply of domestic and imported materials. However, the promotion of leather industries requires substantial technological improvement.

b. Construction Related Industries

363 At present, construction materials and equipment for the implementation of on-going regional development projects are mostly imported since existing local factories are very small in scale and primitive in the level of technology used. In order to capture the demand generated by these projects, up-grading of technology and diversification of products should be encouraged with the provision that production is feasible in small and medium scale factories. The potential can be found in the secondary products made of such materials as wood, iron and steel, aluminum and brassware, chemicals, plastics, glass, ceramics and cement. IIE should provide enough incentives for

up-grading of technology and diversification of products by being an engineering and technological center of the northern region, in addition to the fully serviced industrial plot.

c. Metal Works and Processing of Machinery and Equipments

364 There are many metal workshops in the Irbid Municipality, which are mainly producing and repairing furniture, room units and architectural materials. Besides, number of automobile repair shops are numerous. These are also characterized by small scale of operation and primitive level of technology. If a metal workshop is provided, it supports up-grading of technology of existing factories in the area of metalic materials for construction, equipment and machines for agriculture, and equipment for distribution and services. In addition, a comprehensive automobile service shop on the basis of private business can be introduced into IIE. These are outlined in the next section.

3.5.6 Outlines of Common Metal Workshop and Comprehensive Automobile Repair Shop

a. Common Metal Workshop

365 The function of common metal workshop should be:

i) Training of skills for operation of metal processing machines;

ii) Processing and supply of tools and parts made of metal, and processing of brought-in materials;

iii) Experimental processing of new products;

iv) Repairing of machines, equipment and tools;

v) Renting and leasing of machines; and

vi) Advisery services

These functions will improve the technological and managerial capability of small and medium scale factories.

366 A set of fundamental machines, tools and equipment should be installed in this workshop. These consist of cutting and welding machines, machine tools, tooling machines and other equipment. Details of these are listed in Annex 3.6 on the provisional basis. A survey will be necessary to identify what kind of and how many machines, tools and equipment will be required by potential beneficiaries.

367 The proposed common metal workshop should be owned and managed by Irbid Development Authority which will be a responsible

organization in charge of maintenance and management of IIE as detailed in Chapter VIII. Expenses of every service provided by the common workshop shall be charged to beneficiaries. However, user charge should be kept as low as possible at the early stage of its operation in order to make the best use of these services. The common workshop should also function as on-the-job training for the operation of metal processing machines. For this purpose, a technical advisor for the training of local staffs will be required in the early stage of its operation in addition to a close cooperation with the Vocational Training Corporation.

b. Comprehensive Automobile Service Shop

368 There is a definite needs for a comprehensive automobile service shop, and it can be operated on the basis of private business in IIE. Followings are outlines of this comprehensive automobile service shop at the minimum required level. The function of automobile service shop consists of two major items. One is the checking and testing of automobiles required by the automobile inspection to ensure its safety and well driving. The other is the repairing, overhauling and mending. A scope of such an service shop as the automobile inspection shop is shown in a sketch in Annex 3.7. This shop consists of a standard unit called "Bay". Required number of bays as a minimum comprehensive service shop are eight, namely quick (or general) service, heavy repair, wheel service, cooler service, lubrication, washing, body repair and painting, and required space for accommodating these eight bays is estimated to be about 260 m^2. A gross space is therefore to be 400 m^2 ∿ 500 m^2. Details of equipment required for eight bays are indicated in Annex 3.8.

3.6 Determination of Scale of Newly Developed Industries

369 Seventy-six industries and products suggested for the development of IIE were aggregated into nine industrial categories so to be consistent with the industrial categories used in the land demand projection, and they were re-arranged according to the three priority gruops given in Table 3.29. The result is shown in Table 3.30.

Table 3.30 Aggregation of Suggested Industries and Products to Nine Types of Industry

Types of Industry	Priority Groups		
	Group A	Group B	Group C
1. Metal Works	13	9	5
2. Furniture and Room Units	2	2	7
3. Food and Beverages	3	3	3
4. Garments and Clothes	-	2	3
5. Plastics and Chemicals	2	2	1
6. Construction Materials	3	6	6
7. Auto-repair Shops	-	1	-
8. Trading	-	-	-
9. Paper and Paper Products	-	3	-
Total	23	28	25

Source: Table 3.29.

370 In order to determine the development scale of each industry, three inter-related factors should be taken into consideration. The first factor is the number of establishments in each type of industry. The second one is the size distribution of establishments in each type of industry. The last one is the land demand for each pre-determined size of establishment. In order to derive the number of establishments in each type of industry, the number of industries and products in Table 3.30 was modified by (1) multiplying the number of industries and products in Group A by three, (2) multiplying the numeber of industries and products in Group B by two, and (3) keeping the number of industries and products in Group C as they are. This process was necessary in order to reflect the intensity of priorities on the number of required establishments in each type of industry. Table 3.31 shows the results of this process. Total number of establishments to be newly develoled in IIE was 150.

Table 3.31 Suggested Number of Establishments in Nine Types of Industry

Types of Industry	Number of Establishments Group A	Group B	Group C	Total
1. Metal Works	39	18	5	62
2. Furniture and Room Units	6	4	7	17
3. Food and Beverages	9	6	3	18
4. Garments and Clothes	-	4	3	7
5. Plastics and Chemicals	6	4	1	11
6. Construction Materials	9	12	6	27
7. Auto-repair Shops	-	2	-	2
8. Trading	-	-	-	-
9. Paper and Paper Products	-	6	-	6
Total	69	56	25	150

Source: Table 3.30.

371 In the second step, size distribution of industries and products in Table 3.31 were examined based on the employment data derived from the Industrial Census of Japan. Size distribution of establishment was divided into three categories; namely: very small (VS), small (S) and medium (M). Table 3.32 shows the result of this procedure. The numbers of industries classified into very small (VS), small (S) and medium (M) categories were 120, 17 and 13, respectively.

372 Based on these results so far derived, development scale for these suggested industries and products was determined by using average land size employed in the land demand projection. They are as follows:

Very small size establishment		250 m^2/establishment
Small	"	1,000 m^2/establishment
Medium	"	2,500 m^2/establishment

The result of land requirement for these suggested industries and products is summarized in Table 3.33. Total land requirement was about 79,500 m^2 exclucive of trading.

Tabel 3.32 Size Distribution of Suggested Number of Establishments[1/]

Types of Industry	Establishments Group A	Group B	Group C	Total
1. Metal Works	VS : 30 S : 6 M : 3 39	VS : 18 S : 0 M : 0 18	VS : 5 S : 0 M : 0 5	VS : 53 S : 6 M : 3 62
2. Furniture and Room Units	VS : 6 S : 0 M : 0 6	VS : 4 S : 0 M : 0 4	VS : 6 S : 1 M : 0 7	VS : 16 S : 1 M : 0 7
3. Food and Beverages	VS : 9 S : 0 M : 0 9	VS : 4 S : 0 M : 2 6	VS : 2 S : 1 M : 0 3	VS : 15 S : 1 M : 2 18
4. Garments and Clothes	VS : 0 S : 0 M : 0 0	VS : 4 S : 0 M : 0 4	VS : 1 S : 0 M : 2 3	VS : 5 S : 0 M : 2 7
5. Plastics and Chemicals	VS : 3 S : 3 M : 0 6	VS : 4 S : 0 M : 0 4	VS : 0 S : 0 M : 1 1	VS : 7 S : 3 M : 1 11
6. Construction Materials	VS : 6 S : 0 M : 3 9	VS : 12 S : 0 M : 0 12	VS : 4 S : 2 M : 0 6	VS : 22 S : 2 M : 3 27
7. Auto-repair Shops	VS : 0 S : 0 M : 0 0	VS : 0 S : 0 M : 2 2	VS : 0 S : 0 M : 0 0	VS : 0 S : 0 M : 2 2
8. Trading	VS : - S : - M : -	VS : - S : - M : -	VS : - S : - M : -	VS : - S : - M : -
9. Paper and Paper Products	VS : 0 S : 0 M : 0 0	VS : 2 S : 4 M : 0 6	VS : 0 S : 0 M : 0 0	VS : 2 S : 4 M : 0 6
Total	VS : 54 S : 9 M : 6 69	VS : 48 S : 4 M : 4 56	VS : 18 S : 4 M : 3 25	VS :120 S : 17 M : 13 150

Source: Table 3.31.
Note: 1/ VS, S and M signify very small, small and medium respectively.

Table 3.33 Development Scale for Suggested Establishments

Types of Industry	No. of Establishment	Land Requirement (m^2)
1. Metal Works	62	26,750
2. Furniture and Room Units	17	5,000
3. Food and Beverages	18	9,750
4. Garments and Clothes	17	6,250
5. Plastics and Chemicals	11	7,250
6. Construction Materials	27	15,000
7. Auto-repair Shops	2	5,000
8. Trading	-	-
9. Paper and Paper Products	6	4,500
Total	150	79,500

Source: Table 3.32.

3.7 Industrial Land Composition of IIE

373 Industrial land demand for relocation, expansion and waiting factories were derived in Table 3.8. As mentioned in paragraph 332, the demand in Table 3.8 is effective as of the end of 1980, and a number of establishments will probably locate outisde IIE by 1986 which is the target year of completion. These were assumed to be 35 percent of the demand appeared in Table 3.8. Accordingly, it should be discounted so as to be effective in 1984. On the other hand, industrial land demand for suggested industries was shown in Table 3.33. These were combined in order to derive industrial land composition of IIE as shown in Table 3.34. The number of establishments, size distribution and average land demand so far derived will be used in Chapter V, Land Use Planning.

Table 3.34 Industrial Land Composition of IIE

Types of Industry	Land Demand (m^2)
1. Metal Works	64,050
2. Furniture and Room Units	18,700
3. Food and Beverages	14,950
4. Garments and Clothes	6,750
5. Plastics and Chemicals	7,250
6. Construction Materials	41,000
7. Auto-repair Shops	18,900
8. Trading 1/	6,500
9. Paper and Paper Products	4,500
Total	182,600

Source: Tables 3.8 and 3.33.

Note: 1/ This catagory is used for adjusting industrial land requirement.

CHAPTER IV

SITE SELECTION AND OUTER UTILITY FACILITIES

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SITE SELECTION AND OUTER UTILITY FACILITIES

4.1 Site Selection of the Proposed Irbid Industrial Estate

401 In the previous Chapter, the land demand of the proposed Irbid Industrial Estate was projected to be 27.5 ha with the target year of full occupation of IIE in 1986. In addition, it was projected that 22.5 ha of industrial land shall be required by year 1990 so as to accommodate future expansion of industrial activities in the region. This additional demand for future expansion area should also be taken into consideration in selecting a site of IIE.

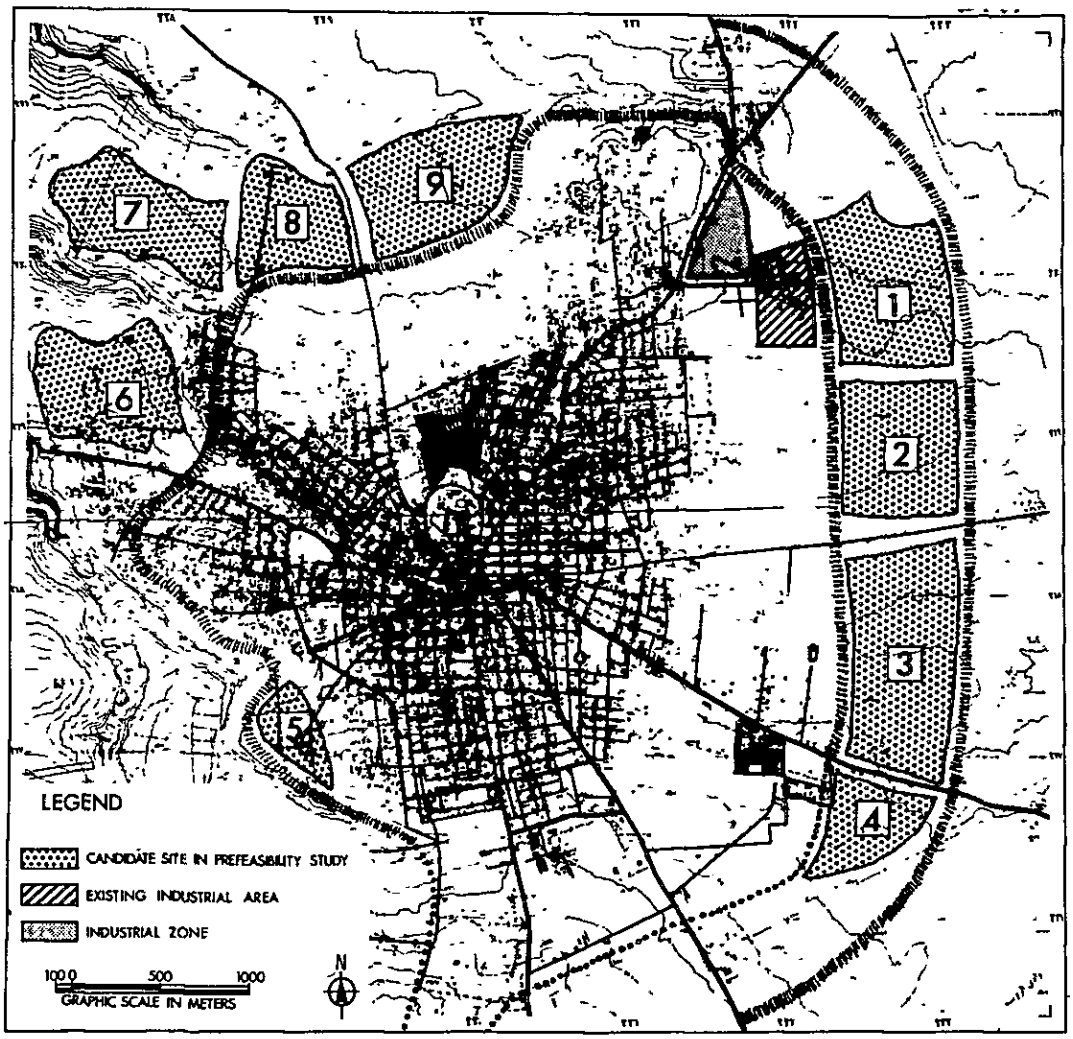
402 In the Prefeasibility Study of Industrial Estate carried out by the Expert Team of JICA, nine candidate sites as shown in Figure 4.1 were examined for the proposed IIE. Each candidate site has a size of about 100 ha. Among them, the site No. 1 adjacent in the east to the existing industrial area was recommended. After the re-examination of these sites in the light of several criteria described in the next paragraph and the discussion with the counterpart committee, the present study reconfirms this site selection.

403 This site has advantage over or equal advantage as alternative sites in the following criteria:

i) presently not urbanized,
ii) the availability of a sufficiently large area,
iii) minimal slope of the land surface,
iv) wind direction
v) the availability of the necessary utilities in the present and the future,
vi) compatibility with the present pattern of land use,
vii) the price of land, and
viii) the relative ease of land acquisition.

404 In particular, its proximity to the presently existing industrial area is an important assets of this site. Inter-linkages among the various kinds of industries and the common use of infrastructure are also decisive factors for selecting this proposed site. The existing industrial area has a size of 25 ha and includes service industries such as many

Figure 4.1 Proposed Sites of Irbid Industrial Estate



auto-repair shops in addition to manufacturing establishments. Although it is difficult to determine the size of an industrial estate above which agglomeration effects are generated, most of the inland industrial estates in Japan fall in the range of 40 to 80 ha. With the future expansion area in mind, the size of combined industrial land, i.e., 25 ha of the existing industrial area and 27.5 ha of the proposed IIE plus 22.5 ha of future expansion area, turns out to be 75 ha in total centering around IIE, which will provide solid basis for generating expected agglomeration effects.

405 The relatively cheap price of land and relatively large holding of individual parcel within the proposed site is another important property for that makes the land acquisition be relatively less burdenome from the financial as well as legal points of view (see paragraph 527).

406 With respect to the relative ease of land acquisition, the degree of current urbanization is another important criteria. The present land use of the site No. 1 is entirely for agriculture and there are only two small buildings within the site. Consequently, it has a better position than the others and costs of removal and compensation for the owners are kept to be minimal.

407 As to the physical conditions, the site No. 1 has a minimal slope of land gradient. Therefore, the required earth works are the minimum among the nine candidate sites examined. As to the wind direction, a west wind is prevailing in Irbid. Since the site No. 1 is located to the east of the urbanized area of Irbid as shown in Figure 4.1, it will be least hazardous to the urbanized area from the environmental point of view.

408 An examination of the existing conditions and development schedule of utility facilities and infrastructure also points out the superiority of the site to the others. The question of access will be solved by constructing the proposed ring roads: Boundary Ring Road and Outer Ring Road. These are fully discussed in the next section of this Chapter.

409 In view of these advantages mentioned above, the proposed site No. 1 was selected as the site for IIE with the approval of Counterpart Committee of this Feasibility Study. The above decision may have a significant impact on the area around the site including the proposed future expansion area. Although this Study is not directly concerned with the land use plan other than the proposed IIE, it is suggested that the land use plan of immediately surrounding area of IIE needs to be prepared so as to realize sound environment. It is also suggested that concerned government agencies should take, at the earliest opportunity, necessary procedures for securing the area adjacent to the east of IIE for the future expansion area of industrial activities.

4.2 Outer Utility Facilities: Present Conditions and Development Schedule

410 The followings deal with existing conditions and development schedule of utility facilities and infrastructure in the area around the proposed site of IIE. Items studied in the following are: Water Supply System; Power Supply System; Telecommunication System; Road Infrastructure and Public Transportation; Sewerage System; Storm Water Drainage; and Solid Waste Disposal System.

4.3 Water Supply System

4.3.1 Existing Water Supply System in Irbid

a. Water Supply Capacity to Irbid

411 Management and operation of water distribution system in the Municiparity of Irbid is the responsibility of the Water Department of the Municipality Government. However, the Water Supply Corporation (WSC) is in charge of supplying water to the Municipality and controlling its quality. Besides, Jordan Valley Authority (JVA) has several projects with regard to water supply to the Northern Region of Jordan.

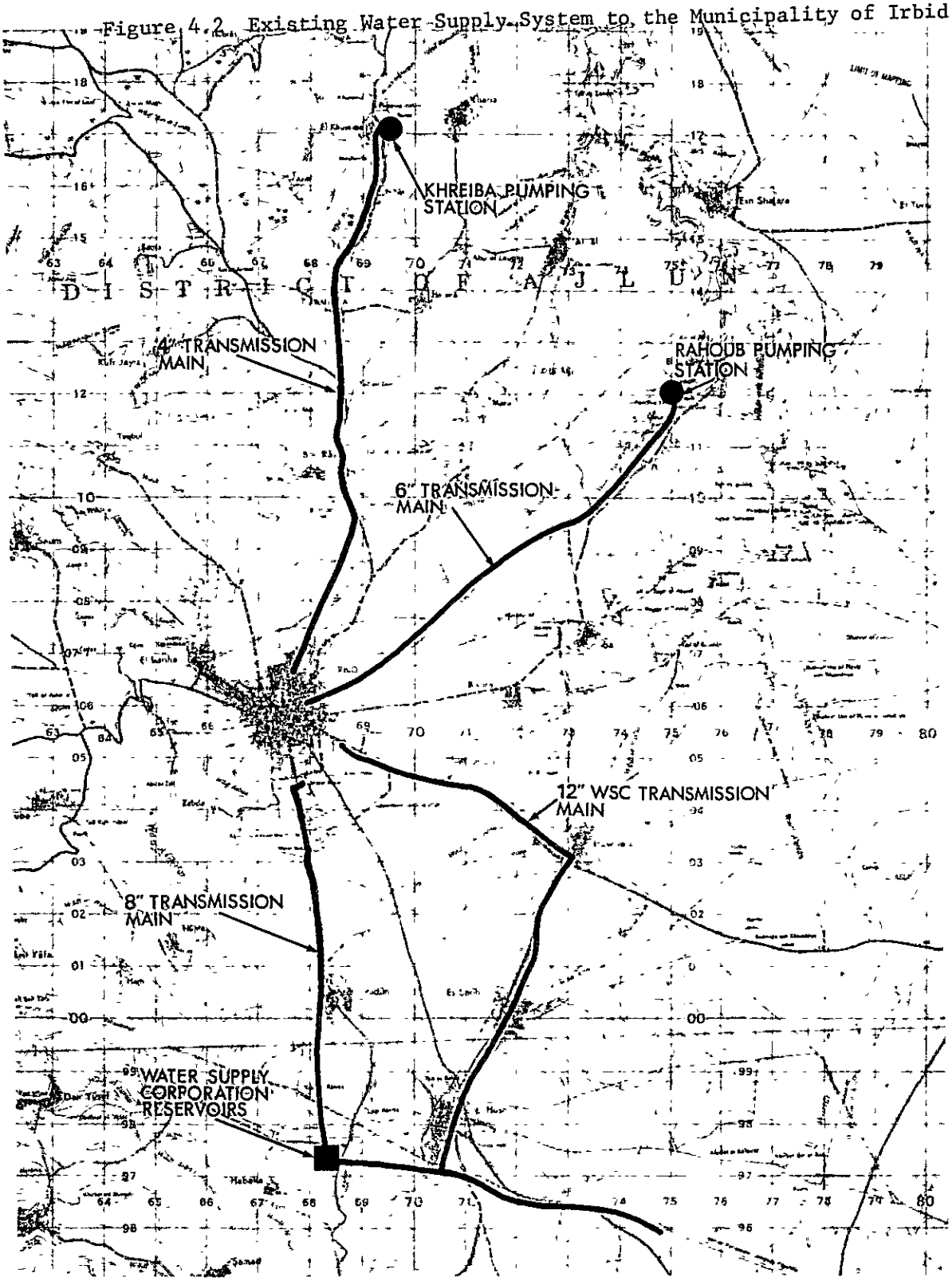
412 WSC supplies water to the Municipality from the two ground water wells, Sama and Dhuleil, as well as one springs in Azraq, each of which located roughly 100 km to the east and south of Irbid. Water from the sources at Sama and Dhuleil is pumped to a collecting reservoir at Zatari, 53 km south-east of Irbid, and from their it is repumped to the reservoir at Haufa 14 km south of Irbid and at an elevation of 800 m. At this site, there are two 6,000 m^3 reservoirs, built in 1977, which serve as the major water supply to the Municiparity. An 8 inches (20 cm) main connects the reservoirs with the municipality as shown in Figure 4.2.

413 Although the delivery head in Irbid is about 630 m which gives a main pressure of approximately 529 kPa at the current rate of flow, the maximum amount of delivery from the reservoirs is limited to 5,500 m^3/day due to the narrow diameter of the main connecting the reservoirs with Irbid.

414 The WSC transmission main from Zatari has also a branch main upstream of the Haufa reservoirs, called Kairawan Circle as shown in Figure 4.2. This 12 inches (30 cm) main supplies El Husn, a small village, south of Irbid, and then connects to the southeast corner of the Irbid system. Presently this connection supplies 1,400-1,700 m^3/day.

415 The Water Department of the Municipality maintains pumping stations at two springs as sources of water supply, one is Rahoub Pumping Station and the other Khreiba Pumping Station. Currently, 2,000 m^3 of water is used daily by the Municipality from these two wells. However, they are operated only few hours per day. According to the Water

Figure 4.2 Existing Water Supply System to the Municipality of Irbid



Department, their capacities of discharge are not fully exploited. The combined water supply capacity from WSC and Municipality sources, therefore, becomes 8,900-9,200 m^3/day.

b. The Existing Distribution System in Irbid

416 The existing water distribution system in the Municipality consists of a network of mains with appurtenances and two small storage facilities. Within the system, pipes used as mains range from 1 inch (2.5 cm) to 10 inches (25 cm) in diameter. Portions of the system are over 30 years old, but there are substantial additions to the system in which 2 inches main has been installed serving new areas.

417 An 4 inches main is placed under the street which connects the existing industrial area with Hakama Street. At present, this is the only available main which brings water to the existing industrial area. Although the existing supply main (6 inches) from the Rahoub pumping station goes through the site proposed for IIE, it does not have any branch pipes, and is connected directly to a ground storage tank in the center of the Municipality.

c. Water Quality

418 Water quality of the existing supply is tabulated in Table 4.1. This table is developed from data obtained by the Natural Resources Authority in 1980 for all the wells supplying to Irbid. The original data are presented in Annex 4.1.

Table 4.1 Existing Water Supply Quality

Water Quality Parameter	Range of Results
Total dissolved solids (T.D.S.)	326 - 1,942 mg/l
Chlorides (CL)	32 - 437 mg/l
Sulfates (SO_4)	29 - 187 mg/l
Hardness (calcium and magnesium)	26 - 312 mg/l
pH	7.80 - 8.36 pH unit
Nitrate (NO_3)	11 - 94 mg/l

Source: Natural Resources Authority, Water Research Laboratories.

419 The amount of total dissolved solids in water is a consideration in its suitability for domestic use. In general, waters with a total dissolved solids content of less than 500 mg/l are most desirable for domestic purpose. However, the U.S. Public Health Service Standards recommend a limit of 1,000 mg/l. As to the hardness, waters supplied to the Municipality range from soft (0-75 mg/l), moderately hard (75-150 mg/l) to hard (150-300 mg/l) categories. Although it is difficult, at this stage, to specify an appropriate hardness for industrial use, there may be a case in which individual enterprises need to install water softners. The level of nitrates in some springs is very high. The World Health Organization limit for nitrate is 45 mg/l. As shown in Annex 4.1, when water supply comes from the Yarmouk River (see paragraph 423), there will be a substantial change in water quality characteristics. The levels of total dissolved solids and hardness will decrease, and the level of nitrates should drop significantly.

4.3.2 Water Distribution Master Plan of Irbid

420 A master plan of water distribution within the Municipality was formulated by Weston, Inc., in 1980.[1/] The proposed distribution system is sized to deliver sufficient water to meet an average daily demand of 56,500 m^3/day by the year 2000. The demand of commercial and industrial use is also estimated to be 4,300 m^3/day in 1980, 7,300 m^3/day in 1990 and 11,600 m^3/day in the year 2000 as shown in Annex 4.2.

421 In order to increase the supply capacity from the Haufa reservoirs (see paragraph 413), the Weston Report recommended to replace the old main of 8 inches with 14 inches main as the Phase One of the Master Plan. WSC is presently undertaking this project which will be completed in 1981 and, then, the supply capacity from the Haifa reservoirs will be increased to 26,400 m^3/day instead of 5,500 m^3/day at present.

422 According to the Weston Report, 15 cm water main will be installed through the existing industrial area during the Phase One which will be completed in 1982. During the Phase Two, the target year of which is not clearly specified in the Weston Report, another 15 cm water main is planned to be extended to the existing industrial area, following roughly the same route as the proposed Boudnary Ring Road (see section 4.6.2). The proposed distribution pipes around IIE is shown in Figure 4.3.

423 As to the outer water supply, Jordan Valley Authority (JVA) is programming Yarmouk Reservoir Project as well as the ground water pumping project at the Yarmouk River. However, the possibility to implement the former project does not appear good for the time being,

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1/ Feasibility Report and Preliminary Engineering Studies, Irbid Municipal Water Distribution, Sewerage, Storm Drainage and Solid Waste Disposal Project, March 1980.

at least, due to political relationship between Syria and Jordan. With regard to the ground water pumping project, JVA has already examined three wells along the Yarmouk River. It was suggested that two of the three wells could be utilized with the maximum discharge capacity of each 3,000 m^3/day. According to JVA, a reservoir is planned to be constructed at Beit Ras, 5 km north of the city, and from there water will be distributed to Irbid. In order to bring this project to realization, close coordination between JVA and WSC will be required.

424 The quantity of water required for IIE is estimated to be 750 m^3/day (see section 6.3). This quantity is less than 3 percent of the proposed supply capacity of WSC (26,400 m^3) after 1981, and accounts for about 10 percent of the total projected commercial and industrial demand(7,300 m^3) in 1990. Also, additional water would become available (1) by utilizing the Municipality owned wells which are not fully operated at present, and (2) by implementing the ground water pumping project of Yarmouk River. The latter is important since it will significantly improve water quality in the Municipality as mentioned in paragraph 418. The Team recommends that the management and operating body of IIE should coordinate with those relevant governmental agencies in order to secure the supply of water to IIE.

4.4 Power Supply System

4.4.1 Existing Power Supply System in Irbid

425 Electricity supply to the Governorate of Irbid and, particularly to the Municipality of Irbid, is the responsibility of Irbid District Electric Company (IDECO), which is a concession company of Jordan Electric Authority (JEA). Electricity distribution system in the IDECO concession area is currently connected to two high voltage (HV) transmission systems, i.e., 132 kV/50 MW double circuit feeder from the Hussein Power Station (Zarqa) and to a 230 kV/100 MW single circuit overhead line from Syria. The latter was completed in June, 1980, but IDECO has not imported any electricity from Syria yet. Besides these outer supplies, IDECO operates three diesel electricity generators of each 3 MW which are connected by 2x2 MW and a 4 MW 33/6.6 kV transformers to the 33 kV system and by two 6.6 kV feeders to the Municipality of Irbid.

426 At present the majority of consumers in the Municipality of Irbid are supplied from a 6.6 kV ring system connected to the Central Power Station of Irbid. The peak demand of electricity recorded during 1980 in the Municipality was 9.6 MW. The present supply capacity of IDECO at the Central Power Station is 17 MW/6.6 kV. However, this supply capacity will become very tight in 1985 when the peak demand is estimated to be 16.6 MW. Besides, the existing 6.6 kV network is not efficient.

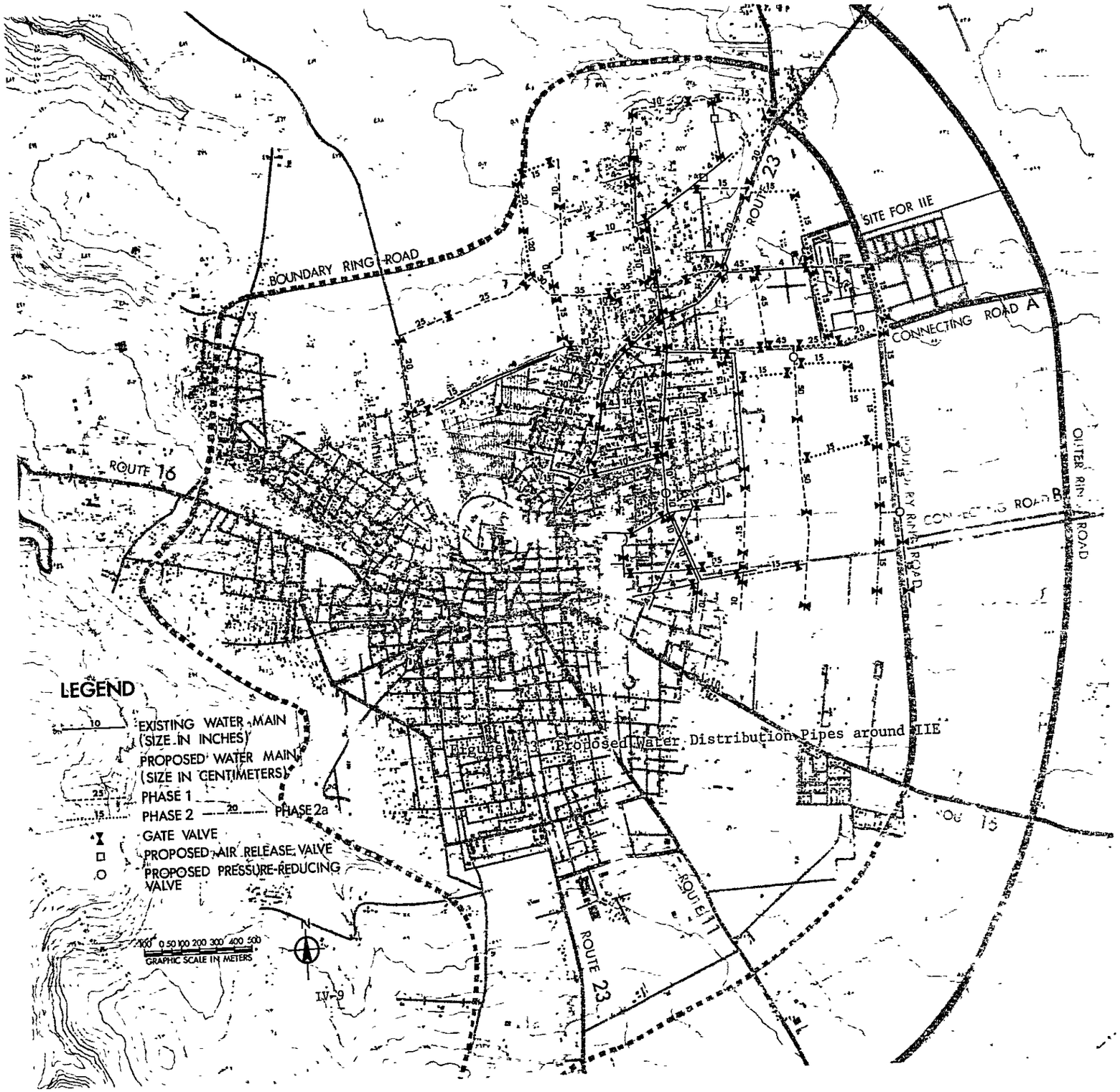


Figure IV-2 Proposed Water Distribution Pipes around IIE

427 Electricity tariffs are determined by the Jordan Electricity Authority. They consist of seven articles in which the first article, Bulk Supply Tariff, and the second article, Retail Tariff, are excepted and shown in Annex 4.3, which is effective as of February 1980. In case of Bulk Supply Tariff, Irbid Governorate has a little advantage over other governorates in Day Energy Tariff (refer to the first article, item 1-B in the Annex 4.3). However, in case of Retail Tariff, Irbid Governorate has a substantial disadvantage compared to other governorates in small industries tariff (refer to the second article, item C in Annex 4.3).

4.4.2 Master Plan of Power Supply System in Irbid

428 A feasibility study of Irbid District, Irbid City Urban Electrification was undertaken in 1979 by Preece, Carden & Rider, a consulting engineers of England. They recommended to change the distribution system from the present 6.6 kV network to 11 kV. New substation will be installed near the center of the Municipality which will be connected to the present main station by two 33 kV cables of each 22 MW. From the new substation, two ring main cables of 11 kV will be extended, and one of them will cover the area which includes the existing industrial area with three packaged substations as shown in Figure 4.4.

429 The proposed three packaged substations of each 630 kW will be mainly used by the existing industrial area. Demand for electricity generated by the proposed IIE is estimated to be 7,800 kW after 1985 (see section 6.6.1). While this additional demand was not taken into account in Preece, Carden & Rider Report, they recommended that the planned development of the HV distribution system at Irbid should be regularly reviewed to take account of new information.

430 IDECO has already initiated construction works to change the distribution system from 6.6 kV to 11 kV. The phase one of this project including the installation of three 630 kW packaged substations in the existing industrial area will be completed in October 1981. According to IDECO, they do not foresee any difficulty in supplying estimated 7,800 kW electricity to IIE. Distribution system to IIE will be connected with one of the two ring main cables as shown in Figure 4.4.

4.5 Telecommunication System

431 The provision of telecommunication facilities to the Irbid Governorate as well as to the Municipality is the responsibility of Jordan Telecommunication Corporation (JTC) which is currently undertaking a project for increasing the telecommunication capacity of the Governorate and Municipality with the target year of 1985.

432 According to JTC, the line capacity of Irbid Municipality will be expanded from the present 9,000 lines to 13,554 lines, while the capacity of Irbid Governorate will be increased to 29,757 lines.

433 A new main switching center for telecommunication equipped with Integrated Desital Switching System (IDSS) is currently under construction in the central part of the Municipality. According to the information given by Nippon Telecommunication Consulting Co. (NTC) which is a telecommunication facilities contractor in Irbid, the main pipe capable of containing 600 telephone lines has been already installed from the new main switching center to the corner of Hakama Street and the road from the existing industrial area.

434 Proposed capacity of a line concentrator which will be installed at the corner of Hakama Street and the road from the existing industrial area is capable of handling 277 telephone lines which will not satisfy the demand not only from IIE but also from the existing industrial area in near future. Since the number of factories in the existing industrial area is said to be 350 and the estimated telephone demand of IIE is 500 lines, the combined telephone demands will be about the order of 800-900 lines. In order to fulfill these demand, it is recommended that the management and operating body of IIE should request to JTC to revise its Five-Year Plan and to extend a capacity of trunk equipment between the new main switching center and the corner of Hakama Street and the road from the existing industrial area from the present 600 line-capacity to, at least, 1,000 line capacity.

4.6 Road Infrastructure and Public Transportation

4.6.1 Existing Road Network in Irbid

435 Figure 4.5 indicates the existing road network in Irbid together with roads planned or under construction. There are seven arterial roads which are radiating from the center of the city of Irbid. Among them, the most important road is Route 11 which is linked to Route 15, a main north-south national highway connected to Amman in the south as well as to Damascus in the north. Route 16 is a main east-west road which connects Irbid with the Jordan Valley in the west and with Route 15 as well as Mafraq in the west extending to Baghdad in Iraq. These two arterial roads are classified into the primary arterial road in the national highway system.

436 Route 23 runs through the northeast and southwest direction from the Municipality center. It connects the City with the Yarmouk River to the north, and Ajlun to the south. It is calssified into the secondary arterial road.

437 Route 11, Rote 16 and Route 23 are a part of natioanl highway network. They have about 20 m to 30 m width of right-of-way. The traffic capacity of these arterial roads in 1979 was estiamted in the

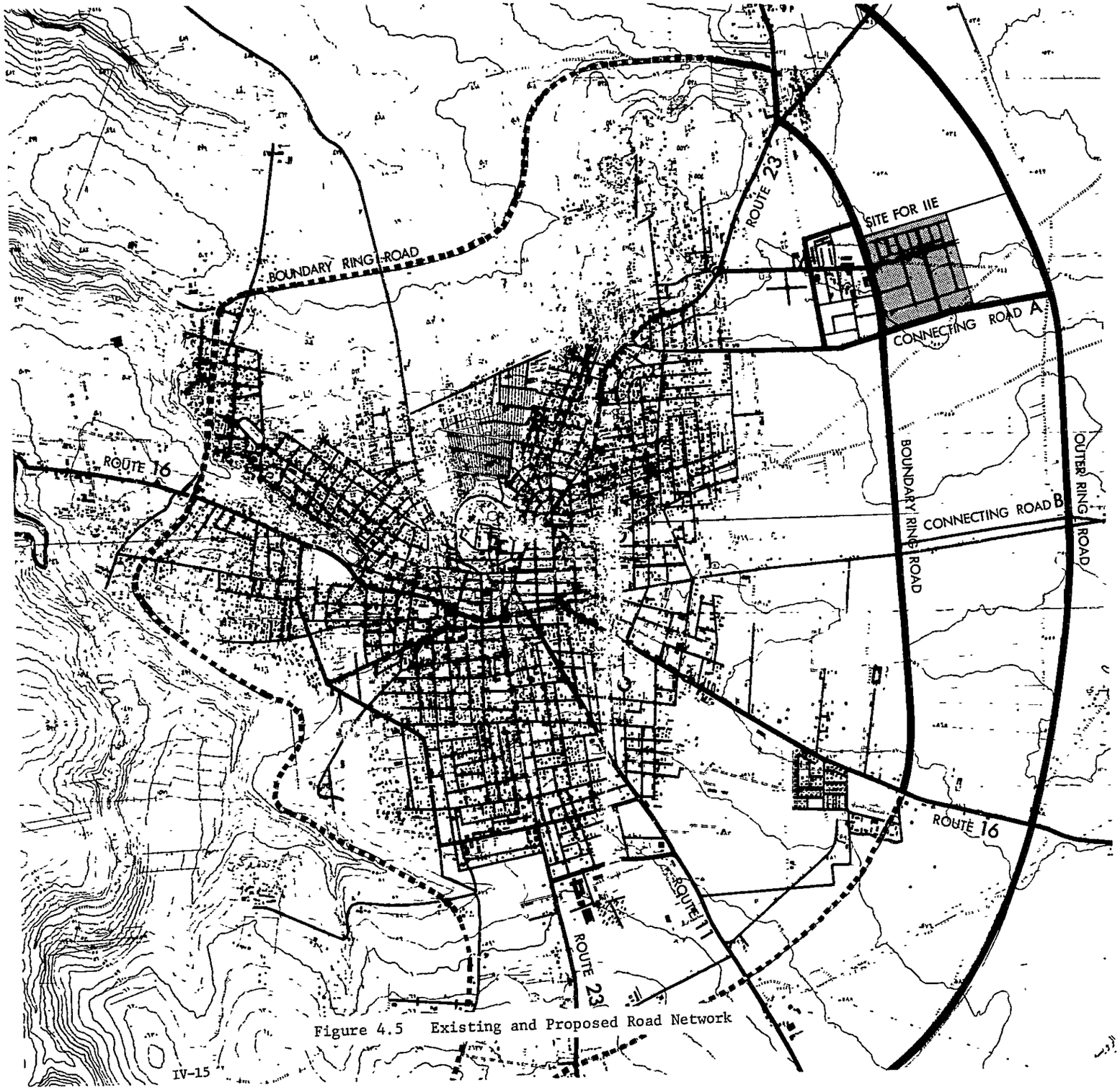


Figure 4.5 Existing and Proposed Road Network

Pre-feasibility Study as follows: Route 11 has an capacity of 13,000 vehicles/day; Route 16 has an capacity of 18,000 vehicles/day in the built-up area of the Municipality and of 48,000 vehicles/day in the suburb; and Route 23 has an capacity of 13,000 vehicles/day. Traffic volumes in the Municipality of Irbid were also surveyed by an Expert Team from JICA in 1978. They concluded that the traffic volume had already reached their full capacity, especially in the built-up area of the Municipality, at that time. Besides these arterial roads, there are 125 km of Municipality road, and the construction of an additional 5 km is currently undertaken. Most of them are two-lane width.

438 At present, there is 20 meter-width road connecting the existing industrial area with Hakama Street (Route 23). Since the proposed site of IIE is located adjacent to the east of existing industrial area, it is quite clear that future traffic volume from IIE as well as the existing industrial area will exceed the road capacity of the existing connector road between the IIE and Hakama Street, and accelerate traffic congestion in the center of the Municipality unless some measure is undertaken.

4.6.2 The Proposed Ring Roads Project in Irbid

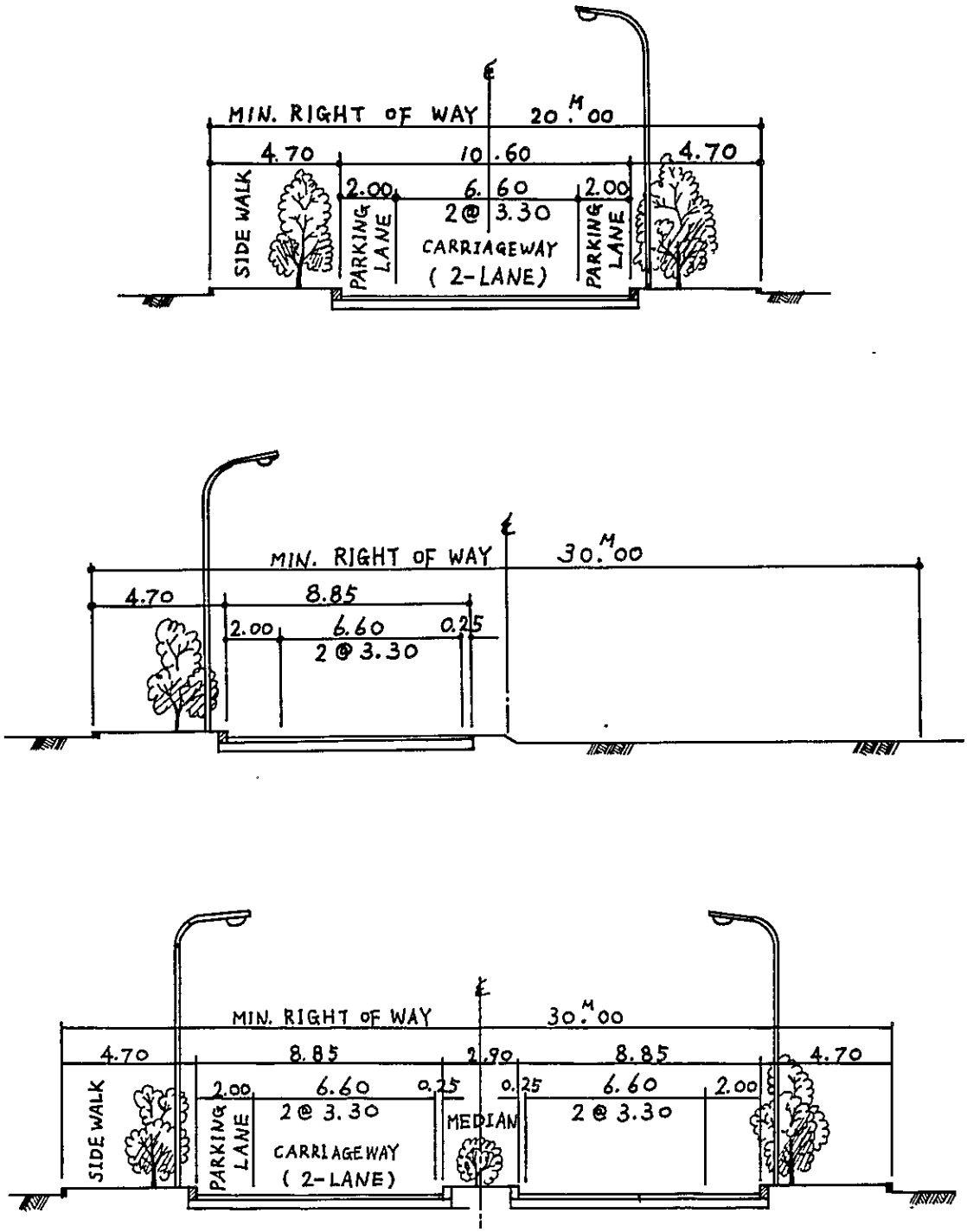
439 In the Phase II Study of Integrated Regional Development Study of Northern Jordan conducted by JICA in 1979, a prefeasibility study of two ring roads in the Municipality of Irbid was undertaken. One is the Boundary Ring Road of 12.3 km length and the other is the Outer Ring Road of 7.7 km length as shown in Figure 4.5.

440 The Boundary Ring Road is planned to have the beginning point on Baghdad Street (Route 16) at 2.5 km to the east from the center of the Municipality, and is extended to the north until it is connected to Hakama Street. This section of the Boundary Ring Road is planned to be 4-lane/2-way road in which 2-lane is scheduled to open in 1985, and 4-lane in 1990. Figure 4.6 shows a typical cross section of the proposed Boundary Ring Road in the Phase II Pre-feasibility of JICA report.

441 The section of the Boundary Ring Road mentioned above was proposed so as to run through the area just between the existing industrial area and IIE. Upon the completion of this section of Boundary Ring Road, interregional traffics generated by the existing industrial area and IIE will be channeled to Baghdad Street (Route 16) which is the main route to Syria and Iraq.

442 The section of Boundary Ring Road between Route 11 and Route 16 is currently under construction. According to the Municipality government, the construction works of this section will be completed in 1982. Therefore, interregional traffics to and from Amman will be able to use Route 11 via Boundary Ring Road.

Figure 4.6 Typical Cross-Sections of the Proposed Boundary Ring Roads



443 The Outer Ring Road is proposed to be about 1 km outside of the Boundary Ring Road, and will be connected to Route 16 as well as Route 11. The section of the Outer Ring Road between Route 11 and Hakama Street is designed to be 2-lane/2-way road. These two ring roads will be connected with each other by the two proposed connecting roads; Connecting Road A and Connecting Road B. The former is laid down so as to be the south boundary of IIE and will diversify traffics from IIE into the two Ring Roads.

444 A feasibility study of these ring roads will be carried out by a team of experts commissioned from JICA in 1981. Since IIE project and ring roads projects are mutually complementary, it is highly recommended that the ring roads projects should be examined on the assumption that the proposed IIE will be implemented according to the schedule described in Chapter 7.

4.6.3 Public Transportation in Irbid

445 Availability of public transportation in the Municipality of Irbid is quite limited. At present, there are only two bus companies which operate a few bases without any regular time schedule. Another means of public transportation is so called service-taxis which operate only on the pre-determined routes but without any pre-fixed taxi stops. However, their transportation capacity is limited and they are also operated without any regular time schedule. Since this heavy dependency on taxis will be one of the main causes for the traffic congestions in the Municipality in near future, it was recommended to establish a bus corporation in Irbid similar to the Public Transport Corporation in Amman in the Phase One Study of Integrated Regional Development Study of Nortehrn Jordan conducted by the expert team commissioned by JICA.

446 Since the proposed site of IIE is located about 3 km northeast from the center of the Municipality and since more than 3,000 workers will commute to the proposed IIE alone upon its completion, it is recommended that, when a public bus service system starts, IIE should be designated as an important part of the service system. A regularly scheduled bus service to IIE will not only help commuters, salesman, service-man and other personals but also mitigate the traffic congestion in the Municipality.

4.7 Sewerage System

4.7.1 Existing Sewerage System in Irbid

447 Presently, there are only three pipes of 500 mm diameter for sanitary sewers, which have a total length of approximately 600 m and serve in the Wadi Tariq Saum drainage area, i.e., the eastern half of the Municipality. However, these pipes were originally installed for storm water drainage, and the Municipality of Irbid, essentially, has no sewer collection system.

448 Cesspools or septic tanks are widely used in domestic and commercial sewage. Cesspools collect most of the heavier solids, and allow the liquid portion of the waste water to flow into the ground. These solids must be periodically pumped out to recover storage capacity of cesspools and septic tanks. They are emptied by pumping into tank trucks at the owner's request.

4.7.2 Sewerage System Master Plan in Irbid

449 A comprehensive study of sewerage collection system in the Municipality was undertaken by Weston, Inc. in 1979, and they formulated a waster plan designed to accomplish the folloiwng:[1/]

i) Provide a sewerage collection system that will serve the entire City by the end of the planning period, year 2000.

ii) Provide sewage collection to both the industrial park[2/] and Army housing area in Phase I of th e construction plan.

iii) Develop a plan for staged expansion.

450 According to the Weston Report, the Municipality is divided into two main drainage basins, with an intercepter serving each basin. One is the southern and western portions of the Municipality, and the other is the northern and eastern portions of the Municipality, these parts being separated roughly by Baghdad Street. Figure 4.7 shows the sewerage collection system proposed by the Weston Report.

451 The ground level of the existing industrial area as well as of proposed IIE is 3 to 4 m lower than surface grade elevation along the intercepter route. According to the Weston Report, a pump station will be provided near the existing industrial area from which a froce main will be extended about 1 km to connect with the intercepter as shown in Figure 4.7. A sewerage treatment plant is also planned to be located at a site approximately 3 km west of the existing industrial area.

452 Weston Report mentions that the proposed treatment plant is intended to accept and adequately treat some high strength waste where justified by specific existing or identified future industry in the Municipality of Irbid, however, any allowable standard with respect to pollutants such as toxic chemicals, metals, etc., is not specified. Instead, they proposed to establish a sewer ordinance which provides for the following:

i) Prohibit the discharge of waste having a temperature greater than 66°C.

1/ Weston Report, page 5-4.

2/ Industrial park in the Weston Report refers to the existing industrial area in this report.

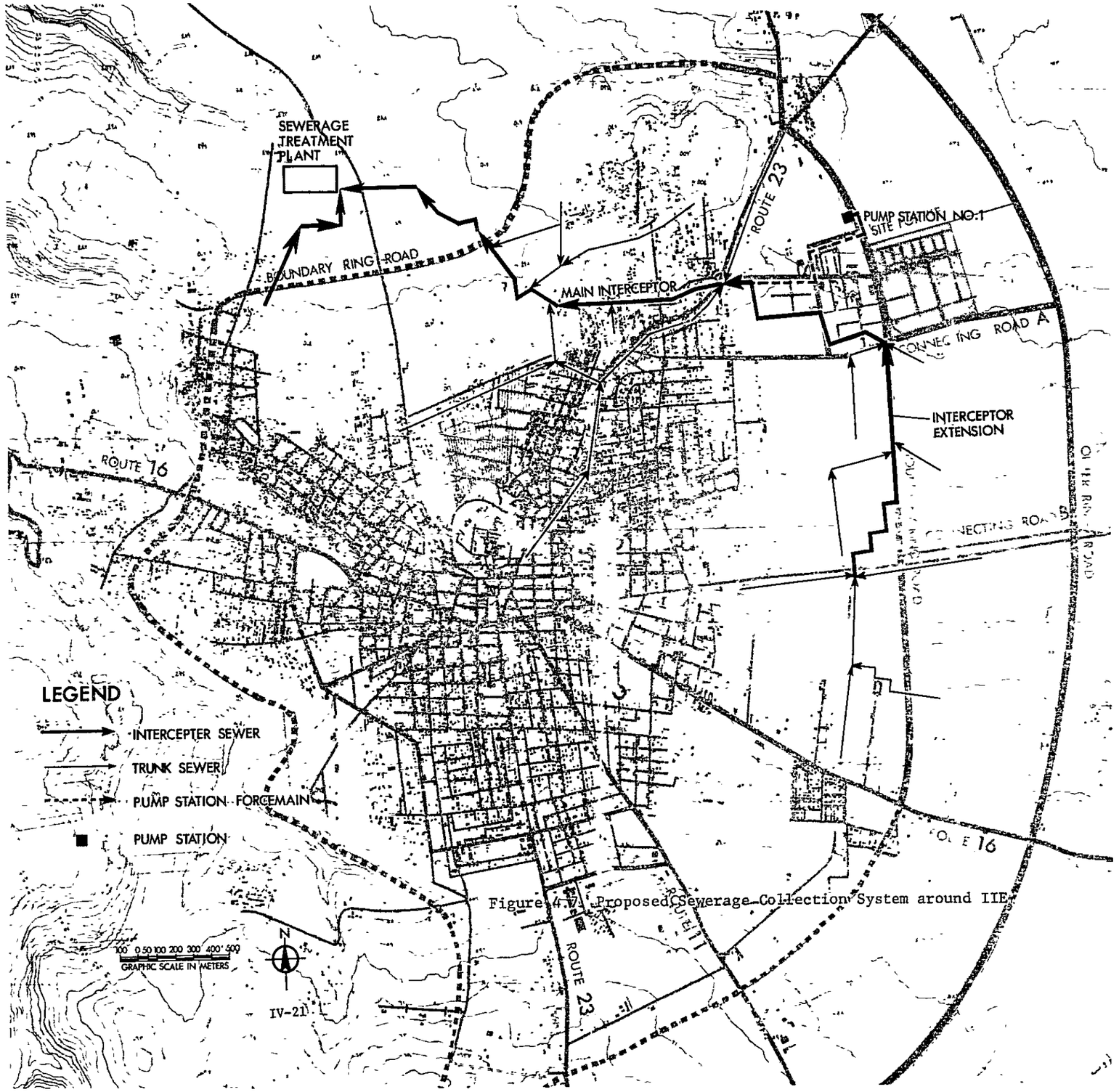


Figure 4.7 Proposed Sewerage Collection System around IIE

ii) Prohibit discharge of waste containing excessive oil and grease.

iii) Prohibit the discharge of any flammable materials.

iv) Prohibit the discharge of ground garbage.

v) Prohibit the discharge of any materials which may be toxic or otherwise hazardous to the wastewater treatment plant staff, or downstream users.

vi) Limit the pH of discharge waste to within the limits of 5.0 and 10.0.

vii) Require a flow measurement and sampling station where deemed appropriate.

453 According to the Municipal Government, Phase I of Sewerage System Master Plan will be initiated in September 1981, and the entire system including the sewerage treatment plant will be completed in 1984. Sewerage which is adequately pretreated by individual establishments will be discharged into the pump station mentioned in paragraph 451 upon the completion of the Sewerage Collection System Project.

4.8 Storm Water Drainage System

454 Although Weston Report proposed storm water drainage system for the Municipality, the north-eastern part of the Municipality including the existing industrial area as well as the proposed site of IIE is excluded from the Study Area in the Weston Report.

455 Topographically, the north-eastern part of the Municipality in which the site of IIE is proposed gently slopes to the north-eastern direction. Until urbanization takes place in immediate surrounding areas of IIE, storm water could be largely absorbed naturally into the surrounding area which is currently used as agricultural land. After the construction of the proposed Ring Roads, storm water can also be discharged into open box culverts along these Ring Roads.

4.9 Solid Waste Disposal System

456 The Municipality of Irbid presently provides solid waste collection and disposal service to its resident. However, due to the lack of solid waste disposal plant, processing of waste material becomes serious problem recently. In order to solve this problem, a feasibility study of solid waste disposal system was also conducted by Weston Inc. in 1979.

457 The Weston Report recommended to construct a sanitary landfill on a 22 ha site located to 3 km northwest from the center of the Municipality. The use of this landfill site becomes available in the middle of 1981 together with the improved collection system in terms of scheduled collection and improved containers.

458 Industrial solid waste generated by IIE may not contain any pollutants such as toxic chemical materials, heavy metals, etc. The only problem is that IIE may have a possibility to generate bulky waste such as bed spring and junk cars, however, this is also taken into account in the construction of the proposed land fill site.

CHAPTER V

LAND USE PLAN OF IRBID INDUSTRIAL ESTATE

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LAND USE PLAN OF IRBID INDUSTRIAL ESTATE

5.1 Basic Approach for Land Use Planning

501 In general, one of the benefits which individual entrepreneurs would expect to receive in locating their factories within an industrial estate is better production facilities for a given amount of expenditure. Besides, they can receive various services within an industrial estate, the supply of which would become possible by the agglomeration of numerous factories. Therefore, these economic benefits should be taken into consideration in formulating land use plan of the industrial estate.

502 Better production facilities can be provided because a site can be chosen at a readily accessible area, the construction is undertaken for a large area, and an agglomeration of utility and infrastructure demand enables a low cost provision of these services.

503 Among benefits which the industrial estate can provide as an organized eocnomic entity are the supply of various facilities and services, unified management and technical trainings, exchange of information among individual entrepreneurs, and stable supply of utilities such as water and electricity.

504 On the other hand, physical environment is another important factor in planning the land use of industrial estate and greater attention must be paid on landscaping as well as architectural design to create pleasant working conditions for the workers of the estate as well as sound living environment to surrounding area as well as villages.

505 In view of the consideration mentioned above, basic approach for land use planning of IIE is summarized as below:

i) IIE should have well coordinated functional relationship with the existing industrial area so that it will become the nodal point of industrial activities in Irbid region, and land use zonning as well as various facilities in IIE should be layouted so that individual factories can perform their own activities to a maximal extent.

ii) Since the main objective of IIE is to foster small and medium scale industries, standard modular type factory buildings should be introduced to the maximal extent that reduces the construction costs and provide attractiveness to potential entrepreneurs. In addition, utility and common facilities should be provided to a full extent which provides another incentives for potential entrepreneurs, and

iii) For the determination of sizes of land and floor space for standard factory buildings, the possibility of future expansion of individual factories should be taken into consideration. Furthermore, the subdivision of plot should have enough flexibility, adaptability and rooms for expansion in order to respond unanticipated changes of location of factories.

5.2 Planning Premises

5.2.1 Introduction

506 In section 3.3.4, the industrial land demand for IIE was derived with the four-category of land size as shown in Table 3.18. For the purpose of formulating an appropriate subdivision system of factory land within IIE, four units of factory size were planned, corresponding to the land size categories in Table 3.18: 1) Custom Built Factory Type I; 2) Custom Built Factory Type II; 3) Standard Factory Building Type A; and 4) Standard Factory Building Type B.

507 Although it is estimated at present that four factories would require land of more than 4,000 m^2, these are excluded in formulating unit size of factory land. However, this does not mean to preclude the possibility of accommodating large scale factories. By combining several largest plots, the subdivision system is able to accommodate these large scale factories.

5.2.2 Plan of Custom Built Factory

508 In general the recommended ratio of factory floor space to land area is set to be 0.3, while the ratio for small scale factory is set to be 0.5. This ratio allows expansion of floor space in future or each factory can use extra space as open working space or parking area.

509 Taking into account these considerations, two types of standard unit of Custom Built Factory are set in response to the average land area per factory indicated in Table 3.18. Table 5.1 below shows planning standards of two types of Custom Built Factory. Figures 5.1 and 5.2 show model layouts of Custom Built Factory Type I and Type II. Architectural designs of two types of Custom Built Factory with ground floor plan, front and back elevations, section and sectional details are shown in Drawings No. 5.1 to 5.6 at the end of Annex of this report.

Table 5.1 Planning Standards of Custom Built Factory

Unit Size of Land Area	Floor Space	Allowable Expansion Space
Type I 1,000 m^2	360 m^2	150 m^2
Type II 2,500 m^2	720 m^2	320 m^2

Note: Unit size of land area corresponds to the average land area of the two intermediate categories in Table 3.18.

5.2.3 Plan of Standard Factory Buildings

510 For the purpose of planning unit sizes of Standard Factory Buildings for IIE, the Study Team examined the following data: the results of the Interview Surveys; standard sheds in the existing industrial area; and unit size of standard factory buildings proposed in the Amman Industrial Estate.

511 According to the results of the Interview Surveys, the desired level of land size for factories below the 500 m^2 category was 250 m^2/factory as seen in Table 3.9. Assuming that working space is 30 percent of the desired level of land size, working space per factory becomes 75 m^2.

512 An inspection of existing or planned standard factory buildings reveals that:

i) Standard factories in the existing Irbid Municipality industrial area have working spaces in the range of 40 to 74 m^2.

ii) Standard factories proposed in the Amman Industrial Estate have working space of 75 m^2.

513 Based on these results, the Study Team recommends the following design standards for Standard Factory Buildings in IIE:

i) Two types of Standard Factory Buildings are planned. Type A has working space of 50 m^2 (200 m^2/factory land) and Type B has working space 100 m^2 (260 m^2/factory land).

ii) In order to promote small scale factories and to provide sound working environment, each standard factory should be equiped with a toilet and an office room.

Figure 5.1 Model Layout of Custom Built Factory Type I

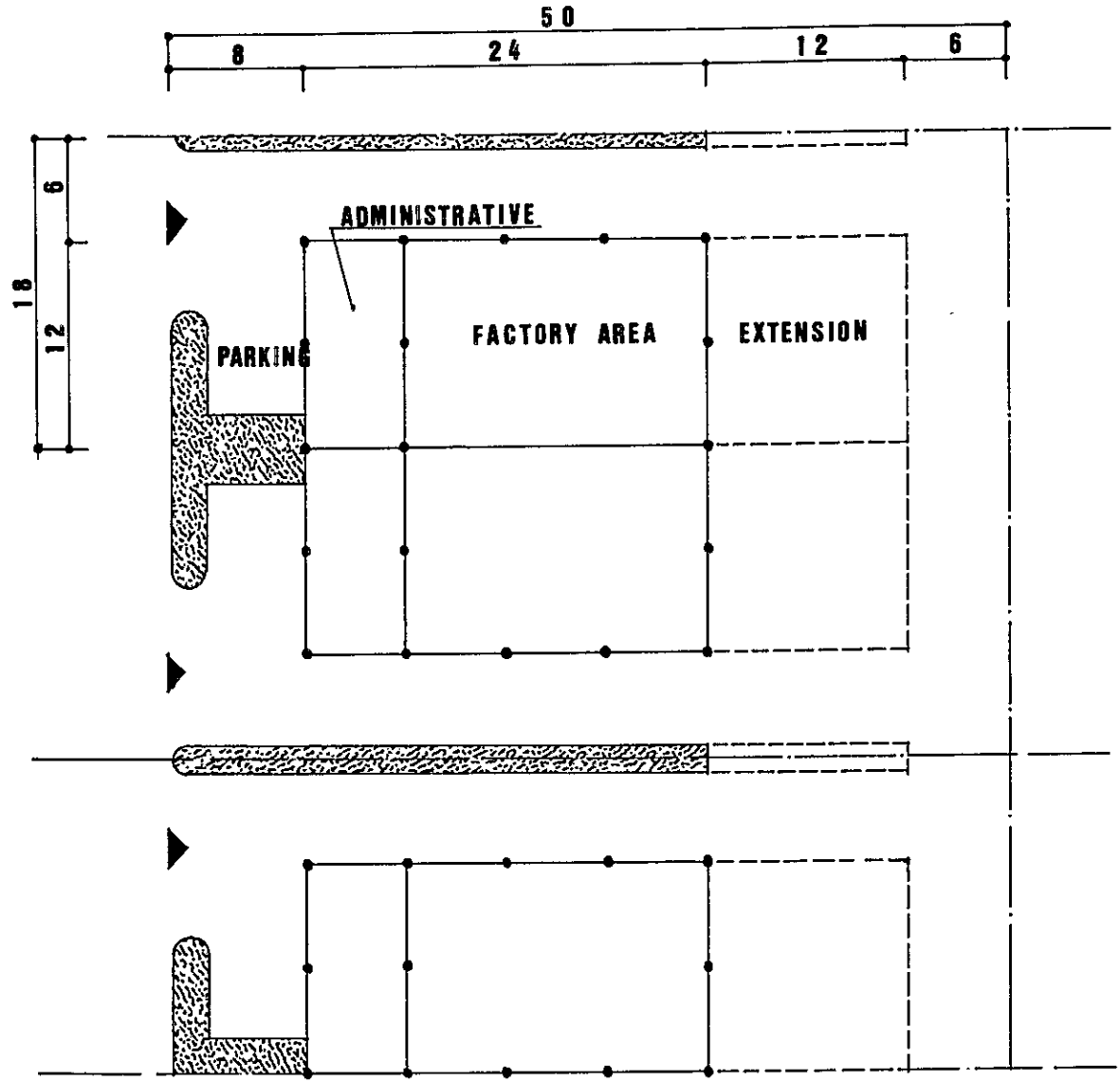
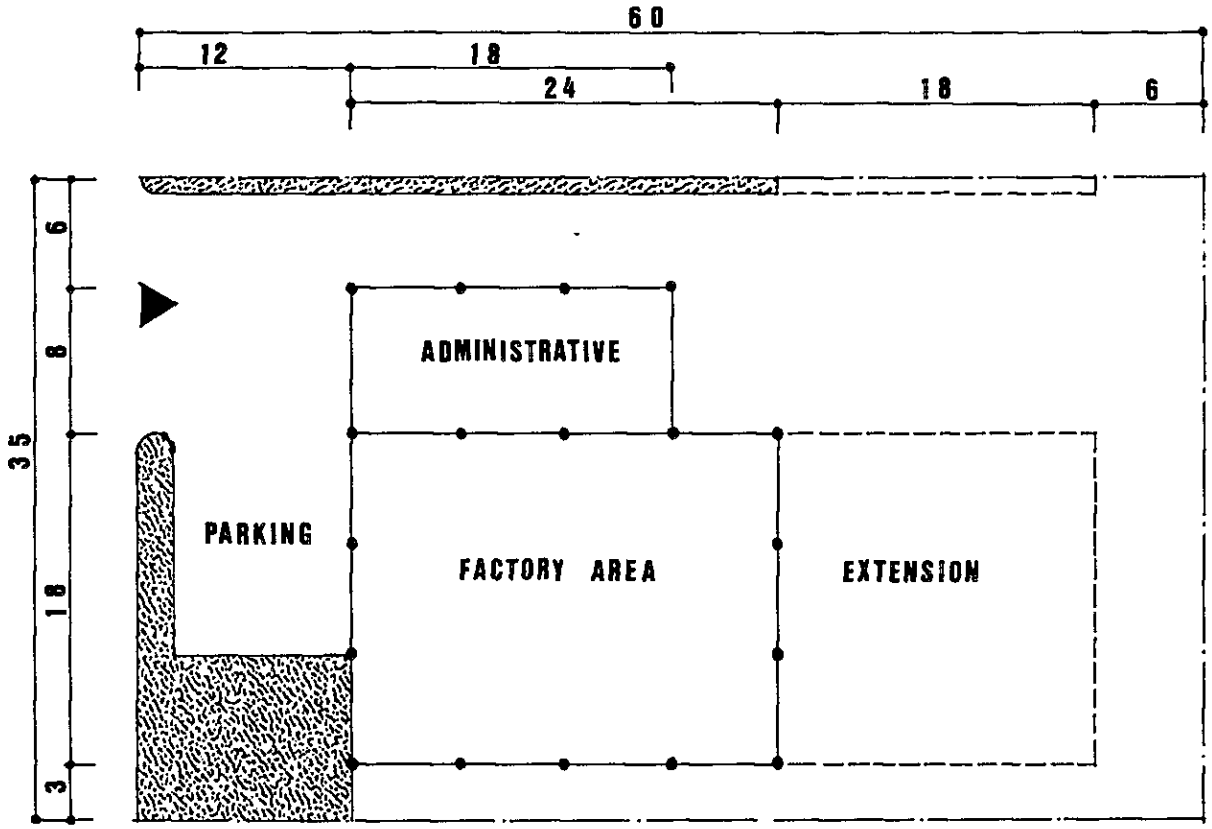


Figure 5.2 Model Layout of Custom Built Factory Type II



iii) Out-door working space should be provided for a certain kind of factories such as auto-repair shops and blacksmith.

Model layouts of Standard Factory Building are shown in Figures 5.3 and 5.4. Architectural designs of two types of Standard Factory Buildings with ground floor plan, front and back elevations, section and sectional details are shown in Drawings No. 5.7 to 5.10 at the end of Annex of this report.

5.2.4 Planning Target of Land Subdivision of IIE

514 From Table 3.18, planning target of land subdivision was set as follows:

i) The number of manufacturing establishments to be accommodated into Standard Factory Building was set to be 210. In addition, it is expected that wholesalers will move into IIE. The number of wholesalers was assumed to be 20 percent of small scale factories. Therefore, the number of required standard factory units was set to be 240.

ii) The number of factories to be accommodated in Type I of Custom Built Factory was set to be about 50 from Table 3.18.

iii) The number of factories to be accommodated in Type II of Custom Built Factory was set to be about 30 from Table 3.18.

These are summarized in Table 5.2.

5.2.5 Estimation of Employment in IIE

515 Number of factory workers employed in IIE was estimated by examining the following two cases based on experiences of small and medium factories in Japan as well as a number of Southeast Asian countries.

i) Number of factory workers based on the planned size of factories.

ii) Number of factory workers based on the composition of industries.

a. Number of Factory Workers Based on the Planned Size of Factories

516 In the following, the number of factory workers was estimated from the planned size of working space of factories as well as unit size of working space per worker.

i) Working space per worker is set to be 14 m^2.

Table 5.2 Planning Target of Land Subdivision of IIE

	Number of Factories	Unit of Factory Land Demand	Land Demand		Note
Land Area of Standard Factory Buildings	240	250 m^2/factory	60,000 m^2	i)	Breakdown of 240 enterprises is as follows: - 210 enterprises for factories - 30 enterprises for wholesaler (assumed to be 15% of manufactures.)
				ii)	Weighted average of land size
Land Area of Custom Built Factory	Type I 50	1,000 m^2/factory	125,000 m^2		
	Type II 30	2,500 m^2/factory			
Total	320	-	185,000 m^2		
Land Area of IIE			275,000 m^2	iii)	The total land area of factories is assumed to be 70% of the whole area for IIE.

Figure 5.3 Model Layout of Standard Factory Building Type A

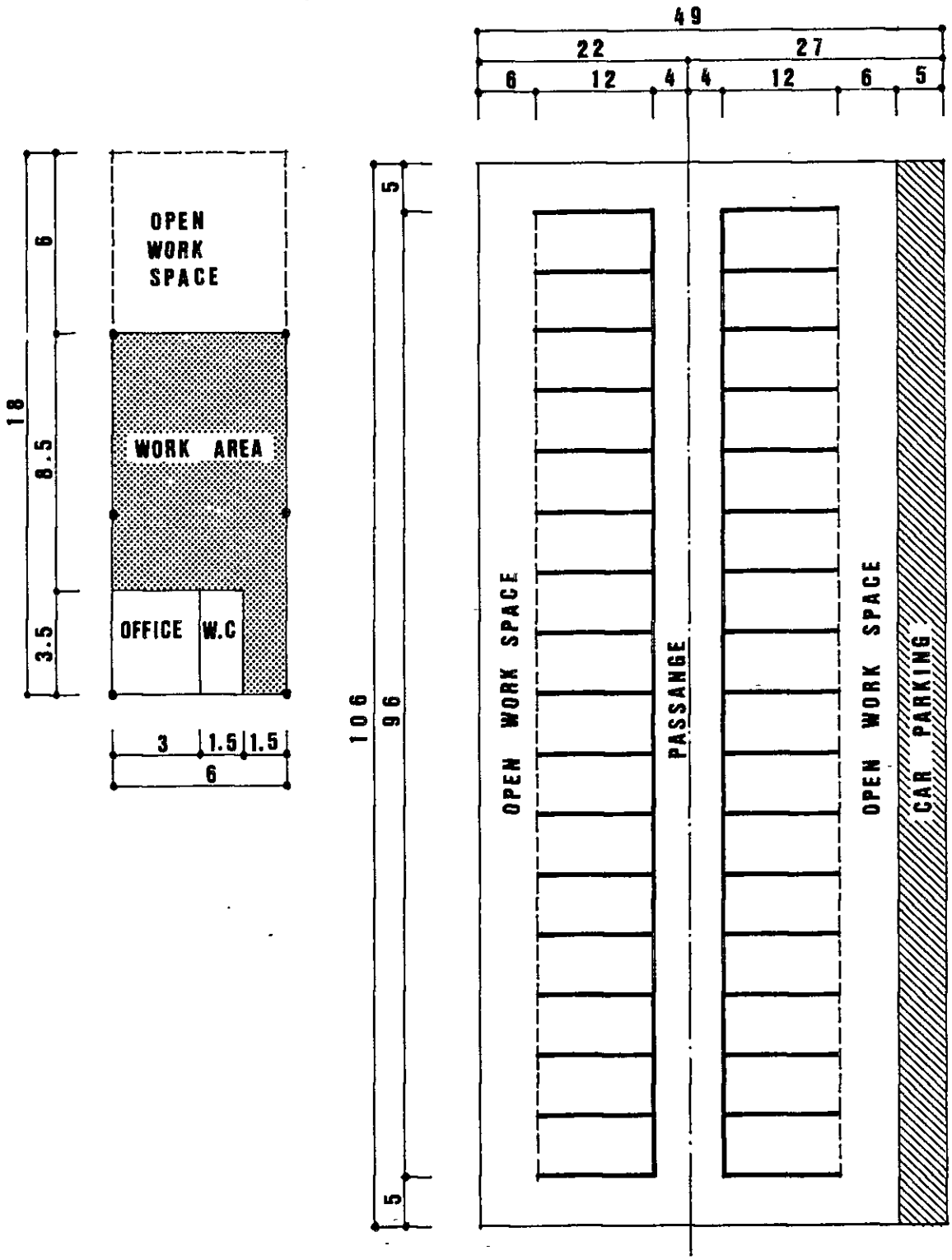
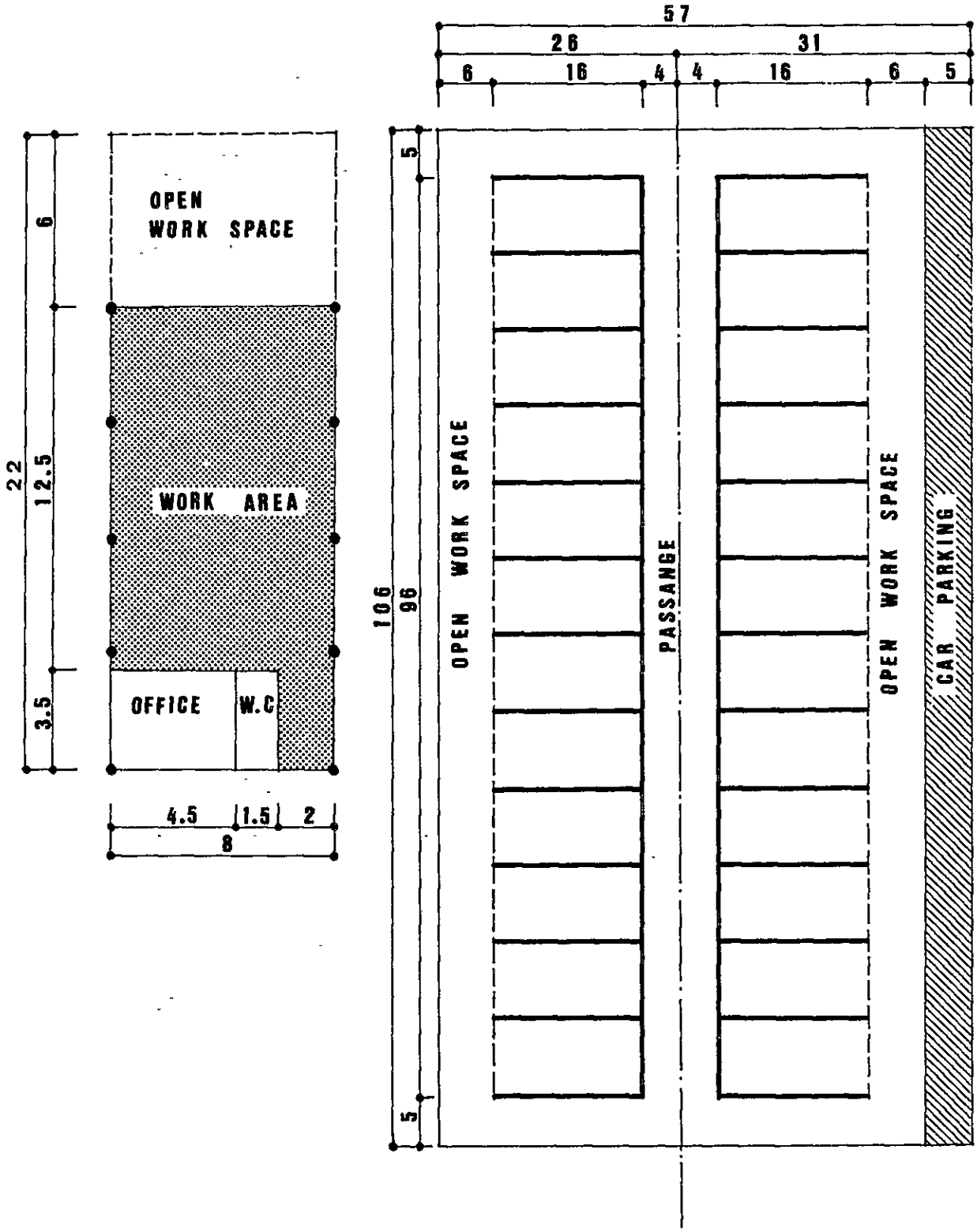


Figure 5.4 Model Layout of Standard Factory Building Type B



ii) Number of workers within the Standard Factory Building Zone is estimated as follows:

Type A (working space: 50 m^2) 3-4 workers/factory

Type B (working space: 100 m^2) 7 workers/factory

Assuming that the average number of workers per factory is five, total number of workers within the Standard Factory Building Zone becomes 1,200 workers as follows:

240 factories x 5 workers/factory = 1,200 workers

iii) Total number of workers within the Custom Built Factory Zone is estimated to be 1,650 workers as follows:

	Workers/ Factory	No. of Factories	Total Number of Workers
Type I	15	50	750
Type II	30	30	900
Total	-	80	1,650

Note: Type I Land Area: 1,000 m^2
Working Space: 216 m^2
Type II Land Area: 2,500 m^2
Working Space: 432 m^2

After the expansion of working space in each Custom Built Factory, the number of workers will increase to 2,750 instead of 1,650 workers. This is given as follows:

	Workers/ Factory	No. of Factories	Total Number of Workers
Type I (working space: 360m^2)	25	50	1,250
Type II (working space: 756m^2)	50	30	1,500
Total	-	80	2,750

iv) In summary, total number of factory workers was estimated to be 2,850 before expansion of working space in Custom Built Factories and 3,950 after expansion of working space.

b. Number of Factory Workers Based on the Composition of Industries

517 Table 5.3 below shows number of required workers per factory which has a similar size to the proposed Custom Built Factory in IIE.

Table 5.3 Number of Required Workers per Custom Built Factory by Industries

Industry	No. of Workers/Factory
Agriculture Oriented Industries	23 - 24
Wooden Products and Furniture	12 - 13
Metal Works and Machines	16 - 17
Non-Metallic Mineral Products and Construction Materials	25 - 27
Plastic Products, Ceramics and Glass Products	23 - 26
Other Industries	
Garment	12 - 13
Paper Boxes and Pesticides	19 - 20
Printing	23 - 24
Other	18 - 19
Average for the Proposed Industries	19 - 20

Source: Study Team.

Based on these figures, the number of workers within the Custom Built Factory Zone is estimated to be in the range of 1,500 to 1,600 workers as follows:

80 factories x (19-20 workers/factory) ≒ 1,500 - 1,600 workers

If we keep the number of workers within the Standard Factory Building Zone as it was estimated in the previous section, the total number of estimated factory workers in IIE falls in the range of 2,700 to 2,800 workers.

c. Total Number of Estimated Factory Workers in IIE

518 Based on the examination of two cases mentioned above, total number of factory workers in IIE is estimated to be about 3,000 as follows:

	No. of Workers
Standard Factory Building Zone	1,200
Custom Built Factory Zone	1,600 1/
Administrative and Supporting Facilities Zone	200 2/
Total	3,000

Notes: 1/ Expansion of working space is not included.
2/ 7% of the total number of factory workers is assumed.

5.2.6 Administrative and Supporting Facilities

519 Table 5.4 indicates types of various administrative and supporting facilities to be introduced into IIE.

520 Sizes of administrative and supporting facilities are estimated as below:

i) Administration Office of Irbid Development Authority (IDA)

1) Staff of IDA is estimated to be 26 persons (see section 8.4).

2) Average office space per person is assumed to be 15 m^2 and a meeting room of 40 m^2 (for 15-20 people) is provided.

3) Floor space becomes as follows:
26 persons x 15 m^2/person + 40 m^2 = 430 m^2

Note: In general, design standards of administration office are as follows: 50 m^2 for a director; 40 m^2 for a manager; 16.5 m^2 for a chief; and 3.3 m^2 for a clerk.

4) Exhibition space shall be provided in the lobby of the first floor of administration building. In addition, about 40 m^2 of management consulting room for factories shall be provided.

Table 5.4 Administrative and Supporting Facilities

Type	Facilities
Administration	- Administration Office of Irbid Development Authority (IDA)
Public Facilities	- Fire Station
	- Post Office
	- Police Station
Common Facilities	- Common Metal Workshops
	- Clinic
	- Meeting Rooms
	- Copy Center
	- Display Booths (Space)
	- Park
Commercial Facilities	- Shops
	- Offices
	- Banks
	- Restaurants and Cafeteria
	- Gas Station

Source: Study Team.

ii) Public Facilities

1) Fire Station

- Fire Station is assumed to be managed by the Municipality of Irbid.

- One ordinal fire engine and one chemical fire engine with 15 fire fighters should be provided.

- Floor space for this size of fire station becomes 240 m^2.

2) Post Office

- 75 m^2 of floor space with five staff is assumed.

3) Police Station

- 50 m^2 of floor space with three policemen is assumed.

iii) Common Facilities

1) Common Metal Workshop

- Floor space of common metal workshop is estimated as below:

Workshop	216 m^2
Instructor's Room Material Storage W.C.	72 m^2
Total	288 m^2

2) Clinic

- Number of factory workers in the existing industrial area and IIE is estimated to be in the range of 3,500 to 4,000. The proposed medical clinic gives a medical treatment and regular medical examination for factory workers.

- Floor space for the proposed clinic is estimated as below.

Examination room:	One unit is 30 m^2 floor space Four units (medicine, surgery, dental, ophthalmology) 4 x 30 m^2/room = 120 m^2
Pharmacist office:	25 m^2
X-ray room:	50 m^2
Waiting room:	75 m^2
Office:	20 m^2
Rest room for doctors and nurses:	20 m^2
Bed room (three beds):	30 m^2
Counselling room:	20 m^2
Total	360 m^2

3) Meeting Rooms

- Multipurpose meeting rooms of 300 m^2 in total floor space will be provided. Breakdown of meeting rooms is as follows:

Four small meeting rooms, each for 10-15 persons 2 m^2 /person x 15 persons x 4 rooms =	120 m^2
A large hall for 100 persons 1.8 m^2/person x 100 persons =	180 m^2
Total	300 m^2

4) Copy Center

- A copy center of 20 m^2 floor space will be provided.

5) Park

- A small park will be provided as a leisure facility for factory workers.

iv) Commercial Facilities

1) Shops and Offices

Two shops (small super-markets) and three offices of each 72 m^2 unit will be provided.

Unit: 6 m x 12 m = 72 m^2
Total floor space: 72 m^2 x 5 = 360m^2

2) Banks

Two branch offices of bank, each having 144 m^2 floor space will be provided.

Total floor space: 144 m^2 x 2 = 288 m^2

3) Restaurant and Cafeteria

Number of seats requried for restaurant/cafeteria is estimated as follows:

- utilization coefficient per worker per week is considered to be in the range of 0.1-0.2.
- each seat is assumed to be occupied two times per day.
- average number of required seats becomes:
  4,000 workers x (0.1-0.2) / 6 / 2 ≈ 34-67 seats.
- assuming that peak demand is 150 percent of the average, number of required seats becomes:
  (34-67) x 1.5 = 50-100 seats.

Assuming that the number of seats is 90, floor space for dining room becomes as follows:

- floor space per seat: 1.3 m^2 - 1.5 m^2
- total floor space for dining room:
  90 seats x (1.3 m^2 - 1.5 m^2) ≈ 117-135 m^2

Therefore, total floor space for restaurant/cafeteria is set to be 200 m^2 including kitchen space.

4) Gas Station

One gas station of 20 m x 30 m (600 m^2) will be provided in IIE.

521 Architectural designs of administration buildings and other supporting facilities are detailed in Drawings No. 5.11 to 5.15 at the end of Annex of this report.

5.3 Conditions of the Selected Site

5.3.1 Location of the Selected Site of IIE

522 The proposed site of IIE is located 3 km north-east from the City Hall of the Municipality to which it is connected by Route 23 as shown in Figure 4.5. As mentioned in Section 4.6, the site shall have excellent transportation conditions upon the completion of two proposed Ring Roads project and Connecting Roads of these Ring Roads.

5.3.2 Present Conditions of the Site of IIE

a. Topographical Condition

523 The site has a topography of gently decending toward north-east as shown in Figure 5.5. Maximum difference of land level is approximately 10 m with average slope gradient of 2 percent. Accordingly, necessary earth works shall be minimal.

b. Geological Condition

524 The site is mostly covered with red and brown soil mixed with sandstone, limestone, chalk and basalt as shown in Figure 5.6. Though it may partly require removal of some stones, land preparation will not require any major work.

c. Land Use Condition

525 The proposed site is currently used as agricultural land, yet a small new commercial building was recently put up within the site in addition to the Tile Factory previously located. Judging from the size and structure of those two buildings, it will not cost much to relocate them if the owners do not refuse. Present land use condition is shown in Figure 5.7.

d. Land Re-adjustment Plan

526 The Municipality of Irbid formulated a land re-adjustment plan in 1972, in which the proposed Boundary Ring Road was set to be the boundary of the plan. An amendment of the plan is currently undertaken, in which the area between the Boundary Ring Road and the expanded Municipality boundary is examined for a suitable readjustment plan. The proposed site of IIE falls into this expanded area for the new readjustment plan.

e. Condition of Land Holdings

527 Condition of land holdings of the site is shown in Figure 5.8. The number of land holders within the site of IIE is about 30.

Figure 5.5 Topography of the Site of IIE

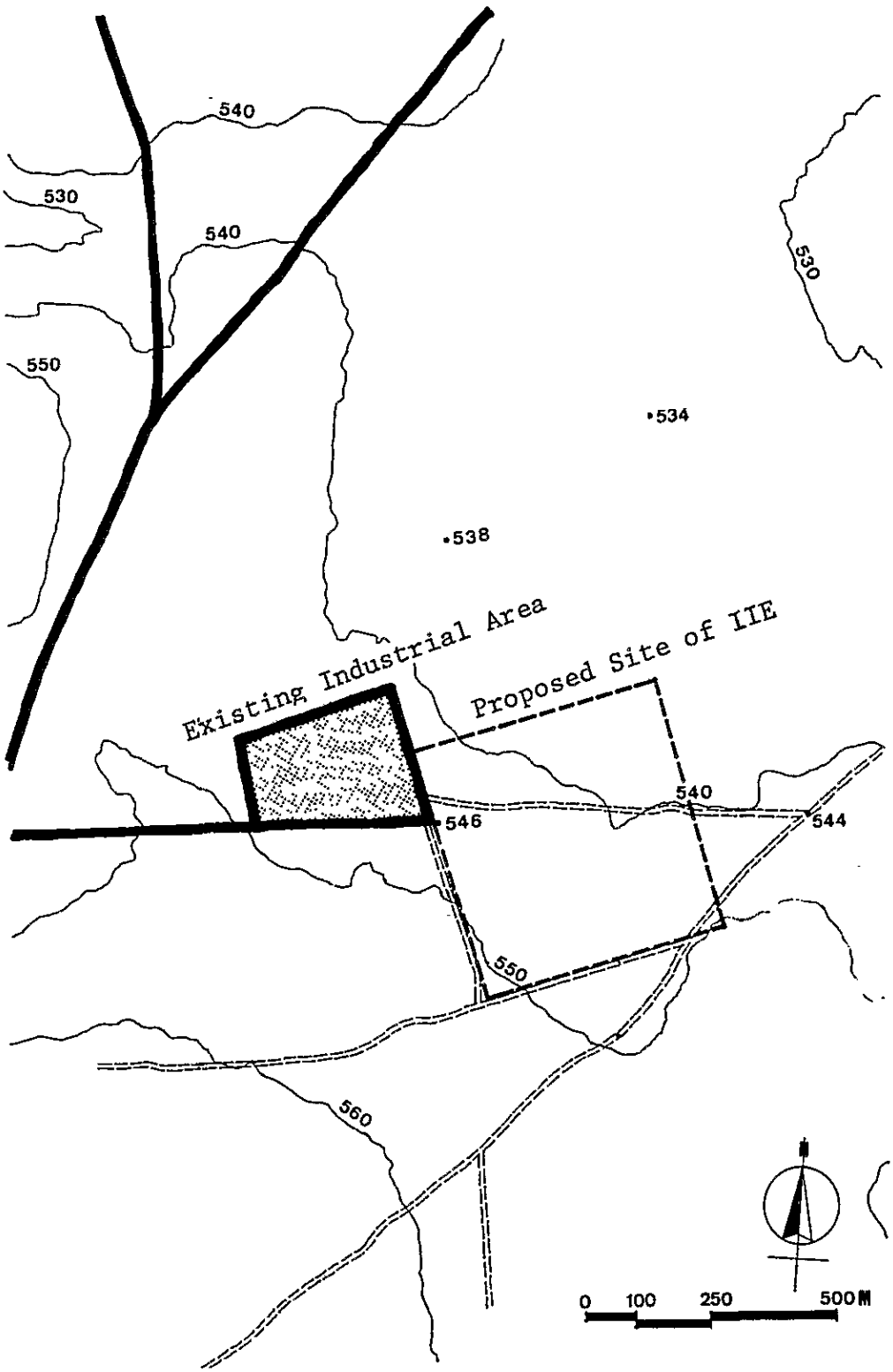
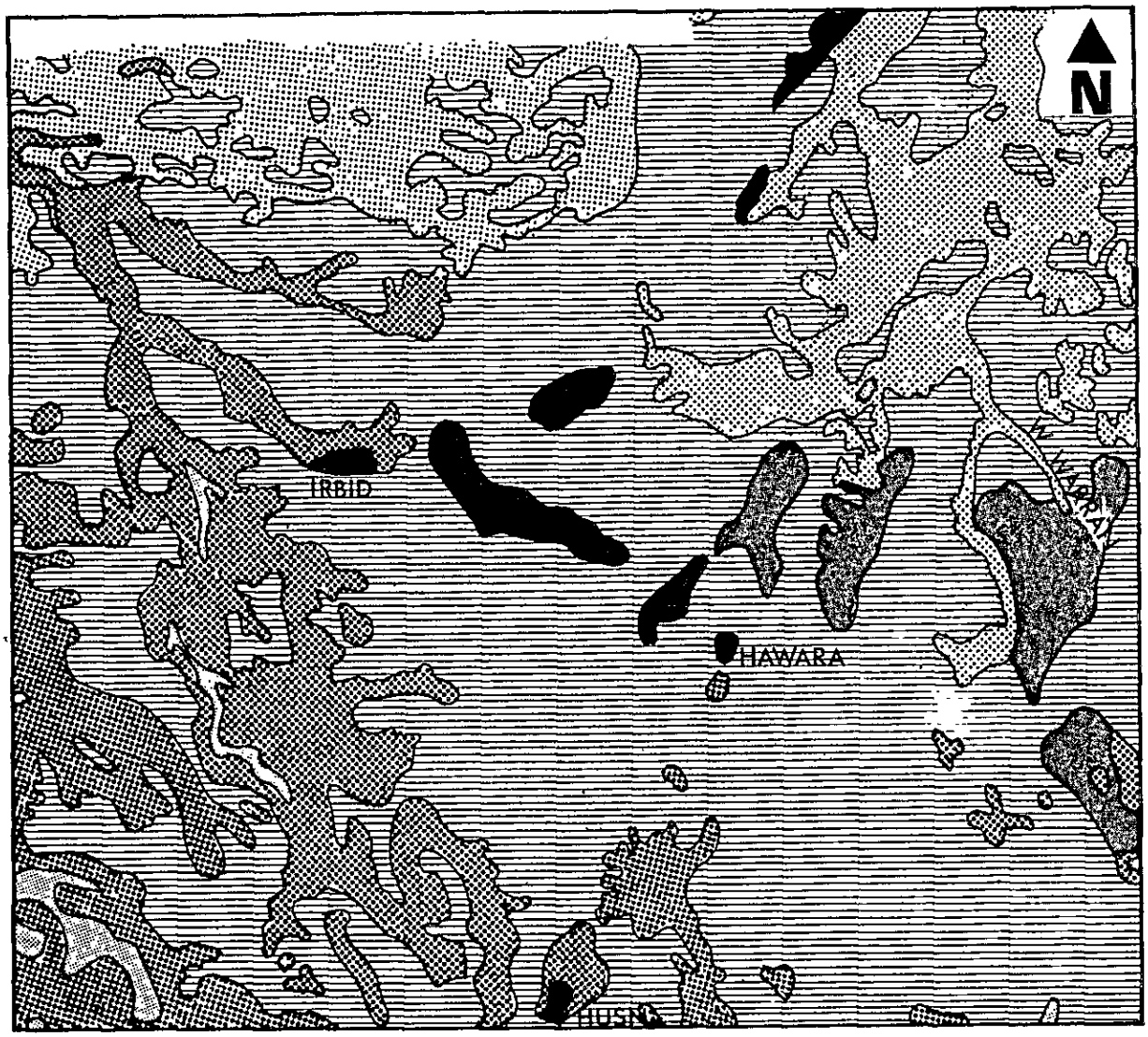


Figure 5.6 Geological Map of the Irbid Area



LEGEND

- Soils and Alluvia
- Basalt
- Undifferentiated
- Lower Chalks
- Upper Limestones
- Upper Limestones and Marls

Source: Natural Resource Authority

Scale 1:100,000

Figure 5.7 Present Land Use Pattern of the Site of IIE

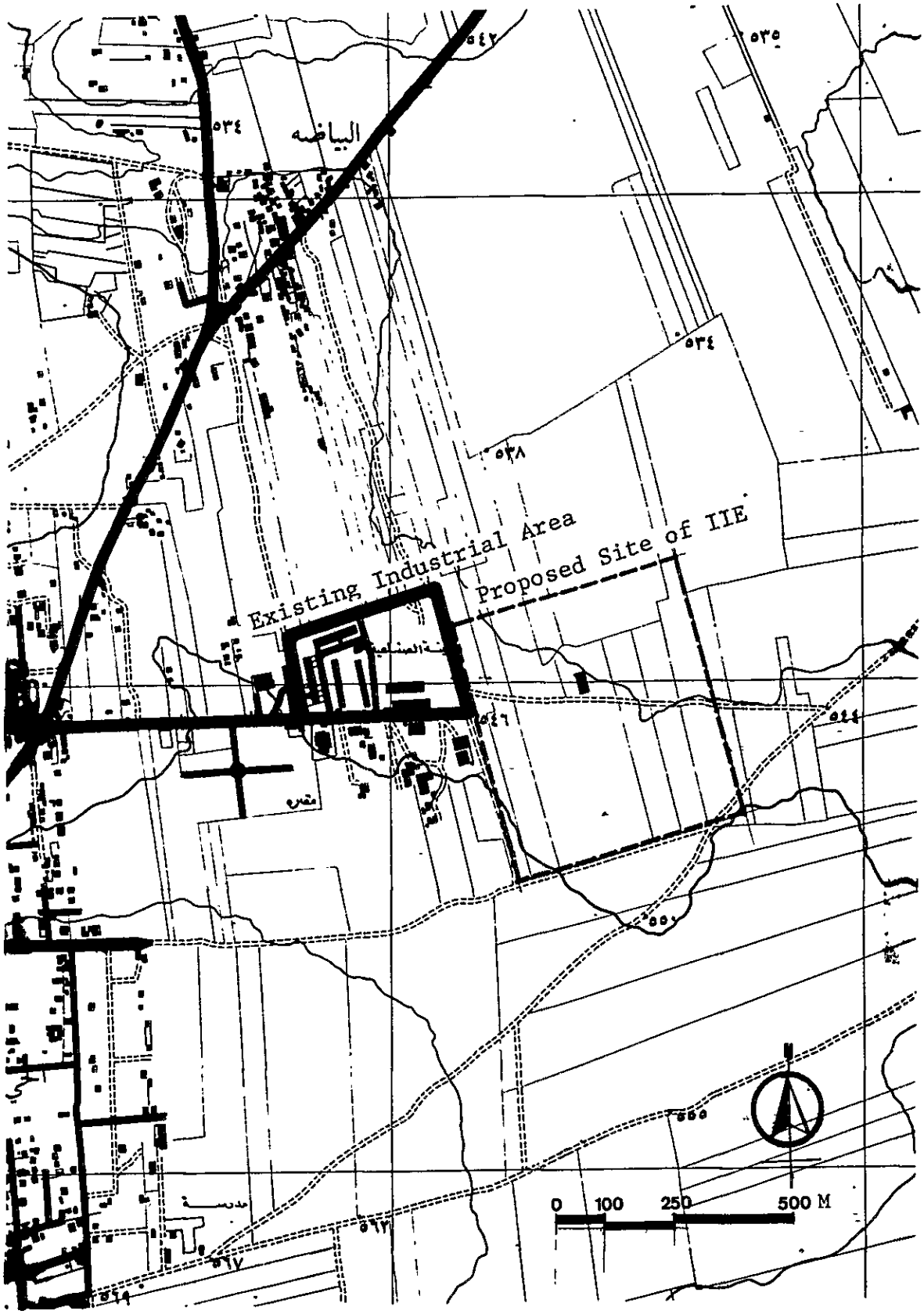
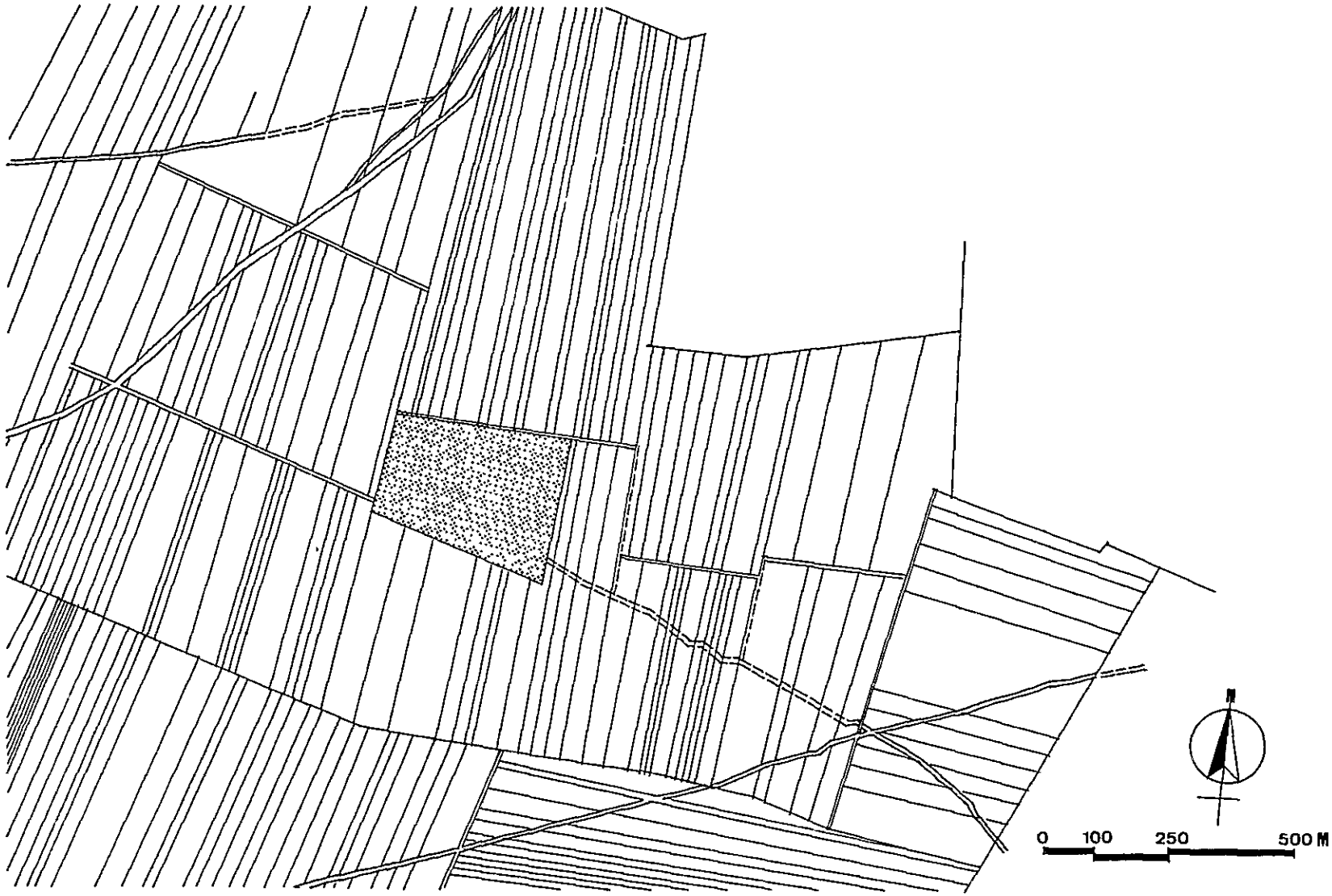


Figure 5.8 Land Holdings of the Site of IIE



5.4 Formulation of Land Use Plan of IIE

5.4.1 Alternative Land Use Plans

528 Several preconditions need to be examined prior to the formulation of alternative land use plans of IIE.

i) Land re-adjustment plan of the Municipality is based upon a certain boundary which is called "Block". The site of IIE is divided into two Blocks as shown in Figure 5.9, and the land demand of 27.5 ha should be properly coordinated with these two Blocks.

ii) Plan I and Plan II in Figure 5.9 were first considered as alternatives so to secure 27.5 ha of land within one Block. However, both plans are not desirable in view of land use planning, since incomplete sandwich-shaped area is generated by both plans.

iii) In view of the above consideration, the area for IIE is set to be adjacent to the existing industrial area althouth it belongs to two Blocks of land readjustment plan. Based upon this selection, alternative site plans of IIE are examined in this Feasibility Study.

529 Two alternative site plans are prepared to deal with the existing two buildings in the proposed site:

i) Site Plan A: To transfer these two buildings as planned in the Pre-feasibility Study, and

ii) Site Plan B: To exclude the area where these two buildings are located and secure the same space of area.

Land use plans for the two site plans of IIE are shown in Figures 5.10 and 5.11. Evaluation of land use plans was made in the followings.

530 Characteristics of land use plan on the site plan A are specified as follows:

i) The shape of this site plan is nearly square, being about 515 meters on east-west direction and about 535 meters on north-south direction, and the area is about 27.5 ha.

ii) Functional land use zoning can be formulated in conjunction with the land use pattern of the existing industrial area, that is, the present access road for the existing industrial area can be extended to the IIE site which shall become the east-west direction trunk road of IIE, and the Standard Factory Building Zone shall be located in the north side of this trunk road while the Custom Built Factory Zone shall be located in south side.

Figure 5.9 Alternative Site Plans of IIE

iii) Administrative and supporting facilities zone shall be located adjacent to the Boundary Ring Road so that it becomes the central location for the combined area of the existing industrial area and IIE site.

iv) Since the shape of the site is almost square, rational layout of factory lots in square shape is possible in land use planning. Hence, dead space can be kept minimum, and land use becomes very efficient.

v) With regard to the expansion of industrial area, this site plan is able to provide about 24 ha of land just between the east edge of this site and the Outer Ring Road. The shape of this expansion area is also close to square shape that is important in considering land use of this area.

vi) The east-west trunk road in this site plan shall be extended to the proposed Boundary Ring Road after the land use of future expansion area is formulated. The only disadvantage of the site plan A is that the functional relationships of IIE may become loose due to in-site through traffics between the two Ring Roads.

531 Characteristics of land use plan on the site plan B are specified as follows:

i) The shape of this site plan is rectangular, being about 900 m on east-west direction and about 300 m on north-south direction, and the area is about 27.2 ha.

ii) Because the shape of the site is a strip on east-west direction, administrative and supporting facilities zone should be placed in the central position on this strip. The only possible way of zoning is to make a parallel zoning, that is, starting from the Boundary Ring Road side, Standard Factory Building Zone comes first, then small size Custom Built Factory Zone, and medium size Custom Built Factory Zone is put on the Outer Ring Road side.

iii) In formulating a location of administrative and supporting facilities zone, convenience for the workers of IIE was put first priority. As a result, there is a quite distance between that location and the existing industrial area.

iv) Since the shape of this site plan is rather irregular, it brings forth irregular shape of factory lots as well as quite lot of dead space.

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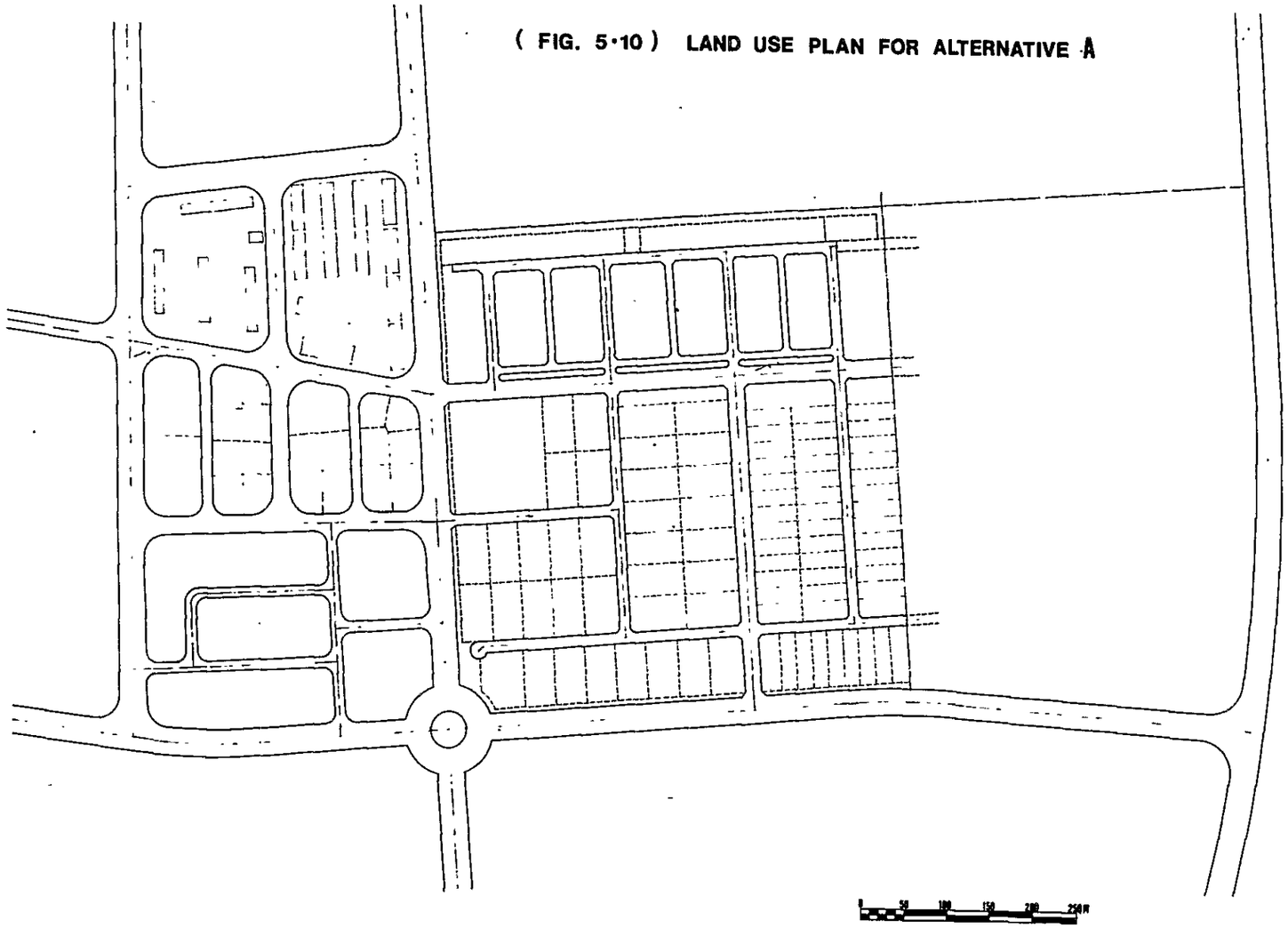
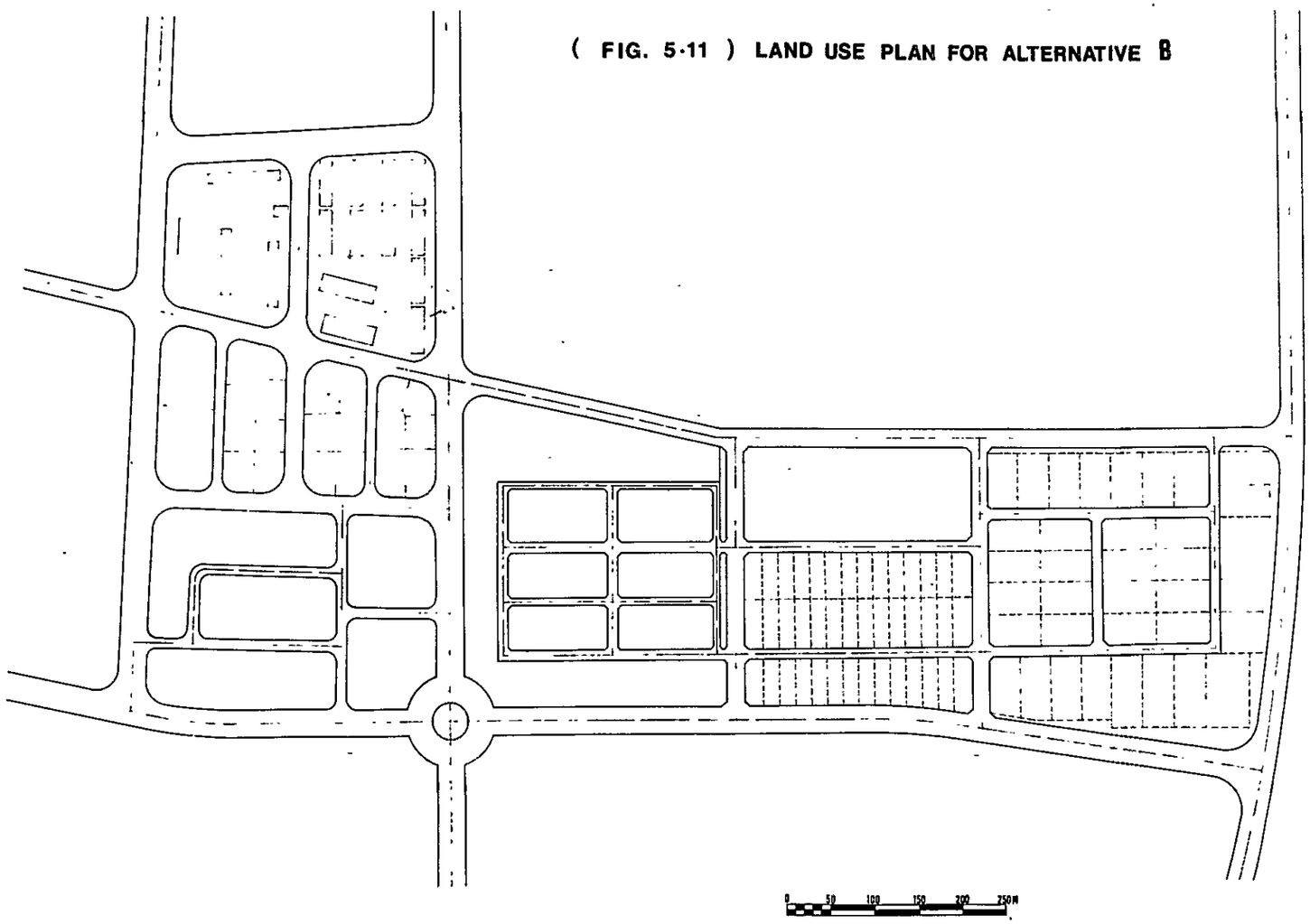
(FIG. 5·10) LAND USE PLAN FOR ALTERNATIVE A



IRBID INDUSTRIAL ESTATE

(FIG. 5-11) LAND USE PLAN FOR ALTERNATIVE B



v) One of the most serious problems of this site plan is that it cannot secure future expansion area. If it is indeavored to secure expansion area, the area north of this site could be provided. However, the shape is quite irregular that will result in very ineffective land use.

vi) The only advantage of this site plan compared to the site plan A is that in-site through traffics can be avoided by providing two east-west connecting roads outside the site.

5.4.2 Formulation of Land Use Plan of IIE

a. Selected Site Plan

532 After the discussin of two alternative site plans with the Counterpart Committee of this Study, the site plan A was selected on which land use plan of IIE is based. The site plan A has advantages over the site plan B in the following points:

i) Efficient and rational layout of factories and other facilities is possible, and

ii) Functional relationships not only with the existing industrial area but also with the future expansion area can be secured.

It should be noted that the expansion area is always kept in mind in formulating the land use plan of IIE.

b. Formulation of Land Use Plan of IIE

533 Two main access roads to IIE shall be provided as shown in Figure 5.12. One is east-west access/primary road which is an extension of the access road in the existing industrial area and shall be extended through the expansion area to the Outer Ring Road. The other is north-south access/primary road which shall be linked to the proposed Connecting Road between the Boundary Ring Roads and the Outer Ring Road. In addition, supplementary access road shall be provided mainly for the traffic to administrative and supporting facilities.

534 In order to maintain efficient functional relationships with the existing industrial area, the Standard Factory Building Zone shall be placed on the north side of the east-west access/primary road. The Custom Built Factory Zone shall be placed on the south side of the east-west access/primary road in which the west side of the north-south access/primary road shall be kept for the medium size Custom Built Factory Zone and the east side for the small size Custom Built Factory Zone as shown in Figures 5.13 and 5.14.

535 Administrative and Supporting Facilities Zone shall be placed adjacent to the Boundary Ring Road for the convenience of users. In addition, a part of small size Custom Built Factory Zone shall be used for utility facilities such as gas station and fire station.

536 Another area for utility facilities such as water supply and electricity shall be provided in the north-west corner of the site in consideration of efficient links with external facilities. A pump station for sewerage shall be provided in the north-east corner of the site by taking the topographical condition into consideration.

537 Buffer greens shall be placed on the surroundings of IIE. In addition, a park shall be provided in the small size Custom Built Factory Zone along the east-west access/primary road.

c. Land Use and Road Plan

538 Access to individual factory lots is provided from the internal primary or secondary roads within IIE, thus avoids unnecessary traffic on the Boundary Ring Road and makes the management of IIE much easier.

539 It is anticipated that traffic volume on the east-west access/primary road will increase upon its extension to the Outer Ring Road. Therefore, any direct access from this road to factory lots should be avoided. Instead, service roads shall be layed out so to maintain good access to individual factories.

540 In view of the above consideration, composition of roads are determined as follows:

Primary Road	width = 240 m
Secondary Road	width = 12.0 m
Service Road	width = 8.0 m

For the design standard of these roads, see section 6.2.2.

d. Plan for Physical Distribution of Industries

541 Physical distribution of industries within IIE is planned, as shown in Figure 5.14, based on the consideration of specific characteristics of each type of industry as well as interlinkages among industries.

e. Location of Various Facilities

542 Locations of various facilities such as the fire station, gas station and electricity substation are shown in Figure 5.15.

5.4.3. Proposed Land Use Composition of IIE

543 As a result of previous land use planning, the land use composition of IIE is proposed as shown in Table 5.5. Factory land area becomes 186,553 m^2 in total, while the area for administrative and supporting facilities becomes 15,855 m^2. In total, the area required for IIE becomes to be 274,950 m^2.

Table 5.5 Proposed Land Use Composition of IIE

Land Use	Land Area		Note
i) Factory Land Area			
1) Standard Factory	53,719 m^2	19.5%	- Type A: 9 Build - 144 Factories = 28,809 m^2 - Type B: 8 Build - 96 Factories = 24,910 m^2
2) Custom Built Factory	132,834	48.3	- Type I = 49 Lots = 50,389 m^2 - Type II = 36 Lots = 82,445 m^2
Sub-total	186,553	67.8	
ii) Administrative and Supporting Facilities	15,855	5.8	
iii) Roads	46,920	17.7	- W = 20m x 806m = 16,120 m^2 - W = 12m x 2.092m = 25,104 m^2 - W = 8m x 712m = 5,696 m^2
iv) Utility Facilities	7,493	2.7	- Water Reservoir, Transformer, etc. = 5,846 m^2 - Pump Station for sewerage = 1,674 m^2
v) Parks	2,486	0.9	
vi) Buffer Greens and Others	15,643	5.7	- Buffer Greens ≃13,883 m^2 - Extension of Roads = 1,760 m^2
Total	274,950	100.0	- About 535m x 515m

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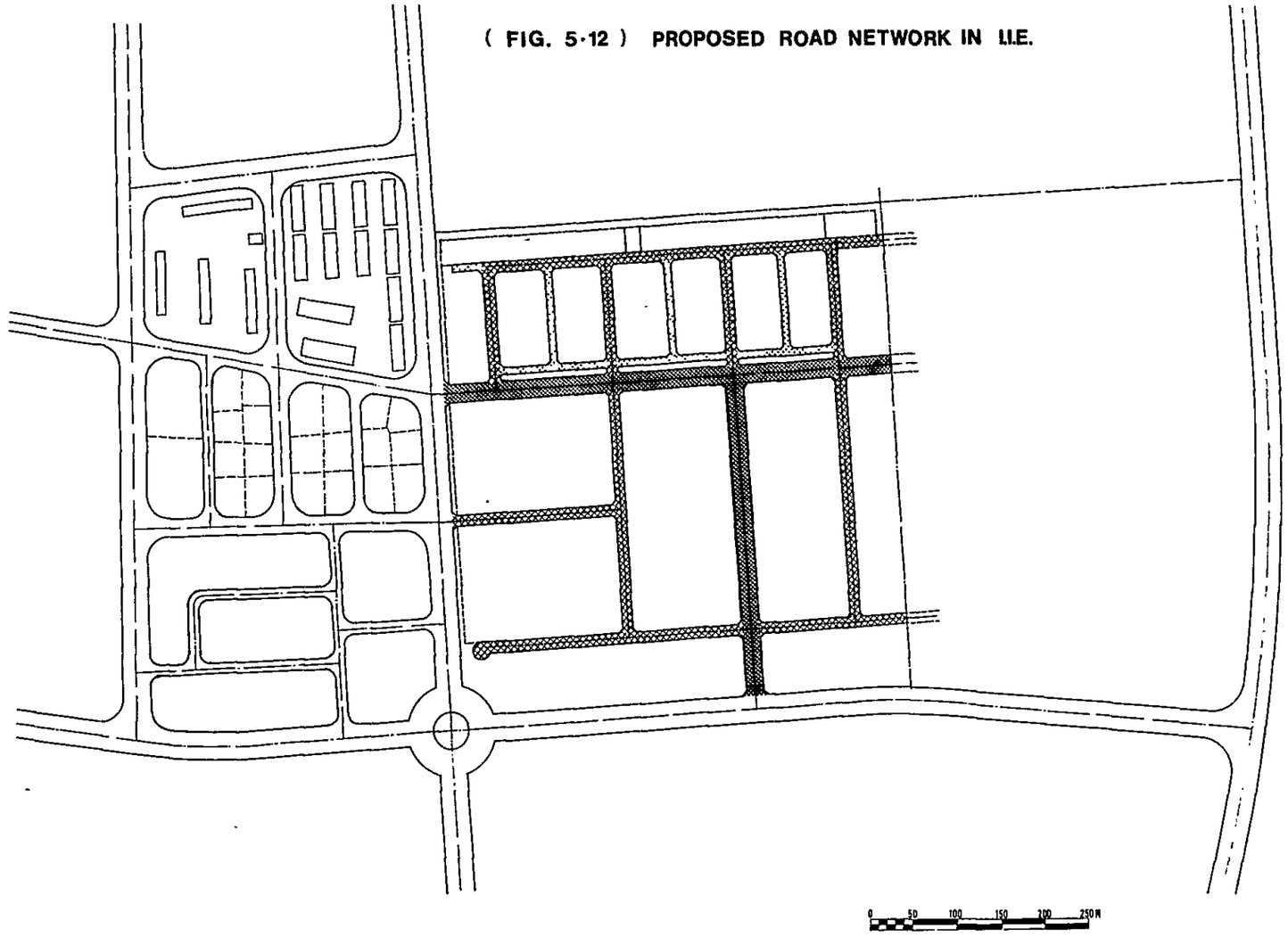
(FIG. 5-12) PROPOSED ROAD NETWORK IN I.I.E.



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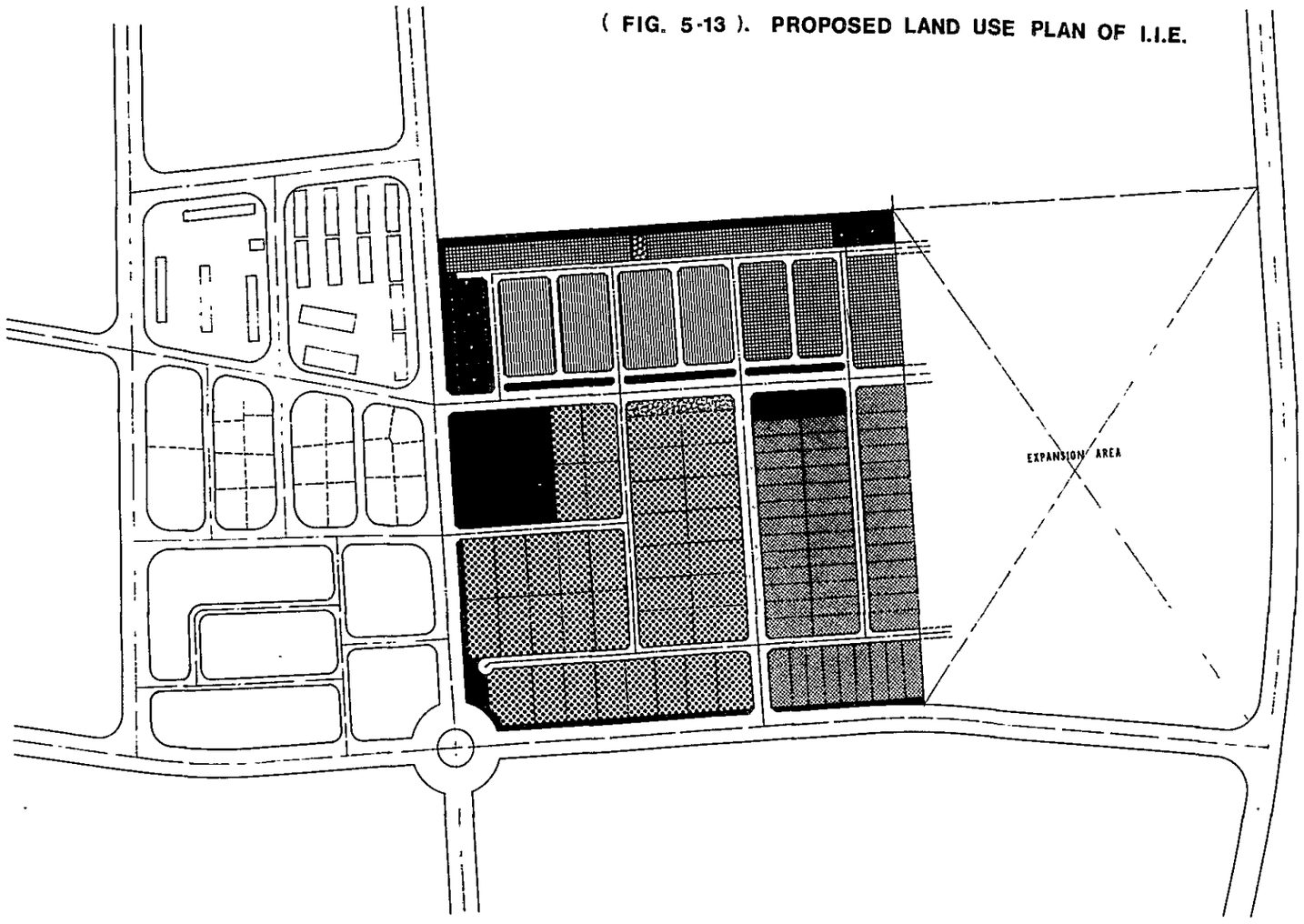
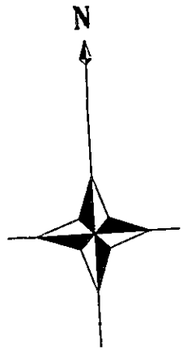
(FIG. 5-13). PROPOSED LAND USE PLAN OF I.I.E.





LEGEND

- SITE FOR STANDARD FACTOTY BUILEINGS (UNIT SIZE 72×)
- SITE FOR STANDARD FACTOPY BUILDINGS (UNIT SIZE 128×)
- SITE FOR SMALL SIZE OF CUSTOM MADE FACTORIES
- SITE FOR MEDIUM SIZE OF CUSTOM MADE FACTORIES
- SITE FOR ADMINISTRATIVE AND SUPPORTING FACILITIES
- SITE FOR UTILITY FACILITIES
- SMALL SIZE PARK
- BORDER GREEN

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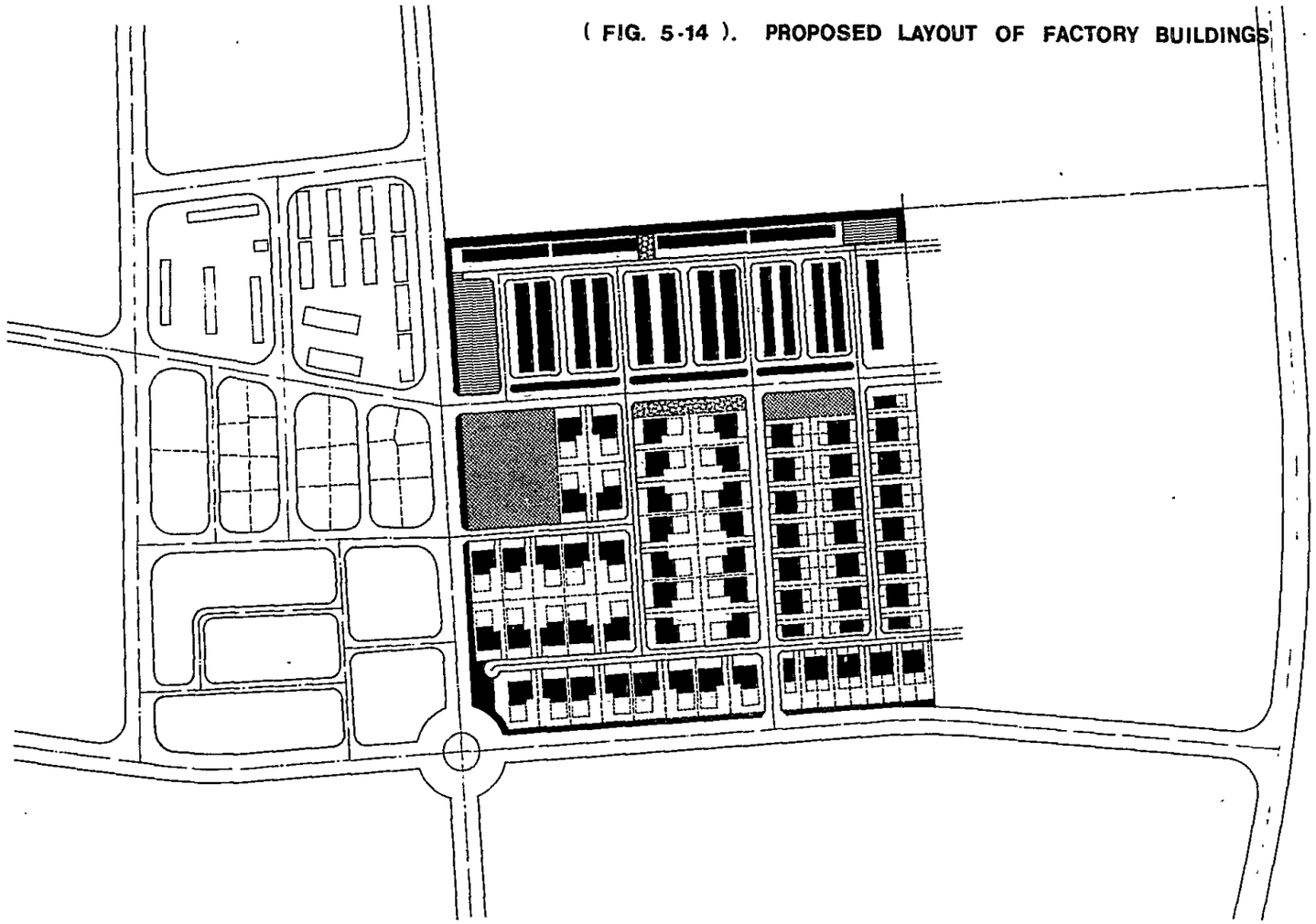
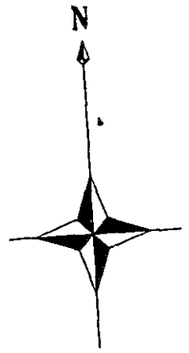
(FIG. 5-14). PROPOSED LAYOUT OF FACTORY BUILDINGS





LEGEND	
	FACTORY BUILDINGS
	SITE FOR ADMINISTRATIVE AND SUPPORTING FACILITIES
	SITE FOR UTILITY FACILITIES
	SMALL SIZE PARK
	BORDER GREEN

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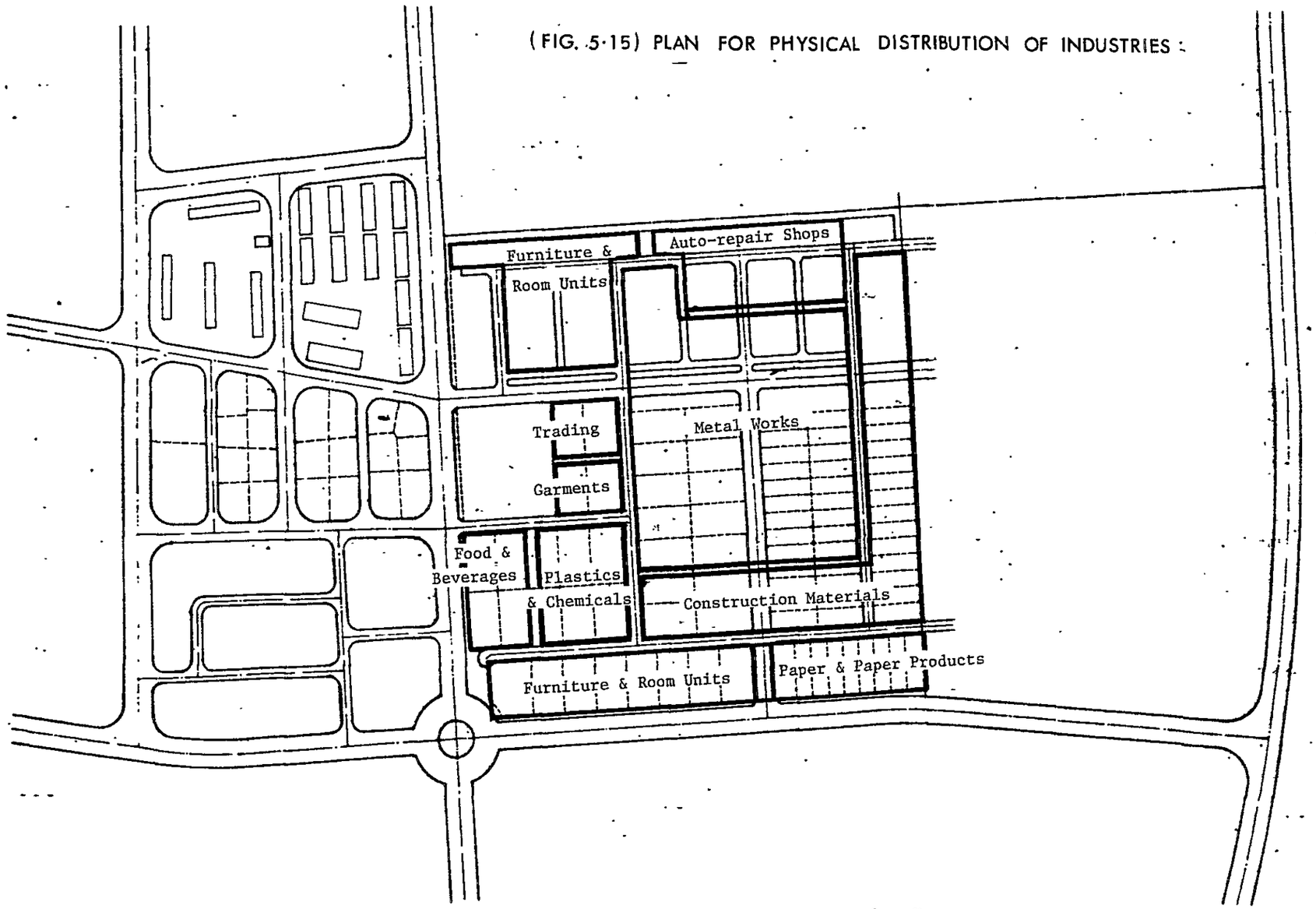
(FIG. 5·15) PLAN FOR PHYSICAL DISTRIBUTION OF INDUSTRIES :-



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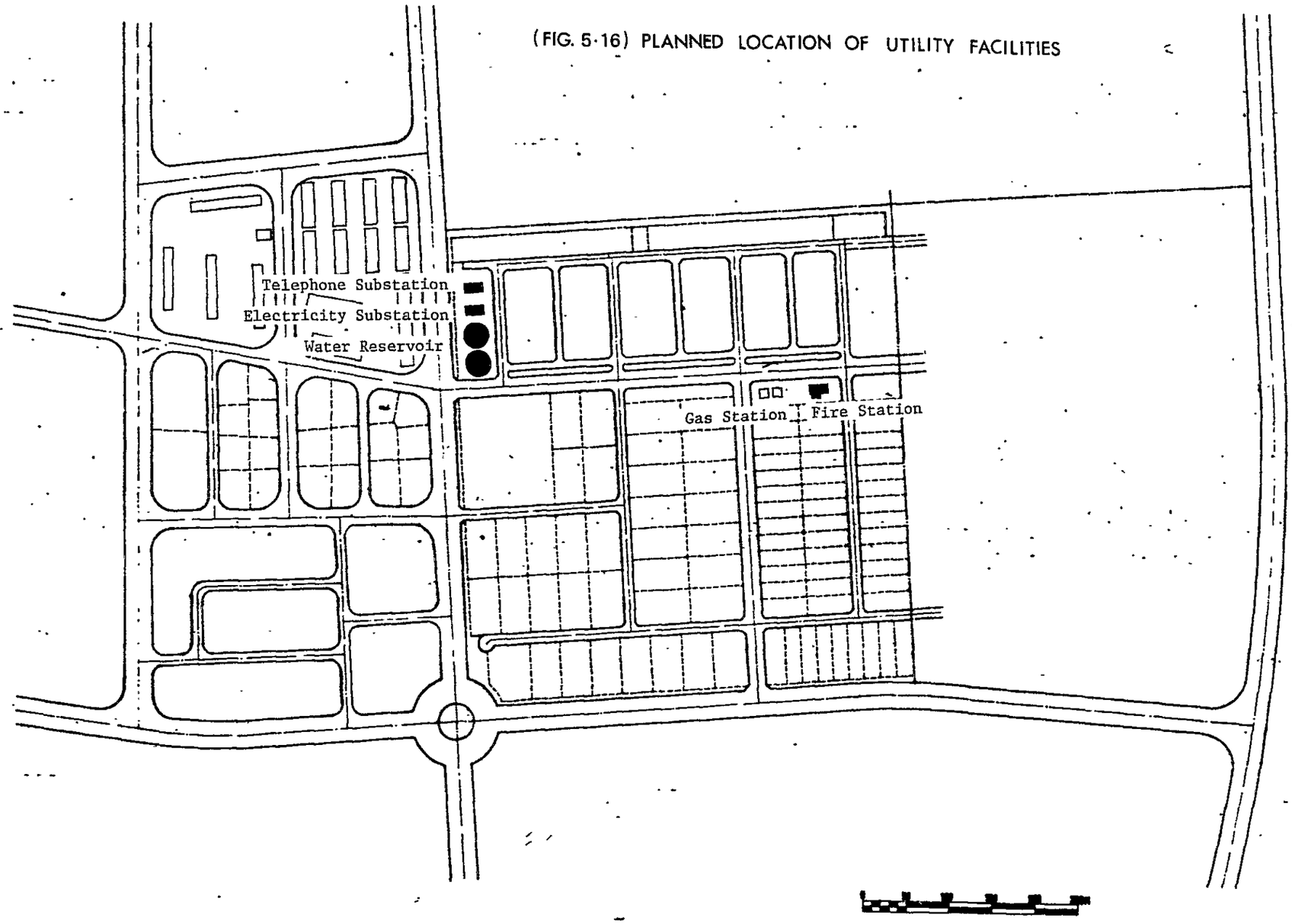
(FIG. 5·16) PLANNED LOCATION OF UTILITY FACILITIES



CHAPTER VI

PRELIMINARY ENGINEERING DESIGN

CHAPTER VI

PRELIMINARY ENGINEERING DESIGN

6.1 Land Preparation

601 The basic approach of land preparation planning was set to minimize necessary earth works and to balance the volume of earth within the site of IIE. Although removal of stones may be required from the geological point of view, it shall not be a major obstacle for land preparation. From the inspection of factory building construction works undertaken in the existing industrial area, there seems to be any problem in the ground conditions.

602 Figure 6.1.A and 6.1.B indicate the proposed land preparation plan of IIE. A special consideration was placed on maintaining smooth approaches to individual factory lots. Since IIE is designed for small and medium scale factories, the frontage of each factory is narrow and the number of factory lots is quite large. Consequently, if land preparation is planned to be a terrace style, a considerable number of factories could not secure good access to them. Therefore, lot allotment shall be shaped along contour in order to eliminate the volume of earth work and to provide easy access to each lot at lower rate of right of way and network for securing smooth traffic flow within the site of IIE. Slope gradient of roads was also taken into consideration in land preparation planning, and it was set to be less than 2 percent.

6.2 Road Network in IIE

6.2.1 Generated Traffic Volume

603 Types of traffics generated from IIE are as follows:

i) Traffics generated by carrying into or out of raw materials and products

ii) Traffics associated with business activities

iii) Traffics associated with activities of administrative and supporting facilities, and

iv) Traffics associated with commuters of IIE.

604 Estimation of generated traffic volume was made on each type of traffics as below. Various unit values used in the following estimation procedure were derived based on experiences of industrial estates in Japan and other countries.

i) Traffics generated by carrying into or out of raw material and products:

1) Since the amounts of goods generated by factories largely depend on specific type of industries to which each factory belongs, the figures indicated in Table 6.1 are used to estimate the amount of generated goods in IIE.

Table 6.1 Estimation of the Amount of Generated Goods in IIE

Industry	No. of Workers	Unit Value of Generated Goods (t/year/worker)	Total Generated Goods (1,000 tons/year)
Machinery Related Industries	1,200	30	36.0
Metal Products	800	100	80.0
Other Industries	800	120	96.0
Total	2,800 1/	-	212.0

Source: Study Team.

Note: 1/ Workers in administrative and supporting facilities are excluded.

2) Given the amount of generated goods in IIE, daily traffic volume generated from IIE for carrying into or out of raw materials and products is estimated by assuming that trucks of 5 ton loading capacity are used 300 days/year with a loading factor of 60 percent.

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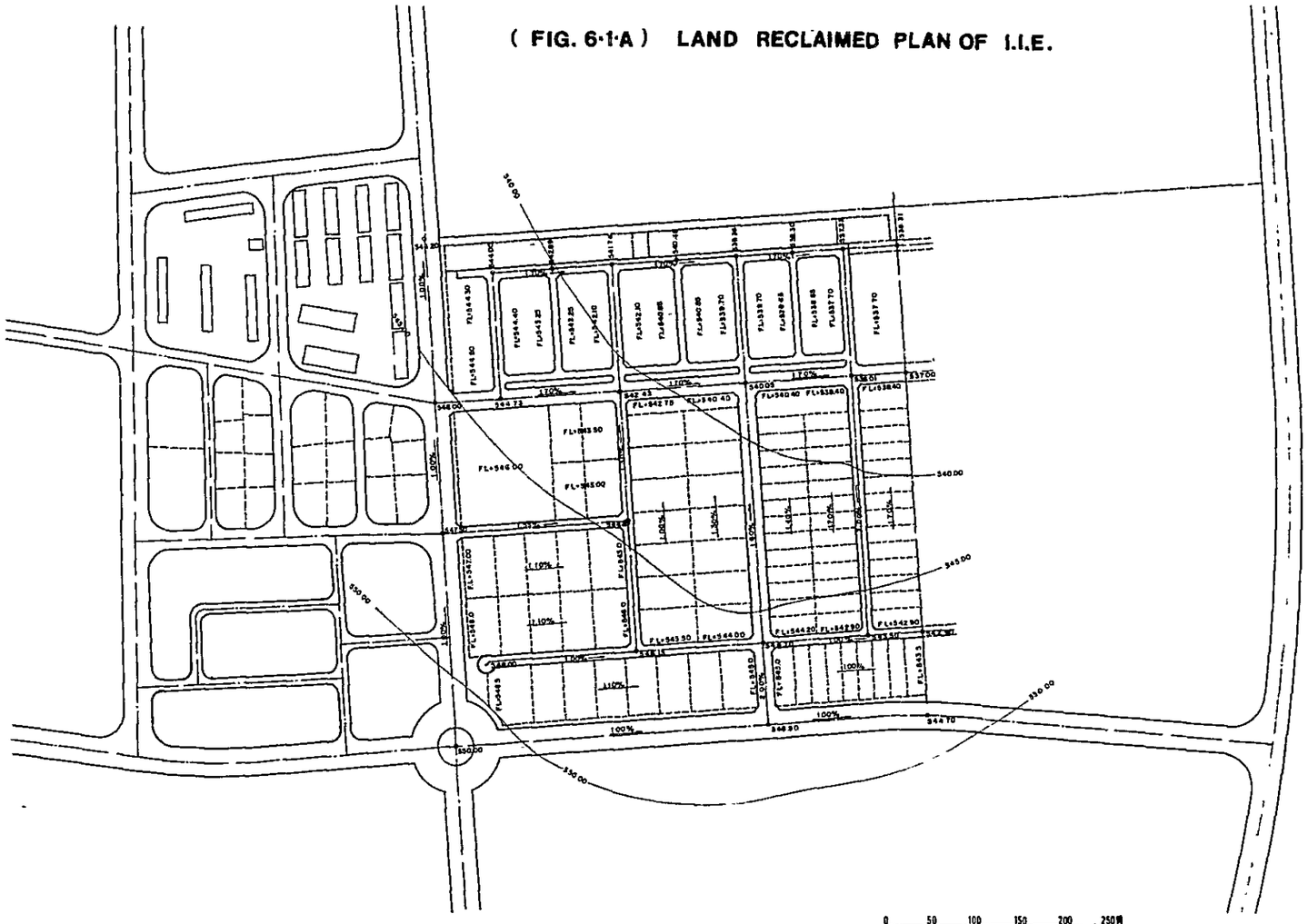
(FIG. 6-1-A) LAND RECLAIMED PLAN OF I.I.E.



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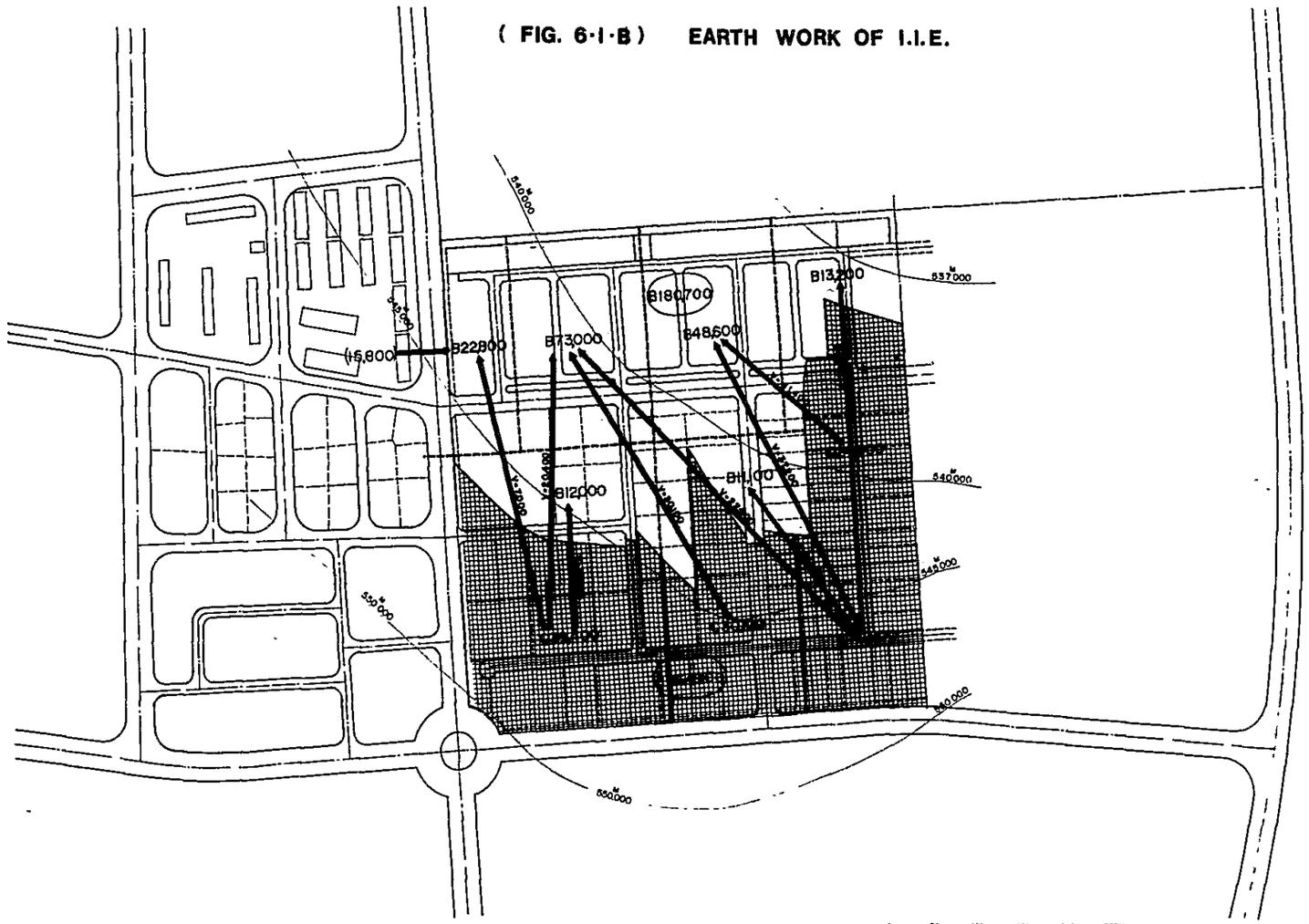
(FIG. 6-1-B) EARTH WORK OF I.I.E.



212,000 tons/year ÷ 5 ton-truck ÷ 0.6 ÷ 300 days
(raw material and products) (loading capacity) (loading factor)

≒ 240 trucks/day (generated)

Since the above figure is the generated traffic volume from IIE, the total traffic volume to and from IIE becomes as follows:

240 trucks/day x 2 = 480 trucks/day

ii) Traffics associated with business activities:

Assuming that the unit volume of traffics per worker associated with business activities is 0.05 cars/worker/day, the daily traffic volume is estiamted to be about 280 cars as follows:

2,800 workers x 0.05 cars/worker/day = 140 cars/day (generated)

140 cars/day x 2 = 280 cars/day (concentrated and generated)

iii) Traffics associated with activities of administrative and supporting facilities:

Assuming that unit value of traffic associated with activities of administrative and supporting facilities is 2.5 cars/100 m^2/day, daily traffic volume becomes 200 cars as below:

4,000 m^2 x 2.5 cars/100 m^2/day = 100 cars/day (generated)

100 cars/day x 2 = 200 cars/day (concentrated and generated)

iv) Volume of commuter traffic to IIE:

Assuming that the relative shares of transportation mode for commuters are 20 percent for private cars, 70 percent for private buses (micro-buses) and the rest of 10 percent for walking, daily traffic volume associated with commuters becomes about 950 cars/day as below:

private cars	2,800	x	0.2 ÷	1.5	x 2	≒ 750 cars/day
private buses	2,800	x	0.7 ÷	20	x 2	≒ 200 cars/day
	(No. of workers)		(share)	(workers/ car)		
Total						950 cars/day

v) In summary, the total volume of daily traffic associated with IIE is estiamted to be about 1,910 cars/day as below:

(1) raw materials & products	480 cars/day
(2) business activities	280 cars/day
(3) administrative & supporting facilities	200 cars/day
(4) commuters	950 cars/day
Total	1,910 cars/day

6.2.2 Road Network in IIE

605 Three different categories of roads, each having a different function, are designed for IIE. An access/primary road is designed to be a divided four-lane road which becomes main axes of IIE. A secondary road is designed to be a two-lane road on which large trucks are able to pass. It mainly provides a direct access to each factory in IIE. The third category of road is a service road which mainly provides an access to standard factory buildings and is designed to be a width of 8 meter on which large trucks are able to pass. Traffic volume generated from Standard Factory Building is estimated as follows:

i) Traffics generated by carrying into or out of raw materials and products

1,200 x 30 t/year = 36,000 t/year

(No. of workers)

36,000 t/year ÷ 5 t/truck ÷ 0.6 ÷ 300 days x 2 = 80 trucks/day

(raw material and products) (loading capacity) (loading factor)

ii) Traffics associated with business activities

1,200 x 0.05 cars/worker/day x 2 = 120 cars/day

iii) Volume of commuter traffic to Standard Factory Building

1,200 x 0.2 ÷ 1.5 workers/car x 2 = 120 cars/day

(share)

iv) Total 520 cars/day

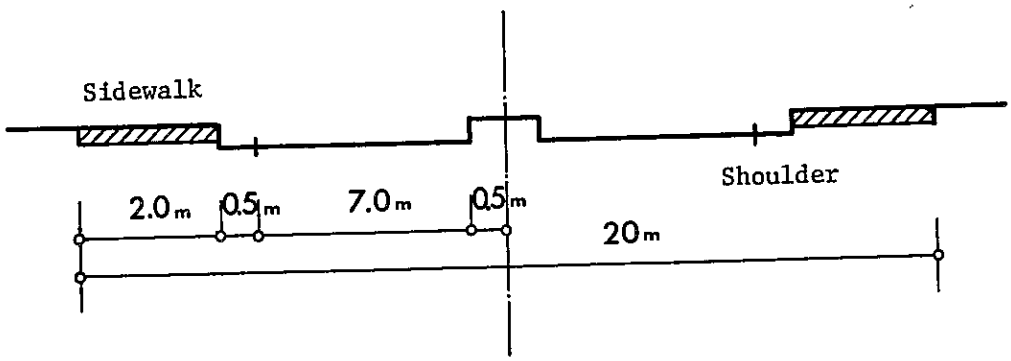
On the other hand, possible capacity of double lanes road of 7 m carriage ways is 870 cars/hour. Therefore, if all the generated traffics (520 cars/day) are concentrated into one hour, they can be well processed by the proposed road standard. In addition, pedistrians can use a space between Standard Factory Buildings. Table 6.2 and Figure 6.2 show design standards of these roads.

Table 6.2 Design Standards of In-site Roads

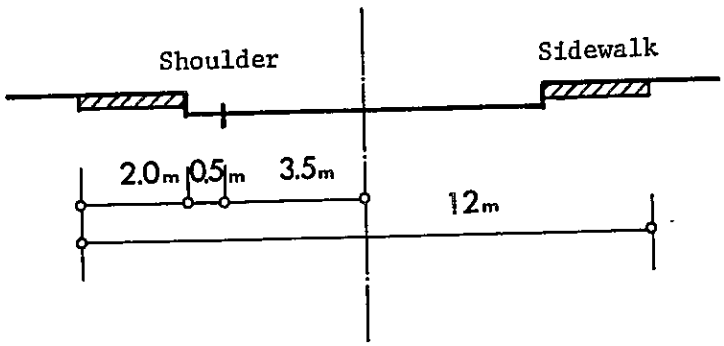
	Lane No.	Median	Right of Way	Sidewalk
Access and Primary Road	4	o	20 m	2.0 m
Secondary Road	2	x	12 m	2.0 m
Service Road	2	x	8 m	x

606 Roads are designed to be asphalt pavement for heavy traffic which has a wheel load of about 54 KN. California Bearing Ration (CBR) for subgrade is assumed to be 6 or greater for preliminary design purpose. The road pavement will consist of a surface course of 50 mm heated asphalt mix; a binder course of 150 mm stabilized bituminous; and a base course of 200 mm thick crusher. Figure 6.3 shows a pavement composition.

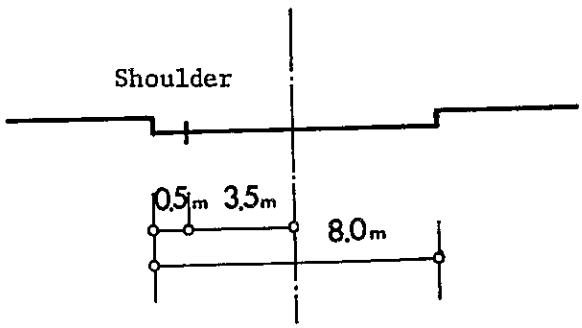
Figure 6.2 Design Standards of In-Site Roads



Access and Primary Road

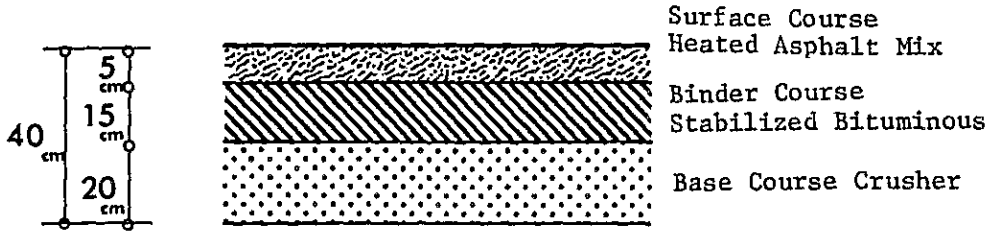


Secondary Road



Service Road

Figure 6.3 Road Pavement Composition



607 Street lights will be provided for primary roads and secondary roads. It is recommended that traffic signals should be installed on cross-section of the proposed Boundary Ring Road and the east-west access/primary road of IIE as well as on the cross section of the proposed Connecting Road A and the north-south access/primary road of IIE. Proposed road network of IIE is shown in Figure 5.12.

6.3 Water Supply System

6.3.1 Estimation of Water Demand of IIE

608 In order to estimate water demand of IIE, Study Team applies three kinds of unit values of water consumption used in the "Master Plan and Preliminary Engineering Study of Amman Industrial Estate", the Weston Report[1/] and unit values derived from small and medium scale factories is Japan as shown below:

i) A unit value of water demand in Amamn Industrial Estate is assumed to be 250 ℓ/day/worker.

ii) In the feasibility study of water distribution in Irbid Municipality, the Weston Report assumes a unit value of water demand for industry to be 20 m^3/ha/day.

iii) A unit value of water demand for each type of industries is derived from the data of Japanese small and medium scale factories as shown below.

1/ Feasibility Report and Preliminary Engineering Studies, Irbid Municipal Water Distribution, Sewerage, Storm Drainage and Solid Waste Disposal Project, Weston Inc., March 1980.

Unit Values of Water Demands

Types of Industry	Land Area (m^2) 1/	Water Demand (m^3/day/m^2)
1. Metal Works	63,900	370
2. Furniture and Room Units	18,500	78
3. Foods and Beverages	14,600	223
4. Garments and Clothes	7,000	50
5. Plastics and Chemicals	7,600	129
6. Construction Materials	40,800	261
7. Auto-repair Shops	22,300	141
8. Trading	7,400	12
9. Paper and Paper Products	4,500	21
10. Administration	15,855	16
Total	202,455	1,301

Source: Study Team.

Note: 1/ Figures in this column differ from the figures in Table 3.34 since they are adjusted to the size of Custom Built Factory and Standard Factory Building. In addition, water demand for administration building is also estimated.

609 Based on these assumed values of water demand, it is estimated that IIE consumes 550-750 m^3/day of water since the estimated water demand based on the Japanese data is too high compared to the local standard.

Unit Value of Water Demand	Water Demand of IIE
(1) In case of Amman Industrial Estate 250 ℓ/day/worker	3,000 x 250 = 750 m^3/day
(2) In case of the Weston Report 20 m^3/ha/day	27.5 x 20 = 550 m^3/day
(3) Japanese factories	1,300 m^3/day

Water demand of IIE is, therefore, set to be 750 m^3/day from these estimates.

6.3.2 Water Distribution System in IIE

610 It is most desirable for IIE to take water from a 150 mm diameter water distribution pipe which will be installed in the existing industrial area according to the Water Distribution Master Plan of the Municipality (see section 4.3.2). However, maximum supply capacity of the 150 mm pipe is estimated to be 500 m^3/day, assuming 8 hours of factory operation time, and that is not able to satisfy the amount of water demanded in IIE (750 m^3/day). Therefore, it is recommended to alter the diameter of external distribution pipe from 150 mm to 250 mm in order to secure the amount of water demanded.

611 In general water supply in the Northern Region is in very tight situation as mentioned in section 4.3.1. The Study Team, therefore, recommends to install a water reservoir in IIE. Distribution of water to individual factory will be made by a water pump. The capacity of water reservoir is desinged to be 1,500 m^3 which is equivalent to 2-day water consumption of IIE, yet an additional land for water reservoir must be reserved for the expected increase of water demand in future.

612 Water distribution system to each factory is designed to be a grid-type so that it can function in case of an accident. Figure 6.4 shows the proposed water distribution system in IIE. In addition, outdoor fireplugs will be provided in each 2 ha of land within IIE.

6.4 Stormwater Drainage System in IIE

613 The average annual rainfall in Irbid area is in the range of 300-400 mm during the last 30 years. Moreover, most of the rainfall is concentrated in the rainy season between October and March. Although there are no published rainfall intensity/duration/frequency curves which are based on actual record rainfall intensities, it is estimated to be about 50 mm/h.

614 At present, there is no stormwater drainage system around the site of IIE and stormwater is naturally penetrated into agricultural land. As for the external drainage system around IIE, it will be provided with the construction of the proposed Boundary Ring Road as well as Outer Ring Road in addition to those planned by the Stormwater Drainage Master Plan by Weston Inc. (see section 4.8).

615 Stormwater within the site of IIE will be collected by open box culvert laid out in the Estate as shown in Figure 6.5, and discharged into the public drain of the Outer Ring Road due to the topographical conditions of IIE.

6.5 Sewerage Disposal System in IIE

616 As stated in section 4.7.2, a pump station for sewerage will be installed near the existing industrial area according to the Sewerage Collection Master Plan of the Municipality. Consequently, sewerage generated in IIE is planned to be discharged into this public sewer system. However, extension of sewerage interceptor which will be installed parallel to the Boundary Ring Road is scheduled to be implemented in Phase II of the Master Plan (see Figure 4.7). In order to utilize the public sewer system, the Study Team recommends to extend the interceptor up to the Boundary Ring Road within the Phase I of the Sewerage Collection Master Plan.

617 For the purpose of preliminary engineering design of sewerage disposal system in IIE, an extension of the intercepter up to the Boundary Ring Road is assumed to be realized as recommended in the previous paragraph, and the following premises are set.

i) The amount of sewer generated in IIE is assumed to be 750 m^3/day which is equal to the amount of water demanded in IIE,

ii) Gravitation method is adopted for designing sewerage collection facilities, and

iii) A pump station is planned to be installed at the north-east corner of IIE from which sewer will be discharged into public sewerage system.

Figure 6.6 indicates the proposed sewerage collection system of IIE with the proposed diameter of sewerage collection pipes.

618 The proposed sewer ordinance in the Master Plan sets certain standards of discharged sewerage quality as described in paragraph 452. Consequently, individual factories should provide a closed system of sewerage treatment facilities so to observe the proposed sewer ordinance.

6.6 Electrical Power Supply System in IIE

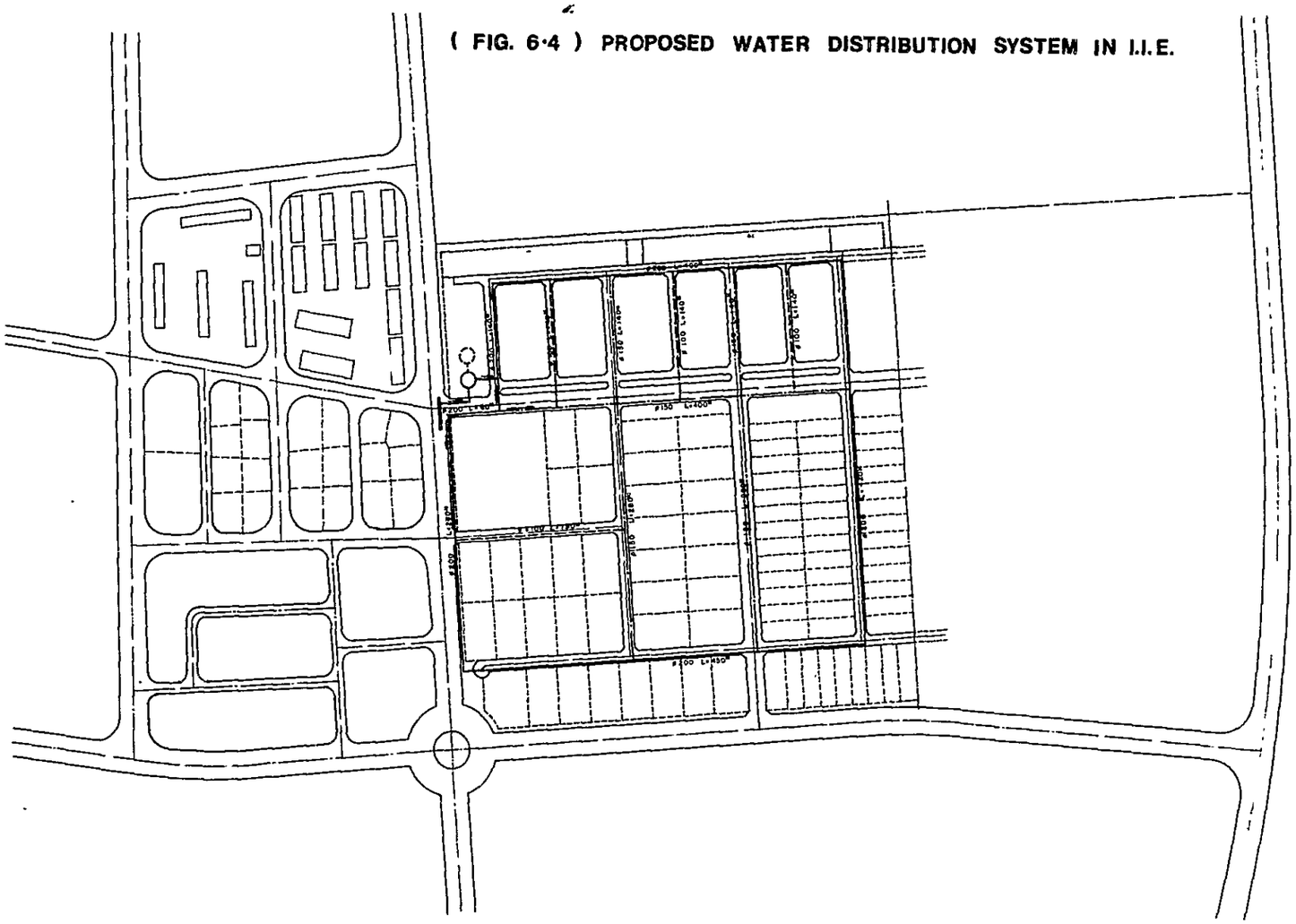
6.6.1 Electrical Power Demand of IIE

619 In order to estimate a capacity of electrical power facilities of IIE, the Study Team employs load density of 100 W/m^2 which was used in the engineering design of Amman Industrial Estate. Since the total floor space of IIE amounts to 71,000 m^2 as shown in Table 6.3, electrical power demand is estimated to be about 7,800 kVA as shown below:

i) 71,000 m^2 x 100 W/m = 7,100 kW

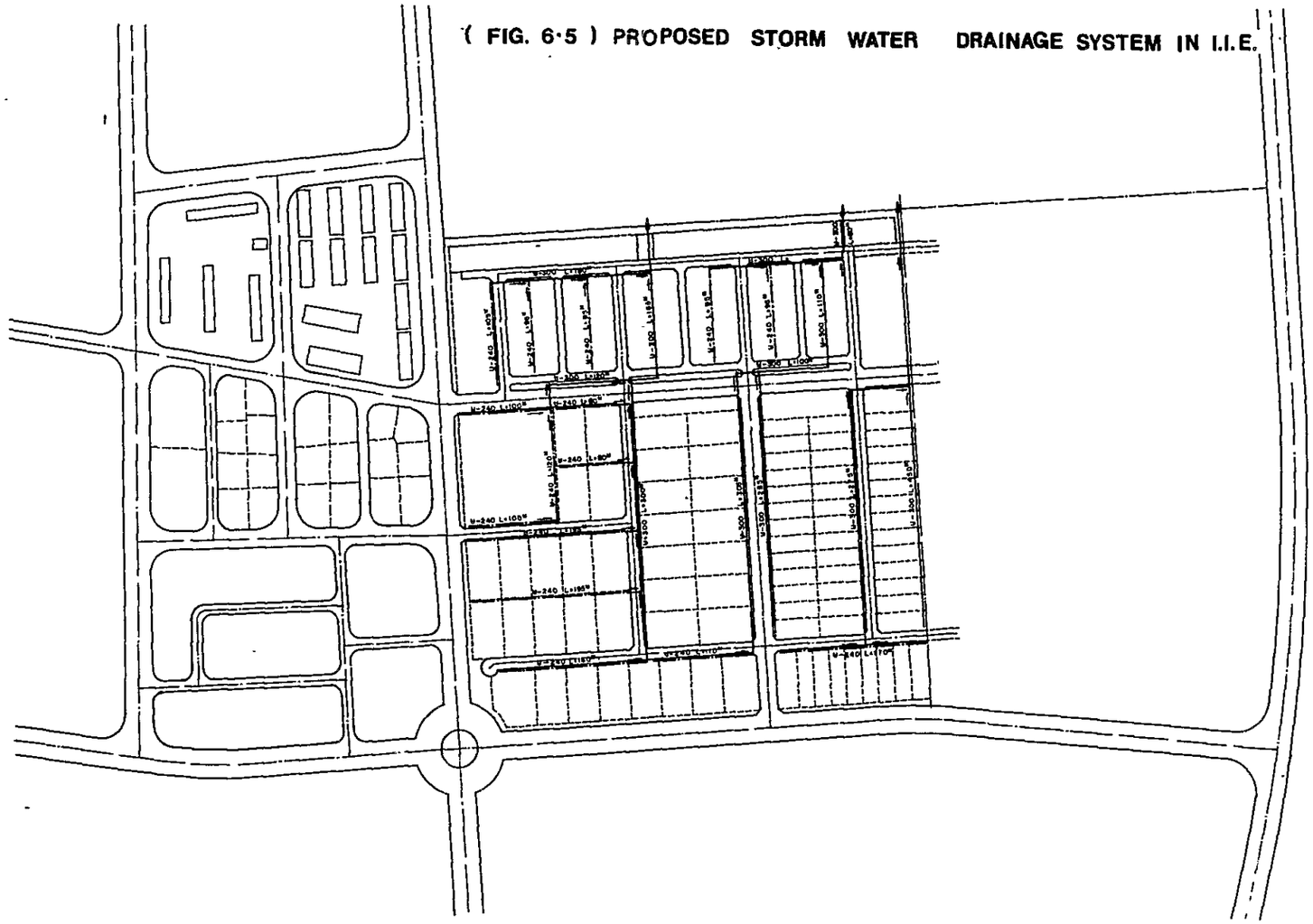
IRBID INDUSTRIAL ESTATE

(FIG. 6·4) PROPOSED WATER DISTRIBUTION SYSTEM IN I.I.E.



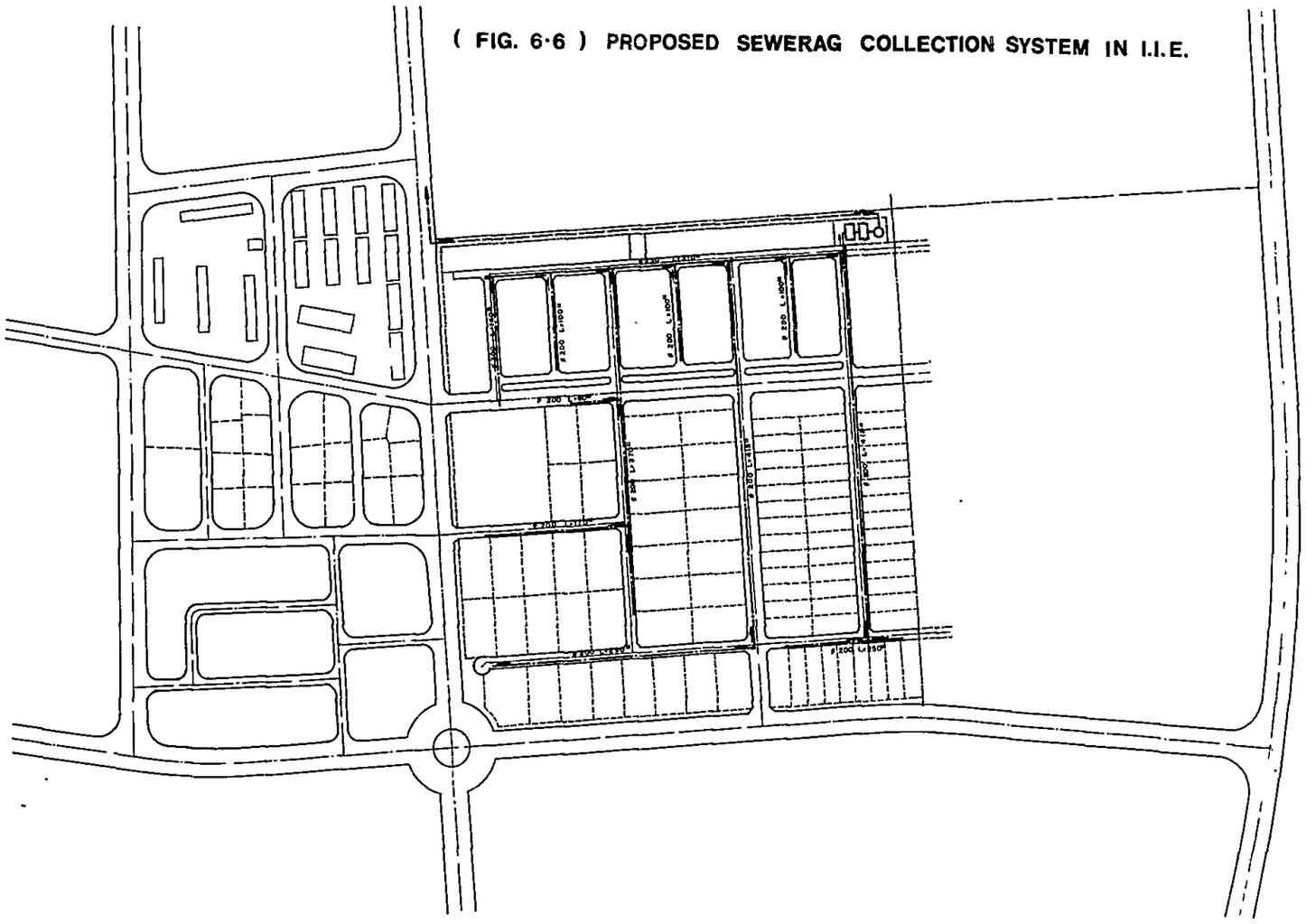
IRBID INDUSTRIAL ESTATE

(FIG. 6·5) PROPOSED STORM WATER DRAINAGE SYSTEM IN I.I.E.



IRBID INDUSTRIAL ESTATE

(FIG. 6·6) PROPOSED SEWERAG COLLECTION SYSTEM IN I.I.E.



ii) extra electricity demand for street lighting etc. is assumed to be 10 percent of the above figure.

7,100 kW x 1.1 = 7,800 kW

Table 6.3 Factory and Other Building Floor Space

Standard Factory Building	23,000 m^2
Custom Build Factory	44,000 m^2
Administrative and Supporting Facilities	4,000 m^2
Total	71,000 m^2

Note: Figures under 100 m^2 were rounded.

The estimated demand is checked against the data derived from small and medium scale factories in Japan as shown below. The newly estimated demand is about 4,600 kW since extra electricity demand is assumed to be 10 percent, the total estimated demand is about 5,000 kW. Therefore, the Team recommends to use 5,000 kW as the planned electricity demand of IIE.

Unit Values of Electricity Demands

Types of Industry	Land Area (m^2) 1/	Electricity Demand (kW)
1. Metal Works	63,900	1,588
2. Furniture and Room Units	18,500	254
3. Foods and Beverages	14,600	729
4. Garments and Clothes	7,000	133
5. Plastics and Chemicals	7,600	398
6. Construction Materials	40,800	909
7. Auto-repair Shops	22,300	492
8. Trading	7,400	37
9. Paper and Paper Products	4,500	64
10. Administration	15,855	40
Total	202,455	4,644

Source: Study Team.

Note: 1/ Figures in this column differ from the figures in Table 3.34 since they are adjusted to the size of Custom Built Factory and Standard Factory Building. In addition, electricity demand for administration building is also estimated.