Annex to 3.4.1 Description Of Proposed Measures For Wastewater Collection, Treatment And Disposal

Contents

22. DAIR ABI SAID TREATMENT PLANT

The proposed Dair Abi Said Scheme area is located about 20 km southeast of Irbid. Presently, there exists no sewerage system. The following communities will be connected to the proposed scheme: Dair Abi Said, Kofur Al Maa, Ashrafiyyeh (Khanzira) and Al Refaeyyeh. Figure 22.1 shows the layout of the proposed sewerage system.

The project foresees the construction of a Dair Abi Said Treatment Plant designed for the wastewater production in 2020. It will be based on an extended aeration process including slow sand filtration as tertiary treatment. Produced sludge will be treated by gravity thickeners and decanter centrifuge. Figure 22.2 shows the proposed treatment system. The projection of the wastewater production is shown in the following table (acc. to Consultant's Study Report). The plant will be implemented in 2010, whereby the design capacity will correspond to the wastewater production

in 2020:   4,900 m³/d (42,400 connected inhabitants)

Suitable agricultural land for irrigation was identified west of the treatment plant (see Figure 22.3). A pump station is required to pump the effluent of the treatment plant to the about 20 m higher located proposed reservoir. The effluents may supply irrigation water for an area of about 105 ha in 2020 taking into account the demand olive and forest trees and barley as winter crops (see following table).

The investment costs based on 1998 prices are:

Treatment plant (primary and secondary treatment)	4.64 million JD
Networks	7.65 million JD
Tertiary treatment and pipeline	0.59 million JD
Dam/storage (pond for reuse)	0 million JD
Total base costs	12.88 million JD
Physical contingencies	1.29 million JD
Engineering	1.42 million JD
Total investment costs	15.59 million JD

According to the Consultant's Study Report implementation of proposed construction measures were foreseen during the years 2010 to 2012 (Phase I).

Consultant's Study Report:
TYPSA, Symonds Travers Morgan and Universal Engineering Consulting: "Wastewater collection, treatment, disposal and/or reuse systems project for the catchment area of Yarmouk River and Jordan River. Final Report", December 1998

FIGURE 22.1:   General Layout of Proposed Sewerage System - DAIR ABI SAID

SA3-278

WIND ROSE

OUTFALL

CHLORINATION BUILDING

SLUDGE DEWATERING BUILDING

ODOUR CONTROL FACILITY

SLUDGE THICKENER

PRELIMINARY TREATMENT

STORM TANK

SEPTAGE FACILITY

SLOW SAND FILTERS

CONTROL BUILDING

ELECT. BUILDING

NOTE:
TOPOGRAPHICAL INFORMATION BASED ON JORDAN NATIONAL GEOGRAPHIC CENTER 1:25,000 SCALE TOPOGRAPHICAL MAPS.

LEGEND:
EXISTING UNIT
PROPOSED UNIT(2020)
FENCE LINE

THE HASHEMITE KINGDOM OF JORDAN
MINISTRY OF WATER AND IRRIGATION

EUROPEAN UNION

WATER AUTHORITY OF JORDAN

WASTEWATER COLLECTION, TREATMENT, DISPOSAL AND/OR REUSE SYSTEMS PROJECT FOR THE CATCHMENT AREA OF YARMOUK RIVER AND JORDAN RIVER

UNIVERSAL ENGINEERING CONSULTING
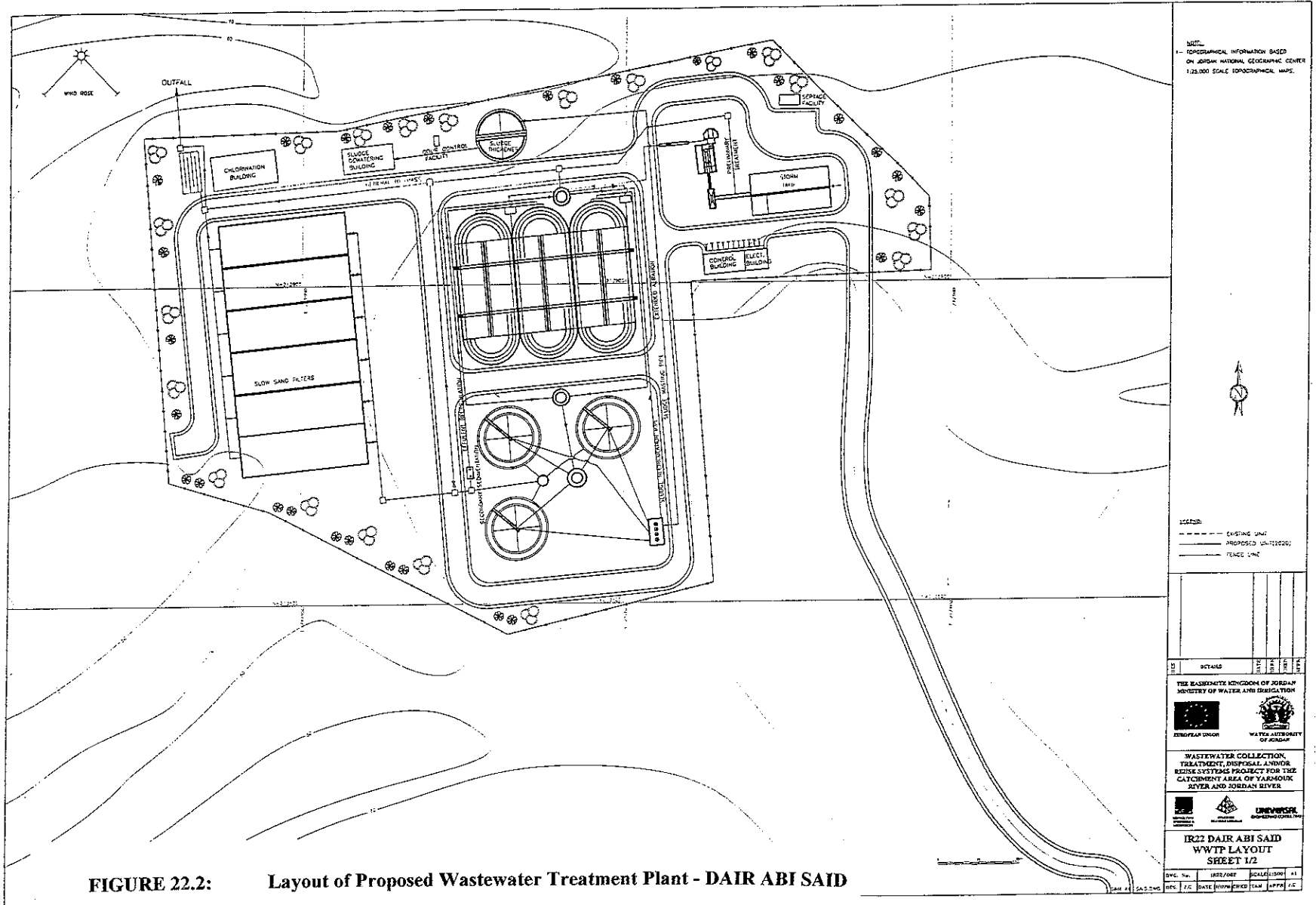
IR22 DAIR ABI SAID
WWTP LAYOUT
SHEET 1/2

FIGURE 22.2: **Layout of Proposed Wastewater Treatment Plant - DAIR ABI SAID**
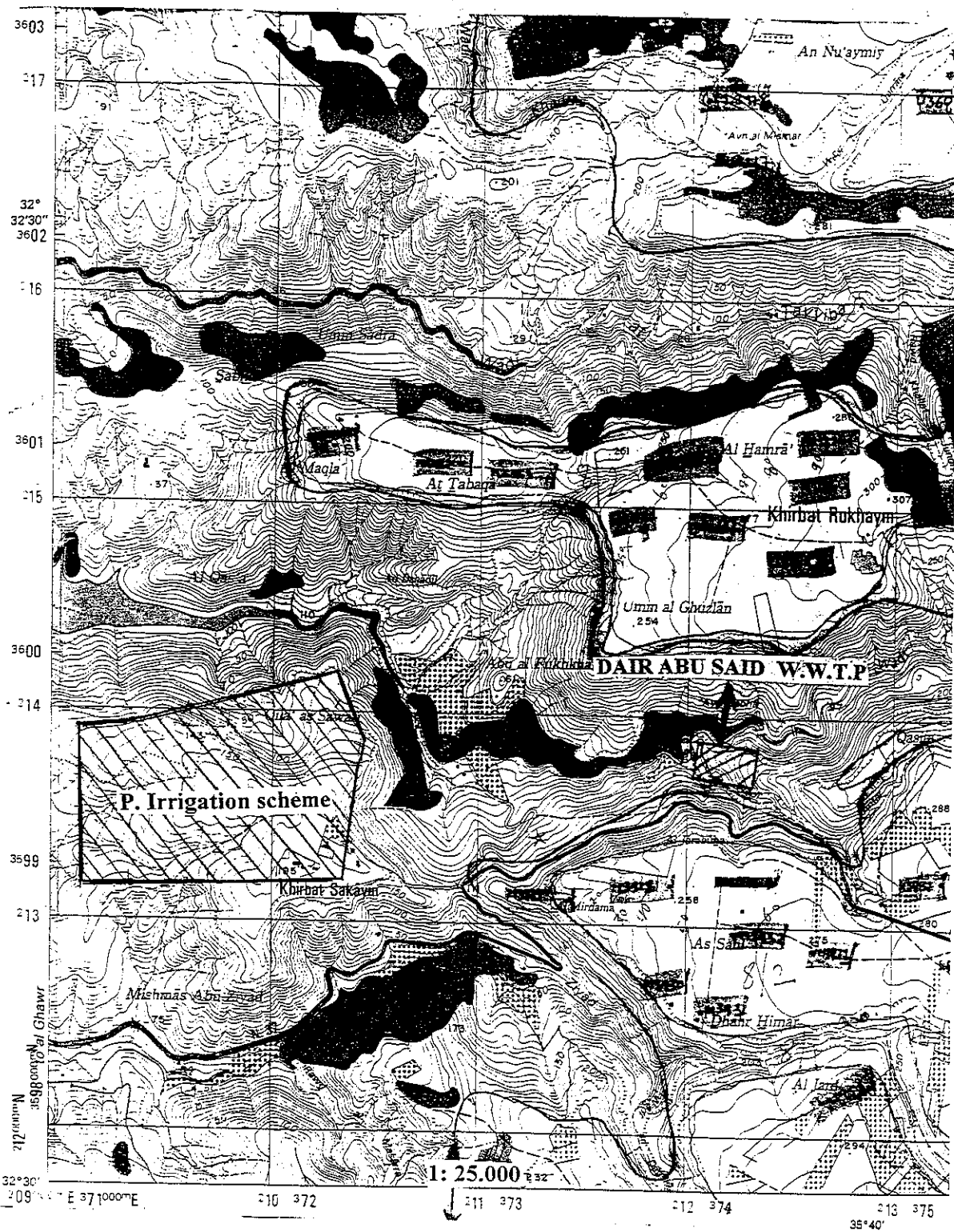
FIGURE 22.3:   Potential Reuse Areas - DAIR ABI SAID

PROJECTION OF WASTEWATER PRODUCTION OF TREATMENT PLANT:

22 DAIR ABI SAID

SCENARIO 0 "Consultants' Study"   (acc. to Consultant's Study Report)

Basic data:

Population in 1994:   22.444

	Unit	1994	2000	2005	2010	2015	2020
Growth rate (previous period)	%	-	3,12	3,12	3,12	3,12	3,12
Spec.water demand	l/c/d	-	146	146	146	146	146
Commercial demand	m³/d						
Small industrial demand	m³/d						
Pastoral demand	m³/d						
Coverage	%	0	0	0	0	85	85
Return factor	-	0,8	0,8	0,8	0,8	0,8	0,8
Losses/inflow	%	0	0	0	0	0	0
Specific pollutional load	gBOD₅/c/d	65	65	65	65	65	65

	Unit	1994	2000	2005	2010	2015	2020
Population	c	22.444	26.987	31.468	36.693	42.786	49.890
Connected (sewerage)	c	0	0	0	0	36.368	42.407
Not connected (sewerage)	c	22.444	26.987	31.468	36.693	6.418	7.484
Water demand							
Domestic demand	l/c/d	-		146	146	146	146	146
	m³/d		0	3.940	4.594	5.357	6.247	7.284
Commercial demand	m³/d						
Small industrial demand	m³/d						
Pastoral demand	m³/d						
Total	m³/d		0	3.940	4.594	5.357	6.247	7.284
Wastewater production							
Return flow (w.demand)	m³/d	0	0	0	0	4.248	4.953
Losses/inflow	m³/d	0	0	0	0	0	0
Total	m³/d	0	0	0	0	4.248	4.953
	m³/month	0	0	0	0	127.434	148.593
	m³/a	0	0	0	0	1.550.443	1.807.883
Pollutional load							
Poll. load (dom.demand)	kgBOD₅/d	0	0	0	0	2.364	2.756
Poll. load (com.demand)	kgBOD₅/d						
Poll. load (small ind.)	kgBOD₅/d						
Others	kgBOD₅/d						
Total load	kgBOD₅/d	0	0	0	0	2.364	2.756
Reuse of wastwater							
Inflow to the treatment plant	m³/a	0	0	0	0	1.550.443	1.807.883
Losses in treatment plant	%	0	5	5	5	5	5
(due to infiltr./evap.)	m³/a	0	0	0	0	77.522	90.394
Effluent of treatment plant	m³/a	0	0	0	0	1.472.921	1.717.489
Net water demand per ha	m³/d/ha		45	45	45	45	45
Irrigable reuse area	ha	0	0	0	0	90	105

Water demand for irrigation   Olive, barley   45   m³/d/ha
Olive and forest trees
Winter crops: barley

23. DAIR ALLA TREATMENT PLANT

The proposed Dair Alla Scheme area is located in the Jordan Valley. Presently, there exists no sewerage system. The following communities will be connected to the proposed scheme: Krayymeh, Twal Al Janoubi, Dherar, Balawneh, Al Sawalha, Muadi, Twal Ash Shamali, Rowaihah, Kharmah, Abu Sedo, Dabbab, Dair Alla and Abu Zeeghan. Figure 23.1 shows the layout of the proposed sewerage system.

The project foresees the construction of the Dair Alla Treatment Plant designed for the wastewater production in 2020. It will be based on an extended aeration process including slow sand filtration as tertiary treatment. Gravity thickeners and decanter centrifuge will treat produced sludge. Figure 23.2 shows the proposed treatment system. The projection of the wastewater production is shown in the following table (acc. to Consultant's Study Report). The plant will be implemented in two phases, whereby the final capacity will be reached

     in 2020:   10,400 m³/d (93,600 connected inhabitants)

The effluents could supply irrigation water for an area of about 160 ha in 2020 taking into account the demand for alfalfa and sudan grass (see following table). 50 ha of irrigable land (south-west of the plant) may be supplied by gravity. It is proposed to construct a pump station for treated effluent together with a 3 km rising main to irrigate a further 110 ha land north-west of the site. Proposed wastewater reuse areas are presented in the Figure 23.3.

The investment costs based on 1998 prices are:

Treatment plant (primary and secondary treatment)	6.59 million JD
Networks	19.08 million JD
Tertiary treatment and pump station (reuse system)	2.23 million JD
Dam/storage (pond for reuse)	0 million JD
Total base costs	27.91 million JD
Physical contingencies	2.79 million JD
Engineering	3.07 million JD
Total investment costs	33.77 million JD

According to the Consultant's Study Report implementation of proposed construction measures were foreseen during the years 2002 to 2004 (Phase I).

Consultant's Study Report:
TYPSA, Symonds Travers Morgan and Universal Engineering Consulting: "Wastewater collection, treatment, disposal and/or reuse systems project for the catchment area of Yarmouk River and Jordan River. Final Report", December 1998

LEGEND:

ROWAIHA

PS5
ZUZEEGHAN

DABBAB

DHERA

BALAWNEH

KHARMAH

PS2   DAIR ALLA

MA'DEBA

PS3

PS7

PS4

ABU SEDO
PS5

TWAL ASH SHAMALI
AND
TWAL AL JANOBI

WWTP

THE HASHEMITE KINGDOM OF JORDAN
MINISTRY OF WATER AND IRRIGATION

WASTEWATER COLLECTION,
TREATMENT, DISPOSAL AND/OR
RE-USE SYSTEMS PROJECT FOR THE
CATCHMENT AREA OF YARMOUK
RIVER AND JORDAN RIVER

SCHEME PLAN
DAIR ALLA
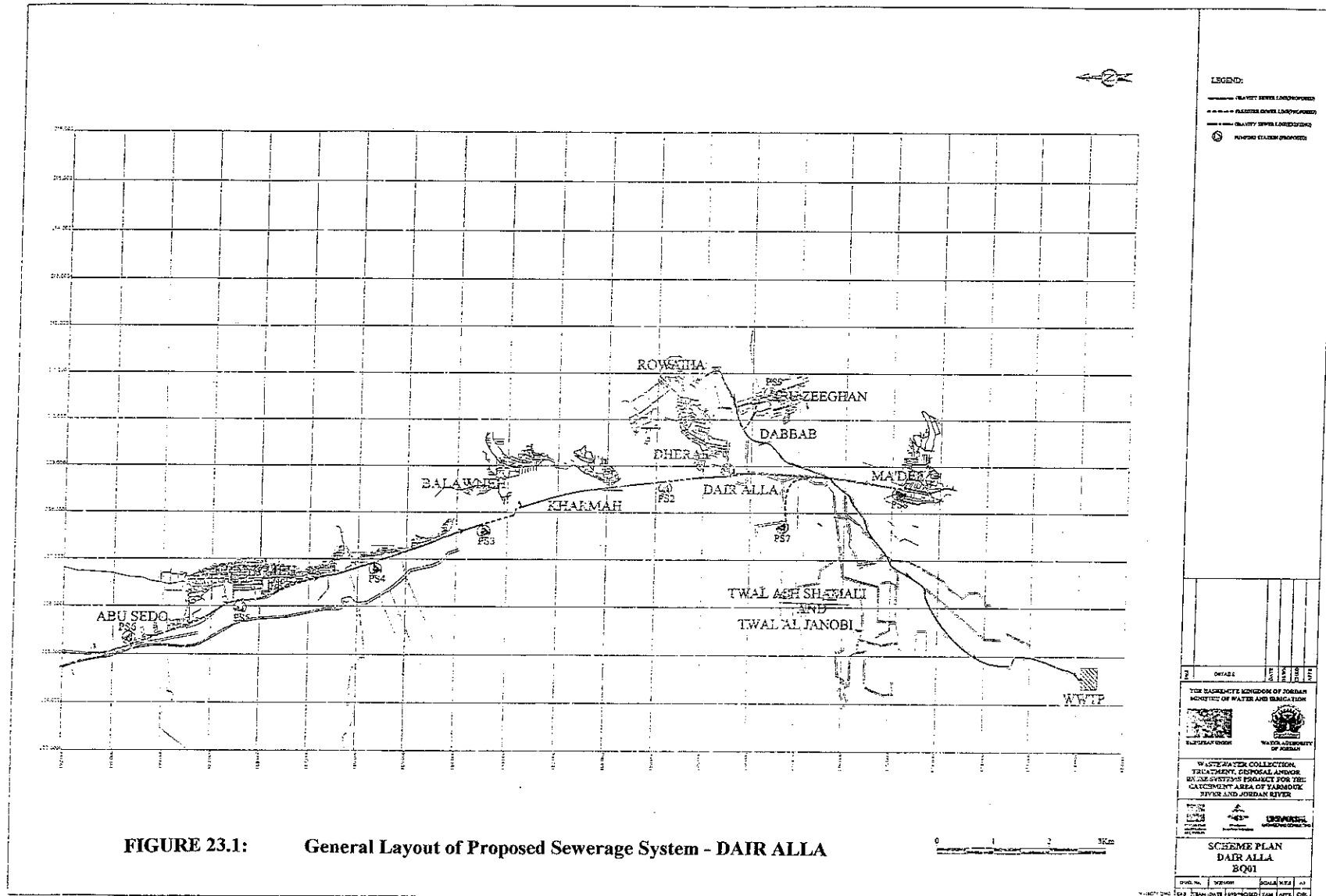BQ01

0   1   2   3Km

FIGURE 23.1:   **General Layout of Proposed Sewerage System - DAIR ALLA**
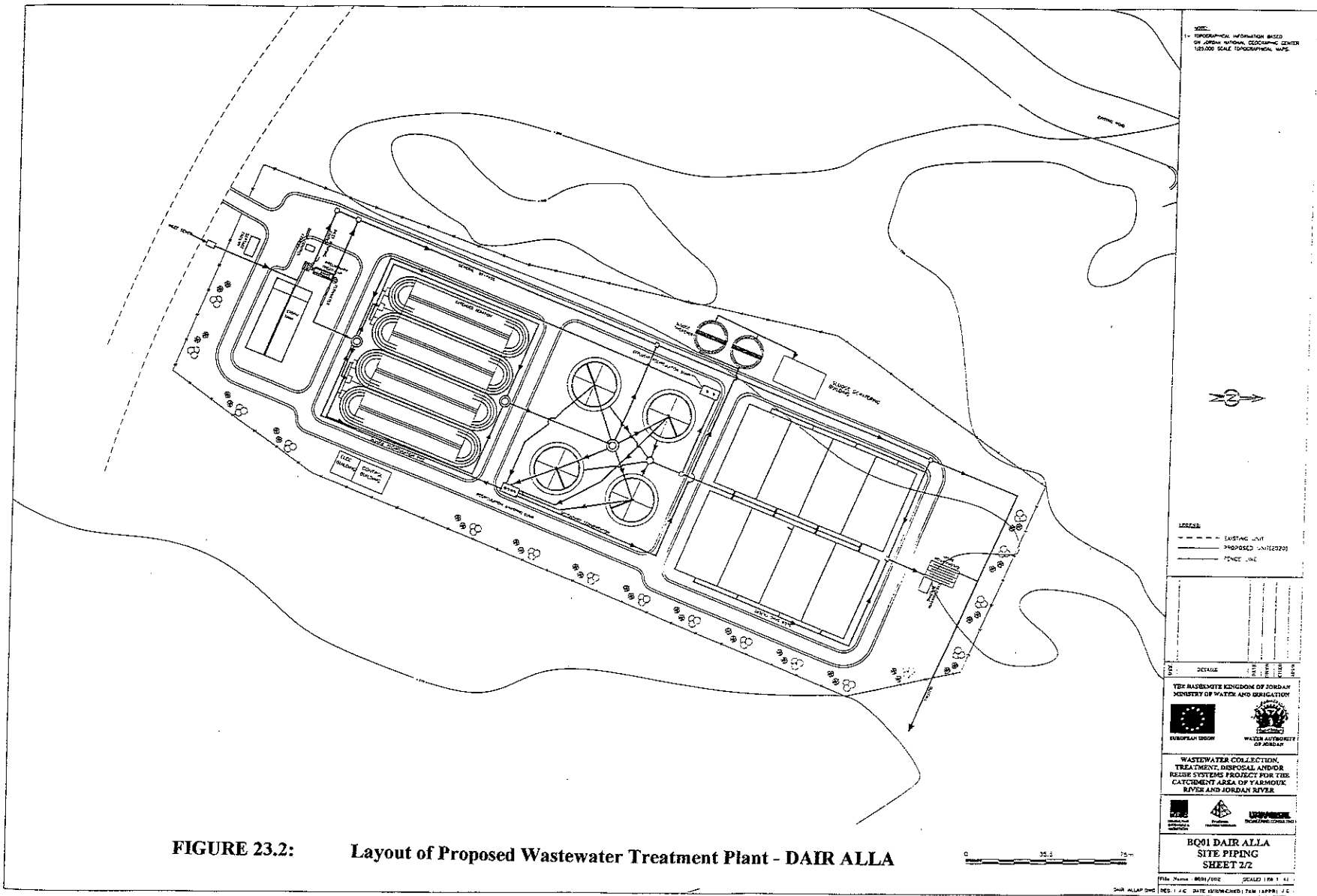
FIGURE 23.2:   **Layout of Proposed Wastewater Treatment Plant - DAIR ALLA**
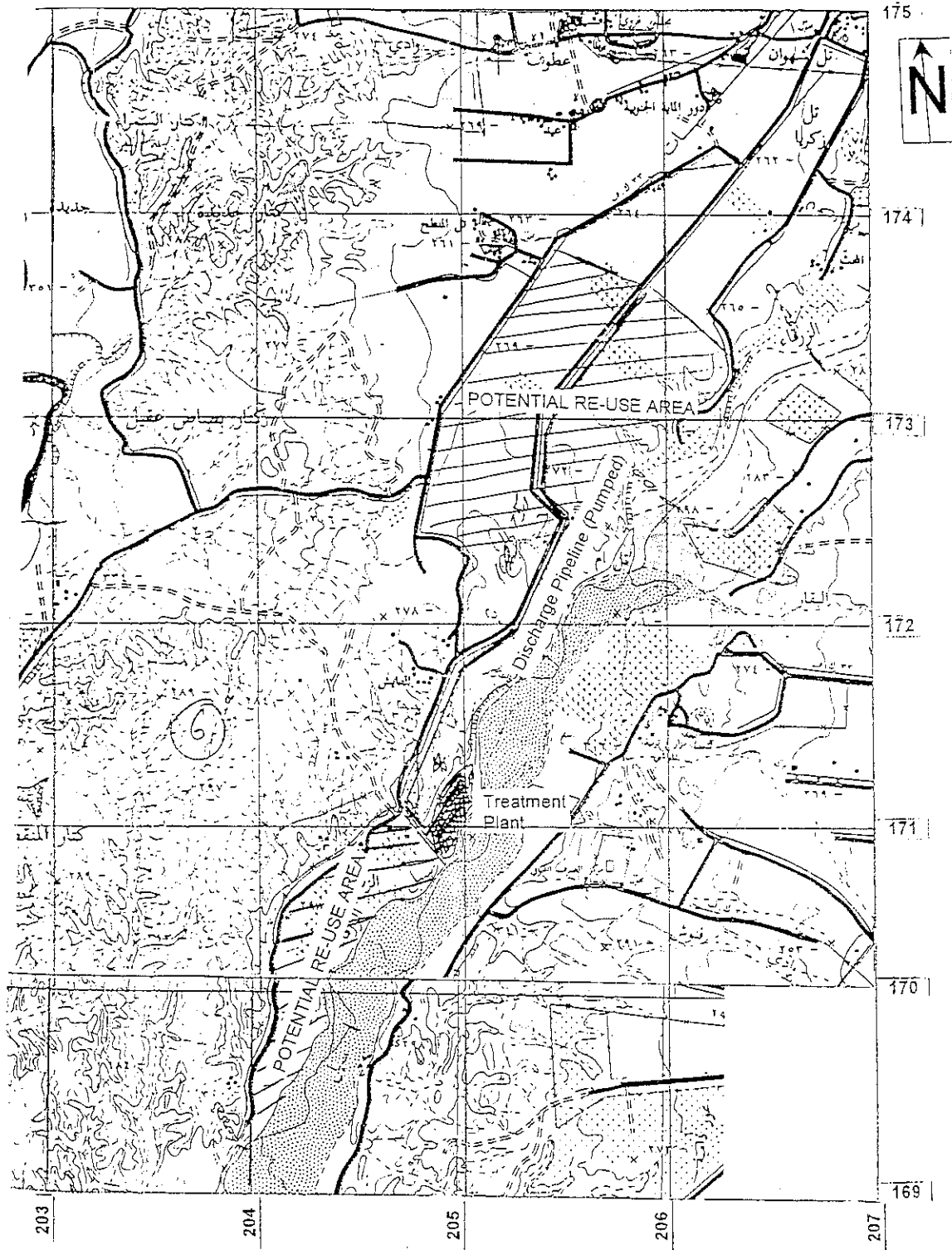
FIGURE 23.3:   Potential Reuse Areas - DAIR ALLA

PROJECTION OF WASTEWATER PRODUCTION OF TREATMENT PLANT:
23 DAIR ALLA

SCENARIO 0 "Consultants' Study"   (acc. to Consultant's Study Report)

Basic data:

Population in 1994:   50.283

	Unit	1994	2000	2005	2010	2015	2020
Growth rate (previous period)	%	-	3,06	3,06	3,06	3,06	3,06
Spec.water demand	l/c/d	-	138	138	138	138	138
Commercial demand	m³/d						
Small industrial demand	m³/d						
Pastoral demand	m³/d						
Coverage	%	0	0	85	85	85	85
Return factor	-	0,8	0,8	0,8	0,8	0,8	0,8
Losses/inflow	%	0	0	0	0	0	0
Specific pollutional load	gBOD$_5$/c/d	65	65	65	65	65	65

	Unit	1994	2000	2005	2010	2015	2020
Population	c	50.283	60.258	70.066	81.470	94.731	110.150
Connected (sewerage)	c	0	0	59.556	69.250	80.521	93.627
Not connected (sewerage)	c	50.283	60.258	10.510	12.221	14.210	16.522
Water demand							
Domestic demand	l/c/d	-		138	138	138	138	138
	m³/d	0	8.316	9.669	11.243	13.073	15.201
Commercial demand	m³/d						
Small industrial demand	m³/d						
Pastoral demand	m³/d						
Total	m³/d	0	8.316	9.669	11.243	13.073	15.201
Wastewater production							
Return flow (w.demand)	m³/d	0	0	6.575	7.645	8.890	10.336
Losses/inflow	m³/d	0	0	0	0	0	0
Total	m³/d	0	0	6.575	7.645	8.890	10.336
	m³/month	0	0	197.249	229.355	266.686	310.094
	m³/a	0	0	2.399.862	2.790.481	3.244.680	3.772.808
Pollutional load							
Poll. load (dom.demand)	kgBOD$_5$/d	0	0	3.871	4.501	5.234	6.086
Poll. load (com.demand)	kgBOD$_5$/d						
Poll. load (small ind.)	kgBOD$_5$/d						
Others	kgBOD$_5$/d						
Total load	kgBOD$_5$/d	0	0	3.871	4.501	5.234	6.086
Reuse of wastwater							
Inflow to the treatment plant	m³/a	0	0	2.399.862	2.790.481	3.244.680	3.772.808
Losses in treatment plant	%	0	5	5	5	5	5
(due to infiltr./evap.)	m³/a	0	0	119.993	139.524	162.234	188.640
Effluent of treatment plant	m³/a	0	0	2.279.869	2.650.957	3.082.446	3.584.168
Net water demand per ha	m³/d/ha		60	60	60	60	60
Irrigable reuse area	ha	0	0	104	121	141	164

Water demand for irrigation   Alfalfa, barley   60   m³/d/ha

24. JERASH WEST TREATMENT PLANT

The proposed Jerash West Scheme area will serve several communities west of the town of Jerash. Due to the limited space at the existing treatment plant of Jerash (see Section 7) there is no possibility to expand the existing facilities to meet the required capacity of both Jerash east and West. Therefore the existing Jerash Treatment Plant (East) will serve in future Jerash Town, Soof, Soof Camp and Dair Laiyat only.

Presently, the communities to be connected to the new treatment plant do not dispose of sewerage systems. The following communities will be connected to the proposed scheme: Jerash Camp, Sakep, Reimoon, Ketteh, Nahla, Dhaher Es Saru and Amamah. Figure 24.1 shows the layout of the proposed sewerage system.

The project foresees the construction of the Jerash West Treatment Plant designed for the wastewater production in 2020. It will be based on an extended aeration process including slow sand filtration as tertiary treatment. Produced sludge will be treated by gravity thickeners and drying beds. Figure 24.2 shows the proposed treatment system. The projection of the wastewater production is shown in the following table (acc. to Consultant's Study Report). The plant will be implemented before 2010, whereby the final capacity will be reached

in 2020: 7,150 m³/d (62,500 connected inhabitants)

There is almost no suitable land for irrigation close to the proposed treatment plant site. Therefore, it is recommended that the treated effluent from the plant will be discharged into the Wadi Al Wadana, which is a tributary of Wadi Zarqa. Finally, Wadi Zarqa mouths into King Talal Reservoir. From there water will flow to the Jordan Valley for ultimate reuse.

The investment costs based on 1998 prices are:

Treatment plant (primary and secondary treatment)	4.61 million JD
Networks	9.25 million JD
Tertiary treatment and pump station (reuse system)	0.79 million JD
Dam/storage (pond for reuse)	0 million JD
Total base costs	14.65 million JD
Physical contingencies	1.47 million JD
Engineering	1.46 million JD
Total investment costs	17.58 million JD

According to the Consultant's Study Report implementation of proposed construction measures were foreseen during the years 2006 to 2008 (Phase I).

Consultant's Study Report:
TYPSA, Symonds Travers Morgan and Universal Engineering Consulting: "Wastewater collection, treatment, disposal and/or reuse systems project for the catchment area of Yarmouk River and Jordan River. Final Report", December 1998

ASFOOR AND
THAGRET ASFOOR

MOQBELAH

SOOF

SOOF CAMP

DAIR LAIYAT

SAKEB   RIMOON

KETTEH

JERASH
CAMP

PST

EXISTING
JERASH JE01

AMAMAH

WWTP

0   1   2Km

LEGEND:

FIGURE 24.1:   **General Layout of Proposed Sewerage System - JERASH WEST**

THE HASHEMITE KINGDOM OF JORDAN
MINISTRY OF WATER AND IRRIGATION

EUROPEAN UNION   WATER AUTHORITY
OF JORDAN

WASTEWATER COLLECTION,
TREATMENT, DISPOSAL AND/OR
REUSE SYSTEMS PROJECT FOR THE
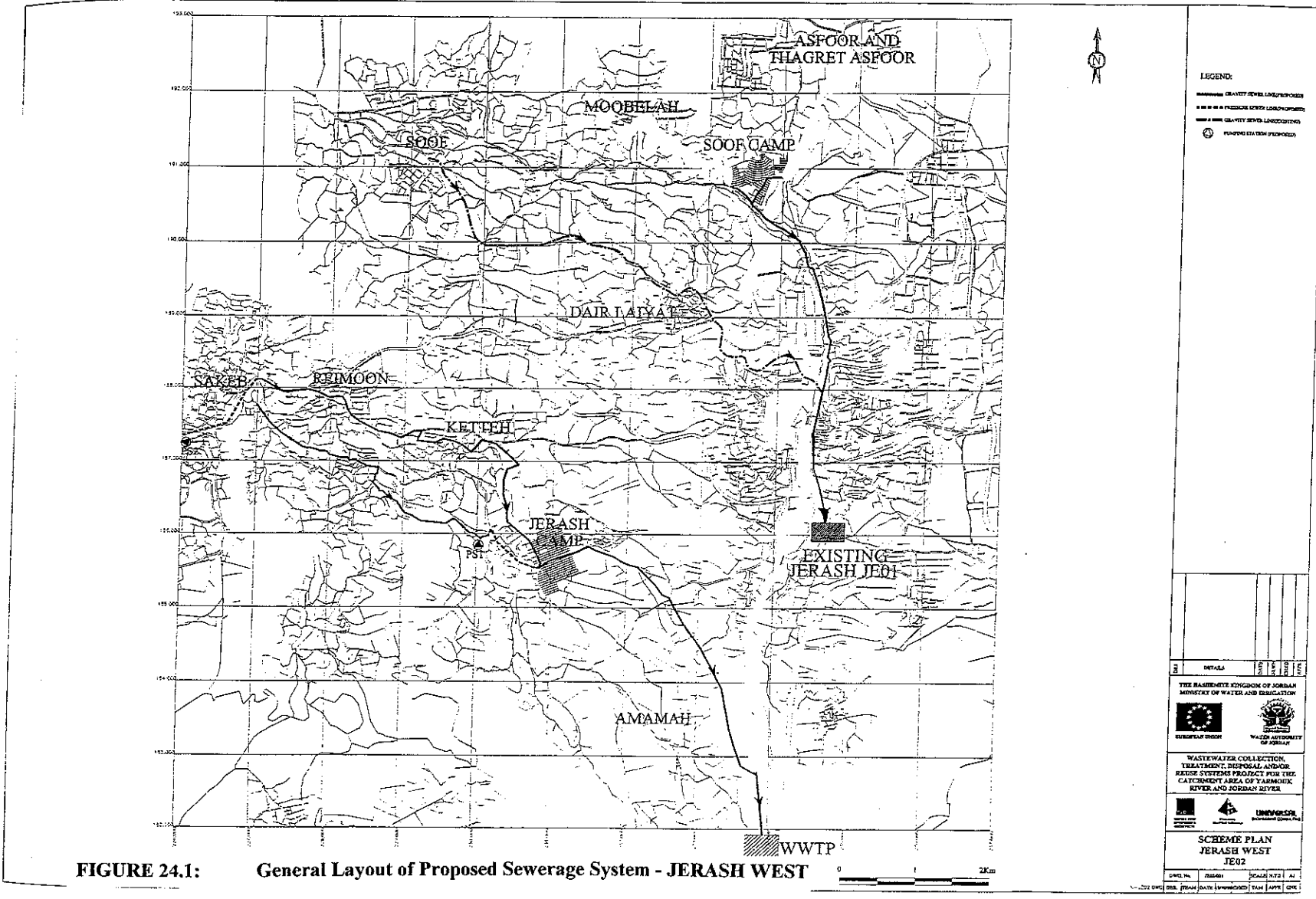CATCHMENT AREA OF YARMOUK
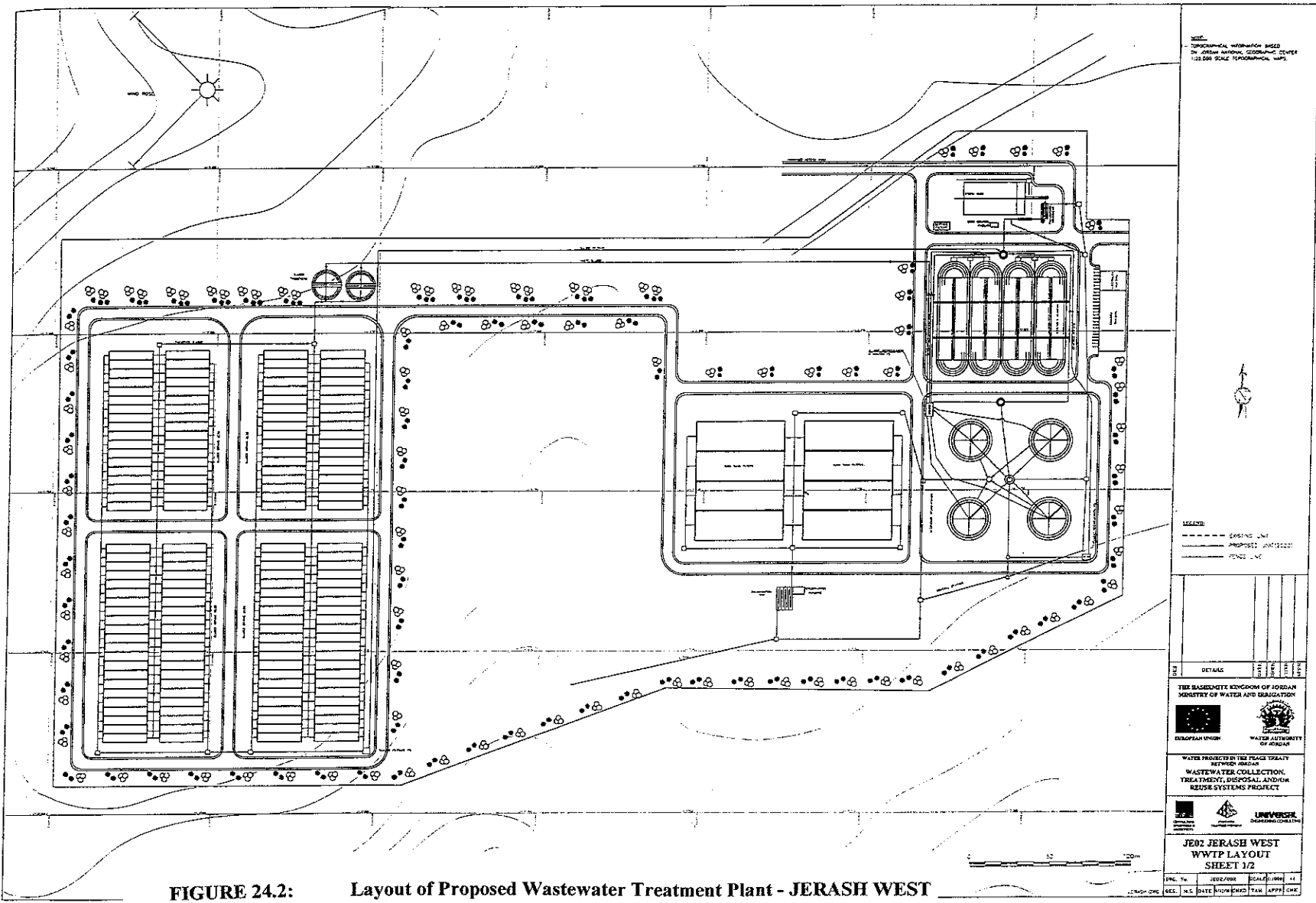RIVER AND JORDAN RIVER

SCHEME PLAN
JERASH WEST
JE02

FIGURE 24.2: Layout of Proposed Wastewater Treatment Plant - JERASH WEST

PROJECTION OF WASTEWATER PRODUCTION OF TREATMENT PLANT:
24 JERASH WEST

SCENARIO 0 "Consultants' Study"   (acc. to Consultant's Study Report)

Basic data:

Population in 1994:   36.061

	Unit	1994	2000	2005	2010	2015	2020
Growth rate (previous period)	%	-	3,02	3,02	3,02	3,02	3,02
Spec.water demand	l/c/d	-	143	143	143	143	143
Commercial demand	m³/d						
Small industrial demand	m³/d						
Pastoral demand	m³/d						
Coverage	%	0	0	0	60	70	80
Return factor	-	0,8	0,8	0,8	0,8	0,8	0,8
Losses/inflow	%	0	0	0	0	0	0
Specific pollutional load	gBOD$_5$/c/d	65	65	65	65	65	65

	Unit	1994	2000	2005	2010	2015	2020
Population	c	36.061	43.109	50.024	58.047	67.358	78.162
Connected (sewerage)	c	0	0	0	34.828	47.151	62.530
Not connected (sewerage)	c	36.061	43.109	50.024	23.219	20.207	15.632
Water demand							
Domestic demand	l/c/d	-	143	143	143	143	143
	m³/d	0	6.165	7.153	8.301	9.632	11.177
Commercial demand	m³/d						
Small industrial demand	m³/d						
Pastoral demand	m³/d						
Total	m³/d	0	6.165	7.153	8.301	9.632	11.177
Wastewater production							
Return flow (w.demand)	m³/d	0	0	0	3.984	5.394	7.153
Losses/inflow	m³/d	0	0	0	0	0	0
Total	m³/d	0	0	0	3.984	5.394	7.153
	m³/month	0	0	0	119.531	161.821	214.603
	m³/a	0	0	0	1.454.295	1.968.825	2.611.000
Pollutional load							
Poll. load (dom.demand)	kgBOD$_5$/d	0	0	0	2.264	3.065	4.064
Poll. load (com.demand)	kgBOD$_5$/d						
Poll. load (small ind.)	kgBOD$_5$/d						
Others	kgBOD$_5$/d						
Total load	kgBOD$_5$/d	0	0	0	2.264	3.065	4.064
Reuse of wastwater							
Inflow to the treatment plant	m³/a	0	0	0	1.454.295	1.968.825	2.611.000
Losses in treatment plant	%	0	5	5	5	5	5
(due to infiltr./evap.)	m³/a	0	0	0	72.715	98.441	130.550
Effluent of treatment plant	m³/a	0	0	0	1.381.581	1.870.384	2.480.450
Net water demand per ha	m³/d/ha	-	-	-	-	-	-
Irrigable reuse area	ha	-	-	-	-	-	-

Water demand for irrigation

25. KOFUR ASAD TREATMENT PLANT

The proposed Kofur Asad Scheme area is located in an area 20 km west of Irbid. Presently, there exists no sewerage system. The following communities will be connected to the proposed scheme: Taybeh, Kofur Yoba, Samma, Kofur Asad, Bait Yafa, Dair Su'na, Qameem, Kofur An, Al Kharaj, Junha, Saydor, Qamm and Hamm. Figure 25.1 shows the layout of the proposed sewerage system.

The project foresees the construction of the Kofur Asad Treatment Plant designed for the wastewater production in 2020. It will be based on an extended aeration process including slow sand filtration as tertiary treatment. Produced sludge will be treated by gravity thickeners and drying beds. Figure 25.2 shows the proposed treatment system. The projection of the wastewater production is shown in the following table (acc. to Consultant's Study Report). The plant will be implemented in two phases, whereby the final capacity will be reached

in 2020: 11,900 m³/d (106,600 connected inhabitants)

To protect the Wadi Arab storage reservoir in case any effluent not reaching the required quality standards or is not used for agricultural irrigation, all flow should be discharged into the Wadi Awaj. Therefore, a pipeline (1.5 km long) will be constructed.

The effluents could supply irrigation water for an area of about 190 ha in 2020 taking into account the demand for alfalfa and barley (see following table). Suitable land for irrigation exists northwest of the plant. A 1.5 km long pipeline is proposed to discharge by gravity the treated wastewater to the irrigation area. Proposed wastewater reuse areas are presented in the Figure 25.3.
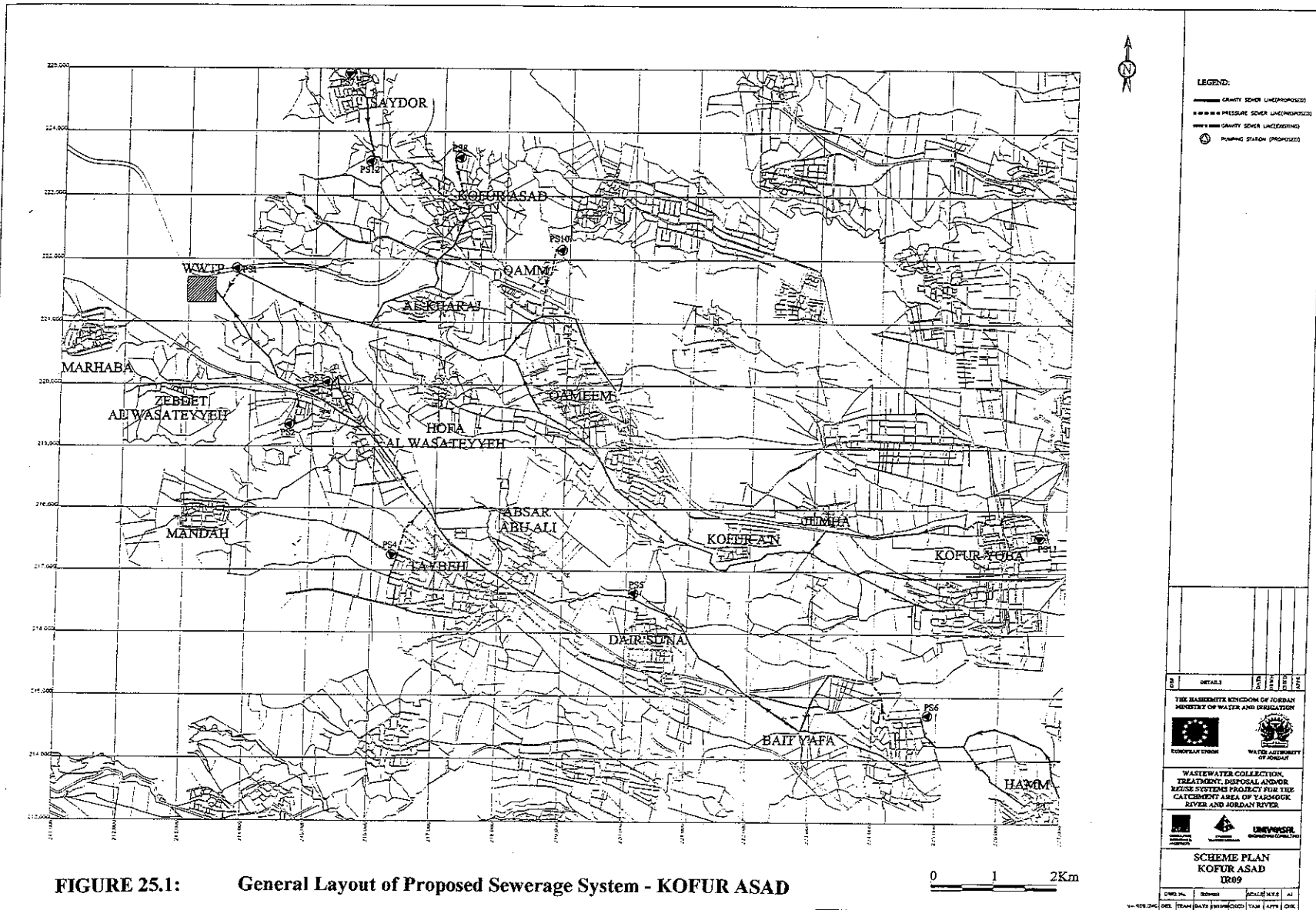
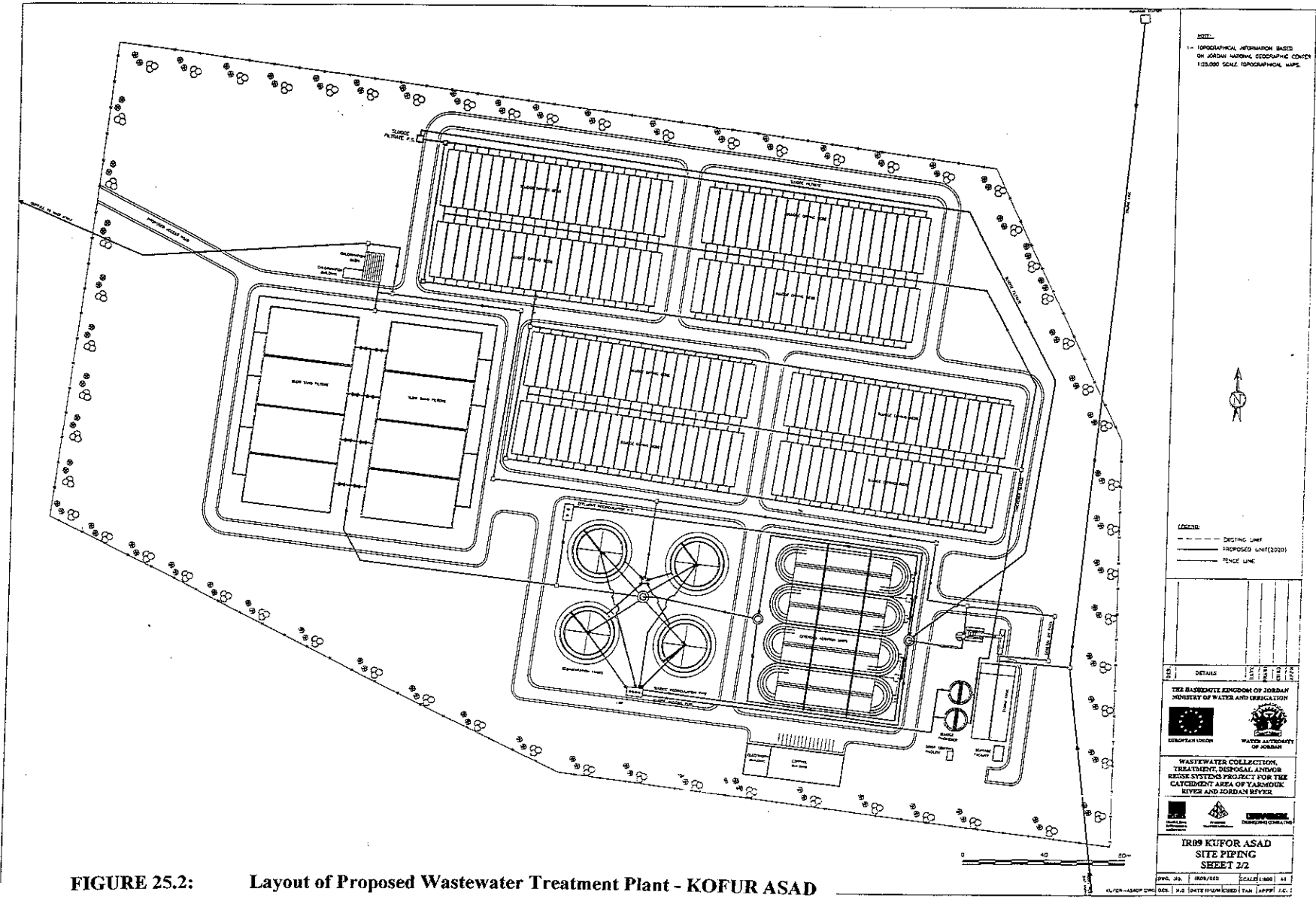The investment costs based on 1998 prices are:

Treatment plant (primary and secondary treatment)	8.60 million JD
Networks	21.32 million JD
Tertiary treatment and pump station (reuse system)	1.66 million JD
Dam/storage (pond for reuse)	0 million JD
Total base costs	31.58 million JD
Physical contingencies	3.16 million JD
Engineering	3.47 million JD
Total investment costs	38.21 million JD

According to the Consultant's Study Report implementation of proposed construction measures were foreseen during the years 2005 to 2007 (Phase I).

Consultant's Study Report:
TYPSA, Symonds Travers Morgan and Universal Engineering Consulting: "Wastewater collection, treatment, disposal and/or reuse systems project for the catchment area of Yarmouk River and Jordan River. Final Report", December 1998

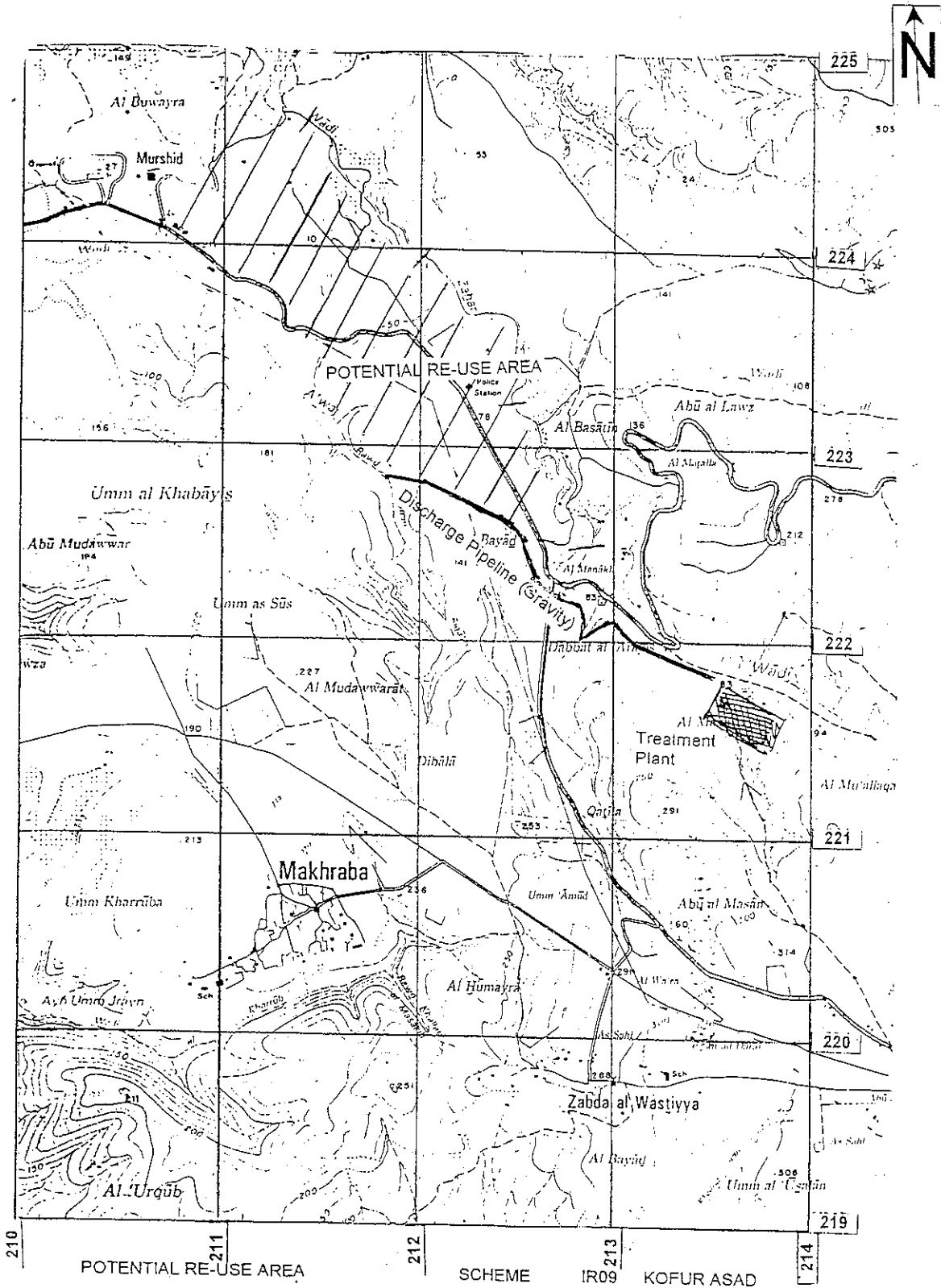FIGURE 25.1:   General Layout of Proposed Sewerage System - KOFUR ASAD

FIGURE 25.2:   **Layout of Proposed Wastewater Treatment Plant - KOFUR ASAD**

FIGURE 25.3:   **Potential Reuse Areas - KOFUR ASAD**

PROJECTION OF WASTEWATER PRODUCTION OF TREATMENT PLANT:
25 KOFUR ASAD

SCENARIO 0 "Consultants' Study"   (acc. to Consultant's Study Report)

Basic data:

Population in 1994:   58.620

	Unit	1994	2000	2005	2010	2015	2020
Growth rate (previous period)	%	-	2,97	2,97	2,97	2,97	2,97
Spec.water demand	l/c/d	-	140	140	140	140	140
Commercial demand	m³/d						
Small industrial demand	m³/d						
Pastoral demand	m³/d						
Coverage	%	0	0	0	85	85	85
Return factor	-	0,8	0,8	0,8	0,8	0,8	0,8
Losses/inflow	%	0	0	0	0	0	0
Specific pollutional load	gBOD$_5$/c/d	65	65	65	65	65	65

	Unit	1994	2000	2005	2010	2015	2020
Population	c	58.620	69.873	80.884	93.630	108.385	125.466
Connected (sewerage)	c	0	0	0	79.586	92.128	106.646
Not connected (sewerage)	c	58.620	69.873	80.884	14.045	16.258	18.820
Water demand							
Domestic demand	l/c/d	-		140	140	140	140	140
	m³/d	0	9.782	11.324	13.108	15.174	17.565
Commercial demand	m³/d						
Small industrial demand	m³/d						
Pastoral demand	m³/d						
Total	m³/d	0	9.782	11.324	13.108	15.174	17.565
Wastewater production							
Return flow (w.demand)	m³/d	0	0	0	8.914	10.318	11.944
Losses/inflow	m³/d	0	0	0	0	0	0
Total	m³/d	0	0	0	8.914	10.318	11.944
	m³/month	0	0	0	267.409	309.549	358.329
	m³/a	0	0	0	3.253.472	3.766.176	4.359.675
Pollutional load							
Poll. load (dom.demand)	kgBOD$_5$/d	0	0	0	5.173	5.988	6.932
Poll. load (com.demand)	kgBOD$_5$/d						
Poll. load (small ind.)	kgBOD$_5$/d						
Others	kgBOD$_5$/d						
Total load	kgBOD$_5$/d	0	0	0	5.173	5.988	6.932
Reuse of wastwater							
Inflow to the treatment plant	m³/a	0	0	0	3.253.472	3.766.176	4.359.675
Losses in treatment plant	%	0	5	5	5	5	5
(due to infiltr./evap.)	m³/a	0	0	0	162.674	188.309	217.984
Effluent of treatment plant	m³/a	0	0	0	3.090.798	3.577.867	4.141.692
Net water demand per ha	m³/d/ha		60	60	60	60	60
Irrigable reuse area	ha	0	0	0	141	163	189

Water demand for irrigation   Alfalfa, barley   60   m³/d/ha

26. AQABA SOUTH COAST TREATMENT PLANT

Two plants will serve in future Aqaba:

- Central Aqaba Treatment Plant (receiving wastewater from Aqaba Town, see Section 2)

and

- South Coast Aqaba Treatment Plant (receiving wastewater from Teeba – Tourist Residential Area)

The proposed sewerage scheme of Aqaba South Coast (Teeba Tourist Residential Area) is presented in Figure 2.1.

The new Treatment Plant Aqaba South Coast will be located near the proposed extension of the railway and east of the power station for the Egyptian Undersea Power Cable. Wastewater shall be treated by screens and 2 grit chambers. Biological treatment shall be based on aeration, denitrification, clarification and recirculation (extended aeration). Additional treatment shall be provided by sand filtration. Sludge generated at the facility will be thickened by sludge thickener and then transported to Aqaba Central Treatment Plant's gravity drying beds. Figure 2.2 shows the proposed new treatment system.

The projection of the wastewater production is shown in the following table (acc. to Consultant's Study). The treatment plant will be implemented in two stages with the following design capacities

in 2010 (Phase 1):   1,000 m³/d (6,900 connected inhabitants)
in 2025 (Phase 2):   2,000 m³/d (13,800 connected inhabitants)

Treated effluent of the treatment plant will be used for irrigation of green areas in the South Coast at hotels and parks. The effluents could supply irrigation water for an area of about 30 ha in 2020 (see following table). A pump station is required to pump the effluent of the treatment plant to the about 15 m higher located proposed reservoir.
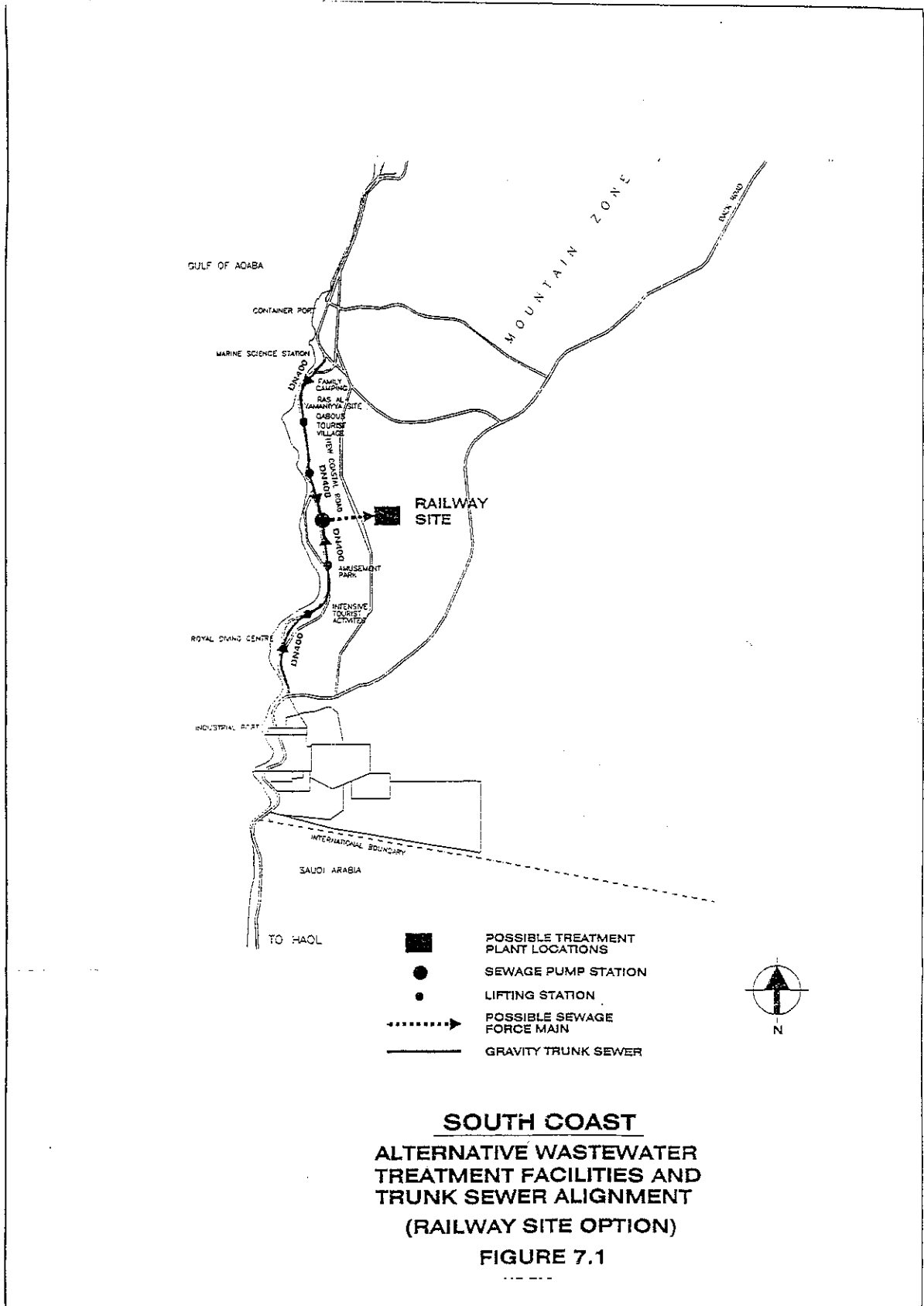
Total investment costs of Phase 1 based on preliminary design and 2000 prices (Study of Montgomery Watson) are:

Treatment plant	0.80 million JD
Force main and pumping station	0.28 million JD
Total base costs	1.08 million JD
Physical contingencies	0.27 million JD
Total investment costs	1.35 million JD

Proposed measures may be implemented between 2001 and 2003 (Phase 1).

Consultant's Study Report:
Montgomery Watson: "Technical and economic Feasibility Study and Final Design of the upgrading and expansion of the water and wastewater facilities at Aqaba. Feasibility Study – Wastewater. Volume I. Final Report", May 2000

POSSIBLE TREATMENT
PLANT LOCATIONS

SEWAGE PUMP STATION

LIFTING STATION

POSSIBLE SEWAGE
FORCE MAIN

GRAVITY TRUNK SEWER

SOUTH COAST

**ALTERNATIVE WASTEWATER
TREATMENT FACILITIES AND
TRUNK SEWER ALIGNMENT**

(RAILWAY SITE OPTION)

FIGURE 7.1

FIGURE 26.1: General Layout of Proposed Sewerage System - AQABA SOUTH COAST

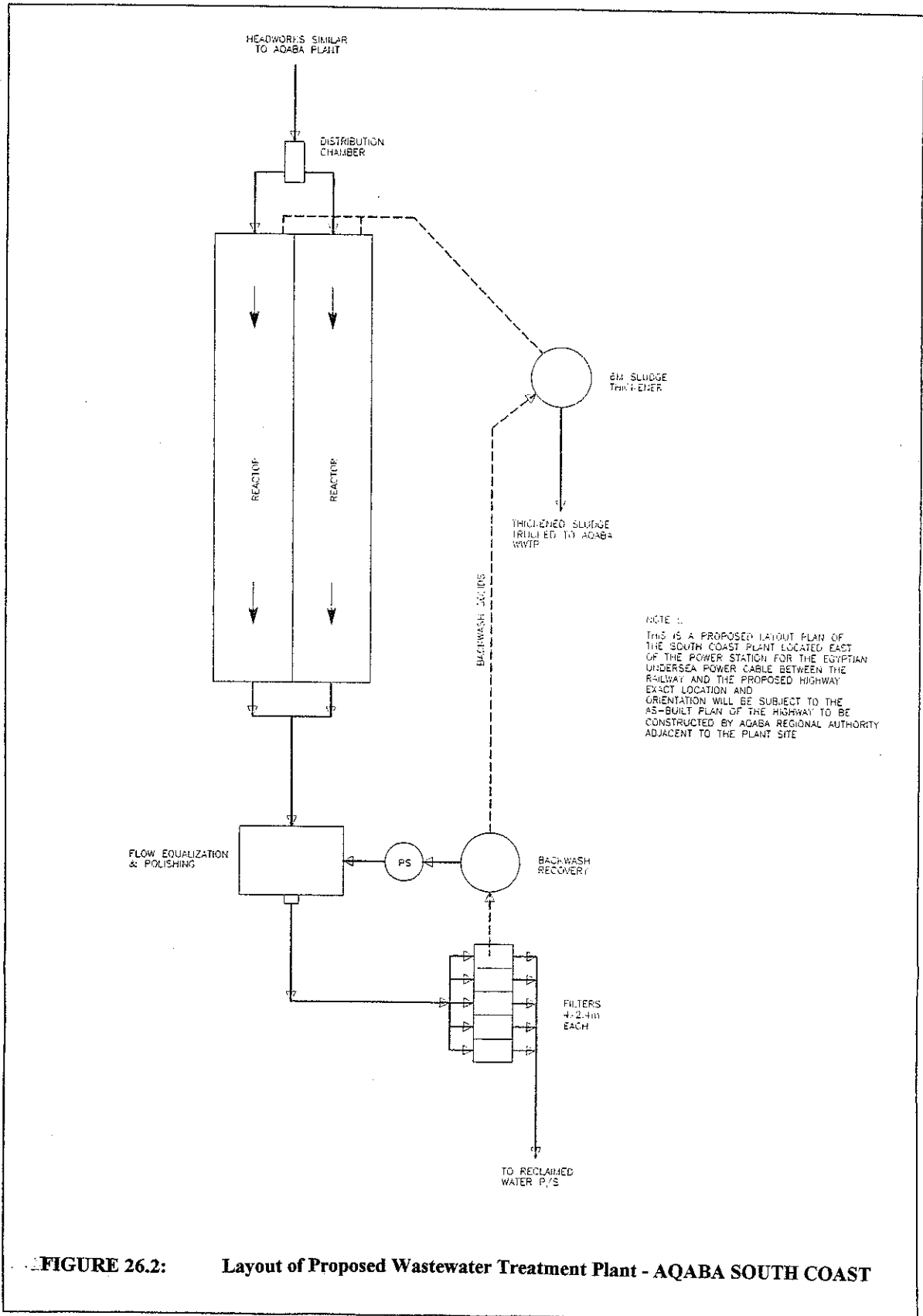**FIGURE 26.2:**   **Layout of Proposed Wastewater Treatment Plant - AQABA SOUTH COAST**

PROJECTION OF WASTEWATER PRODUCTION OF TREATMENT PLANT:
26 SOUTH COAST AQABA

SCENARIO 0 "Consultants' Study"   (acc. to Consultant's Study Report of Montgomery Watson)

Basic data:

Population in 1994:   3.290

	Unit	1994	2000	2005	2010	2015	2020
Growth rate (previous period)	%	-	4,73	4,73	4,73	4,73	4,73
Spec.water demand	l/c/d	105	125	160	160	160	160
Commercial demand	m³/d						
Small industrial demand	m³/d						
Pastoral demand	m³/d						
Coverage	%	0	0	100	100	100	100
Return factor	-	0,9	0,9	0,9	0,9	0,9	0,9
Losses/inflow	%	0	0	0	0	0	0
Specific pollutional load	gBOD₅/c/d	65	65	65	65	65	65

	Unit	1994	2000	2005	2010	2015	2020
Population	c	3.290	4.341	5.470	6.892	8.683	10.941
Connected (sewerage)	c	0	0	5.470	6.892	8.683	10.941
Not connected (sewerage)	c	3.290	4.341	0	0	0	0
Water demand							
Domestic demand	l/c/d	105	125	160	160	160	160
	m³/d	0	543	875	1.103	1.389	1.751
Commercial demand	m³/d						
Small industrial demand	m³/d						
Pastoral demand	m³/d						
Total	m³/d	0	543	875	1.103	1.389	1.751
Wastewater production							
Return flow (w.demand)	m³/d	0	0	788	992	1.250	1.575
Losses/inflow	m³/d	0	0	0	0	0	0
Total	m³/d	0	0	788	992	1.250	1.575
	m³/month	0	0	23.630	29.773	37.512	47.264
	m³/a	0	0	287.497	362.234	456.399	575.043
Pollutional load							
Poll. load (dom.demand)	kgBOD₅/d	0	0	356	448	564	711
Poll. load (com.demand)	kgBOD₅/d						
Poll. load (small ind.)	kgBOD₅/d						
Others	kgBOD₅/d						
Total load	kgBOD₅/d	0	0	356	448	564	711
Reuse of wastwater							
Inflow to the treatment plant	m³/a	0	0	287.497	362.234	456.399	575.043
Losses in treatment plant	%	0	0	5	5	5	5
(due to infiltr./evap.)	m³/a	0	0	14.375	18.112	22.820	28.752
Effluent of treatment plant	m³/a	0	0	273.122	344.122	433.579	546.290
Net water demand per ha	m³/d/ha		50	50	50	50	50
Irrigable reuse area	ha	0	0	15	19	24	30

Water demand for irrigation	Green areas			50	m³/d/ha		

27. NAUR TREATMENT PLANT

The proposed Naur Scheme area is located in an area 15 km southwest of Amman. Presently, there exists no sewerage system. The following communities will be connected to the proposed scheme: Naur, Wasfi Al Tall, eastern part of Marj, Al Hammam, Um Ul Quttin, Mashiyeh, Amireyeh, Bassa and Zabbood, Wadi Umm Tineh. Figure 27.1 shows the layout of the proposed sewerage system.

The project foresees the construction of the Naur Treatment Plant designed for the wastewater production in 2020. It will be based on an extended aeration process including polishing (maturation) ponds as tertiary treatment. Produced sludge will be treated by gravity thickeners and drying beds. Figure 27.2 shows the proposed treatment system. The projection of the wastewater production is shown in the following table (acc. to Consultant's Study Report). The plant will be implemented in two phases, whereby the final capacity will be reached

in 2020:   5,200 m³/d (46,900 connected inhabitants) and
in 2010:   2,900 m³/d (27,300 connected inhabitants) and

The effluents could supply irrigation water (by gravity flow) for an area of about 160 ha in 2020 taking into account demand for selected crops (see following table). Suitable land for irrigation exists at an area close to the plant. Proposed wastewater reuse areas are presented in the Figure 27.3.

The investment costs based on 1995 prices are:

Total investment costs (Phase 1)   5.37 million JD
Total investment costs (Phase 2)   1.75 million JD

According to the Consultant's Study Report implementation of proposed construction measures were foreseen during the years 1997/98 (Phase 1) and 2010/11 (Phase 2). Due to the fact that there are no specific activities in this project, it is supposed that implementation will not be before 2005.

Consultant's Study Report:

Mott MacDonald: "Wastewater collection, treatment and reuse systems for Municipality of Naur and the adjacent areas", May 1996
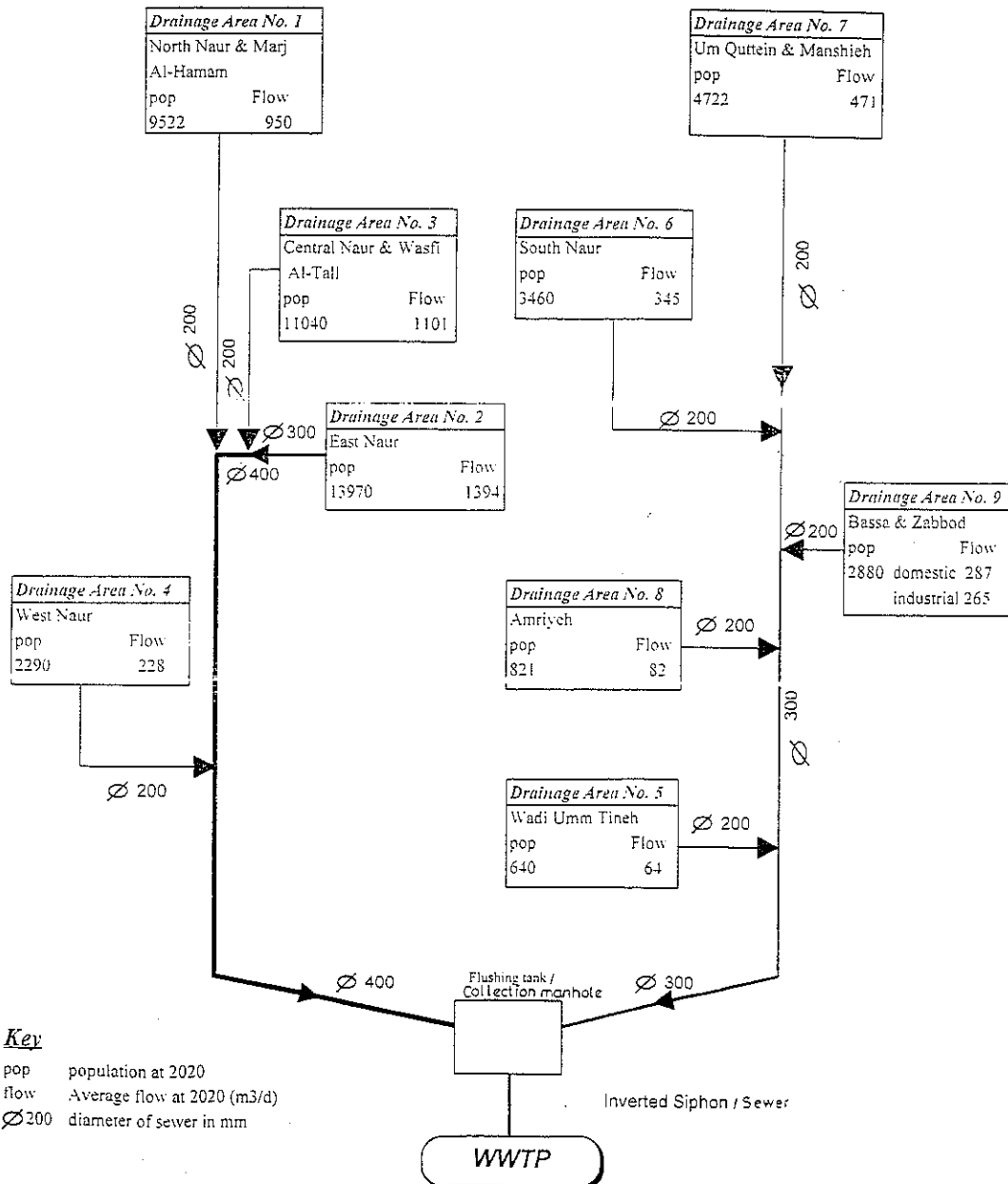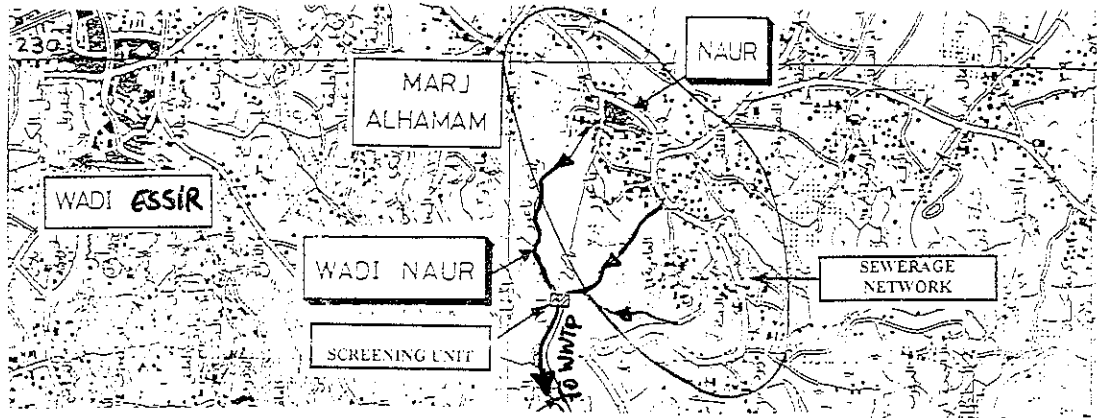
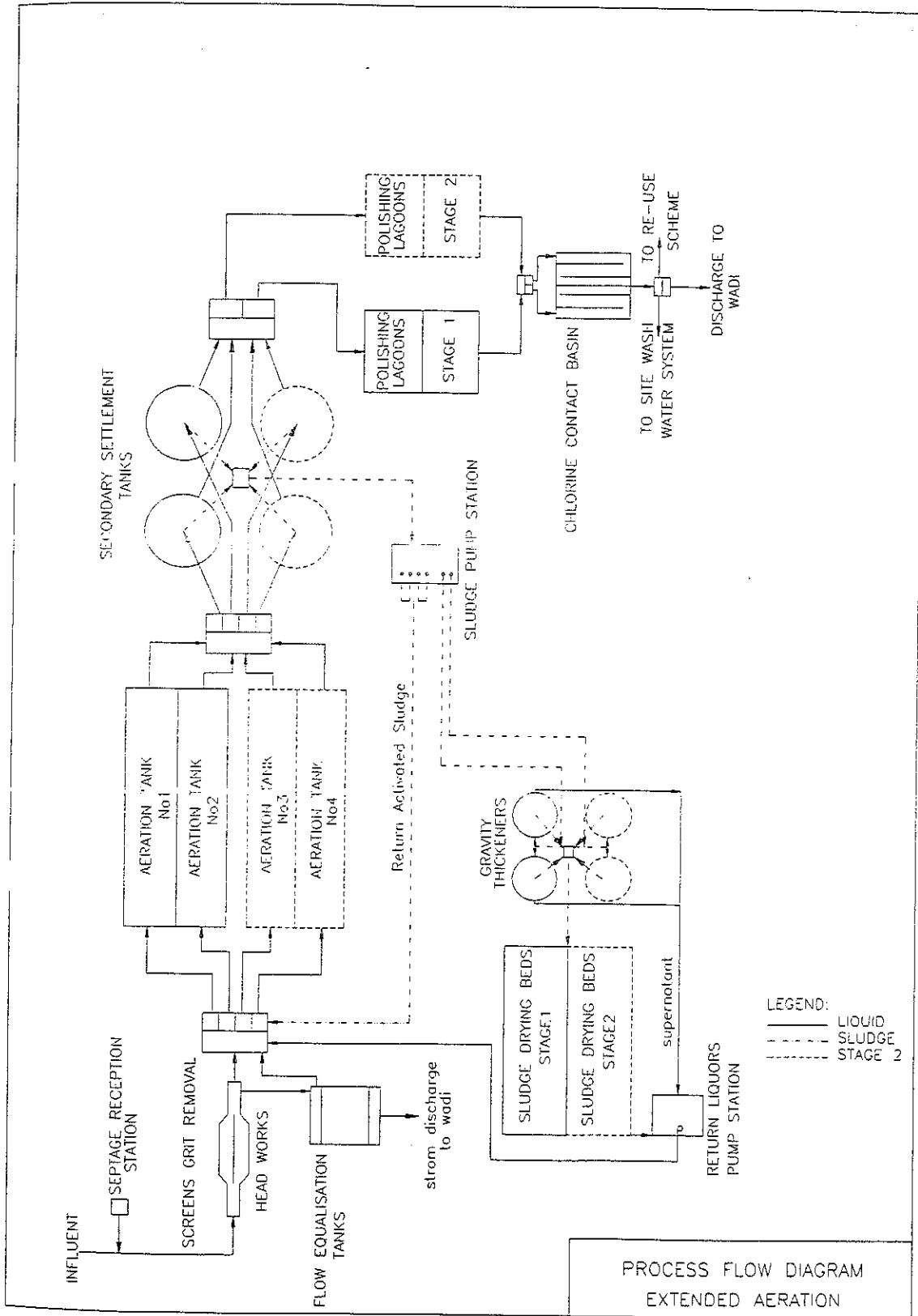**FIGURE 27.1:**   **General Layout of Proposed Sewerage System - NAUR**

FIGURE 27.2:   Layout of Proposed Wastewater Treatment Plant - NAUR

WADI ES-SIR
EFFLUENT/RAW SEWAGE
SEWER

WADI ES-SIR
WWTP

EFFLUENT REUSE
SITE

NAUR WASTEWATER
SEWER

FROM NAUR

SITE D

SITE E

ACCESS
ROAD
TO
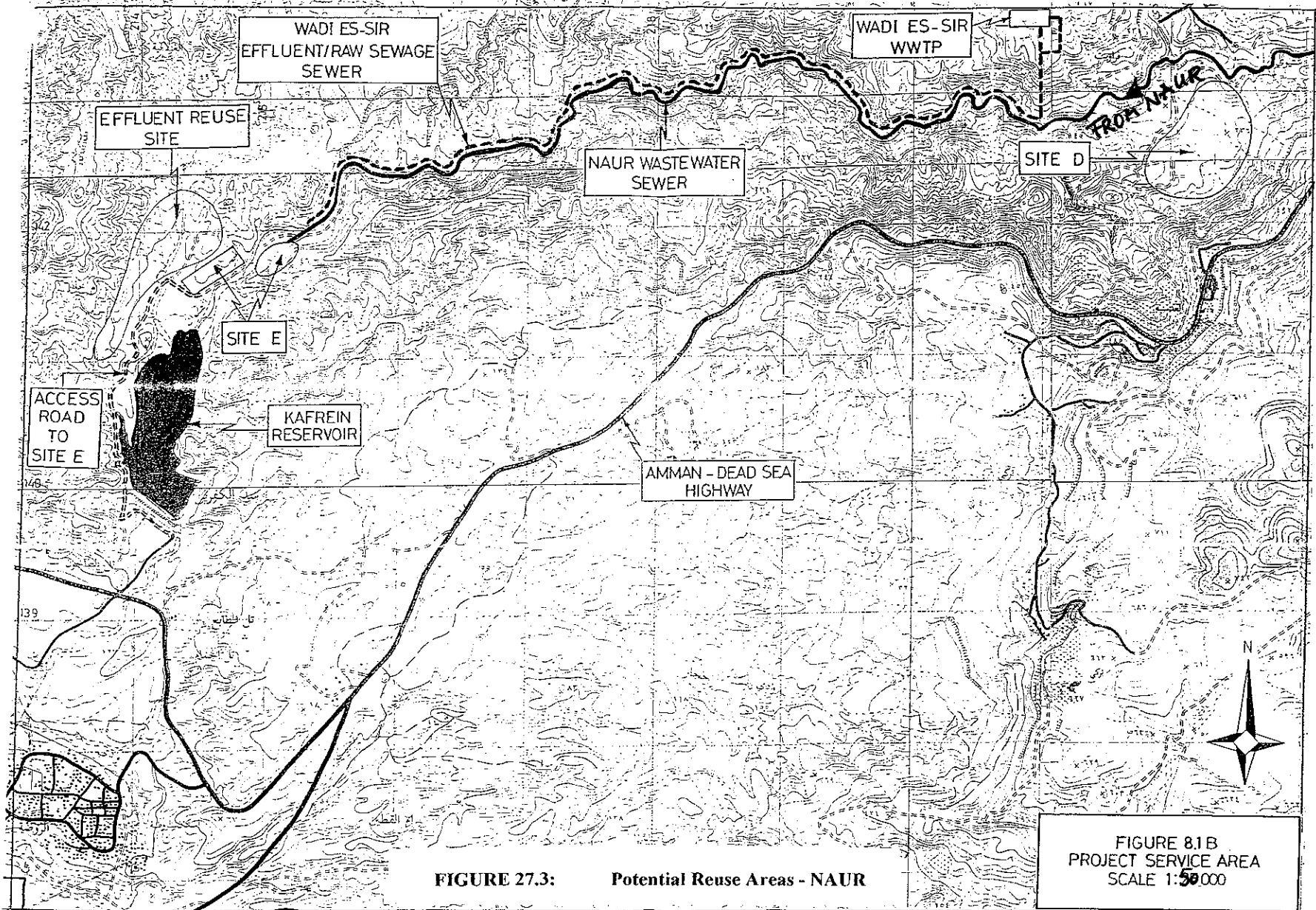SITE E

KAFREIN
RESERVOIR

AMMAN – DEAD SEA
HIGHWAY

N

FIGURE 27.3:   **Potential Reuse Areas - NAUR**

FIGURE 8.1 B
PROJECT SERVICE AREA
SCALE 1:50,000

PROJECTION OF WASTEWATER PRODUCTION OF TREATMENT PLANT:
27 NAUR

SCENARIO 0 "Consultants' Study"   (acc. to Consultant's Study Report of Mott MacDonald)

Basic data:

Population in 1994:   13.881 (living within the drainage area)

	Unit	1994	2000	2005	2010	2015	2020
Growth rate (previous period)	%	-	5,00	5,00	5,00	5,00	5,00
Spec.water demand	l/c/d	-	106	115	121	127	132
Commercial demand	m³/d						
Small industrial demand	m³/d		0	387	368	347	347
Pastoral demand	m³/d						
Coverage	%	0	0	0	90	95	95
Return factor	-	0,8	0,8	0,8	0,8	0,8	0,8
Losses/inflow	%	0	0	0	0	0	0
Specific pollutional load	gBOD₅/c/d	65	65	65	65	65	65

	Unit	1994	2000	2005	2010	2015	2020
Population	c	13.881	18.602	23.741	30.300	38.672	49.356
Connected (sewerage)	c	0	0	0	27.270	36.738	46.888
Not connected (sewerage)	c	13.881	18.602	23.741	3.030	1.934	2.468
Water demand							
Domestic demand	l/c/d	-		106	115	121	127	132
	m³/d	0	1.972	2.730	3.666	4.911	6.515
Commercial demand	m³/d						
Small industrial demand	m³/d	0	0	387	368	347	347
Pastoral demand	m³/d						
Total	m³/d	0	1.972	3.117	4.034	5.258	6.862
Wastewater production							
Return flow (w.demand)	m³/d	0	0	0	2.905	3.996	5.215
Losses/inflow	m³/d	0	0	0	0	0	0
Total	m³/d	0	0	0	2.905	3.996	5.215
	m³/month	0	0	0	87.142	119.890	156.454
	m³/a	0	0	0	1.060.229	1.458.663	1.903.527
Pollutional load							
Poll. load (dom.demand)	kgBOD₅/d	0	0	0	1.773	2.388	3.048
Poll. load (com.demand)	kgBOD₅/d						
Poll. load (small ind.)	kgBOD₅/d						
Others	kgBOD₅/d						
Total load	kgBOD₅/d	0	0	0	1.773	2.388	3.048
Reuse of wastwater							
Inflow to the treatment plant	m³/a	0	0	0	1.060.229	1.458.663	1.903.527
Losses in treatment plant	%	0	10	10	10	10	10
(due to infiltr./evap.)	m³/a	0	0	0	106.023	145.866	190.353
Effluent of treatment plant	m³/a	0	0	0	954.206	1.312.796	1.713.175
Net water demand per ha	m³/d/ha		30	30	30	30	30
Irrigable reuse area	ha	0	0	0	87	120	156

Water demand for irrigation   30   m³/d/ha