

#### 4) 文化財保護

観光省、遺跡局；遺跡法 No. 21, 13章&15章 - 建設許可、建築物の遺跡からの距離の規制、文化財発見の報告義務等

また、「ジョ」国は、環境にかかわる主要な20の国際条約、勧告に加盟している。主要なものは以下のとおりである。

- ・ ワシントン条約
- ・ バーゼル条約
- ・ ラムサール条約
- ・ マルポール73/78条約
- ・ オゾン層保護に関するウィーン及びモントリオール議定書
- ・ 世界の文化遺産及び自然遺産の保護に関する条約
- ・ 気候変動枠組み条約

これらの運用はDOEの所管であるが、環境保護政策がDOEに一元化されておらず、DOEのスタッフも26名にすぎず、十分に運用されているとはいえない。

「ジョ」国においては、いかなるプロジェクトであれ、環境アセスメントの必要性の可否を判断する機関は存在しない。したがって、本計画もその対象とはなっていない。

#### 6-2-2 IEE・EIAの実施体制

環境法制定後はDOEがIEE、EIAの審査機関となるが、現時点ではIEE、EIAの審査機関は存在しない。したがって、IEE、EIAの審査機関をどこにするかを協議した結果、C/P機関が行うこととした。

#### 6-2-3 IEE・EIAの手続き

現時点では環境アセスメントの手続きは定められていない。したがって、C/P機関と協議のうえで調査方法、スケジュール、レポートの内容等について決めることとなる。

#### 6-2-4 相手国のIEE・EIA法制度・実施体制が求める対象案件にかかわる環境調査の内容・精度

「ジョ」国の実施ガイドラインは現時点では未制定であるので、内容、精度はJICAの実施方法に沿って行うこととした。

#### 6-2-5 IEE・EIAの手続き（審査）とマッチングした環境調査等の進め方

##### 1) 環境調査体制

「ジョ」国の環境調査の手続きは現時点では未だ制度化されていない。C/P機関であるWAJは本格調査での環境調査の経験はない。したがって、本格調査団の環境専門家の指導でC/Pが実施することになる。ローカルコンサルタントは必要に応じて活用する。

## 2) 進め方

環境調査に関しての手続き、実施ガイドライン、調査・レポート作成の有資格者の規定等について制度化されていないので、本格調査団の環境専門家がJICAの実施方法に基づきC/Pの協力のもとに調査を実施し、レポートを作成する。

## 6-3 本格調査における環境調査等の作業分担の確認

### 6-3-1 本格調査団の分担範囲

C/P機関が環境調査の経験に乏しいこと、IEE・EIAに関する手続きがないことから、本格調査団は環境調査全般について主導的な立場をとる必要がある。作業内容は、

- ・ 現地踏査の実施
- ・ 環境調査に必要な計画策定
- ・ 環境調査の実施
- ・ 環境調査に必要なデータの収拾・分析と指導
- ・ IEE・EIA 報告書の作成指導

### 6-3-2 相手国機関の分担範囲

C/P機関は、本格調査団の指導のもとに以下の業務を実施する。

作業内容は、

- ・ 現地踏査の実施協力
- ・ 環境調査に関する関係機関との調整
- ・ 環境調査に必要な基礎データの収集及び調査の実施
- ・ IEE、EIA 報告書の作成

なお、M/MではC/P機関と本格調査団が合同で調査を行い、本格調査団が技術的アドバイスをすることとした。

### 6-3-3 本格調査時において動員しうるローカルコンサルタント、研究機関

#### 1) ローカルコンサルタント、研究機関の環境調査実施能力

DOEの推薦によるローカルコンサルタントは、以下のとおりである。

- ・ Royal Scientific Society, Environmental Research Centre (RSS)

政府出資により設立されたコンサルタント会社。水質、土壌汚染などの環境モニタリング

が主な経歴であるが、工場立地に伴う環境アセスメントの経験もある。

・ 個人 (Dr. Maher Abu Talib)

(詳細不明)

## 2) 現地再委託の経費

環境項目のうち、遺跡・文化財についてはローカルコンサルタントに再委託すべきであり、単価 (overhead込み) は以下のとおりである。

Manager クラス	2,200~2,500JD/月
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Specialist クラス	1,600~1,800JD/月
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## 6-4 現地踏査の状況

### 6-4-1 踏査地域、範囲

計画地域のザルカ地区と水源のあるザアタリ、アズラック地区の踏査を実施した。

### 6-4-2 自然環境

ザルカ地区は砂岩、石灰岩より成る丘陵地帯である。ザルカ川の狭い氾濫原を除いては表土は薄く、岩盤が広く露頭する。ザルカ川は調査対象地域で年間を通して水量のある唯一の河川であるが、給水水源はこの河川によらず、地下水によっている。乾燥気候であるうえに、調査対象地域全体の開発が進んでいるために樹木は少なく、限られた地域に小規模な植林が見られる程度である。ザルカ川流域を含めて、調査対象地域内には貴重な動植物やその生息域は存在せず、また、小規模な公園を除いては自然公園や保護地区なども存在しない。

### 6-4-3 社会環境

調査対象地域は人口の密集地であるほか、約50の中小の工場が立地している。インフラの整備は進んでおり、上水道の普及率は90%以上、市街地の下水道普及率は50%以上である。市街地は一般に清潔に保たれ、環境衛生は比較的良好である。給水水源は地下水であるが、過剰揚水により水位の低下、水質の悪化が進んでいる。特記すべき伝染病、水因性疾病は近年において発生していない (Directorate of Health in Zarqa Governorateによる)。

### 6-4-4 予測される環境影響で特記すべき事項

当該計画が地域住民の生活レベルの向上をもたらすものであること、大規模な構造物が想定されていないこと、などから大きな環境影響はないと判断される。しかしながら、調査対象地域が人口密集地や工場が立地することから、新しい施設の立地による住民の移転、施設からの騒音・振動、排水による河川、地下水の汚染などが考えられる。

#### 6-4-5 発生している公害で特記すべき事項

給水が間接的にザルカ川や地下水を汚染している。市街地での下水道の普及率が高いが、村落での下水道の不備や工場排水の垂れ流しによるザルカ川や地下水の汚染が報告されている (Directorate of Water in Zarqa District による)。

#### 6-4-6 環境影響を回避あるいは軽減する緩和策で特記すべき事項

調査対象地域の土地利用計画を考慮して施設の立地を計画すること、給水量については計画されているアズ・サムラ下水処理プラント改善計画の処理能力やサービス地域などを考慮に入れて計画する必要がある。

#### 6-4-7 現況の分析

施設の規模から考えて大きな環境影響はないと判断されるが、調査対象地域は人口の密集・急増地域であり、施設の新設による住民の移転、騒音・振動の影響、間接的に河川・地下水の汚染などが考えられる。

#### 6-5 プロジェクト概要書 (P/D) 及びプロジェクト立地環境書 (S/D)

表-6.1にP/D、表-6.2にS/Dを示した。P/Dの計画諸元については、現時点では不明な要素もある。

#### 6-6 環境調査の必要性の有無の確認 (合同スクリーニング) 及び環境問題の確認 (合同スコーピング) の結果

合同スクリーニング及びスコーピングはWAJの以下の関係者と2回に分けて実施した。WAJから指定のあった環境配慮担当部門は、第1回の合同会議を実施したWAJ、Laboratory Departmentであり、JICAの環境配慮の意義、手順等を説明しつつ、2日にわたりスクリーニング及びスコーピングを実施した。第2回目協議はM/M協議に際して行われたもので、第1回協議の訂正、追加について協議した。

環境予備調査のジョルダン側参加者

##### 第1回

Dr. Raja Jadoun, Laboratory Dept., Director, WAJ

Mr. Mohammed Al - Lafi, Laboratory Dept, WAJ

##### 第2回

Mr. Nazir A. Arkoub, Design & Study Director, WAJ

Mr. Taisir Al - Saqri, Water Design Section, WAJ

#### 6-6-1 合同スクリーニングの結果

スクリーニングの検討は事前調査用環境配慮手引き書及びガイドラインに基づき行い、表-6.3のフォーマットに整理した。合同スクリーニングではフォーマットの各項目について合同で評定を行った。現時点では計画の範囲、施設の規模・位置など不明な点が多く、そのため、表-6.3に示したように評点は不明となったものが多い。スクリーニングの結果、5項目で「不明」、1項目が「有り」と評定され、環境調査の必要が確認された。

また、当該計画の施設建設中の環境への影響、公害についても話し合われたが、いずれも影響は少ないか、有った場合でも工事中の適切な処理などにより十分対処できるとの結論になった。

#### 6-6-2 合同スコーピングの結果

引き続き行ったスコーピングの結果、5項目については現時点では計画内容が明確ではないので、環境インパクトの程度は不明であるが、計画の内容によって起こりうる環境影響として評定C、1項目については施設設計の中で当然考慮されるべきものとして評定Dとした。協議の結果については表-6.4のスコーピングチェックリスト及び表-6.5の総合評価表にまとめた。詳細は以下のとおりである。このうち、2)、3)については先方より問題が提起された。

- 1) 住民移転（評定C）；ポンプ場、配水池の計画位置によっては、用地取得のために住民の移転が必要となる可能性がある。そのために、補償制度、移転対象住民の現況、移転先の状況調査を行う。
- 2) 経済活動（評定C）；計画対象地域は丘陵地形であるが、この計画によって高地への配水が可能になった場合、未給水のため経済活動に利用できなかった土地を有効利用したいと考える地主による借地人の追い出しが行われる可能性がある。その場合は、借地人、特に農民の生産機会が喪失する可能性がある。このため未給水地域の土地利用、土地所有権、移転による損失について調査を行う。
- 3) 遺跡・文化財（評定C）；埋蔵文化財が分布する可能性がある。  
調査対象地域内に散見されるほか、文献によればローマ時代にシリアのバスラとアカバを結ぶ通商路がザルカ川沿いを通っていたため、埋蔵遺跡の存在の可能性は大きい。また、The Antiquities Lawで遺跡に影響を与える掘削の報告と許可の取得が義務付けられている。そのため、文献、インタビュー、踏査による遺跡、文化財の調査をする必要がある。
- 4) 水質汚濁（評定C）；給水量の増加に伴う排水量の増加は、地下水や河川の水質を悪化させる可能性がある。

調査対象地域の下水処理はアズ・サムラの下水処理施設で行われているが、処理能力に余裕がなくザルカ川の水質が悪化している。また、下水道のない地区への給水は、排

水の垂れ流しによる地下水、河川の汚染につながる事が考えられる。このため、給・排水の実態調査と給水量が増加した場合の水質汚濁の影響について予測する。また、水質汚濁は汚濁物質によるものだけでなく、7-8(5)に記したとおり、TDSによる農業用水の再利用についても予測が必要である。

なお、USAIDによるアッサムラ下水処理施設改善のF/Sが実施中であり、このF/Sでも環境アセスメントが実施されるので本格調査でそのレビューを行う必要がある。

- 5) 騒音・振動(評定C); ポンプ場の位置によっては、供用開始後の騒音・振動が近隣住民の生活環境を悪化させる可能性がある。調査対象地域は人口密集地であり、既存のポンプ場から発生する騒音のため、例えばザルカポンプ場周辺には住宅が立地できずにいる。当該計画のポンプ場施設は既存の施設より大きくなると考えられる。このため、ポンプ場から発生する騒音の影響を予測する。なお、施設の基礎部分が岩盤であるため、振動の影響はほとんどないと判断される。
- 6) 災害(評定D); 水道水の消毒には液体塩素が使用されるが、容器等の事故により塩素ガスが漏出して災害をもたらす可能性がある。そのため、影響評価が必要である、と先方より意見が出たが、液体塩素を取り扱う施設においては、塩素ガスの除外設備を設けることになっている。このため、設計で適切な防護策を講じること、適切な日常の管理を行うこと、によって災害の回避が可能であるとのことで双方了解した。

表-6.1 プロジェクト概要書 (PD)

項 目	内 容
プロジェクト名	ジョルダン国ザルカ地区上水道施設改善計画調査 The Study on the Improvement of Water Supply System for the Zarqa District in the Hashemite Kingdom of Jordan
背 景	ザルカ地区は給水施設の老朽化と人口急増のため、給排水状態が悪い
目 的	上水道システム改善による民生の安定と向上 (配水池建設、ポンプ場改善、配水管網改善)
位 置	ザルカ地区 (ザルカ、ルセイファ、シェネラー難民キャンプ、ハシュメイ、ニューザルカ、スクナ、アワジャン)
実 施 機 関	水灌漑省、Water Authority of Jordan (WAJ)
裨 益 人 口	現在の給水人口は約60万人
計 画 諸 元	
計 画 の 種 類	施設改善
計 画 の 性 格	飲料水
水 質 ・ 水 源	水源：8か所の地下水、水質：淡水、塩水（一部）
導 水 施 設	延長約70km (アズラック水源～ザルカポンプ場)
浄 水 場	なし
配 水 池	現況：配水池3か所、容量10,250m³、計画：未定
ポ ン プ 場	現況：8か所、計画：未定
その他特記すべき事項	過剰揚水による地下水位の低下と塩水化が著しい 不正接続及び漏水による不明水が54%

表-6.2 プロジェクト立地環境書 (SD)

項 目		内 容
プ ロ ジ ェ ク ト 名		ジョルダン国ザルカ地区上水道施設改善計画調査
社 会 環 境	地域住民 (居住者／先住民／計画に対する意識等)	対象地区は人口密集地であるうえ、中小工場が立地する
	生活関連施設 (井戸・貯水池・水道／電気等)	上水道による給水普及率は95%以上 下水道は市街地で75%以上、周辺部は未整備
	保健衛生 (伝染病・疾病／病院／習慣等)	水源は地下水、帯水層によってはTDSが1,000mg/ℓを超える 衛生環境は比較的良好
自 然 環 境	地形・地質 (急傾斜地・軟弱地盤・湿地・断層等)	砂岩、石灰岩より成る表土の薄い丘陵地帯
	地下水・湖沼・河川・気象 (水質・水量・降雨量等)	水源8か所の地下水によるが、水質は年々悪化している 年雨量は約150mm、雨期は11月～4月
	貴重な動植物・生息域 (自然公園・指定種の生息域等)	公園はごく小規模、古代遺跡がある 貴重な動植物は存在しない
公 害	苦情の発生状況 (関心の高い公害等)	対象地域の家庭、工場排水による地下水及びザルカ川の汚染 過剰揚水による水質の悪化
	対応の状況 (制度的な対策／補償等)	工場の処理していない排水の対策に県当局は対策に苦慮している 工場排水の基準値と罰則は存在する
そ の 他 特 記 事 項		対象地区は人口の急増地で市街地が急速に広がっている



表-6.3 スクニングのフォーマット「上水道」

環境項目			内 容	評 定	備 考（根拠）
社 会 環 境	1	住 民 移 転	用地占有に伴う移転（居住権、土地所有権の転換）	有・無・ <del>不明</del>	排水池、ポンプ場
	2	経 済 活 動	土地等の生産機会の喪失、経済構造の変化	有・無・ <del>不明</del>	給水システム改善による土地利用価値の増大
	3	交通・生活施設	渋滞・事故等既存交通や学校・病院等への影響	有・ <del>無</del> ・不明	小規模構造物
	4	地 域 分 断	交通の阻害による地域社会の分断	有・ <del>無</del> ・不明	小規模構造物
	5	遺跡・文化財	寺院仏閣・埋蔵文化財等の損失や価値の減少	有・無・ <del>不明</del>	遺跡・文化財が分布
	6	水利権・入会権	漁業権、水利権、山林入会権等の阻害	有・ <del>無</del> ・不明	慣習がない
	7	保 健 衛 生	ゴミや衛生害虫の発生等衛生環境の悪化	有・ <del>無</del> ・不明	改善する
	8	廃 棄 物	建設廃材・残土、汚泥、一般廃棄物等の発生	有・ <del>無</del> ・不明	ほとんど発生しない
	9	災害（リスク）	地盤崩壊・落盤、事故等の危険性の増大	<del>有</del> ・無・不明	消毒用塩素の漏出
自 然 環 境	10	地 形 ・ 地 質	掘削・盛土等による価値のある地形・地質の改変	有・ <del>無</del> ・不明	小規模構造物
	11	土 壌 侵 食	土地造成・森林伐採後の雨水による表土流出	有・ <del>無</del> ・不明	小規模構造物
	12	地 下 水	掘削工事の排水等による潤濁、浸出水による汚染	有・ <del>無</del> ・不明	新規水源の開発はしない
	13	湖沼・河川流況	埋立や排水の流入による流量、河床の変化	有・ <del>無</del> ・不明	行わない
	14	海 岸 ・ 海 域	埋立や海況の変化による海岸侵食や堆積	有・ <del>無</del> ・不明	計画地でない
	15	動 植 物	生息条件の変化による繁殖阻害、種の絶滅	有・ <del>無</del> ・不明	貴重種は存在しない
	16	気 象	大規模造成や建築物による気温、風況等の変化	有・ <del>無</del> ・不明	小規模構造物
公 害	17	景 観	造成による地形変化、構造物による調和の阻害	有・ <del>無</del> ・不明	小規模構造物
	18	大 気 汚 染	車両や工場からの排出ガス、有害ガスによる汚染	有・ <del>無</del> ・不明	汚染源なし
	19	水 質 汚 濁	浄水場からの排水や汚濁等の流入による汚染	有・無・ <del>不明</del>	河川、地下水
	20	土 壌 汚 染	排水・有害物質等の流出・拡張等による汚染	有・ <del>無</del> ・不明	汚染源なし
	21	騒 音 ・ 振 動	車両の走行、浄水場の稼働等による騒音・振動の発生	有・無・ <del>不明</del>	ポンプ場
	22	地 盤 沈 下	地盤変状や地下水位低下に伴う地表面の沈下	有・ <del>無</del> ・不明	浅層地下水は使用しない
	23	悪 臭	排気ガス・悪臭物質の発生	有・ <del>無</del> ・不明	発生源なし
総合評価：IEEあるいはEIAの実施が必要となる開発プロジェクトか				<del>要</del> ・不要	影響が生ずるおそれがある

表-6.4 スコーピングチェックリスト「上水道」

環境項目		評価	根拠
社会環境	1 住民移転	C	配水池、ポンプ場用地取得のため
	2 経済活動	C	土地利用価値が上がることによる借地人の追い出しが懸念される
	3 交通・生活施設	D	導・送水管は道路沿いや未利用地を通過
	4 地域分断	D	導・送水管は道路沿いや未利用地を通過
	5 遺跡・文化財	C	分布が不明で施設の建設によりダメージを与えるおそれがある
	6 水利権・入会権	D	入会権はない、水利権は国家に所属する
	7 保健衛生	D	現在より良くなる
	8 廃棄物	D	工事中に発生するが小規模であり、撤去が簡単
	9 災害（リスク）	D	消毒に塩素を使用するが、施設設計及び取扱いで対応できる
自然環境	10 地形・地質	D	大規模な地形改変はない
	11 土壌侵食	D	大規模な地形改変はない
	12 地下水	D	新規の水源地開発はしない
	13 湖沼・河川流況	D	埋立、工事排水は行わない
	14 海岸・海域	D	内陸部で影響ない
	15 動植物	D	貴重種は存在しない
	16 気象	D	気象に影響を与える施設はない
	17 景観	D	大規模な地形の改変はない
公害	18 大気汚染	D	汚染源となる施設、機器はない
	19 水質汚濁	C	給水量の増大が二次的に河川、地下水を汚染する可能性がある
	20 土壌汚染	D	汚染源は存在しない
	21 騒音・振動	C	ポンプ場からの騒音が発生する可能性がある
	22 地盤沈下	D	給水減の滞水層は岩盤である。また浅層地下水を工事に使用しない
	23 悪臭	D	該当する工事、施設はない

(注1) 評価の区分

A: 重大なインパクトが見込まれる

B: 多少のインパクトが見込まれる

C: 不明（検討をする必要はあり、調査が進むにつれて明らかになる場合も十分に考慮に入れておくものとする）

D: ほとんどインパクトは考えられないため IEE あるいは EIA の対象としない

(注2) 評価にあたっては、該当する項目別解説書を参照し、判断の参考とすること

表-6.5 総 合 評 価

環 境 項 目	評 定	今 後 の 調 査 方 針	備 考
住 民 移 転	C	<ul style="list-style-type: none"> <li>・「ジョ」国の補償制度</li> <li>・移転対象住民の現況</li> <li>・移転先の状況</li> </ul>	
経 済 活 動	C	<ul style="list-style-type: none"> <li>・先住慣習権の状況</li> <li>・既得権益の社会・経済価値の把握</li> <li>・土地利用状況の把握</li> </ul>	
遺 跡 ・ 文 化 財	C	<ul style="list-style-type: none"> <li>・地形・地質調査</li> <li>・土地利用</li> <li>・遺跡・文化財の分布の把握</li> </ul>	
災 害 ( リ ス ク )	D	<ul style="list-style-type: none"> <li>・施設設計、取扱い規則で対応</li> </ul>	
水 質 汚 濁	C	<ul style="list-style-type: none"> <li>・給・排水水量、水質の現況把握</li> <li>・地下水、河川の現況把握</li> <li>・下流域での生活用水、灌漑への利用状況</li> <li>・既存井戸、河川への影響</li> </ul>	
騒 音 ・ 振 動	C	<ul style="list-style-type: none"> <li>・土地利用</li> <li>・施設及び周辺の騒音環境の把握</li> <li>・騒音防止策の策定</li> </ul>	

(注1) 評定の区分

- A：重大なインパクトが見込まれる
- B：多少のインパクトが見込まれる
- C：不明（検討をする必要はあり、調査が進むにつれて明らかになる場合も十分に考慮に入れておくものとする）
- D：ほとんどインパクトは考えられないためIEEあるいはEIAの対象としない

## 6-7 関連する環境資料・情報

### 6-7-1 資料・情報の収集

環境関係の既存資料リストは資料-Lに示した。

### 6-7-2 調査対象地域内で行われる他のプロジェクト

調査対象地域に関係する他のプロジェクトの概要は以下のとおりである。

プロジェクト名	プロジェクト概要	期 間
As-Samra Treatment Feasibility Study	2005年の流入汚水量・質に対応した処理場能力の増強・改善F/S 2万m <sup>3</sup> /dの処理場新設の検討	1991 - 1993
Recharging Ground-water	リチャージ井戸周辺の収支解析、水質保全、リチャージの訓練 リーチャージ井戸4本、観測井戸2本、濁度除去沈澱池、ポンプ設備等	1993 - 1994
Wastewater Strategy for Amman-Zarqa Basin	アンマン-ザルカ地区の人口増加に伴い、既存の下水道施設を見直す 排水計画、処理場計画、処理水再利用計画、運転管理計画	1993 - 1994

(出典)『ジョルダン企画調査(上水道分野)調査結果資料』平成5年8月 JICA

As-Samra Treatment Plant F/Sでは環境調査を行い、最適案選択のために各代替案について環境インパクトを調査し、それぞれの代替案の評価を行っている。環境調査の手法は不明である。その他のプロジェクトの環境調査については不明である。

## 6-8 S/W、M/NでのIEE・EIAに関する協議・合意事項

S/Wにはフェイズ Iで初期環境評価(IEE)の実施、フェイズ IIで環境影響評価(EIA)の実施が記述された。さらに、M/M第5項にスクリーニング、スコーピングの結果を記述するとともに、「ジョ」国にIEE及びEIAにかかわる法制度が未制定であること、IEE及びEIAの審査機関が存在しないこと、環境法が国会で審議中であること、を考慮して次の次項を記述した。

- WAJを本格調査の環境アセスメント手続き、審査に関する責任機関とすること
- IEE及びEIAは共同で実施し、日本側は技術的アドバイスを行うこと

- IEE及びEIAはJICAの実施方法に沿って行うこと
- 環境法は本格調査中に制定された場合でも、IEE及びEIAの実施はM/Mで記述された手順（上記の3項）に従って実施すること。また、環境法成立前のIEE・EIAの結果は有効なものであること。

## 6-9 本格調査での環境調査に関する提言

### 6-9-1 本格調査における環境調査内容に関する提言

環境内容調査に関して次の点に留意する必要がある。

#### 1) 住民移転

- ・ WAJの過去の住民移転事例を調査し、その問題点を検討する。
- ・ 想定される施設は配水池とポンプ場であり、広い用地を必要としないと考えられるが、対象地域は人口の流入等により市街地が急速に広がっている。そのため、移転先の検討が必要な場合は、都市計画に留意する必要がある。

#### 2) 経済活動

- ・ この項目を環境配慮の対象にすることについてWAJから強い要望があった。調査をするにあたって過去の事例、問題点、対応策等についてWAJと十分打合せをする必要がある。

#### 3) 遺跡・文化財

- ・ 「ジョ」国は古代より多くの民族の活躍の場となった地域で、遺跡・埋蔵文化財が多く分布する。現在、把握されているものは、これらの10%程度といわれている。特に埋蔵文化財に関する資料は少ないので、担当機関（Ministry of Tourism and Antiquities）との接触を密にし、その意見を聞きながら調査を進める必要がある。

#### 4) 水質汚濁

- ・ アズ・サムラ浄水場のF/Sで環境アセスメントが実施されているので、このレビュー及び担当者と十分に意見交換をしながら調査を進める必要がある。WAJからも、この点に関し同様な要望があった。

#### 5) 騒音・振動

- ・ 想定される騒音源はポンプ場であり、振動はあまり問題ではない。  
対象地域は市街地が急速に広がっているので、騒音レベルを検討する場合に都市計画を考慮に入れる必要がある。騒音規制に関する法律はない。

#### 6-9-2 法制度、実施体制に見合った環境調査の進め方に関する提言

「ジョ」国には環境アセスメントに関する法制度はないのでJICAの実施方法に従って調査を進め、WAJが調査結果について審査・承認することになる。この点に関してはM/Mで確認されているが、調査期間中に環境法が制定された場合は、WAJは、当然、それを参考にして審査をすると考えられるので、環境法制定後に問題が生じないように、調査の進め方等について、あらかじめ担当機関（Department of Laboratory：WAJ, Department of Environment：MMRA & E）と打合せをしておく必要がある。

## 第 7 章 本 格 調 査 の 実 施 方 針

### 7-1 基本方針

調査の基本方針は次のとおりである。

#### (1) フェイズⅠ

- ・ 限られた水源からの配水を有効に生かし、給水状態の改善を図ること
- ・ 漏水、不明水の減少対策を定めること
- ・ 配水状態を改善し、エネルギー、漏水を最小限とするための最適システムを定めること
- ・ 最適システムに必要な、管路のリハビリ、新設内容を定めること
- ・ 最適システムに必要な、ポンプ場のリハビリ、新設内容を定めること
- ・ 最適システムの運転・維持管理計画を作成すること
- ・ 最適システムに至るための優先プロジェクトを特定すること

#### (2) フェイズⅡ

- ・ 優先プロジェクトのF/Sを実施すること

### 7-2 調査対象地区及び範囲

Zarqa District (ザルカ地区：ザルカ、ルセイファ、シェネラー難民キャンプ、ハシュメイ、ニューザルカ、スクナ、アワジャン) を対象とし、水源地、水源からの導水管及びポンプ場についての実態調査を含める。ただし、水源の新規開発は含めない。

### 7-3 調査項目及び内容

#### 7-3-1 フェイズⅠ 基本構想

##### (1) 既存資料の収集とレビュー

- ・ 実施済み調査、プロジェクトのレビュー
- ・ 自然状況
- ・ 社会・経済状況
- ・ 衛生状態
- ・ 給水状況
- ・ 工業用水の使用状況
- ・ 工場排水の処理状況
- ・ WAJのザルカ地区の組織、要員
- ・ 維持管理の方法、状況

- ・ 財政収支の状況
- ・ 過去3年間に実施されたプロジェクトのコスト確認
- (2) スタディエリアの将来予測
  - ・ 人口推計
  - ・ 工業開発
  - ・ 開発の障害と将来発展の予測
  - ・ 需要水量予測
- (3) 既存水道システムの確認
  - (a) System Layoutの作成
    - ・ 地図（1/10,000、A1サイズ）の作成
    - ・ 井戸、送水管、ポンプ場、配水池、排水本管の図示
    - ・ 作成方法：WAJから提供される1/2,500の配管図を原図とし、現状と異なる部分を修正する。水道施設は、各契約の竣工図面、職員の知見、試験掘、管路位置探査などをもとに記入する。
  - (b) 排水流量の確認
    - ・ 既存流量計の機能確認
    - ・ 流量計新設個所の確認と設置
  - (c) 管網解析
    - ・ 配水管網の確認
    - ・ 現況、将来の水需要量の算定
    - ・ 水理データ（水量配分、水圧変動）の収集
    - ・ 水理モデルの検証
  - (d) 漏水、不明水調査
    - ・ 給水管接続に係る手続きの確認
    - ・ スタディエリアを代表するパイロットエリアの選定
    - ・ パイロットエリア内の水量測定
    - ・ パイロットエリア内の公共水栓、不法接続、正規接続のチェック
    - ・ 漏水量、不明水量の推計
  - (e) 水質調査
    - ・ 飲料水水質基準への適合
    - ・ 下水処理水を再利用するための水質基準への適合



(4) 既存水道システムの評価

(a) 管網解析

- ・配水管網の適否
- ・水理的能力（水量配分、水圧分布）の評価
- ・現状、将来のシステム欠陥の確認

(b) 漏水、不明水調査

- ・漏水、不明水防止のコストと便益
- ・漏水防止対策
- ・不明水防止対策

(5) 基本計画の策定

(a) 計画諸元の決定

(b) ゴールと目標の設定

(c) 水道システムのオールタナティブの比較

- ・オールタナティブ水道システムの内容、配置、現状からの改善内容
- ・水量配分
- ・水圧分布
- ・ポテンシャル（漏水量、エネルギー）
- ・概略建設コスト
- ・概略運転コスト

(d) 最適システムの概要

- ・水道システムの内容、配置、現状からの改善内容
- ・水量配分
- ・水圧分布
- ・ポテンシャル（漏水量、エネルギー）
- ・管網モデルの使用マニュアル作成

(e) 運転方法の改善

- ・ポンプの適正運転
- ・ポテンシャル（漏水量、エネルギー）
- ・運転方法
- ・運転コストの削減

(f) 概算コスト

- ・建設コスト
- ・運転コスト

- (g) 段階施工計画
- (h) 優先プロジェクトの確認
- (i) IEE

#### 7-3-2 フェイズⅡ F/Sの実施

- (1) 計画諸元の決定
  - ・ プロジェクトの内容、配置
  - ・ 各施設のリハビリ、新設の別
- (2) 追加資料の収集
  - ・ サイトの状況（新設する管路、ポンプ場、配水池の予定地）
- (3) 概略設計
- (4) 費用積算
- (5) 財政計画
- (6) EIA
- (7) プロジェクト評価
- (8) プロジェクト実施計画
- (9) 完成後の運転・維持管理計画
  - ・ 訓練計画
- (10) 「ジョ」国における建設段階の能力

#### 7-4 調査工程

調査工程はS/Wに示されたとおりであるが、以下を考慮すること。

##### (1) フェイズⅠ

ローカルコンサルタントによるプロポーザルによると、業務期間は5か月となっており、契約交渉が1か月として、全体で6か月必要である。したがって、フェイズⅠの期間はS/Wのスケジュールから2か月延長して、8か月とすべきである。

なお、このことは、本格調査団が乗り込む前に「ジョ」国側に連絡しておくことが望ましい。

##### (2) フェイズⅡ

「ジョ」国側が、全体を一つのプロジェクトとしたい、と主張する可能性が大きいので、その場合は延長する必要がある。

## 7-5 調査実施体制

### (1) カウンターパート

WAJはカウンターパートを選任するが、パーマネントではなく、人数も未定である。カウンターパートとは、定期的に会議を持ち、常に意見の相違のないようにすること。

また、カウンターパートに、都市計画部門の担当者を入れるように交渉すること。

### (2) ローカルコンサルタントへの再委託

多くの労力を要する作業は、できるだけローカルコンサルタントに再委任すること。考えられる再委託項目は以下のとおりであるが、この場合でも、日本人の団員は必要である。

- ・ システムマップの作成（測量、管路探査含む）
- ・ 管網解析（水理モデルの検定、管網解析含む）
- ・ 漏水、不明水調査

ローカルコンサルタントが必要な下記の資機材については、コンサルタントに適した機材を選定する必要があることから、含めて委託することが望ましい。

- ・ 配水量調査用流量計
- ・ 管網解析用パソコン、ソフト
- ・ 漏水調査用機材

なお、資機材は全て輸入であるので、調達に必要な時間をあらかじめ確認しておき、実施スケジュールにロスのないようにすること。

### (3) 「ジョ」国機関への再委託

水質調査については、Royal Scientific Societyに再委託すること。料金表は付属資料に示す。

### (4) 調査団滞在地

常時はザルカとするが、本省での打合せも多いことから、省内にも1部屋確保すること。

### (5) 通 訳

C/Pとなる人は全て英語が堪能であり、アラビア語との通訳は不要である。

## 7-6 調査団の構成に関する留意点

### (1) 技術面に関すること

本件調査で必要となる専門分野は上水道分野、都市計画分野である。特に、調査対象地域の上水道施設については、人口の急増に併せた無秩序な施設の拡張、未整備地区が多い。施設の老朽化等の問題に加えて、起伏の激しい地形であること等の条件に鑑みた適切な送配水計画が必要となる。また、「ジョ」国有数の工業地帯である調査対象地区に急激かつ無秩序に住宅地が拡大していることから、都市開発を考慮に入れた計画策定が必要となる。また、WAJの維持管理体制が非常に脆弱であることから、維持管理分野のウエイトが高い。

## (2) 調査団員の性格

本件調査のカウンターパートである WAJ は、本件調査においても他のドナーの調査においてもインセプション・レポートを非常に重視している。本件調査においても、協議前にインセプション・レポートを送付する旨、要望するなど、重視のほどがうかがえる。

したがって、インセプション・レポートの作成にあたる団員には、論理的構成能力が求められる。

また、カウンターパートは英語が堪能であり、日本の調査団の英語力を危惧していることから、各協議に参加する調査団員には、高度の英語力及び交渉能力が必要である。

## 7-7 調査用資機材

ただし、「7-5 調査実施体制」で記した、ローカルコンサルタント用の機材も含めて記述している。

### (1) 配水量調査用流量計

- ・ 携帯用超音波流量計 × 4
- ・ 超音波流量計  $\phi 400 \times 4$
- ・ 羽車式流量計  $\phi 150 \times 5$

### (2) 管網解析用ソフト

使用するソフトは、IBM PC Computer で使用可能なものとし、調査終了後は WAJ に提供する。ソフトの一例としては次のものがある。(付属資料 N-4 参照)

ソフト名 : WATNET (Latest Version)

会社名 : Software Services

Water Reserch Centre plc

Frankland Road, Blagrove Swindon Wiltshire,

SN5 8YF, UK

Fax.(0793) 511712

連絡者名 : Mr. Stuart Ogle

### (3) 漏水調査用機材

- 電子音調棒 × 3
- 漏水探知機 × 2
- 相関式漏水探知機 × 1
- 鉄管探知機 × 4
- ボックスロケーター × 4

(4) 事務用機材

- ・コピー機（拡大、縮小付き）×1台
  - ・FAX×1台
  - ・パソコン（DOS/V対応、ノートタイプ、カラー、プリンター）×3セット
- 注：管網解析にはカラーディスプレイが必要
- ・無線機×2セット

(5) 車 輦

- ・4WD×2台

7-8 調査実施上の留意点

(1) Annex Iの取扱いについて

Annex IはM/Mの4に記述されているとおり参考資料（reference）であり、調査の実施において拘束されることはないが、WAJの考え方が具体的に示されていることから、十分に検討する価値があるので、以下のように取り扱うこと。

Objectives of the study, Scope of the studyについて、本格調査で受け入れるべき項目、受け入れられない項目、資料が不足しており、現時点では判断できない項目に分け、それらをIc/Rの中で明記すること。

(2) Ic/Rの作成について

Ic/Rは本格調査の枠組みを定める重要なレポートであり、形式的なものを作成すると、説明の段階で混乱するおそれがある。特にWAJはIc/Rの協議を重視しているので、上述したAnnex Iの取扱いに注意しながら詳細に作成する必要がある。

(3) システムレイアウトの作成について

調査対象地域全域を対象とし、水源、ポンプ場、貯水槽、送水管及び配水管の一次幹線の位置を示すシステムレイアウトを作成する。作成にあたっては、調査団の監督のもと、ローカルコンサルタント等に委託して行い、既存の図面、WAJ職員の知見、測量、管路探査をもとに作成する。

(4) 管網解析について

管網解析では、夏季に需要量が増加し地区ごとに制限給水となるため、解析に支障が生じるおそれがある。このため給水量が最少となり、管網全体に配水できる12月まで解析ができないおそれがある。

(5) 漏水調査について

調査対象地域のうち、各地区の配水量と給水人口の関係等から、不明水が多いとされる代表的な3～5地区程度をパイロットエリアとして選定し、漏水調査を実施し、パイロットエリア

の漏水量とその原因及び不法接続の状況を明らかにし、調査対象地域の不明水の全体像を把握する。実施にあたっては、調査団監督のもと、ローカルコンサルタント等に委託して行う。

(6) 水質調査について

水質調査では7-3-1(3)に記したとおり、「飲料水水質基準への適合」と「下水処理水を再利用するための水質基準への適合」をチェックする。後者は、ザルカ地区の下水は再利用サイクルが完成しており、塩分濃度の高い井戸水を混合する場合には、農業用水としての水質（特に全溶解性物質）にも配慮するという意味である。（4-1-4(10)参照）

(7) ローカルコンサルタントへの再委託について

WAJに登録されたAランクのコンサルタントが7社あり、これらは経験・能力共に、かなり高いと思われ、本格調査の実施にあたっては、調査を効率的に行うため、かなりの部分を再委託すべきである。具体的には、System Layout、Network Analysys、Unaccounted for Water and Leakage Controlなどである。

事前調査団は、これらのコンサルタントから3社を選定しプロザルの提出を依頼した。本格調査団は、これらを参考にし、再委託の範囲と内容を決定すること。

(8) 優先プロジェクトの確認について

S/Wでは、フェイズ I でPriority project (s)を確認し、フェイズ IIでそのF/Sを実施することになっている。この考え方は、全体を数個のプロジェクトに分け、その中から、優先度の高いプロジェクトだけのF/Sを実施することであるが、WAJとしては、ザルカ地区は一つのF/Sでカバーすべきであり、融資対象としても一つと考えている。

これはフェイズ I の結果で判断すべきことであるが、WAJの考え方が現実的であることを認識しておく必要がある。

(9) 組織・制度・経営について

本調査では組織・制度・経営については対象としないが、4-5に記述したとおり、管路、配水施設の維持管理体制が弱いので、対象プロジェクトの実施後における維持管理のあり方について提言・勧告を行うべきである。



## 付属資料 A Terms of Reference





MINISTRY OF WATER AND IRRIGATION  
WATER AUTHORITY

CONSULTING SERVICES

FOR

THE HYDRAULIC ANALYSIS

OF THE

WATER SYSTEM

IN THE

ZARQA GOVERNORATE

JORDAN

## Section 1

### Definitions

It is understood that wherever the following terms appear in this Agreement, they signify:

- 1.1 "Government" means the Government of the Hashemite Kingdom of Jordan.
- 1.2 "Employer" means the Water Authority of the Ministry of Water and Irrigation of Hashemite Kingdom of Jordan.
- 1.3 "WAJ" means the Water Authority and is used synonymously with "Employer".
- 1.4 "Project" means "The Hydraulic Analysis of The Water System in Zarga Governorate".
- 1.5 "Consultant" means JICA
- 1.6 "Services" signifies the services in connection with the project as described in section 3 of this document.
- 1.7 "Jordan" signifies the Hashemite Kingdom of Jordan.
- 1.8 "Days" signifies calendar days.
- 1.9 "Works" means the facilities of the project and any additional facilities that may be proposed by the study.
- 1.10 "TTTP" means Technology Transfer and Training Program.
- 1.11 "Expatriate Staff" means the personnel of the consultant who the consultant intends to employ for this project, who are normally neither citizens nor residents of Jordan.
- 1.12 "Local Staff" means the personnel of the consultant who are citizens of Jordan whether residing in Jordan or not and non-citizens who are residents of Jordan.

## SECTION 2

### BACKGROUND AND OBJECTIVES

#### 2.1 INTRODUCTION

This document contains the proposal for obtaining Technical Assistance for The "The Hydraulic Analysis of th Water System of Zarqa Governorate" herein referred to as "The Study".

The Zarqa-Rusaifa area is one of the densely populated areas as well as one of the principal industrial centers in Jordan, many Housing, Industrial and commercial development projects are being implemented in this area, large number of the 350,000 returnees from the Gulf States have been settled in the area, thus more problems encountered the Water Supply and distribution Systems.

This document is aiming to provide the necessary information of the relevant officials of the Government of Japan to consider an application for technical assistance. The executing agency and counterpart organization for this technical assistance program will be the Ministry of Water & Irrigation/ Jordan Water Authority.

#### 2.2 Background

##### 2.2.1 The Employer

The Water Authority, an agency of the Ministry of Water and Irrigation of the Hashemite Kingdom of Jordan, is a public sector institution with the responsibility for planning, implementing and operating all water supply and wastewater facilities in Jordan and for exploring for new water resources and managing existing resources, including the allocation of water for various users. Overall management is vested in the Board of Directors while the day-to-day operations are managed by the Secretary General of the Authority. More detailed information on the organization and operations of the Water Authority is contained in the Water Authority Law: Law No. 18 (1988).

##### 2.2.2 Study Area

The Hashemite Kingdom of Jordan has a population of about 3.8 million and an area of about 90 sq km. It is divided into eight governorates. The headquarters of Zarqa governorate is at Zarqa city. In the north it borders to Mafraq Governorate, to Saudi Arabia in the east, to Irbid Governorate in the west, and in the south to Amman Governorate. The Zarqa district includes Rusaifa, Shennuler Refugee Camp, Zarqa, Awajan, New Zarqa, Hashmeyeh, and Sukhna. The population of the Governorate is about 750,000 inhabitants, most of them centered in Zarqa and Rusaifa area. It is considered to be one of the principal industrial centers in Jordan.

The study area is stretched 10-40 km north-east of Amman. It covers Zarqa district; namely Zarqa , Rusaifa and adjacent areas which receive water from Khaw Pumping Station and wellfields of Zarqa, Hashmeyer, Awajan and Rusaifa areas.

#### 2.2.3 Existing Water System

The study area receives the water from four main sources, viz; Azraq wellfield, Awajan wellfield, Rusaifa wellfield and Hashmeyer wellfield. Fresh and Saline water are pumped from these underground sources to be mixed and then boosted directly through the distribution systems. Flow chart of the existing pumping stations is shown in Annex 1.

Pumps and reservoirs capacities are so small and structural conditions need to be rehabilitated and expanded. The main and transmission lines within the supply system are deteriorated and/or insufficient, therefore water can't be supplied effectively and evenly to the whole area. Furthermore, Part of Rusaifa city suffers seriously from lack of water and no further expansion can be done due to the weakness of the system to cope with new subscribers. Like all other cities in Jordan, water rationing is followed in Zarqa Governorate. supply shortages become more worse due to rapidly growing activities and due to the influx of returnees to Jordan as a result of the Gulf War.

The total water supplied for the governorate in 1991 was 22.185 Mm<sup>3</sup> and in 1992 was 22.720 Mm<sup>3</sup>. 599641 subscribers have been served by water meters by the end of 1992. The rate of unaccounted-for water (UFW) within the Governorate in 1992 was estimated to 55% of the average water production.

#### 2.2.4 Objectives of the Study

The main objective of the Study is to define a program for the improvement and rehabilitation of Water Supply serving the growing service area in Zarqa Governorate, and thereby to improve living standards by providing an improved Water Supply System. The Study shall include the determination of all rehabilitation requirements to assure the adequate and safe operation and maintenance of the project and related works. This refers to physical requirements (equipments, materials, buildings, Reservoirs, ...etc) as well as personnel requirements and organizational and financial needs. The study shall serve the needs of Zarqa population to the year 2015.

This overall goal will be met through the following objectives:

##### 1. System Layout of the Existing Network

The available drawings of the existing system of Zarqa Governorate are old and have never been updated. System layouts will therefore have to be drawn up from existing record drawings, as-built drawings from main-laying contracts, local knowledge of Water Authority staff and field exploration using Pipe-Locating Equipment and Spot-Chick Excavation, with the implementation of

digitized base maps and drawings which can be easily maintained on a CADD (Computer-Aided Design and Drafting) system. It should be noted that a new water distribution and house connection system has been implemented for the city of Zarga and the "As-built drawings of system can be supplied directly from WAJ.

The stages of system layout preparation shall include the following:

**Existing Drawings and Maps:** Obtaining the latest copy of the maps and drawings for the Project Area from the Water Authority and official departments. It is the Consultant's responsibility to compare and update these maps and drawings to actual conditions, including the naming of main roads and other identifying features.

**System Maps:** Preparing drawings with a scale of 1:10,000 on A1 size paper to show the existing Water System facilities such as well fields, pumping stations, reservoirs, and transmission and primary pipe networks.

**Pipeline Drawings:** Preparing drawings with a scale of 1:2,500 on A1 size paper to show lot number, the route, type, age and diameter of primary and secondary pipe networks (2" & above), including isolating valves, washout valves, air relief valves, pressure reducing valves, zone separations. All other existing utilities such as electric cables, telephone cables and sewers shall be shown on separate drawing of the same scale.

Drawings with a scale of 1:1000 on A1 size paper shall be prepared for main towns of 4,000 people and above to show all information mentioned above for the 1:2,500 scale plus details of house connections for each plot.

**System Facilities Drawings:** Preparing record drawings with a scale of 1:200 (or other appropriate scale to be agreed ) for the pumping stations (to show the contents of each pumping units, suction and delivery components, etc), well fields (to show site plans, piping and fittings, etc), reservoirs ( to show plans, inlet and outlet water lines, drainage lines, etc).

**CADD System:** Preparing and delivering tapes for digitized mapping of all the drawings mentioned in the previous items (compatible with the VAX-GDS SYSTEM available at WAJ/Design Department).

## 2. Network Analysis

Perform a network analysis of the existing water system by developing computerized modelling techniques to show the complex relationships between the network, water consumption, pressure levels, energy and flow rates.

An overall system network model will be prepared to include analysis up to supply points for each city and town. Also, a detailed distribution system network hydraulic analysis will be performed for communities with populations of 2,000 and above.

Collect hydraulic data and water demand information, calculate future demands and identify pressure extremes. Prepare water system network model using an internationally accepted computer software program which is totally suitable for use with the WAJ's IBM-Compatible PC computers. A copy of this software should be handed over to the WAJ. The minimum requirements of the software is shown in Annex 2. Calibrate model with tests. Evaluate system flexibility, optimize pumping schedules and source utilization, identify pipeline constrictions, assess total hydraulic capacity, optimize pressure zones and study system deficiencies. Finally, prepare a report for the water system that will examine alternative modes of operation, identify potential savings, define optimum pumping schedules and recommend measures to reduce operating costs.

After the model development is finished, a user manual should be prepared to assist future users of the Zarqa network model. The model should be turned over to WAJ along with the necessary licenses, computer equipment, documentation and users manual.

### 3. Unaccounted for Water and Leakage Control

Conduct Study to investigate and quantify water which is either lost from trunk lines, reservoirs, and distribution systems due to leakage or is otherwise unaccounted-for. The study shall look into and assess administrative regulations, procedures and current resources charged with control of unaccounted-for water(UFW). Based on the surveys in the selected pilot areas, recommend appropriate leakage control methods and prepare proposals for the expansion and development of the UFW Section in Water Authority. The primary objective is to investigate the economics of improving the present program of controlling water system losses:

Collect information on present administrative procedures related to water system connections, registration of water meters, utilization of meters, accuracy of meters, meter reading frequency and billing and collection procedures.

Collect data on meter performance including source meters and meters within the pilot areas.

Check and evaluate unmetered public water services, unauthorized or illegal connections and under registration of revenue meters, Select pilot areas to reflect typical conditions relating to the water system all over the governorate. The Water Authority has selected the following areas in the Governorate from which the consultant shall choose at least FIVE pilot areas:

Zarqa city center, Awajan, Rusaifa city center, North Rusaifa, Shennuller camp, Hashmeh, Sukhna, North Azraq and Dhail. Selection of the pilot area will depend on results of the water system network analysis conducted in item (2) above.

Provide the necessary specialized equipment to evaluate UFW in the pilot areas. They shall be handed over to WAJ in good conditions at the end of the contract free of charge. This shall include, but not limited to, the following:

- Personal computer (IBM compatible);
- Electronic listening devices;
- Leak noise correlators with Radio-Linked Amplifier;
- Pipe and service box locators;
- Water meters and meter testing equipment;
- Data loggers.

The "combined district and waste metering method" of investigation should be employed in the leakage surveys. As a result of the tests, it is necessary to compare the potential value of water saved against the cost of monitoring, detecting and remedying leaks of varying magnitude and complexity, and to employ the appropriate method of leakage control policy. Interim reports shall be produced by the consultant for each of the pilot areas as work proceeds. The reports shall describe the pilot area, leakage problems encountered, alternative remedial measures, recommended solutions and cost-benefit information. A final report shall be assembled and submitted at the conclusion of the project.

#### 4. System Rationalization and Optimization

The objective of the system rationalization and optimization is to reduce the operating costs of the system.

Most of the data required for the rationalization study will have been collected for the network analysis. However, it will be the responsibility of the consultant to collect pumping costs, power tariffs, treatment costs and operational constraints specifically for the system rationalization.

After finishing the network analysis computer model, alternative modes of operation will be examined for each pressure zone and the overall water system. Operating costs will then be assessed on the basis of the required discharge, pumping times and pumping heads. Potential savings will be identified and the optimum pumping schedules will be defined.

Operations strategy and demand prediction should be addressed during the system optimization.

The system optimization report shall contain the data used, an appraisal of the potential savings, an approach to realizing these savings and recommended scheduling and prediction methods.

The report shall also make recommendations concerning more sophisticated on-line computer solutions and automatic control to show savings and operational advantages that can be obtained by these routes.



## 5. System Rehabilitation

The system Rehabilitation stage shall determine the required improvements; perform design analyses; and prepare tender documents for the implementation of the upgrading of the existing water network in the Governorate. The investigations conducted during the above items (1 thru. 4) will result in the system rehabilitation program which will identify undersized and/or unreliable pipes; inadequate house connections and inadequate pumping stations. The improvements will include transmission and distribution lines and pumping and storage facilities. The consultant shall prepare preliminary design for rehabilitation of the existing water systems in Zarqa Governorate and also continue to prepare detailed design and tender documents for Zarqa district.

The present study aims at achieving the above objectives in three separate stages as a program of Technical Assistance of JICA:

Stage I. Technical, Economic and Feasibility Study and Preliminary Engineering Design.

Stage II. Final Engineering Design.

Stage III. Supervision of Construction (Optional).

The details and Scope of Work of the consultant for the proposed Study are described hereinafter.

## SECTION 3

### SCOPE OF WORK OF THE CONSULTANT

The consultant's work will be divided into three stages, consistent with the three stages referred to under section 2 "Background and Objectives". Activities under stage I shall be started immediately after the signing of this agreement. The services of the consultant shall be self-terminating at the next stage unless specifically authorized in writing by the Employer.

#### 3.1 Stage 1. Technical, Economic and Financial Feasibility Study:

The Feasibility Study will be subdivided into two parts:

Part A: Conceptual study to identify possible alternatives and priorities.

Part B: Feasibility study of preferred alternatives.

##### 3.1.1 PART A \_ Conceptual Study

###### 1. Review of Previous Engineering Studies and Design:

The Consultant shall review all relevant reports and other documents pertaining to the planning, design and operation of Zarqa Gov. Water Supply and Distribution System.

###### 2. Describe and analyze the present conditions of the Existing Systems:

(a) Collect and review all available Physical, economic and social data relevant for the project area, including, but not limited to, the following:

- Number, size and type of towns and villages; Population, population growth and socio-economic structure, including employment and income patterns;
- Economic structure and main economic activities outlining number, type, size and location of important commercial public facilities such as schools, hospitals and military camps (land use and urban development);
- Topographic and geological conditions in the Project Area, as well as soil conditions only as far as necessary for this part of the study;
- Climate and meteorology of the study area;
- Hydrological conditions, including a rough water balance for every catchment in wet and dry seasons, rainfall intensities and frequencies;
- Type and location of all water relevant enterprises and industries.

(b) Identify the major developmental bottlenecks of the area and assess likely patterns of future growth and change.

(c) Appraise existing overall conditions of water supply and water distribution, both in quantitative and qualitative terms, and survey the area and population being served by these systems as well as the status and serviceability of existing installations. The appraisal shall include, but not be limited to the following:

1. Present state and expected development of water supply facilities and quality of service, including areas of water resources, location of springs, wells, pumping stations, transmission mains, and primary and secondary distribution networks. This appraisal shall be based on a review of all available record and "as built" drawings of the system;
2. Population water demand and available water supply in wet and dry weather;
3. Volumes of water supplied (per day, month, year), major consumer's including industries, percentage of population with in-house connections, estimated losses and wastage, amounts used for irrigation of gardens and fields from the tap, and the present state of technical facilities; and
4. Service quality as measured by hours of pressure per day and reported breakdowns and by emergency services such as tankers that may have to be used in the dry season.

(d) Assess the present arrangements and organization of the Water Authority for the operation, maintenance and repair of all facilities in the Project Area. List the number and qualifications of personnel, workshop premises, equipment and vehicles and their state of repair, and type, volume, range and problems of services being carried out.

(e) Collect information on the following from available documentation:

1. Unit prices for the major items in the usual bills of quantities from at least three water and wastewater projects of comparable or larger size that have been executed in Jordan during the last three years;
2. The capacity of construction contractors in Jordan; and
3. Any other information deemed relevant.

(f) Define all areas that may be suitable for the construction of pumping stations and transmission lines. Indicate the size of each area, its present use and land value and possible future uses. Assess soil conditions.

(g) Assess present conditions of sanitation and hygiene in the Project Area, taking into consideration incidences of Water-borne diseases and other health hazards emanating from current system operations. Analyze available health statistics and other sources of information for this purpose.

(h) Describe current institutional arrangements of water supply in the Project Area, including the costs and the cost recovery of these services through tariffs and other financial provisions.

### 3. Technical And Operational Alternatives

Alternatives for the future development of the Project Area shall be worked out considering and combining all feasible technical system components to reach the objectives stated in section 2. Technically feasible alternatives will be further prepared with rough estimates of quantities involved and of the investment and operational cost of their bulk items. The consultant shall establish an appropriate criteria, in order to assess and select truly feasible alternative(s) and combinations and to define priority components.

The most feasible alternatives or combinations shall be worked out with rough quantities and cost calculations for necessary investment accompanied by a concise description of the main components, phasing if necessary, timing and organizational schedule. They shall address all aspects and define priorities. They shall include all essential steps for project implementation, including project preparation, construction of new facilities and rehabilitation of existing facilities. System alternatives may vary or be combined in future stages.

The Consultant shall make recommendations on alternatives(s) and, in particular, on priority components to be selected in the first phase for construction, and on further procedures. The Consultant shall present the results of the technical alternatives along with recommended criteria for selection of the most feasible alternatives, to the Employer for a decision.

#### 3.1.2 PART B \_ Feasibility Study of Preferred Alternatives

After a decision on the alternatives or variants, the technical operational and organizational considerations and the planning and design will concentrate on the components defined for respective alternatives. This will ensure that Part B will deal only with components that all parties have accepted as realistic.

##### a. Layout and Preliminary Design of the Water System

(1) For the proposed Project determine the general layout of the proposed pipelines (including pipe material required by size and type), pumping stations, electrical requirements, storage reservoirs, and other related works on the systems, distinguishing between improvement works on existing facilities and works for additional, new systems or system expansions. In determining the general layout of system in the Project Area consider a planning horizon of twenty years (up to year 2015).

(2) In the context of the general layout as described under (1) above, also determine basic design parameters for the systems.

(3) Prepare the preliminary design of all components of the water system and related works selected to be constructed during 1994-96, under a first phase, for consideration and inclusion under the proposed Project.

(4) Assess whether the design of the Project is compatible with the over all objectives of the Project and sufficiently adapted to local conditions and expected operational capabilities of the Water Authority.

(5) Give proposals for overall Project implementation and staging, including recommended contract packaging based on area, contract capabilities and possible multiple financing sources. Prepare a timetable for planned execution of the Project.

(6) Assess and describe the operational aspects of the Project, including its specific implications on the Water Authority. Assess training requirements for operating and maintenance personnel and outline the training programmes required.

b. Project Cost

(1) Prepare detailed estimates of the capital costs of the selected project alternatives by recommended contract packages, including its foreign exchange costs, on a 1994 price basis. Estimate separately physical contingencies and price escalation during the construction period for each project component.

(2) Outline and determine the operational costs of the systems improved and built up under the Project.

c. Financial Analysis

(1) Outline a financial forecast of the selected alternatives for the project (Income/Expenditure Forecast)

(2) Assess the appropriateness of current water and sewer rates and user charges with respect to expected operating costs taking into account total costs of systems and the ability to pay of the beneficiaries, including low-income groups of the population.

d. Economic and Socio-economic Analysis of the Project

(1) Calculate:

a) the incremental unit costs of the selected alternatives for the Project on a 1994 price basis for the life-span of the Project utilizing discount rate of 5% and 8%;

b) the real internal rate of return; and

c) the least cost solution in economic terms, using alternative assumptions as to critical variables (time of implementation, costs, etc.) to assess the sensitivity of the Project to such changes.

(2) Assess general effects economic of improved water supply in the project area.

(3) Assess its significance for the population in the areas served in terms of meeting basic needs, effect on health and hygienic conditions and the living environment, with particular consideration of low-income groups.

(4) Determine measures for preventing potential wastage of water in the future.

(5) Give a full assessment of environmental and potential project risks and suggest suitable measures to avert them, clarifying institutional responsibilities.

e. Schedule of Reports on the Feasibility Study

The following reports will be required for the Study and the scheduling of the reports is based on the submission by the Consultant in the Technical Proposal and agreement by the Employer.

(1) An Inception Report Shall be submitted to the Employer in 15 copies within 45 days of the Notice to Proceed after signing of this Agreement. In this report the Consultant is expected to describe his staff mobilization, progress in collecting existing data, the problems encountered or foreseen and his projected programme of work.

(3) A Draft Report on the Conceptual Study, listing the feasible and recommended alternatives, shall be submitted to the Employer in 20 copies upon completion of part A.

(4) A Final Report on the Conceptual Study, incorporating revisions if any, to the Draft Report and listing the selected alternatives agreed between the Consultant and the Employer, shall be submitted to the Employer in 20 copies within 20 days after receipt of the decision on the agreed selected alternatives.

(5) A Draft Report on the Feasibility Study, including preliminary engineering design and technical, economic and financial analysis, submitted to the Employer in 20 copies within 90 days after receipt of the decision on the agreed alternatives.

(6) A Final Report on the Feasibility Study, incorporating revisions if any, to the Draft Report on Part B, shall be submitted to the Employer in 50 copies within 30 days after receipt of the Employer's comments on the Draft Report.

(5) Monthly Progress Reports, during the Study period, to keep the Employer advised of the progress of the Study, which shall also outline problems encountered and include items requiring policy decisions by the Employer which may affect the results of the Study, starting at the end of the third month.

(6) The following reports to be submitted during the progress of the Study and comments on Reports to be provided by the Employer within 30 days of receipt thereof:

- Network analysis: Strategic model and Final system model.
- UFW and Leakage Control: Interim Reports for each pilot area and Final UFW Report.
- System Optimization with Final Report.
- System Rehabilitation: Rehabilitation proposals and interim reports monthly after the sixth month and Final Rehabilitation Report to be included in the Final Report.

The Consultant may, with the approval of the Employer submit some of the interim reports as part of the Monthly Progress Reports.

### 3.2 Stage II. Detailed Design and Tender Documents

#### 3.2.1 Detailed design

a. Upon authorization by the Employer to start Stage II, the consultant shall prepare detailed designs including all necessary Structural, mechanical, electrical and other calculations of the proposed rehabilitation program suggested by the Feasibility Study.

b. The study shall include the determination of all requirements for soil surveys and geotechnical investigations and be responsible for the proper supervision and cost of any specialized firm selected by the consultant for such investigations.

c. The Consultant shall prepare detailed working notes setting out the background of the final design and incorporating estimates of the cost of construction.

#### 3.2.2 Design Drawings and Tender Documents:

a. Prepare and print design drawings as may be required.

b. Prepare tender documents for the construction of the works including, Instruction to Tenders, Conditions of Contract, Specifications, Tender Drawings, Schedule of Rates, and Construction Cost Estimates (Confidential). Tender documents shall be in sufficient details to meet the requirements of WAJ conditions and be subdivided into contracts.

c. The Consultant shall obtain maps of the region from appropriate agencies and provide all supplemental surveys to use these maps for a complete and detailed design.

d. All detailed designs, tender documents and estimates prepared for the water supply system shall be in accordance with the Jordan standards and accepted engineering practices.

e. The Consultant shall submit the Draft Detailed design drawings, specifications and tender documents in 20 copies for revision by WAJ before proceeding with the final design.

f. The Consultant shall submit Final Design drawings, specifications and tender documents in 50 copies, incorporating all revisions mutually agreed upon between the Employer and the Consultant after receipt of the Employer's comments on the draft documents, within 30 days after mutual agreement on revisions.

### 3.2.3 Tentative Time Schedule

The whole Study (stage I & stage II) shall be performed and completed within twelve months (12), including one month for preparatory works from the commencement date of the Study.

### 3.3 Stag III. Supervision of Construction (Optional)

The actual time of construction for the Project is anticipated to be (30) months, with a reasonable construction schedule for sub-projects to be suggested by the Consultant. In assisting the Employer with the satisfactory completion of construction of the civil works and the installation and commissioning of the electromechanical equipment, the Consultant shall:

1. Provide services during construction of the Works so as to ensure, within the limits of this Agreement and as defined in the construction contract(s), that the Works are executed in accordance with the contracts between the Employer and the construction Contractor(s).

2. Provide the site staff necessary for administering the construction of works for such periods as may be required. In addition the Consultant shall arrange for visits by senior members of the firms in the joint venture and other specialists at regular intervals, to ensure that the duties required of the resident staff are being performed, the construction of works properly supervised for any other necessary reason. Such visits by senior members of the Consultant from outside Jordan shall have the prior approval of the Authority.

3. Examine the proposals by the contractors for the performance of the contract as to their adequacy and comment to the contractor therein and make recommendations to the Employer.

4. Give all necessary instructions to contractors, providing that the Consultant shall not, without prior approval of the Employer, give any



instruction which, in the opinion of the Consultant, are likely to increase the contract amounts or change the conditions of contract. If it is not practical for the Consultant to obtain such approval where, in his opinion, lives property or the Works are in danger, or further delay would result in additional cost, he shall inform the Employer of his action as soon as possible. The Employer's instructions to the contractor(s) shall be through the Consultant.

5. Perform any services which he may be required to carry out under the contract for the execution of the Works, including where appropriate, the witnessing of normal tests and the commissioning of the Works.

6. Advise the Employer as to the need for inspection during manufacture and prior to shipment of the various materials to be supplied in accordance with the contract and, if so required by the Employer, obtain tenders for such inspection from qualified agents and make such recommendations therein as may be appropriate.

7. From time to time and upon completion of the Project, with the assistance of his site staff, arrange for the proper measuring and determining of the quantity of work completed and calculate its value. He shall certify that the work has been carried out in accordance with the requirements of the contract or indicate any work that has not been so carried out.

8. Submit monthly site reports not later than the tenth of the following month, indicating the progress made since submission of the previous report and commenting on the progress to date in relation to the agreed program. The report shall indicate the approximate value of the works completed and any other problems which may require the attention of the employer.

9. Submit quarterly reports dealing more fully with the progress and commenting on the contractors' performance and whether completion of the Works is likely to be advanced or delayed and whether circumstances have arisen such that the cost is likely to be materially affected.

10. Upon completion of the Works, deliver to the Employer certified final record drawings (based upon contractors' "as built" drawings) and such works as are reasonably necessary.

11. Promptly examine and prepare recommendations on claims from the contractor(s) for extensions of time, payment for extra work and other similar matters, and negotiate with the contractor(s) on the rates for any unscheduled items or work which arise and submit recommendation on these to the Employer.

12. Conduct the final maintenance inspection and prepare a final report for presentation to the Employer.

13. In addition to the above, the Consultant is responsible for:

- a. Periodic checking of quantities of work remaining and constant checks of the cost estimates.
- b. Verification of the accuracy of the measurement of the projects by the contractor(s).
- c. Recommendations as to the acceptance or rejection of any part or parts of the completed work.
- d. Issuing interim and final Certificates for payments to the contractor(s).
- e. Recommending, as appropriate, change orders, extensions of time and variations in payments. Preparing necessary change orders in accordance with such changes in the Project as may be ordered or approved by the Employer, together with analysis of appropriate payments to be made to the contractor(s) in respect of such changes.
- f. Carrying out the necessary inspections, shortly before the end of the construction period. Determining the remaining works to be completed and , when these are satisfactorily completed, issuing Certificates of Substantial or Final Completion for the Employer.

#### 3.4 Technology Transfer and Training Programme (TTTP)

Technology transfer and training programme and transfer of Know-how, knowledge and skills to WAJ staff , so that by the time the consultant leaves JORDAN, WAJ staff should be fully conversant with every item of the project. TTTP is considered to be a very important aspect of this project.

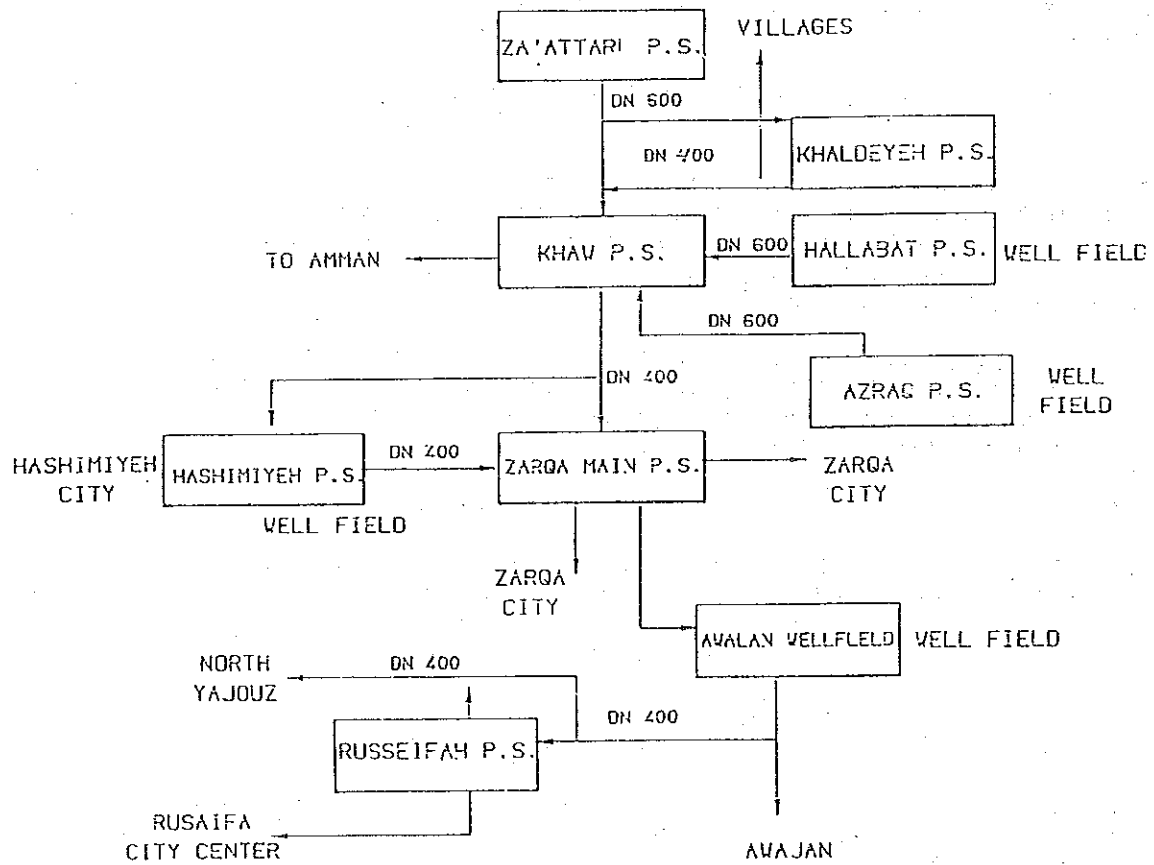
The consultant shall carry out the TTTP for WAJ staff and as agreed by the Employer. The offer shall include, but not be limited to:

Initial training of two senior engineers in the home office of the consultant for observation of design and operation of facilities similar to the technical alternatives that will be recommended to the Employer for a decision on the selection of the most feasible alternative.

On-the-job training in Amman for WAJ staff during the course of the project.

- "Workshops & Seminars" training in Amman for WAJ staff concerned with design, operation and all other aspects of development and management of wastewater systems.

- Training in the home country of the main Consultant of at least two junior engineer for a minimum of one month.



Annex 2

Computer software for hydraulic analyses

1. PC-based network analysis software package for computer modeling of water supply systems:
  - modeling flow level, pressure and energy
  - capable of using and analyzing real information flowing telemetry system
  - a comprehensive error trapping system to guard user in locating and identifying mistakes
2. Features of the programme
  - Interface to real-time telemetry data and data loggers for simultaneous display of real data and model predictions
  - Extensive graphical analysis package for telemetry and logger data such that model results and real data are displayed simultaneously
  - Wide range of pump and valve controls reflecting actual conditions in the network
  - Sophisticated pump modeling features with integral tariff analysis for pump scheduling and modeling actual energy costs
  - Capability to model up to 1,000 pipes and 800 nodes
  - On-line display of the simulation as it proceeds with the capability to interrupt and view results so far
  - Chlorine residual modeling



## 付属資料 B 質 問 状

ここに収めた資料は以下のものである。

1. 調査団からジョルダン側への質問状



QUESTIONNAIRE

FOR  
THE STUDY ON THE IMPROVEMENT OF WATER SUPPLY SYSTEM  
FOR  
THE ZARQA DISTRICT  
IN  
THE HASHEMITE KINGDOM OF JORDAN

APRIL 1994

JAPAN INTERNATIONAL COOPERATION AGENCY



## QUESTIONNAIRE

### 1. Organization

Please explain followings;

Organization of the branch of WAJ Zarqa Governorate

- Organization for construction operation and maintenance of the Project.
- Organization, function and role of local government related to water supply

### 2. Policy of water supply system

Please explain followings and/or arrange documents related to the waterworks and water supply system;

- Laws
- Regulations
- Custom
- Design criteria

### 3. Socioeconomic conditions in the Study Area

Please give information on

- Infrastructure (road maps, communication service methods, service area electricity, percentage of School attendance, economy condition)
- Standard living cost
- Labor circumstances (working conditions, wage level, labor law)

### 4. Natural conditions in the Study Area

Please give information on

- General meteorological condition
- General topography
- General hydrology
- General geology and hydrogeology

### 5. Project information

Please give following information;

5-1 Outline of WAJ

- Water tariff structure
- Do you have the equipment for water leakage inspection as follows?
  - electric acoustic rod
  - leakage detector
  - metal pipe locator
  - correction type leakage detector
  - high sensitive leak nose correlator
  - movable electromagnetic flow meter

5-2 Present water supply system in the Study Area

- Served area, population and household in each city and town
- Information of existing wells (locations, numbers, yield/day, water level, structures, water quality)
- On-going projects and budgetary arrangement
- Relevant water supply project financed by other foreign aid agencies
- List of existing water supply system (classification of new and rehabilitation, project name, construction or rehabilitation year, total cost, name of aid agency)
- Inventory of existing facilities and equipment (facilities, pumps, pipes, valves)
- Served population in each city, town, village

6. Local company

Please give information on local consulting companies in the field of water supply and environmental assessment and surveying companies.

- name
- location
- number of engineers
- experience
- facility and equipment

## 7. Data, maps, drawings and documents for system design

Please answer the availability of following materials in the Study Area

- Data of meteorology
- Data of hydrology
- Topographic map (1/10,000, 1/25,000, 1/50,000, 1/100,000, 1/250,000)
- Geological map (1/25,000, 1/50,000, 1/100,000, 1/500,000)
- Land use map
- Soil map
- Soil-mechanical data
- Drawings of existing pipe networks and facilities
- Data of water quality test
- Price list on pipes, valves, concrete works and other materials

## 8. Environmental Assessment

### 8-1 Legislation

- a) Do you have the law/guideline on environmental impact assessment? Please attach the detail, e.g. responsible ministry or agency, name/guideline, procedure, if any.
- b) Do you have the environmental quality standard(s)? Please attach the detail, e.g. values, penalties, if any.

### 8-2 International conventions on environmental conservation

Have you affiliated to bilateral or multilateral conventions concerning environmental conservation, e.g. Ramsar Convention, Washington Convention, etc.?

Please give the names of the conventions affiliated and the date of affiliation, if any.

### 8-3 Present situation of the Study Area

- a) Socio-economic environment
  - Number of people to be resettled and plan of resettlement or compensation
  - Experience of resettlement in previous projects, if any

- Existence of common land
- b) Natural environment
  - Availability of land use and vegetation map
  - Location of environmental vulnerable areas such as wetland, forest, if any
  - Species of valuable animals and plants in the area, if any
  - Location of particular areas officially protected such as national park and natural park
  - Distribution of important landscape or scenery for tourism or religion

#### 8-4 Environmental pollution

- Existence of environmental pollution, such as air pollution, water and soil contamination, noise and vibration, land subsidence, offensive odor

#### 8-5 Screening and scoping for the Environmental Impact Assessment

Please examine the environmental conditions impacted by facility construction by using attached format. The result will be discussed with JICA's engineer at the meeting on environmental impact assessment.

#### 9. Others

Please give us information on

- National development plan (existing long-term plan of Five year plan)
- Regional plans related to the Study
- National census related to the Study
- National budget concerning water supply



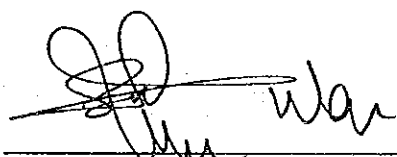
## 付属資料 C    Scope of Work



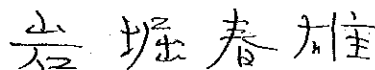
SCOPE OF WORK  
FOR  
THE STUDY  
ON  
THE IMPROVEMENT  
OF  
THE WATER SUPPLY SYSTEM  
FOR  
THE ZARQA DISTRICT  
IN  
THE HASHEMITE KINGDOM OF JORDAN

AGREED UPON BETWEEN  
WATER AUTHORITY OF JORDAN & MINISTRY OF PLANNING  
AND  
JAPAN INTERNATIONAL COOPERATION AGENCY

APRIL 28, 1994  
AMMAN, THE HASHEMITE KINGDOM OF JORDAN



Dr. Safwan Toukan  
Secretary General  
MINISTRY OF PLANNING



Mr. Haruo Iwahori  
Leader, Preparatory Study Team  
JAPAN INTERNATIONAL  
COOPERATION AGENCY



Eng. Koussai Qutaishat  
Secretary General  
WATER AUTHORITY  
OF JORDAN



## I. INTRODUCTION

In response to the request of the Government of the Hashemite Kingdom of Jordan (hereinafter referred to as "the Government of Jordan"), the Government of Japan has decided to conduct a Study on the Improvement of the Water Supply System for the Zarqa District in the Hashemite Kingdom of Jordan (hereinafter referred to as "the Study") in accordance with the laws and regulations in force in Japan.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for implementation of the technical cooperation programs of the Government of Japan, will undertake the Study in close cooperation with authorities concerned of the Government of Jordan.

The present document sets forth the Scope of Work for the Study.

## II. OBJECTIVES OF THE STUDY

The objectives of the study are :

- (1) to formulate a basic plan for the rehabilitation and improvement of the water supply system of the Zarqa District up to the year 2015, and
- (2) to conduct a feasibility study on the identified project(s)

## III. STUDY AREA

The study area of basic study covers the Zarqa District (Zarqa, Rusaifa, Shennuler Refugee Camp, Hashmeyeh, New Zarqa, Sukhna and Awajan).

The study area of the feasibility study will be defined according to the identified project(s).

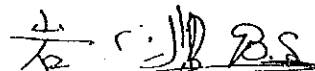
## IV. SCOPE OF THE STUDY

In order to achieve the above objectives, the study will cover the following items:

### Phase I: Basic study

#### (1) Collection and review of existing data

- a) Social and economic conditions
- b) Natural conditions (climate, topography, geology, hydrology etc.)
- c) On-going and planned water supply projects
- d) Existing water sources
- e) Existing water supply system and services
  - transmission lines
  - distribution networks
  - service conditions



- water quality
  - f) Water use
  - g) Management system, institution, laws and regulations on water works
  - h) Environmental conditions
  - i) Other relevant data
- (2) Analysis of existing water supply system
- a) System maps
  - b) Distribution network analysis
  - c) Water leakage (Sample survey at limited area of the pilot areas)
  - d) Water quality
- (3) Evaluation of current water supply system.
- (4) Formulation of a basic plan
- a) Delineation of planning framework (service area, water demand, leakage ratio etc.)
  - b) Determination of goals and targets
  - c) Comparison of technical and operational alternatives for the rationalization and optimization of water supply system
  - d) Outline of the optimal system
  - e) Recommendation on operational improvement
  - f) Rough estimation of cost
  - g) Staged development plan
  - h) Identification of the priority project(s)
  - i) Initial Environmental Examination

## Phase II: Feasibility study

- (1) Confirmation of planning framework
- (2) Supplementary data collection and analysis
- (3) Preliminary design of facilities
- (4) Operation and maintenance plan
- (5) Cost estimation
- (6) Financial plan
- (7) Environmental impact assessment
- (8) Project evaluation
- (9) Project implementation plan

$\frac{4}{12}$  JMD B.S.

## V. STUDY SCHEDULE

The Study will be carried out in accordance with the tentative schedule attached in Appendix 1.

## VI. REPORTS

JICA will prepare and submit the following reports in English to the Government of Jordan.

### 1. Inception Report:

Twenty (20) copies at the commencement of the work in Jordan.

### 2. Interim Report

Twenty (20) copies at the end of the first work in Jordan

### 3. Progress Report

Twenty (20) copies at the end of the second work in Jordan.

### 4. Draft Final Report:

Twenty (20) copies at the beginning of the third work in Jordan. The Government of Jordan will submit their comments to JICA within thirty (30) days after receipt of the Draft Final Report.

### 5. Final Report:

Fifty (50) copies within thirty (30) days, after the receipt of comments on the Draft Final Report.

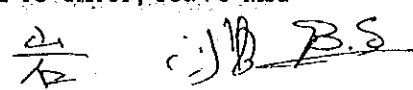
## VII. UNDERTAKINGS OF THE GOVERNMENT OF JORDAN

1. The Government of Jordan shall accord privileges, exemptions, and other benefits to the Japanese Study Team, in accordance with the Agreement on Technical Cooperation between the Government of Japan and the Government of Jordan.

2. To facilitate the smooth conduct of the Study, the Government of Jordan shall take the following necessary measures:

(1) to ensure the safety of the Japanese Study Team in Jordan,

(2) to permit the members of the Japanese Study Team to enter, leave and

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sojourn in Jordan for the duration of their assignment therein, and exempt from foreign registration requirements and consular fees,

(3) to exempt the members of the Japanese Study Team from taxes, duties and any other charges on equipment, machinery, and other materials brought into Jordan for the conduct of the Study, vehicles

(4) to exempt the members of the Japanese Study Team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Japanese Study Team for their services in connection with the implementation of the Study,

(5) to provide necessary facilities to the Japanese Study Team for remittances as well as utilization of the funds introduced into Jordan from Japan in connection with the implementation of the Study,

(6) to secure permission for entry into private properties or restricted areas for the conduct of the Study,

(7) to secure permission for the Japanese Study Team to take all data and documents (including photographs and maps) related to the Study out of Jordan to Japan, and

(8) to provide medical services as needed. Its expenses will be chargeable on members of the Japanese Study Team.

3. The Government of Jordan shall bear claims, if any arises, against the members of the Japanese Study Team resulting from, occurring in the course of, or otherwise connected with, discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the members of the Japanese Study Team.

4. Water Authority of Jordan (hereinafter referred to as "WAJ") shall act as counterpart agency to the Japanese Study Team and also as coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

5. WAJ shall, at its own expense, provide the Japanese Study Team with the following, in cooperation with other organizations concerned:

(1) Available data and information related to the Study,

(2) Counterpart personnel,

(3) Suitable office space with necessary equipment in Amman and Zarqa Governorate Water Administration.  
The main office will be in Zarqa.

JA  
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11/10  
B.S.

(4) Credentials or identification cards.

#### VIII. UNDERTAKINGS OF JICA

For the implementation of Study, JICA shall take the following measures:

1. to dispatch, at its own expense, the Study Team to Jordan,
2. to pursue technology transfer to the Jordan counterpart personnel in the course of the Study.

#### IX. CONSULTATION

JICA and WAJ shall consult with each other with respect to any matter that may arise from or in connection with the Study.

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# ANNEX 1 TENTATIVE STUDY SCHEDULE

MONTH	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DESCRIPTION	Phase I: Basic Plan							Phase II: Feasibility Study							
WORK IN JORDAN	First work							Second work							
WORK IN JAPAN	Third work							Third work							
REPORT	▲						▲			▲		▲		▲	
PRESENTATION	IC/R						IT/R			P/R		DF/R			F/R

IC/R: Inception Report

P/R: Progress Report

IT/R: Interim Report

DF/R: Draft Final Report

F/R: Final Report



## 付属資料 D Minutes of Meeting




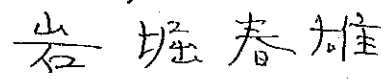


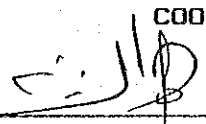
MINUTES OF MEETING  
ON  
THE SCOPE OF WORK  
FOR  
THE STUDY  
ON  
THE IMPROVEMENT  
OF  
THE WATER SUPPLY SYSTEM  
FOR  
THE ZARQA DISTRICT  
IN  
THE HASHEMITE KINGDOM OF JORDAN  
AGREED UPON BETWEEN  
WATER AUTHORITY OF JORDAN & MINISTRY OF PLANNING  
AND

JAPAN INTERNATIONAL COOPERATION AGENCY

IN AMMAN, ON APRIL 28, 1994

  
Dr. Safwan Toukan  
Secretary General  
MINISTRY OF PLANNING

  
Mr. Haruo Iwahori  
Leader, Preparatory Study Team  
JAPAN INTERNATIONAL  
COOPERATION AGENCY

  
Eng. Koussai Qutaishat  
Secretary General  
WATER AUTHORITY  
OF JORDAN

In response to the request of the Government of the Hashemite Kingdom of Jordan (hereinafter referred to as "the Government of Jordan") the Japanese Preparatory Study Team (hereinafter referred to as "the Team") was sent by Japan International Cooperation Agency (hereinafter referred to as "JICA") to discuss, with the Water Authority of Jordan (hereinafter referred to as "WAJ"), and the Ministry of Planning (hereinafter referred to as "MOP") the Scope of Work (S/W) for the Study on the Improvement of the Water Supply System for the Zarqa District in the Hashemite Kingdom of Jordan (hereinafter referred to as "the Study").

The Team headed by Mr. Haruo Iwahori stayed in Jordan from the 18th to the 28th of April, 1994. During their stay in Jordan the Team carried out field reconnaissance in the Study Area, received available information and held a series of interviews with WAJ and MOP officials.

The Team also had discussions with WAJ and MOP on the Scope of Work to be undertaken by both WAJ and JICA for the successful execution of the above-mentioned Study. A list of those who participated in these discussions, field visits and meetings is shown in the Annex (II).

The main items which were discussed by the Team and WAJ are as follows:

#### 1. Name of the Study

The Team and WAJ confirmed that:

Rename the Study to be:

" The Study on the Improvement of the Water Supply System for the Zarqa District in the Hashemite Kingdom of Jordan",

Instead of : " Hydraulic Analysis of Water Systems in Zarqa Governorate".

#### 2. Study Area

The Team and WAJ confirmed the following two items:

- In Clause III of the S/W, delete the second statement concerning the study area of the feasibility study, and substitute the following:  
"The study area of the feasibility study will be defined according to the identified project(s)".

- The existing water sources, transmission lines and pumping stations which are located outside the Study Area will be covered in the study. This includes Khaw P.S., Khaldieh P.S., Azraq and Hallabat wellfields & P.Stations and Za'atari P.S. New sources to be

*DS*  $\frac{21}{12}$  *3/12*

excluded from the study.

### 3. Stages of the Study

The Team and WAJ confirmed the following four items:

- Although the contents of the Jordanian request consist of FOUR stages, the Japanese Side will only conduct the following phases:
  - I - Basic Plan
  - II- Feasibility Study, including Preliminary Design of transmission and primary pipe network and facilities of the system.
- WAJ expressed its strong wish that after the feasibility study has been completed, the Government of Japan will examine the possibility of implementing a Detailed Design Study (D/D) on the identified project(s), upon official request of the Government of Jordan. The Team replied that it will convey this issue to relevant authorities in Japan. The Team also commented that a Detailed Design Study will be conducted under the scheme of Development Study, when and only if the following conditions are fulfilled;
  - a. a feasibility study has been completed by the technical assistance of JICA,
  - b. the recipient government is committed to financing; either locally and/or externally funded, of the construction of the identified project(s),
  - c. the recipient government secures responsibility for the results of the execution of the identified project(s) as an executing agency after approval of D/D by the recipient Government, and
  - d. appropriate budget is available for the D/D study.
- Regarding Sub clause (IV-4-h) of the S/W:  
Priorities of the projects will be identified by WAJ and the Japanese Study Team.
- System layouts will be drawn up on System Maps of scale 1/10,000 on A1 size papers to show the existing water system facilities such as well fields, pumping stations, reservoirs and transmission and primary pipe networks. The following will be excluded from the Study:
  - 1) Pipeline Drawings (scale 1:2,500)
  - 2) System Facilities Drawings (scale 1:200)
  - 3) CADD System.

*BS*  $\frac{1}{12}$

*J. J. J.*

#### 4. Objectives and Scope of the Study

- The Team and WAJ confirmed that objectives and scope of the Study are written in the S/W.  
WAJ requested to attach the details of these objectives and scope of the Study in Annex (I) to be read as part of the S/W. The Team replied that Annex (I) will not be part of the S/W, it will be only as a reference. WAJ accepted that Annex (I) is a reference.

#### 5. Environmental Considerations

- The Team and WAJ confirmed the following items concerning environmental considerations:
    - (1) By the Screening, the identified project(s) may cause the following environmental impacts:
      - a) Water pollution of the Zarqa River by increased water consumption.
      - b) Noise and vibration arise from pumping stations.
      - c) Economic activities effected by change of value and type of land.
      - d) Disaster by chlorine gas.
      - e) Damages and affections to archaeological and cultural heritage in the Area.
      - f) Resettlement.
    - (2) By the Scoping of above(1), the following magnitude of impact(s) may be caused:
      - 1) Unknown impact: a), b), c), e) and f) of the above (1).
      - 2) Negligible impact: d) of the above(1) will be negligible by applying mitigation measure. Concerning above 1), environmental studies are required in the Study.
    - (3) Since environmental laws and regulations of Jordan have not been issued yet, WAJ will be the body in charge of environmental assessment.
    - (4) IEE and EIA are conducted jointly and the Japanese Study Team will advise technically.
    - (5) IEE and EIA will be referred to JICA's procedure.
    - (6) Even if "the Environment Law" will come into effect in Jordan during the Study period, proceeding IEE and EIA of the Study shall be effective and the Study will be carried out according to this clause 5.
6. To guarantee the smooth conduct of the Study, WAJ shall designate the appropriate number of counterparts personnel.
7. WAJ requested the Team to supply the following in

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conjunction with the Study:

- (1) Photocopy Machine
- (2) Two four-wheel drive(4WD) vehicles
- (3) Personal computer(s)

The Team clarified that the request would be studied by JICA based on the strict evaluation of the necessity of the above items for the conduct of the Study. And the Team also clarified that in case JICA supply any of them, they should be exempted from taxes, duties any other charges. And WAJ agreed on this.

#### 8. Undertakings of The Government of Jordan (Clause VII of S/W):

The Team and WAJ confirmed the following three items:

- Subclause (2.3): the exemption shall also cover the vehicles which brought into Jordan on temporary entry need of the Study.
- Amend Subclause (5.3) regarding office of the Japanese Study Team:  
" (3) suitable office space with necessary furniture and local telephone in Amman and Zarqa Governorate Water Administration The main office will be in Zarqa."
- Delete the subclause (5.5) concerning vehicles in its entirety.

#### 9. For the purpose of Technology Transfer, WAJ requested the training of the counterpart(s) of the Study in Japan. The Team recommended WAJ to select one counterpart personnel of the Study and to prepare an application for technical training program consulting with Japanese Study Team at the commencement of the Study.

#### 10. Basic Principles

- JICA will sign a contract with Japanese consulting firm(s) to conduct the Study as specified in the S/W. The competent consulting firm(s) will be selected by JICA in accordance with JICA's laws and regulations.
- Upon the request of WAJ, the Team explained the system of selecting the Japanese consulting firms to conduct the Study which is based on the contents of the brochure:  
"The JICA-Japan's ODA Programme: Development Study" which been handed over to WAJ; and WAJ accepted the explanation.

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- WAJ & JICA are in equal position and shall cooperate to conduct the Study .
- The Japanese Study Team and WAJ will cooperate closely in the course of the Study.

#### 11. Tentative Time Schedule

The Team and WAJ confirmed that:

- The Study shall be performed and completed within FOURTEEN (14) months and the Japanese Study Team should attach a detailed Tentative Time Schedule for the Study.

#### 12. Pilot Areas Of The Unaccounted-For Water (UFW)

- Location, number or size of the pilot areas to be decided by the Japanese Study Team, which in his opinion should represent the entire study area and will enable him to predict the UFW and propose the suitable leakage control policy. So, the study area will be represented by limited pilot areas, i.e, samples.

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## ANNEX (I)

Details of the Objectives and scope of the Study:

### 1. Objectives of the Study

The main objective is to define a program for the improvement and rehabilitation of Water Supply serving the growing service area in Zarqa District, and thereby to improve living standards by providing an improved Water Supply System. The Study shall include the determination of basic rehabilitation requirements to assure the adequate and safe operation and maintenance of the system and related works. This refers to physical requirements (equipments, materials, buildings, Reservoirs, etc) as well as personnel requirements and organizational and financial needs. The study shall serve the needs of Zarqa population to the year 2015. This overall goal will be met through the following objectives:

#### **A. System Layout of the Existing Network**

System layouts will be drawn up on System Maps of scale 1/10,000 on A1 size papers to show the existing water system facilities such as well fields, pumping stations, reservoirs and transmission and primary pipe networks, based on existing drawings, as-built drawings from main-laying contracts, local knowledge of WAJ Staff and field exploration using pipe-Locating Equipment and Spot-Check Excavation. A local consultant through the Japanese Study Team to be hired to implement the required exploration.

Existing Drawings and Maps: The latest copy of the maps and drawings for the Study Area should be obtained from the Water Authority and official departments. It is the Study Team's responsibility to compare and update these maps and drawings to actual conditions, including the naming of main roads and other identifying features.

#### **B. Network Analysis**

Perform a network analysis of the existing water system by developing computerized modelling techniques to show the complex relationships between the network, water consumption, pressure levels, energy and flow rates. An overall system network model will be prepared to include analysis up to supply points for each area of Zarqa District:

- Collect hydraulic data and water demand information, calculate future demands and identify

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- pressure extremes.
- Prepare water system network model using an accepted computer software program which is suitable for use with the WAJ's IBM-Compatible PC computers. A copy of this software should be handed over to WAJ.
- Calibrate model with tests.
- Evaluate system flexibility, optimize pumping schedules and source utilization, identify pipeline constrictions, assess total hydraulic capacity, optimize pressure zones and study system deficiencies.
- Finally, The Interim Report shall include the water system that will examine alternative modes of operation, identify potential savings, define optimum pumping schedules and recommend measures to reduce operating costs.
- A user manual should be prepared to assist future users of the Zarqa network model. The model should be turned over to WAJ along with the necessary licenses, computer equipment, documentation and users manual.

#### C. Unaccounted for Water (UFW) and Leakage Control

Conduct Study to investigate and quantify water which is either lost from trunk lines, reservoirs, and distribution systems due to leakage or is otherwise unaccounted-for. The study shall look into and assess administrative regulations, procedures and current resources charged with control of UFW. Based on the surveys in the selected pilot areas, recommend appropriate leakage control methods and prepare proposals for the expansion and development of the UFW Section in Water Authority. The primary objective is to investigate the economics of improving the present program of controlling water system losses:

- Collect information on present administrative procedures related to water system connections, registration of water meters, utilization of meters, accuracy of meters, meter reading frequency and billing and collection procedures.
- Collect data on meter performance including source meters and meters within the pilot areas.
- Check and evaluate unmetered public water services, unauthorized or illegal connections and under registration of revenue meters,
- Select pilot areas to reflect typical conditions relating to the water system in the Study Area.
- Provide the necessary specialized equipment to evaluate UFW in the pilot areas. They shall be handed over to WAJ in good conditions at the end

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of the Study free of charge. This shall include, but not limited to, the following:

- Personal computer (IBM compatible);
  - Electronic listening devices;
  - Leak noise correlators with Radio-Linked Amplifier;
  - Pipe and service box locators;
  - Water meters and meter testing equipment;
  - Data loggers.
- The "combined district and waste metering method" of investigation should be employed in the leakage surveys. As a result of the tests, it is necessary to compare the potential value of water saved against the cost of monitoring, detecting and remedying leaks of varying magnitude and complexity, and to employ the appropriate method of leakage control policy. The Interim report shall describe each pilot area, leakage problems encountered, alternative remedial measures, recommended solutions and cost-benefit information.

#### D. System Rationalization and Optimization

The objective is to reduce operating costs of the system.

- Most of the data required for the rationalization study will have been collected for the network analysis. However, it will be the responsibility of the Japanese Study Team to collect pumping costs, power tariffs, treatment costs and operational constraints specifically for the system rationalization.
- After finishing the network analysis computer model, alternative modes of operation will be examined for each pressure zone and the overall water system. Operating costs will then be assessed on the basis of the required discharge, pumping times and pumping heads. Potential savings will be identified and the optimum pumping schedules will be defined.
- Operations strategy and demand prediction should be addressed during the system optimization.
- The Final Report shall contain the data used, an appraisal of the potential savings, an approach to realizing these savings and recommended scheduling and prediction methods. The report shall also make recommendations concerning more sophisticated on-line computer solutions and automatic control to show savings and operational advantages that can be obtained

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by these routes.

#### **E. System Rehabilitation**

The investigations conducted during the above items (A thru. D) will result in the system rehabilitation program which will identify the required improvements of transmission and distribution lines and pumping and storage facilities. The Japanese Study Team shall prepare preliminary design for rehabilitation of the existing water systems in Zarqa District.

The present study aims at achieving the above objectives in the two phases mentioned in the S/W as a program of Technical Assistance of JICA.

#### **2. Scope of the Study**

The details of the Scope of Work for the Study are described hereinafter (but not limited to):

##### **a. Review of Previous Engineering Studies and Design:**

The Consultant shall review all relevant reports and other documents pertaining to the planning, design and operation of Zarqa District Water Supply and Distribution System.

##### **b. Describe and analyze the present conditions of the Existing Systems:**

- 1- Collect and review all available Physical, economic and social data relevant for the Study area, including, but not limited to, the following:
  - Number, size and type of towns and villages;
  - Population, population growth and socio-economic structure, including employment and income patterns;
  - Economic structure and main economic activities outlining number, type, size and location of important commercial public facilities such as schools, hospitals and military camps (land use and urban development);
  - Topographic and geological conditions in the Project Area, as well as soil conditions only as far as necessary for this part of the study;
  - Climate and meteorology of the study area;
  - Hydrological conditions, including a rough water balance for every catchment in wet and dry seasons, rainfall intensities and frequencies;
  - Type and location of all water relevant enterprises and industries.

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- 2- Identify the major developmental bottlenecks of the area and assess likely patterns of future growth and change.
- 3- Appraise existing overall conditions of water supply and water distribution, both in quantitative and qualitative terms, and survey the area and population being served by these systems as well as the status and serviceability of existing installations. The appraisal shall include, but not be limited to the following:
  - Present state and expected development of water supply facilities and quality of service, including areas of springs, wells, pumping stations, transmission mains, and primary and secondary distribution networks. This appraisal shall be based on a review of all available record and "as built" drawings of the system;
  - Population water demand and available water supply in wet and dry weather;
  - Volumes of water supplied (per day, month, year), major consumer's including industries, percentage of population with in-house connections, estimated losses and wastage, amounts used for irrigation of gardens and fields from the tap, and the present state of technical facilities; and
  - Service quality as measured by hours of pressure per day and reported breakdowns and by emergency services such as tankers that may have to be used in the dry season.
- 4- Assess the present arrangements and organization of the Water Authority for the operation, maintenance and repair of all facilities in the Study Area. List the number and qualifications of personnel, workshop premises, equipment and vehicles and their state of repair, and type, volume, range and problems of services being carried out.
- 5- Collect information on the following from available documentation:
  - Unit prices for the major items in the usual bills of quantities from water projects of comparable or larger size that have been executed in Jordan during the last three years;
  - The capacity of construction contractors in Jordan; and
  - Any other information deemed relevant.
- 6- Define all areas that may be suitable for the

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construction of pumping stations and transmission lines. Indicate the size of each area, its present use and land value and possible future uses. Assess soil conditions.

- 7- Assess present conditions of sanitation and hygiene in the Study Area, taking into consideration incidences of Water-borne diseases and other health hazards emanating from current system operations. Analyze available health statistics and other sources of information for this purpose.
- 8- Describe current institutional arrangements of water supply in the Project Area, including the costs and the cost recovery of these services through tariffs and other financial provisions.

#### c. Technical and Operational Alternatives

Alternatives for the future development of the Study Area shall be worked out considering and combining all feasible technical system components to reach the stated objectives. Technically feasible alternatives will be further prepared with rough estimates of quantities involved and of the investment and operational cost of their bulk items. The Study Team shall establish an appropriate criteria, in order to assess and select truly feasible alternative(s) and combinations and to define priority components.

The most feasible alternatives or combinations shall be worked out with rough quantities and cost calculations for necessary investment accompanied by a concise description of the main components, phasing if necessary, timing and organizational schedule. They shall address all aspects and define priorities. They shall include all essential steps for project implementation, including project preparation, construction of new facilities and rehabilitation of existing facilities. System alternatives may vary or be combined in future stages.

The Study Team shall make recommendations on alternatives(s) and, in particular, on priority components to be selected in the first phase for construction, and on further procedures.

After a decision on the alternatives or variants, the technical operational and organizational considerations and the planning and design will concentrate on the components defined for respective alternatives. This will ensure that this part will deal only with components that all parties have accepted as

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realistic:

**d. Layout and Preliminary Design of the Water System**

- For the proposed Project determine the general layout of the proposed pipelines (including pipe material required by size and type), pumping stations, electrical requirements, storage reservoirs, and other related works on the systems, distinguishing between improvement works on existing facilities and works for additional, new systems or system expansions. In determining the general layout of system in the Project Area consider a planning horizon of twenty years (up to year 2015).
- In the context of the general layout as described above, also determine basic design parameters for the systems.
- Prepare the preliminary design of the identified project(s) and related works selected to be constructed during 1995-97, under a first phase, for consideration and inclusion under the proposed Project.
- Assess whether the design of the Project is compatible with the over all objectives of the Project and sufficiently adapted to local conditions and expected operational capabilities of the Water Authority.
- Give proposals for overall Project implementation and staging, including recommended contract packaging based on area, contract capabilities and possible multiple financing sources. Prepare a timetable for planned execution of the Project.
- Assess and describe the operational aspects of the Project, including its specific implications on the Water Authority. Assess training requirements for operating and maintenance personnel and outline the training programmes required.

**e. Project Cost**

- Prepare cost estimates of the capital costs of the selected project alternatives by recommended contract packages, including its foreign exchange costs, on a 1994 price basis. Estimate separately physical contingencies and price escalation during the construction period for each project component.

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- Outline and determine the operational costs of the systems improved and built up under the Project.

**f. Financial Analysis**

- Outline a financial forecast of the selected alternatives for the project (Income/Expenditure Forecast)
- Assess the appropriateness of current water and sewer rates and user charges with respect to expected operating costs taking into account total costs of systems and the ability to pay of the beneficiaries, including low-income groups of the population.

**g. Economic and Socio-economic Analysis of the Project**

- Calculate:
  - a) the incremental unit costs of the identified project(s) on a 1994 price basis for the life-span of the Project utilizing discount rate of 5% and 8%;
  - b) the real internal rate of return; and
  - c) the least cost solution in economic terms, using alternative assumptions as to critical variables (time of implementation, costs, etc.) to assess the sensitivity of the Project to such changes.
- Assess general effects economic of improved water supply in the project area.
- Assess its significance for the population in the areas served in terms of meeting basic needs, effect on health and hygienic conditions and the living environment, with particular consideration of low-income groups.
- Determine measures for preventing potential wastage of water in the future.
- Give a full assessment of environmental and project risks and suggest suitable measures to avert them, clarifying institutional responsibilities.

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## ANNEX (II)

### List of Participants

#### Jordanian Side:

##### A) Participants of the M/M discussions:

Mr. Koussai Qutaishat/Secretary General, WAJ  
Mr. Nawaf Dawoud /Assistant S.G., WAJ  
Mr. Nazir A. Arkoub /Design & Study Dir., WAJ  
Mr. Ehsan Sousa /Water Design Section, WAJ  
Mr. Taisir Al-Saqri /Water Design Section, WAJ  
Mr. Ayman Ismail /Infrastructure Dept., MOP

##### B) Other participants:

##### WAJ:

Dr. Raja Jadoun /Laboratory Dept., Director  
Mr. Othman Al-Kurdi /Tender Dept.  
Mr. Ghazi Khalil /Zarqa Water Administration  
Mr. Isam Hamarsha / = = =  
Mr. Imad Haddad / = = =  
Mr. Walid Hussein / = = =  
Mr. Mohammed Al-Lafi/Laboratory Dept.

##### MOP:

Mr. Salim Ghawi /Assistant S.G.  
Mr. Bolus Kefayeh/Infrastructure Dept., Director  
Dr. Nael Al-Hajaj /Bilateral Dept.  
Miss Benitta Sa'ad /Infrastructure Dept.

#### Japanese Side:

Mr. Haruo Iwahori /Leader, Waterworks Development Specialist, JICA  
Mr. Takeshi Mori /Assistant Chief of Development Section, Waterworks Bureau, Fukuoka City  
Mr. Yoshikatsu Nari /Second Development Study Division, Second Development Study Department, JICA  
Mr. Haruhiko Nakamura /Sanyu Consultants Co., Ltd  
Mr. Toshihiro Shinohara /First Secretary of the Embassy of Japan  
Mr. Yuji Shirata /Assistant Resident Representative, JICA Jordan Office  
Mr. Hani Al-Kurdi /Research Coordinator, JICA Jordan Office

*Handwritten signatures and initials:*  
A signature that appears to be "Hani" or "Hani Al-Kurdi".  
Below it, the initials "BS" are written.





## 付属資料 E 主要面談者リスト



## 主要面談者

計 画 省 :

Secretary General

Dr. Safwan Toukan

Assistant Secretary General

Mr. Sallim Ghawi

Economic Researcher

Dr. Nael T. H. Alhajaj

Water Authority of Jordan :

Secretary General

Mr. Koussai Quteishat

Assistant Secretary General

Mr. Nawaf Dawoud

Projects Director

Mr. Nazir A. Arkoub

Water Design Section

Mr. Taisir Al-Saqri

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一等書記官

篠 原 俊 博

JICA ジョルダン事務所 :

職 員

白 田 裕 司

Research Cooordinator

Mr. Hani H. Alkurdi



付属資料 F 「第4次経済・社会開発5か年計画  
(1993～97)における、  
上下水道分野に係る政策・計画  
(抜粋仮訳)



## 第1部 経済・社会の状況

第2章分野別状況の中で、インフラストラクチャー部門（エネルギー、鉱物資源、水・灌漑、電話、建設、運輸）について、以下のように記述されている。

1986～1992年における、この部門のGDPへの貢献割合は平均27.6%であり、多くの労働力を吸収してきたが、この割合は1991年には21.5%、1992年には15.7%へと減少した。建設部門は労働力吸収が大きいが、1986年の11%から1992年の8.2%に減少した。

インフラ部門は政府の重点投資によって、固定資本形成の多くを占めてきた。その割合は、1986年が38.6%、1992年が35.9%であり、加えて、この部門は財政的、技術的、組織的に発展してきた。1992年末には、住宅への電力供給は98.2%、飲料水供給は97%となり、下水道整備も55%に向上した。同期間に、電話加入者は276,000人となり、幹線道路、地方道、農村道は2,650Km、1,679Km、1,898Kmとなった。

インフラ部門には以下の問題点がある。

- (a) インフラサービスは都市に集中していること
- (b) この部門の維持管理費が大きいこと
- (c) 費用回収、成長を確実にするための価格政策に失敗したこと

水・灌漑部門をレビューすると以下のとおりである。

ジ国は、家庭、工業、農業用水の供給で大きな困難を切り抜けてきた。1991年には、全家庭の97%に公共水道を供給し、給水量は179百万m<sup>3</sup>/年であるが、それでも実需要量から見れば、量では76百万m<sup>3</sup>/年、率では30%が不足している。1人当たり給水量は、90ℓ/日、配管網からの漏水30～35%である。これは、同じような状態の国と比較しても悪い状態であると言える。

1991年に、工業部門の需要量はカバーしている（42百万m<sup>3</sup>/年）。灌漑部門では、673,000 dunumsの面積の灌漑に、僅かに615百万m<sup>3</sup>/年を給水しただけであり、実需要量では、主としてジョルダンバレーにおいて、245百万m<sup>3</sup>/年不足している。

水・灌漑部門の主要な問題点は以下のとおりである。

- (a) 水資源の不足、変動と、消費地から離れていること
- (b) 高地灌漑での地下水利用による地下水位の低下
- (c) 都市の膨張に伴う上下水道網の建設費用の増加
- (d) 配水管網の老朽化による高い漏水率
- (e) 過剰用水による地下水源の水質的、水量的低下
- (f) 雨水貯水施設の不足と、ダム、雨水利用施設建設資金の不足
- (g) 水のモニタリング・ネットワークの不足
- (h) 上下水道プロジェクトの実施における環境配慮が不十分
- (i) 水部門の過剰人員と有資格者の不足による、サービスの硬直化



(j) 水利用総合計画の遅延

(k) 近隣諸国との地下水源利用規制の未合意

環境部門の中で、水質に係る主要な問題点は以下のとおりである。

水源が限られているため、灌漑、飲料水、工業への需要量の増加に対応できず、不足量が目立っている。不足量は、1986年で135百万 $\text{m}^3$ /年であったものが、1991年には320百万 $\text{m}^3$ /年になった。

高い人口増加率のため、1人当たり水利用量が90 $\ell$ /日で、先進国の300~700 $\ell$ /日と比べて低いにも拘らず、利用可能な水源が枯渇している。水源の枯渇により、塩分濃度が上昇しており、1960年代に600ppmであったものが、1986年に3,000ppm、1991年には3,500ppmになった。

## 第2部 目標と基本原則

水部門について以下のように記述されている。

ジ国では、関連する地域的、国際的次元で総合的水政策を策定する必要がある。この中で、水資源の確保、貯水方法の改善、配水管網の改善、有効利用の向上、価格政策の見直し、再利用の促進などを確実にすべきである。水政策は、環境保全、維持管理、塩水化の防止、土壌侵食、下水道システムなどと密接に関連している。

水資源の確保については以下のように記述されている。

水の機会費用を勘案し、水を最も有効に利用するための集水、貯水方法を検討し、地下水源、表流水源の再評価を行うべきである。このためには、現在、将来の利用可能水量、社会・経済的視点からの最適利用のための水計画を策定する必要があり、それによって、水関連の公共部門の機構・組織のリストラが可能となる。

## 第4部 経済・社会政策

水・灌漑部門の政策として以下のように記述されている。

### (1) 水資源の最適な利用と保全対策

- (a) 水資源の継続的アセス
- (b) 表流水、地下水のモニタリングの最新化
- (c) 水位低下を引き起こさない地下水利用計画の策定
- (d) 水資源の汚染防止
- (e) 中層、深層の地下水調査
- (f) ダム、貯水池建設に係る表流水調査

- (2) 地下水、地表水を種々の目的に利用するための調整
  - (a) 地下水の灌漑用水への利用規制と累進料金制の適用
  - (b) 灌漑給水施設の整備による既得権の見直しと累進料金制の適用
  - (c) 地下汽水の水量、水質調査
- (3) 水運搬施設の効率改善とロス低下
  - (a) ジョルダンバレーにおける開水路を管路に変更
  - (b) 水運搬施設の見直しによる種々の水源の活用
  - (c) 水道の排水施設の水理解析とそのため基本計画の作成
  - (d) 水道の配水本管、枝管の整備・改善
- (4) ダム、貯水池の数の増加による保水と流失水の有効利用
- (5) 下水処理水の灌漑用水利用のための水質改善と水質管理
- (6) 農場での灌漑の効率化
  - (a) 少ない水で最大収穫をあげられる作物を栽培するよう、農民のインセンティブを高める
  - (b) 小農家が最新の灌漑技術を用い、水を保全するよう財政的、技術的に支援する
- (7) 地域的合意により、近隣諸国と地下水揚水量を調整する

## 第5部 公共部門の投資計画

水・灌漑部門の投資計画として以下のように記述されている。

WAJのプロジェクトは現在・将来の水不足に備えて給水量の増加を目的としており、これは、新地下水源からの揚水と既存の排水管網の効率改善によって実現される。主要なプロジェクトは以下のとおりである。

- (1) アンマン首都圏へのディシ水源からの送水プロジェクト
- (2) アンマン首都圏の排水管網の整備・改善プロジェクト
- (3) サルト市の水道プロジェクト
- (4) イルビット地区の下水道プロジェクト
- (5) キルバットーエルーサムラ下水処理場の拡張と管路布設プロジェクト



## 付属資料 G 水 準 基 準



# JORDAN STANDARD SPECIFICATIONS FOR "DRINKING WATER" NO.(286)

## MICROBIOLOGICAL CHARACTERISTICS

- . The Most Probable Number ( MPN ) of coliform organisms ( colon bacteria ) should not exceed 2.2/100 ml. of the tested water when multiple tube method was used. The number should be zero when membrane filtration technique was used.
- . The Tested (100) ml. should be free from faecal coliform organisms.

## BIOLOGICAL CHARACTERISTICS

- . Drinking Water must be free from the following :-

Organism	Guide line - Value
a. PROTOZOA	0
b. HELMINTHS ( PATHOGENIC )	0
c. FREE LIVING ORGANISM	0

## \* PHYSICAL CHARACTERISTICS

Physical " Natural " characteristics should not exceed the limits shown in the following table :-

CHARACTERISTIC	LIMIT PERMITTED	MAX. ACCEPTABLE LIMIT IF NO OTHER SOURCE COULD BE AVAILABLE
. TASTE	ACCEPTABLE TO MOST CONSUMERS	—
. ODOUR	ACCEPTABLE TO MOST CONSUMERS	—
. COLOUR	10 UNITS "PLATINUM - COBALT STANDARD"	15 UNITS
. TURBIDITY	1 UNIT " JAKSON CANDLE TURBIDIMETER "	5 UNITS
. PH LEVEL	NOT LESS THAN 6.5 NOT MORE THAN 9.00	—
. TEMPERATURE	BETWEEN 8°C TO 25°C	—

\* CHEMICAL CHARACTERISTICS

POISSNESS MATERIALS

THE POISSNESS MATERIAL IN WATER SHOULD NOT EXCEEDS THE LIMITS SHOWN BELOW :-

CNOSTITUENT	MAX. LIMIT mg/L	
LEAD "Pb"	0.05	
SELENIUM "Se"	0.01	
ARSENIC "As"	0.05	
CHROMIUM "Cr"	0.05	
CYANIDE "CN"	0.1	
CADMIUM "Cd"	0.005	
MERCURRY "Hg"	0.001	
ANTIMONY "sb"	0.01	
SILVER "Ag"	0.01	

# CONSTITUENTS OF HEALTH SIGNIFICANCE

THE CINSTITUENTS SHOULD NOT EXCEEDS THE LIMITS SHOWN BELOW

CONSTITUENTS	LIMIT PERMITTED ( mg/L )	MAX. ACCEPTABLE LIMIT IF NO OTHER SOURCE COULD BE AVAILABLE (mg/L)
TOTAL DISSOLVED SOLIDS (TDS)	500	1500
TOTAL HARDNESS TH (Ca Co3)	100	500
DETERGENTS (ABS)	0.5	1.0
ALUMINIUM (AL)	0.2	0.3
IRON (FE)	0.3	1.0
MANGANESE (Mn)	0.1	0.2
COPPER (Cu)	1.0	1.5
ZINC (Zn)	5	15
SODIUM (Na)	200	400
NICKEL (Ni)	0.05	0.1
CHLORIDE (CL)	200	500
FLOURIDE (F)	1.0	1.5
SULFATE (SQ)	200	500
NITRATE (NO <sub>3</sub> )	45	70



## RADIOACTIVE MATERIALS

THE RADIOACTIVE MATERIALS SHOULD NOT EXCEED THE LIMITS SHOWN IN THE FOLLOWING TABLE. IN CASE IT EXCEEDS THE LIMITS, ANALYSIS BY SPECILAIZED BODY SHOULD BE DONE TO FIND THE RADIOACTIVE MATERIALS, AND ITS EFFECT ON HEALTH.

CONSTITUENTS	MAX. LIMIT
ALPHA EMITTERS	0.1 Bq/L (EXCEPT RADON)
BETA EMITTERS	1 Bq/L

## ORGANIC IMPURITIES

THE ORGANIC IMPURITIES SHOULD NOT EXCEED THE LIMITS SHOWN IN THE FOLLOWING TABLE.

CONSTITUENTS	MAX. LIMIT PERMITTED mg/L
a. COLORINATED HYDROCARBONS	
ENDRIN	0.0002
LINDAIN	0.004
METHOXYCHLOR	0.1
TOXAPHENE	0.005
b. CLOROPHENOXYYS	
2,4 DICHLOROPHENOXY ACETIC ACID	0.1
2,4 - 5 TRICHLOROPHENOXY PROPIONIC ACID.	0.01

\* OTHER ORGANIC IMPURITIESS WHICH ARE NOT LISTED IN THE ABOVE TABLE SHOLD COMPLY WITH WORLD HEALTH ORGANOZATION GUIDELINES.

工場排水排出基準

CHARACTERISTICS	MAXIMUM ALLOWABLE LIMIT "mg/ℓ"*			
	RE - USE for Irrigation Purposes	RECHARGE Underground Water	EFFLUENT DISCHARGE TO	
			SEA	Rivers, Wadies & Reservoirs
Bio - Oxygen Demand	—	50	—	50
Chemical Oxygen Demand	—	150	200	150
Disolved Oxygen	1	1	5	1
Tortal Disolved Solids	2000	1500	—	3000
Suspended Solids	100	—	—	50
PH	6.5 - 8.4	6.5 - 9.0	5.5 - 9.0	6.5 - 9.0
Colour	—	15	75	15
Change in Tempreature	—	—	4	—
Fat and Oil Contents	5	—	10	15
Vinyl	0.002	0.002	1	0.002
Detergents (ABS)	—	15	—	25
NITRATE - (NITROGEN)	30	12	—	12
Ammonia	5	5	12	5
Total Nitrogen	50	—	125	—
PHOSPHATE	—	—	—	15
Chloride	350	500	—	500
Sulfate	400	500	—	500
Flouride	—	1.5	—	1.5
Bi - Carbonate	500	—	—	—
Sodium	—	400	—	—
Magnesium	—	—	—	—
Calcium	—	—	—	—
Sodium absrption %	9	—	—	—
Aluminium	5	0.3	—	5
Arsenic	0.1	0.05	0.1	0.05
Boron	1	1	—	1
Chromium	0.1	0.05	0.3	0.1
Copper	0.2	2	0.1	2

CHARACTERISTICS	MAXIMUM ALLOWABLE LIMIT "mg/ℓ"			
	RE - USE for Irrigation Purposes	RECHARGE Underground Water	EFFLUENT DISCHARGE TO	
			SEA	Rivers, Wadies & Reservoirs
Iron	5	1	2	1
Manganese	0.2	0.2	0.2	0.2
Nickel	0.2	0.1	0.02	0.2
Lead	1.0	0.1	0.1	0.1
Selenium	0.02	0.05	0.02	0.02
Cadmium	0.01	0.02	0.07	0.01
Zinc	2	15	—	15
Cyanide	0.1	0.1	1.0	0.1
Mercury	0.001	0.001	0.001	0.001
• Most Probable Number (MPN) of coliform Organism (in 100mm)	—	—	5000	—
• Faecal coliforms (in 100mm)	1000	1000	—	1000
• Intestinal nematodes (No./ℓ)**	< 1	—	—	< 1

\* mg/ℓ = milligram/Liter

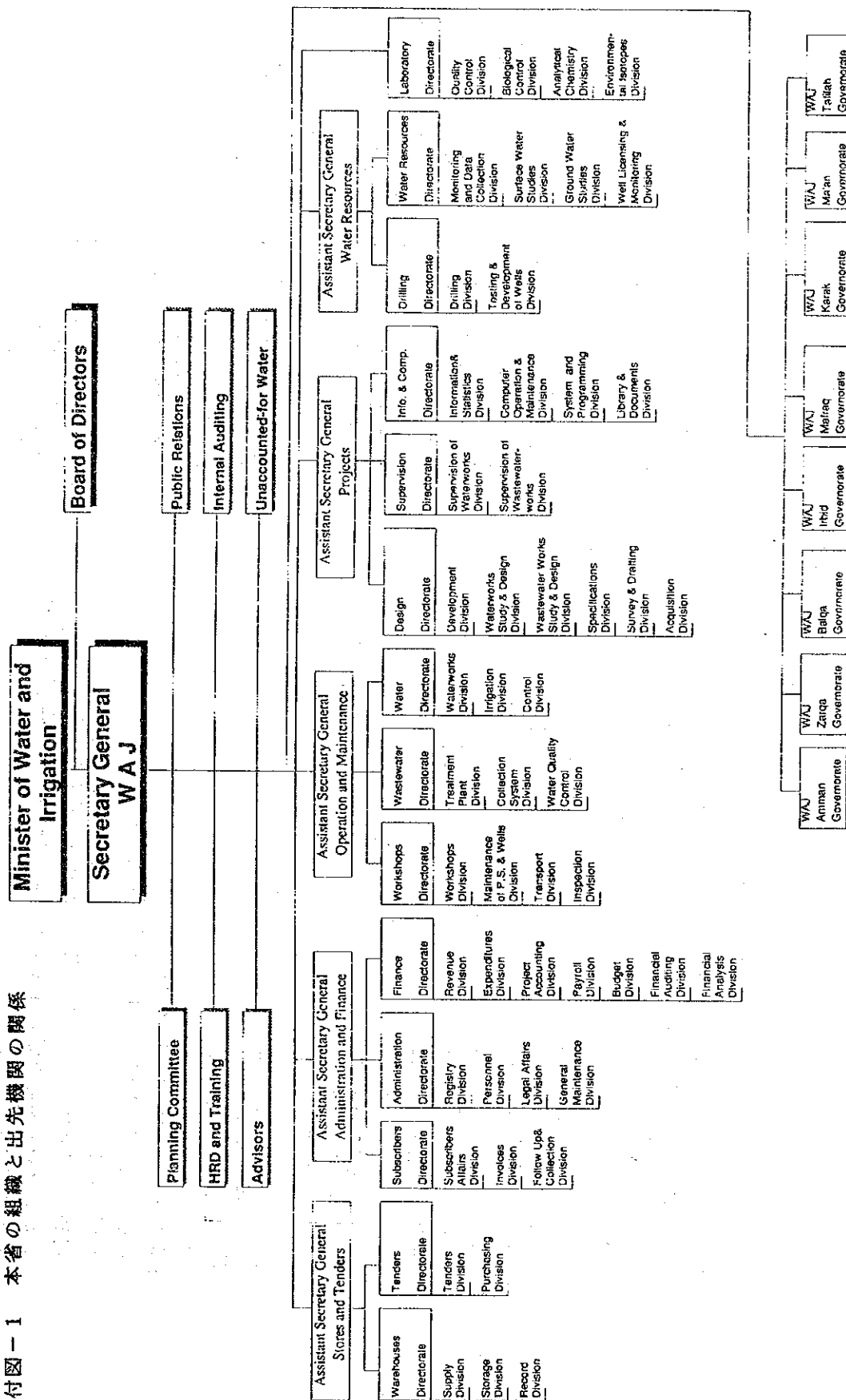
\*\* No./ℓ = Number/Liter

(注) 本表はWAJから入手したものであるが、“Jordan Standard Specifications No. 202 for Industrial Wastewater”と整合していない値もある。

付属資料 H Water Authority of Jordan の組織図

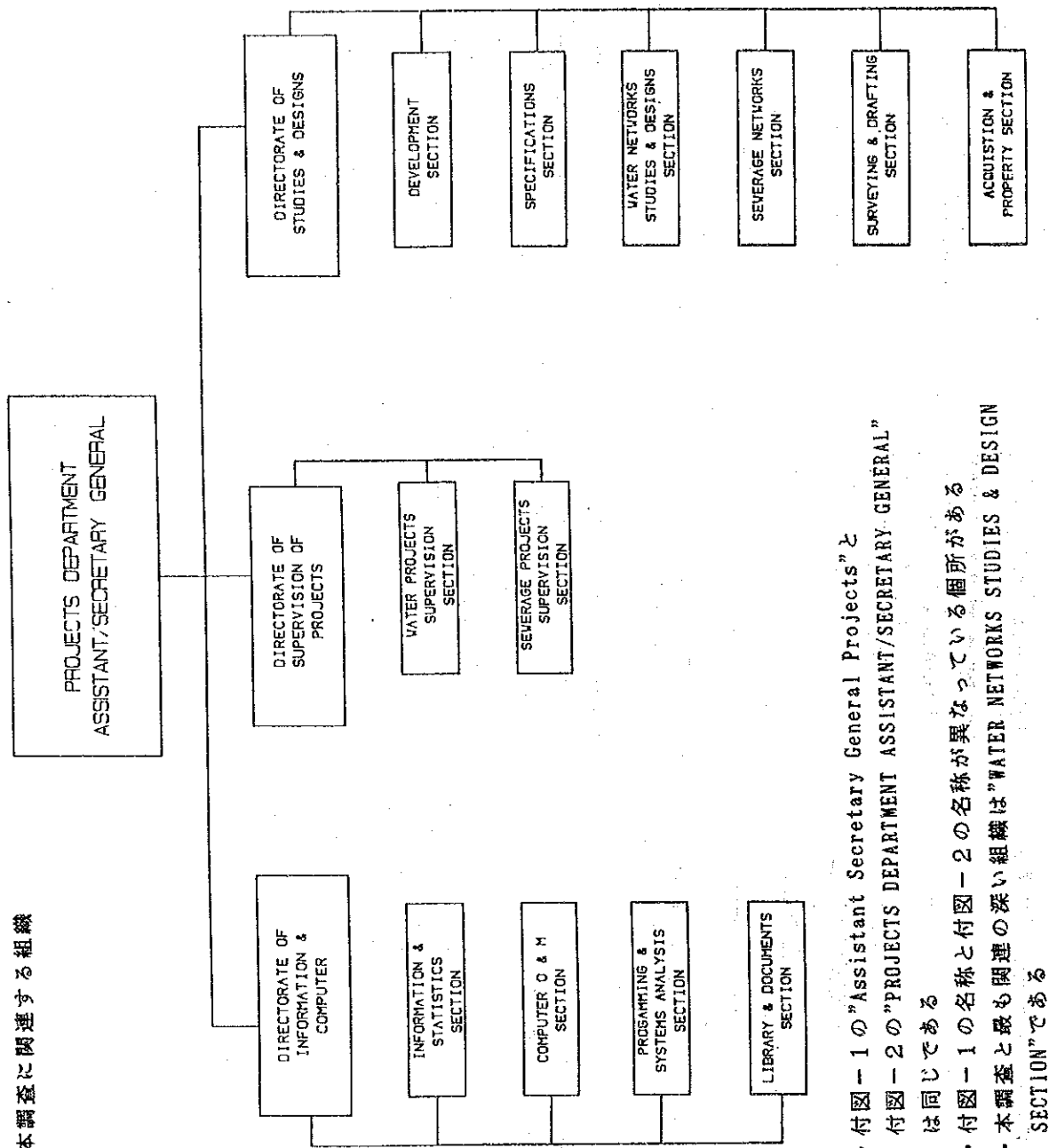


付図-1 本省の組織と出先機関の関係



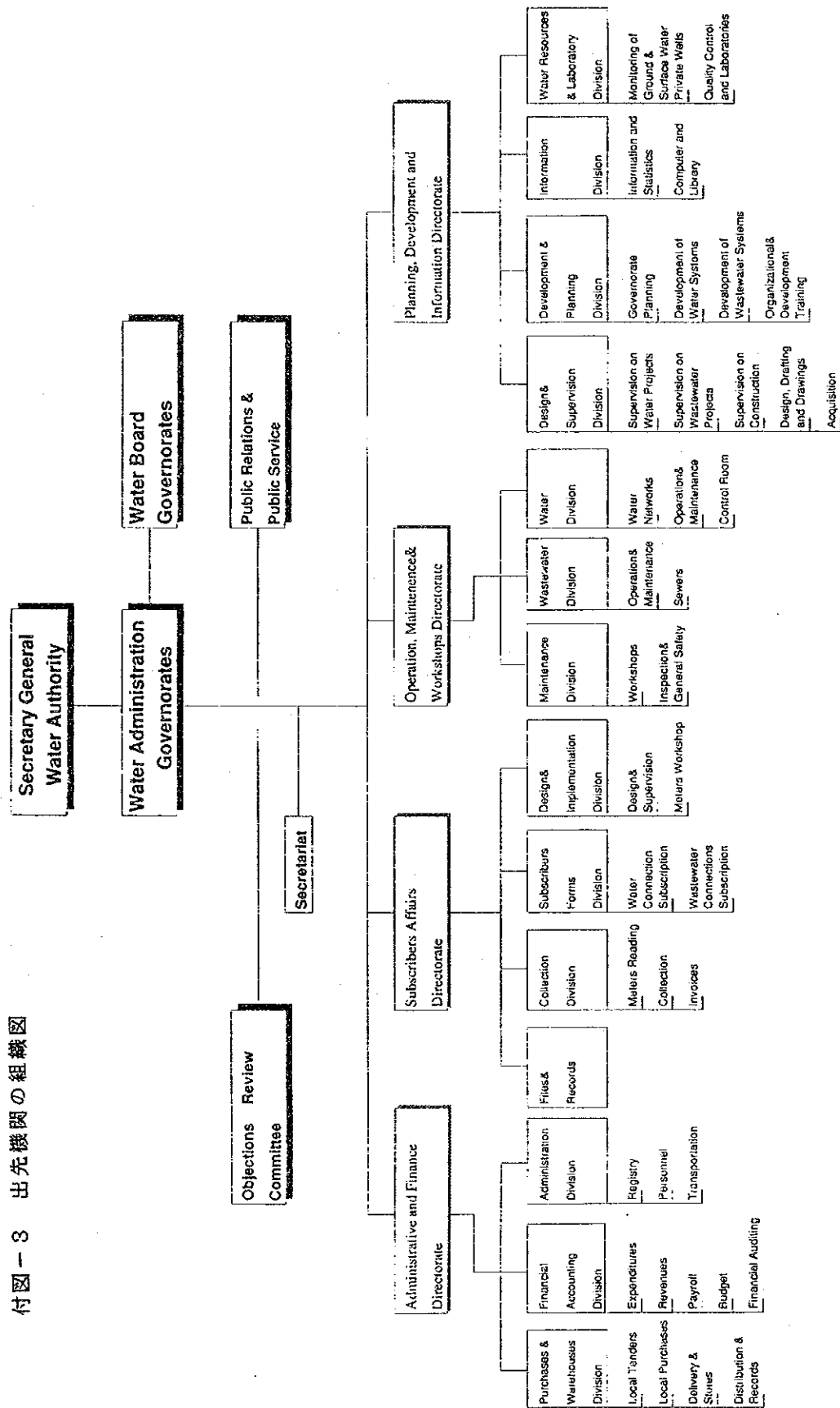
この部分の詳細を図一3に示す

付図-2 本調査に関連する組織



- ・付図-1の"Assistant Secretary General Projects"と付図-2の"PROJECTS DEPARTMENT ASSISTANT/SECRETARY GENERAL"は同じである
- ・付図-1の名称と付図-2の名称が異なっている箇所がある
- ・本調査と最も関連の深い組織は"WATER NETWORKS STUDIES & DESIGN SECTION"である

付図 - 3 出先機関の組織図







## 付属資料 I 給水・料金徴収状況



	NO. OF CUSTOMERS	% OF CUSTOM.	NO. OF POP.	% OF POP.	PERSON/ CONN.	SUPPLIED WATER	% OF SUPPLIED WA.	SOLD WATER	% OF SOLD W.	UNACCOUNTED F.W.	UNF. UFW. % OF TOTAL	SEWAGE CONN.	% OF S.C.
1989													
AMMAN	192,100	44%	1,237,100	42%	7	73,087,000	43%	35,361,188	48%	37,725,832	52%	54,845	59%
ZAFKA	60,700	14%	449,900	14%	7	17,149,000	10%	8,746,466	61%	8,403,545	49%	18,178	9%
IRBID	95,000	22%	753,400	24%	8	30,154,000	18%	11,554,349	38%	19,620,651	62%	5,832	19%
MAFRAQ	16,000	4%	109,000	4%	6	13,188,000	8%	3,375,510	28%	9,792,490	74%	1,777	10%
BALQA	23,000	7%	214,700	7%	7	13,114,000	8%	4,582,188	35%	8,581,802	65%	8,341	9%
KARAK	19,000	4%	132,800	4%	7	5,855,000	3%	3,163,758	58%	2,691,241	44%	911	3%
TAFLAH	8,900	2%	43,900	1%	7	2,336,000	1%	720,141	31%	1,605,859	69%	523	17%
MAA'AN	21,800	5%	108,300	3%	5	15,451,000	9%	6,918,258	45%	8,532,742	55%	2,475	9%
TOTAL	441,400	100%	3,111,000	100%	7	170,135,000	100%	74,371,538	44%	95,763,462	56%	90,682	100%
1990													
AMMAN	201,847	44%	1,346,312	42%	7	75,614,000	43%	35,427,121	47%	40,186,879	53%	130,330	40%
ZAFKA	64,640	14%	468,139	14%	7	20,141,000	11%	8,893,122	49%	10,307,878	51%	23,440	10%
IRBID	95,749	21%	779,511	24%	8	30,682,000	17%	12,225,536	41%	17,456,464	59%	9,474	13%
MAFRAQ	17,409	4%	112,706	3%	6	16,438,000	9%	3,343,100	22%	12,088,901	78%	1,924	12%
BALQA	31,843	7%	222,156	7%	7	12,581,000	7%	4,836,195	39%	7,752,805	62%	1,526	8%
KARAK	19,884	4%	137,325	4%	7	6,101,000	3%	2,709,835	44%	3,391,065	56%	1,889	3%
TAFLAH	7,242	2%	47,368	1%	7	2,182,000	1%	852,783	39%	1,356,207	62%	795	14%
MAA'AN	21,439	5%	112,160	3%	5	15,931,000	9%	8,062,439	57%	8,838,561	43%	5,945	7%
TOTAL	489,063	100%	3,223,876	100%	7	177,650,000	100%	78,271,340	44%	99,378,660	56%	185,123	100%
1991													
AMMAN	203,634	44%	1,616,656	42%	8	74,784,858	42%	34,301,612	46%	40,483,246	54%	138,651	40%
ZAFKA	65,499	14%	569,741	14%	8	22,184,864	12%	10,630,832	48%	11,554,032	52%	30,808	11%
IRBID	100,715	21%	806,039	24%	9	30,581,062	17%	13,875,313	46%	16,705,749	54%	12,342	16%
MAFRAQ	18,337	4%	136,337	3%	7	13,747,241	8%	3,069,768	22%	10,677,473	78%	1,878	11%
BALQA	31,265	7%	286,768	7%	8	13,141,841	7%	5,268,236	40%	7,855,605	60%	1,254	8%
KARAK	20,658	4%	164,900	4%	8	6,335,789	4%	2,688,874	42%	3,646,915	58%	1,728	4%
TAFLAH	7,481	2%	60,380	1%	8	2,281,161	1%	842,847	37%	1,418,314	63%	832	14%
MAA'AN	22,104	5%	134,682	3%	8	15,829,552	9%	7,292,043	46%	8,547,509	54%	5,537	9%
TOTAL	474,630	100%	3,071,000	100%	8	178,606,378	100%	78,077,525	44%	100,528,853	56%	204,927	100%
1992													
AMMAN	220,203	44%	1,672,098	41%	8	88,309,767	47%	38,950,545	38%	61,359,222	62%	158,008	58%
ZAFKA	68,641	14%	684,065	15%	9	22,728,781	11%	10,195,058	46%	12,534,723	55%	394,29	6%
IRBID	103,650	22%	894,650	24%	10	31,492,033	15%	13,336,867	42%	18,155,176	58%	13,952	19%
MAFRAQ	19,090	4%	185,828	4%	9	14,244,789	7%	3,204,671	22%	11,040,218	79%	1,990	6%
BALQA	32,450	7%	248,082	6%	8	15,547,770	7%	5,710,767	37%	9,837,003	63%	13,705	1%
KARAK	21,649	4%	170,336	4%	9	7,016,056	3%	2,828,636	40%	4,187,421	60%	2,188	0.5%
TAFLAH	7,728	2%	65,410	2%	8	2,392,098	1%	917,444	34%	1,584,652	66%	1,057	3%
MAA'AN	22,868	5%	151,778	4%	7	16,512,678	8%	8,439,201	51%	8,073,477	49%	6,591	1%
TOTAL	487,591	100%	4,102,235	100%	8	208,234,870	100%	81,492,978	39%	126,751,892	61%	234,589	100%
1993													
AMMAN	238,421	45%	1,777,441	41%	8	96,563,815	45%	41,556,337	42%	57,007,478	59%	173,094	45%
ZAFKA	73,630	14%	686,928	15%	9	25,557,085	12%	11,873,082	46%	13,683,988	54%	40,249	11%
IRBID	109,663	21%	1,041,369	24%	10	34,511,621	16%	15,856,614	46%	18,654,907	54%	16,731	15%
MAFRAQ	19,873	4%	176,276	4%	9	13,298,446	9%	3,689,868	28%	9,608,578	72%	2,086	8%
BALQA	34,230	6%	257,509	6%	8	18,360,455	9%	6,250,875	32%	13,129,480	68%	14,174	10%
KARAK	22,670	4%	178,000	4%	8	6,990,681	3%	3,213,681	46%	3,786,100	54%	2,275	3%
TAFLAH	7,768	1%	69,008	2%	9	2,453,968	1%	1,195,307	48%	1,268,661	52%	1,212	1.0%
MAA'AN	23,746	4%	159,972	4%	7	17,734,363	8%	9,068,121	51%	8,666,267	48%	8,833	7%
TOTAL	528,101	100%	4,328,533	100%	8	218,499,373	100%	92,691,895	42%	125,807,494	58%	256,663	100%

[illegible]

1980	annular	zarka	hibd	met/eq	belqa	karak	talish	mal'an	total
1	7,897	2,056	2,653	845	943	1,089	223	935	13,352
2	7,295	1,712	2,335	620	844	1,500	131	820	11,844
3	10,002	2,250	3,345	843	1,354	700	189	843	17,233
4	9,567	2,638	3,521	845	1,382	734	187	4,011	16,412
total	35,301	8,746	11,554	3,378	4,853	3,155	750	8,916	59,637
1990									
1	7,442	2,208	2,680	759	1,171	791	189	1,579	10,507
2	7,649	2,070	2,300	640	918	500	171	887	10,548
3	10,227	2,750	3,827	904	1,250	661	216	1,243	20,668
4	10,109	2,835	3,764	851	1,497	782	249	1,077	21,754
total	35,427	8,833	12,009	3,259	4,837	2,110	825	5,186	74,077
1991									
1	7,931	3,176	3,262	704	1,390	607	198	2,037	10,350
2	7,699	2,054	3,171	763	1,264	963	190	1,383	17,065
3	9,156	2,623	3,641	782	1,340	698	215	1,032	19,500
4	9,538	2,770	3,861	859	1,410	740	232	2,209	21,754
total	34,322	10,632	13,575	3,070	5,287	2,588	843	7,281	70,079
1992									
1	8,101	2,265	2,970	839	1,115	650	209	2,054	13,013
2	6,728	2,185	2,737	629	963	509	184	1,457	17,862
3	10,200	3,020	3,676	850	1,208	725	185	2,008	22,008
4	10,760	3,127	4,056	907	2,026	844	229	2,072	23,015
total	36,850	10,195	13,338	3,203	5,711	2,522	817	6,439	61,695
1993									
1	9,076	2,666	3,268	670	1,452	691	212	1,655	18,400
2	9,381	2,442	3,051	781	1,148	787	244	2,497	20,961
3	11,125	3,220	4,432	688	1,649	936	378	2,107	24,729
4	11,975	3,642	4,465	1,071	2,002	900	251	2,317	27,749
total	41,557	11,873	15,857	3,471	6,251	3,214	1,085	6,986	92,413

水道料金体系

使用水量 ( $\text{m}^3/\text{月}$ )	アマン地区 ( $\text{JD}/\text{m}^3$ )	その他の地区 ( $\text{JD}/\text{m}^3$ )
0 - 20	0.10	0.085
21 - 40	0.19	0.090
41 - 70	0.40	0.30
71 - 100	0.50	0.50
101 以上	0.80	0.60

(注) J.D=14817 (1994.4)

月別上水道配水量 (1992)

(1,000)

	Amman	Zarqa	Irbid	Ma'raq	Balqa	Karak	Tafilah	Ma'an	Total
January	7,957	1,651	2,340	835	870	474	164	990	15,281
February	6,710	1,583	1,832	753	914	476	159	974	13,407
March	8,969	1,803	2,295	1,132	1,088	579	208	1,105	17,179
小計	23,636	5,043	6,467	2,720	2,872	1,529	531	3,069	45,867
April	7,534	1,703	2,567	1,038	1,220	583	199	1,297	16,141
May	8,253	1,873	2,845	1,366	1,203	614	211	1,498	17,923
June	8,821	1,937	2,925	1,346	1,403	635	229	1,551	18,857
小計	24,608	5,513	8,337	3,750	3,886	1,832	639	4,356	52,921
July	9,045	2,065	2,863	1,403	1,362	678	217	1,626	19,259
August	8,508	2,141	3,042	1,579	1,418	646	215	1,802	19,351
September	8,477	2,080	2,742	1,655	1,520	674	208	1,836	18,992
小計	26,030	6,266	8,547	4,637	4,300	1,998	640	5,064	57,602
October	8,581	2,305	2,910	1,602	1,563	650	225	1,453	19,360
November	7,631	2,065	2,653	829	1,521	553	192	1,302	16,746
December	7,824	1,456	2,478	705	1,406	444	155	1,268	15,736
小計	24,036	5,886	8,041	3,136	4,490	1,657	573	4,023	51,842
合計	98,310	22,728	31,492	14,243	15,548	7,016	2,383	16,512	208,232

月別上水道料金支払水量 (1992)

(1,000)

	Amman	Zarqa	Irbid	Ma'raq	Balqa	Karak	Tafilah	Ma'an	Total
January									
February									
March									
小計	8,121	2,185	2,727	829	963	596	184	1,457	17,052
April									
May									
June									
小計	10,020	2,629	3,576	836	1,608	725	196	2,906	22,498
July									
August									
September									
小計	10,700	3,127	4,065	907	2,025	846	229	2,011	23,912
October									
November									
December									
小計	9,076	2,567	3,258	670	1,452	691	212	1,555	19,481
合計	37,917	10,508	13,626	3,244	6,048	2,860	821	7,929	82,953
徴収1-3	34	43	42	30	34	39	35	47	37
徴収4-6	41	48	43	22	41	40	31	67	43
徴収7-9	41	50	47	20	47	42	36	40	42
徴収10-12	38	44	41	21	32	42	37	39	38

file : actual85

## ACTUAL RESULTS OF THE YEAR 1993

AMMAN GOVERNORATE 1993									
THE COST FACTOR = 556 FLS									
block	no. of bills	consumption	amount J.D.	% of cus.	% of cons.	% of reve.	cost J.D.	subsidy J.D.	% of cost by
block M3	no. of bills	consumption	amount J.D.	% of cus.	% of cons.	% of reve.	cost J.D.	subsidy J.D.	% of cost by
00 - 20	314,361	3,482,174	507,057	36.01%	8.40%	4.10%	1,936,089	1,428,032	75.44%
21 - 40	270,631	8,178,712	1,068,635	31.00%	19.73%	8.62%	4,527,364	3,480,729	78.23%
41 - 70	171,300	9,114,834	1,898,633	19.82%	21.95%	15.34%	5,067,848	3,160,225	63.92%
71 - 100	60,763	5,087,537	1,497,059	6.98%	12.27%	12.10%	2,828,671	1,330,982	48.09%
101 - more	55,966	15,590,153	7,403,315	6.41%	37.61%	58.83%	8,663,125	1,264,810	14.81%
TOTAL	873,051	41,453,410	12,373,319	100.00%	100.00%	100.00%	22,043,098	10,574,777	47.34%

## OUTSIDE AMMAN 1993

block	no. of bills	consumption	amount J.D.	% of cus.	% of cons.	% of reve.	cost J.D.	subsidy J.D.	% of cost by
block	no. of bills	consumption	amount J.D.	% of cus.	% of cons.	% of reve.	cost J.D.	subsidy J.D.	% of cost by
00 - 20	338,455	4,066,460	358,492	32.98%	8.66%	3.59%	2,285,912	1,502,460	66.00%
21 - 40	374,572	11,178,446	666,792	36.50%	24.96%	8.61%	6,516,012	5,649,220	86.61%
41 - 70	218,377	11,466,574	1,497,630	21.09%	24.52%	14.87%	6,375,415	4,877,785	76.20%
71 - 100	50,135	4,725,713	1,057,730	5.47%	10.09%	10.51%	2,827,486	1,559,706	55.10%
101 - more	40,843	14,981,052	6,287,536	3.96%	31.90%	62.45%	8,023,465	2,041,909	25.08%
TOTAL	1,026,182	46,959,245	10,063,200	100.00%	100.00%	100.00%	26,105,340	16,041,740	62.79%

## JORDAN VALLEY 1993

block	no. of bills	consumption	amount J.D.	% of cus.	% of cons.	% of reve.	cost J.D.	subsidy J.D.	% of cost by
block	no. of bills	consumption	amount J.D.	% of cus.	% of cons.	% of reve.	cost J.D.	subsidy J.D.	% of cost by
00 - 40	40,503	930,505	68,362	58.63%	24.12%	12.38%	519,029	452,877	87.14%
41 - 70	18,024	948,383	73,008	26.09%	24.50%	13.62%	527,273	454,265	86.05%
71 - 100	6,101	535,970	64,097	8.83%	13.85%	11.96%	297,999	233,902	80.22%
101 - 150	2,667	324,723	59,332	3.89%	8.39%	11.07%	180,546	121,214	67.14%
151 - more	1,785	1,127,740	273,077	2.58%	29.14%	50.96%	627,023	353,946	56.39%
TOTAL	69,080	3,870,271	595,866	100.00%	100.00%	100.00%	2,157,871	1,616,004	76.75%

## ALL JORDAN 1993

## DISTRIBUTION SHEET 1993

block	no. of bills	consumption	amount J.D.	% of cus.	% of cons.	% of reve.	cost J.D.	subsidy J.D.	% of cost by
block	no. of bills	consumption	amount J.D.	% of cus.	% of cons.	% of reve.	cost J.D.	subsidy J.D.	% of cost by
00 - 20	682,319	3,482,138	521,901	35.22%	9.19%	4.06%	4,716,069	3,784,168	80.01%
21 - 40	683,277	20,840,491	2,006,436	33.70%	22.59%	8.73%	11,590,649	9,364,213	80.41%
41 - 70	393,778	21,117,378	3,480,350	20.01%	22.88%	15.06%	11,741,262	8,280,912	70.59%
71 - 100	119,585	10,137,973	2,314,751	6.08%	10.89%	11.38%	5,838,713	3,021,962	51.76%
101 - more	98,364	31,688,945	13,863,948	5.00%	34.35%	60.77%	17,824,613	3,660,665	20.52%
TOTAL	1,968,353	82,282,926	22,877,386	100.00%	100.00%	100.00%	51,309,307	28,331,921	55.21%