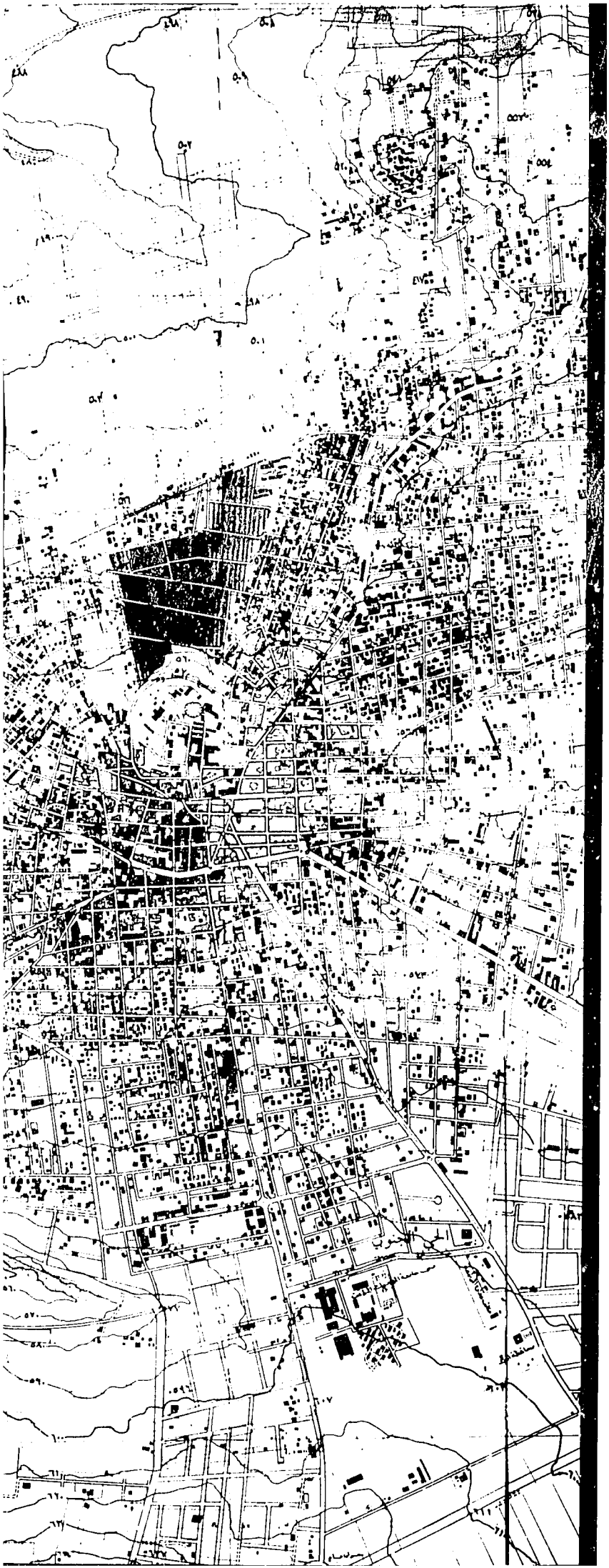

Final
Report
Addendum

FEASIBILITY REPORT
AND PRELIMINARY
ENGINEERING STUDIES

# IRBID MUNICIPAL WATER DISTRIBUTION, SEWERAGE, STORM DRAINAGE AND SOLID WASTE DISPOSAL PROJECT

SUBMITTED THRU

**MINISTRY OF MUNICIPAL, RURAL AND ENVIRONMENTAL AFFAIRS - EXECUTING AGENCY**

TO THE

**NATIONAL PLANNING COUNCIL - THE HASHEMITE KINGDOM OF JORDAN**

August 1980

By
WESTON INTERNATIONAL, INC.

in association with
STANLEY CONSULTANTS, INC.
SIGMA-CONSULTING ENGINEERS
MRM-CONSULTING ENGINEERS
CO., LTD.

PN-AAV-670

WESTON INTERNATIONAL, INC.

CONSULTANTS-DESIGNERS

WESTON WAY • WEST CHESTER, PA 19380 • PHONE: (215) 692-3030 • TELEX: 83-5348 • FROM OFFICE OF THE PRESIDENT, JAMES P. MILLER, P.E.

22 August 1980

Ministry of Municipal,
Rural and Environmental Affairs
Amman, Jordan

Subject: Letter of Transmittal, Report Addendum, Irbid Municipal Water Distribution, Sewerage, Storm Drainage and Solid Waste Disposal Project.

Gentlemen:

Transmitted herewith are 50 copies of the subject report addendum which contains the following information:

| Section | Title |
|---|---|
| 1 | Population Estimates -- Revised population estimates based on the results of the 1979 census. |
| 2 | Wastewater Treatment Alternatives Analysis -- A summary of the analysis of alternatives for wastewater treatment plant sites and treatment processes. |
| 3 | Financial Chapter Revisions -- Revisions requested by NPC/USAID/World Bank. |
| 4 | Responses to Comments -- Responses to comments received from MMREA/NPC/USAID. |
| 5 | Analysis of AID-Funded Project -- Financial analysis of the AID-funded portion of the project. |
| 6 | Cost Estimates -- Water distribution and sewage collection system. |

The revisions contained in this addendum were withheld until liaison work with AID and other financial agencies was completed. In addition, revisions have been made to Chapter 1, the Report Summary, and an Executive Summary has been prepared.

This information is intended to be fully responsive to all comments received by Weston International and its subcontractors by letter and during the March and April meetings at NPC's offices in Amman. In addition, 30 copies of the original draft feasibility report have been forwarded for your use.

If there are further comments or questions, please contact me.

Respectfully submitted,

WESTON INTERNATIONAL, INC.

James P. Miller, P.E.
President

JPM:gw

cc: National Planning Council
Amman USAID/Jordan - Attn: Mr. Cassanos
AID - Washington - Attn: Mr. Fedel

# FINAL REPORT ADDENDUM

Feasibility Report and Preliminary
Engineering Studies

IRBID MUNICIPAL WATER DISTRIBUTION,
SEWERAGE, STORM DRAINAGE AND
SOLID WASTE DISPOSAL PROJECT

Submitted Through
Ministry of Municipal, Rural and
Environmental Affairs --
Executing Agency

To The
National Planning Council
The Hashemite Kingdom of Jordan

August 1980

By
Weston International, Inc.

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## SECTION 1

## POPULATION ESTIMATE REVISIONS

### 1.1 GENERAL

Subsequent to completion and submittal of the draft report to the Ministry of Municipal, Rural, and Environmental Affairs (MMREA, the executing agency) and the National Planning Council, the consultant was informed that preliminary results of the population census conducted in Irbid were available.

### 1.2 CENSUS RESULTS

The Irbid census was taken within the Irbid Town Plan boundary, an area coincident with the project area for the Water, Sewerage, Storm Drainage and Solid Waste Disposal Project. The preliminary census figures show that the actual population in Irbid at the end of 1979 was about 113,000. This number is about 15,000 people less than the 128,000 population estimated by the consultant, a variance of about 12 percent.

The census work also indicated that the average household size was about 7 persons per household, rather than the 8 person per household figure estimated by the consultant using field case study data.

### 1.3 REVISED POPULATION ESTIMATES

The 1979 census population figure for Irbid of 113,000 was used as the basis for reestimating the future population of Irbid using the same growth assumptions specified in the consultant's agreement, which is 4.5 percent growth to 1985, and 4 percent thereafter to the year 2000. The revised population estimates are shown on Figure 1-1 and Table 1-1, both entitled "Revised Population Projections."

### 1.4 IMPACTS OF REVISED ESTIMATE

The numerical impact of starting from the lower population base (i.e., 113,000 vs. 128,000) is to lower the year 2000 projected population from 358,000 to 265,000, a reduction of about 26 percent for the planning period.



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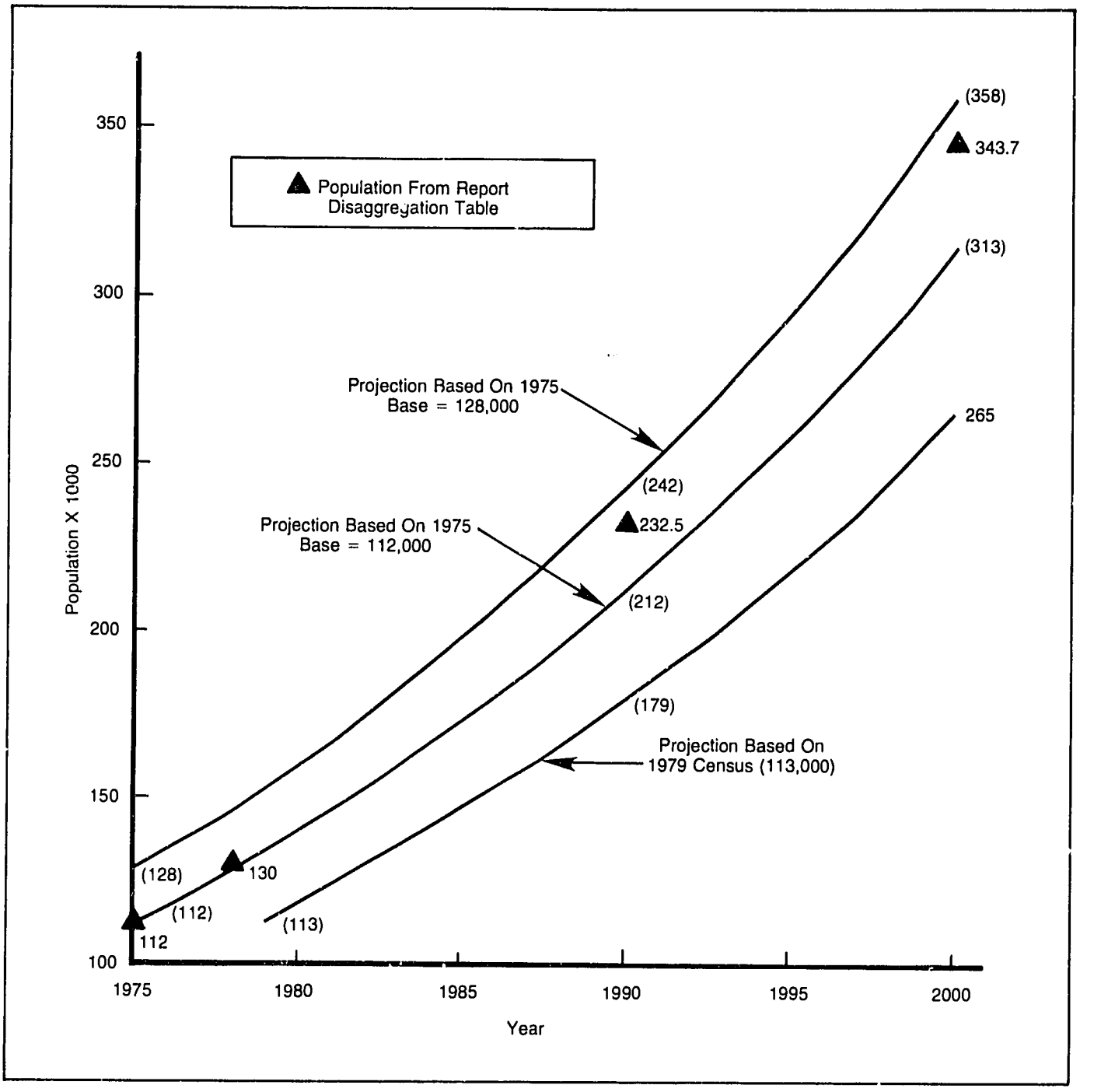


**FIGURE 1-1 REVISED POPULATION PROJECTIONS**



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Table 1-1

Revised Population Projections

| Year | Growth Rate % Per Year | 1975 Base = 112,000 Population x 1,000 | 1975 Base = 128,000 Population x 1,000 | Population From Report Disaggregation Tables | Census 1979 Base = 113,000 Population x 1,000 |
|---|---|---|---|---|---|
| 1975 | 4.5 | 112 | 128 | 112 (128 - 16 = 112) | - |
| 1976 | 4.5 | 117 | 134 | | - |
| 1977 | 4.5 | 122 | 140 | | - |
| 1978 | 4.5 | 128 | 146 | 130 (146 - 16 = 130) | - |
| 1979 | 4.5 | 134 | 153 | | 113 |
| 1980 | 4.5 | 140 | 160 | | 118 |
| 1981 | 4.5 | 146 | 167 | | 123 |
| 1982 | 4.5 | 152 | 174 | | 129 |
| 1983 | 4.5 | 159 | 182 | | 135 |
| 1984 | 4.5 | 166 | 190 | | 141 |
| 1985 | 4.5 | 174 | 199 | | 147 |
| 1986 | 4.0 | 181 | 207 | | 153 |
| 1987 | 4.0 | 188 | 215 | | 159 |
| 1988 | 4.0 | 196 | 224 | | 165 |
| 1989 | 4.0 | 204 | 233 (232.5) | 232.5 | 172 |
| 1990 | 4.0 | 212 | 242 | | 179 |
| 1991 | 4.0 | 220 | 252 | | 186 |
| 1992 | 4.0 | 229 | 262 | | 194 |
| 1993 | 4.0 | 238 | 272 | | 201 |
| 1994 | 4.0 | 248 | 283 | | 209 |
| 1995 | 4.0 | 258 | 294 | | 218 |
| 1996 | 4.0 | 268 | 306 | | 227 |
| 1997 | 4.0 | 279 | 318 | | 236 |
| 1998 | 4.0 | 290 | 331 | | 245 |
| 1999 | 4.0 | 301 | 344 (344.2) | 343.7 | 255 |
| 2000 | 4.0 | 313 | 358 | | 265 |



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A reduction of this magnitude obviously gives rise to the question of whether the sizes of the recommended facilities should be reduced to reflect the lower estimates.

### 1.4.1 Water Distribution System

No changes in the proposed water distribution system are recommended. The population projection shown on Figure 1-1, if extended, shows that the population will reach the figure originally estimated by about the year 2010, or 10 years (±) later, assuming the growth rates given in the agreement are accurate. Therefore, the capacity recommended in the original draft report will be needed within the useful service life of the system. It is more economical to build in the capacity now than to enlarge the system in 20 years and pay the premium of inflated construction costs.

### 1.4.2 Sewage Collection System

The same comments apply to the sewage collection system. Pump choices in lift stations may be affected, but this can be incorporated during the final design process.

### 1.4.3 Sewage Treatment Plant

The extended air process sewage treatment plant recommended in the draft report is of modular design, with capacity modules to be added as flow increases. The staging of construction of these modules will be affected. This has been taken into account in revisions to the report summary and the financial chapter revisions shown in addendum Sections 3 and 5.

### 1.4.4 Solid Waste Collection System

The reduced population estimates will affect the projections of waste generation and landfill utilization. Equipment sizes and personnel requirements are not affected.

### 1.4.5 Storm Drainage System

No impacts from the revised population estimates will be felt on the storm drainage system.

### 1.4.6 Financial Impacts

Less people mean less revenue and either higher rates or higher subsidies during the life of the project. The revisions to Chapter 9 take the reduced population into account.



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## SECTION 2

## WASTEWATER TREATMENT ALTERNATIVES ANALYSIS

### 2.1 INTRODUCTION

Two major issues were raised by MMREA, NPC and AID during the review of the draft feasibility report. These issues were as follows:

1. Site selection -- The treatment plant site selected was questioned due to its proximity to the town.

2. Treatment process -- The analysis of treatment process alternatives was to be reviewed to see if all alternatives were compared on a least-cost basis. Some reviewers questioned the selection of a medium-technology solution, i.e., the "extended-air" process, based on the difficulty of properly operating and maintaining such a facility in a developing nation.

The consultant's response to these issues is described in the following subsections.

### 2.2 SITE SELECTION

During the course of the feasibility studies, the site selection process included the following steps:

1. First, a large-scale (1:10,000) map reconnaissance was made in conjunction with studies of alternative collection system configurations to verify that the Irbid Town Plan area could be largely served by a gravity-type collection system. This study showed that a gravity collection system was possible with only minor pumping required to serve isolated low spots in the urban area. Preliminary cost analysis showed that a gravity system configuration was the least-cost alternatives, as would be expected. Due to the topographic features of the Irbid Town Plan area, the selection of a gravity sewer configuration and the requirement to

maintain minimum flow velocities in the sewers, limits the sites available for gravity flow to, and through a treatment plant to the vicinity of the existing slaughterhouse in the northwest corner of the Town Plan area. All other sites would involve either a multiple treatment plant solution, or would require pumping to reach the site, and were rejected by the consultant because of the additional capital costs and energy costs required.

These studies assumed the site would require about 10 hectares (24.8 acres) of area which is normal for conventional medium-technology treatment facilities of most types.

2. In addition, sites were identified which would contain enough area for some sort of low-technology ponding-type treatment process. Rough sizing studies indicated that the area requirements for such processes ranged from about 25 hectares (60 acres) to about 180 hectares (450 acres), depending on the type of process.

   There are no sites available which would permit serving low-technology treatment solutions by gravity.

3. When the consultant was finally given the 1:1,250-scale maps by the NPC, the collection system analysis was verified, and two medium-technology treatment sites were selected: one to the east of the municipal slaughterhouse and the other to the west of the Irbid Town Plan area between Wadis Tarq Saum and Hamman. Both would ultimately discharge to the Wadi Arab. In addition, low-technology ponding sites were selected in three areas:

   a. The undeveloped area northwest of the present urban area.

   b. The agricultural area north of the Town Plan area.



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c. The undeveloped area near the industrial park in the northeast section outside the Town Plan area.

All of these areas would require that the entire flow from the collection system would have to be pumped.

The land areas and costs for the various sites associated with the treatment processes considered are shown on Table 2-1. It is apparent that the land cost is a critical parameter. Information on land costs were requested from the Municipality of Irbid. The consultant was informed that the undeveloped land area in the northwest section of the Town Plan area is valued at 1.500 to 2.000 JD per square meter, and other areas are valued at 1.000 to 1.500 JD per square meter.

For feasibility report purposes, the cost of land was taken to be 1.500 JD per square meter, and used as the basis for comparison of alternatives. The consultant was informed that the Municipality of Irbid has inquired about the land availability for all of these sites, and feels that the land cost assumed is realistic in the current real estate market. Actual prices will not be known, of course, until the District Authority takes steps to acquire the land. This land acquisition action should be undertaken as soon as possible.

The sites described in Table 2-1 were visited by representatives of the consultant, the NPC, MMREA, USAID/Jordan and AID/Washington on 27 March 1980. During this visit, the characteristics of each site in relation to the requirements of the collection system and the various treatment process alternatives were explained by the consultant. It was generally agreed that the recommended site for the medium-technology alternatives was the most practicable.

## 2.3 TREATMENT PROCESS ALTERNATIVES

During the feasibility studies, the formulation of treatment process alternatives was based on certain criteria described in Chapter 3 of the final feasibility report. These criteria were selected by the consultant and are based on current conditions in Jordan, good engineering practice in the field of sanitary engineering, and the experiences of the consultant's staff in preparing such criteria for similar areas.



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Table 2-1

Treatment Plant Site Areas and Costs

| Treatment Process | | Area (Ha) | Cost (JD) |
|---|---|---|---|
| LT-1,2 | Facultative Waste Stabilization Ponds | 172 | 2,580,000 |
| LT-3,4 | Anaerobic/Aerobic Ponds | 132 | 1,980,000 |
| LT-5,6 | Aerated Lagoons | 60 | 900,000 |
| LT-7,8 | Anaerobic Pond/Aerated Lagoons | 27 | 405,000 |
| MT-1 | Rotating Biological Filter | 6 | 90,000 |
| MT-2 | Trickling Filter/Activated Sludge | 6 | 90,000 |
| MT-3 | Activated Sludge with Nitrification | 6 | 90,000 |
| MT-4 | Extended Air/Activated Sludge | 6 | 90,000 |
| MT-5 | Oxidation Ditch/Activated Sludge | 6 | 90,000 |

Application of these criteria resulted in the formulation of both low- and medium-technology alternatives for wastewater treatment processes capable of meeting the selected criteria. High-technology alternatives were not considered because there is no apparent need for such sophisticated levels of treatment in Jordan at this time. The low-technology alternatives included:

1. Facultative - waste stabilization ponds.
2. Anaerobic/aerobic ponds.
3. Aerated lagoons.
4. Anaerobic ponds followed by aerated lagoons.

Medium-technology process alternatives considered included:

1. Rotating biological filters.
2. Trickling filters.
3. Activated sludge process with nitrification.
4. Extended air-activated sludge.
5. Oxidation ditch-activated sludge.

These alternatives were formulated in terms of the system components of each as shown on Figure 2-1. Items common to all alternatives were not considered because they do not influence the "least-cost" method of analysis.

This "common basis, least-cost analysis" shows that the best low-technology alternative is anaerobic/aerobic ponds built at either sites 3 or 4. The annualized cost for capital facilities and operations and maintenance is about 623,000 JD. The best medium-technology alternative is the extended aeration process, a variant of the activated sludge treatment method, at site 1. Its comparable annualized cost is about 548,000 JD. These figures are shown on Table 2-2.

The variables that have the greatest influence on the selection of the recommended "least-cost" alternative, the extended aeration process, are land costs and O&M costs such as power, labor, and materials. To test the sensitivity of the recommended alternative to these variables, an analysis was made as shown on Table 2-3. This sensitivity analysis demonstrates that the medium-technology alternative recommended is valid even if significant increases in power and other annual costs are experienced.



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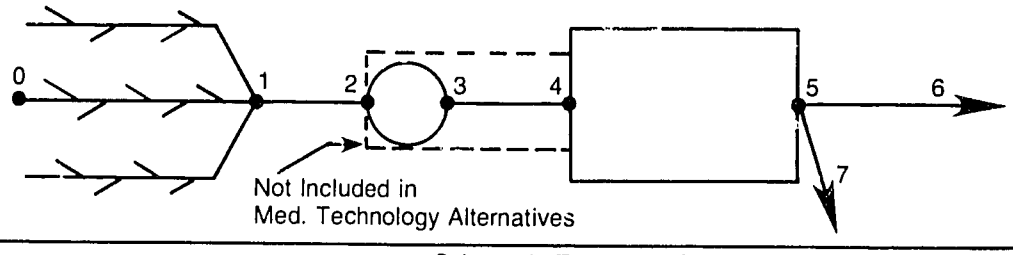


Schematic Treatment System

| System Components | | | Elements Included in Alternative No.: | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | LT-1 | LT-2 | LT-3 | LT-4 | LT-5 | LT-6 | LT-7 | LT-8 | MT-1 | MT-2 | MT-3 | MT-4 | MT-5 |
| 0 | 1 | Collection System | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| 1 | 2 | Interceptor | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| 2 | 3 | Raw Sewage Pump Station | ● | ● | ● | ● | ● | ● | ● | ● | | | | | |
| 3 | 4 | Force Main | ● | ● | ● | ● | ● | ● | ● | ● | | | | | |
| 4 | 5 | Treatment Process | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| 5 | 6 | Effluent Disposal | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| 5 | 7 | Sludge Disposal | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| | | | Facultative-Waste Stabilization Ponds I | Facultative-Waste Stabilization Ponds II | Anaerobic/Aerobic Ponds I | Anaerobic/Aerobic Ponds II | Aerated Lagoons I | Aerated Lagoons II | Anaerobic Pond/Aerated Lagoons I | Anaerobic Ponds/Aerated Lagoons II | Rotating Biological Filter | Trickling Filter/Activated Sludge | Activated Sludge with Nitrification | Extended Air/Activated Sludge | Oxidation Ditch/Activated Sludge |

LT - Low Technology
MT - Medium Technology

| Parameters Included in Analysis Alternatives: | LT-1 | LT-2 | LT-3 | LT-4 | LT-5 | LT-6 | LT-7 | LT-8 | MT-1 | MT-2 | MT-3 | MT-4 | MT-5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Collection System/Interceptor | – | – | – | – | – | – | – | – | – | – | – | – | – |
| 2 Raw Water Pump Station Power Cost | ● | ● | ● | ● | ● | ● | ● | ● | – | – | – | – | – |
| 3 Force Main | ● | ● | ● | ● | ● | ● | ● | ● | – | – | – | – | – |
| 4 Treatment Process | | | | | | | | | | | | | |
| 4-1 Land Area/Cost | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| 4-2 Site Preparation/Grading/Fencing | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| 4-3 Capital Construction Costs (Structures/Equipment) | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| 4-5 O&M Costs | | | | | | | | | | | | | |
| -Materials | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| -Labor | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| -Power | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| -Chemicals | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| 5 Sludge Disposal | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| 6 Effluent Disposal | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| 7 Environmental Impacts | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |

Note: Items common to all alternatives are not included in analysis.

**FIGURE 2-1 IRBID WASTEWATER TREATMENT SYSTEM -- ALTERNATIVES ANALYSIS**



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Table 2-2

## Comparison of Wastewater Alternatives

| Parameter | Stage | LT-1 | LT-2 | LT-3 | LT-4 | LT-5 | LT-6 | LT-7 | LT-8 | MT-1 | MT-2 | MT-3 | MT-4 | MT-5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Costs in Thousands of JD - Alternative | | | | | | | | | | | | |
| 1. Land Area Required - hectares | | 172 | 172 | 132 | 132 | 60 | 60 | 27 | 27 | 6 | 6 | 6 | 6 | 6 |
| CAPITAL COSTS | | | | | | | | | | | | | | |
| 1. Raw Sewage Pump Station | I | 200 | 250 | 200 | 250 | 200 | 250 | 200 | 250 | - | - | - | - | - |
| | II | 100 | 125 | 100 | 125 | 100 | 125 | 100 | 125 | - | - | - | - | - |
| 2. Force Main | I | 85 | 200 | 85 | 200 | 85 | 200 | 85 | 200 | - | - | - | - | - |
| | II | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3. Land Costs | I | 2,580 | 2,580 | 1,980 | 1,980 | 900- | 900 | 405- | 405 | 90 | 90 | 90 | 90 | 90 |
| | II | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 4. Site Preparation/Grading/Fencing | I | 1,040 | 572 | 800 | 436 | 436 | 238 | 97 | 97 | 40 | 40 | 40 | 40 | 40 |
| | II | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 5. Preliminary Treatment Works | I | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 100 | 100 | 100 | 100 | 100 |
| | II | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 37 | 50 | 50 | 50 | 50 | 50 |
| 6. Primary Treatment Works | I | - | - | - | - | - | - | - | - | 150 | 150 | 150 | - | - |
| | II | - | - | - | - | - | - | - | - | 75 | 75 | 75 | - | - |
| 7. Biological Treatment | I | - | - | - | - | - | - | - | - | 3,430 | 1,211 | 1,068 | 982 | 1,844 |
| | II | - | - | - | - | - | - | - | - | 1,528 | 314 | 418 | 599 | 911 |
| 8. Final Clarification | I | - | - | - | - | 60 | 60 | 60 | 60 | 149 | 149 | 149 | 149 | 149 |
| | II | - | - | - | - | 30 | 30 | 30 | 30 | 74 | 74 | 74 | 74 | 74 |
| 9. Disinfection/Reaeration | I | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| | II | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| 10. Gravity Thickeners | I | - | - | - | - | - | - | - | - | 92 | 92 | 92 | - | - |
| | II | - | - | - | - | - | - | - | - | 46 | 46 | 46 | - | - |
| 11. Sludge Holding Tanks | I | - | - | - | - | - | - | - | - | - | - | - | 109 | 210 |
| | II | - | - | - | - | - | - | - | - | - | - | - | 64 | 105 |
| 12. Two-Stage Anaerobic Digesters | I | - | - | - | - | - | - | - | - | 561 | 561 | 561 | - | - |
| | II | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 13. Mechanical Sludge Dewatering | I | - | - | - | - | - | - | - | - | 109 | 109 | 109 | 109 | 109 |
| | II | - | - | - | - | - | - | - | - | 35 | 35 | 35 | 35 | 35 |

Table 2-2

## Comparison of Wastewater Alternatives (continued)

| Parameter | Stage | LT-1 | LT-2 | LT-3 | LT-4 | LT-5 | LT-6 | LT-7 | LT-8 | MT-1 | MT-2 | MT-3 | MT-4 | MT-5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Costs in Thousands of JD - Alternative | | | | | | | | | | | | |
| 14. Ancillary Buildings/Structures | I | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 60 | 71 | 71 | 71 | 71 | 71 |
| | II | - | - | - | - | - | - | - | - | 20 | 20 | 20 | 20 | 20 |
| 15. Facultative Ponds | I | 1,305 | 1,305 | - | - | - | - | - | - | - | - | - | - | - |
| | II | 650 | 650 | - | - | - | - | - | - | - | - | - | - | - |
| 16. Anaerobic Ponds | I | - | - | 260 | 66 | - | - | 260 | 66 | - | - | - | - | - |
| | II | - | - | 130 | 34 | - | - | 130 | 34 | - | - | - | - | - |
| 17. Aerobic Ponds | I | - | - | 538 | 538 | - | - | - | - | - | - | - | - | - |
| | II | - | - | 269 | 269 | - | - | - | - | - | - | - | - | - |
| 18. Slow Sand Filters | I | - | - | 25 | 25 | - | - | - | - | - | - | - | - | - |
| | II | - | - | 12 | 12 | - | - | - | - | - | - | - | - | - |
| 19. Aerated Lagoons (including aerators) | I | - | - | - | - | 3,600 | 1,620 | 1,764 | 924 | - | - | - | - | - |
| | II | - | - | - | - | 1,800 | 800 | 640 | 288 | - | - | - | - | - |
| 20. Emergency Generators | I | 30 | 60 | 30 | 60 | 30 | 60 | 30 | 60 | 33 | 41 | 54 | 54 | 54 |
| | II | 15 | 30 | 15 | 30 | 15 | 30 | 15 | 30 | 14 | 17 | 23 | 23 | 23 |
| 21. Site Piping | I | 30 | 30 | 20 | 20 | 15 | 15 | 10 | 10 | 528 | 282 | 268 | 181 | 288 |
| | II | 20 | 20 | 10 | 10 | 8 | 8 | 5 | 5 | 228 | 93 | 105 | 119 | 136 |
| 22. Total Using Mechanical Dewatering | | | | | | | | | | | | | | |
| a. Capital Cost | | - | - | - | - | - | - | - | - | 7,443 | 3,640 | 3,618 | 2,889 | 4,329 |
| b. Annual Cost | | - | - | - | - | - | - | - | - | 724.5 | 374.9 | 363.5 | 272.1 | 406.4 |
| 23. Sludge Drying Beds (area) - hectares | | - | - | - | - | 7.0 | 7.0 | 7.0 | 7.0 | 9.2 | 9.2 | 9.2 | 9.2 | 9.2 |
| 24. Sludge Drying Cost | I | - | - | - | - | 193 | 193 | 193 | 193 | 251 | 251 | 251 | 251 | 251 |
| | II | - | - | - | - | 27 | 27 | 27 | 27 | 36 | 36 | 36 | 36 | 36 |
| 25. Total Using Sludge Drying Beds (22 - 13 + 24) | | | | | | | | | | | | | | |
| a. Capital Cost | | 6,239 | 6,006 | 4,658 | 4,239 | 7,683 | 4,740 | 4,236 | 2,988 | 7,586 | 3,783 | 3,761 | 3,032 | 4,472 |
| b. Annual Cost | | 673.1 | 642.8 | 505.3 | 460.2 | 756.5 | 480.1 | 426.1 | 309.0 | 741.2 | 391.6 | 380.3 | 284.7 | 427.1 |
| O&M COSTS | | | | | | | | | | | | | | |
| 26. Materials | I | 4.0 | 4.0 | 4.0 | 4.0 | 8.0 | 8.0 | 8.0 | 8.0 | 24.5 | 39.6 | 48.3 | 40.1 | 40.1 |
| | II | 5.0 | 5.0 | 5.0 | 5.0 | 10.0 | 10.0 | 10.0 | 10.0 | 35.5 | 53.9 | 62.0 | 52.3 | 52.3 |
| 27. Power | I | 26.3 | 50.0 | 26.3 | 50.0 | 381.8 | 405.5 | 200.3 | 224.0 | 34.9 | 48.5 | 82.7 | 89.9 | 81.6 |
| | II | 39.4 | 85.0 | 39.4 | 85.0 | 552.4 | 598.0 | 282.0 | 322.0 | 44.0 | 58.5 | 100.6 | 98.0 | 89.2 |
| 28. Labor | I | 56.3 | 56.3 | 56.3 | 56.3 | 69.4 | 69.4 | 69.4 | 69.4 | 89.6 | 89.6 | 87.5 | 83.2 | 83.2 |
| | II | 62.5 | 62.5 | 62.5 | 62.3 | 77.2 | 77.2 | 77.2 | 77.2 | 100.2 | 99.3 | 96.9 | 92.4 | 92.4 |
| 29. Chemicals | I | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 | 3.6 |
| | II | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 | 3.7 |
| 30. Sludge Disposal | I | - | - | 5.0 | 5.0 | 8.0 | 8.0 | 6.3 | 6.3 | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 |
| | II | - | - | 7.0 | 7.0 | 11.1 | 11.1 | 8.7 | 8.7 | 16.7 | 16.7 | 16.7 | 16.7 | 16.7 |
| 31. Total O&M Costs (Stage II) | | 110.6 | 156.2 | 117.6 | 163.2 | 654.4 | 700.0 | 381.6 | 421.6 | 200.1 | 232.1 | 279.9 | 263.1 | 254.3 |
| 32. Total Annual Costs (25b + 31) | | 783.7 | 799.0 | 622.9 | 623.4 | 1,410.9 | 1,180.1 | 807.7 | 730.6 | 941.3 | 623.7 | 660.2 | 547.8 | 681.4 |

# Table 2-3

## Sensitivity Analysis

| Item | Annualized Costs in 000's JD For Alternatives No.: | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LT-1 | LT-2 | LT-3 | LT-4 | LT-5 | LT-6 | LT-7 | LT-8 | MT-1 | MT-2 | MT-3 | MT-4 | MT-5 |
| 1. Capital Costs | 673.1 | 642.8 | 505.3 | 460.2 | 756 | 480.1 | 426.1 | 309.0 | 741.2 | 391.6 | 380.3 | 284.7 | 427.1 |
| 2. Annual O&M Costs (Stage II) | 110.6 | 156.2 | 117.6 | 163.2 | 654.4 | 700.0 | 381.6 | 421.6 | 200.1 | 232.1 | 272.9 | 263.1 | 254.3 |
| 3. Total Costs | 783.7 | 799.7 | 622.9 | 623.4 | 1,410.9 | 1,180.1 | 807.7 | 730.6 | 941.3 | 623.7 | 660.2 | 547.8 | 681.4 |
| 4. Power Costs Sensitivity (Double Stage II Rate - Add | 39.4 | 85.0 | 39.4 | 85.0 | 552.4 | 598.0 | 282.0 | 322.0 | 44.0 | 58.5 | 100.6 | 98.0 | 89.2 |
| 5. Total Cost - Adjusted for Increased Power | 823.1 | 884.7 | 662.3 | 708.4 | 1,963.3 | 1,778.1 | 1,089.7 | 1,052.6 | 985.3 | 682.2 | 768.8 | 645.8 | 770.6 |
| 6. Test 3 for 25% Reduction in Land Cost - Subtract from 3 | 32.2 | 32.2 | 24.8 | 24.8 | 11.3 | 11.3 | 5.1 | 5.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| 7. Total Cost - Adjusted for Decreased Land Cost | 751.5 | 767.5 | 598.1 | 598.6 | 1,399.6 | 1,168.8 | 802.6 | 725.5 | 940.2 | 622.6 | 659.1 | 546.7 | 680.3 |
| 8. Test 3 for 100% Power Increase Plus 25% Land Cost Reduction (5-6) | 790.9 | 852.5 | 637.5 | 683.6 | 1,952.0 | 1,766.8 | 1,084.6 | 1,047.5 | 984.2 | 682.1 | 767.7 | 644.7 | 769.5 |

1. Sensitivity Analysis Notes

1.1 The MT-3 (extended air plant) alternative is the least-cost solution, and is sensitive only to increased costs of power, labor, and materials when coupled with land cost reductions. Present trends in the Irbid area are toward land cost appreciation, so the real sensitivity is to increased O&M costs.

Using LT-3 (anaerobic/aerobic ponds on site 3) as the most comparable alternative, mathematically O&M costs (overall) must increase 139% while land costs remain about the same to achieve a break-even case. While power and other labor costs may well experience increases of this magnitude, corresponding land costs are appreciating at a rate equal to or faster than power cost and other O&M costs. Therefore, the medium-technology solution appears to be the more appropriate choice.

$$505.3 + 117.6\ (n) = 284.7 + 263.1\ (n)$$
$$202.6 = 145.5\ n$$
$$1.3924 = n$$

## 2.4 CONCLUSIONS

Based on the results of the work summarized, it is apparent that the extended aeration treatment process located at site 1, as recommended by the consultant in the feasibility report, is the best choice on a "least-cost" basis of alternative analysis.

Medium-technology facilities are harder to operate and maintain than the low-technology options. This will have to be taken into consideration by the Jordanian government when the recommended training plan is implemented and in the management approach to be used to retain operators in their positions.

## SECTION 3

## REVISIONS TO CHAPTER 9
## ECONOMIC AND FINANCIAL FEASIBILITY ANALYSIS

### FOREWORD

This portion of the addendum provides revisions to Chapter 9, "Economic and Financial Feasibility Analysis," drafted in September 1979 and revised in February 1980. The changes reflect responses to comments prepared by the various reviewers of the report, and adjustments in base assumptions proposed by the funding agencies.



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CHAPTER 9

# ECONOMIC AND FINANCIAL FEASIBILITY ANALYSIS (REVISED)

## 9.1 INTRODUCTION AND PURPOSE

This addendum presents the analysis of the financial and economic aspects of the recommended facility improvements associated with satisfying the Phase 1 development needs for the City of Irbid through 1989. The chapter begins with a section on the costs of the recommended Phase 1 and subsequent Phase 2 facilities. Other sections of this chapter present the financial and economic analyses, including information on possible rate structures, possible needs for subsidies, and financial interval rate of return analysis based on 1979 costs. The financial analysis is summarized in financial statements for the first phase of the project.

The addendum is supported by several appendices (attached to the draft report) which present the details of the methods and evaluations. These appendices substantiate the economic and financial evaluation objectives of this chapter. They are titled: Appendix D, "Utility Pricing Approaches and Policy Considerations"; Appendix E, "Cash Flow Analysis Model"; and Appendix F, "Analysis of Economic Benefits from Planned Project Development."

A cash flow model is used in this study to estimate escalated costs of capital and equipment, and operation and maintenance. The model is also used to determine user charges and fees that will generate sufficient revenues to cover the costs of operation. The model provides inputs to the conventional financial statements, but is not directly connected, and does not produce a balance sheet financial statement as may be misunderstood by the name of the model.

Special attention is directed to rates, fees, and charges. The purpose is to propose an affordable, cost-effective project for the residents of Irbid to meet existing and future needs. This analysis involves testing variables such as phasing, inflation rates, and user charges and fees as to their effects on the generation of revenues and costs over the analysis period.

During the preparation of this preliminary feasibility study, sources of grants and loans have been identified, including a $3 million (U.S. dollars) grant (910,000 JD) from USAID (not applicable to the solid waste project), and a $21 million (U.S. dollars) loan (6,360,000 JD). Financing the proposed project, according to discussions with National Planning Council staff, will depend on foreign sources for 70 percent of the investment needs, and local sources for the remaining 30 percent.

## 9.2 COST SUMMARIES BY CONSTRUCTION STAGE

This section presents the detailed capital and construction costs associated with the Phase 1 and Phase 2 project objectives for the proposed water distribution, wastewater collection and treatment, solid waste disposal, and stormwater drainage schemes. Cost data are presented as follows:

1. Basis of cost estimates.
2. Phase 1 costs.
3. Phase 2 costs.

Price escalation is discussed in this section, as well as selection of a discount rate suitable for evaluation of project alteratives. The cost estimates are used as inputs to the economic and financial analysis.

Table 9-1 summarizes the cost in constant 1979 JD for Phases 1 and 2, and provides total project costs.

### 9.2.1 Basis of Cost Estimates

#### 9.2.1.1 Unit Costs.

Unit costs are used to derive the capital and construction cost for each proposed facility plan. These costs are presented in Jordanian dinars (JD), and are based on current (1979) price levels and exchange rates (0.300 JD per U.S. dollar).

1. Project Construction Costs.

Chapters 4, 5, 6, and 7 identify the selected facility plans for water supply, wastewater collection and treatment, stormwater management, and solid waste disposal. The project construction costs include civil works, mechanical and electrical equipment, land acquisition, contingencies, and engineering and administration.

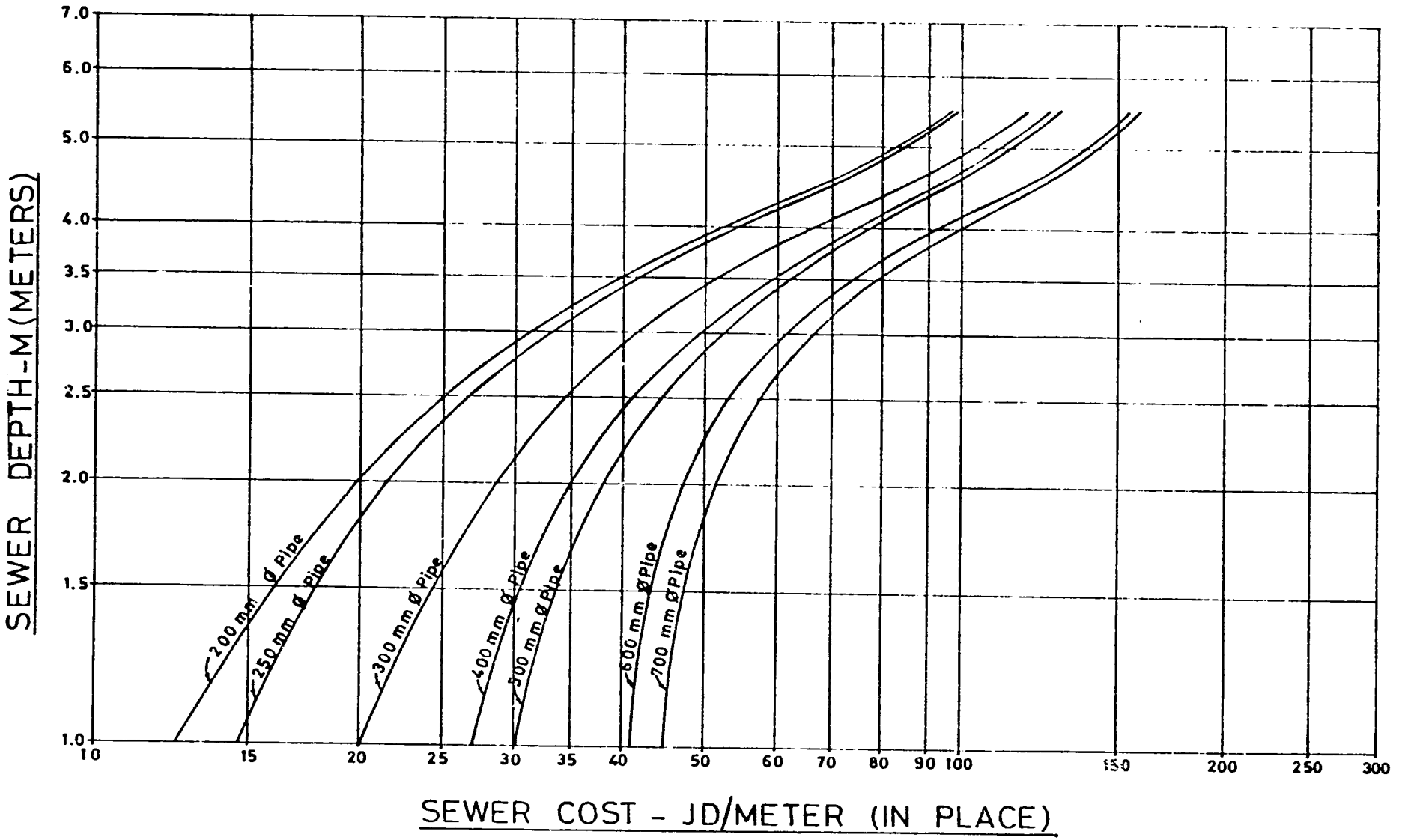
a. Civil works -- Estimates of construction quanti- ties, excavation and backfill were made on the basis of layouts for the proposed facilities. The unit prices were calculated for each item using standard equipment, conventional construction practices, geographical considerations, and experience. Figure 9-1 presents an example of civil works costs. This figure shows the unit cost for sewer pipe (in place) used in this report.

Table 9-1

## Capital Cost Summary
(Costs - JD x 1,000)

| Major Work Element | Phase 1 Local | Phase 1 Foreign | Phase 1 Total | Phase 2 Local | Phase 2 Foreign | Phase 2 Total | Total Project Local | Total Project Foreign | Total Project Total |
|---|---|---|---|---|---|---|---|---|---|
| **Water Supply System** | | | | | | | | | |
| Probable construction cost[1] | 2,279 | 2,264 | 4,543 | 1,978 | 1,799 | 3,777 | 4,257 | 4,063 | 8,320 |
| Contingencies | 341 | 342 | 683 | 295 | 272 | 567 | 636 | 614 | 1,250 |
| Engineering and administration[2] | 228 | 455 | 683 | 189 | 378 | 567 | 417 | 833 | 1,250 |
| Subtotal | 2,848 | 3,061 | 5,909 | 2,462 | 2,449 | 4,911 | 5,310 | 5,510 | 10,820 |
| **Wastewater System** | | | | | | | | | |
| Probable construction cost[1] | 4,170 | 1,910 | 6,080 | 3,025 | 1,367 | 4,392 | 7,195 | 3,277 | 10,472 |
| Contingencies | 625 | 345 | 970 | 454 | 205 | 659 | 1,079 | 550 | 1,629 |
| Engineering and administration[2] | 625 | 345 | 970 | 454 | 205 | 659 | 1,079 | 550 | 1,629 |
| Subtotal | 5,420 | 2,600 | 8,020 | 3,933 | 1,777 | 5,710 | 9,353 | 4,377 | 13,730 |
| **Storm Drainage System** | | | | | | | | | |
| Probable construction cost[1] | 2,289 | 123 | 2,412 | 928 | 14 | 942 | 3,217 | 137 | 3,354 |
| Contingencies | 272 | 18 | 290 | 139 | 2 | 141 | 411 | 20 | 431 |
| Engineering and administration[2] | 91 | 181 | 272 | 47 | 94 | 141 | 138 | 275 | 413 |
| Subtotal | 2,652 | 322 | 2,974 | 1,114 | 110 | 1,224 | 3,766 | 432 | 4,198 |
| **Solid Waste System** | | | | | | | | | |
| Probable construction cost[1] | 449 | 438 | 937 | -- | 316 | 316 | 449 | 754 | 1,253 |
| Contingencies | 26 | -- | 26 | -- | -- | -- | 26 | -- | 26 |
| Engineering and administration[2] | 13 | 12 | 25 | -- | -- | -- | 13 | 12 | 25 |
| Subtotal | 538 | 450 | 988 | -- | 316 | 316 | 538 | 766 | 1,304 |
| Total Project Costs | 11,458 | 6,433 | 17,891 | 7,509 | 4,652 | 12,161 | 18,967 | 11,085 | 30,052 |
| Equivalent U.S. $ Cost (U.S. $ = 0.300 JD) | | 59,637,000 | | | 40,537,000 | | | 100,174,000 | |

[1]Including right-of-way.
[2]Engineering and administration is a fee equal to 15% of the probable construction cost. This represents a commonly used fee which is suitable for the budgetary accuracy required here. A more accurate estimate will be made at the end of the design period.




| | | | |
|---|---|---|---|
| WESTON-INTERNATIONAL, INC.<br>IN ASSOCIATION WITH<br>STANLEY CONSULTANTS, INC.<br>SIGMA CONSULTING ENGINEERS<br>MRM CONSULTING ENGINEERS Co. Ltd. | IRBID WATER SUPPLY, SEWERAGE, STORM DRAINAGE & SOLID WASTE DISPOSAL PROJECT | UNIT COST FOR SEWER CONSTRUCTION | FIGURE 9-1<br>DATE SEPT. 1979<br>BY A. TAYEH<br>CHECKED J.H. |



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b. Mechanical and electrical equipment -- Costs of major equipment for the wastewater treatment plant, and heavy equipment for the solid waste system are based on estimates received from manufacturers of equipment delivered to Jordan.

c. Other costs -- Costs of electricity are based on projected per kilowatt hour rates.

Some costs are basic to the capital cost estimates for each proposed facility. These include:

a. Costs of skilled labor -- Truck drivers, heavy equipment operators -- 140 to 200 JD per month.

b. Costs of common labor -- 75 JD per month.

c. Land prices -- Land prices vary depending on the location. In the wastewater treatment analysis and solid waste system analysis, land costs of 1.5 JD/sq m were assumed.

d. Contingency -- 15 percent of construction cost.

e. Engineering and administration -- 15 percent of construction costs.

2. Price Escalation.

Although inflation is not considered in the evaluation of alternative facility plans, it is a significant factor affecting the total cost of the planned project. Capital equipment costs that will be sensitive to inflationary pressure should be incurred with as little delay as possible to meet near future needs. Delay in construction will adversely affect the costs of the project.

3. Depreciation and Salvage.

Depreciation and salvage are important factors in planning municipal facilities. Depreciation is reflected in the scheduled purchasing of equipment. The rate and amount of depreciation are presented in the financial statements.

Net salvage values are normally considered to be zero, since the type of equipment supplied is generally custom designed and has a limited resale market. Most of the equipment is scheduled to be essentially consumed during the project life. Net salvage value could even conceivably be negative. In this case, the cost of disposing of discarded equipment could be a problem, or the cost of restoring land to a state where it is again suitable for public use could exceed the salvage value.

4. Discount Rate.

A 10-percent discount rate was selected for the purpose of determining the cost effectiveness of alternative water supply distribution, sewerage, stormwater drainage, and solid waste disposal plans. Since the objective of the cost-effectiveness analysis is to assess costs of alternatives in a common time period by assuming that each alternative produces the same benefits, the discount rate reduces the costs of alternatives to a present value. The present value of the costs of each alternative can then be compared to determine the most cost-effective solution. This 10-percent rate is identical to the rate selected for other recent projects in Jordan (Jordan Valley study, Potash study).

### 9.2.2 Phase 1 Costs

The initial Phase 1 capital costs, expressed in 1979 JD, are presented in Table 9-2. The scheduling of these costs reflects the plan for meeting the facilities needs of the residents of Irbid. Details of these costs are presented in Chapters 4, 5, 6, and 7 of the draft feasibility report. Total project costs and costs of each element are summarized as follows:

1979 Capital Costs

| | |
|---|---|
| Water supply system | 5,909,000 JD |
| Wastewater system | 8,020,000 JD |
| Storm drainage system | 2,974,000 JD |
| Solid waste system | 988,000 JD |
| Total Costs (1979 JD) | 17,891,000 JD |

For the financial analyses, 1979 capital costs are escalated at an annual inflation rate of 10 percent. This rate corresponds to recent historic experience and future projections for inflation of capital goods in the countries to which purchases will



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Table 9-2

## Phase 1 Construction Funding Schedule
(Costs - JD x 1,000)

| Description | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | Total Phase 1 Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Water Supply System** | | | | | | | | | | | |
| Water supply system costs | 0 | 924 | 925 | 930 | 930 | 440 | 440 | 440 | 440 | 440 | 5,909 |
| **Wastewater System** | | | | | | | | | | | |
| Wastewater treatment | - | 423 | 829 | 324 | 323 | 323 | 323 | - | - | - | 2,545 |
| Sewer construction | - | 887 | 1,883 | 845 | 753 | 410 | 697 | - | - | - | 5,475 |
| Subtotal -- Wastewater System Costs | 0 | 1,310 | 2,712 | 1,169 | 1,076 | 733 | 1,020 | - | - | - | 8,020 |
| **Storm Drainage System** | | | | | | | | | | | |
| Storm drainage system costs | 991 | 1,983 | - | - | - | - | - | - | - | - | 2,974 |
| **Solid Waste System** | | | | | | | | | | | |
| Landfill development | 440 | 110 | - | - | - | - | - | - | - | - | 550 |
| Equipment procurement | 162 | - | 25 | - | 22 | 100 | 30 | 69 | - | 30 | 438 |
| Subtotal -- Solid Waste System | 602 | 110 | 25 | - | 22 | 100 | 30 | 69 | - | 30 | 988 |
| Total Project Costs | 1,593 | 4,327 | 3,662 | 2,099 | 2,028 | 1,273 | 1,490 | 509 | 440 | 470 | 17,891 |
| Equivalent U.S. Dollar Cost (1.00 U.S. Dollar = 0.300 JD) | 5,310,000 | 14,423,000 | 12,207,000 | 6,997,000 | 6,760,000 | 4,123,000 | 4,967,000 | 1,697,000 | 1,467,000 | 1,567,000 | 59,518,000 |

Note: All costs in this table are constant 1979 costs.

be directed. The escalated Phase 1 capital costs are presented in Table 9-3.

Phase 1 operation and maintenance costs are escalated at a 15-percent annual inflation rate. (See Table 9-4.)

Table 9-5 presents the proposed schedule for connecting water and wastewater customers to the new systems. These projections are consistent with the 1979 census information and reflect the population projections presented in Section 1, "Population Estimate Revisions." Users of the proposed solid waste collection system are the same as those using the water supply system.

### 9.2.3 Phase 2 Costs

As with Phase 2 costs, the additional costs associated with planned future development in Irbid between 1990 and 2000 are expressed in 1979 JD. Depending on the year in which they are incurred, these costs will be higher than the 1979 estimates as a result of inflation. The additional Phase 2 project costs are as follows:

1. Water distribution system costs -- 4,911,000 JD.

2. Wastewater collection and treatment system costs -- 5,710,000 JD.

3. Stormwater drainage system costs -- 1,224,000 JD.

4. Solid waste disposal system costs -- 316,000 JD.



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Table 9-3

Phase 1 Construction Funding Schedule
Escalated Costs
(Costs - JD x 1,000)

| Description | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | Total Phase 1 Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Water Supply System** | | | | | | | | | | | |
| Water supply system costs | 0 | 1,118 | 1,230 | 1,358 | 1,497 | 779 | 857 | 943 | 1,037 | 1,141 | 9,142 |
| **Wastewater System** | | | | | | | | | | | |
| Wastewater treatment | 0 | 512 | 1,102 | 473 | 520 | 572 | 630 | - | - | - | 3,809 |
| Sewer construction | - | 1,073 | 2,504 | 1,234 | 1,212 | 726 | 1,359 | - | - | - | 8,108 |
| Subtotal -- Wastewater System Costs | 0 | 1,585 | 3,606 | 1,707 | 1,732 | 1,308 | 1,989 | - | - | - | 11,917 |
| **Storm Drainage System** | | | | | | | | | | | |
| Storm drainage system costs | 1,090 | 2,399 | - | - | - | - | - | - | - | - | 3,489 |
| **Solid Waste System** | | | | | | | | | | | |
| Landfill development | 484 | 133 | - | - | - | - | - | - | - | - | 617 |
| Equipment procurement | 178 | - | 33 | - | 35 | 177 | 58 | 147 | - | 77 | 705 |
| Subtotal -- Solid Waste System | 662 | 133 | 33 | - | 35 | 177 | 58 | 147 | - | 77 | 1,322 |
| Total Project Costs | 1,752 | 5,253 | 4,869 | 3,065 | 3,264 | 2,264 | 2,904 | 1,090 | 1,037 | 1,218 | 26,688 |
| Equivalent U.S. Dollar Cost (1.00 U.S. Dollar = 0.300 JD) | 5,840 | 17,450 | 16,230 | 10,217 | 10,879 | 7,546 | 9,680 | 3,633 | 3,456 | 4,059 | 88,960 |

Note: All costs in this table are escalated from 1979 costs, using 10% inflation.

Source: Tables 9-9, 9-12, and 9-15

Table 9-4

Phase 1 Operation and Maintenance -- Escalated Costs
(Costs - JD x 1,000)

| Description | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | Total Phase 1 Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Water Supply System | 137 | 158 | 182 | 209 | 241 | 277 | 319 | 367 | 422 | 485 | 2,797 |
| Wastewater System | 0 | 0 | 0 | 209 | 273 | 351 | 449 | 651 | 809 | 999 | 3,741 |
| Storm Drainage System | 3 | 3 | 4 | 4 | 5 | 6 | 7 | 8 | 9 | 11 | 60 |
| Solid Waste System | 187 | 220 | 296 | 314 | 410 | 661 | 585 | 825 | 717 | 950 | 5,165 |
| Total Project Operation and Maintenance | 327 | 381 | 482 | 726 | 929 | 1,295 | 1,360 | 1,851 | 1,957 | 2,445 | 11,763 |

Based on 1979 cost and 15% inflation rate.
Source: Tables 9-9b, 9-15b, and 9-19b.

Table 9-5

Project Construction Schedule
Residential and Nonresidential Connections

| | Water Supply | | Wastewater | |
|---|---|---|---|---|
| | Residential | Nonresidential | Residential | Nonresidential |
| 1980 | 15,500 | 2,800 | 0 | 0 |
| 1981 | 16,300 | 3,000 | 3,000 | 1,000 |
| 1982 | 17,100 | 3,100 | 6,000 | 2,000 |
| 1983 | 18,000 | 3,200 | 8,000 | 3,000 |
| 1984 | 18,900 | 3,400 | 10,000 | 3,400 |
| 1985 | 21,100 | 3,500 | 14,500 | 3,500 |
| 1986 | 22,200 | 3,700 | 17,300 | 3,700 |
| 1987 | 23,200 | 3,800 | 21,400 | 3,800 |
| 1988 | 24,200 | 4,000 | 24,200 | 4,000 |
| 1989 | 25,300 | 4,100 | 25,300 | 4,100 |

Source: Tables 9-9a and 9-15a.

## 9.3 FINANCIAL ANALYSIS

This section presents the preliminary financial analysis of the proposed facility plans for the Municipality of Irbid. The analysis is of sufficient depth to identify the financial feasibility of the proposed project. This section contains available financial information from the existing municipal departments which are currently serving the residents with water and solid waste management. It addresses tariff considerations and assesses the adequacy of proposed financing arrangements, including grants, loans, repayment schedules, and fees and charges. An analysis of the sensitivity to change in the basic assumptions is included. Presentations of income and expenditure statements, balance sheets, and cash flow financial statements are included for the 10-year Phase 1 planning period.

Since no audits of existing municipal department operations were available, and creating such information from partial records was of questionable value, financial statements are limited to the future project. In the case of the wastewater system, existing facilities are virtually nonexistent. The existing water system was judged to be undersized and of no long-term utility. The only value assessed to the existing water distribution system is represented by the continuing debt of the deficit-surplus sheet of the cash flow analysis (financial statements and cash flow analysis). The solid waste system (see subsection 9.3.2.2 and Section 7) consists of a dump 14 kilometers southeast of Irbid, and seven trucks. These facilities were assimilated into the proposed system.

### 9.3.1 Basis for Pricing Policies

A major objective of the financial analysis the determination of effective user charges and fees that will permit stable operation of the proposed facilities in Irbid. User charges are also important mechanisms for efficiently allocating scarce resources, and for achieving other economic and social objectives.

During this study, consideration was given to the existing progressive unit cost pricing policy for water, as well as theoretical and practical approaches that may be used. Pricing approaches which were considered are discussed more fully in Appendix D of the draft feasibility report.

A full-cost pricing approach was developed for the planned Phase 1 project water supply and wastewater elements; i.e., user charges were developed and reflect the price of the system to the user. Increased water consumption will result in increased water and sewerage fees. A flat-rate approach is used for the solid waste system. The drainage system will be financed by local municipal taxes.

### 9.3.2 Existing Municipal Operations

This subsection discusses operations of the Irbid Water Department and Department of Public Works with respect to water supply and solid waste disposal. The information is important since it reflects the ability of these departments to provide municipal services, and it can influence the selection of institutional alternatives to implement the proposed facilities plans. Some of the existing financial information is used as input to the cash flow analysis (costs of existing facilities and operations that will continue into the future). In addition to these municipal departments, this subsection provides details on municipal taxes which could be used to pay the costs of the stormwater collection system.

#### 9.3.2.1 Water System/Irbid Water Department

1. Rate and Fee Schedule.

Water consumption in Irbid is billed bimonthly. The current nationally-administered scale of charges that was introduced in May 1979 is applicable to all consumers, and is as follows:

Current Water Pricing Schedule

| Water Consumption (cu m) | Consumption Charges (fils/cu m) |
|---|---|
| 0-5 | 80 |
| 6-15 | 120 |
| 16-25 | 220 |
| 26 and above | 300 |

According to the same national pricing schedule, wholesale water prices are established at 65 fils per cu m.

Since of the revenues and expenditures that are presented in this subsection were based on the previous pricing schedule, it is also included, as follows:



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Previous Water Pricing Schedule

| Water Consumption (cu m) | Consumption Charges (fils/cu m) |
|---|---|
| 0-5 | 80 |
| 6-15 | 100 |
| 16-19 | 180 |
| 20 and above | 250 |

Prior to May 1979, the wholesale water price was set at 60 fils per cu m.

The following tabulation presents the Water Department's record of water inflow, sold water, and revenues from water sales over the past several years.

| Year | Total Water Inflow (cu m) | Total Sold Water (cu m) | Total Revenue From Sold Water (JD) | Average Price (JD/cu m) |
|---|---|---|---|---|
| 1976 | 1,157,200 | 889,800 | N/A | N/A |
| 1977 | 1,591,000 | 1,085,000 | 110,400 | 0.102 |
| 1978 | 1,752,400 | 1,314,000 | 127,400 | 0.096 |
| 1979 | 2,054,000[1] | 1,540,500[1] | (180,000)[2] | (0.116) |
| | | | (227,000)[3] | (0.148) |

Total water inflow is the quantity of water that is purchased by the Water Department from the Water Supply Corporation. Each cubic meter of water cost the Water Department 60 fils for the years 1976 to 1978. The difference between total water inflow and total sold water is the quantity of unaccounted for water. This loss has been over 30 percent until recently when it decreased to 25 percent. It is significant since the Water

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[1]Projected annual quantity estimated from figures available for the first eight months of 1979.
[2]Estimated water sales from the Water Department 1979 budget.
[3]Estimated water sales based on late 1979 estimates; probably more accurate than budget estimate since it includes statements of actual revenue for the first eight months of 1979 (151,811 JD.

Department pays the per unit wholesale price on total water inflow and cannot recover that cost unless it is able to sell water to its customers.

Based on the previous pricing schedule, revenue from water sales in 1977 (current and previous balance) amounted to 110,400 JD. Revenue increased to 127,400 JD in 1978, an increase of 15.4 percent. Projected 1979 water sales (1979 budget) will be approximately 180,000 JD. Between 1978 and 1979 water sales are expected to increase by 41 percent. This increase reflects the increase in water consumption, the new pricing schedule, and the effort of the Municipality to provide water service to more residents. The average unit charge increased to approximately 148 fils per cu m.

The Water Department also administers various connection and administrative fees. The following charges are collected from each new customer:

| Type of Fee or Charge | Charge (JD) |
|---|---|
| Basic fee (nonrefundable) | 5.000 |
| Deposit (refundable) | 5.000 |
| New network | 3.000 |
| Meter | 5.500 |
| Meter installation | 1.000 |
| Pipe: | |
| Up to 30 meters | 5.000 |
| Additional length (per meter) | 0.100 |
| Gross Fee | 24.500 |

These figures are contained in the current nationally-administered (Water Supply Corporation) scale of charges that was introduced in May 1979, signed by the General Manager on 6 June 1979, and is applicable to the Municipality of Irbid. The charges represent government policy regarding connections. Total revenue from new connections increased from 100 JD in 1977, to 1,500 JD in 1979.

Table 9-6 presents the Water Department income and expenditures for 1977, 1978, and 1979. This table identifies the water sale and connection revenues. It is interesting to note the rather significant differences between budgeted and actual revenues. In 1977, the difference was 14 percent, while in 1978 the budget

Table 9-6

Irbid Water Department Income and Expenditures
(JD x 1,000)

| | 1977 | | 1978 | | 1979 |
|---|---|---|---|---|---|
| | Budget | Actual | Budget | Actual | Budget |
| **Income** | | | | | |
| Water sales | | | | | |
| Current | 100.0 | 110.4 | 150.0 | 127.4 | 180.0 |
| Previous balance | 25.0 | | 36.6 | | 38.5 |
| Connection fee | 1.0 | 0.1 | 1.0 | 0.9 | 1.5 |
| Reconnection fees | 1.2 | 1.2 | 2.0 | 2.8 | 3.5 |
| Meter maintenance | 6.0 | 6.2 | 8.0 | 5.9 | 8.0 |
| Individual participation for network extension | 4.0 | 2.9 | 5.0 | 8.8 | 10.0 |
| Purchasing forms | 0.1 | 0.02 | 0.1 | 0.1 | 0.2 |
| Miscellaneous | - | - | 2.0 | 5.1 | 7.0 |
| Total Income | 137.3 | 120.82 | 207.7 | 151.0 | 248.7 |
| **Expenses** | | | | | |
| Wages and salaries | 18.6 | 15.6 | 21.4 | 18.2 | 24.4 |
| Rent, building maintenance | 6.0 | 5.7 | 8.0 | 6.7 | 7.0 |
| Operation and maintenance | | | | | |
| Fuel | 8.2 | 6.9 | 8.0 | 5.6 | 7.0 |
| Maintenance | 33.2 | 33.1 | 34.0 | 32.7 | 39.1 |
| Chemicals | 0.8 | 0.8 | 1.5 | 0.6 | 1.0 |
| Wholesale water | 63.0 | 33.8 | 75.0 | 37.3 | 75.0 |
| Wholesale water--previous balance | 97.2 | - | 134.9 | - | 172.0 |
| Other Expenses | 2.5 | 1.9 | 4.9 | 1.8 | 4.3 |
| Total Expenses | 229.5 | 97.8 | 287.7 | 102.9 | 329.8 |



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overstated actual revenues by 36 percent. This difference is even more puzzling when budgeted and actual revenues are compared with operation expenses. Budgeted expenses and actual expenses varied by 134 percent in 1977, and 175 percent in 1978. Budgeted expenses exceeded actual expenses in both cases.

Much of the problem seems to occur in purchasing wholesale water. From the records available in 1977, e.g., budget expenses for wholesale water was 63,000 JD, while expenses were 33,800 JD. For the same year, the wholesale water previous balance was 97,200 JD, an apparent debt that was carried forward yearly, and increased by the amount of the apparently unpaid wholesale water charge from the previous year. In 1978, the wholesale water previous balance increased by 37,000 JD, the amount of unpaid wholesale water charge from the previous year. Similar increases occurred yearly for 1978 and 1979, as the wholesale water previous balance increased to 172,000 JD.

Because of the accounting practices used in Irbid, it is difficult to make a fair evaluation of the information in the budgeted and actual income and expenditure record. As a result, no attempt is made here to present a full evaluation of the information presented in Table 9-6.

Although officials suggest that municipal government is not subsidized by the national government, it appears that nonpayment of wholesale water costs is a form of municipal support. An evaluation of the Amman Water and Sewer Authority records, which was presented in the Amman Sewer and Water Feasibility Study, November 1977, suggests a similar cumulative increasing deficit.

2. Wholesale Price of Water.

The wholesale price of water to the City of Irbid is currently 65 fils per cu m. The current price was administratively established, based on national policy, to provide sufficient water to the entire Jordanian population. The current price is 38 percent below the price (105 fils/cu m) needed to cover all costs of providing wholesale water, according to a recent Water Supply Corporation report. The difference between earned revenues and expenses (240,000 JD) is the government subsidy paid to the Water Supply Corporation to balance costs of water production, and revenues collected to meet these obligations.

The wholesale price of water to the City of Irbid is expected to increase in future years as new, more expensive sources of water are developed.

For the financial and economic analysis a wholesale price of 65 fils per cu m was maintained from 1980 to 1988. This study assumed that the wholesale cost of water will continue to be subsidized. Although the future full cost per unit of water for Irbid may be 250 fils per cu m when the North Jordan water supply project is completed (an estimate provided by Stanley Consultants, Inc.), Kingdom policy will continue to offer water at affordable rates. As a result, this study assumes the current (65 fils/cu m) will be maintained by present policy from 1980 to 1988, and will be increased to 153 fils per cu m in 1989, when the North Jordan project is operational. This assumed increase (proposed by AID) is based on a 15 percent annual increase of the current 65 fils per cu m rate.

3. Evaluation.

Irbid's water pricing and current billing practices are discussed in the following paragraphs.

a. Pricing -- Existing Irbid water pricing schedules can be described as a multipart pricing schedule with two components, based on Kingdom (Water Supply Corporation, WSC) Policy:

- A fee schedule associated with the administration and technical aspects of providing service to a customer which reflects the true cost of individualized installation. This fee represents Kingdom policy. It was accepted as the administrative/connection fee for this study without further technical justification.

- A pricing schedule related to water use which imposes progressively higher charges for additional units of water consumption.

This water use pricing schedule is used throughout the Kingdom, with the exception of the City of Amman.

Wholesale prices of 65 fils per cu m are substantially less than the cost of providing the water. The actual charge apparently should be at least 105 fils per cu m. The major effect of these charges is to underprice scarce water resources, and to encourage inefficient use. The 105 fils fee represents the current estimated WSC cost of providing wholesale water. Since it is government policy not to pass on this price, it has no bearing on economic/financial analyses in this report.

b. Effects of current billing practices -- The intent of the national water pricing policy is that the billing schedules reflect progressive unit rates administered on a monthly basis. Current practice, however, charges customers for service bimonthly. The effect of this practice is to charge customers at higher rates than is intended by the Kingdom's charge schedule. This problem is documented further in subsection 9.4.1 where municipal service rates and ability to pay are discussed.

c. Effective water price and water loss problems -- Based on information collected from the Irbid Water Department, it is apparent that the existing water system has experienced a considerable loss of water, either due to leaks or unmetered water use. From this information, it appears that efforts are being made to reduce these losses which were estimated to be 32 percent in 1977 and 25 percent in 1978. The Municipality buys water from the Water Supply Corporation at the wholesale price of 0.065 JD, and sells water to the public at the progressive per unit costs. Since at least 25 percent of the water purchased from the Water Supply Corporation is lost, it is possible to calculate the effective price the Municipality obtains per cubic meter of sold water, assuming that these losses will be borne only by the existing water customers.

The Irbid Water Department currently employs 91 persons. Their duties are described in Chapter 4, subsection 4.2.2, of the draft feasibility report.

The Water Department is currently repaying loans for previous water system improvements. This study assumes that the current value of the Water Department assets to be carried forward to a proposed management agency is equal to the outstanding debt, 75,000 JD. This debt is payable in the amount of 18,000 JD in 1980 and 1981, and 13,000 JD per year in 1982 through 1984.

9.3.2.2 Solid Waste System.

1. Rate and Fee Schedule.

The solid waste section in the Municipality of Irbid is organized according to Ordinance No. 1, 1978, "Ordinance of Odor Prevention and Solid Waste for Collection Within the Limits of Municipalities" issued according to Article 41 of the Municipalities Law No. 29 of 1955.

Article 8 of this ordinance lists the current solid waste fee schedules for the Kingdom. These fee schedules are described in Appendix E of the draft feasibility report.

Data available indicate that the present solid waste department labor force includes 200 men who work approximately 6 hours per day, 6 days per week. The collection frequency is as follows:

a. Commercial waste is picked up daily (except Friday).
b. Residential waste is picked up every other day.
c. Some outlying areas are picked up every third day.

2. Income and Expenses.

Table 9-7 shows revenue and expense figures for the Municipality of Irbid solid waste department for 1977, 1978, and the first eight months of 1979.

The 6-JD annual fee charged to each residence is the principal revenue item. It accounts for over 90 percent of the solid waste system revenue. The amount collected from nonresidential customers has increased almost three times since 1977. This increase was caused by two factors:

a. Professional license rates were increased to between 10 and 20 JD per year from the previous rate of 2 to 6 JD per year.

b. The total number of businesses increased.

Table 9-7

Solid Waste Revenues and Expenses
(JD x 1,000)

| Description | 1977 | 1978 | 1979 |
|---|---|---|---|
| **Income** | | | |
| Residential fees | 97.8 | 102.0 | 106.8 |
| Subsidies | -- | -- | -- |
| Taxes (commercial) | 2.9 | 3.2 | 8.5 |
| Other | 2.0 | 2.0 | 2.0 |
| Total Income | 102.7 | 107.2 | 117.3 |
| **Expenses** | | | |
| Salaries | 74.5 | 108.0 | 72.0[1] |
| Building maintenance and rent | 5.3 | 7.1 | 4.5[1] |
| Operation and maintenance | 0.2 | 1.2 | 2.0[1] |
| Miscellaneous | 0.8 | 1.0 | 0.8[1] |
| Other compensation | 1.1 | 3.9 | 2.1[1] |
| Total Expenses | 81.9 | 121.2 | 81.4[1] |

[1] Expenses for eight months, January to September 1979.



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The largest expense item in the solid waste department is for staff salaries and wages. It accounts for approximately 90 percent of the total expenses.

In 1977, the net income generated from solid waste collection amounted to 20,800 JD. In 1978, a deficit of 14,000 JD was recorded. The solid waste system current assets are primarily collection vehicles. The estimated current net value of these assets to be carried forward to the proposed management agency is 35,000 JD.

9.3.2.3 Municipal Taxes.

Table 9-8 shows Municipality of Irbid taxes and fees for the period 1976 to 1979. Taxes and fees are categorized into three areas as follows:

1. Governmental Fees -- A portion of the fuel oil fees collected by the central government are returned to the Municipality. This fee returned to Irbid increased from 60,000 JD in 1976, to 222,000 JD in 1979.

2. Municipal Fees -- Fees collected directly by the Municipality of Irbid are as follows:

   a. Building and property taxes -- These increased from 68,600 JD in 1976 to 81,000 JD in 1979.

   b. Slaughtering Fees -- Collected per animal slaughtered at the municipal slaughterhouse. Increased from 9,200 JD in 1976 to 20,000 JD in 1979.

   c. Fruit and vegetable fees -- Levied on the tonnage entering the central market in Irbid. Increased from 57,000 JD in 1976 to 130,000 JD in 1979.

   d. Health license fee -- Levied on every restaurant and trade shop.

Table 9-8

Municipal Taxes
Irbid

| Description | 1976 | 1977 | 1978 | 1979[1] |
|---|---|---|---|---|
| Governmental Fees (fuel oil tax) | 60,000 | 130,000 | 182,000 | 222,000 |
| Municipal Fees | | | | |
| Building and property tax | 68,600 | 61,000 | 42,300 | 81,000 |
| Slaughtering fees | 9,200 | 11,000 | 10,700 | 20,000 |
| Fruit and vegetable fee | 57,000 | 92,000 | 105,900 | 130,000 |
| Health license fee | 6,200 | 7,400 | 7,900 | 8,500 |
| Construction fee | 7,600 | 7,700 | 16,000 | 16,000 |
| Refrigeration fee | 9,000 | 19,000 | 21,600 | 35,000 |
| Municipal court fee | 27,000 | 38,700 | 30,300 | 31,000 |
| Other Revenues | | | | |
| Electricity | 5,600 | 7,200 | 5,600 | 5,600 |
| Rent | 32,600 | 37,700 | 57,300 | 80,000 |
| Septic tank | 11,200 | 7,100 | 13,900 | 10,000 |
| Total | 294,000 | 418,800 | 493,500 | 639,100 |

[1] Preliminary figures estimated for 1979.

Source: Municipality of Irbid records

e. Construction fee -- Levied on new buildings. This fee is computed based on the square meters of new construction. It increased from 7,600 in 1976 to 16,000 JD in 1979.

f. Refrigeration fees -- Fees for use of the municipal facilities.

g. Municipal court fee.

3. Other Revenues

a. Electricity.

b. Rent from municipally-owned property.

c. Septic tank -- Pumping fees for emptying septic tanks.

The total amount of fees and taxes collected in Irbid increased from 294,000 JD in 1976, to an estimated amount of 639,100 JD in 1979. This is a 217 percent increase during this period.

### 9.3.3 Proposed Project and Future Operations

The following subsections present analyses of the proposed water supply, wastewater collection and treatment, solid waste disposal, and storm drainage systems.

The cash flow model (see Appendix E) is used in each case where user charges are imposed to determine the most likely base conditions. The construction funding schedule (Table 9-2), user charges, and connection fees were inputed to the cash flow model to produce anticipated project revenues and expenditures. The user charges and connection fees were manipulated to produce positive accumulated surpluses (the difference between accumulated annual revenues and expenditures) in the vicinity of 100,000 to 300,000 JD.

Outputs from the model were used to produce cash flow statements, balance sheets, and income-expenditure statements which were checked for viability. Where outputs from these statements (i.e., insufficient cash flow) were unsatisfactory, user charges and connection fees were adjusted to produce new income-expenditure statements.

The model outputs, income-expenditure statements, balance sheets, and cash flow statements presented in this section are those of the final proposed structure and do not contain all of the interactions.

The cash flow model was then used to evaluate the sensitivity of the proposed facility to various factors, including the effect of 30% and 100% grant coverage of all capital expenditures.

The basic assumption in these analyses is that the municipal services are provided on a nonprofit basis, and are planned to be self-sufficient as soon as possible, relying on service charges and fees for the repayment of initial and future debt.

The "most likely" or base condition used in the analyses reflects the construction schedule as indicated in this section, a medium rate of inflation (10 percent capital and 15 percent for operation and maintenance), financing conditions that are likely to be used, as well as phasing of existing and new users into the system that is most feasible, based on current construction practices.

9.3.3.1 Proposed Water Supply System.

1. Existing Pricing Policy.

In each of the cash flow analyses for the proposed facilities in Irbid, existing pricing policy is first tested to see if sufficient revenues can be generated to cover at least the first several years of operation. Average net water use charges and fees (0.093 JD/month and 0.143 JD/month, residential and nonresidential user charges, respectively; and 19.0 JD for the administrative and installation fee) from Appendix E were used initially. They are based on existing policy. Preliminary testing, however, indicated that these user charges were not sufficient to cover the costs of operation. The 19-JD administrative/connection fee was maintained since it was Kingdom policy.

The rate of increase in water use per household was 14.3% per year. This represents increasing population, decreasing household size, and increasing per capita use. Demand in 1980 is estimated at 1.7 cu m per year, and in 1989 at 8.4 cu m per year (see tabulation in subsection 9.4.1.6); these data generate the water use rate of increase.

Table 9-9a is the first of three tables which fully present the cash flow model analysis. The residential user charge of 0.60 JD per month and nonresidential user charge of 0.92 JD per month are required to generate the necessary revenues in the first four years of operation. The residential rate was increased in 1984 to 0.80 JD and again in 1987 to 0.900 JD in order to increase revenues. Nonresidential charges are increased correspondingly. These fees and charges generate annual revenues which increase from 417,000 JD in 1980 to 1,319,000 JD in 1989.

In 1980, all residents of Irbid who are presently served by the existing water supply system will have to be reconnected to the new system. The 256,000 JD revenue from new customers reflects this reconnection, however, the connection fee generally applied to new system users (19 JD) was reduced to 14 JD since the existing meter would be salvaged. In subsequent years this annual revenue drops to reflect only the new customers entering the system at the 19 JD fee.

It is very likely that existing users, having previously paid a connection fee to the existing system, would object to a second connection fee. Consequently, it is recommended that the 19-JD



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Table 9-9a

## Water Supply and Distribution System--Base Conditions

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WATER SUPPLY                           *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1983
INFLATION RATES :LOW MEDIUM HIGH
---

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D R E V E N U E S (T H O U S A N D S O F J.D)

| YEAR | NUMBER OF CUSTOMERS RESIDENT | NUMBER OF CUSTOMERS NONRSED | USER CHARGES J.D. / MONTH RESIDENT | USER CHARGES J.D. / MONTH NONRESD | REVENUE FROM CUSTOMERS RESIDENT | REVENUE FROM CUSTOMERS NONRESD | ADMINISTR. CONNECTION FEE (LD) | REVENUE FROM NEW CUSTOMERS | RATE OF HOUSEHOLD WATER USE INCREASE | TOTAL ANNUAL REVENUE |
|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 15500 | 2800 | 0.60 | 0.92 | 111 | 30 | 14 | 256 | 1.143 | 417 |
| 1981 | 16300 | 3000 | 0.60 | 0.92 | 117 | 33 | 19 | 19 | 1.143 | 214 |
| 1982 | 17100 | 3100 | 0.60 | 0.92 | 123 | 34 | 19 | 17 | 1.143 | 251 |
| 1983 | 18000 | 3200 | 0.60 | 0.92 | 129 | 35 | 19 | 19 | 1.143 | 298 |
| 1984 | 18900 | 3400 | 0.80 | 1.23 | 181 | 50 | 19 | 20 | 1.143 | 470 |
| 1985 | 21100 | 3500 | 0.80 | 1.23 | 202 | 51 | 19 | 43 | 1.143 | 607 |
| 1986 | 22200 | 3700 | 0.80 | 1.23 | 213 | 54 | 19 | 24 | 1.143 | 704 |
| 1987 | 23200 | 3800 | 0.90 | 1.39 | 250 | 63 | 19 | 20 | 1.143 | 931 |
| 1988 | 24200 | 4000 | 0.90 | 1.39 | 261 | 66 | 19 | 22 | 1.143 | 1110 |
| 1989 | 25300 | 4100 | 0.90 | 1.39 | 273 | 68 | 19 | 22 | 1.143 | 1319 |

NOTES:
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(1) NUMBER OF CUSTOMERS : CALCULATED AS EQUIVALENT DEVELOPMENT UNITS

(2) EQUIVALENT NONRESIDENT USER CHARGE IS 1.54 OF RESIDENT CHARGE.
(3) RATE OF HOUSEHOLD WATER USE INCREASE, BASED ON PROJECTED PER CAPITA WATER CONSUMPTION AND DECREASING HOUSEHOLD SIZE.
(4) ADMINISTRATIVE CONNECTION FEE DOES NOT INCLUDE THE COST OF THE METER WHICH IS PASSED THROUGH



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Table 9-9b

## Water Supply and Distribution System--Base Conditions

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WATER SUPPLY                           *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1989
INFLATION RATES :LOW MEDIUM HIGH

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D E X P E N S E S ( T H O U S A N D S O F J.D)

| YEAR | REVENUE REQUIRED F OR NEW FACILITIES TOTAL CAPITAL COST(1979 JD) | GRANT | NET CAPITAL COST | NET CAPITAL COST INFLATED (10.00PC) | GRACE PERIOD INTEREST ACCUMULATION | LOCAL DEBT ANNUAL PAY. ( 6.00PC+20YR) | O+M IN 1979 (J.D) | O+M INFLATED (15.00PC) | TOTAL EXPENSE OF NEW FACILITIES |
|---|---|---|---|---|---|---|---|---|---|
| 1980 | 0 | 0 | 0 | 0 | 0 | 0 | 120 | 137 | 137 |
| 1981 | 924 | 0 | 924 | 1116 | 67 | 0 | 120 | 158 | 158 |
| 1982 | 925 | 0 | 925 | 1231 | 145 | 0 | 120 | 182 | 182 |
| 1983 | 930 | 0 | 930 | 1361 | 235 | 0 | 120 | 209 | 209 |
| 1984 | 930 | 0 | 930 | 1497 | 259 | 127 | 120 | 241 | 366 |
| 1985 | 440 | 0 | 440 | 779 | 234 | 267 | 120 | 277 | 544 |
| 1986 | 440 | 0 | 440 | 857 | 202 | 422 | 120 | 319 | 741 |
| 1987 | 440 | 0 | 440 | 943 | 164 | 592 | 120 | 367 | 959 |
| 1988 | 440 | 0 | 440 | 1037 | 180 | 680 | 120 | 422 | 1102 |
| 1989 | 440 | 0 | 440 | 1141 | 198 | 778 | 120 | 485 | 1263 |

NOTES:

(1) CAPITAL COST FOR 1980 INCLUDES 7000 JD FOR TAPPING EQUIPMENT .
(2) NO GRANTS AT THIS TIME.

Table 9-9c

Water Supply and Distribution System--Base Conditions

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WATER SUPPLY                           *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :198
INFLATION RATES :LOW MEDIUM HIGH
---

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

D E F I C I T - S U R P L U S A N A L I S I S (T H O U S A N D S J.D.)

| YEAR | TOTAL REVENUE REQ. FOR NEW FACILITIES | DEBT SERVICE ON CURRENT FACILITIES | O+M ON CURRENT FACILITIES | TOTAL EXPENSES | TOTAL REVENUE | ANNUAL SURPLUS | ACCUMULATED |
|---|---|---|---|---|---|---|---|
| 1980 | 137 | 18 | 50 | 205 | 417 | 212 | 212 |
| 1981 | 158 | 18 | 40 | 216 | 214 | -2 | 210 |
| 1982 | 182 | 13 | 30 | 225 | 251 | 26 | 236 |
| 1983 | 209 | 13 | 20 | 242 | 298 | 56 | 292 |
| 1984 | 368 | 13 | 10 | 391 | 470 | 79 | 371 |
| 1985 | 544 | 0 | 0 | 544 | 607 | 63 | 434 |
| 1986 | 741 | 0 | 0 | 741 | 704 | -37 | 397 |
| 1987 | 959 | 0 | 0 | 959 | 931 | -28 | 369 |
| 1988 | 1102 | 0 | 0 | 1102 | 1110 | 8 | 377 |
| 1989 | 1263 | 0 | 0 | 1263 | 1319 | 56 | 433 |



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administrative/connection fee for the 1980 population of 15,500 residential users be covered by a governmental subsidy. This subsidy would be equal to 294,500 JD in 1980 to be used as revenue in the water distribution system. ("Deletion of Administrative Connection Fee to Existing Users," tests the effects of capitalizing the reconnection costs for the existing 15,500 water system users.)

Table 9-9b is the anticipated expenditure schedule. Total annual expenses of new facilities increase from 137,000 JD to 1,263,000 over the 10-year analysis period.

Table 9-9c is the projected deficit-surplus analysis. User charges are adjusted to prevent the accumulated surplus (Table 9-9c) from becoming negative, and excessively large.

Tables 9-9a, 9-9b, 9-9c present the base condition water supply system for Irbid.

2. Deletion of Administrative/Connection Fee to Existing Users.

Because of the need to reconnect many presently connected residential and nonresidential users to the new water system, it is important to test the effect of a policy decision to either charge these residents or to reconnect them at no charge (covering costs with government subsidy). The base case water supply analysis (Tables 9-9a, 9-9b, and 9-9c) includes a reduced 14-JD administrative/connection fee for reconnecting these users to the system. The revenue generated by this fee is 256,000 JD. One option is to redistribute the costs of reconnecting current users into an increased user charge (by capitalizing the cost and recovering it with monthly user charge from all users).

Tables 9-10a, 9-10b, and 9-10c present this analysis, and show that residential user charges would have to be increased from the base case level (0.600 JD/month) in 1980 to 0.700 JD/month, an increase of over 15 percent. It can be seen, however, that no future increases in user charges are necessary to achieve a reasonably-sized accumulated surplus.



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Table 9-10a

## Water Supply and Distribution System--1980 Administrative/ Connection Fee Dropped

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WATER SUPPLY                           *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1989
INFLATION RATES :LOW MEDIUM HIGH

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D R E V E N U E S (T H O U S A N D S O F J.D)

| YEAR | NUMBER OF CUSTOMERS RESIDENT | NUMBER OF CUSTOMERS NONRSED | USER CHARGES J.D. / MONTH RESIDENT | USER CHARGES J.D. / MONTH NONRESD | REVENUE FROM CUSTOMERS RESIDENT | REVENUE FROM CUSTOMERS NONRESD | ADMINISTR. CONNECTION FEE (LD) | REVENUE FROM NEW CUSTOMERS | RATE OF HOUSEHOLD WATER USE INCREASE | TOTAL ANNUAL REVENUE |
|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 15500 | 2800 | 0.70 | 1.08 | 130 | 36 | 0 | 0 | 1.143 | 189 |
| 1981 | 16300 | 3000 | 0.70 | 1.08 | 136 | 38 | 19 | 19 | 1.143 | 246 |
| 1982 | 17100 | 3100 | 0.70 | 1.08 | 143 | 40 | 19 | 17 | 1.143 | 290 |
| 1983 | 18000 | 3200 | 0.70 | 1.08 | 151 | 41 | 19 | 19 | 1.143 | 346 |
| 1984 | 18900 | 3400 | 0.85 | 1.31 | 192 | 53 | 19 | 20 | 1.143 | 497 |
| 1985 | 21100 | 3500 | 0.85 | 1.31 | 215 | 55 | 19 | 43 | 1.143 | 645 |
| 1986 | 22200 | 3700 | 0.85 | 1.31 | 226 | 58 | 19 | 24 | 1.143 | 747 |
| 1987 | 23200 | 3800 | 0.85 | 1.31 | 236 | 59 | 19 | 20 | 1.143 | 879 |
| 1988 | 24200 | 4000 | 0.85 | 1.31 | 246 | 62 | 19 | 22 | 1.143 | 1047 |
| 1989 | 25300 | 4100 | 0.85 | 1.31 | 258 | 64 | 19 | 22 | 1.143 | 1247 |

NOTES:

(1) NUMBER OF CUSTOMERS : CALCULATED AS EQUIVALENT DEVELOPMENT UNITS

(2) EQUIVALENT NONRESIDENT USER CHARGE IS 1.54 OF RESIDENT CHARGE.
(3) RATE OF HOUSEHOLD WATER USE INCREASE, BASED ON PROJECTED PER CAPITA WATER CONSUMPTION AND DECREASING HOUSEHOLD SIZE.
(4) ADMINISTRATIVE CONNECTION FEE DOES NOT INCLUDE THE COST OF THE METER WHICH IS PASSED THROUGH

Table 9-10b

## Water Supply and Distribution System--1980 Administrative/ Connection Fee Dropped

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WATER SUPPLY                           *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1989
INFLATION RATES :LOW MEDIUM HIGH
F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D E X P E N S E S ( T H O U S A N D S O F J.D)

| YEAR | REVENUE REQUIRED F OR NEW FACILITIES TOTAL CAPITAL COST(1979 JD) | GRANT | NET CAPITAL COST | NET CAPITAL COST INFLATED (10.00PC) | GRACE PERIOD INTEREST ACCUMULATION | LOCAL DEBT ANNUAL PAY. ( 6.00PC+20YR) | O+M IN 1979 (J.D) | O+M INFLATED (15.00PC) | TOTAL EXPENSE OF NEW FACILITIES |
|---|---|---|---|---|---|---|---|---|---|
| 1980 | 0 | 0 | 0 | 0 | 0 | 0 | 120 | 137 | 137 |
| 1981 | 924 | 0 | 924 | 1118 | 67 | 0 | 120 | 158 | 158 |
| 1982 | 925 | 0 | 925 | 1231 | 145 | 0 | 120 | 182 | 182 |
| 1983 | 930 | 0 | 930 | 1361 | 235 | 0 | 120 | 209 | 209 |
| 1984 | 930 | 0 | 930 | 1497 | 259 | 127 | 120 | 241 | 368 |
| 1985 | 440 | 0 | 440 | 779 | 234 | 267 | 120 | 277 | 544 |
| 1986 | 440 | 0 | 440 | 857 | 202 | 422 | 120 | 319 | 741 |
| 1987 | 440 | 0 | 440 | 943 | 164 | 592 | 120 | 367 | 959 |
| 1988 | 440 | 0 | 440 | 1037 | 180 | 680 | 120 | 422 | 1102 |
| 1989 | 440 | 0 | 440 | 1141 | 198 | 778 | 120 | 485 | 1263 |

NOTES:

(1) CAPITAL COST FOR 1980 INCLUDES 7000 JD FOR TAPPING EQUIPMENT .
(2) NO GRANTS AT THIS TIME.



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Table 9-10c

## Water Supply and Distribution System--1980 Administrative/ Connection Fee Dropped

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WATER SUPPLY                           *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1980
INFLATION RATES :LOW MEDIUM HIGH
---

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

D E F I C I T - S U R P L U S A N A L I S I S (T H O U S A N D S J.D.)

| YEAR | TOTAL REVENUE REC. FOR NEW FACILITIES | DEBT SERVICE ON CURRENT FACILITIES | O+M ON CURRENT FACILITIES | TOTAL EXPENSES | TOTAL REVENUE | ANNUAL SURPLUS | ACCUMULATED |
|---|---|---|---|---|---|---|---|
| 1980 | 137 | 18 | 50 | 205 | 189 | -16 | -16 |
| 1981 | 158 | 18 | 40 | 216 | 246 | 30 | 14 |
| 1982 | 182 | 13 | 30 | 225 | 290 | 65 | 79 |
| 1983 | 209 | 13 | 20 | 242 | 346 | 104 | 183 |
| 1984 | 368 | 13 | 10 | 391 | 497 | 106 | 289 |
| 1985 | 544 | 0 | 0 | 544 | 645 | 101 | 390 |
| 1986 | 741 | 0 | 0 | 741 | 747 | 6 | 396 |
| 1987 | 959 | 0 | 0 | 959 | 879 | -80 | 316 |
| 1988 | 1102 | 0 | 0 | 1102 | 1047 | -55 | 261 |
| 1989 | 1263 | 0 | 0 | 1263 | 1247 | -16 | 245 |

NOTES:
---

(1) O+M ON CURRENT FACILITIES DOES NOT INCLUDE SALARIES OF PERSONEL,
THESE ARE PROJECTED FROM 1977, 78 , AND 79 MAINTANANCE COST ON EXISTING FACILITIES.



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3. Sensitivity Test on Basic Parameters.

The effect of parameter changes in the 1989 accumulated surplus of the water distribution system was analyzed using the cash flow model. The most important inputs to the cash flow--user charges, capital costs, inflation rates, user population, and per capita water consumption rate of increase--were varied separately as indicated in Table 9-11.

Table 9-11 also shows the base condition for the sensitivity test with a 1989 accumulated surplus of 433,000 JD, and presents the 1989 accumulated surpluses and deficits resulting from the variance in the input parameters. It can be seen that all of the tested parameters are sensitive. This test indicates that the operating agency must monitor parameters it does not directly control, such as inflation, per capita water use, and connected population, and adjust user charges as necessary to generate the revenues required to maintain the financial stability of the project.

4. Cash Flow Analysis Including Wholesale Price of Water.

Tables 9-12a, 9-12b, and 9-12c present the cash flow analysis with wholesale price of water, 65 fils per cu m in 1980 to 1988, and 153 fils per cu m in 1989, as an operation and maintenance cost. The user charges are adjusted in order to recuperate enough revenues to balance out the increased expense due to purchasing water. Thus, the user charges indirectly include the wholesale price of water. The difference between Table 9-9a and Table 9-12a user charges is equal to the wholesale cost.

From 1980 to 1983, the difference is 0.300 JD per month; from 1984 to 1986, it is 0.400 JD per month. In 1989, it is 0.600 JD per month. In effect, this user charge structure accumulates surplus revenues, anticipating the large increase in wholesale water costs postulated for 1989.

5. Grant Coverage.

The base case for the cash flow analysis of the water supply and distribution system does not allow for any grants to offset the 1981 to 1989 capital cost program (see Table 9-9b). Table 9-13 shows the result of 30% grant average of all capital costs. Table 9-14 shows the result of a 100% coverage of all capital costs.



1.9

For both the 30% and 100% grant coverage, user charges were adjusted to achieve a reasonable surplus (100 to 300 JD) in 1989. The 30% grant permits a longer continuation of the 0.600-JD per month residential user charge, with only 0.700 JD per month required from 1987 to 1989. A 0.400-JD per month household user charge will pay for the system if all capital costs are covered by a grant.

Table 9-11

Parameter Sensitivity Analysis
Water Distribution System

| Parameter | Range of 1989 Accumulated Surplus (Deficit) (000 JD) | | | |
|---|---|---|---|---|
| | Low Deviation | Percent Change | High Deviation | Percent Change |
| User Charge | | | | |
| ±10 percent of base | (296) | 168 | 1,153 | 166 |
| Capital Cost | | | | |
| ±10 percent of base | 146 | 66 | 722 | 67 |
| ±20 percent of base | (139) | 132 | 1,223 | 182 |
| Inflation | | | | |
| ±10 percent of base | 169 | 61 | 684 | 58 |
| ±20 percent of base | (292) | 167 | 1,061 | 146 |
| User Population | | | | |
| ±10 percent of base each year | (198) | 146 | 1,068 | 147 |
| Per Capita Water Consumption Rate of Increase | | | | |
| ±10 percent of base | (33) | 107 | 901 | 108 |

Base Case for Sensitivity Analysis

Inflation rate, capital -- 10 percent
Inflation rate, operation and maintenance -- 15 percent
Per capita water consumption rate of increase = 1.143
User charges -- see Table 9-9a
Capital cost scheduling -- see Table 9-9b
User population -- see Table 9-9c
Accumulated surplus -- 433 JD

Note: Numbers in ( ) are negative.



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Table 9-12a

## Water Supply and Distribution System--Includes Wholesale Price of Water as O&M Cost

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WATER SUPPLY                           *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1980
INFLATION RATES :LOW MEDIUM HIGH
F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D R E V E N U E S (T H O U S A N D S O F J.D)

| YEAR | NUMBER OF CUSTOMERS RESIDENT | NUMBER OF CUSTOMERS NONRSED | USER CHARGES J.D. / MONTH RESIDENT | USER CHARGES J.D. / MONTH NONRESD | REVENUE FROM CUSTOMERS RESIDENT | REVENUE FROM CUSTOMERS NONRESD | ADMINISTR. CONNECTION FEE(LD) | REVENUE FROM NEW CUSTOMERS | RATE OF HOUSEHOLD WATER USE INCREASE | TOTAL ANNUAL REVENUE |
|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 15500 | 2800 | 0.90 | 1.38 | 167 | 46 | 14 | 256 | 1.143 | 499 |
| 1981 | 16300 | 3000 | 0.90 | 1.38 | 176 | 49 | 19 | 19 | 1.143 | 312 |
| 1982 | 17100 | 3100 | 0.90 | 1.38 | 184 | 51 | 19 | 17 | 1.143 | 367 |
| 1983 | 18000 | 3200 | 0.90 | 1.38 | 194 | 52 | 19 | 19 | 1.143 | 438 |
| 1984 | 18900 | 3400 | 1.20 | 1.85 | 272 | 75 | 19 | 20 | 1.143 | 696 |
| 1985 | 21100 | 3500 | 1.20 | 1.85 | 303 | 77 | 19 | 43 | 1.143 | 890 |
| 1986 | 22200 | 3700 | 1.20 | 1.85 | 319 | 82 | 19 | 24 | 1.143 | 1046 |
| 1987 | 23200 | 3800 | 1.50 | 2.31 | 417 | 105 | 19 | 20 | 1.143 | 1540 |
| 1988 | 24200 | 4000 | 1.50 | 2.31 | 435 | 110 | 19 | 22 | 1.143 | 1836 |
| 1989 | 25300 | 4100 | 1.50 | 2.31 | 455 | 113 | 19 | 22 | 1.143 | 2183 |

NOTES:

(1) NUMBER OF CUSTOMERS : CALCULATED AS EQUIVALENT DEVELOPMENT UNITS

(2) EQUIVALENT NONRESIDENT USER CHARGE IS 1.54 OF RESIDENT CHARGE.
(3) RATE OF HOUSEHOLD WATER USE INCREASE, BASED ON PROJECTED PER CAPITA WATER CONSUMPTION AND DECREASING HOUSEHOLD SIZE.
(4) ADMINISTRATIVE CONNECTION FEE DOES NOT INCLUDE THE COST OF THE METER WHICH IS PASSED THROUGH

Table 9-12b

Water Supply and Distribution System--Includes Wholesale Price of Water as O&M Cost

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WATER SUPPLY                           *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1989
INFLATION RATES :LOW MEDIUM HIGH
---

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D E X P E N S E S ( T H O U S A N D S O F J.D)

| YEAR | REVENUE REQUIRED F OR NEW FACILITIES TOTAL CAPITAL COST(1979 JD) | GRANT | NET CAPITAL COST | NET CAPITAL COST INFLATED (10.00PC) | GRACE PERIOD INTEREST ACCUMULATION | LOCAL DEBT ANNUAL PAY. ( 6.00PC+20YR) | O+M IN 1979 (J.D) | O+M INFLATED (15.00PC) | TOTAL EXPENSE OF NEW FACILITIES |
|---|---|---|---|---|---|---|---|---|---|
| 1980 | 0 | 0 | 0 | 0 | 0 | 0 | 210 | 241 | 241 |
| 1981 | 924 | 0 | 924 | 1118 | 67 | 0 | 218 | 288 | 288 |
| 1982 | 925 | 0 | 925 | 1231 | 145 | 0 | 231 | 351 | 351 |
| 1983 | 930 | 0 | 930 | 1361 | 235 | 0 | 242 | 423 | 423 |
| 1984 | 930 | 0 | 930 | 1497 | 259 | 127 | 242 | 486 | 613 |
| 1985 | 440 | 0 | 440 | 779 | 234 | 267 | 241 | 557 | 824 |
| 1986 | 440 | 0 | 440 | 857 | 202 | 422 | 242 | 643 | 1065 |
| 1987 | 440 | 0 | 440 | 943 | 164 | 592 | 254 | 776 | 1368 |
| 1988 | 440 | 0 | 440 | 1037 | 180 | 680 | 258 | 907 | 1587 |
| 1989 | 440 | 0 | 440 | 1141 | 198 | 778 | 437 | 1767 | 2545 |

NOTES:
---
(1) CAPITAL COST FOR 1980 INCLUDES 7000 JD FOR TAPPING EQUIPMENT .
(2) NO GRANTS AT THIS TIME.



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Table 9-12c

Water Supply and Distribution System--Includes Wholesale Price of Water as O&M Cost

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WATER SUPPLY                           *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1989
INFLATION RATES :LOW MEDIUM HIGH
---

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

D E F I C I T - S U R P L U S A N A L I S I S (T H O U S A N D S J.D.)

| YEAR | TOTAL REVENUE REQ. FOR NEW FACILITIES | DEBT SERVICE ON CURRENT FACILITIES | O+M ON CURRENT FACILITIES | TOTAL EXPENSES | TOTAL REVENUE | ANNUAL SURPLUS | ACCUMULATED |
|---|---|---|---|---|---|---|---|
| 1980 | 241 | 18 | 50 | 309 | 499 | 190 | 190 |
| 1981 | 288 | 18 | 40 | 346 | 312 | -34 | 156 |
| 1982 | 351 | 13 | 30 | 394 | 367 | -27 | 129 |
| 1983 | 423 | 13 | 20 | 456 | 438 | -18 | 111 |
| 1984 | 613 | 13 | 10 | 636 | 696 | 60 | 171 |
| 1985 | 824 | 0 | 0 | 824 | 890 | 66 | 237 |
| 1986 | 1065 | 0 | 0 | 1065 | 1046 | -19 | 218 |
| 1987 | 1368 | 0 | 0 | 1368 | 1540 | 172 | 390 |
| 1988 | 1587 | 0 | 0 | 1587 | 1836 | 249 | 639 |
| 1989 | 2545 | 0 | 0 | 2545 | 2183 | -362 | 277 |

NOTES:
---
(1) O+M ON CURRENT FACILITIES DOES NOT INCLUDE SALARIES OF PERSONEL, THESE ARE PROJECTED FROM 1977, 78 , AND 79 MAINTANANCE COST ON EXISTING FACILITIES.



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Table 9-13a

Water Supply
and Distribution System -- 30 Percent Grant
on all Capital Costs

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WATER SUPPLY                           *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

ASSUMPTIONS:
CONSTRUCTION PHASING COMPLETED :1989
INFLATION RATES :LOW MEDIUM HIGH

FINANCING :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS,
LOAN INTEREST RATE: 6.0C PERCENT(PC).

ANTICIPATED REVENUES (THOUSANDS OF J.D)

| YEAR | NUMBER OF CUSTOMERS RESIDENT | NUMBER OF CUSTOMERS NONRSED | USER CHARGES J.D. / MONTH RESIDENT | USER CHARGES J.D. / MONTH NONRESD | REVENUE FROM CUSTOMERS RESIDENT | REVENUE FROM CUSTOMERS NONRESD | ADMINISTR. CONNECTION FEE (LD) | REVENUE FROM NEW CUSTOMERS | RATE OF HOUSEHOLD WATER USE INCREASE | TOTAL ANNUAL REVENUE |
|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 1550C | 2800 | 0.60 | C.92 | 111 | 30 | 14 | 256 | 1.143 | 417 |
| 1981 | 1630C | 3000 | 0.60 | C.92 | 117 | 33 | 19 | 19 | 1.143 | 214 |
| 1982 | 17100 | 3100 | 0.60 | C.92 | 123 | 34 | 19 | 17 | 1.143 | 251 |
| 1983 | 1800C | 3200 | 0.60 | C.92 | 129 | 35 | 19 | 19 | 1.143 | 298 |
| 1984 | 1890C | 3400 | 0.60 | C.92 | 136 | 37 | 19 | 20 | 1.143 | 357 |
| 1985 | 2110C | 3500 | 0.60 | C.92 | 151 | 38 | 19 | 43 | 1.143 | 464 |
| 1986 | 2220C | 3700 | 0.6C | C.92 | 159 | 40 | 19 | 24 | 1.143 | 531 |
| 1987 | 2320C | 3800 | 0.70 | 1.08 | 194 | 49 | 19 | 20 | 1.143 | 727 |
| 1988 | 2420C | 4000 | 0.70 | 1.08 | 203 | 51 | 19 | 22 | 1.143 | 867 |
| 1989 | 2530C | 4100 | 0.70 | 1.08 | 212 | 53 | 19 | 22 | 1.143 | 1030 |

NOTES:

(1) NUMBER OF CUSTOMERS : CALCULATED AS EQUIVALENT DEVELOPMENT UNITS

(2) EQUIVALENT NONRESIDENT USER CHARGE IS 1.54 OF RESIDENT CHARGE.
(3) RATE OF HOUSEHOLD WATER USE INCREASE, BASED
ON PROJECTED PER CAPITA WATER CONSUMPTION AND DECREASING HOUSEHOLD SIZE.
(4) ADMINISTRATIVE CONNECTION FEE DOES NOT INCLUDE THE
COST OF THE METER WHICH IS PASSED THROUGH

Table 9-13b

# Water Supply and Distribution System -- 30 Percent Grant on all Capital Costs

```
*************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                       *
* CASH  FLOW ANALYSIS                   *
*                                       *
* WATER SUPPLY                          *
*                                       *
* WESTON INTERNATIONAL, JUNE 1980       *
*                                       *
*************************************
```

ASSUMPTIONS:
CONSTRUCTION PHASING COMPLETED :1989
INFLATION RATES :LOW MEDIUM HIGH

FINANCING :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

ANTICIPATED EXPENSES(THOUSANDS OF J.D)

| YEAR | REVENUE REQUIRED FOR NEW FACILITIES TOTAL CAPITAL COST(1979 JD) | GRANT | NET CAPITAL COST | NET CAPITAL COST INFLATED (10.00PC) | GRACE PERIOD INTEREST ACCUMULATION | LOCAL DEBT ANNUAL PAY. ( 6.(0PC+20YR) | O+M IN 1979 (J.D) | O+M INFLATED (15.00PC) | TOTAL EXPENSE OF NEW FACILITIES |
|---|---|---|---|---|---|---|---|---|---|
| 1980 | 0 | 0 | 0 | 0 | 0 | 0 | 120 | 137 | 137 |
| 1981 | 924 | 277 | 647 | 782 | 47 | 0 | 120 | 158 | 158 |
| 1982 | 925 | 278 | 647 | 861 | 101 | 0 | 120 | 182 | 182 |
| 1983 | 930 | 279 | 651 | 953 | 165 | 0 | 120 | 209 | 209 |
| 1984 | 930 | 279 | 651 | 1048 | 182 | 69 | 120 | 241 | 330 |
| 1985 | 440 | 132 | 308 | 545 | 164 | 187 | 120 | 277 | 464 |
| 1986 | 440 | 132 | 308 | 600 | 141 | 295 | 120 | 319 | 614 |
| 1987 | 440 | 132 | 308 | 660 | 115 | 414 | 120 | 367 | 781 |
| 1988 | 440 | 132 | 308 | 726 | 126 | 476 | 120 | 422 | 898 |
| 1989 | 440 | 132 | 308 | 798 | 139 | 544 | 120 | 485 | 1029 |

NOTES:

(1) CAPITAL COST FOR 1980 INCLUDES 7000 JD FOR TAPPING EQUIPMENT .
(2) NO GRANTS AT THIS TIME.



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Table 9-13c

Water Supply
and Distribution System -- 30 Percent Grant
on all Capital Costs

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WATER SUPPLY                           *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1989
INFLATION RATES :LOW MEDIUM HIGH
---

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

D E F I C I T - S U R P L U S A N A L I S I S (T H O U S A N D S J.D.)

| YEAR | TOTAL REVENUE REQ. FOR NEW FACILITIES | DEBT SERVICE ON CURRENT FACILITIES | O+M ON CURRENT FACILITIES | TOTAL EXPENSES | TOTAL REVENUE | ANNUAL SURPLUS | ACCUMULATED |
|---|---|---|---|---|---|---|---|
| 1980 | 137 | 18 | 50 | 205 | 417 | 212 | 212 |
| 1981 | 158 | 18 | 40 | 216 | 214 | -2 | 210 |
| 1982 | 182 | 13 | 30 | 225 | 251 | 26 | 236 |
| 1983 | 209 | 13 | 20 | 242 | 298 | 56 | 292 |
| 1984 | 330 | 13 | 10 | 353 | 357 | 4 | 296 |
| 1985 | 464 | 0 | 0 | 464 | 464 | 0 | 296 |
| 1986 | 614 | 0 | 0 | 614 | 531 | -83 | 213 |
| 1987 | 781 | 0 | 0 | 781 | 727 | -54 | 159 |
| 1988 | 898 | 0 | 0 | 898 | 867 | -31 | 128 |
| 1989 | 1029 | 0 | 0 | 1029 | 1030 | 1 | 129 |

NOTES:
---
(1) O+M ON CURRENT FACILITIES DOES NOT INCLUDE SALARIES OF PERSONEL,
THESE ARE PROJECTED FROM 1977, 78 , AND 79 MAINTANANCE COST ON EXISTING FACILITIES.

Table 9-14a

# Water Supply and Distribution System -- 100 Percent Grant on all Capital Costs

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WATER SUPPLY                           *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

ASSUMPTIONS:
CONSTRUCTION PHASING COMPLETED :1969
INFLATION RATES :LOW MEDIUM HIGH

FINANCING :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

ANTICIPATED REVENUES (THOUSANDS OF J.D)

| YEAR | NUMBER OF CUSTOMERS RESIDENT | NUMBER OF CUSTOMERS NONRESD | USER CHARGES J.D. / MONTH RESIDENT | USER CHARGES J.D. / MONTH NONRESD | REVENUE FROM CUSTOMERS RESIDENT | REVENUE FROM CUSTOMERS NONRESD | ADMINISTR. CONNECTION FEE (LD) | REVENUE FROM NEW CUSTOMERS | RATE OF HOUSEHOLD WATER USE INCREASE | TOTAL ANNUAL REVENUE |
|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 15500 | 2800 | 0.40 | 0.62 | 74 | 20 | 14 | 256 | 1.143 | 363 |
| 1981 | 16300 | 3000 | 0.40 | 0.62 | 78 | 22 | 19 | 19 | 1.143 | 149 |
| 1982 | 17100 | 3100 | 0.40 | 0.62 | 82 | 23 | 19 | 17 | 1.143 | 173 |
| 1983 | 18000 | 3200 | 0.40 | 0.62 | 86 | 23 | 19 | 19 | 1.143 | 205 |
| 1984 | 18900 | 3400 | 0.40 | 0.62 | 90 | 25 | 19 | 20 | 1.143 | 244 |
| 1985 | 21100 | 3500 | 0.40 | 0.62 | 101 | 26 | 19 | 43 | 1.143 | 326 |
| 1986 | 22200 | 3700 | 0.40 | 0.62 | 106 | 27 | 19 | 24 | 1.143 | 362 |
| 1987 | 23200 | 3800 | 0.40 | 0.62 | 111 | 28 | 19 | 20 | 1.143 | 424 |
| 1988 | 24200 | 4000 | 0.40 | 0.62 | 116 | 29 | 19 | 22 | 1.143 | 504 |
| 1989 | 25300 | 4100 | 0.40 | 0.62 | 121 | 30 | 19 | 22 | 1.143 | 596 |

NOTES:

(1) NUMBER OF CUSTOMERS : CALCULATED AS EQUIVALENT DEVELOPMENT UNITS

(2) EQUIVALENT NONRESIDENT USER CHARGE IS 1.54 OF RESIDENT CHARGE.
(3) RATE OF HOUSEHOLD WATER USE INCREASE, BASED ON PROJECTED PER CAPITA WATER CONSUMPTION AND DECREASING HOUSEHOLD SIZE.
(4) ADMINISTRATIVE CONNECTION FEE DOES NOT INCLUDE THE COST OF THE METER WHICH IS PASSED THROUGH



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Table 9-14b

Water Supply
and Distribution System -- 100 Percent Grant
on all Capital Costs

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WATER SUPPLY                           *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1989
INFLATION RATES :LOW MEDIUM HIGH
F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D E X P E N S E S ( T H O U S A N D S O F J.D)

| YEAR | REVENUE REQUIRED FOR NEW FACILITIES TOTAL CAPITAL COST(1979 JD) | GRANT | NET CAPITAL COST | NET CAPITAL COST INFLATED (10.0JPC) | GRACE PERIOD INTEREST ACCUMULATION | LOCAL DEBT ANNUAL PAY. ( 6.COPC*20YR) | O+M IN 1979 (J.D) | O+M INFLATED (15.00PC) | TOTAL EXPENSE OF NEW FACILITIES |
|---|---|---|---|---|---|---|---|---|---|
| 1980 | 0 | 0 | 0 | 0 | 0 | 0 | 120 | 137 | 137 |
| 1981 | 924 | 924 | 0 | 0 | 0 | 0 | 120 | 158 | 158 |
| 1982 | 925 | 925 | 0 | 0 | 0 | 0 | 120 | 182 | 182 |
| 1983 | 930 | 930 | 0 | 0 | 0 | 0 | 120 | 209 | 209 |
| 1984 | 930 | 930 | 0 | 0 | 0 | 0 | 120 | 241 | 241 |
| 1985 | 440 | 440 | 0 | 0 | 0 | 0 | 120 | 277 | 277 |
| 1986 | 440 | 440 | 0 | 0 | 0 | 0 | 120 | 319 | 319 |
| 1987 | 440 | 440 | 0 | 0 | 0 | 0 | 120 | 367 | 367 |
| 1988 | 440 | 440 | 0 | 0 | 0 | 0 | 120 | 422 | 422 |
| 1989 | 440 | 440 | 0 | 0 | 0 | 0 | 120 | 485 | 485 |

NOTES:
(1) CAPITAL COST FOR 1987 INCLUDES 7000 JD FOR TAPPING EQUIPMENT .
(2) NO GRANTS AT THIS TIME.



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Table 9-14c

Water Supply
and Distribution System -- 100 Percent Grant
on all Capital Costs

```
*************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                       *
* CASH  FLOW ANALYSIS                   *
*                                       *
* WATER SUPPLY                          *
*                                       *
* WESTON INTERNATIONAL, JUNE 1980       *
*                                       *
*************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1989
INFLATION RATES :LOW MEDIUM HIGH
---

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

D E F I C I T - S U R P L U S A N A L I S I S (T H O U S A N D S J.D.)

| YEAR | TOTAL REVENUE REQ. FOR NEW FACILITIES | DEBT SERVICE ON CURRENT FACILITIES | O+M ON CURRENT FACILITIES | TOTAL EXPENSES | TOTAL REVENUE | ANNUAL SURPLUS | ACCUMULATED |
|---|---|---|---|---|---|---|---|
| 1980 | 137 | 18 | 50 | 205 | 363 | 158 | 158 |
| 1981 | 158 | 18 | 40 | 216 | 149 | -67 | 91 |
| 1982 | 182 | 13 | 30 | 225 | 173 | -52 | 39 |
| 1983 | 209 | 13 | 20 | 242 | 205 | -37 | 2 |
| 1984 | 241 | 13 | 10 | 264 | 244 | -20 | -18 |
| 1985 | 277 | 0 | 0 | 277 | 326 | 49 | 31 |
| 1986 | 319 | 0 | 0 | 319 | 362 | 43 | 74 |
| 1987 | 367 | 0 | 0 | 367 | 424 | 57 | 131 |
| 1988 | 422 | 0 | 0 | 422 | 504 | 82 | 213 |
| 1989 | 465 | 0 | 0 | 485 | 596 | 111 | 324 |

9.3.3.2 Proposed Wastewater System.

An attempt was made to incorporate the national pricing structure into the analysis of the proposed wastewater collection and treatment system for Irbid. These charges, however, were not adequate to cover the wastewater system costs for Irbid.

Table 9-15a shows that residential user charges of 0.400 JD per month and nonresidential user charges of 0.620 JD per month are required to generate sufficient revenues for the proposed system in the first year of operation (1983). Since households and businesses can be connected in 1981 and 1982, revenues from these connections can be incurred during these years, and Table 9-15a shows 128,000 JD revenue for both 1981 and 1982 from this source. In the first year of operation (1983) 350,000 JD will be collected.

Over this 10-year study period, it was necessary to raise user charges in 1985 to balance the revenues against the increasing costs of the system. One-time administrative fees, which are Kingdom policy and do not reflect the true cost of connection, were held constant at 32 JD.

Table 9-15b presents anticipated capital costs and annual expenses associated with the proposed wastewater system. A total of 8,020,000 JD will be spent on capital programs from 1981 to 1986. Beginning in 1983, annual operation and maintenance costs increase from 120,000 JD to 247,000 JD in 1989. The grant monies available for this project are applied in this analysis to 1981 and 1982 capital expenditures.

The grace period interest payments are recapitalized to avoid the need for imposing user charges prior to system operation.

Table 9-15c presents the deficit surplus analysis. The proposed project shows a favorable annual surplus relationship, and the accumulated surplus is 408,000 JD in 1989.

1. Household Connections.

Estimated engineering and construction costs of connecting individual units into the system will be as much as 200 JD. This cost is not a part of the capital or operation cost; it is normally borne by the homeowner. It is proposed that the burden of this charge would be minimized by initiating a small loan repayment program. The details and impacts are described in subsection 9.4.1.



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Table 9-15a

## Wastewater Collection and Treatment System -- Base Conditions

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WASTEWATER COLLECTION AND TREATMENT    *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1986
INFLATION RATES :LOW MEDIUM HIGH

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D R E V E N U E S (T H O U S A N D S O F J.D )

| YEAR | NUMBER OF CUSTOMERS RESIDENT | NUMBER OF CUSTOMERS NONRESD | USER CHARGES J.D. / MONTH RESIDENT | USER CHARGES J.D. / MONTH NONRESD | REVENUE FROM CUSTOMERS RESIDENT | REVENUE FROM CUSTOMERS NONRESD | ADMINISTR. CONNECTION FEE(JD) | REVENUE FROM NEW CUSTOMERS | REVENUE FROM SEPTAGE DUMPING | RATE OF HOUSEHOLD WATER USE INCREASE | TOTAL ANNUAL REVENUE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 0 | 0 | 0.0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 1.143 | 0 |
| 1981 | 3000 | 1000 | 0.0 | 0.0 | 0 | 0 | 32 | 128 | 0 | 1.143 | 128 |
| 1982 | 6000 | 2000 | 0.0 | 0.0 | 0 | 0 | 32 | 128 | 0 | 1.143 | 128 |
| 1983 | 8000 | 3000 | 0.40 | 0.62 | 38 | 22 | 32 | 96 | 152 | 1.143 | 350 |
| 1984 | 10000 | 3400 | 0.40 | 0.62 | 47 | 25 | 32 | 76 | 166 | 1.143 | 382 |
| 1985 | 14500 | 3500 | 0.40 | 0.62 | 69 | 26 | 32 | 147 | 180 | 1.143 | 538 |
| 1986 | 17300 | 3700 | 1.30 | 2.00 | 269 | 88 | 32 | 96 | 195 | 1.143 | 1200 |
| 1987 | 21400 | 3800 | 1.30 | 2.00 | 333 | 91 | 32 | 134 | 216 | 1.143 | 1585 |
| 1988 | 24200 | 4000 | 1.30 | 2.00 | 377 | 96 | 32 | 96 | 223 | 1.143 | 1893 |
| 1989 | 25300 | 4100 | 1.30 | 2.00 | 394 | 98 | 32 | 38 | 238 | 1.143 | 2148 |

NOTES:

(1) NUMBER OF CUSTOMERS : CALCULATED AS EQUIVALENT DEVELOPMENT UNITS.
(2) USER CHARGES : AVERAGEMONTHLY USER CHARGES BASED ON EXISTING PRICING POLICY .
(3) ADMINISTRATIVE CONNECTION FEE: BASED ON WEIGHTED RENTAL VALU E OF HOUSING AND COMMERCIAL PROPERTIES ADJUSTED FOR INCREASING AFFLUE NCE AND INFLATION.
(4) REVENUE FROM SEPTAGE DUMPING : REVENUES FROM PERIODIC PUMPING OF ONSITE SYSTEMS NOT SERVED BY SEWER SYSTEM.
(5) RATE OF HOUSEHOLD WASTEWATER INCREASE : INCREASE IN HOUSEHOLD WASTEWATER USED TO INCREASE ANNUAL REVENUES FROM USER CHARGES BASED ON INCREASING PER CAPITA WATER CONSUMPTION AND DECREASING HOUSEHOLD SIZE.

Table 9-15b

## Wastewater Collection and Treatment System -- Base Conditions

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WASTEWATER COLLECTION AND TREATMENT    *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1986
INFLATION RATES :LOW MEDIUM HIGH
---

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D E X P E N S E S ( T H O U S A N D S O F J.D)

| YEAR | REVENUE REQUIRED F OR NEW FACILITIES TOTAL CAPITAL COST(1979 JD) | GRANT | NET CAPITAL COST | NET CAPITAL COST INFLATED (10.00PC) | GRACE PERIOD INTEREST ACCUMULATION | LOCAL DEBT ANNUAL PAY. ( 6.00PC*20YR) | O+M IN 1979 (J.D) | O+M INFLATED (15.00PC) | TOTAL EXPENSE OF NEW FACILITIES |
|---|---|---|---|---|---|---|---|---|---|
| 1980 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1981 | 1310 | 900 | 410 | 496 | 30 | 0 | 0 | 0 | 0 |
| 1982 | 2712 | 100 | 2612 | 3476 | 240 | 0 | 0 | 0 | 0 |
| 1983 | 1169 | 0 | 1169 | 1711 | 357 | 0 | 120 | 209 | 209 |
| 1984 | 1076 | 0 | 1076 | 1732 | 447 | 56 | 136 | 273 | 329 |
| 1985 | 733 | 0 | 733 | 1298 | 303 | 452 | 152 | 351 | 803 |
| 1986 | 1020 | 0 | 1020 | 1987 | 319 | 646 | 169 | 449 | 1095 |
| 1987 | 0 | 0 | 0 | 0 | 214 | 843 | 213 | 651 | 1494 |
| 1988 | 0 | 0 | 0 | 0 | 134 | 990 | 230 | 809 | 1799 |
| 1989 | 0 | 0 | 0 | 0 | 0 | 1216 | 247 | 999 | 2215 |

NOTES:
---
(1) REVENUE REQUIRED FOR NEW FACILITIES : CAPITAL COSTS INCLUDE GRACE PERIOD INTEREST WHICH WAS REFINANCED ONLY DURING G RACE PERIOD AS A COST OF CONSTRUCTION.
(2) GRACE PERIOD APPLIES ONLY TO MAJOR INITIAL INVESTMENTS FROM THE TIME THEY ARE INCURRED.
(3) GRANT : INCLUDES US.AID GRANT.



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Table 9-15c

Wastewater Collection
and Treatment System -- Base Conditions

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WASTEWATER COLLECTION AND TREATMENT    *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1986
INFLATION RATES :LOW MEDIUM HIGH
---

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

D E F I C I T - S U R P L U S A N A L I S I S (T H O U S A N D S J.D.)

| YEAR | TOTAL REVENUE REQ. FOR NEW FACILITIES | DEBT SERVICE ON CURRENT FACILITIES | O+M ON CURRENT FACILITIES | TOTAL EXPENSES | TOTAL REVENUE | ANNUAL SURPLUS | ACCUMULATED |
|---|---|---|---|---|---|---|---|
| 1980 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1981 | 0 | 0 | 0 | 0 | 128 | 128 | 128 |
| 1982 | 0 | 0 | 0 | 0 | 128 | 128 | 256 |
| 1983 | 209 | 0 | 0 | 209 | 350 | 141 | 397 |
| 1984 | 329 | 0 | 0 | 329 | 382 | 53 | 450 |
| 1985 | 803 | 0 | 0 | 803 | 538 | -265 | 185 |
| 1986 | 1095 | 0 | 0 | 1095 | 1200 | 105 | 290 |
| 1987 | 1494 | 0 | 0 | 1494 | 1585 | 91 | 381 |
| 1988 | 1799 | 0 | 0 | 1799 | 1893 | 94 | 475 |
| 1989 | 2215 | 0 | 0 | 2215 | 2148 | -67 | 408 |

2. Sensitivity Test.

The effect of parameter changes on the 1989 accumulated surplus of the wastewater system was analyzed in a manner similar to the water distribution system.

Table 9-16 shows the base conditions for the sensitivity test, as well as the accumulated surplus (deficit) resulting from changes in the parameters. It can be seen that the system is sensitive to all of the tested parameters.

3. Additional Grant Coverage.

Additional grants amounting to 30% of total capital costs and 100% of total capital costs were considered. The cash flow analysis adjusted user charges so that revenues only slightly exceeded expenses for any given year.

Table 9-17 presents the results for the 30% grant coverage. User charges drop from 0.40-JD per month for residential users in the base case (Table 9-15a) to 0.200-JD per month with a 30% grant. The monthly user charge in future years is also lower.

Table 9-18 shows the same analysis for a 100% grant coverage of all capital expenditures. It can be seen that user charges are lowered drastically.



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Table 9-16

Parameter Sensitivity Analysis
Wastewater System

| Parameter | Range of 1989 Accumulated Surplus (Deficit) (000 JD) | | | |
|---|---|---|---|---|
| | Percent Change | Low Deviation | High Deviation | Percent Change |
| User Charge | | | | |
| ±10 percent of base | 148 | (197) | 1,016 | 149 |
| Capital Cost | | | | |
| ±10 percent of base | 107 | (28) | 911 | 123 |
| ±20 percent of base | 246 | (597) | 1,411 | 245 |
| Inflation | | | | |
| ±10 percent of base | 172 | (295) | 1,040 | 155 |
| ±20 percent of base | 285 | (755) | 1,267 | 210 |
| User Population | | | | |
| ±10 percent of base each year | 170 | (284) | 1,112 | 172 |
| Per Capita Water Consumption Rate of Increase | | | | |
| ±10 percent of base | 137 | (153) | 971 | 138 |
| 2 year grace period | 182 | (335) | | |

Base Case for Sensitivity Analysis

Inflation rate, capital--10 percent
Inflation rate, operation and maintenance--15 percent
Per capita water consumption rate of increase = 1.143
User charges -- see Table 9-12a
Capital cost scheduling -- see Table 9-12b
User population--see Table 9-12a
Accumulated surplus -- 408

Note: Numbers in () are negative.

Table 9-17a

Wastewater Collection
and Treatment System -- 30 Percent Grant
on all Capital Costs

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WASTEWATER COLLECTION AND TREATMENT    *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1986
INFLATION RATES :LOW MEDIUM HIGH
---

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D R E V E N U E S (T H O U S A N D S O F J.D )

| YEAR | NUMBER OF CUSTOMERS RESIDENT | NUMBER OF CUSTOMERS NONRESD | USER CHARGES J.D. / MONTH RESIDENT | USER CHARGES J.D. / MONTH NONRESD | REVENUE FROM CUSTOMERS RESIDENT | REVENUE FROM CUSTOMERS NONRESD | ADMINISTR. CONNECTION FEE (JD) | REVENUE FROM NEW CUSTOMERS | REVENUE FROM SEPTAGE DUMPING | RATE OF HOUSEHOLD WATER USE INCREASE | TOTAL ANNUAL REVENUE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 0 | 0 | 0.0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 1.143 | 0 |
| 1981 | 3000 | 1000 | 0.0 | 0.0 | 0 | 0 | 32 | 128 | 0 | 1.143 | 128 |
| 1982 | 6000 | 2000 | 0.0 | 0.0 | 0 | 0 | 32 | 128 | 0 | 1.143 | 128 |
| 1983 | 8000 | 3000 | 0.20 | 0.31 | 19 | 11 | 32 | 96 | 152 | 1.143 | 299 |
| 1984 | 10000 | 3400 | 0.20 | 0.31 | 23 | 12 | 32 | 76 | 166 | 1.143 | 310 |
| 1985 | 14500 | 3500 | 0.20 | 0.31 | 34 | 13 | 32 | 147 | 180 | 1.143 | 431 |
| 1986 | 17300 | 3700 | 1.00 | 1.54 | 207 | 68 | 32 | 96 | 195 | 1.143 | 991 |
| 1987 | 21400 | 3800 | 1.00 | 1.54 | 256 | 70 | 32 | 134 | 216 | 1.143 | 1299 |
| 1988 | 24200 | 4000 | 1.00 | 1.54 | 290 | 73 | 32 | 96 | 223 | 1.143 | 1527 |
| 1989 | 25300 | 4100 | 1.00 | 1.54 | 303 | 75 | 32 | 38 | 238 | 1.143 | 1714 |

NOTES:
---

(1) NUMBER OF CUSTOMERS : CALCULATED AS EQUIVALENT DEVELOPMENT UNITS.
(2) USER CHARGES : AVERAGE MONTHLY USER CHARGES BASED ON EXISTING PRICING POLICY .
(3) ADMINISTRATIVE CONNECTION FEE: BASED ON WEIGHTED RENTAL VALU E OF HOUSING AND COMMERCIAL PROPERTIES ADJUSTED FOR INCREASING AFFLUE NCE AND INFLATION.
(4) REVENUE FROM SEPTAGE DUMPING : REVENUES FROM PERIODIC PUMPING OF ONSITE SYSTEMS NOT SERVED BY SEWER SYSTEM.
(5) RATE OF HOUSEHOLD WASTEWATER INCREASE : INCREASE IN HOUSEHOLD WASTEWATER USED TO INCREASE ANNUAL REVENUES FROM USER CHARGES BASED ON INCREASING PER CAPITA WATER CONSUMPTION AND DECREASING HOUSEHOLD SIZE.

Table 9-17b

Wastewater Collection
and Treatment System -- 30 Percent Grant
on all Capital Costs

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WASTEWATER COLLECTION AND TREATMENT    *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1986
INFLATION RATES :LOW MEDIUM HIGH

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D E X P E N S E S (T H O U S A N D S O F J.D)

| YEAR | REVENUE REQUIRED FOR NEW FACILITIES TOTAL CAPITAL COST(1979 JD) | GRANT | NET CAPITAL COST | NET CAPITAL COST INFLATED (10.00PC) | GRACE PERIOD INTEREST ACCUMULATION | LOCAL DEBT ANNUAL PAY. ( 6.00PC+20YR) | O+M IN 1979 (J.D) | O+M INFLATED (15.00PC) | TOTAL EXPENSE OF NEW FACILITIES |
|---|---|---|---|---|---|---|---|---|---|
| 1980 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1981 | 1310 | 1293 | 17 | 20 | 1 | 0 | 0 | 0 | 0 |
| 1982 | 2712 | 914 | 1798 | 2393 | 145 | 0 | 0 | 0 | 0 |
| 1983 | 1169 | 351 | 818 | 1197 | 225 | 0 | 120 | 209 | 209 |
| 1984 | 1076 | 323 | 753 | 1212 | 310 | 2 | 136 | 273 | 275 |
| 1985 | 733 | 220 | 513 | 908 | 212 | 274 | 152 | 351 | 625 |
| 1986 | 1020 | 306 | 714 | 1391 | 223 | 410 | 169 | 449 | 859 |
| 1987 | 0 | 0 | 0 | 0 | 150 | 548 | 213 | 651 | 1199 |
| 1988 | 0 | 0 | 0 | 0 | 94 | 651 | 230 | 809 | 1460 |
| 1989 | 0 | 0 | 0 | 0 | 0 | 809 | 247 | 999 | 1808 |

NOTES:

(1) REVENUE REQUIRED FOR NEW FACILITIES : CAPITAL COSTS INCLUDE GRACE PERIOD INTEREST WHICH WAS REFINANCED ONLY DURING G RACE PERIOD AS A COST OF CONSTRUCTION.
(2) GRACE PERIOD APPLIES ONLY TO MAJOR INITIAL INVESTMENTS FROM THE TIME THEY ARE INCURRED.
(3) GRANT : INCLUDES US.AID GRANT.

Table 9-17c

Wastewater Collection
and Treatment System -- 30 Percent Grant
on all Capital Costs

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WASTEWATER COLLECTION AND TREATMENT    *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1986
INFLATION RATES :LOW MEDIUM HIGH
---

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

D E F I C I T - S U R P L U S A N A L I S I S (T H O U S A N D S J.D.)

| YEAR | TOTAL REVENUE REQ. FOR NEW FACILITIES | DEBT SERVICE ON CURRENT FACILITIES | O+M ON CURRENT FACILITIES | TOTAL EXPENSES | TOTAL REVENUE | ANNUAL SURPLUS | ACCUMULATED |
|---|---|---|---|---|---|---|---|
| 1980 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1981 | 0 | 0 | 0 | 0 | 128 | 128 | 128 |
| 1982 | 0 | 0 | 0 | 0 | 128 | 128 | 256 |
| 1983 | 209 | 0 | 0 | 209 | 299 | 90 | 346 |
| 1984 | 275 | 0 | 0 | 275 | 310 | 35 | 381 |
| 1985 | 625 | 0 | 0 | 625 | 431 | -194 | 187 |
| 1986 | 859 | 0 | 0 | 859 | 991 | 132 | 319 |
| 1987 | 1199 | 0 | 0 | 1199 | 1299 | 100 | 419 |
| 1988 | 1460 | 0 | 0 | 1460 | 1527 | 67 | 486 |
| 1989 | 1808 | 0 | 0 | 1808 | 1714 | -94 | 392 |

Table 9-18a

Wastewater Collection
and Treatment System -- 100 Percent Grant
on all Capital Costs

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WASTEWATER COLLECTION AND TREATMENT    *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1986
INFLATION RATES :LOW MEDIUM HIGH

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D R E V E N U E S (T H O U S A N D S O F J.D )

| YEAR | NUMBER OF CUSTOMERS RESIDENT | NUMBER OF CUSTOMERS NONRSED | USER CHARGES J.D. / MONTH RESIDENT | USER CHARGES J.D. / MONTH NONRESD | REVENUE FROM CUSTOMERS RESIDENT | REVENUE FROM CUSTOMERS NONRESD | ADMINISTR. CONNECTION FEE(JD) | REVENUE FROM NEW CUSTOMERS | REVENUE FROM SEPTAGE DUMPING | RATE OF HOUSEHOLD WATER USE INCREASE | TOTAL ANNUAL REVENUE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 0 | 0 | 0.0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 1.143 | 0 |
| 1981 | 3000 | 1000 | 0.0 | 0.0 | 0 | 0 | 32 | 128 | 0 | 1.143 | 128 |
| 1982 | 6000 | 2000 | 0.0 | 0.0 | 0 | 0 | 32 | 128 | 0 | 1.143 | 128 |
| 1983 | 8000 | 3000 | 0.05 | 0.08 | 4 | 2 | 32 | 96 | 152 | 1.143 | 256 |
| 1984 | 10000 | 3400 | 0.05 | 0.08 | 6 | 3 | 32 | 76 | 56 | 1.143 | 259 |
| 1985 | 14500 | 3500 | 0.05 | 0.08 | 8 | 3 | 32 | 147 | 180 | 1.143 | 351 |
| 1986 | 17300 | 3700 | 0.40 | 0.62 | 83 | 27 | 32 | 96 | 195 | 1.143 | 571 |
| 1987 | 21400 | 3800 | 0.40 | 0.62 | 102 | 28 | 32 | 134 | 216 | 1.143 | 728 |
| 1988 | 24200 | 4000 | 0.40 | 0.62 | 116 | 29 | 32 | 96 | 223 | 1.143 | 801 |
| 1989 | 25300 | 4100 | 0.40 | 0.62 | 121 | 30 | 32 | 38 | 238 | 1.143 | 850 |

NOTES:

(1) NUMBER OF CUSTOMERS : CALCULATED AS EQUIVALENT DEVELOPMENT UNITS.
(2) USER CHARGES : AVERAGEMONTHLY USER CHARGES BASED ON EXISTING PRICING POLICY .
(3) ADMINISTRATIVE CONNECTION FEE: BASED ON WEIGHTED RENTAL VALU E OF HOUSING AND COMMERCIAL PROPERTIES ADJUSTED FOR INCREASING AFFLUE NCE AND INFLATION.
(4) REVENUE FROM SEPTAGE DUMPING : REVENUES FROM PERIODIC PUMPING OF ONSITE SYSTEMS NOT SERVED BY SEWER SYSTEM.
(5) RATE OF HOUSEHOLD WASTEWATER INCREASE : INCREASE IN HOUSEHOLD WASTEWATER USED TO INCREASE ANNUAL REVENUES FROM USER CHARGES BASED ON INCREASING PER CAPITA WATER CONSUMPTION AND DECREASING HOUSEHOLD SIZE.

Table 9-18b

Wastewater Collection
and Treatment System -- 100 Percent Grant
on all Capital Costs

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WASTEWATER COLLECTION AND TREATMENT    *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1984
INFLATION RATES :LOW MEDIUM HIGH
---

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D E X P E N S E S ( T H O U S A N D S O F J.D)

| YEAR | REVENUE REQUIRED FOR NEW FACILITIES TOTAL CAPITAL COST(1979 JD) | GRANT | NET CAPITAL COST | NET CAPITAL COST INFLATED (10.00PC) | GRACE PERIOD INTEREST ACCUMULATION | LOCAL DEBT ANNUAL PAY. ( 6.00PC+20YR) | O+M IN 1979 (J.D) | O+M INFLATED (15.00PC) | TOTAL EXPENSE OF NEW FACILITIES |
|---|---|---|---|---|---|---|---|---|---|
| 1980 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1981 | 1310 | 1310 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1982 | 2712 | 2712 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1983 | 1169 | 1169 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1984 | 1076 | 1076 | 0 | 0 | 0 | 0 | 120 | 209 | 209 |
| 1985 | 733 | 733 | 0 | 0 | 0 | 0 | 136 | 273 | 273 |
| 1986 | 1020 | 1020 | 0 | 0 | 0 | 0 | 152 | 351 | 351 |
| 1987 | 0 | 0 | 0 | 0 | 0 | 0 | 169 | 449 | 449 |
| 1988 | 0 | 0 | 0 | 0 | 0 | 0 | 213 | 651 | 651 |
| 1989 | 0 | 0 | 0 | 0 | 0 | 0 | 230 | 809 | 809 |
| | | | | | | | 247 | 999 | 999 |

NOTES:
---

(1) REVENUE REQUIRED FOR NEW FACILITIES : CAPITAL COSTS INCLUDE GRACE PERIOD INTEREST WHICH WAS REFINANCED ONLY DURING G RACE PERIOD AS A COST OF CONSTRUCTION.
(2) GRACE PERIOD APPLIES ONLY TO MAJOR INITIAL INVESTMENTS FROM THE TIME THEY ARE INCURRED.
(3) GRANT : INCLUDES US.AID GRANT.

Table 9-18c

Wastewater Collection
and Treatment System -- 100 Percent Grant
on all Capital Costs

```
*************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WASTEWATER COLLECTION AND TREATMENT    *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1986
INFLATION RATES :LOW MEDIUM HIGH
------

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

D E F I C I T - S U R P L U S A N A L I S I S (T H O U S A N D S J.D.)

| YEAR | TOTAL REVENUE REQ. FOR NEW FACILITIES | DEBT SERVICE ON CURRENT FACILITIES | O+M ON CURRENT FACILITIES | TOTAL EXPENSES | TOTAL REVENUE | ANNUAL SURPLUS | ACCUMULATED |
|---|---|---|---|---|---|---|---|
| 1980 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1981 | 0 | 0 | 0 | 0 | 128 | 128 | 128 |
| 1982 | 0 | 0 | 0 | 0 | 128 | 128 | 256 |
| 1983 | 209 | 0 | 0 | 209 | 258 | 49 | 305 |
| 1984 | 273 | 0 | 0 | 273 | 259 | -14 | 291 |
| 1985 | 351 | 0 | 0 | 351 | 351 | 0 | 291 |
| 1986 | 449 | 0 | 0 | 449 | 571 | 122 | 413 |
| 1987 | 651 | 0 | 0 | 651 | 728 | 77 | 490 |
| 1988 | 809 | 0 | 0 | 809 | 801 | -8 | 482 |
| 1989 | 999 | 0 | 0 | 999 | 850 | -149 | 333 |



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9.3.3.3 Proposed Solid Waste Disposal System.

1. Charges.

As with the previous cash flow model analyses, the existing nationally administered charges were tested to see if they would produce sufficient revenues to support the new facility program. The charges, 6-JD per year for residential users and 7-JD per year for nonresidential users, are not adequate and produce unreasonablly large deficits.

Charges were raised to generate sufficient revenues and make the solid waste system self sufficient. The monthly charges, shown in Table 9-19a, were increased in 1980 to 1.500 JD for residential customers, and 1.740 JD for nonresidential customers. These charges were increased again in 1984 to produce the required revenues. The monthly charges for 1984 through 1989 are 2.300 JD for residential customers and 2.67 JD for nonresidential customers. Tables 9-19a, 9-19b, and 9-19c present the results of the solid waste system cash flow analysis. The increased user charges are required because of the landfill purchase and construction costs, as well as the substantial equipment purchases.

This schedule of user charges produces annual revenues starting at 351,000 JD in 1980 and increasing to 850,000 JD in 1989. Residential customers represent the major source of revenues. In addition to revenues from nonresidential users (who produce nearly 20 percent of the annual revenues), a small amount of revenue is collected from hospitals and others for disposal of bulky and special wastes.

Total expenses associated with the new facilities are presented in Table 9-19b. These total expenses increase from 244,000 JD in 1980 to 1,018,000 JD in 1989. The initial annual cost represents a doubling of expenditures from the present 121,200 JD reported for 1978 (Table 9-6). The major component of the annual costs in Table 9-19b is operation and maintenance which primarily includes labor.

Table 9-19c integrates the new facility total annual expenses (referred to as total revenue requirements) with the carry-over expenses from the existing solid waste management program. The carry-over of operation and maintenance costs primarily reflects servicing needs for existing vehicles. These operation and maintenance costs are phased out by 1985.

Table 9-19a

Solid Waste Collection
and Disposal System -- Base Conditions

```
*****************************************
* IRBID - THE HASHEMITE KINGDOM OF JORDAN*
*                                       *
* CASH FLOW ANALYSIS                    *
*                                       *
* SOLID WASTE DISPOSAL                  *
*                                       *
* WESTON INTERNATIONAL, JUNE 1980       *
*                                       *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1981
INFLATION RATES :LOW MEDIUM HIGH
------

F I N A N C I N G :
REPAYMENT PERIOD :20 YEARS.
GRACE PERIOD : 0 YEARS.
LOAN INTEREST RATE:***** PERCENT(PC).

A N T I C I P A T E D R E V E N U E S (T H O U S A N D S O F J.D )

| YEAR | NUMBER OF CUSTOMERS RESIDENT | NUMBER OF CUSTOMERS NONRESD | USER CHARGES J.D. / MONTH RESIDENT | USER CHARGES J.D. / MONTH NONRESD | REVENUE FROM CUSTOMERS RESIDENT | REVENUE FROM CUSTOMERS NONRESD | ADMINISTR. CONNECTION FEE (JD) | REVENUE FROM NEW CUSTOMERS | SPECIAL SERVICE (J.D) | RATE OF HOUSEHOLD WATER USE INCREASE | TOTAL ANNUAL REVENUE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 15500 | 2800 | 1.50 | 1.74 | 279 | 58 | 0 | 0 | 13.70 | 1.000 | 350 |
| 1981 | 16300 | 3000 | 1.50 | 1.74 | 293 | 62 | 0 | 0 | 14.40 | 1.000 | 369 |
| 1982 | 17100 | 3100 | 1.50 | 1.74 | 307 | 64 | 0 | 0 | 15.00 | 1.000 | 386 |
| 1983 | 18000 | 3200 | 1.50 | 1.74 | 324 | 66 | 0 | 0 | 15.80 | 1.000 | 405 |
| 1984 | 18900 | 3400 | 2.30 | 2.67 | 521 | 108 | 0 | 0 | 16.60 | 1.000 | 645 |
| 1985 | 21100 | 3500 | 2.30 | 2.67 | 582 | 112 | 0 | 0 | 18.00 | 1.000 | 712 |
| 1986 | 22200 | 3700 | 2.30 | 2.67 | 612 | 118 | 0 | 0 | 18.90 | 1.000 | 748 |
| 1987 | 23200 | 3800 | 2.30 | 2.67 | 640 | 121 | 0 | 0 | 19.70 | 1.000 | 780 |
| 1988 | 24200 | 4000 | 2.30 | 2.67 | 667 | 128 | 0 | 0 | 20.60 | 1.000 | 815 |
| 1989 | 25300 | 4100 | 2.30 | 2.67 | 698 | 131 | 0 | 0 | 21.60 | 1.000 | 850 |

NOTES:
------
(1) NON RESIDENT CUSTOMERS CHARGES ARE BASED ON 10 PERCENT OF ACTUAL OCCUPATIONAL LICENCE FEE WHICH IS AVERAGED TO BE 70 JD / YEAR / LICENCE
(2) ADMINISTRATIVE CONNECTION FEE NOT APP LICABLE .
(3) SPECIAL SERVICES INCLUDE THE DISPOSAL OF ANIMALS, BULKY WASTE AND SPECIAL WASTE SUCH AS HOSPITAL WASTE.....ETC.
(4) RATE OF HOUSEHOLD WATER USE INCREASE NOT USED IN THIS ANALYSIS.



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Table 9-19b

Solid Waste Collection
and Disposal System -- Base Conditions

```
*****************************************
* IRBID - THE HASHEMITE KINGDOM OF JORDAN*
*                                       *
* CASH FLOW ANALYSIS                    *
*                                       *
* SOLID WASTE DISPOSAL                  *
*                                       *
* WESTON INTERNATIONAL, JUNE 1980       *
*                                       *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1981
INFLATION RATES :LOW MEDIUM HIGH
---

F I N A N C I N G :
REPAYMENT PERIOD :20 YEARS.
GRACE PERIOD : 0 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D E X P E N S E S ( T H O U S A N D S O F J.D)

| YEAR | REVENUE REQUIRED F OR NEW FACILITIES TOTAL CAPITAL COST(1979 JD) | GRANT | NET CAPITAL COST | NET CAPITAL COST INFLATED(10.00PC) | GRACE PERIOD INTEREST PAYMENT | LOCAL DEBT ANNUAL PAY. ( 6.00PC+20YR) | O+M IN 1979 (J.D) | O+M INFLATED (15.00PC) | TOTAL EXPENSE OF NEW FACILITIES |
|---|---|---|---|---|---|---|---|---|---|
| 1980 | 602 | 0 | 602 | 662 | 0 | 57 | 163 | 187 | 244 |
| 1981 | 110 | 0 | 110 | 133 | 0 | 68 | 167 | 220 | 288 |
| 1982 | 0 | 0 | 0 | 0 | 0 | 68 | 195 | 296 | 364 |
| 1983 | 0 | 0 | 0 | 0 | 0 | 68 | 180 | 314 | 382 |
| 1984 | 0 | 0 | 0 | 0 | 0 | 68 | 204 | 410 | 478 |
| 1985 | 0 | 0 | 0 | 0 | 0 | 68 | 286 | 661 | 729 |
| 1986 | 0 | 0 | 0 | 0 | 0 | 68 | 220 | 585 | 653 |
| 1987 | 0 | 0 | 0 | 0 | 0 | 68 | 270 | 825 | 893 |
| 1988 | 0 | 0 | 0 | 0 | 0 | 68 | 204 | 717 | 785 |
| 1989 | 0 | 0 | 0 | 0 | 0 | 68 | 235 | 950 | 1018 |

NOTES:
---
(1) NO GRACE PERIODS APPLIED SINCE THERE IS A COLLECTION SYSTEM PRESENTLY.
(2) NO GRANTS AVAILABLE AT THIS TIME.
(3) O+M COSTS INCLUDE SALARIES AND EXPENSES PLUS AMORTIZED CAPIT AL EXPENDITURES FOR TRUCKS AND HEAVY EQUIPMENT DEPRECIATED OVER 7 YEAR PERIODS.
(4) TOTAL CAPITAL COST FOR 1980 INCLUDES LAND COST OF LANDFIL SITE AND CONSTRUCTION COST .



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Table 9-19c

Solid Waste Collection
and Disposal System -- Base Conditions

```
*****************************************
* IRBID - THE HASHEMITE KINGDOM OF JORDAN*
*                                       *
* CASH FLOW ANALYSIS                    *
*                                       *
* SOLID WASTE DISPOSAL                  *
*                                       *
* WESTON INTERNATIONAL, JUNE 1980       *
*                                       *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1981
INFLATION RATES :LOW MEDIUM HIGH

F I N A N C I N G :
REPAYMENT PERIOD :20 YEARS.
GRACE PERIOD : 0 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

D E F I C I T - S U R P L U S A N A L I S I S (T H O U S A N D S J.D.)

| YEAR | TOTAL REVENUE REQ. FOR NEW FACILITIES | DEBT SERVICE ON CURRENT FACILITIES | O+M ON CURRENT FACILITIES | TOTAL EXPENSES | TOTAL REVENUE | ANNUAL SURPLUS | ACCUMULATED |
|---|---|---|---|---|---|---|---|
| 1980 | 244 | 0 | 5.50 | 249 | 350 | 101 | 101 |
| 1981 | 288 | 0 | 5.50 | 293 | 369 | 76 | 177 |
| 1982 | 364 | 0 | 4.50 | 368 | 386 | 18 | 195 |
| 1983 | 382 | 0 | 3.50 | 385 | 405 | 20 | 215 |
| 1984 | 478 | 0 | 2.50 | 480 | 645 | 165 | 380 |
| 1985 | 729 | 0 | 1.50 | 730 | 712 | -18 | 362 |
| 1986 | 653 | 0 | 0.0 | 653 | 748 | 95 | 457 |
| 1987 | 893 | 0 | 0.0 | 893 | 780 | -113 | 344 |
| 1988 | 785 | 0 | 0.0 | 785 | 815 | 30 | 374 |
| 1989 | 1018 | 0 | 0.0 | 1018 | 850 | -168 | 206 |

NOTES:

(1) O+M CURRENT FACILITIES : VALUES INCLUDE O+M ON EXISTING FACILITIES ONLY. NO SALARIES.
(2) CURRENT FACILITIES HAVE NO OUTSTANDING DEBTS.



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2. Sensitivity Test.

The impacts of changes in a variety of cash flow inputs on the revenues of the solid waste system were analyzed in a manner similar to the water and wastewater systems. The analysis in this instance examined the effects of changes in user charges, capital costs, and inflation rates on capital and operational expenses and user population as they affected the accumulated 1989 surplus or deficit. These data are presented in Table 9-20.

Because of the nature of the solid waste management project, construction timing and delays are not very important to the project financing. Users are already in the system. The only problems that will arise through construction delays are related to inflation. Delays will necessitate higher charges than those proposed, or service levels may need to be reduced.

The results of the sensitivity test reveal that the 1989 accumulated surplus (deficit) is highly sensitive to changes in user charges, inflation, and user population; and relatively insensitive to changes in capital costs.

This analysis shows that increases in user charges and user population on the order of 10 percent can produce a doubling of the accumulated surplus over a 10-year period. Therefore, careful monitoring of changes in both of these parameters is required throughout the operation of the solid waste collection and disposal system.

3. Grant Coverage.

The cash flow analysis for the solid waste system also considered 30 percent and 100 percent grant coverage. User charges were adjusted to maintain a reasonable accumulated surplus.

Table 9-21 presents the results for 30 percent grant coverage of the capital costs incurred in 1980-1981. Initial user charges drop only slightly from 1.500-JD per month for residential users, to 1.400 JD per month. Future user charges drop by an even smaller amount. This is because capital funding of the solid waste element is only a small portion of the annual cost.

Table 9-22 presents the results for 100 percent grant coverage of the same capital costs. A similarly small decrease in user charges results, again because capital funding is only a small portion of the total annual cost.



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Table 9-20

Parameter Sensitivity Analysis
Solid Waste Collection and Disposal System

| Parameter | Range of 1989 Accumulated Surplus (Deficit) (000 JD) | | | |
|---|---|---|---|---|
| | Low Deviation | Percent Change | High Deviation | Percent Change |
| User Charge | | | | |
| ±10 percent of base | (459) | 322 | 508 | 146 |
| Capital Cost | | | | |
| ±10 percent of base | 137 | 33 | 275 | 33 |
| ±20 percent of base | 68 | 66 | 334 | 62 |
| Inflation | | | | |
| ±10 percent of base | (122) | 159 | 504 | 144 |
| ±20 percent of base | (816) | 496 | 985 | 378 |
| User Population | | | | |
| ±10 percent of base each year | (383) | 285 | 795 | 285 |

Base Case for Sensitivity Analysis

Inflation rate, capital--10 percent
Inflation rate, operation and maintenance--15 percent
User charges--see Table 9-15a
Capital cost scheduling--see Table 9-15c
User population--see Table 9-15a
Accumulated surplus--206 JD

Note: Numbers in () are negative.



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Table 9-21a

Solid Waste Collection
and Disposal System -- 30 Percent Grant
on all Capital Costs

```
*****************************************
* IRBID - THE HASHEMITE KINGDOM OF JORDAN*
*                                       *
* CASH FLOW ANALYSIS                    *
*                                       *
* SOLID WASTE DISPOSAL                  *
*                                       *
* WESTON INTERNATIONAL, JUNE 1980       *
*                                       *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1981
INFLATION RATES :LOW MEDIUM HIGH
---

F I N A N C I N G :
REPAYMENT PERIOD :20 YEARS.
GRACE PERIOD : 0 YEARS.
LOAN INTEREST RATE:***** PERCENT(PC).

A N T I C I P A T E D R E V E N U E S (T H O U S A N D S O F J.D )

| YEAR | NUMBER OF CUSTOMERS RESIDENT | NUMBER OF CUSTOMERS NONRESD | USER CHARGES J.D. / MONTH RESIDENT | USER CHARGES J.D. / MONTH NONRESD | REVENUE FROM CUSTOMERS RESIDENT | REVENUE FROM CUSTOMERS NONRESD | ADMINISTR. CONNECTION FEE (JD) | REVENUE FROM NEW CUSTOMERS | SPECIAL SERVICE (J.D) | RATE OF HOUSEHOLD WATER USE INCREASE | TOTAL ANNUAL REVENUE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 15500 | 2800 | 1.40 | 1.62 | 260 | 54 | 0 | 0 | 13.70 | 1.000 | 327 |
| 1981 | 16300 | 3000 | 1.40 | 1.62 | 273 | 58 | 0 | 0 | 14.40 | 1.000 | 345 |
| 1982 | 17100 | 3100 | 1.40 | 1.62 | 267 | 60 | 0 | 0 | 15.00 | 1.000 | 362 |
| 1983 | 18000 | 3300 | 1.40 | 1.62 | 302 | 62 | 0 | 0 | 15.80 | 1.000 | 379 |
| 1984 | 18900 | 3400 | 2.25 | 2.61 | 510 | 106 | 0 | 0 | 16.60 | 1.000 | 632 |
| 1985 | 21100 | 3500 | 2.25 | 2.61 | 569 | 109 | 0 | 0 | 18.00 | 1.000 | 656 |
| 1986 | 22200 | 3700 | 2.25 | 2.61 | 599 | 115 | 0 | 0 | 18.90 | 1.000 | 732 |
| 1987 | 23200 | 3800 | 2.25 | 2.61 | 626 | 119 | 0 | 0 | 19.70 | 1.000 | 764 |
| 1988 | 24200 | 4000 | 2.25 | 2.61 | 653 | 125 | 0 | 0 | 20.60 | 1.000 | 798 |
| 1989 | 25300 | 4100 | 2.25 | 2.61 | 683 | 128 | 0 | 0 | 21.60 | 1.000 | 832 |

NOTES:
---

(1) NON RESIDENT CUSTOMERS CHARGES ARE BASED ON 10 PERCENT OF ACTUAL OCCUPATIONAL LICENCE FEE WHICH IS AVERAGED TO BE 70 JD / YEAR / LICENCE
(2) ADMINISTRATIVE CONNECTION FEE NOT APPLICABLE .
(3) SPECIAL SERVICES INCLUDE THE DISPOSAL OF ANIMALS, BULKY WASTE AND SPECIAL WASTE SUCH AS HOSPITAL WASTE.....ETC.
(4) RATE OF HOUSEHOLD WATER USE INCREASE NOT USED IN THIS ANALYSIS.

Table 9-21b

Solid Waste Collection
and Disposal System -- 30 Percent Grant
on all Capital Costs

```
*****************************************
* IPBID - THE HASHEMITE KINGDOM OF JORDAN*
*                                       *
* CASH FLOW ANALYSIS                    *
*                                       *
* SOLID WASTE DISPOSAL                  *
*                                       *
* DESIGN INTERNATIONAL, JUNE 1980       *
*                                       *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1981
INFLATION RATES :LOW MEDIUM HIGH

F I N A N C I N G :
REPAYMENT PERIOD :20 YEARS.
GRACE PERIOD : 0 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D E X P E N S E S ( T H O U S A N D S O F J.D)

| YEAR | REVENUE REQUIRED FOR NEW FACILITIES TOTAL CAPITAL COST(1979 JD) | GRANT | NET CAPITAL COST | NET CAPITAL COST INFLATED(10.00PC) | GRACE PERIOD INTEREST PAYMENT | LOCAL DEBT ANNUAL PAY. ( 6.00PC+20YR) | O+M IN 1979 (J.D) | O+M INFLATED (15.00PC) | TOTAL EXPENSE OF NEW FACILITIES |
|---|---|---|---|---|---|---|---|---|---|
| 1980 | 602 | 181 | 421 | 463 | 0 | 40 | 163 | 187 | 227 |
| 1981 | 110 | 33 | 77 | 93 | 0 | 48 | 167 | 220 | 266 |
| 1982 | 0 | 0 | 0 | 0 | 0 | 48 | 195 | 296 | 344 |
| 1983 | 0 | 0 | 0 | 0 | 0 | 48 | 180 | 314 | 362 |
| 1984 | 0 | 0 | 0 | 0 | 0 | 48 | 204 | 410 | 458 |
| 1985 | 0 | 0 | 0 | 0 | 0 | 48 | 286 | 661 | 709 |
| 1986 | 0 | 0 | 0 | 0 | 0 | 48 | 220 | 585 | 633 |
| 1987 | 0 | 0 | 0 | 0 | 0 | 48 | 270 | 825 | 873 |
| 1988 | 0 | 0 | 0 | 0 | 0 | 48 | 204 | 717 | 765 |
| 1989 | 0 | 0 | 0 | 0 | 0 | 48 | 235 | 950 | 998 |

NOTES:

(1) NO GRACE PERIODS APPLIED SINCE THERE IS A COLLECTION SYSTEM PRESENTLY.
(2) NO GRANTS AVAILABLE AT THIS TIME.
(3) O+M COSTS INCLUDE SALARIES AND EXPENSES PLUS AMORTIZED CAPITAL EXPENDITURES FOR TRUCKS AND HEAVY EQUIPMENT DEPRECIATED OVER 7 YEAR PERIODS.
(4) TOTAL CAPITAL COST FOR 1980 INCLUDES LAND COST OF LANDFIL SITE AND CONSTRUCTION COST .



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Table 9-21c

Solid Waste Collection
and Disposal System -- 30 Percent Grant
on all Capital Costs

```
*****************************************
* IRBID - THE HASHEMITE KINGDOM OF JORDAN*
*                                       *
* CASH FLOW ANALYSIS                    *
*                                       *
* SOLID WASTE DISPOSAL                  *
*                                       *
* WESTON INTERNATIONAL, JUNE 1980       *
*                                       *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1981
INFLATION RATES :LOW MEDIUM HIGH
---

F I N A N C I N G :
REPAYMENT PERIOD :20 YEARS.
GRACE PERIOD : 0 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

D E F I C I T - S U R P L U S A N A L I S I S (T H O U S A N D S J.D.)

| YEAR | TOTAL REVENUE REQ. FOR NEW FACILITIES | DEBT SERVICE ON CURRENT FACILITIES | O+M ON CURRENT FACILITIES | TOTAL EXPENSES | TOTAL REVENUE | ANNUAL SURPLUS | ACCUMULATED |
|---|---|---|---|---|---|---|---|
| 1980 | 227 | 0 | 5.50 | 232 | 327 | 95 | 95 |
| 1981 | 268 | 0 | 5.50 | 273 | 345 | 72 | 167 |
| 1982 | 344 | 0 | 4.50 | 348 | 362 | 14 | 181 |
| 1983 | 362 | 0 | 3.50 | 365 | 379 | 14 | 195 |
| 1984 | 458 | 0 | 2.50 | 460 | 632 | 172 | 367 |
| 1985 | 709 | 0 | 1.50 | 710 | 696 | -14 | 353 |
| 1986 | 633 | 0 | 0.0 | 633 | 732 | 99 | 452 |
| 1987 | 873 | 0 | 0.0 | 873 | 764 | -109 | 343 |
| 1988 | 765 | 0 | 0.0 | 765 | 798 | 33 | 376 |
| 1989 | 998 | 0 | 0.0 | 998 | 832 | -166 | 210 |



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Table 9-22a

Solid Waste Collection
and Disposal System -- 100 Percent Grant
on all Capital Costs

```
*****************************************
* IRBID - THE HASHEMITE KINGDOM OF JORDAN*
*                                       *
* CASH FLOW ANALYSIS                    *
*                                       *
* SOLID WASTE DISPOSAL                  *
*                                       *
* WESTON INTERNATIONAL, JUNE 1980       *
*                                       *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1981
INFLATION RATES :LOW MEDIUM HIGH

F I N A N C I N G :
REPAYMENT PERIOD :20 YEARS.
GRACE PERIOD : 0 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D R E V E N U E S (T H O U S A N D S O F J.D )

| YEAR | NUMBER OF CUSTOMERS RESIDENT | NUMBER OF CUSTOMERS NONRESD | USER CHARGES J.D. / MONTH RESIDENT | USER CHARGES J.D. / MONTH NONRESD | REVENUE FROM CUSTOMERS RESIDENT | REVENUE FROM CUSTOMERS NONRESD | ADMINISTR. CONNECTION FEE (JD) | REVENUE FROM NEW CUSTOMERS | SPECIAL SERVICE (J.D) | RATE OF HOUSEHOLD WATER USE INCREASE | TOTAL ANNUAL REVENUE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 15500 | 2800 | 1.30 | 1.51 | 241 | 50 | 0 | 0 | 13.70 | 1.000 | 304 |
| 1981 | 16300 | 3000 | 1.30 | 1.51 | 254 | 54 | 0 | 0 | 14.40 | 1.000 | 322 |
| 1982 | 17100 | 3100 | 1.30 | 1.51 | 266 | 56 | 0 | 0 | 15.00 | 1.000 | 337 |
| 1983 | 18000 | 3200 | 1.30 | 1.51 | 280 | 57 | 0 | 0 | 15.80 | 1.000 | 352 |
| 1984 | 18900 | 3400 | 2.10 | 2.44 | 476 | 99 | 0 | 0 | 16.60 | 1.000 | 551 |
| 1985 | 21100 | 3500 | 2.10 | 2.44 | 531 | 102 | 0 | 0 | 18.00 | 1.000 | 651 |
| 1986 | 22200 | 3700 | 2.10 | 2.44 | 559 | 108 | 0 | 0 | 18.90 | 1.000 | 665 |
| 1987 | 23200 | 3800 | 2.10 | 2.44 | 584 | 111 | 0 | 0 | 19.70 | 1.000 | 714 |
| 1988 | 24200 | 4000 | 2.10 | 2.44 | 609 | 117 | 0 | 0 | 20.60 | 1.000 | 746 |
| 1989 | 25300 | 4100 | 2.10 | 2.44 | 637 | 120 | 0 | 0 | 21.60 | 1.000 | 778 |

NOTES:

(1) NON RESIDENT CUSTOMERS CHARGES ARE BASED ON 10 PERCENT OF ACTUAL OCCUPATIONAL LICENCE FEE WHICH IS AVERAGED TO BE 70 JD / YEAR / LICENCE
(2) ADMINISTRATIVE CONNECTION FEE NOT APPLICABLE .
(3) SPECIAL SERVICES INCLUDE THE DISPOSAL OF ANIMALS, BULKY WASTE AND SPECIAL WASTE SUCH AS HOSPITAL WASTE.....ETC.
(4) RATE OF HOUSEHOLD WATER USE INCREASE NOT USED IN THIS ANALYSIS.



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Table 9-22b

Solid Waste Collection
and Disposal System -- 100 Percent Grant
on all Capital Costs

```
*****************************************
* IRBID - THE HASHEMITE KINGDOM OF JORDAN*
*                                        *
* CASH FLOW ANALYSIS                     *
*                                        *
* SOLID WASTE DISPOSAL                   *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1981
INFLATION RATES :LOW MEDIUM HI
---

F I N A N C I N G :
REPAYMENT PERIOD :20 YEARS.
GRACE PERIOD : 0 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D E X P E N S E S ( T H O U S A N D S O F J.D)

| YEAR | REVENUE REQUIRED FOR NEW FACILITIES TOTAL CAPITAL COST(1979 JD) | GRANT | NET CAPITAL COST | NET CAPITAL COST INFLATED(10.00PC) | GRACE PERIOD INTEREST PAYMENT | LOCAL DEBT ANNUAL PAY. ( 6.00PC+20YR) | O+M IN 1979 (J.D) | O+M INFLATED (15.00PC) | TOTAL EXPENSE OF NEW FACILITIES |
|---|---|---|---|---|---|---|---|---|---|
| 1980 | 602 | 602 | 0 | 0 | 0 | 0 | 163 | 187 | 187 |
| 1981 | 110 | 110 | 0 | 0 | 0 | 0 | 167 | 220 | 220 |
| 1982 | 0 | 0 | 0 | 0 | 0 | 0 | 195 | 296 | 296 |
| 1983 | 0 | 0 | 0 | 0 | 0 | 0 | 180 | 314 | 314 |
| 1984 | 0 | 0 | 0 | 0 | 0 | 0 | 204 | 410 | 410 |
| 1985 | 0 | 0 | 0 | 0 | 0 | 0 | 286 | 661 | 661 |
| 1986 | 0 | 0 | 0 | 0 | 0 | 0 | 220 | 585 | 585 |
| 1987 | 0 | 0 | 0 | 0 | 0 | 0 | 270 | 825 | 825 |
| 1988 | 0 | 0 | 0 | 0 | 0 | 0 | 204 | 717 | 717 |
| 1989 | 0 | 0 | 0 | 0 | 0 | 0 | 235 | 950 | 950 |

NOTES:
---

(1) NO GRACE PERIODS APPLIED SINCE THERE IS A COLLECTION SYSTEM PRESENTLY.
(2) NO GRANTS AVAILABLE AT THIS TIME.
(3) O+M COSTS INCLUDE SALARIES AND EXPENSES PLUS AMORTIZED CAPITAL EXPENDITURES FOR TRUCKS AND HEAVY EQUIPMENT DEPRECIATED OVER 7 YEAR PERIODS.
(4) TOTAL CAPITAL COST FOR 1980 INCLUDES LAND COST OF LANDFIL SITE AND CONSTRUCTION COST .

Table 9-22c

Solid Waste Collection
and Disposal System -- 100 Percent Grant
on all Capital Costs

```
*****************************************
* IRBID - THE HASHEMITE KINGDOM OF JORDAN*
*                                       *
* CASH FLOW ANALYSIS                    *
*                                       *
* SOLID WASTE DISPOSAL                  *
*                                       *
* WESTON INTERNATIONAL, JUNE 1980       *
*                                       *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1981
INFLATION RATES :LOW MEDIUM HIGH
---

F I N A N C I N G :
REPAYMENT PERIOD :20 YEARS.
GRACE PERIOD : 0 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

D E F I C I T - S U R P L U S A N A L I S I S (T H O U S A N D S J.D.)

| YEAR | TOTAL REVENUE REQ. FOR NEW FACILITIES | DEBT SERVICE ON CURRENT FACILITIES | O+M ON CURRENT FACILITIES | TOTAL EXPENSES | TOTAL REVENUE | ANNUAL SURPLUS | ACCUMULATED |
|---|---|---|---|---|---|---|---|
| 1980 | 187 | 0 | 5.50 | 192 | 304 | 112 | 112 |
| 1981 | 220 | 0 | 5.50 | 225 | 322 | 97 | 209 |
| 1982 | 296 | 0 | 4.50 | 300 | 337 | 37 | 246 |
| 1983 | 314 | 0 | 3.50 | 317 | 352 | 35 | 281 |
| 1984 | 410 | 0 | 2.50 | 412 | 591 | 179 | 460 |
| 1985 | 661 | 0 | 1.50 | 662 | 651 | -11 | 449 |
| 1986 | 565 | 0 | 0.0 | 585 | 685 | 100 | 549 |
| 1987 | 825 | 0 | 0.0 | 825 | 714 | -111 | 438 |
| 1988 | 717 | 0 | 0.0 | 717 | 746 | 29 | 467 |
| 1989 | 950 | 0 | 0.0 | 950 | 778 | -172 | 295 |

NOTES:
---
(1) O+M CURRENT FACILITIES : VALUES INCLUDE O+M ON EXISTING FACILITIES ONLY. NO SALARIES.
(2) CURRENT FACILITIES HAVE NO OUTSTANDING DEBTS.



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9.3.3.4 Proposed Stormwater Management System.

A cash flow analysis was not conducted for the stormwater system since the costs for this system are expected to be paid out of general tax revenues. In this subsection, however, we have developed the total annual costs and the annual costs per equivalent dwelling unit (EDU) required to repay the stormwater system construction costs, and the annual operation and maintenance costs.

The estimated Phase 1 construction cost for the stormwater system is 2,974,000 JD. It is assumed that this cost will be incurred in 1980 and 1981 (991,000 JD and 1,983,000 JD), and will be paid back over a 19-year period, starting in 1981, at an interest rate of 6 percent. The annual cost of labor required for operation and maintenance of the stormwater system is estimated at 2,600 JD in 1979 prices, and is escalated at 15 percent over future years.

The total number of EDU's, both residential and nonresidential, available to pay for the stormwater costs increase from 20,920 in 1981 to 31,614 in 1989. The total annual stormwater system costs rise from approximately 270,000 JD in 1981 to approximately 277,500 JD in 1989. Because of the projected increase in EDU's over this period, the annual cost per EDU (the cost that must be collected from the taxes paid by each EDU to pay the stormwater system costs) drops from 12.93 JD in 1981 to 8.7 JD in 1989.

9.3.3.5 Summary.

Table 9-23 summarizes the annual user charges and fees that will be required from an average residential user in Irbid from 1980 to 1989. These are the fees required to pay back the capital obligations required to finance the project, and pay the annual operation and maintenance charges.

The total user charges to be paid by the average user will increase from 25.200 JD per year to an estimated 61.700 JD per year in 1989. For these increased charges, the Irbid resident will receive an improved water supply, a modern sewage collection and treatment system, improved solid waste disposal facilities, and adequate stormwater drainage facilities.

The charges listed in Table 9-23 are based on the assumption that 1,000,000 JD will be received in grants, and the remaining capital costs for Phase 1 of the project (17,891,000 JD) will be



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Table 9-23

Summary of Household Average Annual
User Charges and Fees for Proposed Municipal Services
(1980-1989)

(in JD)

| | Water Supply[1] | | Wastewater | | Solid Waste | Stormwater | |
|---|---|---|---|---|---|---|---|
| Year | Administrative Connection Fee | Annual User Charge | Administrative Connection Fee | Annual User Charge | Annual User Charge | Annual User Charge | Total Annual User Charge |
| 1980 | 14 | 7.2 | 0 | 0 | 18.00 | 0 | 25.2 |
| 1981 | 19 | 7.2 | 32 | 0 | 18.00 | 11.30 | 36.5 |
| 1982 | 19 | 7.2 | 32 | 0 | 18.00 | 10.70 | 35.9 |
| 1983 | 19 | 7.2 | 32 | 4.8 | 18.00 | 10.30 | 40.3 |
| 1984 | 19 | 9.6 | 32 | 4.8 | 27.60 | 9.70 | 51.7 |
| 1985 | 19 | 9.6 | 32 | 4.8 | 27.60 | 9.30 | 51.3 |
| 1986 | 19 | 9.6 | 32 | 15.6 | 27.60 | 8.90 | 62.0 |
| 1987 | 19 | 10.8 | 32 | 15.6 | 27.60 | 8.50 | 69.3 |
| 1988 | 19 | 10.8 | 32 | 15.6 | 27.60 | 8.00 | 62.0 |
| 1989 | 19 | 10.8 | 32 | 15.6 | 27.60 | 7.70 | 61.7 |

[1]Charges do not include wholesale water costs.

obtained through 20-year loans at 6 percent interest that will be repaid through user charges. The annual user charges can be reduced if either the amount of loans is reduced through an increase in the amount of grants made available for the project or the loan interest rate is reduced and/or the payback period is increased.

### 9.3.4 Financial Statements

This subsection presents the financial statements which describe in greater detail the base case conditions for water supply, wastewater, and solid waste management systems. The following tables are included in this section:

Table 9-24 Water Supply Income and Expenditure Statement
Table 9-25 Wastewater Income and Expenditure Statement
Table 9-26 Solid Waste Income and Expenditure Statement
Table 9-27 Water Supply and Wastewater Balance Sheet
Table 9-28 Solid Waste Balance Sheet
Table 9-29 Water Supply and Wastewater Cash Flow Statement
Table 9-30 Solid Waste Cash Flow Statement

Income and expenditure statements were prepared individually for each element except stormwater (this project is financed through municipal tax revenues). This approach offers the opportunity for analysis of the revenue projected for each element, and avoids the possibility that one element could subsidize another if they were combined initially. Balance sheets and cash flow statements are provided jointly for water supply and wastewater because they will probably be implemented jointly in a district authority arrangement as recommended in Chapter 10 of the draft feasibility report. Solid waste, however, will most likely be managed by another arrangement, and therefore is presented separately.

The following is a list of notes which describe various assumptions used in preparing these financial statements.

1. Prior period balance sheet items including existing debt for water supply were not included on the balance sheet. Revenue generated from existing operations are included on the income and expenditure statement.

2. The cost of water supply meters, which will be passed on to the customers, was not included in revenue or expense. This was done for ease of calculation and does not represent a recommendation for future policy.

3. Grace period interest of 3,728 JD was financed for the water supply and wastewater systems. This interest was expensed as a more conservative income-expenditure accounting practice. Had the interest been capitalized, the deficit of 2,898 JD in 1989 would have been much smaller.

4. The stormwater system is not included in the balance sheet or cash flow statements. The stormwater system has no cash flow impact as tax revenues will be used to cover the salary costs, operating and maintenance expenses, and principal and interest payments. Since tax revenues are used to cover costs, there is no material income and expenditure or balance sheet effect. The stormwater system would show an equity deficit resulting from interest and depreciation exceeding principal payments. A loan of 2,974,000 JD will be received for the stormwater system.

5. Operation and maintenance costs were calculated on the basis of a percentage of construction costs, and thus, a detailed breakdown is not possible (see supplemental analysis in Section 5).

The prime objective in preparing the financial statements was to balance revenues, considering the ability of the customers to pay, with a stable cash flow position.

This objective, along with expressing the grace period interest, high interest in the initial years of the debt service and liberal depreciation estimates, caused a negative equity position for the years presented on the financial statements. These are noncash flow items which impact the income and expenditure statement, but do not affect the cash flow statement. Over the period of debt service, these items will reverse and the equity at the end of the debt service period will become positive.

For the water supply income and expenditure statement the rate of return varies from incalculable to 7.8% in 1988. In order to generate enough revenues to produce an 8-9% return for each year, user charges would have to be increased 20-30%.[1]

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[1]The analysis presented here reflects a nonprofit approach to pricing services. If an 8 to 9% rate of return were required (recommended potential profit to be considered in analysis from AID and World Bank discussions), user charges would increase by 20 to 30%. This could adversely impact the ability to pay of residents in the Municipality of Irbid.

Table 9-24

Water Supply Income and Expenditure Statement

| Year Ending December 31 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | JD (thousands) | | | | | |
| Revenue | | | | | | | | | | |
| Resident | 191 | 229 | 274 | 331 | 530 | 675 | 813 | 1,214 | 1,448 | 1,731 |
| Nonresident | 52 | 64 | 76 | 88 | 146 | 172 | 209 | 306 | 366 | 430 |
| Administrative/connection fees | 256 | 14 | 13 | 14 | 15 | 32 | 18 | 15 | 16 | 16 |
| Total | 499 | 307 | 363 | 433 | 691 | 879 | 1,040 | 1,535 | 1,830 | 2,177 |
| Operating Costs | | | | | | | | | | |
| Salaries and wages | 127 | 145 | 167 | 192 | 221 | 254 | 293 | 336 | 387 | 445 |
| Operating and maintenance | 53 | 52 | 44 | 36 | 28 | 21 | 24 | 29 | 32 | 37 |
| Wholesale cost of water | - | - | 56 | 118 | 186 | 261 | 300 | 343 | 390 | 442 |
| Depreciation | 104 | 130 | 169 | 214 | 245 | 280 | 324 | 409 | 485 | 1,282 |
| Total | 284 | 327 | 436 | 560 | 680 | 816 | 941 | 1,117 | 1,294 | 2,206 |
| Surplus Before Interest | 215 | (20) | (73) | (127) | 11 | 63 | 99 | 418 | 536 | (29) |
| Interest | - | 67 | 145 | 235 | 339 | 399 | 458 | 518 | 578 | 636 |
| Surplus (deficit) | 215 | (87) | (218) | (362) | (328) | (336) | (359) | (100) | (37) | (665) |
| Average Net Fixed Assets | - | - | 1,706 | 2,915 | 4,192 | 5,106 | 5,644 | 6,222 | 6,846 | 7,519 |
| Rate of Return on Average Net Fixed Assests (%) | - | - | - | - | .3 | 1.2 | 1.8 | 6.7 | 7.8 | - |
| Cash Operating Ratio (%) | 56.9 | 106.5 | 104.7 | 102.1 | 71.5 | 63.1 | 61.6 | 50.4 | 49.4 | 81.2 |

Table 9-25

## Wastewater Income and Expenditure Statement

| Year Ending December 31 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | JD (thousands) | | | | | |
| **Revenue** | | | | | | | | | | |
| Resident | - | - | - | 65 | 92 | 154 | 685 | 970 | 1,255 | 1,499 |
| Nonresident | - | - | - | 37 | 48 | 57 | 224 | 265 | 319 | 373 |
| Administrative/connection fees | - | 128 | 128 | 96 | 76 | 147 | 96 | 134 | 96 | 38 |
| Septage dumping | - | - | - | 152 | 166 | 180 | 195 | 216 | 223 | 238 |
| Total | - | 128 | 128 | 350 | 382 | 538 | 1,200 | 1,585 | 1,893 | 2,148 |
| **Operating Costs** | | | | | | | | | | |
| Salaries and wages | - | - | - | 175 | 201 | 231 | 266 | 306 | 352 | 405 |
| Operating and maintenance | - | - | - | 24 | 69 | 116 | 178 | 335 | 449 | 584 |
| Depreciation | - | - | - | - | - | - | - | 585 | 585 | 585 |
| Total | - | - | - | 199 | 270 | 347 | 444 | 1,266 | 1,386 | 1,574 |
| Surplus Before Interest and Grants | - | 128 | 128 | 151 | 112 | 191 | 756 | 359 | 507 | 574 |
| Interest | - | 30 | 240 | 357 | 482 | 586 | 714 | 717 | 709 | 692 |
| AID Grant | - | 900 | 100 | - | - | - | - | - | - | - |
| Surplus (deficit) | - | 990 | (12) | (206) | (370) | (395) | 42 | (358) | (202) | (118) |
| Average Net Fixed Assets | - | - | - | - | - | - | - | - | 10,823 | 10,238 |
| Rate of Return on Average Net Fixed Assets (%) | - | - | - | - | - | - | - | - | 12.8 | 15.4 |
| Cash Operating Ratio (%) | - | - | - | 56.7 | 70.7 | 64.5 | 37.0 | 40.4 | 42.3 | 46.0 |

Table 9-26

## Solid Waste Income and Expenditure Statement

| Year Ending December 31 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | JD (thousands) | | | | | |
| **Revenue** | | | | | | | | | | |
| Resident | 279 | 293 | 307 | 324 | 521 | 582 | 612 | 640 | 667 | 698 |
| Nonresident | 58 | 62 | 64 | 66 | 108 | 112 | 118 | 121 | 128 | 131 |
| Special service | 14 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 |
| Total | 351 | 369 | 386 | 406 | 646 | 712 | 749 | 781 | 816 | 851 |
| **Operating Costs** | | | | | | | | | | |
| Salaries and wages | 128 | 150 | 176 | 212 | 242 | 283 | 333 | 407 | 468 | 538 |
| Operating and maintenance | 66 | 76 | 88 | 107 | 127 | 148 | 176 | 209 | 249 | 291 |
| Equipment | - | - | 38 | - | 44 | 231 | 79 | 211 | - | 121 |
| Depreciation | - | 31 | 39 | 38 | 39 | 38 | 39 | 38 | 13 | 13 |
| Total | 194 | 257 | 341 | 357 | 452 | 700 | 627 | 865 | 730 | 963 |
| Surplus Before Interest | 157 | 112 | 45 | 49 | 194 | 12 | 122 | (84) | 86 | (112) |
| Interest | 39 | 46 | 44 | 43 | 42 | 40 | 38 | 36 | 35 | 33 |
| Surplus (deficit) | 118 | 66 | 1 | 6 | 152 | (28) | 84 | (120) | 51 | (145) |
| Average Net Fixed Assets | N/A | 289 | 381 | 343 | 304 | 265 | 227 | 189 | 163 | 150 |
| Rate of Return on Average Net Fixed Assets (%) | - | 38.8 | 11.8 | 14.3 | 63.8 | 4.5 | 53.7 | - | 52.8 | - |
| Cash Operating Ratio (%) | 55.3 | 61.2 | 78.2 | 78.6 | 63.9 | 93.0 | 78.5 | 105.9 | 87.9 | 111.6 |

Table 9-27

## Water Supply and Wastewater Balance Sheet

| Year Ending December 31 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | JD (thousands) | | | | | |
| **Assets** | | | | | | | | | | |
| Current Assets | | | | | | | | | | |
| Cash | 147 | 269 | 378 | 475 | 564 | 318 | 290 | 443 | 711 | 271 |
| Inventories | 7 | 8 | 9 | 20 | 25 | 31 | 38 | 50 | 61 | 74 |
| Accounts receivable | 75 | 66 | 74 | 119 | 161 | 215 | 337 | 469 | 559 | 649 |
| Total Current Assets | 229 | 343 | 461 | 614 | 750 | 564 | 665 | 962 | 1,331 | 994 |
| Fixed Assets | | | | | | | | | | |
| Water supply | - | 1,118 | 2,349 | 3,710 | 5,207 | 5,986 | 6,843 | 7,786 | 8,823 | 9,964 |
| Less depreciation | - | - | 56 | 174 | 360 | 621 | 921 | 1,264 | 1,654 | 2,096 |
| Net water supply | - | 1,118 | 2,293 | 3,536 | 4,847 | 5,365 | 5,922 | 6,522 | 7,169 | 7,868 |
| Sewerage | - | - | - | - | - | - | - | 11,700 | 11,700 | 11,700 |
| Less depreciation | - | - | - | - | - | - | - | 585 | 1,170 | 1,755 |
| Net sewerage | - | - | - | - | - | - | - | 11,115 | 10,530 | 9,945 |
| Work-in-process | - | 1,396 | 4,972 | 6,683 | 8,415 | 9,713 | 11,700 | - | - | - |
| Total Fixed Assets | - | 2,514 | 7,265 | 10,219 | 13,262 | 15,078 | 17,622 | 17,637 | 17,699 | 17,813 |
| Total Assets | 229 | 2,857 | 7,726 | 10,833 | 14,012 | 15,642 | 18,287 | 18,599 | 19,030 | 18,807 |
| **Liabilities** | | | | | | | | | | |
| Current Liabilities | | | | | | | | | | |
| Accounts payable | 14 | 15 | 18 | 24 | 29 | 36 | 44 | 66 | 81 | 160 |
| Deposits | - | 5 | 9 | 14 | 19 | 30 | 36 | 41 | 47 | 53 |
| Total Current Liabilities | 14 | 20 | 27 | 38 | 48 | 66 | 80 | 107 | 128 | 213 |
| Long-Term Debt | | | | | | | | | | |
| Loans -- water supply | - | 1,185 | 2,561 | 4,157 | 5,866 | 6,777 | 7,670 | 8,539 | 9,469 | 10,468 |
| Loans -- sewerage | - | 526 | 4,242 | 6,310 | 8,468 | 9,900 | 11,955 | 11,829 | 11,548 | 11,024 |
| Total Long-Term Debt | - | 1,711 | 6,803 | 10,467 | 14,334 | 16,677 | 19,625 | 20,368 | 21,017 | 21,492 |
| Equity | | | | | | | | | | |
| Equity, retained earnings, and capital contribution | 215 | 1,126 | 896 | 328 | (370) | (1,101) | (1,418) | (1,876) | (2,115) | (2,898) |
| Total Liabilities | 229 | 2,857 | 7,726 | 10,833 | 14,012 | 15,642 | 18,287 | 18,599 | 19,030 | 18,807 |
| Debt - Equity Ratio | 0:100 | 60:40 | 88:12 | 97:3 | - | - | - | - | - | - |



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Table 9-28

## Solid Waste Balance Sheet

| Year Ending December 31 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | JD (thousands) | | | | | |
| **Assests** | | | | | | | | | | |
| Current Assests | | | | | | | | | | |
| Cash | 18 | 89 | 101 | 117 | 224 | 191 | 278 | 158 | 184 | 11 |
| Accounts receivable | 88 | 92 | 97 | 102 | 162 | 178 | 187 | 195 | 204 | 213 |
| Total | 106 | 181 | 198 | 219 | 386 | 369 | 465 | 353 | 388 | 224 |
| Fixed Assets | | | | | | | | | | |
| Land | 363 | 363 | 363 | 363 | 363 | 363 | 363 | 363 | 363 | 363 |
| Facilities and equipment | 178 | 432 | 432 | 432 | 432 | 432 | 432 | 432 | 432 | 432 |
| Less depreciation | - | 31 | 70 | 108 | 147 | 185 | 224 | 262 | 275 | 188 |
| Net facilities and equipment | 178 | 401 | 362 | 324 | 285 | 247 | 208 | 170 | 157 | 144 |
| Work-in-progress | 121 | - | - | - | - | - | - | - | - | - |
| Total Fixed Assets | 662 | 764 | 725 | 687 | 648 | 610 | 571 | 533 | 520 | 507 |
| Total Assets | 768 | 945 | 923 | 906 | 1,034 | 979 | 1,036 | 886 | 908 | 731 |
| **Liabilities** | | | | | | | | | | |
| Current Liabilities | | | | | | | | | | |
| Accounts payable | 6 | 6 | 7 | 9 | 11 | 12 | 15 | 17 | 21 | 24 |
| Total | 6 | 6 | 7 | 9 | 11 | 12 | 15 | 17 | 21 | 24 |
| Long-Term Debt | | | | | | | | | | |
| Loans | 644 | 755 | 731 | 706 | 680 | 652 | 622 | 590 | 557 | 522 |
| Total | 644 | 755 | 731 | 706 | 680 | 652 | 622 | 590 | 557 | 522 |
| Equity | | | | | | | | | | |
| Equity, retained earnings, and capital contribution | 118 | 184 | 185 | 191 | 343 | 315 | 399 | 279 | 330 | 185 |
| Total Liabilities | 768 | 945 | 923 | 906 | 1,034 | 979 | 1,036 | 886 | 908 | 731 |
| **Debt-Equity Ratio** | 84:16 | 80:20 | 80:20 | 64:36 | 56:44 | 58:42 | 54:46 | 60:40 | 58:42 | 69:31 |

Table 9-29

## Water Supply and Wastewater Cash Flow Statement

| Year Ending December 31 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | JD (thousands) | | | | | |
| Internal Cash Generation | | | | | | | | | | |
| Net revenue before depreciation and interest | | | | | | | | | | |
| Wastewater | - | 128 | 128 | 151 | 112 | 191 | 756 | 944 | 1,092 | 1,159 |
| Water supply | 215 | (20) | (17) | (9) | 197 | 324 | 399 | 761 | 926 | 413 |
| Total | 215 | 108 | 111 | 142 | 309 | 515 | 1,155 | 1,705 | 2,018 | 1,572 |
| Operating Requirements | | | | | | | | | | |
| Working capital | 68 | (14) | 2 | 45 | 37 | 42 | 115 | 117 | 80 | 18 |
| Debt service - interest | -- | 97 | 385 | 592 | 821 | 985 | 1,172 | 1,235 | 1,282 | 1,328 |
| Debt service - repayment | -- | -- | --- | --- | 68 | 271 | 417 | 578 | 702 | 864 |
| Total Debt Service | -- | 97 | 385 | 592 | 889 | 1,256 | 1,589 | 1,813 | 1,984 | 2,192 |
| Total Operating Requirements | 68 | 83 | 387 | 637 | 926 | 1,298 | 1,704 | 1,930 | 2,064 | 2,210 |
| Total Available From Operations | 147 | 25 | (276) | (495) | (617) | (783) | (549) | (225) | (46) | (638) |
| Construction Costs and Equipment | | | | | | | | | | |
| Project - wastewater | -- | 1,396 | 3,576 | 1,711 | 1,732 | 1,298 | 1,987 | -- | -- | -- |
| Project - water supply | -- | 1,118 | 1,231 | 1,361 | 1,497 | 779 | 857 | 943 | 1,037 | 1,141 |
| Total Construction Costs and Equipment | -- | 2,514 | 4,807 | 3,072 | 3,229 | 2,077 | 2,844 | 943 | 1,037 | 1,141 |
| Balance to be Financed | -- | 2,611 | 5,192 | 3,664 | 3,935 | 2,614 | 3,365 | 1,321 | 1,351 | 1,339 |
| Surplus (Deficit) | 147 | 122 | 109 | 97 | 89 | (246) | (28) | 153 | 268 | (440) |
| Cash Balance at End of Year | 147 | 269 | 378 | 475 | 564 | 318 | 290 | 443 | 711 | 271 |
| Debt Service Coverage | -- | 1.1 | 0.3 | 0.2 | 0.3 | 0.4 | 0.7 | 0.9 | 1.0 | 0.7 |

Table 9-30

Solid Waste Cash Flow Statement

| Year Ending December 31 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | JD (thousands) | | | | | |
| Internal Cash Generation | | | | | | | | | | |
| Net revenue before depreciation and interest | 157 | 143 | 122 | 87 | 277 | 281 | 240 | 165 | 99 | 22 |
| Operating Requirements | | | | | | | | | | |
| Working capital | 82 | 4 | 4 | 3 | 58 | 15 | 6 | 6 | 5 | 6 |
| Debt service-interest | 39 | 46 | 44 | 43 | 42 | 40 | 38 | 36 | 35 | 33 |
| Debt service-repayment | 18 | 22 | 24 | 25 | 26 | 28 | 30 | 32 | 33 | 35 |
| Total Debt Service | 57 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 | 68 |
| Total Operating Requirements | 139 | 72 | 72 | 71 | 126 | 83 | 74 | 74 | 73 | 74 |
| Total Available From Operations | 18 | 71 | 50 | 16 | 151 | 198 | 166 | 91 | 26 | (52) |
| Construction Costs and Equipment | | | | | | | | | | |
| Land | 363 | - | - | - | - | - | - | - | - | - |
| Equipment | 178 | - | 38 | - | 44 | 231 | 79 | 211 | - | 121 |
| Project-solid waste | 121 | 133 | - | - | - | - | - | - | - | - |
| Total Construction Costs and Equipment | 662 | 133 | 38 | - | 44 | 231 | 79 | 211 | - | 121 |
| Balance to be Financed | 662 | 133 | - | - | - | - | - | - | - | - |
| Surplus (Deficit) | 18 | 71 | 12 | 16 | 107 | (33) | 87 | (120) | 26 | (173) |
| Cash Balance at End of Year | 18 | 89 | 101 | 117 | 224 | 191 | 278 | 158 | 184 | 11 |
| Debt Service Coverage | 2.8 | 2.1 | 1.8 | 1.3 | 4.1 | 4.1 | 3.5 | 2.4 | 1.5 | - |



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## 9.4 ECONOMIC ANALYSIS

This section presents an economic analysis of the proposed project and the individual plan elements. The analysis includes review of the incremental revenues and costs associated with each plan element, analysis of ability to pay, and project internal rate of return.

### 9.4.1 Ability to Pay

A basic objective of this study is to provide municipal services that are affordable to all citizens of Irbid. This objective is consistent with Kingdom policy, and implies that the percentage of total household income that will be spent on municipal services should not exceed some maximum levels. As a result, the analysis of ability to pay is a key factor in determining what the residents of Irbid can afford, and in determining what priorities will be set with regard to construction of individual project elements, if residents cannot afford the entire project.

With respect to the ability to pay, this section:

1. Establishes guidelines for determining the maximum percentage of total household income that should be spent on municipal utilities.

2. Evaluates the present household income in Irbid.

3. Identifies the present water consumption by income group, and estimates the percentage of total household income spent on water and solid waste.

4. Develops a progressive water rate structure.

5. Determines the future (1985) ability to pay of income groups.

6. Establishes the need for subsidies and grants.

The data used in preparing these analyses include inputs from socioeconomic surveys of Irbid which, among other things, identify household income and water meter billing numbers. From the water billing records, corresponding to the survey samples, information regarding water use over the past six months was collected.

9.4.1.1 Ability to Pay Guidelines.

The basis for determining the percentage of household income that should be spent on municipal utilities varies from place-to-place. It is dependent on the relative prices of goods and services available, current expenditure patterns, and real family income (after accounting for price level changes). A frequently used rule-of-thumb is that a near subsistence level family should not have to spend more than 5 percent of its income on water. The figure is referenced in "Village Water Supply," a World Bank research publication prepared by Robert J. Saunders and Jeremy J. Warford (1976). Although many urban area water users pay much less than this for their public water supply, this 5 percent figure is reasonable for Irbid, and is used as a ceiling for all low income municipal service users in Irbid.

9.4.1.2 Present Household Income.

An income versus water use survey was conducted in Irbid as part of this study, and serves as the source of information for identifying income distribution. The income survey results are summarized in Table 9-31. The sample size is 105, and the survey average annual household income is 1,834 JD.

Income is distributed in a generally normal pattern into five income groups. A low-income group is identified as having an annual household income below 600 JD, and represents about 12 percent of the Irbid population. The household income increases for the majority of the sample; 51 percent are in the 1,001 to 3,000 JD group, and are clustered around the group average of 1,793 JD which is lower than the overall survey mean. The distribution tapers off as household income continues to increase with the upper distribution somewhat smaller than the lower, i.e., income is skewed to lower income households.

The table includes the average number of workers who generate household income, and the size of households they support. The trend shows an increasing number of workers, as income group and family size increase, and then a decline in the number of workers at the highest income levels. This is consistent with general findings of family income requirements, and the tendency for higher income families to have smaller families. Associated with these trends is the increasing average per capita income, which increases consistently as the number of workers per household and family size change.

Table 9-31

Irbid Household Income Distribution
and Characteristics -- 1979
Socioeconomic Survey Results

| Income Group (JD) | Number In Sample | Distribution Percent | Average No. of Workers Per Household | Average No. of People Per Household | Annual Average Household Income (JD) | Annual Average Per Capita Income (JD) |
|---|---|---|---|---|---|---|
| 0 to 600 | 13 | 12.4 | 1 | 7.3 | 507 | 69.5 |
| 601 to 1,000 | 22 | 21.0 | 1.1 | 10.50 | 877 | 84.3 |
| 1,001 to 3,000 | 54 | 51.4 | 1.4 | 8.20 | 1,817 | 208.5 |
| 3,001 to 5,000 | 14 | 13.3 | 2.25 | 10.60 | 4,130 | 232.0 |
| 5,001 and up | 2 | 1.9 | 1 | 5.5 | 6,000 | 1,090.0 |

Total number in sample -- 105 households

Survey average annual income -- 1,834 JD

9.4.1.3 Current Ability to Pay by Income Group.

From the information presented on household income and family size, it is expected that per capita water use will increase as income increases, and that total household consumption will be affected by family size.

Table 9-32 presents the analysis of the current ability to pay, based on the effect of user charges on income groups. The water use consumption categories are those used in the current water use billing schedules, as are the water charges per cubic meter. From existing water records and survey information, the number of households, average income per household, and total annual revenue are identified for each water use consumption category. The average water cost per household is determined from the fee schedule and average water consumption for the group. Revenue by group, ability to pay, and distribution for the group are calculated within the table. The check on the accuracy of the analysis is provided by comparing the sum of the revenues provided by all groups with the total revenue from residential customers.

Table 9-32 shows that the present low-income water system customers, represented by the 0 to 5 cu m per month consumption group, currently pay 0.28 percent of their income for water. This group consumes 10.3 percent of the water sold in Irbid, and contributes 6.7 percent of the revenue.

Percent of household income spent on water distribution and wholesale water purchases increases to 0.48 percent for the 5 to 15 cu m per month group, and to 2.25 percent and 3.05 percent for the next consumption groups. The table also shows an apparent anomaly, where average household income increases then decreases to 1,275 JD for the 15 to 25 cu m per month group. This is explained by the variation in household size and the greater water consumption of large families.

The analysis required for determining the effect of present solid waste collection and disposal fees is much simpler. Since the charge is 6.00 JD per year, the test is a matter of comparing this fixed annual charge with the present annual income categories. Referring to Table 9-31, at the lowest income group the 6.000 JD annual charge for garbage collection is 1 percent of the 600 JD level and 1.3 percent for the 450 JD low-income group average.

Table 9-32

Existing Conditions
Current Ability to Pay Analysis

| Water Use Consumption Group (cu m/month) | (1) Average Household Water Use (cu m/month) | (2) Unit Cost of Water (JD/cu m) | (3) Number of Households | (4) Average Water Use[1] Per Household (cu m/year) | (5) Average Household Income (JD/year) | (6) Average Water Cost[2] Per Household (JD/year) | (7) Ability to Pay[3] (%) | (8) Annual Revenue By Group (JD) | (9) Total Water Sold (cu m/year) |
|---|---|---|---|---|---|---|---|---|---|
| 0 to 5 | 3.4 | 0.080 | 3,820 | 40.80 | 1,150 | 3.260 | 0.28 | 10,725 | 134,232 |
| 5 to 15 | 9.7 | 0.120 | 5,277 | 77.60 | 1,452 | 6.910 | 0.48 | 36,464 | 409,495 |
| 15 to 25 | 18.6 | 0.220 | 1,759 | 232.20 | 1,275 | 28.700 | 2.25 | 50,483 | 392,609 |
| More than 25 | 28.2 | 0.300 | 1,096 | 338.40 | 1,870 | 57.100 | 3.05 | 62,582 | 370,886 |
| Totals | | | 11,952[4] | | | | 0.98[5] | 160,254[6] | 1,307,222 |

[1] Equals (1) x 12 months

[2] Equals (4) x (2)

[3] Ability to pay is the percent of annual income required for purchase of water. Ability to pay equals average water cost divided by average household income.

[4] Based on survey document 14,500 total meters in 1979 adjusted to exclude non-residential use.

[5] Total ability to pay equals total annual revenue (column 8) divided by total income of all households.

[6] This table contains information from the socioeconomic survey conducted in the summer of 1979. It also uses the existing water rate structure to determine the annual revenue by water consumption group and water sold (each group). As a test, the totals compare favorably with reported values in subsection 9.3.2 of Chapter 9.



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9.4.1.4 Future Ability to Pay Based on Averages.

Table 9-23 summarized the household average annual user charges for the proposed facility plans. These new user charges for 1983 (the first year when user charges are available for all project elements) are compared here with the average household income for Irbid (1,834 JD) obtained from the survey (Table 9-31):

Average Ability to Pay[1]
Percent of Income
(JD)

| | Utility Costs[2] | |
|---|---|---|
| | Partial | Full |
| Water supply | 0.39 | 1.99 |
| Wastewater | 0.26 | 0.26 |
| Solid waste | 0.98 | 0.98 |
| Stormwater | 0.56 | 0.56 |
| Total | 2.19 | 3.79 |

This analysis implies that, on the average, the project can be afforded by the residents of Irbid. This analysis, however, masks the problems of low-income users. The analysis also indicates the significance of the wholesale cost of water as a factor in confusing specific issues related only to the proposed project.

The following subsections develop a rate structure for water supply and analyze the ability to pay based on the annual costs to the user for the water consumed, as well as the other services proposed in this project. This approach focuses on the ability to pay problems of the low-income users.

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[1]This analysis produces a conservative estimate of ability to pay. Actual percentage of income that will be spent is likely to be less than estimated. The calculation compares 1979 average income (survey) with user charges for all utilities (1983, Table 9-23), including the highest wholesale water costs (0.153 JD per cu m, estimated for 1989).

[2]Partial utility costs do not include wholesale water costs; full costs do.

9.4.1.5 Future Water Supply Unit Costs.

Based on the findings of the water use and household income survey (Table 9-31), the relationship between household income level and water consumption was determined. This relationship is important, since the percent of income spent on water depends on the quantity of water consumed by an income group. In addition, this relationship was important for determining the ability to pay, and was the key to structuring a rate charge that would be affordable to low-income users.

Table 9-33 indicates how the average monthly user charges from the water and wastewater cash flow analyses for 1985 were converted to a progressive pricing structure similar to that presented in subsection 9.3.2 for existing water services. For this study, 1985 was selected as the year for which the rates would be structured because it is the midpoint in the planning period, and rates would presumably be set for periods of time for institutional stability and administrative reasons. Also, a 0 to 15 cu m per month water consumption group was formed from the previous 0 to 5 and 6 to 15 groups. This was done because of the apparent concentration of low-income households in these groups.

Table 9-33 presents an average water rate structure which is progressive and is consistent with the percentages of income currently spent by each consumption group for water. The analysis considers water rates both "with" and "without" the wholesale price of water.

This average group unit cost water system pricing structure is very similar to the previous Kingdom pricing structure (which included a subsidized price) for wholesale water. These schedules are compared in the following tabulation:

Water Supply System Unit Costs
(fils/cu m)

| Water Consumption Group (cu m/month) | Proposed Partial Unit Costs | Previous Kingdom Policy Unit Costs | Proposed/With Wholesale Water Unit Costs |
|---|---|---|---|
| 0 to 5 | --- | 80 | --- |
| 0 to 15 | 72 | 100 | 225 |
| 16 to 25 | 160 | 180 | 313 |
| More than 25 | 186 | 250 | 339 |



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Table 9-33

## Water Charges Per Cubic Meter By Income Group -- 1985

| (1) Use Consumption Group (cu m/month) | (2) Average Household Income[1] (JD/year) | (3) Number of Households | (4) Revenue by Consumption Group (JD/year) | (5) Total Yearly Water Use (cu m) | (6) Average Household Water Use[2] (cu m/year) | (7) Partial Unit Cost[3] (fils/cu m) | (8) Wholesale Unit Cost[4] (fils/cu m) | (9) Group Average Water Charge (fils/cu m) |
|---|---|---|---|---|---|---|---|---|
| 0 to 15 | 2,367 | 15,824 | 104,875[5] | 1,444,800 | 91 | 72 | 153 | 225 |
| 16 to 25 | 2,259 | 3,250 | 165,189[6] | 1,032,000 | 317 | 160 | 153 | 313 |
| More than 25 | 3,313 | 2,026 | 179,936[7] | 963,200 | 475 | 186 | 153 | 339 |
| Total | 51,700,000[8] | 21,100[9] | 450,000[10] | 3,440,000[11] | | | | |

[1]Average annual income from Table 9-32, weighted by number of users for the 0 to 15 water use group and inflated 10 percent per year. Variation in income by group is explained in text.

[2]Calculated (5) divided by (3).

[3]Calculated (4) divided by (5).

[4]Based on inflated current wholesale cost of 65 fils per cu m at 15 percent.

[5]Based on 1979 weighted average ability to pay - 0.28% x (2) (3).

[6]Based on 1979 ability to pay -- 2.25% x (2) (3).

[7]Determined by difference in ability to pay.

[8]Equals total of (2) x (3) for each consumption group.

[9]From cash flow analysis distributed based on distribution in Table 9-32.

[10]From Table 9-9a (202,000 JD in 1985 escalated at 14.3 percent per year for 6 years for water use increases -- cash flow model computation procedure), required total revenue by consumption group based on water consumption revenue for residential users, exclusive of wholesale water cost.

[11]Total yearly water use 4,300,000 of cu m (see subsection 9.4.1.6), adjusted to 80 percent for residential use and distributed to water use consumption groups based on 1979 distribution Table 9-32, column (9).



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Table 9-34 summarizes the monthly user charges for water supply and wastewater services. Table 9-35 summarizes all of the user charges by income group, and identifies what percentage of a group's average income (ability to pay) would be spent on each service. The table also presents a combined estimated ability to pay for all services.

In order to demonstrate the ability to pay impact of wholesale water charges on the proposed system, charges are presented for water supply with and without the proposed wholesale unit cost; combined charges are also presented in this manner. The analysis indicates that the proposed project is affordable to each water use consumption group where the wholesale costs of water are omitted from the analysis. Subsidies would be required, however, if the wholesale water cost is included.

The significance of the wholesale water unit cost is again apparent in Table 9-35, which causes the ability to pay to be very close to the 5 percent guideline for the 16 to 25 group, and to exceed the guideline for the more than 25 cu m per month water consumption group. The ability to pay for these two water consumption groups is 4.39 and 6.81 percent, respectively, of the average group incomes. Without considering the wholesale water cost, however, the table indicates that the new system is affordable to all groups, and the maximum percent of annual income spent on the new water system is 2.67 percent.

For the purpose of identifying the need for subsidies concerning the proposed project, it appears appropriate to consider the Irbid project separately from the issue of wholesale water. This is appropriate for two reasons:

1. The wholesale cost per unit of sold water from Table 9-33 ranges from 45 to 68 percent of the total unit cost.

2. Currently, wholesale water is priced by national policy, which does not now cover the costs of water (subsection 9.3.2). Also, it is likely that the current national subsidies will continue to be applied to wholesale water in the future.

As a result of this analysis, the proposed water project elements (water and wastewater) are considered acceptable with respect to the "rule of thumb" 5 percent of annual income guidelines established by the World Bank. However, the ability to pay for all elements of the project (water supply, wastewater, solid waste, and stormwater) exceeds the 5 percent limit for the

Table 9-34

Monthly User Charges[1] (1985) for Water and Wastewater By Water Use Consumption Group

| Water Use Consumption Group (cu m/month) | Unit[2] Charge (JD/cu m) | Monthly[3] Charge (JD) | Unit[4] Charge (JD/cu m) | Monthly Charge (JD) | Combined Water and Wastewater Charge (JD) | Average Group Charge |
|---|---|---|---|---|---|---|
| 0 to 15 | 0.225 | 1.706 | 0.033 | 0.197 | | 1.903 |
| 16 to 25 | 0.313 | 8.268 | 0.046 | 0.969 | | 9.237 |
| More than 25 | 0.349 | 18.802 | 0.050 | 1.583 | | 20.385 |

[1]Costs based on medium inflation rates from cash flow analysis.

[2]Water charge (Table 9-33) includes estimated 1989 wholesale water cost of 153 fils per cu m to better reflect future conditions.

[3]Calculated: (average group household water use from Table 9-33) (average unit charge).

[4]Wastewater charges weighted based on average group unit prices.

Table 9-35

Ability to Pay Annual User Charges for Municipal Services Based on Projected 1985 Costs and Income

| Water Use Consumption Group (cu m/month) | Average Household Income (JD/year) | Water Supply[1] Monthly User Charge (JD) | Water Supply[1] Percent Income | Water Supply[2] Monthly User Charge (JD) | Water Supply[2] Percent Income | Wastewater Monthly User Charge (JD) | Wastewater Percent Income | Solid Waste Monthly User Charge (JD) | Solid Waste Percent Income | Stormwater Monthly User Charge (JD) | Stormwater Percent Income | Combined Charge[1] Monthly User Charge (JD) | Combined Charge[1] Percent Income | Combined Charge[2] Monthly User Charge | Combined Charge[2] Percent Income |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 to 15 | 2,367 | 1.706 | 0.86 | 0.546 | 0.28 | 0.197 | 0.10 | 2.300 | 1.16 | 0.780 | 0.39 | 4.98 | 2.52 | 3.82 | 1.94 |
| 16 to 25 | 2,259 | 8.268 | 4.39 | 4.226 | 2.25 | 0.969 | 0.51 | 2.300 | 1.22 | 0.780 | 0.41 | 12.31 | 6.54 | 8.27 | 3.00 |
| More than 25 | 3,313 | 18.802 | 6.81 | 7.360 | 2.67 | 1.583 | 0.57 | 2.300 | 0.83 | 0.780 | 0.28 | 23.46 | 8.50 | 12.02 | 4.35 |

[1]Charge includes the wholesale price of water.

[2]Charge does not include wholesale price of water.

higher consumption groups, at 6.54 percent of annual income for the 10 to 25 cu m per month consumption group, and 8.50 percent of annual income for the greater than 25 cu m per month consumption group. Although costs of all elements exceed 5 percent, this "limit" was intended, according to the World Bank for analysis of water supply projects. Since the average ability to pay (subsection 9.4.1.4) is 3.79 percent for all project elements, and the percentages of income that will be spent are not significantly more than 5 percent for the higher consumption groups, the project appears to be affordable to the residents of the Municipality of Irbid.

Assistance, however, will be needed to permit low-income households to connect into the system without undue hardship. The following table summarizes all of the administrative/connection fees:

Fees In First Year of System Operation

| | Administrative Fee | Connection Fee | Total Fees | Ability[1] To Pay |
|---|---|---|---|---|
| Water Supply | 19 | 0[2] | 19 | 1.0 |
| Wastewater | 32 | 200 | 232 | 12.6 |
| Solid Waste | 0 | 0 | 0 | 0 |
| Stormwater | 0 | 0 | 0 | 0 |
| Total | 51 | 200 | 251 | 13.7 |

The ability to pay in this table is represented by the average income. The charges will have a greater impact on families with incomes below this level. As a result, a "short-term" installment loan program should be established that will reduce the burden on low-income families. This is typically a 12 to 18-month loan, but in this case, a longer period should be considered.

Grants to connect low-income families to the system should also be considered since one-third of the Irbid households may have incomes below 1,000 JD per year (Table 9-31). The 251-JD combined administrative and connection fee represents 25 percent of the annual income for the highest income level in this group. This is not affordable even with installment loans. An ongoing grant program will probably be needed throughout the project period, as shown on the following Table 9-36.

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[1]Based on 1,834-JD average income (1979), Table 9-31.
[2]Included in administrative fee.



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Table 9-36

Subsidy Needs for Low Income Water/Wastewater User Connections

| Year | Customers Needing Assistance | Water and Wastewater Fee (JD) | Annual Required Subsidy |
|---|---|---|---|
| 1981 | 1,000 | 251 | 251,000 |
| 1982 | 1,000 | 251 | 251,000 |
| 1983 | 660 | 251 | 165,600 |
| 1984 | 660 | 251 | 165,600 |
| 1985 | 1,485 | 251 | 372,700 |
| 1986 | 924 | 251 | 231,900 |
| 1987 | 1,350 | 251 | 338,800 |
| 1988 | 924 | 251 | 231,900 |
| 1989 | 360 | 251 | 90,300 |

Customers needing assistance determined as 33 percent of new customer connections -- number of residential customers (Table 9-15a, and Table 9-31, percent incomes less than 1,000 JD).

9.4.1.6 Constrained vs. Unconstrained Water Supply.

The previous analysis is based on the premise that water and sewer demands will be met for each year of the analysis (1980-1989). This subsection considers the possibility that this demand will not be met for the years 1986, 1987, and 1989.

The following tabulation shows the constrained and unconstrained water supply and demand schedules (M cu m/yr):

| | | Water Supply[1] | |
|---|---|---|---|
| Year | Water Demand | Case I Constrained | Case II Unconstrained |
| 1980 | 1.7 | 2.5 | 2.5 |
| 1981 | 2.0 | 3.5 | 3.5 |
| 1982 | 2.4 | 4.5 | 4.5 |
| 1983 | 3.2 | 5.5 | 7.5 |
| 1984 | 3.7 | 5.5 | 7.5 |
| 1985 | 4.3 | 5.5 | 7.5 |
| 1986 | 5.4 | 5.5 | 7.5 |
| 1987 | 6.3[2] | 5.5[2] | 7.5 |
| 1988 | 7.5[2] | 5.5[2] | 7.5 |
| 1989 | 8.4[2] | 5.5[2] | 12.0 |

Demand exceeds supply by 0.8 M cu m in 1987, by 2.0 M cu m in 1988, and by 2.9 M cu m in 1989 in the constrained case.

During these years, an additional 3,100 residential and 400 nonresidential customers are scheduled to enter the system (Table 9-9a), continued renovation of the existing water system is planned (i.e., net capital costs of 943,000 JD, 1,037,000 JD, and 1,141,000 JD, respectively, for the three years (Table 9-9b), and ordinary factors influencing costs of operation will continue (i.e., operation and maintenance and related inflationary escalation -- 15 percent per year). These factors mean that customers will receive less water from a system that is incurring increasing costs. The results are obvious; the unit costs of water will increase and a continued level of water consumption (constant) from the period of unconstrained use (1986) to constrained use (1987) would be purchased at a higher cost.

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[1]In 1989, the Jordan Valley project is expected to be complete. Case I and Case II estimates of future water supply each represent utilization of existing sources and development of future supplies. Sources now being developed by WSC are the best in this regard.

[2]Years when demand is not met.



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The increased cost will help to allocate the scarce supply. Presumably low income users will be the first to adjust to lower consumption. Other users may, based on the unit cost increase, also use less water (i.e., the cost of lawn watering and swimming pool use may be deterents to increased consumption). In the event price does not adjust the demand on the available supply, shortages will develop.

Shortages can be prevented by limiting the new customers entering the system, physically limiting water use by prohibiting lawn watering, car washing, etc. or by periodically shutting off the system to various sectors of the community.

9.4.1.7 Rate of Return on Average Net Fixed Assets.

As stated previously, AID and World Bank staff were interested in the effect of an 8 to 9 percent rate of return on average net fixed assets. This is not recommended. Total user charges from this project are close to the ability to pay limits of the residents of Irbid. A further increase, while making a higher return, would cause undo hardship to individual users.

9.4.2 Analysis of Incremental Revenues and osts

As defined by the facility's plans and financial analysis sections, this project includes the relevant costs and revenues to satisfy the needs in Irbid for water supply, wastewater, solid waste and stormwater services. Associated with the increased services in these systems, are incremental revenues and costs.

The constant JD incremental revenues and costs were evaluated. Because of the nature (lumpiness) of the investment program, however, the fluctuations in new users coming into the system, changes in fees and charges, and the effects of inflation, the analysis was of little value in determining the relationship between incremental units of service and the associated real incremental costs and revenues. Over a longer analysis period (possibly 20 or 30 years) when the construction program, grace periods, and other interruptions are stabilized, this analysis would be useful in making decisions as to the effective level of service that the system should provide and other matters concerning financing, fees, and charges.



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### 9.4.3 Internal Rate of Return Analysis

The internal rate of return, or rate of return over costs, is an indicator of the benefit that can be realized by various investments. This project evaluation approach is one of many factors considered in determining the feasibility of projects and their suitability for funding. Two methods are generally found in the literature: one approach is referred to as the economic internal rate of return; the other approach is the financial internal rate of return. The gain in income and other benefits (i.e., health, economic development, etc.) in each of the future years is discounted to the present, relative to the cost (foregone income) in the initial phase of the project. This can be expressed in percentage terms, and ranked for various projects in which the investment might otherwise be used.

The general procedure is to determine the rate of return for the Irbid project, i.e., water supply, wastewater collection and treatment, solid waste collection and disposal, and stormwater management, according to the following formula:

$$C = \frac{R1}{1+r} + \frac{R2}{(1+r)^2} + \ldots \frac{Rn}{(1+r)^n} + \frac{S}{(1+r)^n}$$

Where:

r = Rate of return on earned investment
C = Supply price or cost of the project
R = Future cash inflow and other benefits of the project
S = Salvage value or residual
n = Number of years

This is a common expression which equilibrates costs and expected future returns. In this analysis, the future cash inflows and annual revenue outputs of the cash flow analysis are expressed as 1979 revenues instead of inflated revenues. These future returns also include an estimate of the results of the "with" and "without project" analysis benefits. Salvage values have been ignored as previously described in Section 9.2. The analysis period is the project life for each system; 20 years for solid waste and 40 years for stormwater, water distribution, and wastewater.

Other benefits of the proposed project were identified and discussed in Appendix F, "Analysis of Economic Benefits from

Planned Project Development," in the draft feasibility report. These benefits are attributed to the planned water and wastewater systems which are the most significant proposed improvements. Because of the limited information available on the other benefits, it was not possible to identify them specifically to each part of the project.

Tables 9-37 and 9-38 summarize the results of the financial internal rate of return analysis that AID (Washington) needed for its evaluation.

Where:

r = Rate of return on earned investment

C = Supply price or cost of the project including replacement and operations and maintenance

R = Future revenues less operation and maintenance

S = Salvage value or residual

n = Number of years

The analysis is based on procedures that AID specified. Based on the computation, the overall rate of return for all project elements is 0.9 percent, significantly less than the project interest rate (6 percent). This financial rate of return is the discount rate which will equilibrate the stream of revenues, net of operation and maintenance costs, with the total estimated project cost of 42,441,000 JD.

The financial rate of return is low. The major reason is that high revenues are not generated for several years, and are thus heavily discounted.

A low financial rate of return, however, is not inconsistent with the goal of producing public works systems which provide basic facilities to low income users at a reasonable cost.

It should be mentioned that other criteria for evaluating a project are satisfactory. Annual revenues generated by this project produce satisfactory cash accounts, debt-equity ratios and rates of return on average net fixed assets are adequate. It should also be noted that these revenues are derived from annual user charges which are at the limit of low income users' ability to pay. Although a higher financial rate of return is possible, it would produce hardship and generate more cash than necessary for efficient operation of all systems.



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Table 9-37

Internal Rate of Return Calculations--Costs

| | Capital | | | | Operating Costs | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | Water | Sewer | Solid Waste | Stormwater | Water | Sewer | Solid Waste | Stormwater | Total |
| 1980 | 0 | 0 | 602 | 991 | 120 | 0 | 163 | 3 | 1,097 |
| 1981 | 940 | 1,310 | 110 | 1,983 | 120 | 0 | 167 | 3 | 4,617 |
| 1982 | 925 | 2,712 | 0 | 0 | 120 | 0 | 195 | 3 | 3,955 |
| 1983 | 930 | 1,169 | 0 | 0 | 120 | 120 | 180 | 3 | 2,522 |
| 1984 | 930 | 1,076 | 0 | 0 | 120 | 136 | 204 | 3 | 2,469 |
| 1985 | 440 | 733 | 0 | 0 | 120 | 152 | 286 | 3 | 1,634 |
| 1986 | 440 | 1,020 | 0 | 0 | 120 | 169 | 220 | 3 | 1,972 |
| 1987 | 440 | 0 | 0 | 0 | 120 | 213 | 270 | 3 | 1,046 |
| 1988 | 440 | 0 | 0 | 0 | 120 | 230 | 204 | 3 | 997 |
| 1989 | 440 | 0 | 0 | 0 | 120 | 247 | 234 | 3 | 1,045 |
| 1990-2020 | 50 | 100 | 0 | 0 | 120 | 200 | 200 | 3 | 789 |
| Totals | 7,425 | 11,020 | 712 | 2,974 | 4,800 | 7,267 | 8,123 | 120 | 42,441 |

Table 9-38

Internal Rate of Return Calculations--Revenues

| Year | Water | Sewer | Solid Waste | Stormwater | Total | Revenue, Net of Operation and Maintenance |
|---|---|---|---|---|---|---|
| 1980 | 379 | 0 | 318 | 0 | 697 | 441 |
| 1981 | 177 | 128 | 306 | 270 | 881 | 591 |
| 1982 | 188 | 128 | 289 | 269 | 874 | 556 |
| 1983 | 202 | 238 | 275 | 271 | 986 | 563 |
| 1984 | 291 | 237 | 400 | 167 | 1,095 | 632 |
| 1985 | 340 | 301 | 399 | 279 | 1,319 | 758 |
| 1986 | 359 | 612 | 381 | 280 | 1,632 | 1,120 |
| 1987 | 437 | 745 | 367 | 279 | 1,828 | 1,222 |
| 1988 | 466 | 795 | 342 | 275 | 1,878 | 1,321 |
| 1989 | 514 | 838 | 331 | 271 | 1,954 | 1,350 |
| 1990-2020 | 514 | 838 | 331 | 271 | 1,954 | 1,431 |



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## 9.5 SUMMARY AND RECOMMENDATIONS

The Phase 1 capital costs are 17,891,000 JD in constant 1979 costs, phased as listed in Table 9-2. Escalated Phase 1 capital costs are 26,688,000 JD as indicated in Table 9-3. Escalated operation and maintenance costs (given in Table 9-4) associated with implementing the project, increase from 327,000 JD in 1980 to 2,445,000 JD in 1989 due to phasing into service proposed facilities and projected inflation rates. Estimated average annual user charges that would be paid by the residents of Irbid for Phase 1 facilities are given in Table 9-23, with selected costs tabulated as follows:

Average Annual User Charges
(JD)

| System | 1980 | 1985 | 1989 |
|---|---|---|---|
| Water supply[1] | 7.200 | 9.600 | 10.800 |
| Wastewater | 0 | 4.8 | 15.600 |
| Solid waste | 18.000 | 27.600 | 27.600 |
| Stormwater | 0 | 9.300 | 7.700 |
| Total | 25.200 | 51.300 | 61.700 |

In general, the average annual user charges increase due to implementation of new facilities plans and inflation of capital and operations and maintenance costs. The stormwater charge (tax revenue requirement) decreases as a result of increased population.

One time administrative charges based on Kingdom policy are charged to new residents. Together these charges, with the exception of those for wastewater facilities, cover all expenses including principal and interest on debt, assumption of existing liabilities from existing water and solid waste operations, and future operation and maintenance costs for complete service to the residents. According to existing policy, wastewater connection costs for connecting from the building to the property line are the responsibility of the homeowner, and short-term installment loans and grants are

[1]Water supply average user charge does not include the wholesale price of water (estimated previously for 1983 at 29.2 JD per year average for a total 1983 average change of 36.4 JD per year -- see subsection 9.4.1.4).



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recommended to ease the burden on low-income families.

With the exception of the poorest residents of the City of Irbid, these charges are affordable and do not exceed the suggested World Bank 5 percent limit of family income.

Sensitivity analyses of each recommended facility plan address the significance of inflation, capital costs escalation, increased water use, and construction phasing variations on associated costs and revenues.

The sensitivity analyses indicate the project revenues are generally very sensitive to variations in user charges, inflation rates, water use rates, and customer connection rates. The operating agency must be aware of these sensitivities and have the authority to vary user charges and fees to generate the required project revenues.

Based on the analysis of this chapter, the following recommendations are offered:

1. The project is affordable by the people of Irbid, and should be financed based on the benefits that will accrue.

2. Recommended project elements should be financed and work initiated as soon as possible since projected inflation factors have significant effects on overall project costs.

3. Guidelines and procedures should be adopted by the new implementing agency for accounting and cost control in accordance with the methods and procedures of the Financial Accounting Standards Board, Stamford, Connecticut, USA. The new agency should be audited annually.

4. For purposes of maintaining institutional stability, user charges and rate schedules should be established and the frequency of rate changes minimized to provide a positive image to the public.

5. Decisions regarding the new water system should be made concerning reconnection of residents who are currently part of the existing water supply system. It is recommended that the 19 JD administrative/connection fee for the 1980 population

of 15,500 residential users be covered by a governmental subsidy. This subsidy would be equal to 294,500 JD in 1980 to be used as revenues in the water distribution system.

6. Grants should be made available to low-income families who cannot afford the costs of connection (estimated at 200 JD per connection) to the wastewater collection system. A short-term loan program should also be developed to reduce the burden of wastewater connections for other residents. The schedule of subsidies for assisting low-income families is as follows:

Low Income Subsidies
(JD)

| | |
|---|---|
| 1981 | 251,000 |
| 1982 | 251,000 |
| 1983 | 165,600 |
| 1984 | 165,600 |
| 1985 | 372,700 |
| 1986 | 231,900 |
| 1987 | 338,800 |
| 1988 | 231,900 |
| 1989 | 90,300 |

(Based on a constant 251 JD administrative/connection fee (not escalated) for a combined water and wastewater system.)

7. Constrained water supply will likely have severe impacts on the system and its users. A program to deal with water shortages should be developed to allocate water efficiently and equitably to residential users and to commercial and industrial needs. This coordination should be provided by the National Planning Council.

8. The user charges associated with this project are relatively high. Estimates of ability to pay indicate (for the water project) that some users will pay nearly 7 percent of their income. For all elements of the project, some users will pay nearly 9 percent of their income. Two solutions are recommended:

a. Additional grants and low interest loans should be secured in addition to those available from AID.

b. Wholesale costs of water are significant, ranging from 45 to 68 percent of total unit water costs. These could be further subsidized by the WSC.

## SECTION 4

## RESPONSE TO COMMENTS

### 4.1 RESPONSE TO COMMENTS ON FEASIBILITY REPORT AND PRELIMINARY ENGINEERING STUDIES (MARCH 1980), RECEIVED FROM MINISTRY OF MUNICIPAL, RURAL AND ENVIRONMENTAL AFFAIRS (15 APRIL 1980)

This section is presented to describe action taken by Weston International, Inc. in response to the comments received through the Ministry of Municipal, Rural and Environmental Affairs (MMREA) on the Feasibility Report and Preliminary Engineering Studies, Irbid Water Distribution, Sewerage, Storm Drainage and Solid Waste Disposal Project (March 1980). The comments (including the original comment) and our response and proposed action are described in the following paragraphs. The headings and comment numbers correspond to those used in the MMREA list of comments.

#### 4.1.1 General

Comment 2

Report improved but the re-edition not really resulting in a "considerable reduction in the volume."

Original Comment

The report is repetitious and contains a considerable amount of textbook-style explanations on sanitary engineering which will not be read by the layman, and are unnecessary for an engineer qualified to review the report. Careful editing should result in a considerable reduction in the volume of the report.

Response

The organization of several report chapters was drastically revised to reduce repetition. Four appendices were added to the report. These appendices contain information previously presented in the report text. Evaluation of the report on volume alone is inconsistent with the information requirements contained in the Scope of Work section of the agreement. The feasibility report is not primarily directed toward laymen; rather it was written for the informed technical and admin-

istrative staff representatives of the executing agency, the National Planning Council, other interested technical agencies in Jordan, USAID/Jordan, and other potential lending institutions. The report summary and executive summaries are directed toward a less technically-oriented reader.

Comment 3

No action has really been taken on logical implementation stages depending on availability of funds.

Original Comment

The scope of work requires the preparation of a detailed construction operations plan for priority works to be implemented during implementation Phase 1. This has not been included in the report. As discussed during our meeting on 5 December 1979, the proposed contracts for implementation should be very carefully selected by geographical area in order that the implementation Phase 1 may be done in logical stages, depending on the availability of construction funds.

Response

The statement that "no action has really been taken on logical implementation stages depending on availability of funds" is not correct. A construction operations plan has been prepared for the proposed Phase 1 facilities that meets the construction schedule set out in subsection 3.1.8 of our contract. The schedule proposes 18 different construction contracts for construction of the Phase 1 facilities. The interdependence of these contracts, including identification of contracts that may be postponed without impacting on other portions of the project, is described on page 10-42 of the report. Costs for major portions of the project are presented in Tables 9-2 and 9-3.

In addition to this information, we have prepared tables showing the detailed cost breakdown of the nine sanitary sewer contracts and water distribution contracts. These tables are being presented in an addendum to the report.

The implementation schedule has been revised as shown in the revised executive summary.



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4.1.2 Chapter 1

Comment 1

Chapter 1 is surely a "Final Report Summary" but not quite an "Executive Summary" as requested. The 1979 census population figures may have a substantial effect on the costs. Where is the discussion on GOJ policy implications on organization, rate structure, subsidies on connection charges, etc., and the chapter does not list the GOJ policy decisions which must be made, particularly not when.

Original Comment

This chapter should be in the form of an executive summary, covering all the main points and recommendations. It should discuss the GOJ policy implications on organization, rate structure, subsidies on connection charges, etc., and should list the GOJ policy decisions which must be made and when.

Response

We will revise and expand the executive summary as requested. Certain statements made in Comment 1, however, indicate an incomplete review of the chapter. Section 1.12 of Chapter 1 lists several recommendations and required policy decisions that must be made by the government of Jordan. Item 6 deals specifically with subsidies on connection charges to the sanitary system. Item 6 states "the cost of connection to the sanitary sewer system, normally a cost borne by the homeowner, exceeds the ability to pay of the low-income group. The estimated connection cost represents over 25 percent of the annual income of this group. It is recommended that grants be made available to the low-income groups to facilitate these connections. An ongoing grant program will probably be required through the project."

4.1.3 Chapter 2

Comment 1

The justification of "the project in basic human needs terms" is still pretty thin. In fact, only showing in a few (pp. 2-35 to 2-38) pages.

Original Comment

The socioeconomic study report is of considerable importance to the potential funding agency as the report must justify the



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project in basic human needs terms. The report requires considerable rethinking and strengthening to provide this justification. The data on major water-related diseases on page 2-27 does not serve its intended purpose, and can be considered counterproductive as the number of reported cases of water-related diseases usually has little relationship to the actual situation. The health specialist must look beyond the meager statistics available and try to portray the actual situation as it exists.

Response

This section was reviewed in detail with our consultant, Dr. Jarir Dajanai; his suggestions and comments were incorporated into the text. In addition, an attempt to gather supplemental statistics, e.g., sales records for various types of pharmaceutical products throughout the year, was made on field trips with personnel from USAID/Jordan. These data were not available. Accurate medical statistics can only be developed through a long-term survey. It is extremely difficult to be responsive to a nonquantitative comment that this item is "pretty thin," particularly in light of general comment No. 2.

The source of this "basic human needs" justification is the agreement between the NPC and the consultant. We are unaware of a need to justify contract provisions.

4.1.4 Chapter 3

Comment 3

Resistance to chemical characteristics of water has not been taken into consideration.

Original Comment

On evaluation of pipe material characteristics, recommend that a grading factor be placed on each characteristic based on its relative importance. Costs should also be considered as an important characteristic in the evaluation. Also resistance to chemical characteristics of water should be considered.

Response

The pipe material evaluation criteria were reviewed with the National Planning Council prior to completing the revised report. The discussion of pipe materials on pages 3-5 and 3-6

discusses resistance of various pipe materials to corrosion (both internal and external). This item is included in the evaluation criteria under the "service life" evaluation criterion.

Comment 5

What are the assumed "Reasonable total industrial, commercial and industrial wastewater flows" (p. 3-15) and "known existing...wasteloads...?"

Original Comment

How is the figure of 17.2 lpcd arrived at for dispersed industrial/commercial/institutional wastewater? (p. 3-16).

Response

Subsection 3.2.1.2, paragraph 4, describes how the industrial/commercial/institutional flow is allocated to areas of the City for sanitary sewer design. As referenced in paragraph 4, the industrial/commercial/institutional wastewater flow rates are developed in subsection 3.3.3.3, pages 3-46 to 3-55, and are listed in Table 3-6, page 3-47. Commercial/industrial/institutional flows are estimated at 266 cu m per day in 1990 and 491 cu m per day in 2000 for identified industries, and 5,534 cu m per day in 1990 and 8,509 cu m per day in 2000 for other commercial/industrial/institutional sources.

Comment 8

Nothing changed in this respect: page 3-20 and Table 3-1, page 3-22.

Original Comment

Minimum slopes indicated in Table 3-1 may result in sedimentation problems during early stage of sewer use when flow is minimal. (p.3-20).

Response

Minimum slopes are set so that the flow in a sewer flowing full will have a minimum velocity of 0.7 meters per second. Experience has shown that this is a "self-cleaning" velocity for most sewer system deposits. We recognize the fact that flows in



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parts of the system may be low, and this is addressed in subsection 3.3.2.4, Operations and Maintenance, page 3-33;

> "After the sewer has been in operation for some months, especially during the rainless periods of the year, there will be occasions where stoppages will occur in various parts of the system. A program of periodic cleaning and flushing will minimize those stoppages. The entire system should be cleaned and flushed at least every two years. Disinfected wastewater treatment plant effluent can be used for sewer flushing."

Most of the sewers in Irbid will have slopes greater than the minimum slopes. There is no justification for setting minimum slopes at values other than those listed in the report.

Comment 9

No action taken on this comment (p. 3-23).

Original Comment

As local manufacture of manhole rings is limited to 1000-mm diameter, suggest consideration for use of sewer size for 200 mm through 500 mm. (p. 3-21).

Response

The original comment is not true. Manhole rings can be manufactured in Jordan up to 2 meters in diameter at existing facilities. The size of the Irbid project is sufficient to justify setting standards that will be conducive to efficient maintenance over the life of the project rather than acceptance of some arbitrary standard set by past lacks of available materials.

In the detailed design, consideration will be given to use of smaller diameter manholes for shallow (less than 2 meters to outlet invert) applications. Larger diameter manholes should be used for manholes 2 meters and more to outlet invert.

Comment 10

No action taken on this comment. (pp. 3-50 and 3-51)



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Original Comment

Request that consultant provide specific recommendations for effluent discharge standards, including trace elements, when taking into consideration the particular situation in Irbid, with discharge to the Wadi Arab. (p. 3-28).

Response

Proposed Irbid wastewater treatment plant effluent standards are listed in columns 4 and 5 of Table 3-3, page 3-36. Specific limitations for industrial wastes are listed in Appendix C, Section 602, pages C-24 and C-25.

Comment 13

Not answered. The approach suggested in form of specific limitation criteria not attended to (bottom of p. 3-55).

Original Comment

What is source of "Typical industrial wastewater strengths?" Suggest that approach be in form of specific limitation criteria (p. 3-48)

Response

Typical industrial wastewater strengths were developed through an analysis of identified existing and proposed industries presented in subsection 3.3.3.3, pages 3-46 through 3-55. As stated in the third paragraph on page 3-55, wastewater strengths from unidentified industries were assumed to be comparable to domestic waste (which also assumes industrial pretreatment, if needed). As mentioned in the response to comment 10, and referenced in the fourth paragraph, page 3-55, specific limitations for industrial wastes are listed in Appendix C, Section 605.

Comment 14

Not really dealt with. "ARMCO" should have been mentioned and discussed (p. 3-68).

Original Comment

Reinforced concrete pipe is very expensive in the larger sizes and often more costly than cast-in-place box culverts. ARMCO



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type culverts should also be considered (p. 3-59).

The use of velocity of 5.0 to 6.0 meters per second is questioned as the extra cost for anchoring the culverts may well indicate a large diameter ARMCO pipe or box culvert would be more economical.

Response

"ARMCO" is a proprietary name and as such has no place in the report. ARMCO pipe refers to corrugated steel pipe. Subsection 3.4.3.1, "Pipe Material," states as follows:

> "The types of conduit materials considered for use in the stormwater drainage system are:
>
> a. Reinforced concrete pipe.
> b. Corrugated steel pipe.
> c. Cast-in-place concrete box conduit.
>
> "Asbestos cement pipe was not considered because of strength problems, lack of availability in large sizes, and extra care required for installation. Chapter 6 presents a cost-comparison analysis of these conduit materials at equivalent sizes for the collection network. Equivalent conduit size for a given stormwater flow is based upon hydraulic slope, and the roughness coefficient of the three materials considered."

The cost comparison is described on pages 6-24 and 6-37, and in Table 6-2, page 6-38.

4.1.5 Chapter 4

Comment 1

Has it been checked whether "a new 14-inch line will be installed from the WSC transmission main upstream of Houfa to Kairawan Circle"? (p. 4-3).

Original Comment

Recheck size of new line being installed from Houfa reservoir. WSC says 14 inches. WSC also advised that a new 14-inch line will be installed from the WSC transmission main upstream of Houfa to Kairawan Circle. This should be checked. (p. 4-2).



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Response

The situation concerning the WSC supply line to Irbid, as known in January 1980, is stated in the second paragraph on page 4-3 as follows:

> "Because of the limit on flow from Houfa to Irbid, the WSC is currently investigating increasing the amount of flow by either replacing the existing transmission main from the Zataarey-Houfa Line to Kairawan Circle (see subsection 4.1.1.2) with a 14-inch (35 cm) main, or by replacing the present Houfa-Irbid Line with a 14-inch (35 cm) main."

If the NPC, as the clearing house for water facilities planning in Jordan, is aware of information not available to us, please inform us and we will incorporate it into the report as appropriate.

Comment 3

Has any action been taken to check?

Original Comment

The zonal pressure system must also be compatible with water supply delivery from Houfa reservoir and Kairawan Circle. This should be checked. (p. 4-26).

Response

The system is designed to be compatible with both existing and future supply. The distribution system analysis diagram for this analysis is shown in Appendix B, Figure B-4.

Comment 5

Question not answered (p. 4-39)

Original Comment

What is the purpose of the spacing of connections criteria? Is this for estimating purposes only? (p. 4-27)



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Response

Paragraph 5 on page 4-39 is as follows:

> "Service connection diameters will range from 1/2-inch to 2 inches, with 1/2-inch or 3/4-inch being the standard residential connections. Spacing of connections (for estimating purposes only) is according to the following criteria:

| Population Zone | Spacing |
|---|---|
| A | 1 every 20 meters |
| B | 1 every 15 meters |
| C | 1 every 12 meters |
| D and E | 1 every 8 meters |

> "Since the refugee camp is a bulk water user, no service connections will be provided in this area."

Comment 9

Elaborated on but no mention of procurement of equipment under the project. (pp. 4-52 and 4-53).

Original Comment

Recommended expanding leak detection discussions to include recommendation for leak detection equipment to be procured under the project and recommend type of organization and manpower for leak detection and repair.

Response

Paragraph 2, page 4-53, recommends that a hand-held sonic sensor to be used by one or two men with a vehicle and appropriate safety devices should be used to survey the Irbid system for leaks.

4.1.6 Chapter 5

Comment 2

The land acquisition costs for the two alternatives not really dealt with thoroughly. Important as the difference in costs makes the whole difference.

Original Comment

The use of stabilization ponds should be further studied, including ways and means to reduce pond area requirements (p. 5-15), such as:

1. Introduction of an anaerobic pond preceding the aerobic pond.

2. Introduction of an aeration system.

Response

The land costs for the wastewater treatment alternatives are comparable, 1.5-JD per square meter. This cost for land at sites for both low- and medium-technology treatment plants was confirmed as reasonable by Municipality of Irbid officials in the presence of NPC, MMREA, and AID representatives during a field trip on 27 March 1980.

A discussion of land acquisition will be included in the report addendum to clarify the current misunderstanding.

The major difference in selection of medium-technology over low-technology alternatives is the fact that implementation of low-technology alternatives requires pumping virtually all wastewater, while the selected medium-technology site allows gravity flow for all interceptions and all treatment plant forward flow streams.

Comment 3

It would appear that the request for "further study and consideration..."etc., has not been met. (pp. 5-68 to 5-71).

Original Comment

We are concerned about the potential problems of operation and maintenance of mechanical dewatering equipment. Request further study and consideration be given to sludge drying beds located at an appropriate site with sufficient area for both phases of construction. (p. 5-20).

Response

The reviewer should compare the discussion in the draft feasibility report with the discussion in the revised report.



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The revised report recommends selection of the sand-drying bed alternative, in accordance with your previously-stated directions.

Comment 4

No action seems to have been taken on the request for "further study of alternate sites for STP." (p. 5-71).

Original Comment

Per our discussion of 5 December 1979, request further study of alternate sites for STP. (p. 5-24).

Response

The wastewater treatment plant site discussion was expanded and is presented in subsection 5.4.3, pages 5-44, 5-45, and 5-46 of the report. In addition, treatment plant sites were reviewed during a field trip with NPC, MMREA, and AID representatives on 27 March 1980, and selection of the site recommended in the report was confirmed. (See also Section 2 of this addendum.)

4.1.7 Chapter 6

Comment 1

Cannot find that anything is done on this comment in the whole chapter.

Original Comment

Per discussions on 5 December 1979, request that results of November 29/30 storm be investigated to determine whether any adjustments in proposed design of storm drainage system would be appropriate.

Response

Investigations showed that the major stormwater drainage problem areas in Irbid are essentially as determined in previous surveys, and are as indicated on the figures in Chapter 6.

The proposed drainage improvements shown on Figure 6-11 were revised slightly to eliminate some minor drainage problem areas observed in the December 1979 survey. Please note that this



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request for services involved new work, not included in the scope of the agreement.

4.1.8 Chapter 7

Comment 3

One paragraph is added on page 7-61. Is this enough?

Original Comment

Additional study for site selection for landfill is indicated. (pp. 7-57 and 7-58).

Response

Discussion of geologic considerations was added to report as agreed in previous meetings. Soil investigations are needed to obtain additional data regarding the rcommended site before further analysis can be made.

4.1.9 Chapter 8

Comment 1

Somewhat condensed, but still 25 pages.

Original Comment

This chapter can be considerably condensed by careful editing.

Response

These comments are inconsistent with comments received from AID/Washington. The chapter was revised at Weston expense and reformed in an effort to meet AID/Washington's objectives for the environmental assessment. The consultant pointed out this study area as a potential problem during the contract negotiations. In response to the scope included in the agreement, the guidelines discussed with NPC and USAID representatives and the manpower/budget allocations for this work as mutually agreed, the consultant attempted to produce the level of investigation indicated. As shown by the comments, the client organization apparently felt that too much was done, while AID/Washington feels that much too little was done. The consultant is capable of responding to any level of environmental investigations as defined by contract scope and related time and budget considerations.

## 4.2 RESPONSE TO ADDITIONAL COMMENTS RECEIVED BY CONSULTANT ON 15 APRIL 1980

### 4.2.1 Chapter 2

Comment 1

The paragraph is elaborated on, but appropriate adjustment as a result of the 1979 national census has not been made.

Original Comment

As consultant emphasizes that accurate knowledge of household size is critical to proper sizing of water and sewer lines, appropriate adjustment should be made as a result of the 7.0 persons per household in Irbid as revealed by the 1979 national census. (p. 2-15, third paragraph).

Response

The impact of the 1979 census results on the facilities to be included in this project is discussed on page 2-18. This discussion is expanded in the addendum, Section 1, and in the revised executive summary. No changes in facility sizing will be necessary. Changes to the financial and economic analyses will be made, as described in the addendum, Sections 3 and 6.

### 4.2.2 Chapter 3

Comment 1

The report in this context is merely a retyping of the draft feasibility report. The consultant should look more thoroughly into this question.

Original Comment

The report states that peaking factors of 4.0 for laterals and trunk lines and 2.5 for interceptors will be used in Irbid. This is based on data generated in the United States, but the consultant justifies it with the statement that peaking factor is a ratio and is a function of population served rather than actual water consumption. Consultant should dig more deeply for data to justify the ratios or modify them. (p. 3-13).



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Response

Comment 1 is incorrect. The second and third paragraphs on page 3-13 have been added to the discussion. These figures describe our review of actual sewage flow variations over a one-year period for the Amman Ain Ghazal wastewater treatment plant. These data are the best available sewage flow variations data we have been able to obtain in Jordan. The second and third paragraphs on page 3-13 are as follows:

> "Inspection of the daily continuous flow records for Amman, Ain Ghazal wastewater treatment plant, recorded between May 1978 and May 1979 indicates two points:
>
> a. The dry weather average daily flows, which are primarily domestic wastewater flows, do not vary from one season to another, i.e., winter to summer. This observation is consistent with observations of domestic sewage flows (as opposed to potable water flows) for most communities in the United States.
>
> b. The peaking factor or ratio between average daily flow and maximum hourly flow for dry days for the Ain Ghazal treatment plant was approximately 2.2 with a contributing population of approximately 150,000.
>
> "The water use characteristics and peaking factor observed at the Ain Ghazel treatment plant (not water use rates) are in general agreement with similar characteristics and functions observed in the United States. Even though living patterns and water use rates are different in Jordan, this general agreement of wastewater peaking factor is not at all surprising since peaking factor is a ratio and is a function of population served rather than actual water consumption."

4.2.3 Chapter 4

Comment 1

Sensitivity analysis around the 160 lpcd figure needed.



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Original Comment

The consultant predicts an increase in demand from 30 lpcd to 160 lpcd. Given such a large increase and the difficulties in making an estimate, it would have been advisable to do some sensitivity analyses around the 160 lpcd figure to see how it affected water and sewerage costs. (p. 4-11 and following pages).

Response

The sensitivity of per capita water consumption rates was tested and reported in Chapter 9. A 10-percent decrease in the rate of increase of water consumption will result in an accumulated deficit of 284,000 JD by 1989, while a corresponding 10-percent increase will result in an accumulated surplus of 708,000 JD. For the base case (presented in Tables 9-10a, 9-10b, and 9-10c), the suggested user charges produce an accumulated surplus of 354,000 JD by 1989.

Comment 2

Escalation to be included.

Original Comment

Why hasn't escalation been included in total capital costs? (p. 4-30, Table 4-4).

Response

All costs presented in technical chapters are given in constant 1979 prices. Escalated capital costs are presented in Chapter 9.

4.2.4 Chapter 5

Comment 1

The wastewater treatment plant alternatives should show more accurate comparison.

Original Comment

A more accurate comparison of the wastewater treatment plant alternative could be made by using the discounted cash flow system (p. 5-35, Table 5-4).



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Response

The original comment is a matter of opinion and not a matter of fact. Cost-effectiveness analyses in the report were based on comparison of annual costs. Comparison of alternatives will yield identical results, provided the method selected is applied in a consistent manner. Accuracy is not the question, rather consistent application of evaluation criteria. This has been done (see addendum, Section 2).

4.2.5 Chapter 8

Comment 1

None of the seven general comments appears to have been properly attended to in the report.

Original Comment

1. The draft EA does not indicate who it was prepared by, their qualifications, extent and duration of field studies, and technical authorities consulted. In addition, it does not contain a bibliography.

   Response -- Appendix G, Section G-1, lists the environmental bibliography as well as the principal project participants.

2. The draft EA is written as a proponent document; it fails to critically and objectively evaluate the proposed action and its impacts. The approach taken throughout the document is justificatory rather than analytical. The document is padded, superficial and does not present a generally creditable independent study.

   Response -- Chapter 8 was revised in response to this comment.

3. The draft EA does not analyze the proposed project in the context of Jordanian conditions. It does not include an analysis of the reliability of the proposed system, nor does it examine the impacts of system failure or extended periods of downtime. The framework of evaluation of the proposed system is theoretical rather than realistic in approach.



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Response -- This comment was considered in the reformulation of the chapter.

4. The draft EA does not seriously or adequately examine technical alternatives to the proposed project. For example, the use of different levels of treatment or improvements in the existing septic tank/cesspool systems is not examined.

   Response -- Treatment alternatives are addressed in subsection 8.3.3.3, pages 8-10 and 8-11. Renovation and/or upgrading of existing on-site disposal systems is addressed on page 8-10. These systems were dropped from further consideration as treatment and disposal alternatives for the City of Irbid because:

   1. High population density in the developed sections of the City makes these systems impractical.

   2. The local limestone soils and bedrock are not suitable for widespread use of septic systems and are subject to solution cavities. Wastewater entering these solution cavities is not renovated by the time it reaches groundwater, or returns to the surface in downstream watercourses.

5. The draft EA does not provide a proposed mitigation plan.

   Response -- Steps to mitigate adverse impacts are set out in Section 8.6, pages 8-23 and 8-24.

6. The draft EA does not examine short-term impacts of construction, nor does it provide a mitigation plan to address these temporary impacts.

   Response -- Long-term and short-term impacts of the recommended plan are discussed in Section 8.5, pages 8-18 through 8-23. Steps to mitigate adverse impacts are presented in Section 8.6.

7. The draft EA does not adequately address the problems associated with the possible disturbance of archaeological and historic sites. The infor-



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mation provided on this problem is technically inadequate. The draft EA does not provide a proposed mitigation plan.

Response -- This is discussed in the last paragraph of page 8-23 and the first paragraph of page 8-24 as follows:

"Construction in the Irbid streets will impact on the cultural environment, specifically, the archaeological sites. Since sewer and water contractors are not normally sensitive to archaeological factors, and their construction workers are not generally adept at recognizing archaeologically-significant sites, it is recommended that an inspector be provided on-site to observe and stop work if significant sites are uncovered."

"The Ministry of Antiquities is interested in all sites discovered, and requires inspection by a staff member. The procedure to follow requires notification of intent to excavate, work stoppage if a site is found, and contact with the Ministry of Antiquities. The Ministry will remove all significant artifacts, and then excavation will be allowed to continue. These requirements will be reflected in the special conditions section of all construction contracts."

### 4.2.6 Chapter 9

Comment 1

Although some attention has been given to the 17 general comments on Chapter 9, dated 27 January 1980, and that chapter has been re-edited, it is still generally felt that it as a whole is difficult to follow and quite confusing to the reader.

Response

The 17 specific comments made previously have been addressed. In addition, general discussions on pricing approaches and policy considerations, cash flow analysis, model analysis of economic benefits and planned project development have been extracted from the chapter and presented as appendix sections.



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## 4.3 IBRD COMMENTS

### 4.3.1 General

Comments (ii) and (iii) should be addressed.

Original Comment (ii)

While reference is made to the revised (downward) population figures which resulted from the 1979 census, the new census figures are not utilized. (The IBPD projections reflect the 1979 census).

Response

Weston has prepared graphics for the executive summary and addendum which show the relationship between the original and census-based figures, and discusses their impacts on the project. Weston does not intend to redo all of the numbers in the report as this change is outside our present contract.

Original Comment (iii)

The phenomenon of large population increases during the summer season (as is evident in Amman) is not discussed in the socio-economic study.

Response

There are no data or evidence to support this statement. Irbid municipal officials state that the City does not experience the large population increases during the summer season as is evident in Amman.

### 4.3.2 Study Criteria

It was agreed that the figures in comment (iii) are acceptable for their purpose. Other points to be addressed.

Original Comment (i)

The rationale utilized by the consultant in determining the residential demand figures for Irbid is somewhat confusing. The "present water use" is stated at 33 lpcd (based on a population of 146,000 persons) including commercial uses. The table in paragraph 3.2.1.1 shows domestic "demand/use" at 75 lpcd and "total" at 126 lpcd.

Response

As stated in subsection 3.2.1:

> "Due to the lack of an adequate water supply, measurement of present water use in Irbid does not reflect the true demand, only that portion that WSC/Irbid Municipality can supply. The balance of the demand is in excess of supply capacity. This makes an analysis of water demand difficult. Existing water uses have been used only as a guide to estimating water demands."

Original Comment (ii)

It is suggested that the consultants review AWSA's experience and procedures for installing water service connections.

Response

AWSA makes connections to the main with and without corporation cocks. A minimum (usually 1/2 inch) service is run beyond the paving line to a shallow valve box. Water services are shallow or on the surface. Meters are rented to the customer.

Original Comment (iii)

Acceptable, see introduction to subsection 4.3.2, Study Criteria.

Original Comment (iv)

Sewer service connection details should show cleanouts.

Response

Sewer service connection details, including cleanouts and traps, are shown on Figure C-1, Appendix C in the draft feasibility report. The profile shown on Figure 3-3 shows the sewer connection to the property line only.

Original Comment (v)

Manhole construction details should be compared with those used by AWSA.



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Response

This comment was previously addressed. AWSA uses substandard manhole sizes because they reported that normal size manholes are not available. The consultant was able to locate, however, manufacturers in Jordan who have the equipment and materials to construct manholes of the recommended sizes.

Original Comment (vi)

The sewage pumping (and ejector) station details shown in Figure 3-8 appears to be a prefabricated unit of U.S. manufacture. Again, the experience of other Jordanian sewage agencies should be referred to for possibly simpler installations.

Response

Prefabricated or package units, shown as units of this type, would normally be used rather than custom-designed units. Package units are less expensive; its easier to stock parts for them; they are quick and easy to install; and meet the procurement regulations of USAID-funded projects.

Original Comment (vii)

Reference in paragraph 3.3.3.1 to "national water plan" probably should mean National Water Master Plan.

Response

We agree with this comment.

Original Comment (viii)

It is interesting to note that, except for the Amman plant, none of the sewage treatment plants visited by the consultant were operative.

Response

It is also interesting to note that, with one exception, the same sewage treatment plants are presently operative.

Original Comment (ix)

Septage loading created problems at the Amman sewage treatment plant because of low hydraulic loading. The consultants' domestic mass loading rates are shown (Table 3-5) as starting in 1990 when sewage flow rates are relatively high. Problems (particularly odor problems because the proposed treatment plant is located adjacent to the City) occur when the treatment plant is subjected to shock loading or overloading. Reasonable loading rates for extended aeration plants (the consultant's selected alternatives) are as follows:

| % of Operating Capacity | % (Volume) Septage |
|---|---|
| 25 | 3 |
| 50 | 2 |
| 75 | 1 |

If septage is fed to aeration basins in slug loads the loading should be about half of these values. The consultant, in both 1990 and 2000, suggests up to 4% loading rates.

Response

All of the above is true, however, it applies to slug loading. The consultant's recommended design calls for steady loads, not slug loads.

4.3.3 Water System Studies

It would appear that comment (iii) is an error. Comment (v) should not really be the concern of the consultant, but could be elaborated on in a few words. The remark in comment (viii) does not seem to be valid as the point of connection is shown and details would be given in the detailed design. Other points are to be attended to.

Original Comment (i)

In connection with the existing facilities, it would be useful to know the total number of presently served population, and also the number of metered services.

Response

The total number of presently served population is not known exactly, but is estimated to be about 108,500. The number of metered services in 1980 was 15,500.



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Original Comment (ii)

It would appear that, with 1978 unaccounted for water at 25% and a "significant reduction" achieved in 1979 through removal of illegal taps, the unaccounted for water has been reduced to an acceptable level. This would indicate that the existing system is in good repair.

Response

The Municipality of Irbid has done an excellent job with what they have had to work with. The existing system is in relatively good repair. However, the original design is poor and the installed system is grossly undersized. It has no long-term potential for use in the Master Plan system. It has only the potential for short-term use as described in the report.

Original Comment (iii)

In error--see introduction to this subsection.

Original Comment (iv)

The "Domestic Water Use" chart (Figure 4-3) does not reflect the effect of water being supplied every day to half of the overall service area (paragraph 4.2.2.2).

Response

This is a symptom of suppressed water demand, as described previously, and is one of the reasons the demand is projected to increase from 33 lpcd to 75 lpcd.

Original Comment (v)

Total available water (paragraph 4.3.1.3) is based exclusively on construction of the Marqarin Reservoir. Although the consultant's terms of reference are limited to water distribution only, it may become necessary to analyze other sources to serve Irbid in the future.

Response

The consultant went to WSC and found that additional water supplies will be available to Irbid from groundwater sources in the amount of approximately 1 million cubic meters per year.

An analysis of constrained supply was also added to revised Chapter 9.

Original Comment (vi)

Figure 4-5 shows the "JVA" terminal reservoir located about 5 km south of Irbid (probably because of an elevation advantage) which would indicate that some water will travel 10 km round-trip in order to reach the City. The consultant does not suggest an alternate location. Furthermore, if the location of the existing WSC terminal reservoir is superimposed on Figure 4-5, a gap of only about 3.5 km exists between the two terminal reservoirs. By connecting the two, considerable flexibility could be achieved in the Irbid system, and also in the surrounding area.

Response

The situation described in the first sentence would exist during emergency conditions only. Terminal reservoir siting was not included in the scope of the work. NGC mapping was not provided in this area. Interconnection of the two terminal reservoirs is a good idea.

Original Comment (vii)

The "Best Apparent Alternative" seems to have been selected without least-cost analysis. No comparison of operation and maintenance is made between the four alternatives considered.

Response

Costs are included among the analysis parameters in the computer software used to analyze the system alternatives.

Original Comment (viii)

Not valid--see introduction to this subsection.

Original Comment (ix)

In paragraph 4.4.5.1 and Table 4-6 the annual cost of replacing existing water system elements and constructing lateral mains is referred to the years 1985 through 1994, but the rationale used for this time span is not indicated.



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Response

Ten percent of the system elements are replaced per year, except for 1990. This is a reasonable schedule for system replacement.

Original Comment (x)

Operation and maintenance in paragraph 4.4.5.2 should reflect the cost of leak detection and monitoring as well as meter replacement.

Response

This item is included in the present cost estimates.

Original Comment (xi)

Reference to the AWWA Standard C700-77 as the "best guide" to selection, installation, testing and maintenance of meters (paragraph 4.5.3.4) overlooks the value of reviewing AWSA's meter experience.

Response

After reviewing AWSA's meter experience, the consultant would like to stay with AWWA Standard C700-77.

4.3.4 Sewerage System Studies

Comment (i) is not correct and valid. It was agreed that local conditions do not allow for "cluster" septic tanks as suggested in Comment (v). There does not seem to be any possible wastewater treatment plant sites between Wadi Araba and Wadi El Hamman (not Haddad) as mentioned in Comment (vii). Other points to be addressed.

Original Comment (i)

See introduction above.

Original Comment (ii)

Selection of alternatives (paragraph 5.3.2) does not seem to include least cost analysis.



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Response

See addendum, Section 2.

Original Comment (iii)

It would appear that extension of interceptor A-15 toward pump station 3 could reduce the length of the force main.

Response

This has been reviewed and found to be incorrect.

Original Comment (iv)

Paragraph 5.3.3 suggests nine sewer construction contracts be awarded in addition to two interceptor contracts. Jordanian contractors have developed considerable skill in sewer and water main construction. In this regard, consideration could be given to combining contracts.

Response

Construction packages were based on conversations with NPC and MMREA representatives. They are sized so that local contractors with the top three classes of licenses can bid on the work. Nothing will preclude a contractor from bidding on more than one package.

Original Comment (v)

See introduction to this subsection.

Original Comment (vi)

Right-of-way requirements (paragraph 5.3.5 and Figure 5-10b) do not include a statement of availability of the land required for the treatment plant.

Response

Irbid municipal officials state that the land required for the recommended sewage treatment plant site is available and vacant.



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Original Comment (vii)

See introduction to this subsection.

Original Comment (viii)

No least cost analysis accompanies the wastewater treatment plant site selection. We agree with the statement in subsection 5.4.3 referring to odor potential. Plant operation requires close surveillance.

Response

See addendum, Section 2.

Original Comment (ix)

Table 5-2 (Cost Analysis--Low Technology Alternatives) in the draft feasibility report shows, for the four aerated lagoon alternatives, power cost increases of 41 to 49 percent from 1990 to 2000. However, Table 5-5 shows, for activated sludge, increases of only 9 to 10 percent. The method of determining the increases should be explained, particularly when Table 5-4 lists extended aeration as having the highest energy requirement of the other (high technology) alternatives. Additionally the cost of the standby electric generation facility is not mentioned.

Response

See addendum, Section 2. Standby electric generation facility costs are included in the estimates.

Original Comment (x)

While Figure 5-14 is a symbolic representation of the proposed treatment plant showing some flow routes, there is no indication or discussion of where a by-pass would be located or to where raw sewage would be directed.

Response

Bypassing, if necessary, will be routed to the point of discharge and will eventually be held in the Wadi Arab reservoir. The physical details of the bypass will be shown on the design drawings.



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### 4.3.5 Economic and Financial Feasibility Analysis

All five points should be thoroughly addressed and discussed.

Original Comment (i)

Although the existing pricing for water proves that actual prices are not sufficient to generate revenues, and that analysis of cash flow is based on maintaining surplus, the method used for calculating the yield per unit after wholesale cost is confusing (pp. 9-22 and E-10).

Response

Chapter 9 has been revised (see addendum, Section 3--Revisions to Chapter 9, Economic and Financial Feasibility). See also addendum, Section 5.

Original Comment (ii)

Analysis must not be based on considering that all existing consumers of water will be charged for new connections. This will not most likely be the case (p. 9-22).

Response

Existing customers will not be charged for reconnections. A governmental subsidy of 294,500 JD will be needed in 1980 to cover reconnection costs.

Original Comment (iii)

Cash flow analysis is based on excluding wholesale prices from both sides: inflows and outflows. This concept is not applicable because revenues and expenses for wholesale water are functions of different factors and affect user charges (p. 9-47).

Response

Wholesale water costs have been included. See addendum, Sections 3 and 5.

Original Comment (iv)

Ability to pay must be considered on the basis of "with wholesale" and not "without wholesale". This is critical for economic analysis (pp. 9-63 to 9-67).



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Response

Wholesale water costs have been included. See addendum, Sections 3 and 5.

Original Comment (v)

Operation and maintenance costs of the proposed system should be included in the rate of return calculations which also have to include cost of purchased water and revenues taking this cost into consideration (within limits of ability to pay) (p. 9-69).

Response

Has been recomputed to include this method of analysis.

4.3.6 Institutional

It was felt the comment (i) was sufficiently dealt with by the consultant and that comment (ii) would not be within the terms of reference for the study.

## 4.4 ADDITIONAL COMMENTS AND POINTS RAISED IN MARCH 26th MEETING

Comment 1

The latest electrical tariff should be used in evaluating O&M cost. A copy of the latest tariff dated 6 February 1980 is attached for consultant's use (Appendix 4).

Response

The latest tariff was used in evaluating O&M costs. See addendum, Section 3.

Comment 2

Evaluate the economics of adding a sedimentation basin before aeration to cut down on power. This option will necessitate the construction of sludge digesters.

Response

Not compatible with the "extended air" process. Actually, makes it a conventional activated sludge plant. See addendum, Section 2 which shows that the extended air alternative is more economical than the activated sludge plant, even with higher power costs.

Comment 3

Verify the population of study area with the area used by the Census Department. If they coincide, a reduction in size of some elements of the project may be needed.

Response

The study areas are coincident. No size reductions are needed due to the service life of the facilities, i.e., they will be needed at presently recommended sizes before the end of their useful service life. The sewage treatment plant staging has been lengthened, and only one "train" of the process will be built initially.

Comment 4

Cost breakdown is required for proper evaluation.



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Response

Cost breakdowns have been attached; see the addendum, Section 6.

Comment 5

Cash flow sheets should include actual revenues based on existing tariffs projected for the future; expenditures should be realistic so that the real gap can be identified and the level of subsidy can be assessed. The consultant is to recommend ways and means to generate enough revenues to make the project economically viable.

Response

We agree with this comment. See revised financial chapter (Section 3) in the addendum.

Comment 6

The consultant should address the problem of not having enough funds to construct all of the project, and recommend phasing to suit the given situation. World Bank money will not be available before 1982.

Response

It has been decided that work will proceed on one "train" of the sewage treatment plant and the highest priority sewage collection and water system packages. See addendum, Sections 5 and 6, and the revised report summary.

Comment 7

Verify existing number of subscribers in Irbid, and project for the future (water).

Response

This has been done; see addendum, Section 3.

## 4.5 COMMENTS FROM AID-NE/PD/ENGR, FREDERICK J. GUYMONT

### 4.5.1 General

"My overall impression of the report is that Weston has attempted to answer some of the comments on their original draft, but that the report is still weak in a number of areas. My primary criticism is the assumption that per capita demand will grow from 30 to 160 liters per day (p. 1-3). The per capita demand apparently is broken down into 95 liters of domestic demand, 30 liters of system losses, and 35 liters of commercial-industrial demand. I'm not sure that any of these components is really justified in the report. Also, the 1990 and 2000 population projections are 242,000 and 353,000, which assumed a 1978 base of 146,000 and growth rates of 4.5 percent through 1985, and 4 percent thereafter. With the November 1979 census figure of 118,000 projecting the same growth rates gives a population of 179,000 in 1990, and 265,000 in the year 2000. This will have an effect on the engineering design and financial forecasts which I am not sure the study recognizes. My specific comments are limited to the water and sewerage system studies and a brief comment on the financial analysis".

Response

See previous discussion regarding "suppressed" demand. The population comments are valid; see addendum, Section 1.

### 4.5.2 Page 1-12

"The construction operation plan is very ambitious. Three years seems like a short time to design the system, prepare tender documents, evaluate proposals, sign contracts, mobilize and then perform the final construction. The work includes installing numerous house connections which is likely to be quite time consuming."

Response

The construction plan has been modified to reflect the restricted funding pattern, and is shown in the revised



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report summary, the new executive summary, and in the revised financial chapter, addendum Section 3.

4.5.3 Pages 4-13, 2-36 and 2-38

> "The bacteriological figures presented in these tables do not necessarily indicate the clear and present danger to public health that the study speaks about. The fact that 16 percent of the samples were contaminated does not really tell one very much. Also, on page 2-39, I believe the left y axis is mislabeled and should be cases per 100,000 population. The issue of the effect of water quality and quantity on public health is quite complex and the analysis does not recognize this. Their discussion of the subject is much too superficial."

Response

We agree, however, that it is the best the consultant can do with the data available. Better results would require a long-term study/survey that would have to be done by others.

4.5.4 Pages 4-45 through 4-47

> "Much more detail is needed in these tables. Weston must have had figures for length and size of pipe, number and size of valves, construction vs material costs. Why not include these, so the numbers can be evaluated?"

Response

These details have been added and are shown in the addendum, Section 6.

4.5.5 Pages 4-48 and 4-51

> "Although water losses are apparently running at 20 percent per year it seems from statements on these pages that O&M procedures do not need to change very much and that larger costs need not be incurred. On pages 4-52 and 4-53, Weston points out the need for leak detection and system-inspection programs. If the amount of unaccounted water can be reduced, it might be a good idea to spend more on O&M. A breakdown of O&M costs should be included here also."

Response

This comment is not valid because the existing system is to be replaced because of its poor design and undersizing problems.

4.5.6 Page 5-46 and Following Pages

"In my previous memo I wondered why primary treatment was dismissed as a viable alternative. Nothing in this report has convinced me that primary treatment should not be considered as a possible alternative. The water from the plant will flow into the Wadi Arab reservoir, which has an effective capacity of 263 days flow at 23,000 cu m per day. Natural purification will occur during this time and the water should be quite suitable for irrigation."

Response

Please reread the revised discussion in Chapter 3. Primary treatment has never been seriously considered for Irbid or for any other city in Jordan.

4.5.7 Comparison of Anaerobic/Aerobic Stabilization Ponds -- Extended Aeration/Activated Sludge

"In the comparison of anaerobic/aerobic stabilization ponds with extended aeration/activated sludge, the Weston analysis points out that land acquisition for the stabilization ponds costs 1,980,000 JD (p. 5-47). On page 5-48, the report further explains that 132 hectares are needed, therefore, the cost is 15,000 JD per hectare. In developing the costs for extended aeration/activated sludge, the total cost for land acquisition is only 90,000 JD (p. 5-72). Although no precise figures are given for the necessary acreage, sand drying of sludge associated with this process alone accounts for 9.2 hectares of land. Therefore, it is apparent that a much lower cost for land is being used. The report does not explain why."

Response

This is a misunderstanding--all land was costed at the same rate. Please see the addendum, Section 2.



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4.5.8 Labor Costs/Sludge Disposal Costs

"I also have a problem with the labor costs and sludge disposal costs associated with each of the processes compared on page 5-72. Some 50 people (p. 10-37) are shown as necessary to operate the extended aeration/activated sludge plant at an annual cost of 83,200 JD. Assuming about the same average salary, the report infers that some 33 people are necessary to run the anaerobic/aerobic stabilization ponds, which seems more than necessary. Intuitively, I feel that there should be a greater difference in labor costs."

Response

The consultant feels the estimates reported are accurate for feasibility report purposes. We will respond, however, if specifics can be identified.

4.5.9 Sludge Disposal Costs

"Sludge disposal costs also seem to be quite close together, 10,000 JD vs 5,000 JD. This is surprising, since extended aeration/activated sludge requires continuous disposal, dewatering and final disposal while the stabilization ponds would require only intermittent sludge disposal."

Response

Same as paragraph 4.5.8.

4.5.10 Cost Comparisons

"In summary, I feel quite uncomfortable in the cost comparisons that have been developed and would like to see more details. Table 5-6 presents some numbers, but before someone dismisses stabilization ponds, the basis for the numbers developed in the table has to be more fully explained."

Response

See the addendum, Sections 2 and 6.



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4.5.11 Page 9-22

"The specific question I have on the financial analysis is the anticipated revenues computer run. The analysis shows 294,000 JD from new customers in the first year (1980). I don't see how that many people can be hooked up, especially since a three-year construction schedule has been mentioned previously and the table on page 9-8 shows the major capital expenditures for the water supply system occurring in 1981. I would expect that charge for connecting to the new water supply system should more realistically be spread over a number of years."

Response

Comment is well taken and has been addressed in the addendum, Section 3, and the summaries.

4.6 COMMENTS FROM AID-NP/PD, LEONARD ROSENBURG

Numerous comments have been received from Mr. Rosenburg. All comments received from him have been discussed personally with him in Washington, and are reflected in the revisions to Chapter 9 and the AID-financed project as described in the addendum, Sections 3 and 5.



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# SECTION 5

## ANALYSIS OF AID-FUNDED PROJECT

Funding of this project has been the major objective of the studies prepared by Weston International, Inc. In this process Weston International became involved in satisfying the project evaluation needs of various members of the international financial community, including the United States, the Agency for International Development (AID), and, to a lesser extent, the World Bank. At the request of AID, Weston International prepared two packages of supplemental information addressing the Agency's assumptions concerning a revised (limited water and wastewater) project which is under consideration for funding. Contained in this section are the additional analyses prepared for AID.

Each package contains the financial and economic analyses associated with the conditions of service, project engineering, and funding that AID considered appropriate. The submission, dated 18 July 1980, contains the project analysis of conditions most likely to be funded by AID. In addition, memoranda concerning the final project description and adjustments to the initial 2 July 1980 package are included.

In general, the analyses presented in this section reflect assumptions that vary from the original scope of work for which Weston International was contractually responsible. This section also provides in greater detail the evaluation methods and computational techniques used in the study.

FINAL SUBMISSION TO AID -- 18 JULY 1980

WESTON INTERNATIONAL, INC.

DESIGNERS-CONSULTANTS

WESTON WAY • WEST CHESTER, PA 19380 • PHONE, (215) 692-3030 • TELEX 83-5348 • FROM OFFICE OF THE PRESIDENT, JAMES P MILLER, P E.

July 18, 1980

Mr. Robert F. Fedel, P.E.
Chief, Syria, Jordan, Israel Div.
Bureau for Near East
Office of Capital Development
Agency for International Development
Department of State
Washington, D.C. 20520

RE: Irbid, Jordan Project: Financial and Economic Analysis

Dear Mr. Fedel:

Weston International, Inc. is pleased to submit the additional analysis of the Irbid, Jordan Project which you requested. Attached are economic and financial statements and tables that describe a limited water and wastewater project for the Irbid Municipality. Based on the analysis this project appears to be viable for the ten year period studied.

Financial statements, including balance sheets, cash flow statements, and income and expenditure statements, were prepared separately for the proposed water project and the wastewater system, and then as a combined water and wastewater project. Supporting these financial statements are two computer analyses, one each for the proposed water and wastewater systems, and six (6) tables which interpret the average user charges, calculate unit rates and assess the ability-to-pay of the Irbid customers in 1985. These six tables include:

- Summary Household Average Annual User Charges and Fees for Proposed Municipal Services (1980-1989).
- Water Charges Per Cubic Meter by Income Group 1985.
- Existing Conditions Current Ability to Pay Analysis
- Monthly User Charges (1985) Water and Wastewater by Water Use Consumption Group.
- Ability to Pay Annual User Charges for Municipal Services Based on Projected 1985 Costs and Income.
- Breakdown of Wholesale Cost of Water as a Yearly Cost.

Each table has been enhanced with notes and documentation to assist the reader in understanding the assumptions, methods and sources of information used. In addition, the following discussion will further assist the reader.

The basis for this analysis includes the following assumptions:

1. Revision to population and project customers based on recent census data, provided in Tables 5-1 and 5-2.
2. Project size and capital costs revised as instructed by J. Cassanos (Table 5-3).
3. Constrained water sales based on 3.06Mm$^3$ of water sold in 1985. Ultimate water availability is 5.5Mm$^3$ in 1989.
4. Extended project construction period from 1981 to 1984.
5. Growth in wastewater user connections based on J. Cassanos estimate.
6. Wholesale cost of water is included in the annual operation and maintenance cost based on current policy (65 fils/m$^3$) and escalated at 15 percent per annum.
7. A.I.D. grant ($2.5M) and loan ($21.0M) to be disbursed during the construction phase by 1984. Additional capital costs to be financed during later years by government of Jordan Equity as found in Table 5-4 which also presents capital costs and grants.
8. Reconnection costs for existing water system customers are 6.5 JD per hookup and are refinanced as capital costs during 1981, 1982, and 1983, thus eliminating an unpopular 19 JD initial charge for these customers. (See note 1 on page 2 of Water Supply Cash Flow Computer Analysis, Table 5-9.)
9. The cost of connecting existing refugee households to water system (1500 connections), at 6.5 JD each total = 9750 JD, will be included as 1980 operation and maintenance (escalated). The revenue to cover this cost will come from user charges to residential and non-residential users. All further refugee households will pay a 19 JD administrative connection fee. For the purposes of ability to pay, all refugees were included in the 0-15 cu m per month consumption category.
10. Septage dumping fees now reflect a diminishing number of septic tanks in the Irbid sub district. (See Table 5-4.)
11. A 6% increase in per capita water use was maintained:
    1979 estimated use = 32 LCD
    1989 estimated use = 57 LCD

    $$\sqrt[10]{57/32} = 1.059 \approx 6\%$$
12. A financial internal rate of return was attempted but, as anticipated in our letter dated 11 July 1980 this analysis did not prove useful.

Numerous other assumptions underlie this economic and financial assessment. Generally, they have either been previously presented in preliminary economic and financial evaluations, or are expressed in the Table demonstration.



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The many changes in assumptions have had the effect of generally increasing unit costs because the number of customers and quantity of sold water have decreased and the whole sale water cost is now included. These increases have been to some extent reduced by the reduced size of the project and lower capital cost.

Because of these many changes, it is difficult to make comparison with the previous analysis of the water and wastewater project. However, this analysis indicates the project is viable from a financial and economic perspective and within the tolerances that might be expected for ability to pay.

We trust this information will serve your purposes.

Very truly yours,

WESTON INTERNATIONAL, INC.

James P. Miller, P.E.
President

Attachments

WATER AND WASTEWATER CONNECTIONS; CONSTRUCTION FUNDING SCHEDULE: AND APPLICATION OF CAPITAL CONTRIBUTIONS

Table 5-1

Water Connections
(18 July 1980)

| Year | Unconnected Households in Irbid | CONNECTIONS* Residential | Non-Residential | Total |
|---|---|---|---|---|
| 1979 | | | | |
| 1980 | 2000 | 14,200 | 2,800 | 17,000 |
| 1981 | 700 | 16,900 | 3,000 | 19,900 |
| 1982 | - | 18,600 | 3,100 | 21,700 |
| 1983 | - | 19,500 | 3,200 | 22,700 |
| 1984 | - | 20,200 | 3,400 | 23,600 |
| 1985 | - | 21,200 | 3,500 | 24,700 |
| 1986 | - | 22,000 | 3,700 | 25,700 |
| 1987 | - | 22,700 | 3,800 | 26,500 |
| 1988 | - | 23,600 | 4,000 | 27,600 |
| 1989 | - | 24,700 | 4,100 | 28,800 |

* Actual number of non-refugee connections in May 1980 was 14,688. Assumes, as Weston does, that there were 2,800 non-residential connections. Assumes that Irbid will connect existing unserved households in 1980-1982 and that number of households connected will increase in proportion to population growth. (Assuming 172,000 people in 1989 at 7 people per household, number of households - 24,600).

Source: USAID J. Cassanos



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Table 5-2

Wastewater Connections
(18 July 1980)

| YEAR | RESIDENTIAL NO. OF CONNECTIONS | RESIDENTIAL PERSONS SERVED | RESIDENTIAL % OF POPULATION | NON-RESIDENTIAL CONNECTIONS | TOTAL CONNECTIONS |
|---|---|---|---|---|---|
| 1980 | - | - | - | - | - |
| 1981 | - | - | - | - | - |
| 1982 | - | - | - | - | - |
| 1983 | - | - | - | - | - |
| 1984 | 2000 | 14000 | 10 | 1600 | 3600 |
| 1985 | 4000 | 28000 | 19 | 2200 | 6200 |
| 1986 | 5800 | 40600 | 27 | 2400 | 8200 |
| 1987 | 8000 | 56000 | 35 | 2600 | 10600 |
| 1988 | 12200 | 85400 | 52 | 3500 | 17500 |
| 1989 | 18500 | 129500 | 75 | 4100 | 22600 |

Source: U.S.A.I.D. J. Cassanos

Table 5-3

AID Project Construction Funding Schedule,[1]
1981-1989 (18 July 1980)

(Costs - JC x 1,000)
(1979 Costs)

| Description | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **WATER DISTRIBUTION** | | | | | | | | | | | |
| Water Dist. Costs | 286 | 800 | 800 | 800 | 220 | 220 | 220 | 220 | 220 | ---- | 3786 |
| Existing User Connections[2] | 34 | 34 | 34 | | | | | | | | 102 |
| **WASTEWATER SYSTEM** | | | | | | | | | | | |
| Wastewater Trmnt Plant Costs | 284 | 829 | 324 | 323 | --- | --- | --- | --- | --- | ---- | 1760 |
| Sewer Construction Costs | 287 | 1600 | 823 | 700 | --- | --- | 688 | 689 | 688 | ---- | 5475 |
| SUBTOTAL WASTEWATER SYSTEM COSTS | 571 | 2429 | 1147 | 1023 | --- | --- | 688 | 689 | 688 | ---- | 7235 |
| TOTAL PROJECT COSTS | 891 | 3263 | 1981 | 1823 | 220 | 220 | 908 | 909 | 908 | ---- | 11123[4] |
| TOTAL ESCALATED[3] COSTS | 1078 | 4342 | 2900 | 2936 | 390 | 429 | 1947 | 2143 | 2355 | | 18520[4] |

NOTES: [1]All costs in this table are constant 1979 costs. AID-financed construction to start in 1981 and end in 1984. Balance of Phase I program to be completed form 1987 to 1989. An allowance of JD 220,000 per year from 1985 through 1989 has been provided for an annual program by WSC to replace 20% per year of the existing water mains that are no longer usable.

[2]Includes 6.5JD cost (1979 JD) to connect 15,500 existing residential and non-residential users to new system. Total cost = JD 100,750 applied over 1981, 1982, 1983 (JD 34,000 per year).

[3]Costs escalated at 10% per year.

[4]Total cost in 1979 JD cannot be escalated to obtain total escalated cost because a separate escalation factor is applied to each year's total.

Source: Based on U.S.A.I.D. Construction Funding Schedule 16 June 1980 meeting.

Table 5-4

Application of Capital Contributions
(18 July 1980)
(JD x 1000)

| YEAR | 1979 COSTS[1] | | ESCALATED COSTS[2] | | | | GOJ EQUITY | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | CAPITAL REQUIRED | RECONNECTION INVESTMENT | CAPITAL REQUIRED | RECONNECTION INVESTMENT | A.I.D. GRANT | A.I.D. LOAN | CAPITAL REQUIRED | RECONNECTION INVESTMENT | TOTAL GRANT 1979 JD | REQUIREMENT CURRENT JD |
| **WATER** | | | | | | | | | | |
| 1980 | - | - | - | - | - | - | - | - | - | - |
| 1981 | 286 | 34 | 346 | 41 | 250 | - | 96 | 41 | 320 | 387 |
| 1982 | 800 | 34 | 1064 | 45 | - | 665 | 399 | 45 | 334 | 444 |
| 1983 | 800 | 34 | 1171 | 50 | - | 731 | 440 | 50 | 334 | 489 |
| 1984 | 800 | - | 1288 | - | - | 805 | 483 | - | 300 | 484 |
| 1985 | 220 | - | 390 | - | - | - | 390 | - | 220 | 390 |
| 1986 | 220 | - | 429 | - | - | - | 429 | - | 220 | 429 |
| 1987 | 220 | - | 472 | - | - | - | 472 | - | 220 | 472 |
| 1988 | 220 | - | 519 | - | - | - | 519 | - | 220 | 519 |
| 1989 | 220 | - | 571 | - | - | - | 571 | - | 220 | 571 |
| TOTAL | 3688 | 102 | 6250 | 136 | 250 | 2201 | 3799 | 136 | 2388 | 4185 |
| **WASTEWATER** | | | | | | | | | | |
| 1980 | - | - | - | - | - | - | - | - | - | - |
| 1981 | 571 | - | 691 | - | 500 | - | 191 | - | 571 | 691 |
| 1982 | 2429 | - | 3233 | - | - | 2020 | 1213 | - | 911 | 1213 |
| 1983 | 1147 | - | 1679 | - | - | 1049 | 630 | - | 430 | 636 |
| 1984 | | - | 1648 | - | - | 1030 | 618 | - | 383 | 618 |
| 1985 | - | - | - | - | - | - | - | - | - | - |
| 1986 | - | - | - | - | - | - | - | - | - | - |
| 1987 | 688 | - | 1475 | - | - | - | 1475 | - | 688 | 1475 |
| 1988 | 689 | - | 1624 | - | - | - | 1624 | - | 689 | 1624 |
| 1989 | 688 | - | 1784 | - | - | - | 1784 | - | 688 | 1784 |
| TOTAL | 7235 | - | 12134 | - | 500 | 4099 | 7535 | - | 4360 | 8035 |

SOURCE: [1]1979 Capital and reconnection costs: Table 4 A.I.D. Project Funding Schedule 1981-1989.
[2]Escalation at 10% per annum.

Table 5-4
(continued)

NOTES

1. A.I.D. Grant - $2,500,000 x .3 = 750,000 JD to be provided in 1981 on a percentage basis with the balance of funding provided by GOJ Equity Funding.

| | Escalated Capital Required | % Total Capital Required | A.I.D. Grant Distribution |
|---|---|---|---|
| 1981 Water Supply | 346 | 33.4 | 250 |
| 1981 Waste Water | 691 | 66.6 | 500 |
| Total Requirements | 1037 | 100.0 | 750 |

2. A.I.D. Loan - $21,000,000 x .3 = 6,300,000 JD to be provided in 1982,1983, and 1984 on a percentage basis of Capital Required with GOJ equity funding.

| | | | |
|---|---|---|---|
| Escalated W/S Capital Required | ('82,'83,'84) | 3,523 | |
| Escalated W/W Capital Required | ('82,'83,'84) | 6,560 | |
| Total Capital Required | ('82,'83,'84) | 10,083 | (100.0%) |
| Provided by A.I.D. Loans | | 6,300 | ( 62.5%) |
| Provided by GOJ Equity | | 3,783 | ( 37.5%) |

LOAN/EQUITY DISTRIBUTION
(JD x 1000)

| | WATER SUPPLY | | | WASTEWATER | | |
|---|---|---|---|---|---|---|
| YEAR | Total Escalated Capital Required | A.I.D. Loan | GOJ Equity | Total Escalated Capital Required | A.I.D. Loan | GOJ Equity |
| 1982 | 1,064 | 665 | 399 | 3,233 | 2,020 | 1,213 |
| 1983 | 1,171 | 731 | 440 | 1,679 | 1,049 | 630 |
| 1984 | 1,288 | 805 | 483 | 1,648 | 1,030 | 618 |
| TOTAL | 3,523 | 2,201 | 1,322 | 6,560 | 4,099 | 2,461 |



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# IRBID WATER SUPPLY PROJECT
# FINANCIAL ANALYSIS

Table 5-5

Income and Expenditure Statement
Irbid Water Supply Project
(18 July 1980)

| YEAR ENDING DECEMBER 31 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | JD (thousands) | | | | | | | |
| **REVENUE** | | | | | | | | | | |
| Resident | 306 | 386 | 451 | 591 | 647 | 72[illegible] | 794 | 1171 | 1290 | 1433 |
| Non-Resident | 93 | 106 | 115 | 148 | 167 | 183 | 204 | 301 | 336 | 365 |
| Administrative Connection Fees | -- | 41 | 25 | 14 | 13 | 15 | 14 | 11 | 15 | 16 |
| Total | 399 | 533 | 591 | 753 | 827 | 918 | 1012 | 1483 | 1641 | 1814 |
| **OPERATING COSTS** | | | | | | | | | | |
| Salaries and Wages | 41 | 42 | 14 | 48 | 52 | 59 | 70 | 83 | 98 | 116 |
| Rent & Bldg. Maintenance | 14 | 14 | 15 | 16 | 17 | 20 | 23 | 28 | 33 | 39 |
| Fuel | 7 | 7 | 7 | 8 | 9 | 10 | 12 | 14 | 16 | 19 |
| Maintenance | 62 | 68 | 73 | 77 | 86 | 97 | 115 | 137 | 161 | 192 |
| Chemical | 3 | 3 | 3 | 3 | 3 | 4 | 5 | 6 | 7 | 8 |
| Other | 4 | 4 | 4 | 5 | 5 | 6 | 7 | 8 | 10 | 12 |
| Wholesale Water | 167 | 228 | 299 | 378 | 487 | 611 | 731 | 924 | 1136 | 1472 |
| Refugee Reconnection | 3 | 4 | 5 | -- | -- | -- | -- | -- | -- | -- |
| Depreciation | -- | 10 | 47 | 105 | 167 | 209 | 230 | 252 | 277 | 304 |
| Total | 301 | 380 | 497 | 640 | 826 | 1016 | 1193 | 1452 | 1738 | 2162 |
| SURPLUS BEFORE INTEREST | 98 | 153 | 94 | 113 | 1 | (98) | (181) | 31 | (97) | (347) |
| INTEREST | 6 | 5 | 43 | 88 | 141 | 149 | 152 | 151 | 145 | 139 |
| Surplus (Deficit) | 92 | 148 | 51 | 25 | (140) | (247) | (333) | (120) | (242) | (487) |
| AVERAGE NET FIXED ASSETS | N/A | N/A | 908 | 1997 | 3115 | 3767 | 3957 | 4166 | 4397 | 4652 |
| RATE OF RETURN ON AVERAGE NET FIXED ASSETS (%) | N/A | N/A | 10.4 | 5.7 | -- | N/A | N/A | .7 | N/A | N/A |
| CASH OPERATING RATIO (%) | 75.4 | 69.4 | 76.1 | 71.0 | 79.7 | 87.9 | 95.2 | 80.9 | 89.0 | 102.4 |

Table 5-6

Balance Sheet
Irbid Water Supply Project
(18 July 1980)

| YEAR ENDING DECEMBER 31 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | JD (thousands) | | | | | | | |
| **ASSETS** | | | | | | | | | | |
| Current Assets | | | | | | | | | | |
| Cash | 95 | 234 | 367 | 559 | 715 | 751 | 642 | 625 | 555 | 270 |
| Accounts Receivable | 59 | 82 | 90 | 113 | 124 | 138 | 152 | 223 | 246 | 273 |
| Inventories | 5 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 |
| Total Current Assets | 159 | 324 | 467 | 684 | 853 | 905 | 812 | 868 | 823 | 567 |
| Fixed Assets | | | | | | | | | | |
| Water Supply | -- | 387 | 1496 | 2717 | 4005 | 4395 | 4824 | 5296 | 5815 | 6386 |
| Less Depreciation | -- | 10 | 57 | 162 | 329 | 538 | 768 | 1020 | 1297 | 1601 |
| Net Water Supply | -- | 377 | 1439 | 2555 | 3676 | 3857 | 4056 | 4276 | 4518 | 4785 |
| Total Fixed Assets | -- | 377 | 1439 | 2555 | 3676 | 3857 | 4056 | 4276 | 4518 | 4785 |
| **TOTAL ASSETS** | 159 | 701 | 1906 | 3239 | 4529 | 4762 | 4868 | 5144 | 5341 | 5352 |
| **LIABILITIES** | | | | | | | | | | |
| Current Liabilities | | | | | | | | | | |
| Accounts Payable | 21 | 27 | 33 | 40 | 50 | 62 | 74 | 93 | 113 | 145 |
| Deposits | -- | 14 | 23 | 28 | 32 | 37 | 42 | 46 | 51 | 57 |
| Total Current Liabilities | 21 | 41 | 56 | 68 | 82 | 99 | 116 | 139 | 164 | 202 |
| Long-Term Debt | | | | | | | | | | |
| Existing Local Loans | 46 | 33 | 23 | 12 | -- | -- | -- | -- | -- | -- |
| Proposed Aid Loans | -- | -- | 705 | 1523 | 2468 | 2541 | 2534 | 2435 | 2330 | 2219 |
| Total Long-Term Debt | 46 | 33 | 728 | 1535 | 2468 | 2541 | 2534 | 2435 | 2330 | 2219 |

Table 5-6
(continued)

Balance Sheet

| YEAR ENDING DECEMBER 31 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| EQUITY | | | | | | | | | | |
| Equity, Retained Earnings, & Capital Contributions | 92 | 627 | 1122 | 1636 | 1979 | 2122 | 2218 | 2570 | 2847 | 2931 |
| TOTAL LIABILITIES | 92 | 627 | 1122 | 1636 | 1979 | 2122 | 2218 | 2570 | 2847 | 2931 |
| Debt-Equity Ratio | 33:67 | 5:95 | 39:61 | 48:52 | 55:45 | 54:46 | 53:47 | 49:51 | 45:55 | 43:57 |

Table 5-7

Cash Flow Statement
Irbid Water Supply Project
(18 July 1980)

| Year Ending December 31 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | JD (thousands) | | | | | |
| **Internal Cash Generation** | | | | | | | | | | | |
| Net Revenue Before Depreciation and Interest | | | | | | | | | | | |
| Water Supply | 58 | 98 | 163 | 141 | 218 | 168 | 111 | 49 | 283 | 180 | (44) |
| **Operating Requirements** | | | | | | | | | | | |
| Working Capital | - | 43 | 6 | (5) | 13 | (1) | (1) | (1) | 50 | - | (9) |
| Debit Service-Interest | | | | | | | | | | | |
| Existing Local Loans | - | 6 | 5 | 3 | 3 | 1 | - | - | - | - | - |
| Proposed AID Loans | - | - | - | - | - | - | 48 | 98 | 151 | 145 | 139 |
| Debit Service-Repayment | - | 6 | 5 | 3 | 2 | 1 | 48 | 98 | 151 | 145 | 139 |
| Existing Local Loans | - | 12 | 13 | 10 | 11 | 12 | - | - | - | - | - |
| Proposed AID Loans | - | - | - | - | - | - | 28 | 61 | 99 | 105 | 111 |
| Total Repayment | - | 12 | 13 | 10 | 11 | 12 | 28 | 61 | 99 | 105 | 111 |
| Total Debt Service | - | 18 | 18 | 13 | 13 | 13 | 76 | 159 | 250 | 250 | 250 |
| **Total Operating Requirements** | - | 61 | 24 | 8 | 26 | 12 | 75 | 158 | 300 | 250 | 241 |
| **Total Available from Operations** | 58 | 37 | 139 | 133 | 192 | 156 | 36 | (109) | (17) | (70) | (285) |
| **Construction Costs** | | | | | | | | | | | |
| Project-Water Supply | - | - | 387 | 1109 | 1221 | 1288 | 390 | 429 | 472 | 519 | 571 |
| Interest Capitalized | - | - | - | - | - | - | - | - | - | - | - |
| Total Construction Costs-Water Supply | - | - | 387 | 1109 | 1221 | 1288 | 390 | 429 | 472 | 519 | 571 |

Table 5-7
(continued)

Cash Flow Statement

| Year Ending December 31 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | JD (thousands) | | | | | |
| Balance To Be Financed | | | | | | | | | | | |
| Financed By: | | | | | | | | | | | |
| AID Grants | - | - | 250 | - | - | - | - | - | - | - | - |
| AID Loans | - | - | - | 665 | 731 | 805 | - | - | - | - | - |
| GOJ Capital Contributions | - | - | 137 | 444 | 490 | 483 | 390 | 429 | 472 | 519 | 571 |
| Total Financed | - | - | 387 | 1109 | 1221 | 1288 | 390 | 429 | 472 | 519 | 571 |
| Surplus (Deficit) | 58 | 37 | 139 | 133 | 192 | 156 | 36 | (109) | (17) | (70) | (285) |
| Cash Balance at End of Year | 58 | 95 | 234 | 367 | 559 | 715 | 751 | 642 | 625 | 555 | 270 |
| Debt Service Coverage | N/A | 5.4 | 9.1 | 10.8 | 16.8 | 12.9 | 1.5 | .3 | 1.1 | .7 | (.2) |

Table 5-8a

Supplemental Schedules
Irbid Water Supply Project
(18 July 1980)

Schedule 1 -- Revenue

| YEAR | RESIDENT IN 1979 JD (1) | NON-RESIDENT IN 1979 JD (1) | RESIDENT ESCALATED (2) | NON-RESIDENT ESCALATED (2) | ADMINISTRATIVE CONNECTION FEES (3) | DEPOSITS (4) | ADMINISTRATIVE CONNECTION FEES NET OF DEPOSITS (5) | TOTAL REVENUE (6) |
|---|---|---|---|---|---|---|---|---|
| 1980 | 289 | 88 | 306 | 93 | -- | -- | -- | 399 |
| 1981 | 344 | 94 | 386 | 106 | 55 | 14 | 41 | 533 |
| 1982 | 379 | 97 | 451 | 115 | 34 | 9 | 25 | 591 |
| 1983 | 468 | 118 | 591 | 148 | 19 | 5 | 14 | 753 |
| 1984 | 484 | 125 | 647 | 167 | 17 | 4 | 13 | 827 |
| 1985 | 508 | 129 | 720 | 183 | 20 | 5 | 15 | 918 |
| 1986 | 528 | 136 | 794 | 204 | 19 | 5 | 14 | 1,012 |
| 1987 | 735 | 189 | 1,171 | 301 | 15 | 4 | 11 | 1,483 |
| 1988 | 764 | 199 | 1,290 | 336 | 20 | 5 | 15 | 1,641 |
| 1989 | 800 | 204 | 1,433 | 365 | 22 | 6 | 16 | 1,814 |

(1) Per cash flow analysis shown in 1979 JD. The resident and non-resident revenues include the wholesale cost of water which equals The cost of wholesale water is shown in the expense supplemental schedule 2, Table 5-8b.

(2) Escalated at 6% per annum.

(3) Per cash flow analysis shown under revenue from new customers. This number is based on the number of annual connections at a constant connection fee of 19 JD.

(4) The 19 JD connection fee includes a deposit of 5 JD. Therefore, deposits represent 5/19 or .263 of the Administrative Connection Fee.

(5) Administrative Connection Fees Net of Deposits.

(6) The Revenue shown on the financial statements includes escalated resident and non-resident revenues plus administrative connection fees net of deposits.



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Table 5-8b

Schedule 2 -- Expenses

| EXPENSES | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| NEW FACILITIES[1] | 256 | 333 | 422 | 517 | 651 | 809 | 965 | 1202 | 1463 | 1860 |
| CURRENT FACILITIES[2] | 50 | 40 | 30 | 20 | 10 | - | - | - | - | - |
| TOTAL EXPENSES[3] | 306 | 373 | 452 | 537 | 661 | 809 | 965 | 1202 | 1463 | 1860 |
| REFUGEE RECONNECTIONS[4] | 3 | 4 | 5 | - | - | - | - | - | - | - |
| WHOLESALE WATER[5] | 167 | 228 | 299 | 378 | 487 | 611 | 731 | 924 | 1136 | 1472 |
| NET EXPENSES[6] | 136 | 141 | 148 | 159 | 174 | 198 | 234 | 278 | 327 | 388 |
| SALARIES & WAGES[7] | 41 | 42 | 44 | 48 | 52 | 59 | 70 | 83 | 98 | 116 |
| RENT & BLDG. MAINTENANCE[7] | 14 | 14 | 15 | 16 | 17 | 20 | 23 | 28 | 33 | 39 |
| FUEL[7] | 7 | 7 | 7 | 8 | 9 | 10 | 12 | 14 | 16 | 19 |
| MAINTENANCE [7,8] | 67 | 71 | 75 | 79 | 88 | 99 | 117 | 139 | 163 | 194 |
| CHEMICALS[7] | 3 | 3 | 3 | 3 | 3 | 4 | 5 | 6 | 7 | 8 |
| OTHER[7] | 4 | 4 | 4 | 5 | 5 | 6 | 7 | 8 | 10 | 12 |

NOTES:

1) Per cash flow analysis shown under O & M inflated. These costs have been escalated at 15% per annum in addition to the yearly increases shown under O & M in 1979 JD. Based on staff level of 110 to 120 in 1980 with regular increases in staff from 1980-1990 up to a maximum level of 160. Related to the size of system (meters of pipe and customers.)

2) Actual estimated expense of current facilities which phase out in 1984.

3) Not including depreciation and interest.

4) Based on 1,500 refugee households at a 6.5 JD reconnection cost spread equally between 1980, 1981 and 1982. These amounts have been escalated at 15% per annum.

5) Cost of wholesale water is based on 65 fils times estimated water use. The wholesale cost of water shown is escalated at 15% per annum.

6) Total expenses less refugee reconnection costs and cost of wholesale water.

7) These costs reflect the following percentage split of costs times the net expense and are based on the percentage split in the current system. Salaries and wages 30% + Rent and Bldg. Maint. 10% + Operation & Maint. 57% + Other 3% = 100%. Operation & Maintenance = Fuel 5% + Maintenance 50% + Chemicals 2% = 57%. Maintenance costs are reduced by the amount of inventory purchases. See supplemental schedule following.



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## Table 5-8c

## Schedule 3 -- Inventory

| YEAR | INVENTORY (1) | MAINTENANCE COSTS - NET OF INVENTORY |
|---|---|---|
| 1980 | 5 | 62 |
| 1981 | 3 | 68 |
| 1982 | 2 | 73 |
| 1983 | 2 | 77 |
| 1984 | 2 | 86 |
| 1985 | 2 | 97 |
| 1986 | 2 | 115 |
| 1987 | 2 | 137 |
| 1988 | 2 | 161 |
| 1989 | 2 | 192 |

(1) Estimated Inventory Purchases.

## Table 5-8d

## Schedule 4 -- Operating Costs

| YEAR | TOTAL EXPENSES (1) | PLUS: DEPRECIATION (2) | LESS: INVENTORY (3) | OPERATING COSTS (4) |
|---|---|---|---|---|
| 1980 | 306 | -- | 5 | 301 |
| 1981 | 373 | 10 | 3 | 380 |
| 1982 | 452 | 47 | 2 | 497 |
| 1983 | 537 | 105 | 2 | 640 |
| 1984 | 661 | 167 | 2 | 826 |
| 1985 | 809 | 209 | 2 | 1,016 |
| 1986 | 965 | 230 | 2 | 1,193 |
| 1987 | 1,202 | 252 | 2 | 1,452 |
| 1988 | 1,463 | 277 | 2 | 1,738 |
| 1989 | 1,860 | 304 | 2 | 2,162 |

(1) From Schedule 2, Table 5-8b.

(2) From Schedule 9, Table 5-8I.

(3) From Schedule 3, Table 5-8c.

(4) Operating costs shown on Income and Expenditure Statement, Table 5-5.

## Table 5-8e

## Schedule 5 -- Grace Period Interest

| YEAR | A.I.D. LOAN(1) | GRACE PERIOD INTEREST(2) 1982 | 1983 | 1984 | 1985 | 1986 | TOTAL NOTE(1) | PAYMENT STARTS IN YEAR |
|---|---|---|---|---|---|---|---|---|
| 1982 | 665 | 40 | 42 | 45 | -- | -- | 792 | 1985 |
| 1983 | 732 | -- | 44 | 47 | 50 | -- | 873 | 1986 |
| 1984 | 805 | -- | -- | 48 | 51 | 54 | 958 | 1987 |
| TOTAL | 2,202 | 40 | 86 | 140 | 101 | 54 | 2,623 | |

(1) The loan is given to GOJ by AID. The GOJ in turn loans the authority at 6% over 20 years with a three year grace period and a 17 year amortization schedule that includes the grace period interest. Refer to Table 5-4 for A.I.D. loan amounts.

(2) All grace period interest is expensed since the assets are placed in service during the year of construction.

## Table 5-8f

## Schedule 6 -- Loan Amortization[1]

| YEAR | NOTE 1 - 792 ANNUAL PYMT.- 76 PRIN. | INTEREST | NOTE 2 - 873 ANNUAL PYMT.- 83 PRIN. | INTEREST | NOTE 3 - 958 ANNUAL PYMT.- 91 PRIN. | INTEREST | TOTAL FOR YEAR PRIN. | INTEREST |
|---|---|---|---|---|---|---|---|---|
| 1985 | 28 | 48 | -- | -- | -- | -- | 28 | 48 |
| 1986 | 30 | 46 | 31 | 52 | -- | -- | 61 | 98 |
| 1987 | 32 | 44 | 33 | 50 | 34 | 57 | 99 | 151 |
| 1988 | 34 | 42 | 35 | 48 | 36 | 55 | 105 | 145 |
| 1989 | 36 | 40 | 37 | 46 | 38 | 53 | 111 | 139 |
| TOTAL | 160 | 220 | 136 | 196 | 108 | 165 | 404 | 581 |

(1) Loans plus grace period interest are amortized over 17 years at 6% interest.

## Table 5-8g

## Schedule 7 -- Loan Amortization[1] Note on Current Facilities

| YEAR | NOTE ON CURRENT FACILITIES PRIN. | INTEREST | TOTAL |
|---|---|---|---|
| 1980 | 12 | 6 | 18 |
| 1981 | 13 | 5 | 18 |
| 1982 | 10 | 3 | 13 |
| 1983 | 11 | 2 | 13 |
| 1984 | 12 | 1 | 13 |
| | 58 | 17 | 75 |

(1) Amortization for debt service on current facilities. Principal and interest amounts are estimated.

## Table 5-8h

## Schedule 8 -- Interest Costs

| YEAR | GRACE PERIOD INTEREST(1) | LOAN AMORTIZATION - NEW FACILITIES(2) | LOAN AMORTIZATION - CURRENT FACILITIES(3) | TOTAL INTEREST(4) |
|---|---|---|---|---|
| 1980 | -- | -- | 6 | 6 |
| 1981 | -- | -- | 5 | 5 |
| 1982 | 40 | -- | 3 | 43 |
| 1983 | 86 | -- | 2 | 88 |
| 1984 | 140 | -- | 1 | 141 |
| 1985 | 101 | 48 | -- | 149 |
| 1986 | 54 | 98 | -- | 152 |
| 1987 | -- | 151 | -- | 151 |
| 1988 | -- | 145 | -- | 145 |
| 1989 | -- | 139 | -- | 139 |
| TOTAL | 421 | 581 | 17 | 1,019 |

(1) From Schedule 5, Table 5-8e.
(2) From Schedule 6, Table 5-8f.
(3) From Schedule 7, Table 5-8g.
(4) Interest costs shown on Income and Expenditure Statement, Table 5-5.

## Table 5-8i

## Schedule 9 -- Depreciation

| | ESCALATED CAPITAL EXPENDITURES IN YEAR(1) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | 1981 387 | 1982 1,109 | 1983 1,221 | 1984 1,288 | 1985 390 | 1986 429 | 1987 472 | 1988 519 | 1989 571 | YEARLY DEPRECIATION(2) |
| 1981 | 10 | -- | -- | -- | -- | -- | -- | -- | -- | 10 |
| 1982 | 19 | 28 | -- | -- | -- | -- | -- | -- | -- | 47 |
| 1983 | 19 | 55 | 31 | -- | -- | -- | -- | -- | -- | 105 |
| 1984 | 19 | 55 | 61 | 32 | -- | -- | -- | -- | -- | 167 |
| 1985 | 19 | 55 | 61 | 64 | 10 | -- | -- | -- | -- | 209 |
| 1986 | 19 | 55 | 61 | 64 | 20 | 11 | -- | -- | -- | 230 |
| 1987 | 19 | 55 | 61 | 64 | 20 | 21 | 12 | -- | -- | 252 |
| 1988 | 19 | 55 | 61 | 64 | 20 | 21 | 24 | 13 | -- | 277 |
| 1989 | 19 | 55 | 61 | 64 | 20 | 21 | 24 | 26 | 14 | 304 |
| TOTAL | 162 | 413 | 397 | 352 | 90 | 74 | 60 | 39 | 14 | 1,601 |

(1) Refer to Table 5-4 for the yearly escalated Capital Expenditures.

(2) Depreciation is calculated on the straight line basis over 20 years. The half year convention is used which means capital expenditures receive a half year of depreciation in the year the asset is purchased.



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Table 5-8j

Schedule 10 -- Additional Explanations

1. Grants are shown on the cash flow analysis in 1979 JD. They are shown on the financial statements as capital cost and a contribution to equity in escalated JD. Since these capital costs are equity contributions, there is no impact on the cash flow analysis. Table 5-4 shows the conversion from 1979 JD to escalated JD.

2. Accounts receivable equals 15% of billings (including deposits) for the current year.

3. Accounts payable equals 1/12 of all operating costs except salaries and wages and refugee reconnection costs incurred during the current year.

4. The reconnection investment for existing customers of JD 41,000, 45,000 and 50,000 which represents the escalated value for 1981, 1982 and 1983 respectively is shown under water supply capital costs and is financed entirely by GOJ capital contributions.



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Table 5-9a

Anticipated Revenues
Irbid Water Supply Project
(18 July 1980)

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WATER SUPPLY                           *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1982
INFLATION RATES :LOW MEDIUM HIGH

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D R E V E N U E S (T H O U S A N D S O F J.D)

| YEAR | NUMBER OF CUSTOMERS RESIDENT | NUMBER OF CUSTOMERS NONRESD | USER CHARGES J.D. / MONTH RESIDENT | USER CHARGES J.D. / MONTH NONRESD | REVENUE FROM CUSTOMERS RESIDENT | REVENUE FROM CUSTOMERS NONRESD | ADMINISTR. CONNECTION FEE(LD) | REVENUE FROM NEW CUSTOMERS | RATE OF HOUSEHOLD WATER USE INCREASE | TOTAL ANNUAL REVENUE |
|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 14200 | 2800 | 1.70 | 2.62 | 289 | 88 | 0 | 0 | 1.060 | 399 |
| 1981 | 16900 | 3000 | 1.70 | 2.62 | 344 | 94 | 19 | 55 | 1.060 | 547 |
| 1982 | 18600 | 3100 | 1.70 | 2.62 | 379 | 97 | 19 | 34 | 1.060 | 600 |
| 1983 | 19500 | 3200 | 2.00 | 3.08 | 468 | 118 | 19 | 19 | 1.060 | 758 |
| 1984 | 20200 | 3400 | 2.00 | 3.08 | 464 | 125 | 19 | 17 | 1.060 | 831 |
| 1985 | 21200 | 3500 | 2.00 | 3.08 | 508 | 129 | 19 | 20 | 1.060 | 923 |
| 1986 | 22000 | 3700 | 2.00 | 3.08 | 528 | 136 | 19 | 19 | 1.060 | 1017 |
| 1987 | 22700 | 3800 | 2.70 | 4.15 | 735 | 189 | 19 | 15 | 1.060 | 1483 |
| 1988 | 23600 | 4000 | 2.70 | 4.15 | 764 | 199 | 19 | 20 | 1.060 | 1646 |
| 1989 | 24700 | 4100 | 2.70 | 4.15 | 800 | 204 | 19 | 22 | 1.060 | 1820 |

NOTES:

(1) NUMBER OF CUSTOMERS : CALCULATED AS EQUIVALENT DEVELOPMENT UNITS BASED ON 92 PERCENT OF TOTAL POPULATION IN 1980 AND 97 PERCENT OF POPULATION IN 1990.
(2) EQUIVALENT NONRESIDENT USER CHARGE IS 1.54 OF RESIDENT CHARGE.
(3) RATE OF HOUSEHOLD WATER USE INCREASE, BASED ON PROJECTED PER CAPITA WATER CONSUMPTION AND DECREASING HOUSEHOLD SIZE.
(4) ADMINISTRATIVE CONNECTION FEE DOES NOT INCLUDE THE COST OF THE METER WHICH IS PASSED THROUGH
(5) No administrative connection fee in 1980. (See notes page 2.)
(6) Ultimate (1989) Water availability is 5.5Mm$^3$.



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# Anticipated Expenses
# Irbid Water Supply Project
# (18 July 1980)

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WATER SUPPLY                           *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

ASSUMPTIONS:
CONSTRUCTION PHASING COMPLETED :1982
INFLATION RATES :LOW MEDIUM HIGH

FINANCING :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

ANTICIPATED EXPENSES(THOUSANDS OF J.D)

| YEAR | REVENUE REQUIRED FOR NEW FACILITIES TOTAL CAPITAL COST(1979 JD) | GRANT | NET CAPITAL COST | NET CAPITAL COST INFLATED (10.00PC) | GRACE PERIOD INTEREST ACCUMULATION | LOCAL DEBT ANNUAL PAY. ( 6.00PC*20YR) | O+M IN 1979 (J.D) | O+M INFLATED (15.00PC) | TOTAL EXPENSE OF NEW FACILITIES |
|---|---|---|---|---|---|---|---|---|---|
| 1980 | 0 | 0 | 0 | 0 | 0 | 0 | 223 | 256 | 256 |
| 1981 | 320 | 320 | 0 | 0 | 0 | 0 | 252 | 333 | 333 |
| 1982 | 834 | 334 | 500 | 665 | 40 | 0 | 278 | 422 | 422 |
| 1983 | 834 | 334 | 500 | 732 | 86 | 0 | 296 | 517 | 517 |
| 1984 | 800 | 300 | 500 | 805 | 140 | 0 | 324 | 651 | 651 |
| 1985 | 220 | 220 | 0 | 0 | 101 | 76 | 350 | 809 | 885 |
| 1986 | 220 | 220 | 0 | 0 | 54 | 159 | 363 | 965 | 1124 |
| 1987 | 220 | 220 | 0 | 0 | 0 | 250 | 393 | 1202 | 1452 |
| 1988 | 220 | 220 | 0 | 0 | 0 | 250 | 416 | 1463 | 1713 |
| 1989 | 220 | 220 | 0 | 0 | 0 | 250 | 460 | 1860 | 2110 |

NOTES:

(1) Administrative cost to reconnect 1980 population is 6.5 JD per connection. In 1980 there are 12,700 non-refugee residences and 2800 residences (total 15,500) to be connected. Total cost of connection is 100,750 JD in 1979 JD. This is applied as a capital cost to be financed by Government of Jordan Equity in 1981, 1982 and 1983 (34,000 JD per year). The 6.5 JD to reconnect the existing 1500 refugee connections will be applied to 1980, 1981, 1982 operation and maintenance: total = 9,750 JD or 3,000 JD per year.

(2) Capital requirements provided by A.I.D. J. Cassanos.

(3) Grant is combination A.I.D. grant and Government of Jordan Equity. (See Table 5-4.)

(4) Net capital cost inflated equals loan requirement. Total loan this element equals 2,202,000 JD. Total for project = 6,300,000 JD.

(5) O & M includes wholesale water at .065 JD/$m^3$ (1979 price) inflated at 15% in column 9. (See Table 5-19.)



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Table 5-9c

Deficit-Surplus Analysis
Irbid Water Supply Analysis
(18 July 1980)

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WATER SUPPLY                           *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1982
INFLATION RATES :LOW MEDIUM HIGH

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

D E F I C I T - S U R P L U S A N A L I S I S (T H O U S A N D S J.D.)

| YEAR | TOTAL REVENUE REQ. FOR NEW FACILITIES | DEBT SERVICE ON CURRENT FACILITIES | O+M ON CURRENT FACILITIES | TOTAL EXPENSES | TOTAL REVENUE | ANNUAL SURPLUS | ACCUMULATED |
|---|---|---|---|---|---|---|---|
| 1980 | 256 | 18 | 50 | 324 | 399 | 75 | 75 |
| 1981 | 333 | 18 | 40 | 391 | 547 | 156 | 231 |
| 1982 | 422 | 13 | 30 | 465 | 600 | 135 | 366 |
| 1983 | 517 | 13 | 20 | 550 | 758 | 208 | 574 |
| 1984 | 651 | 13 | 10 | 674 | 831 | 157 | 731 |
| 1985 | 885 | 0 | 0 | 885 | 923 | 38 | 769 |
| 1986 | 1124 | 0 | 0 | 1124 | 1017 | -107 | 662 |
| 1987 | 1452 | 0 | 0 | 1452 | 1487 | 35 | 697 |
| 1988 | 1713 | 0 | 0 | 1713 | 1646 | -67 | 630 |
| 1989 | 2110 | 0 | 0 | 2110 | 1820 | -290 | 340 |

NOTES:

(1) O+M ON CURRENT FACILITIES DOES NOT INCLUDE SALARIES OF PERSONEL, THESE ARE PROJECTED FROM 1977, 78 , AND 79 MAINTANANCE COST ON EXISTING FACILITIES.



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# IRBID WASTEWATER PROJECT
# FINANCIAL ANALYSIS

Table 5-10

Septage Revenues
(18 July 1980)

| | Irbid Population[1] 000 | Sanitary District Population[2] 000 | STP Served[3] 000 | Septic Users (Persons)[4] 000 | Septic Users (Households)[5] | Number Emptied (1/5, Once Every Five Years)[6] | Number of Loads[7] | Cost[8] (J.D.) 000 |
|---|---|---|---|---|---|---|---|---|
| 1984 | 140.8 | 245.0 | 14.0 | 212.0 | 30,280 | 6,056 | 15,140 | 151 |
| 1985 | 147.2 | 256.0 | 28.0 | 208.0 | 29,700 | 5,940 | 1,485 | 148 |
| 1986 | 153.1 | 266.4 | 40.6 | 205.8 | 29,400 | 5,880 | 1,470 | 147 |
| 1987 | 159.2 | 277.0 | 56.0 | 200.0 | 28,600 | 5,720 | 1,430 | 143 |
| 1988 | 165.6 | 288.1 | 85.4 | 180.7 | 25,800 | 5,160 | 1,290 | 129 |
| 1989 | 172.2 | 299.6 | 129.5 | 148.1 | 21,200 | 4,240 | 1,060 | 106 |

1. 1979 Census
2. 1.74 times Irbid population
3. See J. Cassanos data
4. Difference between subdistrict population and Irbid served population (does not include refugee population of Table 5-1)
5. Based on 7 persons per household
6. Septic tanks emptied every 5 years (engineers estimate)
7. 2.5 loads per septic tank ($4m^3$ per truckload) $10M^3$ capacity
8. Cost is 10 JD per truckload.



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Table 5-11

Income and Expenditure Statement
Irbid Wastewater Project
(18 July 1980)

| YEAR ENDING DECEMBER 31 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | JD (THOUSANDS) | | | | | | |
| REVENUE | | | | | | | | | | |
| RESIDENT | - | - | - | - | 99 | 210 | 323 | 473 | 765 | 1232 |
| NON-RESIDENT | - | - | - | - | 121 | 177 | 206 | 236 | 336 | 419 |
| ADMINISTRATIVE CONNECTION FEES | - | - | - | - | 115 | 83 | 64 | 76 | 163 | 220 |
| SEPTAGE DUMPINGS | - | - | - | - | 151 | 148 | 147 | 143 | 129 | 106 |
| TOTAL | - | - | - | - | 486 | 618 | 740 | 928 | 1393 | 1977 |
| OPERATING COSTS | | | | | | | | | | |
| SALARIES & WAGES | - | - | - | - | 94 | 121 | 155 | 225 | 280 | 346 |
| MATERIAL | - | - | - | - | 40 | 53 | 70 | 98 | 124 | 156 |
| POWER | - | - | - | - | 103 | 131 | 167 | 243 | 302 | 372 |
| CHEMICAL | - | - | - | - | 20 | 26 | 33 | 48 | 59 | 73 |
| SLUDGE DISPOSAL | - | - | - | - | 11 | 15 | 19 | 27 | 34 | 42 |
| DEPRECIATION | - | - | - | - | 378 | 378 | 378 | 378 | 378 | 378 |
| TOTAL | - | - | - | - | 646 | 724 | 822 | 1019 | 1177 | 1367 |
| SURPLUS BEFORE INTEREST | - | - | - | - | (160) | (106) | (82) | (91) | 216 | 610 |
| INTEREST | - | - | - | - | 265 | 281 | 283 | 280 | 268 | 256 |
| SURPLUS (DEFICIT) | - | - | - | - | (425) | (387) | (365) | (371) | (52) | 354 |
| AVERAGE NET FIXED ASSETS | N/A | N/A | N/A | N/A | N/A | 6996 | 6618 | 6240 | 5862 | 5484 |
| RATE OF RETURN ON AVERAGE NET FIXED ASSETS (%) | N/A | N/A | N/A | N/A | N/A | - | - | - | 3.7 | 11.1 |
| CASH OPERATING REQUIREMENTS % | N/A | N/A | N/A | N/A | 55.1 | 56.0 | 60.0 | 69.1 | 57.4 | 50.0 |



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Table 5-12

Balance Sheet
Irbid Wastewater Project
(18 July 1980)

| YEAR ENDING DECEMBER 31 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| ASSETS | | | | | | | | | | |
| CURRENT ASSETS | | | | | | | | | | |
| CASH | - | - | - | - | 155 | 176 | 105 | 49 | 106 | 390 |
| ACCOUNTS RECEIVABLE | - | - | - | - | 73 | 93 | 111 | 139 | 209 | 297 |
| INVENTORIES | - | - | - | - | 5 | 10 | 15 | 25 | 35 | 45 |
| TOTAL CURRENT ASSETS | - | - | - | - | 233 | 279 | 231 | 213 | 350 | 732 |
| FIXED ASSETS | | | | | | | | | | |
| WASTEWATER | - | - | - | - | 7563 | 7563 | 7563 | 7563 | 7563 | 7563 |
| LESS DEPRECIATION | - | - | - | - | 378 | 756 | 1134 | 1512 | 1890 | 2268 |
| NET WASTEWATER | - | - | - | - | 7185 | 6807 | 6429 | 6051 | 5673 | 5295 |
| WORK-IN-PROGRESS | - | 691 | 4045 | 5915 | - | - | - | 1475 | 3099 | 4883 |
| TOTAL FIXED ASSETS | - | 691 | 4045 | 5915 | 7185 | 6807 | 6429 | 7526 | 8772 | 10178 |
| TOTAL ASSETS | | | | | | | | | | |
| LIABILITIES | | | | | | | | | | |
| CURRENT LIABILITIES | | | | | | | | | | |
| ACCOUNTS PAYABLE | - | - | - | - | 15 | 19 | 24 | 35 | 44 | 54 |
| TOTAL CURRENT LIABILITIE | - | - | - | - | 15 | 19 | 24 | 35 | 44 | 54 |
| LONG TERM DEBT | | | | | | | | | | |
| TEMP. OPERATING LOANS | - | - | - | - | - | - | - | 150 | 150 | - |
| PROPOSED AID LOANS | - | - | 2141 | 3381 | 4676 | 4727 | 4661 | 4475 | 4277 | 4067 |
| TOTAL LONG TERM DEBT | - | - | 2141 | 3381 | 4676 | 4727 | 4727 | 4625 | 4427 | 4067 |
| EQUITY | | | | | | | | | | |
| EQUITY, RETAINED EARNINGS, AND CAPITAL CONTRIBUTIONS | - | 691 | 1904 | 2534 | 2727 | 2340 | 1975 | 3079 | 4651 | 6789 |
| TOTAL LIABILITIES | - | 691 | 4045 | 5915 | 7418 | 7086 | 6660 | 7739 | 9122 | 10910 |
| DEBT-EQUITY RATIO | N/A | N/A | 53:47 | 57:43 | 63:37 | 67:33 | 70:30 | 60:40 | 49:51 | 37:63 |

Table 5-13

Cash Flow Statement
Irbid Wastewater Project
(18 July 1980)

| Year Ending December 31 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | JD (Thousands) | | | | | |
| Internal Cash Generation | | | | | | | | | | |
| New Revenue Before Depreciation and Interest | | | | | | | | | | |
| Wastewater | - | - | - | - | 218 | 272 | 296 | 287 | 594 | 988 |
| Operating Requirements | | | | | | | | | | |
| Working Capital | - | - | - | - | 63 | 21 | 18 | 27 | 71 | 88 |
| Debt Service - Interest | | | | | | | | | | |
| Proposed AID Loans | - | - | - | - | - | 145 | 214 | 280 | 268 | 256 |
| Debt Service - Repayment | | | | | | | | | | |
| Proposed AID Loans | - | - | - | - | - | 85 | 135 | 186 | 198 | 210 |
| Total Debt Service | - | - | - | - | - | 230 | 349 | 466 | 466 | 466 |
| Total Operating Requirements | - | - | - | - | 63 | 251 | 367 | 493 | 537 | 554 |
| Total Available From Operations | - | - | - | - | 155 | 21 | (71) | (206) | 57 | 434 |
| Construction Costs | | | | | | | | | | |
| Project - Wastewater | - | 691 | 3233 | 1679 | 1648 | - | - | 1475 | 1624 | 1784 |
| Interest Capitalized | - | - | 121 | 191 | - | - | - | - | - | - |
| Total Construction Costs - Wastewater | - | 691 | 3354 | 1870 | 1648 | - | - | 1475 | 1624 | 1784 |
| Balanced to be Financed | | | | | | | | | | |
| Financed By: | | | | | | | | | | |
| Aid Grants | - | 500 | - | - | - | - | - | - | - | - |
| Aid Loans | - | - | 2141 | 1240 | 1030 | - | - | - | - | - |
| GOJ Capital Contributions (1) | - | 191 | 1213 | 630 | 618 | - | - | 1475 | 1624 | 1784 |
| Temporary Operating Loans | - | - | - | - | - | - | - | 150 | - | (150) |
| Total Financed | - | 691 | 3354 | 1870 | 1648 | - | - | 1625 | 1624 | 1634 |
| Surplus (Deficit) | - | - | - | - | 155 | 21 | (71) | (56) | 57 | 284 |
| Cash Balance At End of Year | - | - | - | - | 155 | 176 | 105 | 49 | 106 | 390 |
| Debt Service Coverage | N/A | N/A | N/A | N/A | N/A | 1.2 | .8 | .6 | 1.3 | 2.1 |

(1) Includes Capitalized Interest Cost

Table 5-14a

Supplemental Schedules
Irbid Wastewater Project
(18 July 1980)

Schedule 1 -- Revenue

| YEAR | RESIDENT IN 1979 JD (1) | NON-RESIDENT IN 1979 JD (1) | RESIDENT ESCALATED (2) | NON-RESIDENT ESCALATED (2) | ADMINISTRATIVE CONNECTION FEES (3) | SEPTAGE DUMPING (4) | TOTAL REVENUE (5) |
|---|---|---|---|---|---|---|---|
| 1980 | -- | -- | -- | -- | -- | -- | -- |
| 1981 | -- | -- | -- | -- | -- | -- | -- |
| 1982 | -- | -- | -- | -- | -- | -- | -- |
| 1983 | -- | -- | -- | -- | -- | -- | -- |
| 1984 | 74 | 91 | 99 | 121 | 115 | 151 | 486 |
| 1985 | 148 | 125 | 210 | 177 | 83 | 148 | 618 |
| 1986 | 215 | 137 | 323 | 206 | 64 | 147 | 740 |
| 1987 | 297 | 148 | 473 | 236 | 76 | 143 | 928 |
| 1988 | 453 | 199 | 765 | 336 | 163 | 129 | 1,393 |
| 1989 | 688 | 234 | 1,232 | 419 | 220 | 106 | 1,977 |

(1) Per cash flow analysis shown in 1979 JD.

(2) Escalated at 6% per annum.

(3) Per cash flow analysis shown under revenue from new customers. This number is based on the number of annual connections at a constant connection fee of 32 JD.

(4) Per Cash Flow Analysis.

(5) The Revenue shown on the financial statements includes escalated resident and non-resident revenues plus administrative connection and septage dumping.

Table 5-14b

Schedule 2 -- Expenses

| YEAR | EXPENSES NEW FACILITIES (1) | MATERIAL (2) (3) | POWER (2) | SALARIES (2) & WAGES | CHEMICALS (2) | SLUDGE DISPOSAL (2) |
|---|---|---|---|---|---|---|
| 1980 | -- | -- | -- | -- | -- | -- |
| 1981 | -- | -- | -- | -- | -- | -- |
| 1982 | -- | -- | -- | -- | -- | -- |
| 1983 | -- | -- | -- | -- | -- | -- |
| 1984 | 273 | 45 | 103 | 94 | 20 | 11 |
| 1985 | 351 | 58 | 131 | 121 | 26 | 15 |
| 1986 | 449 | 75 | 167 | 155 | 33 | 19 |
| 1987 | 651 | 108 | 243 | 225 | 48 | 27 |
| 1988 | 809 | 134 | 302 | 280 | 59 | 34 |
| 1989 | 999 | 166 | 372 | 346 | 73 | 42 |

(1) Per Cash Flow Analysis shown under O & M inflated. These costs have been escalated at 15% per annum in addition to the yearly increases shown under O & M in 1979 J. D. These expenses do not include Depreciation and Interest.

(2) These costs reflect the following percentage split of costs based on information provided on Table 5-5 of the Final Report.

| | |
|---|---|
| Material | 16.6% |
| Power | 37.3 |
| Salaries and Wages | 34.6 |
| Chemicals | 7.3 |
| Sludge Disposal | 4.2 |
| | 100.0% |

(3) Material costs are reduced by the amount of Inventory Purchases. See Supplemental Schedules 3 and 4, Tables 5-14c and 5-14d.

Table 5-14c

Schedule 3 -- Inventory

| YEAR | INVENTORY(1) | MATERIAL COSTS - NET OF INVENTORY |
|---|---|---|
| 1984 | 5 | 40 |
| 1985 | 5 | 53 |
| 1986 | 5 | 70 |
| 1987 | 10 | 98 |
| 1988 | 10 | 124 |
| 1989 | 10 | 156 |

(1) Estimated Inventory Purchases.

Table 5-14d

Schedule 4 -- Operating Costs

| YEAR | TOTAL EXPENSES(1) | PLUS: DEPRECIATION(2) | LESS: INVENTORY(3) | OPERATING COSTS(4) |
|---|---|---|---|---|
| 1984 | 273 | 378 | 5 | 646 |
| 1985 | 351 | 378 | 5 | 724 |
| 1986 | 449 | 378 | 5 | 822 |
| 1987 | 651 | 378 | 10 | 1,019 |
| 1988 | 809 | 378 | 10 | 1,177 |
| 1989 | 999 | 378 | 10 | 1,367 |

(1) From Schedule 2, Table 5-14b.

(2) From Schedule 8, Table 5-14h.

(3) From Schedule 3, Table 5-14c

(4) Operating costs shown on Income and Expenditure Statement, Table 5-11.



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Table 5-14e

Schedule 5 -- Grace Period Interest

| YEAR | A.I.D. LOAN(1) | GRACE PERIOD INTEREST(2) 1982 | 1983 | 1984 | 1985 | 1986 | TOTAL NOTE(1) | PAYMENT STARTS IN YEAR |
|---|---|---|---|---|---|---|---|---|
| 1982 | 2,020 | 121 | 128 | 136 | - | - | 2,405 | 1985 |
| 1983 | 1,049 | - | 63 | 67 | 71 | - | 1,250 | 1986 |
| 1984 | 1,030 | - | - | 62 | 65 | 69 | 1,226 | 1987 |
| TOTAL | 4,099 | 121 | 191 | 265 | 136 | 69 | 4,881 | |

(1) The loan is given to GOJ by AID. The GOJ in turn loans the authority at 6% over 20 years with a three year grace period and a 17 year amortization schedule that includes the grace period interest. Refer to Table 5-4 for AID loan amounts.

(2) Grace period interest is capitalized for 1982 and 1983 during the construction period. Since the asset is placed in service in 1984, grace period interest is expensed in 1984, 1985 and 1986.



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Table 5-14f

Schedule 6 -- Loan Amortization[1]

| YEAR | NOTE 1 - 2,405 ANNUAL PYMT - 230 | | NOTE 2 - 1,250 ANNUAL PYMT - 119 | | NOTE 3 - 1,226 ANNUAL PYMT - 117 | | TOTAL FOR YEAR | |
|---|---|---|---|---|---|---|---|---|
| | PRIN. | INTEREST | PRIN. | INTEREST | PRIN. | INTEREST | PRIN. | INTEREST |
| 1985 | 85 | 145 | - | - | - | - | 85 | 145 |
| 1986 | 91 | 139 | 44 | 75 | - | - | 135 | 214 |
| 1987 | 96 | 134 | 47 | 72 | 43 | 74 | 186 | 280 |
| 1988 | 102 | 128 | 50 | 69 | 46 | 71 | 198 | 268 |
| 1989 | 108 | 122 | 53 | 66 | 49 | 68 | 210 | 256 |
| TOTAL | 482 | 668 | 194 | 282 | 138 | 213 | 814 | 1,163 |

(1) Loans plus grace period interest are amortized over 17 years at 6% interest.



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Table 5-14g

Schedule 7 -- Interest Costs

| YEAR | GRACE PERIOD INTEREST (1) | LOAN AMORTIZATION - NEW FACILITIES (2) | TOTAL INTEREST (3) |
|---|---|---|---|
| 1984 | 265 | - | 265 |
| 1985 | 136 | 145 | 281 |
| 1986 | 69 | 214 | 283 |
| 1987 | - | 280 | 280 |
| 1988 | - | 268 | 268 |
| 1989 | - | 256 | 256 |
| TOTAL | 470 | 1,163 | 1,633 |

(1) From Schedule 5, Table 5-14e.

(2) From Schedule 6, Table 5-14f.

(3) Interest costs shown on income and expenditure statement, Table 5-11.

Table 5-14h

Schedule 8 -- Depreciation

| YEAR | 1984<br>7.563(1) | YEARLY DEPRECIATION |
|---|---|---|
| 1984 | 378 | 378 |
| 1985 | 378 | 378 |
| 1986 | 378 | 378 |
| 1987 | 378 | 378 |
| 1988 | 378 | 378 |
| 1989 | 378 | 378 |
| TOTAL | 2,268 | 2,268 |

(1) Refer to Table 5-4 for the yearly escalated capital expenditures. Amount capitalized also includes the grace period interest capitalized for 1982 and 1983 of 121,000 and 191,000 respectively.

(2) Depreciation is calculated on the straight line basis over 20 years. Depreciation starts in 1984 the year the asset is placed in service.

Table 5-14i

Schedule 9 -- Additional Explanations

1. Grants are shown on the cash flow analysis in 1979 JD. They are shown on the financial statements as capital cost and a contribution to equity in escalated JD. Since these capital costs are equity contributions, there is no impact on the cash flow analysis. Table 5-4 shows the conversion from 1979 JD to escalated JD.

2. Accounts receivable equals 15% of billings for the current year.

3. Accounts payable equals 1/12 of all operating costs except salaries and wages and refugee reconnection costs incurred during current year.

4. Capital expenditures for 1981, 1982, and 1983 are treated as work-in-process until 1984 when they are placed in service. Capital expenditures for 1987, 1988, and 1989 are treated as work-in-process and are not placed in service during the study period.

Table 5-15a

Anticipated Revenues
Irbid Wastewater Project
(18 July 1980)

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WASTEWATER COLLECTION AND TREATMENT    *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1982
INFLATION RATES :LOW MEDIUM HIGH

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D R E V E N U E S (T H O U S A N D S O F J.D )

| YEAR | NUMBER OF CUSTOMERS RESIDENT | NUMBER OF CUSTOMERS NONRSED | USER CHARGES J.D. / MONTH RESIDENT | USER CHARGES J.D. / MONTH NONRESD | REVENUE FROM CUSTOMERS RESIDENT | REVENUE FROM CUSTOMERS NONRESD | ADMINISTR. CONNECTION FEE(JD) | REVENUE FROM NEW CUSTOMERS | REVENUE FROM SEPTAGE DUMPING | RATE OF HOUSEHOLD WATER USE INCREASE | TOTAL ANNUAL REVENUE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 0 | 0 | 0.0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 1.060 | 0 |
| 1981 | 0 | 0 | 0.0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 1.060 | 0 |
| 1982 | 0 | 0 | 0.0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 1.060 | 0 |
| 1983 | 0 | 0 | 0.0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 1.060 | 0 |
| 1984 | 2000 | 1600 | 3.10 | 4.76 | 74 | 91 | 32 | 115 | 151 | 1.060 | 486 |
| 1985 | 4000 | 2200 | 3.10 | 4.76 | 148 | 125 | 32 | 83 | 148 | 1.060 | 618 |
| 1986 | 5800 | 2400 | 3.10 | 4.76 | 215 | 137 | 32 | 64 | 147 | 1.060 | 740 |
| 1987 | 8000 | 2600 | 3.10 | 4.76 | 297 | 148 | 32 | 76 | 143 | 1.060 | 928 |
| 1988 | 12200 | 3500 | 3.10 | 4.76 | 453 | 199 | 32 | 163 | 129 | 1.060 | 1393 |
| 1989 | 18500 | 4100 | 3.10 | 4.76 | 688 | 234 | 32 | 220 | 106 | 1.060 | 1977 |

NOTES:

(1) NUMBER OF CUSTOMERS : CALCULATED AS EQUIVALENT DEVELOPMENT UNITS.
(2) USER CHARGES : AVERAGEMONTHLY USER CHARGES BASED ON EXISTING PRICING POLICY . (See Final Report Section E.2.1.2.)
(3) ADMINISTRATIVE CONNECTION FEE: BASED ON WEIGHTED RENTAL VALU E OF HOUSING AND COMMERCIAL PROPERTIES ADJUSTED FOR INCREASING AFFLUE NCE AND INFLATION.
(4) REVENUE FROM SEPTAGE DUMPING : REVENUES FROM PERIODIC PUMPING OF ONSITE SYSTEMS NOT SERVED BY SEWER SYSTEM. See Table 5-10.
(5) RATE OF HOUSEHOLD WASTEWATER INCREASE : INCREASE IN HOUSEHOLD WASTEWATER USED TO INCREASE ANNUAL REVENUES FROM USER CHARGES BASED ON INCREASING PER CAPITA WATER CONSUMPTION AND DECREASING HOUSEHOLD SIZE.
(6) Number of residential and non-residential users provided by J. Cassanos of A.I.D.

Table 5-15b

Anticipated Expenses
Irbid Wastewater Project
(18 July 1980)

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WASTEWATER COLLECTION AND TREATMENT    *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1982
INFLATION RATES :LOW MEDIUM HIGH

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D E X P E N S E S ( T H O U S A N D S O F J.D)

| YEAR | REVENUE REQUIRED FOR NEW FACILITIES TOTAL CAPITAL COST(1979 JD) | GRANT | NET CAPITAL COST | NET CAPITAL COST INFLATED (10.00PC) | GRACE PERIOD INTEREST ACCUMULATION | LOCAL DEBT ANNUAL PAY. ( 6.00PC*20YR) | O+M IN 1979 (J.D) | O+M INFLATED (15.00PC) | TOTAL EXPENSE OF NEW FACILITIES |
|---|---|---|---|---|---|---|---|---|---|
| 1980 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1981 | 571 | 571 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1982 | 2429 | 911 | 1518 | 2020 | 121 | 0 | 0 | 0 | 0 |
| 1983 | 1147 | 430 | 717 | 1049 | 191 | 0 | 0 | 0 | 0 |
| 1984 | 1023 | 383 | 640 | 1030 | 265 | 0 | 136 | 273 | 273 |
| 1985 | 0 | 0 | 0 | 0 | 136 | 230 | 152 | 351 | 581 |
| 1986 | 0 | 0 | 0 | 0 | 69 | 349 | 169 | 449 | 798 |
| 1987 | 688 | 688 | 0 | 0 | 0 | 466 | 213 | 651 | 1117 |
| 1988 | 689 | 689 | 0 | 0 | 0 | 466 | 230 | 809 | 1275 |
| 1989 | 688 | 688 | 0 | 0 | 0 | 466 | 247 | 999 | 1465 |

NOTES:

(1) REVENUE REQUIRED FOR NEW FACILITIES : CAPITAL COSTS INCLUDE GRACE PERIOD INTEREST WHICH WAS REFINANCED ONLY DURING G RACE PERIOD AS A COST OF CONSTRUCTION. J. CASSANOS ESTIMATE.
(2) GRACE PERIOD APPLIES ONLY TO MAJOR CAPITAL INVESTMENTS FROM THE TIME THEY ARE INCURRED.
(3) GRANT : INCLUDES US.AID GRANT, AS WELL AS GOVERNMENT OF JORDAN EQUITY.
(4) Net Capital cost inflated is the amount to be financed by loan expressed in current terms. See Table 5-4 for more detail.
(5) Grant reflects $2.5 million A.I.D. grant disbursed in 1981.
(6) Total A.I.D. loan contribution this element = 4,099,000 JD.



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Table 5-15c

Deficit-Surplus Analysis
Irbid Wastewater Project
(18 July 1980)

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WASTEWATER COLLECTION AND TREATMENT    *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1982
INFLATION RATES :LOW MEDIUM HIGH

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

D E F I C I T - S U R P L U S A N A L I S I S (T H O U S A N D S J.D.)

| YEAR | TOTAL REVENUE REQ. FOR NEW FACILITIES | DEBT SERVICE ON CURRENT FACILITIES | O+M ON CURRENT FACILITIES | TOTAL EXPENSES | TOTAL REVENUE | ANNUAL SURPLUS | ACCUMULATED |
|---|---|---|---|---|---|---|---|
| 1980 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1981 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1982 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1983 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1984 | 273 | 0 | 0 | 273 | 486 | 213 | 213 |
| 1985 | 581 | 0 | 0 | 581 | 618 | 37 | 250 |
| 1986 | 798 | 0 | 0 | 798 | 740 | -58 | 192 |
| 1987 | 1117 | 0 | 0 | 1117 | 928 | -189 | 3 |
| 1988 | 1275 | 0 | 0 | 1275 | 1393 | 118 | 121 |
| 1989 | 1465 | 0 | 0 | 1465 | 1977 | 512 | 633 |



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# IRBID WATER SUPPLY
# AND WASTEWATER PROJECT
# COMBINED FINANCIAL ANALYSIS

Table 5-16

Income and Expenditure Statement
Irbid Water Supply and Wastewater Project
(18 July 1980)

| Year Ending December 31 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | JD (Thousands) | | | | | |
| Revenue | | | | | | | | | | |
| Water Supply | 399 | 533 | 591 | 753 | 827 | 918 | 1012 | 1483 | 1641 | 1814 |
| Wastewater | - | - | - | - | 486 | 618 | 740 | 928 | 1393 | 1977 |
| Total | 399 | 533 | 591 | 753 | 1313 | 1536 | 1752 | 2411 | 3034 | 3791 |
| Operating Costs | | | | | | | | | | |
| Water Supply | 301 | 380 | 497 | 640 | 826 | 1016 | 1193 | 1452 | 1738 | 2162 |
| Wastewater | - | - | - | - | 646 | 724 | 822 | 1019 | 1177 | 1367 |
| Total | 301 | 380 | 497 | 640 | 1472 | 1740 | 2015 | 2471 | 2915 | 3528 |
| Surplus Before Interest | 98 | 153 | 94 | 113 | (159) | (204) | (263) | (60) | 119 | 262 |
| Interest | 6 | 5 | 43 | 88 | 406 | 430 | 435 | 431 | 413 | 395 |
| Surplus (Deficit) | 92 | 148 | 51 | 25 | (565) | (634) | (698) | (491) | (294) | (133) |
| Average Net Fixed Assests | | | | | | | | | | |
| Water Supply | N/A | N/A | 908 | 1997 | 3115 | 3767 | 3957 | 4166 | 4397 | 4652 |
| Wastewater | N/A | N/A | N/A | N/A | N/A | 6996 | 6618 | 6240 | 5862 | 5484 |
| Total | N/A | N/A | 908 | 1997 | 3115 | 10763 | 10575 | 10406 | 10259 | 10136 |
| Rate of Return on Average Net Fixed Assets (%) | | | | | | | | | | |
| Water Supply | N/A | N/A | 10.4 | 5.7 | - | N/A | N/A | .7 | N/A | N/A |
| Wastewater | N/A | N/A | N/A | N/A | N/A | - | - | N/A | 3.7 | 11.1 |
| Total | N/A | N/A | 10.4 | 5.7 | N/A | N/A | N/A | N/A | 1.2 | 2.6 |
| Cash Operating Ratio (%) | 75.4 | 69.4 | 76.1 | 71.0 | 70.6 | 75.1 | 80.3 | 76.4 | 74.5 | 75.1 |



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Table 5-17

Balance Sheet
Irbid Water Supply and Wastewater Project
(18 July 1980)

| YEAR ENDING DEC 31 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| | JD (THOUSANDS) | | | | | | | | | |
| ASSETS | | | | | | | | | | |
| CURRENT ASSETS | | | | | | | | | | |
| CASH | 95 | 234 | 367 | 559 | 870 | 927 | 747 | 674 | 661 | 660 |
| ACCOUNTS RECEIVABLE | 59 | 82 | 90 | 113 | 197 | 231 | 263 | 362 | 455 | 570 |
| INVENTORIES | 5 | 8 | 10 | 12 | 19 | 26 | 33 | 45 | 57 | 69 |
| TOTAL CURRENT ASSETS | 159 | 324 | 467 | 684 | 1086 | 1184 | 1043 | 1081 | 1173 | 1299 |
| FIXED ASSETS | | | | | | | | | | |
| WATER SUPPLY | -- | 387 | 1496 | 2717 | 4005 | 4395 | 4824 | 5296 | 5815 | 6386 |
| LESS DEPRECIATION | -- | 10 | 57 | 162 | 329 | 538 | 768 | 1020 | 1297 | 1601 |
| NET WATER SUPPLY | -- | 377 | 1439 | 2555 | 3676 | 3857 | 4056 | 4276 | 4518 | 4785 |
| WASTEWATER | -- | -- | -- | -- | 7563 | 7563 | 7563 | 7563 | 7563 | 7563 |
| LESS DEPRECIATION | -- | -- | -- | -- | 378 | 756 | 1134 | 1512 | 1890 | 2268 |
| NET WASTEWATER | -- | -- | -- | -- | 7185 | 6807 | 6429 | 6051 | 5673 | 5295 |
| WORK-IN-PROGRESS | -- | 691 | 4045 | 5915 | -- | -- | -- | 1475 | 3099 | 4883 |
| TOTAL FIXED ASSETS | -- | 1068 | 5484 | 8470 | 10861 | 10664 | 10485 | 11802 | 13290 | 14963 |
| TOTAL ASSETS | 159 | 1392 | 5951 | 9154 | 11947 | 11848 | 11528 | 12883 | 14463 | 16262 |
| LIABILITIES | | | | | | | | | | |
| CURRENT LIABILITIES | | | | | | | | | | |
| ACCOUNTS PAYABLE | 21 | 27 | 33 | 40 | 65 | 81 | 98 | 128 | 157 | 199 |
| DEPOSITS | -- | 14 | 23 | 28 | 32 | 37 | 42 | 46 | 51 | 57 |
| TOTAL CURRENT LIABILITIES | 21 | 41 | 56 | 68 | 97 | 118 | 140 | 174 | 208 | 256 |
| LONG TERM DEBT | | | | | | | | | | |
| TEMPORARY OPERATING LOANS | -- | -- | -- | -- | -- | -- | -- | 150 | 150 | -- |
| EXISTING LOCAL LOANS | 46 | 33 | 23 | 12 | -- | -- | -- | -- | -- | -- |
| PROPOSED AID LOANS | -- | -- | 2846 | 4904 | 7144 | 7268 | 7195 | 6910 | 6607 | 6286 |
| TOTAL LONG TERM DEBT | 46 | 33 | 2869 | 4916 | 7144 | 7268 | 7195 | 7060 | 6757 | 6286 |
| EQUITY | | | | | | | | | | |
| EQUITY, RETAINED EARNINGS & CAPITAL CONTRIBUTIONS | 92 | 1318 | 3026 | 4170 | 4706 | 4462 | 4193 | 5649 | 7498 | 9720 |
| TOTAL LIABILITIES | 159 | 1392 | 5951 | 9154 | 11947 | 11848 | 11528 | 12883 | 14463 | 16262 |
| DEBT-EQUITY RATIO | 33:67 | 2:98 | 49:51 | 54:46 | 60:40 | 62:38 | 63:37 | 56:44 | 47:53 | 39:61 |



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Table 5-18

Cash Flow Statement
Irbid Water Supply and Wastewater Project
(18 July 1980)

| Year Ending December 31 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Internal Cash Generation | | | | | | | | | | | |
| Net Revenue Before Depreciation and Interest | | | | | | | | | | | |
| Water Supply | 58 | 98 | 163 | 141 | 218 | 168 | 111 | 49 | 283 | 180 | (44) |
| Waste Water | - | - | - | - | - | 218 | 272 | 296 | 287 | 594 | 988 |
| TOTAL | 58 | 98 | 163 | 141 | 218 | 386 | 383 | 345 | 570 | 774 | 944 |
| OPERATING REQUIREMENTS | | | | | | | | | | | |
| Working Capital | - | 43 | 6 | (5) | 13 | 62 | 20 | 17 | 77 | 71 | 79 |
| Debt Service-Interest | | | | | | | | | | | |
| Existing local loans | - | 6 | 5 | 3 | 2 | 1 | - | - | - | - | - |
| Proposed AID Loands | - | - | - | - | - | - | 193 | 312 | 431 | 413 | 395 |
| TOTAL INTEREST | - | 6 | 5 | 3 | 2 | 1 | 193 | 312 | 431 | 413 | 395 |
| DEBT SERVICE REPAYMENT | | | | | | | | | | | |
| Existing Local Loans | - | 12 | 13 | 10 | 11 | 12 | - | - | - | - | - |
| Proposed AID Loans | - | - | - | - | - | - | 113 | 196 | 285 | 303 | 321 |
| TOTAL REPAYMENT | - | 12 | 13 | 10 | 11 | 12 | 113 | 196 | 285 | 303 | 321 |
| TOTAL DEBT SERVICE | - | 18 | 18 | 13 | 13 | 13 | 306 | 508 | 716 | 716 | 716 |
| TOTAL OPERATING REQUIREMENTS | - | 61 | 24 | 8 | 26 | 75 | 326 | 525 | 793 | 787 | 795 |
| Total Available From Operations | 58 | 37 | 139 | 133 | 192 | 311 | 57 | (180) | (223) | 13 | 149 |
| Construction Costs | | | | | | | | | | | |
| Project - Water Supply | - | - | 387 | 1109 | 1221 | 1288 | 390 | 429 | 472 | 519 | 571 |
| Project - Waste Water | - | - | 691 | 3233 | 1679 | 1648 | - | - | 1475 | 1624 | 1784 |
| Interest Capitalized | - | - | - | 121 | 191 | - | - | - | - | - | - |
| Total - Water Supply | - | - | 387 | 1109 | 1221 | 1288 | 390 | 429 | 472 | 519 | 571 |
| Total - Wastewater | - | - | 691 | 3354 | 1870 | 1648 | - | - | 1475 | 1624 | 1784 |
| Total Construction Costs | - | - | 1078 | 4463 | 3091 | 2936 | 390 | 429 | 1947 | 2143 | 2355 |
| Balance to be Financed | | | | | | | | | | | |
| Financed by: | | | | | | | | | | | |
| AID Grants | - | - | 750 | - | - | - | - | - | - | - | - |
| AID Loans | - | - | - | 2806 | 1971 | 1835 | - | - | - | - | - |
| GOJ Capital Contributions (1) | - | - | 328 | 1657 | 1120 | 1101 | 390 | 429 | 1947 | 2143 | 2355 |
| Temp. Operating Loans | - | - | - | - | - | - | - | - | 150 | - | (150) |
| TOTAL FINANCED | - | - | 1078 | 4463 | 3091 | 2936 | 390 | 429 | 2097 | 2143 | 2205 |
| Surplus (Deficit) | 58 | 37 | 139 | 133 | 192 | 311 | 57 | (180) | (73) | (13) | (1) |
| Cash balance at end of year | 58 | 95 | 234 | 367 | 559 | 870 | 927 | 747 | 674 | 661 | 660 |
| Debt Service Coverage | N/A | 5.4 | 9.1 | 10.8 | 16.8 | 29.7 | 1.3 | .7 | .8 | 1.1 | 1.3 |

# ECONOMIC ANALYSIS

Table 5-19

Cost of Wholesale Water
(18 July 1980)

| YEAR | REQUIRED WATER BOUGHT McM/a | COST* 1979 JD 000 | O & M 1979 JD | RECONNECT REFUGEES | TOTAL |
|---|---|---|---|---|---|
| 1980 | 2.24 | 145 | 75 | 3 | 223 |
| 1981 | 2.65 | 172 | 77 | 3 | 252 |
| 1982 | 3.03 | 197 | 78 | 3 | 278 |
| 1983 | 3.32 | 216 | 80 | | 296 |
| 1984 | 3.72 | 242 | 82 | | 324 |
| 1985 | 4.07 | 264 | 86 | | 350 |
| 1986 | 4.23 | 275 | 88 | | 363 |
| 1987 | 4.65 | 302 | 91 | | 393 |
| 1988 | 5.11 | 323 | 93 | | 416 |
| 1989 | 5.61 | 364 | 96 | | 460 |

* 65 fils per $m^3$.



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Table 5-20
(Formerly Table 9-22)

Summary of Residential Average Annual User Charges and Fees For Proposed Water Supply and Wastewater Municipal Services -- 1980-1989 (18 July 1980)

(In Current JD)

| | WATER SUPPLY | | WASTEWATER | | |
|---|---|---|---|---|---|
| YEAR | ADMINISTRATIVE[1] CONNECTION FEE | ANNUAL USER[2] CHARGE | ADMINISTRATIVE[1] CONNECTION FEE | ANNUAL USER[2] CHARGE | TOTAL ANNUAL[3] USER CHARGE |
| 1980 | 0 | 20.4 | 0 | 0 | 20.4 |
| 1381 | 19 | 20.4 | 0 | 0 | 20.4 |
| 1982 | 19 | 20.4 | 0 | 0 | 20.4 |
| 1983 | 19 | 24.0 | 0 | 0 | 24.0 |
| 1984 | 19 | 24.0 | 32 | 37.2 | 61.2 |
| 1985 | 19 | 24.0 | 32 | 37.2 | 61.2 |
| 1986 | 19 | 24.0 | 32 | 37.2 | 61.2 |
| 1987 | 19 | 32.4 | 32 | 37.2 | 69.6 |
| 1988 | 19 | 32.4 | 32 | 37.2 | 69.6 |
| 1989 | 19 | 32.4 | 32 | 37.2 | 69.6 |

1 One time administrative fee, reconnection of existing water supply users is included in capital costs.

2 Annual user charges based on monthly user charges obtained in computer analysis. In the case of the water supply system includes wholesale price of water.

3 Equals water supply user charge plus sewer system user charge.



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Table 5-21
(Formerly Table 9-25)

Existing Conditions
Current Ability to Pay Analysis
(18 July 1980)

| Water Use Consumption Group (cu m/month) | (1) Average Household Water Use (cu m/month) | (2) Unit Cost of Water (JD/cu m) | (3) Number of Households | (4) Average Water Use[1] Per Household (cu m/year) | (5) Average Household Income (JD/year) | (6) Average Water Cost[2] Per Household (JD/year) | (7) Ability to Pay[3] (%) | (8) Annual Revenue By Group (JD) | (9) Total Water Sold (cu m/year) |
|---|---|---|---|---|---|---|---|---|---|
| 0 to 5 | 3.4 | 0.080 | 3,820 | 40.80 | 1,150 | 3.260 | 0.28 | 10,725 | 134,232 |
| 5 to 15 | 9.7 | 0.120 | 5,277 | 77.60 | 1,452 | 6.910 | 0.48 | 36,464 | 409,495 |
| 15 to 25 | 18.6 | 0.220 | 1,759 | 232.20 | 1,275 | 28.700 | 2.25 | 50,483 | 392,609 |
| More than 25 | 28.2 | 0.300 | 1,096 | 338.40 | 1,870 | 57.100 | 3.05 | 62,582 | 370,806 |
| Totals | | | 11,952[4] | | | | 0.98[5] | 160,254[6] | 1,307,222[6] |

1. Equals (1) x 12 months

2. Equals (4) x (2)

3. Ability to pay is the percent of annual income required for purchase of water. Ability to pay equals average water cost divided by average household income.

4. Based on Survey/Document 14,500 total meters in 1979 adjusted to exclude non-residential use.

5. Total ability to pay equals total annual revenue (column 8) divided by total income of all households.

6. This table contains information from the socioeconomic survey conducted in the summer of 1979. It also uses the existing water rate structure to determine the annual revenue by water consumption group and water sold (each group). As a test, the totals compare favorably with reported values in subsection 9.3.2 of Chapter 9.



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Table 5-22
(Formerly Table 9-32)

Water Charges Per Cubic Meter By Income Group -- 1985 (18 July 1980)

(1985 JD)

| (1) Water Use Consumption Group (cu m/month) | (2) Average Household Income (JD/Year)[1] | (3) Number of Households[3] | (4) Revenue by Consumption Group (JD/Year) | (5) Total Yearly Water Use (cu m) | (6) Average Household Water Use (cu m/year) | (7) Water Charge Unit Cost (fils/cu m)[10] |
|---|---|---|---|---|---|---|
| 0 to 15 | 2,367 | 15924 | 151,000[4] | 1,392,000[8] | 87[8] | 109 |
| 16 to 25 | 2,259 | 3250 | 184,000[5] | 853,000[9] | 262[9] | 216 |
| More than 25 | 3,313 | 2026 | 386,000[6] | 805,000[9] | 397[9] | 479 |
| TOTAL | 51,700,000[2] | 21200 | 721,000[7] | 3,050,000 | | |

1. Average annual income from Table 5-21, weighted by number of users for the 0 to 15 water use group and inflated 10 percent per year. Variation in income by group is explained in
2. Equals total of (2)x(3) for each consumption group.
3. From cashflow analysis distributed based on distribution in table "Existing Conditions Ability to Pay."
4. Based on 1979 weighted average ability to pay - 0.40% x (2) (3).
5. Based on 1979 ability to pay - - 2.25% x (2) (3).
6. Determined by difference in ability to pay - - 5.75%
7. From Table 5-9, required total revenue by consumption group based on water consumption revenue for residential users, inclusive of wholesale water cost based on inflated current wholesale cost 65 f/s/$m^3$ at 15% included as an O&M cost.
8. Based on a weighted average of 62 cu m/year per household in 1979 accelerated by 6%, multiplied by number of households.
9. Ratio of 16 to 25 cu m/mo consumption group total yearly use to more than 25 total yearly use was maintained as in 1979. The total for these 2 groups is the total sold in 1985, 3.05 $Mm^3$, less 0 to 15 group use.
10. Calculated (4) divided by (3)x(6).

Table 5-23
(Formerly Table 9-33)

Monthly User Charge (1985) Water and Wastewater By Water Use Consumption Group (18 July 1980)

(See notes to follow)

| Water Use Consumption Group (cu m/month) | Water Charge | | Wastewater Charge | | | | Total Average Unit Charge (JD/cu m) | Combined Monthly Water and Wastewater Average Charge Charge (JD) |
|---|---|---|---|---|---|---|---|---|
| | Average Charge (JD/cu m) | Rate Schedule[1] JD/cu m | Monthly Charge[2] (JD) | Unit Charge (JD/cu m) | Rate Schedule[1] JD/cu m | Monthly Charge[2] (JD) | | |
| 0 to 15 | .109 | .109 | .784 | .219 | .214 | 1.27 | .328 | 2.054 |
| 16 to 25 | .216 | .452 | 4.709 | .432 | 1.760 | 7.510 | .648 | 12.219 |
| More than 25 | .479 | 1.859 | 15.850 | .962 | 3.220 | 23.390 | 1.441 | 39.240 |

Notes:

1 Rate Schedule is the per cubic meter charge showing differential unit charge for each consumption group. See notes for comparison of rate schedule and average unit charge.

2 Equals average charge multiplied by average use.



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Table 5-23
(continued)

## NOTES

### CALCULATION OF WASTEWATER USER CHARGE

| GROUP | 1985 WATER USE | 1985 SEWER USE (80%) |
|---|---|---|
| 0-15 | 87 $m^3$/yr | 70 $m^3$/yr |
| 16-25 | 262 $m^3$/yr | 209 $m^3$/yr |
| 26+ | 397 $m^3$/yr | 317 $m^3$/yr |

### AVERAGE SEWER USE

$$= \frac{(80\%) \times (\text{total water use})}{(\text{total number households})}$$

$$= \frac{(.8)\ (3{,}050{,}000)}{21200} = 115\ m^3/yr$$

### AVERAGE UNIT COST

$$= \frac{\text{Average cost per household}}{\text{Average sewer volume per household}}$$

Average cost per household = monthly user charge x 12

= 3.10 $JD^6$ x 12 (See **Table** 5-22.)

= 37.2 JD/yr.

$$\text{Average Unit Cost} = \frac{37.2\ JD/yr/household}{115\ m^3/yr/household} = .323\ JD/m^3$$

### Calculation of weighted average unit charge for water

| | | | | | |
|---|---|---|---|---|---|
| 0-15 | (15924) | x | (.109) | = | 1735 |
| 16-25 | ( 3250) | x | (.216) | = | 702 |
| 26+ | ( 2026) | x | (.479) | = | 970 |
| | 21200 | | | | 3407 |

$$\frac{3407}{21200} = .161\ JD/m^3$$

### Weight Distribution Factor (Dimensionless)

| | | |
|---|---|---|
| 0-15 | .109/.161 | = .68 |
| 16-25 | .216/.161 | = 1.34 |
| 26+ | .254/.161 | = 2.98 |

Table 5-23
(continued)

NOTES

Weighted Average Unit Wastewater Cost

| Group | Factor | Average Cost | Average Wastewater Rate |
|---|---|---|---|
| 0-15 | .68 | .323 JD/$m^3$ | .219 JD/$m^3$ |
| 16-25 | 1.34 | .323 JD/$m^3$ | .432 JD/$m^3$ |
| 26+ | 2.98 | .323 JD/$m^3$ | .962 JD/$m^3$ |

Calculation of Wastewater Charge (Rate Schedule)

| GROUP | YEARLY WASTEWATER USE | MONTHLY AVERAGE USE | RATE SCHEDULE FOR CONSUMPTION RANGE* |
|---|---|---|---|
| 0-15 | 70 cu m/yr | 5.8 cu m/mo | .219 JD/cu m |
| 16-25 | 209 cu m/yr | 17.4 cu m/mo | 1.760 JD/cu m |
| 26+ | 317 cu m/yr | 26.4 cu m/mo | 3.220 JD/cu m |

* N.B. Average rate = Rate schedule for users in 0-15 cu m/mo range.
To check for other two groups:

i.e. 16-25 group

- 1st 15 cu m @ .219 JD/cu m = 3.285 JD
- 16-17.4 cu m = 2.4 cu m @ 1,760 = 4.22 JD
- Total 7.517 JD ÷ 17.4 cu m consumed = .432 JD/cu m, the average rate.

26+ Group

- 1st 15 cu m @ .219 = 3.285 JD
- 16-25 @ 1.760 = 17.600 JD
- 26-26.4 @ 3.220 = 4.512 JD
- Total = 25.397 ÷ 26.4 cu m = .962 JD.

CALCULATION OF WATER SUPPLY CHARGE (RATE SCHEDULE)

| GROUP | YEARLY WATER SUPPLY USE | MONTHLY AVERAGE USE | RATE SCHEDULE FOR CONSUMPTION RANGE* |
|---|---|---|---|
| 0-15 | 87 cu m/yr | 7.2 cu m/mo | .109 JD/cu m |
| 16-25 | 262 cu m/yr | 21.8 cu m/mo | .452 JD/cu m |
| 26+ | 397 cu m/yr | 33.1 cu m/mo | 1.859 JD/cu m |

*N.B. Average Rate = Rate schedule for users in 0-15 cu m/mo range.

Table 5-23
(continued)

NOTES

TO CHECK FOR OTHER TWO GROUPS:

i.e. 16-25 Group

- 1st 15 cu m @ .109 JD/cu m = 1.635 JD
- 15-21.8 = 6.8 cu m @ .452 JD/cu m = 3.073 JD
- Total = 4.708 JD ÷ 21.8 cu m = .216 JD/cu m which is the average rate.

26+ Group

- 1st 15 cu m @ .109 JD/cu m = 1.635 JD
- 15-25 = 10 cu m @ .452 JD/cu m = 4.520 JD
- 26-33.1 = 8.1 cu m @ 1.198 JD/cu m = 9.704 JD

Total = 15.859 JD ÷ 33.1 cu m = .479 JD/cu m which is the average rate.

Table 5-24
(Formerly Table 9-34)

Ability to Pay Annual User Charges for Municipal Services Based on Projected 1985 Costs and Income
(18 July 1980)

(1985 JD)

| Water Use Consumption Group (cu m/month) | Average Household Income (JD/year) | Water Supply[1] Monthly User Charge (JD) | Water Supply[1] Percent[2] Income | Wastewater Monthly User Charge (JD) | Wastewater Percent Income | Combined Charge[1] Monthly User Charge[2] (JD) | Combined Charge[1] Percent[2] Income |
|---|---|---|---|---|---|---|---|
| 0 to 15 | 2,367 | .78 | 0.39 | 1.27 | 0.64 | 2.05 | 1.04 |
| 16 to 25 | 2,259 | 4.71 | 2.50 | 7.51 | 3.99 | 12.22 | 6.49 |
| More than 25 | 3,313 | 15.85 | 5.74 | 23.390 | 8.47 | 39.24 | 14.21 |

[1]Charge includes the wholesale price of water.

[2]Based on yearly user charge.



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INITIAL SUBMISSION TO
AID--2 JULY 1980

WESTON INTERNATIONAL, INC.

DESIGNERS-CONSULTANTS

WESTON WAY • WEST CHESTER PA 19380 • PHONE (215) 692-3030 • TELEX 83-5348 • FROM OFFICE OF THE PRESIDENT, JAMES P. MILLER, P.E.

July 2, 1980

Mr. Robert F. Fedel, P.E.
Chief, Syria, Jordan, Israel Div.
Bureau for Near East
Office of Capital Development
Agency for International Development
Department of State
Washington, D.C. 20520

RE: Irbid, Jordan Project: Financial and Economic Analysis

Dear Mr. Fedel,

Weston International, Inc. is pleased to submit the additional analysis of the Irbid, Jordan Project which you requested. Attached are economic and financial statements and tables that describe a limited water and wastewater project for the Irbid Municipality. Based on the analysis this project appears to be viable for the ten year period studied.

Financial statements, including balance sheets, cash flow statements, and income and expenditure statements, were prepared separately for the proposed water project and the wastewater system, and then as a combined water and wastewater project. Supporting these financial statements are two computer analyses, one each for the proposed water and wastewater systems, a bar chart showing the phasing of the capital investment, and five (5) tables which interpret the average user charges, calculate unit rates and assess the ability-to-pay of the Irbid customers in 1985. These five tables include:

- Summary Household Average Annual User Charges and Fees for Proposed Municipal Services (1980-1989)
- Water Charges Per Cubic Meter by Income Group 1985
- Existing Conditions Currant Ability to Pay Analysis
- Monthly User Charges (1985) Water and Wastewater by Water Use Consumption Group
- Ability to Pay Annual User Charges for Municipal Services Based on Projected 1985 Costs and Income

Each table has been enhanced with notes and documentation to assist the reader in understanding the assumptions, methods and sources of information used. In addition, the following discussion will further assist the reader.

The basis for this analysis includes the following assumptions:

1. Revision to population and project customers based on recent census data.
2. Project size and capital costs revised as instructed by J. Cassanos
3. Constrained water sales based on 3.06Mm$^3$ of water sold in 1985. Ultimate water availability is 5.5 Mm$^3$ in 1989.
4. Extended project construction period from 1981 to 1984.
5. Growth in wastewater user connections based on hook-up rate of approximately 3500 per year.
6. Wholesale cost of water is included in the annual operation and maintenance cost based on current policy (65h/s/m$^3$) and escalated at 15 percent per annum.
7. A.I.D. grant ($2.5M) and loan ($21.5M) to be disbursed during the construction phase by 1984. Additional capital costs to be financed during later years by government of Jordan Equity according to the following table. Capital costs and grants are presented as constant 1979-80 values.

APPLICATION OF CAPITAL CONTRIBUTIONS

| | WATER SUPPLY | | | | WASTEWATER | | | |
|---|---|---|---|---|---|---|---|---|
| | REQUIRED | AID GRANT | AID LOANS | GOJ EQUITY | REQUIRED | AID GRANT | AID LOANS | GOJ EQUITY |
| 1980 | - | - | - | - | - | - | - | - |
| 1981 | 394 | 263 | 131 | | 692 | 487 | 205 | |
| 1982 | 1118 | | 1118 | | 3233 | | 3233 | |
| 1983 | 1230 | | 1008 | 222 | 1679 | | 755 | 924 |
| 1984 | 1288 | | | 1288 | 1648 | | | 1648 |
| 1985 | 390 | | | 390 | - | | | - |
| 1986 | 429 | | | 429 | - | | | - |
| 1987 | 472 | | | 472 | 1475 | | | 1475 |
| 1988 | 519 | | | 519 | 1624 | | | 1624 |
| 1989 | 571 | | | 571 | 1784 | | | 1784 |
| | 6411 | 263 | 2257 | 3891 | 12135 | 487 | 4193 | 7455 |

8. Reconnection costs for existing water system customers are 6.5 JD per hookup and are refinanced as capital costs during 1981, 1982, and 1983, thus eliminating an unpopular 19JD initial charge for these customers.



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Numerous other assumptions underlie this economic and financial assessment. Generally, they have either been previously presented in preliminary economic and financial evaluations, or are expressed in the Table demonstration.

The many changes in assumptions have had the effect of generally increasing unit costs because the number of customers and quantity of sold water have decreased and the whole sale water cost is now included. These increases have been to some extent reduced by the reduced size of the project and lower capital cost.

Because of these many changes, it is difficult to make comparison with the previous analysis of the water and wastewater project. However, this analysis indicates the project is viable from a financial and economic perspective and within the tolerances that might be expected for ability to pay.

We trust this information will serve your purposes.

Very truly yours,

WESTON INTERNATIONAL, INC.

James P. Miller, P.E.
President



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Table 5-25

Income and Expenditure Statement
Irbid Water Supply Project
(2 July 1980)

| Year Ending December 31 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | JD (thousands) | | | | | |
| **Revenue** | | | | | | | | | | |
| Resident | 137 | 152 | 170 | 191 | 211 | 251 | 280 | 398 | 441 | 489 |
| Non-Resident | 38 | 43 | 47 | 51 | 59 | 63 | 70 | 100 | 111 | 121 |
| Adminstrative Connection Fees | - | 14 | 13 | 14 | 15 | 32 | 18 | 15 | 16 | 16 |
| Wholesale Water | 176 | 198 | 220 | 242 | 387 | 452 | 504 | 1000 | 1108 | 1222 |
| Total | 351 | 407 | 450 | 498 | 672 | 798 | 872 | 1513 | 1676 | 1848 |
| **Operating Costs** | | | | | | | | | | |
| Salaries and Wages | 125 | 130 | 136 | 146 | 160 | 182 | 215 | 256 | 301 | 357 |
| Operating and Maintenances | 7 | 10 | 11 | 12 | 12 | 14 | 17 | 20 | 24 | 28 |
| Wholesale Cost of Water | 132 | 171 | 219 | 282 | 364 | 469 | 601 | 774 | 995 | 1282 |
| Depreciation | - | - | 20 | 60 | 149 | 220 | 243 | 264 | 288 | 314 |
| Total | 264 | 311 | 386 | 520 | 685 | 885 | 1076 | 1314 | 1608 | 1981 |
| Surplus Before Interest | 87 | 96 | 64 | (22) | (13) | (87) | (204) | 199 | 68 | (133) |
| Interest | - | - | - | - | 9 | 89 | 158 | 152 | 146 | 139 |
| Surplus (Deficit) | 87 | 96 | 64 | (22) | (22) | (176) | (362) | 47 | (78) | (272) |
| Average Net Fixed Assets | N/A | N/A | 989 | 2220 | 3504 | 4262 | 4474 | 4671 | 4891 | 5135 |
| Rate of Return on Average Net Fixed Assets (%) | N/A | N/A | 6.5 | - | - | - | - | 4.3 | 1.4 | - |
| Cash Operating Ratio (%) | 75.2 | 76.4 | 81.3 | 88.4 | 79.8 | 83.3 | 95.5 | 69.4 | 78.8 | 90.2 |



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Table 5-26

Balance Sheet
Irbid Water Supply Project
(2 July 1980)

| Year Ending December 31 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | JD (thousands) | | | | | | |
| **Assets** | | | | | | | | | | |
| Current Assets | | | | | | | | | | |
| Cash | 99 | 176 | 247 | 294 | 386 | 375 | 162 | 290 | 387 | 312 |
| Accounts Receivable | 52 | 61 | 68 | 75 | 101 | 121 | 131 | 227 | 252 | 278 |
| Inventories | 4 | 5 | 6 | 7 | 9 | 11 | 13 | 15 | 17 | 20 |
| Total Current Assets | 155 | 242 | 321 | 376 | 496 | 507 | 306 | 532 | 656 | 610 |
| Fixed Assets | | | | | | | | | | |
| Water Supply | - | 402 | 1595 | 2965 | 4392 | 4850 | 5279 | 5751 | 6270 | 6841 |
| Less Depreciation | - | - | 20 | 100 | 249 | 469 | 712 | 976 | 1264 | 1578 |
| Net Water Supply | - | 402 | 1575 | 2865 | 4143 | 4381 | 4567 | 4775 | 5006 | 5263 |
| Total Fixed Assets | - | 402 | 1575 | 2865 | 4143 | 4381 | 4567 | 4775 | 5006 | 5263 |
| Total Assets | 155 | 644 | 1896 | 3241 | 4639 | 4888 | 4873 | 5307 | 5662 | 5873 |
| **Liabilities** | | | | | | | | | | |
| Current Liabilities | | | | | | | | | | |
| Accounts Payable | 11 | 15 | 19 | 24 | 31 | 40 | 51 | 66 | 85 | 109 |
| Deposits | - | 5 | 9 | 14 | 19 | 30 | 36 | 41 | 47 | 53 |
| Total Current Liabilities | 11 | 20 | 28 | 38 | 50 | 70 | 87 | 107 | 132 | 162 |
| Long-Term Debt | | | | | | | | | | |
| Existing Local Loans | 57 | 39 | 26 | 13 | - | - | - | - | - | - |
| Proposed Aid Loans | - | 139 | 1332 | 2480 | 2613 | 2628 | 2529 | 2424 | 2313 | 2195 |
| Total Long-Term Debt | 57 | 178 | 1358 | 2493 | 2613 | 2628 | 2529 | 2424 | 2313 | 2195 |



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Table 5-26
(continued)

Balance Sheet

| | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| Equity | | | | | | | | | | |
| Equity, Retained Earnings, And Capital Contributions | 87 | 446 | 510 | 710 | 1976 | 2190 | 2257 | 2776 | 3217 | 3516 |
| Total Liabilities | 155 | 644 | 1896 | 3241 | 4639 | 4888 | 4873 | 5307 | 5662 | 5873 |
| Debt-Equity Ratio | 40:60 | 29:71 | 73:27 | 78:22 | 57:43 | 55:45 | 53:47 | 47:53 | 42:58 | 38:62 |



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Table 5-27

Cash Flow Statement
Irbid Water Supply Project
(2 July 1980)

| Year Ending December 31 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | JD (thousands) | | | | | |
| **Internal Cash Generation** | | | | | | | | | | | |
| Net Revenue Before Depreciation and Interest | | | | | | | | | | | |
| Water Supply | 75 | 87 | 96 | 84 | 58 | 136 | 133 | 39 | 463 | 356 | 181 |
| **Operating Requirements** | | | | | | | | | | | |
| Working Capital | - | 45 | 1 | - | (2) | 16 | 2 | (5) | 78 | 2 | (1) |
| Debit Service-Interest | | | | | | | | | | | |
| Proposed Aid Loans | - | - | - | - | - | 9 | 89 | 158 | 152 | 146 | 139 |
| Debit Service-Repayment | | | | | | | | | | | |
| Existing Local Loans | - | 18 | 18 | 13 | 13 | 13 | - | - | - | - | - |
| Proposed Aid Loans | - | - | - | - | - | 6 | 53 | 99 | 105 | 111 | 118 |
| Total Repayment | - | 18 | 18 | 13 | 13 | 19 | 53 | 99 | 105 | 111 | 118 |
| Total Debt Service | - | 18 | 18 | 13 | 13 | 28 | 142 | 257 | 257 | 257 | 257 |
| Total Operating Requirements | - | 63 | 19 | 13 | 11 | 44 | 144 | 252 | 335 | 259 | 256 |
| Total Available from Operations | 75 | 24 | 77 | 71 | 47 | 92 | (11) | (213) | 128 | 97 | (75) |
| **Construction Costs** | | | | | | | | | | | |
| Project-Water Supply | - | - | 394 | 1118 | 1230 | 1288 | 390 | 429 | 472 | 519 | 571 |
| Interest Capitalized | - | - | 8 | 75 | 140 | 139 | 68 | - | - | - | - |
| Total Construction Costs-Water Supply | - | - | 402 | 1193 | 1370 | 1427 | 458 | 429 | 472 | 519 | 571 |



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Table 5-27
(continued)

Cash Flow Statement

| Year Ending December 31 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | JD (thousands) | | | | | |
| Balance To Be Financed | | | | | | | | | | | |
| Financed By: | | | | | | | | | | | |
| Aid Grants | - | - | 263 | - | - | - | - | - | - | - | - |
| Aid Loans | - | - | 131 | 1118 | 1008 | - | - | - | - | - | - |
| GOJ Capital Contributions (1) | - | - | 8 | 75 | 362 | 1427 | 458 | 429 | 472 | 519 | 571 |
| Total Financed | - | - | 402 | 1193 | 1370 | 1427 | 458 | 429 | 472 | 519 | 571 |
| Surplus (Deficit) | 75 | 24 | 77 | 71 | 47 | 92 | (11) | (213) | 128 | 97 | (75) |
| Cash Balance at End of Year | 75 | 99 | 176 | 247 | 294 | 386 | 375 | 162 | 290 | 387 | 312 |
| Debt Service Coverage | N/A | 4.8 | 5.3 | 6.5 | 4.5 | 4.9 | .9 | .2 | 1.8 | 1.4 | .7 |

Table 5-28a

Anticipated Revenues
Irbid Water Supply Project
(2 July 1980)

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WATER SUPPLY                           *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1982
INFLATION RATES :LOW MEDIUM HIGH

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D R E V E N U E S (T H O U S A N D S O F J.D)

| YEAR | NUMBER OF CUSTOMERS RESIDENT | NUMBER OF CUSTOMERS NONRESD | USER CHARGES J.D. / MONTH RESIDENT | USER CHARGES J.D. / MONTH NONRESD | REVENUE FROM CUSTOMERS RESIDENT | REVENUE FROM CUSTOMERS NONRESD | ADMINISTR. CONNECTION FEE (LD) | REVENUE FROM NEW CUSTOMERS | RATE OF HOUSEHOLD WATER USE INCREASE | TOTAL ANNUAL REVENUE |
|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 15500 | 2800 | 1.40 | 2.16 | 260 | 72 | 0 | 0 | 1.060 | 351 |
| 1981 | 16300 | 3000 | 1.40 | 2.16 | 273 | 77 | 19 | 19 | 1.060 | 412 |
| 1982 | 17100 | 3100 | 1.40 | 2.16 | 287 | 80 | 19 | 17 | 1.060 | 454 |
| 1983 | 18000 | 3200 | 1.40 | 2.16 | 302 | 82 | 19 | 19 | 1.060 | 503 |
| 1984 | 18900 | 3400 | 1.70 | 2.62 | 385 | 106 | 19 | 20 | 1.060 | 677 |
| 1985 | 21100 | 3500 | 1.70 | 2.62 | 430 | 110 | 19 | 43 | 1.060 | 809 |
| 1986 | 22200 | 3700 | 1.70 | 2.62 | 452 | 116 | 19 | 24 | 1.060 | 878 |
| 1987 | 23200 | 3800 | 2.70 | 4.16 | 751 | 189 | 19 | 20 | 1.060 | 1518 |
| 1988 | 24200 | 4000 | 2.70 | 4.16 | 784 | 199 | 19 | 22 | 1.060 | 1682 |
| 1989 | 25300 | 4100 | 2.70 | 4.16 | 819 | 204 | 19 | 22 | 1.060 | 1854 |

NOTES:

(1) NUMBER OF CUSTOMERS : CALCULATED AS EQUIVALENT DEVELOPMENT UNITS BASED ON 92 PERCENT OF TOTAL POPULATION IN 1980 AND 97 PERCENT OF POPULATION IN 1990.
(2) EQUIVALENT NONRESIDENT USER CHARGE IS 1.54 OF RESIDENT CHARGE.
(3) RATE OF HOUSEHOLD WATER USE INCREASE, ASED ON PROJECTED PER CAPITA WATER CONSUMPTION AND DECREASING HOUSEHOLD SIZE.
(4) ADMINISTRATIVE CONNECTION FEE DOES NOT INCLUDE THE COST OF THE METER WHICH IS PASSED THROUGH
(5) ULTIMATE (1989) WATER AVAILABILITY IS 5.5 $Mm^3$.
(6) O&M COST INCLUDES COST OF WHOLESALE WATER BASED ON 1979 UNINFLATED VALUE OF .065 JD.
(7) CONNECTIONS OF EXISTING CUSTOMERS BASED ON 6.5JD PER HOOKUP REFINANCED AS CAPITAL COST DURING 1981, 1982, 1983.
(8) GRANT STRUCTURE REFLECTS $2.5 MILLION AID GRANT DISBURSED IN 1981 and $21.5 MILLION AID LOAN TO BE DISBURSED DURING CONSTRUCTION: THE BALANCE OF CAPITAL COSTS IS FINANCED BY GOVERNMENT OF JORDAN EQUITY.



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Table 5-28b

# Anticipated Expenses
# Irbid Water Supply Project
# (2 July 1980)

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WATER SUPPLY                           *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1982
INFLATION RATES :LOW MEDIUM HIGH
---

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D E X P E N S E S ( T H O U S A N D S O F J.D)

| YEAR | REVENUE REQUIRED FOR NEW FACILITIES TOTAL CAPITAL COST(1979 JD) | GRANT | NET CAPITAL COST | NET CAPITAL COST INFLATED (10.00PC) | GRACE PERIOD INTEREST ACCUMULATION | LOCAL DEBT ANNUAL PAY. ( 6.00PC*20YR) | O+M IN 1979 (J.D) | O+M INFLATED (15.00PC) | TOTAL EXPENSE OF NEW FACILITIES |
|---|---|---|---|---|---|---|---|---|---|
| 1980 | 0 | 0 | 0 | 0 | 0 | 0 | 190 | 218 | 218 |
| 1981 | 326 | 217 | 109 | 131 | 8 | 0 | 206 | 272 | 272 |
| 1982 | 840 | 0 | 840 | 1118 | 75 | 0 | 222 | 337 | 337 |
| 1983 | 840 | 152 | 688 | 1007 | 140 | 0 | 241 | 421 | 421 |
| 1984 | 800 | 800 | 0 | 0 | 139 | 15 | 263 | 528 | 543 |
| 1985 | 220 | 220 | 0 | 0 | 69 | 142 | 288 | 666 | 808 |
| 1986 | 220 | 220 | 0 | 0 | 0 | 256 | 314 | 835 | 1091 |
| 1987 | 220 | 220 | 0 | 0 | 0 | 256 | 344 | 1052 | 1308 |
| 1988 | 220 | 220 | 0 | 0 | 0 | 256 | 376 | 1322 | 1578 |
| 1989 | 220 | 220 | 0 | 0 | 0 | 256 | 413 | 1670 | 1926 |

NOTES:
---
(1) CAPITAL COST FOR 1980 INCLUDES 7000 JD FOR TAPPING EQUIPMENT .
(2) NO GRANTS AT THIS TIME.
(3) GRACE PERIOD APPLIES ONLY TO MAJOR INITIAL INVESTMENTS,
FOR EXAMPLE NOT APPLICABLE TO 1985 THRU 1989 CAPITAL COSTS.



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Table 5-28c

Deficit-Surplus Analysis
Irbid Water Supply Project
(2 July 1980)

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WATER SUPPLY                           *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1982
INFLATION RATES :LOW MEDIUM HIGH
---

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

D E F I C I T - S U R P L U S A N A L I S I S (T H O U S A N D S J.D.)

| YEAR | TOTAL REVENUE REC. FOR NEW FACILITIES | DEBT SERVICE ON CURRENT FACILITIES | O+M ON CURRENT FACILITIES | TOTAL EXPENSES | TOTAL REVENUE | ANNUAL SURPLUS | ACCUMULATED |
|---|---|---|---|---|---|---|---|
| 1980 | 218 | 18 | 50 | 286 | 351 | 65 | 65 |
| 1981 | 272 | 18 | 40 | 330 | 412 | 82 | 147 |
| 1982 | 337 | 13 | 30 | 380 | 454 | 74 | 221 |
| 1983 | 421 | 13 | 20 | 454 | 503 | 49 | 270 |
| 1984 | 543 | 13 | 10 | 566 | 677 | 111 | 381 |
| 1985 | 808 | 0 | 0 | 808 | 809 | 1 | 382 |
| 1986 | 1391 | 0 | 0 | 1391 | 878 | -213 | 169 |
| 1987 | 1308 | 0 | 0 | 1308 | 1518 | 210 | 379 |
| 1988 | 1578 | 0 | 0 | 1578 | 1682 | 104 | 483 |
| 1989 | 1926 | 0 | 0 | 1926 | 1854 | -72 | 411 |

NOTES:
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(1) O+M ON CURRENT FACILITIES DOES NOT INCLUDE SALARIES OF PERSONEL,
THESE ARE PROJECTED FROM 1977, 78 , AND 79 MAINTANANCE COST ON EXISTING FACILITIES.



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Table 5-29

Income and Expenditure Statement
Irbid Wastewater Project
(2 July 1980)

| YEAR ENDING DECEMBER 31 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | JD (THOUSANDS) | | | | | | |
| REVENUE | | | | | | | | | | |
| RESIDENT | - | - | - | 35 | 57 | 326 | 483 | 655 | 812 | 993 |
| NON-RESIDENT | - | - | - | 9 | 15 | 83 | 109 | 140 | 174 | 217 |
| ADMINISTRATIVE CONNECTION FEES | - | - | 112 | 112 | 115 | 108 | 112 | 144 | 112 | 124 |
| SEPTAGE DUMPINGS | - | - | - | 152 | 166 | 180 | 195 | 216 | 223 | 238 |
| TOTAL | - | - | 112 | 308 | 353 | 697 | 899 | 1155 | 1321 | 1572 |
| OPERATING COSTS | | | | | | | | | | |
| SALARIES AND WAGES | - | - | - | 175 | 201 | 231 | 266 | 306 | 352 | 405 |
| OPERATING AND MAINTENANCE | - | - | - | 24 | 69 | 116 | 178 | 335 | 449 | 584 |
| DEPRECIATION | - | - | - | - | - | 400 | 403 | 403 | 403 | 403 |
| TOTAL | - | - | - | 199 | 270 | 747 | 847 | 1044 | 1204 | 1392 |
| SURPLUS BEFORE INTEREST | - | - | 112 | 109 | 83 | (50) | 52 | 111 | 117 | 180 |
| INTEREST | - | - | - | - | 14 | 245 | 290 | 279 | 267 | 255 |
| SURPLUS DEFICIT | - | - | 112 | 109 | 69 | (295) | (238) | (168) | (150) | (75) |
| AVERAGE NET FIXED ASSETS | N/A | N/A | N/A | N/A | N/A | N/A | 7452 | 7049 | 6646 | 6243 |
| RATE OF RETURN ON AVERAGE NET FIXED ASSETS | N/A | N/A | N/A | N/A | N/A | N/A | .7 | 1.6 | 1.8 | 2.9 |
| CASH OPERATING REQUIREMENTS % | N/A | N/A | N/A | 64.6 | 76.5 | 49.8 | 49.4 | 55.5 | 60.6 | 62.4 |

Table 5-30

Balance Sheet
Irbid Wastewater Project
(2 July 1980)

| YEAR ENDING DECEMBER 31 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| ASSETS | | | | | | | | | | |
| CURRENT ASSETS | | | | | | | | | | |
| CASH | - | - | 95 | 168 | 221 | 128 | 77 | 79 | 97 | 169 |
| ACCOUNTS RECEIVABLE | - | - | 17 | 46 | 53 | 105 | 134 | 173 | 199 | 235 |
| INVENTORIES | - | - | - | 10 | 13 | 17 | 22 | 32 | 40 | 50 |
| TOTAL CURRENT ASSETS | - | - | 112 | 224 | 287 | 250 | 233 | 284 | 336 | 454 |
| FIXED ASSETS | | | | | | | | | | |
| WASTEWATER | - | - | - | - | - | 8053 | 8053 | 8053 | 8053 | 8053 |
| LESS DEPRECIATION | - | - | - | - | - | 400 | 803 | 1206 | 1609 | 2012 |
| NET WASTEWATER | - | - | - | - | - | 7653 | 7250 | 6847 | 6444 | 6041 |
| WORK-IN-PROGRESS | - | 704 | 4144 | 6088 | 8002 | - | - | 1475 | 3099 | 4883 |
| TOTAL FIXED ASSETS | - | 704 | 4144 | 6088 | 8022 | 7653 | 7250 | 8322 | 9543 | 10924 |
| TOTAL ASSETS | - | 704 | 4256 | 6312 | 8289 | 7903 | 7483 | 8606 | 9879 | 11378 |
| LIABILITIES | | | | | | | | | | |
| CURRENT LIABILITIES | | | | | | | | | | |
| ACCOUNTS PAYABLE | - | - | - | 3 | 6 | 10 | 15 | 29 | 38 | 50 |
| TOTAL CURRENT LIABILITIES | - | - | - | 3 | 6 | 10 | 15 | 29 | 38 | 50 |
| LONG TERM DEBT | | | | | | | | | | |
| PROPOSED A.I.D. LOANS | - | 217 | 3657 | 4677 | 4934 | 4839 | 4652 | 4454 | 4244 | 4022 |
| TOTAL LONG TERM DEBT | - | 217 | 3657 | 4677 | 4934 | 4839 | 4652 | 4454 | 4244 | 4022 |
| EQUITY | | | | | | | | | | |
| EQUITY, RETAINED EARNINGS, AND CAPITAL CONTRIBUTIONS | - | 487 | 599 | 1632 | 3349 | 3054 | 2816 | 4123 | 5597 | 7306 |
| TOTAL LIABILITIES | - | 704 | 4256 | 6312 | 8289 | 7903 | 7483 | 8606 | 9879 | 7306 |
| DEBT-EQUITY RATIO | N/A | 31:69 | 86:14 | 74:26 | 60:40 | 61:39 | 62:38 | 52:48 | 43:57 | 36:64 |



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Table 5-31

# Cash Flow Statement
## Irbid Wastewater Project
(2 July 1980)

| Year Ending December 31 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | JD (Thousands) | | | | | |
| **Internal Cash Generation** | | | | | | | | | | |
| New Revenue Before Depreciation and Interest | | | | | | | | | | |
| Wastewater | - | - | 112 | 109 | 83 | 350 | 455 | 514 | 520 | 583 |
| **Operating Requirements** | | | | | | | | | | |
| Working Capital | - | - | 17 | 36 | 7 | 52 | 29 | 35 | 25 | 34 |
| Debt Service - Interest | | | | | | | | | | |
| Proposed AID Loans | - | - | - | - | 14 | 245 | 187 | 198 | 210 | 222 |
| Debt Service - Repayment | | | | | | | | | | |
| Proposed AID Loans | - | - | - | - | 9 | 146 | 290 | 279 | 267 | 255 |
| Total Debt Service | - | - | - | - | 23 | 391 | 477 | 477 | 477 | 477 |
| **Total Operating Requirements** | - | - | 17 | 36 | 30 | 443 | 506 | 512 | 502 | 511 |
| **Total Available From Operations** | - | - | 95 | 73 | 53 | (93) | (51) | 2 | 18 | 72 |
| **Construction Costs** | | | | | | | | | | |
| Project - Wastewater | - | 692 | 3233 | 1679 | 1648 | - | - | 1475 | 1624 | 1784 |
| Interest Capitalized | - | 12 | 207 | 265 | 266 | 51 | - | - | - | - |
| Total Construction Costs - Wastewater | - | 704 | 3440 | 1944 | 1914 | 51 | - | 1475 | 1624 | 1784 |
| **Balanced To Be Financed** | | | | | | | | | | |
| Financed By: | | | | | | | | | | |
| Aid Grants | - | 487 | - | - | - | - | - | - | - | - |
| Aid Loans | - | 205 | 3233 | 755 | - | - | - | - | - | - |
| GOJ Capital Contributions (1) | - | 12 | 207 | 1189 | 1914 | 51 | - | 1475 | 1624 | 1784 |
| Total Financed | - | 704 | 3440 | 1944 | 1914 | 51 | - | 1475 | 1624 | 1784 |
| Surplus (Deficit) | - | - | 95 | 73 | 53 | (93) | (51) | 2 | 18 | 72 |
| Cash Balance At End of Year | - | - | 95 | 168 | 221 | 128 | 77 | 79 | 97 | 169 |
| Debt Service Coverage | N/A | N/A | N/A | N/A | 3.6 | .9 | 1.0 | 1.1 | 1.1 | 1.2 |

(1) Includes Capitalized Interest Cost



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Table 5-32a

Anticipated Revenues
Irbid Wastewater Project
(2 July 1980)

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*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WASTEWATER COLLECTION AND TREATMENT    *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1982
INFLATION RATES :LOW MEDIUM HIGH
------

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D R E V E N U E S (T H O U S A N D S O F J.D.)

| YEAR | NUMBER OF CUSTOMERS RESIDENT | NUMBER OF CUSTOMERS NONRSED | USER CHARGES J.D. / MONTH RESIDENT | USER CHARGES J.D. / MONTH NONRESD | REVENUE FROM CUSTOMERS RESIDENT | REVENUE FROM CUSTOMERS NONRESD | ADMINISTR. CONNECTION FEE (JD) | REVENUE FROM NEW CUSTOMERS | REVENUE FROM SEPTAGE DUMPING | RATE OF HOUSEHOLD WATER USE INCREASE | TOTAL ANNUAL REVENUE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 0 | 0 | 0.0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 1.060 | 0 |
| 1981 | 0 | 0 | 0.0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 1.060 | 0 |
| 1982 | 3000 | 500 | 0.0 | 0.0 | 0 | 0 | 32 | 112 | 0 | 1.060 | 112 |
| 1983 | 6000 | 1000 | 0.40 | 0.62 | 28 | 7 | 32 | 112 | 152 | 1.060 | 308 |
| 1984 | 9000 | 1600 | 0.40 | 0.62 | 43 | 11 | 32 | 115 | 166 | 1.060 | 353 |
| 1985 | 12000 | 2000 | 1.60 | 2.46 | 230 | 59 | 32 | 108 | 180 | 1.060 | 697 |
| 1986 | 15000 | 2500 | 1.80 | 2.77 | 324 | 83 | 32 | 112 | 195 | 1.060 | 918 |
| 1987 | 19000 | 3000 | 1.80 | 2.77 | 410 | 99 | 32 | 144 | 216 | 1.060 | 1171 |
| 1988 | 22000 | 3500 | 1.80 | 2.77 | 475 | 116 | 32 | 112 | 223 | 1.060 | 1333 |
| 1989 | 25000 | 4100 | 1.86 | 2.77 | 546 | 136 | 32 | 124 | 238 | 1.060 | 1583 |

NOTES:
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(1) NUMBER OF CUSTOMERS : CALCULATED AS EQUIVALENT DEVELOPMENT UNITS.
(2) USER CHARGES : AVERAGE MONTHLY USER CHARGES BASED ON EXISTING PRICING POLICY .
(3) ADMINISTRATIVE CONNECTION FEE: BASED ON WEIGHTED RENTAL VALUE OF HOUSING AND COMMERCIAL PROPERTIES ADJUSTED FOR INCREASING AFFLUENCE AND INFLATION.
(4) REVENUE FROM SEPTAGE DUMPING : REVENUES FROM PERIODIC PUMPING OF ONSITE SYSTEMS NOT SERVED BY SEWER SYSTEM.
(5) RATE OF HOUSEHOLD WASTEWATER INCREASE : INCREASE IN HOUSEHOLD WASTEWATER USED TO INCREASE ANNUAL REVENUES FROM USER CHARGES BASED ON INCREASING PER CAPITA WATER CONSUMPTION AND DECREASING HOUSEHOLD SIZE.
(6) NUMBER OF USERS BASED ON HOOK-UP RATE OF APPROXIMATELY 3500 CONNECTIONS ANNUALLY.
(7) 100% OF POPULATION IS SERVICED IN 1989.
(8) NONRESIDENTIAL USER CHARGE IS 1.54 TIMES RESIDENTIAL USER CHARGE.
(9) GRANT STRUCTURE REFLECTS $2.5 MILLION AID GRANT DISBURSED IN 1981 AND $21.5 MILLION AID LOAN TO BE DISBURSED DURING CONSTRUCTION: THE BALANCE OF CAPITAL COSTS IS FINANCED BY GOVERNMENT OF JORDAN EQUITY.



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Table 5-32b

Anticipated Expenses
Irbid Wastewater Project
(2 July 1980)

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*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WASTEWATER COLLECTION AND TREATMENT    *
*                                        *
* WESTON INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1982
INFLATION RATES :LOW MEDIUM HIGH

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

A N T I C I P A T E D E X P E N S E S ( T H O U S A N D S O F J.D)

| YEAR | REVENUE REQUIRED FOR NEW FACILITIES TOTAL CAPITAL COST(1979 JD) | GRANT | NET CAPITAL COST | NET CAPITAL COST INFLATED (10.00PC) | GRACE PERIOD INTEREST ACCUMULATION | LOCAL DEBT ANNUAL PAY. ( 6.00PC+20YR) | O+M IN 1979 (J.D) | O+M INFLATED (15.00PC) | TOTAL EXPENSE OF NEW FACILITIES |
|---|---|---|---|---|---|---|---|---|---|
| 1980 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1981 | 572 | 402 | 170 | 205 | 12 | 0 | 0 | 0 | 0 |
| 1982 | 2429 | 0 | 2429 | 3232 | 207 | 0 | 0 | 0 | 0 |
| 1983 | 1147 | 631 | 516 | 755 | 265 | 0 | 120 | 209 | 209 |
| 1984 | 1023 | 1023 | 0 | 0 | 266 | 23 | 136 | 273 | 296 |
| 1985 | 0 | 0 | 0 | 0 | 51 | 391 | 152 | 351 | 742 |
| 1986 | 0 | 0 | 0 | 0 | 0 | 477 | 169 | 449 | 926 |
| 1987 | 688 | 688 | 0 | 0 | 0 | 477 | 213 | 651 | 1128 |
| 1988 | 689 | 689 | 0 | 0 | 0 | 477 | 230 | 809 | 1286 |
| 1989 | 688 | 688 | 0 | 0 | 0 | 477 | 247 | 999 | 1476 |

NOTES:

(1) REVENUE REQUIRED FOR NEW FACILITIES : CAPITAL COSTS INCLUDE GRACE PERIOD INTEREST WHICH WAS REFINANCED ONLY DURING G RACE PERIOD AS A COST OF CONSTRUCTION.
(2) GRACE PERIOD APPLIES ONLY TO MAJOR INITIAL INVESTMENTS FROM THE TIME THEY ARE INCURRED.
(3) GRANT : INCLUDES US.AID GRANT.



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Table 5-32c

Deficit-Surplus Analysis
Irbid Wastewater Project
(2 July 1980)

```
*****************************************
* IRBID -THE HASHEMITE KINGDOM OF JORDAN *
*                                        *
* CASH  FLOW ANALYSIS                    *
*                                        *
* WASTEWATER COLLECTION AND TREATMENT    *
*                                        *
* DESIGN INTERNATIONAL, JUNE 1980        *
*                                        *
*****************************************
```

A S S U M P T I O N S:
CONSTRUCTION PHASING COMPLETED :1982
INFLATION RATES :LOW MEDIUM HIGH

F I N A N C I N G :
LIFE OF LOAN : 20 YEARS.
GRACE PERIOD : 3 YEARS.
LOAN INTEREST RATE: 6.00 PERCENT(PC).

D E F I C I T - S U R P L U S A N A L I S I S (T H O U S A N D S J.D.)

| YEAR | TOTAL REVENUE REQ. FOR NEW FACILITIES | DEBT SERVICE ON CURRENT FACILITIES | O+M ON CURRENT FACILITIES | TOTAL EXPENSES | TOTAL REVENUE | ANNUAL SURPLUS | ACCUMULATED |
|---|---|---|---|---|---|---|---|
| 1980 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1981 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1982 | 0 | 0 | 0 | 0 | 112 | 112 | 112 |
| 1983 | 209 | 0 | 0 | 209 | 308 | 99 | 211 |
| 1984 | 296 | 0 | 0 | 296 | 353 | 57 | 268 |
| 1985 | 742 | 0 | 0 | 742 | 697 | -45 | 223 |
| 1986 | 926 | 0 | 0 | 926 | 918 | -8 | 215 |
| 1987 | 1128 | 0 | 0 | 1128 | 1171 | 43 | 258 |
| 1988 | 1286 | 0 | 0 | 1286 | 1333 | 47 | 305 |
| 1989 | 1476 | 0 | 0 | 1476 | 1583 | 107 | 412 |



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Table 5-33

Income and Expenditure Statement
Irbid Water Supply and Wastewater Project
(2 July 1980)

| Year Ending December 31 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | JD (Thousands) | | | | | |
| **Revenue** | | | | | | | | | | |
| Water Supply | 351 | 407 | 450 | 498 | 672 | 798 | 872 | 1513 | 1676 | 1848 |
| Wastewater | - | - | 112 | 308 | 353 | 697 | 899 | 1155 | 1321 | 1572 |
| Total | 351 | 407 | 562 | 806 | 1025 | 1495 | 1771 | 2668 | 2997 | 3420 |
| Operating Costs | | | | | | | | | | |
| Water Supply | 264 | 311 | 386 | 520 | 685 | 885 | 1076 | 1314 | 1608 | 1981 |
| Wastewater | - | - | - | 199 | 270 | 747 | 847 | 1044 | 1204 | 1392 |
| Total | 264 | 311 | 386 | 719 | 955 | 1632 | 1923 | 2358 | 2812 | 3373 |
| Surplus Before Interest | 87 | 96 | 176 | 87 | 70 | (137) | (152) | 310 | 185 | 47 |
| Interest | - | - | - | - | 23 | 334 | 448 | 431 | 413 | 394 |
| Surplus (Deficit) | 87 | 96 | 176 | 87 | 47 | (471) | (600) | (121) | (228) | (347) |
| Average Net Fixed Assests | | | | | | | | | | |
| Water Supply | N/A | N/A | 989 | 2220 | 3504 | 4262 | 4474 | 4671 | 4891 | 5135 |
| Wastewater | N/A | N/A | N/A | N/A | N/A | N/A | 7452 | 7049 | 6646 | 6243 |
| Total | N/A | N/A | 989 | 2220 | 3504 | 4262 | 11926 | 11720 | 11537 | 11378 |
| Rate of Return on Average Net Fixed Assets (%) | | | | | | | | | | |
| Water Supply | N/A | N/A | 6.5 | - | - | - | - | 4.3 | 1.4 | - |
| Wastewater | N/A | N/A | N/A | N/A | N/A | N/A | .7 | 1.6 | 1.8 | 2.9 |
| Total | N/A | N/A | 17.8 | 3.9 | 2.0 | - | - | 2.6 | 1.6 | .4 |
| Cash Operating Ratio (%) | 75.2 | 76.4 | 65.1 | 79.3 | 78.6 | 67.7 | 72.1 | 63.4 | 70.8 | 77.7 |



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Table 5-34

Balance Sheet
Irbid Water Supply and Wastewater Project
(2 July 1980)

| YEAR ENDING DEC 31 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|
| | JD (THOUSANDS) | | | | | | | | | |
| ASSETS | | | | | | | | | | |
| CURRENT ASSETS | | | | | | | | | | |
| CASH | 99 | 176 | 342 | 462 | 607 | 503 | 239 | 369 | 484 | 481 |
| ACCOUNTS RECEIVABLE | 52 | 61 | 85 | 121 | 154 | 226 | 265 | 400 | 451 | 513 |
| INVENTORIES | 4 | 5 | 6 | 17 | 22 | 28 | 35 | 47 | 57 | 70 |
| TOTAL CURRENT ASSETS | 155 | 242 | 433 | 600 | 783 | 757 | 539 | 816 | 992 | 1064 |
| FIXED ASSETS | | | | | | | | | | |
| WATER SUPPLY | - | 402 | 1595 | 2965 | 4392 | 4850 | 5279 | 5751 | 6270 | 6841 |
| LESS DEPRECIATION | - | - | 20 | 100 | 249 | 469 | 712 | 976 | 1264 | 1578 |
| NET WATER SUPPLY | - | 402 | 1575 | 2865 | 4143 | 4381 | 4567 | 4775 | 5006 | 5263 |
| WASTEWATER | - | - | - | - | - | 8053 | 8053 | 8053 | 8053 | 8053 |
| LESS DEPRECIATION | - | - | - | - | - | 400 | 803 | 1206 | 1609 | 2012 |
| NET WASTEWATER | - | - | - | - | - | 7653 | 7250 | 6847 | 6444 | 6041 |
| WORK-IN-PROGRESS | - | 704 | 4144 | 6088 | 8002 | - | - | 1475 | 3099 | 4883 |
| TOTAL FIXED ASSETS | - | 1106 | 5719 | 8953 | 12145 | 12034 | 11817 | 13097 | 14549 | 16187 |
| TOTAL ASSETS | 155 | 1348 | 6152 | 9553 | 12928 | 12791 | 12356 | 13913 | 15541 | 17251 |
| LIABILITIES | | | | | | | | | | |
| CURRENT LIABILITIES | | | | | | | | | | |
| ACCOUNTS PAYABLE | 11 | 15 | 19 | 27 | 37 | 50 | 66 | 95 | 123 | 159 |
| DEPOSITS | - | 5 | 9 | 14 | 19 | 30 | 36 | 41 | 47 | 53 |
| TOTAL CURRENT LIABILITIES | 11 | 20 | 28 | 41 | 56 | 80 | 102 | 136 | 170 | 212 |
| LONG TERM DEBT | | | | | | | | | | |
| EXISTING LOCAL LOANS | 57 | 39 | 26 | 13 | - | - | - | - | - | - |
| PROPOSED AID LOANS | - | 356 | 4989 | 7157 | 7547 | 7467 | 7181 | 6878 | 6557 | 6217 |
| TOTAL LONG TERM DEBT | 57 | 395 | 5015 | 7170 | 7547 | 7467 | 7181 | 6878 | 6557 | 6217 |
| EQUITY | | | | | | | | | | |
| EQUITY, RETAINED EARNINGS & CAPITAL CONTRIBUTIONS | 87 | 933 | 1109 | 2342 | 5325 | 5244 | 5073 | 6899 | 8814 | 10822 |
| TOTAL LIABILITIES | 155 | 1348 | 6152 | 9553 | 12928 | 12791 | 12356 | 13913 | 15541 | 17251 |
| DEBT-EQUITY RATIO | 40:60 | 30:70 | 82:18 | 75:25 | 59:41 | 59:41 | 59:41 | 50:50 | 43:57 | 36:54 |



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Table 5-35

# Cash Flow Statement
## Irbid Water Supply and Wastewater Project
## (2 July 1980)

| Year Ending December 31 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Internal Cash Generation** | | | | | | | | | | | |
| Net Revenue Before Depreciation and Interest | | | | | | | | | | | |
| Water Supply | 75 | 87 | 96 | 84 | 58 | 136 | 133 | 39 | 463 | 356 | 181 |
| Waste Water | - | - | - | 112 | 109 | 83 | 350 | 455 | 514 | 520 | 583 |
| Total | 75 | 87 | 96 | 196 | 167 | 219 | 483 | 494 | 977 | 876 | 764 |
| **Operating Requirements** | | | | | | | | | | | |
| Working Capital | - | 45 | 1 | 17 | 34 | 23 | 54 | 24 | 113 | 27 | 33 |
| Debt Service - Interest | | | | | | | | | | | |
| Proposed Aid Loans | - | - | - | - | - | 23 | 334 | 345 | 350 | 356 | 361 |
| Debt Service - Repayment | | | | | | | | | | | |
| Existing Local Loans | - | 18 | 18 | 13 | 13 | 13 | - | - | - | - | - |
| Proposed Aid Loans | - | - | - | - | - | 15 | 199 | 389 | 384 | 378 | 373 |
| Total Repayment | - | 18 | 18 | 13 | 13 | 28 | 199 | 389 | 384 | 378 | 373 |
| Total Debt Service | - | 18 | 18 | 13 | 13 | 51 | 533 | 734 | 734 | 734 | 734 |
| **Total Operating Requirements** | - | 63 | 19 | 30 | 47 | 74 | 587 | 758 | 847 | 761 | 767 |
| **Total Available From Operations** | 75 | 24 | 77 | 166 | 120 | 145 | (104) | (264) | 130 | 115 | (3) |
| **Construction Costs** | | | | | | | | | | | |
| Project - Water Supply | - | - | 394 | 1118 | 1230 | 1288 | 390 | 429 | 472 | 519 | 571 |
| Project - Waste Water | - | - | 692 | 3233 | 1679 | 1648 | - | - | 1475 | 1624 | 1784 |
| Interest Capitalized | - | - | 20 | 282 | 405 | 405 | 119 | - | - | - | - |
| Total - Water Supply | - | - | 402 | 1193 | 1370 | 1427 | 458 | 429 | 472 | 519 | 571 |
| Total - Wastewater | - | - | 704 | 3440 | 1944 | 1914 | 51 | - | 1475 | 1624 | 1784 |
| Total Construction Costs | - | - | 1106 | 4633 | 3314 | 3341 | 509 | 429 | 1947 | 2143 | 2355 |
| **Balance to be Financed** | | | | | | | | | | | |
| Financed by: | | | | | | | | | | | |
| Aid Grants | - | - | 750 | - | - | - | - | - | - | - | - |
| Aid Loans | - | - | 336 | 4351 | 1763 | - | - | - | - | - | - |
| GOJ Capital Contributions (1) | - | - | 20 | 282 | 1551 | 3341 | 509 | 429 | 1947 | 2143 | 2355 |
| Total Financed | - | - | 1106 | 4633 | 3314 | 3314 | 509 | 429 | 1947 | 2143 | 2355 |
| Surplus (Deficit) | 75 | 24 | 77 | 166 | 120 | 145 | (104) | (264) | 130 | 115 | (3) |
| Cash Balance at End of Year | 75 | 99 | 176 | 342 | 462 | 607 | 503 | 239 | 369 | 484 | 481 |
| Debt Service Coverage | N/A | 4.8 | 5.3 | 15.1 | 12.8 | 4.3 | .9 | .7 | 1.3 | 1.2 | 1.0 |

Table 5-36
(Formerly Table 9-22)

Summary of Residential Average Annual User Charges and Fees for Proposed Water Supply and Wastewater Municipal Services -- 1980-1989 (2 July 1980)

(In JD)

| | Water Supply | | Wastewater | | |
|---|---|---|---|---|---|
| Year | Administrative[1] Connection Fee | Annual User[2] Charge | Administrative[1] Connection Fee | Annual User[2] Charge | Total Annual User Charge |
| 1980 | 0 | 16.8 | 0 | 0 | 16.8 |
| 1981 | 19 | 16.8 | 0 | 0 | 16.8 |
| 1982 | 19 | 16.8 | 32 | 0 | 16.8 |
| 1983 | 19 | 16.8 | 32 | 4.8 | 21.6 |
| 1984 | 19 | 20.4 | 32 | 4.8 | 25.2 |
| 1985 | 19 | 20.4 | 32 | 19.2 | 39.6 |
| 1986 | 19 | 20.4 | 32 | 21.6 | 42.0 |
| 1987 | 19 | 32.4 | 32 | 21.6 | 54.0 |
| 1988 | 19 | 32.4 | 32 | 21.6 | 54.0 |
| 1989 | 19 | 32.4 | 32 | 21.6 | 54.0 |

(1) One time administrative fee, reconnection of existing water supply users is included in capital costs.

(2) Annual user charges based on monthly user charges obtained in computer analysis.



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Table 5-37
(Formerly Table 9-25)

Existing Conditions
Current Ability to Pay Analysis
(2 July 1980)

| Water Use Consumption Group (cu m/month) | (1) Average Household Water Use (cu m/month) | (2) Unit Cost of Water (JD/cu m) | (3) Number of Households | (4) Average Water Use[1] Per Household (cu m/year) | (5) Average Household Income (JD/year) | (6) Average Water Cost[2] Per Household (JD/year) | (7) Ability to Pay[3] (%) | (8) Annual Revenue By Group (JD) | (9) Total Water Sold (cu m/year) |
|---|---|---|---|---|---|---|---|---|---|
| 0 to 5 | 3.4 | 0.080 | 3,820 | 40.80 | 1,150 | 3.260 | 0.28 | 10,725 | 134,232 |
| 5 to 15 | 9.7 | 0.120 | 5,277 | 77.60 | 1,452 | 6.910 | 0.48 | 36,464 | 409,495 |
| 15 to 25 | 18.6 | 0.220 | 1,759 | 232.20 | 1,275 | 28.700 | 2.25 | 50,403 | 392,609 |
| More than 25 | 28.2 | 0.300 | 1,096 | 338.40 | 1,870 | 57.100 | 3.05 | 62,502 | 370,806 |
| Totals | | | 11,412[4] | | | | 0.98[5] | 160,254[6] | 1,307,222[6] |

1. Equals (1) x 12 months

2. Equals (4) x (2)

3. Ability to pay is the percent of annual income required for purchase of water. Ability to pay equals average water cost divided by average household income.

4. Based on Survey/Document 14,500 total meters in 1979 adjusted to exclude non-residential use.

5. Total ability to pay equals total annual revenue (column 8) divided by total income of all households.

6. This table contains information from the socioeconomic survey conducted in the summer of 1979. It also uses the existing water rate structure to determine the annual revenue by water consumption group and water sold (each group). As a test, the totals compare favorably with reported values in subsection 9.3.2 of this chapter.



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Table 5-38
(Formerly Table 9-32)

Water Charges Per Cubic Meter
By Income Group -- 1985
(2 July 1980)

| (1) Water Use Consumption Group (cu m/month) | (2) Average Household Income (JD/Year) | (3) Number of Households | (4) Revenue by Consumption Group (JD/Year) | (5) Average house-hold Water Use (cu m/year)[7] | (6) Water Charge Unit Cost (fils/cu m)[8] |
|---|---|---|---|---|---|
| 0 to 15 | 2,367 | 15824 | 149,821[3] | 88 | 107 |
| 16 to 25 | 2,259 | 3250 | 183,543[4] | 268 | 210 |
| More than 25 | 3,313 | 2026 | 276,636[5] | 389 | 351 |
| TOTAL | | 21100 | 610,000[6] | | |

1. Average annual income from **Table 9-37**, weighted by number of users for the 0 to 15 water use group and inflated 10 percent per year. Variation in income by group is explained in the text.
2. From cashflow analysis distributed based on distribution in table "Existing Conditions Ability to Pay."
3. Based on 1979 weighted average ability to pay - 0.40% x (2) (3).
4. Based on 1979 ability to pay - - 2.25% x (2) (3).
5. Determined by difference in ability to pay - - 4.12%.
6. From **Table** 9-9a, required total revenue by consumption group based on water consumption revenue for residential users, **inclusive** of wholesale water cost based on inflated current wholesale cost 65 f/s/$m^3$ at 15% included as an O&M cost.
7. Data are consistent with constrained demand schedule based on 3.06 $Mm^3$ of water sold in 1985.
8. Calculated (4) ÷ (3) (5).



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Table 5-39
(Formerly Table 9-33)

Monthly User Charge (1985) Water and Wastewater
By Water Use Consumption Group
(2 July 1980)

| Water Use Consumption Group (cu m/month) | Water Charge | | Wastewater Charge | | Combined Monthly Water[1] and Wastewater Charge (JD) |
|---|---|---|---|---|---|
| | Unit[1] Charge (JD/cu m) | Monthly[2] Charge (JD) | Unit[3] Charge (JD/cu m) | Monthly Charge (JD) | |
| 0 to 15 | .107 | .784 | .094 | .550 | 1.330 |
| 16 to 25 | .210 | 4.69 | .186 | 3.32 | 8.01 |
| More than 25 | .351 | 12.61 | .345 | 8.94 | 21.55 |

[1]Water charge (Table 9-38) includes estimated 1985 wholesale water cost, 150 fils/cu. m. to better reflect future conditions.

[2]Calculation based on Table 9-38 average household water use (5) and unit charges

[3]Wastewater charges reflect the progressive water rate structure and 80% of water consumption.



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Table 5-40
(Formerly Table 9-34)

Ability to Pay Annual User Charges for Municipal Services Based on Projected 1985 Costs and Income
(2 July 1980)

| Water Use Consumption Group (cu m/month) | Average Household Income (JD/year) | Water Supply[1] Monthly User Charge (JD) | Water Supply[1] Percent Income | Wastewater Monthly User Charge (JD) | Wastewater Percent Income | Combined Charge[1] Monthly User Charge (JD) | Combined Charge[1] Percent Income |
|---|---|---|---|---|---|---|---|
| 0 to 15 | 2,367 | .784 | 0.40 | .550 | .27 | 1.334 | .67 |
| 16 to 25 | 2,259 | 4.69 | 2.49 | 3.320 | 1.76 | 8.01 | 4.25 |
| More than 25 | 3,313 | 12.61 | 4.56 | 8.940 | 3.24 | 21.55 | 7.80 |
| | | | | | Total[2] | | 2.11 |

[1] Charge includes the wholesale price of water.

[2] Total percent of income: Annual Utility Cost ÷ Annual income

INTERNAL WORKING MEMORANDA
AND CORRESPONDENCE

WESTON
ENVIRONMENTAL CONSULTANTS DESIGNERS

# inter-office memorandum

TO: J. Miller cc: T.J. Tuffey
R.E. Beam
C.J. Kelly
R.F. Fedel, A.I.D., Washington, D.C.
L. Rosenberg, A.I.D., Washington, D.C.

DATE: July 11, 1980

FROM: V.D. Polhemus Va

SUBJECT: Jordan Project Analysis Final Effort for A.I.D., Washington, D.C.

W. O. No.:

As a result of the meeting in Washington, D.C. on 8 July 1980 between Weston International staff, (R.E. Beam and V.D. Polhemus) and A.I.D. Washington and Jordan (L. Rosenberg and J. Cassanos), we are in a position where the A.I.D. requested supplemental analysis can be finalized. This memorandum serves to document the base data that will be used in this final iteration, and to identify and limit the analysis and discussion that will be included. Since this will be Weston's final presentation of this analysis, this memo requests immediate approval to proceed, and confirmation regarding the data that will be used and the analysis undertaken. (As a result this memo will be telecopied to R.F. Fedel, A.I.D. Washington on 11 July 1980.)

The requested final submission will be based on the earlier Weston International, Inc. effort directed to Robert Fedel, dated 2 July 1980. However, it will utilize revised input data and respond to the comments in L. Rosenberg's memorandum of 7 July 1980 by including requested additional schedules and clarification. Explanations and discussions of methods used in analysis will be presented as footnotes to the extent possible. More lengthy discussion will be appended, if necessary.

## 2 JULY 1980 WESTON INTERNATIONAL, INC. EFFORT

The 2 July 1980 Weston International, Inc. effort provides the framework for the revised submission including:

1. Basic assumptions from Page 2 of cover letter which are consistent with the discussions of 16 June 1980 (unchanged).
2. Schedule/Application of Capital Contributions (revised-Table 5 attached).
3. Three sets of financial tables (water, wastewater and combined water and wastewater) (to be revised).
4. Five tables presenting user charges, unit costs and ability to pay identified on Page 1 of letter. (to be revised).



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REVISED DATA

Data revisions will include the following:

1. Water Consumption Table provided by Jim Cassanos dated 8 July 1980 (xerox copy attached, Table 1).
2. Water Connections Table provided by Jim Cassanos dated 8 July 1980 (xerox copy attached, Table 2).
3. Wastewater Connections Table provided by Jim Cassanos dated 8 July 1980 (xerox copy attached, Table 3).
4. Capital requirements (escalated) presented by Weston International, Inc. (2 July 1980 on Page 2 of the letter)are consistent with the xerox copy of Construction Funding Schedule 1981-1989 (1979 costs) presented at the 8 July meeting and previsouly at 16 June meeting. The capital requirements, previously including reconnection investments of 40,000 JD in 1981, 1982 and 1983 (which was previously escalated at 10%) will be revised to 34,000 JD in 1981, 1982 and 1983 according to the attached Table 4 to reflect the reduction in reconnections and again escalated.
5. Table 5 (attached) which is consistent with Table 4. This table presents the Application of Capital Contributions and identifies the manner in which A.I.D. grants of $2.5M and $21.0M in loans will be distributed and the allocation of Government of Jordan (GOJ) equity (grants) based on the Table 5 attachment.

RESPONSE TO COMMENTS

The following responses will be made to L. Rosenberg's memorandum 7 July 1980, "Comments Upon Supplemental Financial Analysis Information on Irbid Water Supply and Wastewater Project..." Numbers 1-23 correspond to Mr. Rosenberg's numbers and must be understood in conjunction with his memorandum.

1. Tables 1, 2, and 3 (attached) replace the previously used 2 July 1980 "numbers of customers connected "with estimates acceptable to A.I.D.
2. Non-residential customers are also addressed in Tables 1, 2, and 3.
3. Also addressed in the revised Tables 1, 2 and 3.
4. Bulk water supplies for the Refugee Camp will be included in the financial tables (washed out) based on escalated wholesale water prices from WSC and the Water needs of the Camp identified in Table 1 (attached).

ANNUAL REFUGEE CAMP BULK WATER SALES

| YEAR | WATER REQUIRED* ($M^3 \times 10^6$) | PRICE ($fils/m^3$) | ANNUAL COST (JD x 1000) |
|---|---|---|---|
| 1980 | .26 | 75 | 19.5 |
| 1981 | .29 | 85 | 24.6 |
| 1982 | .33 | 98 | 32.3 |
| 1983 | .36 | 113 | 40.6 |
| 1984 | .40 | 130 | 52.0 |
| 1985 | .42 | 150 | 63.0 |
| 1986 | .45 | 172 | 77.4 |
| 1987 | .49 | 198 | 97.0 |
| 1988 | .54 | 228 | 123.0 |
| 1989 | .59 | 262 | 154.5 |

* Assumes 25% loss 1980-1985 and 20% losses thereafter.



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5. A schedule of deposits will be presented to identify water supply revenue differences between Computer Analysis Tables and Income and Expenditure Statements.

6. The costs of reconnecting existing customers at JD6.5 per connection will be charged to an investment account for 1981, 1982 and 1983 based on the number of reconnections required by Table 2 (attached). These costs will be escalated at 10% along with the other capital costs. The method and basis of the cost will be provided.

7. The cash flow analysis will be used for identifying the portion of user charges and annual revenue that is attributed to wholesale water purchases. This escalated cost of wholesale water will be distributed between residential and non-residential customers.

8. No response required - information not available.

9. A table will be prepared to identify the application of inflation factors, payroll deductions and quantity related cost increases for water and wastewater.Depreciation methods will be explained.

10. The basis for 1980 salaries, wages, and operation and maintenance costs will be prepared and factors affecting increases in costs identified.

11. If possible, the whole sale cost of water will be a wash item in the Income and Expenditure Statement for Water supply. If not, because of complications with the model arrangement, approximations will be made to balance revenues and expenses during the period of the study.

12. The A.I.D. Loan will be $21.0 Million, not $21.5 million. Grants and loans will be applied to the project as identified in Table 5 (attached).

13. Explanation of the basis for the current asset/current liability calculation for water supply and wastewater will be provided. Interest during construction will be capitalized and then expended once facility operations are initiated including grace period interest. Post 1984 financing assumes GOJ equity contributions (grants).

14. A schedule will be prepared for water supply and wastewater indicating the basis for Interest capitalized during construction and the interest payments on existing and on proposed A.I.D. loans to be relent to the utility by the GOJ.

15. The wastewater administrative fees will be collected from new customers at the time the system becomes operational, consistent with the Wastewater Connections Schedule Table 3 (attached). Septage dumping fees will be collected from private haulers, who will be required to dispose of septic tank wastes at the new wastewater treatment plant when it is operational. Current operation by private haulers involves collection and disposal at presumably approved locations. Since there is no existing wastewater management authority, current practices are poorly monitored. The new utility will not assume responsibility for this disposal until the treatment plant is fully operational. The attached table 6 indicates the revenues that will be collected and the technique for calculating that revenue.

16. The basis for wastewater operation and maintenance costs will be presented and factors affecting future conditions and escalation will be described.

17. A schedule will be provided to describe capitalized interest during construction and interest on debt service payments on the GOJ relending of the A.I.D. loan for the total project.

18. Wholesale water costs will be escalated at 15 percent per annum from the 1979 "current" price of 65 fils/$m^3$ (all escalations in this project are escalated from "current"1979 values). Table 1 (attached) presents the Total Water Sold and Total Water Required, which will be the basis for water related costs in the supplemental analysis to be presented by Weston International, Inc.

    Water use increase (lpcd) will be 6.0 percent per annum.

19. Table 9-22 Annual User Charges (residential) for water and wastewater are obtained (see footnote 2) from the computer analysis Table 9-9A "User Charges JD 1/Month Resident" x 12 months. The request for user charges (fils/$m^3$) for the combined project relates to Table 9-33. A column will be inserted in Table 9-33 to express the combined water and wastewater unit charge (JD/$m^3$).

20. Error noted and will be corrected.

21. Table 9-25 number of metered residential households (11,412) based on survey information and reported nubmer of existing connections 14,500 (Irbid Water Department). Numbers are in apparent agreement with Mr. Cassanos' number of water connections (15,500 total connections in 1980, see Table 2.)

22. As indicated in the comment, Table 9-32 excludes in the bulk price of water. Wholesale price is included at 65 fils/$m^3$ escalated at 15% per annum. A description of the analysis methods will be presented, in addition to refined table notes, to explain the JD 610,000 revenue figure (revised) and methods used.

23. Due to the required rapid turn-around-time for the 2 July 1980 Supplemental Analysis, the column Water Charges, Unit Charge includes .389 JD/cu m. This was inadvertently pulled from column 5 instead of 6 in table 9-32. Footnote 1 should read 1985 instead of 1989.

    Sources of data and explanations of consistency will be presented to assist the reader in understanding the revised supplement.

ADDITIONAL SCHEDULES/CLARIFICATION

As indicated in the preceeding section regarding Mr. Roseberg's comments on the 2 July 1980 Weston International, Inc. Supplement to A.I.D., additional schedules and tables will be presented to assist the reader through the analysis. Other analyses tables and supplements will also be included, if they will assist in understanding the project implications. Weston will review the project with respect to internal rate of return. Since the project has been set up to be non-profit and depreciation is not included in the cash flow computer analysis, the calculation will be based on deflated investment costs and operating costs and deflated sales revenues, as we (L. Rosenberg and I) discussed at the 8 July 1980 meeting. In the event the analysis does not appear to be useful, we will notify A.I.D. and omit the exercise from the analysis.

A similar approach will be taken in the preparation of incremental cost and revenue tables. Previous attempts at presenting incremental costs and revenues have been unsatisfactory because of the variability of the project in the initial years.



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TABLE I

8 July 1980

WATER CONSUMPTION

| YEAR | RESIDENTIAL Connections (000) | Persons[1] (000) | LCPD[2] | Total (MCM/YR) | REFUGEE CAMP Connections (000) | Persons[1] (000) | LPCD[2] | Total (MCM/YR) | Total Resid. (MCM/YR) | Non-Res.[3] MCM/YR | Total Water Sold MCM/YR | Water Required (MCM/YR)[4] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 12.7 | 90 | 34 | 1.12 | 2.3 | 16 | 34 | 0.20 | 1.32 | 0.36 | 1.68 | 2.24 |
| 1981 | 14.9 | 104 | 36 | 1.37 | 2.4 | 17 | 36 | 0.22 | 1.59 | 0.40 | 1.99 | 2.6[illegible] |
| 1982 | 16.2 | 113 | 38 | 1.57 | 2.5 | 18 | 38 | 0.25 | 1.82 | 0.45 | 2.27 | 3.0[illegible] |
| 1983 | 16.9 | 118 | 40 | 1.72 | 2.6 | 18 | 40 | 0.27 | 1.99 | 0.50 | 2.49 | 3.32 |
| 1984 | 17.6 | 123 | 43 | 1.93 | 2.7 | 19 | 43 | 0.30 | 2.23 | 0.56 | 2.79 | 3.72 |
| 1985 | 18.4 | 129 | 45 | 2.12 | 2.8 | 20 | 45 | 0.32 | 2.44 | 0.61 | 3.05 | 4.07 |
| 1986 | 19.[illegible] | 134 | 48 | 2.35 | 2.9 | 20 | 48 | 0.36 | 2.71 | 0.67 | 3.38 | 4.23 |
| 1987 | 19.8 | 139 | 51 | 2.59 | 3.0 | 21 | 51 | 0.39 | 2.98 | 0.74 | 3.72 | 4.65 |
| 1988 | 20.6 | 144 | 54 | 2.84 | 3.1 | 22 | 54 | 0.43 | 3.27 | 0.82 | 4.09 | 5.11 |
| 1989 | 21.4 | 150 | 57 | 3.12 | 3.2 | 22 | 57 | 0.47 | 3.59 | 0.90 | 4.49 | 5.61 |

[1] Assume 7 persons per household

[2] LCPD - Liters per capita per day

[3] Non-residential use equals 20% of total water sold

[4] 25% losses from 1980 through 1985 and 20% thereafter

Source: U.S.A.I.D. J. Cassanos

TABLE 2 8 July 1980

WATER CONNECTIONS

| Year | Unconnected Existing Households | | Connections** | | |
|---|---|---|---|---|---|
| | IRBID | Refugee Camp* | Residential | Non-Residential | Total |
| 1979 | | | | | |
| 1980 | 2000 | 2,300 | 12,700 | 2,800 | 15,500 |
| 1981 | 700 | 2,400 | 14,900 | 3,000 | 18,000 |
| 1982 | - | 2,500 | 16,200 | 3,100 | 19,300 |
| 1983 | - | 2,600 | 16,900 | 3,200 | 20,100 |
| 1984 | - | 2,700 | 17,600 | 3,400 | 21,000 |
| 1985 | - | 2,300 | 18,400 | 3,500 | 21,900 |
| 1986 | - | 2,900 | 19,100 | 3,700 | 22,800 |
| 1987 | - | 3,000 | 19,800 | 3,800 | 23,600 |
| 1988 | - | 3,100 | 20,600 | 4,000 | 24,600 |
| 1989 | - | 3,200 | 21,400 | 4,100 | 25,500 |

* Assumes 16,000 persons in 1979; about 7 persons per household; households increase at rate of 4.5% per year through 1985.

** Actual number of connections in May 1980 was 14,688. Assumes, as Weston does, that there were 2,800 non-residential connections. Assumes that Irbid will connect existing unserved households in 1980-1982 and that number of households connected will increase in proportion to population growth. (Assuming 172,000 people in 1989 at 7 people per household, number of households - 24,600)

Source: U.S.A.I.D. J. Cassanos



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TABLE 3

8 July 1980

WASTEWATER CONNECTIONS

| YEAR | RESIDENTIAL NO. OF CONNECTIONS | RESIDENTIAL PERSONS SERVED | RESIDENTIAL % OF POPULATION | NON-RESIDENTIAL CONNECTIONS | TOTAL CONNECTIONS |
|---|---|---|---|---|---|
| 1980 | - | - | - | - | - |
| 1981 | - | - | - | - | - |
| 1982 | - | - | - | - | - |
| 1983 | - | - | - | - | - |
| 1984 | 2000 | 14000 | 10 | 1600 | 3600 |
| 1985 | 4000 | 28000 | 19 | 2200 | 6200 |
| 1986 | 5800 | 40600 | 27 | 2400 | 8200 |
| 1987 | 8000 | 56000 | 35 | 2600 | 10600 |
| 1988 | 12200 | 85400 | 52 | 3500 | 17500 |
| 1989 | 18500 | 129500 | 75 | 4100 | 22600 |

Source: U.S.A.I.D. J. Cassanos

TABLE 4
A.I.D. PROJECT
Construction Funding Schedule[1], 1981-1989
(Costs - JD x 1,000)
(1979 Costs)

| Description | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|
| WATER DISTRIBUTION | | | | | | | | | | | |
| Water Dist. Costs | 286 | 800 | 800 | 800 | 220 | 220 | 220 | 220 | 220 | ---- | 3786 |
| Existing User Connections[2] | 34 | 34 | 34 | | | | | | | | 102 |
| WASTEWATER SYSTEM | | | | | | | | | | | |
| Wastewater Trmnt Plant Costs | 284 | 829 | 324 | 323 | --- | --- | --- | --- | --- | ---- | 1760 |
| Sewer Construction Costs | 287 | 1600 | 823 | 700 | --- | --- | 688 | 689 | 688 | ---- | 5475 |
| SUBTOTAL WASTEWATER SYSTEM COSTS | 571 | 2429 | 1147 | 1023 | --- | --- | 688 | 689 | 688 | ---- | 7235 |
| TOTAL PROJECT COSTS | 891 | 3263 | 1981 | 1823 | 220 | 220 | 908 | 909 | 908 | ---- | 11123[4] |
| TOTAL ESCALATED[3] COSTS | 1079 | 4343 | 2900 | 2936 | 390 | 429 | 1947 | 2143 | 2355 | | 18522[4] |

NOTES: [1]All costs in this table are constant 1979 costs. AID-financed construction to start in 1981 and end in 1984. Balance of Phase I program to be completed form 1987 to 1989. An allowance of JD 220,000 per year from 1985 through 1989 has been provided for an annual program by WSC to replace 20% per year of the existing water mains that are no longer usable.

[2]Includes 6.5JD cost (1979 JD) to connect 15,500 existing residential and non-residential users to new system. Total cost = JD 100,750 applied over 1981, 1982, 1983 (JD 34,000 per year).

[3]Costs escalated at 10% per year.

[4]Total cost in 1979 JD cannot be escalated to obtain total escalated cost because a separate escalation factor is applied to each year's total.

Source: Based on U.S.A.I.D. Construction Funding Schedule 16 June 1980 meeting.

TABLE 5

APPLICATION OF CAPITAL CONTRIBUTIONS
(JD x 1000)

| YEAR | 1979 COSTS[1] | | ESCALATED COSTS[2] | | | | GOJ EQUITY | | |
|---|---|---|---|---|---|---|---|---|---|
| | CAPITAL REQUIRED | RECONNECTION INVESTMENT | CAPITAL REQUIRED | RECONNECTION INVESTMENT | A.I.D. GRANT | A.I.D. LOAN | CAPITAL REQUIRED | RECONNECTION INVESTMENT | TOTAL GRANT REC. IN 1979 JD |
| **WATER SUPPLY** | | | | | | | | | |
| 1980 | - | 34 | - | - | - | - | - | - | - |
| 1981 | 286 | 34 | 346 | 41 | 250 | - | 96 | 41 | 320 |
| 1982 | 800 | 34 | 1064 | 45 | - | 665 | 399 | 45 | 334 |
| 1983 | 800 | - | 1171 | 50 | - | 731 | 440 | 50 | 334 |
| 1984 | 800 | - | 1288 | - | - | 805 | 483 | - | 300 |
| 1985 | 220 | - | 390 | - | - | - | 390 | - | 220 |
| 1986 | 220 | - | 429 | - | - | - | 429 | - | 220 |
| 1987 | 220 | - | 472 | - | - | - | 472 | - | 220 |
| 1988 | 220 | - | 519 | - | - | - | 519 | - | 220 |
| 1989 | 220 | - | 571 | - | - | - | 571 | - | 220 |
| TOTAL | 3688 | 102 | 6250 | 136 | 250 | 2201 | 3799 | 136 | 2388 |
| **WASTEWATER** | | | | | | | | | |
| 1980 | - | - | - | - | - | - | - | - | - |
| 1981 | 571 | - | 691 | - | 500 | - | 191 | - | 571 |
| 1982 | 2429 | - | 3233 | - | - | 2020 | 1213 | - | 911 |
| 1983 | 1147 | - | 1679 | - | - | 1049 | 630 | - | 430 |
| 1984 | 1073 | - | 1648 | - | - | 1030 | 618 | - | 383 |
| 1985 | - | - | - | - | - | - | - | - | - |
| 1986 | - | - | - | - | - | - | - | - | - |
| 1987 | 688 | - | 1475 | - | - | - | 1475 | - | 688 |
| 1988 | 689 | - | 1624 | - | - | - | 1624 | - | 689 |
| 1989 | 688 | - | 1784 | - | - | - | 1784 | - | 688 |
| TOTAL | 7235 | - | 12134 | - | 500 | 4099 | 7535 | - | 4360 |

SOURCE: [1] 1979 Capital and reconnection costs: Table 4 A.I.D. Project Funding Schedule 1981-1989.
[2] Escalation at 10% per annum

TABLE 5

ATTACHMENT NOTES

1. A.I.D. Grant - $2,500,000 x .3 = 750,000 JD to be provided in 1981 on a percentage basis with the balance of funding provided by GOJ Equity Funding.

| | Escalated Capital Required | % Total Capital Required | A.I.D. Grant Distribution |
|---|---|---|---|
| 1981 Water Supply | 346 | 33.3 | 250 |
| 1981 Waste Water | 692 | 66.7 | 500 |
| Total Requirements | 1038 | 100.0 | 750 |

2. A.I.D. Loan - $21,000,000 x .3 = 6,300,000 JD to be provided in 1982,1983, and 1984 on a percentage basis of Capital Required with GOJ equity funding.

| | | | |
|---|---|---|---|
| Escalated W/S Capital Required | ('82,'83,'84) | 3,523 | |
| Escalated W/W Capital Required | ('82,'83,'84) | 6,560 | |
| Total Capital Required | ('82,'83,'84) | 10,083 | (100.0%) |
| Provided by A.I.D. Loans | | 6,300 | ( 62.5%) |
| Provided by GOJ Equity | | 3,783 | ( 37.5%) |

LOAN/EQUITY DISTRIBUTION

(JD x 1000)

| | WATER SUPPLY | | | WASTEWATER | | |
|---|---|---|---|---|---|---|
| YEAR | Total Escalated Capital Required | A.I.D. Loan | GOJ Equity | Total Escalated Capital Required | A.I.D. Loan | GOJ Equity |
| 1982 | 1,064 | 665 | 399 | 3,233 | 2,020 | 1,213 |
| 1983 | 1,171 | 731 | 440 | 1,679 | 1,049 | 630 |
| 1984 | 1,288 | 805 | 483 | 1,648 | 1,030 | 618 |
| TOTAL | 3,523 | 2,201 | 1,322 | 6,560 | 4,099 | 2,461 |

TABLE 6

SEPTAGE REVENUES

| | Irbid Population[1] 000 | Sanitary District Population[2] 000 | STP Served[3] 000 | Septic Users (Persons)[4] 000 | Septic Users (Households)[5] | Number Emptied (1/5, Once Every Five Years)[6] | Number of Loads[7] | Cost[8] (J.D.) 000 |
|---|---|---|---|---|---|---|---|---|
| 1984 | 140.8 | 245.0 | 14.0 | 212.0 | 30,280 | 6,056 | 15,140 | 151 |
| 1985 | 147.2 | 256.0 | 28.0 | 208.0 | 29,700 | 5,940 | 1,485 | 148 |
| 1986 | 153.1 | 266.4 | 40.6 | 205.8 | 29,400 | 5,880 | 1,470 | 147 |
| 1987 | 159.2 | 277.0 | 56.0 | 200.0 | 28,600 | 5,720 | 1,430 | 143 |
| 1988 | 165.6 | 288.1 | 85.4 | 180.7 | 25,800 | 5,160 | 1,290 | 129 |
| 1989 | 172.2 | 299.6 | 129.5 | 148.1 | 21,200 | 4,240 | 1,060 | 106 |

1. 1979 Census
2. 1.74 times Irbid population
3. See J. Cassanos data
4. Difference between subdistrict population and Irbid served population (does not include refugee population of Table 1)
5. Based on 7 persons per household
6. Septic tanks emptied every 5 years (engineers estimate)
7. 2.5 loads per septic tank ($4m^3$ per truckload) $10M^3$ capacity
8. Cost is 10JD per truckload.

WESTON
DESIGNERS CONSULTANTS

# inter-office memorandum

TO: Jim Miller/T.J. Tuffey

DATE: 11 July 1980

cc: D.P. Hunsinger
R.E. Beam
C. J. Kelly

FROM: V. D. Polhemus CK (for VDP)

SUBJECT: IRBID, JORDAN PROJECT: CONSIDERATION OF REFUGEE CAMP

W. O. No.:

Attached is a copy of a telex received today by AID Washington, D.C. (L.Rosenberg) from the Jordan U.S. A.I.D. Mission. The telex indicates that the "base conditions", which we have been trying to finalize for the supplemental analyses to AID, have changed again.

WESTON and U.S.A.I.D. were previously informed that the Refugee camp is currently not serviced by the existing water supply system. The telex indicates to the contrary-in fact some users are paying for services. This is a major factor since we were instructed prevously to ignore connections to the camp residents. This change will affect numbers of connections and all analysis that considered the camp separately-the attached, handwritten notes, prepared by L.Rosenberg indicates how this change should be incorporated into the supplemental analysis for A.I.D., Washington, D.C.

I propose that we incorporate this information into the memo which was to be sent to A.I.D. this afternoon. Areas that will (or may be) affected in the cash flow computer analysis (water supply only) include:

- numbers of customers
- administrative connection fees
- rate of water use increase
- wholesale water costs

Areas that will be affected inthe financial analysis include sections where the Refugee Camp is handled separately (i.e. 11 July 1980 memo p.2)

VDP:mm

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# Department of State

INCOMING TELEGRAM

PAGE 01 AMMAN 04501 181915Z 022308 AID7206
ACTION AID-35

ACTION OFFICE NEPD-03
INFO NEDP-01 NEJL-03 STA-15 AADS-01 DSAG-02 ENGR-02 CHS-01
RELO-01 MAST-01 /025 A1 4

INFO OCT-01 /036 W

P 181451Z JUL 80
FM AMEMBASSY AMMAN
TO SECSTATE WASHDC PRIORITY 0842

UNCLAS AMMAN 04501

AIDAC

E.O. 12065: N/A
SUBJECT: IRBID WATER AND SEWERAGE

REF: (A) STATE 179875, (B) AMMAN 4439

1. AT PRESENT THERE ARE 1,500 HOUSEHOLD CONNECTIONS IN THE CAMP TO THE IRBID MUNICIPAL WATER SUPPLY SYSTEM. USAID ESTIMATES THIS REPRESENTS BETWEEN 9,000 AND 10,500 CONSUMERS. THESE INDIVIDUAL CONNECTIONS ARE METERED AND PAYMENT IS MADE DIRECTLY TO THE MUNICIPALITY AT THE REGULAR TARIFF RATES. CAMP POPULATION APPROXIMATES 15,000.

2. THE DECISION TO BE CONNECTED TO THE IRBID SYSTEM IS DECISION MADE BY THE INDIVIDUAL.

3. THERE IS ALSO A FREE, REPEAT FREE, SUPPLY AVAILABLE TO ALL OTHER RESIDENTS OF THE CAMP THROUGH A SYSTEM OF STAND PIPES. THIS FREE TO RESIDENTS. WATER SUPPLY IS PAID FOR BY UNRWA DIRECTLY TO THE MUNICIPALITY. THE ESTIMATED AVERAGE CONSUMPTION IS 2,500 CUBIC METERS PER MONTH AND UNRWA PAYS THE MUNICIPALITY IN ACCORDANCE WITH THE PUBLISHED TARIFF RATES.

4. WSC HAS NOT GIVEN SPECIFIC CONSIDERATION TO HOW THIS SITUATION WILL BE HANDLED IN THE FUTURE.
VELIDTES

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JUL 11 1980
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V. Polhamus

(215) 692-3030 (EXT 224 or [redacted])

Based on information provided by USAID/Amman in calls today, the Refugee Camp had 1980, 1500 household connections to the Irbid Municipal Water Supply System. We are assuming that these were not included in the previously noted 1,735 residential connections. In 1980, therefore, residential connections now total 14.2 thousand, rather than the 12.7 thousand previously estimated. The following number of residential connections for Irbid for the 1981-89 include both the connecting of current unmetered customers (in 1981 and 1982) and increments in population growth: (000)

| | | | |
|---|---|---|---|
| 1981 - ~~16.7~~ 16.9 | 1985 - ~~20.0~~ 21.2 | 1989 - ~~23.1~~ 24.7 | |
| 1982 - ~~18.7~~ 18.6 | 1986 - ~~20.8~~ 22.0 | | |
| 1983 - ~~18.7~~ 19.5 | 1987 - ~~21.3~~ 22.7 | | |
| 1984 - ~~19.7~~ 20.2 | 1988 ~~22.3~~ 23.6 | | |



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Resources ENG

(2)

Reconnection costs (if necessary) for the current metered customers in the Refugee Camp will not be charged to the investment account but assumed as a direct burden on the customer. The number of non residential water connections remain unchanged.

The assumption remains unchanged that the Refugee Camp will not be connected to the proposed sewage disposal system.



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bc: T.J. Turley
R. E. Beam
C. J. Kelly

WESTON INTERNATIONAL, INC.
DESIGNERS-CONSULTANTS
WESTON WAY • WEST CHESTER, PA 19380 • PHONE (215)692-3030 • TELEX 83-5348

11 July 1980

Mr. Robert F. Fedel, P.E.
Chief, Syria, Jordan, Israel Div.
Bureau for Near East
Office of Capital Development
Agency for International Development
Department of State
Washington, D.C. 20520

Dear Mr. Fedel:

Enclosed is a copy of an internal Weston International memo, transmitted to you for your approval to proceed, in agreement with the instructions provided by Jim Miller before his recent departure to Egypt. We would appreciate your prompt review and sign-off so that we might proceed with the required analysis.

As requested, we have incorporated the data changes associated with the Refugee Camp (reference telecopy cable and notes from L.Rosenberg) into the memorandum so that the final analysis effort accurately reflects project conditions.

Very truly yours,

Van Dyke Pollemus
Principal Economist
For Weston International

VDP:mm

Enclosure

cc: Jim Miller



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# inter-office memorandum

TO: J. Miller cc: T.J. Tuffey
R.E. Beam
C.J. Kelly
R.F. Fedel, A.I.D., Washington, D.C.
L. Rosenberg, A.I.D., Washington, D.C.

DATE: July 11, 1980

FROM: V.D. Polhemus Va

SUBJECT: Jordan Project Analysis Final Effort for A.I.D., Washington, D.C.

W. O. No.:

As a result of the meeting in Washington, D.C. on 8 July 1980 between Weston International staff, (R.E. Beam and V.D. Polhemus) and A.I.D. Washington and Jordan (L. Rosenberg and J. Cassanos), we are in a position where the A.I.D. requested supplemental analysis can be finalized. This memorandum serves to document the base data that will be used in this final iteration, and to identify and limit the analysis and discussion that will be included. Since this will be Weston's final presentation of this analysis, this memo requests immediate approval to proceed, and confirmation regarding the data that will be used and the analysis undertaken. (As a result this memo will be ~~telecopied~~ expressed mailed to R.F. Fedel, A.I.D. Washington on ~~11~~ 12 July 1980.)

The requested final submission will be based on the earlier Weston International, Inc. effort directed to Robert Fedel, dated 2 July 1980. However, it will utilize revised input data and respond to the comments in L. Rosenberg's memorandum of 7 July 1980 by including requested additional schedules and clarification. Explanations and discussions of methods used in analysis will be presented as footnotes to the extent possible. More lengthy discussion will be appended, if necessary.

## 2 JULY 1980 WESTON INTERNATIONAL, INC. EFFORT

The 2 July 1980 Weston International, Inc. effort provides the framework for the revised submission including:

1. Basic assumptions from Page 2 of cover letter which are consistent with the discussions of 16 June 1980 (unchanged).
2. Schedule/Application of Capital Contributions (revised-Table 5 attached).
3. Three sets of financial tables (water, wastewater and combined water and wastewater) (to be revised).
4. Five tables presenting user charges, unit costs and ability to pay identified on Page 1 of letter. (to be revised).



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## REVISED DATA

Data revisions will include the following:

1. Water Consumption Table provided by Jim Cassanos dated 8 July 1980 (xerox copy attached, Table 1).
2. Water Connections Table provided by Jim Cassanos dated 8 July 1980 (xerox copy attached, Table 2).
3. Wastewater Connections Table provided by Jim Cassanos dated 8 July 1980 (xerox copy attached, Table 3).
4. Capital requirements (escalated) presented by Weston International, Inc. (2 July 1980 on Page 2 of the letter)are consistent with the xerox copy of Construction Funding Schedule 1981-1989 (1979 costs) presented at the 8 July meeting and previsouly at 16 June meeting. The capital requirements, previously including reconnection investments of 40,000 JD in 1981, 1982 and 1983 (which was previously escalated at 10%) will be revised to 34,000 JD in 1981, 1982 and 1983 according to the attached Table 4 to reflect the reduction in reconnections and again escalated.
5. Table 5 (attached) which is consistent with Table 4. This table presents the Application of Capital Contributions and identifies the manner in which A.I.D. grants of $2.5M and $21.0M in loans will be distributed and the allocation of Government of Jordan (GOJ) equity (grants) based on the Table 5 attachment.

## RESPONSE TO COMMENTS

The following responses will be made to L. Rosenberg's memorandum 7 July 1980, "Comments Upon Supplemental Financial Analysis Information on Irbid Water Supply and Wastewater Project..." Numbers 1-23 correspond to Mr. Rosenberg's numbers and must be understood in conjunction with his memorandum.

1. Tables 1, 2, and 3 (attached) replace the previously used 2 July 1980 "numbers of customers connected "with estimates acceptable to A.I.D.
2. Non-residential customers are also addressed in Tables 1, 2, and 3.
3. Also addressed in the revised Tables 1, 2 and 3.
4. Bulk water supplies for the Refugee Camp will be included in the financial tables (washed out) based on escalated wholesale water prices from WSC and the Water needs of the Camp identified in Table 1 (attached).

ANNUAL REFUGEE CAMP BULK WATER SALES

| YEAR | WATER REQUIRED* ($M^3 \times 10^6$) | PRICE (fils/$m^3$) | ANNUAL COST (JD x 1000) |
|---|---|---|---|
| 1980 | .26 | 75 | 19.5 |
| 1981 | .29 | 85 | 24.6 |
| 1982 | .33 | 98 | 32.3 |
| 1983 | .36 | 113 | 40.6 |
| 1984 | .40 | 130 | 52.0 |
| 1985 | .42 | 150 | 63.0 |
| 1986 | .46 | 172 | 77.4 |
| 1987 | .49 | 198 | 97.0 |
| 1988 | .54 | 228 | 123.0 |
| 1989 | .59 | 262 | 154.5 |

* Assumes 25% loss 1980-1985 and 20% losses thereafter.

not applicable; to be treated as residential users



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5. A schedule of deposits will be presented to identify water supply revenue differences between Computer Analysis Tables and Income and Expenditure Statements.

6. The costs of reconnecting existing customers at JD6.5 per connection will be charged to an investment account for 1981, 1982 and 1983 based on the number of reconnections required by Table 2 (attached). These costs will be escalated at 10% along with the other capital costs. The method and basis of the cost will be provided.

7. The cash flow analysis will be used for identifying the portion of user charges and annual revenue that is attributed to wholesale water purchases. This escalated cost of wholesale water will be distributed between residential and non-residential customers.

8. No response required - information not available.

9. A table will be prepared to identify the application of inflation factors, payroll deductions and quantity related cost increases for water and wastewater.Depreciation methods will be explained.

10. The basis for 1980 salaries, wages, and operation and maintenance costs will be prepared and factors affecting increases in costs identified.

11. If possible, the whole sale cost of water will be a wash item in the Income and Expenditure Statement for Water supply. If not, because of complications with the model arrangement, approximations will be made to balance revenues and expenses during the period of the study.

12. The A.I.D. Loan will be $21.0 Million, not $21.5 million. Grants and loans will be applied to the project as identified in Table 5 (attached).

13. Explanation of the basis for the current asset/current liability calculation for water supply and wastewater will be provided. Interest during construction will be capitalized and then expended once facility operations are initiated including grace period interest. Post 1984 financing assumes GOJ equity contributions (grants).

14. A schedule will be prepared for water supply and wastewater indicating the basis for interest capitalized during construction and the interest payments on existing and on proposed A.I.D. loans to be relent to the utility by the GOJ.

15. The wastewater administrative fees will be collected from new customers at the time the system becomes operational, consistent with the Wastewater Connections Schedule Table 3 (attached). Septage dumping fees will be collected from private haulers, who will be required to dispose of septic tank wastes at the new wastewater treatment plant when it is operational. Current operation by private haulers involves collection and disposal at presumably approved locations. Since there is no existing wastewater management authority, current practices are poorly monitored. The new utility will not assume responsibility for this disposal until the treatment plant is fully operational. The attached table 6 indicates the revenues that will be collected and the technique for calculating that revenue.

16. The basis for wastewater operation and maintenance costs will be presented and factors affecting future conditions and escalation will be described.



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17. A schedule will be provided to describe capitalized interest during construction and interest on debt service payments on the GOJ relending of the A.I.D. loan for the total project.

18. Wholesale water costs will be escalated at 15 percent per annum from the 1979 "current" price of 65 fils/$m^3$ (all escalations in this project are escalated from "current"1979 values). Table 1 (attached) presents the Total Water Sold and Total Water Required, which will be the basis for water related costs in the supplemental analysis to be presented by Weston International, Inc.

    Water use increase (lpcd) will be 6.0 percent per annum.

19. Table 9-22 Annual User Charges (residential) for water and wastewater are obtained (see footnote 2) from the computer analysis Table 9-9A "User Charges JD 1/Month Resident" x 12 months. The request for user charges (fils/$m^3$) for the combined project relates to Table 9-33. A column will be inserted in Table 9-33 to express the combined water and wastewater unit charge (JD/$m^3$).

20. Error noted and will be corrected.

21. Table 9-25 number of metered residential households (11,412) based on survey information and reported number of existing connections 14,500 (Irbid Water Department). Numbers are in apparent agreement with Mr. Cassanos' number of water connections (15,500 total connections in 1980, see Table 2.)

22. As indicated in the comment, Table 9-32 excludes in the bulk price of water. Wholesale price is included at 65 fils/$m^3$ escalated at 15% per annum. A description of the analysis methods will be presented, in addition to refined table notes, to explain the JD 610,000 revenue figure (revised) and methods used.

23. Due to the required rapid turn-around-time for the 2 July 1980 Supplemental Analysis, the column Water Charges, Unit Charge includes .389 JD/cu m. This was inadvertently pulled from column 5 instead of 6 in table 9-32. Footnote 1 should read 1985 instead of 1989.

    Sources of data and explanations of consistency will be presented to assist the reader in understanding the revised supplement.

ADDITIONAL SCHEDULES/CLARIFICATION

As indicated in the preceeding section regarding Mr. Roseberg's comments on the 2 July 1980 Weston International, Inc. Supplement to A.I.D., additional schedules and tables will be presented to assist the reader through the analysis. Other analyses tables and supplements will also be included, if they will assist in understanding the project implications. Weston will review the project with respect to internal rate of return. Since the project has been set up to be non-profit and depreciation is not included in the cash flow computer analysis, the calculation will be based on deflated investment costs and operating costs and deflated sales revenues, as we (L. Rosenberg and I) discussed at the 8 July 1980 meeting. In the event the analysis does not appear to be useful, we will notify A.I.D. and omit the exercise from the analysis.

A similar approach will be taken in the preparation of incremental cost and revenue tables. Previous attempts at presenting incremental costs and revenues have been unsatisfactory because of the variability of the project in the initial years.

The cost of connecting existing refugee households to water system (1500 connections) at 6.5 JD each total = 9750 JD, will be included as 1980 operation and maintenance (escalated). The revenue to cover this cost will come from user charges to residential and non residential users. All further refugee households will pay a 19 JD administrative connection fee.



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TABLE 1

8 July 1980

## WATER CONSUMPTION

| YEAR | RESIDENTIAL Connections (000) | RESIDENTIAL Persons[1] (000) | RESIDENTIAL LCPD[2] | RESIDENTIAL Total (MCM/YR) | REFUGEE CAMP Connections (000) | REFUGEE CAMP Persons[1] (000) | REFUGEE CAMP LPCD[2] | REFUGEE CAMP Total (MCM/YR) | Total Resid. (MCM/YR) | Non-Res.[3] MCM/YR | Total Water Sold MCM/YR | Water Required[4] (MCM/YR) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1980 | 12.7 | 90 | 34 | 1.12 | 2.3 | 16 | 34 | 0.20 | 1.32 | 0.36 | 1.68 | 2.24 |
| 1981 | 14.9 | 104 | 36 | 1.37 | 2.4 | 17 | 36 | 0.22 | 1.59 | 0.40 | 1.99 | 2.65 |
| 1982 | 16.2 | 113 | 38 | 1.57 | 2.5 | 18 | 38 | 0.25 | 1.82 | 0.45 | 2.27 | 3.03 |
| 1983 | 16.9 | 118 | 40 | 1.72 | 2.6 | 18 | 40 | 0.27 | 1.99 | 0.50 | 2.49 | 3.32 |
| 1984 | 17.6 | 123 | 43 | 1.93 | 2.7 | 19 | 43 | 0.30 | 2.23 | 0.56 | 2.79 | 3.72 |
| 1985 | 18.4 | 129 | 45 | 2.12 | 2.8 | 20 | 45 | 0.32 | 2.44 | 0.61 | 3.05 | 4.07 |
| 1986 | 19.1 | 134 | 48 | 2.35 | 2.9 | 20 | 48 | 0.36 | 2.71 | 0.67 | 3.38 | 4.23 |
| 1987 | 19.8 | 139 | 51 | 2.59 | 3.0 | 21 | 51 | 0.39 | 2.98 | 0.74 | 3.72 | 4.65 |
| 1988 | 20.6 | 144 | 54 | 2.84 | 3.1 | 22 | 54 | 0.43 | 3.27 | 0.82 | 4.09 | 5.11 |
| 1989 | 21.4 | 150 | 57 | 3.12 | 3.2 | 22 | 57 | 0.47 | 3.59 | 0.90 | 4.49 | 5.61 |

[1] Assume 7 persons per household

[2] LCPD - Liters per capita per day

[3] Non-residential use equals 20% of total water sold

[4] 25% losses from 1980 through 1985 and 20% thereafter

See Table 2

Source: U.S.A.I.D. J. Cassanos



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TABLE 2 8 July 1980

## WATER CONNECTIONS

| Year | Unconnected Existing Households: IRBID | Unconnected Existing Households: Refugee Camp* | | Connections**: Residential | Connections**: Non-Residential | Connections**: Total |
|---|---|---|---|---|---|---|
| 1979 | | | | | | |
| 1980 | 2000 | 2,300 | 14.2 | 12,700 | 2,800 | 15,500 |
| 1981 | 700 | 2,400 | 16.9 | 14,900 | 3,000 | 18,000 |
| 1982 | - | 2,500 | 18.6 | 16,200 | 3,100 | 19,300 |
| 1983 | - | 2,600 | 19.5 | 16,900 | 3,200 | 20,100 |
| 1984 | - | 2,700 | 20.2 | 17,600 | 3,400 | 21,000 |
| 1985 | - | 2,800 | 21.2 | 18,400 | 3,500 | 21,900 |
| 1986 | - | 2,900 | 22.0 | 19,100 | 3,700 | 22,800 |
| 1987 | - | 3,000 | 22.7 | 19,800 | 3,800 | 23,600 |
| 1988 | - | 3,100 | 23.6 | 20,600 | 4,000 | 24,600 |
| 1989 | - | 3,200 | 24.7 | 21,400 | 4,100 | 25,500 |

~~* Assumes 16,000 persons in 1979; about 7 persons per household; households increase at rate of 4.5% per year through 1985.~~

** Actual number of connections in May 1980 was 14,688. Assumes, as Weston does, that there were 2,800 non-residential connections. Assumes that Irbid will connect existing unserved households in 1980-1982 and that number of households connected will increase in proportion to population growth. (Assuming 172,000 people in 1989 at 7 people per household, number of households - 24,600)

5-106 Source: U.S.A.I.D. J. Cassanos

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TABLE 3

8 July 1980

WASTEWATER CONNECTIONS

| YEAR | RESIDENTIAL NO. OF CONNECTIONS | RESIDENTIAL PERSONS SERVED | RESIDENTIAL % OF POPULATION | NON-RESIDENTIAL CONNECTIONS | TOTAL CONNECTIONS |
|---|---|---|---|---|---|
| 1980 | - | - | - | - | - |
| 1981 | - | - | - | - | - |
| 1982 | - | - | - | - | - |
| 1983 | - | - | - | - | - |
| 1984 | 2000 | 14000 | 10 | 1600 | 3600 |
| 1985 | 4000 | 28000 | 19 | 2200 | 6200 |
| 1986 | 5800 | 40600 | 27 | 2400 | 8200 |
| 1987 | 8000 | 56000 | 35 | 2600 | 10600 |
| 1988 | 12200 | 85400 | 52 | 3500 | 17500 |
| 1989 | 18500 | 129500 | 75 | 4100 | 22600 |

Source: U.S.A.I.D. J. Cassanos



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TABLE 4

A.I.D. PROJECT

Construction Funding Schedule[1], 1981-1989

(Costs - JD x 1,000)

(1979 Costs)

| Description | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | Total Cost |
|---|---|---|---|---|---|---|---|---|---|---|---|
| WATER DISTRIBUTION | | | | | | | | | | | |
| Water Dist. Costs | 286 | 800 | 800 | 800 | 220 | 220 | 220 | 220 | 220 | ---- | 3786 |
| Existing User Connections[2] | 34 | 34 | 34 | | | | | | | | 102 |
| WASTEWATER SYSTEM | | | | | | | | | | | |
| Wastewater Trmnt Plant Costs | 284 | 829 | 324 | 323 | --- | --- | --- | --- | --- | ---- | 1760 |
| Sewer Construction Costs | 287 | 1600 | 823 | 700 | --- | --- | 688 | 689 | 688 | ---- | 5475 |
| SUBTOTAL WASTEWATER SYSTEM COSTS | 571 | 2429 | 1147 | 1023 | --- | --- | 688 | 689 | 688 | ---- | 7235 |
| TOTAL PROJECT COSTS | 891 | 3263 | 1981 | 1823 | 220 | 220 | 908 | 909 | 908 | ---- | 11123[4] |
| TOTAL ESCALATED[3] COSTS | 1079 | 4343 | 2900 | 2936 | 390 | 429 | 1947 | 2143 | 2355 | | 18522[4] |

NOTES: [1]All costs in this table are constant 1979 costs. AID-financed construction to start in 1981 and end in 1984. Balance of Phase I program to be completed form 1987 to 1989. An allowance of JD 220,000 per year from 1985 through 1989 has been provided for an annual program by WSC to replace 20% per year of the existing water mains that are no longer usable.

[2]Includes 6.5JD cost (1979 JD) to connect 15,500 existing residential and non-residential users to new system. Total cost = JD 100,750 applied over 1981, 1982, 1983 (JD 34,000 per year).

[3]Costs escalated at 10% per year.

[4]Total cost in 1979 JD cannot be escalated to obtain total escalated cost because a separate escalation factor is applied to each year's total.

Source: Based on U.S.A.I.D. Construction Funding Schedule 16 June 1980 meeting



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TABLE 5

APPLICATION OF CAPITAL CONTRIBUTIONS
(JD x 1000)

| YEAR | 1979 COSTS[1] | | ESCALATED COSTS[2] | | | | GOJ EQUITY | | TOTAL GRANT REQ. IN 1979 JD |
|---|---|---|---|---|---|---|---|---|---|
| | CAPITAL REQUIRED | RECONNECTION INVESTMENT | CAPITAL REQUIRED | RECONNECTION INVESTMENT | A.I.D. GRANT | A.I.D. LOAN | CAPITAL REQUIRED | RECONNECTION INVESTMENT | |
| **WATER SUPPLY** | | | | | | | | | |
| 1980 | - | 34 | - | - | - | - | - | - | - |
| 1981 | 286 | 34 | 346 | 41 | 250 | - | 96 | 41 | 320 |
| 1982 | 800 | 34 | 1064 | 45 | - | 665 | 399 | 45 | 334 |
| 1983 | 800 | - | 1171 | 50 | - | 731 | 440 | 50 | 334 |
| 1984 | 800 | - | 1288 | - | - | 805 | 483 | - | 300 |
| 1985 | 220 | - | 390 | - | - | - | 390 | - | 220 |
| 1986 | 220 | - | 429 | - | - | - | 429 | - | 220 |
| 1987 | 220 | - | 472 | - | - | - | 472 | - | 220 |
| 1988 | 220 | - | 519 | - | - | - | 519 | - | 220 |
| 1989 | 220 | - | 571 | - | - | - | 571 | - | 220 |
| TOTAL | 3688 | 102 | 6250 | 136 | 250 | 2201 | 3799 | 136 | 2388 |
| **WASTEWATER** | | | | | | | | | |
| 1980 | - | - | - | - | - | - | - | - | - |
| 1981 | 571 | - | 691 | - | 500 | - | 191 | - | 571 |
| 1982 | 2429 | - | 3233 | - | - | 2020 | 1213 | - | 911 |
| 1983 | 1147 | - | 1679 | - | - | 1049 | 630 | - | 430 |
| 1984 | 1073 | - | 1648 | - | - | 1030 | 618 | - | 383 |
| 1985 | - | - | - | - | - | - | - | - | - |
| 1986 | - | - | - | - | - | - | - | - | - |
| 1987 | 688 | - | 1475 | - | - | - | 1475 | - | 688 |
| 1988 | 689 | - | 1624 | - | - | - | 1624 | - | 689 |
| 1989 | 688 | - | 1784 | - | - | - | 1784 | - | 688 |
| TOTAL | 7235 | - | 12134 | - | 500 | 4099 | 7535 | - | 4360 |

SOURCE: [1]1979 Capital and reconnection costs: Table 4 A.I.D. Project Funding Schedule 1981-1989.
[2]Escalation at 10% per annum

TABLE 5

ATTACHMENT NOTES

1. A.I.D. Grant - $2,500,000 x .3 = 750,000 JD to be provided in 1981 on a percentage basis with the balance of funding provided by GOJ Equity Funding.

| | Escalated Capital Required | % Total Capital Required | A.I.D. Grant Distribution |
|---|---|---|---|
| 1981 Water Supply | 346 | 33.3 | 250 |
| 1981 Waste Water | 692 | 66.7 | 500 |
| Total Requirement | 1038 | 100.0 | 750 |

2. A.I.D. Loan - $21,000,000 x .3 = 6,300,000 JD to be provided in 1982,1983, and 1984 on a percentage basis of Capital Required with GOJ equity funding.

| | | | |
|---|---|---|---|
| Escalated W/S Capital Required | ('82,'83,'84) | 3,523 | |
| Escalated W/W Capital Required | ('82,'83,'84) | 6,560 | |
| Total Capital Required | ('82,'83,'84) | 10,083 | (100.0%) |
| Provided by A.I.D. Loans | | 6,300 | ( 62.5%) |
| Provided by GOJ Equity | | 3,783 | ( 37.5%) |

LOAN/EQUITY DISTRIBUTION

(JD x 1000)

| | WATER SUPPLY | | | WASTEWATER | | |
|---|---|---|---|---|---|---|
| YEAR | Total Escalated Capital Required | A.I.D. Loan | GOJ Equity | Total Escalated Capital Required | A.I.D. Loan | GOJ Equity |
| 1982 | 1,064 | 665 | 399 | 3,233 | 2,020 | 1,213 |
| 1983 | 1,171 | 731 | 440 | 1,679 | 1,049 | 630 |
| 1984 | 1,288 | 805 | 483 | 1,648 | 1,030 | 618 |
| TOTAL | 3,523 | 2,201 | 1,322 | 6,560 | 4,099 | 2,461 |



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TABLE 6

SEPTAGE REVENUES

| | Irbid Population[1] 000 | Sanitary District Population[2] 000 | STP Served[3] 000 | Septic Users (Persons)[4] 000 | Septic Users (Households)[5] | Number Emptied (1/5; Once Every Five Years)[6] | Number of Loads[7] | Cost[8] (J.D.) 000 |
|---|---|---|---|---|---|---|---|---|
| 1984 | 140.8 | 245.0 | 14.0 | 212.0 | 30,280 | 6,056 | 15,140 | 151 |
| 1985 | 147.2 | 256.0 | 28.0 | 208.0 | 29,700 | 5,940 | 1,485 | 148 |
| 1986 | 153.1 | 266.4 | 40.6 | 205.8 | 29,400 | 5,880 | 1,470 | 147 |
| 1987 | 159.2 | 277.0 | 56.0 | 200.0 | 28,600 | 5,720 | 1,430 | 143 |
| 1988 | 165.6 | 288.1 | 85.4 | 180.7 | 25,800 | 5,160 | 1,290 | 129 |
| 1989 | 172.2 | 299.6 | 129.5 | 148.1 | 21,200 | 4,240 | 1,060 | 106 |

1. 1979 Census
2. 1.74 times Irbid population
3. See J. Cassanos data
4. Difference between subdistrict population and Irbid served population (does not include refugee population of Table 1)
5. Based on 7 persons per household
6. Septic tanks emptied every 5 years (engineers estimate)
7. 2.5 loads per septic tank ($4m^3$ per truckload) $10M^3$ capacity
8. Cost is 10JD per truckload.

## SECTION 6

## COST ESTIMATES -- WATER DISTRIBUTION AND SEWAGE COLLECTION SYSTEM CONTRACTS

Total Phase I project costs are given in Chapter 9, Tables 9-2 (1979 prices) and 9-3 (escalated prices). These tables present the proposed investment program developed in accordance with the revised construction schedule presented in Figure 6-1.

The revised construction schedule and investment program were developed after detailed review and analysis of the Phase I construction program for the water distribution and sanitary sewer collection systems. These systems were broken down into prioritized individual construction contract packages. The contract packages listed first (i.e., WAT 1, SAN 1, SAN 2) are viable, self-sufficient projects which will provide improved services to Irbid even if construction of subsequent projects is delayed.

The following tables present descriptions, details, and estimated costs in 1979 prices for the proposed Phase I water distribution and sewage collection system construction contract packages.



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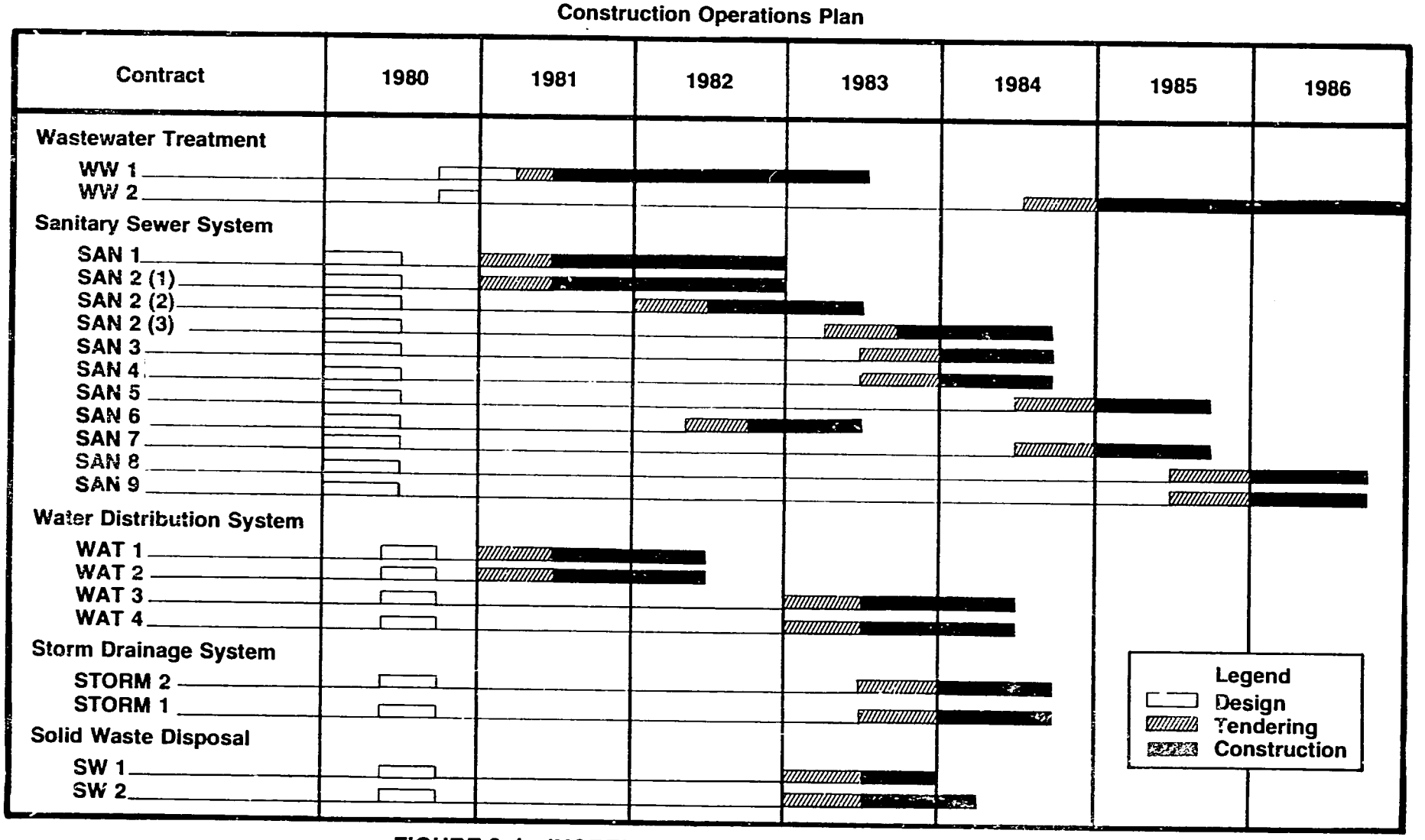


FIGURE 6-1 INCREMENTAL IMPLEMENTATION PLAN



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Table 6-1

## Phase 1 -- Water Distribution System Construction Contracts Contract Description and Estimated Costs

Contract WAT 1 -- Construct water mains to establish the most needed distribution system loops, especially in southern and western areas of the City and establish distribution system pressure zones.

| Item | Cost - JD |
|---|---|
| Pipes | 607,000 |
| Valves | 18,000 |
| Service connections | 248,000 |
| Pressure reducing stations | 46,000 |
| Air relief valves | 5,000 |
| Subtotal | 924,000 |
| Engineering and administration | 139,000 |
| Contingencies | 139,000 |
| Total | 1,202,000 |

Contract WAT 2 -- Construct additional water mains required for distribution system loops.

| Item | Cost - JD |
|---|---|
| Pipes | 325,000 |
| Valves | 10,000 |
| Service connections | 168,000 |
| Subtotal | 503,000 |
| Engineering and administration | 75,000 |
| Contingencies | 75,000 |
| Total | 653,000 |

Contract WAT 3 -- Construct additional water mains required for distribution system loops and replace a portion of undersized and/or unserviceable lateral mains.

| Item | Cost - JD |
|---|---|
| Water main pipe | 112,000 |
| Water main valves | 4,000 |
| Lateral main pipe | 111,000 |
| Lateral main valves | 9,000 |
| Service connections | 389,000 |
| Subtotal | 625,000 |
| Engineering and administration | 94,000 |
| Contingencies | 94,000 |
| Total | 813,000 |

Contract WAT 4 -- Complete Phase 1 water main construction, air relief valves, and carry out additional lateral main replacement.

| Item | Cost - JD |
|---|---|
| Water main pipe | 488,000 |
| Water main valves | 11,000 |
| Lateral main pipe | 146,000 |
| Lateral main valves | 5,000 |
| Air relief valves | 6,000 |
| Service connections | 145,000 |
| Subtotal | 801,000 |
| Engineering and administration | 120,000 |
| Contingencies | 120,000 |
| Total | 1,041,000 |



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# Table 6-2

## Phase 1 -- Sanitary Sewer Construction Contracts
## Contract Description and Estimated Costs

| Contract Designation and Description | Pipe Diameter (millimeters) 750 | | | 600 | | | 500 | | | 400 | | | 250 | | | 200 | | | Pump Station Cost (JD) | Force Main | | Sub-Total (JD) | Contingencies -- 15% (JD) | Engineering and Admin. - 15% (JD) | Total Cost (JD) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Length (meters) | No. of Manholes | Cost (JD) | Length (meters) | No. of Manholes | Cost (JD) | Length (meters) | No. of Manholes | Cost (JD) | Length (meters) | No. of Manholes | Cost (JD) | Length (meters) | No. of Manholes | Cost (JD) | Length (meters) | No. of Manholes | Cost (JD) | | Length (meters) | Cost (JD) | | | | |
| SAN 1 -- Includes Interceptor A; A-4 and A-7 trunks; A-4, A-7A, A-7B, and A-7C laterals; A-5, A-6, A-6A, A-8, A-10, A-11, A-18, and A-19 trunks and laterals; pump station no. 2; and force main. | 2,268 | 27 | 207,881 | - | - | - | 3,025 | 72 | 179,597 | 1,650 | 18 | 57,846 | 1,375 | 15 | 29,711 | 42,245 | 461 | 823,465 | 27,000 | 500 | 7,500 | 1,333,000 | 200,000 | 200,000 | 1,733,000 |
| SAN 2 (1) -- Includes interceptor B to B-3 connection; B-3, B-3A, and B-3B trunks; and B-3A and B-3B laterals. | 1,040 | 10 | 48,508 | 400 | 3 | 20,706 | 1,770 | 15 | 68,157 | - | - | - | - | - | - | 13,770 | 146 | 258,629 | - | - | - | 396,000 | 59,500 | 59,500 | 515,000 |
| SAN 2 (2) -- Includes B-3C and B-3D trunks and laterals. | - | - | - | - | - | - | - | - | - | 1,200 | 17 | 41,882 | - | - | - | 23,130 | 236 | 432,718 | - | - | - | 474,600 | 71,200 | 71,200 | 617,000 |
| SAN 2 (3) -- Includes remainder of interceptor B (Phase I), B-2A, B-2B, B-4, B-6, and B-9 trunks and laterals; industrial park laterals; pump station no. 1; and force main. | - | - | - | - | - | - | 1,010 | 10 | 39,981 | - | - | - | 1,000 | 8 | 20,147 | 23,603 | 216 | 430,412 | 20,000 | 1,250 | 21,860 | 532,400 | 79,800 | 79,800 | 692,000 |
| SAN 2 -- Total | 1,040 | 10 | 48,508 | 400 | 3 | 20,706 | 2,780 | 25 | 108,138 | 1,200 | 17 | 41,882 | 1,000 | 8 | 20,147 | 60,503 | 598 | 1,121,759 | 20,000 | 1,250 | 21,860 | 1,403,000 | 210,500 | 210,500 | 1,824,000 |
| SAN 3 -- Includes A-3 trunk and laterals. | - | - | - | - | - | - | - | - | - | - | - | - | 820 | 9 | 17,813 | 7,740 | 68 | 142,987 | - | - | - | 160,800 | 24,100 | 24,100 | 209,000 |
| SAN 4 -- Includes A-7C1 and A-9 trunk and laterals. | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 14,480 | 127 | 267,700 | - | - | - | 267,700 | 40,150 | 40,150 | 348,000 |
| SAN 5 -- Includes A-14 trunk and laterals; pump station no. 3; and force main. | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 3,170 | 28 | 58,850 | 27,000 | 1,200 | 18,000 | 103,850 | 15,575 | 15,575 | 135,000 |
| SAN 6 -- Includes A-15 and A-16 trunks; and A-15A and A-16A laterals. | - | - | - | - | - | - | - | - | - | 3,180 | 38 | 110,032 | - | - | - | 10,815 | 62 | 192,968 | - | - | - | 303,000 | 45,000 | 45,000 | 393,000 |
| SAN 7 -- Includes B-2 and B-5 trunks and laterals. | - | - | - | - | - | - | - | - | - | - | - | - | 1,200 | 22 | 30,331 | 6,460 | 52 | 129,669 | - | - | - | 160,000 | 24,000 | 24,000 | 208,000 |
| SAN 8 -- Includes A-12 and A-13 trunks and laterals. | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 15,210 | 125 | 279,200 | - | - | - | 279,200 | 41,900 | 41,900 | 363,000 |
| SAN 9 -- Includes A-15B, A-15C, and A-16B laterals. | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 11,140 | 75 | 201,600 | - | - | - | 201,600 | 30,200 | 30,200 | 262,000 |
| Total Phase I Costs | 3,308 | 37 | 256,389 | 400 | 3 | 20,706 | 5,805 | 97 | 287,735 | 6,030 | 73 | 209,760 | 4,395 | 54 | 98,002 | 171,763 | 1,596 | 3,218,194 | 74,000 | 2,950 | 47,360 | 4,212,150 | 631,425 | 631,425 | 5,475,000 |

Note: All costs in this table are 1979 costs.



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