

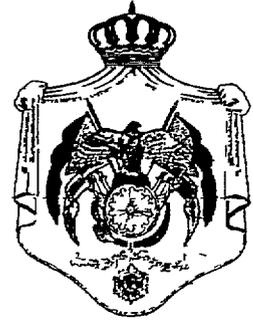
PN-ACE-748  
101052

# Water Quality Improvement and Conservation Project

## Hydrometeorological Monitoring Plan

Ministry of Water and Irrigation  
Science Applications International Corp.  
WAJ Surface Water Basins Division

*The Hashemite Kingdom of Jordan*



*Ministry of Water and Irrigation*



The Technical Assistance Team Includes  
Development Alternatives, Inc  
Science Applications International Corp  
Harza Environmental Services, Inc  
Development Associates, Inc



United States Agency for International Development  
Contract No 278-0288-00-C-4026-00 (Old)  
Contract No 278-C-00-94-0026-06 (New)

April 1998

A

3114-98-1c-041

**Hydrometeorological Monitoring Plan**

**Water Quality Conservation and Improvement Project  
Ministry of Water and Irrigation  
The Hashemite Kingdom of Jordan**

**United States Agency for International Development  
Contract No 278-C-00-94-0026-09**

**April 1998**

**Prepared by Science Applications International Corporation and  
WAJ Surface Water Basins Division  
Ministry of Water and Irrigation**

**Water Quality Conservation and Improvement Project**  
**Ministry of Water and Irrigation**  
**The Hashemite Kingdom of Jordan**

**Table of Contents**

<b><u>Section</u></b>	<b><u>Page</u></b>
<b>List of Tables</b>	11
<b>List of Figures</b>	111
<b>1 0 Introduction</b>	1
<b>2 0 Monitoring Program Objectives</b>	2
2 1 Overview	2
2 2 Program Objectives	3
<b>3.0 Overview of Climate in Jordan</b>	6
<b>4 0 Monitoring Network Design</b>	8
4 1 Status of Existing Monitoring System	8
4 2 Evaluation and Rehabilitation of Precipitation Monitoring Network	9
4.3 Evaluation and Rehabilitation of Evaporation Monitoring Network	14
4 4 Equipment Requirement and Specifications	15
4 5 Telemetry	18
<b>5 0 Data Evaluation</b>	19
<b>6 0 References</b>	20

C

## Table of Contents (Continued)

### List of Tables

#### Table

- 1 Proposed Action for the Rehabilitation and Upgrade of WAJ Precipitation Monitoring Network
- 2 Proposed WAJ Precipitation Monitoring Network
- 3 Proposed Action for the Rehabilitation and Upgrade of WAJ Evaporation Monitoring Network
- 4 Proposed WAJ Evaporation Monitoring Network
- 5 Meteorological Stations, Meteorology Department, Ministry of Transport
- 6 Summary of Rehabilitation and Upgrade of Precipitation Monitoring Network
- 7 Equipment Requirements for Precipitation Monitoring Network

### List of Figures

#### Figure

- 1 Cyclic Behavior of 5 YR MVA Rainfall-Amman 52 & 26 YR Cycles
- 2 Cyclic Behavior of 5 YR MVA Rainfall-Amman 14 & 8 YR Cycles
- 3 Current Status of Precipitation Monitoring Network
- 4 Current Status of Evaporation Monitoring Network
- 5 Rehabilitation and Upgrade of Precipitation Monitoring Network
- 6 Rehabilitation and Upgrade of Evaporation Monitoring Network

## 1 0 Introduction

The Ministry of Water and Irrigation (Ministry) is responsible at the national level for administering water policy and managing water resources in Jordan. A major component of the Water Quality Improvement and Conservation (WQIC) Project is to assist the Ministry in establishing a national water monitoring program for collecting surface and ground water resources and quality data and information. The monitoring program also includes the monitoring of springs and hydrometeorological variables (rainfall and evaporation). This comprehensive and integrated monitoring program is essential to the improvement of the Kingdom's national water resources assessment, management, conservation, and planning. It also will help identify additional sources of water (recharge, water harvesting) and improve water quality.

This document presents the details for the hydrometeorological monitoring program. It discusses the objectives of the monitoring program, an assessment of the existing program, rehabilitation and upgrade of the hydrometeorological monitoring network, types of data to be collected by the program, the uses of the data, and the frequency of monitoring.

## 2 0 Monitoring Program Objectives

### 2 1 Overview

Being in an arid region, Jordan's freshwater resources are limited, dependent on highly variable rainfall, and subject to substantial evaporation losses. In the past, settlement patterns and agricultural activities were adapted to the natural variability of the precipitation. During the last half-century, population growth and rapid urbanization has led to a considerable increase in water demand. This has resulted in the decline of ground water levels and the drying-up of several springs in addition to the deterioration of water quality in several aquifers and springs.

Jordan, as well as any other country of the globe, also may be affected by potential global climate changes due to the greenhouse effect. Possible climate changes would affect the severity and frequency of floods and droughts. More severe floods could be a potential threat to human life and to the economic sector. More prolonged droughts are likely to most adversely affect water shortage areas. A preliminary analysis of precipitation records for the Amman Airport station (Figure 1) indicates that Amman has experienced drought periods reaching up to seven (7) consecutive years of below average precipitation (1958-1963). Under the current water situation in Jordan, a drought period of this magnitude would create a serious water problem. The Amman Airport station data also indicate that the five (5) year moving average annual rainfall follows a quasi-cyclic behavior, which is dictated mainly by the 52, 26, 14, and 8 year cycles (Figures 1 and 2). Further analysis of precipitation data for other parts of the country are recommended. However, the preliminary analysis suggests that annual precipitation data can play a significant role in the prediction of wet and dry sequences which are an important tool for water resources management planning.

The planning, development, management, and protection of national water resources and water quality require an integrated, national water resources monitoring network (especially precipitation, climate, surface water, ground water, spring discharge, and water quality). This is important in order to improve the present knowledge about the national climate and to fully understand how water quantity and quality vary during a year and over a period of years.

This document focuses on the hydrometeorological (precipitation and climate) monitoring program. The ground water, surface water, and springs monitoring programs have been developed and are presented in earlier monitoring plan reports.

## 2 2 Program Objectives

### Objectives

The principal goal for the monitoring program is to obtain reliable precipitation and climate data in order to

- 1) Improve the present knowledge about the climate in different parts of the country
- 2) Provide precipitation and climate data for current and future water planning and development and management projects
- 3) Evaluate the runoff response to precipitation and establish precipitation-runoff relationships or models in order to obtain better estimations of surface water resources and reliable estimations of flood magnitudes, which are very useful for flood warning and operation of dams
- 4) Design storage and recharge dams, roads and bridges, urban storm drainage, and other flood protection and soil conservation structures
- 5) Develop a better understanding of the relationships between precipitation and ground water recharge
- 6) Evaluate the response of spring discharges to precipitation in order to predict the behavior of spring flows, especially during drought periods
- 7) Distinguish between natural variability of ground water levels and spring flows, due to precipitation, and their decline due to over-exploitation
- 8) Obtain more reliable estimates of the water balance for each surface water basin
- 9) Provide realistic estimates of water demands for various crops in order to achieve higher irrigation efficiencies
- 10) Provide data for the national precipitation enhancement (cloud seeding) project and other projects related to non-conventional water resources (waste water reuse, precipitation harvesting, etc )
- 11) Study the behavior of precipitation and climatic patterns and their role in water resources planning and management, especially during drought periods

### Data Requirements

The basic data and information required to achieve the above objectives mainly are air temperature, relative humidity, wind direction and speed, solar radiation, barometric pressure, soil temperature and soil moisture, evaporation, and precipitation. These data may be required on an hourly, daily, weekly, monthly, seasonal, or annual basis depending on their use. Precipitation data also are required for shorter time periods (5 min, 15 min, and 30 min) and in the form of intensity (mm/hr) for design of dams, bridges, roads, culverts, and other hydraulic structures.

The data obtained by the hydrometeorological monitoring program will be analyzed and evaluated using a variety of standard techniques and tools. These practices generally are applicable and consistent world-wide and frequently have been formalized by the World Meteorological Organization (WMO).

#### Decision Rules

There are mainly three types of decision rules which are dependent on precipitation and evaporation data. The first type relates to the operation of dams where specific decision rules must be established (for each dam) according to the magnitude of surface flows generated by each precipitation storm. The second type is related to the operation of irrigation systems which depend on soil moisture, precipitation, and evapotranspiration. The third type of decision rule is related to the management of water allocation priorities for water use sectors, especially under water shortage or drought conditions.

#### Data Quality

Data Quality Objectives (DQOs) are qualitative and quantitative statements specified to ensure that data of known reliability are obtained from a monitoring program. In addition, the identification of monitoring requirements involves specifying the data measurement techniques/methods, monitoring station design, number of stations (network density) according to topography and climate, data measurement frequency, types of data to be measured, and the level of quality control required. As data needs are established or refined, logistical planning can be conducted to ensure that data are acquired expeditiously and cost effectively. Data quality objectives constantly must be re-evaluated and refined as new information is obtained.

Data quality is the degree of certainty of data with respect to precision, accuracy, reproducibility, comparability, and completeness. Several levels of qualitative and quantitative specificity have been defined for data quality and presented in WMO data manuals.

#### **Representativeness**

Data measured or samples collected during performance of the tasks for this program must be representative of the precipitation or climate of the area under investigation and must be obtained using accepted and valid techniques. Any variations in measurement techniques, required field conditions, or environmental conditions should be noted in the field log book. Any observable parameter variations, matrix differences, and environmental conditions likewise will be noted in the field log book.

### **Completeness**

The completeness of the precipitation or hydroclimatic data-set for a particular type of monitoring station will be assessed by comparison of the amount of data required with the amount of data obtained. Loss of data due to equipment or station malfunction should be documented. Quality control data, as appropriate, will be recorded and if data are rejected on the basis of quality control results, the reason for data rejection and corrective action taken should be documented in the analytical report.

### **Comparability**

Consistency in the acquisition, measurement, or analysis of data is necessary for the comparison of results to be meaningful.

### **Precision and Accuracy**

Precision refers to the reproducibility of a measurement method when it is repeated in a homogeneous environment regardless of whether or not the observed values are representative of the true values. Precision can be expressed by standard deviation. Accuracy refers to the agreement between the value of a parameter measured by a method and the actual value of the parameter.

Precision and accuracy of data may be enhanced by using calibrated instrumentation (especially in the case of tipping bucket precipitation gauges), proper measurement techniques for given climatic conditions, and by repeating measurements.

### 3 0 Overview of Climatic Conditions in Jordan

Jordan has a predominantly Mediterranean climate (Hydrometeorology Department, 1988). The climate is characterized by a cool, wet winter and a hot, dry summer. Precipitation mainly falls during the winter season. The topography and the proximity of the desert have a significant affect on the regional climate which is divided into four main zones namely Al Ghor, the hilly or mountain region, Al Badia, and the Gulf of Aqaba.

#### Al Ghor

Al Ghor extends along a north-south axis for approximately 400 kilometers, almost parallel to the eastern coast of the Mediterranean Sea, and its width (east-west) varies gradually from 15 kilometers in the north to 30 kilometers in the south. Al Ghor is composed of three main areas: the River Jordan Valley, the Dead Sea (the lowest area on earth), and Wadi Araba. Its elevation ranges from -190 meters below mean sea level in the north to around -400 meters below mean seas level in the south. The average daily mean temperature varies between 15°C in the winter and around 30°C in the summer. The average relative humidity is approximately 65% in the winter and 45% in the summer. The average annual rainfall is approximately 300 millimeters (mm) in the north decreasing southward to 75 mm in Ghor Al Safi and to less than 50 mm in Wadi Araba.

#### Hilly Region

The hilly region lies along a north-south axis adjacent to Al Ghor and extends eastward to the Badia or the desert region. The mountain peaks reach 1150 meters (above mean sea level) at Ras Maneif near Ajlun, 1365 meters at Shoubak north of Petra, and exceed 1500 meters at El Qurain. Around 80% of Jordan's population live in the hilly region, which is characterized by cold winters with occasional snow falls (1 to 3 times a year) and moderate summers. The average daily mean temperature in Amman is around 8°C in January and reaches 25°C in August. The average relative humidity is 70% during the winter and 35% in the summer. The mean annual precipitation exceeds 500 mm in the northern mountains and decreases to less than 200 mm in the south.

#### Badia Region

The Badia or desert region is located in the eastern part of Jordan. The Badia is characterized by cold winters and hot, dry summers. The average mean daily temperature during the winter is approximately 12°C and 26°C in the summer. The relative humidity is 60% during the winter and 30% during the summer, and the mean annual rainfall is below 100 mm with a significant area below 50 mm.

Gulf of Aqaba

The Gulf of Aqaba is characterized by warm winters and hot, dry summers. The average mean daily temperature is close to 19°C in the winter and 31°C during the summer. The average relative humidity is 55% in the winter and 35% in the summer. The mean annual rainfall is approximately 30 mm.

## **4 0 Monitoring Network Evaluation and Rehabilitation**

### **4 1 Status of Existing Monitoring System**

Precipitation measurements started in 1923 in Amman. A limited number of stations were added in the 1930s. Most of the existing precipitation monitoring network was established in the 1960s (Table 1). On the other hand, climatic data collection was initiated in the late 1950s with an expansion of the network in the 1960s and in the 1980s.

The Water Authority of Jordan (WAJ) in the Ministry of Water and Irrigation and the Meteorology Department (MD) in the Ministry of Transport are the two government agencies which have been responsible for collecting precipitation and climatic data. The MD has a network of 36 meteorological stations divided into five (5) types: (a) six (6) agrometeorological stations, (b) five (5) principal climatological stations, (c) 11 synoptic stations, (d) one (1) marine station in Aqaba, and (e) 13 auxiliary stations (Table 5). Each of the 36 meteorological sites has either recording or non-recording (manual) precipitation gauges. The Meteorology Department also has 60 precipitation monitoring sites run by volunteers. Data from these 60 stations are not published, they are only for internal use.

Being responsible for providing data for water resource assessment, planning, development, and management, the WAJ has a large precipitation network and a significant climatic or evaporation monitoring network. The WAJ database indicates a total of 276 precipitation stations (Table 1 and Figure 3), only 175 are operational. Table 3 and Figure 4 indicate that 21 out of the 34 evaporation sites are operational. The climatic stations will be referred to in this report by their WAJ denomination "evaporation stations".

The existing precipitation and evaporation monitoring network is mainly composed of old equipment, which is no longer manufactured. As a result, a number of precipitation and climatic stations have been discontinued because of lack of spare parts. Recent and future water related projects such as storage/recharge dams, water supply, irrigation, flood protection, basins' water balance, springs and ground water quality remediation, and drought management dictate an urgent need to rehabilitate and upgrade the precipitation and evaporation monitoring network.

## 4 2 Evaluation and Rehabilitation of Precipitation Monitoring Network

### **Type of Precipitation Gauges in Use**

Three types of precipitation gauges are used in the WAJ network. These are the Daily Manual (M) or standard, Totalizer (T), and Recording (R) or Automatic (A) gauges. A description of each of these gauge types and data collection frequencies are presented as follows.

#### Daily Manual Gauge

This gauge consists of a circular collector above a funnel leading to a receiver. Rainfall is measured in millimeters (mm) by pouring the amount of water contained in the receiver into a measuring cylinder calibrated to the collector diameter. Daily rainfall is measured generally at 8:00 am, but the amounts are ascribed to the previous day. The observer registers the daily amount including zero if no rain occurred and reports any useful remark such as indication of cumulative amounts and missing observations.

Daily data are used for water projects such as rainfall-recharge studies, irrigation requirements, rainfall-runoff for water resources assessment, basin water balance, drought assessment, and other climate and environmental studies. The data from manual gauges also provide first-hand information, often requested by high level decision-makers, to assess current precipitation events.

#### Totalizer Gauge

This gauge is similar to the ordinary daily manual or standard gauge, but has a much greater capacity to hold seasonal or annual rain. This gauge is used in the remote uninhabited areas of the Jordanian desert. Totalizer gauges generally provide data, with sufficient level of accuracy, for annual or mean annual rainfall isohyets.

#### Recording or Automatic Gauge

There are three types of recording gauges: tipping bucket, weighing, and float. The tipping bucket gauge is the one used in Jordan, and it is the most common worldwide. It consists of a collector that funnels rainfall alternately into one of two equal sized compartments in a tipping bucket. When one compartment fills, the bucket tips and empties into a collector. Simultaneously, the second compartment is moved into place beneath the funnel to receive the incoming rainfall. Each compartment holds a precise quantity of water, equivalent to 0.1 mm, 0.2 mm, or 0.5 mm of rainfall. Each tip generates an electrical impulse which is transmitted to a chart recorder or digital recorder. The tipping bucket gauges require occasional calibration, at least once a year, to maintain the accuracy of the data.

Recording gauges provide data about the intensity and the temporal distribution, at various time increments (5 min or shorter, 10 min, 15 min, 30 min, 1 hour, etc ) These data are mainly essential for flood warning and flood protection, storage or recharge dam design and operation, and design of roads, bridges, and storm drainage systems

### **Evaluation and Rehabilitation**

The evaluation and rehabilitation of the precipitation network took into account the objectives defined in Section 2, the regional climatic characteristics in Jordan (Section 3 of this report), and the World Meteorological Organization (WMO) guidelines about precipitation density networks for various areas The analysis of the current status of the precipitation network, illustrated in Table 1 and Figure 3, reveals the following

- 1) The current network density is generally adequate The network is proposed to be improved by reactivating 17 of the non-operational stations, adding 14 new sites to fill in data gaps, and discontinuing 17 operating stations judged to be in the proximity of either a meteorological station or an operating WAJ station located at similar altitude
- 2) The existing equipment is in urgent need of rehabilitation and upgrading Sixty-nine (69) stations require rehabilitation (19 of them need new SIAP clocks) and 13 stations are planned for upgrading More details are presented in Tables 6 and 7

The proposed monitoring network shown in Table 2 and Figure 5 includes, in addition to the official 36 precipitation stations of the Department of Meteorology stations, 189 WAJ stations divided into 74 manual daily, 82 automatic (chart or digital recorders), and 33 totalizers (Table 6) The regional assessment and analysis of the precipitation monitoring needs are reported hereafter

#### Jordan Valley and Rift Side Wadi Basins

There are 24 operational and 17 non-operational WAJ precipitation stations in this area (Tables 1 and 6) Most of the stations in the Jordan Valley are non-functional This area requires precipitation data for better evaluation of crop water requirements and better irrigation efficiencies Seven (7) non-operational stations are proposed for reactivation, one (1) new site is planned in the southern part of the Jordan Valley (Dead Sea North) and another precipitation gauge will be added as part of the proposed Karama Dam evaporation station Two (2) operational stations are recommended for discontinuation because of their proximity to other stations (see Table 1 and Figure 3 for details)

Tables 1 and 2 show that five (5) stations require rehabilitation and one is suggested for upgrading The rehabilitation, upgrading, reactivation, and installation of new stations require one (1) SIAP clock, 5 new automatic gauges, and 11 new manual gauges (Table 7)

The planned precipitation monitoring network for the Jordan Valley and Rift Side Wadi Basins (Table 6 and Figure 5) is composed of 29 WAJ stations (16 manual daily and 13 automatic) and 7 Meteorology Department stations. This corresponds to a network density of approximately 75 km<sup>2</sup>/gauge. Note that in some cases a WAJ station, generally manual, is retained in the vicinity of a meteorology station to provide first hand information during storm events. In these cases the meteorology station is not counted in the estimation of the network density.

#### Yarmouk River Basin

The Jordanian part of the Yarmouk River Basin has 21 operational and 10 non-operational WAJ precipitation stations (Tables 1 and 6). Three (3) new sites are planned to cover the data gaps in the eastern part of the Basin and in the higher elevations between Ibbin and Irbid (Table 2 and Figure 5). Three operational stations are recommended for discontinuation because of their proximity to other stations (see Table 2 and Figure 3 for details).

Tables 1 and 2 indicate that five (5) stations need rehabilitation and two (2) stations are planned for upgrading. The rehabilitation, upgrading, reactivation, and installation of new stations require two (2) SIAP clocks, five (5) new automatic gauges, and four (4) new manual gauges (Table 7).

The planned precipitation monitoring network for the Jordanian part of the Yarmouk River Basin (Table 6 and Figure 5) has 21 WAJ stations (10 manual daily and 11 automatic) and two (2) Meteorology Department stations. This is equivalent to a network density of approximately 60 km<sup>2</sup>/gauge.

#### Zarqa River Basin

This basin includes 33 operational and 24 non-operational WAJ precipitation stations (Tables 1 and 6). This basin is judged to be heavily gauged, especially in the Greater Amman area. Seven (7) operational stations are recommended for discontinuation because of their proximity to other stations (see Table 2 and Figure 3 for details). On the other hand, 10 stations need rehabilitation and three (3) are planned for upgrading. The rehabilitation, upgrading, reactivation, and installation of new stations require one (1) SIAP clock, three (3) new automatic gauges, and 11 new manual gauges (Table 7).

The planned precipitation monitoring network for the Zarqa River Basin is composed of 26 WAJ stations (16 manual daily, 1 totalizer, and 9 automatic) and six (6) Meteorology Department stations. This corresponds to a network density of approximately 130 km<sup>2</sup>/gauge (Table 6).

### Dead Sea Basin

This basins has nine (9) operational and nine (9) non-operational WAJ precipitation stations (Tables 1 and 6) Two (2) non-functional stations are recommended for reactivation and one (1) gauge is planned as part of the new proposed Dead Sea Evaporation Station (Table 2 and Figure 5) Eight (8) stations need rehabilitation and four (4) are planned for upgrading The rehabilitation, upgrading and reactivation require three (3) SIAP clocks, four (4) new automatic gauges, and eight (8) new manual gauges (Table 7)

The planned precipitation monitoring network for Dead Sea Basin (Table 2 and Figure 5) includes 12 WAJ stations (2 manual daily and 10 automatic) and one (1) Meteorology Department station This is equivalent to a network density of approximately 125 km<sup>2</sup> /gauge (Table 6)

### Wadi Mujib and Hasa Basins

Both Wadi Mujib and Hasa Basins have 25 operational and 13 non-operational WAJ precipitation stations (Tables 1 and 6) Two (2) of the non-functional stations are recommended for reactivation and one (1) operational station (Qatrana Evaporation Station), in Mujib Basin, will be discontinued because of its proximity to the Qatraneh Department of Meteorology station Four (4) new sites are planned to cover data gaps in the southern part of the Wadi Mujib Basin and in the eastern part of the Hasa Basin in the western high altitude areas (Table 2 and Figure 5) Fifteen (15) stations need rehabilitation and two (2) are planned for upgrading The rehabilitation, upgrading, reactivation, and installation of new stations require seven (7) SIAP clocks, four (4) new automatic gauges, and 25 new manual gauges (Table 7)

The planned precipitation monitoring network for the Wadi Mujib and Hasa Basins (Table 2 and Figure 5) include 30 WAJ stations (12 manual daily, 15 automatic, and 3 totalizers) and nine (9) Meteorology Department stations This corresponds to a network density of approximately 280 km<sup>2</sup> /gauge (Table 6)

### Wadi Araba Basins

Both Wadi Araba North and South Basins have 28 operational and 14 non-operational WAJ precipitation stations (Tables 1 and 6) Four (4) of the non-functional stations are proposed for reactivation and one (1) operational station (Aqaba Evaporation Station), in Araba South, will be discontinued because of its proximity to the Aqaba Department of Meteorology station and Aqaba WAJ precipitation station (ED0001) Three (3) new sites are planned to cover data gaps in the 800 meter altitude and the low land areas (Table 2 and Figure 5) Sixteen (16) stations, mainly in Wadi Araba North, need rehabilitation and one (1) is planned for upgrading The rehabilitation, upgrade, reactivation, and installation of new stations

require four (4) SIAP clocks, four (4) new automatic gauges, and 17 new manual gauges (Table 7)

The planned precipitation monitoring network for the Wadi Araba North and South Basins (Table 2 and Figure 5) include 34 WAJ stations (11 manual daily, 14 automatic, and 9 totalizers) and three (3) Meteorology Department stations. This is equivalent to a network density of approximately 200 km<sup>2</sup>/gauge (Table 6)

#### Azraq Basin

This basin includes 14 operational and six (6) non-operational WAJ precipitation stations (Tables 1 and 6). One (1) of the non-functional stations (Qasr Tuba) is proposed for reactivation to cover a data gap in the southern part of the basin. Six (6) stations need rehabilitation. The rehabilitation and reactivation of new stations require one (1) new automatic gauges, one (1) SIAP clock, and six (6) new manual gauges (Table 7)

The planned precipitation monitoring network for the Azraq Basin (Table 2 and Figure 5) has 15 WAJ stations (2 manual daily, 7 automatic, and 6 totalizers) and three (3) Meteorology Department stations. This corresponds to a network density of approximately 870 km<sup>2</sup>/gauge (Table 6)

#### Jafer Basin

Jafer Basin has 12 operational and five (5) non-operational WAJ precipitation stations (Tables 1 and 6). One (1) of the non-functional stations (Jordhan) is recommended for reactivation, and the Ma'an Railway station is suggested for discontinuation because of its proximity to the Ma'an station (G0003). Four (4) stations need rehabilitation. The rehabilitation and reactivation require five (5) new manual gauges (Table 7)

The planned precipitation monitoring network for the Jafer Basin (Table 2 and Figure 5) includes 12 WAJ stations (5 manual daily, 1 automatic, and 6 totalizers) and four (4) Meteorology Department stations. This is equivalent to a network density of approximately 1000 km<sup>2</sup>/gauge (Table 6)

#### Desert Areas

These areas have nine (9) operational and three (3) non-operational WAJ precipitation stations (Tables 1 and 6). One (1) new gauge is planned for installation as part of the proposed Disi evaporation station. All the nine (9) operational stations, mainly totalizers, do not require rehabilitation. The planned precipitation monitoring network for the Desert Areas (Table 2 and Figure 5) includes 10 WAJ stations (2 automatic, and 8 totalizers) and one (1) Meteorology Department station. This corresponds to a network density of approximately 40000 km<sup>2</sup>/gauge (Table 6)

The WMO standard precipitation density guidelines are 100-250 km<sup>2</sup>/station for mountain areas of Mediterranean climate, 600-900 km<sup>2</sup>/station for flat regions of Mediterranean climate, and 1500-10000 km<sup>2</sup>/station for desert areas. A comparison of these standards to the network densities in various parts of Jordan indicate once again that in all cases the existing and the planned network densities, which are approximately similar because only 14 new stations were added in this plan, generally are greater than the WMO standard. Further rationalization of the precipitation network might be achieved after more manipulation and analysis of the precipitation data.

#### **4.3 Evaluation and Rehabilitation of Evaporation Monitoring Network**

The evaporation monitoring network in Jordan is composed of 69 sites, 36 (Table 5) belong to the Meteorology Department of the Ministry of Transport (referred herein as Met) and 33 to WAJ (Table 3). Approximately 56 stations (36 Met and 20 WAJ) are operational. This represents a significantly high number, which ideally should be about 40 as a maximum. The regional distribution of the climatic network (also referred as the evaporation network) indicates overlap of the Met and WAJ stations in some areas. Prior to the evaluation of the WAJ network, the different types of Met stations were analyzed in comparison with the WAJ climatic parameters monitoring requirements.

The Ministry of Water and Irrigation stations (operated by WAJ) are required to provide parameters for the estimation of evaporation and evapotranspiration. This can be accomplished with a station which measures air temperature, relative humidity, wind speed and direction, solar radiation, barometric pressure, evaporation, precipitation, soil temperature and soil moisture.

Among the Met stations, the agrometeorological stations comply with all above requirements, the principal climatological and synoptic stations are marginally acceptable. On the other hand, the auxiliary stations provide only precipitation, air temperature, relative humidity and wind speed data, which are insufficient for evapotranspiration calculations. Thus, only 25 Met stations are considered suitable for consideration in the evaluation of the WAJ climatic monitoring network.

Based on climatic data requirements, the status of WAJ's current climatic network, and the data provided by the 25 Met stations, it is proposed (as presented in Table 3) to reactivate the Mushaqqar (CC0004) and Khirbit Es Samra (AL0066) stations, and to upgrade King Talal Dam (AL0053), Hasa (CF007), Feedan (DA007), and Rahma (EA002) to automatic stations. It also is proposed to relocate the Hasa and Feedan stations to the location of the future Tannour and Feedan dams, respectively. Five (5) of the current operating stations are

planned for discontinuation because of their proximity to Meteorology Department stations (Table 3) and four (4) other operating stations (namely, AD0037, CD0010, F0002, and H0001) are proposed to be discontinued at a later stage (Table 3). Four (4) new evaporation stations are proposed for Mujib Dam, Karama dam, the Dead Sea, and Disi. The Dead Sea station is supposed to measure the evaporation of the Dead Sea free water. On the other, the Disi station is planned to provide data for future development projects in the area.

The planned WAJ evaporation-monitoring network includes 21 automatic stations (11 existing, 4 to be upgraded, 2 to be reactivated, and 4 new). This will require that 10 new climate stations be procured. After discontinuation of stations AD0037, CD0010, F0002, and H0001, the WAJ evaporation-monitoring network will be reduced to 17 automatic stations.

This monitoring plan also recommends close cooperation between the Ministry of Water and Irrigation and the Ministry of Transport in order to achieve the objectives of their respective programs via a reasonable climatic network, preferably not exceeding 40 stations.

#### **4.4 Equipment Requirements and Specifications**

The equipment requirements and specifications for the Hydrometeorological Monitoring Network in Jordan are presented in two parts: precipitation network requirement and climatic network requirements.

##### **Precipitation Network**

Table 7 indicates that the equipment requirements for the rehabilitation and upgrading of the precipitation monitoring network, including spare parts, is evaluated to 30 automatic rain gauges, 25 SIAP clocks, and 100 manual daily rain gauges. Detailed specifications for the manual daily and automatic rain gauges are given below.

##### Automatic Gauges

A rugged and high accuracy tipping bucket rain gauge and recorder suitable for unattended 3 month (minimum) operation in remote arid areas with temperature varying between -20°C to 60°C. A gauge with a heated system for snow measurement events is preferable for highland areas. Both gauge and recorder should require only minimum maintenance, and preferably should be adaptable for future connection to a telemetry system. Additional specifications for both rain gauges and recorders are as follows:

1. Rain gauge: A rugged tipping bucket gauge with switch closure mechanism, made entirely of corrosion resistant materials including stainless steel, aluminum or copper, collecting funnel with sharp edge smooth inside, and a minimum of 6 inch diameter, bucket capacity of a minimum of 0.2 mm per tip, handles high intensity rain with an

- 
- accuracy of 2% to 3%, unlimited capacity, lockable and weather proof housings to protect the tipping buckets, the wire junctions, and the recording unit
  - 2 Recording unit Preferably dual chart/digital recording units with all accessories Both recorders should handle a minimum of 3 month data Rechargeable long lasting (6 months) batteries
  - 3 Data reader unit A portable field data reader is preferable( downloading data to portable computer is a second option) for data transfer, programming, and calibration
  - 4 Office data retrieval and processing Complete set of friendly user software and associated hardware for office data retrieval and processing

#### Standard Rain Gauge

A rugged gauge to measure daily total rainfall amounts with the following specifications

- 1 Collecting funnel with sharp edge and smooth inside, minimum of 6 inch diameter
- 2 Collecting bucket or tank with a minimum capacity of the equivalent of 300 mm of rain (or 2 times maximum observed daily rainfall in Jordan)
- 3 Measuring glass with graduation varying from 0 to 10 mm or 0 to 20 mm marked with 0.1 mm divisions
- 4 Gauge entirely of corrosion resistant materials including stainless steel, aluminum or copper
- 5 Rigid bracket for fastening the gauge to a post

#### **Climate or Evaporation Network**

The upgrade and rehabilitation of WAJ's evaporation network requires 10 complete climate stations, as detailed in section 4.3. The spare parts consist of 3 sets of sensors for a complete climate station. All new meteorological stations support telemetric data retrieval peripherals (radio, telephone or satellite). Detailed specifications for a complete climate station are presented hereafter.

#### Equipment Specifications of a Complete Climate Station

A rugged and durable self-contained station for measuring climatic parameters in remote arid area with high accuracy and minimum maintenance, and preferably adaptable for future connection to a telemetry system.

#### **Sensors**

The climate station would have the following sensors

- 1 Air Temperature Sensor -20°C to 60 °C, accuracy of about 0.5%
- 2 Relative Humidity Sensor 0 to 100%, accuracy of about 2% to 4%
- 3 Wind Speed (anemometer) 0 to at least 100 knots (maximum observed in Jordan 74 knots in Safawi), accuracy 1% to 2%

- 4 Wind Direction (vane) range of 360° for mechanical and 355° for electrical
- 5 Solar Radiation (Pyronometer) accuracy about 5%
- 6 Barometric Pressure 600 to 1100 mb
- 7 Soil Temperature -20 °C to 60 °C
- 8 Soil Moisture (tensiometer, at 5 cm ,10 cm, 20 cm,50 cm, and 100 cm depths) minimum 0% saturation
- 9 Evaporation Sensor with Class A evaporation pan
- 10 Precipitation See rain gauge specifications

### **Accessories**

- 1 Recording Unit Datalogger that measures all the above sensors and stores data The capacity of the storage module should handle a minimum of 3 months data
- 2 Data Reader Unit A portable field data reader is preferable( downloading data to portable computer is a second option) for data transfer, programming, and calibration
- 3 Office data retrieval and processing Complete set of friendly user software and associated hardware for office data retrieval and processing
- 4 Cables All cables and necessary analog channels required for a complete, user installable, and operational climate station with all above sensors
- 5 Power supply Rechargeable batteries via a solar panel
- 6 Enclosures Lockable and weather proof housings to protect the wire junction panels and recording unit
- 7 Tower Rugged tripod tower with complete hardware to place sensors, enclosures, and power supply (solar power panel)
- 8 Lightning Protection Complete lightning protection equipment for signal lines and power lines

### **Manufacturers**

The manufacturers recommended by USGS and National Office of Hydrology (NOAA)

- 1 Campbell Scientific, Inc  
815 W 1800N  
Logan, Utah 84321-1784  
Tel 435-750-9514  
Fax 435-750-9540  
Email [Karl@campbellsci.com](mailto:Karl@campbellsci.com)
- 2 Sutron  
21300 Ridgetop Circle  
Sterling, Virginia 20166  
Tel 703-406-2800

Fax 703-406-2801

Email [sales@sutron.com](mailto:sales@sutron.com)

3 Handar

5801 Lee Highway

Arlington, Virginia 22207

Tel 703-533-8753

Fax 703-533-3190

4 Qualimetrics (Weathertronics)

1165 National Drive

Sacramento, California 95834

Tel 916-928-1000

Fax 916-928-1165

### 4.3 Telemetry

Telemetry is becoming the most common tool for real-time acquisition of hydrometeorological and other water related data. Telemetry has several important applications. It can be used in Jordan to retrieve precipitation and surface water data on a real time basis for flood forecasting and warning, for real time operation of storage and recharge dams, and operation of the Jordan Valley irrigation network management. It also speeds up data collection and reduces the expense of long trips to remote sites to collect logged data. In addition, telemetry can keep a check on the performance of the data collection stations and give an early warning of failure. At present, however, telemetry systems are expensive to construct and operate.

It is recommended that the feasibility of starting a pilot telemetry project for the acquisition of hydrometeorological and surface water data within the next two to five years be investigated.

## 5.0 Data Evaluation

Data, including quality control data, recorded and collected by the monitoring team will be reviewed for reasonableness and general consistency with water resources conditions in the basins and recent data trends. Significant discrepancies will be discussed with the monitoring team, as appropriate, to determine if unusual conditions occurred during the measurement event or if recording errors or reporting errors may exist. The data will be checked and then will be entered into a computerized water resources database. Data entered into the computerized database will be checked again for entry and keying errors consistent with data management and database management procedures established for the overall monitoring program. Original field forms and computer entry forms will be maintained in the project files.

The analyzed data and related information also will be evaluated with respect to the program objectives and decision statements outlined in Section 2.2. The decision statements establish the basic water resources management objectives for the program. Data evaluation techniques and tools for purposes of evaluating the water resources data are not recommended in this document. Such tools or techniques are readily available depending on specific needs and may become appropriate as the monitoring program and water resources database develop and as water management requirements change.

## 6 0 References

- Ministry of Water and Irrigation 1994 Monitoring Network Objectives Statement, Water Quality Improvement and Conservation Project Prepared under USAID Contract No 278-0288-00-C-4026-00 Amman, Jordan September 1994
- Ministry of Water and Irrigation 1994a Monitoring Network Survey Document, Water Quality Improvement and Conservation Project Prepared by SAIC under funding from USAID Contract No 278-0288-00-C-4026-00 Amman, Jordan December 1994
- Ministry of Water and Irrigation 1994b Management Information System Report, Water Quality Improvement and Conservation Project Prepared by SAIC under funding from USAID Contract No 278-0288-00-C-4026-00 Amman, Jordan December 1994
- Ministry of Water and Irrigation 1995 Artificial Recharge Data Needs Document, Water Quality Improvement and Conservation Project Prepared by SAIC under funding from USAID Contract No 278-0288-00-C-4026-00 Amman, Jordan January 1995
- Ministry of Water and Irrigation 1995a Water Monitoring System Adequacy Report, Water Quality Improvement and Conservation Project Prepared by SAIC under funding from USAID Contract No 278-0288-00-C-4026-00 Amman, Jordan April 1995
- Ministry of Water and Irrigation 1995b Water Monitoring System Upgrade Plan, Appendix A, Volume 2-Monitoring System Procedures, Water Quality Improvement and Conservation Project Prepared by SAIC under funding from USAID Contract No 278-0288-00-C-4026-00 Amman, Jordan August 1995
- Ministry of Transport, Meteorological Department 1988 Jordan Climatological Data Handbook

Table 1 Proposed Action for the Rehabilitation and Upgrade of WAJ Precipitation Monitoring Network

PRCP ID	WAJ ID	SITE NAME	PGE	PGN	ALT (M)	STARTED	CLOSED	STA TYPE	OPER STATUS	ACTION	COMMENTS
1	A 0001	SHUNA (W ARAB)	208 000	224 000	197	1/10/50	30/10/68	M	NW	Discontinue	
2	A 0002	JISR SHEIKH HUSSEIN	204 300	211 500	280	10/1/44	5/15/47	M	NW	Discontinue	
3	A 0003	DAMIYA	202 500	168 000	305	10/1/64	12/30/68	M	NW	Reactivate Manual	
4	A 0006	KING HUSSEIN BR GAUGING ST	201 500	143 000	372	10/1/64	12/30/68	M	NW	Reactivate Manual	
5	A 0007	R J WAHADINA GAUGING ST	202 500	193 700	311	10/1/64	12/30/68	M	NW	Discontinue	
6	Akarama	KARAMA DAM	202 218	157 803				A	NEW		New Evaporation Station, Karama Dam
7	AB0001	AL TAIYIBA	217 500	210 500	365	11/1/34		M		Rehabilitate Manual	
8	AB0002	DEIR ABI SAID (SCHOOL)	214 500	211 500	330	11/1/33		M,R,A		Discontinue	Near AB0010 Evap Station
9	AB0003	EL QARN	204 500	195 300	178	10/1/40	12/30/56	M	NW	Reactivate and Upgrade to Auto	
10	AB0004	KH EL WAHADNEH	210 800	192 800	590	10/1/50		M		Continue Manual	
11	AB0005	GHOR KABID	203 500	149 000	300	10/1/38	10/30/39	M	NW	Reactivate Manual	
12	AB0008	KUFR AWAN	214 800	203 700	470	11/1/34		M		Continue Manual	
13	AB0010	DEIR ABI SAID	215 100	211 700	330			A		Continue Automatic Install Manual	Evap Stat near Met 10 (Taibeh)
14	AD0001	MUKHIBBA	214 000	234 000	75	10/1/51	10/1/68	M	NW	Discontinue	
15	AD0002	HARTHA	229 500	233 300	450	10/1/51		M,R		Continue R and Manual	
16	AD0003	KUFR SAUM	225 200	232 300	455	11/1/34		M		Discontinue	Near Samar Evap Stat
17	AD0004	SAMAR	224 000	231 500	425	10/1/60		M		Discontinue	Near Samar Evap Stat
18	AD0005	UM QEIS	214 000	229 000	360	12/1/34		M,R		Rehabilitate Clock	
19	AD0006	ADASIYA SCHOOL	207 200	230 300	180	11/1/34	10/30/68	M	NW	Discontinue	
20	AD0007	BAQURA AGR STATION	208 000	226 000	200	1/1/48	10/30/69	M	NW	Discontinue	
21	AD0008	KHARJA	233 500	229 500	455	11/1/34		M		Rehabilitate Manual	
22	AD0009	HAWWARA	235 500	215 500	560	11/1/34		M		Rehabilitate Manual	
23	AD0010	HUSN	233 000	210 500	680	11/1/42		M,R		Upgrade to Auto	
24	AD0011	FN NUBIYIMI	236 000	202 800	785	10/1/55		M,R		Upgrade to Auto	
25	AD0012	RAMTHA BOYS SCHOOL	244 500	218 800	520	11/1/33		M,R		Upgrade to Auto	
26	AD0013	KHANASIRA	248 500	200 300	860	10/1/50		M		Continue Manual	
27	AD0016	MAFRAQ POLICE POST	264 000	195 000	695	9/1/34		M,R		Continue R and Manual	
28	AD0017	RIHAB	253 000	192 800	900	10/1/45		M,R		Rehabilitate Clock	
29	AD0018	IBBIN	226 800	196 500	1105	11/1/37		M		Rehabilitate Manual	
30	AD0019	MAFRAQ AIR PORT	266 600	192 500	686	10/1/63		M		Discontinue	Near Met 23 (Al Matraq) and AD0016
31	AD0021	TURRA	243 300	226 600	450	10/1/65		M		Continue Manual	
32	AD0022	HOSHA	250 000	206 600	600	10/1/65		M		Continue Manual	
33	AD0023	JABER MUGHAYYIR	263 000	213 300	600	1/1/65		M		Continue Manual	
34	AD0024	ADASIYA GAUGING STAT	210 100	231 000	210	10/1/64	1967	M	NW	Discontinue	
35	AD0025	WADI KHALID RAILWAY STAT	221 000	238 000	85	10/1/64	10/30/67	M	NW	Discontinue	
36	AD0026	SAMU IRBID	219 000	213 000	380	10/1/65	10/30/73	M	NW	Discontinue	
37	AD0027	SAMA BR ROSAN EVAP STAT	228 700	227 900	550	10/1/68	12/30/85	M,R	NW	Discontinue	Evap stat moved to Samar Evap Sta
38	AD0029	JABER BS SIRHAN	262 400	213 700	595	10/1/68	1988	M	NW	Discontinue	
39	AD0031	KHALID IBN AL WALEED DAM	214 600	234 400	100	1/1/67	10/30/68	M	NW	Discontinue	
40	AD0032	BAQURA MET STATION	206 300	224 300	205	10/1/67		M		Continue Manual	Near Met 1 (Baqura Nursery)
41	AD0034	SAMAR EVAP STATION	231 900	232 300	410	1/1/85		M,R,A		Continue Auto and Manual	Evap stat
42	AD0036	MAQARIN GAUGING STATION	230 000	237 000	12	10/1/64		M		Continue Manual	
43	AD0037	UNIV OF SCIENCE & TECH	242 300	209 800				A		Continue Auto	Evap stat
44	AD0112	RAMTHA GIRLS SCHOOL	245 000	219 300	590	10/1/68	10/30/73	M	NW	Discontinue	
45	ADNEW1	NEW1	262 000	204 000				M	NEW	Install Manual	
46	ADNEW2	NEW2	274 000	203 500				A	NEW	Install Automatic	
47	ADNEW3	NEW3	229 000	205 000				A	NEW	Install Automatic	High Altitude station Approximate Coord

21

Table 1 Proposed Action for the Rehabilitation and Upgrade of WAJ Precipitation Monitoring Network

PRCP ID	WAJ ID	SITE NAME	PGE	PGN	ALT (M)	STARTED	CLOSED	STA TYPE	OPER STATUS	ACTION	COMMENTS
48	AD0400	IZRA A	268 000	252 000	575	10/1/57		SYRIAN			
49	AD0401	NAWA	248 000	255 000	563	11/1/58		SYRIAN			
50	AD0402	RAFEED	235 000	265 000	750	11/1/58		SYRIAN			
51	AD0403	SANMEIN	263 000	273 000	750	10/1/57		SYRIAN			
52	AD0404	KUNEITRA	227 000	280 000	941	12/1/58		SYRIAN			
53	AD0405	SHAHBA	302 000	252 000	1250	11/1/57		SYRIAN			
54	AD0406	FIQ	217 000	243 000	349	1/1/56		SYRIAN			
55	AD0407	EL HIMMA	213 000	233 000	167	11/1/58		SYRIAN			
56	AD0408	TELL SHIHAB	241 000	234 000	299	11/1/57		SYRIAN			
57	AD0409	SUWEIDA A	297 000	236 000	1010	11/1/57		SYRIAN			
58	AD0410	EIN ELARAB	303 000	258 000	1510	11/1/61		SYRIAN			
59	AD0411	RUSHFIDAH	323 000	232 000	1400	11/1/57		SYRIAN			
60	AD0412	DARAA	253 000	225 000	500	11/1/57		SYRIAN			
61	AD0413	MSEIFRAH	276 000	228 000	685	11/1/58		SYRIAN			
62	AD0414	BUSRAL SHAM	289 000	215 000	800	11/1/57		SYRIAN			
63	AE0001	IRBID SCHOOL	230 000	218 500	585	10/1/33		M,R		Continue R and Rehabilitate Manual	
64	AE0002	IRBID AGR STATION	230 300	217 000	555	10/1/54		M		Discontinue	Near Irbid School and Met 8 (Irbid Nursery)
65	AE0003	KAFR YUBA	225 300	216 700	560	11/1/34		M		Rehabilitate Manual	
66	AE0004	KAFR ASAD	217 000	223 000	350	12/1/62		M		Continue Manual	
67	AE0005	QUMEIM	219 000	219 600	375	10/1/73		R	NW	Discontinue	Near Met 10 (Taibeh) and AB0001
68	AF0001	WADI ZIQLAB	207 300	214 500	190	10/1/50	10/30/77	M	NW	Reactivate and Upgrade to Auto	
69	AG0002	RIHABA	224 000	204 800	925	1/1/63		M,R		Continue R and Manual	
70	AG0001	WADI JURUM	206 800	205 800	180	10/1/50	10/30/68	M	NW	Discontinue	
71	AH0001	ISHTAFTINA	220 400	196 500	920	10/1/52		M		Discontinue	Near Met 11 (Ras Muneif) and AJ0001
72	AH0002	WADI KI YAHH	207 000	199 500	200	10/1/62		M		Continue Manual	
73	AH0003	RAS MUNI II LVAP STATION	226 800	198 800	1150	10/1/68	9/20/88	M,A	NW (M)	Discontinue	Evap stat Near Met 11 (Ras Muneif)
74	AH0004	IRJAN	219 000	200 100	740	12/1/37		R		Continue R	
75	AJ0001	AJ UN POLICE POST	221 000	193 500	760	12/1/37		M,R		Rehab Manual and Rehab Clock	
76	AJ0002	KUFRINJA	216 400	189 400	640	11/1/39		M,R		Rehab Manual and Upgrade to Auto	
77	AJ0003	WADI KUFRINJA	206 800	186 000	200	10/1/51	10/30/76	M	NW	Reactivate and Upgrade to Auto	
78	AJ0004	AJLUN TEACHERS INSTITUTL	221 070	191 800	760	10/1/70	11/30/73	M,R	NW	Discontinue	
79	AL0001	AIN KHUNEIZIR	249 000	190 500	360	10/1/53	10/30/55	M	NW	Discontinue	
80	AL0002	MIDWAR	244 000	188 500	760	10/1/50		M		Rehabilitate Manual	
81	AL0003	BALAMA	252 700	182 800	695	10/1/50		M		Rehabilitate Manual	
82	AL0004	JARASH	234 500	187 500	585	11/1/42		M,R		Continue R and Rehab Manual	
83	AL0005	KI IIA	229 500	187 000	665	11/1/43		M		Continue Manual	
84	AL0006	DIBBIN NATIONAL PARK	229 000	184 800	780	10/1/50	4/30/75	M	NW	Discontinue	
85	AL0007	JARASH BR (O/D ROAD)	228 300	177 800	145	10/1/50	10/30/51	M	NW	Discontinue	
86	AL0008	ALUK	237 200	174 800	630	11/1/50		M,R		Continue Manual and Rehab Clock	
87	AL0009	DEIR ALLA (NRA)	209 500	178 500	180	10/1/50	10/30/75	M	NW	Discontinue	
88	AL0010	DEIR ALLA AGR STATION	208 500	178 000	224	10/1/52		M		Rehabilitate Manual	
89	AL0011	RUMMAN	228 500	174 300	560	9/1/42		M		Discontinue	Near King Talal Dam (AL0053)
90	AL0012	SUKHNA	250 700	171 000	500	10/1/50		M		Rehabilitate Manual	
91	AL0013	NAWASIF	267 500	166 500	590	10/1/61		M		Continue Manual	
92	AL0014	KHAW	258 000	166 000	575	10/1/46	10/30/73	M	NW	Discontinue	
93	AI 0015	ZARQA	253 000	163 800	610	11/1/34		M,R		Rehab Manual and Upgrade to Auto	
94	AL0016	RUSEIFA	248 500	158 500	655	10/1/64		M		Discontinue	Near Zarqa (AL0015)

Table 1 Proposed Action for the Rehabilitation and Upgrade of WAJ Precipitation Monitoring Network

PRCP ID	WAJ ID	SITE NAME	PGE	PGN	ALT (M)	STARTED	CLOSED	STA-TYPE	OPER STATUS	ACTION	COMMENTS
95	AL0017	SWEILIH	229 500	159 000	1000	9/1/42		M,R		Rehab Manual and Upgrade to Auto	
96	AL0018	JUBEIHA	232 000	159 200	980	11/1/37		M		Discontinue	Near Met 15 (Sweileh) and Sweilih (AL0017)
97	AL0020	AMMAN AIN GHAZAL	240 800	153 000	720	10/1/56	10/30/64	M	NW	Discontinue	
98	AL0021	AMMAN JABEL TAJ	240 000	151 500	800	10/1/52	10/30/54	M	NW	Discontinue	
99	AL0022	AMMAN HUSSEIN COLLEGE	238 200	152 000	834	11/1/50		M		Rehabilitate Manual	
100	AL0023	AMMAN JABEL AMMAN	238 000	150 500	810	10/1/39	10/30/52	M	NW	Discontinue	
101	AL0024	AMMAN LANDS DEPARMENT	238 000	150 750	821	10/1/40	10/30/61	M	NW	Discontinue	
102	AL0025	AMMAN JABEL LUWEIBDA	237 700	150 700	840	10/1/61	10/30/78	M	NW	Discontinue	
103	AL0026	BURMA	224 000	181 000	600	12/1/62		M		Rehabilitate Manual	
104	AL0027	SUBEIHI	216 500	173 000	500	11/1/62		M		Rehabilitate Manual	
105	AL0028	RUMBEIMIN	225 500	168 500	675	10/1/67		M		Discontinue	Near AL0035
106	AL0029	TAB QIRA	234 000	162 500	975	10/1/62	10/30/74	M	NW	Discontinue	
107	AL0030	RUJM ESH SHOUK (BADRAN)	238 500	165 000	950	10/1/62	10/30/74	M	NW	Discontinue	
108	AL0031	AIN ZARBI	243 000	159 500	800	10/1/62	10/30/66	M	NW	Discontinue	
109	AL0032	YAJUZ	237 000	160 000	850	10/1/61	10/30/75	M	NW	Discontinue	
110	AL0033	AMMAN RADIO STATION	238 500	146 000	925	10/1/62	10/30/77	M	NW	Discontinue	
111	AL0035	K H NURSERY EVAP ST (BAQA)	230 000	165 400	700	10/1/66		M,R		Rehabilitate Manual	Evap stat
112	AL0036	PRINCE FEISAL NURSERY	234 500	180 500	300	11/1/63		M		Upgrade to Auto	Upstream of King Talal Dam
113	AL0037	AMMAN CIGARETTE CO	239 900	151 300	780	12/1/64	10/30/75	M	NW	Discontinue	
114	AL0038	AMMAN ALWIHDAT	238 500	149 000	825	10/1/65	10/30/70	M	NW	Discontinue	
115	AL0039	ABU HAMID	233 500	165 000	700	2/1/66	10/30/72	M	NW	Discontinue	
116	AL0041	AIN AL BASHA	228 800	162 800	680	2/1/66	10/30/68	M	NW	Discontinue	
117	AL0042	AMMAN JABEL AMMAN (NRA)	235 500	151 300	840	11/1/65	10/30/78	M,R	NW	Discontinue	
118	AL0043	ABU ALANDA	241 300	145 500	990	1/1/67	3/30/85	M	NW	Discontinue	
119	AL0044	MAJDAL	229 300	181 700	500	2/1/67		M		Discontinue	Near AL0053 and AL0036
120	AL0045	UM JAUZA	220 000	167 000	860	10/1/67		M		Continue Manual	
121	AL0046	EL AL	228 600	136 300	800	10/1/67	1988	M	NW	Discontinue	
122	AL0047	SIHAN	221 600	171 800	495	10/1/67		M		Discontinue	Near AL0027
123	AL0048	KHALDIYA	276 000	177 000	630	10/1/67		M		Continue Manual	
124	AL0049	QASR I L HALLABAT	275 400	167 200	610	10/1/68		M,R		Continue R and Manual	
125	AL0050	QAFQAF A	238 800	195 300	930	10/1/67		M		Continue Manual	
126	AL0051	WADI ZARQA GAUGING STAT	232 300	180 400	230	10/1/68	1980	M,R	NW	Discontinue	
127	AL0052	BEIR EL AD AM	268 200	150 200	800	9/1/68		T		Continue to use Totalizer	
128	AL0053	KING TALAL DAM (BURMA)	228 600	178 000	218	11/1/72		M		Continue Manual	Evap stat (JVA)
129	AL0054	HASHIMIYA	255 200	171 700	550	10/1/68		M		Continue Manual	
130	AL0055	WADI DHULEIL NURSERY	271 000	174 000	575	10/1/73		M		Discontinue	Few meters form Met 25 (Wadi Dhuleil)
131	AL0057	WADI ES SIR (NRA)YARD	230 200	151 600	900	10/1/79		M,R		Continue R and Manual	
132	AL0058	SABHA AND SUBHIYEH	291 800	194 000	850	10/1/67		M		Continue Manual	
133	AL0059	UM EL JUMAL EVAP STATION	276 800	190 400	650	6/10/68		M,R,A		Continue Manual and Auto	Evap stat
134	AL0066	KHIRBET ES SAMRA EVAP ST	258 250	173 500	540	9/1/84		M,A		Continue Manual and Auto	Evap stat
135	AI 0069	W UM AL DANANIR	227 300	165 900	565	2/1/66	11/30/86	M	NW	Discontinue	
136	AL0400	SALKHAD	311 000	211 000	1447	11/1/57		SYRIAN			
137	AM0001	SALT	219 000	160 500	796	1/1/34		M,R		Continue R and Rehab Manual	
138	AM0002	W SHU BIB AGR STATION	218 000	152 800	300	10/1/54		M		Continue Manual	
139	AM0003	W SHU I IB KM 47	217 000	151 500	220	10/1/53	10/30/59	M	NW	Discontinue	
140	AM0004	SHUNET NIMRIN EVAP ST	209 500	146 000	185	11/1/54	10/30/68	M,R	NW	Discontinue	Evap stat transferred to South Shuna
141	AM0005	HUMMAR	227 000	158 800	925	10/1/55		M		Continue Manual	

Table 1 Proposed Action for the Rehabilitation and Upgrade of WAJ Precipitation Monitoring Network

PRCP_ID	WAJ_ID	SITE NAME	PGE	PGN	ALT (M)	STARTED	CLOSED	STA TYPE	OPER STATUS	ACTION	COMMENTS
142	AM0006	IRA	213 000	157 000	650	10/1/68		M		Continue Manual	
143	AM0007	SOUTH SHUNA(W SHUIB DAM)	210 500	146 000	160	3/1/65		M		Continue Manual	Evap stat
144	AMNEW1	NEW1	206 000	132 000				A	NEW	Install Automatic	Dead Sea North
145	AN0001	KAFREIN	213 800	140 000	200	10/1/44	11/30/68	M	NW	Discontinue	
146	AN0002	WADI ES SIR	227 500	151 000	720	9/1/42		M		Continue Manual	
147	AN0003	NA'UR	228 500	142 500	800	9/1/42		M,R		Continue R and Manual	
148	AN0004	ADASIYA JANOUBIYA	222 700	140 600	750	10/1/67		M		Continue Manual	
149	AN0005	KAFREIN DAM	213 800	139 300	153	2/1/69	10/30/73	M	NW	Reactivate Manual	
150	AP0001	ER RAMA	214 800	137 000	185	10/1/57	10/30/68	M	NW	Discontinue	
151	CA0002	KHANZIRA (TAIYBAT KARAK)	207 300	051 800	1000	9/1/45		M,R		Continue R and Manual	
152	CA0003	MUREISED	200 300	060 500	350	5/1/63	10/30/65	M	NW	Reactivate and Upgrade to Auto	
153	CA0004	AIY	211 000	060 300	900	5/1/63		M,R		Rehab Manual and Rehab Clock	
154	CA0005	AL AINA	224 000	042 200	775	10/1/67	10/30/68	M	NW	Discontinue	
155	CA0006	MUHAI	231 800	044 500	1000	10/1/67		M		Rehabilitate Manual	
156	CA0012	GHOR EI MAZRAA	201 000	78 000	300	1/9/39	15/6/82	M	NW	Reactivate Manual	
157	CC0001	MADABA	225 500	125 000	785			M,R		Rehab Manual and Upgrade to Auto	
158	CC0002	MA IN	219 900	120 800	810	10/1/67		M,R		Rehab Manual and Upgrade to Auto	
159	CC0004	MUSHAQQAR EVAP ST	226 200	132 900	0	12/1/84		M,R,A		Rehab Manual and Upgrade to Auto	Evap stat
160	CD0001	SAHAB	245 000	142 500	830	10/1/57		M		Rehabilitate Manual	
161	CD0002	YADUDA	236 500	139 500	850	10/1/45	2/28/66	M	NW	Discontinue	
162	CD0003	EL-MUWAQQAR	255 000	136 500	910	2/1/40		M		Rehabilitate Manual	
163	CD0004	BEIR EL TUNEIB	239 500	134 300	795	11/1/38	1/1/79	M	NW	Discontinue	
164	CD0005	JIZA	241 000	123 000	705	1/1/38		M,R		Rehab Manual and Rehab Clock	
165	CD0006	WADI WALA	223 000	107 500	350	10/1/54		M,R		Rehab Manual and Upgrade to Auto	
166	CD0007	DHIBAN	224 000	100 800	745	1/1/38		M,R		Rehab Manual and Rehab Clock	
167	CD0008	WADI MUJIB GAUGING STATION	226 500	95 000	138	10/1/52		M,R		Continue R and Rehab Manual	Install Mujib Dam evap Station at this location
168	CD0009	HEMUD	226 000	078 000	890	10/1/34		M		Rehabilitate Manual	
169	CD0010	RABBA	220 500	075 500	970	10/1/51		M,A		Continue R and Rehab Manual	Evap stat
170	CD0011	QATRANA POLICE POST	249 500	072 500	770	1/1/38		M,R		Rehab Manual and Upgrade to Auto	
171	CD0012	BIR HAI IRA	265 000	060 000	940	10/1/38	10/30/43	M	NW	Discontinue	
172	CD0013	MAZAR	216 500	052 000	1140	10/1/34		M,R		Rehab Manual and Rehab Clock	
173	CD0014	QASTAL	239 000	128 300	750	10/1/62	10/30/64	M,R	NW	Discontinue	
174	CD0015	DHABA NURSERY	250 500	111 600	750	11/1/62		M,R		Rehab Manual and Rehab Clock	
175	CD0016	JUDAYDA	211 500	105 000	725	11/1/62		M,R		Rehab Manual and Rehab Clock	
176	CD0017	UM EL RI'AS	237 500	101 000	750	10/1/62		M		Rehabilitate Manual	
177	CD0018	KHANEZ ZABEEB	255 000	097 800	775	11/1/62	10/30/78	M	NW	Reactivate Manual	
178	CD0019	JADA	222 000	089 500	900	11/1/62		M		Rehabilitate Manual	
179	CD0020	SIWAQA EVAP STATION	253 700	086 800	775	11/3/65	12/30/73	M,R	NW	Discontinue	Evap stat (closed)
180	CD0021	MANZIL	247 000	051 500	825	1/1/63	10/30/65	M	NW	Discontinue	
181	CD0022	QASR EL MUSHHEISH	254 000	038 000	850	12/1/62	10/30/63	M	NW	Reactivate Manual	
182	CD0023	QASR EVAP STATION	221 000	080 900	900	7/1/68	12/30/85	M,R	NW	Discontinue	Evap stat transferred to Rabbah
183	CD0024	YADUDA FAHID ABU JABER	236 500	139 500	850	10/1/63		M		Rehabilitate Manual	
184	CD0025	UM EL AMAD	235 000	132 000	800	10/1/63	10/30/78	M	NW	Discontinue	
185	CD0026	EZ ZEITUNA EVAP STATION	235 700	129 700	765	8/1/68	12/30/84	M	NW	Discontinue	Evap stat transferred to Mushaqqar
186	CD0027	ZABAYIR EL ADWAN	236 000	128 000	750	10/1/67	10/30/68	M	NW	Discontinue	
187	CD0028	MULEIH	228 000	110 900	630	10/1/67		M		Rehabilitate Manual	
188	CD0029	SIRFA	212 500	081 600	900	10/1/67		M		Rehabilitate Manual	

Table 1 Proposed Action for the Rehabilitation and Upgrade of WAJ Precipitation Monitoring Network

PRCP_ID	WAJ_ID	SITE NAME	PGE	PGN	ALT (M)	STARTED	CLOSED	STA-TYPE	OPER STATUS	ACTION	COMMENTS
189	CD0030	JABEL ABU HALLUFA	272 900	086 000	950	9/1/67		T		Continue Totalizer	
190	CD0031	WADI EL JINZ	276 000	054 500	825	9/1/67		T		Continue Totalizer	
191	CD0032	UM AL KINDOM	233 800	138 900	895	12/1/68	10/30/76	M	NW	Discontinue	
192	CD0033	JABEL SAKHRIYAT	274 000	026 600	910	10/1/68		T		Continue Totalizer	
193	CD0034	QATRANA EVAP STATION	249 500	073 600	730	3/1/70	12/30/82	M,A	NW (M)	Discontinue	Evap stat near Met 32 (Qatraneh)
194	CDNEW	NEW1	245 000	60 000				A	NEW	Install Automatic	
195	Dead Sea	Dead Sea	206 000	115 000				A	NEW		New Evap St Dead Sea Shore
196	CE0001	RAKIN	217 500	070 000	1050	10/1/58		M,R		Rehab Manual and Rehab Clock	
197	CE0002	AIN BISAS	213 500	067 800	700	10/1/51		M,R		Rehab Manual and Upgrade to Auto	
198	CE0003	RAS ABU HAMMUR	220 000	066 000	1090	10/1/50	10/30/57	M	NW	Discontinue	
199	CE0004	KARAK	217 000	066 000	1000	10/1/38		M,R		Rehab Manual and Rehab Clock	
200	CE0005	QABR MADHA	234 000	069 300	700	12/1/67	10/30/68	M	NW	Discontinue	
201	CF0001	GHOR ES SAFI P POST	194 800	049 500	277	9/1/39	10/30/78	M	NW	Discontinue	
202	CF0002	QAL AT AL-HASA	239 000	027 800	810	10/1/37	10/30/38	M	NW	Discontinue	
203	CF0003	JURF ED DARAWISH	233 000	011 800	940	1/1/38		M,R		Continue R and Rehab Manual	
204	CF0004	LAABAN	217 000	035 000	700	10/1/45	10/30/65	M	NW	Discontinue	
205	CF0005	HASA POLICE POST	243 000	025 800	825	11/1/62	1994	M	NW	Discontinue	
206	CF0006	GHOR ES SAFI MET STATION	193 000	051 000	285			M,R,A		Continue Auto and Rehab Manual	Evap stat Potash Company station
207	CF0007	HASA EVAP STATION	243 600	030 600	900	6/1/67		M,R		Rehab Manual and Rehab Clock	Evap stat
208	CF0008	HASA GAUGING STATION	220 400	041 600	380	10/1/68		R		Rehab Manual and Rehab Clock	
209	CFNEW1	NEW1	268 000	15 000				A	NEW	Install Automatic	Coordinates are approximate
210	CFNEW2	NEW2	215 000	17 000				M	NEW	Install Manual	Coordinates are approximate
211	CFNEW3	NEW3	210 000	35 000				M	NEW	Install Manual	Coordinates are approximate
212	DA0001	SHAUBAK SCHOOL	202 000	992 000	1300	11/1/33	10/30/81	M	NW	Discontinue	
213	DA0002	SHAUBAK AGR STATION	200 500	991 500	1475	10/1/62		M		Rehabilitate Manual	
214	DA0003	BEIR ED DABBAGHAT	198 000	980 000	1600	1/1/63		M		Rehabilitate Manual	
215	DA0004	IFJEIJ	209 000	994 000	1275	1/1/63	10/30/86	M	NW	Discontinue	
216	DA0005	UNEIZA RAILWAY STATION	226 500	989 000	1050	1/1/63		R		Rehabilitate Clock	
217	DA0006	AL HUSEINIYA SCHOOL	226 200	999 400	1062	10/1/68	1986	M	NW	Discontinue	
218	DA0007	FT'EDAN	187 300	003 750	96	12/13/85		M		Rehabilitate Manual	Evap stat
219	DB0001	TAFLE	208 000	027 500	1000	1/1/38		M,R		Rehab Manual and Rehab Clock	
220	DB0002	PRINCE HASAN NURSERY (ABUR)	218 200	023 300	1220	10/1/67		M,R		Continue R and Rehab Manual	
221	DC0001	BUSEIRA	208 000	017 000	1100	12/1/34		M,R		Continue R and Rehab Manual	
222	DC0002	RASHADIYA P POST	210 000	012 500	1500	10/1/69		M,R		Rehab Manual and Rehab Clock	
223	DD0001	AIN LAHDHA	207 300	012 800	1420	10/1/50	10/30/70	M	NW	Discontinue	
224	DD0002	DHAHAL	189 000	027 000	200	12/1/34	10/30/67	M	NW	Reactivate and upgrade to Auto	
225	DE0001	DANA	208 300	009 500	1230	12/1/34		M,R		Continue R and Rehab Manual	
226	DF0001	BEIR MADKHUR	183 000	978 700	250	12/1/34	10/30/65	M	NW	Discontinue	
227	DF0002	UM METLA	177 600	987 100	106	1/12/85		M		Continue Manual	Evap stat
228	DG0001	WADI MOUSA	196 000	970 000	1100	12/1/34		M,R		Continue R and Rehab Manual	
229	DG0002	HAY	197 000	974 000	1500	12/1/34	1988	M	NW	Reactivate and Upgrade to Auto	
230	DG0003	PETRA	192 000	972 000	1000	12/1/34		M		Rehabilitate Manual	
231	DGNEW	NEW1	180 000	970 000				M	NEW	Install Manual	
232	DH0001	TAIYIBA JANOUBIYA	194 000	963 000	300			M		Rehabilitate Manual	
233	DH0002	DILAGHA	189 000	949 300	1350	12/1/34		M		Rehabilitate Manual	
234	DH0003	RAJIF	193 000	956 000	500	12/1/34		M,R		Rehab Manual and Rehab Clock	
235	DHNEW	NEW1	185 000	953 000				A	NEW	Install Automatic	approx 800 m Alt to cover elev data gaps

Table 1 Proposed Action for the Rehabilitation and Upgrade of WAJ Precipitation Monitoring Network

PRCP_ID	WAJ_ID	SITE NAME	PGE	PGN	ALT (M)	STARTED	CLOSED	STA-TYPE	OPER STATUS	ACTION	COMMENTS
236	EA0001	GHRANDAL	169 000	945 000	220	12/1/34	10/30/66	M	NW	Reactivate and upgrade to Auto	
237	EA0002	RAHMA	162 000	926 000	105	12/13/85		M		Continue Manual	Evap stat
238	ED0001	AQABA	150 000	881 500	40	12/1/34		M		Rehabilitate Manual	
239	ED0002	RAS EN NAQB	197 000	935 000	1570	12/1/34		M,R		Continue R and Rehab Manual	
240	ED0003	RAM P POST	191 000	887 500	950	12/1/34	1995	M	NW	Reactivate and upgrade to Auto	
241	ED0004	QUWEIRA EVAP STATION	181 000	914 000	800	9/9/67	4/30/90	M	NW	Discontinue	Evap stat (closed)
242	ED0006	AL KHALDY	172 000	896 500	725	12/1/34	10/30/78	M	NW	Discontinue	
243	ED0009	JABEL BAKIR	163 500	887 000	600	12/1/62	10/30/65	M	NW	Discontinue	
244	ED0010	WADI YUTM GAUGING STAT	160 300	880 600	350	10/1/64	10/30/66	M	NW	Discontinue	
245	ED0012	RAM(QADISI) EVAP STATION	199 800	896 000	790	11/1/65		M	NW	Discontinue	Evap stat
246	ED0015	FASSUA ST	236 200	908 500	1150	10/1/65		T		Continue Totalizer	
247	ED0016	WADI RATMA	193 000	915 000	900	5/1/67		T		Continue Totalizer	
248	ED0017	WADI NASII A	209 000	902 000	850	5/1/67		T		Continue Totalizer	
249	ED0018	WADI MAS ADA	177 000	896 000	850	5/1/67		T		Continue Totalizer	
250	ED0019	WADI ARADA	225 000	899 000	920	5/1/67		T		Continue Totalizer	
251	ED0020	QAKHREIM	220 000	882 000	830	5/1/67		T		Continue Totalizer	
252	ED0021	WADI SABIF	173 000	872 000	850	5/1/67		T		Continue Totalizer	
253	ED0022	WADI MUQUR	193 000	872 000	1000	5/1/67		T		Continue Totalizer	
254	ED0023	QA'EL GHAL	208 000	882 400	910	5/1/67		T		Continue Totalizer	
255	ED0026	AQABA EVAP ST	148 000	887 000	40	1/1/96		M		Discontinue	Evap stat
256	EDNEW	NEW1	155 000	900 000				M	NEW	Install Manual	Coordinates are approximate
257	F 0001	UM EL QUTTEIN	303 500	192 500	986	10/1/47		M,R		Continue R and Manual	
258	F 0002	H5 Evap stat	348 500	180 000	715	6/3/68		M,R		Continue Manual and Rehab Clock	
259	F 0003	AZRAQ POLICE POST	321 000	139 500	533	12/1/34	10/30/70	M	NW	Discontinue	
260	F 0004	DEIR EL-KAHF	325 000	185 000	1025	3/1/63		M,R		Continue R and Rehab Manual	
261	F 0005	AZRAQ PROJECT	348 500	180 000	715	11/1/62	10/30/63	M	NW	Discontinue	
262	F 0006	AL QARYATEIN	330 000	170 000	800	3/1/63		M		Rehabilitate Manual	
263	F 0007	AL WISAD	435 000	144 800	700	3/1/63		M		Rehabilitate Manual	
264	F 0008	QASR EL HAMMAM	280 000	167 000	600	11/1/63	10/30/64	M	NW	Discontinue	
265	F 0009	AZRAQ EVAP STATION	320 000	141 500	533	10/1/64		M,R,A		Continue Auto and Rehab Manual	Evap stat
266	F 0010	ESH SHAUMARI	317 000	130 500	525	10/1/62	10/30/65	M	NW	Discontinue	
267	F 0011	EL UMARI	342 000	107 300	525	11/1/62		M,R		Continue R and Rehab Manual	
268	F 0012	QASR TUBA	300 000	083 000	750	9/1/68	10/30/89	M,R	NW	Reactivate and upgrade to Auto	
269	F 0013	WADI SALAHIB	381 500	159 700	700	9/1/67		T		Continue Totalizer	
270	F 0014	TULLUL EL KHURISHA	303 000	156 000	550	9/1/68		T		Continue Totalizer	
271	F 0015	TULLUL EL-GHAR	404 800	151 500	750	9/1/68		T		Continue Totalizer	
272	F 0016	QASAMKA	370 200	187 000	760	9/1/68		T		Continue Totalizer	
273	F 0017	GADIR EL MALLAH	358 200	163 800	630	9/1/68		T		Continue Totalizer	
274	F 0018	JABEL ASEIKHIM	334 700	151 600	640	9/1/68	10/30/70	T	NW	Discontinue	Totalizer closed
275	F 0019	JABEL MUDAYSISAT	268 000	119 200	800	9/1/68		T		Continue Totalizer	
276	F 0020	QASR EL KHARRANA	288 500	127 000	650	10/1/68		T,R		Continue R and Totalizer	
277	F 0400	IMTAN	321 000	203 000	1260	11/1/58		SYRIAN			
278	F 0401	KHIRBET AWAD	310 000	194 000	1065	12/1/57		SYRIAN			
279	G 0001	UDRUH SCHOOL	207 000	971 200	1300	11/1/62	10/30/68	M	NW	Discontinue	
280	G 0002	JAFR P POST	269 000	969 000	1300	10/1/47	6/1/80	M	NW	Discontinue	
281	G 0003	MA AN	221 000	956 500	1080	10/1/34		M,R		Continue R and Rehab Manual	
282	G 0004	BASTA	201 800	960 300	1450	1/1/62		M		Rehabilitate Manual	

Table 1 Proposed Action for the Rehabilitation and Upgrade of WAJ Precipitation Monitoring Network

PRCP ID	WAJ ID	SITE NAME	PGE	PGN	ALT (M)	STARTED	CLOSED	STA TYPE	OPER STATUS	ACTION	COMMENTS
283	G 0005	SADAQA	196 500	952 500	1500	1/1/63		M		Rehabilitate Manual	
284	G 0006	QUREIN	195 000	945 300	1500	3/1/63		M		Rehabilitate Manual	
285	G 0007	MAAN RAIL WAY STATION	223 000	954 000	1006	10/1/63		M		Discontinue	
286	G 0008	JAFR EVAP STATION	267 000	970 000	900	4/1/67	12/30/76	M	NW	Discontinue	Evap stat (closed)
287	G 0009	UDRUH EVAP STATION	206 300	973 600	1350	7/1/67		M		Continue Manual	Discontinue Evap stat keep only precip Gauge
288	G 0010	JORDHAN GAUGING STATION	221 900	965 900	1082	10/1/68	10/30/73	M	NW	Reactivate Manual	
289	G 0011	JABEL QUZEMEH	284 300	995 500	920	9/1/67		T		Continue Totalizer	
290	G 0012	QABR ES SAWW	247 000	984 000	945	9/1/67		T		Continue Totalizer	
291	G 0013	ABU TARAF	239 000	935 000	990	9/1/67		T		Continue Totalizer	
292	G 0014	INAB	331 400	932 200	950	9/1/67		T		Continue Totalizer	
293	G 0015	KABID	296 200	929 500	870	9/1/67		T		Continue Totalizer	
294	G 0016	JABEL EL BATRA	210 000	924 000	1300	5/1/67		T		Continue Totalizer	
295	G 0017	HUMEIMA	183 300	929 200	1100	5/1/67	10/30/69	M,T	NW	Discontinue	Totalizer closed
296	H 0001	H4 EVAP ST	450 500	216 000	755	6/1/68		M,R,A		Continue Auto and Manual	Evap stat Department of Meteorology
297	H 0002	TARABEEL	527 800	245 000	800	9/1/67		T		Continue Totalizer	
298	H 0003	KH UM RUJEIM	486 800	228 800	800	9/1/67		T		Continue Totalizer	
299	H 0004	TULLUL EL ASHQAF	389 200	193 000	900	9/1/67		T		Continue Totalizer	
300	J 0001	BAYIR EVAP STATION	310 500	020 000	902	9/20/67	12/30/71	M	NW	Discontinue	Evap stat (closed)
301	J 0002	EL KHERQA	333 000	076 000	635	9/1/67		T		Continue Totalizer	
302	J 0003	WADI BAYIR	359 600	042 400	650	9/1/67		T		Continue Totalizer	
303	J 0004	QA'ES SIQ	365 400	972 500	870	9/1/67		T		Continue Totalizer	
304	K 0001	EL MUDAWWARA EVAP STAT	249 000	859 000	820	9/9/67	12/30/77	M	NW	Discontinue	Evap stat (closed)
305	K 0002	DURRAH EVAP STATION	147 000	867 500	15	6/1/68	7/30/77	M	NW	Discontinue	Evap stat (closed)
306	K 0003	MUHEISH	234 000	866 000	800	5/1/67		T		Continue Totalizer	
307	K 0004	WADI DUREIBA	215 000	866 000	950	5/1/67		T		Continue Totalizer	
308	Kdis1	DISI	250 000	880 000				A	NEW		New Evaporation Station in Disi Area

NOTES

- M= Manual (daily)
- R = Chart Recorder
- T = Totalizer
- A = Automatic Digital Recorder
- NW = Not Working

27

Table 2 Proposed WAJ Precipitation Monitoring Network

PRCP_ID	WAJ_ID	SITE NAME	PGE	PGN	ALT (M)	STA TYPE	OPER_STATUS	ACTION	COMMENTS
1	A 0003	DAMIYA	202 500	168 000	305	M	NW	Reactivate Manual	
2	A 0006	KING HUSSEIN BR GAUGING ST	201 500	143 000	372	M	NW	Reactivate Manual	
3	Akarama	KARAMA DAM	202 218	157 803		A	NEW		New Evaporation Station
4	AB0001	AL-TAIYIBA	217 500	216 500	365	M		Rehabilitate Manual	
5	AB0003	EL QARN	204 500	195 300	178	M	NW	Reactivate and Upgrade to Auto	
6	AB0004	KH EL WAHADNEH	210 800	192 800	590	M		Continue Manual	
7	AB0005	GHOR KABID	203 500	149 000	300	M	NW	Reactivate Manual	
8	AB0008	KUFR AWAN	214 800	203 700	470	M		Continue Manual	
9	AB0010	DEIR ABI SAID	215 100	211 700	330	A		Continue Automatic Install Manual	Evap Stat near Met 10 (Tarbeh)
10	AD0002	HARTHA	229 500	233 300	450	M R		Continue R and Manual	
11	AD0005	UM QEIS	214 000	229 000	360	M R		Rehabilitate Clock	
12	AD0008	KHARJA	233 500	229 500	455	M		Rehabilitate Manual	
13	AD0009	HAWWARA	235 500	215 500	560	M		Rehabilitate Manual	
14	AD0010	HUSN	233 000	210 500	680	M R		Upgrade to Auto	
15	AD0011	EN NUHEYIME	236 000	202 800	785	M R		Upgrade to Auto	
16	AD0012	RAMTHA BOYS SCHOOL	244 500	218 800	520	M R		Upgrade to Auto	
17	AD0013	KHANASIRA	248 500	200 300	860	M		Continue Manual	
18	AD0016	MAFRAQ POLICE POST	264 000	195 000	695	M R		Continue R and Manual	
19	AD0017	RIHAB	253 000	192 800	900	M R		Rehabilitate Clock	
20	AD0018	IBBIN	226 800	196 500	1105	M		Rehabilitate Manual	
21	AD0021	TURRA	243 300	226 600	450	M		Continue Manual	
22	AD0022	HOSHA	250 000	206 600	600	M		Continue Manual	
23	AD0023	JABER MUGHAYYIR	263 000	213 300	600	M		Continue Manual	
24	AD0032	BAQURA MET STATION	206 300	224 300	205	M		Continue Manual	Near Met 1 (Baqura Nursery)
25	AD0034	SAMAR EVAP STATION	231 900	232 300	410	M R A		Continue Auto and Manual	Evap stat
26	AD0036	MAQARIN GAUGING STATION	230 000	237 000	12	M		Continue Manual	
27	AD0037	UNIV OF SCIENCE & TECH	242 300	209 800		A		Continue Auto	Evap stat
28	ADNEW1	NEW1	262 000	204 000		M	NEW	Install Manual	
29	ADNEW2	NEW2	274 000	203 500		A	NEW	Install Automatic	
30	ADNEW3	NEW3	229 000	205 000		A	NEW	Install Automatic	High Altitude station Approximate Coord
31	AD0400	IZRA A	268 000	252 000	575	SYRIAN			
32	AD0401	NAWA	248 000	255 000	563	SYRIAN			
33	AD0402	RAFELD	235 000	265 000	750	SYRIAN			
34	AD0403	SANMEIN	263 000	273 000	750	SYRIAN			
35	AD0404	KUNEITRA	227 000	280 000	941	SYRIAN			
36	AD0405	SHAHBA	302 000	252 000	1250	SYRIAN			
37	AD0406	FIQ	217 000	243 000	349	SYRIAN			
38	AD0407	EL HIMMA	213 000	233 000	167	SYRIAN			
39	AD0408	TELL SHIHAB	241 000	234 000	299	SYRIAN			
40	AD0409	SUWEIDA A	297 000	236 000	1010	SYRIAN			
41	AD0410	EIN ELARAB	303 000	238 000	1510	SYRIAN			
42	AD0411	RUSHEIDAH	323 000	232 000	1400	SYRIAN			
43	AD0412	DARA A	253 000	225 000	500	SYRIAN			
44	AD0413	MSEIFRAH	276 000	228 000	685	SYRIAN			
45	AD0414	BUSRAL SHAM	289 000	215 000	800	SYRIAN			
46	AE0001	IRBID SCHOOL	230 000	218 500	585	M R		Continue R and Reabiltate Manual	

28

Table 2 Proposed WAJ Precipitation Monitoring Network

PRCP_ID	WAJ_ID	SITE NAME	PGE	PGN	ALT (M)	STA TYPE	OPER_STATUS	ACTION	COMMENTS
47	AE0003	KAFR YUBA	225 300	216 700	560	M		Rehabilitate Manual	
48	AE0004	KAFR ASAD	217 000	223 000	350	M		Continue Manual	
49	AF0001	WADI ZIQLAB	207 300	214 500	190	M	NW	Reactivate and Upgrade to Auto	
50	AF0002	RIHABA	224 000	204 800	925	M R		Continue R and Manual	
51	AH0002	WADI EL YABIS	207 000	199 500	200	M		Continue Manual	
52	AH0004	IRJAN	219 000	200 100	740	R		Continue R	
53	AJ0001	AJLUN POLICE POST	221 000	193 500	760	M R		Rehab Manual and Rehab Clock	
54	AJ0002	KUFRINJA	216 400	189 400	640	M R		Rehab Manual and Upgrade to Auto	
55	AJ0003	WADI KUFRINJA	206 800	186 000	700	M	NW	Reactivate and Upgrade to Auto	
56	AL0002	MIDWAR	244 000	188 500	760	M		Rehabilitate Manual	
57	AL0003	BAL AMA	252 700	182 800	695	M		Rehabilitate Manual	
58	AL0004	JARASH	234 500	187 500	585	M R		Continue R and Rehab Manual	
59	AL0005	KITTA	229 500	187 000	865	M		Continue Manual	
60	AL0008	ALUK	237 200	174 800	630	M R		Continue Manual and Rehab Clock	
61	AL0010	DEIR ALLA AGR STATION	208 500	178 000	224	M		Rehabilitate Manual	
62	AL0012	SUKHNA	250 700	171 000	500	M		Rehabilitate Manual	
63	AL0013	NAWASIF	267 500	166 500	590	M		Continue Manual	
64	AL0015	ZARQA	253 000	163 800	610	M R		Rehab Manual and Upgrade to Auto	
65	AL0017	SWEILIH	229 500	159 000	1000	M R		Rehab Manual and Upgrade to Auto	
66	AL0022	AMMAN HUSSEIN COLLEGE	238 200	152 000	834	M		Rehabilitate Manual	
67	AL0026	BURMA	224 000	181 000	600	M		Rehabilitate Manual	
68	AL0027	SUBEIHI	216 500	173 000	500	M		Rehabilitate Manual	
69	AL0035	K H NURSERY EVAP ST (BAQA)	230 000	165 400	700	M R		Rehabilitate Manual	Evap stat
70	AL0036	PRINCE FEISAL NURSERY	234 500	180 500	300	M		Upgrade to Auto	Upstream of King Talal Dam
71	AL0045	UM JAUZA	220 000	167 000	860	M		Continue Manual	
72	AL0048	KHALDIYA	276 000	177 000	630	M		Continue Manual	
73	AL0049	QASR EL HALLABAT	275 400	167 200	610	M R		Continue R and Manual	
74	AL0050	QAFQAF	238 800	195 300	930	M		Continue Manual	
75	AL0052	BEIR EL ADAM	268 200	150 200	800	T		Continue to use Totalizer	
76	AL0053	KING TALAL DAM (BURMA)	228 600	178 000	218	M		Continue Manual	Evap stat (JVA)
77	AL0054	HASHIMIYA	255 200	171 700	550	M		Continue Manual	
78	AL0057	WADI ES SIR (NRA)YARD	230 200	151 600	900	M R		Continue R and Manual	
79	AL0058	SABHA AND SUBHIYEH	291 800	194 000	850	M		Continue Manual	
80	AL0059	UM EL JUMAL EVAP STATION	276 800	190 400	650	M R A		Continue Manual and Auto	Evap stat
81	AL0066	KHIRBET ES SAMRA EVAP ST	258 250	173 500	540	M A		Continue Manual and Auto	Evap stat
82	AL0400	SALKHAD	311 000	211 000	1447	SYRIAN			
83	AM0001	SALT	219 000	160 500	796	M R		Continue R and Rehab Manual	
84	AM0002	W SHU EIB AGR STATION	218 000	152 800	300	M		Continue Manual	
85	AM0005	HUMMAR	227 000	158 800	925	M		Continue Manual	
86	AM0006	IRA	213 000	157 000	650	M		Continue Manual	
87	AM0007	SOUTH SHUNA(W SHUIB DAM)	210 500	146 000	160	M		Continue Manual	Evap stat
88	AMNEW1	NEWI	206 000	132 000		A	NEW	Install Automatic	Dead Sea North
89	AN0002	WADI ES SIR	227 500	151 000	720	M		Continue Manual	
90	AN0003	NA UR	228 500	142 500	800	M R		Continue R and Manual	
91	AN0004	ADASIYA JANOUBIYA	222 700	140 600	750	M		Continue Manual	
92	AN0005	KAFREIN DAM	213 800	139 300	153	M	NW	Reactivate Manual	

29

Table 2 Proposed WAJ Precipitation Monitoring Network

PRCP_ID	WAJ_ID	SITE NAME	PGE	PGN	ALT (M)	STA TYPE	OPER_STATUS	ACTION	COMMENTS
93	CA0002	KHANZIRA (TAIYBAT KARAK)	207 300	051 800	1000	M R		Continue R and Manual	
94	CA0003	MUREISED	200 300	060 500	350	M	NW	Reactivate and Upgrade to Auto	
95	CA0004	AIY	211 000	060 300	900	M R		Rehab Manual and Rehab Clock	
96	CA0006	MUHAI	231 800	044 500	1000	M		Rehabilitate Manual	
97	CA0012	GHOR EI MAZRA A	201 000	78 000	300	M	NW	Reactivate Manual	
98	CC0001	MADABA	225 500	125 000	785	M R		Rehab Manual and Upgrade to Auto	
99	CC0002	MA IN	219 900	120 800	810	M R		Rehab Manual and Upgrade to Auto	
100	CC0004	MUSHAQQAR EVAP ST	226 200	132 900	0	M R A		Rehab Manual and Upgrade to Auto	Evap stat
101	CD0001	SAHAB	245 000	142 500	830	M		Rehabilitate Manual	
102	CD0003	EL-MUWAQQAR	255 000	136 500	910	M		Rehabilitate Manual	
103	CD0005	JIZA	241 000	123 000	705	M R		Rehab Manual and Rehab Clock	
104	CD0006	WADI WALA	223 000	107 500	350	M R		Rehab Manual and Upgrade to Auto	
105	CD0007	DHIBAN	224 000	100 800	745	M R		Rehab Manual and Rehab Clock	
106	CD0008	WADI MUJIB GAUGING STATION	226 500	95 000	138	M R		Continue R and Rehab Manual	Install Mujib Dam evap Station at this location
107	CD0009	HEMUD	226 000	078 000	890	M		Rehabilitate Manual	
108	CD0010	RABBA	220 500	075 500	970	M A		Continue R and Rehab Manual	Evap stat
109	CD0011	QATRANA POLICE POST	249 500	072 500	770	M R		Rehab Manual and Upgrade to Auto	
110	CD0013	MAZAR	216 500	052 000	1140	M R		Rehab Manual and Rehab Clock	
111	CD0015	DHABA NURSERY	250 500	111 600	750	M R		Rehab Manual and Rehab Clock	
112	CD0016	JUDAYDA	211 500	105 000	725	M R		Rehab Manual and Rehab Clock	
113	CD0017	UM EL RISAS	237 500	101 000	750	M		Rehabilitate Manual	
114	CD0018	KHANEZ ZABEEB	255 000	097 800	775	M	NW	Reactivate Manual	
115	CD0019	JADA	222 000	089 500	900	M		Rehabilitate Manual	
116	CD0022	QASR EL MUSHEISH	254 000	038 000	850	M	NW	Reactivate Manual	
117	CD0024	YADUDA FAHID ABU JABER	236 500	139 500	850	M		Rehabilitate Manual	
118	CD0028	MULEIH	228 000	110 900	830	M		Rehabilitate Manual	
119	CD0029	SIRFA	212 500	081 600	900	M		Rehabilitate Manual	
120	CD0030	JABEL ABU HALLUFA	272 900	086 000	950	T		Continue Totalizer	
121	CD0031	WADI EI JINZ	276 000	054 500	825	T		Continue Totalizer	
122	CD0033	JABEL SAKHRIYAT	274 000	026 600	910	T		Continue Totalizer	
123	CDNEW	NEW1	245 000	60 000		A	NEW	Install Automatic	
124	Dead Sea	Dead Sea	206 000	115 000		A	NEW		New Evap St Dead Sea Shore
125	CE0001	RAKIN	217 500	070 000	1050	M R		Rehab Manual and Rehab Clock	
126	CE0002	AIN BISAS	213 500	067 800	700	M R		Rehab Manual and Upgrade to Auto	
127	CE0004	KARAK	217 000	066 000	1000	M R		Rehab Manual and Rehab Clock	
128	CF0003	JURF ED DARAWISH	233 000	011 800	940	M R		Continue R and Rehab Manual	
129	CF0006	GHOR ES SAFI MET STATION	193 000	051 000	285	M R A		Continue Auto and Rehab Manual	Evap stat Potash Company station
130	CF0007	HASA EVAP STATION	243 600	030 600	900	M R		Rehab Manual and Rehab Clock	Evap stat
131	CF0008	HASA GAUGING STATION	220 400	041 600	380	R		Rehab Manual and Rehab Clock	
132	CFNEW1	NEW1	268 000	15 000		A	NEW	Install Automatic	Coordinates are approximate
133	CFNEW2	NEW2	215 000	17 000		M	NEW	Install Manual	Coordinates are approximate
134	CFNEW3	NEW3	210 000	35 000		M	NEW	Install Manual	Coordinates are approximate
135	DA0002	SHAUBAK AGR STATION	200 500	991 500	1475	M		Rehabilitate Manual	
136	DA0003	BEIR ED DABBAGHAT	198 000	980 000	1600	M		Rehabilitate Manual	
137	DA0005	UNEIZA RAILWAY STATION	226 500	989 000	1050	R		Rehabilitate Clock	
138	DA0007	FEEDAN	187 300	003 750	96	M		Rehabilitate Manual	Evap stat

30

Table 2 Proposed WAJ Precipitation Monitoring Network

PRCP_ID	WAJ_ID	SITE NAME	PGE	PGN	ALT (M)	STA TYPE	OPER STATUS	ACTION	COMMENTS
139	DB0001	TAFILE	208 000	027 500	1000	M R		Rehab Manual and Rehab Clock	
140	DB0002	PRINCE HASAN NURSERY (ABUR)	218 200	023 300	1220	M R		Continue R and Rehab Manual	
141	DC0001	BUSEIRA	208 000	017 000	1100	M R		Continue R and Rehab Manual	
142	DC0002	RASHADIYA P POST	210 000	012 500	1500	M R		Rehab Manual and Rehab Clock	
143	DD0002	DHAHAL	189 000	027 000	200	M	NW	Reactivate and upgrade to Auto	
144	DE0001	DANA	208 300	009 500	1230	M R		Continue R and Rehab Manual	
145	DF0002	UM METLA	177 600	987 100	106	M		Continue Manual	Evap stat
146	DG0001	WADI MOUSA	196 000	970 000	1100	M R		Continue R and Rehab Manual	
147	DG0002	HAY	197 000	974 000	1500	M	NW	Reactivate and Upgrade to Auto	
148	DG0003	PETRA	192 000	972 000	1000	M		Rehabilitate Manual	
149	DGNEW	NEW1	180 000	970 000		M	NEW	Install Manual	
150	DH0001	TAIYIBA JANOUBIYA	194 000	963 000	300	M		Rehabilitate Manual	
151	DH0002	DILAGHA	189 000	949 300	1350	M		Rehabilitate Manual	
152	DH0003	RAJIF	193 000	956 000	500	M R		Rehab Manual and Rehab Clock	Coordinates are approximate
153	DHNEW	NEW1	185 000	953 000		A	NEW	Install Automatic	approx 800 m Alt to cover elev data gaps
154	EA0001	GHARANDAL	169 000	945 000	220	M	NW	Reactivate and upgrade to Auto	
155	EA0002	RAHMA	162 000	926 000	105	M		Continue Manual	Evap stat
156	ED0001	AQABA	150 000	881 500	40	M		Rehabilitate Manual	
157	ED0002	RA'S EN NAQB	197 000	935 000	1570	M R		Continue R and Rehab Manual	
158	ED0003	RAM P POST	191 000	887 500	950	M	NW	Reactivate and upgrade to Auto	
159	ED0015	FASSU A ST	236 200	908 500	1150	T		Continue Totalizer	
160	ED0016	WADI RATMA	193 000	915 000	900	T		Continue Totalizer	
161	ED0017	WADI NASIFA	209 000	902 000	850	T		Continue Totalizer	
162	ED0018	WADI MAS ADA	177 000	896 000	850	T		Continue Totalizer	
163	ED0019	WADI ARADA	225 000	899 000	920	T		Continue Totalizer	
164	ED0020	QA KHREIM	220 000	882 000	830	T		Continue Totalizer	
165	ED0021	WADI SABIT	173 000	872 000	850	T		Continue Totalizer	
166	ED0022	WADI MUQUR	193 000	872 000	1000	T		Continue Totalizer	
167	ED0023	QA EL GHAL	208 000	882 400	910	T		Continue Totalizer	
168	EDNEW	NEW1	155 000	900 000		M	NEW	Install Manual	Coordinates are approximate
169	F 0001	UM EL QUTTEIN	303 500	192 500	988	M R		Continue R and Manual	
170	F 0002	H5 Evap stat	348 500	180 000	715	M R		Continue Manual and Rehab Clock	
171	F 0004	DEIR EL KAHF	325 000	185 000	1025	M R		Continue R and Rehab Manual	
172	F 0006	AI QARYAT'IN	330 000	170 000	800	M		Rehabilitate Manual	
173	F 0007	AL WISAD	435 000	144 800	700	M		Rehabilitate Manual	
174	F 0009	AZRAQ EVAP STATION	320 000	141 500	533	M R A		Continue Auto and Rehab Manual	Evap stat
175	F 0011	FL UMARI	342 000	107 300	525	M R		Continue R and Rehab Manual	
176	F 0012	QASR TUBA	300 000	083 000	750	M R	NW	Reactivate and upgrade to Auto	
177	F 0013	WADI SALAHIB	381 500	159 700	700	T		Continue Totalizer	
178	F 0014	TULLUL EL KHURISHA	303 000	156 000	550	T		Continue Totalizer	
179	F 0015	TULLUL EL GHAR	404 800	151 500	750	T		Continue Totalizer	
180	F 0016	QA SAMIKA	370 200	187 000	760	T		Continue Totalizer	
181	F 0017	GADIR EL MALLAH	358 200	163 800	630	T		Continue Totalizer	
182	F 0019	JABEL MUDAYSISAT	268 000	119 200	300	T		Continue Totalizer	
183	F 0020	QASR EL KHARRANA	288 500	127 000	650	T R		Continue R and Totalizer	
184	F 0400	IMTAN	321 000	203 000	1260	SYRIAN			

Table 2 Proposed WAJ Precipitation Monitoring Network

PRCP_ID	WAJ_ID	SITE NAME	PGE	PGN	ALT (M)	STA TYPE	OPER_STATUS	ACTION	COMMENTS
185	F 0401	KHIRBET AWAD	310 000	194 000	1085	SYRIAN			
186	G 0003	MA AN	221 000	956 500	1080	M R		Continue R and Rehab Manual	
187	G 0004	BASTA	201 800	960 300	1450	M		Rehabilitate Manual	
188	G 0005	SADAQA	196 500	952 500	1500	M		Rehabilitate Manual	
189	G 0006	QUREIN	195 000	945 300	1500	M		Rehabilitate Manual	
190	G 0009	UDRUH EVAP STATION	206 300	973 600	1350	M		Continue Manual	Discontinue Evap stat keep only precip Gauge
191	G 0010	JORDHAN GAUGING STATION	221 900	965 900	1082	M	NW	Reactivate Manual	
192	G 0011	JABEL QUZEMEH	284 300	995 500	920	T		Continue Totalizer	
193	G 0012	QABR ES SAWW	247 000	984 000	945	T		Continue Totalizer	
194	G 0013	ABU TARAF	239 000	935 000	990	T		Continue Totalizer	
195	G 0014	INAB	331 400	932 200	950	T		Continue Totalizer	
196	G 0015	KABID	296 200	929 500	870	T		Continue Totalizer	
197	G 0016	JABEL EL BATRA	210 000	924 000	1300	T		Continue Totalizer	
198	H 0001	H4 EVAP ST	450 500	216 000	755	M R A		Continue Auto and Manual	Evap stat Department of Meteorology
199	H 0002	TARABEEL	527 800	245 000	800	T		Continue Totalizer	
200	H 0003	KH UM RUJEIM	486 800	228 800	800	T		Continue Totalizer	
201	H 0004	TULLUL EL ASHQAF	389 200	193 000	900	T		Continue Totalizer	
202	J 0002	EL KHERQA	333 000	076 000	635	T		Continue Totalizer	
203	J 0003	WADI BAYIR	359 600	042 400	650	T		Continue Totalizer	
204	J 0004	QA ES SIQ	365 400	972 500	870	T		Continue Totalizer	
205	K 0003	MUHEISH	234 000	866 000	800	T		Continue Totalizer	
206	K 0004	WADI DUREIBA	215 000	866 000	950	T		Continue Totalizer	
207	Kdisi	DISI	250 000	880 000		A	NEW		New Evaporation Station in Disi Area

NOTES

- M= Manual (daily)
- R = Chart Recorder
- T = Totalizer
- A = Automatic Digital Recorder
- NW = Not Working

32

Table 3 Proposed Action for the Rehabilitation and Upgrade of WAJ Evaporation Monitoring Network

ID	SITE NAME	PGE	PGN	TYPE	OPER. STATUS	ACTION	Comments	
1	AB0010	DEIR ABI SAID	215 100	211 700	A			
2	AD0027	SAMA ER ROSAN EVAP STATION	228 700	227 900	M	NW	Continue Monitoring Discontinue	Also precipitation station at another location near Met 1 (Baqura Nursery) Closed
3	AD0034	SAMAR EVAP STATION	231 900	232 300	M A		Continue Monitoring	
4	AD0037	UNIV OF SCI & TECH	242 300	209 800	A		Continue Monitoring	to be discontinued in the near future close to Met 8 (Irbid Nursery)
5	AH0003	RAS MUNEIF EVAP STATION	226 800	198 800	M A	NW (M)	Discontinue	Close to Met 11 (Ras Muneif)
6	AL0035	K H NURSERY EVAP ST (BAQA)	230 000	165 400	M A		Continue Monitoring	
7	AL0053	KING TALAL DAM (BURMA)	228 600	178 000	M		Upgrade to Auto	
8	AL0059	UM EL JUMAL EVAP STATION	276 800	190 400	M A		Continue Monitoring	
9	AL0066	KHIRBET ES SAMRA EVAP ST	258 250	173 500	M A	NW	Reactivate to Auto	
10	AM0004	SHUNET NIMRIN EVAP ST	209 500	146 000	M	NW	Discontinue	Station transferred to South Shuna (AM 0007)
11	AM0007	SOUTH SHUNA(W SHUIB DAM EV ST)	210 500	146 000	M A		Continue Monitoring	
12	CC0004	MUSHAQQAR EVAP ST	226 200	132 900	M A	NW	Reactivate to Auto	
13	CD0010	RABBA	220 500	75 500	M A		Continue Monitoring	to be discontinued in the near future close to Met 18 (Er Rabbah)
14	CD0020	SIWAQA EVAP STATION	253 700	086 800	M	NW	Discontinue	
15	CD0023	QASR EVAP STATION	221 000	080 900	M	NW	Discontinue	Station transferred to Rabbah (CD 0010)
16	CD0026	EZ ZEITUNA EVAP STATION	235 700	129 700	M	NW	Discontinue	
17	CD0034	QATRANA EVAP STATION	249 500	073 600	M A	NW (M)	Discontinue	Close to Met 32 (Qatraneh)
18	CF0006	GHOR ES SAFI MET STATION	193 000	051 000	M A		Continue Monitoring	Potash Company Station
19	CF0007	HASA EVAP STATION	243 600	030 600	M		Upgrade to Auto	Relocate near future Tannour Dam
20	DA0007	FEEDAN	187 300	003 750	M		Upgrade to Auto	Relocate near future Feedan Dam
21	DF0002	UM METLA	177 600	987 100	M		Discontinue	DA0007 is sufficient for the area
22	EA0002	RAHMA	162 000	926 000	M		Upgrade to Auto	
23	ED0004	QUWEIRA EVAP STATION	181 000	914 000	M	NW	Discontinue	
24	FD0012	RAM(QA DISI) EVAP STATION	199 800	896 000	M	NW	Discontinue	
25	ED0026	AQABA LVAP ST	148 000	887 000	M		Discontinue	Close to Met 6 (Aqaba Airport) and Met 7 (Aqaba Port)
26	F0002	H5 EVAP STATION	348 500	180 000	M		Continue Monitoring	to be discontinued in the near future close to Met 24 (Al Safawi)
27	F0009	AZRAQ I VAP STATION	320 000	141 500	M A		Continue Monitoring	
28	G0008	JAI R I VAP STATION	267 000	970 000	M	NW	Discontinue	
29	G0009	UDRUH LVAP STATION	206 300	973 600	M		Discontinue	Close to Met 20
30	H0001	H4 EVAP ST	450 500	216 000	M A		Continue Monitoring	to be discontinued in the near future close to Met 24 (Al Ruwashed)
31	J0001	BAYIR EVAP STATION	310 500	020 000	M	NW	Discontinue	
32	K0001	EL MUDAWWARA EVAP STATION	249 000	859 000	M	NW	Discontinue	
33	K0002	DURRAH EVAP STATION	147 000	867 500	M	NW	Discontinue	
34	CDmujib	Mujib Dam	226 500	95 000	A	NEW	Install Auto	Future Mujib Dam Same location as CD0008 (W Mujib Gauging St )
35	Akarama	Karama Dam	202 218	157 803	A	NEW	Install Auto	New Karama Dam Coordinates are approximate
36	Dead Sea	Dead Sea	206 000	115 000	A	NEW	Install Auto	Dead Sea Shore Coordinates are approximate
37	Kdisi	DISI	250 000	880 000	A	NEW	Install Auto	New Station in DISI Future Development Area Coordinates are approximate

NOTES

A = Automatic  
M= Manual  
NW = Not Working

Table 4 Proposed WAJ Evaporation Monitoring Network

ID	SITE NAME	PGE	PGN	TYPE	OPER. STATUS	ACTION	Comments
1	AB0010 DEIR ABI SAID	215 100	211 700	A		Continue Monitoring	Also precipitation station at another location, near Met 1 (Baqura Nursery)
2	AD0034 SAMAR EVAP STATION	231 900	232 300	M,A		Continue Monitoring	
3	AD0037 UNIV OF SCI & TECH	242 300	209 800	A		Continue Monitoring	to be discontinued in the near future close to Met 8 (Irbid Nursery)
4	AL0035 K H NURSERY EVAP ST (BAQ A)	230 000	165 400	M,A		Continue Monitoring	
5	AL0053 KING TALAL DAM (BURMA)	228 600	178 000	M		Upgrade to Auto	
6	AL0059 UM EL-JUMAL EVAP STATION	276 800	190 400	M,A		Continue Monitoring	
7	AL0066 KHIRBET ES SAMRA EVAP ST	258 250	173 500	M,A	NW	Reactivate to Auto	
8	AM0007 SOUTH SHUNA(W SHUIB DAM EV ST)	210 500	146 000	M,A		Continue Monitoring	
9	CC0004 MUSHAQQAR EVAP ST	226 200	132 900	M,A	NW	Reactivate to Auto	
10	CD0010 RABBA	220 500	75 500	M,A		Continue Monitoring	to be discontinued in the near future close to Met 18 (Er Rabbah)
11	CF0006 GHOR ES SAFI MET STATION	193 000	051 000	M,A		Continue Monitoring	Potash Company Station
12	CF0007 HASA EVAP STATION	243 600	030 600	M		Upgrade to Auto	Relocate near future Tannour Dam
13	DA0007 FEEDAN	187 300	003 750	M		Upgrade to Auto	Relocate near future Fidan Dam
14	EA0002 RAHMA	162 000	926 000	M		Upgrade to Auto	
15	F0002 H5 EVAP STATION	348 500	180 000	M		Continue Monitoring	to be discontinued in the near future, close to Met 24 (Al Safawi)
16	F0009 AZRAQ EVAP STATION	320 000	141 500	M,A		Continue Monitoring	
17	H0001 H4 EVAP ST	450 500	216 000	M,A		Continue Monitoring	to be discontinued in the near future close to Met 24 (Al Ruwashed)
18	CDmujb Mujb Dam	226 500	95 000	A	NEW	Install Auto	Future Mujb Dam, Same location as CD0008 (W Mujb Gauging St)
19	Akarama Karama Dam	202 218	157 803	A	NEW	Install Auto	New Karama Dam, Coordinates are approximate
20	Dead Sea Dead Sea	206 000	115 000	A	NEW	Install Auto	Dead Sea Shore Coordinates are approximate
21	Kdisi DISI	250 000	880 000	A	NEW	Install Auto	New Station in DISI Future Development Area, Coordinates are approximate

NOTES  
A = Automatic  
M= Manual  
NW = Not Working

24

**Table 5 Meteorological Stations**  
**Meteorological Department**  
**Ministry of Transport**

No	Station Name	Elevation (m)	PGE	PGN	Type
1	Baqura Nursery	170	208 119	226 501	Agrometeorological
2	University Farm (Ghor)	230	208 314	174 749	Auxiliary or Purpose
3	Wadi Yabis	200	205 081	200 613	Principal Climatological
4	Deir Alla	224	208 294	180 294	Agrometeorological
5	Ghor Safi	350	194 458	49 038	Agrometeorological
6	Aqaba Airport	51	149 596	884 586	Synoptic
7	Aqaba Port	2	149 589	880 892	Marine
8	Irbid Nursery	616	230 071	217 367	Synoptic
9	Ramtha	590	242 635	211 904	Auxiliary or Purpose
10	Taibeh	373	217 556	215 451	Auxiliary or Purpose
11	Ras Munief	1150	220 780	196 983	Synoptic
12	Jordan University	980	233 572	158 240	Auxiliary or Purpose
13	Amman Airport (WAJ AL 0019 station)	766	233 595	154 544	Synoptic
14	Roman Amphitheatre Amman	750	239 921	150 888	Auxiliary or Purpose
15	Sweileh	1050	235 158	156 402	Principal Climatological
16	Madaba	785	225 872	124 928	Auxiliary or Purpose
17	Wadi Wala	450	224 396	106 438	Auxiliary or Purpose
18	Lr Rabbah	920	221 384	75 006	Agrometeorological
19	Al Hasan Agrmet (Tafielah)	1200	218 452	21 401	Principal Climatological
20	Shoubak	1365	200 987	991 772	Agrometeorological
21	Ll Qurain (Kasmiya)	1510	194 692	945 564	Auxiliary or Purpose
22	Al Ruwashed (H4)	683	451 013	215 579	Synoptic
23	Al Mafraq	686	267 842	197 330	Synoptic
24	Al Safawi (H5)	672	351 324	179 992	Synoptic
25	Wadi Dhuleil	580	271 219	173 331	Agrometeorological
26	Zarka Refinery	555	255 557	165 794	Principal Climatological
27	Azraq North	533	322 035	140 684	Auxiliary or Purpose
28	Azraq South	521	322 063	138 836	Synoptic
29	Queen Alia Int Airport	715	243 257	125 036	Synoptic
30	Ma'an Airport	1069	225 180	953 065	Synoptic
31	Al Jafr	865	260 395	966 233	Synoptic
32	Qatraneh	768	256 322	73 385	Principal Climatological
33	Daba a	750	249 676	112 145	Auxiliary or Purpose
34	Mu'ta University	1125	216 728	50 960	Auxiliary or Purpose
35	Wadi Musa (Petra)	1115	194 638	969 583	Auxiliary or Purpose
36	Al Ghwair	980	221 402	71 309	Auxiliary or Purpose

Table 6 Summary of Rehabilitation and Upgrade of Precipitation Monitoring Network

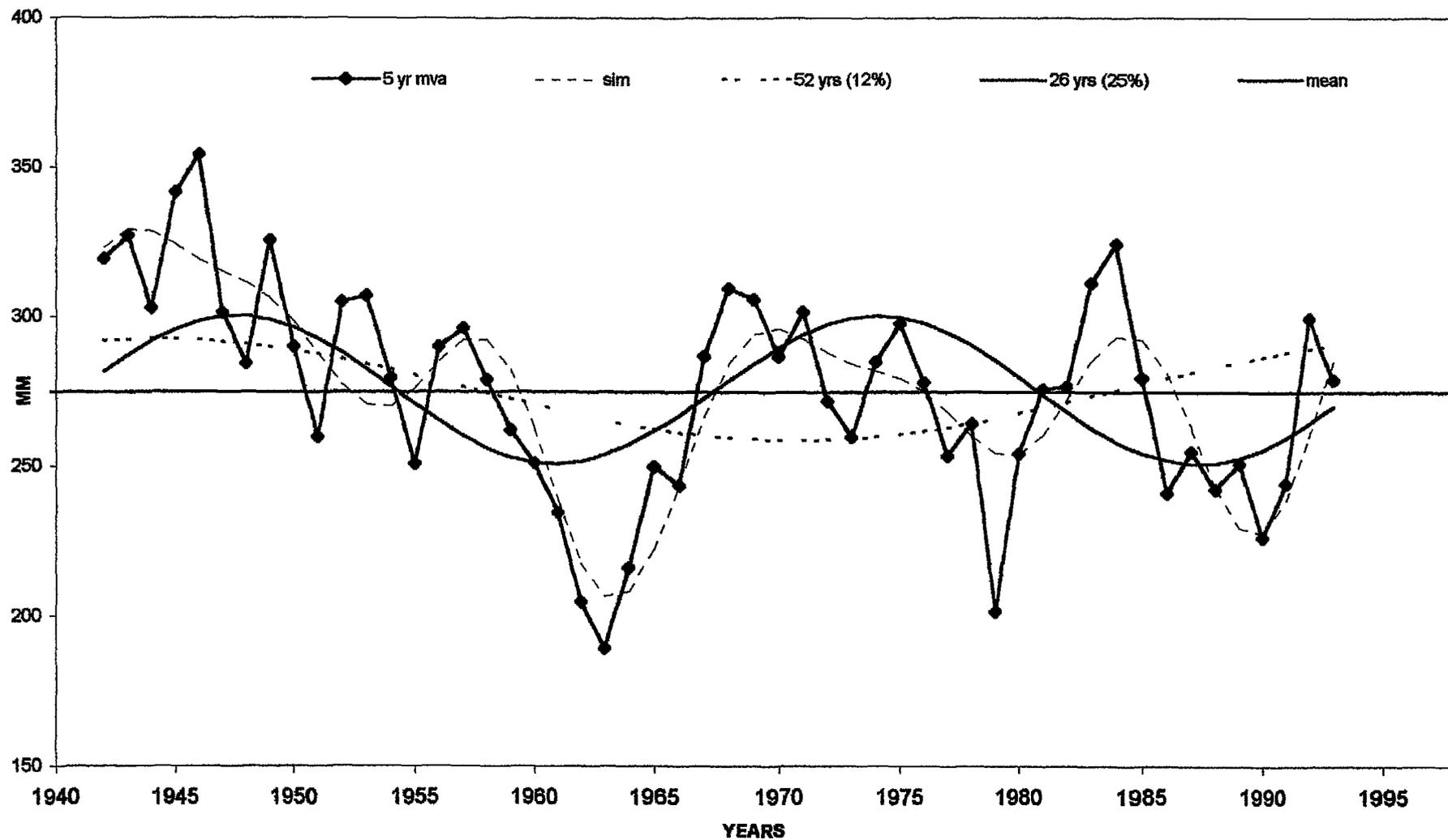
Basin/Region	Operational	Non-Operational	New	Discontinued	Reactivated	Rehabilitated	Upgraded	Planned	Density km <sup>2</sup> /Gauge
Jordan Valley and Rift Side Wadis	24	17	2	14	7	5	1	29 16 M & 13 A	75
Yarmouk	21	10	3	13	0	5	2	21 10 M & 11 A	60
Zarqa	33	24	0	31	0	10	3	26 16 M 9 A 1T	130
Dead Sea	9	9	1	7	2	8	4	12 2 M & 10 A	125
Mujib and Hasa	25	13	4	12	2	15	2	30 12 M 15 A 3 T	280
Araba	28	14	3	11	4	16	1	34 11 M 14 A 9 T	200
Azraq	14	6	0	5	1	6	0	15 2 M 7 A 6 T	870
Jafer	12	5	0	5	1	4	0	12 5 M 1 A 6 T	1000
Desert Areas	9	3	1	3	0	0	0	10 2 A & 8 T	40000
<b>Total</b>	<b>175</b>	<b>101</b>	<b>14</b>	<b>101</b>	<b>17</b>	<b>69</b>	<b>13</b>	<b>189 74 82 33 T</b>	

36

**Table 7 Equipment Requirement for Precipitation Monitoring Plan**

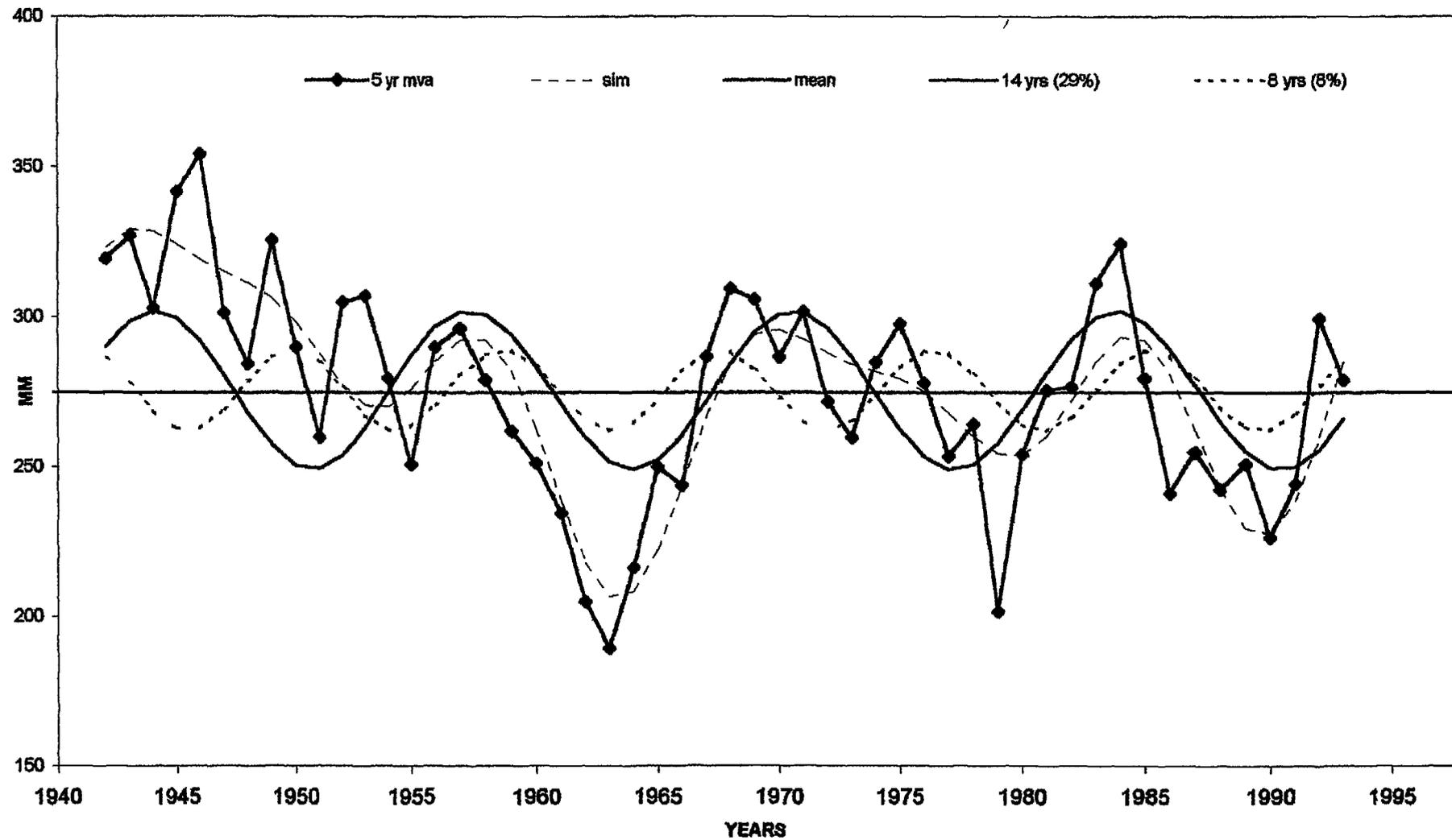
Basin/Region	Auto	SIAP Clocks	Manual
Jordan Valley and Rift Side Wadis	5	1	11
Yarmouk	5	2	4
Zarqa	3	1	11
Dead Sea	4	3	8
Mujib and Hasa	4	7	25
Araba	4	4	17
Azraq	1	1	6
Jafer	0	0	5
Desert Areas	0	0	0
Spare parts	4	6	13
<b>Total</b>	<b>30</b>	<b>25</b>	<b>100</b>

Figure 1. Cyclic Behavior of 5 YR MVA Rainfall - Amman 52 and 26 YR Cycles



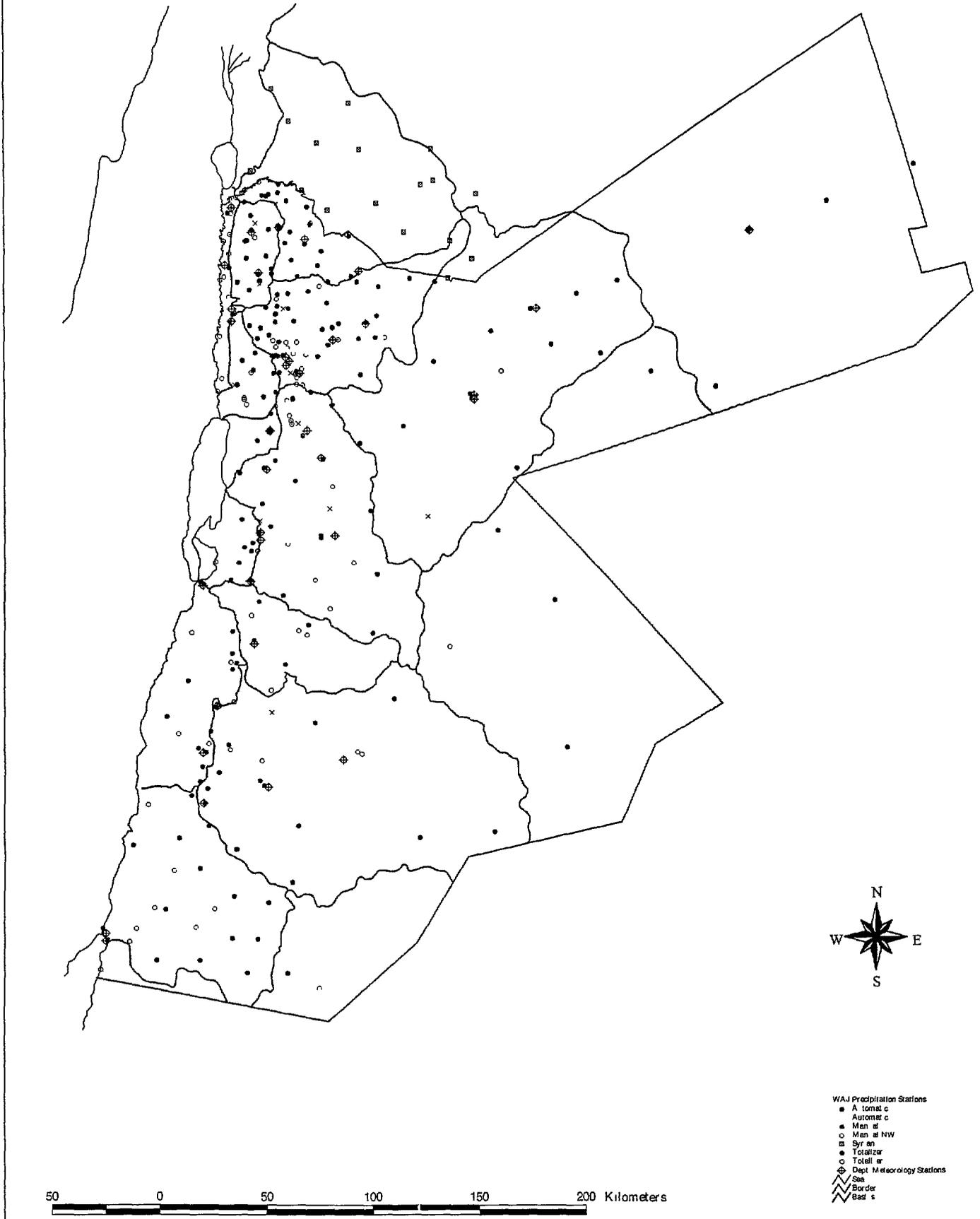
85

Figure 2. Cyclic Behavior of 5 YR MVA Rainfall - Amman 14 and 8 YR Cycles



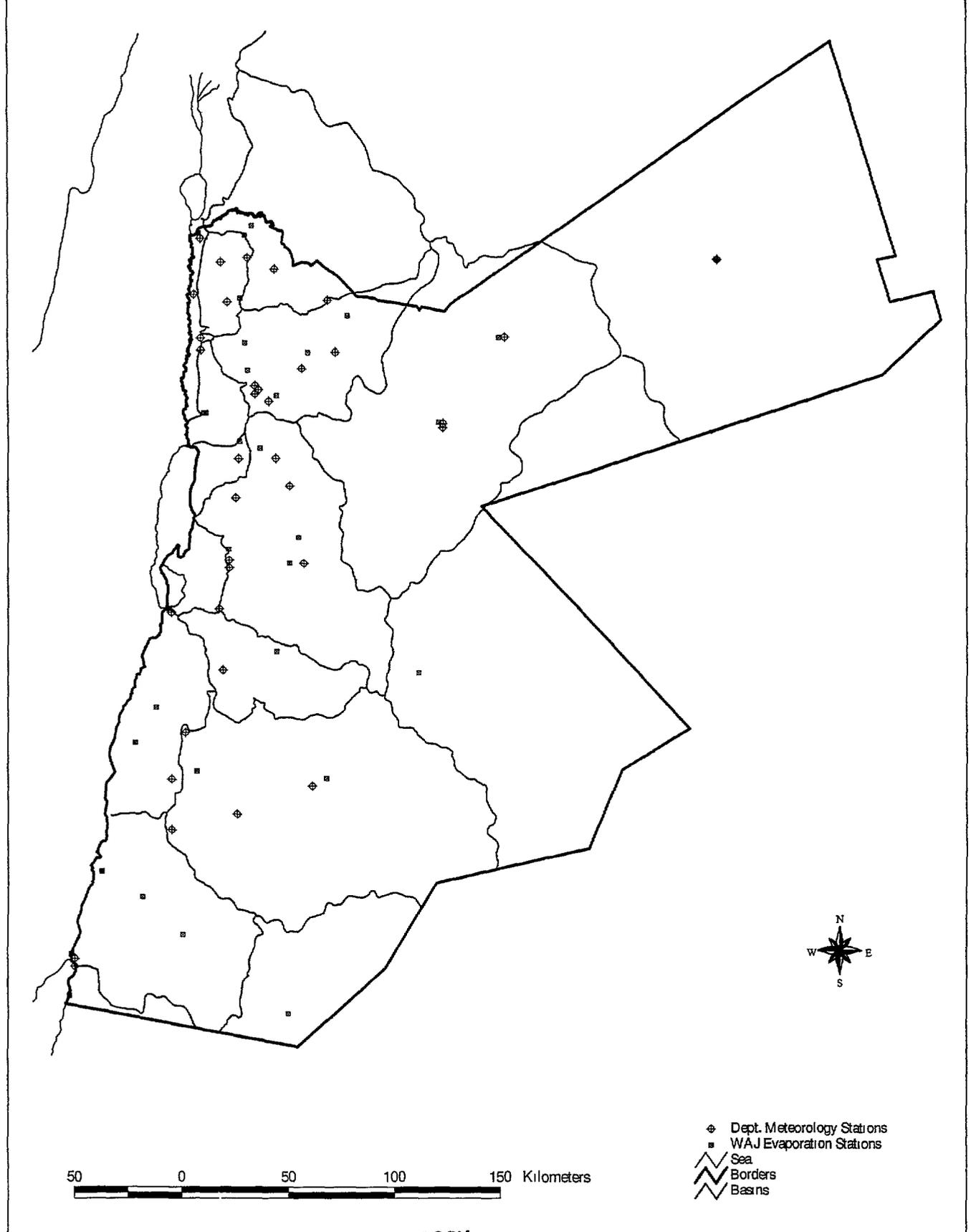
39

**Figure 3 Current Status of Precipitation Monitoring Network**



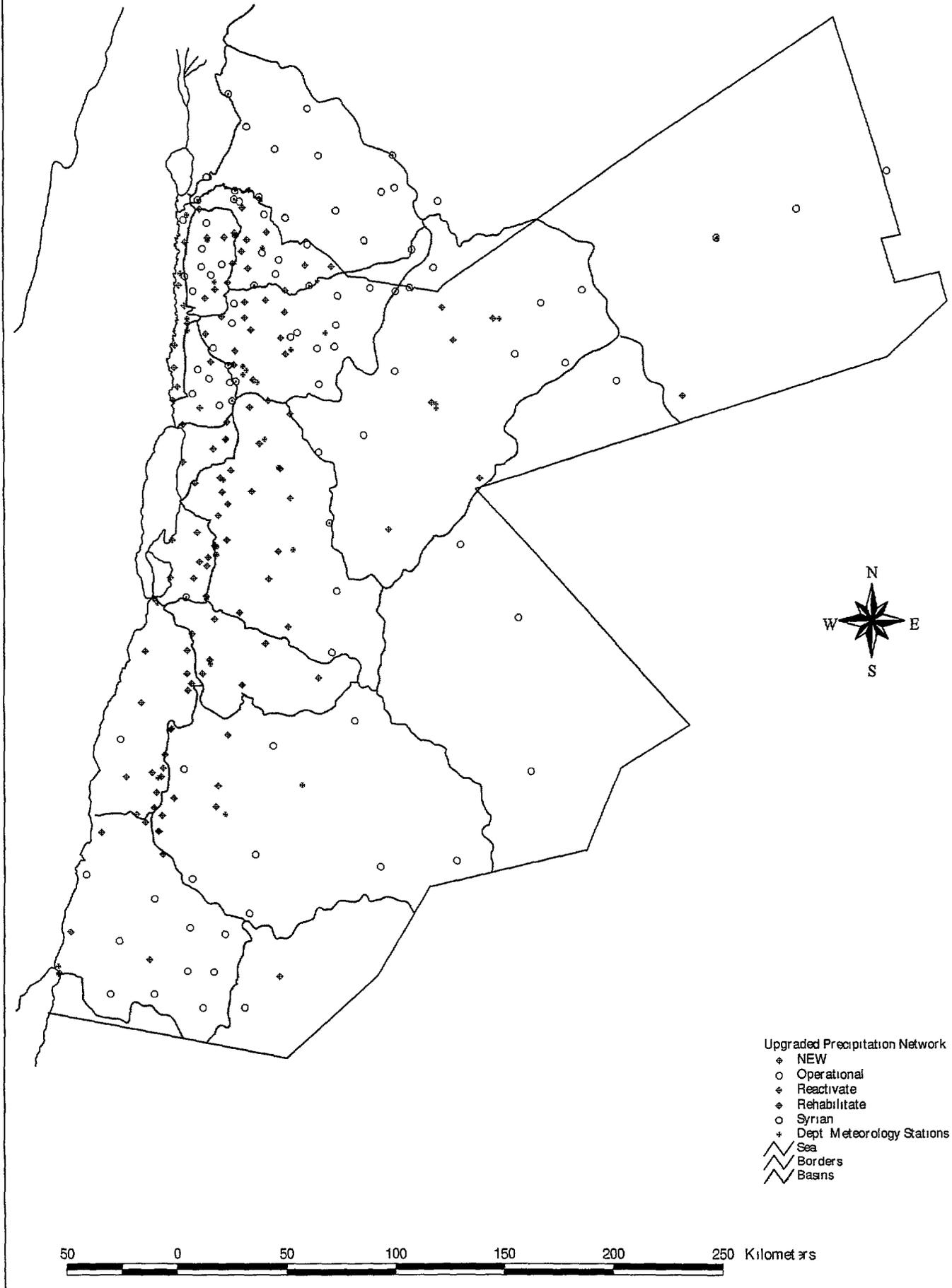
BEST AVAILABLE COPY

**Figure 4 Current Status of Evaporation Monitoring Network**



**BEST AVAILABLE COPY**

**Figure 5. Rehabilitated and Upgraded Precipitation Monitoring Network**



**Figure 6. Rehabilitated and Upgraded Evaporation Monitoring Network**

