**JORDAN WATER COMPANY – MIYAHUNA LLC**

# C-T-22-0015 - FARA 7

**Smart Utility Transformation Project**

**March 2022**

# VOLUME III

## CONDITIONS OF CONTRACT

**Table of Contents**

**List of Tables**

**GENERAL ACRONYMS**

| | |
|---|---|
| AI | Artificial Intelligence |
| AMI | Advanced Metering Infrastructure (AMI) |
| AMR | Automatic Meter Reading |
| ANSI | American National Standards Institute |
| ASME | American Society of Mechanical Engineers |
| ASTM | American Society for Testing and Materials |
| AWWA | American Water Works Association |
| BOQ | Bill of Quantities |
| CIS | Customer Information System |
| DMA | District Metering Areas |
| DN | Nominal Diameter |
| DZ | Distribution Zone |
| EN | European standards |
| EPDM | Ethylene-Propylene-Diene Terpolymer |
| FARA | Fixed Amount Reimbursement Agreement |
| GIS | Geographic Information System<br>In miyahuna the system is ESRI ArcGIS V10.8 |
| ISO | International Organization for Standardization |
| JSMO | Jordanian Standard and Meteorology Organization |
| NBR | Nitrile Butadiene Rubber |
| NRW | Non-Revenue Water |
| NSF | National Science Foundation |
| PN | Nominal Pressure |
| RFP | Request for Proposal |
| TRC | Telecommunications Regulatory Commission |
| USAID | United States Agency for International Development |
| X7 | Miyahuna Billing Database System |
| Static Meters | Ultrasonic and Electromagnetic Meters |

## 1. INTRODUCTION AND BACKGROUND

Jordan Water Company (Miyahuna) is a limited liability company, fully owned by Water Authority of Jordan (WAJ). The company was established and started working as a water and wastewater business-oriented utility company in 2007. Its service area in its start was covering only the governorate of Amman. Later, WAJ added Madaba and Zarqa governorates to Miyahuna service area in 2019 and 2020, respectively.

Miyahuna serves about (951) thousand customers (end of 2019 record), with 3.4% growth rate in customer count compared to 2018. The water supplied to Miyahuna's system during 2019 reached 10 MCM in Madaba, 30.9 MCM in Zarqa and 200 MCM in Amman.

Having most of the supply for Amman coming from faraway and/or low elevation sources that need high energy consumption to convey water, therefore, the cost of supplying water is relatively high in Amman which make the efforts to minimize losses more feasible and essential to sustain the service.

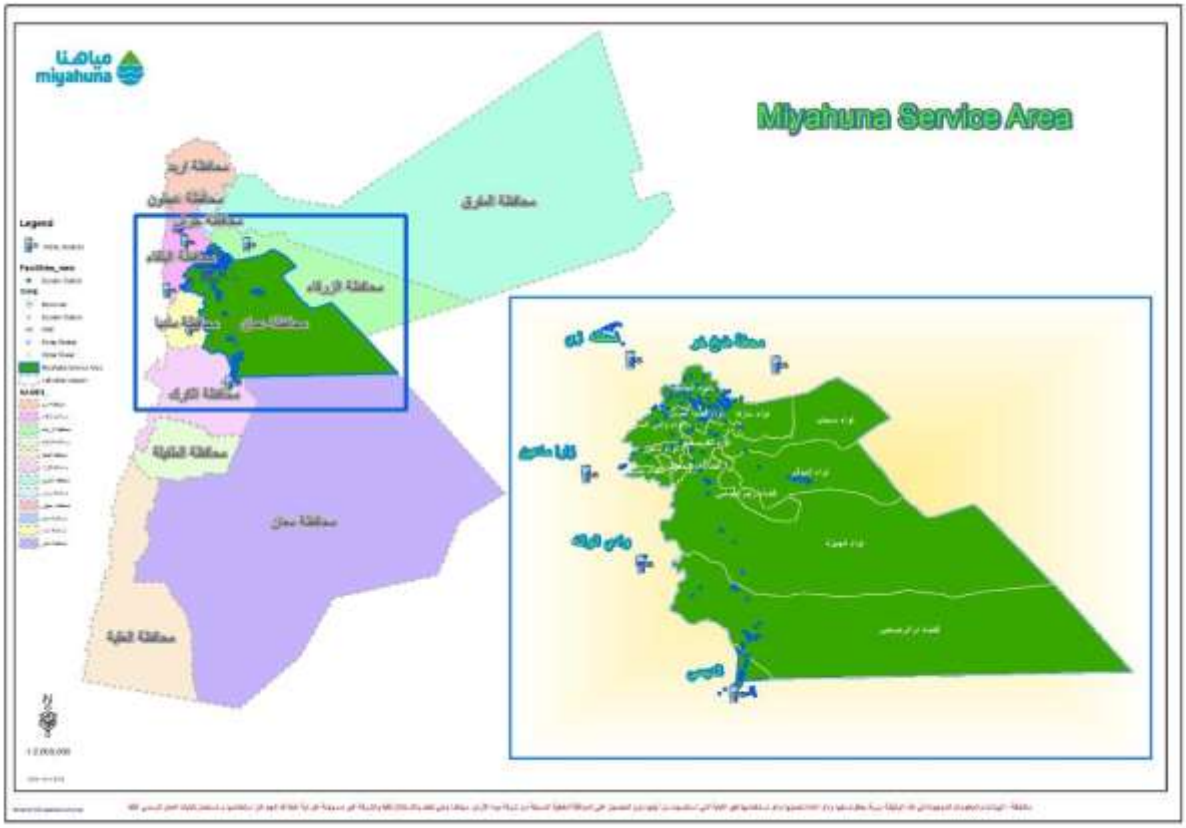
The Non-Revenue Water (NRW) percentage is one of the most important performance indicators for any water utility. Having the NRW percentage in Miyahuna ranging between 38-54.4% in the various service area indicates high losses in the system and/or considerable amounts of revenue water not billed due to deficits in metering and billing infrastructure. The planning and prioritization of investments and improvement efforts lack support from solid informational infrastructure causing weak impacts and results on Miyahuna performance and service levels.

**All needed data / information are provided in the Data Room link located in Volume I Section 5.**

### 1.1. Amman Service Area

The total area of Amman is 7579.2 km2. The elevations range from 750 mAD in the Iraq El Amir to 1,100 mAD in the Khilda, Swaileh and Dabouq areas. Figure 1 below shows the boundaries of Amman Service Area.

Figure 1: Miyahuna Amman Service Area




### 1.2. Description OF Existing System

Amman governorate is fed mainly from a number of local well fields, including Ain Ghazal, Tadj, Mowaqar, and Swaqah, in addition to local springs such as Wadi Essier and Ras Al Ain. The total production of the wells and springs in 2020 totaled 31.6 MCM/year. Table 1 shows the detailed production by well field and springs in 2020. (Details information available in data room).

*Table 1: production by well field and springs in 2020*

| Local resources | Production Per Year ($m^3$) |
|---|---|
| Muhajereen well | 3,074,605 |
| Ras El Ain Spring | 6,389,490 |
| Tadj wells | 8,401,664 |
| Ruseifa wells (Sum of untreated wells) | 1,403,949 |
| Rusaifa TP10 Outlet | 2,994,110 |
| Suwaqa East wells | 2,586,211 |
| Suwaqa West wells | 989,217 |
| Muwaqqar wells | 662,754 |

| | |
|---|---|
| Wadi Sir Spring | 4,926,460 |
| Irainbeh well | 134,200 |
| Total | 31,562,660 |

In addition to the existing wells and springs, the governorate is fed from the Zara Maeen WTP, Zai WTP, and Disi system. In 2020, the Zara Maeen WTP fed Amman with 34.11 MCM, the Zai WTP fed Amman with 85.5 MCM, and the Disi system fed Amman with 100 MCM. In this same year, 10 MCM of water was exported to Zarqa, 2.87 MCM to Russeifa, and 3.06 MCM to the northern governorates. The total supply to Amman will be as shown in Table 2 below:

*Table 2 Amman Governorate Existing Supply Resources*

| Year | Net Supply |
|---|---|
| 2018 | 198 MCM |
| 2019 | 200 MCM |
| 2020 | 209 MCM |

The total number of subscribers to the system is 730740,000. The system's coverage percentage is 100. The system experienced an average NRW% of 38.7% in 2019. The Dabouq water supply system serves nearly 60% of the population in the governorate, while the Abu Alanda system serves 30% and the Deep South system serves 10%.

### 1.2.1. Primary Water Supply System

The water supply system in Amman is a mixed system. The total length of the primary and secondary system pipes is 851.85 km. The system includes 75 reservoirs and 46 pumping stations. The system has an existing capacity of 790,560 m3.

The existing water supply system can be split into three major systems:

• **Dabouq Water Supply System**: The Dabouq reservoir is the system's main water reservoir. It is fed from the Disi system and Zai WTP. Water is then pumped to Swaileh, Khilda, Um Al Shujairat, and Abu Nsair reservoirs through the Dabouq PS. While Al Kharabsheh, Shmaisani, Tabarbour, Tariq, Um Uzainah, Al Akhdar, Al Yasmeen, Nazzal, Marj Al Hamam East, Marj Al Hamam West, Na'oor Upper, Na'oor Lower, Wadi Essier Upper, Bader Upper, Bader Lower, Rabahiya and Ain Ghazal reservoirs are fed by gravity from Dabouq reservoir. The Ain Ghazal reservoir is also fed from the Racing Club wellfield, Russeifa wellfield, and Taj reservoir, and it in turn feeds the Marka, Hashmi Upper, and Hashmi Lower reservoirs. The Abu Nsair reservoir feeds the Shafa Badran Upper and Shafa Badran Lower reservoirs. The Wadi

Essier Upper reservoir feeds the Wadi Essier Lower reservoir, which in turn feeds the Iraq Al Amir Upper and Lower reservoirs. The Wadi Essier system can be fed in a reverse scheme through pumping from the Wadi Essier Spring PS to the Wadi Essier Lower reservoir and from the Wadi Essier Lower to the Wadi Essier Upper reservoir. The Wadi Essier Lower West reservoir is fed through pumping from the Wadi Essier Springs PS.

• **Abu Alanda Water Supply System:** The main water reservoir in the system is the Disi reservoir, which consists of the AA1, AA2, and Abu Alanda Old reservoirs. By gravity the system feeds the Hizam, Nasr, Taj, Quaismeh, Qal'a, and Sahab reservoirs. The Taj reservoir in turn feeds through pumping the Jofeh, Qal'a, and Ashrafiyyeh reservoirs. The Abu Alanda system is fed from the Disi pipeline at the Disi reservoirs in addition to the Zara Maeen WTP, which feeds the system through pumping from the Al Muntazah PS, or PS-6. The Al Muntazah PS reservoir is fed also from the Dabouq reservoir and is connected to the Madaba system. The pipeline connecting the Muntazah PS reservoir to the Madaba system is operated in both directions where Madaba can supply Amman or Amman can supply Madaba when needed.

• **Deep South System**: The main reservoir in the system is the Damkhi reservoir, which is fed from the Swaqah wellfield. This in turn feeds the Swaqah reservoir, which is also fed from the Qatraneh wellfield. The Swaqah reservoir feeds by gravity the Qastal PS reservoir through an 800-mm pipeline. Several localities are fed along the pipeline route including Zmaileh through the Zmaileh booster, Hammam Al Shamout through the Hammam Al Shamout booster, and the Arainbeh PS reservoir, which is also fed from Arainbeh wellfield. The system can be fed from the Dabouq reservoir through the Muntazah PS reservoir. As explained above, the three systems are interconnected. Some reservoirs such as the Taj are fed from the Dabouq and Abu Alanda systems. Both the Taj and Dabouq reservoirs feed the Ain Ghazal reservoir. Thus, three subsystems could be added: Dabouq and Ain Ghazal, Dabouq and Abu Alanda, and Abu Alanda and Taj. The schematic diagrams for the Amman water supply system is available in data room addressed in Volume 1 section 5 (data room link).

### 1.2.2. Secondary

**Secondary (Distribution) Network**

All required information about the Miyahuna secondary system is available on the data room.

- No. of customers per DMA
- DZ inlet Diameter
- PRV & Meter

- Water distribution program per DMA
- Feeder location
- Schematic for each DZ

It is the Bidder/ Contractor responsibility to request any additional information needed for the conducting the Design analysis.

### 1.2.3. Supervisory Control and Data Acquisition (SCADA)

Supervisory Control and Data Acquisition (SCADA) system in Miyahuna is a centralized system, physically located in Dabouq control room, monitoring and controlling water resources in Miyahuna service area which includes the Capital Governorate (Amman) and Madaba Governorate.

The centralized system connects seven local SCADA system groups (Dabouq booster, Dabouq reservoir, Tadj pumping station, Ain ghazal pumping station, Abu Alanda reservoir, Damkhi Pumping station and Madaba reservoir) which are a combination of reservoirs, boosters, tower reservoirs, pumping stations, wells, and some other sites.

#### 1.2.3.1. Description

The main SCADA system controls and monitors pressure and flow, and detects leakages in primary and secondary networks. The system is interfaced with an Asset management system that has real-time maintenance advisor (IOT) platform for predictive maintenance and decision support to abnormal asset conditions. Moreover, the system is interfaced with a calibration system which adequately manage instrument calibration activities through PROCAL V5 calibration system (some of the devices and instruments have HART protocol). Also, a dashboard system (DATA click- LIVAclick) is interfaced to SCADA Amman system to provide real time results such as KPIs and manageable visual information.

#### 1.2.3.2. Main SCADA system details

1- Main SCADA and related local SCADA software: Structure ware clearSCADA v.2017

2- Main technologies and protocols recently used and adopted in Miyahuna SCADA are for RTU/PLC:

   a. Modicon M580 (Modbus TCP and Ether Net/IP protocols),

   b. SCADA pack 575 (DNP3, IEC 60870-5-101/104, Modbus and supporting HART protocols)

3- Communications: The sites communicate through a VPN network provided by ISP.

4- SCADA Server: (HPE proliant DL380 Gen10: Processor 10-core, 32GB Ram Memory, 3x300GB in RAID Configuration and Eight 1GB Ethernet Ports.4-SCADA Firewall: Palo Alto

### 1.2.4. Big Customers

Miyahuna's Big Customer metering is conducted using a variety of methodologies and technologies. Currently, Miyahuna uses mechanical water meters, ultrasonic water meters and Electromagnetic water meters. Meter readings are collected manually. Collected meter readings are entered into Miyahuna's X7 database, the version is 71300, it is an oracle based system oracle database which uses or supplies this data to other systems for billing and analysis, like its Customer Information System (CIS) and Geographic Information System (GIS). The issuing of system generated water bills to customers is conducted manually by Miyahuna staff, who are also responsible for collecting payment from domestic users. The data collection and billing process has a variety of limitations which inhibit Miyahuna from conducting effective management of the water network.

The process of collecting meter readings manually is time consuming and costly. In addition to the high costs, these legacy technologies and methodologies delay Miyahuna in collecting the frequent and accurate information it needs to achieve its objectives in reducing Non-Revenue Water (NRW) and improving customer satisfaction.

The list of existing big customers meters data is available on the DATA Room

Remote disconnection valves shall be installed at the big customers meters as stated in the data room: <List of customers/ remote disconnection valves to be installed>

## 2. SCOPE OF WORK

### 2.1. Project Overview

The Project comprises design, analysis, construction and operation of a solution to convert the operations of Miyahuna-Amman primary system and selected area as shown in table below. within Miyahuna's service area into smart, integrated, and automated metering and monitoring processes to control the water supply and distribution on primary level, The activities included in this project will upgrade the monitoring and metering system and the Information Technology (IT) systems in Miyahuna which will improve the operations efficiency and the utilization of available resources and optimization of water distribution.

This project aims also to automate the water distribution in an isolated, restructured area (DZ 13/ Khilda distribution zone) of approximately (47k) subscribers. The smart operation on secondary level will result in Dynamic Rationing schedule, supply hours and Supplied Quantities between the DMAs in the aforementioned DZ based on the availability of water and the demand. Furthermore, the project activities includes replacement of approximately 10,000 existing customer meters with smart meters in the assigned DMA's,also the replacement of around 4,000 Big customers meters located in various areas

in Amman with static meters, and establish AMI system to collect the meters data remotely, and connect the AMI system with the smart platform. Remote disconnection valves shall be installed at the big customers meters as stated in the data room.

Miyahuna will go one step deeper to introduce the concept of Smart intermittent supply approach with continuously pressurized network in one DMA using shut-off valves in one District Metered Area (DMA) of approximately 1,000 house connections within the same Distribution Zone (DZ).

Note: Quantities may vary and are for guidance only.

The final list will be provided after awarding the contract to ensure the inclusion of all new customers

| DISTRICTS | static meter | Mechanical meters | No. of customers | HC's | Feeder point | Existing of PRV | Type of work |
|---|---|---|---|---|---|---|---|
| 13B1 | 71 | 3800 | 3871 | 548 | 300(DI)-400(DI)-500(DI)-600(DI)Ground Res. | NA | Meter replacement |
| 13B4 | 65 | 2397 | 2462 | 298 | 300(DI)-400(DI)-500(DI)-600(DI)Ground Res. | NA | Smart intermittent supply approach<br>Meter replacement and shut off valves |
| 13D5 | 12 | 2408 | 2420 | 355 | 300(DI)-400(DI)-600(DI)Ground Res. | NA | |
| 13C* | 1 | 1776 | 1777 | 334 | 400(DI)-400(DI)-500(DI)-600(DI)Ground Res. | NA | |

The project aims to connect the primary network of Amman, secondary of the selected distribution zone, and tertiary of a selected district metered area DMA within the DZ to a single unified platform that allows the interpretation of data from the devices in the relevant network, the ERP system (oracle) The ERP which includes the Meter data management module is under development, and Miyahuna will provide the bidder with all necessary data after awarding, SCADA and the Advanced Metering Infrastructure AMI to produce comprehensive, useful, real-time information that facilitate decision making.

The expected objectives for the project:

- Balanced distribution of the available water quantities by controlling and operating the primary system;
- Mitigating crises by Smart network operation mechanism and remote controlling;
- Dynamic response to events related to water supply emergencies, interruptions, water demand alteration and network bursts of the primary water network on a real-time basis;
- Minimize operating pressure, reduce physical water losses, reduce number of bursts and interruptions, and extend the life of the water distribution networks in DZ 13. Consequently, this will decrease NRW level and improve measurement accuracy in the Miyahuna service area.
- Quantification of the NRW components and intervention impacts. This will establish guidelines for future rolling out of the examined NRW improvement model.
- Improve the service level for around one million customers in the Miyahuna service area.

In case of any dismantling or replacement works the contractor is responsible to dismantle the existing Items/devices with care, and the dismantled materials/ devices must be transferred and handled to the client in his store/ Miyahuna.

### 2.2. Project Outcomes

The detailed objectives of this Project is as shown on Table 3;

*Table 3 Current and future Status*

| | **Current Status** | **Status after Project Execution** |
|---|---|---|
| **PRIMARY LEVEL** | Miyahuna has a SCADA system that covers the primary network. Not all direct connections on the primary are monitored and controlled | All nodes/connections on the primary network connected to the SCADA system, monitored and controlled.<br>Modulating valves and static meters to be installed depending on the hydraulic model outcomes.<br><br>Note: Additional nodes include the direct connections on the primary network. For more information check the DATA ROOM.<br>And this includes also the Export and Import nodes in/out Amman, the system shall be expandable to integrate Zarqa Local SCADA, if it implemented<br><br>- Connections shown in Blue color in the Data Room-FARA7 /Schematics/Primary<br>In addition to the Excel sheet in the folder (Data room-FARA7/Bulk Meters), |

| | | |
|---|---|---|
| | | all the required equipment ( Meter, Valve, Sensor on each node ) is installed and in operation. |
| | The operation on the primary level is done through the intervention of the operators on the SCADA system based on the operation manager decisions. | The artificial intelligence algorithms are used to give the decision makers two options for operation with the ability to respond dynamically to the events related to water supply emergencies, interruptions, water demand alteration and network bursts of the primary water network on a real-time basis:<br>1. Allow the system to operate automatically without any human intervention<br>2. Provide the best operational scenarios after conducting the analysis of available water resources, the demand and the historical data... etc. |
| | NRW calculation can be achieved on the primary level based on the current primary network | Ability to conduct NRW calculations on the primary level on real time basis. Through dash boarding systems specialized in NRW calculations according to the international standards. |
| | SCADA system availability is around 100% | The Smart operation system availability 100% |
| | SCADA system Dashboard available for the nodes connected to the SCADA. | Dash boarding system that presents the smart operation for different management's levels on real-time. GIS based graphical presentation. Visualization of all network components and devices. |
| | Pre-determined Rationing schedule, supply hours and Supplied Quantities in DZ 13. | Dynamic Rationing schedule, supply hours and Supplied Quantities based on the availability of water and the demand. |
| **Secondary level** | DZ 13 is restructured and isolated, The water supply distribution in DZ 13 on DMA level through the intervention of the operators on the SCADA system. | The DZ and DMA inlets are fully monitored and controlled, and smartly operated on the DMA level. |
| **Tertiary level** | Big customer's meters are combination of mechanical and Static meters. | All Big customers meters to be replaced by static meters with remote reading capabilities |

| | |
|---|---|
| Reading of Big customers meters are done manually through meter readers either on monthly or quarterly basis | Automatic Meters Readings through the established AMIsoftware, and monitoring of the consumption patterns with alarming system and notifications to be sent automatically to the concerned teams.<br>The billing process for those customers is to be done electronically.<br>The system is open, and expandable to include all the new customers. |
| Monitoring of the big customers is based on the analysis of the billed quantities | Real time monitoring of the Big Customer meters<br>the alarming system is customized based on the rationing schedule |
| Disconnection of water supply of the Big customers meters done manually ; is either done by closing valve installed before the meter or removing the meter from site and install end caps. | Automatic shut off valves installed and the disconnection of water supply to be done remotely through AMI software. |
| Meters of the selected DMAs from DZ 13 (approximately 8,000 to 10,000 customers) are combination of mechanical and Ultrasonic meters. | The Customers meters for selected DMAs ( as illustrated in table above) to be replaced with static meters and connected to the established AMI software. |
| Reading of meters are done manually through meter readers quarterly. | Automatic meters readings through established AMIsoftware and the analysis of the consumption data are done through the existing meter data management software. |
| The Supply Scheme in all DMAs of DZ 13 depends on intermittent supply | Smart intermittent supply approach with continuously pressurized network in one DMA, using automatic shut-off valves installed on all House Connections.<br>Ability to alter the rationing schedule remotely. |
| Irregular leak detection campaign done by Miyahuna NRW department. | Active leak detection through smart platform on a real-time basis using all the equipment needed. |
| The quantification of NRW is not applicable due to lack of information. | Quantification of NRW in the selected DMA.<br>A case study report that quantifies impacts and calculate technical and financial feasibility of each project component. |

| | | |
|---|---|---|
| | Different systems and software operated as a standalone system separated from each other. | Single unified platform that can deal with all Miyahuna related systems ( Existing, under development and New) such as SCADA, ERP, Billing, AMI…etc. |
| **Smart Platform** | Remote Network management is not available. | Ability to manage the water network remotely using Artificial intelligence (AI) algorithms. All the network components automatically in a smart manner which will enhance the network management and utilization of the available water resources. |
| | Data analysis is done manually after extracting the reports from different systems. | Automatic Data Analysis that feeds the Artificial Intelligence (AI) algorithms for smart operation, or generate automatic reports that support the operation decision makers/making |
| | Data storing locally on separate databases and servers, with no interaction among the Data Bases. | Unified centralized data base with all necessary Hardware needed. |
| | Remote control is available for the nodes connected to the SCADA. | Perform comprehensive control of all the metering, monitoring and controlling points. |
| | Water distribution is depending on the available information and the rationing schedule | Balanced distribution of the available water quantities. |
| | Firewalls devices exist on SCADA Network. | Advance security software to protect smart platform components and devices from any external hack. |

## 3. General and Technical Requirements

### 3.1. Technical Requirements

The Contractor shall cover the following requirements and activities. The Contractor shall carry out any further activities that he believes are necessary to complete his obligations, these activities will be considered as an integral part of his obligations.

1. **Establish smart platform for Metering, Monitoring and Controlling in Miyahuna integrating the AMI, SCADA, and ERP systems.**
    - The Contractor is requested to supply, install and commission a Server with application /software should be located at Miyahuna to receive, analyze and store the data. The Platform system must be open and not limited to a certain type or number of nodes and Miyahuna must be able to add new nodes without any additional cost.

- Create multiple scenarios for the water supply scheme to handle the scheduled and unscheduled resources interruptions, seasonal water demands, bursts occurring on the primary lines to achieve the best decision/solution according to the aforementioned circumstances.

**2. Improve Metering, Monitoring, and Operation for Primary Water Supply System in Amman and Parts of Zarqa and Madaba.**

- Define and implement the requirements to automate the water distribution in smart manner using Artificial intelligence algorithms; including but not limited to the procurement and installation of monitoring, control, and metering devices (e.g.: CVs, Bulk Meters, Remote Telemetry Units (RTU), Programmable Logic Controls (PLC), and pressure loggers); and Connect those nodes to the SCADA system of Miyahuna, and use the established smart platform to smartly operate the primary water supply system using automatic operation modes.

**3. Smart operation for secondary water supply system in Khilda Distribution Zone (DZ13) in Amman:**

Smart operation of the secondary system in the DZ 13.

The activity will include:

- Procure, install, and connect to Smart platform, all required devices;
- Automate the water supply distribution in DZ 13.

**4. Improve metering, monitoring, and operation for tertiary water supply system in selected DMAs inside DZ 13:**

This activity will introduce a comprehensive approach in selected DMAs within DZ 13 to investigate the impact on NRW levels resulting from each water network improvement measure; network enforcement, meter replacement, continuous pressurized network, illegal use survey, and active live leak detection. The DMAs will be selected to include approximately 8,000 to 10,000 customers.

The following activities will be implemented in the selected DMAs:

- Design, develop, supply and install the AMI system/software. The system shall facilitate collecting the meter readings and all logged data and alarms remotely. The AMI software must also facilitate a two way communication to control the disconnection valves, and configure the meters remotely. The AMI system must be open and expandable, and connected to the smart platform and the Meter Data Management software under the ERP system.
- Procure and install smart meters equipped with communication modules enabling the smart remote metering using Advanced Metering Infrastructure (AMI) system;

- Implement automation system for relevant operation, maintenance, customer service, and inspection transactions including the procurement of portable computers including the procurement and installation of live leak detection system using sensors and meters;
- Procure and install automatic smart shut-off valves in one DMA, communicating and operating under the smart platform system. The Contractor is responsible for all related works, materials and fittings...etc. needed to complete the work including the Civil works if needed without any additional cost.
- The shut-off valves will be used to pilot the smart intermittent supply approach with continuously pressurized network and analyze findings and issue a case study report to quantify impacts and calculate technical and financial feasibility of each project component.

**5. Big Customers meters replacement**

Miyahuna is willing to procure around 4000 Static water meters for Miyahuna's water big customers at which all of them should be connected to the established AMI system and Meter Data Management Software to get all the logged data such as readings of the meters, flow rates, Flow profile, alarms and ….etc. For meter with DN>=2" data must be uploaded into Miyahuna servers on real time basis while for the remaining DNs the reading frequency will be on a regular basis in a way to avoid any losses in the logged reading and it is the Bidder responsibility to propose in his technical offer the methodology to be adopted to collect the data.

Moreover, the Contractor must be responsible for the installation of the water meters according to the manufacturer requirements and specifications; The Contractor is also requested to Supply, Install and operate Remote Disconnection valves for meters with DN>=2" to be used for disconnecting the water supply remotely from the AMI system.

The Contractor may need to modify the installation of the existing meters and The Contractor is responsible for all related works, materials, air release valves and fittings...etc. needed to complete the work including the Civil works if needed without any additional cost.

Also, The Contractor is responsible for establish AMI system and connecting all the Meters to this system. The Communication must be of an open protocol, and all meters' data should be transferred via a communications network to the AMI system for further analysis and alarm system on special customized software and Meter Data Management Software that should be integrated with Miyahuna CIS and GIS (ERSI ArcGIS V10.8).

Before the implementation the Contractor must conduct a study, design and analysis phase, to revise the existing situation and supply conditions to come up with the optimum/ best installation conditions as well as meter sizing.

**6. Communication**

- The Contractor shall study and understand the coverage of the telecommunication services carefully for each device to ensure proper communication between the device and the Server (software/ application).
- The solution provided by the Contractor must be acceptable by the TRC and meet the regulation and Jordanian laws.
- The communication must be of two way to facilitate Control and configuration in addition to data collection.
- The communication solution for all project components must be open/standard system.
- Contractor must prepare any needed approvals with any parties such as TRC approval and the design must be approved accordingly and meet the Jordanian laws and regulations.
- The Contractor should be responsible for paying any fees and/or cost (electricity, communication, licensing….etc.) for the project period in addition to the defect notification period of two years after the end of commissioning period, the contractor must demonstrate in his financial offer annual expenses of the project for the support period.
- In case the Contractor sign a communication services contract with communication service providers in Jordan, it is requested that the Contractor provide Miyahuna with a copy of the contract agreement, in addition; the contractor is obliged to provide Miyahuna with a commitment letter for all costs and fees incurred for 5 years annually from the mother company / Service Provider, and insure the availability of this communication solution for at least 5 years after the commissioning date. The Contractor is obliged to pay all fees for the communication service during the support period contract and transfer it Miyahuna Amman by the end of Defect Notification Period.
- 2G/3G technologies are not accepted.
- The bidder must provide an official commitment letter that the communication solution proposed through his offer is valid/ operable for at least 10 years.
- The minimum Data Collection/receiving Rate for design purposes only, with ability to reconfigure the rate remotely.

| | | |
|---|---|---|
| **Residential water meters** | Daily | With possibility to adjust the data collection rate for NRW calculations such as MNF |
| **Big Customers water meters** | Daily | The data collection rate should be remotely adjustable/ configurable |
| **Bulk Meters** | Real Time | The data collection rate should be remotely adjustable/ configurable |
| **Shut off valves** | Daily | The data collection rate should be remotely adjustable/ configurable |
| **Flow Control Valve** | Real Time | The data collection rate should be remotely adjustable/ configurable |

3.
3. For communication solution the contractor must abide to the following requirements:

- The bidders are invited to provide a detailed offer for an end-to-end communication network that is designed to achieve the best communication coverage with high network redundancy, scalability, and availability. Furthermore, the bidder shall only offer all needed network devices and any other needed components that are manufactured by an internationally recognized manufacturer with deployment proven records in the requested field according to the code requirements stated in the tender documents.
- The bidder shall provide in his offer an architectural overview of the Network Server/Data Management / Gateway solution.
- If the bidder offer a solution based on Radio it is required that during the design stage the bidder shall conduct and submit a detailed comprehensive radio frequency coverage plan to identify the approximate optimum total number of needed gateways to provide the optimum RF coverage and service for the selected coverage phase and to identify their individual geographical locations.

- The gateways should Works with its antennas on harsh environmental conditions including high humidity tolerance levels, high wind speeds and wide temperature range not less than (-20 to 70 °C)
- And shall be rated with its antennas as an IP67 with different outdoors mounting options including, and must support geolocation functionality through Time difference of Arrival (TDoA) and received signal strength indication (RSSI)
- Supports GPS antenna for positioning and time synchronization of the gateway.
- Assuring high communication availability not less than 99.99 % with redundancy and availability when identifying the locations of network gateways
- The proposed communication solution must maximize the end devices battery life time, network capacity, quality of service, security and the variety of applications served by the network.
- The bidder shall indicate if the solution provides a software/firmware release management and deployment of network components
- The bidder shall provide dashboard functionality for monitoring the communication network and network server performance.
- Supports full advanced remote management functions including those for configuration, updating and status monitoring.
- Allows reading and sending data at different frequencies.
- Network components must support full advanced remote management functions including those for configuration, updating and status monitoring.
- Shall support different security features including: IPSec (Two IPsec tunnels – support Active/Active or Active/Standby mode) and Public Key Infrastructure (PKI).

Disaster recovery Plan for the whole IT infrastructure shall be proposed and provided.The Contractor shall provide all investigation, design, plant, equipment, materials, and labor that is required for completion of the works mentioned above and related works in accordance with the requirements and specification.

The Contractor shall use international standards; and shall use the products having the highest quality in themarket.

### 3.2. Project Stages

The Execution of the project is expected to follow the suggested outline as below in order to achieve the project objectives. The Contractor is free to suggest the project stages that satisfy his work flow.

*Table 4 Project Stages guideline*

| **Stage** | Time for completion of the Works | | | | | |
|---|---|---|---|---|---|---|
| **Stage 1** | **730** calendar days | **Data Gathering, Site Survey and analysis** | **1** | | | |
| **Stage 2** | | **Design Stage** | **2.1** | Smart Platform, AMI and Big customers Design | | End of each design phase subjected to Miyahuna approval |
| **Stage 3** | | **Execution Stage** | **3.1** | Develop Smart Platform implementation and AMI System implementation | | |
| | | | **3.2.1** | Implementation on Primary | procurement | Report is to be submitted at the end of the implementation phase |
| | | | **3.2.2** | | Installation of monitoring, control and metering devices and connect them into SCADA System | |
| | | | **3.2.3** | | Integration of all nodes of the primary system (exist and new nodes) into the smart platform, including the operation mode analysis and learning phase | |
| | | | **3.2.4** | | Commissioning, testing and reporting | |
| | | | **3.2.1** | Implementation | Procurement | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | **3.2.2** | on Secondary | Installation of monitoring, control and metering devices and connect them into SCADA System | |
| | | | **3.2.3** | | Commissioning, testing and reporting | |
| | | | **3.3.1** | | Procurement | |
| | | | **3.3.2** | | installation of customer smart meter and connect them to AMI system | |
| | | | **3.3.3** | Implementation on tertiary | Commissioning, testing and reporting | |
| | | | **3.3.4** | | installation of shut-off valves and connect them to AMI system | |
| | | | **3.3.5** | | Commissioning, testing and reporting | |
| **stage 4** | | **Commissioning and Operation** | **4.1** | | The contractor is obliged to commission and operate the full system for six months | |
| **stage 5** | During the defect notification period for two years | **Support** | **5.1** | | The contractor is obliged to provide technical Support after the final taking over and during the defect notification period for two years<br>The Support includes the annual fees (communication, electricity...etc.) , licenses and maintenance during this period | |

### 3.2.1. Stage 1: Data Gathering, Site Survey and analysis

- The Contractor shall visit the site, make the necessary investigation, coordinate with all concerned authorities to get their requirements and collect all data needed for the design and successful implementation of the system.
- The Contractor shall carry out a data gathering and a site survey in accordance with the given (by the employer) and/or available data (available in the data room), to include all the existing systems (primary, Secondary, Tertiary), to satisfy himself with respect to the nature of the works required as per this document, the Contractor shall be fully responsible for the analysis and results. All assumptions depending on these results and the consequences of these assumptions either regarding the cost, resources, time or others, on which he builds his rates and expecting problems he may face, will be the Contractor's liability. The Contractor will submit a comprehensive report and Survey results and assumptions, subject to the Employer/Engineer approval. Noting that the data given are for guidance only, it is the Contractor's responsibility to verify the given data.
- The Contractor shall liaise with the following authorities, among others, to obtain the necessary information, permits, approvals and permissions to implement the Works:
  - Liaison with all ministries and authorities who have jurisdiction in relation to the execution of Works, e.g. Ministry of Public Works and Housing, Amman and Zarqa and Madaba Municipalities, the Army, Traffic Department and Telecommunication Companies, Telecommunication Regulatory Commission, Jordan Standards and meteorology Organization… etc.
  - The Ministry of Public Works and Housing have their regulations and standards that regulate Road Detours, Excavations, Backfilling and Reinstatement within roads and street corridors, the Contractor shall bear the full responsibility to know, understand, implement and follow these rules and standards during designing and executing works.
- Site survey requirements:
  a. Carry a full field survey to know and assess existing condition of the Selected distribution Zone (DZ13) and primary water supply network and investigate the status and condition of current existing water network components.

1. Gathering and collecting information and data about the existing conditions of the DZ13 and Primary water distribution networks areas in Amman and parts of Zarqa and Madaba.
2. Submit a proposed plan for carrying out a detailed survey.
3. Start field study to investigate the current existing water network components, operational supply procedures
4. Start field study to investigate the Flow rates for sizing purposes
5. Prepare a full survey report and documents for the field study infrastructure of the existing conditions with coordination with Miyahuna.
6. The survey documents shall include the cost of maintenance (if any).

b. Carry a full communication survey study for each node to obtain the best available communication technology to be used within the node's geographical area for data transferring to SCADA and AMI system and integration to the smart platform:
    1. Conduct site survey to the targeted areas in Amman and parts of Zarqa and Madaba which will be metered, monitored, and controlled through SCADA system and smart platform that will be established under this project.
    2. Determine the best available communication technology and an alternative solution to be used within the targeted areas considering the geographic topology and the availability of this technology in hardware and software components required under this project.
    3. The study shall include data rate calculation, cost estimate calculation and any extra work required to establish a communication network with SCADA Amman system.
    4. Prepare a full survey report and documents for the study.
    5. The study document shall include the following but not limited to:
        i. General Communication network topology in CAD format.
        ii. Detailed network architecture drawing (site coordination, data rate…etc.).
        iii. Equipment distribution.
        iv. General description.
        v. Site survey result.
        vi. Data rate calculation.
        vii. Cost calculation.

c. Carry a full site survey study for each maintenance advisor system nodes to investigate and determine that the current connected nodes meet the targeted requirements or not, if not specify and determine the needs to upgrade, replace or add to achieve the targeted requirements, which will be implemented by the contractor in the execution stage.

### 3.2.2. Stage 2: Design Stage

In this stage; the role of the Contractor includes but not limited to:

a) Identify key technical constraints.
b) Identify the risks and prepare the risk mitigation matrix.
c) Prepare demand forecasts based on the consumption and supply data, and specify the optimum way to utilize the available resources to meet the customer current and future demand, which will be fed later into the smart operation system.
d) Prepare the algorithms, the integration method with current and upcoming systems, data migration techniques.
e) Complete the Employer's Requirements.
f) Utilize the available information, data, drawings and specifications and the results of the previous stage.
g) Prepare the drawings and the works to be done in the implementation stage.
h) Identify any new flow / pressure monitors and other types of sensors need to be installed at another intermediate locations in the networks (e.g. pump stations, DZ control points, Major junctions, Reservoirs, etc.), and to determine the number, types, and locations of sensors to be installed
i) Determine the type of communication to be adopted
j) Determine the size of equipment including ( Meters, valves, Shut off valves this can be determined during the site survey. According to the location of installation of shut-off valves. The house connection diameter normally varies from 25-32mm

#### 3.2.2.1. Smart Platform Design

Miyahuna is currently monitoring a large part of the primary water networks through SCADA systems that were established earlier and are currently being upgraded to include a larger part of its Primary Water Networks through current projects that are expected to be completed soon. Miyahuna is also able to control a large part of the Primary Water Supply System through its Existing SCADA system which will be also upgraded to include a larger part of its Primary System. Due to the increase in the number of

metering points and different systems used by Miyahuna; the need for a smart platform to perform comprehensive analysis/control of all the collected data/metering, monitoring and controlling points is vital. The Contractor is required to design a unified platform that facilitates the visualization and control of all the network components automatically in a smart manner which will enhance the network management and utilization of the available water resources.

Smart infrastructure, smart systems, smart water utility are new terms that were introduced during the recent years. Miyahuna has implemented several projects to introduce new technologies during the past years. But, technology is only part of the solution set. Super-efficient, "smart systems" will not only be achieved by changing the equipment only, but also having a unified platform that includes all these technologies, equipment, systems working together. The objective of this platform is to assist Miyahuna in benefitting from the collected data and do the analysis that would help the decision making process on different levels to take the right decision based on real time analyzed data which enhance all the utility activities in future.

AMI will feed the platform with the data required for the smart operation of the system, such as calculating the demand, NRW calculations, etc.…

The Design of the Smart platform must take into consideration the following technical aspects:

- Set the back bone and the road map for moving into the smart utility level.
- Interface with all current network components.
- The proposed smart platform must be expandable for any devices, nodes or systems to be added in the future.
- Reference for all systems/software and to assure the connectivity and proper data migration and data transfer between all different software.
- Deals with different communication protocols for the network equipment.
- Rapid increase in the number of metering, monitoring and controlling points.
- Changes in the demand behaviors, and the availability of water resources.
- Intermittent supply which may cause Variation in supply hours, pressure and flow rates.
- Ensure the smooth adaptation of the smart operation approach in future expansions.
- Utility can monitor and read the big customers meters from a Central Station that will be installed in utility Offices
- The methods of connection, data sending procedure and the detailed technical specifications for all the equipment to be used.

- Determine the ongoing software licenses, which cover patches and upgrades to ensure that the system and its software continue to perform according to the design criteria.
- Storing, analyzing, viewing, alarming and reporting of all metering, monitoring and controlling points.
- The system shall accept data from various metering and monitoring engines, and it shall receive data from the different collection systems.
- Allow programming the reading frequency.
- The ability to modify fields or add fields to Database tables.
- The system must ensure data integrity (so that the readings from the meters, location, ID numbers, and other data are always associated with the correct meter and customer) and data security, the system must ensure against loss of data.

The proposed smart platform design concept for the secondary system in DZ13 is to integrate various advanced technologies such as GIS, SCADA, ERP establishing a secondary water supply management information platform, achieving unified data management. Several sub-systems with different functions including project management, operation and maintenance, asset management, customer service, and emergency alarming are all combined in one overall monitoring and management system that can provide different kinds of water supply services.

The Employer will select DMA's to install smart customer meters and shut-off valves by the contractor using the following criteria:

1. No. of customers ranging between 1500-2500.
2. Can be supplied continuously with water.
3. Have typical customers, not on any extreme of demographic or living level condition.
4. Water supply system independent from other districts; no feeding points from or to other districts.

The platform is expected to assure the effective communication of sub-systems for information exchange, and eventually realizes a society-oriented, leadership-oriented, decision-oriented integrated management system. Given the information platform, comprehensive and reliable water-related information are expected to be available for water utilities to check up regularly in order to ensure stable operation and water safety, providing a strong technical support for decision making. Moreover, measures of online monitoring, dynamic data assessment and remote control of the water supply system

in residential communities shall greatly improve water supply management and services, as well as customers' satisfaction.

Dashboard Reports generated from the smart platform must be configurable and expandable

**Total number of users access to the Smart Platform (administrator, editor/publisher, viewer, analysts are shown in table below, These numbers are as a minimum**

| User Level | Number of users |
|---|---|
| Administrator | 2 |
| Engineer | 6 |
| Operator | 20 |
| Viewer | 20 |

The software development process must follow the recommended sub tasks below:

a. Develop a detailed user specification document: At the start of the project the Contractor should be required to engage the various role players within Miyahuna and develop a User Requirements Specification (URS) document that clearly explains what the Client requires for software functionality. This document should then be submitted to the Client for approval.

b. Detail Design Specification: The Contractor should be required to develop Detail Design Specifications (DDS) in which the detailed functionality of the software is explained. The DDS should be submitted to the Client for Approval. The business process re-engineering should also be submitted with the DDS.

At this stage it is the bidder responsibility to submit the proposed methodology to connect the smart platform to all Miyahuna Systems, including the ERP which is in under implementation for Miyahuna approval. Miyahuna will provide the contractor with all necessary documents required to facilitate the connection of systems; whereas it is the contractor sole responsibility to assure the connectivity between all systems to meet the project requirements.

### 3.2.2.2. Design of Big customers

At this stage the Contractor must study the following items at least:

1) Meter Sizing:

The Contractor in this stage must conduct the following:

- Verify the meter sizing, analyze the data and study the site conditions.

- Submit a list of meters that need resizing (oversized meters & under-sized meters) and recommend the best size along with proofs and calculations that in the technical report submitted at the end of this stage.
- The Contractor must take the necessary approvals from Miyahuna, taking into consideration that the Contractor must send a technical report at the end of the project generated from the software to prove the correctness of meter sizing.
- After taking the approvals the Contractor must replace the meter with the correct size during the execution phase, and this includes any additional works such as piping, installation of fittings etc… to perform the work in a proper way according to the manufacturer recommendations and specifications
- After the implementation the Contractor is requested to submit another detailed report to prove the correctness and verify the sizing and study of meter readings and accuracy, also meter's installation, validation and verification. At this time the report must be generated from the software.

2) Installation Conditions:

At this stage the Contractor must conduct a field study and submit the installation recommendation that fits the manufacturer as well as the field conditions.

Due to intermittent supply the meter may encounter the following cases (More elaboration on these cases is illustrated in the technical specification, volume IV)

- Pipe may not full, where the contractor must install the meter in such a way to ensure the full pipe conditions
- Air Bubbles during the beginning of supply due to intermittent supply.

The Contractor must propose an installation method to overcome those cases to enhance the meter accuracy.

After the implementation the Contractor is requested to submit another detailed report to prove the correctness of meter installation to fit the field conditions and to overcome any problems that may lead to reduce the accuracy by conducting the necessary Site acceptance tests.

Miyahuna have the right to Conduct on site verification to verify the correctness of the installation condition (to verify that the solution would overcome the air bubble problem especially at the beginning of the supply) by verifying the actual water volume passed through the meter. The Bidder shall nominate

three third parties and Miyahuna will choose one of them. Where the testing will be conducted on different flow rates and different timing (Beginning of supply, during the supply ... etc.) to verify the accuracy of meters at different stages.

3) Software and Communication

The Contractor must submit the connection software and integration process with Miyahuna Data bases to be reviewed and approved by Miyahuna.

### 3.2.3. Stage 3: Execution Stage

#### 3.2.3.1. Requirements

The Contractor shall fulfill the following requirements and submit the following documents prior to the execution of the Works. The following are main requirements, any further detailed processes or requirements, which counted as part of good practice, shall be considered to be part of the Contractor obligations and shall be deemed to be included in his total price.

- Approved Platform Design
- Approved system integration methodology
- Approved method statement of the works to be implemented.
- Design drawings for the primary system
- Proposed Work Program including the procurement plan and Cash flow.
- Materials Submittals subjected to the Employer Approval.
- Design of any structural component (e.g. chambers).
- Proposed telecommunication solution
- All Network topology approved proposal.
- Meter Sizing and installation recommendation for Big Customer meters
- Chamber design must include flood alarm system

- Contractor responsibilities during the execution phase listed but not limited to :

- The water supply scheme shall not be affected by his works ( shall sustain the supply without interruptions)
- The contractor shall take in his liability to reserve the existing assets within the work field.
- The contractor shall reflect any modification, installation and replacement on the Miyahuna SCADA system.
- Any new findings - unseen during the design stage - shall be reviewed and included in the hydraulic execution stage.

#### 3.2.3.2. Environment, Health and safety requirements

- The Contractor shall be responsible for safety and protection of the environment. Safety in this context refers to the health and safety of people and the protection of the environment. Nothing contained herein relieves the Contractor from complying with all applicable National standards and regulations.
- The Contractor shall have an EHS Representative (also known as Safety Officer or SO), approved by the Employer, present on the Project at all times when Work is physically being performed. The SO may have other minor duties, but the position's primary role is to oversee safety of the worksite and Work being performed by the Contractor, as well as that of his Subcontractors. If shift work will be utilized, the Contractor must have a SO for each shift. In the case of shift work, the Contractor will designate one SO as the lead for the Project.
- The Contractor shall have a documented Site Specific Contractor Environment Management Plan (EMP) in place which shall be subject to the approval of the Employer/Engineer before work will be authorized to start. This plan must be consistent with the requirements in the Employer's Contractor Safety Policy, national regulations as well as Environmental Impact Assessment study for the Project.

#### 3.2.3.3. Security requirements

NGFW should be deployed in IOT proposal to secure the **IOT devices**& the **IOT GW** that could be hosted locally at Miyahuna DC or on a public cloud (for example AWS, Azure or GCP).

Securing IOT devices:

- The solution must be agnostic to IOT vendor, IOT function (ex. Water Meters, pressure meters …)
- The solution must include backhaul security over Mobile (3G/4G/5G) or Wifi networks.
- IOT security gateway must include the following:
  - A full IOT Security lifecycle starting with understanding the asset, identify the assets risk, apply risk reduction policy, prevention of known threats and detection& response to unknown threats.
  - Solution should be able to monitor IOT devices transparently.

- Solution should use machine learning capability to detect the IOT device details in multi-tiers, including device type, vendor & model and device instance
- Solution should provide full visibility on the IOT devices firmware vulnerabilities and the corresponding risk score
- Solution should provide policy recommendation based on the detected risk, which can be directly applied on the next-generation firewall.
- A native IOT security policy, that can be applied natively at the security policy using device-ID

- The solution must be able to offer IOT security functional specs as mentioned above in conjunction with Mobile (3G/4G/5G) security:
  - Clear separation between mobile core packet gateway (PGW) used for Miyahuna IOT and other mobile subscribers (logical or physical is acceptable)
  - Support user plane security as defined at GSMA FS.37 recommendations
  - The security GW must support GTP (user -U & control -C) stateful inspection.
  - The security GW must prevent GTP-C flood protection, GTP-in-GTP attacks, GTP protocol validation and action to allow, alert or block capabilities under GTP security.
  - Securing S5 Interface user plane: ability to activate full threat prevention on all user traffic (Application Control, Anti-virus, Anti-Spyware, Intrusion Prevention, Advanced Threat Prevention with Wildfire for zero-day threat prevention)
  - DNS Security - Automatically securing DNS traffic by using a cloud-based analytics platform providing the firewall with access to DNS signatures generated using advanced predictive analysis and machine learning, with malicious domain data from a growing threat intelligence sharing community.
  - Ability to correlate between security threats to user ID (IMSI/IMEI) in real time utilizing 3GPP S5 interface
  - Support to apply Application Control, Anti-virus, Anti-Spyware, URL Filtering, Intrusion Prevention, Advanced Threat Prevention with Wildfire per 4G subscriber ID (IMSI) or Equipment ID (IMEI)
  - Support for option to add single or multiple IMSI(users) in a security policy

Securing IOT GW:

The IOT gateway is the application used to collect the readings from the IOT devices, which can be deployed on cloud or on-premise.

In case of cloud hosting the bidder must abide local regulations

الصادرة عن وزارة الاقتصاد الرقمي والريادة وأي تحديثات صادرة 2020على المقاول الالتزام بسياسة المنصات السحابية وخدماتها عليها من الجهات ذات العلاقة والاختصاص

Next-Generation firewall must be deployed in the front of the IOT GW to prevent and secure the GW and should have the following specs (Virtual or Physical appliance is acceptable):

**Gartner and Third-Party Testing:**

Firewall vendor should be in the Leader's Quadrant of the Gartner Report for Network/Enterprise Firewalls in last 9 years

Firewall vendor should have at least 95% of Security Effectiveness in NSS labs Next Generation Firewall 2019 report.

Firewall vendor should be in the Leading position of the latest Forrester Enterprise Firewall 2020

**Firewall Security Policy Control features:**

Security policies control based on Layer 7 applications irrelevant to the TCP/UDP port number (non-profile-based application control)

Built-in Security Optimizer in the Firewall User Interface to convert legacy Layer 4 Port based security policies to Next Generation Layer 7 application based security polices by automatically detecting applications utilization each security policy rule and hence allowing the admin to match the correct applications for each legacy rule

**Firewall Decryption & Tunnel Inspection features:**

SSL decryption policies covering SSL encapsulated protocols such as HTTP(S), IMAP(S), POP3(S), SMTP(S), and FTP(S), and Secure Shell (SSH) traffic

SSL decryption broker for inline inspection rather than decryption mirroring for offline solutions

SSH decryption to detect SSH tunneling

Decryption policy control based on Active Directory users, groups, IP addresses, URL categories, or countries

**Firewall Threat Prevention (IPS, Credential Theft Prevention, AV, and Anti-Spyware) features:**

Vulnerability Protection against: brute-force, code-executions, code obfuscation, command-executions, exploit-kits, info-leaks, overflow, phishing, scan, dos and sql-injections attacks

Anti-Spyware protection against: adwares, backdoors, botnets, browser-hijacks, data-theft, keyloggers, net-worms, spywares, peer to peer communications, phishing kits, and post exploitations

Anti-Virus support for the following applications: http, https, ftp, smb (v3 & v3.1), smtp, imap, and pop3

Credential Theft Prevention by comparing Active-Directory credential hashes with credentials hashing submitted to external or internet websites

Creation of custom user-defined IPS signatures (payload based)

Creation of custom user-defined Anti-Spyware/Command & Control signatures (payload based)

Threat packet capture for up to 50 packets from IPS, Ani-Spyware and Anti-Malware engines

Selection between allow, alert, reset client, rest server, reset client & server and block for detected threats

File blocking based on file type, application, file direction (upload or download), user id, URL category or country

**Firewall URL Filtering features:**

Multi-URL Categorization support for the same website

SSL decryption control per URL category

Quality of Service control per URL category

Credential Theft Prevention control per URL category

HTTP header modification and insertion capability

Control SaaS application access to specific corporate Google G Suite accounts, specific corporate MS office 365 tenants, and specific corporate Dropbox accounts while blocking all personal Google G Suite, MS office 365 and Dropbox accounts

**Firewall Advanced DNS Protection features:**

Real time machine learning based DNS protection against tens of millions of malicious domains for advanced DNS attacks.

DNS tunneling protection though Machine Learning to quickly detect Command & Control traffic hidden inside dns tunnels

Domain Generation Algorithm (DGA) protection through Machine Learning by predicting and stopping DGAs used by malware with real-time domain query analysis.

Category- Based DNS Security Policies based on type of DNS threat

Free Access to threat intel system (like autofocus) to get detail DNS threats Analytics

**Firewall Advanced Zero-day Malware Protection features:**

Direct integration with the proposed firewalls through Rest APIs (Non-ICAP based integration)

Analysis of embedded links within emails and ability to provide phishing verdict

Advanced Firewall built-in inline machine learning capabilities to protect against zero day malware without the need of submitting the files to a sandboxing environment unless needed.

Realtime signature creation and pushing to all firewalls within seconds

Extraction of thousands of unique features from each file, training a predictive machine learning model to identify new malware, which is not possible with static or dynamic analysis alone within seconds rather than minutes.

Network traffic profiling to detect malicious traffic patterns that might otherwise be misclassified as benign, such as communications with legitimate sites used as part of a command and control.

Files to be analyzed based on the application transferring the file, user id, ip address, file direction like downloading/uploading, file Type, and file location (country)

File support for Windows Executables (EXE, DLL…etc.), Scripts (VB Scripts, Java Scripts, and Power Shell Scripts), Java (Jar and class), PDF (using multiple Adobe versions analysis), Adobe Flash (.swf), MS Office Documents including Macros (Word, Excel and Power Point), Linux ELF, Compressed files (tar, rar, Zip, 7zip, Gzip, and .tg), Android APK, MAC-OS executables (mach-o, dmg, and pkg) and embedded Objects inside documents

Custom virtual environment (custom hypervisor) within the sandbox for sandbox anti-evasion protection

Bare-Metal sandbox analysis for highly advanced sandbox anti-evasion protection

Full forensic report automatically generated for each malicious file including file Information, malware coverage status, session information, static analysis, dynamic analysis, and behavior summary

**Firewall User Identification, and Authentication features:**

Identifying User AD ID by running as syslog receiver, XML APIs with Third Party solutions and terminal servers

Sharing "IP Address to User ID" mapping with other firewalls and centralized management

Direct Multi-Factor Authentication integration with RSA, Okta, PingID and Duo

Enforcing user authentication including single-sign on and multi-factor authentication through authentication policies based on user id, server name/ip address, URL, and URL category

**Firewall Remote VPN features:**

Split tunneling based on ip addresses, domains and applications for remote user VPN

VPN Authentication override using cookies

Exclusion of video traffic from main remote user VPN tunnel

VPN Gateway selection criteria based on source user id, region, OS and ip address

**Firewall Advanced Mobility & Host Information Profiling features:**

Host Information Check by collecting & reporting device information & attributes back to the firewall

Host Information Profiling attributes based on Managed/Unmanaged certificates status, OS type, Client version, Host name, Host ID, Serial number, Mobile model, Phone number, Root/Jailbroken status, Passcode presence, Installed Applications, Patch presence & status, Firewall agent presence & status, Anti-malware agent presence & status, Disk backup agent presence & status, Disk encryption agent presence & status, DLP agent presence & status, process list presence & status, registry key presence & status and Plist presence & status

Security policies control & decision based on Device/Host Information Profiles

Distribution of Host Information Profiles directly between firewalls

**Firewall Networking features:**

Flexible deployment mode of Layer 1 Deployment Mode (Virtual Wire Mode), Layer 2 Deployment Mode (Bridge Mode) and Monitoring Deployment Mode (Tap Mode)

Quality of Service Traffic Shaping Policy support (priority, guaranteed, maximum) based on IP Addressing, Layer 7 Application, User ID, Tunnel, URL Category, and DSCP classification

**Firewall Built-in Management, Logging & Reporting features:**

XML Rest API based management support

Commit based configuration management

Config audit support by comparing running config against candidate config

Automated security action based on any firewall log fields. For example, a firewall can automatically block a specific ip address/user and can automatically initiate some API calls to a ticketing system to create a help desk ticket if one firewall threat log reported one host as being infected/compromised

Dedicated SaaS application report (like office365 and others)

**3.2.3.4. Submittals**

The Contractor shall submit all descriptive information that will enable the Engineer to determine whether Contractor's proposed materials, equipment, and Work methods are in general conformance to the design concept and in accordance with the Drawings and Specifications. The information submitted may consist of drawings, specifications, descriptive data, certificates, samples, test results, product data, and such other information, all as specifically required in the Drawings and Specifications. In some instances, specified submittal information describes some, but not all features of the material, equipment, or Work method.

Procedures:

A. Direct all submittals to the Engineer unless specified otherwise.

B. Transmittal of Submittal:

1. Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall ensure that the material, equipment, or Work method shall be as described in the submittal.

   a. Contractor shall verify that all features of all products conform to the requirements of the Drawings and Specifications.

b. Contractor shall ensure that there is no conflict with other submittals and notify Engineer in each case where its submittal may affect the work of Employer or others.

c. Contractor shall ensure coordination of submittals among the Subcontractor(s).

2. Contractor shall complete, sign, and transmit with each submittal package, one Transmittal of Contractor's Submittal form in a format approved by Engineer.

3. Submittal Identification shall include; Project information, date, a serial number, specification section applied, name of vendor or subcontractor, if there is deviation from specification or drawing it should be indicated.

C. Format:

- Submittals regarding material and equipment shall be presented directly to the Engineer and be accompanied by a transmittal form. A separate form shall be used for each specific item. Submittals that are related to or affect each other shall be forwarded simultaneously as a package to facilitate coordinated review. When catalogue pages are submitted, applicable items must be clearly identified.
- Submittals that do not have all the information required, including deviations, are not acceptable and will be returned without review.

D. Timelines: Schedule and submit in accordance with the Execution Schedule, and requirements of individual Specification sections.

E. Effect of Review of the Contractor's Submittals:

- Review of Shop Drawings, data, Work methods, or information regarding materials or equipment the Contractor proposes to provide shall not relieve the Contractor of the responsibility for errors therein and will not be regarded as an assumption of risks or liability by Engineer or Employer, or by any officer or employee thereof; and the Contractor shall have no claim under the Contract on account of the failure or partial failure of the Work methods, materials, or equipment so reviewed.
- Approval on submittals will mean that Employer has no objection to the Contractor, upon his own responsibility, using the Work method proposed, or providing the materials or equipment proposed.

#### 3.2.3.5. Training

The theoretical training and site work are expected to provide the Employer Staff with the relevant background, skills and hands-on experience to enable them to operate the new system sufficiently.

The contractor shall provide the training plan for the Employers approval that includes training on all project activities covering the operation, maintenance. The training to be sufficient to enable utility personnel to adequately operate and maintain the system, manage and back up data, configure and install additional nodes to the platform as needed.

#### 3.2.3.6. Documentation

The contractor shall provide all the necessary documents and manuals needed at the end of the execution stage, including (3 copies):

1. Operation and Maintenance manual.
2. SOPs.
3. Recovery Backup.
4. Software manual.
5. Licenses.
6. Program software with license.
7. Final Design.
8. As-Built Drawings.

### 3.2.4. Stage 4: Commissioning and Operation

After the completion of Execution stage for all project components, the comprehensive period of commissioning will start, where all hardware and software supplied shall prove its full functionality, the Commissioning shall be for a period of 6 months operation with no significant fault occurring. The Employer, the Employer's operational staff and the Contractor will monitor this period. In the event of any system failures, (i.e. failure requiring hardware replacement or software configuration, smart platform, control software or communications network...etc.). Penalties will be applied as illustrated below:

| Event | Performance Indicator | Criteria | Penalties percentage for each month per Event (Max 25%) |
|---|---|---|---|
| **A. Failure to repair a hardware or software problem (for each event).** | Time to Repair (TTR) [hrs.] From the time of notification of a system failure. | Within 24 consecutive hours | 0% |
| | | More than 24 up to 48 consecutive hours | 1 % |
| | | More than 48 up to 72 consecutive hours | 2% |
| | | More than 72 consecutive hours | 4% |
| **B. Recurrent hardware or software problems** | number of recurring problems [No.] | Up to 2 times | 0% |
| | | From 3 to 4 times | 5% |
| | | Equal or more than 5 times | 10% |
| **C. Software problem causing a processor to halt execution.** | Number of hours [hrs.] ( any part of hour is considered as an hour) | Up to 1 hour | 5% |
| | | From 2 to 3 hours | 10% |
| | | Equal or more than 4 hours | 15% |
| **D. System Availability** | Availability percentage [%] (according to SAD below) | 100% | 0% |
| | | Less than 100% & equal and more than 99.7% | 2% |
| | | Less than 99.7 % & equal and more than 99.0% | 4% |
| | | Less than 99.0% | 10% |
| **E. Un-Read meters** | Percentage of un-read meters [%] ( This applicable for all meters at time of monthly test conducted by the Employer ) | 0% | 0% |
| | | Up to 0.5% | 4% |
| | | More than 0.5 % & equal and less than 1% | 8% |
| | | More than 1% | 15% |

The Contractor shall provide a full written report to the Employer, notifying them of a defect or system problem within 2 working days and after solving the problem.

System Availability Demonstration (SAD) shall begin following completion of the system field test and continue until a time frame has been achieved wherein the system (hardware and software) availability meets 100 percent for 30 consecutive days and no failures have occurred which result in penalties illustrated in the table above.

During the commissioning the system shall be fully available to plant operations. The system availability shall be calculated based on the following equation:

$$A = \frac{TTO}{TTO + TTR} x\ 100\%$$

Where;

A = system availability in %

TTO = total time in operation, and

TTR = total time to repair

Time to repair shall be the time between notification of the Contractor of a failure and the time the system is restored to operation, with an allowance for the following dead times (not part of the repair period):

a) Actual travel time for personnel to get to the plant up to 2 hours per incident from the time Contractor is notified of system failure.

b) Time for receipt of spares to site once requested up to 24 hours per incident. If no work can be done while waiting for spares.

c) Dead time shall not be counted as part of the system available period. The dead time shall be logged and the duration of the SAD extended for an amount of time equal to the total dead time.

d) Force majeure as stated in the General and Special conditions of the contract.

In case of faults, the Contractor shall pay all costs for replacement, i.e. delivery, installation and start-up. If it should be necessary for the Contractor to change the technical solution, any costs will be to his account, including any increase in costs for electricity, maintenance and consumption of spare parts for the following two years.

### 3.2.5. Stage 5: Support

After the completion of both execution and commissioning stage and taking over of all project components by the Employer and during the defect notification period for two years the contractor is responsible for the following:

- Full technical support with full responsibility of solving any system failures, (i.e. failure requiring hardware replacement or software configuration, smart platform, control software or communications network...etc.).
- Regular maintenance for all project components to maintain the system availability.
- All operational cost and fees to run the system (i.e. communication fees, licenses, etc.)
- The bidder shall provide a description of the support.
- The bidder shall have local staff and long-term local presence. Bidder shall also have proven records of deploying communication networks. Bidders with international and regional presence are more preferable.
- The bidder shall provide a description of the SLA terms & conditions including reaction time incident/problem solving time and prices involved for On-site deployments

- The bidder shall describe the ticketing system.
- The bidder shall indicate the number of staff required and their skill sets required to implement and operate the network.

## 4. INSPECTION AND REJECTION

### 4.1. Factory acceptance test (FAT)

The contractor is requested to provide in his technical offer three options for accredited international third party companies; the purchaser will choose one of them to perform the needed inspections.

The contractor is requested to call the chosen company to attend and witness the tests to be done at the manufacturer's testing premises or any place the manufacturer chooses after the approval of the Employer and the accredited third party. The third Party representative must ensure 100% complete matching and compliance between the product and what is required in tender/contract documents in terms of standards, specifications and conditions. A sample is to be randomly chosen by the owner or third party representatives for testing; and tests must be witnessed by the third party representative and the representatives of the Employer.

The pre-shipment and manufacturer inspection is obligatory and cost for travelling of the appointed member from the Employer as follows

1. (3 persons) for residential water meter
2. (3 persons) for Big Customers water meter
3. (3 persons) for valves

"the pre-shipment inspection is obligatory and the full cost for travelling for Miyahuna representatives ("Overseas Pre shipment and inspection for engineers for a week, with all related expenses including Visas arrangements and costs, hotels transportation and all related fees taxes airfare tickets and per diems equal to one hundred fifty JD per day for the staff and 250 JD for top management , director or CEO per day ") shall be borne by the supplier/contractor and shall be incorporated in the tender prices.

Also, the Contractor should be required to set-up a mock-up of the smart platform system prior to full scale implementation to enable complete testing of all of the software functionality for the various cases. The Client should attend testing and sign-off on the system prior to implementation.

### 4.2. Site acceptance test (SAT)

The Contractor shall provide full Site Acceptance Tests on completion at the end of the execution stage and/or Sub-stage. Any special test equipment relevant to the SAT shall become the property of the Employer at the end of project.

## 5. Project Sign board

The contractor is required within one week from the site handover to provide four project sign boards with dimension minimum 1.5*0.75 m to be installed in the project site according to the Engineer instructions, which indicates the following information:

- Project Name and Tender No. C-T-22-0015 fara
- USAID
- Employer Name ( Jordan water company-Miyahuna)
- The Supervision Department from Miyahuna ( to be assigned later)
- Contractor Name and address
- Project Commencement date and the project duration

The Project signboard specification is shown in the data room