US Army Corps of Engineers
Europe District
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ARMENIA\am36

Statement of Work
OHASIS Number:85872
Project No.: 574554
Fiscal Year: 2026
Water Supply System for Bazum Village Armenia
Bazum, Armenia

Prepared by:
Design Branch
Engineering Division
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SECTION 01 10 10

STATEMENT OF WORK

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1.0 GENERAL
1.1 PROJECT DESCRIPTION
The Request for Proposal (RFP) provides parameters for a design-build project for construction of a water collection system in Bazum, Armenia.

General Project Location: 40°54'6.89"N, 44°25'40.38"E

Refer to the attached Site Location Map.

This project will provide a sustainable water supply and storage system for the Bazum community in northern Armenia.

The project includes the following general items of work. Water will be obtained from the river or from a groundwater well. There are detailed requirements contained elsewhere in this Statement of Work:

a. Clear, grub, and grade the site
b. Provide site improvements including roads and parking/vehicle access
c. Conduct a hydrologic study of the watershed
d. Conduct a groundwater survey
e. Construct (2) 100,000-liter tanks
f. Construction of chlorination system and storage station
g. Construction of pump and treatment enclosure structure
h. Construction of foundation for pump and treatment enclosure
i. Construct foundation for water tanks
j. Pipes from the tanks to the water collection system (pump)
k. Design a water supply system from the river (Option 1)
    a. Construct new stilling basin
    b. Construct intake structure & piping
    c. Pump to pull water from river
l. Construct groundwater well (Option 2)
    a. Drilled water well (estimated 150m deep)
    b. Pump for the well
m. Repair existing concrete fence that encloses the existing abandoned water storage tank
n. Provide power to water supply system

o. Provide communications to support automation systems
p. Provide a telecommunications enclosure near the water tanks
q. Provide interior and site security lighting
r. Provide fences to replace displaced existing fences to accommodate improvements and to prevent access to all water tanks, basins, and enclosures.
s. Realign and replace existing fencing to align with new aggregate roads.

1.2 GENERAL REQUIREMENTS

The Contractor must deliver fully functional, turnkey type facilities (without mobile furniture) as described in this document. The work includes - but is not limited to - design, demolition, fabrication, delivery, installation, construction, functionality testing, operational permitting, and site work.

The facility in this project must be complete and usable to meet codes and technical and functional requirements per this Statement of Work (SOW). The proposal price must include all design, calculations, approvals, certificates, fees, labor, material, equipment, direct overhead, indirect overhead, general and administrative expenses (G&A) and general conditions to complete this project as described in the SOW.

Plans and Specifications must follow UFC 1-300-01 paragraph 1.7.2. Plans and Specifications must follow UFC 1-300-01 paragraphs 2-2 except do not list English measurements.

These design and product requirements are minimum requisites. Compliance with the provisions of this section by subcontractors is the responsibility of the Contractor.

1.2.1 BASE ITEMS AND OPTIONAL ITEMS

This Statement of Work addresses the technical requirements necessary to complete all work associated with this project. For information and requirements regarding the allocation of pricing between elements of the work, refer to Specification Section 01 22 00 PRICE AND PAYMENT PROCEDURES. The Schedule of Items identifies the breakdown between the individual base items and optional items for all work identified in this Statement of Work, associated drawings, and attachments. All work as described in these documents is included in either the Base or Optional Items. Consider all items not specifically identified in the Optional Items as part of the Base Items.

1.3 SUBMITTALS

Designer of Record approval is required for submittals with a “DA” designation. Government approval is required for submittals with a “G” or “GA” designation. Submittals having an “FIO” designation are for Contractor Quality Control approval. Submit the following to the Contracting Officer (KO) in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals
Hydrological Survey; DA/GA
Groundwater Investigation; DA/GA

SD-05 Design Data
Hydrologic and groundwater studies course of action; DA/GA
65% Pre-Final Design; DA/GA
95% Final Design; DA/GA
100% Corrected Final Design; DA/GA

SD-06 Test Reports
Test Results and Reports; FIO

1.3.1 DESIGN SUBMITTALS
Provide a complete design package at each milestone, as described in RFP Section 01 33 16-DESIGN AFTER AWARD. The milestones for this project are indicated above in Section 1.3 SUBMITTALS. The specific requirements of each milestone are described in each discipline-specific section of this Specification.

1.3.2 REPORTS
Provide all test results and reports identified in this SOW to the Government as a submittal in accordance with RFP Section 01 33 00-SUBMITTAL PROCEDURES. Submittals will be considered for information only (FIO) submittals unless specifically identified as a submittal requiring government approval. Coordinate with the KO after award for the specific items to be included in the submittal register.

1.4 MATERIALS AND EQUIPMENT
Materials and products used must be durable, heavy duty, industry standard. The equipment must be the manufacturer’s standard quality and must be compatible with all other equipment and materials within the system or assembly. Equipment and materials must include all connections and accessories necessary to ensure operability and correct installation according to manufacturer’s requirements.

Provide a nameplate secured to each major piece of equipment. Each nameplate must have the manufacturer’s name, address, contact information, type or style, model or serial number, and catalog number. The definition of a “major piece of equipment” is at the discretion of the KO.

1.4.1 LIFE-SPAN
The facility and the installed equipment must be permanent construction with an expected lifespan of more than 25 years.

1.4.2 MAINTAINABILITY
Provide low maintenance materials and systems appropriate for the project climate and location.

1.4.3 OPERABILITY
Systems (including but not limited to architectural, electrical, communications, and mechanical systems) must be simple to operate and easy to maintain.

1.4.4 STANDARDIZATION
Provide standardized materials, products, equipment, and systems to minimize the requirements for replacement parts, storage facilities, and service requirements.

1.5 DESIGN DIMENSIONS
Develop the design using the metric system.

1.6 DESIGN CRITERIA
Project design, site facilities, utility systems and material standards must be in accordance with Host Nation building codes (current versions as of the date of RFP, unless otherwise indicated). In the absence of Host Nation building codes, use the International Building Code (IBC) and the codes, technical standards, and regulations referenced in this RFP.

While this RFP references various source standards and specifications, all design documents must meet Host Nation codes and requirements. It is the designer's responsibility to demonstrate that the Host Nation standard is equal to the cited standard or specifications being supplanted. Apply the more restrictive standards when conflicts arise between the requirements of this RFP and any referenced or other applicable codes, standards or regulations. If equivalency cannot be met, use the more stringent requirement and quote both codes verbatim in correspondence

to the KO. The designer is responsible to determine the required material and execution standards where specific standards are not indicated.

Provide an electronic copy of the local Host Nation standards and building codes in their original language as related to facility design and construction.

1.7 SPECIAL CONSTRUCTION REQUIREMENTS

1.7.1 DEMOLITION

The Contractor is responsible for all required demolition as indicated in this scope.

1.7.1.1 ABATEMENT AND DISPOSAL

All demolished materials, including hazardous materials identified below, must be abated and disposed of in accordance with local laws, codes and regulations. The Contractor is responsible for all required testing before, during and after demolitions as well as for all required compliance with safety standards.

1.7.1.2 LOCATION OF HAZARDOUS MATERIAL

The Contractor is responsible to survey the site and determine if hazardous materials exist. If hazardous materials are found to exist, immediately notify the KO and provide the results of the relevant sampling and testing. Provide the hazardous material report no later than 30 days after Notice to Proceed (NTP) for information and approval.

1.7.2 PROTECTION OF WORK AREA

1.7.2.1 DUST AND DEBRIS CONTAINMNET

Seal the project area with construction barriers and dust partitions in order to contain construction dust and debris and maintain a clean environment outside of the work area. Patch and repairing any damage caused during construction. Coordinate the locations of barriers with the Government and Host Nation prior to the start of work.

1.7.2.2 PROTECTION OF FURNITURE, FIXTURES, AND EQUIPMENT

Protect all existing utilities and structures that remain within the work area. The Contractor is responsible for repairing or replacing any damage caused during construction. The Contractor must conduct a preconstruction survey of utilities and other features with a government representative present.

1.7.2.3 NOISE AND VIBRATION CONTROL

Employ demolition and construction methods that minimize the production of sound and vibration. Coordinate the schedule of especially loud or disruptive activities with the KO prior to the start of work.

1.7.3 SEQUENCING OF CONSTRUCTION WORK

The Contractor must sequence construction to allow the highway and adjacent site to remain accessible during construction. Do not block access to occupied areas during construction. Utility and communication services must remain functional in all occupied areas.

Some relocation of storm drainage, the gravel access road, and fences may be required to comply with this requirement, all restrictions are listed below:

a. The existing highway adjacent to the site must remain fully open during construction.
b. Vehicle access to other buildings near the site must always be possible during construction.

END OF SECTION

2.0 CIVIL AND GEOTECHNICAL

Provide and perform civil engineering design and construction services as required to provide a complete, accessible, functional, and usable project. The Contractor is required to extensively coordinate civil design and construction work with the scope of the other disciplines described in this SOW.

2.1 SCOPE SUMMARY

Civil works for this project include, but are not limited to, site survey, geotechnical investigation, site layout, demolition, earthwork, storm system, hydrological survey, groundwater investigation, water system, pavement, road repair/reconstruction, fencing, outdoor furnishings, and landscaping. Refer to the bid schedule for which of these are base bid or optional.

2.2 EXISTING CONDITIONS

The existing site is in a rural area adjacent to the M3 highway, just before it enters a tunnel. Near where the river meets the highway, there is an area partially enclosed with a concrete fence that contains an existing, buried concrete water tank that was never brought into service. The underground tank was reported to have had a capacity of 400 metric tons and was abandoned in the 1980’s. The existing concrete fence is in need of repair. Approximately 30% of the 50 meters of fence are damaged and in need of repair.

The river is named Bazumtad (or Բազումքաղ in Armenian), and in this document will be referred to as the river.

The river has a gravel road the runs along the north side (left side when looking downstream) for the entire project area that was investigated.

The gravel road has an existing chain link fence running along the landward shoulder. The fenced area contains an additional dirt road, drainage structures, access to tunnel infrastructure, the transformer station for the tunnel, grass and small vegetation, and other buildings that are lightly used or abandoned.

2.2.1 TOPOGRAPHY

There is no known topographic survey for the project site. The existing site contains adjacent buildings, gravel roads, utilities, fences, and vegetation as shown on the attached Conceptual Site Plan. The site to be used for structures generally has a gentle slope and contains a river and riverbank. Steep valley walls are on the north and south sides of the site. The existing information shown on the attached Conceptual Site Plan was compiled from site visit notes, Google Earth, and site photos.

2.2.2 UTILITIES

There are existing storm connections located at the around the proposed site. The highway tunnel and other areas have storm drainage pipes that drain into the river.

There is no functional water system at the site.

There is no sanitary system at the site.

Power is available near the site. Refer to the attached proposed site plan for locations of proposed power sources.

Contractor must verify all utility locations (surface and subsurface) in the field prior to the first design submittal.

2.2.3 GEOTECHNICAL

There is no geotechnical information available for the project site.

The Contractor must perform a Geotechnical Investigation and submit a Geotechnical Report as part of the Design Analysis. Refer to other sections of this SOW for the requirements of the Geotechnical Investigations and Report.

2.2.4 ENVIRONMENTAL
There are no known environmental protection areas or archeological preservation areas on the project site.

There is no prior knowledge of any hazardous or contaminated materials in the site's soil.

Environmental related Host Nation requirements for drainage, flooding, and erosion control must be followed during design development, as well as any Host Nation requirements for chemical storage or handling.

2.2.5 EXISTING CONDITIONS INVESTIGATION
Prior to bid, investigate the general and local conditions which can affect the work and/or its cost, including but not limited to:

a. Weather, river stages, seismic activity (earthquakes), or similar physical conditions at the site.
b. Surface and subsurface materials or obstacles to be encountered insofar as this information is reasonably ascertainable from an inspection of the site and due diligence research of as-built drawings, geotechnical reports, environmental reports, and publicly available information on the site.
c. Mobilization and staging constraints.

2.3 DESIGN SUBMITTALS
Provide civil design submittals in accordance with RFP Section 01 33 16-DESIGN AFTER AWARD and in compliance with SOW Section 1.0 - GENERAL.

Prior to the prefinal (65%) submittal, submit the hydrological survey and groundwater study, along with the recommendations and conclusions that come from these studies.

65% Design Submittal:
a. Pre-Final Design Analysis of civil features.
b. Final Site Survey (include in the Design Analysis).
c. Final Geotechnical Report (include in the Design Analysis).
d. Final Existing Conditions Plan.
e. Pre-Final Demolition Plan
f. Pre-Final Site Layout Plans - Indicate existing and proposed Civil features. Include other disciplines' features that affect the Design (buildings, mechanical structures, electrical utilities, etc.).
g. Pre-Final Grading Profiles, Cross Sections, and Details. Include spot grades and slopes in Grading Plan. Include foundation profiles, cross sections, and details. Include erosion control design.
h. Pre-Final Pavement Plans, Profiles, Trench Cross Sections, and Details
i. Pre-Final Utility (Electrical and Water) Profiles, Cross Sections, and Details.
j. Pre-Final Fencing and Outdoor Furnishings Plans & Details
k. Pre-Final Landscape Plan and Details, including seed mix and seed coverage rate, if applicable
l. Preliminary Civil Specifications

95% Design Submittal:
Update all items from the 65% Design Submittal to 95% (Final) Design. Incorporate all 65% design comments.

100% Submittal:
The 100% Submittal provides a complete and final set of contract documents ready for construction. Update all Final submittals from 95% to a corrected Final submittal. Address all previous government review comments before submitting.

As Built Drawing Submittal:
In addition to the as-built requirements discussed in RFP Section 01 78 00-CLOSEOUT SUBMITTALS, provide a topographical survey of the site per requirements of SOW Section 2.6-SITE SURVEY. Include existing utility lines or structures (both modified and unmodified) encountered in the construction footprint that were not located on the original Site Survey.

2.3.1 DESIGN ANALYSIS
Submit a Design Analysis in accordance with RFP Section 01 33 16-DESIGN AFTER AWARD. Provide a Design Analysis for all Civil features that documents significant design choices and substantiates design compliance with contract requirements, applicable codes and standards. Documentation includes narrative, calculations, photographs, sketches, and catalog cut sheets. Reference all applicable regulations, standards, and criteria for the design. Reference sources are subject to Government approval. Provide design assumptions. For design choices, discuss alternative systems considered, and provide rationale for the selected alternative.

The Design Analysis includes but is not limited to:

a. Discussion of Site Layout constraints and design decisions, including but not limited to, land use, vehicle and pedestrian access, location of stilling basin, orientation of features on-site, setbacks from site features, minimizing utility lengths, minimizing earthwork and tree removal, and future expansion.
b. Discussion of Demolition constraints and design decisions. Include discussion on how access will be provided during construction, and how each utility will be maintained and operated during construction.
c. Discussion of Earthwork and Site Grading constraints and design decisions. Provide cut and fill calculations. Provide slope stability calculations for slopes steeper than 2H:1V or slopes supporting proposed structures. Include pertinent geotechnical information that affects earthwork.
d. Discussion of Storm system constraints and design decisions. Provide a hydrologic and hydraulic analysis of the storm system, including offsite areas that contribute to and influence the project’s storm system. Provide drainage basin map(s), rainfall data, and coefficients used. For each section of pipe, include analyses indicating pipe size, friction factor, length, elevations at each end of pipe, slope, design flow (Q), maximum flow capacity, design depth of flow, design percentage full, and design flow velocity. Analyze how the storm system of the proposed enclosures and tanks will interact with the existing stormwater pipes in and around the proposed site. Provide Inlet design calculations. Provide calculations for sizing of structures, including detention, infiltration, and LID features. Provide documentation for the 100 year flood elevation determination. Provide Pre and Post Development comparisons for detention/retention facilities. Use the Rational Method or TR-55 for analysis and design. In the absence of Host Nation or Installation requirements, use a minimum 10-year storm frequency for analysis and design. Provide calculations on the pipe’s structural capacity if the pipe is shallower than required in section 2.10-Utilities. Include pertinent geotechnical information that affects the storm system. Confirm that the existing receiving system has adequate capacity to receive the additional stormwater flow generated by the project.
e. Discussion of the hydrological survey and groundwater study and why the picked Option was chosen.

f. [If water is collected from the river.] Discussion of water system constraints, design decisions and source. Provide calculations to demonstrate water source meets project requirements, including demand, water pipe sizing, stilling basin design, design water pressure and flow rates at the water collection point. Provide field conducted flow tests from the pump system. Provide lab assured water quality analysis of source water at intake. Provide discussions on design chlorination system and piping/storage tank for materials. Provide calculations on the pipe's structural capacity if the pipe is shallower than required in section 2.10-Utilities. Provide water tank calculations.
g. [If water is collected from groundwater.] Discussion of Water system constraints, design decisions and source. Provide calculations to demonstrate water system meets project requirements, including demand, water pipe sizing, design water pressure and flow rates from the well. Provide field conducted flow tests from the well. Provide lab assured ground water quality analysis in location of the proposed well. Provide discussions on design chlorination system and piping/storage tank for materials. Provide calculations on the pipe's structural capacity if the pipe is shallower than required in section 2.10-Utilities. Provide well and water tank calculations.
h. Discussion of Pavement constraints and design decisions. Provide the design vehicle(s) specifications. Demonstrate the turning path of the largest anticipated vehicle(s) in the most constrained situations on the site plans. Provide vehicular circulation patterns using AutoTURN or equivalent method. Provide calculations for the pavement section. Include traffic studies (if available). Provide design traffic calculations and assumptions. Include pertinent geotechnical information that affects the pavement design.
i. Discussion of Fencing constraints and design decisions.
j. Discussion of Outdoor Furnishings constraints and design decisions. Provide structural calculations for foundations if the foundation is designed by the Designer of Record. Calculations are not necessary if the foundation design is from an industry standard detail.
k. Discussion of Landscaping constraints and design decisions.
l. Site Survey as an appendix.
m. Geotechnical Investigation and Report as an appendix.

2.3.2 DESIGN DRAWINGS

Provide Civil design drawings of sufficient detail to address the requirements of each design submittal. Civil drawings include plans, profiles, cross sections, and details of Civil features for the project. Civil drawings also include temporary construction plans/methods that affect the design and construction of the project. These temporary plans include mobilization, traffic control, erosion control, dewatering, shoring, construction sequence, etc. Design drawings include all necessary information (labeling, dimensioning, legend, details, notes, etc.) to allow for complete understanding and constructability of all proposed features. Provide comprehensible differentiation between features that are proposed, existing, future, or proposed to be demolished by use of appropriate choice of line styles, line weights, and/or colors. Reference USACE *A/E/C Graphics Standard* for graphic requirements.

2.3.3 SPECIFICATIONS

Provide Civil specifications of sufficient detail to address the requirements of each design submittal. Specifications, when combined with the design drawings, allow for complete understanding and constructability of all proposed Civil features.

2.4 DESIGN CRITERIA

Provide civil design in accordance with Host Nation codes. In the absence of Host Nation codes, use the latest release of the International Building Code (IBC) and the following codes and technical standards:

a. Uniform Facility Criteria (UFC) 3-201-01, *Civil Engineering*
b. UFC 3-220-01, Geotechnical Engineering
c. UFC 3-230-01, Water Storage, Distribution, and Transmission
d. UFC 3-250-01, Pavement Design for Roads and Parking Areas
e. USACE Protective Design Center *Standard Fence Drawings*
f. World Health Organization (WHO) Guidelines for Drinking-water Quality
g. USACE *A/E/C Graphics Standard* (ERDC/ITL TR-19-6)
h. ANSI/AWWA A100-06, *Water Wells*
i. AWWA M50 - Water Resources Planning
j. NTRP 4-04.2.13/FM 3-34.469/AFMAN 32-1072, *Water-Well Drilling Operations*

2.5 GEOTECHNICAL INVESTIGATION AND REPORT

Perform a geotechnical investigation and assessment of the project site to determine the subsurface conditions and geotechnical parameters for foundation, grading, and utility design. Perform the necessary amount of testing, borings and test pits at depths suitable for the project improvements. Include geotechnical investigation in areas where borrow material will be used. The Geotechnical work must be performed under the supervision of a professional geotechnical engineer registered with the jurisdiction having authority, and the report must be signed by the Geotechnical Engineer. In the absence of Host Nation codes, perform the geotechnical investigation and report per UFC 3-220-01, *Geotechnical Engineering* and IBC.

Coordinate testing locations with the KO to avoid impact to existing utilities and facility operations. Utility locates, permits, and vegetation clearing are the Contractor’s responsibility. Repair disturbed areas with a concrete patch in paved areas, and compacted soil in non-paved areas. The repaired area must be flush with the adjacent surface. Following restoration, stake and flag each of the hole locations with boring identification numbers. Provide a map indicating the borehole and test pit locations.

The water storage tank locations must have borings of at least 30m below the ground surface.

2.5.1 REPORT

Include, as a minimum, the following information:

a. Description of field work completed and equipment used; names, signatures and stamps of licensed professionals involved; name of companies involved.
b. A description of site subsurface conditions, regional geology, and seismic conditions at the site.
c. Site map of test pit locations.
d. High resolution color digital photographs of each borehole and test pit location.
e. Test pit logs with classification of all subsurface materials. The logs must distinguish fill materials from native materials, include all in-situ test results, and include groundwater depth information, if groundwater is encountered. Distinguish between bedrock and rock boulders.
f. Reports of all the field and laboratory testing.
g. Recommendations for allowable bearing capacity for both static and dynamic conditions, expected settlement, type of foundation, minimum footing dimensions, lateral earth pressure parameters, and minimum depth of foundation for footings.

h. The report must determine a ground site class in accordance with Eurocode EN 1998-1, table 3.1 or host nation equivalent. The geotechnical report must clearly indicate the criteria used to determine the ground type (shear wave velocity, blow count, or unconfined shear strength) and the ground type classification of the soil (Type A, B, C, etc.).
i. The geotechnical report must research potential for liquifiable soils, and if encountered how the liquification will be mitigated.
j. Recommendations for preparation, placement, and compaction of onsite soils, borrow material, soil replacement, structural fill, and trench backfill. Include dewatering and temporary retaining structure needs.
k. Soil Resistivity.
l. Frost Depth.
m. Recommendations for the water well.
n. Recommendations for gravel pavement design and construction.
o. Calculations to support conclusions and recommendations.

2.5.2 DESIGN DRAWINGS AND SPECIFICATIONS
On the design drawings and/or specifications, include geotechnical information that affect the design of the project, including but is not limited to, boring locations, boring logs, groundwater and frost depths, and any details that convey requirements for site preparation.

Perform geotechnical investigations necessary for the design and construction of project features. Provide any geotechnical investigations and reports to the Government that are performed. Provide geotechnical information and assumptions in the Design Analysis to support design decisions. In the absence of geotechnical investigations performed on-site, an allowable soil bearing pressure is discussed in STRUCTURAL section 4.0. Perform geotechnical work required for construction (i.e. compaction tests, inspection of structure foundation excavations). In the absence of Host Nation standards, perform the geotechnical scope of work per UFC 3-220-01, *Geotechnical Engineering* and IBC.

2.6 SITE SURVEY
Conduct and provide a topographic survey from a licensed surveyor that includes all existing site information needed to design and construct the project. Survey must be conducted prior to the first design submittal. Include x, y, and z coordinates to the nearest 0.005 meters, dimensions, material, and basic characteristics of all features within the project site limits, as well as all features outside of the project site limits that will affect the design and construction of the project. Research record drawings to obtain utility and pavement information that is not visible from the surface. Provide notes indicating the sources and any limitations or assumptions of the data. Provide a copy of the survey in CAD, in addition to the paper/electronic requirements of the Design Analysis. Locate and show on the topographic survey the following information:

a. Property boundary, public right of way, and easements. Include the address numbers, street names, and easement records.
b. Survey monuments. Include description.
c. Spot elevations covering the entire survey limits showing high points, low points, grade changes, and at sufficient intervals to represent the general character of the terrain.
d. Contours in intervals of 0.25 meters.
e. Buildings and other miscellaneous structures. Provide finish floor elevation.
f. Pavements. Include pavement type, thicknesses, joint patterns, and pavement markings. Include top of curb and gutter elevations.
g. Surface Drainage Features. Indicate normal water level for the river.

h. Utility lines and structures. Include rim elevations and invert elevations for utility structures; identification of lines as underground or aboveground; pipe sizes and materials.
i. Fences. Include height, material, direction of outrigger, gate locations and types.
j. Signs. Include sign text.
k. Trees: If there are trees that are to be protected, locate outside drip line of the trees, include general density and type of trees. For wooded areas with proposed tree removal, identify trees per Host Nation permitting requirements. Where selective clearing will be proposed, locate trees over 150-millimeter diameter at chest height, and include tree species, diameter at chest height, and dripline diameter.
l. Geotechnical boring locations.
m. Locate environmentally sensitive areas (determined and marked by others).
n. North arrow and scale of drawing.
o. Legend depicting the symbols and abbreviations used on the drawing.
p. Horizontal and vertical coordinate systems, date of survey, licensed surveyor name and license number.

Site information provided to the Contractor by the Government is not to be considered accurate Site Survey information. Utility field locates and as-built research are the responsibility of the Contractor.

Upon completion of construction, update the original survey with an As-built survey of the site as constructed, including underground utility locations and depths. Submit the As-built survey to the KO for approval.

Reference UFC 3-201-01, *Civil Engineering*, Section 2-2.2-SURVEYING for survey requirements. Use the Universal Transverse Mercator (UTM) coordinate system. The vertical coordinate system must be based on sea level.

2.7 HYDROLOGIC SURVEY

Perform a hydrologic study of the river and upstream watershed. A hydrologic study for a river intended as a drinking water source is a comprehensive evaluation of the water's quantity, quality, and surrounding environment. At a minimum, the study must include the following:

a. Streamflow Analysis: This involves measuring the volume of water flowing in the river over time, including seasonal variability and historical flood and drought frequency. Include an analysis of groundwater interaction, i.e. determining if this river is fed by groundwater or if it leaks water into the ground. This will determine if the river can consistently provide the required amount of water.
b. Water Quality Assessment (Physical, Chemical, and Biological):

   Provide measurements that show turbidity and temperature. Analyze the color, taste, and odor of the water.

   Provide measurements of the chemical composition of the water, including pH, dissolved oxygen, nitrogen and phosphorus and salt content. Metal content like arsenic, lead, copper, and mercury should be analyzed. Measure for pesticides, herbicides, and industrial chemicals.

2.8 GROUNDWATER INVESTIGATION

a. Obtain a preliminary analysis of the area, including regional geology, any known previous investigation reports from the area, identification of potential contamination sources (such as agriculture operations and septic systems) climate data, and any known public and private wells in the area. Investigate any upstream pollution sources from industries and agricultural operations.

b. Drill one or more exploratory boreholes and log each hole. Install monitoring wells and piezometers in the boreholes. Conduct a pumping test by pumping water for a period of time and monitoring the drawdown in the well and any observation wells. This will help provide the aquifer's transmissivity, hydraulic conductivity, and storativity. Measure static water levels in all of the wells to determine groundwater flow direction and hydraulic gradients.
c. Collect water samples for laboratory analysis. Analyze the physical parameters (pH, electrical conductivity, turbidity, etc…), major ions in the water (Calcium, magnesium, sodium, etc…), Nitrate contamination, heavy metals, microorganism content, and other organic compounds, such as pesticides or VOCs (volatile organic compounds).

This data will be used to prepare a report that will inform the final decision of the borehole. The report shall include a conceptual hydrogeological model, borehole design recommendation, long term sustainable yield assessment, environmental impact assessment, and the conclusions derived from this data.

2.9 SITE LAYOUT

Locate the proposed building and other improvements as indicated on the attached Conceptual Site Plan. Amend the site layout as determined by the site-specific constraints, the owner’s preferences, accessibility, future expansion, and opportunities that are identified and evaluated as part of the Contractor’s scope of work.

The Contractor is responsible for all aspects of the project whether they are shown on the conceptual plan or not.

2.10 DEMOLITION

Remove existing structures, utilities, pavement, vegetation, and any other features to construct the proposed improvements. Remove trees with driplines within the footprint of the proposed improvements. Provide straight, neat sawcuts at limits of pavement removal. All contaminated soils discovered require special testing and disposal per Host Nation requirements.

2.10.1 CONSTRUCTION LIMITS

Do not disturb the project site beyond necessary for installation of proposed construction. Do not disturb any areas past the site’s property line. Show demolition work and limits of disturbance in the drawings. Stake-out the limits of disturbance on-site with temporary fencing before beginning construction.

2.10.2 ITEMS TO REMAIN IN PLACE WITHIN CONSTRUCTION LIMITS

Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government. Repair or replace damaged items as required by the KO. Construct and maintain shoring, bracing, and supports as required. Ensure that structural elements are not overloaded. Provide new supports and reinforcement for existing construction weakened by demolition, deconstruction, or removal work. Repairs, reinforcement, or structural replacement require approval by the KO prior to performing said work.

2.10.3 TREES

Unless otherwise noted on the attached Conceptual Site plan, protect trees which might be damaged during construction, with a 1.8-meter-high fence around the dripline of the tree(s), which is assumed to be the extent of the tree’s roots. Trees are defined as larger than 150mm diameter at 1.3-meters above existing grade. Mitigate for tree removal per Host Nation requirements.

2.10.4 UTILITIES
Any existing utilities encountered that are impacted by this project must be protected or relocated if protection is not feasible. Remove existing and abandoned utilities under or within 3.0 m of the foundation of any proposed facility or building foundation. Reroute existing utilities to remain in accordance with SOW Section 2.10-UTILITIES. Abandoned utilities must be removed up to the utility main (or next utility main junction) and capped. Manholes or underground structures to be abandoned must be removed to a minimum depth of 50 centimeters below finish grade. Fill abandoned manhole or structure per Section EARTHWORK requirements.

2.10.5 DUST, DEBRIS, AND EROSION CONTROL
Prevent the spread of dust, debris, and erosion from the project site. Install erosion control measures before beginning construction. Sweep pavements as often as necessary to control the spread of debris. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, erosion, or pollution. Remove snow, dust, dirt, and debris from work areas daily. Remove and transport the debris in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

2.10.6 ADDITIONAL REQUIREMENTS
Reference RFP Section 00 74 01-SPECIAL CONDITIONS and 01 30 01-GENERAL REQUIREMENTS for additional demolition, protection, and permitting requirements.

2.11 EARTHWORK
Perform all earth work necessary for the installation of the proposed improvements.

2.11.1 PLANS AND SPECIFICATIONS
Define earthwork requirements in the plans and specifications. Include requirements for satisfactory material, borrow material, structural fill, utility trenches, replacement and improvement of on-site soils, soil compaction (for subgrades of structures, paving, and landscaped areas), compaction for utility trenches, maximum lift depths, density testing frequency, maximum temporary and permanent slopes, and engineered support systems. The earthwork requirements must not conflict with the recommendations in the Contractor-provided Geotechnical Report.

2.11.2 UNEXPLODED ORDNANCE (UXO) CLEARANCE
If UXO are discovered on site, stop work in the area and immediately notify the KO. UXO will be treated as an unforeseen site condition. Refer to RFP Section 01 30 01-GENERAL CONDITIONS.

2.11.3 CONTAMINATED SOIL
Inspect and test all soil according to Host Nation requirements. If hazardous materials are discovered, cease excavation, secure the area, and notify the KO for further guidance.

2.11.4 CULTURAL RESOURCES
Cultural resources, such as archaeological remains, may be uncovered during excavation operations. If suspected cultural remains are found, cease excavation, secure the area, and notify the KO for further guidance.

2.11.5 SATISFACTORY MATERIAL
Excavated material, if satisfactory for reuse per the Contractor’s Geotechnical Engineer, may be used on the project site where fill is required. Unsatisfactory material, and surplus excavated material not required for fill, must be disposed of offsite, and is the responsibility of the Contractor. Borrow material may be required for construction from sources off site. Borrow materials are to be free

of hazardous materials and contaminants. Any soil brought in from off-site sources must be certified clean.

2.11.6 BACKFILL COMPACTION

In the absence of Host Nation requirements and geotechnical recommendations, fill and backfill must be placed in layers of 20 centimeters loose thickness and compacted to a minimum 95% of the maximum dry density as determined by Host Nation test method equivalent to ASTM D-1557 (Modified Proctor test). Provide density tests on all lifts at a frequency of 1 test per 40 square meters for foundations and parking, and 1 test per 30 meters of road and utility trench. Round up to nearest whole number (i.e. a 25 square meter foundation requires one test). The location of all tests must be selected by the Contractor's geotechnical engineer, and copies of all test results must be furnished to the KO. All structure foundation excavations must be inspected and approved by the Contractor's Geotechnical Engineer prior to placing concrete. Repair earthwork areas as recommended by the Contractor's Geotechnical Engineer and approved by the KO.

2.11.7 ENGINEERED SOIL SUPPORT SYSTEMS

Provide engineered soil support systems (i.e. shoring) as required for the construction of the proposed improvements. The Contractor is responsible for all dewatering necessary for earthwork.

2.11.8 SITE GRADING

Provide site grading that directs storm water runoff away from structures. Finished grades must not create stagnating water or ponding anywhere on the project site, nor create ponding on adjacent properties. Provide storm improvements if ponding is unavoidable.

Site grading around the enclosures and structures must meet Host Nation accessibility guidelines.

2.12 UTILITIES

This section applies to all project underground utilities for water conveyance and storage, including but not limited to water supply, storm drainage, electrical, and communications. See Sections 5.0-ELECTRICAL & COMMUNICATIONS for additional utility requirements.

Proposed utility main alignments must be at least 3.0-meters from facility or building foundations, except for building connections. Provide horizontal and vertical separation between new and existing utilities for rehabilitation, maintenance, repair or replacement. Provide utility line depths, bedding, and backfill as required by applicable requirements and geotechnical recommendations. Minimum cover over pipes is 0.6 meters; greater than frost penetration; or sufficient to support imposed dead and live loads for the pipe materials used; whichever is more stringent. Place plastic warning tape along the route of the buried pipe after installation at a height of 0.3-meters above the pipe.

Coordinate all required installation, relocation, improvement and protection of utilities held by third party (e.g. public or private utility). This includes coordination of any work to be performed by the utility owner. Choice of materials and products for utility installation must be coordinated with the utility owner (customer or third party) to ensure proper integration and compliance with existing systems and allow for easy maintenance and repair of the utilities in the future.

Provide utility materials per IBC requirements. Provide corrosion protection for utilities that provides the minimum life expectancy specified in Section 1.0-GENERAL. Any piping or equipment exposed to sunlight must be coated with

protective coatings suitable for UV exposure with a minimum expected coating life of 10 years before recoating.

2.12.1 STORM SYSTEM
Provide grading to direct stormwater runoff away from improvements, enclosures, concrete pads, and new aggregate roads to eliminate ponding, and prevent erosion. In the absence of Host Nation standards, design the storm drainage system per UFC 3-201-01, *Civil Engineering* Chapter 3-Storm Drainage Systems.

Connect building downspouts to splash blocks that drain away from foundations a minimum of 2 meters. Provide drainage for new aggregate roads to ensure stormwater is not routed to any improvements.

2.12.2 SANITARY SYSTEM
A sanitary sewer system is not proposed.

2.12.3 WATER SYSTEM
Design water system to meet the potable water regulations and requirements of the local government agencies or equivalent in the host nation. Use UFC 3-230-01 in the absence of host nation standards.

For the piping distribution system and appurtenances, provide materials, equipment, components, manufactured units and appurtenances of the potable water system in accordance with Unified Facilities Guide Specifications and NSF 61 or equivalent host nation standard. Any part of the water piping system such as, valves, joining materials, gaskets, or appurtenances that come in contact or has the potential to come in contact with potable water is considered part of the potable water system.

Select materials and use of coatings to preserve high hydraulic efficiency to control tuberculation, slime formation and encrustations. During material and coating selection evaluate control potential, structural strength, field conditions, cost and maintenance requirements.

[Option 1] Provide a water system to connect the proposed water tanks to the proposed river water collection system. Provide a stilling basin or similar structure to route and collect water from the river to an area that will provide the depth and flow restriction to allow natural turbidity to settle before the water is pumped to be treated. Design the system to meet all flow requirements of the tank system. The pump for the stilling basin must be powered by the nearby substation, and must have sufficient performance to fill the water storage tanks in the amount of time required for proper operation of the water supply system. Provide a locked access to the pump with 2 sets of keys.

[Option 2] Provide a water system to connect the proposed water tanks to the proposed well. Design the system to meet all flow requirements of the tank system. Assume a well depth of 150m for bidding purposes. The well pump must be powered by the nearby substation, and must have sufficient performance to fill the water storage tanks in the amount of time required for proper operation of the water supply system. Provide a locked access to the pump with 2 sets of keys. Provide a manual pump option to the well if the electric pump fails. New wells must be located a minimum of 50 m from all septic systems and pit latrines.

Water Storage Structures. Use materials for water storage that protect the quality of the stored water. Select materials in accordance with Unified Facilities Guide Specifications and NSF 61 or equivalent host nation standard. Tanks must be designed, fabricated and constructed for drinking water use. The water tanks and piping must be UV resistant and include appropriate features (i.e. shading, insulation) to ensure water temperatures stay at an acceptable level for use,

including freeze protection. The water tank must have the ability to be filled by the pump system and include an access ladder and man-way for interior access for cleaning. The location of the fill connection must be convenient and labeled. The fill point and cleaning access must be secured and locked. The water tanks should be isolatable, allowing maintenance to one tank without causing disruptions in the whole system.

Provide materials, equipment, components, manufactured units, and appurtenances necessary to provide chlorinated disinfection, including chlorine residual, meeting Host Nation Standards for potable (drinking) water. In the absence of Host Nation regulations, an approved international equivalent shall be used. All piping and associated system materials shall comply with the relevant EN (European Norm) standards. Where a direct EN standard is not applicable, the relevant host nation, or other local standard shall apply. All materials must be accompanied by a Certificate of Conformity. The Contractor shall provide all necessary certificates of conformity. Storage of chemical solutions must be secure (i.e. UV resistant/protected, labelled, temperature controlled or removed from exposure to extreme temperatures, placed in adequately sized secondary containment, etc) as quantified in host nation and local standards.

[Option 2] In the absence of Host Nation standards, design the well system per ANSI/AWWA A100-06, *Water Wells*, NTRP 4-04.2.13/FM 3-34.469/AFMAN 32-1072, *Water-Well Drilling Operations*, and the IBC.

After installation, test water supply lines according to local codes for leakage. Before the water supply line is put into final operation, disinfect the line, and then flush the line to remove traces of the sterilization agent. Test treated line for coliform bacteria and for the presence of any regulated chlorine residuals. Provide test results to the KO. Locate and repair any sections failing to pass the required tests. Repeat the specified tests and inspections on the repaired sections.

See SOW Section 6.0 – MECHANICAL for pump, water tank, and well scope of work.

2.13 PAVEMENT

Provide site access to allow operational and maintenance access to the facility. Provide geometric layout of the paved areas to allow for the design vehicles to access the site features and exit the site safely. Design vehicles for the project are a local ambulance, fire truck, delivery vehicle, and a water truck. Average daily traffic (ADT) is below 250 vehicles/day. Proposed pavements for the project include:

a. Aggregate access roads from the existing adjacent highway to the proposed water tank location, and from the water tank to the treatment system and the pump and treatment enclosure connecting back to the existing gravel road. Design road per AASHTO-A Policy on Geometric Design of Highway and Streets. Provide a minimum 5-meter road width even if the analysis demonstrates a thinner width would suffice. Minimum thickness for aggregate surfaced roads is 200mm.
b. Slabs for the water tanks, treatment station, pump enclosure, and other outdoor features are defined per the Structural section of this document.

Provide minimum 1-meter wide concrete apron around foundation pads. See foundation pad requirements in the Structural section of this document.
In the absence of Host Nation standards, design pavements per UFC 3-201-01, *Civil Engineering.*

2.14 FENCE

Provide minimum 1.83-meter high, galvanized metal fences around the perimeter of the proposed water collection and storage systems. Provide at least one 4.5-meter-

wide double swing gate for maintenance access for each fence built. Provide a lock for each gate with (2) keys for each lock. Provide electrical grounding every 30 meters of fence, fence corner, and at gate posts (2 per gate). Provide fencing and gates per Host Nation requirements.

Provide new concrete panels for the proposed concrete fence repair. Provide panels that are the same size and thickness as what is existing.

Replace the existing chain link fence as needed to accommodate the new and realigned roads and structures.

2.15 OUTDOOR FURNISHINGS

2.15.1 BOLLARDS

Provide bollards at the exterior corners of the enclosure, tanks, and other structures that have the potential to be exposed to vehicle traffic to protect from vehicle impacts.

Bollards must be a minimum 1.22 meter high above ground level, 10 centimeters diameter steel pipe filled with concrete, painted yellow, and embedded in a Portland cement concrete foundation. Steel pipe wall must be minimum 6 millimeter thick. The foundation must not be attached to the building foundation or the slab.

2.15.2 SIGNS

Provide facility signage in accordance with the Installation and Host Nation standards. Size messages and graphics on signs according to the functional viewing distance. Typically, at least 25 millimeter of letter height per 7.62 meters of viewing distance is required for readability.

2.15.3 EXTERIOR DEDICATION PLAQUE

Provide a dedication plaque for each site approximately 600 mm wide x 450 mm high fabricated from powder coated aluminum with permanent printed 18 mm high, "Arial" font letters as indicated below. Adhesive applied images or text are not acceptable. Provide the emblem of the United States European Command between two flag emblems, one flag of the United States of America and one of Armenia. Plaque location and mounting height to be directed by the KO. See the attached sample.

The exterior dedication plaque must have text similar to the following in both English and the Host Nation language: "The Construction of the Water Supply System for Bazum Village, Armenia was accomplished as a partnership between the people of the United States of America and the people of Armenia, with support from the United States European Command and the Office of Defense Cooperation, U.S. Embassy Armenia and Local Municipality." Provide the year of the project completion below the text. Coordinate the final dedication plaque verbiage and graphics with the KO prior to procuring the sign.

2.16 LANDSCAPING

Provide grass seed and 20 centimeters of topsoil on the site in areas that do not have pavement or a building within the limits of disturbance. Seeds must be locally sourced from a certified plant nursery, and native to the area. Provide seed coverage density per manufacturer/supplier's recommendations. Provide watering, weeding, and any other necessary care to establish growth. Limit planting to times of the year per local codes and/or manufacturer/supplier's recommendations. Replace topsoil and seeds, at Contractor's expense, in areas which do not have new growth coverage of 75% before the warranty period ends.

END OF SECTION

3.0 ARCHITECTURAL

This section is not used.

END OF SECTION

4.0 STRUCTURAL

4.1 GENERAL

The Contractor must provide and perform structural engineering design and construction services as required to provide a complete, accessible, functional and usable project.

The primary structural effort of this project includes

a. The design and construction of new reinforced concrete foundations that will support new water storage tanks.
b. The design and construction of new water storage tanks and their associated anchorage to concrete slab.
c. [Option 1) The design and construction of the reinforced concrete elements associated with the new stilling basin with an intake structure.
d. The design and construction of the new reinforced concrete foundation and storage components associated with the chlorination storage station.
e. The design and construction of the new reinforced concrete foundation supporting a pre-engineered metal enclosure structure for the pump and treatment station.
f. [Option 2] The design and construction of the new water well.
g. Other elements must include but are not limited to foundations, superstructure (i.e. walls, columns and beams), roof framing, lateral load stability and diaphragm design, framing and connection of any architectural features, and support of mechanical and electrical equipment.

The Contractor must have as part of his design team a licensed structural engineer per Host Nations standards. If work is being performed in a country that does not have licensed structural engineers, then engineering degrees along with extensive structural design experience can be submitted to the KO for qualification verification and approval. The structural engineer’s licensure or qualifications must be submitted to the KO in the design quality control plan prior to the start of design. The Contractor’s structural engineer must be responsible for the design of any part of the building structural systems.

The structural design of the foundation, superstructure and any other structural aspects must be in accordance with the design criteria listed in this document. The superstructure of the project building and the foundation must be constructed from locally available materials.

4.2 APPLICABLE DESIGN CRITERIA

All Design, Safety in Construction, Materials, and Performance of Construction Services must be in accordance with current local or national Host Nation codes and standards under consideration of the applicable US codes as stated below. In absence of Host Nation codes, use Eurocode and National Annexes for structural calculations. In case of conflicting requirements between the various elements, the more stringent criteria must govern.

Any material or construction installed by the Contractor as part of this contract that does not meet the requirements of this RFP or does not meet the applicable codes and standards must be removed and replaced at the Contractor’s expense.

Structural design methods and allowable stresses or load factors for the various structural materials must be in accordance with paragraph 1.7 of this document and the following codes/criteria:

- Eurocode and National Annexes

4.3 SUBMITTALS

4.3.1 DESIGN SUBMITTALS

The Contractor must provide the structural submittals after contract award in accordance with RFP Section 01 33 00-SUBMITTAL PROCEDURES. In addition to General Section 1.4 SUBMITTALS of this document the following documents must be submitted.

4.3.1.1 DRAWINGS & SPECIFICATIONS

The following structural detail drawings must be provided by the Contractor as required, but must conform to the requirements of this SOW and are subject to the approval of the KO. Construction drawings must include:

65% Design Submittal

a. Preliminary floor plans which provide information of the main structural system of the construction giving general information about dimensions of main elements such as columns, beams, bearing walls, etc. (min. scale 1:50)
b. Preliminary foundation plans which include for all typical structures, showing dimensions, arrangements, locations referred to a column line grid system, type of foundation and foundation obstructions. Include the layout of all slabs, footings, piers, grade beams, piles, etc., showing all foundation features of the design. (min. scale 1:50)
c. Preliminary drawings of water tanks showing general dimensions of tank and approximate anchorage location with reference to supporting slab. (min. scale 1:50)
d. Preliminary drawings of water well showing general dimensions of all the water well components. (min. scale 1:50)

95% Design Submittal

a. All items from the 35% Design Submittal requirements
b. Complete reinforcement drawings for foundations and other concrete elements (min. scale 1:50).
c. Shop drawings and performance data associated with the pre-engineered metal structure (min. scale 1:50).
d. All necessary sections and details of the load bearing structure (min. scale 1:20)
e. Roof framing plan with member sizes and connection details.
f. Details of all connections for the steel structure (min. scale 1:10)
g. Final shop drawings of water tank and all product data associated with tank. (min. scale 1:50)
h. Final details and locations of water tank anchorage. (min. scale 1:10)
i. Final shop drawings of water well components and all product data associated with pre-engineered components. (min. scale 1:50)
j. Letter of certification from senior level engineer performing the independent review.
k. Detailed specifications that are typically sent to sub-contractors.

100% Submittal

a. The 100% Submittal provides a complete and final set of contract documents ready for construction. All previous government review comments must have been addressed. Include all updated drawings, specifications and calculations from the 95% Submittal.
b. The design criteria actually used for the structural design must be referenced in the structural notes on the drawings including but not limited to applicable codes, standards and specified material strengths.
c. Final structural proofing report/Letter of certification from senior level engineer performing the independent review.

As Built Drawing Submittal

a. The As-built Submittal provides a complete and final set of record drawings documenting site conditions based on a survey of the final construction performed by the Contractor.

The design documents actually used for the structural design must be referenced in the structural notes on the drawings.

4.3.1.2 STRUCTURAL CALCULATIONS & DESIGN ANALYSIS
The Contractor must submit the structural calculations of all load bearing structural elements and their connections related to this RFP in a design analysis provided with each submittal. The design analysis must state and list the basis of design for all project aspects and features. The design analysis and calculations must be in accordance with the enclosed NAU Engineering Guideline 01/2016 Preparation of Structural Calculations. The current local or national Host Nation codes and standards on which the structural calculation are based must be referenced in the calculations. If applicable, an electronic copy of the applicable local or national Host Nation codes must be provided. Structural calculations must be sequentially numbered for ease of referencing for all submittal stages. Strict adherence to NAU Engineering Guideline 01/2016 Preparation of Structural Calculations will be enforced with all submittals. Any non-adherence to these guidelines will result in rejection of submittal.

4.4 PROOFING OF STRUCTURAL DESIGN
The Contractor must have the project reviewed in accordance with the following guideline "Scope for Independent Structural Proofing" which is included in the attachments. Host nation based structural proofing processes that require a similar level of structural engineering oversight are accepted if the documentation is provided in English language.

4.5 STRUCTURAL DESIGN CRITERIA
Structural design methods and allowable stresses or load factors for the various structural materials must be in accordance with the Applicable Design Criteria paragraph 4.2. Requirements in the codes, specifications and industry standards are requirements of this document, unless specified otherwise. The references used for the project design and contract documents must be included in the design analysis required for this project.

4.5.1 MINIMUM STRUCTURAL DESIGN LOADS
The design loads must be determined in accordance with the codes and standards listed in the Applicable Design Criteria paragraph 4.2. The design load criteria specified herein are minimums; the Contractor is responsible for verifying the actual design loads for this site. If actual design loads are different than that listed herein, the Contractor must notify the KO. The Contractor should determine if special loadings must be considered and notify the KO. Any cost and/or schedule impact due to the Contractor’s failure to notify the KO of these requirements specified herein four weeks before the submittal is due must be to the Contractor’s account. Design loads must be included in the structural notes on the drawings. The minimum design load criteria for this project as follows:

4.5.1.1 DEAD LOADS
The structural system must be designed and constructed to safely support all dead loads, permanent or temporary, including but not limited to self-weight, partitions, insulation, ceiling, floor covering, and all equipment that is fixed in position. Loads from architectural/mechanical/electrical equipment must be coordinated with the appropriate discipline. All loads and load case combinations must be in accordance with the codes and standards listed in the Applicable Design Criteria paragraph 4.2. Load factors for designs must be based on the applicable material design standard.

4.5.1.2 LIVE LOADS

4.5.1.2.1 FLOOR LIVE LOADS

Floor live loads must be in accordance with the codes and standards listed in the Applicable Design Criteria paragraph 4.2 for the anticipated usage.

4.5.1.2.2 ROOF LOADS

Roofs must be designed to support live loads; snow loads, including drifting loads, sliding loads, and rain on snow; and support wind loads including components and cladding in accordance with the Applicable Design Criteria paragraph 4.2.

4.5.1.2.3 ROOF SNOW LOADS

Design new roof for a minimum ground snow load for the regional conditions. Unbalanced snow loads, sliding and drifting loads (in particular areas), or wind loads may be the controlling load case for particular elements.

4.5.1.2.4 HORIZONTAL LOADS

The structural system wind design, including components and cladding, and the seismic design must be in accordance with the codes and standards listed in the Applicable Design Criteria paragraph 4.2. Research local wind requirements and indicate in the design analysis and wind calculations whether a wind speed greater than the code minimum is required.

4.5.1.2.4.1 SEISMIC LOADS

Seismic loads to be a minimum based on EN 1998-1:
No collapse requirement (TNCR = 475 years), Reference Peak Ground Acceleration, agR = 2.94 m/s2 (0.3g). Damage Limitation Requirement (TDLR = 95 years), Reference Peak Ground. Acceleration, agR = 1.47 m/s2 (0.15g).

4.6 MATERIALS

The use of the recommended materials and/or alternative materials must be in conformance with the publications listed in the Applicable Design Criteria paragraph 4.2. Any exceptions must be noted. Alternative materials may be submitted to the KO for approval if the Contractor determines the materials are more economically viable for this geographic region. Any material or construction that does not meet the requirements of this SOW or does not meet the applicable codes and standards must be removed and replaced at the Contractor’s expense.

4.6.1 REINFORCED CONCRETE

All concrete must be at least equivalent C 20/25 and reinforcing steel must be equivalent Grade B500C conforming to the applicable Eurocode standard. Ductility class must be in accordance with local codes and standards. Reinforcement welding is not permitted.

4.6.1.1 CONCRETE MIXTURE PROPORTIONS

Concrete mixture proportions must be the responsibility of the Contractor. Mixture proportions must include the dry weights of cementitious material(s); the nominal maximum size of the coarse aggregate; the specific gravities, absorptions, and saturated surface-dry weights of fine and coarse aggregates; the quantities, types, and names of admixtures; and quantity of water per cubic meter concrete. All materials included in the mixture proportions must be of the same type and from the same source as will be used on the project.

4.6.2 FORMS

Materials for forms must be plywood, metal, metal-framed, reinforced fiberglass, or plywood-faced to provide continuous, straight, smooth, exposed surfaces.

4.6.3 STRUCTURAL STEEL
Structural steel must be of a minimum steel grade equivalent S 235 conforming to the applicable Eurocode standard.

4.6.4 HOLLOW STEEL SECTIONS
Hollow steel sections must be of a minimum steel grade equivalent S 235 conforming to the applicable Eurocode standard.

4.7 BUILDING STRUCTURAL SYSTEMS
4.7.1 FOUNDATION SYSTEMS
Foundations must be permanent reinforced concrete foundations in accordance with the structural calculations. Foundations must be appropriately sized for anticipated loading, both live and dead. Foundations must extend below the frost line for the local area. If foundations are near or below water table, appropriate water proofing measures must be implemented into foundation design, e.g. waterproof membranes, coatings, drains, etc. Water and storm drainage piping is prohibited under building foundations without special provisions and approval by the KO.

4.7.1.1 SLABS-ON-GROUND
Floor slabs-on-ground must be a minimum of 10 cm thick. Floor slabs-on-ground must be reinforced with either bar or mat reinforcing having a minimum area of reinforcing of 0.2% of the slab cross sectional area and located 4 cm clear from the top surface of the slab. Fiber mesh reinforcing in the slab concrete will not be allowed.

4.7.1.2 CAPILLARY WATER BARRIER
A 15 cm thick capillary water barrier must be provided under all new interior slabs-on-ground. Recycled crushed material from demolition of pavements must not be used as granular fill below building slabs-on-ground.

4.7.1.3 VAPOR BARRIER
If used, vapor barrier must be polyethylene sheeting with a minimum thickness of 15 mils. The vapor barrier must comply with Class B, five ply, nylon, or polyester cord reinforced high density polyethylene sheets. Place 8 cm of compacted granular sand material between the underside of the slab and the vapor barrier. The use of a vapor barrier under new slabs-on-ground is discouraged except under sensitive floor finishes within the building where its use is required by the flooring finish material manufacturer. Tile, and PVC flooring are not normally considered sensitive floor finishes such that they require a vapor barrier under the slabs-on-ground.

4.7.1.4 ALLOWABLE SOIL BEARING PRESSURE
The allowable soil bearing pressure used for foundation design must be based on a geotechnical investigation. Reference the Civil Design section of this document for geotechnical investigation requirements.

4.7.1.5 MINIMUM EXCAVATION AND GRADING REQUIREMENTS
Minimum excavation and grading requirements must be in conformance with the requirements in the Applicable Design Criteria paragraph 4.2.

4.7.2 SUPERSTRUCTURE SYSTEMS
The superstructure system must provide vertical and lateral load carrying capacity and must provide durability, maintainability, and cost effectiveness. Roof openings and all supports for electrical and mechanical equipment must be detailed or adequately described on the drawings or in the specifications. Door openings must be sufficiently strong and solid to support the door structure and keep it level and plumb throughout the life of the structure. The structural designer must ensure that all architectural/mechanical/electrical equipment is properly

anchored/braced and that these elements are adequately framed and connected as required by the design criteria, especially where seismic design is required.

4.7.2.1 LATERAL (HORIZONTAL) FORCE RESISTING SYSTEM

4.7.2.2 NEW BUILDING (PUMP AND TREATMENT ENCLOSURE STRUCTURE)
Roof framing members must be either wood or steel. Roof sheathing must be plywood, wood planking, or standing seam metal and must be of sufficient thickness to perform as a lateral diaphragm for transferring lateral loads to the main lateral force resisting system (shear walls). Any trusses/joists used for roof framing must be designed with web member arrangement such that members are symmetrically loaded in the plane of the truss and sloped to achieve the required roof pitch. Metal framing members must be painted or factory finished with a corrosion resistant coating that will last the design life of the structure.

4.7.2.3 NEW WATER STORAGE TANKS
New water storage tanks to be either fully designed or can be pre-engineered. If pre-engineered tanks are used then all design information and product information must be submitted with the design. Permissible materials for water tanks are concrete, steel, aluminum, or fiber reinforced plastics.

Water storage tanks and associated anchorage must be designed to withstand gravity loads and wind or seismic loads as defined in this SOW. Additional seismic requirements to be considered are as follows:
- Calculation of fundamental period of tank based on properly substantiated analysis.
- Calculation of Impulsive and Convective (sloshing) forces with a damping of 0.5%
- Combination of Impulsive and convective forces using SRSS or CQC methods
- Application of vertical accelerations and forces and resulting hydrodynamic hoop stresses in cylindrical tanks.
- anchorage of tank to foundations
- flexible connections to the tank (pipes, etc).
- maximum permitted displacements
- calculation of required freeboard.

4.7.2.1 NEW WATER WELL
New water well and components to be either fully designed or can be pre-engineered. If pre-engineered components are used, then all design information and product information must be submitted with the design. Permissible materials for water tanks are steel or high strength PVC. Ensure water well and all components are designed to resist lateral earth pressure including any surface surcharges. Also ensure buoyant soil due to ground water level is considered in the design.

Refer to CIVIL AND GEOTECHNICAL section 2.0 of this document for additional information on the well, specifically the assumed well depth. For bidding purposes, it can be assumed the surface casing (typically top 10m) is 8-10 inches in diameter and the production casing (extending the remaining depth) is 4-6 inches in diameter. There is to be a reinforced concrete pad installed at the surface and sloped away to prevent water infiltration. For bidding purposes, the concrete pad can be assumed to be approximately 4m diameter around well.

4.8 ANTITERRORISM / FORCE PROTECTION (ATFP) STANDARDS
4.8.1 DOD MINIMUM ANTITERRORISM STANDARDS
Antiterrorism / force protection (ATFP) does not apply to this project as new structures are defined as low occupancy.

4.9 TESTS AND INSPECTIONS

Construction inspections and material testing must be in accordance with local building codes. If no local codes are available regarding testing and inspection, follow guidance in Eurocode and National Annexes.

END OF SECTION

5.0 ELECTRICAL & COMMUNICATIONS

5.1 GENERAL

This section includes requirements for the design, procurement, installation, and testing of a complete electrical power system. Provide a complete design and perform all labor and provide all materials, equipment, machinery, supervision, and any other items necessary to complete the electrical systems.

Electrical design must conform to the design criteria, standards, codes, and locally accepted equivalent host nation practices. Specially selected design products must have been proven reliable and trouble-free in commercial service locations for two years and longer in an environment similar to that of the project site.

5.1.1 APPLICABLE DESIGN CRITERIA

Project design must be in accordance with the requirements outlined in Section 1.7 DESIGN CRITERIA. In the absence of Host Nation Building Codes, use the International Building Codes (IBC) and/or the following U.S. Codes and Technical Standards and regulations:

International Electrical Commission Publications I.E.C.:

IEC 60364 Low-voltage electrical installations
IEC 61439 Low-voltage switchgear and controlgear assemblies
IEC 60947 Low-voltage switchgear and controlgear
IEC 60269 Low voltage fuses
IEC 60227 Polyvinyl chloride insulated cables of rated voltages to and including 450/750V
IEC 60309 Standard for plugs, socket-outlets, and couplings for industrial purposes
IEC 61386 Conduit systems for cable management
IEC 61537 Cable Tray Systems and Cable Ladder Systems for Cable Management
IEC 60423 Outside diameters of conduits for electrical and threads for conduits and fittings
IEC 60454-1-3 Specifications for pressure-sensitive adhesive tapes for electrical purposes
IEC 60598 Luminaires
IEC 62612 Self-ballasted LED Lamps for General Lighting Services with Supply voltages > 50V
IEC 62305 Protection against lightning
IEC 60331 Tests for electric cables under fire conditions - Circuit integrity
IEC 60332 Tests on electric and optical fiber cables under fire conditions
IEC 60695 Fire hazard testing
IEC 11801-1 Information technology – Generic cabling for customer premises
IEC 60728 Cable networks for television signals, sound signals, and interactive services – Installation and safety requirements
IEC 61156 Multicore and symmetrical pair/quad cables for digital communications
IEC 61935 Testing of balanced communication cabling in accordance with ISO/IEC 11801
IEC 61754 Fiber optic connector interfaces
ISO/IEC 14763-2 Information Technology – Implementation and Operation of Customer Premises Cabling – Part 2: Planning and Installation
ISO/IEC 30129 Telecommunications Bonding Networks for Buildings and Other Structures
ISO/IEC 14763-3 Implementation and Operation of Customer Premises Cabling – Part 3: Testing of Optical Fiber Cabling
IEC 60793-1 Optical Fibres – Measurement Methods and Test Procedures

5.1.2 SD-03 PRODUCT DATA
The following product data must be submitted and accepted by the KO prior to installation and commencement of required feature of work:

a. Metal Tubing
b. Conduit Fittings
c. Conductors
d. Outlet and splice boxes
e. Receptacles
f. Toggle Switches
g. Panel board
h. Circuit Breakers
i. Terminal Cabinets
j. Disconnect Switches
k. Conduits
l. Cable Trays
m. Surface Metallic Raceway
n. Lighting Fixtures, including Drivers and Lamps
o. Data outlets
p. Communications Rack
q. Data Cables

5.1.3 SD-02 SHOP DRAWINGS
Submit the following to the KO during construction:

a. Panel boards
b. Circuit Breakers (to be submitted together with Item a)
c. Panel board Accessories (to be submitted together with Item a)

5.1.4 SD-06-09 FIELD TEST REPORTS
Submit the following to the KO during construction:

a. Insulation Resistance Test
b. Continuity Test
c. Circuit Breaker and Protective Device Test
d. Panel and Switchboard Inspection
e. Light Level Test
f. Emergency Lighting System Test
g. Grounding System Test
h. Lightning Protection System Inspection
i. Communications Cable Certification Report
j. Continuity and Polarity Test
k. End-to-End Network Test

5.1.5 DRAWINGS AND DESIGN ANALYSIS
The following electrical detail drawings must be provided as required, but must also conform to the requirements of this SOW’s and are subject to the approval of the KO. Provide the following drawings and analyses of each of the listed submittals:

65% Design Submittal

a. Legend and Abbreviations.
b. Electrical and communication site plans identifying the new electrical service, the location of new and electrical panels, exterior electrical cable installations, communications manholes, and outside plan communications ductbank and cabling.
c. Demolition plan(s), showing existing conditions and demolition work.
d. Single line diagrams for the building electrical system.
e. Power Plan(s) showing locations of MDP’s (Main Distribution Panels), SDP’s (Sub-Distribution Panels), transformers, wire ways, power receptacles, ground bars, and electrical connections for mechanical and other equipment. Circuit information must be shown.

f. Lighting Plan(s) showing fixture layouts, fixture schedule, emergency fixtures, controls, circuiting, and exit signage.
g. Lighting illumination calculations
h. Communications floor plan(s) showing rack locations and voice/data connections.
i. Cable Tray Plans.
j. Communications and special systems rack elevation plans.
k. Special systems floor plan(s) to include security, fire alarm, and public address systems, etc.
l. Grounding floor plan(s) and risers.
m. Lightning protection system and roof Grounding plan(s).
n. Panel schedules.
o. 65% Design Analysis (DA) including electrical calculation package.
p. Lighting illumination calculation.
q. Pre-Final Specifications providing detailed explanations of requirements for all performed work or provide product specific manufacturer information (brochures, technical information, cut sheets) for all materials and products to be provided/installed.

95% Design Submittal
a. All requirements for the 65% submittal, updated per comments from the 65% review meeting.
b. Additional plans and Risers.
c. 95% Design Analysis.
d. Final specifications detailing materials, equipment and installation methods.

100% Design Submittal
a. All requirements for the 95% submittal, updated per the comments for the 95% review meeting.

5.1.6 ELECTRICAL DESIGN ANALYSIS
Provide a design analysis for each design phase of the project. Provide the following minimum information:
a. Load calculations and demand factors to include an additional 15% spare capacity for future loads.
b. Short circuit calculations and ampere interrupting capacity (AIC) rating of distribution equipment.
c. Electrical coordination study of new building power distribution and protective devices in coordination with existing systems.
d. Voltage drop calculations.
e. Lighting calculations including both general and emergency lighting. Digitally produced lighting calculation must show the average, minimum, maximum illuminance, and the illuminance uniformity for every area of the facility.
f. Electrical design narrative describing electrical design components and changes and decisions completed from each design reviews.
g. Catalog cut sheets for cables, light fixtures, MDP, subpanels, circuit breakers, and other unique equipment.
h. Lightning Protection Risk Analysis IAW IEC 62305-2

5.2 ELECTRICAL SCOPE
Provide electrical systems design for the new construction of Bazum water supply system. Design must include power, lighting, communications, grounding, and security systems. This package is comprised of the furnishing, delivery, equipment, and associated protection systems. Design to include the following items:

a. Provide new power to pumping station system, water tanks, and water treatment chlorination system from any combination of existing substations on site (tunnel substation and closed business substation).
b. Provide new exterior LED site security lighting around the pump station, water tanks, and stilling basin.
c. Provide new interior LED lighting and receptacles for any interior spaces.
d. Provide new lightning protection system for pump station building, water tanks, and water treatment chlorination system building.
e. Provide new telecommunications enclosure and cabling system to report alarms and operational status of water supply system to external user via cellular wireless signal.
f. Provide site IDS and CCTV.
g. Provide Building Automation System for pump station, water tank, and chlorination system.

Through the KO, the Contractor must coordinate power and communications utility line locations and any required installation phasing. The following are local utility POCs:

For the Contractor, the electrical installation starts with the proposed substation connection points, and use of these substations must be coordinated with the local authority. The local authority contact information is:
Electric Networks of Armenia CJSC (ENA) – Debed Branch, Lori Region
Customer service phone: 0800 00 180 or (+374 10) 59-13-12.

Information on electrical and communications utilities can be requested from the village administration:
Bazum Village Administration (Community Hall), Bazum Village, Lori Region, Armenia
Phone: (+374-94)06-00-12

5.3 DEMOLITION
No electrical demolition is anticipated for this project.

5.4 EXTERIOR ELECTRICAL WORK
5.4.1 PRIMARY POWER
Coordinate with the local power company to clarify the connection point, availability of capacity and adequateness of incoming feeder lines. Any cost incurred is the Contractor’s responsibility.

5.4.2 EXTERIOR POWER RECEPTACLES
Exterior weather proof receptacles must be installed at each location of outdoor equipment, and at the exterior entrance of any buildings. Exterior weatherproof receptacles must be 10ma RCBO (Ground Fault Circuit Interrupter-GFCI) protected.

5.4.3 LIGHTNING PROTECTION AND GROUNDING
Provide lightning protection and grounding system for the facility in accordance with IEC 62305 and local standards. Perform a lightning risk assessment to determine the required lightning protection class. For bidding purposes, assume that the lightning protection system (LPS) must be designed to lightning protection class 3 at a minimum. The LPS must be an integral LPS that consists of air terminals, roof conductors, down conductors, ground connections, grounding electrodes and ground ring electrode conductor for the purpose of carrying lightning current from a direct strike to the ground in a manner that will protect assets and personnel.

The grounding ring material must at a minimum be 50 mm2 bare copper wire or 78 mm2 (minimum) stainless steel V4A buried 800mm deep, 1 meter outside the building foundation with a 20 mm diameter x 2.4m copper clad steel ground rod or stainless steel V4A at each corner. Do not use a combination of materials that forms an

electrolytic couple of such nature that corrosion is accelerated in the presence of moisture unless moisture is permanently excluded from the junction of such metals.

The ground resistance must be determined from the soil conductivity, local conditions, and embedded earth electrodes in the foundations. The ground resistance will not exceed 10 ohms earth transition resistance. In the event that the measured ground resistance exceeds this value, additional ground rods must be provided. Do not perform testing within 48 hours of rainfall.

Connect the Grounding System to the main grounding (potential equalization) bus bar located in the building Main Electrical room. The grounding system must be connected to all metal surfaces of sanitary, ventilation, heating systems, and electrical systems, to include the metallic cable support systems.

Provide lightning protection system and grounding system test plans in compliance with IEC 62305 and local standards.

Supply cable system (from Power Source) must be TN-S with division of neutral conductor into neutral conductor and grounding conductor. Facility cable system must be TN-S.

Provide a ground bus bar in all electrical and telecommunications rooms.

5.5 INTERIOR POWER SYSTEMS

5.5.1 METERING

Provide electricity meter to monitor the water supply system’s power consumption.

Configure the meter to report power consumption to the facility operator.

5.5.2 GENERAL REQUIREMENTS MAIN DISTRIBUTION PANEL (MDP)

The configuration of the existing substations was not observed on the requirements development site visit, and the following information on the MDP is assumed. Modifications to the existing substations are assumed to require only additional breakers to supply subpanels to the pump station, chlorination system, and water tanks. Modifications will require coordination with and approval from the local utility authority.

The switchgear and installed equipment parts must be sized to meet circuit load and the relevant short circuit requirements. Short-circuit currents must be limited as specified in Host Nation Requirements (HNR).

Nominal voltage:	400/230 V
Frequency:	50 Hz
System:	TNS (L1, L2, L3, N and E)

Molded Case Circuit Breakers (MCCBs) must be used generally within the Low Voltage (LV) distribution system. Circuit breakers must be of one common manufacturer. Breakers must comply with Host Nation requirements and the following:

a. Sized for a minimum of 125% of the demand load they serve for future growth.
b. Expandable and must have a minimum spare space of approximately 25%.
c. Ammeters must be provided with 15 min average maximum indication.
d. Provide voltmeters.
e. Distribution boards must be provided with a suitable earth bar and neutral bar, with adequate provision for the connection of a circuit protective conductor for each outgoing way.
f. Fully rated for the available fault current and furnished with main circuit breakers, branch breakers, insulated neutral busses and bonded equipment-grounding busses.

g. Panel board bus bars must be copper.
h. Each distribution board must be provided with an engraved plastic label on the outside of the front cover, bearing the designation of the board and its reference number, if any, as given on the drawings or in the schedules. The label must be fixed in position by chromium-plated set screws. Each such label must be not less in size than 100 mm x 30 mm and must bear the required inscription in white on a black background, using letters and/or digits not less than 5 mm high.
i. Surge/over voltage protection is to be provided within the panels in accordance with Host Nation Regulations.

5.5.3 GENERAL REQUIREMENTS SUB DISTRIBUTION PANELS (SDP's)
The following text covers each individual sub distribution panel. SDP must be provided for the facility in electrically strategic locations to meet voltage drop requirements and provide service to branch circuits in a logical and efficient manner.

The construction of the SDP must conform to applicable Host Nations requirements. The switchgear and installed equipment parts must be sized to meet circuit load and the relevant short circuit requirements. Short-circuit currents must be limited as specified in Host Nation Requirements (HNR).
Do not install live parts at the front of the distribution panels. (Dead front panels)

Nominal voltage:	400/230 V
Frequency:	50 Hz
System:	TNS (L1, L2, L3, N and E)

It is intended that MCCBs, Miniature Circuit Breakers (MCBs) are used generally within the LV distribution system. Circuit breakers must be of one common manufacturer. Breakers must comply with HNR.

a. Sized for a minimum of 125% of the demand load they serve for future growth.
b. Expandable and must have a minimum spare space of approximately 25%.
c. Distribution boards must be provided with a suitable earth bar and neutral bar, with adequate provision for the connection of a circuit protective conductor for each outgoing way.
d. Fully rated for the available fault current and furnished with main circuit breakers, branch breakers, insulated neutral busses and bonded equipment-grounding busses.
e. Panel board bus bars must be copper.
f. Each distribution board must be provided with an engraved plastic label on the outside of the front cover, bearing the designation of the board and its reference number, if any, as given on the drawings or in the schedules. The label must be fixed in position by chromium-plated set screws. Each such label must be not less in size than 100 mm x 30 mm and must bear the required inscription in white on a black background, using letters and/or digits not less than 5 mm high.
g. Surge/over voltage protection is to be provided within the panels in accordance with HNR.
h. Location for the subpanels must be determined during design (must be outside means of egress area).

5.5.4 INTERIOR POWER INSTALLATION
Surface mounted cable installation in wire-ways, conduit, and cable tray will be the general installation method in utility rooms as part of this project.

Cables for receptacle and lighting circuits must be plastic coated cable or as required by Host Nation codes and standards for the facility type. Maximum voltage loss for any branch circuit must be 3% and for a feeder must not be more than 2%. The minimum cross sections of the cables must be 125% of the required maximum load. The cross-section must not be less than 1.5 mm^2 for lighting circuits, and

2.5 mm² for electrical outlets. These minimum cable sizes may need to be increase in size to stay within the voltage drop requirements. Calculations and design analysis must be provided for all circuits. Do not provide aluminum cable.

The interior electrical distribution system must match existing incoming supply feeder and utilize a separate equipment ground conductor run continuous throughout the facility. Actual electrical loads and demand factors, where known, must be used for electrical calculation purposes. Where loads are unknown, the Contractor must utilize loading, demand factors as appropriate, and conduit fill limited to 40%. Branch circuits feeding receptacles of unknown loads must be limited to 1200 VA per circuit.

All receptacle and lighting circuits must be connected to 230-volt, single-phase power. Special receptacle circuits must be connected to the voltage level as indicated by manufacturer’s data sheet. Separate lighting and power outlet circuits must be provided. Do not connect lighting to power circuits and do not connect outlets/power items to lighting circuits. Provide circuit for all mechanical and miscellaneous equipment, including space heaters, pumps, and chlorination system. Each telecommunications rack/cabinet must have a dedicated circuit.

European style 230-volt (16A) receptacles (high standard type) must be provided. Outlet circuits must be limited to no more than six (6) outlets per 16A-1P circuit breaker.

Exterior power receptacles and other wet locations must be protected by residual current operated Circuit-Breaker with Overcurrent protection (RCBO), 2-pole, with 10mA differential residual current trip, 6kA combination breaker. All other branch circuits must be protected with 30mA RCBO breaker in combination with a B16A miniature circuit breaker.

One receptacle is required in each interior facility.

5.6 LIGHTING SYSTEM

5.6.1 GENERAL LIGHTING SYTEM

Provide a complete LED lighting system for the building interior, building entrances, and security lighting for exterior equipment and spaces. All light fixtures must be new and be provided in all interior spaces. Provide proposed light fixtures and proposed layout that is coordinated with room usage and ceiling/mounting type.

The lighting fixtures must be installed according to their characteristics as XXW LED with driver. Lighting characteristics must be provided on lighting plans. Exterior/waterproof rated lighting fixtures must be provided at all entrances to the buildings.

Lighting calculations must be provided showing that all rooms are provided with the minimum lighting requirements. The minimum required average lighting intensity of each space is shown in the following list:

Area	Lighting Intensity (Lux)	Illuminance Uniformity (average:minimum)
Mechanical/Electrical	200 at 1067 mm AFF	3:1

Exterior Lighting: Vandal-proof fixtures with photocell controllers. Main entrance must have both motion detection and photoelectric control.

Provide the following controls systems for each space:

Area	Lighting Control
Building entrance	Manual on/off, Occupancy Sensors, Time Schedule
Mechanical/Electrical/Telecommunications Rooms	Manual on/off switch

5.6.2 SITE LIGHTING
Provide pole mounted and building mounted security lighting for the project site. The lighting must be LED. The minimum required average lighting intensity for site area must be the following:

Area	Lighting Intensity (Lux)	Lighting Control
Exterior doors and entrances	20	Occupancy Sensor, Daylight Sensor
Zones around water tanks, chlorination facility, pump enclosure, and fenced basin	10	Occupancy Sensor, Daylight Sensor

Use fully shielded or IES U0 luminaires to eliminate direct light above the horizontal plane.

5.7 COMMUNICATIONS
This section must include requirements for the design, procurement, installation, and testing of a complete telecommunications system. The Contractor must provide a complete design and must perform all labor and provide all materials, equipment, machinery, supervision, and all other items necessary to complete the construction of the telecommunications systems.

The telecommunications systems must be designed and installed in accordance with the Telecommunications Industry Association (TIA) and Electronics Industry Alliance (EIA) Building Telecommunications Wiring Standards general guidelines.

Telecommunications work includes design, procurement, and installation of a building telecommunications cabling systems (BCS) consisting of a LAN system to support collection of automation data and report it to a remote equipment operator. This includes but is not limited to copper and fiber horizontal distribution cable, convenience outlets, racks/cabinets, UPS, cable management, patch panels, cable tray, cable ladder, conduits, grounding, and labeling. For all required telecommunications systems, supply all material and labor to design, install, integrate, test and make operational.

5.7.1 OUTSIDE PLANT (OSP) CABLING AND TERMINATION
Provide cellular wireless (SIM)-based external network connection to enable remote access to the community to pump and water tank management sensors and site CCTV and security alarms. No hardwired external connection is required. KTR may coordinate outside plant connection of the telecommunications system with the local utility, Smart Net LLC, address Vanadzor City, 5/2-1 Shinara-rneri Street, Director: Davit Ghazarvan, phone: +374 93 666 817.

5.7.2 TELECOMMUNICATIONS ENCLOSURE(TE)
Locate a weatherproof, outdoor rated, and lockable telecommunications enclosure on the site to provide cable distribution for the pump system, chlorination system, water tanks, and any security systems. Ensure the TE is properly ventilated and cooled for the local conditions. Enclosure must meet the criteria of TIA-569, Telecommunications Pathways and Spaces.

Utilize CAT 6 or better copper cabling or fiber cabling. CAT 6 cabling must not exceed 90 meters in length from the TR to the room outlet.

400/230V, 3 phase, 50Hz power must be provided to the TE from the nearest practical subpanel, so that electrical maintenance issues may be addressed without accessing the substation power source. The panel must feed all telecommunications loads for the TE to include cooling, lighting, receptacles, and rack power.

Fiber optic patch panels must be one rack unit and must have 12 LC duplex couplers (bulkhead connectors) installed. Copper Patch Panels be one rack unit RJ-45, 24 port, CAT 6 or higher compliant. LSA+ Quick Disconnect Shelves and blocks must be installed. The Contractor must supply enough RJ 45 to LSA+, RJ-45-to-RJ-45 and appropriate fiber patch cables to enable available cross patching.

5.7.3 TELECOMMUNICATIONS OUTLETS
Provide one work area outlet inside pump enclosure as 8-pin modular (RJ45 type) outlet/connector in double gang outlet faceplates.

All utility rooms and closets, such as electrical, mechanical and telecommunications, must be wired with at least one wall mounted telecommunications outlet, with a mounting lug face plate.

Provide outlets to support building automation systems. Pump station, water tanks, and chlorination system must be provided with sensors and automation system that connect to the site main telecommunications enclosure to report equipment operational status and equipment alarms to the community via wireless signal. The automation systems are intended only to monitor and report, no control capability is required.

5.7.4 CABLING
All horizontal and backbone wiring must be designed in a star configuration or hierarchical-star configuration. All cables must be terminated with TEs and work areas/outlets.

5.7.4.1 COPPER
One CAT 6 or better unshielded twisted pair (UTP) cable must be installed to each standard 8-pin modular connector provisioned at the outlet. For example, install two 4-pair UTP cables to a standard administrative outlet, or one 4-pair UTP cable to each single connector outlet. Copper cables must not be split between multiple modular connectors.

5.7.4.2 COPPER AND FIBER OPTIC TERMINATIONS
All copper horizontal cabling must be terminated at cabinet/rack mounted patch panel and at the outlet. All copper terminations must be IAW with TIA/EIA 568A pin out standard. All fiber optic distribution cable must be terminated in cabinet/rack-mounted patch panels, and at the outlet. All fiber strands must be terminated with TIA/EIA 604-3A “LC” type connectors. Other small form factor connectors may be terminated at the user’s request. Provide fiber optic adapters and connectors in accordance with TIA/EIA-604 Fiber Optic Connector Intermateability Standard (FOCIS) and the corresponding FOCIS for the type of connector used.

5.7.5 TESTING
Testing must be done in accordance with manufacturer’s instructions. All telecommunications cable must be tested to the commercial standards for that cable system. The results of the tests must be provided to the KO for acceptance/rejection. Any unsatisfactory results must be remediated by the Contractor(s) and require acceptance by the KO.

5.7.5.1 UTP TESTS
All metallic cable pairs must be tested for proper identification (ID) and continuity. All opens, shorts, crosses, grounds, and reversals must be corrected. Correct color-coding and termination of each pair must be verified in the TE and at the outlet. Horizontal wiring must be tested from, and including, the termination device in the TE to, and including, the modular jack in each room. Backbone wiring must be tested end-to-end, including termination devices, from terminal block to terminal block, in the respective TEs. These tests must be completed and all errors corrected before any other tests are begun.

5.7.5.2 CAT 6 CIRCUITS
All CAT 6 circuits must be tested using a test set that meets the accuracy requirements of the most recent revision of the ANSI/TIA/EIA-568 standards for cabling.

5.7.5.3 FIBER OPTIC CABLE (FOC)
All FO circuits must be tested using a test set that meets the accuracy requirements of the most recent revision of the ANSI/TIA/EIA-568 standards for cabling. Unless stated otherwise, tests must be performed from both ends of each circuit. Connectors must be visually inspected for scratches, pits, or chips and must be re-terminated if any of these conditions exist.

5.7.5.4 TEST PLAN
The Contractor must submit for Government review a draft test plan of all proposed cabling and equipment being installed under the project. Upon the draft's approval, the Contractor must prepare a finalized test plan to the Government. After the Contractor has completed the installation and testing of the BCS, the Contractor must submit a test report for all fiber and copper cabling. A Registered Communications Distribution Designer (RCDD) must approve both the test plan and the test report.

5.8 SECURITY SYSTEMS
5.8.1 INTRUSION DETECTION SYSTEM (IDS)
Provide a complete IDS to be installed at the door leading into the pump enclosure and at each gate entrance to the site. The IDS must be networked to the site main telecommunications enclosure so that the alarms can be monitored remotely by the community via wireless communication. IDS design must include cable pathways, junction boxes, pull boxes, and component boxes for installation of the cables and power. The IDS system must include infrastructure for balance magnetic switches at each door and window.

5.8.2 CLOSED-CIRCUIT TELEVISION (CCTV)
Provide a closed circuit television system to monitor the entrances, exits water tanks, and chlorination system at the facility. CCTV design must include cable pathways, junction boxes, pull string, pull boxes, and mounting boxes. For exterior locations install CCTV camera mounting boxes underneath the roof to be out of range of vandalism. All exterior locations must be in weather proof box. The CCTV system must be networked to the site main telecommunications enclosure so that the CCTV can be monitored remotely by the community via wireless communication.

END OF SECTION

6.0 MECHANICAL & PLUMBING

The services covered by this section include all labor, material supplies, equipment, and incidental work required for the design, installation and testing of all heating, air conditioning, ventilation, and plumbing systems to provide support for Water Supply System for Bazum Village in Armenia. The contractor must perform design and construction services as required to provide a complete and usable facility.

The mechanical design and construction must be coordinated with all other trades. The mechanical systems and equipment must be permanent construction. The contractor must reference applicable Host Nation laws, codes and standards for design, except when specifically noted in this scope of work. The designer must reference the architectural description and perform site surveys to determine mechanical equipment capacities, locations, sizing constraints, fixture quantities and other relevant design and construction requirements when not stated in this mechanical section.

All mechanical systems must be designed and provided in accordance with the criteria provided herein, and with the minimum standards specified in the applicable referenced codes. Should conflicts occur between the criteria provided and the codes, the more stringent requirements must govern.

6.1 GENERAL OVERVIEW

Project to provide a new pump station enclosure for the water supply. The pump station will be located near the intake and will bring water from the stilling basin or drilled well to the water storage tanks.

6.2 TECHNICAL CRITERIA & STANDARDS REFERENCE

Project design must be in accordance with the requirements outlined in Section 1.6.

In the absence of Host Nation Building Codes the Contractor must use the International Building Codes (IBC) and/or the following U.S. Codes and Technical Standards and regulations:

INTERNATIONAL CODE COUNCIL (ICC):
ICC - International Building Code (IBC)
ICC - International Plumbing Code (IPC)
ICC - International Mechanical Code (IMC)

UNIFIED FACILITIES CRITERIA:
UFC 3-230-01 Water Storage and Distribution
UFC 3-420-01 Plumbing Systems

NATIONAL SCIENCE FOUNDATION/AMERICAN NATIONAL STANDARDS INSTITUTE
NSF/ANSI 372: Drinking Water System Components – Lead Content

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ISO 4427-1 Plastic Piping Systems – Polyethylene (PE) Pipes and Fittings for Water Supply

AMERICAN WATER WORKS ASSOCIATION
AWWA D100 Welded Carbon Steel Tanks for Water Storage
AWWA D102 Coating Steel Water-Storage Tanks
AWWA D120 Thermosetting Fiberglass-Reinforced Plastic Tanks
AWWA C652 Disinfecting Water Storage Facilities

WORLD HEALTH ORGANIZATION

WEDC Technical Notes on drinking-water, sanitation, and hygiene in Emergencies - CHAPTER 9: How much water is needed in Emergencies

HOST NATION STANDARDS:
RA Building Norms (RA BN) IV-11.05.02-09 – "Internal Water Supply and Sewer Systems"
RA Construction Norms (SNiP 2.04.01-85*) – "Internal Water Supply and Sewerage"
HTD-III-9.02-15 – "Design Rules for Water Supply Systems of Residential and Public Buildings"

6.3 GENERAL REQUIREMENTS
6.3.1 SUSTAINABILITY
The Contractor must provide a sustainable design that considers the energy and environmental impacts of operating and maintaining the building. All designs, drawings, and specifications must specify material and systems that reduce the need for maintenance, and/or require less water, energy, and toxic chemicals and cleaners to maintain.

6.3.2 EQUIPMENT SELECTION
Equipment must be selected based on calculated design values, manufacturer recommendations, and accepted engineering practice. All equipment must be designed and installed in accordance with the equipment manufacturer's clearance recommendations for operations and maintenance. Required maintenance access areas must be shown on the design drawings.

All materials and equipment must be the standard cataloged product of manufacturers regularly engaged in production of such materials and equipment and must be the manufacturer's latest standard design. All mechanical components, including all equipment and piping must be new. Previously installed or used equipment is not acceptable. Contractor must only select materials and equipment that is readily available in the area.

6.3.3 STRUCTURAL LOADING
Mechanical system design, equipment selection and placement must consider the allowable structural loading of the floors and roof. Designer is responsible for evaluating the structural capabilities of the building and ensuring that design loads are not exceeded.

6.3.4 MECHANICAL PENETRATIONS
All penetrations required to install the mechanical systems must be provided. The annular space around penetrations is to be sealed and finished to match surrounding surface. Any penetration through a fire rated wall must be fire stopped to match the fire rating of the penetrated wall.

Provide one piece or split hinge metal escutcheons plates for piping entering floors, walls, and ceilings in exposed spaces. Provide chromium-plated on copper alloy plates or polished stainless-steel finish in finished spaces. Provide paint finish on plates in unfinished spaces.

Provide sleeves where piping passes through walls, floors, roofs, and partitions. Secure sleeves in proper position and location during construction. Provide sleeves of sufficient length to pass through entire thickness of walls, floors, roofs, and partitions. Provide not less than 7 mm space between exterior of piping or pipe insulation and interior of sleeve. Sleeves will be steel pipe or schedule 40 PVC plastic pipe. Sleeves are not required where drain, waste, and vent (DWV) piping passes through concrete floor slabs located on grade. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth. Firmly pack space with insulation

and caulk at both ends of the sleeve with plastic waterproof cement which will dry to a firm but pliable mass or provide a segmented elastomeric seal.

6.3.5 PIPING
All newly installed piping must be new. Piping must be concealed except in mechanical rooms or on the roof when serving roof mounted equipment (i.e. water storage, etc.), unless specifically stated otherwise in the Statement of Work. No piping must be routed through communications, elevator machine or electrical rooms.

Access panels/doors must be provided for valves and appurtenances where concealed. All panel locations and sizes must be indicated on the design drawings. Panels must be clearly labeled in English and Host Nation language as to the system and function. Access panels must be provided for access to mechanical valves, resets, cleanouts, etc.

6.3.6 EQUIPMENT
Provide working space around all new equipment in accordance with manufacturer's guidelines. Provide all required fittings, connections and accessories required for a complete and usable system. All equipment must be installed per the criteria in this document and the manufacturer's recommendations. Where the word "should" is used in manufacturer's instructions, substitute the word "must".

6.3.7 CLEANING AND DISINFECTION
Clean all mechanical and plumbing systems. Thoroughly flush piping before final filling. All fittings are to be stored with covers on the open ends to prevent dust from settling in the components.

Potable water piping must be flushed and sterilized according to US and local codes. The contractor must perform sterilization only after all pressure tests on the new water system are performed.

6.3.8 IDENTIFICATION AND LABELING
All aboveground piping must be provided with identification and labels in accordance with Host Nation standards. Piping must be provided with permanent identification labels and flow arrows. Labels must be installed at each change of direction, point of entry and in congested areas but must not be spaced more than 7.5m apart.

6.3.9 DESIGN SUBMITTALS
The contractor must provide submittals after contract award in accordance with Section 01 33 00 SUBMITTAL PROCEDURES. At each design submission, provide all necessary documents and information to clearly communicate compliance with the project's requirements.

The contractor must submit the complete mechanical design for acceptance prior to construction. Designs following local codes or regulations must be accompanied with the related referencing standard.

6.3.9.1 DESIGN ANALYSIS
The following plumbing design analysis must be provided and must conform to the requirements of this SOW and are subject to the approval of the Contracting Officers (KO). The design analysis must include:

65% Design Submittal
- Narrative functional description of the proposed plumbing systems
- Code review for the project based on project location
- Construction specifications in short form/table of contents
- Technical data for mechanical and plumbing equipment

- Description of connection to existing site utilities
- Narrative description of conflicts during the concept design development and the reasoning on how the conflict was resolved
- Justification provided for special materials when relevant
- Complete mechanical calculations (reference Section CALCULATIONS of this document)
- Summary of mechanical calculations
- Draft specifications detailing materials, equipment, and installation methods

95% Design Submittal

- All items from the 65% Design Submittal requirements. All previous government review comments must have been addressed. Include all updated drawings, specifications, and calculations for the 95% Submittal. This will be a complete design package
- Complete narrative functional description of the proposed mechanical and
- Updated from the 65% submittal, all Manufacturer’s data sheets clearly marked showing model selected for all major equipment including model numbers
- Final construction specifications

100% Corrected Design Submittal

- The 100% Corrected Submittal provides a complete and final set of contract documents ready for construction by the D/B Contractor. All previous government review comments must have been addressed. Include all updated drawings, specifications and calculations.
- Contractor must submit a complete Design Submittal for the 100% Corrected Design Submittal. All electronic files will be bookmarked in the PDF and searchable.

6.3.9.2 DRAWINGS

The following mechanical drawings must be provided by the Contractor as required but must conform to the requirements of this SOW (USACE A/E/C Graphics Standard (ERDC/ITL TR-12-1)) and are subject to the approval of the Contracting Officer (KO). Construction drawings must include:

65% Design Submittal

- Full legend to clarify all symbols, lines and abbreviations used on the drawings. All symbols, lines and abbreviations must be unique and easy to differentiate
- Floor plan drawings showing equipment locations and piping runs
- Typical sectional and elevation views
- Typical plumbing detail drawings
- Flow and riser diagrams for plumbing systems
- Preliminary equipment schedules/lists

95% Design Submittal

- All items from the 65% Design Submittal with all review comments addressed
- Complete floor plan drawings showing equipment locations and piping runs
- Complete sectional and elevation views
- Complete plumbing detail drawings
- Complete flow and riser diagrams
- Complete equipment schedules/lists

100% Corrected Design Submittal

- The 100% Corrected Design Submittal provides a complete and final set of contract documents ready for construction by the D/B Contractor. All previous government review comments must have been addressed. Include all updated drawings, specifications, and calculations.

- Contractor must submit a complete Design Submittal.

6.3.9.3 CALCULATIONS
Detailed calculations must be performed in accordance with the requirements below.

Documentation of the load calculation program may be requested, including a written summary of the program intent and function, assumptions, formulas, numerical methods used, nomenclature, limitations of the program, and references used in developing the program.

Design analysis must include complete input data and the following output data (as a minimum):
- Systems summary
- Head loss calculations for all pumps

Provide an electronic and hard copy file in English and the Host Nation language. An electronic copy of the actual input file must be provided.

6.3.10 CONSTRUCTION SUBMITTALS
The list below states the minimum mechanical submittals required. The KO or other requirements may dictate additional submittals. All submittals to be provide in accordance with Section 01 33 00.

6.3.10.1 SD-02 SHOP DRAWINGS:
Submit the following to the KO during construction:
- Pumps
- Piping

6.3.10.2 SD-03 PRODUCT DATA:
The following product data must be submitted and accepted by the KO prior to installation and commencement of required feature of work:
- Pumps
- Plumbing Piping & Fittings

6.3.10.3 SD-06 & SD-09 FIELD TEST REPORTS:
Submit the following to the COR during construction:
- Testing, Adjusting, and Balancing Report
- Pipe Pressure Test Reports

6.4 PLUMBING
Provide a new pump station inside the new pump enclosure to deliver water to the two 100,000-liter water storage tanks.

6.4.1 EXISTING
There is an existing, buried concrete water tank that was never brought into service. The underground tank was reported to have had a capacity of 400 metric tons and was abandoned in the 1980’s.

6.4.2 DEMOLITION
The existing water tank will remain and is not part of this project. No mechanical or plumbing demolition is anticipated for this project.

6.4.3 WATER SUPPLY
Provide a new pump station inside the new pump enclosure to deliver water to the two 100,000-liter water storage tanks. Provide an electric heating unit inside the pump enclosure at a set point of 4.5 degrees Celsius in order to ensure frost protection for the equipment and piping therein contained.

Water system design shall be in accordance with applicable Host Nation standards. In the absence of such standards, refer to UFC 3-230-01 WATER STORAGE AND DISTRIBUTION.

Pump station design shall satisfy the flow and total dynamic head required to transmit to and fill a 100,000-liter water tank over a span of 6 hours.

[Option 1] Distance between proposed stilling basin and new water tanks is approximately 140 meters. Contractor shall verify elevation change and distance between stilling basin and new water tanks.

[Option 2] Assume a well depth of 150 meters for bidding purposes.

Provide a minimum of two pumps at each pump station. Pumping capacity must be able to discharge the peak flow with the largest pump out of service.

Backflow prevention valves and water meters must be installed in all supply systems.

6.4.4 PUMP STATION
Provide a pump station that is appropriate for the water system design inside the new pump enclosure. Pump flow and size shall satisfy the flow and head required to meet the requirements of the designed water system. Provide the pump station with a check valve on the discharge and two normally open (N.O.) isolating valves.

Pump shall be specifically designed to be compatible and powered with the provided electrical supply. See Electrical Section for further information.
Pump shall be selected in the middle of the recommended operation range of unit capacity, to allow increase or decrease in unit operation.

The pump shall have a weather protected disconnect switch located adjacent to the pump and be overload protected with breakers. Provide all controls required for manual operation inside the pump enclosure.

The manual control switch shall be rated for outdoor use. The switch shall be compatible with the pumping system that it controls. Control relays required shall be weather rated adjacent to the pump being controlled.

Provide all controls required to automatically stop the pump when the elevated water tank is full, and restart as the water level drops. Control of the pump on and off cycle must be controlled via a float valve.

6.4.5 WATER PIPING
Provide piping for the pump station and distribution system within pump enclosure.

All components in contact with the water will be lead free in accordance with Host Nation standards and regulations. In the absence of such standards, use NSF/ANSI 372: Drinking Water System Components – Lead Content.

6.4.5.1 UNDERGROUND PIPING
Underground water lines shall be installed at a minimum depth as indicated in the civil section of this RFP.

All underground water piping materials shall be High Density Polyethylene (HDPE). It shall be manufactured under ISO 4427: Plastic Piping Systems – Polyethylene (PE) Pipes and Fittings for Water Supply and/or DIN 8074. Fusion welded joints shall be used where applicable. Pipe shall be solid blue or black with a blue stripe.

6.4.5.2 ABOVEGROUND PIPING
Above ground piping shall be metal: galvanized steel compatible with the water quality and conditions and painted with corrosion protection. Transitions from plastic to metal shall happen at ground level.

6.4.5.3 PIPE FITTINGS AND COUPLINGS
Pipe fittings and coupling shall be specifically made for the connection of the pipe size and materials to be joined. No homemade couplings shall be accepted.

6.4.5.4 VALVES
Shut off valves shall not be plastic.

Valve DN65 and under shall be red brass or bronze. Valves DN80 and over shall be ductile iron resilient-seat gate valves. Ball valves located at the well headers used to re-attach makeshift connections shall be position lockable ball valves. The hand-hole valves shall be ball valves. The header valves and hand-hole valves shall be prepared with a coupling method that allows easy connection by the local community users. Valves shall be considered industrial and durable, capable of functioning without regular seal maintenance.

All valves used shall be lead free. The contractor shall provide evidence to the contracting office from the valve manufacturers that the products are lead free and certified for potable water consumption.

6.5 CONTROLS
Pump station shall be provided with sensors and automation system that connect to the remote site building automation system to report equipment operational status and equipment alarms to the community via wireless signal. The automation systems are intended only to monitor and report, no control capability is required.

6.6 CLOSEOUT
Provide complete start-up and operational testing of the plumbing equipment and systems. Simulate all modes of operation and emergency shutdowns of equipment and systems. Provide corrective actions and re-testing as necessary to demonstrate that the actual equipment and system performance is in accordance with the design requirements at all design conditions.

Contractor to provide a submittal to the KO with all inspection and start-up procedures, requirements, and recommendations from the Installation, Operations, and Maintenance (IOM) manuals for all new equipment. The submittal will also include the IOM manuals. The procedures for the inspection and start-up are to be provided in English and Host Nation language.

This document will provide an outline of the steps the contractor will follow prior to acceptance of the equipment. All controls will be tested for functionality, safety operations, and power failure restart.

The contractor must pretest all of the equipment prior to a scheduled final test coordinated with the KO to allow observation of the final testing with the US Government and end users. All testing and inspections will be documented with the contractor's Project Management or Quality Control team to sign off that the pretest was completed successfully.

6.6.1 OPERATIONS AND MAINTENANCE MANUALS

Operations and maintenance instruction must be provided for all equipment. Information must be in English and Host Nation language. Documentation must be provided in both hardcopy and electronic format (PDF).

6.6.2 TRAINING

The Contractor must provide on-site training for the operation and maintenance personnel in the appropriate language. Training duration must be based on the complexity of the systems involved but must not be less than 4 hours. Training must include complete operation and regular maintenance of all mechanical and plumbing systems as well as associated controls. Standard sequence of operations, failure modes, and alarms must be thoroughly covered and demonstrated. This must be provided to the appropriate personnel prior to handover of the completed installation.

The contractor must provide written documentation (in both English and the local language) to the KO outlining what training occurred, how long the training lasted, and who was trained. The document must be dated and signed by each person in attendance to include the contractor. Contractor must also provide all equipment O&M manuals to the KO.

Training must be scheduled and coordinated with building maintenance and building users with a minimum of two week notice.

END OF SECTION

7.0 FIRE PROTECTION

This section is not used.

END OF SECTION

8.0 SUSTAINABILITY

This section is not used.

END OF SECTION

9.0 CYBERSECURITY

This section is not used.

END OF SECTION