AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE OF PAGES
	1

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO.(If applicable)
0003	04-May-2012		PAPW040702AP

6. ISSUED BY	CODE	7. ADMINISTERED BY (If other than item 6)	CODE
AFGHANISTAN DISTRICT SOUTH (AES) US ARMY CORPS OF ENGINEERS APO AE 09355	W5J9LE	See Item 6	

8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)		
	X	9A. AMENDMENT OF SOLICITATION NO. W5J9LE-12-R-0051
	X	9B. DATED (SEE ITEM 11) 09-Apr-2012
		10A. MOD. OF CONTRACT/ORDER NO.
		10B. DATED (SEE ITEM 13)
CODE / FACILITY CODE		

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

[X] The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer [ ] is extended, [X] is not extended.

Offer must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended by one of the following methods: (a) By completing Items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS. IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

[ ] A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.

[ ] B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(B).

[ ] C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:

[ ] D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor [ ] is not, [ ] is required to sign this document and return _____ copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

Afghan National Civil Order Police 2/3 Patrol Battalion Muqur District, Badghis Province
The purpose of this amendment is to:
Replace Section 00010 - Proposal Schedule
Replace Section 00150 - Project Phases
Replace Section 01015 - Technical Requirements
Technical questions with answers from prospective contractors

Proposal due date remains the same 12 May 2012 at 4:00 pm Kandahar Afghanistan time.
Point of contact is Clauirce Dingle at Claurice.m.dingle@usace.army.mil

SEE CONTINUATION PAGE

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) TEL: EMAIL:	
15B. CONTRACTOR/OFFEROR (Signature of person authorized to sign)	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA BY (Signature of Contracting Officer)	16C. DATE SIGNED 04-May-2012

SECTION SF 30 BLOCK 14 CONTINUATION PAGE

SUMMARY OF CHANGES

SECTION 00010 - SOLICITATION CONTRACT FORM

The following have been added by full text:
PROPOSAL SCHEDULE

PROPOSAL SCHEDULE

The Contractor shall provide a price for all items, including any labeled "Optional Items".

ITEM	DESCRIPTION	QTY	UNIT	Unit Price	AMOUNT
0001	**GENERAL**				
0001AA	Mobilization/Demobilization	1	LS	XXX	$_____
0001AB	Security	1	LS	XXX	$_____
0001AC	Unexploded Ordinance (UXO) Removal and Clearance	1	LS	XXX	$_____
0002	**DESIGN PROGRAM**				
0002AA	Site Survey	1	LS	XXX	$_____
0002AB	Geotechnical Report	1	LS	XXX	$_____
0002AC	A/E Design	1	LS	XXX	$_____
0002AD	Record Drawings	1	LS	XXX	$_____
0003	**SITE DEVELOPMENT**				
0003AA	Site Preparation	1	LS	XXX	$_____
0003AB	Site Grading and Stormwater Management	1	LS	XXX	$_____
0003AC	Well	1	LS	XXX	$_____
0003AD	Potable Water System and Storage	1	LS	XXX	$_____
0003AE	Wastewater Collection and Treatment Plant	1	LS	XXX	$_____
0003AF	Electrical Generation and Distribution System	1	LS	XXX	$_____

0003AG	Communication System	1	LS	XXX	$_____
0003AH	Fuel Storage, Generator Canopy, and Vehicle Fuel Point	1	LS	XXX	$_____
0003AJ	Asphalt Roadways/Driveways, Sidewalks and Parking	1	LS	XXX	$_____
0003AK	Aggregate	1	LS	XXX	$_____
	Roadways/Driveways Parking				
0003AL	Flagpoles	1	LS	XXX	$_____
0004	**FORCE PROTECTION**				
0004AA	Perimeter Security Wall	1	LS	XXX	$_____
0004AB	Fencing, Gates and Barriers	1	LS	XXX	$_____
0005	**FACILITIES**				
0005AA	Administration Bldg	1	EA	$_____	$_____
0005AB	Dining Facility	1	EA	$_____	$_____
0005AC	Training Building	1	EA	$_____	$_____
0005AD	Open Bay Barracks	3	EA	$_____	$_____
0005AE	Senior Barracks	2	EA	$_____	$_____
0005AF	Female Barracks	1	EA	$_____	$_____
0005AG	Latrines	3	EA	$_____	$_____
0005AH	Guard Towers	5	EA	$_____	$_____
0005AJ	Guard Shacks	3	EA	$_____	$_____
0005AK	Guard House	1	EA	$_____	$_____
0005AL	Well House	1	EA	$_____	$_____
0005AM	Secure Storage Building (ASP)	1	EA	$_____	$_____
0005AN	Vehicle Maintenance and POL Buildings	1	EA	$_____	$_____
0005AP	Warehouse	2	EA	$_____	$_____

0005AQ	Trash Collection Point	2	EA	$_____	$_____
0005AR	Small Arms Maintenance Building	1	EA	$_____	$_____
0006	**DBA INSURANCE (CLINSs 0001- 0005)**	1	LS	XXX	$_____
The amount listed by the offeror on this CLIN is the estimated DBA insurance premium (estimated payroll of the offeror and its subcontractors times the applicable rate(s)). The DBA insurance premium amount varies with payroll and the nature of services and will, therefore, be taken into account during price evaluation of offers. The actual amount paid by the government under this CLIN will be based on the amount of the Rutherfoord invoice, stamp "paid" and submitted by the offeror after contract award. In the event of recalculation of the premium by CNA based on actual payroll amounts, the contracting officer will adjust this CLIN by contract modification to reflect the actual premium amounts paid.					
	TOTAL BASE BID ITEMS:				$_____
	SCHEDULE TOTAL:				$_____

PROPOSAL SCHEDULE NOTES:

1. Offeror shall submit prices on all items. Scopes of Work for each item are described in Section 01010.

2. Only one contract for the entire schedule will be awarded under this solicitation. This project will be awarded as a single contract.

3. PERIOD OF PERFORMANCE AND LIQUIDATED DAMAGES: See Section 00150 for performance schedule. Period of performance is defined as the number of calendar days from receipt of notice to proceed. The period of performance will not be extended if the options are exercised. Liquidated Damages are included in this contract. See FAR Clause 52.211-12.

4. Abbreviations:

LS = Lump Sum
EA = Each

- END OF SECTION-

SECTION 00150
PROJECT PHASES

1.0 GENERAL

The Contractor shall construct the buildings included in this contract according to the Government issued building designs (included in the Appendices) and to design and construct all other structures, buildings and site features not included in the Government issued designs to provide a fully functioning facility as described in Section 01010 Scope of Work. Any building designs not included as part of this solicitation, but stated as part of this contract, are the responsibility of the Contractor to design as well as build. The facility shall be designed and built by a single Contractor. The Contractor may be a single firm or a team of firms that includes registered Architects and Engineers either employed by or subcontracted to the Contractor. The Contractor shall be responsible for all Contractor furnished designs, whether the Contractor utilizes services of licensed architects and engineers employed by its firm or subcontracts with independent architectural and/or engineering firm(s). The Contractor shall be solely liable for design errors and/or omissions and should be insured as the A-E firm against design errors and omissions. For this specification, the term "Government" is defined as the Contracting Officer for the US Army Corps of Engineers, Afghanistan District South.

The Contractor may be a single firm or a team of firms that includes registered Architects and Engineers either employed by or subcontracted to the contractor. Licensing jurisdiction of Architects and Engineers of record shall be shall be verifiable. The Contractor shall be the Architect/Engineer-of-Record for all work not associated with the furnished drawings, whether the Contractor utilizes services of licensed architects and engineers employed by its firm or subcontracts with independent architectural and/or engineering firm(s). The Contractor shall be solely liable for design errors and/or omissions and should be insured as the A-E firm against design errors and omissions.

Section 00555, DESIGN CONCEPT DOCUMENTS identifies project documents furnished herewith to be used as the basis for the project design and construction documents. The successful Offeror shall be required to complete the design and construction documentation, and construct the project in compliance with these completed requirements.

2.0 OUTLINE DESCRIPTION OF THE DESIGN PHASE

No work can begin on any phase of the process until an authorization Clearance For Construction (CFC) for that phase is issued.

2.1 PROPOSAL PHASE

The Proposal Phase includes the period from the time from the issuance of the solicitation through the selection process and the final award of the Contract.

The proposals to be submitted include a Management/Technical Proposal and a Cost/Price Proposal. The Government will evaluate and award the contract to a single Offeror based upon the criteria indicated.

2.2 DESIGN PHASE

The successful contractor shall develop and submit for formal review Design Phase Submittals as indicated below and in the Project Schedule.. The contractor is encouraged to develop and submit multiple cost saving proposals for innovative design alternatives. The Design Phase will consist of four parts as follows:

a. A Pre-design meeting will be conducted to distribute drawings to the Contractor, finalize and clarify technical information, and clarify other necessary information., if deemed necessary by the Government.

b. Basic services required to develop the preliminary submittal which represents items necessary for wells and subsurface investigation: Geotechnical report, well design and test results, and percolation test locations

and results. After approval of the 10% design submittal, the Government may issue a CFC letter to commence with the construction phase of the well and wastewater treatment features.

c. Basic services required to develop the first facility design submittal which represents: 65% complete drawings and specifications for site preparation work, utility construction, paving, foundation, water and wastewater features of all facilities. After approval of the 65% design submittal (drawings and specifications), the Government may issue a CFC letter to commence with the Build Phase for all site and off-site utilities, clearing, grubbing, rough grading the site, demolition work, parking lot base course, foundation, and all building features.

d. All design services required to complete the 95% design submittal: 100% complete drawings and specifications for site preparation work, utility construction, paving, foundation, and structural diaphragm of all work. 95% design shall not begin until an approval of the 65% design submittal is issued.

3.0 BUILD PHASE

The Build Phase will be initiated by a CFC letter issued by the Contracting Officer. A CFC will be provided separately by the Contracting Officer for each phase of the work. The Government may give the Contractor authorization for the Build Phase for portions of the work following review and approval of the particular design submittal.

Weekly coordination meetings will be held at which, as a minimum, the contractor's Project Manager, a representative of the Designer, the site Superintendent, and the Quality Control Manager shall be present.

4.0 PROJECT SCHEDULE

The following is an internal design schedule and is subject to modification by the Offeror to suit their particular method of operation. Overall time constraints are required and cannot be changed except by contract modification. Prospective Offerors shall be required to submit a complete schedule for design and construction that meets or exceeds the overall time goals of the Government for this project. (All days are in calendar days.)

Notice to Proceed	following Award of Contract (upon written notification)
Design Phase - Basic Services Pre-design Meeting	if deemed necessary by the Government
10% Design Submittal	within 45 days following Notice to Proceed
65% Design Submittal	within 90 days following Notice to Proceed
95% Design Submittal	within 150 days following Notice to Proceed
100% Design Submittal	within 180 days following Notice to Proceed
Total Contract Period	**540** days

--END OF SECTION--

SECTION 01015
TECHNICAL REQUIREMENTS

1.0 GENERAL

1.1 COMPLIANCE

The Contractor's design must comply with Technical Requirements contained herein. The Contractor's designer shall have a minimum of 5 years experience with the design and construction of the same magnitude and complexity as required in this project. The Contractor shall provide design and construction using the best blend of cost, construction efficiency, system durability, ease of maintenance and environmental compatibility.

Technical Requirements, as included in this Section, shall only be used for Work that is to be designed per the contract requirements. Work that is to be constructed using the provided Standard Designs shall not use the Technical Requirements herein; that Work shall be built to the requirements of the 01010, the Standard Designs.

1.2 MINIMUM & ALTERNATE REQUIREMENTS

The design and product requirements stated in these documents are minimum requirements. Exceeding the minimum requirements for the equipment and products as improvements to the design stated herein is highly encouraged at no additional cost and as approved by the government. The technical requirements listed in Codes and Technical Criteria, Section 1.8, apply to this project. Any deviation from the technical requirements shall be approved by the Contracting Officer. Request for deviations shall be submitted for approval. Variations shall furnish the same system safety, durability, ease of maintenance and environmental compatibility. The Contractor will be required to submit information as specified in Section 01335, 3.6.4 Variations, for all proposed variations with which to make a comprehensive comparison of the proposed alternate. All variations of approved designs must be approved by the Contracting Officer.

1.3 ASBESTOS CONTAINING MATERIALS

Asbestos containing material (ACM) shall not be used in the design and construction of this project. If no other material is available which will perform the required function or where the use of other material would be cost prohibitive, a waiver for the use of asbestos containing materials must be obtained from the Contracting Officer.

1.4 SAFETY

1.4.1 UNEXPLODED ORDNANCE (UXO)

1.4.2 UXO/MINE DISCOVERY DURING PROJECT CONSTRUCTION

It is highly recommended that all construction ground guide/ground observation personnel maintain a minimum 16 m buffer zone from all heavy equipment during excavation activities. A daily check of the area for signs of recently emplaced UXO/IED's is also highly recommended, to include unusual disturbed soil areas or mounds of soil from the previous day. If during construction, the contractor becomes aware of or encounters UXO/Mine or potential UXO/Mine, the contractor shall immediately stop work at the site of encounter, clearly mark the area of UXO/Mine, move to a safe location, notify the COR, and mitigate any delays to scheduled or unscheduled contract work. Once the contractor has informed the COR, the contractor will await further direction. UXO/Mine disposal will not be the responsibility of the Contractor.

1.5 LIMITATION OF WORKING SPACE

The Contractor shall, except where required for service connections or other special reason(s), confine his operations strictly within the boundaries of the site. Workmen will not be permitted to trespass on adjoining property. Any operations or use of space outside the boundaries of the site shall be by arrangement with all interested parties. It

must be emphasized that the Contractor must take all practical steps to prevent his workmen from entering adjoining property and in the event of trespass occurring the Contractor will be held entirely responsible.

Areas located immediately outside the construction area are known to contain mines and unexploded ordnance (UXO). Contractors assume all risks when venturing in or out of the designated work area.

1.6 TEMPORARY STRUCTURES

The Contractor shall erect suitable temporary fences, lighting, and necessary structures to safeguard the site, materials and plant against damage or theft and for the protection of the general public and shall adequately maintain the same throughout the course of the contract.

1.7 SUBCONTRACTORS

Compliance with the provisions of this section by subcontractors will be the responsibility of the contractor.

1.8 LIST OF CODES AND TECHNICAL CRITERIA

The following codes and technical criteria and those referenced therein shall be required for this project. References within each reference below shall be required and adhered to. If there is conflict in the criteria the most stringent requirement shall be applied. This list is not exhaustive and is not necessarily complete. The publications to be taken into consideration shall be those of the most recent editions.

AABC - Associated Air Balance Council (National Standards for total System

Balance)

ACI 301M Specifications for Structural Concrete, latest edition, American Concrete Institute

ACI 318 Building Code Requirements for Structural Concrete, latest edition, American Concrete Institute

ACI 530/ASCE 5/TMS 402, Building Code Requirements for Masonry Structures, latest edition

Air Force Manual 32-1071, Security Engineering, volumes 1-4, 1 May 1994

American Institute of Steel Construction (AISC), Specifications for Structural Steel Buildings (latest edition)

American Petroleum Institute (API) Codes

American Water Works Association, ANSI/AWWA C651-99 standard

AISC 360 Specification for Structural Steel Buildings, latest edition, American Institute of Steel Construction

AISC 341 Seismic Provisions for Structural Steel Buildings, latest edition

American Water Works Association, ANSI/AWWA C651-99 standard

AR 190-11, Physical Security of Arms, Ammunition, and Explosives, latest edition

ASCE 7-05, Minimum Design Loads for Buildings and Other Structures

ASHRAE - American Society of Heating, Refrigeration and Air-Conditioning

Engineers Handbooks latest editions: Fundamentals; HVAC Systems and Equipment; HVAC Applications; Refrigeration.

ASHRAE Standard 55-latest edition, Thermal Environmental Conditions for Human Occupancy

ASHRAE Standard 62.1-latest edition, Ventilation for Acceptable Indoor Air Quality

ASHRAE Standard 62.2-latest edition, Ventilation and Acceptable Indoor Air Quality for Low-Rise Residential

ASHRAE Standard 90.1-latest edition, Energy Standard for Buildings Except Low-Rise Residential Buildings

ASHRAE Standard 90.2-latest edition with Supplement, Energy-Efficient Design of Low-Rise Residential Buildings

ASME - American Society for Mechanical Engineering

ASTM - American Society for Testing and Materials

ASTM-D-1586 Standard Test Method for Standard Penetration Test

ASTM-D-5299 Standard Guide for Decommissioning Ground Water Wells

AWS D1.1, Structural Welding Code – Steel, American Welding Society

Design Standard per Memorandum for Record, Design Standards, DTD 16 August 2009 BT, Appendix B-1 and B-2

DoD Ammunition and Explosives Safety Standards

EIA ANSI/TIA/EIA-607: Commercial Building Grounding/Bonding Requirement Standard

Factory Mutual (FM) Approval Guide-Fire Protection (2002)

IBC – International Building Code, latest edition

BS 7671 British Standard for Electrical Installations requirements

IEEE C2, National Electrical Safety Code (NESC), latest edition

IFGC – International Fuel Gas Code, latest edition

IMC – International Mechanical Code, latest edition

IPC – International Plumbing Code, latest edition

Lighting Handbook, IESNA, latest edition

MIL-HDBK-1190, Facility Planning and Design Guide

National Association of Corrosions Engineers (NACE) Codes

Codes and Standards of the National Fire Protection Association (NFPA), as applicable and enacted in 2002 or later.

NFPA 1, General Fire Protection, latest edition

NFPA 10, Portable Fire Extinguishers, latest edition

NFPA 30, Flammable and Combustible Liquids Code, latest edition

NFPA 30A, Code for Motor Fuel Dispensing Facilities and Repair Garages, latest edition

NFPA 54, National Fuel Gas Code, latest edition

NFPA 58, Liquefied Petroleum Gas Code, latest edition

NFPA 70, National Electrical Code, latest edition

NFPA 72, National Fire Alarm Code, latest edition

NFPA 75, Standard for the Protection of Information Technology Equipment

NFPA 80, Fire Rated Doors and Windows, latest edition

NFPA 90A, Air Conditioning and Ventilating Systems, latest edition

NFPA 96, Fire Protection for Commercial Kitchens, latest edition

NFPA 101, Life Safety Code, latest edition

NFPA 110, Standard for Emergency and Standby Power Systems, latest edition

NFPA 221, Standard for Chimneys, Fireplaces, Vents, And Solid Fuel–Burning Appliances, latest edition

NFPA 1141, Site Fire Protection, latest edition

Plumbing and Drainage Institute (PDI-WH-201) water hammer arrestors

International Mine Action Standards, latest edition; (see http://www.mineactionstandards.org for copy of standards)

SMACNA-Sheet Metal and Air Conditioning Contractors' national Association, Standards and Guides

TM 5-785 Weather Data

TM 5-805-4 Noise and Vibration

UFC 1-200-01, Design: General Building Requirements

UFC 1-300-07A, Design Build Technical Requirements

UFC 1-300-09N, Design Procedures

UFC 3-220-03fa, Soils and Geology

UFC 3-230-03a, Water Supply, latest edition

UFC 3-230-04a, Water Distribution, latest edition

UFC 3-230-06a, Subsurface Drainage, latest edition

UFC 3-230-07a, Water Supply: Sources and General Considerations, latest edition

UFC 3-230-08a, Water Supply: Water Treatment, latest edition

UFC 3-230-09a, Water Supply: Water Storage, latest edition

UFC 3-230-10a, Water Supply: Water Distribution, latest edition

UFC 3-230-13a, Water Supply: Pumping Stations, latest edition

UFC 3-230-17FA, Drainage in Areas Other than Airfields, latest edition

UFC 3-240-03N, Operation and Maintenance: Wastewater Treatment System Augmenting Handbook, latest edition

UFC 3-240-09fa Domestic Wastewater Treatment, latest edition

UFC 3-240-07fa Gravity Sewers, latest edition

UFC 3-240-04A Wastewater Collection latest edition

UFC 3-310-01, Structural Load Data

UFC 3-310-02A, Structural Design Criteria for Buildings

UFC 3-301-01 Structural Design Criteria for Buildings

UFC 3-410-01FA, Heating, Ventilation and Air Conditioning

UFC 3-410-02A, HVAC Control Systems, latest edition

UFC 3-410-04N, Industrial Ventilation

UFC 3-420-01, Plumbing Systems Design

UFC 3-420-02FA, Compressed Air

UFC 3-430-01FA, Heating and Cooling Distribution Systems

UFC 3-460-01, Petroleum Fuel Facilities

UFC 3-501-03N, Electrical Engineering Preliminary Considerations, latest edition

UFC 3-520-01, Interior Electrical Systems, latest edition

UFC 3-520-05, Stationary Battery Areas, latest edition

UFC 3-530-01AN, Design: Interior and Exterior Lighting and Controls, latest edition

UFC 3-535-01, Visual Air Navigation Facilities, latest edition

UFC 3-540-04N Design: Diesel Electric Generating Plants, latest edition

UFC 3-550-03FA Design: Electrical Power Supply and Distribution Systems, latest edition

UFC 3-550-01 Exterior Electrical Power Distribution, latest edition

UFC 3-600-01, Design: Fire Protection Engineering for Facilities, 14 Jul 2009

UFC 4-010-01, Design: Minimum DoD Antiterrorism Standards for Buildings, latest edition

UFC 4-010-02, DoD Minimum Antiterrorism Standoff Distances for Buildings, latest edition

UFC 4-020-03, Security Engineering: Fences, Gates, and Guard Facilities, 14 June 2007

UFC 4-020-01FA, Security Engineering: Project Development, latest edition

UFC 4-020-02FA, Security Engineering: Concept Design, latest edition

UFC 4-020-03FA, Security Engineering: Final Design, latest edition

UFC 4-020-04FA, Electronic Security Systems: Security Engineering, latest edition

UFC 4-021-01, Design and O&M: Mass Notification Systems, latest draft version

UFC 4-022-01, Security Engineering: Entry Control Facilities/Access Control Points, latest edition

UFC 4-229-01N, Design: General Maintenance Facilities, latest edition

UFC 4-022-03, Security Engineering: Fences, Gates, and Guard Facilities, latest edition

UFC 4-722-01, Design: Dining Facilities, 27 January 2003

UL Standards (as applicable)UL 142, Steel Aboveground Tanks for Flammable and Combustible Liquids

Underwriters' Laboratories (UL) Fire Protection Equipment Directory (2002)UL 710, Exhaust Hood for Commercial Cooking Equipment, latest edition

UL 752, Bullet Resisting Equipment, 2000 or later

USCINCCENT OPORD 97-1

Overseas Environmental Baseline Guidance Document, Department of Defense, May 2007

Unified Facility Criteria (UFC) is available online at http://www.wbdg.org/ccb/browse_cat.php?o=29&c=4

In addition, technical criteria provided in USACE-AED Design Requirements (most recent version) shall be required for use in design and construction specifications as indicated in the following documents. The following design criteria shall be used:

AED Design Requirements - Site Layout Guidance, latest version

AED Design Requirements - Well Pumps & Well Design/Specifications, latest version

AED Design Requirements – Water Tank and Water Distribution Systems, latest version

AED Design Requirements - Booster Pumps, latest version

AED Design Requirements – Chlorinators, latest version

AED Design Requirements - Hydro-Pneumatic Tanks, latest version

AED Design Requirements - Jockey Pumps, latest version

AED Design Requirements - Water Tanks, latest version

AED Design Requirements – Hydrology, latest version

AED Design Requirements - Culvert and Causeway Design, latest version

AED Design Requirements - Sanitary Sewer and Septic Systems, latest version

AED Design Requirements - Grease Trap, latest version

AED Design Requirements - Oil-Water Separator, latest version

AED Design Requirements - Package Wastewater Treatment Plants and Lagoons, latest version

AED Design Requirements - Vertical Curves, latest version

AED Design Requirements – Horizontal Curves & Super elevation, latest version

AED Design Requirements – Geotechnical Investigations for USACE Projects, latest version

The AED Design Requirement documents can be downloaded at Afghanistan Engineering District's website located at http://www.aed.usace.army.mil/engineeringtop2010.asp

Standards other than those mentioned above may be accepted if the standards chosen are internationally recognized and meet the minimum requirements of the specified standards. The Contractor shall be prepared to submit proof of this if requested by the Contracting Officer.

1.9 AED DESIGN REQUIREMENTS DOCUMENTS

AED Design Requirements documents (latest version) listed above shall be adhered to in this contract. These documents are available from the AED-N website located at: http://www.aed.usace.army.mil/engineeringtop2010.asp. These documents shall be used as the basis for design and construction, and for selecting options within the United Facilities Guide Specifications (UFGS). It is the contractor's option to use specifications contained in the AED Design Requirements Documents, when provided, or to adapt the UFGS specifications to match the requirements provided in the AED Design Documents and specifications. Site or project specific data and requirements in the AED Design Requirements documents shall supersede UFGS language where there are differing criteria which must be evaluated and selected. The AED-N electrical standards and load calculations shall not be used for designing the electrical system.

2.0 SITE DEVELOPMENT

2.1 ENVIRONMENTAL PROTECTION

2.1.1 APPLICABLE REGULATIONS

The Contractor shall comply with all Host Nation laws, rules, regulations or standards concerning environmental pollution control and abatement with regard to discharge of liquid waste into natural streams or manmade channels. The contractor shall review host nation and U.S. Government environmental regulations with the contracting officer prior to design and discharge of any liquid wastes into natural streams or manmade channels.

2.1.2 NOTIFICATION

The Contracting Officer will notify the Contractor in writing of any observed non-compliance with the foregoing provisions. The Contractor shall immediately take corrective action. If the Contractor fails or refuses to promptly take corrective action, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No extension of time or damages will be awarded to the Contractor unless it was later determined that the Contractor was in compliance.

2.1.3 SPILLAGES

Measures shall be taken to prevent chemicals, fuels, oils, greases, bituminous materials, waste washings, herbicides and insecticides, and construction materials from polluting the construction site and surrounding area.

2.1.4 DISPOSAL

Disposal of any materials, wastes, effluents, trash, garbage, oil, grease, chemicals, etc., shall be taken to a dumpsite off site and subject to the approval of the Contracting Officer. Burning at the project site for the disposal of refuse and debris will not be permitted.

2.2 CIVIL SITE DEVELOPMENT

2.2.1 SITE PLAN (MASTER PLAN)

The Contractor shall prepare plat or plan of property consisting of a Boundary and Site Survey. The survey shall show the closure of the property boundary consisting of identifying all property corners, establishing horizontal and vertical control, listing all bearing and distances of property lines from all property corners, and tie-ins (showing bearing and distance) from at least two (2) major offsite man-made or natural features. This survey shall meet the requirements of World Geodetic System 1984 (WGS 1984 UTM Zone 41North in decimal degrees). The survey design shall include topographic information with existing contour lines and spot elevations of relevant topographic features, and show the locations of all buildings, structures, major trees, road pavements right of ways, names of roads, drainage features, widths of roads, easements, right of ways, setbacks, parking and paving areas, storage containers, stoops, sidewalks and walkways, walls, fences and gates, Concrete barriers, bunkers, existing above-ground and underground utilities, dry creek beds (wadis), drainage channels, and hydroplogical, geological,or other physical conditions that could impact design. If there are areas where offsite surface water runoff has the potential to affect this project, topographic information of these areas will be required to be provided.

Based on the Boundary Survey and the provided Concept Site Plan, a separate Master (Site) Plan shall be prepared showing the property boundary, and all proposed surface features including but not limited to buildings/facilities, roads, setbacks, parking and paving areas, storage containers, stoops, sidewalks and walkways, above ground utilities, bunker locations. The Contractor shall identify and show perimeter walls, fences and gates, guard towers and entry control point structures. Also shown on the Site Plan shall be pertinent existing features (on-site and off-site) that will have an influence or impact on the development of the site. The Contractor shall locate the facilities in general agreement with the Concept Site Plan and any requirements in Section 01010. All site features shall be clearly defined and dimensioned on the Site Plan. Buildings shall be located to provide access for emergency vehicles and fire fighting. Roads and parking areas shall be designed for turning radius of the largest vehicle entering the compound. The site plan shall show geometric design of the site, including applicable dimensions of all exterior facilities, mechanical equipment, pavements, utilities, etc. Required facilities are described in the following sections of this specification. All roads and areas where tractor-trailer vehicles will travel shall be designed for the worst case turning radius. Design and construction of roads and pavements shall be based on recommendations from geotechnical investigation required herein.

All Master (Site) Plans shall be drawn in the following projection and datum for incorporation into the U.S. Army Corps of Engineers GIS system:

WGS 1984 UTM Zone 41 North

2.2.2 DEMOLITION

Demolition shall include removal of all structures, foundations, pavements, and utilities, to include clearing and grubbing. All refuse and debris shall be disposed of off-site as described in paragraph DISPOSAL. Holes and depressions shall be backfilled and compacted in lifts not to exceed 2000 mm in height unless specified otherwise. Fill materials shall be composed of satisfactory soils or aggregates defined in ASTM D 2487 as GW, GM, GC, GP, SP, SW, SM, and SC. Minimum soil compaction shall be 95 percent of maximum density as defined in ASTM D 1557.

Scrap metal shall be the property of the Host Government. The scrap metal on site shall be moved to an area away from the site perimeter as directed by the Contracting Officer's Representative and left for the Host Government to remove and/or salvage. Demolished fencing and concertina wire shall be neatly rolled up for reuse by the host government. Likewise, used fence posts and outriggers shall be neatly stockpiled for reuse by the host government.

2.2.3 SITE GRADING & DRAINAGE (STORMWATER MANAGEMENT)

The Contractor shall design and construct all necessary site grading to insure adequate drainage so that no areas will be flooded due to a 24-hour rainfall of a 20-year frequency. Drainage of the area should be compatible with the existing terrain. Provide adequate drainage to minimize flooding, and promote drainage to the nearest wadi or adequate drainage ditch for the entire development. Building floor elevation shall be a minimum 150 mm above grade and slope away from the building on all sides at a minimum of five percent for a distance of 3 m.

Rainfall data utilized for hydrology calculations shall be based on data obtained from meteorological records collected in Afghanistan. National agencies may be consulted for data. In the absence of site specific data, intensity-duration-frequency curves contained in the AED Design Requirements – Hydrology, latest edition shall be used by extrapolating the rainfall intensity information from the stations in closest proximity to the project. Under no circumstances will relationships developed by extrapolation from foreign countries be used for hydrologic studies.

The installation of culverts, sized for maximum stormwater flows, shall be required at all road and walkway locations which cross drainage ditches. All culverts at the Perimeter Security Wall shall include personnel access denial system(s). Culvert shall be designed for HS-20 loading.

The sides of all new earthen storm drainage (including canals, trenches, ditches, swales, etc) shall not have a slope greater than 1:3 (vertical: horizontal). The sides of storm drainage with greater slope is allowed, but the drainage must be lined with a stone and mortar finish or concrete lined to prevent erosion.

Place aggregate groundcover (native crushed stone) in areas to reduce erosion and to provide dust control. Contractor shall compact underlying subgrade to a minimum 95 percent of the laboratory maximum dry density as determined by ASTM D 1557, Modified Proctor test.

2.2.4 ROADWAYS/DRIVEWAYS

Location, type, and width of roads, parking, maneuver, and storage areas required are stated in Section 01010. Roads, parking, maneuver, and storage areas shall be geometrically designed, graded for proper drainage, and provided with necessary drainage structures. All roads shall be of wearing surface 7.3 meters (24 feet) wide, unless required noted, graded for proper drainage, provided with necessary drainage structures and completed with prescribed surfaces in accordance with applicable sections of UFC 3-250-18FA and UFC 3-250-01FA. Contractor shall notify the Contracting Officer immediately if initial site survey determines that area hydrology requires major drainage structures or bridges. Also, the Contracting Officer shall be immediately notified if the required lengths of road or preexisting conditions are determined to be substantially or materially different than the above-described conditions/estimates.

All intersecting roads, parking, maneuver areas, storage areas, and foot paths, driveways, and culvert crossings are required to end with a smooth transition with new road profiles.

For all roads, the Contractor shall provide 1.0 m wide, aggregate base shoulder compacted to 95% maximum density that is 150 mm thick at 2.0% slope on both sides of the roadway. Provide 1.0 m wide shoulder around all parking areas, storage areas, and motor pools consisting of 150 mm thick aggregate base course material at 2.0% slope. The centerline of all roads shall be sloped a minimum of 1% and a maximum of 8%.

The roads shall be designed for HS-20 loading. All roads shall be designed geometrically with applicable sections of UFC 3-250-18FA and UFC 3-250-01FA to accommodate WB-50 vehicles with a maximum speed of 20 kilometers per hour. Pavement surfaces shall be designed for a design life of 25 years, Road Class F, Category IV.

The above pavement structures dictated above are minimum requirements. Design of roads, parking, maneuver, and storage areas shall be conducted based on geotechnical data. The geotechnical data shall be used to calculate the pavement structure using the minimum pavement structure as dictated above as a reference. Reference Section “Geotechnical” below.

Aggregate Base Course (ABC) material must be well graded, durable, uniformly moistened, and mechanically stabilized by compaction. Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure in ASTM D 1557.

2.2.4.1 ASPHALT ROADWAYS AND DRIVEWAYS

All roads and areas indicated in Section 01010 to be asphalt paved shall be surfaced with minimum 50 mm thick hot mix asphalt concrete compacted at 98% maximum density placed above a minimum 200 mm thick base course minimum compacted at 95% maximum proctor density placed above 150 mm thick of scarified sub-grade compacted to 95% maximum density, unless otherwise noted.

2.2.4.2 AGGREGATE ROADWAYS, DRIVEWAYS AND PARKING AREAS

The aggregate surface road section shall have a minimum of the following: 100 mm thick aggregate base course material compacted to 95% maximum proctor density, placed above 150mm of aggregate sub base compacted to 95% maximum dry density, placed above scarified subgrade compacted to 90% maximum proctor density. The Contractor shall adhere to the material gradations per UFC 3-250-09FA.

2.2.4.3 SIDEWALKS/FOOTPATHS

The Contractor shall design and construct 100 mm thick by 1.5 m wide **aggregate** foot paths along roads, between buildings, parking areas, and other logically anticipated areas to serve as pedestrian foot paths and fire lanes. If footpaths are to be used as fire lanes, the fire lane shall be a minimum of 3 m wide and shall be designed for HS-20 loading.

2.2.4.4 SITE GRADING AND DRAINAGE

The road shall be built up above existing grade for storm water drainage and protection where necessary. Poor subgrade material shall be removed and replaced with clean, compactable gravel.

2.2.4.4.1 STORM DRAINS

New storm drain pipes shall be designed for gravity flow during the design storm having a recurrence interval of no less than 20 years. The hydraulic grade line shall be calculated for the storm drain system and all energy losses accounted for. Design computations shall adhere to procedures contained in UFC 3-230-17A. Storm drain systems shall be designed to provide a minimum flow velocity of 0.75 meters per second when the drains are one-third or more full.

2.2.4.4.2 CONCRETE PIPE

Reinforced concrete pipe shall be a minimum Class III. Type I cement may be used only when sulfates in the soil are 0.1 percent or less and dissolved sulfates in the surface water are 150 ppm or less. Type II cement may be used only when sulfates in the soil are 0.2 percent or less and dissolved sulfates in the surface water are 1,500 ppm or less. Only Type V cement may be used if sulfates in the soil exceed 0.2 percent or dissolved sulfates in the effluent exceed 1,500 ppm. Concrete pipe shall be assumed to have a minimum design service life of 50 years unless the Contractor determines that conditions at the site will reduce the service life. Concrete culverts and storm drains shall be protected by a minimum of 1 m of cover during construction to prevent damage by heavy construction equipment.

2.2.4.5 ROAD SIGNS

The roadway shall have proper road signage. All road signage shall be in English, Pashto and Dari. Signage shall be required to notify drivers of speed limits, approaching curves, schools, towns, speed bumps, etc. Road signs are required at every intersection of the road. Regulatory signs shall be placed such that all traffic entering the main roads from side roads will be required to stop. The bottom edge of the sign shall be a minimum of 2 meters above the road surface at the shoulder. Signage type, size and placement shall be in accordance with the UNCRSS. Details of all signs with dimensions and either coloring or notes describing the colors shall be provided.

2.2.5 FORCE PROTECTION DESIGN

The Contractor shall design and construct force protection measures. The Force Protection design shall incorporate minimum setbacks for new facilities to maximum extent possible as permitted by size of the site and the requirements of the user. Force Protection design shall also meet the requirements of UFC 4-010-01, Design: Minimum DoD Antiterrorism Standards for Buildings, 8 Oct 2003 and UFC 4-010-02, DoD Minimum Antiterrorism Standoff Distances for Buildings, 8 Oct 2003.

2.2.5.1 PERIMETER SECURITY WALL

The Perimeter Security Wall shall be constructed according to the Standard Design detail in the appendix.~~.~~ Inside grade shall in all cases be higher than outside grade. The ground grade shall slope away from the wall for at least 5 meters and shall be kept a minimum of 3.0 meters below the top of wall for a minimum distance of 10 meters. The wall shall be designed to prevent visual access to the inside of compound by all pedestrian and vehicular traffic outside the compound which may require the wall to be built at a higher level in some locations. Any penetrations through the Perimeter Security Wall shall only be for site drainage purposes and shall have force protection such as a welded bar grill, welded grating, or other pre-engineered barrier.

2.2.5.2 OUTRIGGERS

Outrigger supporting arms shall be "Y" shaped with middle post, securely embedded 400mm by a 50mm diameter metal tube into the top of the wall. Posts shall conform to ASTM F 1083, Pipe, Steel, Hot Dipped Zinc Coated (Galvanized) Welded. Outriggers shall be spaced a maximum of 3000mm on center.

2.2.5.3 ECP GATES

2.2.5.4 REINFORCED BARBED TAPE

Reinforced barbed tape shall be 600 mm diameter concertina style coil consisting of 31 loops. Each loop shall consist of 19 barb clusters per loop. Adjacent coils loops shall be alternately clipped together at three points about the circumference to produce the concertina effect upon deployment. Spacing between attachments points when deployed shall be 400 mm. The reinforced barbed tape shall be fabricated from 430 series stainless steel with hardness range of Rockwell (30N) 37-45 conforming to the requirements of ASTM A 176. Each barb shall be a minimum of 30.5 mm (1.2 inch) in length, in groups of 4, spaced on 102 mm (4 in) centers. The stainless steel core wire shall have a 2.5 mm (0.098 in) diameter with a minimum tensile strength of 895 MPa. Sixteen gauge stainless steel twistable wire ties shall be used for attaching the barbed tape to the barbed wire. The reinforced barbed tape shall be equivalent to NSN: 5660-01-457-9852.

2.2.5.5 CHAIN-LINK FENCE AND GATES

Chain link fence and gate fabric shall be No. 9 gage wires woven into a 50 mm diamond mesh. Fabric shall be coated with 366 grams per square meter zinc galvanizing. Posts shall be ASTM F 1083 Pipe, Steel, Hot Dipped Zinc Coated (Galvanized) Welded or equal. Top of fence and gates shall be provided with outriggers and reinforced barbed tape as indicated above.

The gates shall be swing type. Hinged gates shall be a pair of 3 m wide x 2.4 m high leafs, constructed of a steel tube frame and steel tube intermediate posts and rails. The design of the gates shall insure that it is dimensionally stable, square, true and planar. Gate leafs shall not rack or deflect when install on its hinges. Gates shall have a sufficient number of hinges; anchor mounted to the exterior masonry walls, to support each gate leaf. Gates should include locking mechanisms that can be secured with a padlock, Provide a locking mechanism that holds the gates together when in the closed position as well as a drop bolt that engages a steel sleeve embedded in the pavement.

2.2.5.6 PRIMARY ECP

Primary ECP shall be laid out and constructed as illustrated in the Concept Site Plan. The gate shall be considered the Active Vehicular Barrier (AVB). Drop arms and guard shack shall be provided and located at a minimum distance of one and a half vehicles away from the entrance to serve as a checkpoint. Jersey Barriers or other approved alternatives shall be used to design and construct a Passive Vehicular Barrier (PVB) beyond and away from the checkpoint to significantly slow down approaching vehicles. The PVB shall be laid out to force approaching vehicles into a snake-like manoeuvre while approaching the checkpoint and to significantly slow them down.

Provide rejection lanes where applicable after vehicle inspection and before entrance to the compound to allow rejected vehicles to circle back to the entrance road without interruption of the queue.

2.2.5.6.1 CONCRETE PVB

Barriers shall be concrete blocks of one meter by one meter by one meter dimensions. Similar arrangements of large stones (one cubic meter size), jersey barriers or equal sized obstacles may be used.

2.3 CIVIL UTILITIES

2.3.1 WATER

2.3.1.1 GENERAL

The Contractor shall provide water distribution mains, branches, service connections to include all pipe, valves, bends, thrust blocking, fittings and appurtenances. Exterior water line construction shall include service to all buildings and facilities as described in the Scope of Work Section 01010.

The required average daily flow (ADF) shall be the average daily demand (ADD) per person - derived from 155 liters per capita per day (lpcd) – multiplied by a capacity factor of 1.5, multiplied by the design population.

In the event potable or non-potable use water is required prior to completion of the water facilities infrastructure the Contractor may be issued a Request for Proposal to provide non-potable (tank truck) and potable (bottled or other reliable source) consumption.

Provide a minimum of one (1) outside water hydrant (hose spigot) for all buildings with water service. Every hose spigot shall have a lockable valve on its water line located inside an adjacent building or in a valve box. All buildings with water supply shall have a water meter installed in a locked cabinet area inside the building.

The water system shall be designed to operate between 345-414 kPa. Minimum pressures of 207 kPa will be allowed at peak domestic flow conditions.

Features of the water system shall be sized to provide flow or storage capacity as follows:

- Water Well Pump Capacity - Capacity and total dynamic head (TDH) shall be based on providing one day’s capacity per day over a 16 hour period.

- Water Storage Tank - Capacity for compound populations of less than 250 people shall be capable of storing two (2) days supply of water. Capacity for compound populations of 250 or greater people shall be capable of storing three (3) days supply of water. Note: the maximum capacity of any elevated tank is indicated on the Water Tower Standard Design drawings.

- Booster Pumps – The capacity shall be based on the total fixture unit flow for the entire compound. Three (3) identical pumps shall be provided which are all sized to deliver 50 percent of the calculated capacity. Pumps shall automatically alternate to distribute wear and shall automatically turn on and off based on demand and system pressures. The total dynamic head (TDH) of the booster pumps shall be calculated to maintain a minimum, residual system pressure of 0.28 MPa (40 psi) at the calculated capacity unless stated otherwise in the contract documents. Either a bladder style expansion tank or a hydro-pneumatic tank shall be supplied when booster pumps are used in the water system.

- Hydro pneumatic tanks – Volume and pressure regulation to maintain a pressure range provided in the technical requirements based on a rate equal to the ADF (ADD x c x CF).

- Water Mains – Diameter based on the installation fixture unit flow or two times the ADF (ADD x c x CF) and velocity requirements per this guide unless a minimum diameter is specified which is adequate to provide flow and meet the specified maximum velocity. The flow through the system shall be distributed on the basis of fixture unit flow in each the buildings serviced or per contract

- Water Service Lines - Diameter based on fixture units of the building serviced.

2.3.1.2 WATER WELLS

Construct water well(s) inside the compound, to provide sufficient supply for the population of the facility. The water well capacity shall be based on the allowable safe yield of the new well determined by a well pump test as described in the USACE-AED Design Requirements - Well Pumps & Well Design/Specifications, latest version. The new well site shall be at a location approved by the Government. The new well site shall be no closer than 60 m from any existing wells. Well construction shall be in accordance with the USACE-AED Well Design Guide and Water Well Guide Specification.

After de-mining (if applicable), but prior to the construction of any structures, the Contractor shall submit a well test plan, drill and test the water well, conduct well design activities, conduct a chemical analysis of the water, and submit all required information to AES for review prior to installing any permanent well features. A plan for decommissioning dry wells, per ASTM D 5299, shall be included with the well drilling plan. It is acknowledged that water may not be available at the site despite Contractor good faith efforts to find it.

Well construction shall be in accordance with AED Design Requirements - Well Pumps & Well Design/Specifications, latest version - which includes, but is not limited to, requirements for well screen, casing, gravel pack, well pump, disinfection, water meters and testing requirements. All design requirements, material specifications, and testing contained in this document shall be used and submittals shall be made promptly in accordance with Section 01335. Failure to follow the construction and submittal procedures outlined may, at AED's discretion, result in rejection of the well and, the Contractor having to remove the well casing and screen, re-drill the well and reinstall the proper features per the approved design.

Well Depth. The well shall be drilled to a minimum depth as described in the 01010 Scope of Work in an attempt to find potable water meeting WHO water quality requirements. The depth of the permanent well shall take into consideration the drawdown depth, screen depth and pump submergence as described in the AED Design Requirements document. If water cannot be found at a sufficient yield after drilling to that linear depth, the Contractor will be considered to have fulfilled the terms of the contract and will be entitled to the full price of the contract CLIN for Well. However, the Contractor must still furnish all other parts of the water distribution system as described in the specifications.

Casing. Selection of the casing diameter, material and depth shall be per the AED Design Requirements document. In unconsolidated material, casing shall extend to the top of the well screen. In rock formations (drilled wells) the hole may be left open (i.e., well screen not required) with casing extended 3 m into the rock formation. All wells will be cased 610 mm above grade (i.e., base of pit, ground surface, etc.) and be fitted with a lockable cap with air gap (vacuum relief during pumping). Each section of casing will be joined with standard couplings and full-threaded joints, or by proper welding, so that all joints are sound and watertight. Well casing alignment shall not interfere with the proper installation and operation of the pump. The bottom of the casing shall be fitted with a metal or PVC well screen that will permit maximum transmission of water without clogging. The minimum length of screen shall be at least 3 m.

Screen. The casing will be fitted with a well screen that will permit maximum transmission of water without clogging. Screen shall only be placed in the interval of the aquifer targeted. Screen shall not be placed at intervals throughout the well depth. The material of construction, opening requirements, minimum lengths and placement shall be per the AED Design Requirements document.

Sealing - The drilling process will create a hole (borehole) larger than the casing (minimum of 50mm). The annular space between the casing and the borehole will be filled with gravel, overburden, or concrete as follows:

1) The annular space between the well screen and borehole shall be filled with material that will form a filter to minimize production of fines and not clog the slots in the screen (e.g., washed, well-graded silica sand).

2) The annular space above the filter pack up to the base of the grout seal may be backfilled with overburden or other clean earth material.

3) The upper 3 m of the well bore shall be sealed with neat cement grout. The grout shall be placed in one continuous mass and shall be impermeable.

4) Crushed stone for well sealing shall consist of crushed stone containing angular shapes and surfaces with no rounded surfaces with the following gradation:

Sieve Size	% Total Wt. Passing
12.5 mm	100
4.75 mm	75 ± 13
1.18 mm	25 ± 15
75 µm	8 ± 4

5) All aggregate shall contain less than 5 percent of shale, clay lumps, coal, lignite, soft or unfragmented stone, or other deleterious materials.

Well screen, casing, gravel pack, well pump, disinfection, and testing requirements for well construction shall meet the specifications and design requirements in AED *Design Requirements - Well Pumps & Well Design/Specifications*, June 2009, or most recent version.

Source protection - Surface drainage within 30 m of wellhead shall ensure no ponding, flooding or collection of runoff adjacent to the well. This can be accomplished through surface grading or use of gravel drains to modify site drainage in the vicinity of the well. Identify all sources of contamination and ensure the proposed well site meets minimum standoff distances as indicated below:

a. Sewage storage areas (outhouses, tanks, individual sewage pits, lagoons, and WWTP) – 30 m
b. Septic fields (infiltration galleries) – 30 m
c. Fuel storage, engine maintenance/repair – 30 m

Well Pump – A submersible, centrifugal pump shall be installed inside the casing set no less than 2.0 m from the base of the excavation. Control of the pump shall be by means of a Hand-Off-Auto (HOA) switch. In the "Auto" position, the pump shall be started and stopped automatically by water levels in the water storage tank. Pump shall start at low level and shall stop at high level. Level controls shall be adjustable. Manual start shall be the Hand position.

Expansion Tank – Provide bladder style expansion tank for well pump to minimize pressure surges and water hammer effects.

2.3.1.3 WELL PUMP TESTING

Well pump testing and water clarity testing after well development shall be per the requirements in AED Design Requirements - Well Pumps & Well Design/Specifications, latest version or most recent version.

2.3.1.4 WATER QUALITY SAMPLING AND ANALYSIS

The Contractor shall perform water quality sampling and testing at the source. The Contractor shall utilize well-qualified and equipped testing capability in the project site area, if available. If professional testing services are not available in the area, the Contractor will submit an alternative practical testing source for approval.

See USACE-AED Well Pumps & Well Design Guide with Attachment A – Guide Specifications for Drinking Water Wells, latest version and Appendix A of TM 5-813-3 (UFC 3 230 08a Water Supply Water Treatment, January 2004) for requirements for laboratory testing.

2.3.1.5 RAW WATER DISINFECTION

Contractor shall perform disinfection of the well water in accordance with AED Design Requirements - Well Pumps & Well Design/Specifications, latest version. Bacteriological samples shall be collected and examined in accordance with Standard Methods for the Examination of Water and Wastewater by a qualified lab as approved by the Contracting Officer.

2.3.1.6 SERVICE BOOSTER PUMPS

Contractor shall provide a booster pump station with capacities defined above with end suction or split case double suction horizontal split case (frame mounted) centrifugal pumps arranged in parallel for pumping water storage into the main distribution system. The pumps and controls shall be designed to supply and maintain acceptable system pressure throughout the distribution network given the full range of flow conditions (low flow to peak). Provide suitable expansion tank for booster pump system sized for anticipated pressure surges, if hydro pneumatic tanks are not to be used. The suction side of the service booster pumps shall have an eccentric reducer and gate valve installed. The discharge side shall have a gate valve, check valve between the pump and the gate valve and concentric reducer, pressure gage and air relief valve.

2.3.1.7 HYDRO-PNEUMATIC SURGE TANK

The Contractor shall provide horizontally mounted and insulated above ground surge hydro-pneumatic tank(s) containing water and compressed air located adjacent to the water pumps to maintain pressure during surges. A compressor is required to charge the tank with air, or a pre-charged bladder type tank may be used. At low level the water remaining in the tank(s) shall be at least ten percent of the capacity of the tank. The tank(s) size shall be determined such that the pump cycles not less than 4 times per hour or more than 10 times per hour.
Tank shall be sized for peak demand. Use the capacity factor required by AED Design Guide to approximate the peak demand. An additional safety factor (multiplying factor) of 1.2 shall be used.
Tank volume= D/[1-(Pf+Patm)/(Po+Patm)], where D=t*(Q*60)/4, where D = Drawdown (liters, T = cycle time (min.) and Q = tank flow rate (liters/sec.)

2.3.1.8 WATER STORAGE TANK

Water storage tank capacity shall be based on what is dictated in Section 01010. Contractor shall provide a steel ground storage reservoir (GST) to be located on the ground surface as dictated in Section 01010. Water shall continuously circulate through the tanks piping and shall be heated to prevent freezing of the tank and pipes entering the tank. A system of heat wrapped tape and exterior tank insulation is not considered a feasible permanent insulation system as it does not conform to a twenty (20) year life expectancy. The storage facilities shall be located above drainage areas and locations subject to flooding as approved by the Contracting Officer. The storage facilities shall be located on the higher elevations of the site to promote gravity flow and reduce pumping requirements. Overflow and air vents shall be screened so that birds, rodents and debris cannot enter the reservoir. The tank shall meet all applicable codes for potable water storage. The interior coatings for the tank shall meet NSF/ANSI 61 requirements.

Exterior area lights shall be installed, either mounted to the side of the building or on poles.

Contractor shall provide commercially fabricated, steel, elevated water storage tank(s). The elevated water storage tank(s) and supporting structures shall be constructed in strict conformance with the furnished drawings and specifications. The tank shall meet all applicable codes for potable water storage. The interior coatings for the tank shall meet NSF/ANSI 61 requirements. Contractor shall ensure that all elements of the Water Tank have been designed, fabricated, and erected in accordance with AWWA D100-05 Welded Carbon Steel Tanks for Water Storage and AWWA D102-06 Coating Steel Water Storage Tank.

The following geotechnical investigation will be conducted at the proposed location of the water tanks:

Current geotechnical requirements as outlined in the AED Design Guide for Geotechnical Investigations provide geotechnical information for shallow foundation structures constructed on AED projects. The geotechnical characteristics of the soils at the location of the water towers must be adequate to support the deep loadings

generated by the tower and water tank. The following are required prior to approval for construction of water towers using the design provided by AED. Information listed below should be submitted to AED as soon as practicable to allow construction of the tower in a timely manner.

1. Site Characteristics Information
   - A. Site plan showing location of each tower.
   - B. Elevation of original and finished grade at the center of each tower foundation.
   - C. Finished floor elevations of every building on the site receiving water.
   - D. Top of concrete of pedestal containing anchor bolts used to secure each tower.

2. Bore Hole Information
   - A. Boring log for each water tower foundation. Diameter shall be 150 mm or 200 mm diameter. Depth shall be 16.5 m from finished grade. Location shall be center of water tower foundation.
   - B. Samples shall be collected every 0.75 m.
   - C. Sample results for EVERY sample taken during boring operation.
     - (1) Penetration Test and Split-Barrel Sampling of Soils using ASTM D 1586.
     - (2) Lab Determination of Water (Moisture) Content of Soils using ASTM D 2216.
     - (3) Liquid Limit, Plastic Limit, and Plasticity Index of Soils using ASTM D 4318.
     - (4) Classification of Soils for Engineering Purposes (Unified Soil Classification System) using ASTM D 2487.

The water system shall be designed and constructed in accordance with the AED Design Requirements, latest version, and UFC 3-230-03A Water Supply which include the use of a capacity factor. Water demand required for fire fighting and for irrigation and landscaping needs shall not be included in design demand calculations.

2.3.1.9 DISINFECTION & CHLORINATION SYSTEM

Use hypochlorite compounds for disinfection. A manufacturer assembled, self-contained, skid-mounted, hypo-chlorinator consisting of mixer, mixing tank, pump pipe injector, and control panel shall be used to feed a sodium hypochlorite solution of 1- 5 percent available chlorine into the system. Hypochlorite compound may be a liquid or solid form. The pump shall feed a hypochlorite solution in proportion to the water demand. The hypo-chlorinator shall have a pumping rate, liters per day (lpd) (gallons per day (gpd)) adequate to deliver 5 percent available hypochlorite solution adjustable to the quantity of water being produced from the source. The chlorine-feeding system shall consist of controls and devices necessary for a complete operating system. Dosage rate will vary somewhat depending on actual pump production rate and available residual chlorine in the system. Contractor shall determine the required dosage rate milligrams per liter (mg/l) to maintain the required chlorine residual (usually 0.2-0.4 mg/l) in the distribution system. Chlorine solution tank shall be large enough to hold a three days supply of hypochlorite solution. A fresh solution shall be prepared every two or three days because the solution may lose its strength over time and this will affect the actual chlorine feed rate. The hypochlorite shall be stored in a cool dry place. Sodium hypochlorite can lose from two to four percent of its available chlorine content per month at room temperature. Contractor shall verify required minimum residual chlorine in accordance with local requirements verified and approved by the Contracting Officer. The chlorination system shall have the capability for manually adjusting the dosage rate and be installed in such a manner that the system can be easily disconnected and bypassed in the event of health safety or routine maintenance and repair. Disinfection of water mains shall be in accordance with AWWA standard C651-86 and disinfection of storage facilities in accordance with AWWA standard C652-86. The package disinfection system shall be located in the well pump house.

2.3.2 WATER DISTRIBUTION SYSTEM

2.3.2.1 GENERAL

The Contractor shall provide a water distribution system. The distribution network shall be laid out in a combination grid and looped pattern with dead ends not exceeding 30 m. Use similar piping materials for all buildings and pipe runs in the distribution system for efficiency of future maintenance activities. Dead end sections shall not be less than 150 mm diameter and shall either have blow off valves or fire hydrants (flushing valves) installed for periodic flushing of the line. Any pipe with a fire hydrant on the line shall be at least 150 mm in diameter. Water supply distribution shall connect to a building service at a point approximately 1.5 m outside the

building or structure to which the service is required. All piping and joints shall be capable of at least 1.03 MPa leakage testing and 1.38 MPa hydrostatic test pressure, unless otherwise specified. Pipe diameters shall be adequate to carry the maximum flow of water at velocities less than 1.5 m/sec. Piping segments where velocities less than 0.15 m/sec are anticipated shall be noted and brought to the attention of AES. The operating pressure range shall be between 276 kPa to 414 kPa at all points of the distribution system. If pressures greater than 690 kPa (100 psi) cannot be avoided, pressure-reducing valves shall be used.

A system pressure of 207 kPa (30 psi) is acceptable at extreme peak flow conditions. A system pressure below 207 kPa shall be considered a deviation in the technical requirements requiring Contracting Officer approval.

Adequate cover must be provided for frost protection. A minimum cover of 800 mm is required to protect the water distribution system against freezing. Water lines less than 1.25 m deep under roadway/driveway crossings (to include parking areas) shall be encased in concrete of at least 150 mm thickness around the pipe extending out to one m from each road edge.

2.3.2.2 PIPE

The Contractor shall provide Ductile Iron or PVC pipe of adequate strength, durability and be corrosion resistant with no adverse effect on water quality.

2.3.2.2.1 WATER MAINS AND BRANCHES

Pipe material for water mains and branches shall be PVC or Ductile Iron (DI). The exterior surface of the pipe must be corrosion resistant. Distribution lines shall be 100 mm (4 in) and larger and shall be reduced only at the junction of building connections. Pipe diameters shall be selected to meet the previously specified flow, velocity, and pressure conditions. If Ductile Iron (DI) pipe is installed underground the pipe shall be encased with polyethylene in accordance with AWWA C105. Ductile iron pipe shall conform to AWWA C104. DI fittings shall be suitable for 1.03 MPa (150 psi) pressure unless otherwise specified. Fittings for mechanical joint pipe shall conform to AWWA C110. Fittings for use with push-on joint pipe shall conform to AWWA C110 and C111. DI fittings shall be cement mortar lined (standard thickness) in accordance with C104. All pipes and joints shall be capable of at least 1.03 MPa (150 psi) and 1.38 MPa (200 psi) hydrostatic test pressure unless otherwise specified herein. Polyvinyl Chloride (PVC) pipe shall conform to ASTM D 1785. Plastic pipe coupling and fittings shall be manufactured of material conforming to ASTM D 1784, Class 12454B. PVC screw joint shall be in accordance with ASTM D 1785, Schedules 40, 80 and 120. PVCu pipe couplings and fittings shall be manufactured of material conforming to ASTM D 1784, Class 12454B. Pipe less than 80mm (3 inch), screw joint, shall conform to dimensional requirements of ASTM D schedule 80. Elastomeric gasket-joint, shall conform to dimensional requirements of ASTM D 1785 Schedule 40, PVCu (or uPVC) pipe and fittings shall have SDR that provide equal or superior strength properties to ASTM 1785 SCH 40 or SCH 80 pipe and fittings.

2.3.2.2.2 WATER SERVICE

Water service line diameter shall be based on fixture units of the building serviced or per contract Building service lines will be sized according to the following guidance. Water service connections from the mains to the buildings shall vary from 19 mm, 25 mm, 38 mm, 75 mm, to 100 mm as calculated, depending on the maximum flow velocity and minimum pressure requirements as determined by hydraulic analysis of fixture flows. Pipe service connections from the distribution main to the building shall be either Polyvinyl Chloride (PVC) plastic Schedule 80 ASTM D 1785 or copper tubing conforming to ASTM B 88M, Type K, annealed. PVC pipe couplings and fittings shall be manufactured of material conforming to ASTM D 1784, Class 12454B. Contractor shall not use HDPE for any of the water pipes.

2.3.2.2.3 HYDROSTATIC, LEAKAGE, AND DISINFECTION TESTS

The Contracting Officer will be notified not less than 48 hours in advance of any water piping test and will be given full access for monitoring testing procedures and results. Where any section of water line is provided with concrete thrust blocking for fittings or hydrants, tests shall not be made until at least 5 days after installation of concrete

thrust blocking, unless otherwise approved. Pressure and leakage testing shall be as specified in AED Design Requirements – Water Tank and Water Distribution Systems, latest version.

2.3.2.2.4 HYDRO STATIC (PRESSURE) TEST

After the pipe is laid, the joints completed, and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for 1 hour to a hydrostatic pressure test of 1.38 MPa (200 psi). Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, hydrants and valves shall be carefully examined during the partially opened trench test. Joints showing visible leakage shall be replaced or remade as necessary. Cracked or defective pipe, joints, fittings, hydrants and valves discovered following this pressure test shall be removed and replaced and retested until the test results are satisfactory.

2.3.2.2.5 LEAKAGE TEST

Leakage tests shall be conducted after all pressure tests have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and, during the test, water lines shall be subjected to not less than 1.38 MPa (200 psi). Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section, necessary to maintain pressure to within 34.5 kPa of the specified leakage test pressure after the pipe has been filled with water and all air expelled. Pipe installation will not be accepted if leakage exceeds the allowable leakage, as determined by the following formula:

METRIC UNITS:

$L = 0.00042454*N*D*P^{1/2}$ where:

L = Allowable leakage in liters per hour
N = Number of joints in the length of pipeline tested
D = Nominal diameter of the pipe in mm
P = Average test pressure during the leakage test, in MPa gauge

US UNITS:

$L = 0.0001351*N*D*P^{1/2}$ where:

L = Allowable leakage in gallons per hour
N = Number of joints in the length of pipeline tested
D = Nominal diameter of the pipe in inches
P = Average test pressure during the leakage test, in psi gauge

Should any test of pipe disclose leakage greater than that calculated by the above formula, the defective joints shall be located and repaired until the leakage is within the specified allowance, without additional cost to the government.

2.3.2.2.6 PIPELINE DISINFECTION TESTS

2.3.2.2.6.1 DISINFECTION PROCEDURE

Before acceptance of potable water operation, each unit of completed waterline shall be disinfected as prescribed by AWWA C651. After pressure tests have been completed, the unit to be disinfected shall be thoroughly flushed with water until all entrained dirt and mud have been removed before introducing the chlorinating material. Flushing will be performed in a manner and sequence that will prevent recontamination of pipe that has previously been disinfected. The chlorinating material shall be liquid chlorine, calcium hypochlorite, or sodium hypochlorite. The chlorinating material shall provide a dosage of not less than 50 ppm and shall be introduced into the water lines in an approved manner. Polyvinyl Chloride (PVC) pipelines shall be chlorinated using only the above-specified chlorinating material in solution. The agent shall not be introduced into the line in a dry solid state. The treated water shall be retained in the pipe long enough to destroy all non-spore forming bacteria. Except where a shorter period is approved, the retention time shall be at least 24 hours and shall produce not less than 25 ppm of free chlorine residual throughout the line at the end of the retention period. Valves on the lines being disinfected shall be

opened and closed several times during the contact period. The line shall then be flushed with clean water until the residual chlorine is reduced to less than one ppm. During the flushing period, each fire hydrant on the line shall be opened and closed several times.

2.3.2.2.6.2 SAMPLING

For each building connected to the water system, personnel from the Contractor's commercial laboratory shall take at least 3 water samples from different points, approved by the Contracting Officer, in proper sterilized containers and perform a bacterial examination in accordance with approved methods. The commercial laboratory shall be verified to be qualified by the appropriate authority for examination of potable water. Contractor shall submit a water sampling protocol for approval. This shall include at a minimum the name of the laboratory, parameters to be tested, the Company conducting the sampling, and the sample locations.

2.3.2.2.6.3 ACCEPTANCE REQUIREMENTS

The disinfection shall be repeated until tests indicate the absence of bacteria for at least 2 full days. The unit will not be accepted until satisfactory bacteriological results have been obtained. All retests shall be conducted at the Contractor’s expense.

2.3.2.2.6.4 TIME FOR MAKING (HYDROSTATIC/PRESSURE) TESTS

Except for joint material setting or where concrete thrust blocks necessitate a five (5) day delay, pipeline jointed with rubber gaskets, mechanical or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill.

2.3.2.2.6.5 CONCURRENT (HYDROSTATIC AND LEAKAGE) TESTS

The Contractor may elect to conduct the hydrostatic tests using either or both of the following procedures. Regardless of the sequence of tests employed, the results of pressure tests, leakage tests, and disinfection shall be recorded for submission and approval. Replacement, repair or retesting required shall be accomplished by the Contractor at no additional cost to the Government. Pressure and leakage testing may be conducted concurrently. Hydrostatic tests and disinfection may be conducted concurrently using water treated for disinfection to accomplish the hydrostatic tests. If water is lost when treated for disinfection and air is admitted to the unit being tested, or if any repair procedure results in contamination of the unit, disinfection shall be re-accomplished.

2.3.3 VALVES

2.3.3.1.1 GATE AND BUTTERFLY VALVES

Valves (Gate valves w/box) shall be placed at all pipe network tees and cross intersections, and the number of valves shall be one less than the number of lines leading into and away from the intersection. For isolation purposes valves shall be spaced not to exceed 40 m. Gate valves shall be in accordance with AWWA C 500 and/or C509. Butterfly valves (rubber seated) shall be in accordance with AWWA C504 et. al. The valves and valve boxes shall be constructed to allow a normal valve key to be readily used to open or close the valve. Provide traffic-rated valve boxes. Provide concrete pad, one m square, for all valve boxes. Valves shall be pressure rated to 1.38 MPa (200 psi).

2.3.3.1.2 VACUUM AND AIR RELEASE VALVES

Air release valves are required to evacuate air from the main high points in the line when it is filled with water, and to allow the discharge of air accumulated under pressure. Vacuum relief valves are needed to permit air to enter a line when it is being emptied of water or subjected to vacuum. Contractor shall submit manufacturer’s data for properly sized combination air and vacuum release valves and determine their locations on the distribution system subject to review and approval of the Contracting Officer.

2.3.3.1.3 BLOW-OFF VALVES

The Contractor shall provide 40-50 mm blow-off valves at ends of dead end mains. Valves should be installed at low points in the mains where the flushing water can be readily discharged to natural or manmade drainage ditches, swales or other.

2.3.3.1.4 THRUST BLOCKING

Contractor shall provide concrete thrust blocking at any point where the layout of the system changes the direction of the flow, increases the velocity, or decreases or stops the flow. At these points, the pipes and fittings must be anchored and kept from moving or pulling apart by the use of thrust blocks installed against undisturbed earth.

2.3.4 SANITARY SEWER (WASTEWATER SYSTEM)

2.3.4.1 GENERAL

The Contractor shall obtain topographic information or other maps that show vegetation, drainage channels and other land surface features such as underground utilities and related structures that may influence the design and layout of the collection system. Sanitary sewers less than 1.25 meters under roadways/driveways (to include parking areas) shall have reinforced concrete cover at least 150 mm thick around the pipe. Concrete cover will extend out to at least 1 m from each road edge.

Exterior sanitary sewer line construction shall include service to all buildings as described in the Scope of Work Section 01010. Contractor shall design sanitary sewer collection system using approved field survey data and finished floor elevations. Depending upon the topography and building location, the most practical location of sanitary sewer lines is along one side of the street. In other cases they may be located behind buildings midway between streets. Main collection sewers will follow the most feasible route to the point of discharge. The sewer collection system shall be designed to accommodate the initial occupancy and a reasonable expansion capability. Sewer collection capacity shall be based on the two times the average daily wastewater flow unless minimum diameter specified is adequate to provide flow and required maximum velocity; wastewater flow through the system shall be distributed on the basis of fixture unit flow in each the buildings serviced by multiplying the proportion of the total fixture flow from each building or facility times the total wastewater flow for the project or installation as determined above.

All sewers shall be located outside of the roadways as much as practical, and minimize the number of roadway crossings. To the extent practical, a sewer from one building shall not be constructed under another building, or remain in service where a building is subsequently constructed over it. Construction required shall include appurtenant structures and building sewers to points of connection with building drains 1.5m (5 feet) outside the building to which the sewer collection system is to be connected.

The Contractor shall use the following criteria where possible to provide a layout which is practical, economical and meets hydraulic requirements:

Follow slopes of natural topography for gravity sewers.

Check subsurface investigations for groundwater levels and types of subsoil encountered. If possible, avoid areas of high groundwater and the placement of sewers below the groundwater table.

Avoid routing sewers through areas which require extensive restoration or underground demolition

Depending upon the topography and building locates, the most practical location of sanitary sewer lines is along one side of the roadway/driveway. In other cases they may be located behind buildings midway between roadways. The intent is to provide future access to the lines for maintenance without impacting vehicular traffic.

Avoid placing manholes in low-lying areas where they could be submerged by surface water or subject to surface water inflow. In addition, all manholes shall be constructed 50 mm higher than the finished grade, with the ground sloped away from each manhole for drainage.

Sewer lines shall have a minimum of 800 mm of cover for frost protection.

Locate manholes at change in direction, pipe size, or slope of gravity sewers.

Sewer sections between manholes shall be straight. The use of a curved alignment shall not be permitted.

If required by the design, locate manholes at intersections of roadways/driveways where possible. This minimizes vehicular traffic disruptions if maintenance is required.

Sewer lines less than 1.25 m deep under road crossings shall have a reinforced concrete cover of at least 150 mm thickness around the pipe or shall utilize a steel or ductile iron carrier pipe. It is recommended to continue the reinforced concrete cover or carrier pipe a minimum of one m beyond the designated roadway.

Verify that final routing selected is the most cost effective alternative that meets service requirements.

2.3.4.2 PROTECTION OF WATER SUPPLIES

The Contractor shall ensure that the sewer design meets the following criteria:

Sanitary sewers shall be located no closer than 30 m horizontally to water wells or reservoirs to be used for potable water supply.

Sanitary sewers shall be no closer than 3 m horizontally to potable water lines; where the bottom of the water pipe will be at least 300 mm above the top of the sanitary sewer, horizontal spacing shall be a minimum of 1.8 m.

Sanitary sewers crossing above potable water lines shall be constructed of suitable pressure pipe or fully encased in concrete for a distance of 2.7 m (9 ft) on each side of the crossing. Pressure pipe will be as required for force mains in accordance with local standards and shall have no joint closer than 1 m (3 ft) horizontally to the crossing, unless the joint is fully encased in concrete.

When sanitary sewers cross water lines the designer shall cross the water line above the sewer line whenever possible. In such cases the water line shall be located a minimum distance of 450 mm above the sewer line or shall be fully encased in concrete for a distance of 3 m on each side of the crossing.

2.3.4.3 QUANTITY OF WASTEWATER

System capacity shall be calculated as 80% of the calculated daily water use.

2.3.4.4 GRAVITY SEWER

Sanitary sewers shall be designed in accordance with the AED Design Requirements for Sanitary Sewer and Septic Systems, latest version to flow at a maximum in the following way:

a. Sanitary sewer laterals, mains and trunk lines flow velocities shall be designed to provide a minimum velocity of 0.6 m per second (mps)
b. A minimum velocity of 0.8 to 1.05 mps at the peak diurnal flow rate
c. Flows shall be based on allocating the proportion of the average daily or peak daily flow to each building or facility on the basis of fixture unit flow developed for the plumbing design.
d. Minimum pipe slopes shall be provided regardless of the calculated flow velocities to prevent settlement of solids suspended in the wastewater. Minimum pipe slopes are provided in the AED Design Requirements for Sanitary Sewer and Septic Systems. (A partial listing of requirements is listed in the cart below.)

Minimum Slopes for Sewers	
Sewer Pipe Size (mm)	Minimum Slope in meters per 100 meters
100	1.00
150	0.62
200	0.40

250	0.28
300	0.22
350	0.17
400	0.15

Unless otherwise indicated (see Building Connections and Service Lines), gravity sewer pipe shall be installed in straight and true runs in between manholes with constant slope and direction. Adequate cover must be provided for frost protection. A minimum cover of 800 mm will be required to protect the sewer against freezing.

2.3.4.4.1 MANHOLES

The Contractor shall provide standard depth manholes (MH), (depth may vary) with an inside dimension of 1.2 m. Manholes shall be made of either a cast-in-place reinforced concrete with reinforced concrete cover, or of pre-cast reinforced concrete manhole that tapers to a 750 mm (30 in) cast iron frame that provides a minimum clear opening of 600 mm (24 in). In every case, the manholes, frames and covers shall be traffic rated, H-20 load rating. All manholes shall be provided with a concrete bench with a flow line trough, smoothly formed to guide waste flow to the outlet pipe from the inlet pipe(s). The top surface of the bench shall be above the crown of all pipes within the manhole. All surfaces of the bench shall be sloped smoothly toward the trough to guide flow, even under peak flow conditions. Sanitary sewer lines shall enter at the manhole flow line. Where the invert of the inlet pipe would be more than 0.5 m above the manhole floor, a drop inlet shall be provided. No internal drop structures shall be permitted at lift stations. Inlet to lift station wet wells shall enter below the lowest water level of the pump operating range, and if necessary a drop inlet approach pipe external to the lift station may be used to avoid cascading influent flow. The angle between inflow and outflow pipes converging at a manhole shall not be less than 90^{0}.

2.3.4.4.2 MANHOLE DESIGN REQUIREMENTS

Manholes are required at junctions of gravity sewers and at each change in pipe direction, size or slope, except as noted hereinafter for building connections. Manholes shall be installed at start of all main runs.

2.3.4.4.3 SPACING

The distance between manholes must not exceed 120 m in sewers of less than 460 mm in diameter. For sewers 460 mm and larger, and for outfalls from wastewater treatment facilities, a spacing of up to 180 m is allowed, provided the velocity is sufficient to prevent sedimentation of solids.

2.3.4.4.4 PIPE CONNECTIONS

The crown of the outlet pipe from a manhole shall be on line with or below the crown of the inlet pipe.

2.3.4.4.5 FRAMES AND COVERS

Frames and covers shall be cast iron, ductile iron or reinforced concrete, traffic rated in any case to an H-20 load rating. Cast iron frames and covers shall be traffic rated, circular with vent holes.

2.3.4.4.6 STEPS FOR MANHOLES

Steps shall be cast iron, polyethylene coated, at least 15 mm thick, not less than 400 mm in width, and spaced 300 mm on center.

2.3.4.5 PIPE

Pipe shall conform to the respective specifications and other requirements as follows: Provide Polyvinyl Vinyl Chloride (PVC) conforming to ASTM D 3034, Type PSM with a maximum SDR of 35, size 380 mm or less in diameter. PVC shall be certified as meeting the requirements of ASTM D 1784, cell Class 12454 B. Minimum pipe sizes for the main lines shall be 200 mm (8 in) diameter and service lines/laterals shall be a minimum of 150 mm diameter. Smaller diameters shall not be used. Contractor may use PVC or HDPE pipe provided the SDR and strength properties of the pipe equal or exceed the properties of ASTM D 1784 for PVC.

2.3.4.5.1 FITTINGS

Fittings shall be compatible with pipe supplied and shall have a strength not less than that of the pipe. Fittings shall conform to the respective specifications and requirements as follows: provide PVC fittings conforming to ASTM D 3034 for type PSM pipe.

2.3.4.5.2 JOINTS

Joints installation requirements shall comply with the manufacturers installation instructions. Flexible plastic pipe (PVC or high density polyethylene pipe) gasket joints shall conform to ASTM D3212.

2.3.4.5.3 BRANCH CONNECTIONS

Branch connections shall be made using regular fittings or solvent-cemented saddles as approved. Saddles for PVC pipe shall conform to Table 4 of ASTM D 3034. The minimum depth of the cover over the pipe crown shall be 0.8 m.

2.3.4.5.4 BUILDING CONNECTIONS AND SERVICE LINES

Building connections and service lines will be planned to eliminate as many bends as practical and provide convenience in rodding. Bends greater than 45 degrees made with one fitting should be avoided; combinations of elbows such as 45-45 or 30-60 degrees should be used with a cleanout provided. Connections to other sewers will be made directly to the pipe with standard fittings rather than through manholes. However, a manhole must be used if the connection is more than 30 m from the building cleanout. Tee connections to the main or branch are not allowed. Service connection lines will be a minimum of 150 mm diameter and laid at a minimum one percent grade. Service laterals shall be at least 200 mm and sloped to maintain the minimum velocity as described in paragraph "Gravity Sewer."

2.3.4.5.5 CLEANOUTS

Cleanouts must be installed on all bends of sewer-building connections to provide a means for inserting cleaning rods into the underground pipe. Install manufactured wye fittings. In lieu of a wye fitting, an inspection chamber may be installed. The inspection chamber shall be of the same construction as a manhole. The cleanout will be of the same diameter as the building sewer, and never be smaller than 150 mm. If there are no bends in the sewer building connection, a cleanouts shall be installed within 1 m from the building.

2.3.4.6 GREASE INTERCEPTORS

Grease interceptors are used to remove grease from wastewater to prevent it from entering the sanitary sewer and septic systems. All Dining Facilities (DFACs) shall incorporate preliminary treatment with use of a grease interceptor prior to the sanitary sewer system. The only waste lines upstream of the grease interceptor shall be grease laden waste from the kitchen or other areas. Grease interceptor design shall be based on AED Design Requirements - Grease Trap, latest version. The grease interceptor shall be of reinforced cast-in-place concrete, reinforced precast concrete or equivalent capacity commercially available steel, with removable three-section, 9.5 mm checker-plate cover, and shall be installed outside the building. Steel grease interceptors shall in be installed in a concrete pit and shall be epoxy-coated to resist corrosion as recommended by the manufacturer. Concrete shall

have 28MPa minimum compressive strength at 28 days. The grease interceptor shall connect to the sanitary sewer system.

Contractor shall provide bollards around the tank and construct a minimum 4 m wide access road from the closest roadway to the grease interceptor for a pump truck. The access road shall be of the same material as the main roads in the compound. Under no circumstance shall the grease interceptor be installed inside the building. Provide outside water spigot for cleaning.

2.3.4.7 FIELD QUALITY CONTROL

2.3.4.7.1 FIELD TESTS AND INSPECTIONS

The Contracting Officer will conduct field inspections and witness field tests specified in this section. The Contractor shall perform field tests and provide labor, equipment and incidentals required for testing.

Check each straight run of pipeline for gross deficiencies by holding a light in a manhole; it shall show a practically a full circle of light through the pipeline when viewed from the adjoining end of the line. When pressure piping is used in a non-pressure line for non-pressure use, test this piping as specified for non-pressure pipe.

Test lines for leakage by either infiltration tests or exfiltration tests. Prior to testing for leakage, backfill trench up to at least lower half of the pipe. When necessary to prevent pipeline movement during testing, place additional backfill around pipe to prevent movement during testing, but leaving joints uncovered to permit inspection. When leakage or pressure drop exceeds the allowable amount specified, make satisfactory correction and retest pipeline section in the same manner. Correct visible leaks regardless of leakage test results.

Infiltration tests and ex-filtration tests: Perform these tests for sewer lines made of specified material, not only concrete, in accordance with ASTM C 969M, ASTM C 969. Make calculations in accordance with the Appendix to ASTM C 969M and ASTM 969.

Perform tests as follows:

Concrete pipe: Test in accordance with ASTM C 924M, ASTM C 924. Allowable pressure drop shall be given in ASTM C 924M ASTM C 924. Make calculations in accordance with the Appendix to ASTM C 924M, ASTM C 924;

Ductile-iron pipe: Test in accordance with the applicable requirements of ASTM C 924M, ASTM C 924. Allowable pressure drop shall be as given in ASTM C 924M, ASTM C 924. Make calculations in accordance with the Appendix to ASTM C 924M, ASTM C 924;

PVC Plastic pipe: Test in accordance with applicable requirements of UBPPA UNI-B-6. Allowable pressure drop shall be as given in UBPPA UNI-B-6. Make calculations in accordance with the Appendix to UBPPA UNI-B-6.

2.3.4.7.2 DEFLECTION TESTING

Deflection testing will not be required however; field quality control shall ensure that all piping is installed in accordance with deflection requirements established by the manufacturer.

2.3.5 WASTEWATER TREATMENT LAGOON SYSTEMS

Partial mix aerated wastewater treatment lagoon systems shall be designed in accordance with AED Design Requirements - Package Wastewater Treatment Plants and Lagoons, latest version.

Wastewater Lagoon Site Survey. The Contractor shall conduct a topographic survey to determine existing site characteristics. The Contractor shall conduct a utility survey to determine the locations of any nearby security fences and buildings, water lines, wells, sanitary sewers, storm sewers and communication/electrical lines. The Contractor shall provide survey for all outfall piping locations and the outfall area in the existing wadi to include topographic survey of a minimum of 20 m on both sides of the proposed outfall location.

Waste water Treatment Lagoon Layout. The Contractor shall design a layout for the system to include all lagoon geometry, waste water inlet and off loading station configurations, number of process compartments, yard piping, bypass valves, surface aerators and disinfection equipment and piping, effluent contact chambers and discharge facilities including the outfall system, and sludge drying, sludge drying water recirculation piping, grey water irrigation pond and pumps and related site preparation and earthwork.

2.3.5.1 WASTE WATER TREATMENT LAGOON SYSTEM CAPABILITIES

The partial mix aerated wastewater treatment lagoon system shall be designed to accommodate the wastewater hydraulic load as specified in Section 01010. The wastewater treatment lagoon system shall be designed and constructed such that it operates with the ability to process inflow rates to the waste water lagoon system from the off loading station based on the calculated peak hourly flow. Feed rate to the plant components shall be determined by the Contractor from the analysis of the installation peak flow and average daily flow evaluation. All treatment train components shall be designed and constructed in pairs and with bypass capability in order to continue wastewater treatment while performing maintenance on a particular component in the treatment train.

2.3.5.2 REQUIREMENTS OF DESIGN

Design to pass 100% of design capacity without overflowing.

Influent Characteristics of Wastewater:

a. BOD_5 – 400 mg/L
b. TSS –400 mg/L
c. TKN – 80 mg/L
d. Fecal Coliform – 10^8 MPN /100 mL

Effluent Criteria Limitations for Direct Surface Water Discharge:

a. BOD_5
b. The 30-day average will not exceed 30 mg/L
c. The 7-day average will not exceed 45 mg/L
d. $CBOD_5$ may be substituted for BOD_5. In those cases the following limits will apply:
    1. 30-day average will not exceed 25 mg/L
    2. The 7-day average will not exceed 40 mg/L

Note: Parameter $CBOD_5$ limit, if substituted for the parameter BOD_5, should be at least 5 mg/L less than each numerical limit for the thirty (30) day and seven (7) day average for the BOD_5 limit. The $CBOD_5$ test procedure suppresses the nitrification component in the BOD_5 test procedure, thereby reducing the value or effects and lowering the oxygen demand.

e. TSS
f. The 30-day average will not exceed 30 mg/L.
g. The 7-day average will not exceed 45 mg/L.
h. pH
i. The effluent pH values will be maintained between 6.0 and 9.0.

Temperature Ranges: see the mechanical section for the range of temperatures that apply.

Processes: To be determined by the Contractor as part of the scope of work subject to Government approval as required in AED Design Requirements - Package Wastewater Treatment Plants and Lagoons latest version.

2.3.5.3 LAGOONS

The Contractor shall design the partial mix aerated lagoons in accordance to the AED Design Requirements - Package Wastewater Treatment Plants and Lagoons latest version. The lagoons shall be lined with a geomembrane

liner with a hydraulic conductivity no greater than 1 x 10^{-7}cm/sec, or shall be concrete lined. The Contractor shall construct a minimum of two (2) lagoons of equal volume.

2.3.5.4 FLOW SPLITTING

For multiple treatment trains, provide flow splitting capabilities to evenly distribute flow to each treatment train with broad adjustable rectangular weirs. Plant influent shall be conveyed directly into the flow lagoon basins.

2.3.5.5 INLET BAR SCREEN

A bar screen shall be provided prior to flow equalization to remove large solids from the incoming raw sewage. The bar screen will be fabricated from 13 mm diameter bars spaced 25 mm apart. The bars shall be sloped to permit easy cleaning of acculumulating debris. A deck shall be furnished for drying the debris. Minimum area of bar screen shall be 0.9 m x 0.9 m.

2.3.5.6 FLOW EQUALIZATION

Provide flow equalization volume designed to attenuate maximum peak flows equal to 150% of the design flow for two hours. Flow control to the lagoons shall be accomplished by gravity flow of the influent from the off loading station. The off loading station shall contain broad adjustable rectangular discharge weirs. The broad weirs will be adjustable so that a measured amount of influent will flow to the lagoons.

2.3.5.7 CHLORINE CONTACT CHAMBER

A chlorine contact chamber will be provided for proper disinfection of the treated waste water prior to discharging from the plant. The chlorine contact chamber will have appropriate detention time based on the design flow to meet effluent standards. Sufficient flow baffles will be supplied to ensure proper mixing of the chlorine solution with the plant effluent and detention time.

2.3.5.8 HYPOCHLORITE SYSTEM

Provide a liquid chlorine (hypechlorite) feed system sized to satisfy all disinfection requirements at the waste water treatment plant. It is anticipated that calcium hypochlorite will be delivered to the plant in the small containers and stored in a dedicated, dry, well ventilated building. No other chemicals, cleaning solvents, lubricants, etc. are to be stored in the dedicated space. The hypochlorite feed system will consist of batch mix/feed storage tanks, positive displacement metering pumps, piping, valves and other appurtenacnes, and pump controls. For redundancy, provide a dedicated metering pump for each treatment train.

Provide two minimum 400 liter fiberglass reinforced plastic or polyethylene mix/feed tanks. The Contractor shall base the preliminary tank size on commercial strength 12.5% hypochlorite batch solution, and assumption that 45 kilograms of calcium hypochlorite batched in each tank. Tanks shall be elevated on a pad for housekeeping and to provide a flooded metering pump suction, and shall come with hinged cover, top mounted mixer, and 25 mm bottom outlet connection. The Contractor shall provide a concrete secondary containment for the mix/feed tank. The concrete secondary containment shall provide a minimum total of 900 liter capacity. The Contractor shall construct a concrete Mixers shall have local, manual on/off control. Hypochlorite metering pumps shall be positive displacement type with stroke and speed control. The pumps shall be capable of adjustable speed operation using DC SCR drive and shall be flow-paced off a flow signal from the lagoon system. Coordinate pump motor type with drive unit provided. Metering pumps shall have capacity to dose minimum 10 mg/L chlorine or as required to meet applicable discharge limits, whichever is greater. Provide a dedicated pump for each treatment train. At a minimum, each metering pump shall be provided with the following appurtenances: Pulsation dampener, adjustable diaphragm backpressure valve, adjustable pressure relief valve, calibration column, pressure indicator with diaphragm seal, Y-strainer. Provide a suitable diffuser or injection assembly for dispersing chemical at the point of application.

Provide non-potable dilution water for batching the dry calcium hypochlorite. Provide appropriate protective clothing and eye protection. Provide an emergency shower and eyewash station in the chlorine feed building.

Chlorine feed piping shall be 13 mm schedule 80 PVC. Provide double walled containment for chlorine lines between the feed building and the point of application. Provide isolation valves to allow equipment to the isolated for maintenance.

Provide power, control wiring and dilution water as required for a complete and operable system.

2.3.5.9 CENTRAL CONTROL PANEL

The electrical controls will consist of magnetic starters, program timers and switches necessary to automatically control all electrical devices and/or motors on the waste water treatment system.

Manual-off-auto selector switches and magnetic starters in conjunction with the program timer will control the blower/motor. The program timers will have the capability to operate the treatment system when required as determined by the variation in the daily flow rate. Properly sized circuit breakers and fuses will protect all electrical equipment and circuitry. The control system will be designed to operate all duplex or standby equipment.

Electronic flow meters shall be installed at appropriate locations on inflow and outfall locations to monitor influent and effluent flows. The controls and monitors shall be located at the central control panel.

2.3.5.10 ACCESS LADDER, WALKWAYS AND HANDRAILS

Provide an access ladder to each structure above grade. Provide service walkways with handrails to service the plant equipment. Walkways shall be a minimum 0.9 m. Provide service walkways between trains and other plant structures so each structure can be accessed without having to climb back down a ladder.

2.3.5.11 PIPING

All piping that is not buried in accordance with this section shall be Schedule 40 black steel pipe.

2.3.5.12 VALVES

The Contractor shall install bypass valves and piping so that each component in the process train can be bypassed for maintenance.

2.3.5.13 SLUDGE DRYING BEDS

Provide four (4) sludge drying beds sized to adequately provide the capacity to dry sludge produced by the lagoon system. Convey sludge from lagoons to beds by gravity. Provide isolation valves to each bed and splash plate in front of outlet to spread the sludge over the bed and prevent erosion of the sand.

Beds shall be capable of holding 0.3 m of liquid sludge. Profile the following bed layers:

a. 0.3 m top layer of uniform coarse sand (effective size between 0.3 to 0.75 mm)

b. 0.1 m intermediate layer of uniform fine gravel (effective size between 4 to 5 mm)

c. 0.1 m bottom layer of uniform coarse gravel (effective size between 20 to 25 mm)

Slope bed subgrade to drain to drainage laterals. Encase drainage laterals in 0.1 m of uniform coarse gravel. Drainage lateral shall be 0.1 m below bottom gravel layer. Slope drainage laterals and header a minimum of 1% to drain to lift station. Drainage laterals shall be perforated ASTM 3034 100 mm PVC pipe with two rows of holes 13 mm in diameter on 120 mm centers and 120° apart. Space laterals evenly at 3 m apart. Lateral are to run entire length or width of bed. Manifold laterals to common ASTM 3034 150 mm PVC header. Locate feed pipe at opposite end of access point for dried sludge removal equipment (e.g. bulldozer). Slope bed side walls at 2H: 1V slope.

The Contractor shall design and construct effluent recirculation system for the excess effluent that collects in the drying beds. The effluent recirculation system shall consist of, but not inclusive of, pumps and piping that will convey effluent to the lagoon system.

2.3.5.14 START UP TESTING

The Contractor shall include a proposed start-up testing and training program in the operation and maintenance manuals. When the wastewater system construction nears completion and all units are operative, the Contractor shall commence a commissioning and startup procedure for the treatment system. The treatment system includes all treatment plant units and associated equipment, sludge holding and digestion, sewage dump pad, and all buildings. The Contractor shall operate the treatment facility for a trial period of two months performing all daily and weekly operation and maintenance (O&M) tasks recommended by the equipment manufacturer. The Contractor shall utilize services of qualified operators; including the use of at least two Afghan Nationals that the Contractor shall train. During the routine O&M, the Contractor shall perform all sampling and testing necessary to ensure proper daily operations in achieving the required effluent standards. The Contractor shall maintain a log that includes records of daily O&M activities, e.g. repairs, inflow measurement, aeration cycles, effluent cycling, waste and return sludge pumping, and sludge drying. The Contractor shall also maintain and operate the sludge disposal operation during the trial period.

2.3.6 STORM SEWER SYSTEMS

2.3.6.1 DESIGN STORM RETURN PERIOD (BASELINE FREQUENCY)

Developed portions of the site installation such as administration, industrial and barracks areas, shall be based on a rainfall of 20-year frequency. Basic system design shall be in accordance with UFC 3-230-17A, Chapter 2. Potential damage or operational requirements may warrant a more severe criterion or in certain areas a lesser criterion may be appropriate. The design of roadway culverts and other on-site storm drainage features & structures will normally be based on 20-year rainfall event. Protection of installations against flood flows originating from areas exterior to the base installation shall be based on a 20-year or greater rainfall.

2.3.6.2 STORM DRAINAGE SYSTEM DESIGN

The Contractor shall be responsible for the complete design of the storm drainage system. Drainage of runoff from unpaved areas onto pavements shall be minimized. If storm drain piping is required it shall comply with the requirements in this section. Where storm drain pipes are of different diameters, the pipe crown elevations should be matched at the drainage structure. Storm drain lines shall be located outside of paved areas to the extent possible. Under no circumstance shall storm drain lines be located beneath buildings. All open storm drainage channels shall be concrete lined. Erosion control shall be provided for all storm drain structures during construction. Water from roof down spouts shall be drained off building site. All storm drain pipe and structures shall comply with the requirements specified in UFGS Specification Section 33 40 00 Storm Drainage Utilities. For cases when there is a need to penetrate the perimeter wall for drainage purposes (outfall), multiple wall penetrations shall be used to provide redundancy. Each drainage penetration through the perimeter wall shall be protected from unauthorized ingress/egress through the use of grates or rebar.

2.3.6.3 HYDRAULIC DESIGN

New storm drain pipes shall be designed for gravity flow during the design storm baseline unless otherwise approved by the Government. The hydraulic grade line shall be calculated for the storm drain system and all energy losses accounted for. Design computations shall adhere to procedures contained in UFC 3-230-17A. Storm drain systems shall be designed to provide a maximum velocity of 2m/s.

2.3.6.4 AREA INLETS

Area inlets shall be properly sized and designed to accommodate the design flows. All grates shall be of a “bicycle safe” design.

2.3.6.4.1 CONCRETE PIPE

Reinforced concrete pipe shall be a minimum Class III. Type I cement may be used only when sulfates in the soil are 0.1 percent or less and dissolved sulfates in the effluent are 150 ppm or less. Type II cement may be used only when sulfates in the soil are 0.2 percent or less and dissolved sulfates in the effluent are 1,500 ppm or less. Only Type V cement may be used if sulfates in the soil exceed 0.2 percent or dissolved sulfates in the effluent exceed 1,500 ppm. Concrete pipe shall be assumed to have a minimum design service life of 50 years unless the Contractor determines that conditions at the site will reduce the service life. Concrete culverts and storm drains shall be protected by a minimum of one m of cover during construction to prevent damage by heavy construction equipment.

2.3.6.4.2 CORRUGATED METAL PIPE

Corrugated metal pipe shall not be used.

2.3.6.4.3 PLASTIC PIPE

Stiffness of the plastic pipe and soil envelope shall be such that the predicted long-term deflection shall not exceed 7.5 percent. Plastic culverts and storm drains shall be protected by a minimum of one m of cover during construction to prevent damage by heavy construction equipment. Split couplers shall not be allowed for corrugated high-density polyethylene pipe. Plastic pipe shall be assumed to have a minimum design service life of 50 years unless the Contractor determines that conditions at the site will reduce the service life (then plastic pipe shall not be used).

2.3.7 OIL WATER SEPERATORS

Oil/water separators shall be utilized for all drains from the vehicle wash racks. Separators shall be located for easy maintenance and cleaning. Drain water from the separator shall drain to the surface drainage system.

2.4 GEOTECHNICAL

2.4.1 SOIL INVESTIGATION

Existing geotechnical information is not available at the project site. Any site-specific geotechnical data required to develop foundations, materials, earthwork, and other geotechnical related design and construction activities for this project shall be the Contractor's responsibility. The Contractor shall develop all pertinent geotechnical design and construction parameters by appropriate field and laboratory investigations and analyses. The Contractor shall produce a detailed geotechnical report that includes:

a. Clear description of the anticipated construction including planned grading and structural details to provide an estimation of foundation loads (compression, uplift, lateral, and moment) and settlement tolerance.

b. Detailed site and area reconnaissance that includes a description of local geology and origin of sediments, surface features (e.g., ditches or other excavations, existing structures, vegetation, rock outcrops, seeps or springs), surface soil type(s), and subsurface lithology).

c. Justification of number and depth of borings.

d. Site plan illustrating exploratory boring locations.

e. Boring logs that include groundwater levels (if encountered).

f. Field tests and analyses (e.g., Unified Soil Classification System, field density, SPT).

g. Analytical laboratory test results in accordance with ASTM or other recognized standards (e.g., sieve analysis, Atterberg Limits (plastic and liquid), moisture content, hydrometer, consolidation/collapse potential, specific gravity of solids, direct shear, density, chemical [sulfate, chloride, pH, lime], K values)

and any other tests as needed to properly conduct necessary calculations to determine the engineering properties of the soil.

h. A summary of the results of the subsurface geotechnical conditions including allowable soil bearing capacity, foundation recommendations, pavement design criteria, and construction materials (e.g. concrete cement, asphalt, and aggregates).

Two copies of the geotechnical report shall be submitted to the COR. Foundations, including sub-grade, shall be designed and constructed based on calculations and recommendations from a licensed structural engineer provided by the Contractor.

For standard penetration test (SPT), the Contractor shall use ASTM D1586. All geotechnical laboratory and field work shall be based on standards set forth in the ASTM. Contractor shall not use any DIN standards for penetration tests in lieu of ASTM D 1586. Soil investigations shall be in accordance with AED Design Requirements: Geotechnical Investigations for USACE Projects, latest version, or most recent version.

For foundation design, allowable soil bearing pressures shall be determined by calculations made based on the physical and mechanical properties obtained from laboratory testing. The soil bearing pressures calculated shall be compared with the International Building Code (IBC) 2006 Table 1804.2. The lower of the two bearing pressures, calculated or Table 1804.2, shall be chosen for the allowable soil bearing pressure.

California Bearing Ratio (CBR) tests shall be conducted on the existing soils throughout the proposed road alignment and vehicle parking and maneuver areas. Results from the tests shall be used to calculate the pavement structure using the minimum pavement structure as dictated in paragraph 2.3 as a reference. In the event that the calculations based on the CBR tests reveal that the pavement structure dictated in paragraph 2.3 is insufficient to carry the design load, the Contractor shall design and construct a subbase layer for the pavement structure.

The Contractor shall conduct soils classification per ASTM D 2487-06.

No design review submittal shall be considered complete without an approved geotechnical report. Geotechnical investigation plans and report of investigations shall be submitted promptly in accordance with Section 01335.

2.4.2 GEOTECHNICAL QUALIFICATIONS

A geotechnical engineer that is a member of a geotechnical firm responsible to the Contractor shall oversee all geotechnical engineering design parameters. The geotechnical engineer shall be qualified by:

a. Education in geotechnical engineering;

b. Professional registration;

c. Minimum of ten (10) years of experience in geotechnical engineering design.

The geotechnical firm conducting the field investigation and laboratory work shall be certified by the Chief, Quality Assurance Branch USACE-AES or Chief, Quality Assurance Branch USACE-AEN. Certification document shall be submitted as part of the Geotechnical Report.

3.0 STRUCTURAL

3.1 GENERAL

Foundations shall be properly placed on suitable compacted ground area and shall be in accordance with the recommendations from the geotechnical investigation. Building foundations shall be founded a minimum of 800 mm below grade. Foundation designs shall be corroborated with the geotechnical findings and recommendations.

Building foundations were designed for a soil bearing capacity of 72 KPa (1500 psf). The geotechnical investigation shall confirm bearing capacity to be no less than 72 KPa (1500 psf). If geotechnical investigation shows less than 72 KPa (1500 psf), Contractor shall redesign footings based on the geotechnical investigation. Foundation designs shall be corroborated with the geotechnical findings and recommendations.

Field welding shall not be used for any part of the Main Structural Force Resisting System for significant structures. The Main Structural Force Resisting System is that part of the structural system providing the required resistance to all gravity loads (dead; live) and all lateral loads (wind; seismic). Bolted connections in lieu of welding are recommended. Exemptions to these guidelines would be minor structural connections; including metal trusses bearing on a reinforced concrete roof, and non-load bearing applications. Certified shop welding of pre-engineered buildings and various structural members shall be permitted.

3.2 DESIGN

For any structure that is designed, rather than provided, the design shall be performed by or under the direct supervision of the Contractor's structural engineer. All structural design documents shall be stamped and signed by a registered structural engineer.

Calculations shall be in SI (metric) units of measurements. All components of the structures shall be designed and constructed to support safely all loads without exceeding the allowable stress for the materials of construction in the structural members and connections.

3.3 STANDARDS

The Contractor should use the following American standards to provide structural design if local standards are not available, relevant, or applicable. The Contractor shall follow American Concrete Institute Standards (ACI) for design and installation of all concrete structures.

Concrete	ASTM C 39 and ACI 318; 28 MPa (f'_c = 4,000 psi) minimum specified compressive strength @ 28 days, and maximum water-cement ratio of 0.45.
Steel Reinforcement	ASTM A 615; 420 MPa (F_y = 60 ksi) yield strength.
Welded Wire Fabric	ASTM A 185.
Anchor Bolts	ASTM F 1554; Grade 36 steel.
Bolts and Studs	ASTM A 307.
Plaster	ASTM C 926.
Concrete Masonry Units	ASTM C 90; Type I (normal weight, moisture control).
Mortar	ASTM C 270; Type S (ultimate compressive strength of 13 MPa).
Grout	ASTM C 476; 14 MPa (2,000 psi) minimum compressive strength @ 28 days (slump between 200 mm to 250 mm).
Structural Steel	ASTM A 36; 250 MPa (F_y = 36,000 psi).
Welding	AWS D1.1 (American Welding Society)
Cold-Formed Steel	AISI Specification for the Design of Cold-formed Steel Structural Members

3.4 DEAD AND LIVE LOADS

Dead loads shall be in accordance with ASCE 7-05 Minimum Design Loads for Buildings and Other Structures. Dead loads consist of the weight of all materials of construction incorporated in the buildings. Live loads shall be per Chapter 4. All facilities shall be classified as a minimum of Category II in accordance with Table 1-1.

3.5 WIND LOADS

Wind loads shall be calculated in accordance with ASCE 7-2005 using a "3-second gust" wind speed of 135 km/hr. Exposure = C. Importance Factor = 1.0.

3.6 SNOW LOADS

Snow Loads shall be calculated per local standard practice where known and shall not be reduced based on tributary area. Strcutures shall be designed for roof snow load where it exceeds the roof live load.

3.7 SEISMIC

The building and all parts thereof shall be designed for the seismic requirements as defined by the International Building Code referenced herein.

Spectral ordinates shall be S_s = 1.28g and S_1 = 0.51g; I = 1.0

3.8 REINFORCED CONCRETE

All concrete members shall be designed and constructed in accordance with the provisions of the American Concrete Institute, Building Code Requirements for Structural Concrete, ACI 318. A minimum 28 day compressive strength of 28 MPa shall be used for design and construction of all concrete. Concrete shall have maximum water-cement ratio of 0.45. Reinforcing steel shall be deformed bars conforming to American Society for Testing and Materials publication ASTM A 615, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement. The minimum yield strength Fy shall be 420 MPa.

No concrete shall be placed when the ambient air temperature exceeds 32 degrees C unless an appropriate chemical retardant is used. In all cases when concrete is placed at 32 degrees C or hotter it shall be covered and kept continuously wet for a minimum of 48 hours.

3.9 STRUCTURAL CONCRETE

Concrete structural elements shall be designed and constructed in accordance with the provisions of the American Concrete Institute, Building Code Requirements for Structural Concrete, ACI 318. A minimum cylinder 28 day compressive strength of 28 MPa shall be used for design and construction of all concrete, except that 24 MPa shall be used for Shotcrete applications. Reinforcing steel shall be deformed bars conforming to American Society for Testing and Materials publication ASTM A 615, Deformed and Plain Billet-Steel Bars for Concrete Reinforcement. Concrete members at or below grade shall have a minimum concrete cover over reinforcement of 75 mm. Concrete shall have maximum water-cement ratio of 0.45. No concrete shall be placed when the ambient air temperature exceeds 32 degrees C unless an appropriate chemical retardant is used. In all cases when concrete is placed at 32 degrees C or hotter it shall be covered and kept continuously wet for a minimum of 48 hours. Except with authorization, do not place concrete when ambient temperature is below 5 degrees C or when concrete is likely to be subjected to freezing temperatures within 24 hours. When authorized, when concrete is likely to be subjected to freezing within 24 hours after placing, heat concrete materials so that temperature of concrete when deposited is between 18 and 27 degrees C. Methods of heating materials are subject to approval of the Contracting Officer. Do not heat mixing water above 74 degrees C. Remove lumps of frozen material and ice from aggregates before placing aggregates in mixer. Follow practices found in ACI 306.1.

3.10 MASONRY

Masonry shall be designed and constructed in accordance with the provisions of the latest editions of Building Code Requirements for Masonry Structures, ACI 530/ASCE 5/TMS 402. Mortar shall be Type S and conform to ASTM C 270. All masonry used below grade shall me fully grouted. All cells of exterior CMU walls shall be fully grouted. For interior CMU walls, only the reinforced cells shall be grouted. All interior and exterior CMU walls shall have reinforced horizontal bond beams at a maximum spacing of 1,200 mm on center.

3.11 STRUCTURAL STEEL

Structural steel shall be designed and constructed in accordance with the provisions of American Institute of Steel Construction (AISC), Specifications for Structural Steel Buildings.

3.12 COLD-FORMED LIGHT GUAGE STEEL

Design of cold-formed steel structural members shall be in accordance with the provisions of American Iron and Steel Institute (AISI), Specifications for Design of Cold-Formed Steel Structural Members.

3.13 STEEL ROOF JOISTS

Steel roof joists shall be placed according to the roof design and roof manufacturer specifications. Steel purlins shall be installed perpendicular to the steel beams. Use continuous metal roof sheets from ridge to eave to avoid constructing roof seams. In lieu of the continuous metal roof sheets, the Contractor can submit a plan for roofing seams; however, the plan must show a detail of how leaks will be avoided, and the Contracting Officer before application must approve the plan. Steel "hat channels" can be installed for the connection to the CONEX box module. Provide all necessary metal framing for roof fascia and soffits. See structural paragraph for structural characteristics of steel joists.

3.14 OPEN WEB STEEL JOISTS

Open web steel joists shall conform to SJI Specifications and Tables. Joists shall be designed to support the loads given in the standard load tables of SJI Specifications and Tables.

3.15 METAL DECK

Deck units shall conform to SDI Publication Number 29. Panels of maximum possible lengths shall be used to minimize end laps. Deck units shall be fabricated in lengths to span three or more supports with flush, telescoped or nested 50 mm (2 in) laps at ends, and interlocking, or nested side laps. Metal deck units shall be fabricated of steel thickness required by the design and shall be galvanized.

3.16 CORRUGATED METAL ROOFING

Design of cold-formed steel structural members shall be in accordance with the provisions of American Iron and Steel Institute (AISI), Specifications for Design of Cold-Formed Steel Structural Members.

3.17 FOUNDATIONS

All structures shall be provided with a reinforced concrete foundation properly placed on suitable native or compacted earth and shall be prepared in accordance with the recommendations from the geotechnical investigation. Where frost protection is required, the perimeter foundation shall be founded a minimum of 800 mm below final grade.

All foundations have been or shall be designed for a maximum soil bearing capacity of 0.75 kg/cm^2. A geotechnical investigation shall confirm bearing capacity to be no less than 0.75 kg/cm^2. If geotechnical investigation shows less than 0.75 kg/cm^2, the Contractor shall redesign the foundation based on the values provided in the geotechnical investigations.

3.18 EARTHWORK AND FOUNDATION PREPARATION

3.19 CAPILLARY WATER BARRIER

Bedding material for slabs on grade shall be coarse-graded gravel with little or no fines in order to prevent surface water from migrating up and maintaining contact with the bottom surface of the building slab. Graded material shall comply with ASTM C136 test method for sieve analysis of gravels with only 3 percent by weight passing the 37.5mm (1.5 inch) mesh size sieve, and no more than 2 percent by weight passing the 75 micrometers (No. 200) mesh size sieve, and conforming to the soil quality requirements specified in the paragraph entitled "Satisfactory Materials."

Capillary water barriers shall be placed under floor slabs (not under footings) and be a minimum of 150 mm thick.

3.20 SATISFACTORY MATERIALS

Any materials classified by ASTM D 2487 as GW, GM, GC, GP, SP, SW, SM, and SC and free of debris, roots, wood, scrap material, vegetation, refuse, soft unsound particles, or objectionable materials. Unless specified otherwise, the maximum particle diameter shall be one-half the lift thickness at the intended location.

3.21 UNSATISFACTORY MATERIALS

Any materials which do not comply with the requirements set forth in the Satisfactory Materials paragraph. Unsatisfactory materials also include man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than 75mm. The Contracting Officer shall be notified of any unsatisfactory materials.

3.22 CLEARING AND GRUBBING

Unless indicated otherwise, remove tress, stumps, logs, shrubs, brush and vegetation, and other items that would interfere with construction operations within lines 1.5 m outside of the building and structure line. Remove stumps entirely. Grub out matted roots and roots over 50 mm in diameter to at least 460mm below existing surface.

3.23 STRIPPING

Strip suitable soil from the site where excavation or grading is indicated and stockpile separately from other excavated material. Material unsuitable for use as topsoil shall be stockpiled and used for backfilling. Locate topsoil so that the material can be used readily for the finished grading. Where sufficient existing topsoil conforming to the material requirements is not available on site, provide borrow materials suitable for use as topsoil. Protect topsoil and keep in segregated piles until needed.

3.24 EXCAVATION AND COMPACTION OF FILL

Excavate to contours, elevation, and dimensions indicated. Reuse excavated materials that meet the specified requirements for the material type required at the intended location. Keep excavations free from water. Excavate soil disturbed or weakened by Contractor's operations, soils softened or made unsuitable for subsequent construction due to exposure to weather. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be removed as directed. Refill with satisfactory material and compact to at least 95 percent of the maximum dry density, as determined by the Modified Proctor laboratory procedure. ASTM D 1557 shall be used for producing the Modified Proctor moisture-density curve, unless the soil to be compacted includes more than 30 percent retained on the 19 mm (3/4"in) sieve. In this case, the Contractor must replace the ASTM D 1557 laboratory compaction procedure with AASHTO T 180, Method D, corrected with AASHTO T 224.

During compaction, the moisture content of the soil shall be within 1.5 percent of the optimum moisture content, as determined by the Modified Proctor laboratory procedure. The thickness of compacted lifts shall not exceed 15 cm and the dry density of each compacted lift shall be tested by either sand cone (ASTM D 1556) or nuclear gage (ASTM D 2292). If the nuclear gage is used, it must first be compared to sand cone tests for each soil type to verify the accuracy of the nuclear gage measurements for moisture content, wet density, and dry density. Furthermore, every tenth nuclear gage test must be accompanied by a sand cone test and these verification data must be summarized and submitted to the Contracting Officer. Density tests shall be performed at a frequency of not less than one test for each 200 square meters and not less than two tests per compacted lift.

3.25 STRUCTURES WITH SPREAD FOOTINGS

Ensure that footing subgrades have been inspected and approved by the Contracting Officer prior to concrete placement. Fill over excavations with concrete during foundation placement.

4.0 ARCHITECTURAL REQUIREMENTS

Architectural-related Technical Requirements, as included in the following sub-paragraphs, shall only be used for Work that is to be designed per the contract requirements. Work that is to be constructed using Standard Designs shall not use the requirements of the following sub-paragraphs; that Work shall be built to the requirements of the 01010, the Standard Designs.

4.1 GENERAL

All materials and products to be used throughout the facilities under contract are to be in accordance with the provided drawings and specifications. Different sub-contractors shall not use different material or standards under the contract. Intent of the project is to use locally procured materials (unless specified otherwise) and labor to the maximum extent possible while satisfying seismic, international building code, and national fire protection agency life safety code. Conflicts between criteria shall be brought to the attention of the Contracting Officer for resolution. In such instances, the Contractor shall furnish all available information with justification to the Contracting Officer.

4.2 DESIGN CRITERIA

Designs for the facility types requested in this proposal are provided in the Appendix. These designs shall be used to create a complete and usable facility meeting the minimum requirements stated in these documents. The Codes, Standards, and Regulations listed in these documents shall be used in the construction of this project. The publications shall be the most recent editions. Standards other than those mentioned may be accepted provided they meet the minimum requirements and the contractor shall submit proof of equivalency to the Contracting Officer for approval.

IBC - International Building Code, latest edition

NFPA 101 - Life Safety Code, latest edition

4.3 LIFE SAFETY/ FIRE PROTECTION/ HANDICAPPED ACCESSIBILITY

A life safety and fire protection analysis shall be completed prior to construction commencement for all buildings designed by the Contractor. This analysis shall be documented in plans and in the design analysis. All spaces shall be classified following NFPA 101 or IBC. Whichever code is used shall be stated and referenced in the life safety plan. The facilities of this contract shall comply with all safety requirements of the NFPA 101.

4.4 CONCRETE

4.4.1 FINISH

If finish is exposed concrete, then the floor shall be a broom finish for texture and shall not interfere with sloping for drainage of the surface. Vertical work shall have a form finish. Exposed concrete shall be sealed with an approved sealer.

4.4.2 PRECAST

Storage of precast units shall be in a dry place or materials shall be covered with a plastic or protective layer. Units shall be detailed to provide size, shape and location of installation. Precast units shall meet the minimum concrete strength requirements.

4.5 MASONRY

Storage of masonry materials shall be in a dry place or materials shall be covered with a plastic protective layer. Cover open walls each day to keep them protected and dry. Masonry construction systems shall be reinforced.

4.5.1 CONCRETE MASONRY UNITS

Concrete masonry units (CMU) for exterior walls shall be either 290 mm wide x 390 mm x 190 mm high or otherwise as shown on the standard drawings. They shall be installed in running bond level and plumb. Mortar joints shall be 10 mm on all sides between CMU. Joints shall be struck with a concave tool to provide a smooth recessed curved surface. Install only quality units. The surface shall be free of chips, cracks, or other imperfections that would detract from the overall appearance of the finished wall. Defective CMU or mortar shall be rejected. All CMU for internal or exterior walls shall be reinforced. CMU shall be sealed in all wet areas/rooms.

4.6 STONE

Stone type shall be identified for approval in design. Mortar shall be of lower strength than stone and weep holes shall be provided in cavity wall systems.

4.7 THERMAL PERFORMANCE OF EXTERNAL BUILDING ASSEMBLIES

External building assemblies shall meet the requirements of TI-800, Design Criteria, UFC 3-400-01 Design: Energy Conservation, and ASHRAE Standard 90.1, latest editions, but shall meet the following minimum requirements:

Assembly	Minimum Thermal Value
Exterior walls (above grade)	RSI 2.280 (R 13)
Ceilings/roof	RSI 5.284 (R 30)
Floor (over unheated space)	RSI 3.346 (R 19)
Exterior doors	RSI 0.252 (R 1.43)
Exterior windows/(glazing within doors)	RSI 0.308(R 1.75)
Skylights	RSI 0.180 (R 1.02)

This table is a summary of ANSI/ ASHRAE 90.1 Table 5.5-5, Climate Zone 5 (A,B,C)

RSI measured in K-m2/W, R measured in SF-F-hr/BTU. 1 K-m2/W = 5.678 SF-F-hr/BTU.

4.8 ANTITERRORISM / FORCE PROTECTION

Force protection/anti-terrorism measures for this location shall be as defined in 01010.

4.9 ROOFING AND WEATHERPROOFING

All buildings shall have a sloped metal roof. Buildings with pitched roofs shall be provided with metal eaves, and soffits. All exterior entry ways to be covered and protected by rain gutters and diverters as to not have water falling on the entry ways to all buildings.

4.9.1 SLOPING METAL ROOFING

Building shall be weatherproofed in accordance with manufacturer's recommendations, and shall be provided with prefinished sloping metal roofing system (including structural support) with a minimum 2:12 slope. Install soffit and ridge venting. Provide rigid insulation over concrete roof slab, in accordance with contract drawings. Roof shall have a gutter and downspout system, or a diverter, at main entrances only to evacuate rain accumulation. Downspouts shall be attached securely to building exterior wall utilizing wall straps, as required. Metal roofing shall be prefinished in manufacturer's standard white color. All roof components (ridge vents, exhaust fans hoods, gutters, metal fascia, metal roof trim, etc.) shall be prefinished to match metal roof color.

4.9.2 METAL FASCIA

No wood fascias and/or soffits are allowed. Use metal fascias throughout. Attach drip flashing to metal fascia so that it extends past bottom of metal fascia to 50mm over stucco fascia, as indicated on contract drawings. Concrete soffits shall be a minimum width of 600mm extending from the building exterior wall.

4.9.3 METAL SOFFIT VENT

Provide perforated lay-in type metal soffit venting where indicated on drawings provided by the government. Soffit vents shall be prefinished to match color of metal fascia.

4.9.4 CONCRETE SOFFIT VENT

Provide venting through concrete soffit. Vent openings shall be 50mm diameter and spaced 2000 mm and set in a minimum of 200 mm from the exterior fascia edge. Provide insect screen over vent opening.

4.9.5 OPTIONAL STRIP VENT AT METAL FASCIA

Contractor may use optional continuous strip vent to provide attic ventilation in lieu of concrete soffit vent openings described above. Metal fascia will be required to be extended forward 40mm (1.5 in.) of the original detail location to accommodate the continuous strip vent. This will be accomplished by attaching purlins of 40 mm (1.5 in.) height to eave steel stud fascia support, and then attaching fascia to purlins. Strip vent shall be mechanically fastened to eave steel studs above the top edge of concrete soffit such that metal fascia drip edge will overlap to provide closure and hide vent strip. The completed installation shall allow continuous venting between metal fascia and concrete soffit. Attachment of strip vent shall be in accordance with vent strip manufacturer's recommended installation instructions. Strip vent shall be prefinished to match fascia color.

4.9.6 CONTINUOUS RIDGE VENT

For sloping roofs, provide continues metal ridge vent at the top of roof along the ridge. Ridge vent shall be sized to provide adequate ventilation of the roofing system.

4.9.7 FLASHING &SHEET METAL

4.9.7.1 MATERIALS

Any metal listed by ASTM, DIN, BS or EN standards. Manual for a particular item may be used, unless otherwise specified or indicated. Materials shall conform to the requirements specified below and to the thicknesses and configurations established in ASTM, DIN, BS or EN standards. Different items need not be of the same metal, except that if copper is selected for any exposed item, all exposed items shall be copper.

4.9.7.2 STEEL SHEET, ZINC-COATED (GALVANIZED)

Zinc coated steel conforming to ASTM A 525, DIN BS or EN Standards.

4.9.7.3 CONNECTIONS AND JOINTING

4.9.7.3.1 SOLDERING

Soldering shall apply to copper and stainless steel items. Edges of sheet metal shall be pre-tinned before soldering is begun. Soldering shall be done slowly with well heated soldering irons so as to thoroughly heat the seams and completely sweat the solder through the full width of the seam. Edges of stainless steel to be pre-tinned shall be treated with soldering acid flux. Soldering shall follow immediately after application of the flux. Upon completion of soldering, the acid flux residue shall be thoroughly cleaned from the sheet metal with a water solution of washing soda and rinsed with clean water.

4.9.7.3.2 SEAMING

Flat-lock and soldered-lap seams shall finish not less than 25 mm. wide. Unsoldered plain-lap seams shall lap not less than 75 mm. unless otherwise specified. Flat seams shall be made in the direction of the flow.

4.9.7.3.3 CLEATS

A continuous cleat shall be provided where indicated or specified to secure loose edges of the sheet metalwork. Butt joints of cleats shall be spaced approximately 3 mm. apart. The cleat shall be fastened to supporting wood construction with nails evenly spaced not over 300 mm. on centers. Where the fastening is to be made to concrete or masonry, screws shall be used and shall be driven in expansion shields set in concrete or masonry.

4.9.8 PROTECTED MEMBRANE ROOFING SYSTEM

Contractor shall install protected membrane roofing system in accordance with government provided specifications. Components of the roofing system shall comply with the manufacturer's specification.

4.9.9 SEALANTS

Provide a sealant compatible with the material(s) to which it is applied. Do not use a sealant that has exceeded shelf life or has jelled and cannot be discharged in a continuous flow from the gun. Apply the sealant in accordance with the manufacturer's instructions with a gun having a nozzle that fits the joint width. Force sealant into joints to fill the joints solidly without air pockets. Tool smooth fresh sealant after application to ensure adhesion. Sealant shall be uniformly smooth and free of wrinkles. Upon completion of sealant application, roughen partially filled or unfilled joints; apply sealant, and tool smooth as specified. Sealer shall be applied over the sealant when and as specified by the sealant manufacturer.

4.9.9.1 INTERIOR SEALANT

ASTM C 834 or ASTM C 920, Type S or M, Grade NS, Class 12.5. Use NT, DIN, BS, or EN equal standards.

4.9.9.2 EXTERIOR SEALANT

For joints in vertical and horizontal surfaces, provide ASTM C 920, Type S or M, Grade NS, DIN, BS, or EN equal standards.

4.9.9.3 FLOOR JOINT SEALANT

(ASTM C 920) Type S or M, Grade P, class 25, use T.

4.9.9.4 PRIMERS

Provide a non-staining, quick-drying type and consistency recommended by the sealant manufacturer for the particular application.
Immediately prior to application of the sealant, clean out loose particles from joints. Where recommended by sealant manufacturer, apply primer to joints in concrete masonry units, wood, and other porous surfaces in accordance with sealant manufacturer's instructions. Do not apply primer to exposed finish surfaces.

4.9.9.5 BOND BREAKERS

Provide the type and consistency recommended by the sealant manufacturer to prevent adhesion of the sealant to backing or to bottom of the joint. Provide bond breakers to the back or bottom of joint cavities, as recommended by the sealant manufacturer for each type of joint and sealant used, to prevent sealant from adhering to these surfaces. Carefully apply the bond breaker to avoid contamination of adjoining surfaces or breaking bond with surfaces other than those covered by the bond breaker.

4.9.9.6 BACKING

Backing shall be 25 to 33 percent oversize for closed cell and 40 to 50 percent oversize for open cell material, unless otherwise indicated.

4.9.9.7 CLEANING SOLVENTS

Provide type(s) recommended by the sealant manufacturer except for aluminum and bronze surfaces that will be in contact with sealant.

4.9.9.8 SURFACE PREPARATION

Surfaces shall be clean, dry to the touch, and free from dirt frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter that would tend to destroy or impair adhesion. Oil and grease shall be removed with solvent and surfaces shall be wiped dry with clean cloths. When resealing an existing joint, remove existing calk or sealant prior to applying new sealant. For surface types not listed below, the sealant manufacturer shall be contacted for specific recommendations.

4.9.9.9 MASKING TAPE

Masking tape shall be placed on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant smears. Masking tape shall be removed within 10 minutes after joint has been filled and tooled.

4.9.9.10 BACKSTOPS

Install backstops dry and free of tears or holes. Tightly pack the back or bottom of joint cavities with backstop material to provide a joint of the depth specified.

4.9.9.11 PROTECTION

Protect areas adjacent to joints from sealant smears. Masking tape may be used for this purpose if removed 5 to 10 minutes after the joint is filled.

4.9.9.12 FINAL CLEANING

Provide cleaning solvent type(s) recommended by the sealant manufacturer except for aluminum and bronze surfaces that will be in contact with sealant. Upon completion of sealant application, remove remaining smears and stains and leave the work in a clean and neat condition. Remove excess sealant with a solvent-moistened cloth on metal and other non-porous surfaces.

4.10 LOUVERS

4.10.1 INTERIOR LOUVERS

SDI 111-C, Louvers shall be stationary sight-proof or lightproof type as required. Louvers for lightproof doors shall not transmit light. Detachable moldings on room or non security side of door; on security side of door, moldings to be integral part of louver. Form louver frames of 0.90 mm thick steel and louver blades of a minimum 0.60 mm. Louvers for lightproof doors shall have minimum of 20 percent net-free opening. Sight-proof louvers shall be inverted "V" blade design with minimum 55 or inverted "Y" blade design with minimum 40 percent net-free opening.

4.10.2 EXTERIOR LOUVERS

Louvers shall be inverted "Y", "V" or "Z" type. Weld or tenon louver blades to continuous channel frame and weld assembly to door to form watertight assembly. Form louvers of hot-dip galvanized steel of same gage as door facings. Louvers shall have steel-framed insect screens secured to room side and readily removable. Provide aluminum wire cloth, 7 by 7 per 10 mm or 7 by 6 per 10 mm mesh, for insect screens.

4.11 WINDOWS, DOORS & GLAZING

4.11.1 WINDOWS

Windows shall be operable: side-hinged, horizontal sliding, awning type complying with NFPA101. Glazing in windows shall be laminated in accordance with the force protection criteria, UFC 4-010-01.

Provide insect screens only in Dining Facilities and medical-related rooms. Insect screens shall be removable type.

4.11.1.1 MATERIALS

4.11.1.1.1 ALUMINUM EXTRUSIONS

Provide alloy and temper recommended by the window manufacturer for the strength, corrosion resistance, and application of required finish, meeting the DIN 1725 raw material requirements, but not less than 215 N/mm2 ultimate tensile strength and not less than 1.5 mm thick at any location for main frame and sash members.

4.11.1.1.2 FASTENERS

Provide aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by the manufacturer to be non-corrosive and compatible with aluminum window members, trim, hardware, anchors, and other components of window units.

4.11.1.1.3 REINFORCEMENT

Where fasteners screw-anchor into aluminum less than 3 mm thick, reinforce the interior with aluminum or nonmagnetic stainless steel to receive screw threads or provide standard non-corrosive pressed-in splined grommet nuts.

4.11.1.1.4 EXPOSED FASTENERS

Except where unavoidable for application of hardware, do not use exposed fasteners. For application of hardware, use fasteners that match the finish of the member or hardware being fastened, as appropriate.

4.11.1.1.5 ANCHORS, CLIPS, AND WINDOW ACCESSORIES

Fabricate anchors, clips, and window accessories of aluminum, nonmagnetic stainless steel, or hot-dip zinc-coated steel or iron complying with the requirements of DIN 1748; provide sufficient strength to withstand design pressure indicated. As a minimum provide 3 anchors on each side of the frame.

4.11.1.1.6 COMPRESSION-TYPE GLAZING STRIPS AND WEATHERSTRIPPING

Unless otherwise indicated, and at the manufacturer's option, provide compressible stripping for glazing and weather stripping such as molded EPDM or neoprene gaskets.

4.11.1.1.7 SEALANT

For sealants required within fabricated window units, provide type recommended by the manufacturer for joint size and movement. Sealant shall remain permanently elastic non-shrinking, and non-migrating. Comply with Sealants of these specifications for selection and installation of sealants.

4.11.1.1.8 WIRE FABRIC INSECT SCREEN

Wire Fabric Insect Screen shall be permanently fixed to the exterior of operable windows, as required in the 01010.

4.11.1.2 HARDWARE

Provide the manufacturer's standard hardware fabricated from aluminum, stainless steel, or other corrosion-resistant material compatible with aluminum and of sufficient strength to perform the function for which it is intended. Provide at a minimum one locking device on the interior of each window. Any operable window over 2 square meters shall have two locking devices as a minimum.

4.11.1.3 FABRICATION

Provide aluminum windows with factory finish in all buildings as indicated in the design drawings. Provide a locking device on the interior of each window. Provide anchors on each side of the frame into the adjoining structure, 3 on each side. Provide weather stripping system for all exterior windows and doors.

4.11.1.4 METAL WINDOW SILLS

Galvanized metal window sills, 0.90 mm, shall be installed on the exterior of all windows. The metal window sills shall have a turn down of 50 mm over the exterior masonry and stucco. Metal sills shall extend from side to side of the masonry opening in a single piece. Extend the metal window sill a minimum of 20 mm under the bottom of the aluminum windows. Install masonry mortar as required for a smooth surface under the window sills. Sills shall slope a minimum of 6 mm to the exterior and not allow water to puddle.

4.11.1.5 FINISHES

Apply baked enamel in compliance with paint manufacturer's specifications for cleaning, conversion coating, and painting. Color shall be white meeting the requirements of DIN 50018

4.11.1.6 INSPECTION

Inspect openings before beginning installation. Verify that rough or masonry opening is correct and the sill plate is level. Masonry surfaces shall be visibly dry and free of excess mortar, sand, and other construction debris.

4.11.1.7 INSTALLATION

Comply with manufacturer's specifications and recommendations for installation of window units, hardware, operators, and other components of the work. Set window units plumb, level, and true to line, without warp or rack of frames or sash. Provide proper support and anchor securely in place. Set sill members and other members in a bed of compound or with joint fillers or gaskets, as shown, to provide weather tight construction. Refer to the Sealant sections for compounds, fillers, and gaskets to be installed concurrently with window units. Coordinate installation with wall flashings and other components of the work.

4.11.1.8 ADJUSTING

Adjust operating sash and hardware to provide a tight fit at contact points and at weather stripping for smooth operation and a weather tight closure.

4.11.1.9 CLEANING

Clean aluminum surfaces promptly after installation of windows. Exercise care to avoid damage to protective coatings and finishes. Remove excess glazing and sealant compounds, dirt, and other substances. Lubricate hardware and other moving parts.

4.11.2 DOORS

Fire rated doors and frames shall be tested and approved as an assembly and shall be provided by a single manufacturer/distributor. Hardware for fire rated door assemblies shall be labeled as appropriate for fire rated applications and shall be coordinated with door manufacturer. All exterior doors shall be heavy duty metal doors

with metal frames. Interior door shall be hollow metal doors with hollow metal frames. Commercial duty lock sets and hardware shall be used on all doors. Hinges shall be the 5 knuckle type or equivalent. Provide door handles and locksets that can be locked with a key on all doors. All door locks shall have a thumb latch on inside of door such that no key is necessary to exit the room or building. Coordinate the final keying schedule with Contracting Officer prior to ordering lock sets. Generally each building should have 8 master keys fitting all locks, 8 sub-master keys fitting all exterior doors and 3 keys each for each interior door. Include 25% spare key blanks for the amount of keys provided per building. Provide numbering system identifying key to associated room door. Provide weather stripping system for all exterior doors.

4.11.2.1 STEEL DOORS

SDI A250.8, except as specified otherwise. Prepare doors to receive specified hardware. Undercut where indicated. Exterior doors shall have top edge closed flush and sealed to prevent water intrusion. Doors shall be 44.5 mm thick, unless otherwise indicated. Doors shall be constructed using heavy gauge steel with minimum thickness of 1.2 mm.

4.11.2.2 FIRE AND SMOKE DOORS AND FRAMES

The requirements of NFPA 80 and NFPA 105 respectfully shall take precedence over details indicated or specified.

4.11.2.3 THRESHOLDS

All exterior doors (except Mech/Elect rooms) shall be provided with manufactured metal thresholds conforming to ANSI/BHMA A156.21. Thresholds shall span continuously from jamb to jamb.

4.11.2.4 STANDARD STEEL FRAMES

SDI A250.8, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners or knock-down field-assembled corners. Provide steel frames for doors, transoms, sidelights, mullions, cased openings, and interior glazed panels, unless otherwise indicated.

4.11.2.5 WELDED FRAMES

Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth.

4.11.2.6 STOPS AND BEADS

Form stops and beads from 0.9 mm thick steel. Provide for glazed and other openings in standard steel frames. Secure beads to frames with oval-head, countersunk Phillips self-tapping sheet metal screws or concealed clips and fasteners. Space the fasteners approximately 300 to 400 mm on centers. Miter molded shapes at corners. Use butt or miter square or rectangular beads at corners.

4.11.2.7 WEATHER-STRIPPING, INTEGRAL GASKET

Provide weather-stripping that is a standard cataloged product of a manufacturer regularly engaged in the manufacture of this specialized item. Black synthetic rubber gasket with tabs for factory fitting into factory slotted frames, or extruded neoprene foam gasket made to fit into a continuous groove formed in the frame, may be provided in lieu of head and jamb seals. Weather stripping shall be looped neoprene, synthetic rubber gasket, or vinyl held in an extruded non-ferrous metal housing. Air leakage of weather stripped doors shall not exceed 0.003125 cubic meters per second of air per square meter of door area when tested in accordance with ASTM E 283.

4.11.2.8 ANCHORS

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, anchors not lighter than 1.2 mm thick.

4.11.2.9 WALL ANCHORS

Provide at least three anchors for each jamb. For frames which are more than 2285 mm in height, provide one additional anchor for each jamb for each additional 760 mm or fraction thereof.

4.11.2.9.1 FLOOR ANCHORS

Provide floor anchors drilled for 10 mm anchor bolts at bottom of each jamb member. Where floor fill occurs, terminate bottom of frames at the indicated finished floor levels and support by adjustable extension clips resting on and anchored to the structural slabs.

4.11.2.10 HARDWARE PREPARATION

Provide minimum hardware reinforcing gages as specified in ANSI A250.6. Drill and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of SDI A250.8 and ANSI A250.6. For additional requirements refer to BHMA A115. Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of SDI A250.8, as applicable. Punch door frames, with the exception of frames that will have weather-stripping or lightproof or soundproof gasketing, to receive a minimum of two rubber or vinyl door silencers on lock side of single doors and one silencer for each leaf at heads of double doors. Set lock strikes out to provide clearance for silencers.

4.11.2.11 HINGES

Exterior hinges shall have non-removable pins and be satin-chrome steel or stainless steel; Grade 1 anti-friction or ball bearing; and 3 each of 115 mm x 115 mm per leaf up to 900 mm wide door 125 mm x 125 mm for doors 900 mm to 1,200 mm wide. Interior hinges shall be Grade 1; antifriction or ball bearing; and 3 each of 115 mm x 115 mm per leaf up to 900 mm wide door 125 mm x 125 mm for doors 900 mm to 1,200mm wide. Hinges for labeled fire doors must be either steel or stainless steel. Hinges shall conform to ANSI/BHMA A156.1 and A156.7.

4.11.2.12 LOCKSETS, LATCHETS, EXIT DEVICES, AND PUSH AND PULL PLATES

Exterior doors shall have mortise locks conforming to ANSI/BHMA A156.13 for metal doors. Emergency exit devices shall be Grade 1, flush mounted type. Interior doors shall have mortise locksets conforming to ANSI/BHMA A156.13, Series1000, Grade 1. All locks and latch sets shall be the product of the same manufacturer. Locksets, padlocks and latch sets shall be provided, as required, with lever handles on each side. Provide heavy duty hasp and locks at all fuel storage tanks.

4.11.2.13 CLOSERS

Closers shall be provided on all exterior doors and fire-rated doors. All exterior doors and interior doors that require security or privacy such as toilet room shall be provided with heavy-duty hydraulic closers. Closers shall conform to ANSI/BHMA A156.4, Grade 1. Closers shall be surface-mounted, modern type, with cover. Closer shall be adjustable type and have slow-down control to prevent door leaf from slamming to frame. Provide door silencers on all door frames provided with closers.

4.11.2.14 DOOR STOPS

Door Stops: Door stops shall be provided on all exterior and interior doors. Door stops shall comply with ANSI/BHMA A156.16 and shall be satin chrome on bronze, Grade 1.

4.11.2.15 KEYING SYSTEM & LOCK CYLINDERS

Provide locks for all doors. A Master key system shall be provided. Master key system shall include a separate & different key for each door with a master key provided to open any & all doors.

Cylinders: Lock cylinders shall comply with BHMA A156.5. Lock cylinder shall have six pins. Cylinders shall have key removable type cores. All locksets, exit devices, and padlocks shall accept same interchangeable cores.

4.11.2.16 FINISHES

All surfaces of doors and frames shall be thoroughly cleaned, chemically treated and factory primed with a rust inhibiting coating as specified in SDI A250.8, or paintable A25 galvanize-annealed steel without primer. Where coating is removed by welding, apply touchup of factory primer.

4.11.2.17 WATER-RESISTANT SEALER

Provide a water-resistant sealer compatible with the specified finish as approved and as recommended by the door manufacturer.

4.11.2.18 FABRICATION AND WORKMANSHIP

Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction provided. Corner joints shall be well formed and in true alignment. Conceal fastenings where practicable. On wraparound frames for masonry partitions, provide a throat opening 3 mm larger than the actual masonry thickness. Design other frames in exposed masonry walls or partitions to allow sufficient space between the inside back of trim and masonry to receive caulking compound.

4.11.2.19 INSTALLATION

Before installation, seal top and bottom edges of doors with the approved water-resistant sealer. Seal cuts made on the job immediately after cutting using approved water-resistant sealer. Fit, trim, and hang doors with a 2 mm minimum, 3 mm maximum clearance at sides and top, and a 5 mm minimum, 6 mm maximum clearance over thresholds. Provide 10 mm minimum, 11 mm maximum clearance at bottom where no threshold occurs. Bevel edges of doors at the rate of 3 mm in 50 mm. Door warp shall not exceed 6 mm when measured in accordance with WDMA I.S. 1-A. Hang doors in accordance with clearances specified in SDI A250.8. After erection and glazing, clean and adjust hardware.

4.11.2.19.1 FRAMES

Set frames in accordance with SDI 105. Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. Backfill frames with mortar. When an additive is provided in the mortar, coat inside of frames with corrosion-inhibiting bituminous material. For frames in exterior walls, ensure that stops are filled with rigid insulation before grout is placed.

4.11.2.19.2 GROUTED FRAMES

For frames to be installed in exterior walls and to be filled with mortar or grout, fill the stops with strips of rigid insulation to keep the grout out of the stops and to facilitate installation of stop-applied head and jamb seals.

4.11.2.20 PROTECTION AND CLEANING

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is completely removed. Clean thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat. Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks.

4.11.2.21 WEATHERSTRIPPING

Provide weather-stripping that is a standard cataloged product of a manufacturer regularly engaged in the manufacture of this specialized item. Weather stripping shall be looped neoprene or vinyl held in an extruded non-ferrous metal housing. Air leakage of weather stripped doors shall not exceed 0.003125 cubic meters per second of air per square meter of door area when tested in accordance with ASTM E 283. Install doors in strict accordance with the manufacturer's printed instructions and details. Weather strip the exterior swing-type doors at sills, heads and jambs to provide weather tight installation. Apply weather stripping at sills to bottom rails of doors and hold in place with a brass or bronze plate. Apply weather stripping to door frames at jambs and head. Shape weather stripping at sills to suit the threshold.

4.11.2.22 PRE-FITTING

At the Contractor's option, doors may be provided factory pre-fit. Doors shall be sized and machined at the factory by the door manufacturer in accordance with the standards under which they are produced. The work shall include sizing, beveled edges, mortising, and drilling for hardware and providing necessary beaded openings for glass and louvers. Provide the door manufacturer with the necessary hardware samples, and frame and hardware schedules as required to coordinate the work.

4.11.2.23 FINISHES

Provide door finish colors as selected by the Contracting Officer from the color selection samples.

4.11.3 GLAZING

All glazing shall be double laminated and insulating. Laminated glazing shall be constructed of two panes of minimum 3mm annealed glass laminated to a minimum 0.75mm polyvinyl-butyral (PVB) interlayer, in accordance with UFC 4-010-01. Two panes of laminated glazing shall be installed in each window with hermetically sealed 13mm airspace between them. After installation of windows, the contractor shall install a minimum 3mil tinted film (Scotch shield Ultra Safety and Security Window Film or approved equal) to the inside face of the glazing in accordance with manufacturer’s instructions.

4.11.3.1 TEMPERED GLAZING

Tempered glass shall be kind FT fully tempered flat type. Class 1 clear, condition A uncoated surface, Quality q3-glazing select, conforming to ASTM, DIN, BS or EN standards. Color shall be clear.

4.11.3.2 GLAZING ACCESSORIES

4.11.3.2.1 SEALANT

Sealant shall be elastomeric conforming to ASTM, DIN, BS, or EN standards. Type S or M, Grade NS, Class 12.5, Use G, of type chemically compatible with setting blocks, preformed sealing tape and sealants used in manufacturing insulation glass. Color of sealant shall be as selected from manufacturer’s full range of standard colors by Contracting Officer.

4.11.3.2.2 GLAZING GASKETS

Glazing gaskets shall be extruded with continuous integral locking projection designed to engage into metal glass holding members to provide a watertight seal during dynamic loading, building movements and thermal movements. Glazing gaskets for a single glazed opening shall be continuous one-piece units with factory-fabricated injection-molded corners free of flashing and burrs. Glazing gaskets shall be in lengths or units recommended by manufacturer to ensure against pull-back at corners.

4.11.3.2.3 FIXED GLAZING GASKETS

Fixed glazing gaskets shall be closed-cell (sponge) smooth extruded compression gaskets of cured elastomeric virgin neoprene compounds conforming to ASTM, DIN, BS or EN standards.

4.11.3.2.4 WEDGE GLAZING GASKETS

Wedge glazing gaskets shall be high-quality extrusions of cured elastomeric virgin neoprene compounds, ozone resistant, conforming to ASTM, DIN, BS, or EN standards.

4.11.3.2.5 PUTTY AND GLAZING COMPOUND

Glazing compound shall conform to ASTM, DIN, BS, or EN standards for face-glazing metal sash. Putty shall be linseed oil type conforming to DIN, BS, or EN standards for face-glazing primed wood sash. Putty and glazing compounds shall not be used with insulating glass or laminated glass.

4.11.3.2.6 SETTING AND EDGE BLOCKING

Neoprene setting blocks shall be dense extruded type conforming to ASTM, DIN, BS, or EN standards. Silicone setting blocks shall be required when blocks are in contact with silicone sealant. Profiles, lengths and locations shall be as required and recommended in writing by glass manufacturer.

4.11.3.2.7 PREPARATION

Openings and framing systems scheduled to receive glass shall be examined for compliance with glass manufacturer's recommendations including size, squareness, offsets at corners, presence and function of weep system, face and edge clearance requirements and effective sealing between joints of glass-framing members. Detrimental materials shall be removed from glazing rabbet and glass surfaced and wiped dry with solvent. Glazing surfaces shall be dry and free of frost.

4.11.3.2.8 INSTALLATION

Glass and glazing work shall be performed in accordance with, glass manufacturer's instructions and warranty requirements. Glass shall be installed with factory labels intact and removed only when instructed. Edges and corners shall not be ground, nipped or cut after leaving factory. Springing, forcing or twisting of units during installation will not be permitted.

4.11.3.2.9 CLEANING

Upon completion of project, outside surfaces of glass shall be washed clean and the inside surfaces of glass shall be washed and polished in accordance with glass manufacturer's recommendations.

4.11.3.3 PROTECTION

Glass work shall be protected immediately after installation. Glazed openings shall be identified with suitable warning tapes, cloth, or paper flags, attached with non-staining adhesives. Reflective glass shall be protected with a protective material to eliminate any contamination of the reflective coating. Protective material shall be placed far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass. Glass units which are broken chipped, cracked, abraded, or otherwise damaged during construction activities shall be removed and replaced with new units.

4.12 FINISHES

All exterior and interior surfaces, including facility exterior shall be selected from or match standard RLB manufacturer's colors. Flooring shall be sheet vinyl. Provide color boards with all materials for COR approval prior to ordering materials.

4.12.1 PAINTS & COATINGS

Paints and coatings shall be provided per the UFGS Specification 09 90 00 Paints and Coatings.

4.12.2 CONCRETE HARDENER

Concrete sealers shall be a liquid chemical sealer-hardener compound. Apply a minimum of two coats. Sealer shall be compatible with climate temperatures and not reduce the adhesion of resilient flooring, tile, paint, roofing, waterproofing or other materials applied to the concrete.

4.12.3 PAINT

Paint shall be oil based or latex. A primer shall be placed prior to any coats of paint. A minimum of two (2) coats of paint shall be used for each surface. Existing painted material shall be cleaned, cracks patched, and prepared for new paint. Existing sealant shall be inspected, cleaned or removed and new sealant placed.

4.12.4 EXPOSED EXTERIOR STEEL TRIM, FRAMES, DOORS AND PIPE RAILINGS

Exposed exterior steel shall include items such as trim, frames, door, pipe rails and other exposed steel surfaces. Provide manufacturers standard baked on finish where possible. For unfinished steel items, paint with one coat oil-based primer, with 2 coats of oil-based alkyd gloss enamel, color to be selected by the Contracting Officer from the color board provided by the Contractor.

4.12.5 EXPOSED WOOD TRIM, FRAMES AND DOORS

Exposed wood shall include items such as trim, frames, doors and other exposed wood surfaces. Paint with one coat oil-based primer, 2 coats of gloss enamel, color to be selected by the Contracting Officer from the color board provided by the Contractor

4.12.6 EXPANSION JOINTS IN PLASTER & STUCCO

Expansion joints shall be provided as specified in ASTM, DIN 18339, BS or EN Standards for all walls, floors and ceilings.

4.12.7 EXTERIOR WALLS

The exterior of all buildings shall be stucco and/or plaster conforming to ASTM C926 where indicated in standard building design. A temperature of between 4 and 27 degrees C shall exist for a period of not less than 48 hours prior to application of plaster and for a period of at least 48 hours after plaster has set. Control joints shall be designed for expansion and contraction of plaster work due to thermal exposure. Control joints shall comprise of back to back casing beads. Install new stucco in 2 coats. The first coat shall be a scratch coat approximately 10 mm thick. Allow 7 days to cure. The second coat shall be finish stucco, smooth finish, approximately 10 mm thick. Allow 7 days to cure before painting. Stucco showing over sanding, cracks, blisters, pits, checks, discoloration or other defects is not acceptable. Defective plaster work shall be removed and replaced with new plaster at the expense of the Contractor. Patching of defective work will be permitted only when approved by the Contracting Officer. Patching shall match existing adjacent work in texture and color. All exterior color finish shall be integral with the stucco finish. No painted stucco shall be permitted due to minimize future maintenance.

4.12.8 INTERIOR WALLS

4.12.8.1 PLASTER WALLS

Interior walls shall be plaster applied in a similar manner as exterior stucco. Paint with 2 coats of semi-gloss off-

white with less than 0.06% lead by weight color to be selected by the Contracting Officer from the color board provided by the Contractor.

4.12.8.2 SOUND CONTROL

Walls between sleeping rooms shall have a Sound Transmission Class (STC) minimum 45-55 or better, An STC value is a single number rating used to characterize the sound insulating value of a partition (wall, floor, or ceiling). All walls shall be caulked at floor and ceiling prior to installing wall base. All openings between rooms shall be caulked or sealed. Doors shall have rubber seal around frames and threshold.

4.12.8.3 HARDENED (CMU) INTERIOR WALLS

Interior walls intended to be CMU shall be a minimum thickness of 100 mm. Interior CMU walls shall be plaster applied in a similar manner as exterior stucco. Paint with 2 coats of flat off-white paint with less than 0.06% lead by weight color to be selected by the Contracting Officer from the color board provided by the Contractor.

4.12.9 INTERIOR CEILINGS

4.12.9.1 CONCRETE CEILINGS

Concrete ceilings shall be exposed concrete painted with 2 coats of flat white, with less than 0.06% lead by weight.

4.12.9.2 SUSPENDED CEILINGS

Suspended ceilings shall be 13 mm Gypsum Wall Board (GWB) supported by metal grid system per manufacturer's standard. Fire rated GWB, where required, shall be type X per NFPA 252 requirements or approved foreign equivalent.

4.13 TILE WORK

Tile work shall not be performed unless the substrate and ambient temperature is at least 10 degrees C and rising. Temperature shall be maintained above 10 degrees C while the work is being performed and for at least 7 days after completion of work. Upon completion, tile surfaces shall be thoroughly cleaned in accordance with manufacturer's approved cleaning instructions. Acid shall not be used for cleaning glazed tile. Floor tile with resinous grout or with factory mixed grout shall be cleaned in accordance with instructions of the grout manufacturer. After the grout has set, tile wall surfaces shall be given a protective coat of a non-corrosive soap or other approved method of protection.

4.14 SPECIALTIES

4.14.1 MIRRORS

600 mm x 900 mm, 6 mm plate glass shall be mounted above all lavatories. Mount bottom of mirrors 1100 mm above finished floor.

4.14.2 TOILET PAPER HOLDERS

Toilet paper holders with removable pin shall be stainless steel, installed approximately 200 mm above floor by eastern toilets and 600 mm above floor by western toilets.

4.14.3 SHOWER CURTAIN RODS & SHOWER CURTAIN

Shower curtain rods, stainless steel, heavy duty, 1.20 mm shall be mounted between the walls of each shower stall. Mount rod 2000 mm above finished floor. Provide a shower curtain with support rings for each shower stall.

4.14.4 GRAB-BARS

Stainless steel grab-bars, heavy duty, 1.20 mm, two each 900 mm and 1050 mm long, 40 mm diameter shall be mounted behind and beside all eastern toilets, and bathtubs as they occur. Mount grab-bars between 610mm - 900 mm height on the walls. Each bar shall support no less than 91 Kg in any direction.

4.14.5 PAPER TOWEL DISPENSERS

Paper towel dispensers, 0.683 mm Type 304 stainless steel, surface mounted. Furnish tumbler key lock locking mechanism.

4.14.6 LIGHT DUTY METAL SHELF

Provide a 600 mm long x 150 mm wide, light duty stainless steel shelf with integral brackets over each lavatory and laundry sink.

4.14.7 ROBE HOOKS

Provide a minimum of two robe hooks on all toilet and shower stalls.

4.14.8 CLOTHESLINES

Fabricate clothes line assembly in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling imitations. Clearly mark units for reassembly and coordinated installation. Wire-rope assemblies (clothes line cable) shall minimize the amount of turnbuckle take-up used for dimensional adjustment so the maximum amount is available for tensioning wire ropes. Wire rope shall be nylon covered. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of ~1 mm, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces. Form work true to line and level with accurate angles and surfaces. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate. Cut, reinforce drill, and tap as indicated to receive finish hardware, screws, and similar items. Welded connections: cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

5.0 MECHANICAL

5.1 GENERAL

Provide complete heating, ventilating and air-conditioning (HVAC) systems. Where systems and equipment are fully designed and specified in the appendix drawings, provide in strict accordance with the Standard Design drawings. Where any system or equipment is not fully designed or specified, provide the necessary engineering services to complete the design.

5.2 HVAC INSTALLER QUALIFICATIONS

The HVAC works shall be executed by a heating and cooling specialist experienced in the design and construction HVAC equipment to include conventional refrigerant systems, heat pump units, space heaters and knowledge in fabricating specialized units consisting of supplemental electric resistance heaters in satisfying the specified indoor design conditions.

5.3 STANDARD PRODUCTS

All materials and equipment shall be standard products of manufacturers regularly engaged in the manufacture of the product and shall duplicate products that have been in satisfactory use for at least two (2) years prior to bid opening.

The Contractor shall submit the following for equipment to be provided under this section of the specification: Manufacturer’s data including performance characteristics at design conditions; Catalog cuts showing dimensions,

performance data, electrical requirements, compliance with the codes, standards and regulations; Drawings, as necessary, indicating location and installation details.

5.4 CODES, STANDARDS AND REGULATIONS

The design and installation of all HVAC systems shall conform to the standards, codes, and regulations provided in the paragraph, List of Codes and Technical Criteria, where applicable, except where otherwise indicated under particular clause(s). The publications to be taken into consideration shall be those of the most recent editions and primarily in accordance with the American Society of Heating, Refrigeration, and Air-Conditioning (ASHRAE). Standards other than those mentioned may be accepted provided that the standards chosen are internationally recognized and meet the minimum requirements of the specified standards. The Contractor shall submit proof of equivalency if requested by the Contracting Officer.

5.5 EQUIPMENT PROTECTION

Provide exterior pad-mounted mechanical equipment with either protective fences and concrete-filled steel bollards or protective screen walls to prevent accumulation of debris and vandalism.

5.5.1 OUTDOOR DESIGN CONDITIONS

Contractor shall use the below weather data for equipment compatibility with the site conditions). The Outdoor Design Conditions given are for purposes of sizing HVAC equipment. Generators shall be designed to operate in an ambient Temperature of 50 Degrees Celsius due to annual maximum temperature as well the loss of performance due to dusty conditions and less than ideal installation conditions.

[Herat Area:]

Latitude – (approx.) 34.22 deg. North

Longitude – (approx.) 62.22 deg. East

Elevation – (approx.) 964 m (3,163 ft)

Summer – 38 C (100 F) Dry Bulb (DB) & 20 C (68 F) Wet Bulb (WB)

Winter – (-6 C/21 F)

Daily Range – 9 C (17 F)

5.5.2 INDOOR DESIGN CONDITIONS

Facility Type	**Summer Temperature**	**Winter Temperature**
Headquarters / Administration Buildings	Communications room only: Cooling 25 C (78 F)	Heating 20 C (68 F)
Barracks	No Cooling	Heating 20 C (68 F)
Latrines	No Cooling	Heating 20 C (68 F)
Training Building	No Cooling	Heating 20 C (68 F)
DFAC	No Cooling	Heating 20 C (68 F)
POL Storage Building	No Cooling	Heating 20 C (68 F)

Facility Type	Summer Temperature	Winter Temperature
Fuel Operator's Building	No Cooling	Heating 20 C (68 F)
Guard Towers	No Cooling	Heating 20 C (68 F)
Guard House	No Cooling	Heating 20 C (68 F)
Booster Pumps	No Cooling	Heating 13 C (55 F)
Small Arm Storage	No Cooling	Heating 20 C (68 F)
Vehicle Maintenance Building	No Cooling	Heating 20 C (68 F) in Offices Heating 13 C (55 F) in Maintenance Areas
Well House	No Cooling	Heating 13 C (55 F)
Storage Buildings / Warehouses	No Cooling	Heating 20 C (68 F); Offices Only

Warehouses , storage buildings and vehicle maintenance bays shall be provided with ventilation to maintain the indoor conditions to 10 F above the summer ambient DB temperature.

5.5.3 NOISE LEVEL

Noise levels inside occupied spaces generated by HVAC systems indoors shall not exceed NC 35.

5.5.4 INTERNAL LOADS

Occupancy: ASHRAE standards shall be used to calculate sensible and latent heat from people. In general, light/moderate office work is 73 W (250 Btuh) sensible and 45 W (155 Btuh) latent.

Lighting: 21.5 W/sq.m (2 W/sq.ft) maximum (however lighting levels shall meet minimum requirements and shall be accounted for in the cooling loads based on the actual lighting design).

Outdoor Air: Outdoor ventilation air shall be provided per ASHRAE Standard 62.1. Minimum outside ventilation requirements for offices and bedroom sleeping quarters shall be 2.5 lps/person (5.3 cfm/person) plus 0.3 lps/sq.m of floor space (0.6 cfm/sq.ft). Outdoor air requirements can be satisfied by windows that open to the outside. Enclosed occupied areas without windows shall have outside air ventilation rates based on occupancy using the formula above in combination with a means for providing outside make-up air by means of forced-air outside air ventilation systems or forced-air exhaust systems.

Communication (Comm) Rooms: Comm rooms containing computer servers and other heat-producing electronic equipment shall be provided with independently controlled cooling. See Electrical for comm room equipment requirements.

Toilet/Shower Exhaust: 85 cmh (50 cfm) per toilet, urinal, and shower head.

Ablution Exhaust: 35 cmh/sq.m (2 cfm/sq.ft).

Building Pressurization: 1.3 mm wg (or 12,5 Pa or 0.05" wg); Maintain negative pressure in latrine areas. Pressurization is only applicable for buildings provided with central ducted forced air systems

5.6 HVAC EQUIPMENT

The Contractor shall size and select all heating and cooling equipment based on equipment manufacturer's performance data for the project site location and elevation.

5.6.1 EXTERIOR HVAC EQUIPMENT

For exterior pad-mounted mechanical equipment, provide protective fences, concrete-filled steel bollards, and/or protective screen walls to prevent vandalism and damage by natural elements.

5.6.2 AIR COOLING & HEATING EQUIPMENT

Environmental control of the facilities shall be achieved by HVAC equipment as listed below and approved by the U.S. Government. Contractor shall size and select equipment based on equipment manufacturer's performance data at the project site elevation and temperature conditions and ensure the equipment's performance meets the design heating and cooling sizing requirements. The following table represents, as a minimum, facility-specific system requirements and does not limit the applicability of general system requirements stated elsewhere in this specification.

* Indirect-tempering of outside make-up air shall be accomplished by locating heating and/or cooling equipment in close proximity to outside air louvers (fitted with filters, screens, and dampers as a minimum) for minor conditioning of raw outside air.

5.6.3 CONTROL WIRING AND PROTECTION DEVICES

HVAC controls shall be products of the equipment manufacturers and shall be installed in accordance with the manufacturers' recommendations. Thermostats of individual units shall be located near the unit return intakes; thermostats of units serving multiple areas shall be located near the return of the space with the highest heat generation. For each thermostat, provide a lockable housing that allows viewing of settings without permitting access. Thermostats shall be mounted 1.5 meters (5 feet) above the finished floor and shall be easily accessible.

5.6.4 EQUIPMENT FANS

All HVAC fans shall be heavy-duty centrifugal forward curved, backward inclined, or airfoil fans with overload protection. Each fan shall be provided complete with vibration isolator, external lubricators, individual wall on/off switches, and all accessories as necessary and indicated.

5.6.5 CEILING FANS

Ceiling fans shall be 5-bladed, 1320 mm (52"), minimum, in diameter, and provided at one 40 sq.m of floor space, or as indicated. Fans shall have reversible motors. Fans shall be centered or distributed evenly throughout the room. Coordinate placement with the lighting plan to prevent conflict or casting shadows. Fan mount shall be flush, standard, or angle mount depending on ceiling height. Fan shall be mounted such that the fan blade is a minimum 2.5 m (98") above the finished floor. The fans shall be provided without light kits. The finish shall be factory painted white. The controls shall be wall-mounted from either a single pole switch or from two (2) 3-way switches to provide on/off operation. Install per manufacturers' instructions.

5.6.6 UNIT HEATERS

Provide commercial, self-contained unit heaters with fans and heating elements. Heating elements shall be nickel chromium and shall have overload protection. Unit heaters shall have integral thermostats.

5.7 AIR TRANSFER SYSTEMS

5.7.1 DUCTWORK

Ductwork systems include ductwork, fittings, manual volume control dampers, grills, and/or registers. Ductwork shall be constructed of galvanized steel or aluminum sheets and installed in accordance with SMACNA "HVAC Duct Construction Standards (Metals and Flexible).

5.7.2 DUCT INSULATION, VAPOR BARRIER, AND JACKETING

Duct insulation shall be provided for all makeup air ductwork that is located in the conditioned space. All ductwork exterior to the building shall be insulated with a minimum RSI=0.88 (R5).

Makeup air duct systems shall be provided with vapor barrier protection to prevent condensation. Insulation exposed to weather or physical damage shall be protected with aluminum jacketing.

5.7.3 REGISTERS AND GRILLES

Registers and grilles shall be factory fabricated of steel or aluminum and distribute the specified air quality evenly over the space intended. The devices shall be square, rectangular, or with perforated face. Units will be mounted in ceilings, high sidewalls, or directly to ductwork and shall be sized for the airflow to be delivered with a maximum NC rating of 35.

5.7.4 AIR FILTRATION

All supply air shall be filtered using manufacturer's standard washable filters mounted inside the unit. In addition, all outdoor air intakes shall be equipped with 50 mm (2 inch) thick washable filters. Outdoor air intakes shall be installed as high as is reasonably possible in order to minimize dust entrainment. The intakes shall be sized so that free air velocities are below 2.5 m/s (500 fpm).

5.7.5 WALL PENETRATIONS

Building wall penetrations for fans, exhaust duct, vents, louvers, etc. shall be carefully made so as not to deteriorate the structural integrity of the wall system. The Contractor is encouraged to locate exterior wall louvers above doors, whenever possible, to take advantage of the structural framing void located above doors. The Contracting Officer shall be consulted and the recommendations strictly adhered to.

5.7.6 OUTSIDE AIR INTAKE, MAKE-UP, AND EXHAUST LOUVERS

Outside air louvers shall be factory fabricated of steel, stainless steel, or aluminum and allow the specified air quantity into the intended space. Louvers shall be square or rectangular with rain-proof exterior face blades and internal grille. To reduce sand and dirt migration, outside air intakes shall be installed as high as possible within architectural constraints or a minimum of 1.5 m (5') above the ground. Consideration shall be given to locating the louvers near the heating and cooling units (for indirect tempering of air) and encourage air flow across the room in conjunction with the exhaust fan. Outside air intake louvers shall be provided with air filter (See Air Filtration), insect screen, and, if indicated, motorized dampers interlocked to open when the toilet-shower room exhaust fans operate. Minimum louver dimensions shall be 300 mm x 300 mm (12" x 12") on the exhaust fans and submitted in the design analysis (DA) calculations.

All supply air shall be filtered using manufacturer's standard washable filters mounted inside the unit. In addition, all outside make-up air intakes shall be equipped with 50 mm (2") thick washable filters. Control wiring and protection of the air conditioning units shall be the manufacturer's standard, pre-wired factory installed or as recommended.

5.7.7 VENTILATION & EXHAUST FAN SYSTEMS

All fans used for building ventilation, exhaust, and pressurization shall be selected for minimum noise level generation. All fans used for supply or roof/wall exhaust, including toilets, showers, and ablutions, shall be **centrifugal** forward curved, backward inclined, or airfoil fans with non-overloading characteristics of high efficiency and quiet running design. The fans shall be of the heavy-duty type with durable construction and proved performance in a desert environment. Each wall exhaust fan shall be provided with motorized or gravity dampers which close automatically when the fan is not running. Each ventilation or intake air fan shall be provided with an interlocked motorized damper which closes automatically when the fan is not running and shall be sized for and provided with filter and insect screen. Each fan shall be provided complete with vibration isolator, external lubricators, individual wall on/off switches, and all accessories and sound attenuators as necessary.

Intake or outside make-up air openings for exhaust fans shall be provided with motorized dampers which are interlocked with the exhaust fans and provided with air filters and insect screens. The motorized dampers shall open

or close when the ventilation or exhaust fan is on or off respectively. Louvered openings for ventilation or exhaust fan systems shall be sized for a maximum static pressure (SP) drop (that includes filter resistance) of 25 Pa (0.10" wg) to prevent excessive negative pressurization of the building. **Exterior outside door louvers and undercuts are not permitted except under special circumstances.**

Maintenance shops and similar spaces that use solvents and oils shall be provided with mechanical exhaust air systems. Intake or outside make-up air openings for an exhaust fan system shall be provided as indicated above. The exhaust systems shall consist of a fan, ductwork, exhaust grills, and interlock controls. Design shall be in compliance with the latest addition of the Industrial Ventilation UFC 3-410-04N or ACGIH Industrial Ventilation manual.

All occupied windowless rooms, without connections to a ducted central HVAC system (or without an avenue for obtaining outside ventilation air) shall be provided with forced-air outside air ventilation systems or forced-air exhaust systems.

5.7.8 WALL TRANSFER GRILLES

Wall penetrations for air transfer between two spaces shall be provided with a factory fabricated grille on both the inlet and outlet sides of the opening. For fire-rated walls in accordance with NFPA-90A with air transfer penetrations, fire dampers shall be installed between the inlet and outlet grilles.

5.8 SPECIAL SYSTEMS

5.8.1 KITCHEN HOOD EXHAUST AND MAKE-UP AIR

Provide a commercial kitchen exhaust hood and make-up air system in strict accordance with the appendix drawings. The installation shall be in accordance with NFPA 96, SMACNA, and equipment manufacturer recommendations. The exhaust hoods shall be selected for Type I (grease smoke) operation and shall be provided with baffle grease filters. The hoods and all associated ductwork shall be constructed from 1.0mm (20-gauge) stainless steel material.

All exhaust duct joints and seams shall be continuously welded or brazed. Brazing and supports shall be constructed of non-combustible material securely fastened to the structure. Bolts, screws, rivets, and other fasteners shall not penetrate the duct walls. Ducts shall be placed a minimum of 450mm (18 inches) from combustible material or 75mm (3 inches) from gypsum wallboard attached to non-combustible structures. Ductwork terminating through the roof shall extend a minimum of 450mm (18 inches) above the roof. Ductwork shall be pitched to drain back to the hood.

The roof-mounted centrifugal exhaust fan shall be the upblast type with fan motor located outside the airstream. The fan discharge shall be a minimum 1000 mm (40”) above the roof and shall not impinge on other equipment or nearby building surfaces. The fan shall be manufactured in such a way as to permit easy inspection and cleaning. The connection between ductwork and exhaust fan shall be flanged, gasketed, and bolted. The exhaust fan shall be electrically interlocked with its corresponding makeup air fan to prevent system operation without both fans in service.

The make-up air grille shall be integral with the hood system as detailed in the appendix drawings.

5.8.2 LPG/PROPANE STOVE EXHAUST

Each LPG/propane stove shall be provided with a dedicated chimney as indicated. The minimum flue thickness for metal chimneys shall be not less than 1.5 mm (16-gauge) thick steel. High temperature metal flues shall be guarded against human contact and protected from potential damage from large cooking pots by means of metal guards or masonry walls. All metal chimney flues shall be insulated and be sized as indicated for the stove flue gases to keep warm and flow quickly through the system. The chimney shall run straight up without offsets because each change in direction presents resistance to flow. The chimney system shall be reasonably well-sealed to prevent leaks that introduce cool air and make the system more vulnerable to adverse pressures. The LPG/propane stove kitchen shall be well vented with louvers located high on the walls on the building ends as indicated. The Contractor must submit shop drawings for approval.

5.9 WOOD COOKING STOVES FOR DINING FACILITIES

A separate wood burning cooking stove kitchen annex building shall be provided within the DFAC yard with commercial grade built-in-place wood-fired cooking stoves. The annex shall be located adjacent to the kitchen as indicated. The annex shall be provided with a concrete slab, a sloped metal or concrete roof slab, and a minimum of three (3) reinforced CMU walls. Walls shall have a minimum height of 3.0 m (10') from floor to finished ceiling). The wood stove kitchen shall be well vented with louvers elevated a minimum of 1.5 m (5') on the end or side walls. Exhaust fans shall NOT be provided because of the effects on the chimney draft. A covered wood storage area, equal to a minimum of 0.3 cu.m (10 cu.ft) of volume per stove, shall be provided for rain shielding. Security fencing with gates with locks shall be provided around the entire annex kitchen complex.

The annex kitchen concrete floors shall be provided with trench drains that extends the length of the cooking area for cleaning purposes. Water service shall be provided for the cooking annex. Water piping shall be buried to prevent pipe freezing. Freeze-proof yard hydrants (where the actual valve is located below the frost line) shall be provided.

The kitchen annex shall be provided with power for light fixtures, receptacles, and other electrical devices required for a complete functional facility, see Electrical.

5.9.1 STOVES

(4) Four stoves shall be constructed from masonry fire bricks and cooking stove tops shall be wide enough for a person to walk and accessible by small movable stairs. The stove firebox shall be shaped to maximize the heat absorbed by the cooking pots above and lined with an 15 mm (1/4") cast-iron insert to protect the fire brick. A 40 mm (1.5") toe space shall be provided for the entire interior length of floor in front of the stove lineup.

The minimum height of the stove shall be 950 mm (37") with a minimum stove-to-finished-ceiling clearance of 2.0 m (80"). Stoves shall be topped with a minimum 50 mm (2") thick cast-iron plate. The cast-iron stove top shall be a minimum of 1,000 mm x 1,000 mm (40" x 40") square with a 750 mm (30") diameter hole in the center to accommodate a similar diameter stove plate insert. The 750 mm (30") metal insert shall also have a 450 mm (18") diameter hole in the center that accommodates a second smaller stove plate insert. The second insert shall have a 250 mm (10") diameter hole in the center that accommodates a final stove plate insert.

A minimum 25 mm (1") thick cast-iron fire grate (grid plate or fire basket) shall be provided in the wood firebox not less than 100 mm (4") nor more than 150 mm (6") above the firebox floor . The fire grate grill spacing shall not be less than 50 mm (2"). The wood feeding and ash removal doors shall be located on the exterior. The doors shall be constructed of not less than 7.0 mm (1/4") thick steel and provided with 40 mm (1.5") thick metal frames. One (1) exterior wood loading door shall have at least one (1) smaller peek door on the door itself that is approximately 100 mm x 100 mm (4" x 4").

5.9.2 STOVE CHIMNEYS

Each stove shall be provided with a dedicated chimney routed inside the building envelope (or kitchen space) for the maximum allowable distance; hotter exhaust gases produce better chimney drafts. The main chimney shall be constructed using a stainless steel vent (or flue) enclosed with face brick. The face brick shall protect the user from accidental human contact and the metal flue from potential damage from large cooking pots; metal rails may be provide with approval. The minimum flue diameter shall not be less than 200 mm (8") diameter and thickness shall not be less than 3.0 mm (12-gauge). Chimneys penetrating and exiting through walls shall be provided with a 16 mm (5/8") thick steel lentil and exterior escutcheon type pipe sleeve for wall anchoring. All exterior portions of a chimney that exits through a wall shall be double-wall stainless steel with a minimum 25 mm (1") gap filled with fire-proof insulation.

All chimneys shall rise a minimum of 60 cm (24") above the roof ridge so a stable draft can be produced. In addition, the chimney shall be provided with rain cap to reduce the chances of adverse wind pressures. The chimney system shall be reasonably well-sealed to prevent leaks that introduce cool air and make the system more vulnerable to adverse pressures. When the chimney system is installed in a building kitchen with a fan powered exhaust and ventilation systems, the wood stove area shall be under positive pressure to facilitate the chimney draft. Contractor must submit shop drawings for approval prior to starting construction.

5.9.3 MECHANICAL REQUIREMENTS FOR GENERATORS

Note: The full specification for the generator consists of this section, Mechanical Requirements for Generators, in combination with Generator Power System-Electrical Requirements for Generators specification found in the Electrical portion of this Section 01015.

The following shall be provided in the Mechanical design and installation for prime stationary generator sets and related mechanical systems with their interface with the facility. This includes, but not limited to, the following: Foundations, mountings, exhaust systems, cooling systems, ventilation, noise attenuation, and equipment configuration. See Electrical Section for power and electrical equipment requirements and Plumbing Section for fuel system requirements.

The generator set(s) shall be the manufacturer's design for outdoor weatherproof installation with skid-mounted high-ambient temperature radiator rated for 50 C (120 F).. Weatherproof generator set(s) shall be protected from the elements with a structural cover as indicated.

Heating devices for the generator set engine coolant and starter batteries shall be provided as per manufacturer's recommendation for cold starting. Ambient temperature and elevation derating calculations shall be clearly shown in the design analysis (DA).

Generator noise levels shall be based on the location and operating at 100% load. All generator sets, irrelevant where installed, shall be provided with the manufacturer's factory installed sound attenuation enclosure cabinets, the manufacturer's integral muffler system, as a minimum, to reduce noise.

All exterior installed generator sets (i.e. With three or fewer walls) shall be provided with, as a minimum, the manufacturer's factory installed weather-proof enclosure cabinet, the manufacturer's integral muffler system, vibration isolators, and vibration isolating foundation to reduce noise and prevent damage to the overhead structure. Generator set(s) shall be oriented with the prevailing winds when possible (with the alternator upwind) to promote heat removing air flow across the alternator and engine by the radiator fan.

All exterior weather-proof generator sets shall be provided with a covered structure and enclosed with a chain link security fence]. A structural cover shall also be provided over the generator accessories (i.e. Switch gear, etc.) [and bulk fuel storage tank(s)] [if the total fuel capacity is 38,000 l (10,000 gal) or less]. The overhead structure shall have a minimum clearance of 2.0 m (6.5’) above the equipment and extend out with a minimum overhang of 1.0 m (40”) beyond the equipment and any spill containment dikes.

Exterior exhaust system shall be with minimal backpressure, directed to disperse the noise away from people and occupied buildings, and located near the radiator air discharge.

For fuel and day tank requirements, see Plumbing paragraph, "GENERATOR FUEL STORAGE/DISTRIBUTION."

For fire emergencies, see Fire Protection paragraph, "PORTABLE FIRE EXTINGUISHERS."

Generator set(s) shall be oriented with the prevailing winds when possible (with the alternator upwind) to assist ventilation air flow across the alternator and engine and promote heat removal by the fan and radiator. All weather-proof generator sets and fuel storage tanks shall be provided with a covered (roof-only) structure enclosed with a chain link security fence. Covered structure shall have a minimum clearance of 2.0 m above the equipment.

5.10 TEST ON COMPLETION

Upon completion of the work, the Contractor shall demonstrate to the Contracting Officer that the installation is adjusted and regulated correctly to fulfill the function for which it has been designed. The Contractor shall test, adjust, balance and regulate the section or sections of concern as necessary until the required conditions are obtained. Contractor shall coordinate with the Contracting Officer to schedule the tests. Tests shall include all interlocks, safety cutouts, and other protective devices to ensure correct functioning. All such tests shall be carried out with full written records of the values obtained and the final settings. All test results shall be submitted to the Contracting Officer in tabulated form. The following tests and measurements shall be performed:

Outdoor Conditions:	DB and WB temperatures
Indoor Conditions:	DB and WB temperatures

Heat Pumps and Unit Heaters:	Fan motor speed and input ampere reading
	Supply and return air temperature.
Ducted Make-Up Air Heaters:	Fan motor speed and input ampere reading
	Air flow rate
Exhaust Fans:	Fan motor speed and input ampere reading
	Air flow rate

5.11 WOOD STOVE HEATERS

Contractor shall provide Wood Stoves for heating in accordance with all requirements of Section 01015 including clearance to combustibles, heating unit criteria, venting and manufacturers requirements. Provide wood stoves for room heating in all occupied spaces larger than 8 m^2 in floor area as is indicated in Appendix drawings. Do not install wood stoves for room heating in wet areas, such as latrines, ablution or laundry rooms. Do not install wood stoves for room heating in spaces that require tighter control of temperature such as communication rooms, ammunition storage, secure storage and critical spaces in medical facilities. Do not provide wood stoves for room heat in locations that require mechanical cooling. Mechanical cooling is achieved by equipment that requires a compressor and refrigerant, ventilation and air movement equipment such as ceiling fans and exhaust fans are not considered mechanical cooling.

Wood stoves for room heating shall be standalone type wood stoves, they shall not be recessed or connected to any part of the building structure other than non-combustible floor surface. Wood stove heaters shall have both a chimney and combustion make-up air. In no case, shall a wood stove heater receive combustion air from the room or interior space without the room receiving make-up air directly from the outside. All wood stove heaters shall be made of cast iron with fire brick interior. All wood stove heaters shall be manufactured in accordance to UL or EN standards. In no case, will a “homemade” or site built wood stove heater be accepted. The chimney vent shall penetrate through the wall at all wood stove locations. For a roof penetration, the contractor shall submit written request to USACE engineering no later than at 65% design submittal, approval shall be in writing from USACE, until written approval is received from USACE, the contractor shall not assume the roof penetration is approved. The chimney venting shall pass through a wall thimble at least 24” above stove flue collar connection. Chimney venting shall meet UL 103 High Temperature or as required by manufacturer. The chimney shall be routed up the exterior side of the wall of the building and shall clear eve and terminate as required by manufacturer installation requirements. The rain cap shall not have any moving parts or hinges, field installed dampers are not allowed at any location within the chimney duct. The only acceptable damper is a wood stove manufacturer installed damper.

Clearance to Combustibles: The wood stove heater shall be located on a non-combustible surface with clearances to combustibles as required by manufacturer. All venting shall maintain clearance to combustibles as required by manufacturer and the IMC and UL or EN standards. The Contractor shall submit drawings showing clearances along with cut sheets of stove and venting at 65% submittal.

6.0 PLUMBING

6.1 GENERAL

Provide complete plumbing systems. Where any system or equipment is not fully designed or specified, provide the necessary engineering services to complete the design.

The Contractor shall design and build domestic cold and hot water systems, waste, drain and vent systems, fuel-oil storage and distribution systems required in the facilities identified in Section 01010 Scope of Work and as described herein. The Contractor shall also be responsible for complete design and construction of all domestic and special plumbing systems required for full and safe operations in the Generator Plant, Water Storage and other facility or structures required in this contract.

The work covered in this scope also includes the delivery to site, erection, adjusting, testing and balancing, and handing over in full operating condition all equipment and associated works.

6.1.1 QUALIFICATIONS

The plumbing systems shall be executed by a specialist experienced in the installation of these systems.

6.1.2 STANDARD PRODUCTS AND SUBMITTALS

All materials and equipment shall be standard product of a manufacturer regularly engaged in the manufacture of the product and shall duplicate items that have been in satisfactory use for at least two (2) years prior to bid opening.

The Contractor shall submit the following for equipment to be provided under this section of the specification: Manufacturer's data including performance characteristics at design conditions; Catalog cuts showing dimensions, performance data, electrical requirements, compliance with the codes, standards and regulations; Drawings, as necessary, indicating location and installation details.

6.2 CODES, STANDARDS AND REGULATIONS

The design and installation of equipment, materials and work covered under the plumbing services shall conform to the standards, codes, and regulations provide in the paragraph, List of Codes and Technical Criteria, where applicable except where otherwise indicated under particular clause(s). The publications to be taken into consideration shall be those of the most recent editions and primarily in accordance with the ICC International Plumbing Code (IPC) and ASHRAE Handbook-HVAC Applications for Service Water Heating. Standards other than those mentioned may be accepted provided that the standards chosen are internationally recognized and meet the minimum requirements of the specified standards. The Contractor shall submit proof of equivalency if requested by the Contracting Officer.

6.3 EQUIPMENT PROTECTION

Exterior plumbing equipment shall be pad-mounted. In addition, security fences and traffic bollards, designed overhead structure/shelters for exterior generators, and 45-kg LP gas-propane tank storage areas shall be provided.

6.4 PLUMBING SYSTEMS

6.4.1 WATER

Domestic cold and hot water shall be provided in the facilities to serve the water usage and plumbing fixtures provided for the facility. Water service to each facility shall enter the building in a mechanical, toilet, storage, or similar type space. A pressure reducer shall be placed at the water entry if the supplied pressure exceeds 80 PSI. The building service line shall be provided with a shut off valve installed either outside in a valve pit or inside the mechanical room or similar spaces. Water piping shall not be installed in or under the concrete foundation except for the service line. All water piping shall be routed parallel to the building lines and concealed in all finished areas. Insulation shall be provided where required to control sweating of pipes or to provide protection from freezing. Electric heat trace cable for freeze protection shall not be provided as a substitute for space heating systems.

6.4.1.1 PIPING MATERIALS

Domestic cold water shall be distributed by means of standard weight schedule 40 galvanized steel pipe, Polyvinyl Vinyl Chloride (PVC) or Polyethylene (PE) (ASTM D 2737) plastic piping. Domestic hot water shall be distributed by means of standard weight schedule 40 galvanized steel pipe, or Chlorinated Polyvinyl Vinyl Chloride (CPVC) piping. Domestic water joints shall be connected using either solvent cement or mechanical threads. Polypropylene (PP) pipe is not permitted for either domestic hot or cold water piping.

Waste and vent piping shall be either galvanized steel pipe (schedule 40) or Polyvinyl Vinyl Chloride (PVC) conforming to ASTM D 2665. Flexible waste and vent lines from fixtures (i.e. lavatories, water closets, etc.) and inserted into an adjacent pipe are not allowed except for clothes washer installations.

Corrosion protection shall be provided if galvanized piping comes in contact with earth or masonry floors, walls or ceilings. The Contractor shall attempt to route all piping beyond the grasp of the occupants. All exposed domestic water, sanitary waste, and vent piping shall be schedule 40 galvanized steel when surface mounted. Wall-mounting

brackets for exposed domestic water, waste, and vent piping shall be spaced a maximum of 40 cm (16") apart to minimize vandalism.

6.4.2 PLUMBING FIXTURES

The following typical plumbing fixtures shall be provided:

a. Eastern Water Closet shall be provided with flush tank assembly. Provide acid resisting ceramic water closet complete with rotating No-Hub 'P' trap and No-Hub coupling to meet piping requirements. Eastern Style water closet shall be furnished with integral non-skid foot pads and bowl wash down non-splashing flushing rim. The water closet shall be completely self supporting requiring no external mounting hardware and shall be flush with floor. The Eastern Style water closet shall incorporate waterproofing membrane flashing flange. Provide a cold water spigot 300mm above finished floor on the right (from a perspective of standing inside of the cubicle and looking out) sidewall of the cubicle. Spigot shall have a flexible hose and spray nozzle such that the occupant can wash over the water closet. Toilets shall be oriented north and south. Toilets shall not face east or west.

b. Lavatories. All sinks shall be trough type constructed of block and concrete with ceramic tile exterior and lining capable of withstanding abuse. Provide maintenance access to waste piping and P-traps from under the sink. Trough-type sink faucets shall be similar to service (mop or janitor's) sink faucets with one-piece brass body construction, fixed short integral spout, hot and cold water manual mixing valves, and capabilities for withstanding abuse. Lavatories inside the prison cells shall be tamper-proof with integral spout, soap depression, and outlet connection to slip 40mm OD tubing.

c. Sink Faucets. LN faucets shall be chrome plated brass or bronze alloy with hot and cold water valves for manual mixing. Faucet handles shall be chrome plated brass or bronze alloy. No goose neck faucet fixtures shall be used. Fixtures shall have flow restrictors not to exceed 4.0 lpm (1.0 gpm) (Note: Provide flow restrictor to achieve designated flow at available water pressure)

d. Service (Mop or Janitor’s) Sinks. Floor mount janitor, enameled cast iron with copper alloy rim guard. Provide hot and cold water valves with manual mixing. Faucet handles shall be copper alloy. Include a stainless steel shelf and three mop holders.

e. Shower. Showerhead and faucet handles shall be stainless steel prison grade for LN facilities and regular stainless steel for coalition facilities. Provide hot and cold water valves for manual mixing. In addition to a shower head, provide each shower stall with a threaded faucet approximately 1.2 m above finished floor with hot and cold-water controls, mixing valve and a diverter type valve so water can be directed to either the shower or to the lower faucet. Shower shall be provided with low flow shower head. The shower head shall be heavy duty type and securely fastened to the wall.

f. Emergency Shower and Eye Wash Assembly. Provide emergency shower and or eye wash assembly in Power Plant and in other facilities where appropriate. Provide a floor drain in the area, if appropriate (where emergency water flowing on the floor may lead to additional safety or operational complications).

g. Kitchen Sink. Sinks shall be corrosion resisting formed stainless steel. Faucet bodies and spout shall be cast or wrought copper alloy. Handles, drain assembly, and stopper shall be corrosion resisting steel or copper alloy.

h. Ablution Trench. Provide trench drains, as indicated on drawings, with brass grating and strainer. Provide each station with hot and cold water valves with manual mixing. Faucet handles shall be copper alloy.

i. Grease Interceptor (Exterior only). Shall be steel construction manual cleaning type with removable checker-plate cover complete with flow control valve. Tested and rated in accordance with PDI G-101. Concrete shall have a minimum compressive strength of 21 MPa (3045 psi) in 28 days (kitchen use only).

j. Floor Sink: Provide floor sink, circular or square, with 300mm overall width or diameter and 250mm nominal overall depth. They shall have acid resistant enamel interior with cast iron body, aluminum sediment bucket and

perforated grate of cast iron. Outlet size as indicated on plans.

k. Floor or Shower Drain: Cast iron construction with galvanized body, integral seepage pan, and adjustable perforated or slotted chromium plated bronze, nickel-bronze, or nickel brass strainer consisting of a grate and threaded collar. Toilet room floor drains are similar except are provided with built-in, solid, hinged grate.

l. Trench Drains: Floor trench shall be concrete construction with a cast iron grate. The cast iron grate shall be sectionalized and hinged so that it can easily be opened to clean out the trench. Iron grates shall be fabricated in sections in length not greater than 1500 mm. The floor trench shall be provided with perforated aluminum pan inserts which can be removed to clean out large food particles. The floor trench drain shall be adjustable perforated or slotted chromium plated bronze, nickel-bronze, or nickel brass strainer consisting of a grate and threaded collar. This style of floor trench shall be installed in the kitchen area of the DFACs in response to kitchen cleaning practices of the local national staff.

m. Room hose bibs and floor drains shall be provided as required. Afghan dining facility kitchen area clean-up hose bib to be supplied with connecting hose on reel including approximately 12 meters of hose. Provide clean-up spray nozzle with hose assembly.

n. Provide P-Traps per International Plumbing Code IPC for all fixture drains, floor and trench drains, and shower drains. P-traps shall have minimum of 50 mm water seal.

o. Large Pot sink, provide clean-up spray nozzle with hose assembly.

6.4.3 HOT WATER

Where domestic hot water systems are required to be designed by the Contractor, design these systems to supply 50°C (120°F) hot water to fixtures and outlets requiring hot water. Water of a higher temperature, 60 C (140 F) and above, shall be provided for special uses or processes as in kitchens (except hand wash lavatories) and for sterilization. All hot water piping shall be insulated. A hot water re-circulating pump shall be provided if hot water piping run exceeds 30 m (100). All water heaters shall be set to generate/store hot water at no less than 60 C (140 F).

6.4.3.1 WATER HEATERS

Domestic hot water shall be generated by electric water heaters (WHs). All WHs shall be factory insulated. Each water heater shall be equipped with a vacuum relief valve and temperature and pressure (T&P) relief valve that discharge into a nearby floor drain; discharge piping shall terminate 50 mm (2") above the floor drain. The larger floor-mounted unit(s) shall be typically located inside a mechanical room, storage room, toilet/janitor room or similar type space. Smaller wall-mounted units may be located in toilet-lavatory areas for single remote water closets. Multiply water heaters (two or more) shall be of equal size and connected by common inlet and outlet manifolds in a "reverse return" configuration to ensure equal flow and drawdown rates. All floor-mounted WHs shall be elevated on a 100 mm (4") raised concrete pads. In cases where the pressure of the water system violates the manufacturer’s recommendations, a pressure reducer shall be installed in the line before the water heater.

Water heater storage capacity (liters) and recovery capacity elements (kW or liters per hour) shall be sized in accordance with ASHRAE Fundamentals Handbook-HVAC Applications, "Service Water Heating." Provide water heater sizing according to the following chart:

Building Type	ASHRAE Category
Barracks, Latrine	Hotel
HQ, Administration	Office
DFAC	Hotel

The unit(s) capacities shall be for commercially available tank and electric heating element sizes.

6.5 WASTE, DRAIN AND VENT SYSTEM

6.5.1 GENERAL

Every trap and trapped fixture shall be vented in accordance with the IPC. In order to minimize vent piping, incorporate either "Circuit Venting," "Combination Drain & Vent," or "Wet Venting" options systems in accordance with the IPC.

6.5.2 DESIGN CONSIDERATIONS

The Designer shall have in mind a vent option (i.e. Fixture Venting, Circuit Venting, Wet Venting, etc.) before designing the route of the waste line(s) in a building in order to comply and avoid inconsistencies with the IPC. Vent piping shall not be routed horizontally under the floor. Every dry vent connection shall rise up vertically from the waste pipe no less than 45 degrees with the horizontal (Note: In most cases, the connection will be 90 degrees for the horizontal or straight up. See IPC). Every dry vent shall rise up vertically at least 15 cm above the flood level rim, of the fixture being vented, before going horizontally.

6.5.2.1 FLOOR DRAINS

Floor drains shall be provided in each room that contains a water source. Floor drains shall be provided in the mechanical equipment and toilet/shower/ablution rooms. Floor drains shall be provided next to water heaters. In mechanical rooms, floor drains shall be provided to avoid running drain piping long distances above or over the floor. Drain outlet shall use a P-trap system to trap sewer gases and shall be a one-piece system without removable parts.

6.5.2.2 CLEANOUTS

Cleanouts shall be provided no more than 8 m (25') apart when measured from the upstream entrance of the cleanout.

6.6 SPECIAL PLUMBING SYSTEMS

6.6.1 GENERATOR FUEL STORAGE / DISTRIBUTION

The Contractor shall design and provide a complete generator fuel storage/distribution system.

6.6.1.1 FUEL OIL STORAGE AND CONTAINMENT

Tanks shall be installed in accordance with NFPA 37 and shall be of the sizes required in Section 01010. Design and provide above-ground horizontal steel tank(s) with single-walls and a secondary containment dike. Under NO circumstances shall GALVANIZED tanks be provided for storage of fuel oil or diesel.

Bulk storage tanks shall be designed and manufactured for horizontal aboveground installation sized to store a 30-day supply of fuel. A 30 day supply of fuel is defined as the fuel rate at 100% multiplied by 0.75. Multiply the resulting number by 24 hours and 30 days for the total fuel storage demand for 30 days.Tanks shall be complete with fill tube and cap, suction tube, tank gauge, vent, and other fittings and appurtenances required for full and safe operation. Tanks shall be provided with support saddles, platform/stair and concrete pad. Molded neoprene isolation pads shall be provided at locations where steel contacts concrete to isolate the tank. Steel tank supports specifically are prone to encounter premature rusting due to constant exposure to moisture and their incompatibility with concrete.

The containment dike shall be sized to contain the entire contents of the largest tank plus 10 percent. The dike structure shall be constructed of reinforced concrete.

Tanks shall be complete with fill tube and cap, suction tube, tank gauge, vent, and other fittings and appurtenances required for full and safe operation. Tanks shall be provided with support saddles, platform/stair and concrete pad. Molded neoprene isolation pads shall be provided at locations where steel contacts concrete to isolate the tank. Steel tank supports specifically are prone to encounter premature rusting due to constant exposure to moisture and their incompatibility with concrete.

Any tanks of 3,880 to 45,400 liters (1,000 to 12,000 gallons) capacity shall have a minimum of one (1) 760 mm (30") diameter manway. Any tanks larger than 45,400 liters (12,000 gallons) shall be provided with minimum of two (2) 900 mm (36") diameter manways. Any tanks 3,800 liters (1,000 gallons) and larger shall be provided with a minimum of one (1) tank manway to allow for internal tank access. Piping shall not penetrate through access manways. Tank shall be provided with a combination cleanout and gauge connection.

Vent pipe sizing shall be not less than 32 mm (1-1/4") nominal inside diameter. Vent shall be the rupture disc type calibrated to burst at 14 kPa (2 psi) pressure, and operate at 80 percent of burst setting. Tank shall be provided with an overfill alarm system. Tank shall be provided with two (2) stick gauges graduated in m and mm. Stick gauge shall be of wood and treated after graduating to prevent swelling or damage from the fuel being stored. Cathodic protection shall be provided for metal components in accordance with the manufacturer's recommendations. Storage tanks shall be handled with extreme care to prevent damage during placement and shall be installed in accordance with the manufacturer's installation instructions.

At least one (1) external platform/ladder access to tank top (i.e. manway) shall be provided and installed on a concrete pad.

6.6.1.2 FUEL DISTRIBUTION SYSTEM

Design and provide a complete fuel distribution system to supply clean fuel to the generators. Fuel shall be transferred from the bulk storage tank(s) by either the generator engine fuel pump(s), bulk tank submersible pump(s), or duplex-fuel pumps as determined by the designer and/or manufacturer, and be fitted with in-line fuel filters within 2 m (7') of the tank shell.

Fuel piping shall be black steel for all piping above grade and either steel or fiberglass for underground piping segments. Rubber hoses shall not be allowed. Galvanized piping, fittings, valves, or other equipment shall not be used for fuel oil or diesel conveyance. Secondary containment for underground fuel piping shall be provided with either double-wall fiberglass, double-wall black steel inner and steel outer with cathodic protection, double-wall black steel inner and fiberglass outer, or either black steel or fiberglass piping located in a concrete secondary containment trench with applied POL-resistant coating and removable covers (traffic-rated as applicable). Piping shall be installed straight and shall bear evenly on supports. Piping shall be free of traps, not embedded in concrete or pavement, and drain toward the corresponding storage tank when elevation permits. Belowground nonmetallic pipe shall be installed in accordance with pipe manufacturer's instructions. Belowground piping shall be laid with a minimum pitch of 0.4 m per 100 m (0.4 percent slope).

Design and provide a complete fuel filling system for unloading fuel from fuel tanker into individual bulk storage tanks. The fuel filling system shall include truck pad(s), duplex fuel transfer pumps, piping manifold and valves all in weather-proof cabinets. The system shall provide remote fuel level monitoring panels at the pad(s). Lockable containment box shall be provided to contain any spillage encountered during tank filling. Before construction begins, the Contractor shall coordinate with the Contracting Officer Representative and locate the fuel off-loading point outside of the perimeter wall to facilitate transfer of fuel from the commercial tanker trucks to the bulk storage tanks.

Provide complete fuel piping hydraulic calculations and all equipment product data in the 65% design analysis.

6.6.2 FUEL OFF-LOAD SYSTEM

A fuel filling system shall be provided for unloading fuel from fuel tanker into individual bulk storage tanks comprising of truck pad(s), duplex fuel transfer pumps, piping manifold and valves all in weather-proof cabinets. The system shall provide remote fuel level monitoring panels at the pad(s). Lockable containment box shall be provided to contain any spillage encountered during tank filling. Before construction begins, the Contractor shall coordinate with the Contracting Officer Representative and locate the fuel off-loading point outside of the perimeter

wall to facilitate transfer of fuel from the commercial tanker trucks to the bulk storage tanks. The Contractor shall provide a full supply of fuel for EACH tank at the time of turnover to the Government.

6.6.3 LPG COOKING STOVES

Cooking areas shall be provided with canopy type exhaust and associated exhaust and outside make-up air fans. See paragraph "Mechanical" in this Section. New stoves shall be set into formed concrete openings such that they can easily be removed for replacement, maintenance, and cleaning.

6.6.3.1 COOKING STOVES/BURNERS

Each LPG-propane stove shall be provided with three (3) burners and metal frame with four (4) legs. The stoves shall be of commercial quality and be capable of producing the highest heat output with all three (3) burners on. The center burner is low heat, center and middle burner is medium heat and all three burners is high heat. A gas flow regulating-adjusting valves shall be provided for each burner at the face of the appliance.

Stove dimensions are approximately 720 mm (28") long by 720 mm (28") wide by 500 mm (20") high.

6.6.3.2 GAS PIPING

Gas piping from the LPG/propane tanks to the respective gas stoves shall be wrought iron, ASTM B36.10M or steel (black or galvanized), ASTM A53. The steel piping shall terminate in front of the stoves with a shut off valve and quick disconnect nipple. A stainless steel flexible hose shall connect from the LPG/propane stove to the steel piping. Each end of the flexible hose shall be provided with quick disconnect fittings.

The LPG/propane piping shall not be embedded in the concrete floor. Installation of the LPG/propane piping in concrete trenches is highly recommended. The piping may be surface mounted provided that it is not susceptible to damage or causes any safety hazards.

Piping passing through the exterior wall shall be provided with pipe sleeves.

New stoves shall be set into formed concrete openings such that they can easily be removed for replacement, maintenance, and cleaning. Stove dimensions are 720 mm long by 720 mm wide by 500 mm high. The height includes the grill.

6.6.3.3 PROPANE FUEL STORAGE (45 KG BOTTLES)

LPG-propane storage tanks shall be located outside and exterior to the building in a storage yard.

The storage of fuels shall consist of individual 45 kg (100-pound) portable bottle tanks. For a 30-day supply of fuel, provide four (4) bottles per cook stove. The Contractor shall provide all tanks filled with LPG/propane fuel at time of completion.

Remote Storage Area: Stored filled and empty LPG/propane storage tanks shall be installed on a concrete pad and placed within a covered, secure, enclosure located a minimum of 8.0 m (26') from any occupied building. Portable bottle tanks shall be secured with chains to prevent tipping, and have caps on all bottles. Chain link enclosure with two (2) walkways and four (4) rows of tanks is recommended for ready access and easy securing of the bottles. Enclosed buildings are discouraged due to the potential for the buildup of propane in the event of a leak. Chain link fences with a visibility barrier are acceptable if the visibility barrier allows minimally impeded airflow.

Connected Storage: Connected Portable Tanks shall be located outdoors near or adjacent to the building behind a fire rated exterior wall. Tank area shall have a cover and be located in a chain link secured enclosure. One (1) tank per stove will be allowed in this location, with all tanks manifolded together (For facilities with three (3) or fewer stoves, the stoves may be individually piped.). The tanks shall be complete with fill fittings, tank gauge, vent, 2-stage and line regulators, and other fittings and appurtenances required for full and safe operation. Portable bottle tanks shall be secured with chains to prevent tipping.

6.7 TESTING AND COMMISSIONING

The Contractor shall test all piping systems in accordance with IPC International Plumbing Code. The final test shall include a smoke test for drainage and vent system and pressure test for the domestic water piping. After completing the work, the Contractor shall demonstrate that all plumbing systems operate to fully satisfy the function for which these systems have been designed. The Contractor shall test, adjust, balance and regulate the system and its controls as necessary until the required designed conditions are met. The Contractor shall include tests for interlocks, safety cutouts and other protective devices to demonstrate safe operation. All such tests shall be carried out in the presence of the Contracting Officer and full written records of the test data and final settings shall be submitted to the Contracting Officer. After all tests are complete, the entire domestic hot and cold water distribution system shall be disinfected. The system shall not be accepted until satisfactory bacteriological results have been obtained.

7.0 FIRE PROTECTION

7.1 PORTABLE FIRE EXTINGUISHERS

Portable fire extinguishers shall be provided inside all facilities and at exterior locations. Provide extinguishers per the greater requirement of A) as required in accordance with NFPA 10, or B) minimum of one (1) A-B-C 6kg fire extinguishers for every 100sm of floor space. Generally, extinguishers will be of the multi-purpose dry chemical type except for occupancies requiring a special type extinguisher (e.g., carbon dioxide portable fire extinguishers for electrical rooms). Where located in the presence of fuel, the fire extinguisher shall be rated for extinguishing fuel fires for the types of fuel used.

8.0 ELECTRICAL

8.1 GENERAL

Contractor shall design and construct all electrical systems for the facilities to be provided. This includes design, construction, all necessary labor, equipment, and material for a fully functional system.

8.2 ELECTRICAL WORKERS QUALIFICATIONS

Electrical work shall be performed by qualified persons with verifiable credentials who are thoroughly knowledgeable with applicable code requirements. Verifiable credentials consist of a certificate of graduations from an approved trade school and required amount of experience, depending on work being performed, and should be identified in the proposal that is submitted. A qualified person is one who has received training in and has demonstrated skills and knowledge in the construction and operation of electrical equipment and installations and the hazards involved. This includes the skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment, to determine the nominal voltage of exposed live parts, the clearance distances and corresponding voltages to which the qualified person will be exposed.

8.2.1 SUPERVISORY ELECTRICIAN

Supervisory electricians must be graduates of an approved trade school, and must have two years of relevant electrician experience. Approved programs include but are not limited to the Afghanistan Technical and Vocational Institute (in Kabul), the Kunar Trades Training Center, and the Commercial Technical Training Center (in Jalalabad). Work experience resumes and graduation certificates shall be submitted and approved prior to commencement of any design or construction involving electrical work. Approval is granted by the Contracting Officer's Representative with guidance by the Quality Assurance Branch and/or the Safety Office of the US Army Corps of Engineers Afghanistan Engineer District – South.. Supervisory electricians shall be on site at all times when electrical work activities are in progress.

8.2.2 ELECTRICIANS

Electricians must be graduates of an approved trade school and must be able to provide upon request a certification of successful course work completion and graduation in addition to a resume of work experience.

8.3 DESIGN CRITERIA

8.3.1 APPLICABLE STANDARDS

Design shall be in the required units as stipulated herein. Conflicts between criteria and/or local standards shall be brought to the attention of the Contracting Officer for resolution. In such instances, all available information shall be furnished to the Contracting Officer for approval.

All electrical systems and equipment shall be installed in accordance with the requirements set forth in the documents referenced herein.

8.3.2 ACCEPTANCE TESTING

Contractor shall develop and submit for approval complete acceptance test procedures on all systems provided. As a minimum the testing procedures shall comply with the requirements of the National Fire Protection Association (NFPA) and the International Electrical Testing Association Inc. (NETA).

8.4 MATERIAL

8.4.1 GENERAL

Unless noted otherwise, all material used shall be in compliance with the requirements of UL standards. In the event that UL compliant materials are not available, Contractor may then select applicable British Standards (BS), IEC, CE, CSA, GS, DIN listed material (or equivalent), but the contractor must prove equivalence and must provide the government with a full copy of the relevant specification(s)/standard(s). Material and equipment installed under this contract shall be for the appropriate application and installed in accordance with manufacturers recommendations and/or manufacture test results.

Equipment enclosure types shall be in compliance with the National Electrical Manufacturer's Association (NEMA) or the International Electro-Technical Committee (IEC) standards.

Major components of equipment shall have the manufacturer's name, address, type or style, voltage and current rating, and catalog number on a non-corrosive and non-heat sensitive plate, securely attached to the equipment. All equipment delivered and placed in storage, prior to installation, shall be protected from the weather, humidity and temperature variation, dirt and dust, and any other contaminants. All equipment shall be in new condition, undamaged and unused.

8.5 STANDARD PRODUCT

All material and equipment shall be a standard product of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least two (2) years prior to bid opening.

8.5.1 DESIGN CONDITIONS

All equipment shall be rated and designed for the maximum ambient temperature and altitude of the construction site. Equipment that is altitude and temperature sensitive, such as generators, shall be de-rated according to the manufacturer’s recommendations. Generic de-rating criteria for altitude and for ambient temperature may be used to approximate the required size of such equipment during the design phase, but a stipulation shall be placed on the construction plans to adjust the size according to the de-rating criteria specific to the manufacturer’s equipment chosen before the equipment is ordered.

8.5.2 RESTRICTIONS

Aluminum conductors shall not be specified or used except as bare steel reinforced (ACSR) overhead conductors in an aerial primary distribution system. Aluminum windings shall not be used in transformers.

8.6 DESIGN REQUIREMENTS

8.6.1 ELECTRICAL DISTRIBUTION SYSTEM

The Contractor shall provide generator power as a prime source of power for the facilities. The electrical distribution system shall be designed based on the latest edition of NEC and the requirements or standards stipulated herein.

The Contractor shall provide a prime power distribution system to distribute power to the site's facilities and other loads as required. The distribution system shall be underground.

The Contractor shall provide all required conduit stub ups to connect all equipment (to include equipment included as part of any Optional Bid Items) to the switchgear lineup.

Secondary electrical distribution system shall be 380/220 volt, 3-phase, 4 wire, 50 hertz. Design of the electrical system within facilities shall include, but is not limited to (a) interior secondary power distribution system, (b) lighting and power branch circuit and devices, and (c) fire detection and alarm system. Electrical panelboards and feeders shall be designed for the connected loads, plus 25% spare capacity.

The underground distribution system shall be in direct buried schedule 80 ductbanks, Under roadways and vehicular traffic areas, ductbanks shall be buried not less than 1220mm below grade. Underground ducts shall be not less than 100mm diameter Schedule 80 PVC for non-roadway and light traffic areas, and concrete encased under roadways and heavy traffic areas. A spare conduit of equal size shall be provided.

Manholes and handholes shall be provided at changes of direction of more than 40 degrees and elsewhere as required to limit the pulling tension and sidewall pressure on the cables during installation to acceptable levels as defined by the cable ,manufacturer. Manholes shall be provided for ductbanks with more than 2 ducts. Handholes shall be provided wherever a manhole is not required by quantity of ducts or by cable manufacturer's installation recommendations.

Manholes and handholes for ductbanks shall be constructed in accordance with UFC 3-550-03, Plates UG-1 through UG-7 for both traffic and non-traffic applications.

All panelboards shall be circuit breaker 'bolt-on' type panels. Minimum size circuit breaker shall be rated at no less than 20-amperes. All panels shall have copper bus bars. Circuit breakers shall be connected to bus bar(s) within the panelboards. Daisy chain (breaker-to-breaker) connection(s) are not acceptable. Indoor distribution panels shall be flush mounted in finished areas and surface mounted in unfinished areas. All circuit breakers shall be labeled with an identification number corresponding to the panel schedule. A 3-pole circuit breaker shall be a single unit and not made up of 3 single pole circuit breakers connected with a wire or bridge to make a 3-pole breaker. All branch circuit wiring shall be copper, minimum #4 mm^2 (#12 AWG) installed in metal conduit. Wiring shall be surface mounted in all areas. Provide 25% space for future circuit breakers in all panelboards. Power receptacles (outlets) shall be duplex type 220 V, 50 hertz, type CEE 7/7 with Earth Ground rated for 16A or better and shall be compatible with the required secondary power.

All splicing and terminations of wires shall be performed in junction or device boxes. Proper wire nuts/connectors shall be used for splicing wire. No twist-wire connections with electrical tape wrapped around it shall be acceptable. All electrical installation shall be in accordance with NEC. All building service entrance (service intake) panels shall be provided with kilowatt-hour (kWh) meters. A voltmeter and ammeter shall be provided also. All metering shall read true RMS values. Series rated equipment is not permitted. A digital power meter in lieu of a kWh meter, ammeter and voltmeter may be provided. Digital power meters shall meet or exceed ANSI/IEEE C37.90.1 All loads shall be coordinated to provide balanced loading. Phase imbalance at each panel shall not exceed 5%.

Voltage Drop for branch circuits shall be limited to no more than 3%; voltage drop from power source to loads shall be limited to no more than 5%.

All circuit breakers shall use down-stream coordination to ensure the breaker nearest a fault or overload is the first to trip.

8.6.1.1 GENERATOR POWER SYSTEM

Note: The full specification for the generator consists of this section, Generator Power System-Electrical Requirements for Generators, in combination with the Mechanical Requirements for Generators specification found in the Mechanical portion of this Section 01015.

The generator shall be sized to support the total demand load of the site. The site's total demand load is defined as 1 Kilowatt per person + 20% spare capacity. The generators shall supply power at the utilization voltage of the facilities served. The generator power system shall be configured as an N+1 system with the N representing the number of generators needed to supply the site's total load and +1 representing the number of additional generators of the same size required as a spare, and the entire system shall be connected to a synchronization panel.The generator power system shall be provided with a make-before-break, 4-pole, automatic transfer switch (ATS) rated for the capacity of the system. The ATS shall be capable of automatically and manually transferring the site's distribution system to generator power upon loss of local utility power and transferring back automatically and manually to local utility power upon its restoration.

The ATS shall be equipped with synchronizing/paralleling equipment to allow the generators to share the load of the site. When generator power is required at least one (1) generator shall be online at all times. When the load reaches 90% of the online generator's capacity, the standby generator(s) shall start. When the load drops below 80% of the online generators' capacity, the generator(s) shall drop off line, one at a time, keeping a minimum of one generator operating online.

If a commercial electrical service is available nearby, or anticipated to be available in the near future (within five years), switching shall be included to allow connection to commercial power. The transfer switch between the commercial power and generators shall be a make-before-break, 4-pole, manual transfer switch (MTS) rated for the capacity of the system.

Whenever a generator starts, it shall go through a cool down cycle prior to shutdown. All relaying shall be automatically reset for automatic restart and stopping of generators as the load increases or decreases. Load sharing by the standby generator(s) shall be adjustable between 50% and 95% of the load on the online generator(s). Sequence of operation shall be time clock controlled. A properly sized main switchboard shall be provided to distribute the power produced by the generator(s) to the facilities on the site.

Generators shall have a radiator nameplate ambient temperature rating of 50 degrees centigrade and be derated as necessary for the altitude of the site. Installing a generator with a lower ambient temperature and de-rating it for 50 degrees centigrade is not acceptable. Generator shall be provided inside "weather-proof" (IP54 or better) enclosure.

Generator fuel storage capacity shall be based on usage at total load for a minimum of 30 days. For fuel storage requirements, see Mechanical paragraph: Generator Fuel Storage/Distribution.

8.6.1.2 GENERATOR POWER TESTING AND COMMISSIONING

The Contractor shall test generator power system.

8.6.2 LIGHTING

Lighting shall be provided as indicated in the attached Standard Designs, except at buildings without complete design. In those facilities, the Contractor shall provide and design the lighting system. Design levels shall be per IES standards as a minimum. For convenience, the following lighting level table is listed. Note: all spaces listed below may not be within the work required within this contract.

Living room/Quarters	30 FC (350 Lux)
Toilets, Showers, Latrines, washrooms	20 FC (200 Lux)
Mechanical/Electrical rooms	30 FC (300 Lux)
Corridors and Stairways	20 FC (200 Lux)
Offices (private)	30 h/3 v FC (300 h/30 v Lux)

Office areas (open)	30 h/5 v FC (300 h/50 v Lux)
Kitchens (commercial)	50 h/3 v FC (500 h/30 v Lux)
Dining Areas	20 h/3 v FC (200 h/30 h Lux)
Auditoriums (social)	5 h/3 v FC (50 h/30 v Lux)
Conference/Training	30 h/5 v FC (300 h/50 v Lux)
Armories	30 h/3 v FC (100 h/30 v Lux)
Patient Rooms (general)	Per UFC 4-510-01
Patient Rooms (critical)	Per UFC 4-510-01
Egress path (incl. exterior)	10 Lux
Areas adjacent to egress path	0.5 Lux

FC = Foot Candle

h = horizontal component

v = vertical component

Indoor lighting for all areas shall consist of fluorescent surface mounted light fixtures. Exterior lighting shall be HID high pressure sodium Area lighting for the Motor Pool shall have photocell controlled switches. Moisture resistant/waterproof fluorescent light fixtures shall be provided in high humidity and wet areas such as latrines, showers and at exterior applications. Battery powered 'emergency' and 'exit' lights shall be provided within each building, as applicable, for safe egress during a power outage. All light fixtures shall be factory finished, complete and operational, to include but not be limited to, lens, globe, lamp, ballast etc. Industrial type fluorescent light fixtures shall not be used. Every room shall be provided with a minimum of one light switch. Light fixtures shall be mounted approximately 2.5-meters (8 feet) above finished floor (AFF) minimum. Fixtures may be pendant or ceiling mounted, depending on the ceiling type and height.

8.6.3 LIGHT FIXTURES

Lighting fixtures shall be a standard manufacturer's product. Fluorescent surface mounted light fixtures shall be power factor corrected and equipped with standard electronic ballast(s). All light fixtures shall properly operate using standard lamps available locally. Fixtures shall be fully factory wired and designed for appropriate application i.e. appropriate for that location where installed. Grounding rods shall be installed at all exterior light pole fixtures.

8.6.4 EMERGENCY "EXIT" LIGHT FIXTURES

Emergency "EXIT" light fixture shall be provided in accordance with NFPA requirements. Fixtures shall be single or double sided as required by the location and for wall/ceiling mounting. Unit shall illuminate continuously and be provided with self-contained nickel cadmium battery pack, to operate on floated-battery or trickle charge circuit. Fixture shall operate satisfactorily for 90 minutes during a power outage. Unit shall have test/re-set button and failure indication lamp. Primary operating voltage shall be 220 volts. Lettering "EXIT" in both Pasto and Dari, shall be color red and not less than 6 inches (150 mm) in height and on matte white background. Illuminations shall be with LEDs.

8.6.5 SEARCH LIGHTS

Searchlights shall be equivalent to the following:

- Prison grade
- Nickel reflectors (bullet resistant)
- 65 million candlepower (1,000 watts)
- Manual operation from below with one hand

- Xenon lamp
- Weatherproof design

8.6.6 EMERGENCY LIGHTING

Battery powered emergency lights shall be provided within each building per NFPA for safe egress during power outage. Fixtures shall be provided with self-contained nickel cadmium battery pack to operate on stand-by circuit for 90-minute minimum. Unit shall have test/re-set button and failure indication lamp. Normal operating voltage shall be 220volts. Emergency lighting fixtures shall be connected to the normal lighting system.

8.6.7 LIGHT SWITCHES

Light switch shall be single pole. Minimum of one light switch shall be provided in every room. Lighting in large rooms/areas may be controlled from multiple switches.

8.6.8 RECEPTACLES

All receptacles shall be duplex, unless otherwise specified in this section, the NEC, or other referenced standard.

Receptacles shall be spaced per NEC at a maximum of 2 meters (6 feet). Areas with computer work-stations or similar equipment will have additional receptacles. All circuits in wet/damp areas or within 1 meter (~3 feet) of sinks, lavatories, or wash-down areas shall have ground fault circuit interrupter (GFCI) type or residual current disconnect (RCD) type, as required per NEC. Total number of duplex receptacles shall be limited to six (6) per 16-ampere circuit breaker.

8.6.9 CONDUCTORS

All cable and wire conductors shall be copper. Conductor jacket and insulation shall be color coded to satisfy NEC requirements. The use of 75 or 90 degree C (minimum) terminals and insulated conductors is required. Use of higher degree C rated conductors on circuits with protective device terminals rated at a lower degree C is allowed but must be de-rated to the rating of the device terminals. Conductors sized No. 8mm and larger diameter shall be stranded. Conductors sizes No. 6mm and smaller diameter shall be solid, except that conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3, shall be stranded unless specifically indicated otherwise. Conductors shall be sized per NEC requirements.

8.6.10 GROUNDING AND BONDING

Grounding and bonding shall comply with the requirements of NEC. Underground connections shall be exothermally welded. All exposed non-current carrying metallic parts of electrical equipment in the electrical system shall be grounded. Insulated grounding conductor (separate from the electrical system neutral conductor) shall be installed in all feeder and branch circuit raceways. Grounding conductor shall be green-colored, unless the local authority requires a different color-coded conductor. Ground rods shall be 20 millimeters (0.75 inches) in diameter and 3 meters (~10 feet) long made of copper-clad steel. Final measurement of the ground resistance shall be in compliance with the requirements of the local authority but shall not exceed 25 ohms when measured more than 48 hours after rainfall.

8.6.11 ENCLOSURES

Enclosures for exterior and interior applications shall be NEMA Type 3S (IEC Classification IP54) and NEMA Type 1 (IEC Classification IP10) respectively.

8.6.12 FIRE DETECTION & ALARM SYSTEM

The Contractor shall install hardwired initiating devices and notification appliances to provide local alarm only.

Initiating devices and notification appliances shall be provided as required by the latest edition of NFPA 72. Each initiating device shall be capable of alarming all notification devices within the same building/structure when activated. All initiating devices and notification appliances shall be interconnected per NFPA 72 and hard-wired to AC power supply. The initiating devices and notification appliances will operate on battery only if site power is lost.

8.6.13 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS)

Transient Voltage Surge Suppression shall be provided utilizing surge arresters to protect sensitive and critical equipment. As a minimum TVSS protection shall be provided at each panel serving electronic loads and shall be shown on the panel schedule. It is recommended that Metal Oxide Varistors (MOV) technology be used for such applications.

8.6.14 CONDUIT RACEWAY SYSTEM

Metal conduit (EMT) system shall be complete, to include but not limited to, necessary junction and pull boxes for all surface mounted conduit systems. Surface mounted nonmetallic raceways shall not be allowed. Smallest conduit size shall be no less than 20mm in diameter. All empty conduits shall be furnished with pull wire or cord or rope (depending on the size of conduit and length of run). System design and installation shall be per NEC requirements. Exterior conductors below grade shall be installed in concrete encased PVC conduit at a depth of 1220 millimeters.

8.6.15 CABLE TRAY RACEWAY SYSTEM

Cable trays shall be galvanized steel or aluminum wire mesh type and provided with, but not limited to, splices, end plates, dropouts and miscellaneous hardware. System shall be complete with manufacturer's minimum standard radius and shall be free of burrs and sharp edges. Nominal width of cable tray shall be 300mm. Nominal depth shall be 100mm. System design and installation shall be per NEC requirements.

8.6.16 IDENTIFICATION NAMEPLATES

Major electrical equipment, such as transformers, panelboards, and load centers, etc. shall be provided with permanently installed engraved identification nameplates. Nameplates or labels shall indicate the source feeding each piece of major electrical equipment.

8.6.17 SCHEDULES

All panel boards and load centers shall be provided with a directory. Directory shall be typed written in English, Dari and Pashto. The directory shall identify the conductor color code present in the panel. The directory shall also indicate the source where the panelboard/loadcenter is fed from.

8.6.18 SINGLE LINE DIAGRAM

Complete single line diagrams shall be provided for all systems installed. All major items in each system shall be identified and labeled for respective ratings. Single line diagrams for each system, installed in a clear plastic frame, shall be provided. Most current version of design, based on current design review, shall be kept on project site at all times for reference, and updated with redline edits to show any and all variations from the drawings.

9.0 COMMUNICATIONS

9.1 APPLICABLE SPECIFICATIONS

The Publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by designation only.

United States Department of Agriculture, Rural Utilities Service

RUS Bulletin 1751F-643 (2002) Underground Plant Design

RUS Bulletin 1751F-644 (2002) Underground Plant Construction

RUS Bulletin 1753F-151 (2001) Construction of Underground Plant, Parts II & III

ANSI TIA/EIA 606-A (2002) Administration Standard for The Telecommunications Infrastructure

ANSI TIA/EIA 607-A (2002) Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications

ANSI TIA/EIA 569-B (2004) Commercial Building Standard for Telecommunications Pathways and Spaces

ANSI TIA/EIA 758-A (2004) Customer-owned Outside Plant Telecommunications Infrastructure Standard

9.2 COMMUNICATION SYSTEM

The communications system for this project is to be RJ45 outlets (for telephone and data), and empty conduits designed, supplied and constructed by the Contractor. Communications wiring is by others. The design and construction of the systems shall be in accordance with the references and the requirements contained herein.

9.3 EXTERIOR COMMUNICATION SYSTEM

The Contractor shall design, provide and install the exterior communications infrastructure system. The system shall include but is not limited to communications manholes, hand-holes, and underground ductbank. The Contractor shall coordinate the communication system with the power distribution system to distribute communications to the compound's facilities as required. The distribution system shall be an underground system. Communications manholes and handholes shall not be shared with other utilities. Manholes and handholes shall be either cast-in-place or precast concrete. Manholes minimal interior dimensions shall be 3.66m L x 1.83m W x 2.13m H. Hand-holes minimal interior dimensions shall be 1.22m L x 1.22m W x 1.22m H. The minimum concrete thickness shall be 127mm for walls, 152mm for roof, and 127mm for the floor. The quality of the concrete pour and the construction of the manhole and hand-hole shall be such that the rebar or visible rock shall not be seen in the surface of a wall. In other words, the pour shall not have any voids. The maximum distance between manholes and/or hand-holes shall be 170 m. Place a manhole or hand-hole at all 90 degree turns. The ducts shall be direct buried with a minimum of 600 mm of properly tamped dirt/backfill on the top. Hand-holes shall be installed in laterals in between manholes and buildings and only where the distance between the main duct system and the building is 100 meters or more. The maximum number of ducts in a hand-hole wall shall be two, with one having four (4) inner ducts installed unless there are two buildings close by and can be fed from one hand-hole. In this case, four (two with inner ducts) conduits can be installed in the walls. Manholes and hand-holes shall be installed on a leveled, crushed, washed gravel base of sufficient depth, i.e., a minimum thickness of 150 mm under the entire manhole, to allow for drainage and stability. Where manholes and hand-holes are installed in roadways or areas subject to vehicular traffic, the structure and lid (cover) shall support heavy vehicular traffic. Manholes and hand-holes shall be equipped with corrosion-resistant pulling irons and cable racks that are grounded and with a sump for drainage. Cable racking diagrams (manhole/hand-hole butterflies) shall be provided for the manholes and hand-holes. See accessories chart below for additional requirements.

Manhole and Hand-hole Accessories	HANDHOLE 1.22m X 1.22m X 1.22m	MANHOLE 3.66m X 1.83m X 2.13m
Bonding Ribbon 16mm	20	65
Bonding Ribbon Clamps	12	20
Cable Rack 762mm	4	
Cable Rack 47 Hole		14
Corner Cable Rack Support		8
Cable Rack Hook 191mm	8	14 minimum
Cable Rack Standoff Bracket	9	12
Concrete Collar 152mm	1	1
Cover (Lid) 762 Diameter	1	1
Frame Support Structure for Lid	1	1
Ground Rod 19mm X 3m	1	1
Ground Rod Clamp 19mm	1	1

Metal Hit Anchor	10	20
Pull-In Irons	4	4
Sump	1	1

9.4 EXTERIOR CONDUIT

The underground conduit for the manhole and duct system shall be direct buried (600 mm below surface), 100 mm DB type PVC or schedule 80, PVC. Inner ducts shall be four (4) 25 mm PVC or PE inner ducts field installed in the outer-duct. The inner ducts shall be installed in the duct face and secured with properly sized duct plugs which expand to seal the duct. The ducts shall be stubbed up, sealed, capped and tagged in the communications equipment room, and shall be sealed, capped, tagged and marked at the other end. Empty ducts shall be sealed with a mechanical, screw-type, reusable duct plug. The ducts will be concrete encased when install under roadways or areas subject to vehicular traffic. The ducts (inner and outer) shall be listed on the RUS list of materials acceptable for use on RUS projects. The minimum duct configuration in the main duct system (manhole to manhole) shall be a four (4) way ductbank, two conduits wide by two conduits deep (2 X 2) with one of the conduits having inner-ducts installed. Laterals off of the main duct system (manhole/hand hole to building) shall be a 2 way (1x2) with one duct having inner ducts. All conduits shall be terminated in ABS plastic terminators cast into the walls of the concrete structures. In manholes, all conduit windows shall be recessed. Pull wire/rope must be provided in all conduits. Conduits shall enter the manholes and hand-holes in the lower portion of the knockout window to simplify future conduit additions.

9.5 TELEPHONE/DATA CABLING DISTRIBUTION SYSTEM FOR EACH BUILDING

The Contractor shall design, provide and install the building communications infrastructure system. The system shall include but is not limited to communications equipment racks, conduit, pull boxes, communications outlet boxes, and communications grounding/bonding infrastructure. Provide communications outlet boxes at all workstation locations in the open office, private office and receptionist areas. Outlet boxes shall be a single gang box (51 mm x 102 mm x 57 mm) or double gang box (119 mm x 119 mm x 57 mm boxes). The Contractor may use an equivalent sized outlet box. Conduit shall be installed from each outlet box location to the communications equipment rack location. Label the conduit on both ends with room number and outlet box number. Equipment racks shall be standard 475mm wide steel telecommunications racks. Provide all empty conduits with a pull rope. Properly sized metallic conduit and cable tray shall be used as appropriate to distribute the telephone/data cabling throughout the building. Minimum conduit size shall be 20 mm inside diameter. Pull boxes shall be placed in conduit runs where a continuous conduit length exceeds 30 meters or where there are more than two 90-degree bends. Pull boxes shall be placed in straight runs of conduit and shall not be used in lieu of a bend. Equipment racks shall have a minimum 900 mm of space both in front of and behind the rack and behind any installed equipment. A minimum side clearance of 600 mm shall be provided on end racks.

9.6 TELECOMMUNICATION GROUNDING AND BONDING

The Contractor shall provide a grounding and bonding system in accordance with ANSI TIA/EIA 607-A. The grounding system shall include but is not limited to a Telecommunications Main Grounding Busbar (TMGB), Telecommunications Grounding Busbars (TGB) where applicable, Telecommunications Bonding Backbone (TBB), Grounding Equalizer (GE), and Bonding Conductors.

9.7 LOUDSPEAKER AND ALARM SYSTEM

Install Loud Speaker & Alarm System that can alert the entire compound via panic button from any tower or guard post station using either an aluminum or steel post. Loud Speaker & Alarm System shall include, but is not limited to central control stations, high power speaker arrays (HPSA), communication links, and ancillary equipment. Central control stations shall operate and control the system. Loud Speaker & Alarm System shall be capable of providing intelligible live and pre-recorded voice signals. The system shall include tones for conventional attack warning, non-conventional attack warning, all clear, and a system test tone. Speaker & Alarm System shall be

exterior grade components to withstand severe weather conditions of cold, heat, rain, sleet, and dust storms and to be completely understandable during these conditions from any point within the compound. All wires shall be installed in conduits.

9.7.1 CENTRAL CONTROL STATIONS

Loud Speaker & Alarm System shall be provided with at least one primary and one redundant central control station. The locations of the central control stations shall be coordinated with the Contracting Officer's Representative. The primary central control station should be located at the command post or similar location. The redundant central control center should be located at a physically separate location such as a security forces building, military police station, fire station, or emergency services office. The central control stations shall control the operation of outdoor speakers. Each central control station shall be equipped with batteries to supply power for a minimum of 4 hours of full-load operation. Control stations shall be capable to provide automatic status reporting for each HPSA and for all activations and the status of the activations. The controls shall provide an alarm summary report that provides a historical report for all changes of status, including all troubles, equipment failure, power system trouble (including normal and emergency power), unsolicited messages, tamper/supervision of the enclosure for the HPSA electronics, amplifier status, last activation and synchronization error, operator log on and log off, and configurable reports for time-based events such as "report all troubles from 1/01/04 to 6/30/04." Control stations shall feature multiple levels of password protection, including levels for system operators, maintainers, supervisors, and military commanders. The control stations shall be capable to deliver at least two essentially concurrent voice messages: one for threatened areas or buildings and one for adjacent areas or buildings. This includes the capability for two pre-recorded voice messages, or one live and one pre-recorded voice message. The control station shall have the capability to target specific messages to any individual HPSA, zone of HPSAs, or to all areas on the installation

9.7.2 HIGH POWER SPEAKER ARRAYS (HPSA)

HPSAs shall be arranged into zones so that each zone can be individually controlled by the control station. HPSAs shall be designed with directional characteristics that will minimize the distortion of voice signals by interface from other zones. HPSAs shall be designed to maintain the intelligibility of voice signals within the zone at a level no less than 0.8 on the Common Intelligibility Scale (CIS) or 0.7 on the Speech Transmission Index (STI) during normal weather conditions in special outdoor areas such as those with a high concentration of multi-story buildings in close proximity. Parade grounds, training fields, and similar outdoor areas should also be provided with this higher intelligibility. Intelligibility may be less than 0.8 CIS in areas of the zone if personnel can determine that a voice signal is being broadcast and could walk less than 25 m to find a location in the zone with a CIS score of at least 0.8. It is necessary to control the occupational noise exposure to personnel from the HPSA. Sound levels at any location where personnel may be located, including directly underneath the HPSA, shall not exceed 120 decibels (adjusted) (dBA) when measured on the A-scale of a standard sound level meter at slow response. Do not exceed 85 dBA at the location of the individual HPSA equipment cabinet for those HPSAs designated to be furnished with a local microphone. Each HPSA site for each zone shall include a field-mounted local control unit, microprocessor, amplifier, standby batteries, charger, power supply, radio, mounting brackets and loudspeaker assembly for pole or building mounting. Designated HPSA sites shall be capable of microphone input and shall be provided with a microphone designed to prevent feedback at that particular microphone location. All external conductors (conductors passing outside of the HPSA equipment cabinet) shall be provided with surge suppression tested to Underwriters Laboratories, Inc. (UL) standards. The HPSA control units shall feature a digitally addressable controller. The HPSA control units shall receive and store messages via the primary (and redundant, if required) communication link with a confirmation signal sent back to the primary and redundant central control stations. Provide a charger/ power supply that will accept alternating current (AC) input, backup electrical power generator input, battery input, or solar power cell input. The HPSA control units shall have the capability of storing pre-recorded messages. The HPSA control units shall provide a minimum of 7 standard tones. In addition, the systems shall have the capability to provide custom tones. Provide a tamper switch that will signal the central control station that the HPSA enclosure door is open. All equipment for each HPSA speaker site shall be housed in modular, mountable cabinets suitable for the local environmental conditions, including space heaters and ventilation fans, as appropriate. Speakers shall be able to operate between temperatures of -40 degrees Celsius (C) (-40 degrees Fahrenheit (F)) to +60 degrees C (+140 degrees F). Enclosures shall protect the HPSA control unit from external temperatures ranging from -40 degrees C (-40 degrees F) to +60 degrees C (+140 degrees F). The height shall not be less than 9 m (30 ft) or greater than 18 m (60 ft) above ground level. Poles shall be spun aluminum or galvanized steel poles. HPSA equipment cabinets shall be mounted on the elevated supporting structure with the top of the

enclosure no more than 3 m (10 ft) above ground level. The equipment cabinet and power boxes must be capable of being locked shut.

9.7.3 COMMUNICATIONS LINKS

Primary communications shall use radio frequency-type systems that comply with National Telecommunications and Information Administration (NTIA) requirements. The systems shall be designed to minimize the potential for interference, jamming, eavesdropping, and spoofing. Confirm that the devices conform to regulations and obtain the approval from the authority having jurisdiction prior to using radio frequency-type devices. Redundant communication means (when required) should be established using several alternate wireless radio frequency paths to the radios. The redundant communication means might be accomplished by using the communications backbone network (e.g., optical fiber cable). In this case, the central control units should accomplish this by being directly connected to the backbone network. Communications equipment furnished as part of the wide area MNS shall be commercial off-the-shelf (COTS). All programming codes or passwords required to access, update, modify, and maintain the communications equipment shall be provided no later than the date of final system acceptance. Full system supervision shall be provided. Notification of system alarm, supervisory, and trouble signals shall be provided to the central control stations within a time period not to exceed 200 seconds. The communications systems shall provide self-test and diagnostics capabilities. Local diagnostics information shall be transmitted to the central control stations.

-END OF SECTION-

TECHNICAL QUESTIONS

1. In Section 00150/4.0 Project Schedule gives Total Contract Period as 460 days, on the other hand W5J9LE12R0051 RFP gives Total Project Period as 540 days. Would you please verify total project duration?

ANSWER: See section 00150, Project Phase, paragraph 4.0 (Proposal Schedule).

2. Would you please determine scope of Proposal Schedule Item 0003AC "Mitigation of Onsite Wadis", because in Section 01010/2.3.2.1 Mitigation of Onsite Wadis prompts to price "Contractor shall grade the site, or design and construct via engineered means, to divert surface rainwater (stormwater) around the compound as water flows from the elevated areas in the surrounding areas of the compound to the existing wadi on the opposite side of the compound." under "Site Grading and Stormwater Management" in the 00010 Bid Schedule?

ANSWER: Per revised Proposal Schedule – Section 00010, line item 0003AC "Mitigation of Onsite Wadis" was deleted and shall be included as part of line item 003AB Site Grading and Stormwater Management – Per Section 01010, paragraph 2.3.2.1 – "Mitigation of Onsite Wadis".

3. Would you please specify composition of sidewalks which is given as aggregate in Section 01010/2.3.10 Aggregate Roadways/Driveways/Sidewalks and Parking and concrete in 01012 Technical Requirements/2.2.4.3 Sidewalks/Footpaths?

ANSWER: See revised section 01015 paragraph 2.2.4.3, please read in its entirety.

4. Would you please clarify whether vehicle gates will be sliding type as stated in Section 01010/2.4.2 Fencing, Gates, and Barriers or swing type as given in 01012 Technical Requirements/2.2.5.5 Chain-Link Fence and Gates?

ANSWER: See section 01010, paragraph 2.4.2, please read in its entirety.

5. Would you please assign height of fencing around Motor Pool Area?

ANSWER: See section 01010 paragraph 2.4.2, please read in its entirety.

6. Would you please specify whether there will be a personnel gate for the area around Dining Facility as shown on Concept Site Plan?

ANSWER: See section 01010, paragraph 2.4.2, please read in its entirety.

7. Per Downloaded SOW from AED website stated on the paragraph 2.3.5.1 and Technical specification we have to design and construct Partial Mix aeration Lagoon system for Waste Water Treatment Plant for 500 People, but according to attached AED Design Requirement for WWTP more than 375 m3/day lagoon system is recommended.

ANSWER: Please read section 01010 paragraph 2.3.5.1 and section 01015, paragraph 2.3.5 in its entirety and bid accordingly.