

<b>AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT</b>			1. CONTRACT ID CODE J	PAGE OF PAGES 1   117
2. AMENDMENT/MODIFICATION NO. 0001	3. EFFECTIVE DATE 23-Jun-2011	4. REQUISITION/PURCHASE REQ. NO.		5. PROJECT NO.(If applicable) ANA 10-SW013
6. ISSUED BY AFGHANISTAN DISTRICT SOUTH (AES) US ARMY CORPS OF ENGINEERS APO AE 09355	CODE W5J9LE	7. ADMINISTERED BY (If other than item 6) <b>See Item 6</b>		
8. NAME AND ADDRESS OF CONTRACTOR (No., Street, County, State and Zip Code)		X	9A. AMENDMENT OF SOLICITATION NO. W5J9LE-11-R-0048	
		X	9B. DATED (SEE ITEM 11) 08-Jun-2011	
			10A. MOD. OF CONTRACT/ORDER NO.	
			10B. DATED (SEE ITEM 13)	
CODE	FACILITY CODE			
11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS				
<input checked="" type="checkbox"/> The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offer <input type="checkbox"/> is extended, <input checked="" type="checkbox"/> 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 <u>1</u> 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 <input type="checkbox"/> is not, <input type="checkbox"/> 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.)  Project: ANA, 215th Brigade Garrison Phase I at Camp Garmsir, Helmand Province, Afghanistan; PN: 10-SW013 Contracting POC: John Perez, john.m.perez@usace.army.mil  The purpose of this Amendment is as follows: 1. Answer questions/clarifications from industry. 2. Revise SECTION 00100, BIDDING SCHEDULE/INSTRUCTIONS TO BIDDERS, Clause 52.236-27 SITE VISIT (CONSTRUCTION)(FEB 1995). 3. Revise SECTION 00110, INSTRUCTIONS, CONDITIONS, AND NOTICES TO BIDDERS - BEST VALUE ANA: SITE-ADAPT, item 1.8, PREPROPOSAL CONFERENCE/SITE VISIT. 4. Revise, SECTION 01010, SCOPE OF WORK. 5. Revise, SECTION 01015, TECHNICAL REQUIREMENTS. 6. Revise, SECTION 00150, THE SITE SITE-ADAPT PROCESS. . All other terms and conditions remain the same.				
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  23-Jun-2011	

**SUMMARY OF CHANGES**

**W5J9LE-11-R-0048, Amendment 0001:**

The following have been modified:

**SECTION 000100  
BIDDING SCHEDULE/INSTRUCTIONS TO BIDDERS**

**The following clause is revised FROM:**

**“52.236-27 SITE VISIT (CONSTRUCTION) (FEB 1995)**

(a) The clauses at 52.236-2, Differing Site Conditions, and 52.236-3, Site Investigations and Conditions Affecting the Work, will be included in any contract awarded as a result of this solicitation. Accordingly, offerors or quoters are urged and expected to inspect the site where the work will be performed.

(b) An organized site visit will be held on **24 May 2011 at 15:00 (3:00 PM)**. Vendors shall not visit the site on their own schedule. POC for access approval is **Mr. Joshua Adekanbi, [joshua.a.adekanbi2@usace.army.mil](mailto:joshua.a.adekanbi2@usace.army.mil)**. All prospective attendees must register with POC to attend the site visit. Because space is limited, only two (2) representatives per company will be admitted. If you are not registered, you will not be admitted onto the site. **You must register no later than 22 May 2011.**

Please plan to arrive early, as it may take time to be processed and screened through the security checkpoint. All attendees must possess a Government issued Identification Document such as National ID Card, CAC Card, Passport, etc. Security will begin screening attendees at 13:00 (1:00 PM). If you are not registered, security will not admit you.

**IMPORTANT NOTES.** (1) Remarks and explanations addressed during the site visit shall not qualify or alter the terms and conditions of the solicitation. (2) The terms and conditions of the solicitation remain unchanged unless the solicitation is formally amended in writing.

(End of provision)”

**TO:**

**“52.236-27 SITE VISIT (CONSTRUCTION) (FEB 1995)**

(b) An organized site visit will not be scheduled

(c) Participants can visit the site at their discretion.

(End of provision)”

**SECTION 00110  
INSTRUCTIONS, CONDITIONS, AND NOTICES TO BIDDERS - BEST VALUE  
ANA: SITE-ADAPT**

**The following item is revised FROM:**

**“1.8. PREPROPOSAL CONFERENCE / SITE VISIT**

See FAR 52.236-27, SITE VISIT (CONSTRUCTION) (FEB 1995)”

**TO:**

**“1.8. SITE ASSESSMENT SURVEY**

See Appendix B for a copy of Site Assessment Survey (SAS). The SAS is for information only.”

## QUESTIONS/CLARIFICATIONS AND ANSWERS

**Q1:** CII kindly requests a two week extension to the submission date of the Afghanistan National Army (ANA), 215th Brigade Garrison Phase I at Camp Garmsir, Helmand Province, Afghanistan. (W5J9LE-11-R-0048) as the currently established date/time is not sufficient for a us to complete a bid with the magnitude and complexity of this project.

**A1:** Regrettably, we will not approve an extension for this project.

**Q2:** The solicitation for the above reference proposal includes a paragraph on a bid-bond requirement for submittal (see attached). However, this paragraph contradicts the SF1442 Box 13a section which cites that a bid-bond (an offer guarantee) is not required. What type of bond are bidders required to submit for the proposal? Please advise.

**A2:** The bonding information on the SF 1442 is NOT correct. **BONDING IS REQUIRED.** See solicitation/RFP for bonding requirements.

**Q3:** Reference to the RFP, Section 01010 Scope of Work, paragraph 5.34 “Demolition”, the costs associated with any demolition work shall be accounted for by the Contractor in the bid item for which the demolition is associated. Please specify the bid items that shall include demolition costs.

**A3:** The Contractor shall determine all items to be demolished in accordance with the solicitation to provide a fully functioning facility. The Contractor shall determine what demolition shall be associated with the appropriate bid item.

**Q4:** Referring to RFP, Section 01010 Scope of Work, paragraph 4.34 “035 Clotheslines”, Construct two (2) Clotheslines for every Latrine (400PN) and one (1) Clothesline for every Small Latrine (120PN), this amounts to  $(2 \times 6) + (1 \times 20) = 32$  clotheslines not 26 as indicated in the Proposal schedule. Please clarify.

**A4:** The Contractor shall construct a total of 26 clotheslines, one at each Latrine (400PN) and one at each Small Latrine (120PN).

**Q5:** Referring to RFP, Section 01010 Scope of Work, paragraph 5.51 “Latrines”, are these three clotheslines in addition to the clotheslines mentioned in item 4.34? Please advise.

**A5:** In regards to clotheslines, see A4. The Latrine paragraph was revised; see revised Scope of Work.

**Q6:** On the “Solicitation Offer and Award”, item no. 12 indicates that the contractor will not furnish performance and payment bonds; whereas in section 00700 “Contract Clauses” 52.228-15 “Performance and Payment Bond – Construction (OCT 2010)” item [(b) Amount of required bonds. Unless the resulting contract price is \$150,000 or less, the successful offeror shall furnish performance and payment bonds to the Contracting Officer as follows: (1) Performance bonds (Standard Form 25). The penal amount of performance bonds at the time of contract award shall be 30 percent of the original contract price. (2) Payment Bonds (Standard Form 25-A). The penal amount of payment bonds at the time of contract award shall be 30 percent of the original contract price.]

Please confirm if the performance and payment bonds are needed or not, if needed please provide us with the required calendar days for preparing them to issue Notice to Proceed (NTP).

**A6:** The bonding information on the SF 1442 is NOT correct. **BONDING IS REQUIRED.** See solicitation/RFP for bonding requirements.

**Q7:** The “Solicitation Offer and Award” defines the project performance as 545 calendar days after NTP; section 00150 “The Design Build Process” item “4.0 Project Schedule” shows that total design and construction period is 700 calendar days after NTP. Also, in section 01010 “Scope of Work” item “1. General” shows that the project must be completed in 550 days from the NTP while in item “5. Completion of Work” shows that all work required under this contract shall be completed within 700 calendar days including government review time from NTP. Please clarify the duration of the project.

**A7:** The total contract duration shall be 700 days from NTP, the contractor shall follow the construction priority schedule in Section 00150. See revised Scope of Work and Section 00150.

**Q8:** According to paragraph 52.236-27 "SITE VISIT (CONSTRUCTION)" of the RFP under section "52.215-1 INSTRUCTIONS TO OFFERORS--COMPETITIVE ACQUISITION (JAN 2004)" an organized site visit will be held on 24 May 2011 at 15:00 (3:00 PM). Since the RFP documents were issued on June 8th, kindly advise the modified date for the site visit.

**A8:** An organized site visit will not be scheduled. Offerors may visit the site at their own discretion.

**Q9:** Reference to Section 01010 "Scope of Work" of the RFP, Items No. 1 (last paragraph) states: "*All buildings and facilities are categorized in four (4) priorities. Refer to Section 8, Completion of Work, for general requirements and for the priority listing of building and facilities as shown in Table 8.1, "Construction Priorities Schedule";* section 8 and table 8.1 describing the priority schedule are not provided within the RFP, please provide missing Section 8.

**A9:** See revised Scope of Work.

**Q10:** Reference to Section 01010 "Scope of Work" of the RFP, Item No. 3.2.1 (Second paragraph) states: "*The contractor is responsible to identify all buildings, facilities and site features by construction priority following the Construction Priorities Schedule, Table 6-1*"; table 6-1 describing the describes the priorities' schedule is not provided in the RFP, please provide the missing table 6-1.

**A10:** See revised Scope of Work.

**Q11:** Reference to Section 01010 "Scope of Work" of the RFP, Items No. 5 "Completion of Works" (third paragraph) states: "*The required Period of Performance is stated in days following the NTP/Award Date, as described in the Table 5-1 below*"; however there is no required periods stated in that table, please clarify.

**A11:** See revised Scope of Work.

**Q12:** Reference to Section 01015 paragraph 6.10.2, how many working hours per day shall the contractor consider in the calculation of volume of fuel storage tanks?

**A12:** See revised Section 01015. There is no paragraph 6.10.2 in the amended Section 01015. Refer to paragraph 6.12.1 for size requirements, where storage system volumes are prescribed.

**Q13:** There is a conflict between section 01010 paragraph 4.16 (CLIN item 0003AN) and paragraph 5.4 regarding the CLIN item to which the water well submersible pump, booster pump, and water storage tanks should be accounted for. Please clarify.

**A13:** There is no conflict between the referenced requirements.

**Q14:** Reference to Section 01015 paragraph 4.5 "005 Troop Medical Center", there is no requirement or reference to the contractor's obligation to design and construct/supply of any medical gas systems. However, in Section 01015 paragraph 6.9.4 there is a reference to provide three different medical gas systems. Please clarify whether those systems are required or not.

**A14:** See revised Section 01015. There is no paragraph 6.9.4 in the amended Section 01015.

**Q15:** Reference to Section 01010 paragraph 4.19 and section 01015 paragraph 6.11, please provide more details for the required booster pump (s) in wash rack. And if water storage tank/s are required or not in this facility.

**A15:** Design and provide in accordance with the RFP/Solicitation.

**Q16:** Please provide the Master Site Plan (drawing # MP-001) to scale.

**A16:** The Master Site Plan (“Concept Plan”) is to scale.

**Q17:** In reference to the DFAC drawings, there is a conflict between Drawing No. A-102 “Reflected Ceiling Plan” & Drawing No. A-603, please advise which one supersedes.

**A17:** Drawing A-102 shall supersede.

**Q18:** In reference to the Medical Clinic drawings there is a conflict between Drawing No. A-102 “Reflected Ceiling Plan” & Drawing No. A-603, please advise which one supersedes.

**A18:** Drawing A-102 shall supersede.

**Q19:** Reference to Section 01010 Paragraph 4.37, only 7 facilities require back-up generators. Paragraph 4.38 “Battalion HQ” shows 9 typical buildings, please specify if each building will have a back-up generator or only the buildings indicated in the master plan Drawing No. “MP001” with a back up generator, the same for the rest of the facilities.

**A19:** Only 7 facility back-up generator systems are required in accordance with the Concept Plan, the bid schedule, and Section 01010. Only one Battalion HQ Building will have a back-up generator: 101 Battalion HQ.

**Q20:** Reference to SPEC SEC 01010 Para 5.6, the electrical distribution should be according to British standard, please confirm that the electrical distribution design will follow the NEC and the material will be British standard.

**A20:** The electrical distribution system shall be designed and provided in accordance with the RFP/solicitation.

**Q21:** Referring to section 00150 “The Design Build Process”, item #3.0 “Build Phase”, states “The government may give the contractor authorization for the Build Phase for portions of the work following review and acceptance of the 65% design submittal.” However section 01335 : “Submittal Procedures”, item #1.2.1.2 “General Design (65%)”, third paragraph states “Any design adaptations of the concept plan and detailed design drawings furnished with this contract that might be required due to actual site constraints” and the fifth paragraph states “Complete design analysis, plans and specifications for any feature not already provided in the contract.”; our understanding from the above that the contractor will have a CFC drawings after the 10% design submission approval for the facilities design already provided in the contract document after completing the geotechnical investigation and topographic survey and design verification in the 10% design submittal. Please confirm.

**A21:** Refer to attached Section 00150 paragraph 2.2 Design Phase.

**SECTION 00150  
THE DESIGN BUILD PROCESS**

**1.0 GENERAL**

**1.1 PROCESS**

The facility shall be designed and constructed by a single contractor. The Contractor shall construct all buildings per the standard designs supplied by the Government; all other designs are the responsibility of the Contractor. See Section 01010 for identification of Contractor design. The contractor shall construct work in exact conformance to all drawings furnished in the Contract, and perform design analysis and prepare drawings and specifications necessary to complete all other remaining Contract requirements. The design analysis and contractor-developed drawings and specifications shall be submitted for review in accordance with Section 01335. For this project, specifications not supplied by the Government shall also be completely developed for work shown in the furnished drawings and provided for AES review per Section 01335.

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 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.

For this specification, the term "Government" is defined as the Contracting Officer for the US Army Corps of Engineers, Afghanistan District South.

**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 Request for Proposals (RFP) 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 three submittals and the final design. The contractor is encouraged to develop and submit multiple cost saving proposals for innovative design alternatives. The Design-build portion of this contract is listed in section 2.2.1 of this specification. The Design Phase will consist of four parts as follows:

1. A Pre-design meeting will be conducted to distribute drawings to the contractor, finalize and clarify technical information, and clarify other necessary information.
2. 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.

3. 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 (and the D-B facilities listed in section 01010 of this contract and per the submittals description in section 2.2.1 of this specification). After acceptance 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.
4. All design services required to complete the 99% design submittal: 100% complete drawings and specifications for site preparation work, utility construction, paving, foundation, and structural diaphragm of all work. 99% design shall not begin until an acceptance of the 65% design submittal is issued.

**2.2.1 THE DESIGN PHASE SUBMITTALS**

**10% Design Submittal** will be the 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 Clearance for Construction (CFC) letter to commence with the construction phase of the well. A master plan is required in this submittal and detailed per section 01010 requirements.

**65% Design Submittal** shall include 100% complete drawings and specifications for site preparation work and utility construction and shall include the incorporation of all review comments from the previous review. The 65% submittal shall also include approximately 65% complete drawings, design analysis and specifications of all other required construction documents.

**99% Design Submittal** shall include 100% complete drawings, design analysis, and specifications for all required construction. The 99% submittal shall also include the incorporation of all review comments from the previous review.

**100% Submittal** shall include all design services required to complete the design to 100% including the incorporation of all design review comments.

**3.0 BUILD PHASE**

The Build Phase will be initiated by an authorization letter. The authorization letter 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 acceptance of the 65% 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.

Written Notice to Proceed (NTP) following Contract Award

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<b>DESIGN PHASE</b>	
Pre-design Meeting	within 7 days from NTP
<b>10% Design Submittal Due</b>	<b>within 60 days following NTP</b>
Government Review	within 7 days following submittal submission
Incorporate Changes to Submittal	within 7 days following review conference
<b>65% Design Submittal Due</b>	<b>within 120 days following NTP</b>

Government Review  
Incorporate Changes to Submittal

within 7 days following submittal submission  
within 7 days following review conference

**99% Design Submittal Due**

**within 150 days following NTP**

Government Review  
Incorporate Changes to Submittal

within 7 days following submittal submission  
within 7 days following review conference

**100% Design Submittal Due**

**within 180 days following NTP**

Government Review  
Incorporate Changes to Submittal

within 7 days following submittal submission  
within 7 days following review conference

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**BUILD PHASE**

**Clearance for Construction**

**after acceptance of 65% design submittal**

Complete Priority 1 Construction

within 270 days following NTP

Complete Priority 2 Construction

within 360 days following NTP

Complete Priority 3 Construction

within 450 days following NTP

Complete Priority 4 Construction

within 550 days following NTP

Finish all requirements of contract

within 700 days following NTP

Total Design and Construction Period

700 days (performance period includes design and construction phases)

**5.0 LIQUIDATED DAMAGES**

Liquidated damages in the amount of **\$4,422.30** every calendar day of delay shall be assessed and charged to the Contractor.

*All days are in calendar days.*

**--END OF SECTION--**

## **SECTION 01010 SCOPE OF WORK**

### **1. GENERAL**

The project consists of the design construction of the Afghanistan National Army 215<sup>TH</sup> Brigade Garrison Phase I at Camp Garmsir, Helmand Province, Afghanistan. The project is defined as the engineering, materials, labor, and equipment to site-adapt and construct buildings, roads, utilities, and other infrastructure for an end population of approximately 5500 personnel.

The project includes buildings and facilities that shall be constructed using full design arch-Span type construction methods according to the standard design plans located in the Appendix and full design standard drawings for facilities CMU type construction located in Appendix of this RFP.

Buildings, facilities, utilities and infrastructure shall be built following the construction priority list included in this RFP. The contractor shall be responsible for providing final design and as built drawings for most facilities, site work, and related designs. The Contractor may be required to coordinate the efforts required under this contract with at least one other contractor at the site. Such coordination is required as part of this contract. The coordination effort may be significant and may include such tasks as the exchange of information with other contractors such as design data, drawings, calculations, and technical information. Additionally, it may be necessary for the contractor to conduct meetings, hold teleconferences, and prepare the submittal of additional information to the Contracting Officer (KO) that demonstrates the coordination and integration of new work with existing and future work of other contractors. All coordination shall be in agreement with the KO and approved prior to the commencement of any work.

All buildings and facilities must be constructed and become operational following the Construction Priority List specified in the Section 01010. All buildings and facilities are categorized in four (4) priorities. Refer to Section 5, Completion of Work, for general requirements and for the priority listing of buildings and facilities as shown in Table 5-1, "Facility Quantities and Prioritization."

#### **1.1. ENGLISH LANGUAGE REQUIREMENT**

All information shall be presented in English. The Contractor shall have a minimum of one English-speaking representative to communicate with the COR at all times when work is in progress.

#### **1.2. CQM TRAINING REQUIREMENT**

The Contractor's Quality Control (QC) Manager is required to complete the U.S. Army Corps of Engineers (USACE) Construction Quality Management (CQM) course, or equivalent. The CQM course will be offered periodically by the USACE Afghanistan Engineer District (AES). If the QC Manager has not completed the course, then he shall apply for the first available class after the award of the contract. Additional approved CQM courses include those offered by the Commercial Technical Training Center (in Jalalabad) and the Champion Technical Training Center (in Kabul). The Quality Assurance Branch of the AES can provide information related to AES offerings of the CQM course, as well as contact information for training centers. Alternative CQM courses, other than those mentioned above, must be approved by the Quality Assurance Branch.

The Contractor's quality control plan, as defined in USACE Guide Specification 01451, entitled "Contractor Quality Control" (CQC), shall include "The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function." For the QC Manager, qualifications must include a certificate demonstrating completion of an approved CQM course. In lieu of a certificate, provide date of enrollment for the next CQM course.

#### **1.3. SUBMITTALS REQUIREMENTS**

Submittals and a Submittal Register are required as specified in Section 01335 of the Basic Contract.

#### **1.4. COST ESTIMATE REQUIREMENTS**

The Contractor shall prepare a parametric construction cost estimate for AES data collection purposes. The Contractor shall prepare a thorough, well-supported, estimate reflecting the final design features, construction schedule, conditions, and any construction prioritizing requirements. The cost estimate shall be submitted as part of the 100% design submittal.

## **1.5. LOCATION**

The location of the 215<sup>TH</sup> Brigade Garrison Phase I, Camp Garmsir, Helmand Province, Afghanistan, shall generally be within the area bounded by the following coordinates:

LongitudeLatitude

64°4'14.3"E31°4'54.5"N

64°4'48.9"E31°5'20.0"N

64°4'34.3"E31°4'28.5"N

64°5'8.8"E31°4'54.0"N

## **1.6. GENERAL REQUIRMENTS FOR FACILITIES**

All requirements set forth in the Scope of Work (01010), but not included in the Technical Requirements (01015), shall be considered as set forth in both and vice versa.

In general, this project consists of designing and constructing facilities as described in this Section, the Concept Plan, standard design arch-Span type building designs attached in the Appendix, CMU type building standard building designs attached in the Appendix , and the requirements stated in Section 01015 - Technical Requirements. In case of any discrepancy between Section 01010 and Section 01015, Section 01010 takes precedence. The USACE construction representative shall be notified immediately of any inconsistencies discovered in this RFP.

All standard construction amenities such as underground utilities, site grading, plumbing, heating, and electrical, etc. shall be implied as a design and construction requirement.

All construction of the Standard Building designs identified in the Appendix of this RFP shall be done in strict accordance with the plans and specification furnished, with no changes made to any feature of work shown in these design drawings and specifications, unless otherwise specified.

The Contractor shall match existing on-site architectural materials and colors. All construction shall be done in the same style and paint schemes as existing buildings, respective of sustainable construction and design except as indicated and approved by the COR. All toilets shall be eastern style and shall face north or south.

The Contractor shall provide boot scrapers for boot cleaning at all building ingress/egress points.

Barracks shall be spaced as far apart from each other as possible given the final site design configuration, as to minimize sound propagation and to increase privacy.

The Contractor shall provide potable water, toilets, ablution areas, electrical, and communications service backbone in buildings as specified, connecting to and integrating with existing systems and shall be responsible for installing all upgrades. Specification of equipment and materials that match stocked items by the facility or central Department of Public Works is highly desirable. The Contractor shall reference the Appendix for building-specific construction details.

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 2 years prior to bid opening.

All other design work not specifically identified in this RFP shall be the responsibility of the Contractor and it shall be submitted for review in accordance with Section 01335 of this RFP.

### **1.6.1. LIFE SAFETY**

The facilities shall comply with all other safety requirements as required within references. A fire sprinkler system is not required. The Contractor shall equip buildings with wall-mounted A-B-C 6 kg fire extinguishers at a 1:100 SM density (minimum). Exit signs shall be placed above doors opening to the exterior and labeled in English, Dari, and Pashto. The Contractor shall install hardwired smoke detectors to provide local alarm only. Install carbon monoxide (CO) monitors in large occupancy areas (15 SF per person or greater occupant density) and sleeping areas. . These CO monitors/alarms shall be hardwired for reliability and to prevent pilferage. For other requirements, refer to Section 01015.

### **1.6.2. LIGHTING**

General lighting shall be provided for each building type and function within each building, in accordance with standard drawings in the Appendices. For any design build features that contractor shall adhere to the requirements in Section 01015.

### **1.6.3. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)**

Environmental control of the facilities shall be achieved by natural ventilation, mechanical ventilation, and heating per the standard drawings in the Appendices. Cooling shall be provided in only specified rooms of specified buildings. In the case of design build facilities, for inside design conditions and air cooling and heating requirements for various spaces, see Section 01015.

### **1.7. UNEXPLODED ORDINANCE (UXO)/ MINES**

The Contractor **IS NOT** responsible for the clearance or removal of mines and unexploded ordnance (UXO) from the site prior to the commencement of construction. The site has been cleared to a depth of 1.0 m (40") and the certificate of clearance is available for review. No construction activities are to be conducted without review of the written clearance certification for the site. If sub-surface construction activities will be performed on this site the clearance certification must state that the clearance depth was conducted to a minimum 1.0 m (40") in depth.

NOTE 1: For previous UXO/mine information, and a copy of the clearance certification the following points of contact from the UN Mine Action Center of Afghanistan are provided:

Mohammad Sediq, Chief of Operations,  
Email: [sediq@unmaca.org](mailto:sediq@unmaca.org)  
Cell: +93 070 295207

Hansie Heymans, Chief Information Officer,  
Email: [hansie@unmaca.org](mailto:hansie@unmaca.org)  
Cell: +93 070 294286

Ron Cates  
UXO Safety/ Demining COR, USACE  
[tas.uxo.safety@usace.army.mil](mailto:tas.uxo.safety@usace.army.mil) Comm: 540-667-6359  
Roshan: 079-467-3891

NOTE 2: For construction in excess of 1.0 m (40") in depth on areas previously cleared. If the contract parameters for sub-surface construction exceed the minimum 1.0 m (40") clearance depth the Contractor **WILL** be responsible for clearance to these depths.

The Contractor may only provide clearance/removal services via UN Mine Action Center for Afghanistan (UNMACA) accredited entities and Clearance/removal may only be undertaken in accordance with International Mine Action Standards (IMAS), Afghanistan Mine Action Standards (AMAS), and applicable U.S. Army Corps of Engineer (USACE) Ordnance & Explosives (OE) safety standards.

The Contractor will provide a standard UXO/Demining safety work plan to the US Army Corps of Engineers UXO / Demining COR for review prior to commencement of all UXO clearance/demining activities on the project sites. Once the UXO/ Demining clearance has concluded, the Contractor shall provide the US Army Corps of

Engineers UXO / Demining COR a clearance certificate for review and approval before any construction activities are to commence.

NOTE 3: The Contractor should be aware that many areas demined by NGOs and other groups may have only been cleared to a depth of 130 mm (5") for humanitarian purposes. If construction will take place, a minimum of 1.0 m (40") in depth is mandatory.

It is the responsibility of the Contractor to be aware of the risk of encountering UXO/mines and to take all actions necessary to assure a safe work area to perform the requirements of this contract. The Contractor assumes the risk of any and all personal injury, property damage or other liability arising out of or resulting from any Contractor action taken hereunder. The Contractor and its subcontractors may not handle, work with, move, transport, render safe, or disarm any UXO/mine, unless they have appropriate accreditations from the MAC.

If a UXO/mine is encountered during project construction, the Contractor shall immediately stop work in the affected area, mark the area of the UXO/Mine and immediately notify the Contracting Officer, COR or the Government Construction Representative. UXO/Mine disposal will not be the responsibility of the Contractor unless the area exceeds the 1.0 m (40") clearance depth of the original clearance certificate.

## **2. SUMMARY OF WORK**

### **2.1. MOBILIZATION/DEMOBILIZATION**

Mobilization and Demobilization shall consist of all labor, equipment, supplies and facilities required to stage all equipment and facilities needed for construction of this project. See Contract Clauses for more information.

The Contractor shall install temporary access points and roads, temporary parking, construction lay-down areas, and foot paths with compacted base, appropriately graded for drainage, and cover with a well graded, crushed stone aggregate surface capable of withstanding the anticipated construction traffic. At a minimum, the Contractor shall place 50 mm of crushed, well-graded, and compacted aggregate over areas to be used for drainage, pedestrian circulation (not including foot paths), and/or dust control.

Portable latrines: During construction, the Contractor shall furnish and install portable latrine units in locations as required. Portable latrines shall be a mix of western and eastern style units. Mix shall be determined by Contracting Officer.

Portable lavatories: During construction, the Contractor shall furnish and install handwash units in locations as required. Handwash units shall each include four (4) wash units. Each wash unit shall consist of a basin, foot controlled wash water dispenser, hand soap dispenser, and towel dispenser.

Mobilization/Demobilization shall have a unit measurement of lump sum and paid for under bid items 0001A, Mobilization/Demobilization, of the Proposal Schedule (Section 00010).

### **2.2. SECURITY**

Security is critical to construction in Afghanistan, especially on roads and remote areas away from Coalition Force bases. The Contractor must have an appropriate amount of security/protection to match the threat in the project area and along the supply routes. A detailed security plan in accordance with Section 01040 SECURITY shall be approved by the Government before construction notice to proceed.

The Contractor shall be responsible for physical security of all materials, supplies, and equipment of every description, including property which may be Government-furnished or owned, for all areas occupied jointly by the Contractor and the Government, as well as for all work performed.

Security shall have a unit of measure lump sum and paid for under bid items 0001AB, Security, of the Proposal Schedule (Section 00010).

### **2.3. SITE SURVEY / EXISTING CONDITIONS MAP**

The site survey and existing conditions map shall consist of all labor, equipment and supplies necessary to produce the topographical data in accordance with the requirements specified in Sections 01015 and 01335.

Site Survey and Existing Conditions Map shall have a unit of measure lump sum and be paid for under bid items 0001AC, Site Survey/Existing Conditions Map, of the Proposal Schedule (Section 00010).

#### **2.4. A/E DESIGN**

The Contractor shall design all aspects of the project in which the Government did not provide a design. All drawings shall be submitted in accordance with the requirements specified in Section 01335 and 01780A.

A/E Design shall have a unit measure of lump sum and paid for under bid items 0001AD, A/E Design, of the Proposal Schedule (Section 00010). This shall also include payment for all required items as stated in paragraph 3.2.1, Master Planning, and paragraph 3.2.2, Foundation Design.

#### **2.5. MASTER PLANNING**

The Concept Plan attached in the Appendix is for conceptual purposes only and does not constitute a design. The Contractor shall prepare a site Master Plan based on information contained in this Request for Proposal (RFP). The Contractor shall submit the site Master Plan for review within 21 days from the Notice to Proceed (NTP). The Contractor shall participate in a Master Plan design charrette that shall be conducted at the Corps of Engineers Kandahar Area Office at Kandahar Airfield, if deemed necessary by the Government. If necessary, the Contractor shall modify and implement changes to the Master Plan based on the information gathered during the design charrette process.

Current site conditions are only partially indicated in the Concept Site Plan. The Contractor is responsible to identify all buildings, facilities and site features by construction priority following the Facility Quantities and Prioritization schedule, Table 5-1.

The Contractor must verify all space requirements and code compliance in accordance of Section and Section 01015 of this contract. The final Master Plan shall be site-specific and it shall include the location of all temporary structures such as the construction office/storage containers and lay-down and construction debris removal areas. The Contractor shall indicate all other site features on the Master Plan regardless of whether they are indicated on the Government supplied Concept Plan or not. The Contractor shall include all information pertinent to this project into the Master Plan to achieve a complete design in accordance with the requirements of this contract.

#### **2.6. FOUNDATION DESIGN**

Foundations, including sub-grade, are based on an assumed soil bearing value for standard building designs. The Contractor shall design and construct foundations for standard designs based on recommendations from geotechnical investigation, as described in paragraph 3.3, Geotechnical Investigation, are required herein.

#### **2.7. GEOTECHNICAL INVESTIGATION**

Existing geotechnical information is not available at the project site. Any site-specific geotechnical data required to develop foundations, fill at elevated slabs, materials, earthwork, roads, and other geotechnical related design and construction activities for this project shall be the Contractor's responsibility.

The geotechnical report shall contain the results of a geotechnical investigation conducted in accordance with the requirements specified in Section 01015. All labor, equipment and supplies necessary to conduct a geotechnical investigation shall be considered a part of the geotechnical report.

The Geotechnical Investigation shall have a unit of measure lump sum and be paid for under bid items 0001AE, Geotechnical Investigation, of the proposed schedule.

#### **2.8. AS-BUILT DRAWINGS REQUIREMENTS**

The Contractor shall provide the Government with complete as-built drawings at the conclusion of the project. The bid item "As-Built Drawings" shall consist of all labor, equipment, and all supplies needed to produce design records, documents and drawings in accordance with the requirements specified in Section 01335 and 01780A.

The As-built Drawings shall have a unit of measure lump sum and paid for under bid items 0001AF, As-Built Drawings, of the Proposal Schedule (Section 00010).

### **3. FACILITIES**

For all facilities described, refer to the Appendix Drawings and the Facility Quantities and Prioritization Table (Table 6-1) in this section. As in those tables, facilities are listed here in accordance with the series numbers shown in the Concept Plan.

#### **3.1. 001 TACTICAL OPERATIONS CENTER (TOC)**

The Contractor shall construct this facility per the Appendix drawing, Tactical Operations Center. Quantities and locations of windows and doors shall be as illustrated on the floor plans in the Appendix. All building engineering requirements shall be met.

There shall be a total of one (1) Tactical Operations Center building. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Facility Quantities and Prioritization table in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The TOC shall have a unit of measure lump sum and paid for under bid items 0003AA, Tactical Operations Center (TOC), of the Proposal Schedule (Section 00010).

#### **3.2. 002 DEPARTMENT OF PUBLIC WORKS BUILDING (DPW)**

The Contractor shall construct this facility per the Appendix drawing, DPW Building. Quantities and locations of windows and doors shall be as illustrated on the floor plans in the Appendix. All building engineering requirements shall be met.

There shall be a total of one (1) DPW Building. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Facility Quantities and Prioritization table in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The DPW Building shall have a unit of measure lump sum and paid for under bid items 0003AB, Department of Public Works (DPW), of the Proposal Schedule (Section 00010).

#### **3.3. 003 FIRE STATION**

The Contractor shall construct this facility per the Appendix drawing, Fire Station (2-Bay). Quantities and locations of windows and doors shall be as illustrated on the floor plans in the Appendix. All building engineering requirements shall be met.

There shall be a total of one (1) Fire Station. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Facility Quantities and Prioritization table in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

In accordance with the Appendix drawings, the facility and the utility systems shall be designed with adequate capacity for the population of 25 persons (2 officers and 23 firemen). This population is for one working shift; there are 3 shifts per day, seven days a week. Additionally, the facility shall accommodate 6 visitors (max).

The Fire Station shall have a unit of measure lump sum and paid for under bid items 0003AC, Fire Station of the Proposal Schedule (Section 00010).

### **3.4. 004 DFAC**

The Contractor shall construct this facility per the Appendix drawing, DFAC – Small (792 PN). Quantities and locations of windows and doors shall be as illustrated on the floor plans in the Appendix. All building engineering requirements shall be met.

There shall be a total of two (2) DFAC facilities. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Facility Quantities and Prioritization table in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

In particular, the DFAC shall include the following:

- a. Provide walk-in refrigerators and walk-in freezers as shown in the Appendix drawings. The Contractor shall insure proper placement, installation, and initial operation of these units.
- b. Provide an exterior grease interceptor in accordance with Appendix drawing 004a Grease Interceptor (“GREASE INTERCEPTOR DETAIL”).
- c. Provide covered and fenced-in storage area adequate for propane cylinder/canister storage in close vicinity to kitchen as shown in the Appendix drawings. Provide propane-filled 100-pound propane storage tanks in sufficient quantity for a 30 day supply (provide calculations).
- d. Provide a fenced-in storage area adequate for wood storage in close proximity to the wood stoves. This is a site feature that shall be designed by the contractor; it is not shown in the Appendix drawings.
- e. Provide an aggregate-surfaced service area in support of the DFAC building as shown in the Concept Plan. The service area shall be surrounded with a 3 m high chain link fence with Y-channel and triple strand concertina wire and one (1) lockable double swing arm vehicle gate and two (2) lockable personnel gates. Construct the fence and gates per the standard design drawings in the Appendix. The service area shall be able to accommodate propane storage, wood stoves, wood storage area, and storage areas, area for the future location of trailers, and maneuver area.

The DFAC shall have a unit of measure per each and paid for under bid items 0003AD, DFAC, of the Proposal Schedule (Section 00010).

### **3.5. 005 TROOP MEDICAL CENTER**

The Contractor shall construct this facility per the Appendix drawing, Medical Clinic - Large.

There shall be a total of one (1) Medical Center. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Facility Quantities and Prioritization table in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Troop Medical Center shall have a unit of measure lump sum and paid for under bid items 0003AE, Troop Medical Center, of the Proposal Schedule (Section 00010).

### **3.6. 006 PX / BARBER / ATM**

The Contractor shall construct this facility per the Appendix drawing, Post Exchange. Quantities and locations of windows and doors shall be as illustrated on the floor plans in the Appendix. All building engineering requirements shall be met.

There shall be a total of two (2) PX/Barber/ATM facilities. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Facility Quantities and Prioritization table in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The PX shall have a unit of measure per each and paid for under bid items 0003AF, PX/Barber/ATM, of the Proposal Schedule (Section 00010).

### **3.7. 007 DETENTION CENTER**

The Contractor shall construct this facility per the Appendix drawing, Detention Center. The Detention Center shall be surrounded with a 3 m high chain link fence with Y-channel and triple strand concertina wire with a lockable personnel gate. One hundred millimeter thick crushed aggregate shall be placed inside the fenced area.

There shall be a total of one (1) Detention Center. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Facility Quantities and Prioritization table in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Detention Center shall have a unit of measure lump sum and paid for under bid items 0003AG, Detention Center, of the Proposal Schedule (Section 00010).

### **3.8. 008 MWR BUILDING**

The Contractor shall construct this facility per the Appendix drawing, MWR Building.

There shall be a total of one (1) MWR. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Facility Quantities and Prioritization table in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The MWR shall have a unit of measure lump sum and paid for under bid items 0003AH, MWR Building, of the Proposal Schedule (Section 00010).

### **3.9. 009 MAIN ENTRY CONTROL POINT (ECP)**

The Contractor shall construct one (1) Main ECP per the conceptual ECP drawings in the Appendix. The ECP shall include a paved entrance, one (1) manually operated sliding steel vehicular gate, one (1) steel swing personnel gate, one (1) Guard Shack, one (1) steel canopy, three (3) vehicle drop arm barriers, one (1) bypass road and passive anti-vehicle barriers. See Section 01015 for technical requirements.

The ECP shall have a unit of measure lump sum and be paid under bid items 0003AJ, Main Entry Control Point (ECP), of the Proposal Schedule (Section 00010).

### **3.10. 010 SERVICE ENTRY CONTROL POINT (ECP)**

The Contractor shall construct three (3) Service ECPs per the conceptual ECP drawings in the Appendix. The ECPs shall include a paved entrance, one (1) manually operated sliding steel vehicular gate, one (1) steel swing personnel gate, one (1) Guard Shack, one (1) steel canopy, three (3) vehicle drop arm barriers, one (1) bypass road and passive anti-vehicle barriers. See Section 01015 for technical requirements.

The Service ECPs shall have a unit of measure per each and be paid under bid items 0003AK, Service Entry Control Point (ECP), of the Proposal Schedule (Section 00010).

### **3.11. 011 POWER PLANT**

The Contractor shall design and construct one (1) centralized Power Plant Building. The Contractor shall use the drawings titled "Power Plant Building" in the Appendix as a reference for design.

All electrical engineering and installation shall meet British Standard BS 7671 requirements. All wiring shall be run and pulled through conduits. Electrical receptacles shall be provided as indicated. Conductors and circuits shall be sized for the specific design loads.

The Power Plant primary voltage shall be 15kV, 50Hz. Secondary voltage shall be 220/380V, 50Hz. The power plant shall include prime power generators, switchgear, and all appurtenances necessary to meet the current design and anticipated additional electrical demand (spatial capacity to add generator(s)) capacity.

Power generation shall be supplied by six (6) individual 1.0 megawatt prime power rated (1.25 megawatt nominal, or 1.0 megawatt at 50Hz as rated for temperature and altitude) capacity generators for supply and distribution to all buildings to include generation with fuel storage and underground electrical distribution. The Contractor shall reference the Appendix Concept Plan for location details and Section 01015 for engineering details.

The Generators shall be all weather generators suited for outdoor operation. The generators shall be provided with a synchronizer switch, so that when the total power demanded from one generator reaches 90 percent of the generator's maximum, an additional generator shall automatically start and supplement the running generator(s), sharing the load between the generators equally.

The Contractor shall construct a suitable generator pad with containment and minimum required weather protection (detachable roof/shade) and security fencing (when not in a power plant). The Contractor shall install the generators with connections to the fuel supply tank, complete transmission/distribution system, switchgear, oil filled transformers, panels and all other required appurtenances for a basic, fully operational system. The Contractor shall physically attach the generators to the concrete pad. The generator pad shall have vibration isolators and the capability to dampen vibration to the surrounding ground through the use of foam plastic and sand. Grounding of the generators through the pad may only be done if the pad is designed and constructed in accordance with the requirements for a reinforced concrete grounding system.

Contractor shall engineer any and all interior electrical systems and any required exterior lighting as described in Section 01015. Refer to paragraph 6.6 Electrical Distribution System in this section for distribution system requirements.

The Power Plant shall have a unit of measure lump sum and be paid under bid items 0003AL, Power Plant, of the Proposal Schedule (Section 00010).

### **3.12. 012 FUEL TANKS**

The Contractor shall provide fuel tanks for the generators. Power Plant fuel storage capacity shall be a 30-day supply of fuel for the generators; volume shall be as specified in section 01015. The Contractor shall provide a full supply of fuel to the tanks at the time of turnover to the Government.

The location for the new fuel storage tanks shall be adjacent to the power plant in accordance with the Appendix Concept Plan and drawing Electrical Power Generation and Distribution. The storage tanks shall be single walled and surrounded by a concrete containment structure for spill containment. The concrete containment structure shall be designed and constructed to provide a 165,000 liter containment volume. The storage tanks shall have adequately protected distribution lines to the prime power generation plant. The tanks shall be surrounded by concrete T-walls (Alaska barriers) and secured with fence with lockable entry gate. Tanks shall be provided with remote off-loading capabilities. The Contractor shall provide fuel truck access to the fuel off-loading areas that is capable of supporting the expected weight. The design shall provide capability for fuel delivery from two locations; one from outside the perimeter wall surrounding the compound and one at the fuel tanks.

The fuel tanks shall have a unit of measure lump sum and be paid under bid items 0003AM, Fuel Tanks, of the Proposal Schedule (Section 00010).

### **3.13. 013 WATER WELL HOUSE**

The Contractor shall construct one (1) water well house and design and construct the water well system. The well house shall be constructed per the standard drawings in the Appendix titled "Well House". The Contractor shall design and install a submersible pump to provide a minimum of 19 liters per second pumping capacity.

The well house design should be such that the well pump, motor and drop pipe can be removed readily. The well house shall protect valves and pumping equipment plus provide freeze protection for the pump discharge piping beyond the check valve.

The Contractor shall construct a complete, functioning water well to include, but not inclusive of, all piping, flow meters, controls and hypochlorite disinfection system to meet the requirements of Section 01015 and in accordance with the AED Design Requirements-Water Wells, latest version.

The Contractor shall enclose the well facility (10 m x 10 m area) with 3 m high perimeter fence. All gates shall be swinging gates for these facilities. The technical requirements for fences and swinging gates are described in Section 01015.

The Water Well House shall have a unit of measure lump sum and paid for under bid items 0003AN, Water Well House, of the proposed schedule (Section 00010).

### **3.14. 014 WATER STORAGE**

The Contractor shall provide a circular steel ground storage reservoir (GST). The usable storage volume of the reservoir tank shall be equivalent to a full day's water supply: 852,500 liters. The storage facility shall be located above drainage areas and locations subject to flooding as approved by the Contracting Officer. The storage facility 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, insects, rodents and debris cannot enter the reservoir. The Contractor shall provide pipe of adequate strength, durability and be corrosion resistant with no adverse effect on water quality. The exterior surface of the pipe must be corrosion resistant. Provide heat tracing on any exposed piping to prevent freezing. Provide heating of the storage tank water to prevent freezing.

The water storage tank shall have a unit of measure lump sum and paid for under bid items 0003AP, Water Storage, of the proposed schedule (Section 00010).

### **3.15. 015 WASTE WATER TREATMENT PLANT**

The Contractor shall design and construct a Wastewater Treatment Plant (WWTP) per the requirements of Section 01015. The Wastewater Treatment Plant shall be a partial mix aerated lagoon type system and shall be located to minimize the use of lift stations and shall utilize gravity sewers as much as possible. The Waste Water Treatment Plant shall be designed and constructed such that the system shall not be flooded by a 25-year storm event and shall include considerations for potential flooding events originating upstream. The wastewater treatment plant shall be designed to treat 1,030,000 liters per day of waste water. The Contractor shall design and construct the Wastewater Treatment Plant to include sludge drying beds and shall include an adequate outfall to the proposed sewer lagoons per the Concept Plan in the Appendix. The design and construction of the outfall shall include concrete lining or rip rap measures to prevent erosion due to the flow from the Wastewater Treatment Plant.

The Contractor shall design and construct a 35 m<sup>2</sup> CMU type building for laboratory/office space and a 35 m<sup>2</sup> CMU type building for the hypochlorite disinfection system/chemical storage room. Both buildings shall have emergency eye wash stations and stainless steel sinks. See Section 01015 for technical requirements.

Approximate location of the proposed WWTP is indicated on the Concept Plan attached in the Appendix.

The WWTP shall have a unit of measure lump sum and paid for under bid items 0003AR, Waste Water Treatment Plant (WWTP), of the Proposal Schedule (Section 00010).

### **3.16. 016 EFFLUENT WATER PUMP / FILL STATION**

The Contractor shall design and construct an Effluent Water Pump / Fill Station in accordance with the requirements of this section and Section 01015. The Effluent Water Pump / Fill Station shall be located as indicated in the Concept Plan.

The Effluent Pump/Fill Station shall have a unit of measure lump sum and paid for under bid items 0003AS, Effluent Water Pump / Fill Station, of the Proposal Schedule (Section 00010).

### **3.17. 017 INCINERATOR**

The Contractor shall construct incinerators in accordance with the requirements of this section and Section 01015.

The Contractor shall construct a minimum twelve (12) ton per day incinerator system using two (2) equally sized incinerator units. The incinerators shall have primary chambers, secondary chambers, and cyclone particulate filters. The incinerator shall be located in accordance with the Concept Plan in order to maximize the flow of waste through the Waste Management Area while allowing sufficient room for vehicle operations and future expansion.

In like manner, the Contractor shall provide a medical waste incinerator with capacity for 300 kg per day capacity.

The Contractor shall provide and install a complete fuel system (i.e. Tanks, pump (as required), piping, etc.) for the incinerator plant. Volume of fuel storage tanks shall be as specified in Section 01015. The Contractor shall provide a full supply of fuel to the tanks at the time of turnover to the Government.

The location for the new fuel storage tanks shall be adjacent to the incinerator plant. The storage tanks shall be single walled and surrounded by a concrete containment structure for spill containment. The storage tanks shall have adequately protected distribution lines to the incineration plant. The tanks shall be surrounded by concrete T-walls (Alaska barriers), provided with a metal canopy roof to keep precipitation out of the tank pit, and secured with fence with lockable entry gate. Tanks shall be provided with remote off-loading capabilities. The Contractor shall provide fuel truck access to the fuel off-loading area that is capable of supporting the expected weight.

The incinerators shall have a unit of measure per each and be paid under bid items 0003AT, Incinerator (not medical waste incinerator), of the Proposal Schedule (Section 00010).

The medical incinerator shall have a unit of measure lump sum and be paid under bid items 0003AU, Medical Waste Incinerator, of the Proposal Schedule (Section 00010).

### **3.18. 018 FUEL POINT & POL**

The Contractor shall construct one (1) POL building in accordance with the Appendix drawing, POL Storage.

The contractor shall construct the Fuel Point in accordance with the Appendix drawing, fuel Storage and Vehicle Refueling Point. The fuel point shall be designed to accommodate three (3) 7-ton vehicles side by side in accordance with the Concept Plan. Provide 200 mm diameter by 1,000 mm high concrete-filled steel bollards around the pumps to prevent damage from vehicles. Provide a concrete hard surface pad around the fuel pumps and dispensers. The concrete hard surface pad shall extend for the full length of the dispensing area as shown in the standard drawings. Provide electrical service to the fuel pumps in accordance with the manufacturer's recommendations. Provide area lighting for general illumination of vehicle fuel dispensing areas; all lighting and electrical devices shall be explosion-proof. Each refueling point shall have a metal roof canopy per the standard design in the Appendix. Provide fire extinguishers.

The Contractor shall provide above-ground fuel tanks. Fuel Storage capacity shall be 50,000 liters of diesel fuel and 10,000 liters of MOGAS. The storage tanks shall have adequately protected distribution lines to the vehicle refueling points. The tanks shall be surrounded by concrete T-walls (Alaska barriers) and have a metal roof to keep precipitation out of the tank pit. The Contractor shall provide a full supply of fuel to the tanks at the time of turnover to the Government.

The Contractor shall provide maneuver areas for the dispensers and maneuver area for fuel truck deliveries. Grade and level the parking area with appropriate slope and drainage shall tie into the storm drainage system.

The Contractor shall provide a Fuel Operator Building in connection with the Fuel Point & POL in accordance with the Appendix drawing, Fuel Operators Building.

All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The fuel point, POL, and fuel operator building shall have a unit of measure lump sum and paid for under bid items 0003AV, Fuel Point & POL, of the Proposal Schedule (Section 00010).

### **3.19. 019 VEHICLE WASH STATION**

The Contractor shall construct one (1) vehicle wash station located per the Concept Plan. The vehicle wash station shall include elevated concrete pads to accommodate 3 vehicles side by side, as indicated on the Concept Plan. The Vehicle Wash Racks shall be built according to the Appendix drawing, Wash Rack and per the requirements of Section 01015.

The Contractor shall design and construct water service for the vehicle wash racks by a pressure pump connected to the nearest water source. Provide broom finish texture concrete pad and elevate with appropriate slope for drainage run-off to a trench drain. Extend drainpipes from trench drain away from the wash stations, with grit chambers, an oil/water separator, and clean outs, and tie into the storm drainage system.

All surface inside the compound up to the elevated concrete racks, shall be designed and constructed with 150 mm of aggregate surface. The Contractor shall allow for adequate vehicle maneuver space.

The Vehicle Wash Station shall have a unit of measure lump sum and paid for under bid items 0003AW, Vehicle Wash Station, of the Proposal Schedule (Section 00010).

### **3.20. 020 CONVOY ASSEMBLY AREA**

The contractor shall design and construct convoy assembly areas in accordance with the Appendix drawings and Section 01015. In support of the Brigade Garrison, design and construct aggregate surfaced Convoy Assembly Areas, each 135 m long x 18 m, along the road connecting east and west ECP's. These assembly areas shall each accommodate two (2) parallel sets of vehicles parked in formation ready for exiting the Garrison secondary ECP's.

The convoy assembly areas shall have a unit of measure per each and be paid under bid items 0003AX, Convoy Assembly Area, of the Proposal Schedule (Section 00010).

### **3.21. 021 HELICOPTER LANDING ZONE (HLZ)**

The Contractor shall construct two (2) helicopter pads similar to the existing pad. The helicopter pad shall consist of a 30 m by 30 m unreinforced concrete pad with 7.5 m wide thick aggregate paved shoulders. The helicopter pad shall not be lighted for night time operations. The Helipad pavement shall be designed based on the wheel load of 22,667 kg (50,000 lb) at a contact pressure of 1,724 kPa (250 psi) and results from calculations from California Bearing Ratio tests on the soil. All calculations shall be shown in the design analysis. The helicopter pad shall be designed in accordance with UFC 3-260-01 located in the Appendix. A 7.3m-wide asphalt paved access road shall be designed and constructed to provide access to the helicopter pad.

The helicopter pads shall have a unit of measure per each and paid under bid items 0003AY, Helicopter Landing Zone (HLZ) Expansion, of the Proposal Schedule (Section 00010).

### **3.22. 022 SOCCER FIELD**

The contractor shall design and construct one soccer field of dimensions 100m x 50m. The location shall be in a central, common area within the garrison as shown in the Concept Plan. There are no standard drawings for the sports field; the contractor shall use established international standards for sports field engineering.

The soccer field shall have a unit of measure lump sum and paid under bid items 0003AZ, Soccer Field, of the Proposal Schedule (Section 00010).

### **3.23. 023 PARADE FIELD WITH REVIEW STAND**

The contractor shall construct a Parade Field with Review Stand per the Appendix drawing, Parade Ground Review Stand, and Section 01015. Provide approximately 2,240 SM (82m x 27m) compacted crushed aggregate surface to withstand traffic of 18,000-kg (20-ton) vehicles. No grass or extra landscaping is required. Elevate and grade the ground surface to ensure that site drainage does not erode the field. There shall be no ponding. Engineer and construct an appropriate storm drainage network system along with all appurtenances such as manholes, area inlets, catch basins, culverts, cleanouts, drainage swales, and other standard appurtenances for

optimum system performance. Provide an electrical system for the Review Stand and spectator bleachers for the Parade Field in accordance with the Appendix drawings.

The parade field and review stand shall have a unit of measure lump sum and paid under bid items 0003BA, Parade Field with Review Stand, of the Proposal Schedule (Section 00010).

### **3.24. 025 CLASSROOM FACILITY**

The Classroom buildings shall be designed and constructed in accordance with Appendix drawing, “Classroom Building”.

There shall be a total of two (2) Training Classroom buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 6-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The classrooms shall have a unit of measure per each and shall be paid for under bid item 0003BC, Classroom Facility, of the Proposal Schedule (Section 00010).

### **3.25. 026 FLAGPOLE LOCATION**

The contractor shall construct Flagpole Locations in accordance with the Appendix drawing, Flagpole Details, and Section 01015. The Contractor shall refer to the Concept Plan for the locations of the flagpoles.

The flagpoles shall have a unit of measure per each and shall be paid for under bid item 0003BD, Flagpole Location, of the Proposal Schedule (Section 00010).

### **3.26. 027 MOSQUE – N.I.C.**

A mosque is not in the scope of work of this contract. No drawings are provided; neither engineering nor construction is required. A site shall be provided for future construction of a mosque in accordance with the approximate proportions indicated in the Concept Plan.

### **3.27. 028 GUARD TOWERS**

The Contractor shall construct fifteen (15) Guard Towers per the standard design drawings titled “Guard Tower” in the Appendix.

The Guard Towers shall be located at intervals of approximately 275 m apart from each other, as well as at all access penetration points in the perimeter wall. The floor height shall be elevated as to allow the window sill to be 500 mm above the top of the wall.

The Guard Towers shall be fitted with one 360-degree omni- directional searchlight. One weather-resistant duplex receptacle shall be provided as required for general use. The area in the immediate exterior vicinity of the guard tower shall be provided with an all weather non-slip surface and shall be graded to sufficiently drain away from structure. Lighting shall not consist of white lights inside guard towers. The Contractor shall use red, blue, or black lenses in interior guard tower lighting.

The guard towers shall have a unit of measure per each and paid under bid items 0003BE, Guard Tower, of the Proposal Schedule (Section 00010).

### **3.28. 029 FUEL POINT CONTROL OFFICE**

The contractor shall construct a Fuel Point Control Office in accordance with the Appendix drawing, Fuel Operator Building, and Section 01015. The Contractor shall refer to the Concept Plan for the location of the office.

The fuel office shall have a unit of measure lump sum and paid under bid items 0003BF, Fuel Point Control Office of the Proposal Schedule (Section 00010).

### **3.29. 030 ECP RECEPTION BUILDING**

The contractor shall design and construct Entry Control Point (ECP) Reception Buildings in accordance with the Appendix drawings and Section 01015. One shall be provided for each ECP. The Contractor shall refer to the Concept Plan for the location of the buildings.

The reception buildings shall have a unit of measure per each and paid under bid items 0003BG, ECP Reception Building, of the Proposal Schedule (Section 00010).

### **3.30. 031 FITNESS CENTER**

The Fitness Center building shall be constructed in accordance with Appendix drawing, Fitness Center.

There shall be a total of one (1) fitness center. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 6-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The fitness center shall have a unit of measure lump sum and shall be paid for under bid item 0003BH, Fitness Center, of the Proposal Schedule (Section 00010).

### **3.31. 032 TRASH COLLECTION POINT**

The contractor shall construct forty-four (44) Trash Collection Points per the Standard Design drawing, Trash Collection Point, in the Appendix. The Contractor shall locate each Trash Collection Point in locations convenient for easy removal. The Contractor shall locate trash points evenly spaced around the property and at each common facilities location.

The Trash Collection Points shall have a unit of measure per each and paid under bid items 0003BJ, Trash Collection Point, of the Proposal Schedule (Section 00010).

### **3.32. 033 WASTE MANAGEMENT AREA**

The contractor shall design and construct a complete Waste Management Area in accordance with the Appendix drawing, Waste Management Area, and Section 01015. A Waste management Office is not required. The area shall have a 150 mm aggregate surface throughout. Provide a 3 meter high chain link fence with concertina outriggers surrounding the entire area. Provide a 7.3 meter width double gate for vehicular traffic servicing the area.

The Contractor shall design and construct three separate fifteen (15) meter by fifteen (15) meter concrete pads to be used for composting, recycling, and hazardous materials, respectively, in accordance with the Appendix drawings and Section 01015. These pads shall be located within the Waste Management Area. Each pad shall be constructed of 100 mm thick reinforced concrete sections (3 each) having smooth finish such that storm water will drain toward the edges.

The Contractor shall construct four ash holding bins for the storage of the incinerator waste in accordance with the Appendix drawings and Section 01015. Each bin shall have a 150 mm thick slab and 200 mm thick walls that are one (1) meter high. Each ash holding bin shall have an approximate area of 16 square meters and shall be constructed with a bottom liner. Due to the nature of the incinerated waste and the possibility that incomplete incineration will occur, the ash holding bin area shall be designed as required to accept untreated solid waste. This shall conform to the specifications in the USFOR-A Environmental SOP, Annex E-1. The Contractor shall construct a spraying/wetting system to control the blowing of ash by wind.

The waste management area shall have a unit of measure lump sum and paid under bid items 0003BK, Waste Management Area, of the Proposal Schedule (Section 00010).

### **3.33. 034 MEDICAL CENTER PARKING AREA**

The Contractor shall design and construct a parking area for the Medical Center in accordance with the Appendix drawings and Section 01015. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site. Refer to paragraph 5.3 of this section for further requirements for parking areas.

The parking area shall have a unit of measure lump sum and paid under bid items 0003BL, Medical Center Parking Area, of the Proposal Schedule (Section 00010).

### **3.34. 035 CLOTHESLINES**

The Contractor shall construct clotheslines in accordance with the Appendix drawing, Standard Detail, Clothline1, and Section 01015. Construct two (2) Clotheslines for every Latrine (400PN) and one (1) Clothesline for every Small Latrine (120PN) and as noted for other facilities in this scope of work section.

The clotheslines shall have a unit of measure lump sum and paid under bid items 0003BM, Clotheslines, of the Proposal Schedule (Section 00010).

### **3.35. 036 PERSONNEL BUNKERS**

The Contractor shall construct an approximate number of one hundred and thirty-seven (137) Personnel Bunkers per the Appendix drawing, Personnel Bunker.

The contractor shall place bunkers at optimal locations on the Master Plan in relationship to personnel requirements.

The Personnel Bunkers shall have a unit of measure per each and paid under bid items 0003BN, Personnel Bunkers, of the Proposal Schedule (Section 00010).

### **3.36. 037 PERIMETER WALL**

The Contractor shall construct the perimeter wall of masonry or native stone per the Concept Plan for the general location. The Contractor shall follow the standard construction drawing, Perimeter Wall, in the Appendix.

The height of the walls shall measure the standard of 3.0 m from the inside and outside grades to the top of the concrete wall cap. The wall shall be topped with Y shaped outriggers and single-coil concertina style razor wire. The ground grade shall slope away from the wall for at least 5.0 m and shall be kept a minimum of 3.0 m below the top of wall for a minimum distance of 10 m.

The wall shall be designed to keep all pedestrian and truck traffic outside the compound from having a visual line of site into the compound. The perimeter road shall be at a standoff distance of no less than 3.0 m from the inside face of the perimeter wall.

The Perimeter Stone Wall shall have a unit of measure lump sum and be paid under bid items 0003BP, Perimeter Stone Wall, of the Proposal Schedule (Section 00010).

### **3.37. 038 FACILITY BACKUP GENERATOR SET**

The contractor shall construct backup generator sets to provide full backup power to seven facilities in the event of garrison power failure. Provide in accordance with the requirements of Section 01015 for generators. The seven facilities to be served by these backup generator sets are indicated in the Concept Plan and in this section. Each backup generator and its accompanying day tank shall be sized based upon the associated building's full electrical load and shall have sufficient fuel capacity for 48 hours continuous operation at this loading. For each, provide a gated fence around the generator set and day tank. Provide a concrete foundation with sufficient secondary containment volume for 110% of the total volume of the day tank and the generator set fuel tank. The generator shall be a packaged unit with a sound-attenuating enclosure. Provide a canopy to cover the generator and associated electrical components. The Contractor shall provide a full supply of fuel to the tanks at the time of turnover to the Government.

The generator sets shall have a unit of measure per each and paid under bid items 0003BR, Facility Backup Generator Set, of the Proposal Schedule (Section 00010).

**3.38. 101 BATTALION HQ BUILDING (201, 301, 401, 501, 601 ALSO)**

The Battalion Headquarter building shall be constructed following the standard construction drawings, Headquarters Building, attached in the Appendix.

There shall be a total of nine (9) Battalion Headquarters buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 6-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Battalion Headquarter Buildings shall have a unit of measure per each and shall be paid for under bid item 0003BS, Battalion HQ Building, of the Proposal Schedule (Section 00010).

**3.39. 102 VIP QUARTERS**

The VIP Quarters building shall be constructed following the standard construction drawing, VIP Barracks, attached in the Appendix.

There shall be a total of one (1) VIP Barracks building. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 6-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The VIP Barracks shall have a unit of measure per each and shall be paid for under bid item 0003BT, VIP Quarters, of the Proposal Schedule (Section 00010).

**3.40. 103 OFFICERS BARRACKS (202, 302, 402, 502, 802 ALSO)**

The Officers Barracks building shall be constructed following the standard construction drawing, Officers Barracks – Large, attached in the Appendix.

There shall be a total of nine (9) Officer Barracks buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 6-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Officers Barracks shall have a unit of measure per each and shall be paid for under bid item 0003BU, Officers Barracks, of the Proposal Schedule (Section 00010).

**3.41. 104 COMBO NCO/ENLISTED BARRACKS (204 ALSO)**

The Combination NCO / Enlisted Barracks building shall be constructed following the standard construction drawing, Combination NCO Enlisted Barracks, attached in the Appendix.

There shall be a total of four (4) Combination NCO / Enlisted Barracks buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 6-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Combination NCO/Enlisted Barracks shall have a unit of measure per each and shall be paid for under items 0003BV, Combo NCO/Enlisted Barracks, of the Proposal Schedule (Section 00010).

**3.42. 105 ENLISTED BARRACKS (205, 304, 404, 504, 804 ALSO)**

The Enlisted Barracks building shall be constructed following the standard construction drawing, Enlisted Barracks, attached in the Appendix.

There shall be a total of twenty-six (26) Enlisted Barracks buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 6-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Enlisted Barracks shall have a unit of measure per each and shall be paid for under items 0003BW, Enlisted Barracks, of the Proposal Schedule (Section 00010).

### **3.43. 106 LATRINES – SMALL (206, 305, 506, 703, 806 ALSO)**

The small latrine building shall be constructed following the standard construction drawings, Small Latrine, attached in Appendix.

There shall be a total of twenty (20) Small Latrine buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

All toilets shall be Eastern Style and shall face North–South.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 6-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Small Latrine Buildings shall have a unit of measure per each and shall be paid for under bid item 0003BX, Latrines - Small, of the Proposal Schedule (Section 00010).

### **3.44. 107 BATTALION STORAGE BUILDING (207, 306, 406, 507, 807 ALSO)**

The storage building shall be constructed following the standard construction drawings, Storage Building, attached in the Appendix.

There shall be a total of eleven (11) Warehouse/Storage buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 6-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Storage Building shall have a unit of measure per each and shall be paid for under bid items 0003BY, Battalion Storage Building, of the Proposal Schedule (Section 00010).

### **3.45. 108 MOTOR POOL (209, 308, 408, 509, 604, 705, 809 ALSO)**

Design and construct Motor Pool Areas in coordination with the facilities required in this RFP. There shall be eleven (11) motor pool areas, varying in sizes and number of facilities contained within each area, as indicated in the Concept Plan attached in the Appendix.

Each Motor Pool Area shall be enclosed by a 3.0 m high chain link fence with Y-channel and triple strand concertina wire and two (2) lockable double swing arm vehicle gates and two (2) lockable personnel gates. The grade shall slope away from the fence for at least 5 meters and shall be kept a minimum of 3.0 m below the top of the fence for a distance of 10 m. The Contractor shall construct the fence and gates per the standard design drawings attached in the Appendix.

All motor pools shall be designed and constructed with 150 mm of aggregate surface compacted to 100% maximum density above 150 mm scarified fill compacted to 95% maximum density. Allow adequate vehicle maneuver space to access all parking and facilities.

Exterior pole-mounted lighting along the fence line shall be provided to provide illumination for night-time operations and safe movement of vehicles within the motor pool compound. The Contractor shall construct light poles per the details in the Appendix.

The motor pool areas shall have a unit of measure lump sum and be paid for under bid items 0003BZ, Motor Pool, of the Proposal Schedule (Section 00010).

**3.46. 109 SMALL ARMS STORAGE (210, 309, 409, 510, 706, 810 ALSO)**

The Small Arms Storage building shall be of a CMU type construction following the standard construction drawings, Small Arms Storage, attached in the Appendix.

There shall be a total of ten (10) Small Arms Storage buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

Each Small Arms Storage building shall include the following:

- a. Provide wooden racks for storing long-arm weapons vertically. Racks shall not be furnished with locking bars.
- b. The facility will be enclosed with a 3.0 m high fence and a secure entranceway.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 6-1 in this Section.

Small Arms Storage Buildings shall have a unit of measure per each and be paid under bid item 0003CA, Small Arms Storage, of the Proposal Schedule (Section 00010).

**3.47. 110 TRAINING FACILITY (211, 310, 410, 511, 707, 811 ALSO)**

The Training buildings shall be constructed following the standard construction drawing, Training Building, attached in the Appendix.

There shall be a total of ten (10) Training Buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 6-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Training Buildings shall have a unit of measure per each and shall be paid for under bid item 0003CB, Training Facility, of the Proposal Schedule (Section 00010).

**3.48. 201A ADMIN (701 ALSO)**

The Administration building shall be constructed following the standard construction drawing, Admin Building, attached in the Appendix.

There shall be a total of three (3) Administration buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 6-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Administration Buildings shall have a unit of measure per each and shall be paid for under bid items 0003CC, Administration Building, of the Proposal Schedule (Section 00010).

**3.49. 203 NCO BARRACKS (303, 403, 503, 702, 803 ALSO)**

The NCO Barracks building shall be constructed following the standard construction drawings, NCO Barracks – Large, attached in the Appendix.

There shall be a total of fourteen (14) NCO Barracks building. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 6-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The NCO Barracks shall have a unit of measure per each and shall be paid for under items 0003CD, NCO Barracks, of the Proposal Schedule (Section 00010).

### **3.50. 208 VEHICLE MAINTENANCE BUILDING (307, 407, 508, 603, 704, 808 ALSO)**

The Vehicle Maintenance building shall be constructed following the standard construction drawings, Vehicle Maintenance Building, attached in Appendix.

There shall be a total of fourteen (14) Vehicle Maintenance buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site. Other facilities that may be missing from the Concept Plan shall also be indicated.

Additionally the design shall comply with the requirements of Section 01015 and follow the following programming standards:

- a. There shall be four, 200 mm diameter by 1,000 mm high concrete filled steel bollards adjacent to each roll up door on the interior and exterior of the building.
- b. There shall be a concrete hardstand apron outside all garage doors at a minimum 10 m width. Concrete hardstand apron shall support a minimum loading of a 3-axle, 30,000 kg vehicle without failing. There shall be at least 18 m clear distance around the vehicle maintenance building before any parking or between any other facilities.
- c. Emergency eye-wash stations shall be provided for each building or for every two (2) maintenance bays, as applicable.
- d. Battery rooms shall have emergency eyewash stations and one (1) acid resistant sink.
- e. An overhead vehicle tailpipe exhaust removal system shall be provided. The location of the system shall be coordinated so that it does not interfere with vehicle access.
- f. The air compressor shall be located outside and to the rear of the building under a canopy and enclosed in a security with gate.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 6-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Vehicle Maintenance Facility shall have a unit of measure per each and shall be paid for under bid item 0003CE, Vehicle Maintenance Building, of the Proposal Schedule (Section 00010).

### **3.51. 405 LATRINES (505, 805 ALSO)**

The Latrine Buildings shall be constructed following the standard construction drawings, Latrine – Large, attached in Appendix.

There shall be a total of six (6) Latrine Buildings. The Contractor shall refer to the Concept Plan for the location of this facility type in relationship to other buildings and facilities on site.

All toilets shall be Eastern Style and shall face North–South.

The Contractor shall coordinate the construction of this facility based on the Construction Priority List, Table 6-1 in this Section. All materials, finishes, and equipment shall comply with the requirements of Section 01015.

The Latrine shall have a unit of measure per each and shall be paid for under bid item 0003CF, Latrines, of the Proposal Schedule (Section 00010).

## **4. SITE DEVELOPMENTS/IMPROVEMENTS**

### **4.1. DEMOLITION**

The Contractor shall remove and dispose of all debris, trash, CONEXs, concrete, buildings, existing utilities (above or below ground), fuel tanks, HESCO baskets, and foundations. The Contractor shall be responsible for locating and paying all fees associated with removal and relocation of all debris and shall verify the location of debris disposal with the Contracting Officer. Scrap metal and CONEXs on site shall be moved to an area away from the site perimeter as directed by the COR and left for the host government to salvage. Demolished fencing

and concertina wire shall be neatly rolled up and used fence posts and outriggers shall be neatly stockpiled for reuse by the host government.

There will be no separate measurement or payment for demolition and the costs associated with any demolition work shall be accounted for by the Contractor in the bid item for which the demolition is associated.

#### **4.2. SITE GRADING AND DRAINAGE**

The Contractor shall design and construct a complete stormwater drainage system in accordance with the requirements of Section 01015. Site grading and drainage features shall conform to the requirements and references specified herein for development of the facility. The Contractor shall design and submit a Site Grading and Drainage Plan showing the location of all required drainage structures.

The Grading and Drainage Plan shall indicate the existing and proposed contour lines, the location of drainage structures and the direction of flow. Spot elevations shall be indicated at the beginning and the end of all drainage structures and inflexion points and they shall be spaced every 25 m along the alignment. Proposed contour lines shall meet with existing contour lines on the Grading and Drainage Plan. The Grading and Drainage Plan shall be at a scale that all lines and structures can be easily seen and ascertained.

Culverts at perimeter wall penetrations shall have personnel access denial system(s).

The side slopes of all new earthen storm drainage (including canals, trenches, ditches, swales, etc) shall have preferably a slope no greater than 1 Vertical to 3 Horizontal. For side slopes at a greater slope, the drainage features must be lined with a stone and mortar finish or concrete to prevent erosion.

Native crushed stone 100 mm thick shall be placed around all buildings, from the building wall or building landscaping out 2.0 m and all areas of anticipated foot or vehicle traffic to reduce erosion and to provide dust control.

The site grading and drainage shall have a unit of measure lump sum and paid for under bid items 0004AA, Site Grading and Drainage, of the Proposal Schedule (Section 00010).

#### **4.3. ROADS, PARKING AREA AND FOOT PATHS**

Provide a complete network of roads, parking areas, and foot paths throughout the garrison based on the analysis of the Contractor's geotechnical investigation. The road layout shall provide ease of access to entrance points, buildings, loading ramps and docks, vehicle maintenance facilities, fuel points, trash collection points, grease traps, oil/water separators, convoy assembly area, etc. Roads shall be able to withstand 18,000 kg (20 ton), 5-axle vehicles. A storm drainage system shall also be included. The main access road shall be 7.3 m wide with a stand-off distance of 3 m from the perimeter wall.

The Contractor shall provide design drawings showing detailed cross sections and road structure to comply with the Technical Requirements, Section 01015.

#### **4.4. INTERIOR ROADS**

Interior roads shall be aggregate surfaced. The Contractor shall provide design drawings showing detailed cross sections and road structure and plan and profile drawings showing proper stationing. Roads shall be 7.3 m wide unless otherwise noted. Provide a complete storm drainage system corresponding to the road network design. Roads shall be elevated relative to the adjacent site and shall be sloped for proper surface runoff. Drainage ditches shall be provided for both sides of each road; the ditches shall terminate in areas where water can drain away from the road structure. The hydrology of the area shall be evaluated to determine drainage ditch and structure sizes.

The interior roads shall have a unit of measure lump sum and paid for under bid items 0004AB, Interior Roads, of the Proposal Schedule (Section 00010).

#### **4.5. EXTERNAL ACCESS ROAD**

Provide an external access road between all ECP's. The external access road shall be 3.5 m wide and shall link the ECP's for emergency and operation-specific purposes. The road length, siting, and overall dimensions for construction shall be based on a 1 m set-back from the perimeter wall.

The external roads shall have a unit of measure lump sum and paid for under bid items 0004AC, Exterior Roads, of the Proposal Schedule (Section 00010).

#### **4.6. FOOTPATHS**

The Contractor shall design and construct 1.5 m wide concrete footpaths to serve all facilities and features as conveyed in the Concept Plan. Provide foot paths from each exterior door to the nearest connecting footpath, even where not detailed on the Concept Plan. Footpaths shall be compacted base, appropriately graded for drainage, and covered with a well graded, crushed stone aggregate surface. Footpaths shall be shown on the Contractor's Master Plan and a detail of the foot paths shall be provided in the engineering drawings.

The footpaths shall have a unit of measure lump sum and paid for under bid items 0004AD, Footpaths, of the Proposal Schedule (Section 00010).

#### **4.7. PARKING**

Provide parking to individual facilities as dictated above in this section. Parking adjacent to roadways shall have drainage culverts passing underneath. Parking spaces and geometry shall be shown on the Master Plan. Refer to feature 034 Medical Center Parking Area on the Concept Plan for specific layout of that parking area. A supplemental parking area shall also be provided as shown in the Concept Plan. Provide other miscellaneous parking as indicated in the Concept Plan.

The parking areas shall have a unit of measure lump sum and paid for under bid items 0004AE, Parking (not including line item 0003BK), of the Proposal Schedule (Section 00010).

#### **4.8. WATER WELL AND DISTRIBUTION SYSTEM**

The Contractor shall engineer and provide a complete well water system in accordance with the following requirements and Section 01015. This provision includes but is not limited to preliminary water exploration to locate a well site and drill to an appropriate depth. Water shall be tested and be accepted for quality standards for human consumption. The system shall include a wells, well pumps, booster station, storage tanks, and disinfection system. Design the entire system capacity for a population of 5500 personnel consuming 155 liters per person per day.

The Contractor shall drill one (1) well to a depth of 350 m to 400 m in an attempt to find potable water meeting all World Health Organization (WHO) water quality requirements. If water cannot be found after drilling to 400 m, the Contractor shall immediately notify the Contracting Officer's Representative (COR). 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 "Water Well and Distribution System".

The Contractor shall design and construct a complete potable water distribution system having an enclosed booster pump station to provide sufficient water pressure. The main distribution piping shall be fully looped about the interior of the garrison. The system shall have hydro-pneumatic water storage tank(s), water storage tank(s) and underground pipe distribution system to all buildings and features requiring water supply. The Contractor shall install water meters between the water well and storage tanks and between the storage tanks and the distribution system. The water system shall be designed and constructed in accordance with the AED Design Requirements, latest version. See Section 01015 for design and construction criteria. Water demand required for fire fighting and for irrigation and landscaping needs shall not be included in design demand calculations.

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.

The well and distribution system shall have a unit of measure lump sum and paid for under bid items 0004AF, Water Well and Distribution System (not including line items 0003AN and 0003AP), of the Proposal Schedule (Section 00010).

#### **4.9. WASTE WATER COLLECTION SYSTEM**

The Contractor shall design and construct a complete waste water collection and system for all facilities in accordance with the following requirements and Section 01015. The system and its components shall be designed for a population of 5500 at 120 liters waste flow per person per day. Provide a waste water collection system consisting of gravity sewer pipe and all appurtenances such as manholes, cleanouts, building service connections and lift station(s) required to provide service to all facilities with sanitary sewer waste. Refer to Section 01015 for technical requirements.

The Wastewater collection system shall have a unit of measure lump sum and paid for under bid items 0004AG, Wastewater Collection System, of the Proposal Schedule (Section 00010).

#### **4.10. ELECTRICAL DISTRIBUTION SYSTEM**

The Contractor shall design and provide a complete, 15kV medium-voltage underground electrical distribution system in accordance with the following requirements and Section 01015. The electrical distribution system shall provide electricity to all facilities and features requiring power at this garrison. The system shall be looped to provide the minimum disruption to operations by a fault on any single portion of the system. The Contractor shall provide oil-filled outdoor transformers, cable and any other equipment necessary for a fully functioning electrical distribution system. All electrical design and installation shall meet British Standard BS 7671 requirements. All wiring shall be run and pulled through conduits.

The Contractor shall also design and provide a complete electrical secondary, low-voltage (220/380V, 50Hz, utilization voltage) system for building and occupant utilization. All electrical design and installation shall meet BS 7671, 17th Edition requirements. All wiring shall be run and pulled through conduits. Electrical receptacles and devices shall be provided as indicated. Conductors and circuits shall be sized for the specific design loads. Contractor shall design all interior electrical systems and any required exterior lighting as described in Section 01015.

There shall be no lightning protection systems except as indicated on the standard building designs.

The Electrical Distribution System shall have a unit of measure lump sum and be paid for under bid items 0004AH, Electrical Distribution System (not including line items 0003L and 0003M), of the proposed schedule.

#### **4.11. TELECOMMUNICATION SYSTEM**

The Contractor shall design, provide, and install the exterior and interior communications infrastructure. The exterior communications infrastructure shall provide a looped communication system for perimeter security functions. The communications duct bank shall run to all guard towers, guard shacks, ECPs, and back to the central Communications Room located in the Battalion Headquarters Building.

The interior communications infrastructure shall provide a pathway to all communications outlets and head-end equipment located in the building. Communications head-end equipment, cabling, RJ45 jacks, and faceplates shall be provided by others. The design and construction of the systems shall be in accordance with the references and the requirements contained herein and in Section 01015.

The Telecommunication System shall have a unit of measure lump sum and be paid for under bid items 0004AJ, Telecommunications System, of the Proposal Schedule (Section 00010).

#### **4.12. GARRISON LOUDSPEAKER/ALARM SYSTEM**

The Contractor shall install a loudspeaker/alarm system that can alert the entire compound via panic button from any tower or guard post station. The speaker and 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.

The loudspeaker/alarm system shall be paid for under the lump sum bid items 0004AK, Loudspeaker/Alarm System, of the Proposal Schedule (Section 00010).

**5. COMPLETION OF WORK**

The order of construction for all buildings and facilities shall be prioritized. The contractor shall construct in accordance with the Construction Priority Schedule and the requirements specified in Section 00150, Design/Build Process.

All work required under this contract shall be completed within 700 calendar days including Government review time from Notice-to-Proceed (NTP) for site work.

All work under this contract shall be completed and buildings ready for beneficial occupancy in accordance with the required Build Phase periods of performance shown in Section 00150. Facility Quantities and Prioritization shall be in accordance with Table 5-1 below.

<b>FACILITY QUANTITIES AND PRIORITIZATION</b>		
<b>PRIORITY 1</b>		
<b>Site Work, Force Protection, Utilities, DFAC, Infantry and CS/RCC Kandaks</b>		
<b>SITE WORK, FACILITIES AND SITE FEATURES TO BE CONSTRUCTED</b>		<b>QUANTITY</b>
Site	Site grading and drainage	ALL
	023 Parade Field with Review Stand	1
Utilities	Complete domestic water system including well(s), 013 Water Well House, 014 Water Storage, and water distribution piping system	ALL
	038 Facility Backup Generator Set – Water well and pumping system	1
	Complete sanitary sewer system including 015 Waste Water Treatment Plant (WWTP), 016 Effluent Water Pump/ Fill Station, 024 Lagoon, and sanitary waste piping system; Complete stormwater drainage system.	ALL
	038 Facility Backup Generator Set – WWTP, effluent pump/fill station	1
	Complete electrical system including 011 Power Plant, 012 Fuel Tanks, and electrical distribution system	ALL
	Complete telecommunications system	ALL
	Complete 033 Waste Management Area, including 017 Incinerator (municipal and medical waste incinerators)	ALL
	018 Fuel Point & POL	1

	029 Fuel Point Control Office	1
Force Protection	007 Detention Facility	1
	009 Main Entry Control Point	1
	010 Service Entry Control Points	3
	028 Guard Towers	15
	030 ECP Reception Building	4
	037 Perimeter Wall	ALL
	Complete Garrison Loudspeaker/Alarm System	ALL
DFAC	004 D-FAC/ Outdoor Kitchen/ Propane (nearest the Priority 1 Kandaks)	1
	038 Facility Backup Generator Set – DFAC	1
Infantry Kandaks	501 Battalion HQ Building	4
	502 Officers Barracks	4
	503 NCO Barracks	8
	504 Enlisted Barracks	16
	505 Latrines	4
	506 Latrines – Small	8
	507 Battalion Storage Building	4
	508 Vehicle Maintenance Building	4
	509 Motor Pool	4
	510 Small Arms Storage	4
	511 Training Facility	4
CS/RCC	201 Battalion HQ Building	1
	201a Admin-RCC	1
	202 Officers Barracks	1
	201 NCO Barracks	1
	204 Combo NCO/ Enlisted Barracks	2
	205 Enlisted Barracks	2
	206 Latrines – Small	4
	207 Battalion Storage Building	2

	208 Vehicle Maintenance Building	3
	209 Motor Pool	1
	210 Small Arms Storage	1
	211 Training Facility	1
Bunkers	All bunkers associated with Priority 1 facilities	ALL
Amenities	All clotheslines associated with Priority 1 facilities	ALL
<b>PRIORITY 2</b>		
<b>Brigade HQ, GSU, and CSS Kandaks; DFAC</b>		
<b>SITE WORK AND FACILITIES TO BE CONSTRUCTED</b>		<b>QUANTITY</b>
Brigade HQ	001 Tactical Operations Center (TOC)	1
	038 Facility Backup Generator Set – TOC	1
	101 Battalion HQ Building	1
	038 Facility Backup Generator Set – Brigade HQ Building	1
	102 VIP Quarters	1
	103 Officers Barracks	1
	104 Combo NCO/Enlisted Barracks	1
	105 Enlisted Barracks	1
	106 Latrines – Small	1
	107 Battalion Storage Bldg	1
	108 Motor Pool	1
	109 Small Arms Storage	1
	110 Training Facility	1
GSU	401 Battalion HQ Building	1
	402 Officer Barracks	1
	403 NCO Barracks	1
	404 Enlisted	1
	405 Latrines	1
	406 Battalion Storage Building	1
	407 Vehicle Maintenance Building	1

	408 Motor Pool	1
	409 Small Arms Storage	1
	410 Training Facility	1
CSS	301 Battalion HQ Building	1
	302 Officers Barracks	1
	303 NCO Barracks	1
	304 Enlisted Barracks	2
	305 Small Latrine	3
	306 Battalion Storage	2
	307 Vehicle Maintenance Building	3
	308 Motor Pool	1
	309 Small Arms Storage	1
	310 Training Facility	1
DFAC	004 D-FAC/ Outdoor Kitchen/ Propane (nearest the Priority 2 Kandaks)	1
	038 Facility Backup Generator Set – DFAC	1
Bunkers	All bunkers associated with Priority 2 facilities	ALL
Amenities	All clotheslines associated with Priority 2 facilities	ALL
<b>PRIORITY 3</b>		
<b>MP, Transient, and ETT Kandaks</b>		
<b>SITE WORK AND FACILITIES TO BE CONSTRUCTED</b>		<b>QUANTITY</b>
MP	701 Admin Building	1
	702 NCO Barracks	1
	703 Latrines – Small	2
	704 Vehicle Maintenance Building	1
	705 Motor Pool	1
	706 Small Arms Storage	1
	707 Training Facility	1
Transient Facilities	801 Admin Building	1

	802 Officers Barracks	1
	803 NCO Barracks	2
	804 Enlisted Barracks	4
	805 Latrines	1
	806 Latrines – Small	2
	807 Battalion Storage Building	1
	808 Vehicle Maintenance Building	1
	809 Motor Pool	1
	810 Small Arms Storage	1
	811 Training Facility	1
ETT Facilities	601 Battalion HQ Building	1
	602 Combo NCO/ Enlisted Barracks	1
	603 Vehicle Maintenance Building	1
	604 Motor Pool	1
Bunkers	All bunkers associated with Priority 3 facilities	ALL
Amenities	All clotheslines associated with Priority 3 facilities	ALL
<b>PRIORITY 4</b>		
<b>Common Facilities</b>		
<b>SITE WORK AND FACILITIES TO BE CONSTRUCTED</b>		<b>QUANTITY</b>
Facility Requirements	002 DPW	1
	003 Fire Station	1
	005 Troop Medical Center	1
	038 Facility Backup Generator Set – Troop Medical Center	1
	006 PX/ Barber/ ATM	2
	008 MWR Building	1
	019 Vehicle Wash Station	1
	025 Classroom Facility	2
	031 Fitness Center	1
Additional Site Facilities	020 Convoy Assembly Area	2
	021 Helicopter Landing Zone	2
	022 Soccer Field	1

	026 Flagpole Location	12
	032 Trash Collection Points	ALL
	034 Medical Center Parking Area	1

-- END OF SECTION --

## **SECTION 01015 TECHNICAL REQUIREMENTS**

### **1.0 GENERAL**

#### **1.1 COMPLIANCE**

The Contractor's design and construction must comply with technical requirements contained herein. The senior designers of all engineering disciplines shall have a minimum of 10 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. This section 01015 represents technical requirements to support the scope of work section 01010. These requirements are generic in nature and to be used in conjunction with the referenced codes of this specification. In case of conflict between the sections 01010 and 01015, the 01010 will supersede.

#### **1.2 MINIMUM & ALTERNATE REQUIREMENTS**

The design and product requirements stated in these documents are minimum requirements. Exceeding the minimum requirements as improvements to the design stated herein is highly encouraged at no additional cost and as approved by the government. Any deviation from the technical requirements shall be approved by the Contracting Officer. Request for deviations shall be submitted for approval. The Contractor is encouraged to propose alternate design or products (equipment and material) that are more commonly used in the region; but these variations shall be equal in performance from a technical standpoint as well as more cost effective or allow for more timely completion. 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, paragraph 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)**

###### **1.4.1.1 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 Camp Shorab 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, as much as possible. Standards that cannot be met or require interpretation of their usage, the contracting officer shall make the determination. If there is conflict in the criteria the contracting officer shall make the determination. This list is not exhaustive and is not necessarily complete.

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

ARI - Air Conditioning and Refrigeration Institute

ASCE 7, Minimum Design Loads for Buildings and Other Structures (latest edition)

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 (latest edition), American Welding Society

DCID 6/9 Physical Security Standards for Sensitive Compartmented Information Facilities  
DCID 1/21, Manual for Physical Security Standards For Sensitive Compartmented Information Facilities (SCIF)  
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: (1994) Commercial Building Grounding/Bonding Requirement Standard  
Factory Mutual (FM) Approval Guide-Fire Protection (2002)  
HESCO® Bastion Concertainer® Construct Guide for Engineers  
IBC - International Building Codes, 2006 edition (and its referenced codes including those inset below)  
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 13, Fire Sprinkler Code, 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 55, Standard for the Storage, Use and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders and Tanks, latest edition  
NFPA 58, Liquefied Petroleum Gas Code, latest edition  
NFPA 70, National Electrical Code, latest edition  
NFPA 72, National Fire Alarm Code, 2002 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 99, Health Care Facilities, latest edition  
NFPA 101, Life Safety Code, latest edition  
NFPA 110, Standard for Emergency and Standby Power Systems, 2005 edition  
NFPA 1141, Site Fire Protection, latest edition  
Plumbing and Drainage Institute (PDI-WH-201) water hammer arrestors  
SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, Standards and Guides, latest editions

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

TM 5-785 Weather Data

TM 5-805-4 Noise and Vibration

TM 5-811-1 Electrical Power Supply and Distribution

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

UFC 1-300-07A Design Build Technical Requirements

UFC 3-220-03fa Soils and Geology

UFC 3-230-03a, Water Supply, 16 Jan 2004

UFC 3-230-04a, Water Distribution, 16 Jan 2004

UFC 3-230-06a, Subsurface Drainage, 16 Jan 2004

UFC 3-230-07a, Water Supply: Sources and General Considerations, 16 Jan 2004

UFC 3-230-09a, Water Supply: Water Storage, 16 Jan 2004

UFC 3-230-10a, Water Supply: Water Distribution, 16 Jan 2004

UFC 3-230-17FA, Drainage in Areas Other than Airfields, 16 Jan 2004

UFC 3-240-04a, Wastewater Collection, 16 Jan 2004

UFC 3-240-07fa Gravity Sewers 16 Jan 2004

UFC 3-240-04A Wastewater Collection 16 Jan 2004

UFC 1-300-09N, Design Procedures

UFC 3-310-01, Structural Load Data

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

UFC 3-410-01FA Heating, Ventilating and Air Conditioning, latest edition

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

UFC 3-410-04N, Industrial Ventilation, latest edition

UFC 3-420-01, Plumbing Systems Design, latest edition

UFC 3-420-02FA, Compressed Air, latest edition

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

UFC 3-460-01, Petroleum Fuel Facilities, latest edition

UFC 3-501-03N, Electrical Engineering Preliminary Considerations, 16 Jan 2004

UFC 3-520-01, Interior Electrical Systems, 10 June 2002

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

UFC 3-530-01AN, Design: Interior and Exterior Lighting and Controls, 19 Aug 2005

UFC 3-550-03FA Design: Electrical Power Supply and Distribution Systems, 1 Mar 2005

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

UFC 4-010-01, Design: Minimum DoD Antiterrorism Standards for Buildings, 22 Jan 2007

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

UFC 4-020-03FA, Security Engineering: Final Design, 1 Mar 2005

UFC 4-020-04FA, Electronic Security Systems: Security Engineering, 1 Mar 2005

UFC 4-021-01, Design and O&M: Mass Notification Systems, draft 1 May 2006

UFC 4-022-01, Security Engineering: Entry Control Facilities/Access Control Points, 25 May 2005

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

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

UL Standards (as applicable)

Underwriters' Laboratories (UL) Fire Protection Equipment Directory (2002)

UL 752, Bullet Resisting Equipment, 2000 or later

USCINCCENT OPORD 97-1

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

The publications to be taken into consideration shall be those of the most recent editions.

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

In addition, technical criteria provided in USACE-AED Design Requirements (located in appendix C) 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 – Water Tank and Water Distribution Systems, 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 - Vertical Curves, latest version

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

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

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 COR. 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.

## **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 be 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 EXISTING CONDITIONS MAP AND SITE PLAN**

The Contractor shall prepare an Existing Conditions Map of the property including 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 84 UTM Zone 41 North in decimal degrees). The Existing Conditions Map shall include topographic information with existing contour lines and spot elevations of relevant topographic features, and show the locations of all on-site and nearby offsite existing features including but not limited to buildings, structures, major trees, road pavements and right of ways, names of roads, widths of roads, easements, right of way, setbacks, parking, paved areas, storage containers, stoops, sidewalks, walkways, walls, fences and gates, barriers, and existing underground and aboveground utilities, dry creek beds, drainage channels, etc. and hydrological, geological, and vegetative 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 a separate Site Plan shall be prepared showing the property boundary, and all proposed surface features including but not limited to buildings, 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. 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 agreement with the associated drawings included 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, utilities, etc. Required facilities are described in the

following sections of this specification. All site plans and master plans shall be drawn in the following projection and datum for incorporation into the USACE GIS system:

WGS 1984 UTM Zone 41 North

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 stormwater outfall piping locations where the contractor is tying into the existing stormwater drainage system.

Topographic survey and geotechnical investigation of the proposed sewage treatment site is required and the Contractor shall design the wastewater treatment system to be compatible with site and soil conditions.

*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.

#### **2.2.2 DEMOLITION**

Demolition shall include removal of all structures, foundations, pavements, and utilities, and clearing and grubbing. Holes and depressions shall be backfilled.

#### **2.2.3 SITE GRADING & DRAINAGE**

The Contractor shall provide all necessary site grading to insure adequate drainage so that no areas will be flooded due to a rainfall of a 25-year frequency. Drainage of the area should be compatible with the existing terrain. Building floor elevation shall be a minimum 150mm above grade and slope away from the building on all sides at a minimum of 5% for 3 m. All other grading on site shall be a minimum of 1% to ensure proper drainage.

Proper drainage calculations shall be conducted in order to size drainage structures and channels properly.

Rainfall data 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-most recent version 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 of hydrological data from foreign countries be used for hydrologic studies.

#### **2.2.4 ROADS, PARKING AREAS, MOTOR POOLS AND FOOT PATHS/FIRE LANES**

Location, type, and width of roads required are stated in Section 01010. Roads shall be geometrically designed, graded for proper drainage and provided with necessary drainage structures. 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 preexisting conditions are determined to be substantially or materially different than the above-described conditions/estimates.

For all asphalt roads, the Contractor shall provide 1.0 m wide, aggregate base shoulder compacted to 100% maximum density that is 100 mm thick at 2.0% slope on both sides of the roadway. The centerline of all roads shall be sloped a minimum of 1% and a maximum of 8%.

The roads shall be capable of withstanding traffic of 18,000-kg vehicles. All roads shall be designed geometrically with applicable sections of UFC 3-250-18FA and UFC 3-250-01FA to accommodate WB-50 five axle 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.

All intersecting roads, foot paths, driveways, and culvert crossings are required to end with a smooth transition to the new road alignment. The Contractor shall show spot elevations of the existing terrain at all road tie in locations on the site plans.

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.

### **2.3 SIDEWALKS, FIRELANES AND AGGREGATE PAVED AREAS**

The Contractor shall provide 1.5 m wide concrete foot paths between buildings, parking areas, and other logically anticipated areas to serve as pedestrian foot paths. The Contractor shall assume these above stated standards throughout this document unless otherwise noted.

For emergency access, each building or facility shall have 3.0 m wide fire lanes on three (3) sides. Fire lanes shall consist of 100 mm thick aggregate. This is in compliance with NFPA 2008, Section 6.2.1. Foot paths may be used as fire lanes if the footpaths are at a minimum of 3.0 m wide concrete and designed to accommodate vehicular traffic.

The Contractor shall pave all areas listed in Section 01010 as requiring aggregate paving with 100 mm thick crushed stone aggregate.

The pavement structures dictated above are minimum requirements. Design of foot paths and aggregate paved 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.

Parking areas, motor pools and areas requiring aggregate paving per Section 01010 shall consist of 100 mm thick compacted aggregate base course compacted to 100% maximum density placed above 150 mm thick of scarified sub-grade compacted to 95% maximum density, unless otherwise noted.

Provide 1.0 m wide shoulder around all parking areas and motor pools consisting of 100 mm thick aggregate base course material at 2.0% slope.

#### **2.3.1 FORCE PROTECTION DESIGN**

The Contractor shall design and construct force protection measures as shown in the Appendix Concept Plan. 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, as shown in the Concept Plan. For all fire lane design, reference the International Fire Code (IFC) latest edition.

##### **2.3.1.1 CHAIN-LINK FENCE AND GATES**

Provide chain-link fences and gates where required. 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. Post sizes shall be as shown on drawings.

The gates shall be swing type. Hinged gates shall be a pair of 3.65 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 installed on its hinges. Gates shall have a sufficient number of hinges, anchor mounted to the exterior masonry walls, to support each gate leaf. 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.

### **2.3.1.2 OUTRIGGERS**

Outrigger supporting arms shall be “Y” shaped with post securely embedded into the top of the wall. Posts shall conform to ASTM F 1083, Pipe, Steel, Hot Dipped Zinc Coated (Galvanized) Welded.

### **2.3.1.3 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 in length, in groups of 4, spaced on 102 mm centers. The stainless steel core wire shall have a 2.5 mm (0.098 inch) 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.

### **2.3.1.4 PERIMETER STONE WALL**

Native stone masonry walls, 600 mm thick, shall be constructed around the perimeter of the site. The height of the walls shall measure at least 3 m from the inside grade. Inside grade shall in all cases be higher than outside grade. The wall shall be capped with a cast-in-place concrete capping. Outriggers shall be installed to support barbed wires and 2 strands of concertina style razor wire. The ground grade shall slope away from the wall for at least 5 m and shall be kept a minimum of 2.5 m below the top of wall for a minimum distance of 10 m. 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. Details of any penetrations shall be produced by the contractor and provided in the design drawings.

### **2.3.1.5 PERIMETER WALL ACCESS GATES**

#### **2.3.1.5.1 SLIDING STEEL GATES**

Gates shall be K4 sliding type. Gate shall be 3 m high with 0.5 m of high tension razor wire mounted on top. Gate shall be constructed of 100 mm x 100 mm x 5 mm square steel tubing, faced with 5mm steel plate. The design and construction of the gates shall insure that it is dimensionally stable, square, true and planar. Sliding Gate shall not rack or deflect when open, closed, or in motion. Gate tracks shall be anchor mounted to galvanized steel stanchions. Provide a locking mechanism that holds the gate closed. Provide reinforced grade beam across gateway flush with pavement to lock gate with flush mounted vertical sliding bolts, bolts shall be 50 mm diameter solid steel. The sliding gate will also have a built- in personnel gate with its own locking mechanism.

### **2.3.1.6 ENTRY CONTROL POINT (ECP)**

The new Secondary ECP shall be laid out and constructed by the Contractor to facilitate secure entrance of authorized vehicles into the compound. A Guard House shall be provided inside the compound as part of the ECP. Entrance to the ECPs shall be paved, and shall have a single-leaf manually operated sliding steel gate. The gate shall be considered the Active Vehicular Barrier (AVB). A drop arm and guard shack shall be provided and located at a 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 a rejection lane 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.

### **2.3.1.6.1 VEHICLE BARRIERS**

#### **2.3.1.6.1.1 ACTIVE BARRIERS - DROP ARM GATES**

The height of the beam shall be a minimum of 762 mm above finished grade. The crash beam must be capable of blocking a minimum road width of 4.0 m. The crash beam shall be manually raised and lowered with less than 133 Newtons of force. The end of the crash beam should include a locking pin with padlock acceptance for securing the beam when it is in the down position capable of stopping large (4500 kg) trucks, in addition to heavy duty steel gates into the compound.

The gate shall be designed to accommodate a vehicle that is 6 m high (including gunners nest). Show a sketch in the design drawings of how the arm will clear the vehicle and gunners nest.

#### **2.3.1.6.1.2 PASSIVE BARRIERS - CONCRETE**

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.

## **2.4 CIVIL UTILITIES**

### **2.4.1 WATER**

#### **2.4.1.1 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 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 (or 41 gallons) per capita per day (lpcd) – times a capacity factor, times the effective population. A capacity factor of 1.5 shall be used if the effective population is less than or equal to 5,000. The capacity factor for larger populations is found in UFC 3-230-07a, Water Supply: Sources and General Considerations guidance. The capacity factor shall be utilized as described in the following paragraph. 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 building with water supply shall have a water meter installed in a locked cabinet area inside the building.

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 an adjusted ADF (ADD, times the population, times the capacity factor) over a 16 hour period).
- Water Tanks - Capacity shall be based on  $ADF (ADD \times c \times CF \times 3)$ .
- Booster Pumps – The capacity shall be based on the installation wide, total fixture unit flow or 2 times the average daily flow (16 hour basis), whichever is greater. Three identical pumps shall be provided which are all sized to deliver 50% 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 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 ( $ADD \times c \times CF$ ).
- Water Mains – Diameter based on the installation fixture unit flow or two times the ADF ( $ADD \times c \times CF$ )

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 or per contract

#### **2.4.1.2 WATER WELLS**

The Contractor shall construct water well(s) inside the compound, to provide sufficient supply for the facility. The water well pump capacity and Total Dynamic Head (TDH) shall be based on an adjusted ADF (ADD, times the population, times the capacity factor) over a 16 hour period. The new well capacity shall have an allowable safe yield 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 meters from any existing wells. Well construction shall be in accordance with the USACE-AED Well Design Guide and Water Well Guide Specification. If installation of one or more wells with sufficient yield is not possible within the compound, the Contractor shall immediately notify the COR for resolution. Off-site water wells may then be considered upon approval by the COR.

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 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 Contractor shall drill a minimum of two wells to a minimum depth of between 350 meters and 400 meters 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. If water cannot be found the Contractor shall immediately notify the Contracting Officer's Representative (COR). 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 drilling. However, the Contractor must still furnish all other parts of the water distribution system as described in the specifications. At this time, off site water wells and other alternatives may be considered upon approval by the COR.

**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.

**Sealing:** The drilling process shall create a hole (borehole) larger than the casing (minimum of 2 inches). The annular space between the casing and the borehole will be filled with gravel, overburden, or concrete as follows:

- a. 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).
- b. 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.

- c. 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.
- d. 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

- e. 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.

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

**Source Protection:** Surface drainage within 30 m of the 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. The Contractor shall identify all sources of contamination and ensure the proposed well site meets minimum standoff distances as indicated below:

Sewage storage areas (outhouses, tanks, individual sewage pits, lagoons, and WWTP) – 30 m

Septic fields (infiltration galleries) – 30 m

Fuel storage, engine maintenance/repair – 30 m

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

### 2.4.1.3 WATER QUALITY CONTROL AND TESTING

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. Raw water quality criteria requirements for laboratory testing shall be addressed in accordance with USACE-AED Well Pumps & Well Design Guide with Attachment A – Guide Specifications for Drinking Water Wells, latest version for requirements for laboratory testing.

### 2.4.1.4 WELL WATER PUMPS

An electric submersible well pump will fill the above ground water tank. The well pump shall be installed inside the casing set no less than 3 m above the screen or in casing between screened intervals a minimum of 3 m above and below the screens. Pumps shall not be located in a screened interval. 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.

#### **2.4.1.5 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.

#### **2.4.1.6 SERVICE BOOSTER PUMPS**

Contractor shall provide a booster pump station to provide water to the water distribution system. The system shall be equipped with hydropneumatic surge tank(s). Service booster pumps shall be end suction or split case double suction horizontal split case (frame mounted) centrifugal pumps arranged in parallel for pumping water storage into the water distribution system. The pumps and controls shall be designed to supply and maintain acceptable system pressure to the water distribution system. 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.

Three identical pumps shall be provided. Two pumps shall alternate to distribute wear (with one as a back-up) and shall automatically turn on and off based on demand. The booster pump system shall be enclosed in a CMU booster pump building per the drawings titled "Booster Pump Building" in Appendix B.

##### **2.4.1.6.1 HYDRO-PNEUMATIC SURGE TANK(S)**

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.

#### **2.4.1.7 WATER STORAGE TANK**

Water storage tank capacity shall be based on 300% of the required daily demand based on 155 liter/capita/day times the effective population. Contractor shall provide a steel ground storage tank(s) (GST) to be located on the ground surface. The Contractor shall verify storage volume requirements based on final design population. The storage facility shall be located above drainage areas and locations subject to flooding as approved by the Contracting Officer. The storage facility 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.

#### **2.4.1.8 DISINFECTION & CHLORINATION SYSTEM**

The Contractor shall test water for World Health Organization (WHO) potable drinking water standards and if treatment is required, the Contractor shall immediately notify the Contracting Officer. Regardless of water quality the Contractor shall provide and install a water disinfection system. The chlorination system shall be enclosed in the booster pump building.

Use hypochlorite compounds for disinfection. A hypo-chlorinator shall be used to feed a sodium hypochlorite solution of 5-15% available chlorine into the system. Hypochlorite compound may be a liquid or solid form. The hypo chlorination system shall consist of a chemical solution tank for hypochlorite, diaphragm-type pump, power supply, water pump, pressure switch and storage tank (optional hydro-pneumatic/storage). 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) adequate to deliver 5 percent (%) available hypochlorite solution adjustable to the quantity of water being produced from the source. 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 0.2-0.4mg/l) in the distribution system. Chlorine solution tank shall be large enough to hold a three day 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.

#### **2.4.1.9 WATER DISTRIBUTION CHLORINE BUILDING**

The Contractor shall design and construct a 35 m<sup>2</sup> CMU Chemical Building for housing the chlorination system and storage of chemicals. The Chemical Building shall have an emergency eye wash station, one (1) stainless steel sink and water source for mixing chemicals. The chemical building shall be adequately vented to maintain a safe working environment and per the chlorine manufacturer's requirements. The Contractor shall provide manufacturers catalog information and shop drawing to the Contracting Officer for approval.

#### **2.4.2 WATER DISTRIBUTION SYSTEM**

##### **2.4.2.1 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 pressure test, unless otherwise specified. Pipe diameters shall be adequate to carry the maximum flow of water at velocities less than 1.5m/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 345 kPa to 414 kPa at all points of the distribution system. If pressures greater than 690 kPa cannot be avoided, pressure-reducing valves shall be used. A system pressure of 30 psi is acceptable at extreme peak flow conditions. A system pressure below 30 psi shall be considered a deviation in the technical requirements requiring Contracting Officer approval.

Contractor shall not use HDPE pipe and fittings, regardless if existing project water distribution system had this pipe material.

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 road crossings shall have a reinforced concrete cover of at least 150 mm thickness around the pipe extending out to 1 m from each road edge.

##### **2.4.2.2 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.

##### **2.4.2.2.1 WATER MAINS AND BRANCHES**

Water main diameter shall be based on the installation fixture unit flow or two times the ADF ( $ADD \times c \times CF$ ) and velocity requirements per this guide unless a minimum diameter is specified which is adequate to provide flow and meet the specified maximum velocity. 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 not be less than 100mm in diameter. Pipe diameters shall be 100mm and larger. 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 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 leakage test and and 1.38 MPa hydrostatic pressure test 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.

#### **2.4.2.2.2 WATER SERVICE**

Water service line diameter 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 19mm, 25mm, 38mm, 75mm, to 100mm 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.

#### **2.4.2.3 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.

#### **2.4.2.4 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. 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.

#### **2.4.2.5 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 1.01 MPa. 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:

$L = 0.0001351ND (P \text{ raised to } 0.5 \text{ power}), \text{ where:}$

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.

#### **2.4.2.6 BACTERIOLOGICAL DISINFECTION**

##### **2.4.2.6.1 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 1.0 ppm. During the flushing period, each fire hydrant on the line shall be opened and closed several times.

##### **2.4.2.6.2 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.

##### **2.4.2.6.3 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.

##### **2.4.2.6.4 TIME FOR MAKING TESTS**

Except for joint material setting or where concrete thrust blocks necessitate a 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.

##### **2.4.2.6.5 CONCURRENT 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.

##### **2.4.2.6.6 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 3600 mm (12 feet). Gate valves shall be in accordance with AWWA C 500 and/or C509. Butterfly valves (rubber seated) shall be in accordance with C504 etal. 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, 1 m square, for all valve boxes.

#### **2.4.2.6.7 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.

#### **2.4.2.6.7.1 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.

#### **2.4.2.7 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.

For piping that has **restrained joints** and **less than** 100 mm diameter, thrust blocking is not necessary.

### **2.4.3 SANITARY SEWER**

#### **2.4.3.1 GENERAL**

Sanitary sewers less than 1.25 meters under road crossings 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.

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

- 1) Follow slopes of natural topography for gravity sewers.
- 2) 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.
- 3) Avoid routing sewers through areas which require extensive restoration or underground demolition.

- 4) Depending upon the topography and building locates, 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. The intent is to provide future access to the lines for maintenance without impacting vehicular traffic.
- 5) 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.
- 6) Sewer lines shall have a minimum of 800 mm of cover for frost protection.
- 7) Locate manholes at change in direction, pipe size, or slope of gravity sewers.
- 8) Sewer sections between manholes shall be straight. The use of a curved alignment shall not be permitted.
- 9) If required by the design, locate manholes at intersections of streets where possible. This minimizes vehicular traffic disruptions if maintenance is required.
- 10) 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 (1) m beyond the designated roadway.
- 11) Verify that final routing selected is the most cost effective alternative that meets service requirements.

#### **2.4.3.2 PROTECTION OF WATER SUPPLIES**

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

- 1) Sanitary sewers shall be located no closer than 30 m horizontally to water wells or reservoirs to be used for potable water supply.
- 2) 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.
- 3) Sanitary sewers crossing above potable water lines shall be constructed of suitable pressure pipe or fully encased in concrete for a distance of 3 m 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 horizontally to the crossing, unless the joint is fully encased in concrete.
- 4) 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.

#### **2.4.3.3 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:

- 1) Sanitary sewer laterals, mains and trunk lines flow velocities shall be designed to provide a minimum velocity of 0.6 meters per second (mps).
- 2) A minimum velocity of 0.8 mps at the peak diurnal flow rate.
- 3) 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.
- 4) 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.

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.

#### **2.4.3.4 SITE SELECTION FOR SUBMERSIBLE INFLUENT SEWAGE LIFT STATION**

The Contractor shall locate sewage lift stations as needed based primarily on topographic considerations. The lift stations will be located, so that all points within the intended service areas of the facility can be served adequately by gravity sewers en route to the lift station.

#### **2.4.3.4.1 SUBMERSIBLE INFLUENT LIFT STATION PUMP CAPACITY**

The number and capacity of pumps provided will be sufficient to discharge minimum, average, peak daily and extreme peak flow rates as calculated in TM 5-814-1/AFM 88-11, Vol 1 or UFC 3-240-08FA. Pumping capacity will be adequate to discharge the peak flow rates with the largest pump out of service.

Each pumping unit will be a constant speed type, and will be capable of discharging the extreme peak flow rate. Influent lift stations will be used to pump major wastewater flows to the treatment facility and operate on a continuous basis. The rate of pumpage must change in increments as the flow to the station varies. The Contractor will provide two or more wastewater pumps of the constant speed type, as required to match the incoming flow rate.

#### **2.4.3.5 MANHOLES**

The Contractor shall provide standard depth manholes (MH), (depth may vary) an inside dimension of 1.2 m. Manholes shall be made of cast-in-place reinforced concrete with reinforced concrete cover. Alternate pre-cast manhole option shall taper to a 750 mm cast iron frame that provides a minimum clear opening of 600 mm. 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 meter 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°.

#### **2.4.3.5.1 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.

#### **2.4.3.5.2 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.

#### **2.4.3.5.3 PIPE CONNECTIONS**

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

#### **2.4.3.5.4 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.

#### **2.4.3.5.5 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.

#### **2.4.3.6 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 and laterals shall be 200 mm diameter and service lines shall be a minimum of 150 mm diameter. Contractor may use uPVC pipe provided the SDR and strength properties of the pipe equal or exceed the properties of ASTM D 1784 for PVC.

#### **2.4.3.6.1 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.

#### **2.4.3.6.2 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.

#### **2.4.3.6.3 BRANCH CONNECTIONS**

Branch connections shall be made by use of 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.

#### **2.4.3.6.4 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 1% grade. Laterals shall be 200 mm and sloped to maintain the minimum velocity as described in paragraph "Gravity Sewer."

#### **2.4.3.6.5 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.

#### **2.4.3.7 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 a minimum compressive strength of 21 MPa 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.

#### **2.4.3.8 FIELD QUALITY CONTROL**

##### **2.4.3.8.1 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 Low Pressure Air tests as follows:

- 1) 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.
- 2) 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.
- 3) 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.

##### **2.4.3.8.2 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.

#### **2.4.4 WASTEWATER TREATMENT LAGOON SYSTEMS**

The Contractor shall design and construct a partial mix aerated wastewater treatment lagoon system in accordance with AED Design Requirements - Package Wastewater Treatment Plants and Lagoons, latest version. The Waste water treatment plant shall include a laboratory/office and a chlorine storage building.

##### **2.4.4.1 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.

#### **2.4.4.2 REQUIREMENTS OF DESIGN**

Design to pass 100% of design capacity per day without overflowing.

Influent Characteristics of Wastewater:

BOD<sub>5</sub> – 400 mg/L

TSS –400 mg/L

TKN – 80 mg/L

Fecal Coliform – 10<sup>8</sup> MPN /100 mL

Effluent Criteria Limitations for Direct Surface Water Discharge:

BOD<sub>5</sub>

- a. The 30-day average shall not exceed 30 mg/L
- b. The 7-day average shall not exceed 45 mg/L

CBOD<sub>5</sub> may be substituted for BOD<sub>5</sub>. In those cases the following limits will apply:

- a. 30-day average will not exceed 25 mg/L
- b. The 7-day average will not exceed 40 mg/L

Note: Parameter CBOD<sub>5</sub> limit, if substituted for the parameter BOD<sub>5</sub>, 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<sub>5</sub> limit. The CBOD<sub>5</sub> test procedure suppresses the nitrification component in the BOD<sub>5</sub> test procedure, thereby reducing the value or effects and lowering the oxygen demand.

#### **TSS**

The 30-day average shall not exceed 30 mg/L.

The 7-day average shall not exceed 45 mg/L.

#### **pH**

The effluent pH values shall 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.

#### **2.4.4.3 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  $1 \times 10^{-7}$ cm/sec, or shall be concrete lined. The Contractor shall construct a minimum of two (2) lagoons of equal volume.

#### **2.4.4.4 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.

#### **2.4.4.5 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 accumulating debris. A deck shall be furnished for drying the debris. Minimum area of bar screen shall be 0.9 m x 0.9 m.

#### **2.4.4.6 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.

#### **2.4.4.7 CHLORINE CONTACT CHAMBER**

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

#### **2.4.4.8 HYPOCHLORITE SYSTEM**

The Contractor shall design and construct a liquid chlorine (hypochlorite) 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 appurtenances, 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 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 be isolated for maintenance.

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

#### **2.4.4.8.1 WASTEWATER TREATMENT CHLORINE BUILDING**

The Contractor shall design and construct a 35 m<sup>2</sup> CMU Chemical Building for housing the chlorination system and storage of chemicals. The Chemical Building shall have an emergency eye wash station, one (1) stainless steel sink and water source for mixing chemicals. The chemical building shall be adequately vented to maintain a safe working environment and per the chlorine manufacturer's requirements. The Contractor shall provide manufacturers catalog information and shop drawing to the Contracting Officer for approval.

#### **2.4.4.9 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.

#### **2.4.4.10 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.

#### **2.4.4.11 PIPING**

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

#### **2.4.4.12 VALVES**

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

#### **2.4.4.13 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.

#### **2.4.4.14 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.

#### **2.4.5 STORM SEWER SYSTEMS**

##### **2.4.5.1 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 10-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 be based on 10-year rainfall event. Protection of installations against flood flows originating from areas exterior to the base installation shall be based on a minimum 25-year rainfall event.

##### **2.4.5.2 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 Specification Section 33 40 00 Storm Drainage Utilities. Holding or evaporation of stormwater shall not be accepted as an acceptable design. All stormwater shall be conveyed either from camp shorab or into adequate existing ditches.

##### **2.4.5.3 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.

##### **2.4.5.4 AREA INLETS**

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

##### **2.4.5.4.1 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 1 m of cover during construction to prevent damage by heavy construction equipment.

#### **2.4.5.4.2 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 1 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).

#### **2.4.6 OIL WATER SEPERATORS**

Oil/water separators shall be utilized for all drains from industrial sites. Separators shall be installed as close as possible from the drain location. Storm sewer system shall not be mixed with sanitary sewer system and shall be in accordance with UFC 3-240-07FA, latest edition.

### **2.5 EARTHWORK AND FOUNDATION PREPARATION**

#### **2.5.1 CAPILLARY WATER BARRIER**

ASTM C 33 fine aggregate grading with a maximum of 3 percent by weight passing ASTM D 1140, 75 micrometers, No. 200 sieve, or 37.5 mm and no more than 2 percent by weight passing the 4.75 mm No. 4 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.

#### **2.5.2 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.

#### **2.5.3 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 75 mm. The Contracting Officer shall be notified of any unsatisfactory materials.

#### **2.5.4 CLEARING AND GRUBBING**

Unless indicated otherwise, remove trees, 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 50mm in diameter to at least 460 mm below existing surface.

#### **2.5.5 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% 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% retained on the 19 mm 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% 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.

## 2.6 GEOTECHNICAL

### 2.6.1 SOIL INVESTIGATION

Existing geotechnical information is not available at the project site. Any site-specific geotechnical data required to develop foundations, fill at elevated slabs, materials, earthwork, and other geotechnical related design and construction activities for this project shall be the Contractor's responsibility. **Contractor shall be aware that rock has been found at shallow depths. The contractor shall bid anticipating encountering shallow rock.** 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. 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. A 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).
- i. 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 Ration (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 2.3.4 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.

### **2.6.2 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**

The structures shall consist of reinforced concrete footings supporting a variety of structure types.

### **3.2 DESIGN**

Design shall be performed by or under the direct supervision of the Contractor's structural engineer. The structural engineer shall be a registered Professional Engineer. All structural design documents shall be stamped and signed by the structural engineer. Calculations shall be in SI (metric) units of measurements.

### **3.3 STANDARDS**

The Contractor should use the following American standards to provide structural design if local standards are not available, relevant, or applicable. All codes are latest edition.

Concrete	ACI 318 and ASTM C 39
Steel Reinforcement	ASTM A 615
Anchor Bolts	ASTM F 1554; Grade 36 steel.
Bolts and Studs	ASTM A 307.
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 (2,000psi) minimum compressive strength @ 28 days (Slump between 200 mm to 250mm).
Structural Steel	ASTM A 36; 250 MPa ( $F_y = 36,000\text{psi}$ ).
Welding	AWS D1.1 (American Welding Society).
Cold-Formed Steel Members	AISI Specification for the Design of Cold-formed Steel Structural

### **3.4 LOADS (DEAD & LIVE)**

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 SEISMIC**

Seismic design of all structures in southern Afghanistan shall be in accordance with ASCE 7-05.

Seismic Acceleration Parameters shall be  $S_s = 1.28g$  and  $S_1 = 0.51g$ .

### **3.7 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  $F_y$  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.

### **3.8 REINFORCED 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.

### **3.9 MASONRY**

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

### **3.10 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.

### **3.11 COLD-FORMED LIGHT GAUGE 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.

### **3.12 ARCH-SPAN COLD-FORMED LIGHT GAUGE STEEL ARCHES**

Cold-formed light gauge steel Arch-span arch structures shall be constructed with Arch-span building machines.

Fabrication shall be in accordance with the building machine manufacturer's recommendations. Finite element models and design calculations for cold-formed steel Arch-span shapes shall use effective section properties to account for localized buckling. Structural analysis and design calculations for Arch-span arch type structures shall use the building machine manufacturer's proprietary finite element software when available.

Thickness of Arch-span sheet metal shall be as required by design in accordance with manufacturer's recommendation for span of Arch-span, but in no case shall thickness be less than 1 mm.

Arch-span steel specification requirements (international standards)  
DESIGN LOADS (DE GRADE 40 AND 50)

THICKNESS FROM 0.60mm TO 1.524mm

SAMPLE PPGI STEEL COIL SPECS :

Galvanized steel in coils conforming to ASTM A 653-05

Structural quality (SS) suitable for roll forming.

Minimum base material complies with AISI 1018.

Minimum elongation is 40%.

Hardness range is between 70-78 Rb.

Coil Maximum outside diameter: 101.60 cm, inside diameter: 48-53cm.

Maximum coil weight: 2,270 kilograms.

Galvanized coating class G-90 (Z-275), Regular spangle, chemically treated, lightly oiled with evaporative lubricant

Coil width: 91.44 cm

Steel Grade: Grade 40: Yield strength - 28 kg/mm<sup>2</sup> (280MPa)

### **3.13 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.

### **3.14 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. The foundation shall be designed so that the bottom is 800mm below the local frost line depth.

## **4.0 ARCHITECTURAL REQUIREMENTS**

### **4.1 GENERAL**

All material approved shall become standardized material to be used throughout the facilities under contract. 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**

Schematic 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

#### **4.2.1 PREMANUFACTURED ARCH-SPAN COMPONENTS**

It is recommended that all Arch-Span exterior penetrations shall be designed and pre-manufactured off-site using modular design techniques that shall be applied for both structural and finish construction components.

Provide complete architectural and engineering services from project inception through completion of construction.

Prior experience in design and support of major industrial complexes, military bases, ministry projects, as well as public and private projects and provides a wide range of engineering services in Afghanistan or other similar building environments is highly desirable.

Recommend minimal field assembly to the highest extent possible. Pre-manufactured elements are recommended to include Doors, Windows, Vent Louvers, stove through wall/roof sleeve and other exterior envelope penetrations.

Fabricate all pre-manufactured components to engineered design specifications under controlled conditions, to ensure consistent quality and maximum load bearing capabilities.

Specifications shall address the following criteria:

High strength-to-weight ratio.

Use of non-combustible material.

Wind and seismic resistance.

Compatibility with most decking and roofing systems.

Modular design.

The Arch-Span system shall meet or exceeds local and international building codes and seismic standards.

Structural and architectural components shall be designed as integral components, so that the site erection is quicker.

The building system shall be fully insulated using non-flammable and non-toxic spray on systems and allow for fully heated, cooled, or refrigerated facilities.

#### **4.2.2 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 facility shall comply with all other safety requirements of the NFPA 101, as much as possible, the final determination of code application made by the contracting officer. To the extent possible, all facilities shall be designed in accordance with recognized industry standards for life safety and building egress. An adequate fire alarm system, fire extinguishers, and smoke alarms shall all be included as required. Due to the lack of adequate water volume and pressure, sprinkler systems are not feasible. In keeping with the intended function of these facilities, handicapped accessibility will not be incorporated in this project. Due to the war contingency requirement, it is assumed that only able-bodied military and civilian personnel will use the facilities listed herein.

#### **4.2.3 ANTITERRORISM / FORCE PROTECTION**

Construct force protection measures to include gates and personnel bunkers. Force protection requirements shall be in accordance with UFC 4-010-01, *Minimum DoD Anti-terrorism Standards for Buildings*; and UFC 4-010-02, *DoD Minimum Anti-terrorism Standoff Distances for Buildings, as much as possible*. Stand-off distances between buildings and other structures shown on the concept site plan are to be kept as indicated; the UFC requirements are not required in these instances. Provide protective concrete barriers around and between billeting building and high occupancy facilities. When there is doubt of the application of the UFC reference, the contracting officer shall make the determination.

### **4.3 CONCRETE**

#### **4.3.1 FINISH**

Horizontally placed concrete shall be vibrated and floated prior to screening, followed by progressive troweling and edging with a radius profile edging tool as the concrete sets. Broom finished texture shall be applied to fully trowel finished surfaces and shall be re-edged after the broom finish is added.

Vertical work shall have a form finish. Exposed concrete shall be sealed with an approved sealer.

#### **4.3.2 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.

### **4.4 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.

#### **4.4.1 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 reinforced and 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.

#### 4.5 STONE

Stone type shall be identified for approval in design. Provide and use Type “S” mortar for all stone work. Provide weep holes at veneer installations and all cavity wall systems.

#### 4.6 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 3.540 (R 20)
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-m<sup>2</sup>/W, R measured in SF-F-hr/BTU. 1 K-m<sup>2</sup>/W = 5.678 SF-F-hr/BTU.

The building design shall utilize solar heating by orientating the buildings and wind breaks, insulation and exterior window shading techniques to reduce building heat loss and heat gain. Contractors shall include energy efficient heating and cooling solutions to minimize energy consumption.

#### 4.7 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.

##### 4.7.1 SLOPED ROOFS

A sloping roof shall be as defined in the IBC. On sloping roofs provide and install 0.60 mm galvanized steel in either corrugated or standing seam design. Metal roofing shall be anchored to the steel “Z” purlins using exposed fasteners at 300 mm on center at all seams and at 600 mm on center in the panel field. Fasteners shall be placed at the top of the corrugation taking care not to dent panel. Roof sealant or adhesive shall be placed over each anchor head. Roofing system shall include all edge, ridge and penetration flashings necessary for a watertight installation and as described in this section. All metal roof panel systems and associated trim/accessories shall be in the manufacturer’s standard white color. Provide 600mm x 600mm white metal louvered vents with insect screen in all gable end walls. Panels shall be overlapped two corrugations side to side and be continuous sheets from ridge to eave. Provide continuous ridge vents on all gable roofs.

##### 4.7.1.1 INSULATION

Provide sprayed on polyurethane insulation on underside of all K-span structures. For standard design drawings, provide a 50 mm thick extruded polystyrene rigid thermal insulation boards, conforming DIN, EN 13164 BS, EN 13164, k=0.2 @ 75 degrees F mean temperature, 2.82 kg/sq cm compressive strength, hydrophobic, Type VI. Provide thickness by multiple boards to meet the designed R-value. Comply with insulation manufacturer’s instructions and recommendations for handling, installing, and bonding or anchoring insulation to substrate. Insulation boards shall be installed loose, without glue, in staggered manner. Attention should be paid not to leave separation along edges. Where overall insulation thickness is 50 mm or greater, install required thickness in two layers with joints of second layer offset from joints of first layer a minimum of 300 mm each direction.

## **4.8 CONNECTIONS AND JOINTING**

### **4.8.1 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.

#### **4.8.1.1 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.

#### **4.8.1.2 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 METAL**

### **4.9.1 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.

#### **4.9.1.1 STEEL SHEET, ZINC-COATED (GALVANIZED)**

Zinc coated steel conforming to ASTM A 525, DIN BS or EN Standards. Cold-formed light gage steel K-span arch structures shall be constructed per industry standards.

Fabrication shall be in accordance with the building machine manufacturer's recommendations. Finite element models and design calculations for cold-formed steel K-span shapes shall use effective section properties to account for localized buckling. Structural analysis and design calculations for K-span arch type structures is required and shall be submitted as part of a design analysis for design submittals.

Thickness of S-span sheet metal shall be as required by design in accordance with manufacturer's recommendation for span of K-span, but in no case shall thickness be less than 1 mm.

#### **4.9.1.2 ALUMINUM WALL CAPPING**

Aluminum wall capping shall conform to ASTM B 209 M, DIN 18339, BS or EN Standards.

### **4.9.2 FLASHING**

Flashing shall be installed at locations indicated and as specified below. Sealing shall be according to the flashing manufacturer's recommendations. Flashings shall be installed at intersections of roof with vertical surfaces and at projections through roof, except that flashing for heating and plumbing, including piping, roof and floor drains, and for electrical conduit projections through roof or walls are specified in other sections. Except as otherwise indicated, counter flashings shall be provided over base flashings. Perforations in flashings made by masonry anchors shall be installed on top of joint reinforcement. Lashing shall be formed to direct water to the outside of the system.

#### **4.9.2.1 THROUGH-WALL FLASHING**

Through-wall flashing includes sill, lintel, and spandrel flashing. The flashing shall be laid with a layer of mortar above and below the flashing so that the total thickness of the two layers of the mortar and flashing are the same thickness as the regular mortar joints. Flashing shall not extend further in to the masonry backup wall than the first mortar joint. Joints in flashing shall be lapped and sealed. Flashing shall be one piece for lintels and sills.

#### **4.9.2.2 LINTEL FLASHING**

Lintel flashing shall extend the full length of lintel. Flashing shall extend through the wall one masonry course above the lintels and shall be bent down over the vertical leg of the outer steel lintel angle not less than 50 mm, or shall be applied over top of masonry and pre-cast concrete lintels. Bed joints of lintels at joints shall be under laid with sheet metal bond breaker.

#### **4.9.2.3 VALLEY FLASHING**

Valley flashing shall be provided at intersections of roofs where a valley is formed. Flashing shall be a minimum of 500 mm centered on the valley (extending each direction a minimum of 250 mm). Valley flashing shall have a small ridge in the center to allow for expansion and contraction. Material shall be stainless steel, galvanized or match finished roofing metal.

#### **4.9.2.4 SILL FLASHING**

Sill flashing shall extend the full width of the sill and not less than 100 mm beyond ends of sill except at joint where the flashing shall be terminated at the end of the sill.

#### **4.9.3 METAL FASCIA & SOFFIT**

No wood fascias and/or soffits are allowed. Use metal fascias and soffits throughout. Extend roof decking out over fascia a minimum of 20 mm. Provide a 40 mm drip flashing over edge of roof decking so that it extends past bottom of decking on all sides of the building. Soffits shall be a minimum width of 600mm extending from the building wall.

#### **4.9.4 CONTINUOUS SOFFIT VENT**

Enclose soffits and return to vertical wall. Provide continuous soffit venting of all overhangs on the underside of the soffit. The opening shall be no larger than 100 mm and set in a minimum of 50 mm from the exterior fascia edge.

#### **4.9.5 RIDGE VENT**

For sloping roofs, provide continuous metal ridge vent at the top of roof along the ridge. Ridge vent shall be sized to provide adequate ventilation of the roofing system. Provide all ridge vents in white to match the roof panel system.

#### **4.9.6 SCREEN**

Provide insect screen for all soffit, ridge, vents, louvers and all openings except for doors and windows unless otherwise specified.

#### **4.9.7 EXPANSION JOINT PROFILES**

Metal expansion joints shall have a profile to allow deflection and expansion in two directions. Metal shall be treated for exterior conditions. Expansion joints shall be water proof.

#### **4.9.8 ROOF GUTTERS**

Roof gutters shall be installed as indicated. Roof gutters shall be rigidly attached to the building. Supports for roof gutters shall be spaced according to manufacturer's recommendations. A 600 mm overlap, jointing with approved crimping or welding shall provide a continuous gutter along the building eaves. Provide all gutters in white to match the roof panel system.

#### **4.9.9 DOWNSPOUTS**

Downspouts shall be designed and fabricated for each specific application. Unless otherwise specified or indicated, exposed edges shall be folded back to form a 13 mm hem on the concealed side, and bottom edges of exposed vertical surfaces shall be angled to form drips. Bituminous cement shall not be placed in contact with roofing membranes other than built-up roofing and shall not block the flow of water to the downspout for low sloped roofs. Downspouts shall be rigidly attached to the building with supports a minimum of 1.5 m apart. At the base of each downspout, concrete splash block shall be placed to eliminate damage to the building due to rain water runoff toward the building. In rural locations, a layer of rock 10 - 80 mm in size, 100 mm thick, may be substituted upon governmental approval. Provide all downspouts in white to match the roof panel system. All downspouts shall be a minimum of 100mm in diameter or greater based on the projected rain amounts to be handled by the system.

#### **4.9.10 WALL CAPPING**

Wall Capping shall be installed according to the manufacturer's recommendations.

#### **4.10 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. The Contractor shall 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.

##### **4.10.1 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.

##### **4.10.2 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.

##### **4.10.3 FLOOR JOINT SEALANT**

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

##### **4.10.4 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.

##### **4.10.5 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.

##### **4.10.6 BACKING**

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

#### **4.10.7 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.

#### **4.10.8 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.

#### **4.10.9 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.

#### **4.10.10 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.

##### **4.10.10.1 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.

##### **4.10.10.1.1 MASONRY AND OTHER POROUS SURFACES**

Immediately scrape off fresh sealant that has been smeared on masonry and rub clean with a solvent as recommended by the sealant manufacturer. Allow excess sealant to cure for 24 hours then remove by wire brushing or sanding.

##### **4.10.10.1.2 METAL AND OTHER NON-POROUS SURFACES**

Remove excess sealant with a solvent-moistened cloth.

#### **4.11 LOUVERS**

##### **4.11.1 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.

##### **4.11.2 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.

## **4.12 WINDOWS, DOORS & GLAZING**

### **4.12.1 WINDOWS**

Windows shall be operable. Operable windows shall be slider or awning type. A window with blackout film on the inside shall be provided only for the laundry space.

#### **4.12.1.1 WINDOW SECURITY BARS**

Provide 20 mm diameter steel bars, 100 mm on center spacing. Provide frame and secure with fasteners a minimum of 100 mm deep.

#### **4.12.1.2 MATERIALS**

##### **4.12.1.2.1 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/mm<sup>2</sup> ultimate tensile strength and not less than 1.5 mm thick at any location for main frame and sash members.

##### **4.12.1.2.2 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.

##### **4.12.1.2.3 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.

##### **4.12.1.2.4 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.

##### **4.12.1.2.5 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.

##### **4.12.1.2.6 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.

##### **4.12.1.2.7 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.

##### **4.12.1.2.8 WIRE FABRIC INSECT SCREEN**

Wire Fabric Insect Screen shall be permanently fixed to the exterior of operable windows.

#### **4.12.1.3            **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.

#### **4.12.1.4            **FABRICATION****

Provide aluminum windows with factory finish in all buildings as indicated in the design drawings. Window openings shall be provided with insect screening permanently fixed to the exterior. Provide a minimum of 3 anchors on each side of the frame into the adjoining structure. Provide weather stripping system for all exterior windows and doors.

#### **4.12.1.5            **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.

#### **4.12.1.6            **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

#### **4.12.1.7            **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.

#### **4.12.1.8            **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.

#### **4.12.1.9            **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.

#### **4.12.1.10           **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.

#### **4.12.2             **DOORS****

Fire rated door assemblies including hollow metal frame and hardware shall be provided as indicated in the design drawings. 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.

#### **4.12.2.1 OVERHEAD DOORS**

Overhead doors shall be sized as required. Doors shall be fabricated from interlocking cold-rolled slats, designed to withstand building wind loading and be installed with wind locks. Curtain door slats shall be continuous for the width of the door and steel interlocking flat-profile design. Standard steel slats shall be made of roll-formed steel 18 gauge steel, either primed & painted galvanized, stainless steel or anodized aluminum as provided by manufacture. Channel or curtain door guides shall be provided on each side of door. Overhead doors shall have a weather stripping bottom bar, head and jambs. Weather stripping and astragals shall be natural rubber or neoprene rubber. A manual pull chain shall be connected to the operation of the rolling door to provide open and close operation. A locking pin shall be provided on each jamb of the interior side of the door. Door shall have manufacturer's standard five pin tumbler locks, keyed. Coiling housing shall be mounted above all opening, on the interior side. For rated openings, a fusible link shall be provided on the most hazardous side. The coiling shutter shall also be rated and designed accordingly by the manufacture for the required fire rating. Hoods shall be fabricated from steel sheets with minimum yield strength of 227.5 MPa. Doors shall be counterbalanced by an adjustable, steel, helical torsion spring mounted around a steel shaft in a spring barrel and connected to the door curtain with the required barrel rings.

Counterbalance-barrel components shall be as follows:

- 1) Spring barrels shall be hot-formed structural-quality carbon steel, welded or seamless pipe. Pipe shall be of sufficient diameter and wall thickness to limit deflection to a maximum of 1/360 of the span.
- 2) Counterbalance springs shall be oil-tempered helical steel springs designed with a safety factor of 4.

Springs shall be sized to counterbalance the weight of the curtain at any point of its travel, and shall be capable of being adjusted to counterbalance not less than 125% of the normal curtain load. Spring adjustment shall be arranged in such a way that the curtain need not be raised or lowered to secure the adjustment.

- 3) Counterbalance shafts shall be case-hardened steel of the proper size to hold the fixed ends of the spring and carry the torsion load of the spring.
- 4) Barrel plugs shall be fabricated from cast steel machined to fit the ends of the barrel. Plugs shall secure the ends of the spring to the barrel and the shaft.
- 5) Barrel rings shall be fabricated from malleable iron of the proper in-volute shape to coil the curtain in a uniformly increasing diameter.
- 6) Shaft bearings shall be factory sealed ball bearings of the proper size for load and shaft diameters.

Door operators shall consist of an endless steel hand chain, chain-pocket wheel and guard, and a geared reduction unit of at least a 3:1 ratio. Required pull for operation shall not exceed 16 kg. Chain hoists shall have a self-locking mechanism allowing the curtain to be stopped at any point in its upward/downward travel and to remain in that position until moved to the fully open or closed position. Hand chains shall be cadmium-plated alloy steel with a yield point of at least three times the required hand-chain pull. Pretreated zinc-coated steel sheets shall be given the manufacturer's standard prime coat and an enamel finish coat applied to the exterior face after forming.

After installation, doors, track, and operating equipment shall be examined and tested for general operation and weather against the specified wind pressure, and weather resistance. Doors that fail the required tests shall be adjusted and retested. Doors that have been adjusted and fail subsequent tests shall be removed and replaced with new doors at no additional cost.

#### **4.12.2.2 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.

#### **4.12.2.3 FIRE AND SMOKE DOORS AND FRAMES**

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

#### **4.12.2.4 THRESHOLDS**

All exterior doors (except Mech/Elect rooms) shall be provided with manufactured metal thresholds conforming to ANSI/BHMA A156.21. Doors at all wet areas with ceramic tile or terrazzo tile flooring shall be provided with solid marble thresholds with marble threshold set 13 mm above tile. Thresholds shall span continuously from jamb to jamb.

#### **4.12.2.5 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.

#### **4.12.2.6 WELDED FRAMES**

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

#### **4.12.2.7 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.

#### **4.12.2.8 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.

#### **4.12.2.9 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.

##### **4.12.2.9.1 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.

##### **4.12.2.9.2 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.

#### **4.12.2.10            **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.

#### **4.12.2.11            **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.

#### **4.12.2.12            **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 latchsets shall be the product of the same manufacturer. Locksets, padlocks and latchsets shall be provided, as required, with lever handles on each side. Provide heavy duty hasp and locks at all fuel storage tanks.

#### **4.12.2.13            **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.

#### **4.12.2.14            **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.

#### **4.12.2.15            **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.

#### **4.12.2.16            **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 galv-annealed steel without primer. Where coating is removed by welding, apply touchup of factory primer. Provide door finish colors as selected by the Contracting Officer from the color selection samples.

#### **4.12.2.17            **WATER-RESISTANT SEALER****

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

#### **4.12.2.18 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 indicated. 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.

#### **4.12.2.19 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.

##### **4.12.2.19.1 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.

##### **4.12.2.19.2 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.

#### **4.12.2.20 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.

##### **4.12.2.21 WEATHER STRIPPING**

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. Insert gasket in groove after frame is finish painted.

##### **4.12.2.22 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.

### **4.12.3 GLAZING**

All glazing shall be tempered double laminated and insulating. Laminated glazing shall be constructed of two panes of minimum 3 mm tempered glass laminated to a minimum 0.75 mm polyvinyl-butylal (PVB) interlayer, in accordance with UFC 4-010-01. Two panes of laminated glazing shall be installed in each window with hermetically sealed 13 mm airspace between them. After installation of windows, the contractor shall install a minimum 3 mil 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.

#### **4.12.3.1 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.

#### **4.12.3.2 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.

#### **4.12.3.3 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.

#### **4.12.3.4 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.

#### **4.12.3.5 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.

#### **4.12.3.6 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.

#### **4.12.3.7 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.

#### **4.12.3.8 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.

#### **4.12.3.9           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.

#### **4.12.3.10          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.

#### **4.12.3.11          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.

### **4.13    FINISHES**

All exterior metal surfaces, including container exterior shall be painted to match existing adjacent buildings. Provide color boards with all materials, paints and finishes for COR approval prior to ordering materials. Color boards shall remain on site in view or with the Contractor until completion of the facility.

#### **4.13.1          PAINTS & COATINGS**

Paints and coatings shall be provided as a Specification 09 90 00 Paints and Coatings.

#### **4.13.2          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.

#### **4.13.3          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.

##### **4.13.3.1          EXPOSED EXTERIOR STEEL**

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.

##### **4.13.3.2          EXPOSED WOOD**

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

#### **4.13.4          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.

#### **4.13.5 EXTERIOR WALLS**

The exterior of all buildings not scheduled to be K-span 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.

#### **4.13.6 INTERIOR WALLS**

##### **4.13.6.1 INTERIOR WALLS FOR K-SPAN BUILDINGS (SANDWICH PANELS)**

Interior walls shall be a standard manufacturer's noncombustible, Class "A" rated, panelized insulated wall system that has been in production a minimum of 5 years. The interior wall system may either be an interlocking composite panel system of foam core units, with color coated prefinished metal skins on both sides, and an integral metal frame system with prefinished face sheathing both sides. The interior wall panel system shall be a complete system including trims and shall be able to receive multiple options on door and frame assemblies. Assembly including doors should provide a composite Sound Transmission Class (STC) of at least 42. Panelized system shall provide fire separation rating where required by design. Rating shall be by Underwriters Laboratory (UL) or an approved international testing agency.

##### **4.13.6.2 PLASTER WALLS**

Interior walls (except Arch-Span) 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.

##### **4.13.6.3 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.

##### **4.13.6.4 HARDENED (CMU) INTERIOR WALLS**

Interior walls intended to be CMU (except Arch-Span) 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.

#### **4.13.7 INTERIOR CEILINGS**

##### **4.13.7.1 CONCRETE CEILINGS**

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

#### **4.14 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.

Floors in wet areas shall be 300 mm x 300 mm terrazzo tile with thin set mortar. Joints shall be 2-3 mm. Waterproof gray grout shall be applied the full depth of the tile. Floors shall slope, minimum 1/50, to floor drains. Slope shall be obtained with sloping mortar bed of minimum 20 mm thickness. Provide continuous waterproofing membrane beneath sloping mortar bed, turn up wall 300 mm behind wall base. Membrane shall be fully sealed at joints and shall shed water into body of floor drain. Color of tile shall be selected by the Contracting Officer from samples provided by the Contractor.

Floors in administration areas, living quarters, corridors, and all rooms unless otherwise stated in the standard drawings shall be sealed concrete. Joints shall be 2-3 mm. Waterproof gray grout shall be applied the full depth of the tile. Color of tile shall be selected by the Contracting Officer from samples provided by the Contractor.

Walls in wet areas shall be tiled with 150 mm x 150 mm glazed ceramic tile up to 2000 mm above the floor to include interior of toilet stalls, showers and behind sinks. Joints shall be 2-3 mm. Waterproof gray grout shall be applied full depth of the tile. Grout shall cure for 72 hours and then be sealed with a commercial grout sealant in two coats. Color of tile shall be selected by the Contracting Officer from samples provided by the Contractor.

The ablation drain areas shall be recessed below the floor level 200 mm and lined with ceramic tile. Ceramic tile shall extend up the wall past the water spigots to a height of 2000 mm above finished floor. Seats shall be formed concrete with terrazzo tile finish to match the floor, 300 mm x 300 mm x 300 mm high finished dimensions. Color of ceramic tile shall be selected by the Contracting Officer from samples provided by the Contractor. Spacing between tiles shall be similar to terrazzo tile.

#### **4.15 SPECIALTIES**

##### **4.15.1 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.

##### **4.15.2 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.

##### **4.15.3 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.

##### **4.15.4 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.

##### **4.15.5 PAPER TOWEL DISPENSERS**

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

#### **4.15.6 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.

#### **4.15.7 ROBE HOOKS**

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

#### **4.15.8 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.

#### **4.16 FACILITY TYPES**

All facility types shall be constructed according to the standard designs unless otherwise noted.

### **5.0 MECHANICAL**

#### **5.1 GENERAL**

The work covered by this section consists of design, supply, fabrication, and installation of building heating, ventilation and air-conditioning (HVAC), and Mechanical Requirements for Generators. It also includes the delivery to site, erection, setting to work, adjusting, testing, balancing and handing over in perfect operating and running condition all of the equipment including all necessary associated mechanical works. HVAC equipment will normally consist of electric unit heaters, ceiling fans, split-pack heat pump units, ducted packaged heat pump units, industrial quality unit heaters, air ventilation systems, kitchen hood exhaust, and specialized industrial ventilation systems.

#### **5.2 DESIGN REQUIREMENTS**

The Contractor shall design and construct Mechanical systems in accordance with the following requirements.

##### **5.2.1 STANDARD DESIGNS**

Where fully-developed design drawings have been provided in the Appendix, the Contractor shall construct the facility per the Appendix drawings without alteration. The Contractor shall prepare HVAC load calculations for sizing the mechanical equipment and devices wherever the capacities are not listed in the respective Appendix drawings' mechanical equipment schedules.

In any cases where the Appendix contains only concept drawings, the Contractor shall fully design the mechanical systems in accordance with the requirements of this section.

##### **5.2.2 DESIGN**

A design drawing shall be a drawing that is generated by the contractor based on a programmatic description of the project. The description may include a written requirement for the space with or without an attached floor plan.

The design documents shall consist of the following: the contractor shall produce a complete set of coordinated construction documents including Engineering Analysis, Drawings, and Specifications.

### **5.3 SPECIALIST SUB-CONTRACTORS QUALIFICATIONS**

The HVAC works shall be executed by a heating and cooling specialist sub-contractor experienced in the engineering 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.

### **5.4 STANDARD PRODUCTS**

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.

### **5.5 CODES, STANDARDS, & REGULATIONS**

The design and installation of equipment, materials, and work covered under the mechanical 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. 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.

### **5.6 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. In addition to fences and bollards or screen walls, provide designed overhead canopies/shelters for exterior electrical generators and adjacent fuel tanks as well as fuel point tanks. Overhead canopy height shall be a minimum of 2 m (80") above the highest point of the engine cabinets and fuel tanks.

### **5.7 ELECTRICAL REQUIREMENTS**

Note that electrical requirements for all HVAC systems shall be designed and installed to operate on the secondary power standard required herein. All electrical work shall comply with the British Standard 7671.

All thermostats shall be wall-mounted. In lieu of a thermostat, a temperature sensor may be located in the same location or in the return duct and connected to a thermostat located near the unit return. Wall-mounted thermostats shall be mounted 1.5 m (5') above the finished floor and be easily accessible. Thermostats for the latrine facilities shall be located near the unit return and mounted 1.5 m (5') above the finished floor. Operation of the control system shall be at the manufacturer's standard voltage for the unit.

The following are the minimum requirements for motors regarding enclosure, insulation and protection:

- 1) Compressor Hermetic: Provide inherent (internal) overload protection.
- 2) Condenser: Provide internal thermal overload protection.
- 3) Evaporator (Open Class "A") fan motor type provides internal thermal overload protection.

### **5.8 DESIGN CONDITIONS**

Outside Design Conditions for Garmsir, Helmand:

Summer: 44.4 C (112F) db and 24.4° C (76° F) WB.

Winter: -5.5° C (22° F) db

Range of DB: Summer 17.8 (32)

### 5.8.1 INDOOR DESIGN CONDITIONS

Where the Appendix drawings indicate heating or cooling equipment in spaces of the referenced facility types, the following design conditions apply. For any other facilities not listed here, the design temperatures shall be typical.

<b>Facility Type</b>	<b>Summer Temperature</b>	<b>Winter Temperature</b>
Tactical Operations Center	Cooling 25 C (78 F)	Heating 20 C (68 F)
Department of Public Works Building (DPW)	No Cooling	Heating 20 C (68 F)
Fire Station	No Cooling	Heating 20 C (68 F)
DFAC	No Cooling	Heating 20 C (68 F)
Troop Medical Center	Cooling 25 C (78 F)	Heating 20 C (68 F)
PX/Barber/ATM	No Cooling	Heating 20 C (68 F)
Detention Facility	No Cooling	Heating 20 C (68 F)
MWR	No Cooling	Heating 20 C (68 F)
Well Water House	No Cooling	Heating 20 C (68 F)
Waste Water Treatment Plant (WWTP)	No Cooling	Heating 20 C (68 F)
Effluent Water Pump/Fill Station	No Cooling	Heating 20 C (68 F)
Classroom Buildings	No Cooling	Heating 20 C (68 F)
Guard Towers	No Cooling	Heating 20 C (68 F)
Fuel Point Control Office	No Cooling	Heating 20 C (68 F)
ECP Reception Building	No Cooling	Heating 20 C (68 F)
Fitness Center	No Cooling	Heating 20 C (68 F)
Battalion HQs	Cooling 25 C (78 F)	Heating 20 C (68 F)
VIP Quarters	No Cooling	Heating 20 C (68 F)
Officers Barracks	No Cooling	Heating 20 C (68 F)
Combination NCO/Enlisted Barracks	No Cooling	Heating 20 C (68 F)

Facility Type	Summer Temperature	Winter Temperature
Enlisted Barracks	No Cooling	Heating 20 C (68 F)
Latrine-Small	No Cooling	Heating 20 C (68 F)
Battalion Storage Building	No Cooling	Heating 10 C (50 F) Heating 20 C (68 F) (Office)
Small Arms Storage	No Cooling	Heating 20 C (68 F)
Training Facility	No Cooling	Heating 20 C (68 F)
NCO Barracks	No Cooling	Heating 20 C (68 F)
Vehicle Maintenance Building	No Cooling	Heating 20 C (68 F)
Latrines	No Cooling	Heating 20 C (68 F)

## 5.9 NOISE LEVEL

Noise levels inside occupied spaces generated by HVAC systems indoors shall not exceed NC 35. Noise levels for outdoor generators are provided in paragraph: Mechanical Requirements for Generators.

## 5.10 INTERNAL LOADS

Where the Appendix drawings do not include equipment schedules showing required capacities, provide load calculations based upon the following internal loads:

Occupancy: Use ASHRAE standards to calculate sensible and latent heat from people. In general, light/moderate office work is 73 Watts sensible and 45 Watts 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 heating and cooling loads based on the actual lighting design).

Outdoor Air: Outdoor ventilation air shall be provided per ASHRAE Standard 62.1. In general this requires 9 cmh/person (5.3 cfm/person) plus 1 cmh/sq.m (0.6 cfm/sq.ft) of floor space; outdoor air requirements can be satisfied by windows that open to the outside.

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

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

Ventilation systems for K-span buildings shall be in accordance with the Appendix design drawings. For any facilities for which design drawings have not been provided, ventilation shall be as follows:

K-span buildings with suspended ceilings shall be provided with natural (or non-mechanical) ventilation only above the ceilings. Areas directly above the ceiling panels will contain insulation rated as per this Section and Section 01010. K-span buildings without suspended ceilings will have exhaust fans and intake air louvers sized to meet the minimum anticipated ventilation requirements. All fans shall have Architectural styled louvers, insect screens, and gravity backdraft dampers (to prevent infiltration of air when the fan is off). All outside make-up air louvers shall be similar to the exhaust fan louvers and have insect screens, and motorized dampers interlocked with the associated exhaust fan(s) (to prevent infiltration of air when the fan is off). Fans shall be controlled by a labeled wall switch.

Building pressurization for buildings provided with centralized ducted forced air systems: 12.5 Pa (0.05" wg).

### 5.11 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.

Facility Type	Type of HVAC System	Remarks
Tactical Operations Center	Per Appendix Drawings	Per Appendix Drawings
Department of Public Works Building (DPW)	Per Appendix Drawings	Per Appendix Drawings
Fire Station	Per Appendix Drawings	Per Appendix Drawings
DFAC	Per Appendix Drawings	Per Appendix Drawings
Medical Center	Per Appendix Drawings	Per Appendix Drawings
PX/Barber/ATM	Per Appendix Drawings	Per Appendix Drawings
Detention Facility	Electric Unit Heaters (all areas) and Ceiling fan in Guard Office Makeup air for cells shall be sized to account for all building exhaust, and will be heated	Electric room requires no Exhaust Fan or Electric Unit Heater. Exhaust in cell shall be roof mounted exhaust fan with a heavy duty welded duct taken to the ceiling, no larger than 200 mm on each side.
MWR	Per Appendix Drawings	Per Appendix Drawings
Well Water House	Provide electric unit heater, exhaust fan and make up air louver.	
Classroom Buildings	Per Appendix Drawings	Per Appendix Drawings
Guard Towers	Electric Unit Heater	
Fuel Point Control Office	Electric Unit Heater	
ECP Reception Building	Electric Unit heater and ceiling fan	Provide exhaust fan for restroom.
Fitness Center	Per Appendix Drawings	Per Appendix Drawings
Battalion HQ	Per Appendix Drawings	Per Appendix Drawings
VIP Quarters	Per Appendix Drawings	Per Appendix Drawings
Officers Barracks	Per Appendix Drawings	Per Appendix Drawings

<b>Facility Type</b>	<b>Type of HVAC System</b>	<b>Remarks</b>
Combination NCO/Enlisted Barracks	Per Appendix Drawings	Per Appendix Drawings
Enlisted Barracks	Per Appendix Drawings	Per Appendix Drawings
Latrine-Small	Per Appendix Drawings	Per Appendix Drawings
Battalion Storage Building	Per Appendix Drawings	Per Appendix Drawings
Small Arms Storage	Electric Unit Heater	Exhaust system for 1 air change per hour and associated motorized makeup air damper.
Training Facility	Per Appendix Drawings	Per Appendix Drawings
Admin -RCC	Per Appendix Drawings	Per Appendix Drawings
NCO Barracks	Per Appendix Drawings	Per Appendix Drawings
Vehicle Maintenance Building	Per Appendix Drawings	Per Appendix Drawings
Latrines	Per Appendix Drawings	Per Appendix Drawings

### **5.11.1 SINGLE ZONE PACKAGED AIR HANDLERS**

The following requirements pertain to any single zone packaged air handlers provided for garrison facilities:

Provide a single zone, constant volume heat pump air handling unit consisting of a filter/mixing box, heat pump cooling/heating coil, forward curved centrifugal supply fan, and any final filter and supply plenum as specified or required.

Cooling shall provide sufficient staging to allow about 4 C -5 C (8 F- 10 F) temperature change per stage. Generally, this will mean 3 to 4 stages of cooling will be required to maintain discharge air control within a reasonable range, 10C (50 F) to 18 C (65F).

Fans shall be Class II fans of direct drive construction. Fans shall be selected to operate quietly. The unit shall come complete with motorized damper actuators and control components to allow the following features:

System on/off

Outside air/Return air positioning

Control and staging of heating /cooling based on input from a remote thermostat. For use in critical facilities, the unit shall have automatic changeover control, with manual override capability at the control panel.

Remote Condensing unit or heat pump unit to meet the specified duty.

Refrigerant piping and components for connection.

Control system will terminate at a control panel with the following features:

Hand on/off/auto switch with normally open and normally closed contactors

Damper position indicating lamps

Heat enable override switch

Cooling enable override switch

Heat enable indicator lamp  
Cooling enable indicator lamp  
Discharge air temperature  
Return Air temperature  
Outside air temperature  
DX unit or Heat Pump Status indicator

Controller to include a simple user interface for service programming, preferably with an option for displaying in English and in Dari.

The manufacturer shall provide for review fan performance data, unit construction data including dimensioned drawings showing the arrangement of all components, a temperature controls wiring diagram, control panel details, a sequence of operations, cooling performance data [based on the selected condensing unit or heat pump unit provided], heating performance data, and a detailed refrigerant piping diagram showing all required components and installation instructions.

### **5.11.2 UNITARY DUCTED HEAT PUMP UNITS**

Unitary ducted heat pump units shall be provided as indicated. Ducted forced air systems are required to satisfy the indoor air quality as specified in ASHRAE 62.1 and to maintain positive pressure of 1.3 mm wg (or 12.5 Pa or 0.05" wg) in the buildings. Ducted packaged heat pump units shall be unitary in design and factory manufactured ready for installation. Heat pump units shall provide cooling during summer and heating during winter. The unit shall consist of DX coil, fan, supplemental electric heater elements, washable filter, and condenser unit containing the compressor, condenser coil, fans and all internal controls/fittings complete all mounted in a weatherized housing finished for exposed installation. The unit shall be suitable for exterior installation and be mounted level on steel supports or on a concrete pad. Roof mounted installation shall be avoided. Copper refrigerant suction and liquid piping shall be sized, insulated and installed in accordance to unit manufacture recommendations. Unit temperature control shall include wall-mounted adjustable thermostat, blower on-off-auto switch and heating-cooling change over control. Heat pump units shall be limited to about 10 tons each, but smaller units shall be provided when zoning is warranted for building areas with different heating-cooling load characteristics.

### **5.11.3 UNITARY DUCTLESS (SPLIT-PACK) HEAT PUMP UNITS**

Unitary ductless split-pack heat pump units shall be provided as indicated. Ductless split units shall be unitary in design and factory manufactured ready for installation. Heat pump units shall provide cooling during summer and heating during winter. Heat pump units shall be suitable for low ambient operation. Provide supplemental resistance heating in split-pack to provide heat during exceptionally cold water. Interior evaporator fan coil units shall consist of a DX coil, blower, and washable filter all mounted in a housing finished for exposed installation. Cooling coil condensate piping shall route to and discharge to the sanitary sewer system. The exterior condensing units shall contain compressor, condenser coil, and all controls/fittings enclosed in a weatherized housing. Outdoor condensing unit shall be wall-mounted on steel supports or on a level concrete pad. Copper refrigerant suction and liquid piping shall be sized, insulated and installed in accordance to unit manufacture recommendations. Unit temperature control shall include standard battery operated wireless thermostat to be mounted within one (1) meter of the unit.

### **5.11.4 ELECTRIC UNIT HEATERS**

Electric resistance unit heaters shall be installed in spaces where only heating is required. Generally, unit heaters shall be mounted as high as possible. Where used to temper outside air, units shall be located near where the air is introduced and oriented to intercept the airstream. Where multiple heaters are used to heat a large space, they shall be oriented to direct the airflow along the exterior exposure. Unit heaters shall be industrial grade, durable, and securely fastened to the ceiling, wall or structure. Electric unit heater shall be self-contained with heating elements and fan. Unit shall be provided with control-circuit terminals and single source of power supply with disconnect. Limit controls shall be provided for overheat protection. Hard-wired wall thermostats shall be provided and generally located under the unit in the return air stream.

### **5.11.5 CONTROL WIRING AND PROTECTION DEVICES**

Control wiring and protection of the air conditioning units being offered must be the manufacturer's standard, pre-wired, installed in the unit at the factory or as recommended.

### **5.12 DUCTWORK**

Air shall be distributed from packaged heat pump to achieve proper airflow throughout the facility. Air distribution system shall be comprised of supply and return ductwork, fittings, manual volume control dampers, grilles, registers, and/or diffusers. Ductwork shall be constructed of galvanized steel or aluminum sheets and installed as per SMACNA "HVAC Duct Construction Standards (Metal and Flexible)." Flexible non-metallic duct may be used for final unit/diffuser connection in ceiling plenums. These flexible duct run-outs shall be limited to 3 m (10') in length.

Exhaust duct may be required where the exhaust system serves more than one space, or where the exhaust fan cannot be located in an exterior wall or needs to terminate through the roof.

Makeup air may require ducting to deliver the air to an interior space or to deliver the air at a location remote from the makeup air intake louver.

#### **5.12.1 DUCT INSULATION**

Duct insulation shall be provided for all supply ductwork that is not located in the conditioned space and for return ductwork not located within the conditioned space. All ductwork exterior to the building shall be insulated with a minimum RSI=0.88 (R5). Insulation shall be jacketed with foil scrim and taped at all joints and exposed ends.

Exhaust duct shall not be insulated.

In general interior ducts shall be exposed to the rooms and will not be insulated. The heat lost or gained from the un-insulated ducts shall be considered as part of the heating or cooling of the conditioned space. Makeup duct systems shall be provided with insulation and vapor barrier to prevent condensation. Insulation exposed to weather or physical damage shall be protected with sheet aluminum jacketing.

#### **5.12.2 DIFFUSERS, REGISTERS, & GRILLES**

Diffusers (no damper attached), registers (comes with a damper), and grilles shall be factory fabricated of steel or aluminum and distribute the specified air quantity evenly over the space intended. The devices shall be round, square, rectangular, linear, or with perforated face as determined by the design. 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. Pressure loss through the diffuser shall be considered in sizing the duct system and the system static pressure calculations.

#### **5.12.3 BRANCH TAKE-OFFS**

45-degree entry corners ("boots") shall be provided at all branch duct take-offs. Manual volume control dampers shall be included at the branch duct take-offs and where required to facilitate air balancing and shall be shown on the engineering drawings.

### **5.13 WALL PENETRATIONS**

Building wall penetrations for fans, exhaust duct, vents, and louvers shall be carefully made so as not to deteriorate the structural integrity of the wall system. The Contractor shall consult with the building structural engineer or manufacturer to determine the best way to penetrate the walls. The Contractor is encouraged to locate exterior wall louvers above doors, whenever possible, to take advantage of the structural framing void located above doors.

#### **5.13.1 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.

### **5.13.2 OUTSIDE AIR INTAKE, MAKEUP, AND EXHAUST LOUVERS**

Outside air louvers shall be factory fabricated of steel or aluminum and allow the specified air quantity into the space intended. 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 unit 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 motorized dampers interlocked to open when the exhaust fans operate. Minimum louver dimensions to be 300 mm x 300 mm. The size requirements of the louver shall be calculated and be submitted in the engineering analysis calculations. The total pressure drop of the louver, screen, damper and filter shall not exceed 25 Pa (0.1" wg).

All supply air shall be filtered using manufacturer's standard washable filters mounted inside the unit. In addition, all outdoor makeup air intakes shall be equipped with 50 mm (2") thick washable filters. Control wiring and protection of the air conditioning units being offered must be the manufacturer's standard, pre-wired, installed in the unit at the factory or as recommended. Thermostats shall be located near the unit return.

### **5.14 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 makeup air openings ventilation and 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 intake openings, or ventilation or exhaust fan system, shall be sized for a maximum static pressure (SP) drop (that includes filter resistance) of 25 Pa (0.10" of H<sub>2</sub>O) to prevent excessive negative pressurization of the building. Exterior outside door louvers and undercuts are not permitted.

Ventilation and exhaust fan systems shall be provided as described in the fully developed K-span or CMU design drawings in the Appendix. Where characteristics are not specified in those drawings, the following guidance applies:

Consideration shall be given to wall-mounted fans (except for battery rooms) to reduce roof penetrations and possibility for water leaks (especially for metal roofs).

Maintenance shops and similar spaces that use solvents and oils shall be provided with mechanical exhaust air systems. Intake or makeup 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 or as listed in the 01015.

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 unless directed otherwise.

All occupied windowless rooms, including interior occupied spaces shall be provided with forced-air outside air ventilation systems or forced-air exhaust systems.

#### **5.14.1 CEILING FANS**

Ceiling fans shall be 5-bladed, 1320 mm (52"), minimum, in diameter, and provided at one per 40 sq.m (430 sq.ft) of floor space unless indicated otherwise. 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 fan shall be provided without light kit. 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. The electrical supply shall be as indicated. Install per manufacturers' instructions.

#### **5.14.2 BATTERY ROOM EXHAUST**

Battery room exhaust systems shall be provided in accordance with the Appendix drawings. Any components such as fan and ductwork in contact with the exhaust air shall be constructed out of fiberglass reinforced plastic (FRP) or polyvinyl chloride (PVC).

#### **5.14.3 OVERHEAD VEHICLE TAILPIPE EXHAUST SYSTEMS**

Overhead vehicle tailpipe exhaust systems shall be provided where required in the Appendix drawings.

Duct shall be constructed of stainless steel sheets of the minimum gauge thickness for ducts as required in SMACNA or as provided by the tailpipe exhaust system manufacturer. Ducts shall be constructed and sealed in accordance with SMACNA and shall be round with longitudinal lock seam or spiral wound duct for use in a negative pressure system.

Tailpipe adapters shall be of the tapered-cone type with spring clips or other suitable devices for exhaust pipe attachment. The adapter shall fit the nominal diameter exhaust pipe.

Flexible exhaust hose shall be 0.30 mm (0.012") minimum stainless steel or suitable material recommended by the manufacturer.

#### **5.14.4 KITCHEN HOOD EXHAUST AND OUTSIDE MAKE-UP AIR**

Kitchen hood exhaust and outside make-up air system shall be provided in accordance with the Appendix drawings.

These systems shall comply with ASHRAE Handbook- HVAC Applications, NFPA 96, SMACNA, as per Kitchen design specialist and equipment supplier requirements, and as stated in this Section. Outside make-up air and exhaust systems for each hood shall be independent of the other duct systems in the DFAC. Residential kitchen ventilation hoods shall NOT be used. Kitchen exhaust hoods and exhaust ductwork shall be design for Type I (grease and smoke hood installed over the stove area) and provided with baffle grease filters. Hood and exhaust ductwork shall be constructed from minimum 1.0 mm (20-gauge) stainless steel material. Exhaust flow rates shall be in accordance with the Appendix drawing schedules.

All exhaust duct joints and seams shall be continuously welded or brazed. Access door shall be provided at all changes of direction to ensure all portions of the duct system can be cleaned. Bracing 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 450 mm (18") from combustible material or 75 mm (3") from gypsum wallboard attached to non-combustible structures. All exhaust ductwork shall be pitched to drain back to the hood.

Roof-mounted centrifugal exhaust fans shall be rated for use as a grease exhaust fan. Exhaust fans shall be centrifugal and fan motors shall be located outside the airstream. Fan discharge shall not impinge on the roof, other equipment or appliances, or parts of the building. Discharge outlet of exhaust fans shall be a minimum of 1,000 mm (40") above the roof. Up-blast fans shall be hinged and supplied with a flexible weatherproof electrical cable to permit inspection and cleaning. Connection between ductwork and exhaust fans shall be flanged, gasketed, and bolted. Each exhaust fan shall be electrically interlocked with its corresponding outside make-up air fan to prevent system operation without both fans in service.

The bottom of kitchen hood should be mounted about 2.3 m to 2.4 m (7'-6" to 8'-0") above the floor, if possible.

Outside make-up air inlet locations shall take into consideration the prevailing wind direction and shall be placed upstream of exhaust outlets. Wherever possible, outside make-up air inlets shall be located a minimum distance of 3 m (10') from exhaust outlets. Where outside make-up air inlets are located within this distance from the exhaust outlets, the outside make-up air inlet shall be located a minimum of 920 mm (3') below the exhaust outlet. Each outside make-up air fan shall be electrically interlocked with its corresponding exhaust air fan to prevent system operation without both fans in service.

To reduce sand and dirt migration, outside air intakes shall be located as high as possible within architectural constraints. The intakes shall be sized so that free area velocities of the louvers are below 2.5 mps (500 fpm). For inhabited buildings, locate all air intakes (from center-line of intake) at least 1.5 m (5') above the ground. Each air intake shall be provided with a motorized damper which is interlocked with the exhaust fan(s).

## **5.15 STOVES**

Kitchen stoves and all associated features shall be provided in accordance with the Appendix drawings.

### **5.15.1 STOVE CHIMNEYS**

Each kitchen stove shall be provided with a dedicated chimney and all associated features in accordance with the Appendix drawings.

## **5.16 COLD STORAGE SYSTEMS**

All cold storage units shall be designed to operate as either refrigerators or freezers (should a freezer become non-operational requiring the frozen stores to be transported to the other unit). The Contractor shall submit to the Contracting Officer for approval, prior to start of work, copies of both the assembly and installation instructions along with shop drawings for appropriately sized walk-in refrigerators and freezers. The submittal shall also include the proposed manufacturer, cooling load calculations, evacuation and charging procedures, operation and maintenance data, and start-up and initial operational tests.

### **5.16.1 MODULAR CONSTRUCTION**

Dimensions shall be as indicated. All walk-in cold storage units shall be the prefabricated insulated panel (or modular) type. Doors shall be the swing type. Remote refrigeration equipment shall be located on the exterior of the building. Floors of cold storage units shall be the prefabricated insulated type provided by the manufacturer of the cold storage units. The concrete floors under the cold storage units shall NOT be depressed.

Walls, ceilings, doors, and flooring of the cold storage units shall not contain any wood or wooden material. Walls, ceilings, doors, and flooring shall be made of sandwiched panels filled with polystyrene or urethane insulation material. Interior panel surfaces shall be aluminum or stainless steel lined. Ramps shall be provided at the door of each cold storage unit.

### **5.16.2 REFRIGERATION EQUIPMENT**

All refrigeration systems shall be designed for continuous operation and shall maintain the interior product temperature between -23 to -18 C (-10 to 0 F) with an outside ambient temperature down to -18 C (0 F). Remote condensing units shall be factory fabricated and rated in accordance with UL303 and ARI 365 and consist of, as a minimum, motors, air cooled condensers, receivers, and compressors all mounted on a common base. Compressors shall be hermetic type.

Evaporators shall be factory fabricated and rated in accordance with UL 412 and ARI 420. Evaporator shall be the forced convection unit cooler type made to suspend from the ceiling panels with forced air discharged parallel to the ceiling. Evaporators shall be provided with air circulating motors, multi-fin tube type coils assembled within a protective housing, and grilles. Air circulation motors shall be lifetime sealed and the entire unit-cooler assembly shall be accessible for cleaning. Refrigeration piping shall be annealed or hard drawn seamless copper tubing in conformance with ASTM B280.

Condensate drip pan and drain connections shall be provided for the evaporators. Condensate drains and drain lines shall be accessible and shall be routed on the exterior wall of the unit to the extent possible and taken to a dedicated floor drain immediately adjacent to the unit. Condensate lines and plumbing waste lines shall not be routed beneath the units. Electric heat cable may be allowed inside the freezer, as designed and recommended by the unit manufacturer.

Outdoor condensing units shall be provided with a protective canopy and security fence or wall to protect from direct sun, weather, and vandalism.

### 5.16.3 CONTROLS

A recording thermometer, temperature alarm system, and interior lighting with exterior switch shall be provided as a minimum. The temperature alarm shall be connected to a remote temperature alarm located in a frequented area. Automatic electric heat defrosting system shall be provided for ALL cooler units to allow for freezing operations, Timer type defrost controllers shall be provided. For power characteristics; See Electrical.

### 5.16.4 COLD STORAGE TESTING

Start up and initial operation shall be undertaken upon completion of the equipment and refrigerant piping installation. Safety and automatic controls shall be adjusted to place them in operating sequence. The manufacturer's recommended readings shall be record hourly for a period not less than 24 hours. Upon completion of operational tests, the systems shall be performance tested for a duration not less than eight (8) hours. The test shall include the following information to be in the report with conclusions regarding the adequacy of the systems:

Time, dates, and duration of tests

Inside dry-bulb and wet-bulb temperatures maintained in each cooler during the tests employing recording instruments calibrated before the tests.

Outside dry-bulb and wet-bulb temperatures obtained from recording instruments calibrated and checked hourly with a sling psychrometer.

Evaporator and condenser entering and leaving air temperatures taken hourly with the compressors in operation.

The make, model, and capacity of each evaporator and condensing unit.

Voltmeter and ammeter readings for condensing units and evaporators.

### 5.16.5 COLD STORAGE OPERATIONS & MAINTENANCE

A chart showing the complete layout of the refrigeration systems, including piping, valves, wiring, and control mechanisms shall be provided. Printed instructions covering the maintenance and operation of refrigeration equipment shall be submitted. Shutoff valves shall be tagged in accordance with the instructions. Special tools necessary for repair and maintenance of the systems shall be provided. Upon completion of the work and at a time designated by the Contracting Officer, instruction shall be given to designated personnel in the operation and maintenance of each refrigeration system. The period of instruction shall not be less than one 8-hour day.

## 5.17 MECHANICAL REQUIREMENTS FOR GENERATORS

Associated Sections:

**Electrical:** Generator Power System and **Plumbing:** Generator & Incinerator Fuel Storage & Distribution

Generator quantities and sizes shall be as stated in Section 01010 and 01015. The following shall be provided in the Mechanical design and installation for Prime stationary generator sets and related mechanical systems: Foundations, mountings, exhaust systems, cooling systems, ventilation, noise attenuation, and equipment configuration. See Electrical for power and electrical equipment requirements, and Plumbing for fuel system requirements, and Fire Protection for fire safety requirements.

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 de-rating calculations shall be clearly shown in the engineering analysis.

### 5.17.1 EXTERIOR GENERATORS

The generator set(s) shall be the manufacturer's design for outdoor weather-proof installation with skid-mounted high-ambient temperature radiator rated for 50 C (120 F). All exterior installed generator sets 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. Additionally, the generator shall be equipped with an 8-hour day tank, pump and particulate and water filters. The generator shall be mounted on a pad that is designed to be secondary containment for the 8 hr

day tank. Generator set(s) shall be oriented with the prevailing winds when possible (with the alternator upwind) to promote heat removing airflow 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.). 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.

Exhaust systems shall have minimal backpressure, directed to disperse the noise away from people and occupied buildings, and be located near the radiator air discharge.

## **5.18 INCINERATORS AND WASTE MANAGEMENT EQUIPMENT**

Note: See Civil for site layout and drainage requirements and Electrical for site power and lighting requirements.

The incinerator(s) shall be designed for the specific solid waste (i.e. Municipal, medical, etc.) to be minimized and burned. The Contractor shall coordinate incineration projects between the environmental regulations, technical requirements, and concerns of multiple agencies within federal, state, and local governments.

The incinerators shall be completely protected from the weather with an overhead canopy. The canopy shall have a minimum clearance of 2.0 m (6.5') above the equipment. All areas under the canopy (not occupied by equipment foundations) shall be provided with a reinforced concrete surface.

### **5.18.1 MUNICIPAL SOLID WASTE INCINERATORS**

Municipal waste incinerator quantities and capacities shall be as required in Section 01010 and as follows. All units shall be designed for 24-hour 7-day-a-week continuous operation.

All municipal solid waste incinerators shall have the daily waste stream divided between two (2) equally sized units so the operation may continue (at a reduced capacity) when one incinerator is down for repair. Each incinerator shall be sized at 12 metric ton per day capacity.

Incinerators shall be capable of processing both wet and dry material and operating on diesel fuel, JP-8 fuel, or waste oil; see Plumbing for fuel storage system requirements. The following shall be provided as a minimum: Reinforced concrete mounting foundations, feed or charging hoppers (or loaders), primary combustion chambers with ash cleanout doors, secondary combustion chambers with ash cleanout doors, cyclone air filters (or separators), and forced air exhaust stacks (or chimneys).

The charging system shall consist of, as a minimum, a hopper for top feeding and manually operated hydraulic charging ram or augur. To prevent warpage or excessive thermal expansion, a charger cooling system using either air or water shall be provided.

Primary combustion chamber shall be either the rotary- or stationary-hearth (or kiln) type incinerator. Burner and combustion air controls shall be fully automatic comprising of, as a minimum, electronic ignition and all necessary interlocks and safety devices to provide safe operation. The chamber and burner shall be designed to maintain a minimum combustion temperature of at least 700 to 870 C (1300 to 1600 F), but shall not to exceed 980 C (1800 F).

Secondary combustion chamber shall be either the rotary- or stationary-hearth (or kiln) type incinerator designed to oxidize (or burn) the organic vapors and gases. Burner and combustion air controls shall be fully automatic comprising of, as a minimum, electronic ignition and all necessary interlocks and safety devices to provide safe operation. The chamber and burner shall be designed to maintain a minimum combustion temperature of at least 930 to 980 C (1700 to 1800 F), but shall not to exceed 1150 C (2100 F).

Cyclone air filters shall be provided to remove the larger particulates. Cyclone air separators may be provided with powered fans to increase the velocity of the gases inside the cyclone to improve the collection efficiency for smaller particles.

### **5.18.2 MEDICAL WASTE INCINERATORS**

The medical waste incinerator shall be provided as required in Section 01010 and shall be specifically designed by the manufacturer to dispose of all medical wastes. The unit shall be designed for 8 hours per day of continuous

operation and be rated for 100 kg per day. The unit shall have all features specified above for municipal solid waste incinerators.

### **5.18.3 INCINERATOR STACKS (OR CHIMNEYS)**

Stack size shall be in accordance with the manufacturer's recommendations. Stacks shall be the forced-air type and completely self-supporting and unattached to nearby structures. As a minimum, stack heights shall minimize downwash of stack emissions due to aerodynamic influences from nearby structures and be calculated in accordance with DoD 4715.05-G, Overseas Environmental Baseline Guidance Document. Stacks shall be provided with corrosion-resistant steel weather caps.

### **5.19 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 on when the test shall be scheduled. 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 and submitted to the Contracting Officer in writing.

The following tests and readings shall be made by the Contractor in the presence of the Contracting Officer and all results shall be recorded and submitted in a tabulated form:

- 1) Ambient DB and WB temperatures.
- 2) Room Inside Conditions:
  - a) Inside room DB & WB temperatures.
  - b) Air flow supply, return, and/or exhaust.
  - c) Plot all temperatures on psychrometric chart.
- 3) Split-Pack Heat Pumps and Heaters the following readings shall be made:
  - a) Motor speed, fan speed, and input ampere reading for each fan.
  - b) Supply and return air temperature for each system.
- 4) Packaged Air Handling Equipment: Air quantities shall be obtained by anemometer readings and all necessary adjustments shall be made to obtain the specified quantities of air indicated at each inlet and outlet. Following readings shall be made:
  - a) Supply, return and outside air cmh (cfm) supplied by each air conditioning system.
  - b) Motor speed, fan speed, and input ampere reading for each fan.
  - c) Supply, return, and outside air temperature for each air-conditioning system.
- 5) Exhaust air fans the follow reading shall be made:
  - a) Total cmh (cfm) by each fan.
  - b) Speed in rpm.
  - c) Amperes for each phase.
  - d) Power input in kW.
- 6) Electric Motors: For each motor:
  - a) Speed in rpm.
  - b) Amperes for each phase.
  - c) Power input in kW.

## **5.20 OPERATIONS & MAINTENANCE (O&M) FOR MECHANICAL**

Contractor is required to provide a 12-month supply of parts for operation and maintenance of equipment according to the manufacturer's recommendations. In addition to this, the Contractor shall provide an inventory of all items, location/address stored and secured, and commissioning plans.

The O&M manuals must be provided prior to any training activities. Manuals shall be "tri-lingual" in Dari, Pashto, and English.

All control panels shall have tri-lingual name plates in Dari, Pashto and English.

The contractor shall provide an outline of the training lesson plan (to be approved by the Government) prior to conducting training. CD recordings of training on video shall also be provided, after training is conducted.

## **6.0 PLUMBING**

### **6.1 GENERAL**

The Contractor shall design and build domestic cold and hot water systems, waste, drain and vent systems, compressed air, fuel-oil storage and distribution systems and as 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.

Where fully-developed design drawings have been provided in the Appendix, the Contractor shall construct the facility per the Appendix drawings without alteration. The Contractor shall prepare calculations for sizing the plumbing equipment and devices wherever the capacities are not listed in the respective Appendix drawings' plumbing equipment schedules.

In any cases where the Appendix contains only concept drawings, the Contractor shall fully design the plumbing systems in accordance with the requirements of this section.

### **6.2 SUB-CONTRACTORS QUALIFICATIONS**

The plumbing systems shall be executed by a plumbing specialist subcontractor experienced in the design and construction of these types of systems.

### **6.3 STANDARD PRODUCTS**

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.

### **6.4 CODES, STANDARDS, & 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). 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.

## **6.5 EQUIPMENT PROTECTION**

Exterior plumbing equipment shall be pad-mounted. In addition, security fences and traffic bollards for exterior equipment shall be provided. In addition to fences and bollards or screen walls, provide designed overhead canopies/shelters for exterior electrical generators and adjacent fuel tanks. Overhead canopy height shall be a minimum of 2 m (80") above the highest point of the engine cabinets and fuel tanks.

## **6.6 PLUMBING SYSTEM REQUIREMENTS**

### **6.6.1 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. 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.

### **6.6.2 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.

Waste and vent piping can be made of 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, waste, and vent piping shall be schedule 40 galvanized steel; wall mounting brackets for exposed domestic water, waste, and vent piping shall be spaced a maximum of 40 cm (16") apart to minimize vandalism.

Polypropylene (PP) pipe is not permitted.

Gas piping for 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. 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.

### **6.6.3 PLUMBING WATER FIXTURES**

Fixtures and valves in showers, toilets and lavatories, shall be detention-grade, vandal-resistant products.

The following typical plumbing fixtures shall be provided:

**WC-1:** Eastern Water Closet with flush tank assembly. Provide acid resisting fired porcelain enameled cast iron 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/hose bib 300 mm (12") above finished floor on the right (from a perspective of standing inside of

the cubicle and looking out) sidewall of the cubicle. Toilets shall be oriented north and south; toilets shall not face east or west.

**WC-2:** (only for areas used by NATO forces) Western style toilets with flush tanks shall be provided as requested by the User. Western style toilets shall be white vitreous china, siphon jet, round bowl, pressure assisted, floor mounted with floor outlet. Top of toilet seat height shall be 356 to 381 mm. Water closet shall be flush tank type. Provide a cold water spigot 300mm above finished floor. Spigot shall have a flexible hose and spray nozzle.

**FU-1:** Flush Valve Urinals. Urinals shall be white, vitreous china, wall-mounted, wall outlet, siphon jet, integral trap and extended side shields. Provide urinal with the rim 600 mm (24") above the floor. Water flushing volume of the urinal and flush valve combination shall not exceed 0.5 liters (0.125 gallons) per flush. Mount flush valves not less than 280 mm (11") above the fixture.

**L-1:** Lavatories (In Afghan Facilities). 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.

**L-1 Faucet Option 1:** Trough-type sink faucets shall be similar to heavy duty service sink faucets with one-piece brass body construction, fixed short integral spout, hot and cold water manual mixing valves, and ability to withstand abuse. Lavatories inside prisoner cells shall be tamper-proof with integral spout, soap depression, and outlet connection to slip 40 mm (1.5") OD tubing.

**L-1 Faucet Option 2:** Trough type sink faucets shall be constructed of 12mm quarter turn ball valves and schedule 40 galvanized piping material. Assembly shall be constructed to function as a service faucet mixing fixture using elbows, tee's, and piping. Provide assembly detail in the construction documents.

**L-2:** Lavatories (NATO Facilities): All sinks shall be the vitreous china wall-mounted type. Provide maintenance access to waste piping and P-traps from under the sink.

**L-2 Lavatory Faucet:** 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 and the non-lever type. No goose neck faucet fixtures shall be used.

**Sink Faucets:** 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 and the non-lever type. No goose neck faucet fixtures shall be used.

**JS-1:** Janitor's Sink. All janitor's sinks shall be floor mounted, enameled cast iron, and be provided with copper alloy rim guard. Service sinks provided in maintenance areas shall be concrete. Service sinks in battery rooms shall be acid resistant. Include a stainless steel shelf and three (3) mop holders with janitor sinks.

**Janitor Sink Faucets:** Provide hot and cold water heavy duty service sink valves with manual mixing. Faucet handles shall chrome plated brass or bronze alloy.

**SH-1:** Shower Base shall be sized to fit from wall to wall. Refer to Architectural drawings and specifications.

**SH-1 Faucet and Trim:** Showerhead and faucet handles shall be chrome plated brass or bronze alloy. 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 (4') AFF with hot and cold-water controls, mixing valve, and diverter 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. Hand-held shower head with flexible hose shall be allowed.

**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.

**ESE-1:** Emergency Shower and Eye Wash. Provide emergency shower and eye wash assembly as indicated on architectural drawings. In non freezing locations, a floor drain shall be provided. Provide a floor drain in the area if appropriate (i.e. Non-freezing locations, etc.).

**EEW-1:** Emergency Eye Wash Assembly. Provide emergency eye wash assembly in facilities where shown on the architectural drawings. Provide a floor drain in the area if appropriate (i.e. Non-freezing locations, etc.).

**EEF-1:** Emergency Eye and Face Wash: Provide emergency eye and face wash assembly in facilities where shown on the architectural drawings. Provide a floor drain in the area if appropriate (i.e. Non-freezing locations, etc).

**KS-1:** Kitchen Sink. Single bowl sink shall be heavy gauge formed type 304 stainless steel.

**KS-2:** Kitchen Sink. Two (2) compartment sink shall be heavy gauge formed type 304 stainless steel.

**KS-1 and KS-2 Faucet:** Faucet bodies and spout shall be chrome plated brass or bronze alloy. Handles, drain assembly, and stopper shall be corrosion resisting steel or brass/bronze alloy.

**Ablution Trench:** See building floor plans for size and construction of trench and number of stations. Provide trench drain with brass grating and strainer.

**Ablution Trench Faucet type:** See L-1 Option 1 and Option 2 above. Provide faucets above with hose end, 1 meter of hose a spray nozzle and a hook to hang the nozzle. Install faucet 300 mm above the floor.

**Grease Interceptor:** Refer to Civil Drawings.

**FS-1:** Floor Sink. Provide square floor sink 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. Provide full, half or three quarter grates as needed

**TD-1:** Trench Drains: Floor trench shall be of concrete construction with a flush mounted cast iron grate. The cast iron grate shall be sectionalized for cleaning access. The grate shall fit into a frame so the grate is flush with the finished floor. Iron grates shall be fabricated in sections in length not greater than 1,500 mm (5'). The cast iron grate shall have 12 mm wide slots, maximum. 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. Trench drains shall not be piped into the grease waste system.

**HB-1:** Hose bib for exterior use. Provide attached handle.

**HB-2:** 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 m (40') of hose. Provide clean-up spray nozzle with hose assembly.

**Traps:** Provide P-Traps per IPC for all fixture drains, floor and trench drains, and shower drains. P-traps shall have minimum of 50 mm (2") water seal.

**PS-1:** Large Pot sink, provide clean-up spray nozzle with hose assembly.

**PS-1 Faucet:** Provide hot and cold water heavy duty service sink valves with manual mixing. Faucet shall have hose end on fixture spout. Provide 2 m of hose and spray nozzle. Mount faucet 300 mm above top of largest pot.

**TS-1:** Laundry Tub Sink: Sinks shall be the standard height polypropylene single-bowled floor-mounted on four (4) legs. Approximate tub dimensions shall be approximately 660 mm depth x 635 mm front (22" x 25") with a minimum 80 l (20 gal) capacity. Sinks shall be provided with hot and cold water valves for manual mixing. Faucet handles shall be copper alloy.

## **6.7 HOT WATER**

Hot water shall be provided for the facility to supply 50 C (120 F) hot water to fixtures and outlets requiring heated 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 recirculating pump and a recirculation line shall be provided if hot water piping run exceeds 30 m (100) in accordance with the IPC.

### **6.7.1 WATER HEATERS**

The hot water shall be generated by electric water heaters (WH). All WHs shall be factory insulated, and in cases where the pressure of the inlet water exceeds the manufacturer's working pressure, pressure reducer(s) shall be installed in the line before the water heater. Each water heater shall be equipped with a vacuum relief valve and temperature and pressure (T&P) relief valve that discharges into a nearby floor drain; discharge piping shall terminate 50 mm (2") above the floor drain. The larger floor-mounted units shall be located inside mechanical

rooms, storage rooms, janitor rooms, or similar type spaces. Smaller wall-mounted units may be located in toilet-lavatory areas for single remote water closets. Multiple 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.

Water heater storage capacity (liters) and recovery capacity elements (kW or liters per hour) shall be in accordance with the Appendix drawings. If not scheduled in the Appendix drawings, water heaters shall be sized in accordance with ASHRAE Fundamentals Handbook-HVAC Applications, "Service Water Heating." Provide water heater sizing according to the following chart:

<b>Building Type</b>	<b>ASHRAE Category</b>
Barracks, Latrine	Hotel
HQ, Admin, TOC, DPW, PX,	Office
DFAC	Hotel
Medical Clinic, Hospital	Hospital

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

## **6.8 WASTE, DRAIN, & VENT SYSTEMS**

### **6.8.1 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.

### **6.8.2 ENGINEERING & INSTALLATION CONSIDERATIONS**

The Designer and installer 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. Under no circumstances shall vent piping be routed horizontally under the floor due to blockages over time. 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 (6") above the flood level rim, of the fixture being vented, before going horizontally.

### **6.8.3 FLOOR DRAINS**

Floor drains, floor sinks, and trench drains shall be provided in accordance with the Appendix drawings. For facilities not having fully developed designs in the Appendix drawings, provide these fixtures in accordance with the following guidance:

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.

Floor sinks shall be used in areas of high water flow, such as dishwashing and prep sinks and at the condensate discharge of the walk-in freezers and refrigerators.

Trench drains shall be provided for the DFAC kitchen areas.

#### **6.8.4 CLEANOUTS**

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

#### **6.9 SPECIAL PLUMBING SYSTEMS**

Contractor shall design and construct compressed air storage and distribution, waste-oil collection and storage, fuel-oil storage and distribution and other plumbing systems that are required for full performance of equipment and operations and for maintenance in the Power Plant and Vehicle Maintenance facilities. Special plumbing systems shall be constructed in accordance with the Appendix drawings. Where design detail is not provided in the Appendix drawings, these systems shall be designed and built in accordance with codes and publications referenced herein before and in compliance with equipment manufacturer recommendations.

##### **6.9.1 PLUMBING FOR BATTERY ROOMS**

Plumbing features for battery rooms shall be in accordance with the Appendix drawings. Dump sink shall be resistant to the battery contents. Provide a garden hose and rack for flushing and neutralizing spilled electrolytes in the battery room.

##### **6.9.2 COMPRESSED AIR DISTRIBUTION SYSTEMS**

Compressed air distribution systems shall be in accordance with the Appendix drawings for the Vehicle Maintenance Facility. Although the Appendix drawings indicate the compressor is "by others," the provision of a compressor is a requirement of this contract for each Vehicle Maintenance Facility. Size the compressor for the quantity of compressed air normally anticipated in a vehicle maintenance application with the number of drops shown in the Appendix drawings.

Compressed air distribution systems shall be capable of operation up to 10 kPa (200 psig) maximum for 6 kPa (125 psig) normal units. The air distribution system shall be provided with necessary regulator valves to maintain desired pressure. Compressed air drops shall be provided as shown in the Appendix drawings. Where required, line filters, lubricators, and/or hose reels shall be provided. Compressed air piping shall be black steel pipe and painted to match wall color.

#### **6.10 VEHICLE WASH FACILITIES (RACKS)**

Provide full design and construction for complete vehicle wash facilities/racks. The wash racks shall be constructed according to the concept plans included in the Appendix.

For each wash station provide one 5-meter (18 foot) high tower of sufficient strength to support a swing arm without visible deflection. The swing arm shall rotate 180 degrees and shall be 3 meters (10 feet) in length and shall be mounted such that it can pass freely over a 15-foot tall vehicle. Provide nozzles on the swing arm arranged to deliver high-pressure water suitable for washing vehicles. Pressure at the nozzles shall be 50 kPa (75 psi) with a design flow rate of 95 lpm (25 gpm) per swing arm. For each tower provide a flexible hose in 10 meter (32 feet) length that is fitted with a durable triggered wand and is controlled by a tower-mounted manual valve. The flexible hose/wand assembly shall be designed for 95 lpm (25 gpm) at 50 kPa (75 psi). For each tower provide a general-duty hydrant with hose connection for clean-up. This hydrant need not be fed through the booster pumps; it shall be fed at normal supply pressure of the domestic water system. Provide booster pumps to enable simultaneous operation of swing arm nozzles and pressurized hose/wand assemblies at each wash station. All pumps shall be installed on a concrete pad and shall be protected in a weather-proof enclosed structure with bollards. Provide hydraulic calculations for pump sizing.

For each wash station, provide heavy-duty traffic-rated trench drains and a below-grade concrete valve box (with traffic-rated cover) with water supply valve. For freeze protection, all above-ground piping shall be sloped back to the base of the tower and provided with a 3 mm (1/8") weep hole where the piping penetrates the concrete.

## **6.11 FUEL OFF-LOAD SYSTEMS**

For the generator plant fuel farm, the vehicle fuel point, and the incinerator fuel tanks, design and construct complete fuel filling systems. These systems shall each facilitate unloading fuel from fuel tanker trucks into individual bulk storage tanks. These systems shall include truck pad(s), duplex fuel transfer pumps, piping manifolds, and valves all in weather-proof cabinets. The system shall provide remote fuel level monitoring panels at the pad(s). Weather-proof cabinets shall be lockable and shall 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 points outside of the perimeter wall to facilitate transfer of fuel from the commercial tanker trucks to the respective bulk storage tanks.

### **6.11.1 TANK/PIPE TESTING AND TURNOVER**

A tightness test shall be performed on each storage tank and associated piping. The tank tests shall be performed prior to making piping connections. Tests shall be capable of detecting a 0.1 ml/s (0.0126 cu.ft/h) leak rate from any portion of the tank while accounting for effects of thermal expansion or contraction. Each storage tank shall be pressurized with air to 35 kPa (5 psi) and monitored for a drop in pressure over a two (2) hour period during which there shall be no drop in pressure in the tank greater than that allowed for pressure variations due to thermal effects. Following the tank tightness test(s), each storage tank shall be leak tested in accordance with the manufacturer's written test procedure if the manufacturer's test procedure is different from the tightness tests already performed. Also following the tank tightness test(s) all associated piping shall be tested using the same procedures stated for testing the tank(s). The Contractor shall provide a full supply of fuel for each tank at the time of turnover to the Government.

## **6.12 GENERATOR & INCINERATOR FUEL STORAGE & DISTRIBUTION**

The work shall include the fabrication and installation of the entire fuel storage and distribution system.

Associated Sections:

**Electrical:** Generator Power System and **Mechanical:** Mechanical Requirements for Generators

### **6.12.1 FUEL OIL STORAGE AND CONTAINMENT**

Fuel Oil Storage and Distribution system shall be provided to support the operation of diesel engine generator set(s) and incinerator(s). Incinerator tanks shall be protected from the weather by a structural cover. Generator Storage tanks will not be covered. Covered structure shall have a minimum clearance of 2.0 m (6.5') above the tank equipment and extend out with a minimum overhang of 1.0 m (40") beyond the equipment and spill containment dike.

Incinerator diesel fuel storage tank capacity shall be 22,000 l (5,800 gal) of fuel storage. The given size is based on a 30 day continuous supply for a 12 ton per day load.

Power Plant generator fuel storage shall be sized at 750 m<sup>3</sup>. This sizing is based on 75% consumption of five generators for 30 days.

The Contractor shall provide a full supply of fuel for each tank at the time of turnover to the Government.

Bulk storage of fuels shall be designed around above-ground horizontal steel tanks with single-walls and containment dike. Under no circumstances shall galvanized tanks be provided for storage of fuel oil or diesel. Tanks shall be installed in accordance with NFPA 37.

The containment dike(s) shall be sized to contain the entire contents of the tank plus 10 percent. The dike structure shall be constructed of reinforced concrete. If more than one (1) tank is sharing a containment dike, then the dike need only be sized for the capacity of the largest tank, plus 10 percent. Covered containment dikes shall NOT be equipped with rainwater drain valves due to accidentally remaining open and due to becoming non-functional overtime because of corrosion and weathering. Covered containment dikes shall NOT be equipped with drains and oil-water separators due to a tank failure overwhelming the separator capacity and allowing volatile fuel into the sewer system.

Bulk storage tanks shall be designed and manufactured for horizontal aboveground installation. 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.

Tanks of 3,880 to 45,400 liters (1,000 to 12,000 gallons) capacity shall be provided with 760 mm (30") diameter manways. Tanks larger than 45,400 liters (12,000 gallons) shall be provided with 900 mm (36") diameter manways. 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. 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.

#### **6.12.2 FUEL DISTRIBUTION SYSTEM**

Fuel system shall be designed to supply clean fuel to the generator(s). 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. Rubber hoses shall not be allowed. Under no circumstances shall galvanized piping, fittings, valves, or other equipment 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 true to 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).

#### **6.12.3 TANK/PIPE TESTING AND TURNOVER**

A tightness test shall be performed on each storage tank and associated piping. The tank tests shall be performed prior to making piping connections. Tests shall be capable of detecting a 0.1 ml/s (0.0126 cu.ft/h) leak rate from any portion of the tank while accounting for effects of thermal expansion or contraction. Each storage tank shall be pressurized with air to 35 kPa (5 psi) and monitored for a drop in pressure over a two (2) hour period during which there shall be no drop in pressure in the tank greater than that allowed for pressure variations due to thermal effects. Following the tank tightness test(s), each storage tank shall be leak tested in accordance with the manufacturer's written test procedure if the manufacturer's test procedure is different from the tightness tests already performed. Also following the tank tightness test(s) all associated piping shall be tested using the same procedures stated for testing the tank(s). The Contractor shall provide a full supply of fuel for each tank at the time of turnover to the Government.

#### **6.13 VEHICLE REFUELING POINT (STORAGE AND DISPENSING)**

Design and construct a complete vehicle refueling system including storage and distribution. The refueling point shall provide for both diesel and MOGAS of quantities as stated in Section 01010. The Contractor shall provide a full supply of fuel for ALL tanks at the time of turnover to the Government.

The fuels shall be stored in one or more above-ground horizontal steel tanks. 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 have overfill protection devices and remote overfill alarms. Tanks shall be provided with support saddles, platform/stair, concrete pad, and spill containment provisions. Secondary containment dikes shall be provided for aboveground tank(s) and sized to contain the entire contents of the tank plus 10 percent. If more than one (1) tank is sharing a containment dike, then the dike need only be sized and have the capacity for the largest tank plus 10 percent.

Fuel piping shall be black steel only for piping located above grade and either steel or fiberglass for underground; rubber hoses shall not be allowed, except for fuel dispensers. Under no circumstances shall galvanized piping, fittings, valves, or other equipment be used for fuel oil or diesel conveyance. Secondary containment for underground piping shall be provided with either double-wall fiberglass pipe, double-wall steel with cathodic protection, or steel or fiberglass pipe located in a concrete secondary containment trench with removal covers (traffic-rated as applicable) and applied POL-resistant coating.

Separate dispensing units shall be provided for diesel and MOGAS. Each dispensing unit shall be equipped with dual nozzles, two (2) mechanical dispensing meters, and key control. Fuel dispensing unit shall be installed on an island such that two (2) vehicles can simultaneously fuel on either sides of the dispensing unit.

#### **6.14 PROPANE FUEL STORAGE (45 KG BOTTLES)**

LPG-propane storage tanks shall be located outside and exterior to the building in accordance with the Appendix drawings. The storage of fuels shall consist of individual 45 kg (100-pound) portable bottle tanks. The Contractor shall provide all tanks filled with LPG/propane fuel at time of completion.

#### **6.15 SPARE INVENTORY**

Contractor shall provide spare inventory of plumbing supplies. The purpose of the spare inventory is to provide the owner with spare parts. The contractor shall provide separately any parts needed for warranty.

Provide a quantity of:

Ten (5) ball valves each for 15 mm (½”), 20 mm (¾”), 25 mm (1”), 32 mm (1-1/4”) and 40 mm (1-1/2”).

Ten (10) isolation valves of each type for lavatories, sinks, toilets and other devices with shutoff valves.

Five (5) spare faucets of each type and size installed. If faucets are made of ball valves and schedule 40 pipe, provide as assembled units.

Three (3) spare hose bibs of each size.

Ten (10) spare P-trap assemblies of each size.

Three (3) spare mixing valves of each type.

Three (3) spare fixtures of any vitreous china types.

Ten (10) spare toilet flush valves of each type.

Contractor to provide COR an inventory list prior to delivery of parts for approval. Contractor shall arrange delivery of spare products at the end of the project and shall obtain a receipt from the COR.

#### **6.16 TESTING & COMMISSIONING**

The Contractor shall test all piping systems in accordance with IPC International Plumbing Code. The final test shall include a pressure test for all piping. After completing the work, the Contractor shall demonstrate that all piping 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 Government 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 as required in accordance with NFPA 10. 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). Fire extinguishers shall be located in an accessible location, free from blocking by storage and equipment, near room exits that provide an escape route. The top of the extinguisher shall not be more than 1.5m above the floor and not less than 101mm above the floor. The extinguisher shall be easy to reach and placed where it will not be damaged.

## **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 U.S. Army Corps of Engineers, Afghanistan Engineer District-South.

#### **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.

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.

### **8.4.2 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.

### **8.4.3 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 derated according to the manufacturer's recommendations. Generic derating 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 derating criteria specific to the manufacturer's equipment chosen before the equipment is ordered.

### **8.4.4 RESTRICTIONS**

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

## **8.5 DESIGN REQUIREMENTS**

### **8.5.1 ELECTRICAL DISTRIBUTION SYSTEM**

The Contractor shall design and build 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 underground portion of the distribution system shall be in direct buried schedule 80 ductbanks, except for under roadways and heavy traffic areas, with the ducts not less than 1220mm below grade. 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. Underground ducts shall be not less than 100mm diameter Schedule 80 PVC for non roadway and light traffic areas and concrete

encased schedule 40 for roadways and heavy traffic areas. The Contractor shall provide one additional duct per duct bank beyond the design for future growth.

The Contractor shall design and build a medium voltage primary distribution system with distribution feeders to supply power to distribution transformers. The transformers shall be loop feed, dead front type with load break elbows. Each transformer shall be sized to provide power for the total load of the facility served without being loaded to more than 110% of its rated capacity.

The Contractor shall provide all required conduit stub ups to connect all equipment (both present and planned) to the switchgear lineup. Contractor shall provide stepup transformers and the required conduits to connect the generators to their respective transformer and the transformers to the switchgear lineup.

Transformers shall be strategically located close to the loads. Primary side load-break disconnecting means shall be provided with all transformers. Transformers shall come complete from manufacturer. Transformer selection, design, and installation shall be governed by NEC, NESC, ETL 1110-3-412, TM 5-684, UFC 4-510-01, UFC 3-550-03FA, UFC 3-550-03N, IEEE C57.12.28, ANSI/IEEE C57.12.22, IEEE C57.12.34, and C57.12.80.

Size of transformers and power feeds shall be governed by UFC 4-510-01, NFPA 99, and the NEC. In case of conflict between transformer design criteria between the above named standards, UFC 4-510-01 shall govern; in cases where UFC 4-510-01 cannot resolve the conflict, it shall be brought to the attention of the Contracting Officer for resolution.

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. All systems shall be designed for the demand loads, plus 25% spare capacity.

The Contractor shall provide feeders from the distribution system to each facility. Equipment shall include a distribution panel board shall be sized for the total load of each facility plus 25% spare capacity for future growth. Feeder lengths shall be kept as short as possible to minimize voltage drop.

All panelboards shall be circuit breaker 'bolt-on' type panels. 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 surface mounted. 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. 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. Power receptacles (outlets) shall be 220 V, 50 hertz, 16 amp type CEE 7-7 three-wire grounded 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 NFPA 70 (National Electric Code), British Standard (BS) Wiring Regulations, International Electrotechnical Commission (IEC) standards, or Deutsches Institut fur Normung (DIN) standards. Receptacle locations are dictated by NEC, British, and other electrical standards.

Contractor shall design and provide circuits for all mechanical equipment and any other equipment that requires power and make the final connections.

Phase imbalance at each panel shall not exceed 5%.

Voltage Drop for branch circuits should be limited to no more than 3%; voltage drop for branch and feeder circuits combined should 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.

## **8.5.2 LIGHTING**

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	35 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)	50 h/5 v FC (500 h/50 v Lux)
Office areas (open)	30 h/5 v FC (300 h/50 v Lux)
Kitchens (commercial)	70 h/3 v FC (700 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	30 h/5 v FC (300 h/50 v Lux)
Armories	30 h/3 v FC (100 h/30 v Lux)
Reading (at desk-serious)	50 h/10 v FC (500 h/100v 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
Areas Requiring Lighting Per Section 010100.5	0.5 Lux

FC = FootCandle

h = horizontal component

v = vertical component

Area lighting for the Motor Pool shall have photocell controlled switches.

### **8.5.3 INTERIOR AND EXTERIOR LIGHTING**

Indoor lighting for all areas shall consist of fluorescent surface mounted light fixtures.

Exterior lighting such as light steel pole shall be HID (metal halide or high pressure sodium).

Moisture resistant/waterproof fluorescent light fixtures shall be provided in high humidity and wet areas such as latrines, showers and outside. 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. Every room shall be provided with a minimum of one light switch. Light fixtures shall be mounted approximately 2.5-meters above finished floor (AFF) minimum. Fixtures may be pendant or ceiling mounted, depending on the ceiling type and height.

### **8.5.4 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), except in medical facilities where magnetic ballast(s) are required. Ballasts shall be rapid start type. 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.

### **8.5.5 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” shall be color red and not less than 150 mm in height and on matte white background. Illuminations shall be with LEDs.

### **8.5.6 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 220 volts. Emergency lighting fixtures shall be connected to the normal lighting system.

### **8.5.7 LIGHT SWITCHES**

Light switch shall be single pole. Minimum of one light switch shall be provided in every room. Lighting in rooms with multiple means of egress may be controlled from multiple switches.

### **8.5.8 RECEPTACLES**

General-purpose receptacles shall be as required herein.

Areas with computer work-stations or similar equipment will have additional receptacles. Sinks may have a receptacle above. All receptacles shall be duplex, unless otherwise specified in this section, the NEC, or other referenced standard. Receptacles in wet/damp areas or within 1 meter of sinks, lavatories, or wash-down areas shall be ground fault circuit interrupter (GFCI) type or residual current disconnect (RCD) type. Total number of receptacles shall be limited to six (6) per 20-ampere circuit breaker.

### **8.5.9 CONDUCTORS**

All cable and wire conductors shall be copper. Conductor jacket or insulation shall be color coded to satisfy requirements of the NEC. 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 derated to the rating of the device terminals.

### **8.5.10 GROUNDING AND BONDING**

Grounding and bonding shall comply with the requirements of NFPA 70. All exposed non-current carrying metallic parts of electrical equipment in the electrical system shall be bonded. Insulated equipment grounding conductor (separate from the electrical system neutral conductor) shall be installed in all feeder and branch circuit raceways. Equipment grounding conductor shall be green-colored, unless the local authority requires a different color-coded conductor. If required, ground rods shall be 20 millimeters in diameter and 3 meters long made of copper-clad steel.

### **8.5.11 ENCLOSURES**

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

### **8.5.12 FIRE DETECTION & ALARM SYSTEM**

A complete Fire Detection and Alarm System shall be provided throughout the buildings and installed in accordance with NFPA 72 requirements. System shall include, but not limited to, Fire Alarm Control Panel (FACP), manual pull stations, horns, strobes, and smoke and/or heat detectors (with alarm verification feature). Fire alarm system shall be complete and a standard product of one manufacturer.

### **8.5.13 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. PVC conduit, junction and pull boxes are allowed for raceways not subject to severe damage. 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 NFPA 70 requirements.

### **8.5.14 CABLE TRAY RACEWAY SYSTEM**

Cable trays shall be ladder 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 per NFPA 70 requirements. The cable tray shall be made of galvanized steel.

### **8.5.15 IDENTIFICATION NAMEPLATES**

Major electrical equipment, such as transformers, panelboards, and load centers, etc. shall be provided with permanently installed engraved identification nameplates. The nameplates shall mention the source that feeds each major piece of electrical equipment.

### **8.5.16 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS)**

Transient Voltage Surge Suppression shall be provided utilizing surge arresters to protect sensitive and critical equipments. 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 Varistor (MOV) technology be used for such applications.

### **8.5.17 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 also indicate the source where the panelboard/loadcenter is fed from.

### **8.5.18 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 enclosure, 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.

## **8.6 OPERATIONS AND MAINTENANCE (O&M) FOR ELECTRICAL**

The O&M manuals must be provided prior to any training activities. Manuals shall be "tri-lingual" in Dari, Pashto and English.

All control panels shall have tri-lingual name plates in Dari, Pashto and English.

The Contractor shall provide an outline of the training lesson plan (to be approved by the Government) prior to conducting training. CD recordings of training on video shall also be provided, after training is conducted.

## **9.0 COMMUNICATIONS SYSTEM**

### **9.1 DESIGN CRITERIA**

#### **9.1.1 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 communications systems and equipment shall be installed in accordance with the requirements set forth in the documents referenced herein.

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 568-C.1 (2009) Commercial Building Telecommunications Cabling Standard

ANSI TIA/EIA 568-C.2 (2009) Balanced Twisted-Pair Telecommunications Cabling and Components Standards

ANSI TIA/EIA 568-C.3 (2008) Optical Fiber Components Standard

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

UFC 3-580-01 Telecommunications Bldg Cabling Systems Planning/Design

## **9.2 COMMUNICATION SYSTEM**

The Contractor shall design, provide, and install the exterior and interior communications infrastructure. The exterior communications infrastructure shall provide a looped communication system for perimeter security functions. The communications duct bank shall run to all facilities requiring connectivity. See Section 01010 and the standardized drawings for each facility communications connectivity requirements. The interior communications infrastructure shall provide a pathway to all communications outlets and head-end equipment located in the building. Communications head-end equipment, cabling, RJ45 jacks, and faceplates shall be provided by others. The design and construction of the systems shall be in accordance with the references and the requirements contained herein.

### **9.2.1 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, inner duct, and underground ductbank. The Contractor shall coordinate the communication system with the power distribution system to distribute communications to the site's facilities as required. The distribution system shall be an underground system. Communications manholes and hand-holes shall not be shared with other utilities. Manholes and hand-holes shall be cast in place or precast type. 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 900 mm of properly tamped dirt/backfill on the top. Hand-holes shall be installed in laterals between manholes and buildings only where the distance between manhole 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 or handhole, 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.

<b>Manhole and Hand-hole Accessories</b>	<b>HANDHOLE</b> 1.22m X 1.22m X 1.22m	<b>MANHOLE</b> 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

### **9.2.1.1 EXTERIOR CONDUIT**

The underground conduit for the manhole and duct system shall be direct buried (900 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 shall 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 shall be a six way duct, being three conduits wide by two conduits deep (3 X 2) with two of the conduits having inner-ducts installed. Laterals off of the main duct system manhole to manhole shall be a minimum of a 4 way (1x4) with one duct having inner ducts. The duct system from the manhole/hand hole to a building with cable installed shall be a 1x2, 100 mm PVC duct bank with one duct having inner ducts. The duct system from a manhole/hand-hole to a building with allocations only shall be two (2), 100 mm DB type PVC conduits stubbed out 3 meters from the manhole/hand hole. 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..

### **9.2.2 MAIN DISTRIBUTION FRAME**

The Contractor shall route all communications to the Main Distribution Frame located in central Communications Room.

### **9.2.3 BUILDING INTERIOR COMMUNICATIONS SYSTEM**

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, plywood backboards, and communications grounding/bonding infrastructure. For standardized facilities, the contractor shall provide communications outlet boxes in locations shown on the standard drawings. For non-standardized facilities, the contractor shall provide outlets at a density rate of one outlet per 15 square meters of floor space in occupied rooms (minimum of one per occupied room).

### **9.2.3.1 OUTLET BOXES**

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.

### **9.2.3.2 CONDUIT SYSTEM**

The Contractor shall design, provide, and install the horizontal and backbone conduit system. Conduit shall be installed from each outlet box location to the communications equipment rack location. Conduit shall be sized and installed in accordance with ANSI TIA/EIA 569-B. 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. Label the conduit on both ends with room number and outlet box number.

### **9.2.3.3 PULLBOXES**

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. Pull boxes shall be sized and installed in accordance with ANSI TIA/EIA 569-B.

### **9.2.3.4 EQUIPMENT RACKS**

Contractor shall coordinate the location of the communications rack to be installed in Communications Room. Equipment racks shall be standard floor mounted 475mm steel telecommunications racks. 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.

### **9.2.3.5 PLYWOOD BACKBOARD**

A minimum of one wall of the Telecommunications Room shall be covered with 19 mm A-C plywood, void free, 2.4 m high, and securely fastened to the wall. Plywood shall be fire-rated (fire retardant) to meet applicable codes. To reduce warping, fire-rated (fire retardant) plywood shall be kiln-dried to a maximum moisture content of 15%.

### **9.2.3.6 GROUNDING**

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.

## **9.3 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. 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.

### **9.3.1 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.

### **9.3.2 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. 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.

### **9.3.3 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**