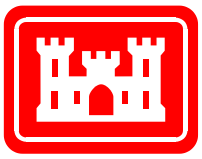

US Army Corps of Engineers

Engineering and Support Center, Huntsville

ENGINEERING GUIDANCE

DESIGN MANUAL

REVISION 8

31 DECEMBER 2013

PREPARED BY

DIRECTORATE OF ENGINEERING

U.S. ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE

HUNTSVILLE, ALABAMA

FOREWORD

No changes can be made to this document without the agreement of the authorizing signatory and must be approved by the authorizing signatory before implementation.

ACTION	TITLE	SIGNATURE
Approval	Director of Engineering	
Review	Mechanical-Electrical Division Chief	
Review	Civil-Structures Division Chief	
Review	Systems Engineering Division Chief	
Review	Medical Center of Expertise Chief	
Initiate	Subject Matter Expert	

Date	Issue	Revision	Description	Approved By

This document provides a consolidated guide for architect-engineers, contractors, and Government personnel when preparing project-related engineering documents, contract drawings and specifications, and various supporting materials. This document will also be used as guidance for all in-house designs prepared by U.S. Army Engineering and Support Center, Huntsville (USAESCH). It also provides information on acceptable design standards and processes that the USAESCH (aka Huntsville Center) has determined to be essential for prudent project execution. All personnel employed, either directly or indirectly, by the Huntsville Center should familiarize themselves with the guidance contained in this design manual.

The first USAESCH Design Manual was published in July l968. Seven editions have been published since 1968. This eighth edition has been updated by the technical branches responsible for USAESCH designs and is considered basic to USAESCH design activities.

Revisions and changes to this manual will be made as necessary and noted in the table above. The official copy of this design manual will be available on the USAESCH website and will be updated as the need arises; any hard copies are unofficial. Specific comments on the contents of this manual are requested from users and should be directed to the U.S. Army Corps of Engineers, Huntsville Center, Directorate of Engineering, Chief of Design (CEHNC-ED), in accordance with the change request procedure described in paragraph 5.22.

BOYCE L. ROSS, P.E.
Director of Engineering
Engineering and Support
Center, Huntsville

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CHAPTER 1

1. GENERAL INSTRUCTIONS

1.1 PURPOSE AND APPLICABILITY.

1.1.1 Purpose

The purpose of this design manual is to identify and establish technical requirements and instructions for all technical products and services produced by or for the U.S. Army Engineering and Support Center, Huntsville, (USAESCH, aka Huntsville Center or CEHNC), including but not limited to the preparation of facility designs, specifications, design analyses, cost estimates, scopes of work/performance work statements, systems engineering plans and associated CADD/BIM/geographic information systems (GIS) standards, regardless of the method of project delivery.

1.1.2 Applicability

This manual applies to architect/engineers (A-Es), engineering service contractors, other government agencies and in-house personnel involved with technical products and services for which USAESCH is responsible. The procedures and instructions in this manual will be referenced in all architect-engineer (A-E) and engineering services contracts where applicable. In the event of conflict between this manual and the contract documents, the contract will take precedence. Conflicts will be brought to the immediate attention of the USAESCH Contracting Officer (KO) and project manager (PM). In the event of conflict between this document and good design practice the contractor will notify the KO and PM for resolution. In-house personnel will bring such conflicts to the attention of their supervisors, for resolution at the Division Chief or Director of Engineering level, as required. Use of this document and adherence to its requirements in no way relieves the contractor of any of his or her professional, legal, or other responsibility to deliver a safe, functional, useable design that complies with all relevant codes and standards. Each SOW/PWS, whether architect-engineer, design-build, or work-plan based, should require compliance with the applicable portions of this Manual. The following template language is recommended for use:

“The Huntsville Engineering and Support Center Design Manual (HNC-PR-ED-2000.10) is an important guidance document for doing business with CEHNC and contains technical information, detailed requirements, and quality expectations supplemental to this SOW. The Design Manual can be found at: http://www.hnc.usace.army.mil/Missions/Engineering.aspx.

1.2 RELATIONSHIP OF THIS MANUAL TO THE USAESCH QUALITY MANAGEMENT SYSTEM.

This Manual is a Level 4 document primarily supporting Level 2 Key Processes 01 (Design) and 02 (Construction). To a lesser extent, it also supports the other three Key Processes, 03 (Services), 04 (Supplies), and 05 (Acquisition). As a Level 4 document, this Manual is binding only on ED personnel, and on contractors when referenced in the contract documents. References herein to other organizations such as Project Management and Contracting are only intended to depict how ED should interact with these organizations and for informational purposes.

1.3 REFERENCE DOCUMENTS.

A consolidated list of reference documents is included in Appendix A. Designers and

design reviewers must be thoroughly knowledgeable with the documents listed in Appendix A as well as the discipline-related documents referenced in each chapter. Designers are responsible to obtain a copy of the cited references. The latest revision of each document will be used. Department of the Army (DA) Pamphlet 25-30, Consolidated Index of Army Publications and Forms, provides current information on Army publications. (To view Army regulations, visit http://www.apd.army.mil/. For other documents listed in Appendix A visit http://www.hnc.usace.army.mil/missions/engineering/techinfo.aspx or http://www.wbdg.org/ccb/ccb.php.) Any deviations from these references or those of the subsequent chapters including the use of criteria obtained directly from the Using Agency or other sources must be considered, approved or resolved by USAESCH.

1.4 GENERAL GUIDANCE

1.4.1 Overall Objective.

The goal for all technical products is that they should clearly, concisely, and comprehensively address the customer's requirements, applicable policy and criteria, and enable a technically sound, cost effective approach to be implemented to meet those requirements. Deliverables should be at an appropriate level of detail for the size and complexity of the project. Goals of the project (including scope, schedule, and budget), applicable criteria, existing conditions, alternatives considered to meet the goals, the selected or recommended alternative, and rationale for the technical choices made should all be documented in sufficient detail so that (1) the physical work to be done is clearly understood, can be reliably priced by the performer and the Government, and results achieved can be measured against customer and other stakeholder expectations, and (2) the technical approach taken to meet the project goals is described sufficiently to document compliance with the relevant criteria and sound technical practices.

1.4.2 Ownership and Rights.

The final technical product and associated deliverables are the property of the Government. As such, when technical products are prepared by Contractor personnel, the Contractor shall not, within professional engineering guidelines, copyright, or otherwise restrict the Government from using, distributing, duplicating, or disseminating this product.

1.5 PROFESSIONAL REGISTRATION

ER 1110-1-12, Chapter 6 and Appendix H, and ER 1110-1-8152 discuss design responsibility. While the doctrine of Federal Supremacy limits the requirement for USACE to comply with state professional registration requirements to six specific environmental statutes, the ERs also provide that all in-house design packages will be signed and dated by the Chief of Engineering or designated deputies. In the case of design documents prepared by A-Es, the ER requires the A-E to sign and stamp at least one set of design documents. It is USAESCH policy that the following general types of documents constitute "design documents" requiring the signature/stamp of a registered professional of the organization holding "Designer of Record" responsibility:

- Plans and specifications intended for advertisement as a Design-Bid-Build construction project
- Technical documents under the purview of the six environmental statutes named in ER 1110-1-12, Appendix H.

- Design submittals prepared as part of a Design-Build contract
- Work plans for renovations or other minor construction where life safety code, structural design, fire protection, anti-terrorism design, water distribution system, or stormwater discharge issues are involved.

This list is not all-inclusive and other deliverables may be required to be stamped, based on customer or installation requirements. Each project-specific DQCP or A-E/engineering services contract will specifically list the documents required to be signed/stamped by the responsible professional. For specific procedures, see paragraphs 3.2.17 for design-bid-build projects or 3.3.16 for design-build projects.

1.6 SUSTAINABLE DESIGN

1.6.1 Policy.

The Federal Government is committed to designing, locating, constructing, maintaining, and operating its facilities in an energy efficient and sustainable manner that strives to achieve a balance that will realize high standards of living, wider sharing of life's amenities, maximum attainable reuse and recycling of depletable resources, in an economically viable manner, consistent with Department and Agency missions. In doing so and where appropriate, the use of life cycle concepts, consensus-based standards, and performance measurement and verification methods that utilize good science, and lead to sustainable buildings are strongly encouraged. Energy and utility consumption and cost are one of the largest single expenses incurred by the government and thus it is imperative that that the consumption and related costs be reduced to the greatest extent possible with the ultimate goal of achieving net zero buildings and installations. Since this is a ubiquitous requirement, it is essential that all disciplines work collectively in each type of design/redesign effort to eliminate the consumption of energy to the greatest extent possible. Therefore, the energy mandates contained in this document and any subsequent updated mandates, since energy mandates are very dynamic, shall be a primary focus of each discipline in achieving the Army Energy Goals. The Corps develops and publishes various Engineering and Construction Bulletins to provide further guidance on these mandates for implementing energy conservation actions.

The design analysis for all disciplines shall determine applicability and address any sustainability requirements for all projects as required by UFC 1-200-02 High Performance and Sustainable Building Requirements. The design analysis will include an evaluation of Table 1-1 in UFC 1-200-02 to determine what, if any, chapters apply to this design. The design analysis should also include a narrative description of how the design will address the specific requirements of UFC 1-200-02 that are applicable.

All projects including in-house design, design bid build/design build AE design submittals for review, and performance contracting design submittals for review will be checked by the CEHNC Engineering Directorate to insure compliance with energy and sustainability criteria as required by the contract. Energy and Sustainability requirements are addressed in UFC 1-200-02 High Performance and Sustainable Building Requirements. Each discipline will be responsible for reviewing their applicable criteria and one of these disciplines will be designated to act in a lead role by the Project Engineer for that program.

The CEHNC discipline acting in the lead role to insure adherence to energy and sustainability criteria will typically be Architectural, Mechanical, or Electrical depending on the type of project/work type. Project/Work Type defined as new construction, new

addition, and major renovation (as defined in UFC 1-200-02 dated 01 March 2013, Table 1-1) will typically have the Architectural discipline designated as the lead. Project/Work Type defined as minor renovation, O&M, or sustainment/restoration/modernization (as defined in UFC 1-200-02, Table 1-1) will typically have the discipline with the majority of the work designated as the lead.

1.6.2 LEED.

LEED requirements will be determined on a case by case basis. In almost every case, LEED is required for new construction and major renovation projects as defined in UFC 1-200-02 High Performance and Sustainable Building Requirements. Where LEED is not required, the first design submittal will include rationale for why it is not required as part of the design analysis.

Leadership in Energy and Environmental Design (LEED) is a rating system developed by the US Green Building Council (USGBC). Note, since USACE's adoption of LEED, the requirements continue to evolve and the criterion directing which version will change; designs should use the latest version unless directed otherwise. Currently, ECB 2013-5, Continuity of the High Performance Energy and Sustainability Policy (use current if this criterion is superseded) directs projects to attain LEED Silver rating within the current applicable version of LEED.

1.6.2.1 Checklist

USGBC provides a checklist of each point within the rating system. The checklist has a "Y" for yes, "N" for no and a "?" for unsure. The earliest in the project that a checklist can be filled out of the points towards meeting a silver rating provides the team members, owners, and project managers vital information if meeting the required silver rating is possible. Ideally the checklist would be started back in the planning/PDR stage of our projects. At a minimum, a completed checklist must be provided at the concept design submittal.

1.6.2.2 Project Documentation

Design team must fill out LEED online templates after the project is registered. Registration provides access to LEED Online. LEED online data will show if the rating point requirements or prerequisite requirements are met. Information on the project name and access must be provided to the construction team to finish off the documentation.

1.6.2.3 Drawings

Drawings must show all documentation requirements for boundaries, materials, and equipment. If necessary information for LEED is documented in the online templates and not needed for construction of the facility then don't duplicate the information on the drawings. Rather complete the online information and reference in the Design Analysis.

1.6.2.4 Specifications

Specifications must coordinate with LEED requirements for materials and methods of installation.

1.6.2.5 Design Analysis

Provide checklists and template information in the Design Analysis to demonstrate completion of LEED requirements.

1.6.2.6 General Requirements

The following paragraph comes from UFC 1-200-02 High Performance and Sustainable Building Requirements dated 1 March 2013, paragraph 5-4:

In accordance with OUSD AT&L Memorandum, “Department of Defense Sustainable Buildings Policy”, DoD Components will design and build all new construction and major renovations projects: 1) in compliance with the Guiding Principles, 2) third-party certified to the US Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) Silver level (or approved equivalent rating), and 3) achieve no fewer than 40% of the certification points related to energy and water conservation. Major Renovation projects are defined in Table 1-1 of UFC 1-200-02. In addition, all repair and renovations projects must conform to the Guiding Principles where they apply.

Refer to “USACE Army LEED Implementation Guide” for details regarding compliance with LEED requirements. New construction projects and major renovation projects are required to be registered with the US Green Building Council (USGBC) and use the LEED Letter Templates for project documentation. Registration and payment of registration fees must be specified as being by the Government or contractor depending on the type of contract. Administration of the online project will be by the Government or A-E during the design phase. Validation of the credits will be by the Government. USGBC certification of the project by the Contractor is not required. The Government may choose to seek USGBC certification of the project, in which case the Government will pay certification fees and coordinate with the USGBC and the Contractor will furnish audit data as requested at no additional cost.

LEED Project Implementation Major Activities are as follows:

Initial Project Programming/Planning Charrette (if applicable)

- LEED Training as needed for all PDT members
- Establish LEED Project Strategy and checklist
- Program Sustainable Design and Development Cost
- PM coordinate formal endorsement and filing of LEED Project Checklist with Green Building Certification Institute

Code 3 Design/Parametric Estimating and Project Definition Charrette (if applicable)

- Provide updated LEED Project checklist
- Update/Validate Sustainable Design and Development Cost
- PM coordinate formal endorsement and filing of updated LEED Project Checklist

Design-Build (DB) Request for Proposal (if applicable)

- RFP to contain information identified in USACE Army LEED Implementation Guide

DB Post Award Conference/DBB Pre-Design Conference

- Design Team LEED Accredited Professional (AP) confirmed
- Assignment of LEED responsibilities by LEED AP

- Discussion of LEED Project Checklist
- PM coordinate formal endorsement and filing of LEED Project Checklist with Green Building Certification Institute (if not done previously)

DBB Intermediate /DB Interim Design Submittals

- LEED credit requirements incorporated into drawings and specifications
- LEED supporting documentation provided in a separable portion of design analysis
- Updated LEED Project checklist
- Written verification from LEED AP that LEED supporting documentation has been uploaded to US Green Building Council (USGBC) LEED OnLine

DBB Final /DB Complete Design Submittal

- Final design LEED Interim Score and Rating
- Final design LEED Project Checklist

Green Building Certification Institute (GBCI) Design Review Approval (for GBCI certified DBB Projects)

CHAPTER 2

2. PROJECT INITIATION

2.1 USAESCH BUSINESS PROCESSES.

2.1.1 General.

Appendix C contains a series of flow charts which depict the 'normal' processes applied at various stages of a project. These are written from the standpoint of ED; other organizations such as Project Management (PM) and Contracting (CT) are depicted only to the extent that they interact with ED and the flow charts do not attempt to represent the full details of tasks performed by PM and CT. The flow charts are intended to depict 'business as usual' but this does not cover the diversity of work performed by ED; it is permissible to adapt these processes to suit the demands of a particular program or project, but such adaptations must be documented in the Project/Program Management Plan (PMP) and approved in advance by the appropriate PE/A, upon consultation with ED management when required.

2.1.2 Swimlane Flow Chart Descriptions

- C.2 - PROJECT PLANNING. This swimlane flowchart details the project planning process flow from notifying the Chief of Design that a project has been initiated to finalizing the Scope of Work (SOW) and Independent Government Estimate (IGE). It also addresses assembling the Project Delivery Team (PDT) and development and review of the Project Management Plan (PMP) and the Design Quality Control Plan (DQCP). This process applies to in-house personnel.
- C.3.1 - CRITERIA DEVELOPMENT. This swimlane flowchart details the criteria development process flow from participation in the pre-design conference/design charrette to the development and delivery of the resulting report to the customer/client, user, and records management. This process applies to in-house personnel.
- C.3.2 - CRITERIA DEVELOPMENT (A/E). This swimlane flowchart details the criteria development process for an A/E or Services Contractor from participation in the pre-design conference/design charrette to the development and delivery of the resulting report to the customer/client, user, and records management. This process applies to in-house and contractor personnel.
- C.3.3 – MEDICAL MILCON PROCESS FLOW. This swimlane flowchart depicts the typical workflow of a major MILCON medical project from issuance of the design directive to the geographic District, to Design During Construction (DDC) services following award of the construction contract (for design-bid-build project delivery) or release for construction (for design-build project delivery). This process applies to in-house personnel.
- C.4 - SITE PERMITS, SURVEYS, AND INVESTIGATIONS. This swimlane flowchart details the site investigation process to include development and execution of the acquisition strategy for obtaining site permits and other environmental/ordnance investigations, topographic surveys, erosion control and sedimentation plans, and the geotechnical site investigation. This

process applies to in-house personnel.

- C.5 - PARAMETRIC DESIGN. This swimlane flowchart details the process from issuance of the Code 3 design directive and origination of the parametric design report (PDR) to finalization of ENG Form 3086, Current Working Estimates for Budget Purposes. This process applies to in-house personnel, including those at geographic Districts, installations, ACSIM, and HQUSACE.
- C.6.1 - CONCEPT DESIGN SUBMITTAL. This swimlane flowchart details the development of the concept design submittal from the origination of the plans, list of required specifications, basis of design and construction cost estimate through design submittal review and origination of the value engineering study and report to storage of the submittal documents in records management. This process applies to in-house personnel.
- C.6.2 – TECHNICAL SUBMITTAL REVIEW. This swimlane flowchart details the general process of reviewing submittals received from contractors or other non-USAESCH document preparers, generating and coordinating review comments, and resolving them. This process applies to in-house and contractor personnel.
- C.6.3 – DRAFT SOW/PWS/RFP. This swimlane flowchart details the process of translating customer requirements into a draft contract statement of work (SOW), performance work statement (PWS), or request for proposals (RFP), with associated value engineering study and cost estimate as required. This process applies to in-house personnel.
- C.6.4 - PREPARE DRAFT TECHNICAL DOCUMENT. This swimlane flowchart depicts the general process of preparing a draft study, explosive safety submittal, or similar document, submitting it to customers and other stakeholders, and responding to comments received from reviewers. This process applies to in-house personnel.
- C.6.5 – MEDICAL MILCON TECHNICAL SUBMITTAL REVIEW. This swimlane flowchart is an adaptation of flowchart C.6.2 to the specific requirements of major MILCON medical projects. This process applies to in-house personnel.
- C.7 – INTERMEDIATE DESIGN SUBMITTAL. This swimlane flowchart details the process of preparing an intermediate design submittal including drawings, specifications, design analysis, and cost estimate, submitting it to customers and other stakeholders, and responding to comments received from reviewers. This process applies to in-house personnel.
- C.8 – PRE-FINAL DESIGN SUBMITTAL. This swimlane flowchart details the process of preparing a pre-final design submittal including drawings, specifications, design analysis, and cost estimate, submitting it to customers and other stakeholders, conducting an independent technical review (ITR) and responding to comments received from reviewers. This process applies to in-house personnel.
- C.9.1 – FINAL DESIGN SUBMITTAL. This swimlane flowchart depicts the process of finalizing a set of plans and specifications from the pre-final

stage (C.8), including conducting a Biddability, Constructability, Operability, Environmental, and Sustainability (BCOES) review, incorporating and closing out all comments, and obtaining final signatures as required. This process applies to in-house personnel.

- C.9.2 – FINAL SOW/PWS/RFP. This swimlane flowchart depicts the process of finalizing a SOW, PWS, or RFP and associated cost estimate from the draft stage (C.6.3), including conducting a BCOES review, resolving/incorporating and closing out all comments, and obtaining final signatures as required. This process applies to in-house personnel.
- C.9.3 – PREPARE FINAL TECHNICAL DOCUMENT. This swimlane flowchart depicts the process of finalizing technical documents from the draft stage (C.6.4), including conducting an ITR when required, incorporating and closing out all comments, and obtaining final signatures as required. This process applies to in-house personnel.
- C.10 – PRE-AWARD. This swimlane flowchart depicts ED support to the advertisement process, primarily providing responses to technical Requests for Information (RFIs) and preparing the technical portion of RFP amendments when required. This process applies to in-house and A-E personnel.
- C.11.1 – POST-AWARD. This swimlane flowchart depicts ED support to the construction process when the project has been designed in-house, primarily providing responses to technical RFIs, User-Requested Changes (URCs), or Value Engineering Change Proposals (VECPs) and preparing the technical portion of contract modifications when required. This process applies to in-house personnel.
- C.11.2 – COORDINATE RFI RESPONSE/CONTRACT MOD WITH DOR. This swimlane flowchart covers the same topics as C.11.1 when the Designer of Record (DOR) is an A-E or Services contractor. This process applies to in-house and contractor personnel.

2.2 PROJECT INITIATION.

Project initiation consists of establishing scope, schedule, and budget, and as such is primarily a PM task. The ED role in this process is a supporting role; key tasks for ED include assigning a project engineer/architect to coordinate technical support to the PM.

2.3 PROJECT PLANNING.

2.3.1 PMP Development.

Again, this is primarily a PM responsibility. Key tasks for ED during this phase include providing input to the PMP, assigning PDT members to supply appropriate technical expertise, and preparing a Design Quality Control Plan (DQCP) when required.

2.3.2 Criteria Development.

Primarily an Engineering responsibility, this process has two parts. In addition to identifying and compiling relevant laws, regulations, industry codes and standards, and other technical criteria, it is necessary to define what constitutes project “success”, i.e. what are the functional and technical requirements of the project. Depending on the size and complexity of the project, one or several members of the PDT should visit the

customer's site, establish existing conditions, and identify the customer's functional and operational requirements. This could be as simple as one person talking to the site representatives for a couple of hours, or as involved as a full-scale design charrette lasting for several days and attended by the customer, designer (either in-house or Architect–Engineer), the PM, and possibly representatives from regulatory agencies. The charrette process consists of a series of on-site interviews with the purpose of fully developing and quantifying the functional and technical requirements of the project, including cost estimates. In any case, at the end of the criteria development process the PDT (including customer representatives) should have achieved early consensus on project design priorities, have an early understanding of the potential impact of various design strategies, and have identified potential project strategies for exploration with their associated costs, time constraints, and the needed expertise to eliminate costly "surprises" later in the design and construction processes.

2.4 INTERRELATION BETWEEN TECHNICAL PRODUCTS AND SERVICES, CUSTOMER REQUIREMENTS, AND ACQUISITION.

The goal for all technical products is that they should clearly, concisely, and comprehensively address the customer's requirements and applicable policy and criteria, and enable a technically sound, cost effective approach to be implemented to meet those requirements. Many factors must be balanced in achieving this goal. The customer's expectations must be reconciled with schedule, budget, laws and regulations, other relevant criteria such as industry codes and standards, and good technical practice. Environmental and other permits will require their own supporting technical products, and will likely affect the technical solution chosen. Acquisition requirements (such as contracting method/vehicle to be used, approval requirements for acquisitions above various thresholds, prescribed policies and procedures, etc) will all impact the content, format and schedule of the technical product. Simply put, the technical staff cannot work in isolation; rather it must work as part of a truly integrated Project Delivery Team (PDT) and coordinate to assure that all requirements are integrated in a timely manner. The PE/A is the lead person for ED in ensuring this coordination, working together with the PM.

2.5 PREPARATION OF SCOPE OF WORK (SOW).

2.5.1 Basic Definition.

The Scope of Work is a portion of a contract which establishes and defines all non-specification requirements for contractor's efforts either directly or with the use of specific cited documents.

2.5.2 General.

The Government Request for Proposal (RFP) or solicitation defines the Government's requirements and becomes the basis for the resultant contract. Therefore, the SOW as a component of the RFP must be consistent with the remainder of the RFP. The SOW preparer should work closely with the overall RFP drafter and all contract section authors to achieve consistency. The SOW should specify in clear, understandable terms the work to be done in developing or producing the goods to be delivered or services to be performed by a contractor. Preparation of an effective SOW requires both an understanding of the goods or services that are needed to satisfy a particular requirement and an ability to define what is required in specific, performance-based, quantitative terms. A SOW prepared in explicit terms that make expectations clear will enable offerors to clearly understand the Government's needs. This facilitates the

preparation of responsive proposals and delivery of the required goods or services. A well written SOW also aids the Government in the conduct of the source selection prior to award and contract administration after award. After contractor selection and contract award, the contract SOW becomes a standard for measuring contractor performance. Consequently, the SOW writer must consider the contractual and legal implications of the SOW during its preparation. As the contracted effort progresses, the Government and the contractor will refer to the SOW to determine their respective rights and obligations. In this respect, the SOW defines the contract and is subject to the interpretations of contract law. The SOW must clearly define the work to be performed, since the language detailing the contractor's effort may be pertinent to legal questions concerning the scope of work. The standard format for a SOW typically includes:

- Section 1 SCOPE. This section includes a brief statement of what the SOW should cover. The scope paragraph defines the breadth and limitations of the work to be done. In some cases, the use of an introduction, background, or both, is appropriate, but should be limited to only that information needed to familiarize the proposers with the basic acquisition requirement.
- Section 2 APPLICABLE DOCUMENTS. Lists those documents specifically referred to in Section 3.
- Section 3 REQUIREMENTS. Specific work tasks are called for in SOW Section 3. These tasks, developed to satisfy customer requirements, are essentially the contractor work requirements. Section 3 should specify requirements clearly and state the specific duties of the contractor in such a way that the contractor knows what is required and can complete all tasks to the satisfaction of the contract administration office. Section 3 should be written so specifically that there is no question of whether the contractor is obligated to perform specific tasks. It avoids directing how tasks are to be performed and states only what results are required.
- Safety Requirements. Contractor’s work must comply with EM 385-1-1. An Accident Prevention Plan (APP) or Abbreviated APP (AAPP), depending on the type of work being performed, must be accepted by the USAESCH Safety Office before work can begin on site. Site specific safety requirements, such as special training or limited access areas, may also apply.
- An example SOW outline is shown in Appendix E.

2.5.3 MILCON SOWs.

SOWs for MILCON design-build projects should be prepared using the Model RFP Wizard, available at http://mrsi.usace.army.mil/rfp/SitePages/Home.aspx.

2.5.4 Architect-Engineer (A-E) SOWs .

For guidance and examples regarding A-E scopes of work, refer to EP 715-1-7.

2.6 PREPARATION OF PERFORMANCE WORK STATEMENT (PWS).

2.6.1 Basic Definition of a PWS.

The PWS is a statement of work for performance-based acquisitions that describes the required results in clear, specific and objective terms with measurable outcomes. It is an integral part of the acquisition strategy. In a performance-based acquisition, PWS

requirements are stated in general terms of what (outcome) is to be produced rather than how (methodology) the work is to be accomplished. There is no prescribed format for the PWS as long as it describes the requirement in terms of results rather than process, it uses measurable performance standards and a quality assurance surveillance plan (QASP), it provides for disincentives such as reductions of fees or prices, and it includes performance incentives where appropriate.

2.6.2 Elements of a PWS

- Project Title
- Brief Synopsis. Describe the objective of the PWS, the mission of the organization, and the current work site conditions. Include a brief description of the goods or services required.
- Scope. Describe the type of procurement, the objective, and the expected outcomes.
- Applicable Documents/Regulations.
- Summary of Requirements. Identify type of tasks to be performed and describe WHAT is to be done – most important. Be clear and concise, accurate and complete, and descriptive. Use language that will ensure equal competition. Be careful with the use of “shall” and “should” for contractor and “will” or “may” for government. Use directive language rather than passive; avoid use of "shall" whenever possible. Do not define HOW the work is to be done - allow the contractor to develop the best method to accomplish the desired outcome. Identify “must haves” regarding materials or methodologies with the customer and project engineer. If left up to the Contractor, it will be their choice if not specified. Find the right balance between prescriptive and performance.
- Deliverables. Refer to base contract for guidance – use Contract Data Requirements List (CDRL), Data Item Deliverables (DIDs), Technical Data Packages (TDPs), etc, as appropriate. Be specific! Where a Work Plan or similar document is required, requirements for this document, whether contained in a DID or elsewhere in the contract requirements, should be described clearly, specifically, and unambiguously. The PWS preparer, at both the base contract and task order stages, should carefully consider the requirements of the type of work being done and tailor the contract Work Plan deliverables accordingly.
- Government Support. Describe access to work location, identify government furnished equipment (GFE) or information, and identify specific restrictions or limitations of use.
- Payment Schedule.
- Points of Contact. List Contracting Officer, project manager, project engineer, on-site representative, others (such as Contracting Officer’s Representative or COR) as required.
- Schedule and Period of Performance. Include specific due dates or time periods and identify any particular milestone dates that are tied to a site-specific requirement.

- Quality Assurance. Develop a Quality Assurance Surveillance Plan (QASP) to measure contractor performance. Describe performance objectives that are meaningful (i.e. important and tied directly to the overall objectives to be achieved), reasonable, achievable, and measurable. Describe type and frequency of inspection. Describe evaluation methodology, such as error rate, availability percentage, or response times. See FAR part 46.103(a) for services contracts, or part 46.312 for construction contracts, for more details.
- Safety Requirements. Contractor's work must comply with EM 385-1-1. An Accident Prevention Plan (APP) or Abbreviated APP (AAPP), depending on the type of work being performed, must be accepted by the USAESCH Safety Office before work can begin on site. Site specific safety requirements, such as special training or limited access areas, may also apply.

2.7 PREPARATION OF TECHNICAL REQUIREMENTS FOR DESIGN-BUILD RFPS

Ensure that RFP technical specifications for Design-Build (DB) construction projects clearly define program/project requirements, performance attributes, performance factors, submittal procedures, as well as other mandatory requirements such as building envelopes. Any condition or element absolutely essential to the project must be stated in the RFP. Identify mandatory Federal, technical, regulatory, fire protection, life safety code, and quality requirements that must be included in the RFP technical specifications. State project requirements, criteria, and evaluation factors. The RFP Design Criteria should include only as much criteria as necessary to ensure that essential and mandatory technical criteria will be met. The emphasis should be on performance criteria, in lieu of prescriptive criteria, to the extent practicable.

Define whether the project/work type is new construction; new addition; major renovation; minor renovation; O&M, sustainment, restoration and modernization; or leased building as defined in UFC 1-200-02 High Performance and Sustainable Building Requirements. Providing the project/work type further defines which chapters in UFC 1-200-02 are required by the RFP.

The number of reviews, percentage of completion for review, and the design detail expected at each submittal must be determined as part of the Project Criteria Approach. The RFP must specify the submittal requirements for the Design-Build contractor's design. Submittal detail requirements are covered in paragraph 3.3 for the various disciplines.

The RFP can have one of three levels of criteria; nominal, partial, or full criteria.

- **Nominal criteria** RFP's are typical of many Design-Build projects and essentially represent an almost total performance specification approach.
- **Partial criteria** RFP's include concept floor plans which indicate a special mechanical equipment layout, overall dimensions, and any special requirements. Enlarged floor plans are provided, as required, to explain special design conditions.
- **Full criteria** RFP's represent a more prescriptive approach. The criteria begin to resemble the traditional design of the design-bid-build approach. In some cases, the criteria are essentially a complete design.

The RFP should include provisions for future expansion where appropriate.

2.8 PREPARATION OF ARCHITECT-ENGINEER (A-E) DESIGN ESTIMATE.

Cost estimates for A-E contracts will be prepared in accordance with the requirements of EP 715-1-7, Appendix Y. An Independent Government Estimate (IGE) for A-E services will be developed from a detailed analysis of the SOW, assuming reasonable economy and efficiency, and modern and effective methods. IGEs will be prepared by engineers, architects, and/or other appropriate personnel having expertise (education, training, and professional experience) in the type of work being contracted, and approved by a supervisor also having appropriate expertise. The level of supervisory approval will be commensurate with the complexity and dollar value of the contract action, and will be in accordance with Procurement Instruction Letter (PIL) 2012-03-R1 or current acquisition policy.

2.9 PREPARATION OF DESIGN-BUILD (DB) COST ESTIMATE.

The type of estimate required for Design Build construction is highly dependent upon the amount of information available at the time the IGE is being prepared. If the design maturity represented by the SOW/PWS is less than 35% then the designer will be expected to develop a parametric estimate utilizing the PACES software. If more information is available (equivalent to a design of 35% or more) the designer should utilize the MII software to develop the estimate as a “bottom-up” detailed estimate. Preparation requirements and signature authorities for IGEs for various contract types and dollar amounts are prescribed in PIL 2012-03-R1.

2.10 PREPARATION OF DESIGN QUALITY CONTROL PLAN (DQCP)

2.10.1 Applicability.

A DQCP will be prepared for all ED in-house projects that require in house designs for multiple disciplines. Studies are not required to have a DQCP nor are the development of standards even if they are multiple disciplinary standards. The DQCP is written for projects that are intended to occur one time only and use a significant portion of in-house design.

2.10.2 Development of DQCPs.

The assigned PE/A or design team lead is responsible for the development of the DQCP. The DQCP will be considered to be a draft until it has been reviewed and approved. The electronic version of the DQCP uploaded into the electronic project design files will be considered to be the official version to be used and audited. The DQCP will list all QP-EDs and USAESCH Quality Procedures that will be used in the work covered by the DQCP, including this manual. The following will originate/authorize/review/recommend/approve all DQCPs before they are considered to be in effect:

- Originate: PE/A or design team lead
- Authorize: Management Representative
- Review: Branch Chiefs with employees on the design team
- Review: QA Engineer
- Review: Value Engineering Officer

- Review: Division Chiefs
- Recommend: Chief of Design
- Approve: Director of Engineering

At the conclusion of the project, the final DQCP will be filed with the electronic Project Design Files.

2.10.3 Contents of DQCPs.

The DQCP will be coordinated with the Project Management Plan, which is maintained by the project manager. The DQCP will, at a minimum, cover the following items:

- General Information. This section includes general information about the project that is being described, including project name, brief project history, and project definition.
- Scope of Service. This section defines the scope of service that will be provided by ED.
- Project Team Members. This section identifies the project team members and their roles.
- Quality Management Activities. This section identifies all of the relevant and appropriate quality processes, SOPs, etc, that will be used for quality management purposes. Any special information needed to clearly define how the quality processes will be used will be included.
- Significant Meetings. This section will identify any significant project meetings that will normally be held. It will also identify who will be responsible for developing and maintaining the minutes for the meetings.
- Independent Technical Review (ITR). This section will indicate ITR team members and their respective roles. An ITR will always be conducted for projects requiring a DQCP unless specifically authorized by the Chief of Design.
- Design Information. This section includes all unique design facts that should be incorporated or considered for incorporation into this project.
- Scope Revisions. This section will identify how revised scopes will be implemented.
- Biddability, Constructability, Operability, Environmental, Sustainability (BCOES) review schedule and method of accomplishment, including who will perform the BCOES reviews.
- BIM Project Execution Plan (PxP)
- BIM Minimum Modeling Matrix
- Design Budget
- Design Schedule

2.11 TECHNICAL AND COST EVALUATIONS.

The Proposal Evaluation Team (PET) conducts an analysis of price/cost and technical factors on task order proposals forwarded by the KO/Contract Specialist. The team

should produce a completed consensus document within 10 calendar days of proposal receipt. Each contractor's proposal will be evaluated separately utilizing the Section 863 Evaluation Consensus Form and the established evaluation plan. PET members may compose detailed notes on a Word or Excel document; however, members that do so must ensure the data is either incorporated or referenced as an attachment within the form.

Technical Evaluations are conducted without visible pricing data. Overall past performance and technical/management approach ratings as well as price information derived from each contractor's Section 863 Evaluation Consensus Form shall be placed within the appropriate fields within the Section 863 Evaluation Consensus Matrix Form. The evaluation team shall not use any other descriptors to enhance the ratings (such as "+" or "-") other than those adjectival ratings identified in the evaluation plan. The PM or PET lead shall compose a summary stating the PET's consensus to the KO within the Summary Comments of the Section 863 Evaluation Consensus Matrix Form. The PM or PET lead shall ensure the summary is understandable and based on the results documented in each Section 863 Evaluation Consensus Form. Upon the PM or PET lead's concurrence, he or she shall sign the form. The author of the form should strive for making the recommendation brief, understandable and value added so the KO may make an informed business decision. The level of detail to support the evaluation should be proportional to the dollar amount and project complexity of the acquisition being evaluated. The PET leader forwards the Section 863 Evaluation Consensus Form(s) (along with supporting attachments) and Section 863 Evaluation Consensus Matrix Form to the KO, who will conduct a review of the 863 Evaluation Package and make a determination as to whether to make a selection based on initial offers or to negotiate. If the documented evaluation is not sufficient, the KO will make every possible effort to resolve issues with the PET leader.

CHAPTER 3

3. TECHNICAL REQUIREMENTS

3.1 CAD/BIM DELIVERABLES

3.1.1 Computer-Aided Design (CAD)

CAD-related documents/data (e.g., construction drawings, work plan drawings/sketches, as-built drawings, etc.) will adhere to the latest version of the A/E/C CAD Standard (ERDC/ITL TR-12-X) as well as the CAD Drafting Standard (ERDC/ITL TR-12-1). Use the resource files (e.g., border sheets, line styles, symbols, patterns, templates, etc.) provided with the A/E/C CAD Standard during the development of CAD-related documents/data. Standards and resource files are available for download from https://cadbim.usace.army.mil/cad.

3.1.2 Building Information Modeling (BIM)

3.1.2.1 Applicability

Army vertical construction projects, regardless of funding source, will utilize BIM to accomplish associated design and construction. All other vertical construction projects, regardless of funding source, will utilize BIM to accomplish associated design and construction unless directed by the customer with a valid justification. For the purposes of this requirement, "vertical construction" is considered to be new construction or additions to existing buildings. BIM may be required for major renovations of existing buildings, but this decision should be made on a case by case basis considering benefit to the project. Include a justification for this decision in the DQCP for in-house designs, or the contractor's design plan for A-E or DB designs, along with the specific CAD/BIM platform to be utilized. Civil Works horizontal construction projects will use BIM or related Civil Information Modeling (CIM) tools (e.g., Civil 3D, InRoads, etc.) to accomplish associated design and construction.

3.1.2.2 Compliance

BIM will adhere to the latest version of the USACE BIM Contract Language, commonly referred to as “Attachment F”. Prepare a BIM Project Execution Plan (PxP) and a BIM Minimum Modeling Matrix for each project as required by Attachment F. The BIM Contract Language as well as templates for the PxP and the modeling matrix are available for download from https://cadbim.usace.army.mil/bim.

3.2 DESIGN-BID-BUILD DESIGN SUBMITTALS.

3.2.1 Geotechnical.

3.2.1.1 Drawings.

a. Concept Design. Planned or actual locations of soil/rock borings, test pits, test wells, monitoring wells, piezometers, or other investigative works should be shown on the civil site plan or on a separate boring location plan. Boring logs and test results may be shown in the drawings or as an appendix to the specifications; in either case, indicate on the civil site plan/boring location plan (as appropriate) the locations of the individual borings as well as the drawing or specification reference for the boring logs.

b. Intermediate Design. Further development of the drawings from the Concept stage should include necessary details and incorporation of the recommendations of the geotechnical report into civil, structural, and architectural drawings as appropriate.

c. PreFinal Design. The drawings at the prefinal stage should include all necessary details and be fully coordinated between disciplines as well as with the specifications.

d. Final Design. The only changes required at this stage should be incorporation of comments from the ITR or customer review of the prefinal submittal.

3.2.1.2 Specifications.

See paragraph 3.2.14 'Project Specifications' for guidance in preparation of the geotechnical specifications.

3.2.1.3 Design Analysis.

a. Concept Design. The Geotechnical Report, if available, including boring logs and laboratory test data, should be included in the Concept Design Analysis as an appendix. Incorporate recommendations stated in the Geotechnical Report into the design and provide any required geotechnical design calculations (such as settlement, slope stability, bearing capacity, etc) using parameters outlined in the Report. If the Geotechnical Report is not available at this stage, list assumptions made as a basis for design, pending confirmation by the Investigation and Report.

b. Intermediate Design. Update and expand the Concept Design Analysis to support the submittal. Incorporate the accepted comments on the concept design. Perform any Concept Design tasks that were not completed. List additional information or criteria needed for final design.

c. PreFinal Design. Update the previously prepared analysis to support final plans and specifications, and ensure that the recommendations of the Geotechnical Report have been incorporated into drawings and specifications of all affected disciplines.

d. Final Design. The only changes required at this stage should be incorporation of comments from the ITR or customer review of the prefinal submittal.

3.2.1.4 Special features unique to USAESCH work.

a. Depending on the size, complexity, and mission criticality of the project, as described in UFC 3-310-04, special attention to seismicity may be required. This may include a probabilistic or deterministic seismic hazard analysis to define site-specific ground motions. Such an analysis should follow the requirements of UFC 3-310-04 and ASCE 7.

b. Dynamic soil properties can become an issue for large rotating machinery such as generators, air compressors, or process equipment, as well as feeding into the analysis of the entire building/structure for

seismic events. Support structures for missile defense radar systems are also especially sensitive to dynamic effects and may require a dynamic analysis of the entire structure, including the foundation. In such cases, the geotechnical investigation should include a determination of the shear modulus and Poisson's ratio of the in-situ soil mass.

c. Unexploded ordnance. Land uses on military installations are subject to change over time, with records from World War II or earlier likely to be spotty at best. Construction projects on military installations may be sited in areas formerly used as ammunition production or storage facilities, or firing ranges and may encounter either unfired ammunition/explosives or unexploded ordnance (collectively referred to as "munitions and explosives of concern" or MEC.) The potential for MEC contamination must be evaluated on a case by case basis, using visual observation, historical information, or guidance from installation personnel on previous uses of the site or previous MEC discoveries. A specific investigation using geophysical or other appropriate methods may be required, as described in paragraph 5.9. The potential for MEC contamination should be evaluated early in the project life cycle, so that if a complete or partial site change is necessary, it can be accomplished without impacting the overall project schedule.

3.2.2 Civil.

Criteria and requirements for the development of the design analysis, drawings, and specifications are found in ER 1110-345-700, Design Analysis, Drawings and Specifications. General parameters for the Civil design analysis are addressed in Part 2, para. 1. Civil. Civil site design concerns the development and most efficient use of the available site for the proposed project. It includes, but is not limited, to the following:

- a site investigation and topographic survey to document the existing site conditions,
- designation of wetlands
- archeological preservation
- identification of wildlife and plants that are adversely impacted by the placement and operation of the project on the site
- unexploded ordnance (Munitions and Explosives of Concern (MEC))
- demolition
- siting of buildings and other structures
- cut-and-fill
- borrow and spoil
- grading
- surface and sub-surface storm drainage
- pre- and post-development hydrology
- erosion and sedimentation control and best management practices

- storm water permits
- road layout
- paving and curbing
- road signage and marking
- vehicle and pedestrian ingress/egress and circulation
- access control
- vehicle parking
- fencing and gates
- anti-terrorism/force protection requirements
- sustainable design
- landscaping

Civil site design shall also, as needed, include project specific related design, such as line-of-sight for live-fire range design. Environmental designs to include water and waste water facilities, and solid waste and hazardous waste disposal facilities, shall be in accordance with applicable chapters of the relevant standards listed in Appendix A. The designer must always keep in mind that these publications represent minimum standards and design criteria. In the event that local, state, or federal requirements (or host nation standards when applicable) are more stringent, the more stringent requirements govern. Water systems (i.e., potable water systems) may include sources (wells or surface water service pumps), treatment, storage, and transmission and distribution. Wastewater (both domestic and industrial) systems may include collection, pumping and conveyance, and treatment and disposal facilities. Solid and hazardous waste facilities may include landfills, incinerators, or other disposal/treatment facilities.

3.2.2.1 Drawings. See ER 1110-345-700, Appendix C.

a. Concept

At a minimum the drawings shall:

- identify and locate wildlife, plants, wetlands, and archeological sites that are adversely impacted by the project
- convey the existing site conditions based on a topographic survey
- provide the general layout of all buildings and ancillary features associated with the project

Water and Wastewater: Plans shall show all existing water and wastewater facilities of interest, i.e. receiving mains, force mains, sanitary sewer manholes, etc. New water service lines and fire protection facilities, i.e., fire mains and fire hydrants, etc. shall be shown to the point of connection of existing utilities. Similarly, domestic wastewater (i.e., sanitary sewer) collection and pumping and conveyance facilities shall be shown to the existing receiving facilities or onsite treatment facilities (existing or proposed). For water systems principal valves and appurtenances shall be sufficiently depicted to convey the proposed flow/process directions as applicable for water service facilities, or water supply, treatment, and distribution systems. Major facilities such as, storage tanks, treatment units, pumping facilities, etc. shall be depicted. Similarly, for wastewater

systems major facilities and components such as collection, treatment, pumping and conveyance facilities including building connections, service laterals, manholes, as applicable shall be shown to the point of connection or disposal. Pipe sizes shall be indicated. Inverts and elevations for gravity facilities shall be indicated to demonstrate the validity of Concept design. Pipe sizing should reflect known or calculated project demands and as applicable be based on field conducted flow tests to obtain necessary existing data such as available flow and residual pressures so as to properly design and size system components. Requests for field conducted flow test should specify exact hydrant or other component locations where flow and pressure are desired to be measured. Requests for field conducted flow tests shall be submitted to USAESCH project manager. Proposed water and wastewater facility drawings shall be sufficiently detailed showing major new work as necessary to obtain reasonably accurate project Concept design cost estimates. The designer shall provide component and facility details on the drawing in addition to those specified above that he or she considers necessary to show the intent of design.

Solid and Hazardous Waste: Sanitary or hazardous waste landfill drawings shall include preliminary site layout with location of active landfill areas, monitoring or methane vent wells, truck scales, roads, parking, and any buildings including equipment storage and administrative/control buildings. Preliminary grading and draining plans shall include siting of any ditching and sediment control basins.

b. Intermediate

The drawings shall be sufficiently complete to include all project related design as indicated in paragraph 3.2.2, Civil, incorporating changes resulting from comments received from the concept submittal.

Water and Wastewater: In addition to requirements of Concept design, details required for construction of new work should be developed and included in the Intermediate design, and should be generally complete. For example, detailed facility plans, sections, and elevations shall be provided with dimensions. Where crowded conditions exist due to the proximity of other facilities, either existing or proposed, sufficient blow ups of the affected areas shall be provided to clearly indicate the location and orientation of new facilities. A legend shall be provided on drawings to clearly differentiate between existing and new work. Existing construction is generally indicated by light and dashed symbols whereas new construction is indicated by solid and heavy symbols. Where equipment connection details are shown indicate all required valves, fittings, and appurtenances. Drawings should be coordinated with specification requirements to preclude conflicting requirements and ensure that all requirements are sufficiently specified. Performance characteristics for all items of equipment shall be specified by equipment schedules. Equipment characteristics specified solely by "Note" fashion, or in random locations on the drawings shall not be acceptable. Manufacturer's trade names shall not be shown on the drawings. Electrical characteristics, such as phase, voltage, frequency, horsepower ratings, classification of National Electrical Manufacturers Association (NEMA) type, if applicable, and motor rotation speeds shall be included in equipment schedules and shall be consistent with the specifications. Specified equipment characteristics selected shall not be restrictive to any one manufacturer, and ideally should allow for consideration among at least three manufacturers. The location of all new work including equipment and piping shall be completely coordinated with other features of the project i.e., architectural, plumbing, mechanical, structural, electrical, etc. For treatment and disposal systems, all treatment and unit operations

facilities should be depicted and detailed with hydraulic profiles to demonstrate proper flow through the facilities. Instrumentation and control schematics, diagrams, and details shall be generally complete. Horizontal and vertical control shall be established and depicted on the drawings. Equipment components, piping, valves, fittings and appurtenances shall be depicted showing proposed layout. Construction details, notes, and other information, e.g., piping profiles (gravity lines as well as pressure mains), utility conflicts, etc. shall be generally complete. All piping, valves, fittings and appurtenances shall be sized and called out on the drawings. Connections to existing systems shall be depicted and detailed. Proposed water and wastewater facility drawings shall be generally complete with sufficient detail required to obtain refined project cost estimates for all proposed new work commensurate with Intermediate design.

Solid and Hazardous Waste: Update the preliminary site plan provided at the concept stage to an intermediate level of development. Provide floor plans and sections of structures.

c. Pre-Final

The drawings shall be sufficiently complete to include all project related design as indicated in paragraph 3.2.2, Civil, incorporating changes resulting from comments received from the intermediate submittal and from the ITR comments. The intent of the pre-final submittal should be a complete design which is submitted to obtain final review and comment.

d. Final

The drawings shall be sufficiently complete in detail to provide for fair and competitive bids from contractors and to provide for the construction of the project without additional drawings except for those items that are to be designed by others as allowed by UFC 3-301-01. Drawings shall include all project related design as indicated in paragraph 3.2.2, Civil, incorporating changes resulting from comments received from the pre-final submittal and from the BCOES comments.

At a minimum, the drawings shall indicate:

- stated above minimum content required for the pre-final submittal with completion of the minor details lacking to provide complete Civil drawings
- all valid comments made on the previous submittals are incorporated into this submittal
- details and requirements of the erosion, sedimentation and pollution control (ES&PC) plan

3.2.2.2 Specifications. See paragraph 3.2.14, Project Specifications.

3.2.2.3 Design Analysis.

See 3.2.15, Design Analysis and ER 1110-345-700, Appendix B for guidance in preparation of the Civil design analysis. The Civil design analysis will document general parameters, functional and technical requirements, design objectives and provisions, provide design calculations applicable to the project, and identify coordination with the installation or outside agencies. The design analysis shall not conflict with the drawings and specifications and shall contain necessary information to serve as the basis of site design. Copies of emails, memorandums and record of conversations obtained during the design process shall be included as warranted to document basis of design.

Design computations will be originated to support all facets of the Civil design. The computations shall be systematic and accurate. The designer will present the calculations in a clear and legible form, incorporating title page and a table of contents. Pages will be numbered consecutively and identified in the table of contents. Cross-referencing will be clear. The source of formulas and references will be identified. Assumptions and conclusions will be explained. All computations will be given a complete numerical and theoretical check and the designer and reviewer names and dates of design and review will be recorded on the individual calculation sheets or the calculation cover sheet. For computer software analyses, the designer will include all applicable input and output data in readable printed form as part of the design calculations. All computer codes will be identified. Computer-generated procedures and calculations will be verified by hand calculations to verify the procedures used and accuracy of the results. All calculations do not have to be verified by hand, but sufficient hand calculations will be performed by the designer to demonstrate the accuracy of the computer calculations and results. Critical design information such as service populations, waste characteristics and loadings, flood elevations, etc. shall be identified. All governing assumptions and requirements shall be explicitly stated.

At a minimum, the design analysis shall include the information listed below for the various stages of submittals.

a. Concept

The design analysis shall include the basis of design to support the content of the concept submittal of the drawings. The design analysis shall be sufficiently complete to clearly show project requirements and utility support capacity. The design analysis shall also include flood protection, wetland mitigation, and related issues, as applicable. Sanitary and hazardous waste design at this stage shall include a description of treatment processes, leachate and gas recovery systems, handling/containment of storm water runoff, and post closure plan/procedures.

The design analysis shall include:

- all items previously identified in the parametric submittal and all design progress up to the concept submission
- design criteria and code/standard references
- general design parameters and assumptions
- functional and technical requirements
- design objectives and provisions
- design calculations
- input from coordination with installation or outside agencies
- copies of emails, memorandums and record of conversations obtained during the design process
- DD1391 if applicable

b. Intermediate

The design analysis shall include the basis of design to support the content of the intermediate submittal of the drawings and specifications and shall incorporate all valid

comments from the previous submittal.

The design analysis shall include:

- all items previously identified in the concept submittal and all design progress up to the intermediate submission
- design criteria and code/standard references
- general design parameters and assumptions
- functional and technical requirements
- design objectives and provisions
- design calculations
- input from coordination with installation or outside agencies
- copies of emails, memorandums and record of conversations obtained during the design process
- Piping analyses indicating design flows velocities, pipe sizes, friction factors, slopes for gravity pipes, pipe lengths, and elevations or required depth of cover.
- Flow diagrams depicting process unit operations and treatment units for waste treatment and disposal systems.
- Determination of total dynamic head for pumps incorporating static head, and friction and minor losses.
- For pumps, system-head curves superimposed on manufacturer's pump curves annotating the desired operating point
- For pumping stations with multiple pumps, determine operating points for single and multiple pump operation

c. Pre-Final

The design analysis shall include the basis of design to support the content of the pre-final submittal of the drawings and specifications and shall incorporate all valid comments from the previous submittal. All design calculations shall be completed and checked by a qualified senior engineer. Only minor changes are expected between this stage of completion and the final submission.

The design analysis shall include:

- all items previously identified in the intermediate submittal and all design progress up to the pre-final submission
- design criteria and code/standard references
- general design parameters and assumptions
- functional and technical requirements
- design objectives and provisions
- design calculations

- input from coordination with installation or outside agencies
- copies of emails, memorandums and record of conversations obtained during the design process

d. Final

The design analysis shall include the basis of design to support the content of the final submittal of the drawings and specifications and shall incorporate all valid comments from the previous submittal. All design calculations shall be completed and checked by a qualified senior engineer.

The design analysis shall include:

- all items previously identified in the pre-final submittal and all design progress up to the final submission
- design criteria and code/standard references
- general design parameters and assumptions
- functional and technical requirements
- design objectives and provisions
- design calculations
- input from coordination with installation or outside agencies
- copies of emails, memorandums and record of conversations obtained during the design process

3.2.3 Structural.

Structural design shall be in accordance with applicable chapters of UFC 1-200-01 GENERAL BUILDING REQUIREMENTS and UFC 3-301-01 STRUCTURAL ENGINEERING. Structural designs should use material efficiently, provide maximum usable space, minimize the use of special equipment, and utilize conventional methods of construction. Consideration must be given to future uses of the structure, possibilities of alterations, and alternate functions and maintenance costs during the required lifetime of the structure. The structural engineer shall not only consider providing adequate strength for the building or structure, but also serviceability. At a minimum, the structural engineer shall consider the following factors:

- Type of construction (structural system)
- Column locations
- Bracing or shear walls locations
- Floor and roof penetrations
- Floor to floor heights
- Exterior cladding
- Equipment and utility arrangements
- Modifications to existing buildings
- Protective Construction (Antiterrorism and Explosives Safety)

- During the design process, the structural engineer will consistently coordinate with other design disciplines to ensure no conflict of information is shown on the drawings or in the specifications. Within the structural discipline, the drawings, specifications and design analysis shall not conflict and shall contain all necessary information for procurement, construction and validation of the design.

3.2.3.1 Drawings. See paragraph 3.1.1 for CADD standards' requirements. See ER 1110-345-700, Appendix C.

a. Concept

The drawings shall indicate the construction type and general load bearing (gravity and lateral) systems. At a minimum the drawings shall indicate:

- foundation plan indicating the type of foundation (spread footing, strip footing, mat footing, pile foundation, etc.)
- floor framing plan with primary members
- roof framing plan with primary members
- foundation plan, floor plan, roof plan and other structural plan will have an alpha-numeric grid system aligned with the columns, or with load bearing and non-load bearing walls, as applicable. Use the same grid system for all plan views. Grid system will match other design disciplines.
- gravity and lateral load resisting system with primary members
- General Notes sheet with, at minimum, preliminary design criteria for the project, primary structural member material types. State the fire resistance criteria for all portions of the structural system and identify structural members by fire rated element (column line, wall line).
- Identify fire walls, fire barriers and fire partitions as defined in IBC.

b. Intermediate

The drawings shall be sufficiently complete to demonstrate the structural system and clearly indicate gravity and lateral load paths to the foundation. At a minimum the drawings shall indicate:

- content of the 'Concept' submission and all design progress up to point of the intermediate submission
- General Notes providing criteria for general contractor instructions, design criteria and loading, construction material type, special inspections, pre-engineered metal buildings and other items where design is delegated to others and abbreviations. State the fire resistance criteria for all portions of the structural system and identify structural members by fire rated element (column line, wall line).
- identify fire walls, fire barriers and fire partitions as defined in IBC.
- plans, sections, elevations and typical details for the foundation, floor and roof.
- plans, elevations, sections and details will have all necessary dimensions to

define the locations of the grid lines, offsets and all structural elements, as well as the overall sizes of buildings and structures.

- size of primary structural members for gravity and lateral load resisting system
- typical details for the structural system
- connection details for primary framing members
- reinforcing steel sizes and spacing for all primary concrete framing members.
- specialty items or methods of construction differing from general conventional structural practice. A few examples are base isolation systems, equipment required to be seismically qualified to withstand and operate after or during a seismic event, anchorage of specialized mission critical equipment, protective construction related to antiterrorism and/or explosives safety and new material types.

c. Pre-Final

The drawings shall be sufficiently complete in detail to demonstrate the entire primary and secondary structural system, including interfaces with other design disciplines. All coordination efforts with other design disciplines will be incorporated into this submittal. With the exception of completing minor details, this submittal could be used to obtain fair and competitive bids from contractors and used for construction. At a minimum the drawings shall indicate:

- content of the 'Intermediate' submission and all design progress up to point of the Pre-Final submission
- complete General Notes providing criteria for general contractor instructions, design criteria and loading, construction material type, special inspections and abbreviations. Identify systems or component parts of the structure where the Designer of Record is delegating the design responsibility to a qualified delegated engineer (see UFC 3-301-01). State the fire resistance criteria for all portions of the structural system and identify structural members by fire rated element (column line, wall line).
- identify fire walls, fire barriers and fire partitions as defined in IBC.
- if not identified in a performance specification, identify stress or load diagrams for systems or component parts of the structure that are being designed by a delegated engineer
- plans, sections, elevations and details (typical and special) for the foundation, floor and roof.
- foundation plan, floor plan, roof plan and other structural plan will have an alpha-numeric grid system aligned with the columns, or with load bearing and non-load bearing walls, as applicable. Use the same grid system for all plan views. Grid system will match other design disciplines.
- plans, elevations, sections and details will have all necessary dimensions to define the locations of the grid lines, offsets and all structural elements, as well as the overall sizes of buildings and structures. Dimension shall not

conflict with other discipline drawings.

- construction, expansion and contraction joint locations in the floor slab and foundation walls
- control joint locations in Masonry walls
- framing plan for floor and roof including details of all penetrations and openings
- all required schedules, including but not limited to footings, columns, connections, base-plates, beams and joist.
- stair details on multistory structures
- details for specialty items
- all critical structural steel connections will be completely detailed and shown on the contract drawings. Critical connections are those connections subjected to moment, axial and shear loads, or combinations thereof. Only simple connections (i.e., connections classified as shear connections and subjected to shear loads only) may be deferred to the construction contractor for detailing.

d. Final

The drawings shall be sufficiently complete in detail to provide for fair and competitive bids from contractors and to provide for the construction of the project without additional drawings except for those items that are to be designed by others as allowed by UFC 3-301-01. At a minimum the drawings shall indicate:

- stated above minimum content required for the 'Pre-Final' submission with completion of the minor details lacking to provide complete structural drawings. All valid comments made on the previous submittals are incorporated into this submittal.

3.2.3.2 Specifications

See paragraph 3.2.14 'Project Specifications' for guidance in preparation of the specifications.

3.2.3.3 Design Analysis

See 3.2.15 'Design Analysis' and ER 1110-345-700, Appendix B for guidance in preparation of the structural design analysis. The structural design analysis will document general parameters, serviceability requirements, functional and technical requirements, design criteria, design objectives, design assumptions, and provide design calculations applicable to the project. The design analysis shall not conflict with the drawings and specifications and shall contain necessary information to serve as the basis of design of the structure and structural elements of the project. Copies of emails, memorandums and record of conversations obtained during the design process shall be included as warranted to document basis of design.

Design computations will include an investigation of loading (gravity, wind, seismic, blast, etc.), shear, moment, stress analysis diagram, uplift, stability, and deflection calculations. The computations will be systematic and accurate. The designer will present the calculations in a clear and legible form, incorporating title page, table of

contents, and a tabulation showing all design loads and conditions and load combinations. Pages will be numbered consecutively and identified in the table of contents. Cross-referencing will be clear. The source of loading conditions, formulas, and references will be identified. Assumptions and conclusions will be explained. All computations will be given a complete numerical and theoretical check and the designer's and reviewer's names and dates of design and review will be recorded on the calculation sheets. For computer software analyses, the designer will include all applicable input and output data in readable, printed form as part of the design calculations. All computer codes will be identified. Computer-generated procedures and calculations will be verified by hand calculations to verify the procedures used and accuracy of the results, unless this verification has been done on a previous project. All calculations do not have to be verified by hand, but sufficient hand calculations will be performed by the designer to demonstrate the accuracy of the computer calculations and results.

At a minimum the design analysis shall include the information listed below for the various stages of submittals.

a. Concept

The design analysis shall include the basis of design to support the content of the concept submittal of the drawings.

The design analysis shall:

- include the structural design criteria and code/standard references
- include the structural design loads and conditions. Include environmental (wind, snow, rain, seismic) loads, antiterrorism (force protection) and explosives blast loads from accidental or intentional detonations
- include the structural calculations supporting the concept drawings
- include the type and fabrication or construction of the structural system, to include the basis for selection for at least three competitive systems (reference ER 1110-345-700, App B, Part 2, section 4 'Structural', c. (4)). The base installation design guide shall be considered in the selection of the structural system. The basis for selection should at a minimum consider the ability of the system to adequately resist all structural loads, availability of material, future additions, use of prefabricated building systems and components, costs and skill sets of the labor force. Selection of a system which is not the most economical system must be justified. In the event that design, architectural or functional requirements or site conditions dictate the system selection, a statement to this effect should be included and fully justified.
- clearly describe the vertical and lateral load resisting systems.
- include requirement for special inspections,
- identify pre-fabricated structural items (such as pre-engineered metal buildings, precast concrete panels) and other items where design is delegated to others. Address design responsibilities related to the designer of record and portions of the design that is being delegated to others.
- state the fire resistance criteria for all portions of the structural system.

- further describe impacts of specialty items and design considerations (such as the seismic design requirement for a site specific ground motion study) that are potential cost drivers, long lead items or items that require non-conventional design and construction methods including undesirable subsurface conditions
- provide necessary explosives safety information to support a preliminary Explosives Safety Site Plan if applicable to the project (See Section 5.17.2 'Explosives Safety' and Section 5.10 'Hardened/Protective Construction')

b. Intermediate

The design analysis shall include the basis of design to support the content of the intermediate submittal of the drawings.

The design analysis shall:

- include all items previously identified in the concept submittal and all design progress up to the intermediate submission
- in close coordination with the mechanical and electrical design disciplines, identify equipment requiring seismic qualification. Indicate the 'seismic functionality' requirement of the equipment (i.e. remain anchored but can accept damage, survive the event and operate post-earthquake, or remain operable during the event)
- include complete calculations and load path distributions for the primary gravity and lateral load structural systems (main members included diaphragms, bracing, and moment frames).
- include preliminary design of structural connections for the primary gravity and lateral load structural systems
- include preliminary calculations for secondary structural members and exterior cladding
- include protective construction calculations needed to support a final Explosives Safety Site Plan submission. The structural design of protective construction elements schedule will be in advance of the remainder of the structural design for the project and be at Pre-Final stage of submission.
- include narratives stating how each applicable UFC 4-010-01 Anti-Terrorism Standard, related to the structural discipline, is met.
- Include identification of applicable explosive weights (I, II and III) and levels of protection in accordance with UFC 4-010-01
- Include information (test data or analyses) on blast resistant window systems
- Include structural calculations for blast resistant window supporting structural elements and connections or test results in accordance with UFC 4-010-01.
- In accordance with UFC 4-010-01, include building element structural analysis or design calculations in the following cases: 1) where standoff distances are less than the conventional construction standoff; 2) where

walls or roof construction does not meet the conventional construction parameters in UFC 4-010-01 Table 2-3.

c. Pre-Final

The design analysis shall include the basis of design to support the content of the pre-final submittal of the drawings and incorporate all valid comments from the previous submittals. All structural calculations shall be completed and check by a qualified senior engineer. Only minor changes are expected between this stage of completion and final submission.

The design analysis shall:

- include all items previously identified in the intermediate submittal and all design progress up to the pre-final submission
- include complete design of structural connections for the primary gravity and lateral load structural systems
- include complete calculations for secondary structural members and exterior cladding
- identify all structural elements and components where the design will be delegated to others. Clearly indicate interface points of the structure between the designer of record and the qualified design of delegated components.
- include calculations that indicate an independent technical review by a qualified structural engineer to ensure quality control.

d. Final

The design analysis shall include the basis of design to support the content of the final submittal of the drawings and specifications and shall incorporate all valid comments made on the pre-final submission. All structural calculations shall be completed and checked by a qualified senior engineer.

3.2.4 Architectural.

This section states requirements and guidance for more typical aspects of architectural design. Specific project conditions may dictate the need for design that exceeds these requirements. The architectural design efforts must result in code compliant, functional, life-cycle cost effective, buildable, discipline coordinated, and sustainable design solutions throughout all phases of project programming and design. The objective of the COE is to obtain attractive structures which are designed using sound technical knowledge and which are constructed using recognized, good industry practices, as well as being cost effective. The design and construction shall incorporate those characteristics which will provide structures with present and continuing utility, durability and desirability, and which will be economical to maintain for the life of the structure.

Facility designs shall be governed by the functional requirements of the projects, conform to criteria and standards, and be consistent with applicable congressional cost limitations. Provide the appropriate quality of construction that is appropriate for the type of facility being designed, within funding limitations, taking into account life cycle cost considerations. Include design economies that are affected by the use of suitable local and regional construction methods, materials, and skills that are consistent with the

intent of these criteria. Design shall utilize commercially available standard or stock equipment, fixtures and materials when they meet functional requirements.

3.2.4.1 Architectural Drawing Requirements

a. Concept Design. At a minimum the concept design drawings must have a developed floor plan, elevations, a life safety plan and typical wall sections. At 35% the drawings should solve the functional needs of the user. The design solution must meet the base installation design requirements and relevant criteria. The design solution though only 35% complete, should be thoroughly coordinated by the architects with structural engineers for layout of structural elements, mechanical, electrical, and fire protection engineers for chases or raceways for ducts, piping and electrical and vertical loading of mechanical or communication rooms, and with civil/site engineers for positioning building on the site. The 35% should set the design through the construction document development.

(1) Floor Plans. Provide plans at scales in accordance with the AEC CADD Standards and at a minimum size for each floor to show functional elements, when drawn to scale. In addition the following shall be shown:

- The general building layout showing exterior walls, interior partitions, and circulation elements (stair, elevators, corridors, etc.) drawn to scale.
- The identification of major areas and their functional relationship.
- Match lines locations shall be shown for large floor plans and a key plan must be provided to delineate which part of the overall plan is being shown.
- Cross references for enlarged floor plans, elevations, wall types and building sections.
- Planning grid or column lines.
- Overall and building element location dimensions
- Room names and numbers.
- Finish floor elevations for each floor or change in floor level.
- Fenestration to scale and located (doors, windows, etc.).
- All major equipment.
- Furnishing and equipment layouts will be coordinated with Interior Design Drawings see 3.2.5.
- Provisions for handicap access.
- Floor area tabulations.
- Demolition/Existing Condition information for repair, renovation or addition design.

(2) Roof Plan(s).

(3) Planning grid or column lines.

- o Call out materials for membrane or roofing type, insulation and flashing.
- o Indicate slope, drainage areas and drains/scuppers.
- o Show roof mounted equipment.
- o Show any skylights or major penetrations.
- o Show access.
- o Show cross references for elevations, details and sections.
- o Provide dimensions for overall, changes in wall/parapet direction and distance from edge of building to any items on the roof to locate those items.
- o Show gutter, downspout and locations

(4) Elevations

- o Planning grid or column lines.
- o Note, call out or show the exterior finishes and extent of where the materials occur.
- o Material colors or description of material must be provided on the elevations.
- o Show all doors, windows or other openings and indicate if operable.
- o Provide dimensions for height of building.
- o Show elevation height markers of finish floor, roof, parapet and any other element visible in elevation.
- o Show major equipment that is attached to building or pad mounted next to building.
- o Show downspouts and gutters.

(5) Typical Wall and Building Sections

- o Show and note the vertical bearing materials
- o Show and describe the building envelope materials
- o Wall section thickness overall will be drawn to scale. Certain elements should be emphasized (over scaled) to be able to be called out and communicated to reviewers and contractors. For example, a liquid applied or thin membrane air barrier would not be readable in a smaller scale section, but must be noted if it is part of the wall system.
- o List the insulation value.
- o Sections should be provided to show the structural spanning elements and how they bear on vertical structure.

(6) Life Safety Plan

The analysis of building life safety should be coordinated with the design team and rest of the design submittal. At a minimum the sheet(s) must include the following data and provide a legend for symbols used on the drawings:

- The occupancy type(s).
- Type of construction
- Fire/smoke compartments.
- Exit width calculations and number of exits.
- Location and rating of walls
- Door label requirements, devices, required door swing directions and smoke proof doors.
- Egress, dead-end, and common path of travel distances indicating code compliance.
- Exit lights.

b. Intermediate Design Drawings

Incorporate comments from the Concept Design. The drawings should be blocked out to form the final number of drawings so an index can be completed. Final coordination of spaces and materials must be finalized so full construction document development is undertaken to a 50-65% level of effort and minimal changes impacting all disciplines will occur later.

(1) Building Plans

- o Provide plans for each floor, roof, and ceiling showing dimensions, functional arrangement, and equipment for all areas, including corridors, exits, stairs, and utility spaces.
- o The relationship of the building to exterior access, vehicle parking, service areas etc. shall be indicated on site plans.
- o Detail any non-standard building design that deviates from normally acceptable building methods.
- o All column lines must be shown and coordinated with structural engineering.
- o Identify fire walls, smoke partitions and all fire rated construction.
- o Show indication of phased construction and delineate which parts or areas are to be done in order.
- o All drawing symbols will be thoroughly cross referenced.
- o All wall types should be finalized and referenced to sections and details.
- o All floor finishes must be coordinated with interior design plans.

(2) Building Elevations

- o Elevations should be significantly complete showing all materials and their extents.

- The elevations must show each side of the buildings and what the facility will appear like when complete.
- All fenestration and building joints must be shown.

(3) Building and Wall Sections

- All section references should appear on the plans.
- Building sections should be significantly complete and show major elements of the building envelope and structural systems.
- At least one of every wall type shall be developed to demonstrate envelope materials, attachment to structure, thermal performance, moisture protections, and majority of details needed.

(4) Schedules

- The drawings shall include door, window, and equipment schedules.
- Indicate any AT/FP requirements for the doors and windows or coordinate in specifications.
- Windows and doors will have elevations and details.
- Indicate for each window type, dimensions, type of operation, frame material, glazing type and thickness.
- Door schedule must show door numbers, door and frame types, door size, door and frame materials and fire ratings.
- Provide interior and exterior finish schedules.

(5) Details

Details should be cross referenced on their location within the drawing set.

c. PreFinal Design Drawings

Incorporate comments from previous reviews, Concept, Intermediate or any over the shoulder during design. Provide response to each comment.

Final drawings shall show all pertinent plans, elevations, section, details, schedules and notes to present a complete description of the construction required. All drawing sheets shall have Huntsville Center File Numbers and Huntsville Center Drawing Numbers as shown in Index of Drawings. Architectural drawings shall be coordinated with the civil, structural, mechanical, electrical and site drawings and with the specifications. Dimensions, schedules, sections and details shall be completely checked. Door, window, and space numbers or symbols shall be properly shown. Locations of wall sections and cross sections shall be shown on plans and elevations. Details must be complete and cross referenced. All errors and discrepancies noted shall be corrected. Ensure drawing index is complete and coordinated with the drawings. Coordinate reflected ceiling plans with lighting and air conditioning plans.

d. Final Design Drawings

Incorporate all review comments. Provide responses to comments. If comments result in drawing or design changes, complete change, coordinate with disciplines, and go over changes with reviewer until accepted. Make drawings ready to advertise.

3.2.4.2 Architectural Specification Requirements

See paragraph 3.2.14 'Project Specifications' for guidance in preparation of the specifications.

3.2.4.3 Architectural Design Analysis Requirements

a. Concept Analysis

Analysis shall develop or respond to any previous comments or design action items from the design kick-off, parametric design, customer concerns, or design team coordination concerns. The design analysis should be significantly complete except for any final calculations while coordinating final design concept to proceed on construction documents.

b. Intermediate, PreFinal and Final Design Analysis Requirements

Analysis shall incorporate or respond to any previous comments. The design analysis should be complete including any final calculations as the details of building envelope are completed.

3.2.5 Interior Design.

Interior Design is required for new building construction and renovation projects, regardless of funding source. The Comprehensive Interior Design (CID) is comprised of two design deliverables: the Structural Interior Design (SID), a part of the design and construction effort programmed within the DD-1391; and, the Furniture, Fixtures and Equipment Design (FF&E), a functional requirement for a move-in ready facility usually funded with O&M funds. SID is design for building-related interior design elements that are part of the building itself and is performed concurrently with the architectural design. It includes but is not limited to walls, ceilings, floor coverings, signage, finish schedules and built-in casework. This design effort includes the accommodation of needed furniture and equipment within the building and the coordination of furniture and equipment layout with other related design disciplines. The FF&E is performed either during the building design or the construction process. It includes the design for furniture and equipment related to building functionality and includes the detailed selection and specification of furniture and equipment, as well as space planning, necessary for a fully functional facility that meets the operational needs of the end user.

Interior Design is responsible for producing fully coordinated SID and FF&E design efforts for new construction and renovation projects. Each design effort shall incorporate best practices and principles of interior design into the completed design efforts. Both SID and FF&E must be developed in full compliance with the contractual scope of work; comply with applicable codes, regulations and laws; produce a design within funding limits, fully satisfy the design scheme, aesthetic and functional requirements of the project; provide a design fully coordinated with other related design disciplines (architecture, electrical, mechanical, fire protection; provide a fully integrated design solution (coordination of interior finishes, furniture, equipment, electrical, lighting, window treatments, etc.); incorporate sustainable design principles and energy conservation methods into the design; consider life cycle cost analysis in the selection of interior finishes and furnishings; incorporate best practices for maintainability of facilities and furnishings; and, result in the production of complete, accurate and coordinated construction and procurement documentation for the project. Designs shall be developed in compliance with the published design guide for installation. Special design consideration shall be given to projects with historical or architectural significance.

Interior Design concepts and schemes shall be developed to be in harmony with the existing architectural character and local environment of each project.

3.2.5.1 Interior Design Drawing Requirements

a. Concept Design. Design drawings shall be produced at the Concept Design phase to meet the user's functional, physical and aesthetic needs for the facility design. The SID and the layout of the furniture and equipment shall be developed. The interior design drawings shall be coordinated with all related design disciplines (architecture, mechanical, electrical, etc.) at the Concept Design Phase. Drawings shall include:

- Finish Floor Plan
- Reflected Ceiling Plan
- Key Interior Elevations for Finish Applications
- Finish Schedule, Material Key
- Furniture and Equipment Layout

b. Intermediate. Incorporate comments from the review of the concept design submittal. The design drawings shall be developed to clearly convey the design for the project and shall include:

- Finish Floor Plans, including design of all finish materials, transitions, notes, dimensions
- Reflected Ceiling Plan, including design of all finish materials, transitions, notes, dimensions
- Interior Elevations to convey the design and application of wall finishes, transitions, notes, dimensions
- Sections and Details as required to fully document the design
- Finish Schedules, keys, Legends
- Interior Design and Finish Notes
- Furniture and Equipment Layout coordinated with MEP

c. Pre-Final. The design drawings shall be completely developed to fully define the design and provide design drawings ready for construction. All comments from previous design reviews shall be incorporated or addressed during the Pre-Final phase of design. Drawings shall be complete, clear, accurate, and fully-coordinated with all design disciplines.

d. Final. Incorporate all review comments or address comments not incorporated into design. The drawings shall be sufficiently complete in detail to provide for fair and competitive bids from contractors and to provide for the construction of the project without additional drawings required.

3.2.5.2 Specifications.

See paragraph 3.2.14 'Project Specifications' for guidance in preparation of the

specifications.

3.2.5.3 Design Analysis.

See 3.2.15 ‘Design Analysis’ and ER 1110-345-700, Appendix B for guidance in preparation of the Interior Design design analysis. The Interior Design design analysis will document general parameters, functional and technical requirements, design criteria, design objectives, design assumptions, and provide sustainability, energy conservation and life cycle cost factors applicable to the project. The design analysis shall not conflict with the drawings and specifications and shall contain necessary information to serve as the basis of design of the Structural Interior Design (SID) and the Furniture, Fixtures and Equipment Design (FF&E). Copies of emails, meeting minutes, memorandums and record of conversations obtained during the design process shall be included as warranted to document basis of design.

a. Concept.

The design analysis shall include the basis of design to support the content of the Concept Design Phase submittal of the drawings. The design analysis shall incorporate or respond to any previous comments. Any changes in the direction of the design development shall be reflected in the design drawings in addition to being captured in the design analysis. The design analysis should be significantly complete at the completion of the concept phase.

b. Intermediate.

The design analysis shall be reviewed at the Intermediate Design Phase to ensure compliance and coordination with the design development through the drawings and specifications. Revisions should be minor. Incorporate any revisions necessary due to the progression of the design into the design analysis. Incorporate or address any review comments received prior to this submittal.

c. Pre-Final.

The design analysis shall be reviewed at the Pre-Final Design Phase submittal to ensure compliance and coordination with the design development through the drawings and specifications. Revisions should be minor or non-existent. Incorporate any revisions into the design analysis. Incorporate or address any review comments received prior to this submittal.

d. Final.

The design analysis should be complete prior to the Final Design Phase submittal. If there are any outstanding comments from previous design reviews, address or incorporate these into the final design analysis.

3.2.6 Fire Protection.

All designs must comply with UFC 3-600-01. Unless the project scope of work specifies the performance design of the fire protection system, the designer will show all information necessary to construct the fire protection system(s) ("total design"). The information provided will be detailed to the extent that the construction contractor will only provide shop drawings that show compliance with the contract requirements. Where the project SOW specifies the "performance design" of a water sprinkler system, the designer will include the following in the contract documents: water system supply curve plotted on semi-logarithmic paper, occupancy classification, design density, design

area, hose stream (where applicable), and duration of the water supply. The performance design will include adequate hydraulic calculations to determine if the facility will require fire pumps or water storage tanks. If calculations demonstrate the need for either item, the designer will include in detail, the necessary items in the design. The designer will ensure that all designs provide the most cost effective fire protection that complies with all applicable requirements and does not increase the risk of property damage or adversely impact life safety considerations. A qualified Fire Protection Engineer (FPE) is required to be a member of the design team for projects involving any feature identified by UFC 3-600-01 paragraph 1-5, other than minor sprinkler head relocation or like-kind sprinkler head replacement. At the Final Design stage, the FPE will provide a letter/statement certifying that the plans and specifications are in compliance with UFC 3-600-01 and all applicable criteria. The project FPE is required to review stamp fire protection shop drawings.

3.2.6.1 Drawings

a. Concept Design. For either "performance" or "total" design concept drawings, the information specified above for "performance design" of a water sprinkler system, or the equivalent information for other extinguishing systems will be submitted. Equipment will be drawn to scale.

b. Intermediate Design. For “performance design,” the concept design drawings will be updated to reflect any changes made to the design since the concept submittal. For “total design,” the he layout plan of all equipment and piping will be shown. Section and detail views will be identified. Maintenance access areas will be identified.

c. PreFinal Design. The performance requirements of all equipment will be included in an appropriate schedule. A sequence of operation will be included where required to clearly understand the function or operation of any systems or equipment. All equipment will be shown in detail. Where equipment connection details are shown, all valves, gauges, and fittings required by the specifications or otherwise required will be shown. For proper operation and maintenance of the equipment, adequate space will be allotted based on the requirements in the catalog cuts furnished above. Clearances or access required for proper operation and maintenance will be shown on the drawings. Sections, elevations, and details of mechanical rooms and all other congested areas will be provided where required for clarity and coordination. All piping within the mechanical room and all other congested areas will be drawn double-line (to scale). All supports, other than standard piping supports, will be shown on the drawings and clearly detailed. Flow diagrams and/or isometrics and sequences of operation will also be provided as needed for clarity. Fire protection drawings will not contain information pertaining to other disciplines, except where required for reference or coordination.

(1) For "performance design," the intermediate drawings will be updated to reflect any changes made to the design since the concept submittal.

(2) For "total design," the intermediate drawings will be expanded to include the location of all sprinklers, risers, and piping, or the equivalent

information for other extinguishing systems. Center-to-center dimensions between sprinklers on branch lines and between branch lines, from end sprinklers to adjacent walls, from walls to branch lines, from sprinkler feed mains and cross mains and branch lines to finished floors and roof or ceiling will be shown. Sections will be included that show typical branch line and cross main pipe routing as well as the elevation above finished floor for typical sprinklers.

d. Final Design. The only changes required at this stage should be incorporation of comments from the ITR or customer review of the prefinal submittal.

3.2.6.2 Specifications.

See paragraph 3.2.14 ‘Project Specifications’ for guidance in preparation of the specifications.

3.2.6.3 Design Analysis.

a. Concept Design.

(1) General Description. A description of the system(s) to be used along with a list of standards (including date and reference to applicable sections or paragraphs) upon which the design is based will be submitted. A preliminary version of the Fire Protection Design Analysis in accordance with UFC 3-600-01 will be included.

(2) Design Analysis Calculations. For "total" or "performance design" of water sprinkler systems, the hydraulic calculations specified above for "performance" designs will be submitted at this stage. An equivalent level of information will be submitted at this stage for other extinguishing systems. The calculations required for a "performance design" should be essentially complete at this point. The source for each equation used will be listed, including title, chapter, equation number, etc.

b. Intermediate Design.

(1) General Description. The concept description will be updated to reflect any changes made to the design since the concept submittal. The basis for changes will be documented. Include the final draft of the Fire Protection Design Analysis in accordance with UFC 3-600-01.

(2) Calculations. The concept calculations will be updated to reflect any changes made to the design since the concept submittal. The basis for changes will be documented. Calculations should be complete at t his stage for all extinguishing systems.

c. Pre-Final Design.

(1) General Description. The intermediate description will be updated to reflect any changes made to the design since the intermediate submittal. The bases for changes will be documented. Include the final version of the Fire Protection Design Analysis in accordance with UFC 3-600-01.

(2) Calculations. The intermediate calculations will be updated to reflect

any changes made to the design since the intermediate submittal. The basis for changes will be documented. Catalog cuts from at least three contractors, sufficient in detail to demonstrate compliance with all contract requirements including the contract specifications, will be included for all major items of equipment. For "total design" of water sprinkler systems, completed hydraulic calculations or the equivalent information for other extinguishing systems will be submitted. The calculations will substantiate that the design area indicated is, in fact, the most hydraulically demanding. Computer prepared hydraulic calculations will have a cover sheet that includes design input and provides an explanation of output generated. Output will include a plot of the water system supply and the sprinkler system demand curves plotted on semi-logarithmic paper. Computer software which uses typical k-factors for branch lines will not be used. All calculations will be accompanied by sketches that identify areas, nodes, piping segments, etc., used in the calculations to facilitate review.

d. Final Design. The only changes required at this stage should be incorporation of comments from the ITR or customer review of the prefinal submittal..

3.2.7 Plumbing

3.2.7.1 Drawings.

a. Concept Design. The drawings will include plumbing fixture layout, floor and area drains, and single-line piping and equipment layout. All equipment will be drawn to scale. Preliminary performance requirements of all equipment will be included in appropriate schedules.

b. Intermediate Design. The drawings provided at concept submittal will be updated to include the piping plan and piping isometrics for the water and waste/vent systems. Drawings shall be coordinated with other non-plumbing systems such as providing floor drains for air handling units. Drawings will typically show natural gas piping systems even when they are part of non-plumbing systems such as building heating systems.

c. PreFinal Design. A plumbing fixture schedule will be provided that lists individual fixtures and the size of all piping connections (cold water, hot water, vent, and waste). The performance requirements of all equipment will be included in an appropriate schedule. A sequence of operation will be included, where required, to clearly understand the function or operation of any systems or equipment. All equipment will be shown in detail. Where equipment connection details are shown, all valves, gauges, and fittings required by the specifications or by other standards will be shown. For proper operation and maintenance of the equipment, adequate space will be allotted based on the requirements in the catalog cuts furnished above. Clearances or access required for proper operation and maintenance will be shown on the drawings. Sections, elevations, and details of mechanical rooms and all other congested areas will be provided as necessary for clarity and

coordination. All supports, other than standard piping supports, will be shown on the drawings and clearly detailed. Isometrics and sequences of operation will also be provided as needed for clarity. Plumbing drawings will not contain information pertaining to other disciplines, except where required for reference or coordination. Drawings will be sealed by a mechanical professional engineer where required by contract.

d. Final Design. The only changes required at this stage should be incorporation of comments from the ITR or customer review of the prefinal submittal.

3.2.7.2 Specifications.

See paragraph 3.2.14 'Project Specifications' for guidance in preparation of the specifications.

3.2.7.3 Design Analysis.

a. Concept Design.

(1) General Description. A description of the system(s) to be used along with a list of standards (including date and reference to applicable sections or paragraphs) upon which the design is based will be submitted.

(2) Calculations. The number and type of plumbing fixtures required will be provided along with calculations to determine the cold and hot water load (flow) requirements. The types and capacity requirements for drainage systems will also be included. Calculations necessary to determine equipment capacities and their corresponding utility requirements will be provided. To facilitate review, all calculations will be accompanied by sketches that identify nodes, piping segments, etc., used in the calculations. The source of each equation used will be listed, including title, chapter, equation number, etc. Calculations related to water conservation features such as gray water systems and solar preheat systems will be included. The design analysis shall also determine applicability and address any sustainability requirements for all projects as required by UFC 1-200-02 High Performance and Sustainable Building Requirements. The design analysis will include an evaluation of Table 1-1 in UFC 1-200-02 to determine what, if any, chapters apply to this design. The design analysis should also include a narrative description of how the design will address the specific requirements of UFC 1-200-02 that are applicable.

b. Intermediate Design.

All pipe sizing calculations should be completed and submitted. For all pipes, the calculations will include design flow (in gpm or liters per second and fixture units), pipe size, velocity, friction factors, slopes, lengths and the pressure and flow available at each fixture at designed conditions. Compressed air, natural gas, and other plumbing systems will include design flow, pipe sizing, and storage tank sizing calculations.

c. PreFinal Design.

All pipe sizing calculations will be completed at this stage. Catalog cuts sufficient in

detail to demonstrate compliance with all contract requirements, including the contract specifications from at least one vendor, will be included for all major items of equipment.

d. Final Design.

The only changes required at this stage should be incorporation of comments from the ITR or customer review of the prefinal submittal.

3.2.8 Process

3.2.8.1 Drawings.

a. Concept Design. The concept submittal will include drawings with sufficient information to indicate the envelope the equipment requires. Electric and other utilities required will be identified. Provide scaled floor plans for all support facilities with major pieces of equipment located. Process flow drawings (PFD) and piping and instrumentation diagrams (P&ID) will be provided. Piping plan drawings will depict the routing of major lines.

b. Intermediate Design. This submittal will have the equipment outline clearly defined on the plans with locating dimensions given from walls or columns. Section and detail views will be included if sufficient information is available. Process and Utility Diagrams showing pipe sizes, equipment and control devices; equipment lists; comprehensive functional and operational system description of the control system, and site plan showing all site elements. At the intermediate submittal PFD's and P&ID's will be complete. PFD's will have the flow rates for all process lines identified for the design conditions. P&ID's will have all lines sized and numbered; instrumentation identified including tag numbers. Piping plan drawings will be provided that show the routing of all lines along with pipe identification numbers. Elevation and detail drawings will be started but are not expected to be complete at this time. When equipment is furnished by other than the construction contractor, the interface will be clearly identified. Any areas on hold awaiting information will be identified.

- Piping System Drawings. Piping drawings will include plans and elevations of the piping runs with the location of expansion devices, anchors, and changes in direction indicated and located on both the plans and elevations. Sufficient detail will also be provided to ensure interface definition between piping systems and contractor and Government-furnished equipment. A process and instrumentation diagram showing the system control components and instrumentation will be provided for each process piping system. Instrumentation symbols used will be in accordance with Instrumentation and Symbols Standard (ISA-S5.1).
- Piping Details. Piping details will be shown in isometric wherever practical.
- Computer-Developed Drawings. Computer-developed pipe detail drawings will be used when possible.

- o Miscellaneous. Pipelines, valves, controllers, and instrumentation will be numbered on the drawings. A pipeline and valve listing will be provided.

c. PreFinal Design. Details will be furnished for supports, anchors, pipe sleeve closures, valve pits, guides, and other such features.

d. Final Design. The only changes required at this stage should be incorporation of comments from the ITR or customer review of the prefinal submittal.

3.2.8.2 Specifications.

See paragraph 3.2.14 'Project Specifications' for guidance in preparation of the specifications. In addition, the following considerations will be addressed:

a. Cleaning. The details of the cleaning processes and the number and location of cleanings will be specified. The specification will call out the degree of inspection and will require the use of approved cleaning facilities. The contractor will be required to provide detailed cleaning procedures before piping is cleaned. Pipe or components cleaned in a shop off the job will be sealed against contamination through use of a substantial sealing method.

a. Components. Components such as valves, strainers, gauges, and other devices will be specified in detail with pressure or temperature rating, size, capacity, pressure, and temperature ranges; test pressures, tolerances, and materials will be called out. Components will be cleaned to the specified cleanliness level at the manufacturer's plant; they will be sealed and packaged so as to arrive on the job site in the specified clean condition.

b. Inspection. Methods and degree of cleanliness and welding inspection will be specified. Generally, welding inspections will consist of visual and radiographic or other nondestructive inspection. The method of testing and the standards used will be documented.

c. Testing. Detailed requirements will be specified for pressure testing, leak testing, and operational testing. Test requirements for components such as leak testing and proof testing will be called out in detail. Operational tests will also be indicated. Records of tests will be made and a reproducible copy turned over to the contracting officer. Performance and other tests of valves, strainers, etc., will require certification with copies furnished the contracting officer.

d. Piping Connections. The method of making piping connections will be specified. Welding and inspection of welding will be in accordance with the ASME Boiler and Pressure Vessel Code, ANSI Piping Code, and the American Welding Society Standards. A requirement for welding procedure, welding operator, and welder qualification and identification will be specified. No unqualified procedure or welder will be used. Detailed requirements for welding will be specified.

(1) Protective Coatings. Protective coatings for both aboveground and underground piping will be specified with appropriate test procedures.

(2) Materials. The options on materials for the piping systems will be furnished as part of the design criteria.

(3) Piping Identification. Requirements for piping identification will be specified.

3.2.8.3 Design Analysis.

a. Concept Design.

A design analysis will be furnished by the designer for all major items of equipment. The parameters, calculations, and rationale used for selecting the equipment will be identified, and at least, three manufacturers' names and the model numbers of their equipment will be provided to verify that competition is available. Catalog cuts from at least one manufacturer will be provided to demonstrate compliance with project requirements. A process description, site concepts or layouts, control systems concept, and code analysis as applicable for each will be furnished by the designer. The designer will document the required capability of material handling equipment to fulfill mission requirements and ensure the equipment has built-in safety features. Material Handling covers items such as elevators, pneumatic-tube systems, monorails, overhead cranes, etc.

(1) Seismic Design. Seismic design of piping, equipment, supports, and anchors will conform to UFC 3-310-04. (Coordinate requirements with Structural.)

(2) Noise Control. Design work will be in accordance with UFC 3-450-01 and UFC 3-450-02.

(3) Special Conditions

- Hazardous Facilities. Hazardous facilities require special design considerations which include selecting equipment items and materials that prevent damage and hazards to personnel and facilities. Hazards may be created by corrosive acids, explosions, fire, lethal gases, or other causes. AMC-R 385-100 will be used for designing facilities where hazardous (but non-nuclear) munitions materials will be manufactured, processed, stored, handled, or transported within a facility. The safety requirements of the American Petroleum Institute may be imposed for facilities associated with petroleum products or with the conversion of one energy form into another.
- Hazardous and Toxic Waste. Hazardous and toxic wastes piped underground must have double containment and meet the requirements of Resource Conservation and Recovery Act (RCRA).

b. Intermediate Design. Calculations will be included for the sizing of all equipment and major distribution lines..

c. Pre-Final Design.

(1) Alignment. The horizontal and vertical alignment of the piping will be carefully planned to use the inherent flexibility of the pipe to absorb expansion. Consideration will be given to road crossings and other

obstructions in the route of the piping.

(2) Expansion. The design of flexibility of the system, will consider the maximum and minimum temperatures to which the line will be exposed. This will include not only environmental temperature, but temperatures of cleaning processes such as steam or vapor cleaning. Ample provision will be made for such temperature ranges, and this will be covered by the design analysis. Where expansion of piping will be absorbed by using the inherent flexibility of the piping or by providing expansion loops and bends, the pipe expansion stresses will be calculated by a standard method used in industry. Where computer analysis is used, the analysis will include a user's manual and a sample problem.

(3) Supports. Supports for above ground piping will be designed with full allowances for the movement and forces developed by the piping either during operation, testing, cleaning, or shock loading, whichever is the most severe condition. Supports will be of ample strength to withstand the forces developed by the piping. Supports will be designed to allow free movement of the piping during expansion and to adequately guide the line without binding it. Support design will incorporate stock or production parts, provided they conform to the requirements of design loads and are commonly used. Accurate stress and weight balance calculations will be made to determine forces and movements at each support point, anchor, and equipment connection. Vibration and shock loads will be examined in detail and accommodated. All calculations will be included in the design analysis.

(4) Anchors. Pipe anchors will be designed to withstand the maximum forces developed by the pipe system during the most severe condition of either regular operation, testing, shock loading, or cleaning. Anchors will be proportioned to not less than twice the section modulus of the pipe. Design calculations for anchors will be a part of the design analysis. These calculations should show forces, assumptions, soil bearing values, etc. When it is necessary to use a bellows type expansion device, anchors and supports will be designed to take the full pressure thrust at the highest pressure to which the line will be subjected, either in normal operation or during the pressure testing.

(5) Drainage and Sectionalizing. System operation conditions will be taken into consideration when designing the drainage points and sectionalizing. If a system is to be cleaned in place, the line will be capable of being divided into short sections for ease of cleaning without cutting the piping. Drains will be located at low points, and if they are to be used for cleaning or flushing, they will be large enough to ensure adequate flow. Horizontal pipe runs will be pitched for gravity drain in the desired direction.

d. Final Design. The only changes required at this stage should be incorporation of comments from the ITR or customer review of the prefinal submittal.

3.2.9 HVAC

3.2.9.1 Drawings.

a. Concept Design. A single-line layout will be provided for all equipment, ductwork, and piping. Equipment will be drawn to scale. Preliminary performance requirements of all equipment will be included in appropriate schedules. A preliminary sequence of operation for each system will be included on the drawings.

b. Intermediate Design. The drawings provided at concept submittal will be updated to include the equipment, piping and duct locations. Equipment schedules will include information available based on the calculations. Ductwork shall be shown with double lines and all fire/smoke dampers shall be located. Sequence of Operation will be expanded to address all major control sequences.

c. PreFinal Design. The performance requirements of all equipment will be included in appropriate schedules. A sequence of operation will be included where required to clearly understand the function or operation of any systems or equipment. All equipment will be shown in detail. Where equipment connection details are shown, show all valves, gauges, and fittings, required by the specifications or otherwise required. For proper operation and maintenance of the equipment, adequate space will be allotted based on the requirements in the catalog cuts furnished above. Clearances or access required for proper operation and maintenance will be shown on the drawings. Sections, elevations, and details will be provided for mechanical rooms and all other congested areas where required for clarity, coordination, or detail. All piping and ductwork within the mechanical room and all other congested areas will be drawn double-line (to scale) with exterior dimensions that reflect any required insulation. All supports, other than standard ductwork or piping supports, will be shown on the drawings and clearly detailed. A flow diagram and sequence of operation will be provided for each system. HVAC drawings will not contain any information pertaining to other disciplines, except where required for reference or coordination. Drawings will be coordinated with specifications to show all items by which the specifications refer to the drawings for additional visual detail. Drawings will be sealed by a mechanical professional engineer where required by contract.

d. Final Design. The only changes required at this stage should be incorporation of comments from the ITR or customer review of the prefinal submittal.

3.2.9.2 Specifications.

See paragraph 3.2.14 ‘Project Specifications’ for guidance in preparation of the specifications.

3.2.9.3 Design Analysis.

a. Concept Design. The description of the system(s) will include the indoor and outdoor design conditions for each area. Where energy from an existing plant is to be used, verification will be included that capacity, availability, and the reliability of the plant are adequate to

serve the intended loads. As a minimum, block loads that take into account all loads that will influence equipment size will be submitted for each system. All calculations will be accompanied by sketches that identify nodes, piping, or duct-work segments, etc., used in the calculations to facilitate review. The size of major pipe and duct mains will be included. The source for each equation used will be listed, including title, chapter, equation number, etc. The design analysis will reference the building seismic design analysis where seismic hazards exist and determine whether mechanical system piping, equipment, and ductwork must be braced according to seismic hazard level A, B, C, or D per latest edition of SMACNA Seismic Restraint Manual. The design analysis shall also determine applicability and address any sustainability requirements for all projects as required by UFC 1-200-02 High Performance and Sustainable Building Requirements. The design analysis will include an evaluation of Table 1-1 in UFC 1-200-02 to determine what, if any, chapters apply to this design. The design analysis should also include a narrative description of how the design will address the specific requirements of UFC 1-200-02 that are applicable. New construction, new addition, and major renovation (as defined in UFC 1-200-02 dated 01 March 2013, Table 1-1) will typically include (but not be limited to) the following deliverables (see UFC 3-410-01):

- Energy Cost Budget (ECB) Compliance Report as shown in Appendix G of ASHRAE 90.1 User's Manual including backup calculations.
- Life Cycle Cost Analysis (LCCA) narrative including calculations for specific conservation measures that exceed requirements.
- ASHRAE Standard 62.1 ventilation analysis including detailed calculations.
- Minor renovation projects will typically include ASHRAE Standard 62.1 ventilation analysis including detailed calculations

b. Intermediate Design. Calculations will be included for the sizing of all equipment and major air and water distribution lines. Design analysis shall determine whether ASHRAE Standard 15 Safety Standard for Refrigeration Systems is applicable.

c. Pre-Final Design. All pipe sizing calculations will be completed at this stage. For all pipes, the calculations will include design flow (over the entire range where applicable), duct size, velocity, slope (if applicable), length and all pertinent details relative to the calculation method used. The entering and leaving design conditions at each piece of equipment (over the entire operating range where applicable) will be listed. The cycle of each heating and/or cooling system will be plotted on a psychrometric chart with each point on the chart cross-referenced to the corresponding point in the system. Individual room heat gain/loss calculations will be made. The extrapolation of "typical" room calculations or the proration of block load calculations will not be permitted. A completed ventilation analysis based on the requirements

listed in UFC 3-410-01FA will be provided. Catalog cuts from at least three vendors sufficient in detail to demonstrate compliance with all contract requirements, including the contract specifications, will be included for all major items of equipment.

d. Final Design. The only changes required at this stage should be incorporation of comments from the ITR or customer review of the prefinal submittal.

3.2.10 Electrical.

Electrical design shall be in accordance with UFC 1-200-01 General Building Requirements. This UFC provides general building requirements, establishes the use of consensus building codes and standards, identifies key core UFCs, and identifies unique military requirements, such as facilities in support of military operations. This UFC applies to the design and construction of new and renovated Government-owned facilities for the Department of Defense. It is applicable to all methods of project delivery and levels of construction.

Levels of construction are permanent, semi-permanent, and temporary. Use the International Building Code (IBC) except as modified by this UFC. Substitute all references in the IBC to the International Fire Code (IFC) with criteria in UFC 3-600-01 Fire Protection. Substitute all references in the IBC to the International Fuel Gas Code with criteria in NFPA 54 and NFPA 58. Core UFCs referenced in this UFC provide the unique military building criteria that parallel the International Building Code (IBC). For electrical design, Chapter 27 – Electrical of the IBC is modified by 2-27 of this UFC. In addition to these IBC modifications, electrical design will comply with other criteria in Chapter 3 and UFCs referenced in Appendix A of this UFC. Chapter 3 addresses Higher Authority Mandates, Unified Facility Criteria (both core UFCs and specific Facility Criteria (FC)), Antiterrorism, Explosive Safety, Physical Security, High Performance and Sustainable Building requirements mandated by law and policy.

See paragraph 3.2.14 ‘Project Specifications’ for guidance in preparation of the specifications.

IBC Chapter 27 – Electrical is modified by a number of core UFCs with UFC 3-501-01 Electrical Engineering specifying the general electrical requirement criteria as the overarching electrical design guide. A block diagram is provided in Figure 1-1 Electrical UFC Delineation and in Appendix B, Figure B-1 Additional Electrical-Related UFCs. The USACE Technical Excellence Network (TEN) has a listing of these UFCs.

IBC and UFC 3-501-01 shall be used in the development of the plans, specifications, calculations, and Design/Build Request for Proposals (RFP) and shall serve as the minimum electrical design requirements for design-build and design-bid-build projects. Compliance with this UFC is mandatory for the design of electrical systems at all facilities, bases, and at leased facilities. UFC 3-501-01 establishes design analysis requirements in support of design activities and defines minimum requirements for design drawings in terms of drawing types and content.

During the design process, the electrical engineer will consistently coordinate with other design disciplines to ensure no conflict of information is shown on the drawings or in the specifications. Within the electrical discipline, the drawings, specifications and design analysis shall not conflict and shall contain all necessary information for pricing, procurement, construction and validation of the design.

3.2.10.1 Drawings

Drawings shall be submitted in accordance with UFC 3-501-01 CHAPTER 3 DESIGN ANALYSIS AND DOCUMENTATION, 3-3 DRAWING REQUIREMENTS.

a. Concept Design Drawings. Drawings shall indicate the level of construction and general electrical and telecommunication systems requirements. In addition to the requirements of UFC 3-501-01, the drawings shall include:

- Legends and Abbreviations associated with the electrical design
- Demolition Plans
- Site Plans for Exterior Electrical Power and Lighting and Telecommunications: Electrical and telecommunications drawings will include plan and elevation drawings. Electrical power and lighting and telecommunications layouts will show new and existing utilities. Plans will show locations of electrical supply equipment, building service equipment, and exterior supply circuits affected by new construction or renovation. The plans will be coordinated with other utility plans concerning scale, landmark references for proximity, and interference management. The plans will be separate from water, sewage, and other utility plans. Elevation views of assemblies will be scaled and will identify each item of equipment arranged on the front of cabinets, compartments, cubicles, panels, and units. Electrical power and lighting and telecommunications layouts depicting exact locations with defining details will be included
- Building Floor and Ceiling Plans for Interior Electrical Power and Lighting and Telecommunications: Plans will include layouts for power, lighting, conduits, cable tray, backboard/distribution frames, telecommunication systems (voice and data), feeders, branch circuits, grounding, and electrical receptacles. For renovation and modification projects, plans will depict the work and no work requirements. Where work is extensive, separate sheets should be used to show existing-to-remain, demolition, and new work
- Single-line Diagrams: Concept single-line diagrams will depict proposed power sources and distribution schemes (interior and exterior). The diagrams will include existing and proposed protective device types in sufficient detail to communicate the system protection philosophy
- Drawings will contain nameplate data for components of existing systems which are affected by the new design or which affect the new equipment or systems
- Riser diagrams for power, telecommunications, intercommunication/paging, special systems, fire alarm, and grounding (includes service entrance equipment, grounding electrode system, lightning protection system, and cathodic protection)

b. Intermediate Design Drawings. Drawings shall be sufficiently complete to demonstrate the electrical and telecommunication systems requirements. In addition to the requirements of UFC 3-501-01, the drawings shall include:

- Single-line diagrams: Single-line diagrams will depict power sources and distribution schemes (interior and exterior). The diagrams will show the distribution and utilization equipment protective device types
- Three-line diagrams required for annunciation, instrumentation, control, and coordinated protection of power system equipment and materials
- Drawings will identify and describe existing and proposed conductors, devices, equipment, and materials by data shown on the manufacturers' nameplate data and on single-line and three-line diagrams
- Elementary and schematic control diagrams for telecommunication systems
- Riser diagrams for power, telecommunications, intercommunication/paging, special systems, fire alarm, and grounding (includes service entrance equipment, grounding electrode system, lightning protection system, and cathodic protection)
- Schedules and elevations for power panels, panel boards, motor control centers, switchboards, and switchgear
- Grounding and lightning protection plans and details

c. Pre-Final Design Drawings. Drawings shall be sufficiently complete in detail to demonstrate the entire electrical and telecommunication systems requirements, including interfaces with other design disciplines. All coordination efforts with other design disciplines will be incorporated into this submittal. With the exception of completing minor details, this submittal could be used to obtain fair and competitive bids from contractors and used for construction. At a minimum the drawings shall include:

- Content of the ‘Intermediate’ submission and all design progress up to point of the Pre-Final submission
- General notes providing criteria for general contractor instructions, design criteria for electrical and telecommunication systems, construction materials and equipment, and inspections, testing and verification of systems intended function. Identify systems or component parts of the electrical and telecommunication systems where the Designer of Record is delegating the design responsibility to a qualified delegated engineer
- Final drawings will show all pertinent plans, elevations, sections, details, schedules, and notes to present a complete description of the construction required. All elements to be constructed will be

properly annotated and located with proper dimensions

(1) Pre-Final exterior electrical drawings will include:

- o Details which clearly depict the installation requirements of overhead and underground supply and utilization equipment and telecommunication systems
- o Clearances required by IEEE C2
- o Plans and details which clearly distinguish new from existing construction and define their interfaces
- o Equipment schedules for all equipment included in the design will be complete

(2) Pre-Final interior electrical drawings will include:

- o A lighting fixture schedule
- o Complete electrical wiring details
- o Riser diagram indicating connections and wiring to main switch, distribution, power and lighting panels
- o Details for mounting fixtures and equipment
- o Horsepower ratings of all motors
- o Panel board and switch schedule, together with connected loads
- o Designation of all rooms and areas as shown on architectural and other drawings
- o Internal and external equipment wiring diagrams, including interconnections between related items of equipment
- o Cable and conduit schedules
- o Electrical equipment plan, elevation, side views, sectional views, and details (interior and exterior).
- o Interface drawings between existing electrical systems/equipment and new electrical systems/equipment
- o Nameplate data for components of existing systems which are affected by the new design or which affect the new equipment or systems
- o Completely developed schedules for all equipment included in the design will be submitted

d. Final Design Drawings. Drawings shall be complete in detail to demonstrate the entire electrical and telecommunication systems requirements by including the ‘Pre-Final’ submission with addition of minor details noted during the ‘Pre-Final’ review. All valid comments made on previous submittals shall be incorporated into this final submittal. The drawings shall be complete in detail to provide for fair and competitive bids from contractors and to provide for the construction of the project without additional drawings.

3.2.10.2 Specifications:

See paragraph 3.2.14 'Project Specifications' for guidance in preparation of the specifications.

3.2.10.3 Design Analysis shall be submitted in accordance with paragraph 3-2 Design Analysis of UFC 3-501-01 CHAPTER 3 DESIGN ANALYSIS AND DOCUMENTATION,. Refer to 3.2.15 'Design Analysis' and ER 1110-345-700, Appendix B for guidance in preparation of the electrical design analysis. Electrical design analysis will document general parameters, serviceability requirements, functional and technical requirements, design criteria, design objectives, design assumptions, and provide design calculations applicable to the project. Electrical design analysis shall not conflict with the drawings and specifications and shall contain necessary information to serve as the basis of design of the electrical elements of the project. Copies of emails, memorandums and record of conversations obtained during the design process shall be included as warranted to document basis of design.

a. Concept Design Analysis. (Provide all items in the Parametric Design Analysis and additional design work to include further development of all systems and features described in Sections 3.2.1 Basis of Design, 3.2.2 Electrical Calculations, and 3.2.3 Load Analysis of UFC 3-501-01.

b. Intermediate Design Analysis. Provide all items in the Concept Design Analysis and all special features of the design. Include the studies and analysis described in sections 3.2.4 through 3.2.17 of UFC 3-501-01.

c. Pre-Final Design Analysis. Analysis shall be sufficiently complete in detail to demonstrate the entire electrical and telecommunication systems requirements, including interfaces with other design disciplines. All coordination efforts with other design disciplines will be incorporated into this analysis.

d. Final Design Analysis. Analysis shall be complete in detail to demonstrate the entire electrical and telecommunication systems requirements by including the Pre-Final Analysis with addition of minor details noted during the Pre-Final review. All valid comments made on previous submittals shall be incorporated into this final submittal.

3.2.11 Telecommunications.

3.2.11.1 Fire Detection & Alarm/Mass Notification Systems. All designs must comply with UFC 3-600-01 and UFC 4-021-01.

a. Drawings. Legends shall contain only symbols used in the design.

(1) Concept Submittal. Provide a layout showing locations of panels and devices. Provide a preliminary system riser diagram reflecting anticipated devices and circuit types.

(2) Intermediate Submittal. Update concept layout drawings and system riser diagram. Include detail drawings to show device wiring and installation.

(3) Final Submittal. Finalize drawings to comply with comments and

scope changes/clarifications.

b. Specifications. See paragraph 3.2.14 'Project Specifications' for guidance in preparation of the specifications.

c. Design Analysis. Design analysis shall be a part of the Fire Protection Design Analysis required by UFC 3-600-01, Section 1-4.

(1) Concept Submittal. To be provided as part of the summary required by UFC 3-600-01. Provide a description of the type of system(s) and devices to be used, including the criteria, codes and standards driving the design.

(2) Intermediate Submittal. Provide a full design analysis of the system(s) to be provided, including battery calculations. Verify that the fire alarm/MNS configuration follows the guidance of UFC 4-021-01.

(3) Final Submittal. Update and finalize to comply with any comments or scope changes. Analysis shall reflect the final design.

3.2.11.2 Telecommunications & Medical Communications Systems. Designs for telecommunications systems on Army installations shall be in compliance with the Technical Criteria for the Installation Information Infrastructure Architecture (I3A), otherwise, UFC 3-580-01. Telecommunications in medical facilities and medical communications systems shall be in compliance with UFC 4-510-01.

a. Drawings. Legends for different communications systems may be combined or separate but shall contain only symbols used in the design. Where the final, signed design drawings are part of subcontractor's shop drawings submittal, the design shall include a typical system riser diagram, with any detail diagrams for needed clarity, showing all types of equipment, all types of circuits and all connections to other systems that will be provided in the construction process. Use the I3A examples in Appendix B as a style guide.

(1) Concept Submittal. Provide a conceptual floor plan showing the location of panels and devices. Provide a conceptual systems riser diagram.

(2) Intermediate Submittal. Provide final systems layout and system installation details, such as system riser for each system, telecommunications room layout, rack/cabinet layouts, outlet configurations, cable tray layout and grounding details.

(3) Final Submittal. Provide final drawings, including any changes from comments and/or scope changes.

b. Specifications.

See paragraph 3.2.14 'Project Specifications' for guidance in preparation of the specifications.

c. Design Analysis. Provide a separate analysis for each system.

(1) Concept Submittal. Provide a general description of the systems to

be provided, including the codes, standards and criteria that govern the design.

(2) Intermediate Submittal. Provide a full design analysis, including any design changes due to scope changes and/or comments.

(3) Final Submittal. Update and finalize the analysis, verifying that it fully reflects the design.

3.2.11.3 Instrumentation and Controls

a. Drawings.

(1) Concept Submittal. Provide a conceptual floor plan showing the location of panels and devices. Provide a conceptual systems riser diagram for each system.

(2) Intermediate Submittal. Provide final systems layout and system installation details.

(3) Final Submittal. Provide final drawings, including any changes from comments and/or scope changes.

b. Specifications.

See paragraph 3.2.14 'Project Specifications' for guidance in preparation of the specifications.

c. Design Analysis.

(4) Concept Submittal. Provide a general description of the systems to be provided, including the codes, standards and criteria that govern the design.

(5) Intermediate Submittal. Provide a full design analysis, including any design changes due to scope changes and/or comments.

(6) Final Submittal. Update and finalize the analysis, verifying that it fully reflects the design.

d. Design Considerations.

Specify controlled devices with a device setting which minimizes the overall system impact when control system failure occurs. Controlled devices critical to system operation will be provided with a control mode, such that a failure in a control system will automatically transfer to the manual or fail-safe mode as required for safe system operation. Alarms are defined as those audible and visual signals for alerting operating personnel of the need to take corrective process action or to be advised of an operating condition which is deviating from preset limits.

3.2.12 Utility Monitoring And Control Systems (UMCS).

3.2.12.1 General.

a. Utility Monitoring and Control Systems, which include Energy Monitoring and Control Systems (EMCS), Building Automation Systems (BAS), and other computer-based direct digital control systems, are composed of computer hardware and associated peripherals, software,

communication networks, instrumentation, and control equipment. Although usually non-critical, UMCS is classified as a subset of Industrial Control Systems (ICS). Design of these systems should conform to UFC 3-470-01 and UFC 3-410-02. Design packages will include appropriate UFGSs and drawings. The design package provides design configuration and functional description of hardware and software. The design shall incorporate security engineering to comply with Information Assurance requirements as shown in paragraph 5.19. Energy conservation and life cycle cost design features will be reflected in the Energy Conservation and Life Cycle Cost Design Analysis.

b. PROFESSIONAL ENGINEER REQUIREMENTS. Where the design of controls modifies the function of equipment as initially approved by a Professional Engineer, that change shall also require drawings stamped by a licensed Professional Engineer.

c. DESIGN AND INSTALLATION**.** The design of the facilities and control systems and the performance of the installation work will be in accordance with the facility criteria, guide specifications, drawings, and other industry standards as designated by the scope of work. Design and installation of facilities used for processing classified information will be IAW applicable Department of Defense documents. The design of the facilities/systems will be in sufficient detail to allow repetitive construction of future facilities/systems from one set of drawings and will limit the amount of layout engineering required by the construction contractor.

3.2.12.2 Drawings.

Plans will contain the following:

(1) Floor Plans. The floor plans will show all principal architectural features of the building that will affect the design.

- Room designation and number.
- Dimensional height, location, number, and size of raceways.
- Dimensional height, location, size, and designation of cabinets, outlet boxes, etc. Plans should clearly indicate type of mounting required (flush and surface, wall or floor).
- Conduit and communication cable routing and numbers.
- Dimensional size, location, space requirements, and designation for all control consoles, equipment local cabinets, power supplies, etc.
- Grounding requirements.

(2) Schedules. Conduit and cable schedules will be used to show conduits and cables installed. The schedule will contain the number, type, size, origination point, destination point, and termination requirements for each conduit cable.

(3) Connections. Connection details will be shown for each cabinet or

console in which cables are terminated. The connection details will show locations of terminal blocks in cabinet, type of terminal blocks, termination of conductors, type of terminals used to terminate the cables, and any grounding required. The termination of shields, if used, will also be shown.

(4) Construction. Construction details and complete dimensions will be shown for each cabinet. The details will show the outline of the cabinets, thickness of the metal, mounting of internal equipment such as channel support, location of all openings in the cabinet, mounting and securing of doors, and other pertinent features.

(5) Sections and Elevations. Details, sections, and elevations will be shown where required for clarifications.

(6) Equipment by Others. The drawings will indicate equipment furnished and/or installed by others.

b. Concept Design Drawings.

- Title sheet
- Site drawing
- Abbreviations and symbol list
- Network Architecture Diagram
- UMCS Block Diagram (includes front-end server equipment layout)
- Communication network and Information Assurance description
- Control Drawings and schematic of equipment showing instrumentation placement
- Floor Plans showing relative locations of HVAC equipment and new DDC controls
- Sequences of Operations for each piece of HVAC equipment
- Bills-of-Materials (BOM) for each sub-system
- Details of power (include source breaker nomenclature), grounding and surge protection
- Building Level Controller/ Building Point of Connection MAC Address (i.e., Network Application Engines, Java Application Control Engines, SmartServers, Loytec, etc.)
- Points List: Every connected analog output (AO), analog input (AI), digital output (DO), digital input (DI), pulse accumulator (PA) input and other input or output device connected to the UMCS shall represent a point.
- Drawings: A sample (one system) of Instrumentation and Control wiring and installation drawings, showing wire routing on floor plans including terminal numbers, wire colors/numbers, and cable designations.

- Two representative buildings will be completed in accordance with UFC 3-410-02, including sequences of operations and data base information related to set points and alarm limits.

c. Intermediate Design Drawings.

Intermediate design review submittals for UMCS will have all concept review comments incorporated into the project drawings and other documents before the intermediate design is submitted.

The level of design completion submitted will be in accordance with the contract, normally 65%, for all structures in accordance with UFC 3-410-02, including the sequence of operation, and data base information related to set points and alarm limits, communications network layout, and cable routing.

d. Pre-Final Drawings.

Final Instrumentation and control wiring and installation drawings, showing wire routing on floor plans including terminal numbers, wire colors/numbers, and cable designations. Drawings submitted for the pre-final review will incorporate all notes and comments from all previous reviews. Drawings at this stage should be essentially complete, subject only to final corrections and comment incorporation.

e. Final Drawings.

After the final review conference, drawings containing review corrections will be delivered to the project manager.

3.2.12.3 Specifications.

See paragraph 3.2.14 ‘Project Specifications’ for guidance in preparation of the specifications.

3.2.12.4 Design Analysis.

Design Analysis shall be in accordance with the general requirements of para 3.2.15 and the specific requirements listed below. Control system design analysis will document general parameters, serviceability requirements, functional and technical requirements, design criteria, design objectives, design assumptions, and provide design calculations as applicable to the project. Control system design analysis shall not conflict with the drawings and specifications and shall contain necessary information to serve as the basis of design of the Control system elements of the project. Copies of emails, memorandums and record of conversations obtained during the design process shall be included as warranted to document basis of design.

a. Concept Design Analysis.

Provide a written narrative accurately addressing the control system basis of design. The basis of design shall include as a minimum:

b. Interview with site personnel/occupants and resulting recommendations

- Review of past energy/feasibility studies (i.e., EEAP)
- Review of Master Plan (if any)
- Field survey data

- o Survey of existing data communication infrastructure
- o Bandwidth calculations from impact of new components
- o Proposed data communication system (include routers/switches)
- o Existing front end system protocol and interface requirements
- o Integration to existing system technical solution
- o Network Architecture
- o Workstation/server
- o Security engineering and information assurance requirements
- o Preliminary system components
- o Instrumentation and execution of sequences of operation to achieve control
- o Control Logic Diagram
- o Preliminary points tables
- o DD Form 1391 validation report, including cost estimate

Narrative shall address the communication protocol with respect to open or proprietary systems, overall point capacity, expandability, processor speed, memory size, component and equipment selection (functionality, reliability, durability - mean time between failures, sustainability). Present the alternative technical design solutions and options considered and justify the final selection.

c. Intermediate Design Analysis.

Update and expand the Concept Design Analysis to support the submittal. Develop all items in the Concept Design Analysis and all special features of the design. Finalize the studies, surveys and analysis required and described in the Concept Design Analysis.

d. Pre-Final Design Analysis.

Analysis shall be sufficiently complete in detail to demonstrate the entire control system requirements, including cyber security engineering and interfaces with other design disciplines. All coordination efforts with other design disciplines will be incorporated into this analysis.

e. Final Design Analysis.

Analysis shall be complete in detail to demonstrate the entire control system requirements by including the Pre-Final Analysis with addition of minor details noted during the Pre-Final review. Update the cost estimate. All valid comments made on previous submittals shall be incorporated into this final submittal.

3.2.13 Electronic Security Systems (ESS)

3.2.13.1 General Considerations.

a. Basic Concepts

Due to the changing nature of threats, and the rapid evolution of technologies, security systems are impacted in numerous ways, beginning with design, installation and system operations. The basic guidance related to the security systems is covered in UFC 4-

021-02, Electronic Security Systems. This UFC includes the basic references, criteria and policy documents for design and installation of security systems. DoD and U.S. Army Corps of Engineers, Electronic Security Systems-Mandatory Center of Expertise (ESS-MCX) criteria states that ESS systems are integrated security systems consisting of access control system (ACS), intrusion detection system (IDS), closed-circuit television (CCTV) system, data transmission system and site central command and control system (at times also referenced to as a dispatch center). The central command and control system includes the servers, workstations and their peripherals; and the data transmission system includes the cables, routers, communication switches, interfaces and termination devices for the transmission of video, audio and data.

b. Design Considerations.

- ESS design features must include components and software for the protection of the assets, but also physical protection of the components that comprise the ESS. Security systems may store administrative and response procedures to protect the assets in case of an attack. Access control systems store personnel information, such as credentials, and other personnel information needed for authentication. Stored information has to be managed in compliance with DoD regulations as well as the specific requirements imposed by the respective Uniform Service, DoD Agency, or Federal Agency.
- ESS uses existing Local Area Networks (LAN), Wide Area Networks (WAN), and Non-Secure Internet Protocol Router Network (*NIPRnet*) – which is a Federal Government - DoD's Ethernet based unclassified communication network.
- Security systems may use the DoD Global Information Grid at various sites, both at CONUS and OCONUS locations, therefore the security systems must comply with DoD regulations, and certification of the systems per DODI 8510.01 Department of Defense Information Assurance Certification and Accreditation Process (DIACAP). In addition, security systems must also comply with Army Regulation AR 25-1 and AR 25-2. Similarly, for Air Force and Navy projects the service specific regulations, policies and criteria must be adhered to when designing and installing ESS.

c. Governing Criteria

- A-E or Designer of Record shall perform the work in accordance with UFC 4-020-01, UFC 4-021-02 and other UFCs listed for security systems. UFC 1-200-01 General Building Requirements is applicable for a security system when the design is being provided for new or renovated facilities. UFC 1-200-01 provides general building requirements, establishes the use of consensus building codes and standards, identifies key core UFCs, and identifies unique military requirements, such as facilities in support of military operations. This UFC applies to the design and construction of new and renovated Government-owned facilities for the Department of Defense. It is applicable to all methods of

project delivery and levels of construction.

- o Applicability of DoD Criteria, National and International Codes and Standards: Levels of construction are permanent, semi-permanent, and temporary. Use the most current DoD, DA, and UFCs listed in Appendix A and UFC 4-021-02 for Electronic Security Systems design.
- o International Building Code (IBC) shall be used to the extent where it does not conflict with the DoD, DA and UFCs. In case of any conflicts the listed criteria supersedes IBC. UFC 1-200-01, "General Building Requirements", provides applicability of model building codes and government-unique criteria for typical design disciplines and building systems, as well as for accessibility, antiterrorism, security, sustainability, and safety.
- o For protection or security of assets, where requirements of UFC 4-020-01 cannot adequately meet user requirements, then the design shall be based on UFC 4-020-02. DoD Antiterrorism Handbook shall be used in the development of the plans, specifications, calculations, and Design/Build Request for Proposals (RFP). These documents shall be used in conjunction with DoD Regulations, DA Regulations, and DoD Instructions where applicable to the design and subsequent installation/construction of electronic security systems.

d. Coordination with Architectural and Other Disciplines:

In new and existing facilities, where access control systems (ACS) is part of the security system, the requirements of ingress and egress controls and entry control and credential verification devices need to be coordinated on plans and in specifications. Devices such as electronic locks (electric strikes, magnetic locks, door controller, motion sensor, etc.) as well as card readers, biometric sensors, and iris scanners will require coordination of location as well as appropriate cross references in the Architectural plan's door schedules and electrical (power) drawings for power to electric strikes, maglocks, as well as door controllers. Since ingress and egress from a facility has architectural features, the placement of security devices, especially CCTV cameras and motion sensors must be carefully coordinated for not only proper esthetics but also high reliability, high detection, and functionality. Lighting should not wash the camera images, motion sensors should not be obstructed and cameras should be placed in locations to capture images which are useable to identify individual's face and features. Wiring should not be subject to physical damage or accessible to personnel to allow disconnection or tampering. In all such installations it will be necessary to have a well coordinated set of plans and specifications to define all trenching, excavation and routing of data, communication and power cables needed at required exterior locations.

- Exterior of Buildings of Facilities Coordination: For all work exterior to a building, such as lighting in parking lots, and building ingress and egress points, uniform lighting to identify personnel or equipment will be provided.
- Low visibility Buildings or Facilities: For those buildings or facilities requiring low visibility or security profile at night time, reduced or no lighting is desirable, therefore use of infra-red and thermal imaging cameras must be considered.

e. Site Survey:

Electronic Security Systems are generally installed in and on existing installations, facilities and buildings. For new construction a site survey may not be needed. For all ESS upgrades, replacement, and system expansion it is necessary for the designer to physically perform the survey and obtain site specific data of the installation, facility or building to make the necessary determinations for placement of cameras, sensors, devices, cabling infrastructure, and make the measurements for placement and coverage of CCTV cameras, fence sensors, gate and door controllers. Designer must obtain data on architectural and other obstructions from other buildings, terrain, and site specific information which would require variation of approach or alternate equipment, sensor or camera placements. The site survey report in combination with security system equipment, software and cabling infrastructure must be used to develop a realistic cost estimate.

3.2.13.2 Drawing Requirements.

Drawings shall be submitted in accordance with UFC 3-501-01 CHAPTER 3 DESIGN ANALYSIS AND DOCUMENTATION,

a. Concept Design Drawings.

Drawings shall indicate the level of construction and general location of sensor cabling and data transmission cabling from controllers, sensors and workstations. Sensors, door closures, magnetic or electric locks, and any unique requirements for control and access to areas, spaces or rooms shall be called out in the design analysis, and drawings. Architectural, electrical drawing schedules for power, door locks, and interior and exterior camera locations shall be addressed for coordination of the trades involved. Controllers, electric locks, electrical power circuit available for ESS equipment, and data transmission system interfaces and requirements. In addition to the requirements of UFC 4-021-02, the drawings shall include:

- Legends and Abbreviations associated with the security system design.
- Representative floor plans.
- Site Plan showing all exterior CCTV camera poles and exterior light fixtures, site utilities, cable/conduit/duct plans for the site.
- Site Plans for Exterior Security System Components, Panels and Devices: Security system drawings will include plan and elevation drawings. Site plans and layouts will show new and existing utilities. Plans will show locations of CCTV cameras, controllers, panels, IDS sensors, fences, camera poles. If building service equipment and exterior architectural and structural features affect camera view or conflicts with requirements of controlled ingress and egress for security or life safety, such issues will be addressed as a part of the design. The plans will be coordinated with other utility plans concerning scale, landmark references for proximity, and interference management. The plans will be separate from water, sewage, and other utility plans. Elevation views of security system equipment, such as camera poles, panels, and fenced areas and gates will be scaled and will identify each item of equipment.
- Building Floor and Ceiling Plans for Interior Security System. Plans will include layouts for CCTV cameras, sensors, locks, card readers, door

controllers, conduits, cable trays, communication equipment, and data transmission systems (video and data) cables. For renovation and modification projects, plans will depict the work and 'Work Not in the Contract, or Task Order, or Delivery Order' on all drawings and plans. Where work is extensive, separate drawing sheets shall be used to show existing-to-remain, demolition, and new work.

- Single-line Diagrams: Single-line diagrams of IDS, CCTV and ACS subsystems shall be developed as a part of concept design. Single-line diagrams shall include the over-arching security system block diagram showing the integrated subsystems, i.e. ACS, IDS, CCTV, Site Central Command and Control Workstations/Servers and peripherals, data transmission system component and interfaces. The single line diagrams for each subsystem shall show workstations, controllers, perimeter sensors, panels and sensor and data transmission conduits and cables.
- Design drawings shall depict proposed power sources and devices, controllers, card readers, and communication system interface schemes (interior and exterior). The diagrams will include existing and proposed overvoltage and surge protection device types in sufficient detail to demonstrate security system protection philosophy. For exterior panels and equipment, lightning protection shall be designed and specified.
- Drawings will contain nameplate data for components of existing systems which are affected by the new design or which affect the new equipment or systems.
- Riser diagrams for security system shall include grounding, grounding electrode system, and lightning protection system.

b. Intermediate Design Drawings.

Drawings shall be sufficiently complete to demonstrate the design compliance with regulations and applicable criteria. The drawings developed as concept design drawings shall include additional detail and requirements, specifically as related to:

- Legends and Abbreviations
- Floor plans drawn to scale.
- Site plans showing all exterior CCTV camera poles, CCTV equipment panels, exterior light fixtures, site utilities, and point of entry of security system cables and sensor wiring, cable/conduit/duct plans for the site.
- Exterior Security System Components, Panels and Devices: Security system drawings will include plan and elevation drawings. Site plans and layouts will show new and existing utilities. Plans will show locations of CCTV cameras, gate and door controllers, panels, IDS sensors, fences, and exterior camera poles. Pole and building mounted CCTV cameras and light fixtures. The plans will be coordinated with other utility plans concerning scale, landmark references for proximity, and interference management. The plans will be separate from water, sewage, and other utility plans. Elevation views of security system equipment, such as camera poles, panels, and fenced areas and gates will be scaled and will identify each item of equipment. If building service equipment, exterior architectural,

and/or structural features affect the field of view of CCTV cameras or conflicts with requirements of controlled ingress and egress doors or areas, for security or life safety, such issues will be addressed as a part of the design prior to submission of the pre-final design plans and specifications.

- Building Floor and Ceiling Plans for Interior Security System. Plans will include layouts for CCTV cameras, sensors, locks, card readers, door controllers, and conduits, cable trays, communication equipment, and data transmission systems (video and data) cables. For renovation and modification projects, plans will depict the work and 'Work Not in Contract' requirements. Where work is extensive, separate sheets shall be used to show existing-to-remain, demolition, and new work.
- Single-line Diagrams: Additional details of components and appropriate features shall be included to the concept single-line diagrams of IDS, CCTV and ACS subsystems.

c. Pre-Final Design Drawings.

Drawings shall be sufficiently complete in detail to demonstrate the entire security system and the data transmission systems requirements, including interfaces with other design disciplines. All coordination efforts with other design disciplines will be incorporated prior to completion and submittal of this submittal. With the exception of completing minor details, this submittal could be used to obtain fair and competitive bids from contractors and used for construction. At a minimum the drawings shall include:

- Content of the 'Intermediate' submission and all design progress up to point of the Pre-Final submission, incorporating resolution of conflicts and all prior approved comments issued prior to the pre-final design submittal.
- General notes providing criteria for general contractor instructions, design criteria for security system and the data transmission systems, construction materials and equipment, and inspections, performance verification and endurance testing, and verification of system(s) intended function. Identify systems or component parts of the security system and the data transmission systems where the Designer of Record is delegating the design responsibility to a qualified delegated engineer
- Pre-Final drawings will show all pertinent plans, elevations, sections, details, locks, card readers, controllers, communication interfaces, field distribution panels, door and camera schedules, and notes to present a complete description of the construction/installation required. All elements to be constructed/installed shall be properly annotated and located with proper dimensions.
- Pre-Final security system, exterior areas, drawings will include:
    - 1. Details which clearly depict the installation requirements of overhead and underground data transmission system cables, underground or above ground exterior sensors, power sources, distribution panels, gate controllers, door controllers, pole and building mounted CCTV cameras and light fixtures.
    - 2. Exterior security systems power and communication cables clearances based on NEC, and for over 600 volt power lines as

required by IEEE C2.

- 3. Lighting levels for exterior areas and equipment, and placement of light fixtures to provide the light to dark ratio based on criteria.
- 4. Plans and details which clearly distinguish new from existing construction and define their interfaces.
- 5. Equipment schedules for all equipment included in the design will be complete.

- Pre-Final interior security system drawings will include:
  - 1. A CCTV camera schedule.
  - 2. Door Schedule for doors controlled with card reader or security locks.
  - 3. Complete electrical power wiring details for all electronic security equipment requiring normal power. Include uninterruptible or and emergence power and their sources.
  - 4. Riser diagram communication network connectivity and interfaces, showing routers, switches and cables.
  - 5. Details for mounting card readers, sensors, electric/security locks, and security system equipment.
  - 6. Designation of all rooms and areas as shown on architectural and other drawings.
  - 7. Internal and external equipment wiring diagrams, including interconnections between related items of equipment.
  - 8. Cable and conduit schedules.
  - 9. Security system equipment plan, elevation, side views, sectional views, and details (interior and exterior).
  - 10. Interface drawings between existing security systems/equipment and new security systems/equipment.
  - 11. Nameplate data for components of existing systems which are affected by the new design or which affect the new equipment or systems.
  - 12. Completely developed schedules for all equipment included in the design will be submitted.

d. Final Design Drawings.

Drawings shall be complete in detail to demonstrate the entire security and data transmission systems requirements by including the 'Pre-Final' submission with addition of minor details, and resolution of approved review comments provided as a part of the 'Pre-Final' review. All valid comments made on previous submittals shall be incorporated into this final submittal. The drawings shall be complete in detail to provide for fair and competitive bids from contractors and to provide for the construction of the project without additional drawings.

3.2.13.3 Specifications.

See paragraph 3.2.14 'Project Specifications' for guidance in preparation of the specifications.

3.2.13.4 Design Analysis.

Design Analysis shall be submitted in accordance with ER 1110-345-700. Refer to ER 1110-345-700, Appendix B for guidance in preparation of the security system design analysis. Security system(s) design analysis will document general parameters, serviceability requirements, functional and technical requirements, design criteria, design objectives, design assumptions, and provide design calculations applicable to the project. Security system(s) design analysis shall not conflict with the drawings and specifications and shall contain necessary information to serve as the basis of design of the Security system(s) elements of the project. Copies of emails, memorandums and record of conversations obtained during the design process shall be included as warranted to document basis of design.

a. Concept Design Analysis.

Provide a written narrative accurately addressing the Security system(s) design. The basis of design shall include as a minimum:

- The security system to be constructed or installed. Integration of the new security system with the existing system if an existing security system is in place. All exterior IDS, CCTV ACS systems and their components and interface or integration with an existing ESS, if a security system exists at the site or installation. Data transmission system, if existing, which will be used, or a new data transmission being provided under this project. Back-up or emergency power requirements for the security system components, devices, controller, data transmission system equipment, workstation, and servers.
- Other exterior systems and requirements which are needed for support of the ESS:
    - o Exterior lighting systems
    - o Emergency or back-up power system
    - o Security system maintainability

All systems and features described in paragraph 3.2.1 Basis of Design of UFC 3-501-01.

b. Intermediate Design Analysis.

Provide all items in the Concept Design Analysis and all special features of the design. All studies and analysis performed as a part of the contract, or provided by the Government shall be included by reference and as attachments to the Design Analysis.

c. Pre-Final Design Analysis.

Analysis shall be sufficiently complete in detail to demonstrate the entire security system requirements, including interfaces with other design disciplines. All coordination efforts with other design disciplines will be incorporated into this analysis.

d. Final Design Analysis.

All studies and analysis performed as a part of the contract, or provided by the

Government shall be included by reference and as attachments to the Design Analysis.

3.2.14 Project Specifications

3.2.14.1 Role of USAESCH Specifications Branch. The Specifications Branch primary function is to compile specifications sections into a complete Project Manual. The Manual includes attachments referenced in the specifications text as well as the submittal register. In accomplishing the primary function, the specifications specialists provide overall project quality assurance confirming continuity across the specification sections and across the specifications and drawings. Ensuring that like terms are used throughout, sections referenced in the specifications are in the package, items indicated on the drawings are contained in the specifications using the same term for the item throughout. The Branch also serves as the bridge between the technical designers and Contracting. The Division 01 specification sections, which the Specifications Branch is responsible for preparing, must reflect the project's procurement methods as well as technical aspects. Directly the Specifications Writer in conjunction with the PE/A, prepares the Project Information Document (Appendix G) to aid Contracting in preparing the procurement package.

3.2.14.2 Prepare Project Specifications from Unified Facilities Guide Specifications (UFGS) unless written permission is given from USAESCH Contracting Officer on A-E designed projects or from ED Director of Engineering or Chief of Design on in-house designed projects. The specifications, when combined with contract drawings, will provide sufficient detail to attract fair and competitive bids and to allow USAESCH to conduct equitable negotiations. Specifications shall be prepared in accordance with approved and established engineering standards as well as established design requirements.

3.2.14.3 Special Features Unique to USAESCH Work. Generally the Corps of Engineers geographic districts maintain a set of the Division 01 General Requirements specification sections adapted to the area and installations within their jurisdictions. Unlike the geographic districts, Huntsville Center work is not restricted to a particular geographic area or jurisdictional installations. Therefore, coordinate with the project specific geographic district for the site dependent Division 01 sections to include in the project.

3.2.14.4 General Instruction

a. Guide Specifications. ER 1110-1-8155 mandates the use of UFGS to prepare Project Specifications. UFGS are available on the internet at Techinfo at http://www.hnc.usace.army.mil/Missions/Engineering/TECHINFO.aspx or the Whole Building design Guide (WBDG) at http://www.wbdg.org/ccb/browse_cat.php?c=3.

b. Inch-Pound/Metric Specifications. UFGS are available in either inch-pound or metric units. Select inch-pound or metric units depending on the project requirements.

c. Non-UFGS Sections. When a specification section is required that is not covered by the UFGS, preparer shall use an SI template and create

the new section in accordance with UFC 1-300-02 (format) and project requirements.

d. Specification Processing. ER 1110-1-8155 mandates the use of SpecsIntact (SI) to process Project Specifications. The SI software is available on the internet at http://specsintact.ksc.nasa.gov/Software/Software.shtml. Any design not using SPECSINTACT requires USAESCH approval.

e. Plain Language. The UFGS and derived project specifications are written in compliance with the Plain Writing Act of 2010. While the Act encompasses aspects of many types of Federal documents, the crux of it for specifications is to use directive language eliminating most of the occurrences of the word “shall”. Example: Rather than “Aggregates and binders obtained from different sources shall be stockpiled separately” use “Stockpile aggregates and binders obtained from different sources separately.” If directive language is not feasible, then revise “shall” to “must”. Example: Rather than “The Elevator Inspector shall be certified in accordance with the requirements of ASME A17.1/CSA B44” use “The Elevator Inspector must be certified in accordance with the requirements of ASME A17.1/CSA B44”

3.2.14.5 Concept (Outline) Specifications.

a. Content. Prepare the outline specification consisting of a list of specifications to cover all aspects of the project. Sections will come from the current UFGS Master available on the WBDG website. Add sections from other sources when a UFGS is not available. New specification sections shall be numbered in accordance with the current Construction Specifications Institute (CSI) MasterFormat. The outline shall cover applicable Divisions 1 through 49.

b. Deliverable. The SI project table of contents forms an outline specification. Print the project table of contents without scope from a SI developed project utilizing PDF files printing and submit as part of the concept design submittal package.

3.2.14.6 Intermediate Design Specifications

a. When a set of specification sections is edited for the project, the specification preparer shall use sections from the most current UFGS master available. For example, if the concept submittal is submitted in January, but the editing of sections does not occur until March, then the preparer will use UFGS sections from the February release.

b. At the intermediate level, the draft specifications shall be submitted for review in redlined form using software revision features. Discarded design choices will be visible in spite of markings. Additions to the guide specifications will also be easily identified. Edit specifications to the level of the design completion. Incorporate comments evaluated as concurred during the concept design review.

c. Deliverable. Specifications volume consisting of redlined Division 01 through 49 specifications, submittal register, test requirements list, other attachments called out in the specifications. The inserts do not

have to be assembled with the specification sections. Also, submit a draft copy of the bidding schedule with the intermediate design. Provide two hard copies and digitally in PDF file format. Provide the PDF file in color and with revisions shown.

3.2.14.7 Pre-Final Design Specifications. Continuation of section processing from the intermediate stage. Complete to the level that they would be ready to advertise; however, it is likely that a final will be required following the pre-final design review. In-house design projects will use these products to conduct the independent technical review (ITR).

a. Pre-Final Design Process

(1) Incorporate comments from the intermediate review. If an intermediate submittal is not required by the contract, redlined specifications shall be submitted in addition to the manuscript with the pre-final design submittal. A review will determine that all previous review comments have been either incorporated or justifiably withdrawn; that the specifications have been coordinated with the drawings and the design analysis. The redline corrections will be removed from the specifications after all the review comments have been shown to be incorporated.

(2) The source for new UFGS sections added to the project may be the current UFGS release or the release set used for the intermediate design.

(3) SpecsIntact Verification Reports. Clear the conflicts listed in all of the verification reports generated during the SI printing process. Edit the section files and run the processing until all conflicts and errors have been resolved.

b. The contents of the pre-final design specification package shall be as follows:

(1) Cover sheet with title of job, contract number, location, date, and name of designer. Use cover page option available in SI.

(2) Table of contents for entire project, listing in order the section number and title.

(3) Specification Sections, Division 1 should include, as a minimum:

(a) List of Drawings

(b) Summary of Work

(c) Submittal Procedures, including submittal description and automated ENG Form 4288.

(d) LEED Documentation

(e) Safety Requirements

(f) Contractor quality control (QC) and quality control system requirements

(g) Environmental protection

(h) Recycled/Recovered/Biobased materials

(i) Construction waste management

(j) Other site specific specifications (UFGS and non-UFGS)

(4) Specification Sections, Division 2 through 49 as applicable to coordinate with and complement the design drawings.

c. Pre-Final Design Specification Package Accompanying Documents

(1) Bidding schedule (CLIN sheet) including descriptive items, units, and quantities (include listing of payment paragraphs in specifications). It will be developed from specifications and coordinated with the cost estimate.

(2) General Project Information completed for the project. Refer to appendix G or the General Project Information form.

(3) Lists of all Government-furnished, contractor-installed property. Describe on a separate list arranged by reference designator. Descriptions will include manufacturer make and model, weight, dimensions, quantity, cost, and other information required by the contractor to assure the value of the property.

(4) List of all proprietary items with location in specifications, cost, manufacturer's name, and justification

(5) Work sequence including phasing, unusual schedule requirements such as equipment installation during construction, or work split between two contractors working on different jobs at same time.

(6) Construction schedule including duration in calendar days coordinated with list of major milestones.

(7) Special Situations. The A-E shall submit information covering any unusual situations, i.e., interface problems, outages, security and/or safety requirements, storage areas, construction sequences and phasing requirements, access to site, early completion dates, etc.

d. Deliverable. Provide one manuscript copy and two reading copies (loose) of the specifications along with digital media containing the SPECSINTACT and PDF files that contain the processed manuscript information.

(1) SI Settings

(a) Job Properties: Set up Cover Page, select Current CSI MasterFormat, select Numeric Paragraph Format

(b) Print Processing Sections: Reconcile addresses, references and submittals

(c) Print Processing Reports: Select the address verification reference verification, submittal verification, bracket verification and section verification reports to confirm that all of these possible issues have been resolved. Also select submittal register and the test requirements list.

(d) Print Processing Reports Project Table of Contents: Include without scope. Include Division 00 if the project contains sections from that division. Do not list unused divisions.

(e) Print Processing Reports Section Table of Contents: While editing specification sections tag attachments in the section text so they will be listed in the Section TOC. Include without scope.

(f) Other Documents: Print the cover page.

(g) Options: Do not print section dates, notes revisions or tags. Do not print final specifications in color.

(h) Header/Footer: Use SI default values

(i) PDF/Publish: Book mark sections and add section number. Combine into one PDF file and include the project table of contents.

(2) Attachments: incorporated in final PDF as well as individual attachments files in native format

(3) File formats/types

(a) Export the submittal register to the file formats set by the SI defaults.

(b) Test requirements list in PDF format.

(c) SI job backup file: include processed files and PDF files in archive (zip) format.

(d) Consolidated project specifications in PDF format. Include attachments and cover inserted into the file in the proper locations.

(e) Verification reports consolidated into a single PDF file.

3.2.14.8 Final Design Specifications. Final submittals are not considered a normal design level and are required only when pre-final submittals must be revised or corrected due to error or omission. Incorporate corrections and revisions resulting from the pre-final design review and, for in-house design projects, the ITR. Provide the same specifications products required for the Pre-Final Design Specifications.

3.2.14.9 Amendments: Should revisions or corrections to the specifications or drawings be required between the date of issuance of the solicitation and the closing of the solicitation, an amendment will be required. Depending on the terms of the design contract, the specification preparer will be required to either prepare the amendment and make the necessary changes to the contract documents or provide technical assistance to USAESCH in the preparation of the amendment.

a. Scheduling of Amendment. The amendment will be prepared and submitted under a strict time schedule directed by USAESCH.

b. Amended Specifications. The A-E is required to furnish revised sections electronically including all changes made by amendment. The A-E is required to send in paper copy of the revised pages.

(1) Revised text will be indicated by underlining; deleted text will be

struck out (this is a feature of SPECINTACT). Each revision will be indicated by placing an asterisk and the amendment number (e.g. *1, *2, etc.) in the space above each paragraph that is revised.

(2) Deleted Paragraphs. In revising the specifications by amendments, the paragraphs being removed are indicated by deleting the paragraph text and revising the paragraph title to “Deleted.”

(3) Page headers on amended specifications shall match those of the original solicitation. Page footer shall match those of the original solicitation except each section revised by amendment will carry the statement "(Revised by Amendment No. 000_)" to the right of the page number.

(4) When additional specification section(s) are added to the Project Manual by amendment, page headers on specifications shall match those of the original solicitation. Page footer shall match those of the original solicitation except each complete section added by amendment will carry the statement “(Added by Amendment No. 000_)" to the right of the page number..

c. Amendment Narrative. Provide a tabulation of revised, added and/or deleted pages or sections.

3.2.14.10 Proprietary Items. Where specific equipment or material are required by criteria or design conditions, the item is the product of a single manufacturer, and/or no substitutes will be acceptable, compliance with the requirements of ER 1110-345-100 is required. The designer will make the determination that use of the proprietary or "sole source" item is essential. In each case the following actions will be taken:

a. Justification. The preparer will submit a written request to use the proprietary item with complete detailed justification for Government approval prior to including the product in the design documents. Requests will be based on a fully justified determination that only that particular product will meet the essential requirements.

b. Requirements. If proprietary item use is approved, specify the item, and after the make and model number, add the words "No substitutes will be acceptable."

c. "Brand Name or Equal" Specifications. The use of brand name or equal specifications is strongly discouraged, and the burden for justifying such descriptions is placed on the designer. Where used, brand name or equal specifications must meet the requirements of FAR Sub-Part 10.004(b)(3), DFARS Sub-Part 210.004, and DFARS Sub-Part 252.210-7000, "Brand Name or Equal." Note that brand name or equal specifications shall, among other requirements, include a complete common generic identification of the item, a list of all known acceptable name brand products, and all salient physical, functional, or other characteristics used to determine equality and establish essential need by the Government.

3.2.14.11 Specification Writing Guidance

a. Generally the specifications shall contain no provision that requires the Bidder or Offeror to make a submission of any type with his bid or offer. However, Request for Proposal type projects (i.e., design-build, complex projects requiring technical evaluation of Contractor competence and capacity) as determined by the COE may require submission of clearly specified evaluation documentation with offers. Design reviews will address applicability of all proposed submissions.

b. Ambiguities in Specifications. Avoid using ambiguities in the specifications. The expression "as directed by the Contracting Officer" should not be used if it is feasible to give specific instructions in the specifications. Preparers should contact the project manager to obtain specific information so that indefinite terms can be eliminated. For example, when material is to be stored, the specifications should state "to be stored in Building 210" or "in the Base Salvage Yard," rather than "as directed by the Contracting Officer." When it is impossible to determine ultimate disposition of excess excavated materials, broken concrete, etc., specifications should state that the haul will not exceed a stated number of miles.

c. References

(1) References Made to Blank UFGS. References such as "will conform to UFGS-08 34 59" are not valid references. The UFGS are for use in writing project specifications, not as reference documents. It should be noted that these are guides and are not project or standard specifications.

(2) References to a third party will be avoided. The "Contractor" and the "Contracting Officer" are the only contracting parties in a contract; therefore, only "Contractor" and "Contracting Officer," and in certain instances, "Government" will be used throughout. Reference to work to be done "by others" should be made only when that work is not a part of the subject contract and will actually be done under another contract. Reference to third parties, such as "buyer," "supplier," "owner," "post engineer," "architect-engineer," "subcontractor," and "engineer" will not be used in the specifications.

(3) Section number and cross references to other paragraphs, pages or sections by number designation are improper. Reference to other sections will be made by section number and title in lieu of their respective numbers alone. References to paragraphs within in the section will be made by paragraph title alone.

d. Bidding Schedule. Prepare the bidding schedule or CLIN Sheet concurrently with preparation of the specifications. The Schedule shall set up all lump sum and unit price items for work to be accomplished under the contract. The Schedule shall be carefully coordinated with the payment paragraphs (if required) included in the technical specifications. In instances where extremely small quantities are involved in the exterior items of work, payment will be on a "job lump sum basis". The preferred method of payment for all work under the contract will be lump sum on the bidding schedule.

(1) Care should be taken to completely cover each payment item without overlapping other payment items. Payment clauses should be inserted into the appropriate specifications where required. It should be made clear exactly what is and what is not to be paid for under each item. If a pay item description is quoted, the nomenclature should correspond exactly to that given in the bidding schedule.

(2) Additive or deductive bid items, as well as optional bid items, if used, should be clearly defined on the drawings and in the specifications so that only a brief description will be necessary on the bidding schedule.

(3) If the project has multiple funding sources, the bid schedule should reflect the cost estimate in delineation of funding sources, i.e., MCA, O&M, R&D, etc.

(4) Unit prices will be used where large quantities of work such as grading, paving, building outside utilities, or site preparation are involved; where quantities of work, such as excavation, cannot be estimated with sufficient confidence to permit a lump sum offer without a substantial contingency; where estimated quantities of work required may change significantly during construction; or where offerors would have to expend unusual effort to develop adequate estimates.

(5) Payment paragraphs are required at the front of each section covering work where payment will be broken out into separate bid items. When unit- price payment is used, a measurement paragraph is required to define the unit and the method of verifying quantities.

(6) Prior to final submittal, the bidding schedule or CLIN sheet will be prepared to reflect the cost estimate and will be coordinated with the payment paragraphs to verify that each item is properly covered and that it is perfectly clear how and under which items the various costs are to be included.

e. Section 01 11 00 Summary of Work. The scope of work will be a brief written description of the work involved and will include a listing of approximate quantities, such as "the work includes the construction of a 250,000 square foot administrative building...." The project site shall be located by including the name of the county and state in which the work is done. Also, the appropriate cost range shall be selected by the A-E from the ranges listed below and included at the end of the resume:

(1) less than $25,000

(2) between $25,000 and $100,000

(3) between $100,000 and $250,000

(4) between $250,000 and $500,000

(5) between $500,000 and $1,000,000

(6) between $1,000,000 and $5,000,000

(7) between $5,000,000 and $10,000,000

(8) between $10,000,000 and $25,000,000

(9) between $25,000,000 and $50,000,000

(10) between $50,000,000 and $100,000,000

(11) over $100,000,000

f. Submittal Classification. Most guide specifications include paragraphs requiring the Contractor to submit various items to the Government (see submittal categories in UFGS 01 33 00 SUBMITTAL PROCEDURES). These submittals are either classified Government Approved ("G") or information only. Government approval is required for the items meeting the criteria below, all other submittals should be considered information only.

(1) Extensions of design.

(2) Any items of equipment whose compatibility with the entire system must be checked.

(3) Critical materials and major items of equipment.

(4) Deviations from the contract documents.

3.2.15 Design Analysis.

A design analysis shall be prepared by the designer of record (either in-house or contract) in accordance with the requirements of ER 1110-345-700, Appendix B. The purpose of the design analysis is to substantiate compliance with the customer/contract requirements, applicable codes and standards, and other applicable requirements. The design analysis will document significant design choices. That is, it will address alternative systems, arrangements, and hardware that were considered in arriving at the recommended concept and the rationale for selection of the alternatives recommended. The justification of each major selection and design decision must be stated clearly. Calculations shall be included where required or appropriate to document design choices and code compliance. All computations, calculations or design analysis related to code compliance or life safety should have a block at the beginning of that area with "Prepared By:", "Checked By:", and the names of those who prepared and checked the information. Where the scope of the project changes during the course of design due to changes in customer requirements, such changes will be thoroughly documented in the design analysis. Although the ER specifically lists metric units as the default units of measure, the design analysis on USAESCH projects shall be submitted in the same units of measure (English or metric) used in the design itself. If site conditions are different from those presented in the scope to the extent that customer requirements as stated in the scope cannot be met, the designer shall bring this promptly to the attention of the PM and/or KO for resolution. The problem and its resolution shall be documented thoroughly in the design analysis. Specific items to be addressed in each discipline are described in the individual discipline-specific subparagraphs in paragraph 3.2.

3.2.16 Preparation of Design Bid Build Construction Cost Estimates

3.2.16.1 Purpose and Applicability. This paragraph provides requirements for preparing construction cost estimates for construction contracts (Design Bid Build IGEs). The IGEs will be prepared in accordance with this chapter and the cost engineering references shown in Appendix A.

3.2.16.2 Construction Estimator Qualifications. Cost estimates will be prepared by and reviewed under the supervision of personnel who are competent in cost engineering. Estimators must possess a working knowledge of the work to be performed and be capable of making professional determinations based on experience and education. Professional Registration and Cost Estimating Certification are preferred for the personnel that supervise the performance of the construction cost estimate. Professional Registration and/or Cost Estimating Certification are preferred for the employees developing the estimates. Estimators are expected to be proficient in the TRACES software tools (PACES and MII).

3.2.16.3 Design Bid Build Cost Estimates. Design Bid Build estimates should be developed based upon the stage of the design and should be updated as the design progresses. , The designer should develop a ROM estimate based on unit cost at early stages of design then develop an MII estimate as the details of the design become more clear. All quantities should be developed by the estimator and/or a design engineer and all of those quantities should be verified by an independent source. The final estimate should be an MII estimate based on the highest level of design that will occur for the project. All Work Breakdown Structure Items should be defined and the estimate should have all quantities and assumptions for each WBS items defined in the estimate to a detail sufficient for an independent cost engineer to verify the data. Any exceptions to providing an MII estimate must be received from USAESCH Chief of Design or designee.

3.2.17 Design Signature

3.2.17.1 In-house designs. In accordance with ER 1110-1-8152, the USAESCH Director of Engineering will sign and indicate his/her professional registration on appropriate design documents, permit applications, and certifications, before they are released as ‘final’ outside of USACE. Prior to the Director’s signature, the ITR Team Lead shall certify that the ITR is complete as described in paragraph 4.7.2.3; the appropriate technical Branch Chiefs, Division Chiefs, and the Chief of Design shall sign in the appropriate locations; and a BCOES review shall be completed and certified as described in paragraph 4.8.

3.2.17.2 AE Designs. Design documents, permit applications, and certifications will be signed, dated, and stamped or sealed by appropriately licensed professionals in accordance with ER 1110-1-8152 and the specific contract requirements.

3.2.17.3 Revisions to an approved set of design documents shall be prepared and approved in accordance with Appendix B of this Manual and ER 1110-1-8152, to include documentation of the change to be made and the reasons for making the change. Changes to A-E designs should only be made by the original designers, in order to maintain Designer of Record responsibility and accountability.

3.3 DESIGN-BUILD DESIGN SUBMITTALS.

Applies to formal DB submittals and to Work Plan submittals requiring the approval of a registered professional.

3.3.1 Geotechnical.

In general, the same geotechnical considerations/requirements described in paragraph 3.2.1 for DBB design submittals are applicable to DB design submittals, commensurate with project size and complexity. The Government may supply some geotechnical information and recommendations, either preliminary subject to verification by the DB contractor, or fully developed. If the contract/task order SOW/PWS requires, or the designer recommends and is authorized to conduct, additional geotechnical investigations, the additional investigations shall be conducted in accordance with the considerations described in paragraph 5.4. The contract/task order SOW/PWS together with the contractor's accepted proposal and design plan will define the number and content of design submittals.

3.3.1.1 Drawings. Boring locations and logs shall be shown on the appropriate design packages. Using the "typical" design stages of Interim, Final, and Complete, geotechnical information should be shown as early as available, preferably at the Interim submittal, but this scheme may require adjustment based on the RFP requirements and the contractor's proposed and accepted design plan and package structure.

3.3.1.2 Specifications. DB specifications will be developed in accordance with contract requirements, paragraph 3.3.14, and the contractor's accepted design plan. As for DBB specifications, DB specifications must be coordinated between disciplines and with the design drawings, and must reflect the recommendations of the geotechnical report.

3.3.1.3 Design Analysis. The DB design analysis will be developed in accordance with contract requirements, paragraph 3.3.15, and the contractor's accepted design plan. The designers, in their respective disciplines, must be aware of and incorporate the appropriate recommendations of the geotechnical report, whether provided by the Government or by the DB contractor

3.3.1.4 Special features unique to USAESCH work. The same special features described in paragraph 3.2.1.4 are applicable to DB projects. The contractor should consider, based on the size and complexity of the project and the specific characteristics of the project site, which of these considerations may apply. If in the course of preparing the design it becomes evident that one or several of these requirements may be applicable, but are not included in the contract scope, the contractor should bring this situation promptly to the attention of the Contracting Officer with a recommended solution.

3.3.2 Civil.

The DB contractor's design shall comply with the RFP requirements for the project. The RFP will establish the project criteria, phasing of the project (if the fast-track approach is utilized), number of reviews, percentage of completion for each review and the design detail expected at each submittal. At a minimum the DB contractor will submit Interim, Final and Complete design submittals. The Interim, Final, and Complete submittals are roughly comparable to the DBB Intermediate, Pre-Final and Final design

submittals, respectively, described in paragraph 3.2.2 and subparagraphs. The expected content for each submittal as set forth in the RFP will be reviewed accordingly. The Government's review will confirm the civil design is in compliance with the RFP. During the design process, the civil engineer will consistently coordinate with other design disciplines to ensure no conflict of information is shown on the drawings or in the specifications. Within the civil discipline, the drawings, specifications and design analysis shall not conflict and shall contain all necessary information for procurement, construction and validation of the design. Criteria and requirements for the development of the design analysis, drawings, and specifications are found in ER 1110-345-700, Design Analysis, Drawings and Specifications. General parameters for the Civil design analysis are addressed in Part 2, para. 1. Civil.

Environmental designs for water and waste water facilities, and solid waste and hazardous waste disposal facilities, shall be in accordance with applicable chapters of the following standards:

- UFC 3-230-01 WATER STORAGE, DISTRIBUTION, AND TRANSMISSION
- UFC 3-230-03 WATER TREATMENT
- UFC 3-240-01 WASTEWATER COLLECTION
- UFC 3-240-02 DOMESTIC WASTEWATER TREATMENT
- UFC 3-240-05A SOLID WASTE INCINERATION
- UFC 3-240-10A SANITARY LANDFILL

The designer must always keep in mind that the above listed publications represent minimum standards and design criteria. In the event that local, state, or federal requirements (and sometimes host nation standards) are more stringent, the more stringent requirements govern.

Water systems (i.e., potable water systems) may include sources (wells or surface water service pumps), treatment, storage, and transmission and distribution. Wastewater (both domestic and industrial) systems may include collection, pumping and conveyance, and treatment and disposal facilities. Solid and hazardous waste facilities may include landfills, incinerators, or other disposal/treatment facilities.

3.3.2.1 Drawings. See ER 1110-345-700, Appendix C for standards and requirements.

a. Interim

Civil: The drawings shall be sufficiently complete to demonstrate the functionality of the civil site design, to include water and wastewater systems as well as solid and hazardous waste treatment, storage, or disposal facilities. Unless otherwise provided for in the RFP or contractor's accepted proposal and design plan, the Interim drawings shall generally incorporate the requirements for the Concept and Intermediate submittals described in para. 3.2.2.1.a and b.

b. Final

All drawings shall be the refinement and completion of the Interim design drawings incorporating all comments generated by review of preceding submittals. The intent of the Final submittal should be a complete design, corresponding to the Pre-Final submittal described in para. 3.2.2.1.c, which is submitted to obtain final review and

comment.

c. Complete

All drawings shall be complete in all respects and of sufficient detail to provide for the construction of the project without the need for additional drawings or clarification. The Complete submittal shall incorporate all previous valid comments and ideally should be a minor refinement of the Final submittal. EPA National Pollution Discharge Elimination System (NPDES) permits for construction activities may be required. The DB contractor's design will determine the need for the permit. If the permit is required, the DB contractor will prepare the documentation for the Storm Water Pollution Prevention Plan (SWPPP) and monitoring plan.

3.3.2.2 Specifications.

DB specifications will be developed in accordance with contract requirements, paragraph 3.3.14, and the contractor's accepted design plan.

3.3.2.3 Design Analysis.

A design analysis shall be prepared by the designer of record in accordance with the requirements of ER 1110-345-700, Appendix B and para. 3.3.15. The purpose of the design analysis is to substantiate compliance with the contract requirements, applicable codes and standards, and other applicable requirements. The design analysis will document significant design choices. That is, it will address alternative systems, and configurations that were considered in arriving at the recommended concept and the rationale for selected alternative. The justification of each major selection and design decision shall be clearly stated. The design analysis will document general parameters, serviceability requirements, functional and technical requirements, design criteria, design objectives and design assumptions. Calculations shall be included where required or appropriate to document design choices and code or guidance document compliance. The design analysis shall not conflict with the drawings and specifications and shall contain necessary information to serve as the basis of new facility design.

Calculations will be presented in a clear and legible form. Pages will be numbered consecutively and identified in the table of contents. Cross-referencing will be clear. Critical design information such as service populations, waste characteristics and loadings, flood elevations, etc. shall be identified. All governing assumptions and requirements shall be explicitly stated. All computations will be given a complete numerical and theoretical check and the designers' and reviewers' names and dates of design and review will be recorded on the calculation sheets. For computer modeling the designer will include all applicable input and output data in readable, printed form as part of the design calculations. All computer codes will be identified. Computer-generated procedures and calculations, e.g., spreadsheets, will be verified by hand calculations to verify the procedures used and accuracy of the results, unless such verification has been done on a previous project. All calculations do not have to be verified by hand, but sufficient hand calculations will be performed by the designer to demonstrate the accuracy of the computer calculations and results.

At a minimum the design analysis shall include the information listed below for the various stages of submittals.

a. Interim

The Interim design analysis shall include the basis of design to support the content of

the Interim submittal of the drawings and specifications.

Base all new designs on the most economical plan consistent with the applicable criteria including UFCs and applicable references included therein. Include in the design analysis any assumptions made or source of information if not included in manuals, guides, or instructions. The design analysis shall be sufficiently complete to clearly show project requirements and utility support capacity.

The design analysis shall also include flood protection, wetland mitigation, and related issues, as applicable.

The design analysis shall include a narrative that defines:

- All governing design criteria
- For water systems, the source of water for potable use and fire protection
- For treatment and disposal systems, a description of any pretreatment, treatment, and methods of wastewater disposal from the new facilities
- For solid and hazardous waste systems, a description of the waste disposal facilities required

The design analysis may include catalog cut sheets.

The design analysis shall include, as applicable:

- Piping analyses indicating design flows velocities, pipe sizes, friction factors, slopes for gravity pipes, pipe lengths, and elevations or required depth of cover.
- Flow diagrams depicting process unit operations and treatment units for waste treatment and disposal systems.
- Determination of total dynamic head for pumps incorporating static head, and friction and minor losses.
- For pumps, system-head curves superimposed on manufacturer's pump curves annotating the desired operating point
- For pumping stations with multiple pumps, determine operating points for single and multiple pump operation

b. Final

The design analysis shall include the basis of design to support the content of the Final submittal drawings and specifications and shall incorporate all valid comments from the Interim submittal. All calculations shall be completed, checked, and verified by an engineer competent in the applicable discipline. The intent of the Final submittal should be a complete design analysis which is submitted to obtain final review and comment.

c. Complete

The design analysis shall include the basis of design to support the content of the Complete submittal of the drawings and specifications and shall incorporate all valid comments made from the previous submittals.

3.3.3 Structural.

3.3.3.1 General.

The DB contractor's structural design shall comply with the RFP requirements for the project. The Government's review shall confirm the structural design is in compliance with the RFP. The RFP will establish the project criteria, phasing of the project (if the fast-track approach is utilized), number of reviews, percentage of completion for each review and the design detail expected at each submittal. At a minimum the DB contractor will submit Interim, Final and Complete design submittals. The expected content for each submittal as set forth in the RFP will be reviewed accordingly.

Structural design criteria shall be per the criteria set forth in the DB RFP. In general, structural design shall be in accordance with applicable chapters of UFC 1-200-01 GENERAL BUILDING REQUIREMENTS and UFC 3-301-01 STRUCTURAL ENGINEERING. Structural designs should use material efficiently, provide maximum usable space, minimize the use of special equipment, and utilize conventional methods of construction. Consideration must be given to future uses of the structure, possibilities of alterations, and alternate functions and maintenance costs during the required lifetime of the structure. The structural engineer shall not only consider providing adequate strength for the building or structure, but also serviceability. At a minimum, the structural engineer shall consider the following factors:

- Type of construction (structural system)
- Column locations
- Bracing or shear walls locations
- Floor and roof penetrations
- Floor to floor heights
- Exterior cladding
- Equipment and utility arrangements
- Modifications to existing buildings
- Protective Construction (Antiterrorism and Explosives Safety)

During the design process, the structural engineer will consistently coordinate with other design disciplines to ensure no conflict of information is shown on the drawings or in the specifications. Within the structural discipline, the drawings, specifications and design analysis shall not conflict and shall contain all necessary information for procurement, construction and validation of the design.

3.3.3.2 Drawings

a. Interim

The drawings shall be sufficiently complete to demonstrate the structural system and clearly indicate gravity and lateral load paths to the foundation. At a minimum the drawings shall indicate:

- General Notes providing criteria for general contractor instructions, design criteria and loading, construction material type, special inspections, pre-engineered metal buildings and other items where design is delegated to others. State the fire resistance criteria for all portions of the structural system and identify structural members by fire rated element (column line, wall line)

- identify fire walls, fire barriers and fire partitions as defined in IBC
- plans, sections, elevations and typical details for the foundation, floor and roof.
- plans, elevations, sections and details will have all necessary dimensions to define the locations of the grid lines, offsets and all structural elements, as well as the overall sizes of buildings and structures.
- size of primary structural members for gravity and lateral load resisting system
- typical details for the structural system
- connection details for primary framing members
- reinforcing steel sizes and spacing for all primary concrete framing members.
- specialty items or methods of construction differing from general conventional structural practice. A few examples are base isolation systems, equipment required to be seismically qualified to withstand and operate after or during a seismic event, anchorage of specialized mission critical equipment, protective construction related to antiterrorism and/or explosives safety and new material types

b. Final

The drawings shall be sufficiently complete in detail to demonstrate the entire primary and secondary structural system, including interfaces with other design disciplines. All coordination efforts with other design disciplines will be incorporated into this submittal. With the exception of completing minor details, this submittal could be used for construction. At a minimum the drawings shall indicate:

- content of the 'Interim' submission and all design progress up to point of the Final submission
- complete General Notes providing criteria for general contractor instructions, design criteria and loading, construction material type, special inspections and abbreviations. Identify systems or component parts of the structure where the Designer of Record is delegating the design responsibility to a qualified delegated engineer (see UFC 3-301-01).
- state the fire resistance criteria for all portions of the structural system and identify structural members by fire rated element (column line, wall line)
- identify fire walls, fire barriers and fire partitions as defined in IBC
- if not identified in a performance specification, identify stress or load diagrams for systems or component parts of the structure that are being designed by a delegated engineer
- plans, sections, elevations and details (typical and special) for the foundation, floor and roof.
- foundation plan, floor plan, roof plan and other structural plan will have an alpha-numeric grid system aligned with the columns, or with load bearing

and non-load bearing walls, as applicable. Use the same grid system for all plan views. Grid system will match other design disciplines.

- plans, elevations, sections and details will have all necessary dimensions to define the locations of the grid lines, offsets and all structural elements, as well as the overall sizes of buildings and structures. Dimension shall not conflict with other discipline drawings.
- construction, expansion and contraction joint locations in the floor slab and foundation walls
- control joint locations in Masonry walls
- framing plan for floor and roof including details of all penetrations and openings
- all required schedules, including but not limited to footings, columns, connections, base-plates, beams and joist.
- stair details on multistory structures
- details for specialty items
- all critical structural steel connections will be completely detailed and shown on the contract drawings. Critical connections are those connections subjected to moment, axial and shear loads, or combinations thereof. Only simple connections (i.e., connections classified as shear connections and subjected to shear loads only) may be deferred to the steel fabricator for design and detailing

c. Complete

The drawings shall be sufficiently complete in detail for construction of the project. At a minimum the drawings shall include the minimum content stated above for the 'Final' submission with completion of the minor details lacking to provide complete structural drawings. All valid comments made on the previous submittals are incorporated into this submittal

3.3.3.3 Specifications

DB specifications will be developed in accordance with contract requirements, paragraph 3.3.14, and the contractor's accepted design plan.

3.3.3.4 Design Analysis

See 3.3.15 'Design Analysis' and ER 1110-345-700, Appendix B for guidance in preparation of the structural design analysis. The structural design analysis will document general parameters, serviceability requirements, functional and technical requirements, design criteria, design objectives, design assumptions, and provide design calculations applicable to the project. The design analysis shall not conflict with the drawings and specifications and shall contain necessary information to serve as the basis of design of the structure and structural elements of the project. Copies of emails, memorandums and record of conversations obtained during the design process shall be included as warranted to document basis of design.

Design computations will include an investigation of loading (gravity, wind, seismic, blast, etc.), shear, moment, stress analysis diagram, uplift, stability, and deflection

calculations. The computations will be systematic and accurate. The designer will present the calculations in a clear and legible form, incorporating title page, table of contents, and a tabulation showing all design loads and conditions and load combinations. Pages will be numbered consecutively and identified in the table of contents. Cross-referencing will be clear. The source of loading conditions, formulas, and references will be identified. Assumptions and conclusions will be explained. All computations will be given a complete numerical and theoretical check and the designer's and reviewer's names and dates of design and review will be recorded on the calculation sheets. For computer software analyses, the designer will include all applicable input and output data in readable, printed form as part of the design calculations. The input and output data must be clearly identified by highlighting if left as part of the computer code print out or the information should be copied into clearly identified paragraphs. All computer codes will be identified. Computer-generated procedures and calculations will be verified by hand calculations to verify the procedures used and accuracy of the results, unless this verification has been done on a previous project. All calculations do not have to be verified by hand, but sufficient hand calculations will be performed by the designer to demonstrate the accuracy of the computer calculations and results.

At a minimum the design analysis shall include the information listed below for the various stages of submittals.

a. Interim

The design analysis shall include the basis of design to support the content of the intermediate submittal of the drawings. The design analysis shall:

- include a description of the major structures and type of construction materials
- identify if the project involves the storage, handling or production of ammunition/explosives and alert the team of the time frame for getting the proper explosives safety approval (See Section 5.17.2 'Explosives Safety' and Section 5.10 'Hardened/Protective Construction').
- provide necessary explosives safety information to support a preliminary Explosives Safety Site Plan if applicable to the project (See Section 5.17.2 'Explosives Safety' and Section 5.10 'Hardened/Protective Construction'). Include protective construction calculations needed to support a final Explosives Safety Site Plan submission. The structural design of protective construction elements schedule will be in advance of the remainder of the structural design for the project and be at Final stage of submission
- include the structural design criteria and code/standard references
- include the structural design loads and conditions. Include environmental (wind, snow, rain, seismic) loads, antiterrorism (force protection) and explosives blast loads from accidental or intentional detonations
- include the type and fabrication or construction of the structural system, to include the basis for selection for at least three competitive systems (reference ER 1110-345-700, App B, Part 2, section 4 'Structural', c. (4)). The base installation design guide shall be considered in the selection of the structural system. The basis for selection should at a minimum consider

the ability of the system to adequately resist all structural loads, availability of material, future additions, use of prefabricated building systems and components, costs and skill sets of the labor force. Selection of a system which is not the most economical system must be justified. In the event that design, architectural or functional requirements or site conditions dictate the system selection, a statement to this effect should be included and fully justified.

- clearly describe the vertical and lateral load resisting systems.
- include requirement for special inspections,
- identify pre-fabricated structural items (such as pre-engineered metal buildings, precast concrete panels) and other items where design is delegated to others. Address design responsibilities related to the designer of record and portions of the design that is being delegated to others.
- state the fire resistance criteria for all portions of the structural system.
- describe impacts of specialty items and design considerations (such as the seismic design requirement for a site specific ground motion study) that are potential cost drivers, long lead items or items that require non-conventional design and construction methods including undesirable subsurface conditions
- in coordination with the mechanical and electrical design disciplines, identify equipment requiring seismic qualification. Indicate if the 'seismic functionality' of the equipment (i.e. survive and operate after the seismic event or operate during the event)
- include complete calculations and load path distributions for the primary gravity and lateral load structural systems with the exception of connections.
- include calculations for horizontal diaphragms and bracing to include shear transfer connections.
- include preliminary design of structural connections for the primary gravity and lateral load structural systems
- include preliminary calculations for secondary structural members and exterior cladding
- identify antiterrorism requirements above and beyond the minimum set forth in UFC 4-010-01 'DoD Minimum Antiterrorism Standards for Buildings'.
- include narratives how each applicable UFC 4-010-01 Anti-Terrorism Standard, related to the structural discipline, is met.
- include identification of applicable explosive weights (I, II and III) and levels of protection in accordance with UFC 4-010-01
- include information (test data or analyses) on blast resistant window systems
- include structural calculations for blast resistant window supporting structural elements and connections or test results in accordance with UFC 4-010-01.

- in accordance with UFC 4-010-01, include building element structural analysis or design calculations in the following cases: 1) where standoff distances are less than the conventional construction standoff; 2) where walls or roof construction does not meet the conventional construction parameters in UFC 4-010-01 Table 2-3.

b. Final

The design analysis shall include the basis of design to support the content of the Final submittal of the drawings and incorporate all valid comments from the previous submittals. All structural calculations shall be completed and check by a qualified senior engineer. Only minor changes are expected between this stage of completion and final submission.

The design analysis shall:

- include all items previously identified in the Interim submittal and all design progress up to the final submission
- include complete design of structural connections for the primary gravity and lateral load structural systems
- include complete calculations for secondary structural members and exterior cladding
- identify all structural elements and components where the design will be delegated to others. Clearly indicate interface points of the structure between the designer of record and the qualified design of delegated components.
- include calculations that indicate an independent technical review by a qualified structural engineer to ensure quality control

c. Complete

The design analysis shall include the basis of design to support the content of the complete submittal of the drawings and specifications and shall incorporate all valid comments made on the pre-final submission. All structural calculations shall be completed and check by a qualified senior engineer.

3.3.4 Architectural Design-Build Design Submittals.

The DB contractor's architectural design shall comply with the RFP requirements for the project. The Government's review shall confirm the architectural design is in compliance with the RFP. The RFP will establish the project criteria, phasing of the project (if the fast-track approach is utilized), number of reviews, percentage of completion for each review and the design detail expected at each submittal. At a minimum the DB contractor will submit Interim, Final and Complete design submittals. The expected content for each submittal as set forth in the RFP will be reviewed accordingly.

Architectural design criteria shall be per the criteria set forth in the DB RFP. In general, architectural design shall orchestrate the construction requirements of the RFP, shall be in accordance with applicable chapters of UFC 1-200-01 'GENERAL BUILDING REQUIREMENTS', UFC 3-101-01 'ARCHITECTURE', and UFC 3-110-03, 'ROOFING'. Architectural designs shall cover planned and programmatic requirements of user, building envelope requirements, specific material construction requirements, meet

relevant codes and government requirements in accordance with the contract or directive. Each design-build submittal shall also meet the life-safety codes, building codes, material/assembly listing requirements, architectural barriers act, anti-terrorism/force protection requirements, and any relevant requirement for standard construction of the chosen building system. Unless otherwise directed, design should produce a facility with a 50 year life expectancy and no major update until after 25 years of use.

During the design process, the architect will consistently coordinate with other design disciplines to ensure no conflict of information is shown on the drawings or in the specifications. Within the architectural discipline, the drawings, specifications and design analysis shall not conflict and shall contain all necessary information for procurement, construction and validation of the design.

3.3.4.1 Architectural Design-Build Drawing Requirements

a. Interim

The drawings shall be sufficiently complete to demonstrate the functionality and materials used for the project. The Design Build interim drawings shall at a minimum show:

- Schematic floor plans, roof plans, reflected ceiling plans, and siting plan. Plans shall elaborate space planning, building area (s.f.), building orientation and materials used on the project.
- Identify smoke and fire walls, barriers and partitions as defined in UFC 3-600-01 'FIRE PROTECTION ENGINEERING FOR FACILITIES', the IBC and NFPA 101.
- Life Safety plans shall show egress, exits, travel distance, maximum dead-end corridors and solutions to all NFPA 101 requirements of the project.
- Overall dimensions on plans and elevations.
- Elevations that show building mass, appearance and exterior building materials. Architectural style and character shall be communicated at the interim stage.
- Building and wall sections that demonstrate building envelope materials, construction and relation to major structural systems.
- Schedules for doors, windows and equipment.
- Interior elevations to show difficult construction and placement of fixtures and equipment.
- Enough detail of the layout, massing and materials to ensure the constructability of the project.

b. Final

The drawings shall be sufficiently complete in detail to construct the facility. All coordination efforts with other design disciplines will be incorporated into this submittal. All comments from previous review shall be incorporated. At a minimum the drawings shall indicate:

- Content of the 'Interim' submission and all design progress up to the point of

the Final submission.

- Complete notes on drawings, including general notes throughout set.
- Complete dimensioned plans, elevations, sections, details and any portion of drawing(s) that requires placement information to be constructed both horizontally and vertically.
- Fully developed layout of floor plans, roof plans, reflected ceiling plans.
- Finalized elevations of the building that building trades can delineate height, width and extent of all exterior finish materials, placement of fenestration and relation of exterior elements of building.
- Finalized wall sections and details for plans, sections and elevations.
- Complete selection and schedules for windows, doors, hardware and corresponding details for attachment to building.
- Scheduled interior and exterior finishes.
- Complete interior elevations to determine finishes-type and extent, and placement of equipment.
- Scheduled doors, windows, hardware and details for installation.
- Drawings shall detail any sustainable building components such as continuous insulation, thermal breaks, air barriers and transitions.
- Drawings shall account for architectural barriers handicap accessibility requirements.
- Drawings will be fully coordinated with specifications and other disciplines.

c. Complete

The drawings shall be sufficiently complete in detail for construction of the project. At a minimum the drawings shall include the minimum content stated above for the 'Final' submission with completion of the minor details lacking to provide complete structural drawings. All valid comments made on the previous submittals are incorporated into this submittal.

3.3.4.2 Architectural Design-Build Specification Requirements

DB specifications will be developed in accordance with contract requirements, paragraph 3.3.14, and the contractor's accepted design plan.

3.3.4.3 Architectural Design Analysis Requirements

Reference paragraph 3.2.4.3 Architectural Design Analysis Requirements for designs and paragraph 3.3.15 Design Analysis.. Design analysis should cover the same information, showing some notes and calculations on drawings is acceptable.

a. Interim

The Design Analysis will be a narrative presentation of the facts sufficiently complete to demonstrate that the project concept is fully understood and that subsequent design details in the final drawings and specifications will be based on sound architectural and engineering decisions. The design analysis should be developed from Concept Design to include a discussion of any new or unfamiliar products, critical product features,

critical milestones that may require designer consultation, items of particular customer interest revealed in design meetings, shop drawings of particular interest or criticality, anticipated difficult construction features.

b. Final

The design analysis is a written explanation of the project design and is expanded and revised for each submission. The design analysis shall contain a summary of the criteria for and the history of the project design, including criteria designated by the customer, letters, codes, references, conference minutes, and pertinent research. The justification for each major selection and design decision shall be clearly stated. Design calculations, computerized and manual, shall be included in the design analysis in digital format. Narrative descriptions of design solutions shall also be included. Diagrams and sketches to convey design concepts may be provided to illustrate all written material. Design phase review comments and the specific actions (annotations) taken in response to each comment from the preceding design phase review shall be included with each submission of the design analysis. A separate section with pertinent notes to the Resident Engineer shall also be included. State the purpose, function, and capacities in sufficient detail to delineate and characterize functional features and the desired image or visual appearance of the project. The narrative shall reflect the regional architecture as well as the visual characteristics of the existing facilities around the site. Include also, a statement of any requirements for the physically handicapped and signage plans or graphics. Provide a brief statement of the exterior finish materials to be used in the project. Provide discussions which address coordination between other disciplines such as antiterrorism, geotechnical, environmental, hazardous materials abatements, structural, civil, mechanical, electrical, fire protection, plumbing, sustainable design. The Design Analysis shall include or respond to the current DD 1391 information and any other documents that aid in the definition of the project specific scope of work. Additionally, appendices for all meeting notes, telephone conversation records, emails, facsimiles and other correspondence shall be included that detail the design decisions and direction.

c. Complete

The design analysis shall include the basis of design to support the complete submittal of the drawings and specifications and shall incorporate all valid comments made on the final or interim submission.

3.3.5 Interior Design.

The DB contractor shall provide Interior Design for the project in full compliance with the RFP. The RFP will establish the project requirements for interior finish and material requirements, space utilization, personnel requirements, FF&E requirements and an FF&E acquisition strategy, as well as performance specifications for the SID and the FF&E. The DB contractor shall provide a Comprehensive Interior Design in compliance with the RFP to include both the Structural Interior Design (SID) and the Furniture, Fixtures & Equipment (FF&E) design. The DB process for Interior Design shall be in accordance with the applicable chapters of UFC 1-200-01 GENERAL BUILDING REQUIREMENTS and UFC 3-120-10 INTERIOR DESIGN. The government's interior design review shall confirm that the SID and FF&E are in compliance with the RFP and meet the design and functional intent of the project.

The DB contractor is responsible for Interior Design that produces fully coordinated SID and FF&E design efforts that are integrated with the other design disciplines in the

project (architecture, electrical, mechanical and fire protection). The Interior Design shall be developed in full compliance with the RFP and shall comply with all applicable codes, regulations and laws. The SID and FF&E shall fully satisfy the design scheme and functional requirements of the project and produce a design within the funding limits of the project. The DB contractor shall provide a CID that utilizes best practices and principles in Interior Design, incorporates sustainable design principles and energy conservation methods into the design, considers life cycle cost analysis in the design solution, and incorporates best practices for maintainability of facilities and furnishings in compliance with the RFP. Within the Interior Design discipline, the drawings, specifications and design analysis shall not conflict and shall contain all necessary information for procurement, construction and validation of the design.

3.3.5.1 Drawings

a. Interim

The drawings shall be sufficiently complete to clearly indicate the functional, physical and aesthetic needs of the project in accordance with the RFP. The SID and the FF&E layout shall be developed and coordinated with other interfacing design disciplines. At a minimum, the drawings shall include:

- Finish Floor Plan
- Reflected Ceiling Plan
- Key Interior Elevations for Finish Applications
- Finish Schedule and Material Key
- Furniture and Equipment Layout
- FF&E Schedule and Key

b. Final

The drawings shall be sufficiently complete in detail to demonstrate the full SID and FF&E design to clearly convey the functional and aesthetic requirements and design solution to the project. The drawings shall be fully coordinated with all design disciplines to ensure successful execution of the construction. At a minimum, the drawings shall include:

- Finish Floor Plans, including design of all finish materials, transitions, notes, dimensions
- Reflected Ceiling Plan, including design of all finish materials, transitions, notes, dimensions
- Interior Elevations to convey the design and application of wall finishes, transitions, notes, dimensions
- Sections and Details as required to fully document the design
- Finish Schedule, keys, Legends
- Interior Design and Finish Notes
- Furniture and Equipment Layout coordinated with MEP

c. Complete

The drawings shall be sufficiently complete in detail for construction of the project for both SID and FF&E. At a minimum, the drawings shall include the minimum content stated above for the "Final" submission with completion of minor details and notes. All comments shall be addressed and incorporated into the design if applicable.

3.3.5.2 Specifications

See para 3.2.5.2 "Specification" and para 3.3.14 "Specifications" for guidance in preparation of the interior design specifications.

3.3.5.3 Design Analysis

See 3.2.5.3 Design Analysis (for ID DBB), paragraph 3.3.15 Design Analysis (for DB) and ER 1110-345-700, Appendix B for guidance in preparation of the Interior Design design analysis. The Interior Design design analysis will document general parameters, functional and technical requirements, design criteria, design objectives, design assumptions, design aesthetics and provide sustainability, energy conservation and life cycle cost factors applicable to the project. The design analysis shall not conflict with the drawings and specifications and shall contain necessary information to serve as the basis of design of the Structural Interior Design (SID) and the Furniture, Fixtures and Equipment (FF&E) design. Copies of emails, meeting minutes, memorandums and record of conversations obtained during the design process shall be included as warranted to document basis of design.

At a minimum, the design analysis shall include the information listed below for the various stages of submittals:

a. Interim

b. The design analysis shall define Interior Design best practices and principles in accordance with USACE and industry standards. The analysis shall include a general description of the project, the purpose and objective of the design, and define basic functional and spatial requirements of the project to baseline the design program statement and the proposed approach solution. The design analysis shall include:

- A program statement identifying the functional needs of the customer their primary and secondary spatial relations
- Define space allocations
- Address flexible design options for future reutilization of the facility
- Address sustainability, energy conservation and tlife cycle cost analysis approaches to be used in the design
- Describe the noise control criteria established in the SID and FF&E
- Address full code compliance to ensure safety and accessibility in accordance with the latest requirements of OSHA, ADA/ABA, ADAAG and UFAS

c. Final

The design analysis shall include basis of design to support the content of the Final submittal of the drawings and specifications and incorporate all valid comments from the

previous submittals. Revisions should be minor. Incorporate any revisions into the design analysis. Incorporate or address any review comments received prior to this submittal.

d. Complete

The design analysis shall be primarily complete prior to this submittal and shall include the basis of design to support the content of the complete submittal of the drawings and specifications and shall incorporate all valid comments made on the pre-final submission.

3.3.6 Fire Protection.

All designs must comply with UFC 3-600-01. Unless the project scope of work specifies the performance design of the fire protection system, the designer will show all information necessary to construct the fire protection system(s) ("total design"). The information provided will be detailed to the extent that the construction contractor will only provide shop drawings that show compliance with the contract requirements. Where the project SOW specifies the "performance design" of a water sprinkler system, the designer will include the following in the contract documents: water system supply curve plotted on semi-logarithmic paper, occupancy classification, design density, design area, hose stream (where applicable), and duration of the water supply. The performance design will include adequate hydraulic calculations to determine if the facility will require fire pumps or water storage tanks. If calculations demonstrate the need for either item, the designer will include in detail, the necessary items in the design. The designer will ensure that all designs provide the most cost effective fire protection that complies with all applicable requirements and does not increase the risk of property damage or adversely impact life safety considerations. A qualified Fire Protection Engineer (FPE) is required to be a member of the design team for projects involving any feature identified by UFC 3-600-01 paragraph 1-5, other than minor sprinkler head relocation or like-kind sprinkler head replacement. At the Final Design stage, the FPE will provide a letter/statement certifying that the plans and specifications are in compliance with UFC 3-600-01 and all applicable criteria. The project FPE is required to seal construction drawings and calculations and review stamp fire protection shop drawings

3.3.6.1 Drawings

a. Interim

For either "performance" or "total" design concept drawings, the information specified above for "performance design" of a water sprinkler system, or the equivalent information for other extinguishing systems will be submitted. Equipment will be drawn to scale.

b. Final

The layout plan of all equipment and piping will be shown. Section and detail views will be identified. Maintenance access areas will be identified. The performance requirements of all equipment will be included in an appropriate schedule. A sequence of operation will be included where required to clearly understand the function or operation of any systems or equipment. All equipment will be shown in detail. Where equipment connection details are shown, all valves, gauges, and fittings required by the specifications or otherwise required will be shown. For proper operation and maintenance of the equipment, adequate space will be allotted based on the

requirements in the catalog cuts furnished above. Clearances or access required for proper operation and maintenance will be shown on the drawings. Sections, elevations, and details of mechanical rooms and all other congested areas will be provided where required for clarity and coordination. All piping within the mechanical room and all other congested areas will be drawn double-line (to scale). All supports, other than standard piping supports, will be shown on the drawings and clearly detailed. Flow diagrams and/or isometrics and sequences of operation will also be provided as needed for clarity. Fire protection drawings will not contain information pertaining to other disciplines, except where required for reference or coordination.

(1) For "performance design," the final drawings will be updated to reflect any changes made to the design since the interim submittal.

(2) For "total design," the ~~intermediate~~ final drawings will be expanded to include the location of all sprinklers, risers, and piping, or the equivalent information for other extinguishing systems. Center-to-center dimensions between sprinklers on branch lines and between branch lines, from end sprinklers to adjacent walls, from walls to branch lines, from sprinkler feed mains and cross mains and branch lines to finished floors and roof or ceiling will be shown. Sections will be included that show typical branch line and cross main pipe routing as well as the elevation above finished floor for typical sprinklers.

c. Complete

A complete drawing submittal will include the incorporation of all valid comments and completion of all details.

Where required, a registered Fire Protection Engineer will provide a letter/statement certifying that the plans and specifications are in compliance with UFC 3-600-01 and all applicable codes.

Where required, a registered Fire Protection Engineer will seal construction drawings.

3.3.6.2 Specifications.

DB specifications will be developed in accordance with contract requirements, paragraph 3.3.14, and the contractor’s accepted design plan.

3.3.6.3 Design Analysis Calculations

a. Interim

For "total" or "performance design" of water sprinkler systems, the hydraulic calculations specified above for "performance" designs will be submitted at this stage. An equivalent level of information will be submitted at this stage for other extinguishing systems. The calculations required for a "performance design" should be essentially complete at this point. The source for each equation used will be listed, including title, chapter, equation number, etc.

b. Final

Calculations should be complete at this stage for all extinguishing systems. The interim calculations will be updated to reflect any changes made to the design since the interim submittal. The basis for changes will be documented. Catalog cuts from at least three vendors, sufficient in detail to demonstrate compliance with all contract requirements including the contract specifications, will be included for all major items of equipment.

For "total design" of water sprinkler systems, completed hydraulic calculations or the equivalent information for other extinguishing systems will be submitted. The calculations will substantiate that the design area indicated is, in fact, the most hydraulically demanding. Computer prepared hydraulic calculations will have a cover sheet that includes design input and provides an explanation of output generated. Output will include a plot of the water system supply and the sprinkler system demand curves plotted on semi-logarithmic paper. Computer software which uses typical k-factors for branch lines will not be used. All calculations will be accompanied by sketches that identify areas, nodes, piping segments, etc., used in the calculations to facilitate review.

c. Complete

A complete specification submittal will include the incorporation of all valid comments and completion of all details.

Where required, a registered Fire Protection Engineer will seal construction calculations.

3.3.6.4 Design Analysis General Description

a. Interim

A description of the system(s) to be used along with a list of standards (including date and reference to applicable sections or paragraphs) upon which the design is based will be submitted. A preliminary version of the Fire Protection Design Analysis in accordance with UFC 3-600-01 will be included.

b. Final

The interim description will be updated to reflect any changes made to the design since the interim submittal. The basis for changes will be documented. Include the final draft of the Fire Protection Design Analysis in accordance with UFC 3-600-01.

c. Complete

A complete design analysis general description submittal will include the incorporation of all valid comments and completion of all details.

3.3.7 Plumbing

3.3.7.1 Drawings

a. Interim

The drawings will include plumbing fixture layout, floor and area drains, and single-line piping and equipment layout. All equipment will be drawn to scale. Preliminary performance requirements of all equipment will be included in appropriate schedules.

b. Final

The drawings provided at interim submittal will be updated to include the piping plan and piping isometrics for the water and waste/vent systems. Drawings shall be coordinated with other non-plumbing systems such as providing floor drains for air handling units, natural gas lines for HVAC equipment, and makeup water for HVAC systems. Drawings will typically show natural gas piping systems even when they are part of non-plumbing systems such as building heating systems. Backflow prevention devices and trap primer devices shall be shown on drawings.

A plumbing fixture schedule will be provided that lists individual fixtures and the size of

all piping connections (cold water, hot water, vent, and waste). The performance requirements of all equipment will be included in an appropriate schedule. A sequence of operation will be included, where required, to clearly understand the function or operation of any systems or equipment. All equipment will be shown in detail. Where equipment connection details are shown, all valves, gauges, and fittings required by the specifications or by other standards will be shown. For proper operation and maintenance of the equipment, adequate space will be allotted based on the requirements in the catalog cuts furnished above. Clearances or access required for proper operation and maintenance will be shown on the drawings. Sections, elevations, and details of mechanical rooms and all other congested areas will be provided as necessary for clarity and coordination. All supports, other than standard piping supports, will be shown on the drawings and clearly detailed. Isometrics and sequences of operation will also be provided as needed for clarity. Plumbing drawings will not contain information pertaining to other disciplines, except where required for reference or coordination.

Drawings will be sealed by a mechanical professional engineer where required by contract.

c. Complete

A complete drawing submittal will include the incorporation of all valid comments and completion of all details.

3.3.7.2 Specifications

DB specifications will be developed in accordance with contract requirements, paragraph 3.3.14, and the contractor's accepted design plan.

3.3.7.3 Design Analysis and Design Analysis Calculations

a. Interim

A description of the system(s) to be used along with a list of standards (including date and reference to applicable sections or paragraphs) upon which the design is based will be submitted.

The number and type of plumbing fixtures required will be provided along with calculations to determine the cold and hot water load (flow) requirements. The types and capacity requirements for drainage systems will also be included. Calculations necessary to determine equipment capacities and their corresponding utility requirements will be provided. To facilitate review, all calculations will be accompanied by sketches that identify nodes, piping segments, etc., used in the calculations. The source of each equation used will be listed, including title, chapter, equation number, etc. Where connecting to existing systems, calculations will be provided to show that existing systems have adequate capacity to handle additional new loads. Calculations related to water conservation features such as gray water systems and solar preheat systems will be included.

The design analysis shall also determine applicability and address any sustainability requirements for all projects as required by UFC 1-200-02 High Performance and Sustainable Building Requirements. The design analysis will include an evaluation of Table 1-1 in UFC 1-200-02 to determine what, if any, chapters apply to this design. The design analysis should also include a narrative description of how the design will address the specific requirements of UFC 1-200-02 that are applicable.

b. Final

All pipe sizing calculations should be completed and submitted. For all pipes, the calculations will include design flow (in gpm or liters per second and fixture units), pipe size, velocity, friction factors, slopes, lengths and the pressure and flow available at each fixture at designed conditions. Water heating system demand and storage calculations will be provided. Compressed air, natural gas, and other plumbing systems will include design flow, pipe sizing, and storage tank sizing calculations. Catalog cuts sufficient in detail to demonstrate compliance with all contract requirements, including the contract specifications from at least one vendor, will be included for all major items of equipment.

c. Complete

A complete design analysis and calculation submittal will include the incorporation of all valid comments and completion of all details.

3.3.8 Process.

3.3.8.1 Drawings

a. Interim

The interim submittal will include drawings with sufficient information to indicate the envelope that the equipment requires. Electric and other utilities required will be identified. Provide scaled floor plans for all support facilities with major pieces of equipment located. Process flow drawings (PFD) and piping and instrumentation diagrams (P&ID) will be provided. Piping plan drawings will depict the routing of major lines.

b. Final

This submittal will have the equipment outline clearly defined on the plans with locating dimensions given from walls or columns. Section and detail views will be included if sufficient information is available. Process and Utility Diagrams showing pipe sizes, equipment and control devices; equipment lists; comprehensive functional and operational system description of the control system, and site plan showing all site elements. At the intermediate submittal PFD's and P&ID's will be complete. PFD's will have the flow rates for all process lines identified for the design conditions. P&ID's will have all lines sized and numbered; instrumentation identified including tag numbers. Piping plan drawings will be provided that show the routing of all lines along with pipe identification numbers. Elevation and detail drawings will be started but are not expected to be complete at this time. When equipment is furnished by other than the construction contractor, the interface will be clearly identified. Any areas on hold awaiting information will be identified.

Piping System Drawings. Piping drawings will include plans and elevations of the piping runs with the location of expansion devices, anchors, and changes in direction indicated and located on both the plans and elevations. Sufficient detail will also be provided to ensure interface definition between piping systems and contractor and Government-furnished equipment. A process and instrumentation diagram showing the system control components and instrumentation will be provided for each process piping system. Instrumentation symbols used will be in accordance with Instrumentation and Symbols Standard (ISA-S5.1).

- Piping Details. Piping details will be shown in isometric wherever practical.

- Computer-Developed Drawings. Computer-developed pipe detail drawings will be used when possible.
- Miscellaneous. Pipelines, valves, controllers, and instrumentation will be numbered on the drawings. A pipeline and valve listing will be provided.
- Details will be furnished for supports, anchors, pipe sleeve closures, valve pits, guides, and other such features.

c. Complete

The drawings shall be sufficiently complete in detail for construction of the project. At a minimum the drawings shall include the minimum content stated above for the 'Final' submission with completion of the minor details lacking to provide complete process drawings. All valid comments made on the previous submittals are incorporated into this submittal.

3.3.8.2 Specifications

DB specifications will be developed in accordance with contract requirements, paragraph 3.3.14, and the contractor's accepted design plan.

3.3.8.3 Design Analysis

a. Interim

A design analysis will be furnished by the designer for all major items of equipment. The parameters, calculations, and rationale used for selecting the equipment will be identified, and at least, three manufacturers' names and the model numbers of their equipment will be provided to verify that competition is available. Catalog cuts from at least one manufacturer will be provided to demonstrate compliance with project requirements. A process description, site concepts or layouts, control systems concept, and code analysis as applicable for each will be furnished by the designer.

- The designer will document the required capability of material handling equipment to fulfill mission requirements and ensure the equipment has built-in safety features. Material Handling covers items such as elevators, pneumatic-tube systems, monorails, overhead cranes, etc.
- Seismic Design. Seismic design of piping, equipment, supports, and anchors will conform to UFC 3-310-04. (Coordinate requirements with Structural.)
- Noise Control. Design work will be in accordance with UFC 3-450-01 and UFC 3-450-02.
- Special Conditions
    - Hazardous Facilities. Hazardous facilities require special design considerations which include selecting equipment items and materials that prevent damage and hazards to personnel and facilities. Hazards may be created by corrosive acids, explosions, fire, lethal gases, or other causes. AMC-R 385-100 will be used for designing facilities where hazardous (but non-nuclear) munitions materials will be manufactured, processed, stored, handled, or transported within a facility. The safety requirements

of the American Petroleum Institute may be imposed for facilities associated with petroleum products or with the conversion of one energy form into another.

- o Hazardous and Toxic Waste. Hazardous and toxic wastes piped underground must have double containment and meet the requirements of Resource Conservation and Recovery Act (RCRA).

b. Final

Calculations will be included for the sizing of all equipment and major distribution lines.

(1) Alignment. The horizontal and vertical alignment of the piping will be carefully planned to use the inherent flexibility of the pipe to absorb expansion. Consideration will be given to road crossings and other obstructions in the route of the piping.

(2) Expansion. The design of flexibility of the system, will consider the maximum and minimum temperatures to which the line will be exposed. This will include not only environmental temperature, but temperatures of cleaning processes such as steam or vapor cleaning. Ample provision will be made for such temperature ranges, and this will be covered by the design analysis. Where expansion of piping will be absorbed by using the inherent flexibility of the piping or by providing expansion loops and bends, the pipe expansion stresses will be calculated by a standard method used in industry. Where computer analysis is used, the analysis will include a user's manual and a sample problem.

(3) Supports. Supports for above ground piping will be designed with full allowances for the movement and forces developed by the piping either during operation, testing, cleaning, or shock loading, whichever is the most severe condition. Supports will be of ample strength to withstand the forces developed by the piping. Supports will be designed to allow free movement of the piping during expansion and to adequately guide the line without binding it. Support design will incorporate stock or production parts, provided they conform to the requirements of design loads and are commonly used. Accurate stress and weight balance calculations will be made to determine forces and movements at each support point, anchor, and equipment connection. Vibration and shock loads will be examined in detail and accommodated. All calculations will be included in the design analysis.

(4) Anchors. Pipe anchors will be designed to withstand the maximum forces developed by the pipe system during the most severe condition of either regular operation, testing, shock loading, or cleaning. Anchors will be proportioned to not less than twice the section modulus of the pipe. Design calculations for anchors will be a part of the design analysis. These calculations should show forces, assumptions, soil bearing values, etc. When it is necessary to use a bellows type expansion device, anchors and supports will be designed to take the full pressure thrust at the highest pressure to which the line will be subjected, either in normal operation or during the pressure testing.

(5) Drainage and Sectionalizing. System operation conditions will be taken into consideration when designing the drainage points and sectionalizing. If a system is to be cleaned in place, the line will be capable of being divided into short sections for ease of cleaning without cutting the piping. Drains will be located at low points, and if they are to be used for cleaning or flushing, they will be large enough to ensure adequate flow. Horizontal pipe runs will be pitched for gravity drain in the desired direction.

c. Complete

The design analysis shall include the basis of design to support the content of the complete submittal of the drawings and specifications and shall incorporate all valid comments made on the pre-final submission. All process calculations shall be completed and checked by a qualified senior engineer.

3.3.8.4 Other Considerations

- Cleaning. The details of the cleaning processes and the number and location of cleanings will be specified. The specification will call out the degree of inspection and will require the use of approved cleaning facilities. The contractor will be required to provide detailed cleaning procedures before piping is cleaned. Pipe or components cleaned in a shop off the job will be sealed against contamination through use of a substantial sealing method.
- Components. Components such as valves, strainers, gauges, and other devices will be specified in detail with pressure or temperature rating, size, capacity, pressure, and temperature ranges; test pressures, tolerances, and materials will be called out. Components will be cleaned to the specified cleanliness level at the manufacturer's plant; they will be sealed and packaged so as to arrive on the job site in the specified clean condition.
- Inspection. Methods and degree of cleanliness and welding inspection will be specified. Generally, welding inspections will consist of visual and radiographic or other nondestructive inspection. The method of testing and the standards used will be documented.
- Testing. Detailed requirements will be specified for pressure testing, leak testing, and operational testing. Test requirements for components such as leak testing and proof testing will be called out in detail. Operational tests will also be indicated. Records of tests will be made and a reproducible copy turned over to the contracting officer. Performance and other tests of valves, strainers, etc., will require certification with copies furnished the contracting officer.
- Piping Connections. The method of making piping connections will be specified. Welding and inspection of welding will be in accordance with the ASME Boiler and Pressure Vessel Code, ANSI Piping Code, and the American Welding Society Standards. A requirement for welding procedure, welding operator, and welder qualification and identification will be specified. No unqualified procedure or welder will be used. Detailed requirements for welding will be specified.

- Protective Coatings. Protective coatings for both aboveground and underground piping will be specified with appropriate test procedures.
- Materials. The options on materials for the piping systems will be furnished as part of the design criteria.
- Piping Identification. Requirements for piping identification will be specified.

3.3.9 Mechanical.

3.3.9.1 Drawings

a. Interim

A single-line layout will be provided for all equipment, ductwork, and piping. Equipment will be drawn to scale. Preliminary performance requirements of all equipment will be included in appropriate schedules. A preliminary sequence of operation for each system will be included on the drawings.

b. Final

The drawings provided at concept submittal will be updated to include the equipment, piping and duct locations. Equipment schedules will include information available based on the calculations. Ductwork shall be shown with double lines and all fire/smoke dampers shall be located. Sequence of Operation will be expanded to address all major control sequences.

The performance requirements of all equipment will be included in appropriate schedules. A sequence of operation will be included where required to clearly understand the function or operation of any systems or equipment. All equipment will be shown in detail. Where equipment connection details are shown, show all valves, gauges, and fittings, required by the specifications or otherwise required. For proper operation and maintenance of the equipment, adequate space will be allotted based on the requirements in the catalog cuts furnished above. Clearances or access required for proper operation and maintenance will be shown on the drawings. Sections, elevations, and details will be provided for mechanical rooms and all other congested areas where required for clarity, coordination, or detail. All piping and ductwork within the mechanical room and all other congested areas will be drawn double-line (to scale) with exterior dimensions that reflect any required insulation. All supports, other than standard ductwork or piping supports, will be shown on the drawings and clearly detailed. A flow diagram and sequence of operation will be provided for each system. HVAC drawings will not contain any information pertaining to other disciplines, except where required for reference or coordination.

Drawings will be coordinated with specifications to show all items by which the specifications refer to the drawings for additional visual detail.

Drawings will be sealed by a mechanical professional engineer where required by contract.

c. Complete

A complete drawing submittal will include the incorporation of all valid comments and completion of all details.

3.3.9.2 Specifications

DB specifications will be developed in accordance with contract requirements, paragraph 3.3.14, and the contractor's accepted design plan.

3.3.9.3 Design Analysis

a. Interim

The description of the system(s) will include the indoor and outdoor design conditions will be listed for each area. Outdoor design conditions will be selected for dry bulb temperature and cross-checked for peak humidity ratio conditions when sizing systems that may be primarily intended to control temperature. Peak humidity ratio will be used when sizing dehumidification systems. Where energy from an existing plant is to be used, verification will be included that capacity, availability, and the reliability of the plant are adequate to serve the intended loads. As a minimum, block loads that take into account all loads that will influence equipment size will be submitted for each system. All calculations will be accompanied by sketches that identify nodes, piping, or duct-work segments, etc., used in the calculations to facilitate review. The size of major pipe and duct mains will be included. The source for each equation used will be listed, including title, chapter, equation number, etc. Where connecting to existing systems, calculations will be provided to show that existing systems have adequate capacity to handle additional new loads. The design analysis will reference the building seismic design analysis where seismic hazards exist and determine whether mechanical system piping, equipment, and ductwork must be braced according to seismic hazard level A, B, C, or D per latest edition of SMACNA Seismic Restraint Manual.

The design analysis shall also determine applicability and address any sustainability requirements for all projects as required by UFC 1-200-02 High Performance and Sustainable Building Requirements. The design analysis will include an evaluation of Table 1-1 in UFC 1-200-02 to determine what, if any, chapters apply to this design. The design analysis should also include a narrative description of how the design will address the specific requirements of UFC 1-200-02 that are applicable. New construction, new addition, and major renovation (as defined in UFC 1-200-02 dated 01 March 2013, Table 1-1) will typically include (but not be limited to) the following deliverables (see UFC 3-410-01):

- Energy Cost Budget (ECB) Compliance Report as shown in Appendix G of ASHRAE 90.1 User's Manual including backup calculations.
- Life Cycle Cost Analysis (LCCA) narrative including calculations for specific conservation measures that exceed requirements.
- ASHRAE Standard 62.1 ventilation analysis including detailed calculations.

Minor renovation projects will typically include ASHRAE Standard 62.1 ventilation analysis including detailed calculations

b. Final

Calculations will be included for the sizing of all equipment and major air and water distribution lines. Design analysis shall determine whether ASHRAE Standard 15 Safety Standard for Refrigeration Systems is applicable.

All pipe sizing calculations will be completed at this stage. For all pipes, the calculations will include design flow (over the entire range where applicable), duct size, velocity, slope (if applicable), length and all pertinent details relative to the calculation method used. The entering and leaving design conditions at each piece of equipment (over the

entire operating range where applicable) will be listed. The cycle of each heating and/or cooling system will be plotted on a psychometric chart with each point on the chart cross-referenced to the corresponding point in the system. Individual room heat gain/loss calculations will be made. The extrapolation of "typical" room calculations or the proration of block load calculations will not be permitted. A completed ventilation analysis based on the requirements listed in UFC 3-410-01FA will be provided. Catalog cuts sufficient in detail to demonstrate compliance with all contract requirements, including the contract specifications, will be included for all major items of equipment.

c. Complete

A complete design analysis submittal will include the incorporation of all valid comments and completion of all details.

3.3.10 Electrical.

DB contractor's electrical design shall comply with the RFP requirements for the project. The Government's review shall confirm the electrical design is in compliance with the RFP. The RFP will establish the project criteria, phasing of the project (if the fast-track approach is utilized), number of reviews, percentage of completion for each review and the design detail expected at each submittal. At a minimum the DB contractor will submit Interim, Final and Complete design submittals. The expected content for each submittal as set forth in the RFP will be reviewed accordingly.

Electrical design shall be in accordance with paragraph 3.2.10 Electrical of this manual.

3.3.10.1 Drawings shall be submitted in accordance with 3.2.10.1 of this manual.

a. Interim drawings shall include the combined requirements for parametric, concept and intermediate drawings as specified in 3.2.10.1

b. Final drawings shall include all the drawings required by 3.3.10.1.a (interim drawings) and Pre-Final drawings as specified in 3.2.10.1.

c. Complete drawings shall include all drawings required by 3.3.10.1.a (interim drawings), 3.3.10.1.b (final drawings) and shall be complete in detail to demonstrate the entire electrical and telecommunication systems requirements. The drawings shall be complete in detail to provide for the construction of the project without additional drawings.

3.3.10.2 DB specifications will be developed in accordance with contract requirements, paragraph 3.3.14, and the contractor's accepted design plan.

3.3.10.3 Design Analysis shall be submitted in accordance with para. 3.2.10.3 and 3.3.15 of this manual.

a. Interim analysis shall include all the analysis requirements for parametric, concept and intermediate design analysis as specified in 3.2.10.3.

b. Final analysis shall include all the analyses required by 3.3.10.3.a (interim analysis) and Pre-Final analysis as specified in 3.2.10.3.

c. Complete analysis shall include all analysis required by 3.3.10.3.a (interim analysis), 3.3.10.3.b (final analysis) and shall be complete in detail to demonstrate the entire electrical and telecommunication

systems requirements are met.

3.3.11 Telecommunications.

3.3.11.1 Fire Detection & Alarm/Mass Notification Systems. All designs must comply with UFC 3-600-01 and UFC 4-021-01.

a. Drawings. Legends shall contain only symbols used in the design. Where the final, signed design drawings are part of subcontractor's shop drawings submittal, the design shall include a typical system riser diagram, with any detail diagrams for needed clarity, showing all types of equipment, all types of circuits and all connections to other systems that will be provided in the construction process.

(1) Interim Submittal. Provide a layout showing locations of panels and devices. Provide a preliminary system riser diagram reflecting anticipated devices and circuit types.

(2) Final Submittal. Update concept layout drawings, operational matrix and system riser diagram. Include detail drawings to show device wiring and installation.

(3) Complete Submittal. Finalize drawings to comply with comments and scope changes/clarifications.Specifications.

b. DB specifications will be developed in accordance with contract requirements, paragraph 3.3.14, and the contractor's accepted design plan. . Design Analysis. Design analysis shall be a part of the Fire Protection Design Analysis required by UFC 3-600-01, Section 1-4. Clarify any conditions that are different from those presented in the scope that has affected the design such that any requirements are not met.

(1) Interim Submittal. To be provided as part of the summary required by UFC 3-600-01. Provide a description of the type of system(s) and devices to be used, including the criteria, codes and standards driving the design.

(2) Final Submittal. . Provide a full design analysis of the system(s) to be provided, including battery calculations. Verify that the fire alarm/MNS configuration follows the guidance of UFC 4-021-01.

(3) Complete Submittal. . Update and finalize to comply with any comments or scope changes. Analysis shall reflect the final design.

c. Telecommunications Drawings. Legends for different communications systems may be combined or separate but shall contain only symbols used in the design. Where the final, signed design drawings are part of subcontractor's shop drawings submittal, a typical system riser diagram shall be provided, with any detail diagrams for needed clarity, showing all types of equipment, all types of circuits and all connections to other systems that will be provided in the construction process. The I3A examples in Appendix B will be used as a style guide.

(1) Interim Submittal. Provide a conceptual floor plan showing the location of panels and devices. Provide a conceptual systems riser

diagram.

(2) Final Submittal. Provide final systems layout and system installation details, such as system riser for each system, telecommunications room layout, rack/cabinet layouts, outlet configurations, cable tray layout and grounding details.

(3) Complete Submittal. Provide final drawings, including any changes from comments and/or scope changes.

d. Specifications. DB specifications will be developed in accordance with contract requirements, paragraph 3.3.14, and the contractor's accepted design plan. Designer shall not use a mix of service specifications, i.e., Army telecommunications system with Navy raceways.

e. . Design Analysis.

Provide a separate analysis for each system. Clarify any conditions that are different from those presented in the scope that has affected the design such that any requirements are not met.

(1) Interim Submittal. Provide a general description of the systems to be provided, including the codes, standards and criteria that govern the design.

(2) Final Submittal. Provide a full design analysis, including any design changes due to scope changes and/or comments.

(3) Complete Submittal. Update and finalize the analysis, verifying that it fully reflects the design.

3.3.11.2 Instrumentation and Controls.

a. Drawings.

(1) Interim Submittal. Provide a conceptual floor plan showing the location of panels and devices. Provide a conceptual systems riser diagram for each system.

(2) Final Submittal. Provide final systems layout and system installation details.

(3) Complete Submittal. Provide final drawings, including any changes from comments and/or scope changes.

b. Specifications. DB specifications will be developed in accordance with contract requirements, paragraph 3.3.14, and the contractor's accepted design plan. Specify controlled devices with a device setting which minimizes the overall system impact when control system failure occurs. Controlled devices critical to system operation will be provided with a control mode, such that a failure in a control system will automatically transfer to the manual or fail-safe mode as required for safe system operation. Alarms are defined as those audible and visual signals for alerting operating personnel of the need to take corrective process action or to be advised of an operating condition which is deviating from preset limits.

c. Design Analysis.

(1) Interim Submittal. Provide a general description of the systems to be provided, including the codes, standards and criteria that govern the design.

(2) Final Submittal. Provide a full design analysis, including any design changes due to scope changes and/or comments.

(3) Complete Submittal. Update and finalize the analysis, verifying that it fully reflects the design.

3.3.12 Utility Monitoring And Control Systems (UMCS).

3.3.12.1 General.

a. DB contractor's UMCS design shall comply with the RFP requirements for the project. The Government's review shall confirm the UMCS design is in compliance with the RFP. The RFP will establish the project criteria, phasing of the project, number of reviews, percentage of completion for each review and the design detail expected at each submittal. At a minimum the DB contractor will submit Interim, Final and Complete design submittals. The expected content for each submittal as set forth in the RFP will be reviewed accordingly. Utility Monitoring and Control Systems, which include Energy Monitoring and Control Systems (EMCS), Building Automation Systems (BAS), and other computer-based direct digital control systems, are composed of computer hardware and associated peripherals, software, communication networks, instrumentation, and control equipment. Although usually non-critical, UMCS is classified as a subset of Industrial Control Systems (ICS). Design of these systems should conform to UFC 3-470-01 and UFC 3-410-02. Design packages will include appropriate UFGSs and drawings. The design package provides design configuration and functional description of hardware and software. The design shall incorporate security engineering to comply with Information Assurance requirements as shown in paragraph 5.19. Energy conservation and life cycle cost design features will be reflected in the Energy Conservation and Life Cycle Cost Design Analysis.

b. PROFESSIONAL ENGINEER REQUIREMENTS. Where the design of controls modifies the function of equipment as initially approved by a Professional Engineer, that change shall also require drawings stamped by a licensed Professional Engineer.

c. DESIGN AND INSTALLATION**.** The design of the facilities and control systems and the performance of the installation work will be in accordance with the facility criteria, guide specifications, drawings, and other industry standards as designated by the scope of work. Design and installation of facilities used for processing classified information will be IAW applicable Department of Defense documents. The design of the facilities/systems will be in sufficient detail to allow repetitive construction of future facilities/systems from one set of drawings and will limit the amount of layout engineering required by the construction contractor.

3.3.12.2 Drawings.

Plans will contain the following:

- Floor Plans. The floor plans will show all principal architectural features of the building that will affect the design.
    - Room designation and number.
    - Dimensional height, location, number, and size of raceways.
    - Dimensional height, location, size, and designation of cabinets, outlet boxes, etc. Plans should clearly indicate type of mounting required (flush and surface, wall or floor).
    - Conduit and communication cable routing and numbers.
    - Dimensional size, location, space requirements, and designation for all control consoles, equipment local cabinets, power supplies, etc.
    - Grounding requirements.
- Schedules. Conduit and cable schedules will be used to show conduits and cables installed. The schedule will contain the number, type, size, origination point, destination point, and termination requirements for each conduit cable.
- Connections. Connection details will be shown for each cabinet or console in which cables are terminated. The connection details will show locations of terminal blocks in cabinet, type of terminal blocks, termination of conductors, type of terminals used to terminate the cables, and any grounding required. The termination of shields, if used, will also be shown.
- Construction. Construction details and complete dimensions will be shown for each cabinet. The details will show the outline of the cabinets, thickness of the metal, mounting of internal equipment such as channel support, location of all openings in the cabinet, mounting and securing of doors, and other pertinent features.
- Sections and Elevations. Details, sections, and elevations will be shown where required for clarifications.
- Equipment by Others. The drawings will indicate equipment furnished and/or installed by others.
    a. Interim.
- Title sheet
- Site drawing
- Abbreviations and symbol list
- Network Architecture Diagram
- UMCS Block Diagram (includes front-end server equipment layout)
- Communication network and Information Assurance description

- Control Drawings and schematic of equipment showing instrumentation placement
- Floor Plans showing relative locations of HVAC equipment and new DDC controls
- Sequences of Operations for each piece of HVAC equipment
- Bills-of-Materials (BOM) for each sub-system
- Details of power (include source breaker nomenclature), grounding and surge protection
- Building Level Controller/ Building Point of Connection MAC Address (i.e., Network Application Engines, Java Application Control Engines, SmartServers, Loytec, etc.)
- Points List: Every connected analog output (AO), analog input (AI), digital output (DO), digital input (DI), pulse accumulator (PA) input and other input or output device connected to the UMCS shall represent a point.
- Drawings: A sample (one system) of Instrumentation and Control wiring and installation drawings, showing wire routing on floor plans including terminal numbers, wire colors/numbers, and cable designations.
- Two representative buildings will be completed in accordance with UFC 3-410-02, including sequences of operations and data base information related to set points and alarm limits.

b. Final Drawings.

Final design review submittals for UMCS will have all interim review comments incorporated into the project drawings and other documents before the interim design is submitted. The level of design completion submitted will be in accordance with the contract for all structures in accordance with UFC 3-410-02, including the sequence of operation, and data base information related to set points and alarm limits, communications network layout, and cable routing.

c. Complete Drawings.

After the final review conference, drawings containing review corrections will be delivered to the project manager.

3.3.12.3 Specifications.

DB specifications will be developed in accordance with contract requirements, paragraph 3.3.14, and the contractor's accepted design plan.

3.3.12.4 Design Analysis.

Design Analysis shall be in accordance with the general requirements of para 3.3.15 and the specific requirements listed below. Control system design analysis will document general parameters, serviceability requirements, functional and technical requirements, design criteria, design objectives, design assumptions, and provide design calculations as applicable to the project. Control system design analysis shall not conflict with the drawings and specifications and shall contain necessary information to serve as the basis of design of the Control system elements of the project. Copies of emails, memorandums and record of conversations obtained during the design process shall be

included as warranted to document basis of design.

a. Interim Design Analysis.

Provide a written narrative accurately addressing the control system basis of design. The basis of design shall include as a minimum:

- Interview with site personnel/occupants and resulting recommendations
- Review of past energy/feasibility studies (i.e., EEAP)
- Review of Master Plan (if any)
- Field survey data
- Survey of existing data communication infrastructure
- Bandwidth calculations from impact of new components
- Proposed data communication system (include routers/switches)
- Existing front end system protocol and interface requirements
- Integration to existing system technical solution
- Network Architecture
- Workstation/server
- Security engineering and information assurance requirements
- Preliminary system components
- Instrumentation and execution of sequences of operation to achieve control
- Control Logic Diagram
- Preliminary points tables
- Draft specifications
- DD Form 1391 validation report, including cost estimate

Narrative shall address the communication protocol with respect to open or proprietary systems, overall point capacity, expandability, processor speed, memory size, component and equipment selection (functionality, reliability, durability - mean time between failures, sustainability). Present the alternative technical design solutions and options considered and justify the final selection.

b. Final Design Analysis.

Update and expand the Interim Design Analysis to support the submittal. Develop all items in the Interim Design Analysis and all special features of the design. Finalize the studies, surveys and analysis required and described in the Interim Design Analysis.

c. Complete Design Analysis.

Analysis shall be complete in detail to demonstrate the entire control system requirements by including the Final Analysis with addition of minor details noted during the Final review. Update the cost estimate. All valid comments made on previous submittals shall be incorporated into this final submittal

3.3.13 Electronic Security Systems (ESS)

3.3.13.1 General Considerations.

a. Basic Concepts:

DB contractor's ESS design shall comply with the RFP requirements for the project. The Government's review shall confirm the ESS design is in compliance with the RFP. The RFP will establish the project criteria, phasing of the project, number of reviews, percentage of completion for each review and the design detail expected at each submittal. At a minimum the DB contractor will submit Interim, Final and Complete design submittals. The basic guidance related to the security systems is covered in UFC 4-021-02, Electronic Security Systems. This UFC includes the basic references, criteria and policy documents for design and installation of security systems. DoD and U.S. Army Corps of Engineers, Electronic Security Systems-Mandatory Center of Expertise (ESS-MCX) criteria states that ESS system to be an integrated security system consisting of access control system (ACS), intrusion detection system (IDS), closed-circuit television (CCTV) system, data transmission system and site central command and control system, (at times also referenced to as a dispatch center.)

b. Design Considerations.

- ESS design features must include not only components and software for the protection of the assets, but also the security system equipment's software, firmware and hardware from physical damage as well as insider threats, external adversarial threats, attacks by criminal, and other entities seeking to compromise these systems. Security systems may store administrative and response procedures to protect the assets in case of an attack. Access control systems store personnel information, such as credentials, and other personnel information needed for authentication. Stored information has to be managed in compliance with DoD regulations as well as the specific requirements imposed by the respective Uniform Service, DoD Agency, or Federal Agency.
- A characteristic of the ESS, particularly in most installations, is that it uses existing Local Area Networks (LAN), Wide Area Networks (WAN), and Non-Secure Internet Protocol Router Network (*NIPRnet*) – which is a Federal Government - DoD's Ethernet based unclassified communication network.
- Security systems may use the DoD Global Information Grid at various sites, both at CONUS and OCONUS locations, therefore the security systems must comply with DoD regulations, and certification of the systems per DODI 8510.01 Department of Defense Information Assurance Certification and Accreditation Process (DIACAP). In addition, security systems must also comply with Army Regulation AR 25-1 and AR 25-2. Similarly, for Air Force and Navy projects the service specific regulations, policies and criteria must be adhered to when designing and installing ESS.

c. Governing Criteria

- A-E or Designer of Record shall perform the work in accordance with UFC 4-021-02 and other UFCs listed for security systems. UFC 1-200-01 General Building Requirements is applicable for a security system when the design is being provided for new or renovated facilities. UFC 1-200-01 provides general building requirements, establishes the use of consensus building codes and standards, identifies key core UFCs, and identifies

unique military requirements, such as facilities in support of military operations. This UFC applies to the design and construction of new and renovated Government-owned facilities for the Department of Defense. It is applicable to all methods of project delivery and levels of construction.

- Applicability of DoD Criteria, National and International Codes and Standards: Levels of construction are permanent, semi-permanent, and temporary. Use the most current DoD, DA, and UFCs listed in Appendix A and UFC 4-021-02 for Electronic Security Systems design.
- International Building Code (IBC) shall be used to the extent where it does not conflict with the DoD, DA and UFCs. In case of any conflicts the listed criteria supersedes IBC. UFC 1-200-01, "General Building Requirements", provides applicability of model building codes and government-unique criteria for typical design disciplines and building systems, as well as for accessibility, antiterrorism, security, sustainability, and safety.
- Planning and design of electronic security systems shall be performed by using the fundamentals and requirements stated in UFC 4-020-01, DoD Security Engineering Facilities Planning Manual, and UFC 4-021-02 Electronic Security Systems.
- For protection or security of assets, where requirements of UFC 4-020-01 cannot adequately meet user requirements, then the design shall be based on UFC 4-020-02. DoD Antiterrorism Handbook, UFC 4-020-01, UFC 4-010-01 UFC 4-020-02 as applicable, and UFC 4-021-02 ESS, shall be used in the development of the plans, specifications, calculations, and Design/Build RFP. These documents shall be used in conjunction with DoD Regulations, DA Regulations, and DoD Instructions where applicable to the design and subsequent installation/construction of electronic security systems.

d. Coordination with Architectural and Other Disciplines:

In new and existing facilities, where access control systems (ACS) is part of the security system, the requirements of ingress and egress controls and entry control and credential verification devices need to be coordinated on plans and in specifications. Devices such as electronic locks (electric strikes, magnetic locks, door controller, motion sensor, etc.) as well as card readers, biometric sensors, and iris scanners will require coordination of location as well as appropriate cross references in the Architectural plan's door schedules and electrical (power) drawings for power to electric strikes, maglocks, as well as door controllers. Since ingress and egress from a facility has architectural features, the placement of security devices, especially CCTV cameras and motion sensors must be carefully coordinated for not only proper esthetics but also high reliability, high detection, and functionality. Lighting should not wash the camera images, motion sensors should not be obstructed and cameras should be placed in locations to capture images which are useable to identify individual's face and features. Wiring should not be subject to physical damage or accessible to personnel to allow disconnection or tampering. In all such installations it will be necessary to have a well coordinated set of plans and specifications to define all trenching, excavation and routing of data, communication and power cables needed at required exterior locations.

- Exterior of Buildings of Facilities Coordination: For all work exterior to a

building, such as lighting, requires exterior lighting in parking lots, at ingress and egress points to the building to meet requirements for uniform lighting to identify personnel or equipment.

- Low visibility Buildings or Facilities: For those buildings or facilities requiring low visibility or security profile at night time, reduced or no lighting is desirable, therefore use of infra-red and thermal imaging cameras must be considered.

e. Site Survey:

Electronic Security Systems are generally installed in and on existing installations, facilities and buildings. For new construction a site survey may not be needed. For all ESS upgrades, replacement, and system expansion it is necessary for the designer to physically perform the survey and obtain site specific data of the installation, facility or building to make the necessary determinations for placement of cameras, sensors, devices, cabling infrastructure, and make the measurements for placement and coverage of CCTV cameras, fence sensors, gate and door controllers. Designer must obtain data on architectural and other obstructions from other buildings, terrain, and site specific information which would require variation of approach or alternate equipment, sensor or camera placements. The site survey report in combination with security system equipment, software and cabling infrastructure must be used to develop a realistic cost estimate.

3.3.13.2 Drawing Requirements.

Drawings shall be submitted in accordance with UFC 3-501-01 CHAPTER 3 DESIGN ANALYSIS AND DOCUMENTATION,

a. Interim Design Drawings.

Drawings shall indicate the level of construction and general location of sensor cabling and data transmission cabling from controllers, sensors and workstations. Sensors, door closures, magnetic or electric locks, and any unique requirements for control and access to areas, spaces or rooms shall be called out in the design analysis, and drawings. Architectural, electrical drawing schedules for power, door locks, and interior and exterior camera locations shall be addressed for coordination of the trades involved. Controllers, electric locks, electrical power circuit available for ESS equipment, and data transmission system interfaces and requirements. In addition to the requirements of UFC 4-021-02, the drawings shall include:

- Legends and Abbreviations associated with the security system design.
- Representative floor plans.
- Site Plan showing all exterior CCTV camera poles and exterior light fixtures, site utilities, cable/conduit/duct plans for the site.
- Site Plans for Exterior Security System Components, Panels and Devices: Security system drawings will include plan and elevation drawings. Site plans and layouts will show new and existing utilities. Plans will show locations of CCTV cameras, controllers, panels, IDS sensors, fences, camera poles. If building service equipment and exterior architectural and structural features affect camera view or conflicts with requirements of controlled ingress and egress for security or life safety, such issues will be

addressed as a part of the design prior to the construction or renovation. The plans will be coordinated with other utility plans concerning scale, landmark references for proximity, and interference management. The plans will be separate from water, sewage, and other utility plans. Elevation views of security system equipment, such as camera poles, panels, and fenced areas and gates will be scaled and will identify each item of equipment.

- Building Floor and Ceiling Plans for Interior Security System. Plans will include layouts for CCTV cameras, sensors, locks, card readers, door controllers, conduits, cable trays, communication equipment, and data transmission systems (video and data) cables. For renovation and modification projects, plans will depict the work and 'Work Not in the Contract, or Task Order, or Delivery Order' on all drawings and plans. Where work is extensive, separate drawing sheets shall be used to show existing-to-remain, demolition, and new work.
- Single-line Diagrams: Single-line diagrams of IDS, CCTV and ACS subsystems shall be developed as a part of concept design. Single-line diagrams shall include the over-arching security system block diagram showing the integrated subsystems, i.e. ACS, IDS, CCTV, Site Central Command and Control Workstations/Servers and peripherals, data transmission system component and interfaces. The single-line diagrams for each subsystem shall show workstations, controllers, perimeter sensors, panels and sensor and data transmission conduits and cables.
- Design drawings shall depict proposed power sources and devices, controllers, card readers, and communication system interface schemes (interior and exterior). The diagrams will include existing and proposed overvoltage and surge protection device types in sufficient detail to demonstrate security system protection philosophy. For exterior panels and equipment lightning protection shall be designed and specified.
- Drawings will contain nameplate data for components of existing systems which are affected by the new design or which affect the new equipment or systems.
- Riser diagrams for security system shall include grounding, grounding electrode system, and lightning protection system.

b. Final Design Drawings.

Drawings shall be sufficiently complete in detail to demonstrate the entire security system and the data transmission systems requirements, including interfaces with other design disciplines. All coordination efforts with other design disciplines will be incorporated prior to completion and submittal of this submittal. With the exception of completing minor details, this submittal could be used to obtain fair and competitive bids from contractors and used for construction. At a minimum the drawings shall include:

- Content of the Interim submission and all design progress up to point of the Final submission, incorporating resolution of conflicts and all prior approved comments issued prior to the final design submittal.
- General notes providing criteria for general contractor instructions, design

criteria for security system and the data transmission systems, construction materials and equipment, and inspections, performance verification and endurance testing, and verification of system(s) intended function. Identify systems or component parts of the security system and the data transmission systems where the Designer of Record is delegating the design responsibility to a qualified delegated engineer

- Final drawings will show all pertinent plans, elevations, sections, details, locks, card readers, controllers, communication interfaces, field distribution panels, door and camera schedules, and notes to present a complete description of the construction/installation required. All elements to be constructed/installed shall be properly annotated and located with proper dimensions.
- Final security system, exterior areas, drawings will include:
    - Details which clearly depict the installation requirements of overhead and underground data transmission system cables, underground or above ground exterior sensors, power sources, distribution panels, gate controllers, door controllers, pole and building mounted CCTV cameras and light fixtures.
    - Exterior security systems power and communication cables clearances based on NEC, and for over 600 volt power lines as required by IEEE C2.
    - Lighting levels for exterior areas and equipment, and placement of light fixtures to provide the light to dark ratio based on criteria.
    - Plans and details which clearly distinguish new from existing construction and define their interfaces.
    - Equipment schedules for all equipment included in the design will be complete.
- Final interior security system drawings will include:
    - A CCTV camera schedule.
    - Door Schedule for doors controlled with card reader or security locks.
    - Complete electrical power wiring details for all electronic security equipment requiring normal power. Include uninterruptible or and emergence power and their sources.
    - Riser diagram communication network connectivity and interfaces, showing routers, switches and cables.
    - Details for mounting card readers, sensors, electric/security locks, and security system equipment.
    - Designation of all rooms and areas as shown on architectural and other drawings.
    - Internal and external equipment wiring diagrams, including interconnections between related items of equipment.

- Cable and conduit schedules.
- Security system equipment plan, elevation, side views, sectional views, and details (interior and exterior).
- Interface drawings between existing security systems/equipment and new security systems/equipment.
- Nameplate data for components of existing systems which are affected by the new design or which affect the new equipment or systems.
- Completely developed schedules for all equipment included in the design will be submitted.

c. Complete Design Drawings.

Drawings shall be complete in detail to demonstrate the entire security and data transmission systems requirements by including the Final submission with addition of minor details, and resolution of approved review comments provided as a part of the Final review. All valid comments made on previous submittals shall be incorporated into the Complete submittal. The drawings shall be complete in detail to provide for fair and competitive bids from contractors and to provide for the construction of the project without additional drawings.

3.3.13.3 Specifications.

DB specifications will be developed in accordance with contract requirements, paragraph 3.3.14, and the contractor's accepted design plan.

3.3.13.4 Design Analysis.

Design Analysis shall be submitted in accordance with ER 1110-345-700. Refer to ER 1110-345-700, Appendix B for guidance in preparation of the security system design analysis. Security system(s) design analysis will document general parameters, serviceability requirements, functional and technical requirements, design criteria, design objectives, design assumptions, and provide design calculations applicable to the project. Security system(s) design analysis shall not conflict with the drawings and specifications and shall contain necessary information to serve as the basis of design of the Security system(s) elements of the project. Copies of emails, memorandums and record of conversations obtained during the design process shall be included as warranted to document basis of design.

a. Interim Design Analysis.

Provide a written narrative accurately addressing the Security system(s) design. The basis of design shall include as a minimum:

- The security system to be constructed or installed. Integration of the new security system with the existing system if an existing security system is in place. All exterior IDS, CCTV ACS systems and their components and interface or integration with an existing ESS, if a security system exists at the site or installation. Data transmission system, if existing, which will be used, or a new data transmission being provided under this project. Back-up or emergency power requirements for the security system components, devices, controller, data transmission system equipment, workstation, and servers.

- Design Analysis shall address other exterior systems and requirements which are needed for support of the ESS:
    - Exterior lighting systems
    - Emergency or back-up power system
    - Security system maintainability

All systems and features described in paragraph 3.2.1 Basis of Design of UFC 3-501-01.

b. Final Design Analysis.

Provide all items in the Interim Design Analysis and all special features of the design. All studies and analysis performed as a part of the contract, or provided by the Government shall be included by reference and as attachments to the Design Analysis.

c. Complete Design Analysis.

Analysis shall be sufficiently complete in detail to demonstrate the entire security system requirements, including interfaces with other design disciplines. All coordination efforts with other design disciplines will be incorporated into this analysis. All studies and analysis performed as a part of the contract, or provided by the Government shall be included by reference and as attachments to the Design Analysis.

3.3.14 Specifications

3.3.14.1 Design Submittal Requirements.

The RFP and the subsequent contract establish the level of design the winning offeror must submit for review.

a. ER 1110-1-8155 mandates the use of UFGS and SpecsIntact for Corps of Engineers projects. However, Military Business Process RFP designs allow for the use of other established standard specification systems. The RFP will set what the Government requires for design deliverables.

b. A RFP may allow catalog cuts and sketches on a small design build renovation. For Military Construction (MCA) projects, full plans and specifications are normally required.

c. The Designer of Record (DOR) is often allowed to set multiple design submittals. The flexibility allows the contractor to fast track the project. Typically, the contractor will provide a Site Submittal and a Building Submittal, and if required a Demolition Submittal. If the contractor needs to break out specific design submittals that will allow for obtaining components with long lead times, it is in the Government's best interest to allow for the separate submittal.

3.3.14.2 Design Package Specifications. Design Build specifications define construction requirements, but do not have to be written to allow full and open competition. They must be developed to the level that the Government can determine compliance with contract requirements. Submit the following associated documents with each Design Package Specifications.

a. Construction Submittal Register: Provide a comprehensive list of

submittal items; both those that will be reviewed through the contractors quality control program and those requiring Government quality assurance. Government approval is required for the items meeting the criteria below, all other submittals will be managed by the DB contractor.

(1) Critical materials and major items of equipment, including those that will directly impact life safety in the facility.

(2) Deviations from the contract documents.

b. Test Requirements List. Provide a list of testing that will be conducted at the manufacturer's site and in the field. Include the proposed schedule for field testing.

c. Operations and Maintenance (O&M) Plan. Submit a plan for project closeout activities facilitating transition of operation and maintenance to the Government. Address the following as a minimum:

(1) Data. Listing of equipment and systems for which O&M data will be provided, as well as the data type

(2) Training on O&M of installed equipment and systems.

(3) Training Schedule

3.3.15 Design Analysis.

Although ER 1110-345-700, Appendix B, specifically exempts design-build projects from following its requirements, USAESCH intends that DB designers of record shall comply with the ER to the extent appropriate to the complexity of the project in order to substantiate compliance with the contract requirements, applicable codes and standards, and other applicable requirements. As a minimum, the design analysis (sometimes referred to as a "basis of design" or similar nomenclature) shall document the customer's requirements and the applicable codes and standards being followed. The design analysis will document significant design choices. That is, it will address alternative systems, arrangements, and hardware that were considered in arriving at the recommended concept and the rationale for selection of the alternatives recommended. The justification of each major selection and design decision must be stated clearly. Calculations shall be included where required or appropriate to document design choices and code compliance. All computations, calculations or design analysis related to code compliance or life safety should have a block at the beginning of that area with "Prepared By:", "Checked By:", and the names of those who prepared and checked the information. Although the ER specifically lists metric units as the default units of measure, the design analysis on USAESCH projects shall be submitted in the same units of measure (English or metric) used in the design itself. Specific items to be addressed in each discipline are described in the individual discipline-specific subparagraphs in paragraph 3.3.

3.3.16 Design Signatures.

The contractor's Designers of Record (appropriately licensed professionals) shall sign, date, and stamp or seal appropriate design documents, permit applications, and certifications in accordance with ER 1110-1-8152.

3.4 WORK PLAN SUBMITTALS.

These requirements apply to Work Plan submittals not requiring the approval of a registered professional. For the purposes of this paragraph, the term “work plan” refers to any submission by the contractor in which they describe how they will go about fulfilling the contract requirements, regardless of whether it’s called a Work Plan, Technical Data Package, or any other name. For programs/ contracts which spell out program-specific Work Plan deliverables in the form of contract Data Item Deliverables (DIDs) or similar contract provisions, the contract requirements will govern. For programs which do not have specific DIDs, or for purposes of writing new DIDs, the following considerations apply.

- The level of detail contained in each Work Plan should be commensurate with the complexity of the work being performed; i.e., simple jobs require simple work plans.
- Clearly describe the work to be done, including methods/procedures, materials, equipment, and personnel requirements.
- Document any alternative methods considered and the rationale for selecting the chosen alternative.
- Demonstrate/document compliance with contract requirements.
- Demonstrate/document compliance with laws, regulations, industry codes/standards, and/or other relevant requirements. Some of these will be specifically called out in the contract requirements but additional items may be identified by the contractor in the course of establishing the customer’s detailed requirements; all should be captured in the work plan.
- Clearly describe QC measures or metrics to demonstrate compliance with performance objectives or measures stated in the contract.
- Examples of items which may be required include Accident Prevention Plans, Environmental Protection Plans, Stormwater Pollution Prevention Plans, installation safety or security requirements, Quality Assurance Program Plans, Information Assurance Security Engineering, etc. This is not an all-inclusive list, nor will all of these be applicable to every project. The specific requirements for each project should be established in the base contract or task order PWS.

3.5 ENGINEERING DURING CONSTRUCTION.

3.5.1 Requests for Information (RFIs).

3.5.1.1 RFIs submitted by offerors pre-award will be received and answered through the KO. The PE/A/design team lead will coordinate technical evaluation and response to RFIs which are referred to ED, and, if an amendment to the design/SOW/PWS is required as a result of a RFI, will coordinate the preparation of the technical aspects of the amendment.

3.5.1.2 RFIs submitted by the contractor after award will be received and answered through the field office and the KO. The PE/A/design team lead will coordinate technical evaluation and response to RFIs which are referred to ED, and, if a change to the design/SOW/PWS is required as a result of a RFI, will coordinate the preparation of the design change. Actual implementation of the change, in the form of a contract modification, is the

responsibility of the KO; no other member of the Government team has the authority to alter contract or task order scope. Technical personnel, including the COR when that function has been entrusted to ED, shall be careful not to direct the Contractor, either formally or informally, to do anything outside the scope of the contract.

3.5.2 Field Modifications.

In accordance with ER 1110-1-12, Engineering will review all field changes that have a significant impact on design, including VECP, other ECPs, user- or other stakeholder-requested changes, waivers and system changes, to ensure that design intent, safety, health and environment requirements are not compromised. Reviews will be coordinated by the PE/A/design team lead and a consolidated ED position presented back to the PM and KO.

3.5.3 Construction Submittal Review.

Construction submittals will be reviewed in accordance with ER 415-1-10. Submittals are made in RMS through the ACO and/or COR on each contract, and technical personnel should provide responses through the same channels. The contract will typically define submittals as “For Information Only” (FIO) or for “Government Approval” (GA). Review of FIO submittals is a form of Quality Assurance on the part of the Government; the number of submittal QA reviews by the Government will be at the discretion of the organizations providing construction management. GA submittals should be reviewed for conformance and a prompt reply provided, using the action codes listed in ER 415-1-10, Appendix C, and on the back of ENG Form 4025. The number of GA submittals should be limited to the minimum required to assure the required quality. Technical reviewers shall provide their assessment via the PM through the ACO or COR as appropriate, and shall be careful not to direct the Contractor, either formally or informally, to do anything outside the scope of the contract. If it appears that the existing contract scope needs to be changed to achieve the project objectives, this must be coordinated through the PE/A/design team lead, the PM, and the KO. Neither technical reviewers nor the COR have the authority to change contract scope, this is solely the responsibility of the KO.

3.6 AS-BUILT DRAWINGS.

As-built or record drawings will be provided to the customer in accordance with the requirements of ER 415-345-38, Appendix D. As a general rule, as-builts should be produced by the construction contractor. The specifics of format and content will be coordinated with the customer early in the project life cycle and tailored to the customer’s needs. The results of this coordination will be documented in the PMP.

CHAPTER 4

4. QUALITY REQUIREMENTS

4.1 GENERAL REQUIREMENTS.

As stated in ER 1110-1-12, “Accuracy and quality of design effort will always serve as a factor in each designer’s performance evaluation. Design accountability must always rest with those individuals who are performing and/or checking the actual design calculations or making critical decisions relevant to the project.” In other words, quality starts with the working level designer. Regardless of the amount of quality control/quality assurance that comes afterward, designers (both in-house and contractor) should strive to produce a high-quality product from the beginning.

4.2 REVIEW OF CONTRACTOR DESIGNS AND OTHER TECHNICAL PRODUCTS

- Comments shall maintain a professional tone. Each Government comment will be read and responded to by one of our professional colleagues. We owe them the same level of respect that we expect for ourselves. Showing that respect will facilitate discussion and resolution of the issues.
- Comments should in most cases refer back to the established criteria documents or contract requirements; e.g., “Pavement design is not in conformance with UFC 3-250-01FA” or “rebar placement in blast wall does not conform to UFC 3-340-02” followed by the specifics of the nonconformance. There will be occasions where a comment cannot be tied back to the criteria; however, these should be in the minority. Avoid commenting on “designer preferences.”
- Comments shall recommend a specific action to the document under review. Comments should begin with phrases such as: correct, check, verify, revise, clarify, etc. Our goal is to help the designer produce a better document. Questions should not be part of a comment, as the designer then doesn’t have clear guidance as to how to revise the document. If you need to ask a question, pick up the phone and call the PM, PE/A, or Contractor. Clarification is part of the design review process.
- The Government should not be in the business of performing quality control for the Contractor. We should not be performing detailed checks of calculations and making comments on them. If an error jumps off the page at you, a global comment to recheck calcs in a specific area may be appropriate. Evidence of the contractor’s quality control process will be verified as a separate activity. Similarly, we should not be in the business of correcting spelling or grammar for technical documents. If errors appear to be widespread, a global comment to check and correct may be appropriate, especially if the document is intended for release to regulators or the public at large.
- Comments shall not direct the Contractor to do anything that could be construed as a scope change. Please refer suspected scope issues to the PM and/or COR/KO for action.
- Coordinate, coordinate, coordinate. We have other disciplines responsible for specific areas on almost everything we look at – talk to those reviewers

re: areas that may overlap and reach an understanding with them as to who's going to address each topic. If the PM didn't task a review to a discipline you think should have been involved, talk to the PE/A and/or your counterpart in that Branch. Before formalizing their comments, reviewers will ensure that their comments do not conflict with those of other reviewers. In case of a conflict between two reviewers, the person who first notices the discrepancy will contact the other person and resolve the issue at the working level. If necessary, the PE/A can act as a facilitator to help resolve the issue. As a last resort, if the issue cannot be resolved at the working level, the issue should be elevated to Branch Chief level or higher.

- Comment resolution. During the comment evaluation/response period, there may be comments that for some reason are not acceptable to the designer. Those comments identified as requiring further action will be brought to the attention of the PE/A. The PE/A will coordinate discussions between the designers and reviewers on these issues. The focus of these discussions will be to resolve project team comments at the lowest feasible level and obtain confirmation from the project team that the contract requirements have been met.

4.3 SUPERVISORY OVERSIGHT (BOTH IN-HOUSE AND CONTRACTOR).

4.3.1 Designs and Other Technical Products.

ER 1110-1-12 requires that Branch and Division Chiefs ensure that "all technical documents are developed and finalized to result in high quality products." Each discipline supervisor is responsible for the technical quality of all products produced by his/her group. Design documents, studies, scopes of work/performance work statements, and other technical products will be reviewed by the supervisor or his/her designee prior to being released to the wider PDT.

4.3.2 Review Comments.

U.S. Army Engineering and Support Center, Huntsville (USAESCH) reviewers will prepare comments and submit them through their organization's supervisory chain. For comments entered on CEHNC Form 7, the reviewer will use a digital Form 7, including the following preliminary information:

a. PROJECT – Identify the specific project, name and or number. It is also acceptable to put additional information such as the suspense number and date due.

b. REVIEW – Identify what stage of review is provide on the form such as initial, back-check, 30 %, 90 %, Final, etc..

c. DATE – Provide the date the form is completed

d. NAME – Provide the reviewer's name and phone number.

e. Ensure the specific branch of the reviewer is identified by filling in or checking the block next to the appropriate ED branch.

For comments entered in DrChecks, the reviewer will follow the instructions provided at the ProjNet/DrChecks website. Before formalizing their comments, reviewers will ensure that their comments do not conflict with previous comments in the DrChecks data base. In case of a conflict between two reviewers, the person who first notices the discrepancy

will contact the other person (contact information is attached to each comment in DrChecks) and resolve the issue at the working level. The appropriate ED branch Chief will review and approve these comments to ensure that they meet the guidance established in this Manual and that any unresolved issues have been elevated for resolution. The reviewer's supervisor will initial and date a hard copy of these comments following the completion of the quality control review in DrChecks and will transmit the hard copy to the Service Team. The supervisor's initials indicate approval of the applicable reviewer's comments.

4.4 ROLE OF THE PROJECT ENGINEER/ARCHITECT (PE/A) AND FACILITY STANDARDS TECHNICAL LEAD (FSTL).

The PE/A is primarily responsible for the technical quality of products and services provided by Engineering Directorate in accordance with ER 1110-1-12. The PE/A is Engineering Directorate's primary technical representative on the Product Delivery Team (PDT) for an assigned program. The FSTL is the technical expert on their assigned facility type and shall be member of all PDTs involving the standard facilities they are assigned.

4.4.1 Professional and Ethical Responsibilities.

In addition to the responsibilities and duties defined below for PE/As and FSTLs, the ED management has professional and ethical expectations for personnel assigned these duties. As the senior technical representative or technical expert, application of engineering professional canons and judgment to assure public safety, life-safety, codes, regulations, reviews and approval by qualified personnel must be monitored on all the services and products generated by the Center or its contractors. Both the Chief of Design and the Director of Engineering must be kept informed of any concerns that the PE/A or FSTL has regarding professional or ethical issues on assigned projects or programs.

4.4.2 Assignment.

The Director of Engineering is responsible for appointing PE/As and FSTLs. The Director may require a professional registration for certain PE/A assignments depending upon program scope or technical services required. ED Division Chiefs will make recommendations for PE/A and FSTL assignments and the Chief, Civil Structures Division will maintain a roster of current PE/A and FSTL assignments.

4.4.3 Duties Prescribed by Regulation.

In accordance with ER 1110-1-12, the PE/A or the FSTL is specifically responsible for the following for their assigned programs and/or projects:

- Is the ED representative who leads the development of the Quality Control Plan (QCP) and the Quality Assurance Plan (QAP) for the Project Management Plan (PMP).
- Participates in project meetings with the project manager and other PDT members to offer technical guidance.
- Facilitates the comment resolution process between the Independent Technical Review (ITR) team and/or contractor (as appropriate) and the PDT.

4.4.4 Other Duties.

In addition to functions specifically required by the ER, the PE/A is ED's primary technical representative on the PDT and may perform the following roles as applicable on their assigned programs or projects:

- Serves as the ED single point of contact for the Project Manager (PM) and ensures coordination and transmission of technical/engineering products to the customer through the PM. Supports and assures that the Facility Standards Technical Lead (FSTL) is involved on any project for their assigned facility type.
- Ensures that Headquarters, US Army Corps of Engineers (HQUSACE) and Corps of Engineers, Huntsville (USAESCH) Quality Management policies are followed. Prepares, maintains and updates the associated Quality Management Plans, including the Design Quality Control Plan (DQCP), as necessary and ensures that the plans are followed.
- Develops and provides technical input in conjunction with the PM and other appropriate PDT members into the appropriate sections of PMP. This input includes the following: Value Engineering/Value Management plans, technical risks, and any other technical information required. Coordinates ED evaluation of proposed changes to the PMP.
- Provides and/or coordinates technical input and ED commitments to programmatic activities such as project scopes, schedules and contract acquisition strategies. Ensures that reviews of technical products, including designs, studies, white papers, scopes of work (SOW), performance work statements (PWS), and estimates, are conducted and documented in accordance with approved ED work instructions and processes.
- For projects where the design will be performed by contract, the PE/A will ensure that ED has the appropriate role in the acquisition process and leads the acquisition strategy development for technical products and services. The PE/A is responsible for maintaining and assuring the quality of ED technical products included in these contracts. The PE/A should ensure that appropriate technical functions are represented during negotiations. The PE/A ensures that technical acquisition and contractual products are reviewed by ED and required approvals are appropriately staffed and obtained.
- Prepares and coordinates Architect-Engineer (A-E) cost estimates for the PMs approval.
- Coordinates the development and subsequent management of ED budget and schedule for in-house design for their assigned programs. Works closely with ED Branch Chiefs to schedule and provide appropriate resources to in-house design teams.
- Coordinates resource requirements with all appropriate ED functional elements. Through discussion with the PM, the PE/A evaluates the proposed technical requirements for their assigned programs. The PE/A then coordinates the development of resource requirements and schedules with the ED functional managers and consolidates and transmits the ED manpower budget to the PM. The PE/A monitors ED performance against the budget and schedules, and periodically reports to the PM and ED

functional managers.

- Serves as the PDT facilitator for resolving technical issues. Manages coordination and review of technical submittals, shop drawings, and related contract deliverables with appropriate organizational elements. Recommends acceptance or disapproval of contract submittals to the PM based on the results of technical coordination within ED.
- Serves as the Contracting Officer's Representative (COR) when so designated. Provides the primary point of contact for technical advice and assistance to the Contracting Officer and PM.
- Coordinates the evaluation of Engineering change proposals and lessons learned related to technical requirements, design and construction.
- Manages/coordinates programmatic changes, technology transfer, lessons learned, and best practices during all project phases and ensures their integration into their overall program. Evaluates such changes for broader application on similar programs. Develops the technical information in After Action Reviews (AAR).
- Ensures that customer requirements are fully understood, that clear and accurate criteria are established and that guidance and direction to the designer is fully documented.
- Coordinates the final contractor ratings for technical or design related elements, when requested by the PM.
- Coordinates and assembles energy analyses developed by the PDT as needed.

4.4.5 FSTL Responsibilities and Duties.

As the technical expert on their assigned facility type, the FSTL is primarily responsible for the technical quality and content of designs for standard facilities managed within ED and is the primary point of contact for the facility proponent on technical issues. The FSTL ensures standard designs are developed and maintained in accordance with applicable criteria, standards, and codes, and that both customer and proponent input is solicited and incorporated to the maximum extent practical. The FSTL may be assigned the role as PE/A in certain circumstances. The FSTL works closely with the PE/A and the PM and participates in planning and design charrettes to ensure that standard designs are appropriately utilized for development of site-specific project design, and to provide responsive assessment of engineering issues. The FSTL serves as the ED single point of contact to the PM for ensuring coordination and transmission of technical/engineering products to the standard facility proponent and actual/potential facility users.

4.4.6 Training.

Recommended training for current and potential PE/As and FSTLs includes:

- A-E Contracting
- Project Management for Military Construction
- Engineering and Design Quality Management

- Design/Build Contracting (dependent on assignment)
- COR Training (dependent on assignment)
- Cost Reimbursable Contracting (dependent on assignment)
- Conflict Management

4.4.7 Supervisory Support for PE/As and FSTLs.

ER 1110-1-12 requires that Branch and Division Chiefs ensure that "all technical documents are developed and finalized to result in high quality products." To facilitate this, ED Branch Chiefs will work closely with PE/As and FSTLs to incorporate appropriate PE/A and FSTL duties into performance standards for such individuals within their functional areas, coordinate provision of appropriate technical resources to each PDT, consult with the appropriate PE/A (and vice versa) when personnel changes may become necessary, maintain oversight of employee workload that may affect support to assigned PDTs (especially informally assigned tasks that come directly from PMs or other PDT members), support/reinforce PE/As in ensuring that technical quality is maintained, and include appropriate performance standards for inclusion in PE/A TAPES support forms.

4.5 REVIEW OF DESIGN-BUILD DESIGN SUBMITTALS.

In general, the guidelines listed above apply to design-build (DB) design submittals as well, but with a few key differences. The most important difference is that the Contractor is the Designer of Record responsible for the adequacy of the design, not the Government. As such, the Government is reviewing primarily for conformance to the contract requirements and will "accept" the design submittals rather than "approve" them. The Contractor, subject to the specific Contract requirements and with Government concurrence, may elect to split the project up into separate design packages for different aspects of the work and begin construction on some packages before remaining packages are 100% complete and accepted by the Government. The level of detail shown on the drawings will be different from that customarily provided on a design-bid-build (DBB) design package; proprietary items/materials may be called out, and some aspects may be in the form of shop drawings. All this changes the playing field somewhat for design reviewers. Aspects to look for during reviews of design submittals:

- Does the design conform to the RFP requirements and the Contractor's accepted proposal?
- Do the design submittals clearly document compliance with the appropriate criteria?
- Are the design packages adequately coordinated, both internally and with interfacing design packages?
- Reviewers should distinguish between items that are absolutely critical (for example life safety/code compliance, explosive safety, design of cascade ventilation systems) and items that are not so critical (for example, storm drainage or pavement striping plans) and apportion their review accordingly.

4.6 REVIEW OF WORK PLANS.

Similar to DB submittals, the Government is reviewing primarily for conformance to

contract requirements and the accepted proposal, rather than performing a detailed review of drawings, specifications, calculations, and design analysis. Under performance-based contracting, the Contractor can choose its method of accomplishment, and the Government is reviewing for compliance with the requirements of the contract (achievement of the stated objectives as well as conformance with the specified codes, standards, and other criteria).

4.7 REVIEW OF IN-HOUSE DESIGNS – CUSTOMER INPUT/REVIEW, ITR, QUALITY ASSURANCE.

4.7.1 Customer Input and Review.

At appropriate stages during the project life cycle, the customer and, where appropriate, other stakeholders such as regulators, will be afforded the opportunity to review in-progress and final deliverables and provide comments. This is crucial to assuring that USAESCH and the A-E/contractor are correctly capturing customer and other stakeholder requirements. The primary responsibility for customer contact rests with the PM; however, the PE/A and other PDT members are likely to have contact with customer representatives on occasion. PDT members are to report any significant technical results of discussions with the customer to the PE/A and the PM at the earliest opportunity.

4.7.2 Independent Technical Review (ITR).

ED will perform an ITR on all in-house designs in accordance with ER 1110-1-12, chapter 4. The objectives are to ensure that the proposed solution is a technically sound, cost effective response to the customer's requirements, that appropriate criteria, regulations, and policies are being complied with, and that the contract documents being produced are clear and well-coordinated. The contract documents should lay out the project requirements in sufficient detail to allow establishment of a fair price for the work, and should clearly communicate the customer's requirements to the constructor.

4.7.2.1 ITR Planning and Initiation.

The ITR will be shown in the DQCP as an integral part of the project schedule. The PE/A/design team lead will initiate the ITR at the appropriate point in the project progress, typically at the prefinal design stage. Chapter 4 of ER 1110-1-12, in discussing ITR team members, encourages participation from outside the design organization, such as SMEs from geographic Districts, Centers of Expertise (CXs), etc. The main requirement is that the ITR team members have "senior-level competence in the type of work" being performed. If an ITR team has not been previously established for the project, the ITR Team Lead will ask appropriate in-house and outside organizations to assign an appropriate senior-level engineer or architect to perform an ITR of the design.The PE/A/design team lead will ensure that hard or electronic copies of the in-house technical design are provided to all reviewers, and that a review has been established in DrChecks.

4.7.2.2 Comment Review and Closeout.

The PE/A/design team lead will lead comment evaluation, response, and resolution between the PDT and the ITR team. All comments will be formally responded to, backchecked, and closed out in DrChecks prior to ITR certification as described in ER 1110-1-12. Areas where agreement cannot be obtained will be resolved by the Chief of Design.

4.7.2.3 ITR Completion.

When the independent technical reviewer backcheck has been completed, the ITR is considered to be 100-percent complete, and the design can be designated a final design submittal. Upon completion of the ITR, the PE/A/design team lead ensures that the ITR certification is signed by all responsible parties, sends a copy of the certification and the ITR-generated comments and responses to those comments to the PM, and ensures that the PM forwards this data to the Service Team for establishment of a formal record. An ITR certification form is provided as appendix D.1. The form may be modified as required for any specific project. A completed ITR certification form will accompany the final design package during the signature process.

4.8 BIDDABILITY, CONSTRUCTABILITY, OPERABILITY, ENVIRONMENTAL, AND SUSTAINABILITY (BCOES) REVIEWS.

Every project involving construction, regardless of delivery method and whether the design/RFP is prepared in-house or by contract, will have a BCOES review performed in accordance with ER 415-1-11. The PMP and/or DQCP will document the schedule and method of performance of the review, to include performance by the geographic District or other awarding/construction agent (for example NAVFAC) if this is the case. Note that the ER requires BCOES reviews early in the project life cycle as well as at the final design stage. The PM (in coordination with the PE/A/design team lead) will coordinate in-house BCOES review, to include coordinating participation by field personnel, and ensuring that a review is established in DrChecks, comments are appropriately evaluated, responded to, and closed out, and the appropriate certifications have been signed by all responsible parties as required. A sample certification form is shown in Appendix D.2.

CHAPTER 5

5. SPECIAL TOPICS

5.1 PARAMETRIC DESIGN

MILCON projects that receive a code 3 (Parametric Design) directive require the conduct of a design charrette and preparation of a Parametric Design Report (PDR), equivalent to approximately 15% design as defined in AR 420-1. Guidance for production and submission of the PDR is adjusted annually for each year's Code 3 process and is available at http://mrsi.usace.army.mil/pdrs/Shared%20Documents/Forms/AllItems.aspx. Most code 3 directives are the responsibility of geographic Districts, but those that are the responsibility of USAESCH will comply with the current year guidance.

5.2 SITE ADAPTATION OF DESIGN PACKAGES

5.2.1 Standard Designs.

Standard design packages for Army standard facilities are prepared by the various Centers of Standardization (COS) under the direction and guidance of the Army Facility Standardization Committee. The standard designs and associated products such as template 1391s and the corresponding Army Standard, where applicable, are available on the USACE COS website: http://mrsi.usace.army.mil/cos/SitePages/Home.aspx. Where an "adapt-build" model for a particular facility type is available, the design is to be prepared in-house, by either the geographic District, the COS having responsibility for the standard facility in question, or by another Corps District, and advertised as a design-bid-build construction contract. The adapt-build design may be prepared by A-E if no Corps organization has the capacity to prepare it in-house. Where no adapt-build model is available, the project may be advertised as a design-build contract using the Model RFP developed under MILCON Transformation, which is available at the RFP Wizard web site, http://mrsi.usace.army.mil/rfp/SitePages/Home.aspx The Wizard has appropriate technical provisions for various sizes of Army standard facilities and is intended to ensure uniformity and consistency between geographic Districts while allowing design-build contractors the maximum flexibility to apply relevant commercial best practices to meet users' functional and operational requirements. Proposed deviations from the Army Standard or the Standard Design must be approved by the Army Facility Standardization Committee (for deviations from the Army Standard) or HQUSACE (for deviations from the Standard Design); waiver procedures for such deviations are available on the USACE COS website given above.

5.2.2 Explosive safety-related designs.

Site adaptation of designs involving explosive safety issues, such as ammunition production or storage facilities, or barricades intended to provide fragment protection, is addressed in paragraph 5.17.2 of this Manual.

5.2.3 Non-standard designs.

The designer will review and update the existing design package as required to bring it up to the level of a current design. Changes to functional and operational requirements, the site conditions at the new site, and current versions of codes, standards, and other applicable requirements must all be accounted for. The drawings will be revised to meet current requirements and site adapted to the new construction site. The designer will update the specifications to match the revised drawings and to reflect current codes and

standards. The design analysis will also be revised to reflect the changed, site specific design requirements. Submission process of a final, site adapted design package will be the same as for a new design.

5.3 GIS PACKAGES.

General criteria for the use and development of geospatial technologies in the Huntsville Center and throughout the U.S. Army Corps of Engineers (USACE) is established in Engineer Regulation (ER) 1110-1-8156, Policies, Guidance, and Requirements for Geospatial Data and Systems. Detailed technical guidance and procedures for compliance with the policy in ER 1110-1-8156 is found in Engineer Manual (EM) 1110-1-2909, Geospatial Data and Systems. The requirements found in ER 1110-1-8156 and EM 1110-1-2909 are applicable to all Huntsville Center projects/programs that have a geospatial component and/or utilize geospatial data. Geospatial data content and structure must comply with the Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE). The Huntsville Center's designated Geospatial Coordinator serves as the lead for geospatial data standardization, management, and associated software and hardware requirements. Additionally, the Geospatial Coordinator is responsible for the review of project management plans (PMPs) to identify the need for and the preparation of a geospatial data management plan.

5.4 GEOTECHNICAL INVESTIGATION AND REPORT.

All projects involving new vertical or horizontal construction, or repair/renovation of horizontal construction features such as pavement, utility systems, or drainage features, should have some form of geotechnical investigation. The size and complexity of the project should determine the scope and content of the geotechnical investigation. The PM should consult the USAESCH Geosciences Branch for advice on the appropriate scope, schedule, budget, and method of accomplishment (i.e. geographic District, A-E or DB contractor, or separate stand-alone contract) for the project-specific geotechnical investigation. Geotechnical and foundation engineering topics, including investigations and reports, are addressed in UFC 3-220-01, which implements the IBC with selected modifications. Another source which describes geotechnical investigation methods and recommended practices is EM 1110-1-1804, although some of the design stages and products for military construction projects described in this EM are out-of-date. Some items which may be required in the investigation and report include:

- Recommended type and depth of foundation for each structure
- Allowable soil or rock bearing pressure and corresponding settlement
- Allowable dynamic bearing pressure (seismic and wind loading)
- Dynamic soil properties (shear modulus and Poisson's ratio)
- Lateral earth pressure coefficients and soil unit weight
- Groundwater data
- Site class in accordance with ASCE 7 seismic design requirements
- Additional ASCE 7 geotechnical investigation requirements, such as evaluation of slope instability and liquefaction for Seismic Design Categories C through F
- Soil percolation rates for septic systems

- Design values for California Bearing Ratio (CBR) and modulus of subgrade reaction
- Recommended pavement sections for flexible and rigid pavements
- Frost penetration depth
- Stability of existing natural slopes
- Cut and fill slopes
- Depth of topsoil to be stripped
- Satisfactory and unsatisfactory material types
- Corrosion protection requirements for underground utilities
- Excavation and backfill recommendations
- Dewatering requirements and recommendations
- Presence of regional geotechnical issues such as karst terrain, loess, expansive soil, or high soil sulfate content and recommended mitigating measures.
- Methods for dealing with any potential geotechnically related problems at the site not mentioned above.

The report should also include the final plan locations of all borings, soil profiles, and plotted logs of all borings. The geotechnical investigation should be coordinated with the topographic survey, so that boring locations can be accurately laid out in the field and/or as-drilled boring locations and top-of-hole elevations can be accurately determined.

Specific requirements for the project-specific investigation should be determined and called out in the contract or task order SOW/PWS if accomplished by a contractor, or in the PMP if accomplished by in-house (including geographic District) personnel. However, the contractor has the professional responsibility to bring to the Government's attention any additional investigation that may be required over and above what is specifically called out in the contract, for discussion as a possible contract modification.

5.5 TOPOGRAPHIC SURVEY.

Procedural guidance, specifications, and quality control criteria for performing field topographic surveying are found in Engineer Manual (EM) 1110-1-1005, Topographic Surveying. Technical specifications and procedural guidance for control and geodetic surveying is provided in Engineer Manual (EM) 1110-1-1004. Topographic survey shall be in accordance with EM 1110-1-1005 and EM 1110-1-1004. It is recognized that, based on the current technology, procedures and techniques for performing, collecting, and processing topographic survey data may vary from the Engineer Manual. Variances from the Engineer Manuals related to performing, collecting, and processing topographic survey data are acceptable provided the minimum standards of practice are met for the state or local geographic area where the topographic survey is performed.

5.6 ENVIRONMENTAL DOCUMENTATION.

Environmental documentation preparation is the responsibility of the proponent of the project. The designer may be required to prepare environmental documentation as part of the services required by the project scope of work. Environmental impact generated

by the proposed project will be assessed in accordance with the National Environmental Policy Act of 1969 (NEPA) and AR 200-2. All projects will include environmental documentation either in the form of record of environmental consideration (REC), environmental assessment (EA), or environmental impact statements (EIS).environmental control during construction.

5.7 ENVIRONMENTAL CONTROL DURING CONSTRUCTION.

Mitigation of potential environmental pollution during construction will be in accordance with Federal, State, and local regulations. The design may require the construction contractor to submit an environmental protection plan during construction for approval. The environmental protection plan will comply with applicable Federal, State, and local regulations. Environmental pollution will be defined as the discharge of storm water runoff, chemical, physical, or biological elements or agents that adversely affect human health, unfavorably alter ecological balance, or degrade the environment. The foregoing requires consideration of air, water, land, noise, solid and hazardous wastes, radioactive materials as well as other pollutants.

5.8 ENVIRONMENTAL SAMPLING AND LABORATORY REQUIREMENTS.

All projects whether or not it is designated as an environmental project or involves environmental sampling and analysis for Air, Water, Bioassay, Drinking Water, Solids, or Tissue (e.g. asbestos, petroleum, explosive residue, volatile organics, semi-volatiles, metals, chemical agents, biological agents, etc) will prepare a Quality Assurance Project Plan (QAPP) in accordance with the Uniform Federal Policy QAPP guidelines per Public Law 106-554 (2001), ANSI/ASQ E4 Section 5 (Part A) and Section 6 (Part B) as well as the Defense Federal Acquisition Regulation Supplement (DFARS) Subpart 246.2. The Uniform Federal Policy Quality Assurance Project Plan Manual is a joint document adopted by the Environmental Protection Agency and the Department of Defense in the 2004-2005 timeframe. Department of Defense Instruction 4715.15 December 2006 with change 1 May 2011 mandates the use and compliance with the UFP-QAPP. Furthermore, the Department of Defense Environmental Laboratory Accreditation Program compliance requirement was added in 2008. A list of approved laboratories and specific methods for which the laboratory is approved to perform analysis is available at the following website: http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm.

5.9 SPECIAL PROJECTS – MUNITIONS AND EXPLOSIVES OF CONCERN (MEC) RECONNAISSANCE (RECON) SURVEYS

When there is a history of previous MEC use at the site, a MEC Recon survey is recommended to define the type, extent and quantity of surface MEC and estimate subsurface MEC in areas. The survey will be used to recommend response actions required to support DoD sponsored activities in munitions contaminated areas. The MEC survey will also augment existing information that will provide accurate measurements for an independent government estimate (IGE) for future activities. The MEC Recon Surveys are conducted in accordance with EP 75-2-1, EM 1110-1-4009, EM 385-1-1 and the Programmatic Work Plan (PWP). Typically MEC Recon Surveys are conducted by Government personnel but when performed by contractors they shall follow the same guidance. The PWP is maintained/updated by the Environmental technical manager along with site specific documents. Data collected as part of the field effort will be analyzed in accordance with the PWP, project specific data quality objectives (DQO's) and geographical information systems (GIS) standards set forth by

the project delivery team (PDT). The project delivery team will consist of the following disciplines: project management, environmental technical management, spatial data management, and munitions safety oversight. On projects requiring digital geophysics or where soil conditions require more sophisticated analog equipment, geophysics shall be a required discipline within the PDT. Analog metal detection will primarily be performed by the Ordnance and Explosives Safety Specialist (OESS) or project geophysicist. All digital geophysics will be overseen and collected by the project geophysicist or in their supervision. All fieldwork will comply with the site safety and health plan (SSHP) and accident prevention plan as part of the overall PWP. The end product of the surveys will typically be a final report including a site model(s) depicting the risk or probability of encountering MEC throughout the project footprint. The end product(s) may vary based on DQO's and specific needs of the customer. The end product will have an independent technical review at the Draft Final stage prior to being finalized.

5.10 HARDENED/PROTECTIVE CONSTRUCTION

Hardened structures are defined as structures that must resist the effects of nuclear or conventional weapons effects resulting from intentional or accidental explosions.

5.10.1 Governing criteria.

For clarity, a distinction is made between the design of protective construction for Explosives Safety, Antiterrorism (AT), and Nuclear weapons. Although there are similarities in the events that are being mitigated, the performance objectives of the structures vary; therefore, there are applicable UFCs for each. The designer of record is cautioned to ensure the correct UFC is used in order to enhance the likelihood of approval of the design by applicable approving authorities as described in paragraph 5.10.1.1.

5.10.1.1 For Explosives Safety, UFC 3-340-02 *'Structures to Resist the Effects of Accidental Explosions'* is to be utilized in the design of the facility or structure to mitigate the effects from accidental or intentional (for research, testing and development) detonations. UFC 3-340-02 presents methods of design for protective construction used in facilities for development, testing, production, storage, maintenance, modification, inspection, demilitarization and disposal of explosive materials. The UFC establishes design procedures and construction techniques whereby propagation of explosion (from one structure or part of a structure to another) or mass detonation can be prevented, and personnel and valuable equipment can be protected. Generally, protective construction design is part of an Explosives Safety Site Plan (ESSP) that must be approved by the respective Services' Explosives Safety Centers (US Army Technical Center for Explosives Safety (USATCES), Air Force Safety Center (AFSC), Navy Ordnance Safety and Security Activity (NOSSA)) and the Department of Defense Explosives Safety Board (DDESB). DoD 6055.09-M *'DoD Ammunition and Explosives Safety Standards*' and the Services' explosives safety standards and regulations reference UFC 3-340-02 for the design of structures to mitigate explosives effects. See 5.17.2 for explosives safety requirements.

a. For conventional explosions, the charge and its location used in the calculation will be consistent with the operation reflected in the final

drawings. If the operations are not apparent or the User has not established specific operating procedures, then conservative assumptions will be made to envelop worst case structural demand on the blast mitigating elements.

b. A protection category shall be selected based on explosives safety and/or operational requirements. UFC 3-340-02 recognizes four protection categories for the purposes of analysis and design. Higher levels of performance can be achieved if explosives effects and/or user requirements require such. If a greater level of protection is required than UFC 3-340-02, Protection Category 1 provides, then CEHNC-EDC-S (Structural Branch) should be consulted at the earliest stages of the project to aid in developing performance criteria for the structure. Examples of higher levels of protection are the requirement for total containment of explosives effects without damage that would render the structure unusable or total containment of explosives effects with the source of explosion being chemical weapons.

c. The preferred construction type for facilities and major structures is reinforced concrete, but the use of steel is acceptable where economically feasible. The designer of record is responsible for the design coordination of blast-related items (such as blast doors, blast valves) if they are to be designed by others to ensure these items do not conflict with the design elements of the building or structure. If performance specifications are used to procure items such as blast doors and blast valves, the manufacturers of such items are to coordinate their applicable designs, products, and submittals with those of the building in order to avoid conflicts. For example, a blast door manufacturer shall coordinate the blast door frame design and construction with the reinforced concrete wall elements to ensure no conflicts of rebar placement.

(1) Concrete structures that are to be hardened will be designed and detailed to provide continuity, ductility, and resistance to loading and rebound. Reinforcement will be lapped adequately to assure full development. Joints will be detailed to ensure ductile behavior of the entire element and, if practical, to develop the ultimate strength of the weakest connected element.

(2) Steel construction will be designed and detailed to achieve continuity and full plastic strength. Bolted connections, when used, will be designed as bearing type, as opposed to friction type.

5.10.1.2 For antiterrorism (AT) and security, UFC 4-010-01 ‘DoD Minimum Antiterrorism Standard for Buildings’ and UFC 4-010-02 ‘ DoD Minimum Antiterrorism Standoff Distances for Buildings (FOUO)’ and UFC 4-020-01 ‘DoD Security Engineering Facilities Planning Manual’ are to be utilized in the design of the facility or structure. For antiterrorism requirements greater than the minimum standards per UFC 4-010-01, the USACE Protective Design Center (Omaha) Mandatory Center of Expertise shall be consulted. See paragraph 5.12 for more guidance related to AT.

5.10.1.3 For Nuclear, UFC 3-350-03AN, UFC 3-350-04AN, UFC 3-350-

05AN, UFC 3-350-06AN, UFC 3-350-07AN, UFC 3-350-08AN, UFC 3-350-09AN and UFC 3-350-010AN are to be utilized in the design of the facility or structure. Currently the above UFCs are denoted as 'inactive' on the WBDG webpage, but are the most current available. For the design of structures to resist the effects of nuclear weapons, the USACE Protective Design Center (PDC-Omaha) shall be consulted. At the start of project design, the PDC shall be consulted to determine if more current design guidance is available.

5.10.2 Safety Approval.

The technical content requirements for submittals containing facilities or structures that utilize protective construction are provided in paragraphs 3.2, 3.3 or 3.4. For projects requiring an ESSP, the protective construction design deliverables (drawings, specifications and design analysis) may require earlier submittals than the non-hardened elements of the project's facility and structures. Protective construction designs, that are not site-adapt designs of approved DoD standards, require approval by the Services and DDESB. The designer shall notify the project manager of the duration of time for this approval to ensure the project schedule reflects such. A total of 180 days should be scheduled to ensure adequate duration for the review by the Services and DDESB. The final ESSP may be submitted at the project intermediate submittal stage. The protective construction design is included in the final ESSP; therefore, it must be at the Pre-Final submittal stage of completion so the structural performance of the facility is clearly denoted in the deliverables. This Pre-Final stage will be reviewed by the Services' Explosives Safety Centers and the DDESB.

5.11 PHYSICAL SECURITY.

DoD Regulation 5200.08 'Physical Security Program' addresses the physical security of personnel, installations, facilities, operations, and related resources of DoD Components. In overseas areas, Combatant Commanders (COCOMs) may deviate from the policies in this Regulation where local conditions, treaties, agreements, and other arrangements with foreign governments and allied forces require. This Regulation provides minimum standards for the protection of resources normally found on installations and unique resources on the installation. Separate DoD guidance shall be referred to for:

- Classified Information - DoDM 5200.01v1-v4
- Sensitive Compartmented Information Facilities - ICD 705
- Security Policy for Protecting Nuclear Weapons - DoDD 5210.41
- Minimum Security Standards for Safeguarding Chemical Agents - DoDI 5210.65
- DoD Procedures for Security of Nuclear Reactors and Special Nuclear Materials (SNM) - DoDD 5210.63
- Physical Security of Sensitive Conventional Arms, Ammunition and Explosives - DoDM 5100.76

Individual services have specific policies for implementing DoD Regulation 5200.08, 'Physical Security Program'

- Air Force Instruction 31-101, Integrated Defense

- Army Regulation 190-13, The Army Physical Security Program
- Chief of Naval Operations Instructions 5530.14E, Navy Physical Security and Law Enforcement Program
- Marine Corps Order 5530.14A, Marine Corps Physical Security Program Manual

5.11.1 Integrating With Other Requirements.

The designer of record shall contact the Provost Marshall and Antiterrorism Officer at the beginning of the project to request their support in identifying all security requirements. Even where a project is specifically for security and antiterrorism upgrades, there will still be other requirements that must be considered. There will be times where one criterion is more stringent than another, in which case the more stringent one must be applied. In some cases, criteria may conflict. In those cases, those conflicts must be resolved, which may require compromise or adjustment to one or the other criteria. The following are examples of common criteria that must be integrated with security and antiterrorism requirements: Other Security Regulations, Explosive Safety, Other DoD Component Standards, Historic Preservation, Sustainable Design, Other Facility Requirements (life safety and fire protection, functional issues, energy conservation, seismic criteria, barrier-free handicapped access, and aesthetics).

The designer of record needs to recognize conflicts and work with the project team to find optimal solutions.

5.11.2 Submittal requirements.

The technical content requirements for submittals containing facilities or structures that have physical security features are provided in paragraphs 3.2, 3.3 or 3.4.

5.12 ANTI-TERRORISM.

UFC 4-020-01 'DoD Security Engineering Facilities Planning Manual' is intended to provide the uniformity and consistency in planning for security and antiterrorism. It will be used in conjunction with UFC 4-010-01, 'DoD Minimum Antiterrorism Standards for Buildings', to establish the security and antiterrorism design criteria that will be the basis for DoD facility designs. Those criteria include the assets to be protected, the threats to those assets, the levels to which those assets are to be protected against those threats, and any design constraints imposed by facility users.

5.12.1 Governing Criteria.

UFC 4-010-01, 'DoD Minimum Antiterrorism Standards for Buildings', is intended to minimize the likelihood of mass casualties from terrorist attacks against DoD personnel in the buildings in which they work and live. In general, but not all cases, UFC 4-010-01 is applicable to DoD Components, to DoD inhabited buildings, billeting, and high occupancy family housing, and to DoD expeditionary structures. Detailed guidance on how to determine the applicability of the minimum AT standards to new construction and existing inhabited buildings is provided in UFC 4-010-01 and shall be utilized by the designer of record. The designer shall document whether or not this UFC is applicable to the specific project. The design analysis shall document the findings and state if the minimum AT standards apply or not, specifically detailing the logic with references from the UFC of the conclusion reached. If adherence to the minimum AT standards is required, the design analysis shall document how each standard within the UFC will be

addressed. If adherence to the minimum AT standard is not required, the design analysis shall document the provisions that exempt applicability. For renovations or rehabilitation of existing buildings, the 'triggers' in UFC 4-010-01 shall be considered and the applicability shall be documented in the design analysis or work plan. The design analysis or work plan shall contain a statement documenting that all the specified 'triggers' were evaluated and the results of the evaluation.UFC 4-010-02 'DoD Minimum Antiterrorism Standoff Distances for Buildings (For Official Use Only)' is to be utilized in conjunction with UFC 4-010-01 for application of the minimum AT standards.

5.12.2 Level of Protection.

The minimum AT standards provide a built-in minimum level of protection against terrorist aggressor tactics in order to reduce the probability of mass casualties. In some instances a level of protection greater than what the minimum AT standards provide are required for a project. DoD Instruction 2000.16 requires every installation or base to have an Antiterrorism Officer (ATO). The role of the ATO is to orchestrate the development of comprehensive antiterrorism plans and to coordinate the efforts of all organizations on the installations with respect to antiterrorism preparations. The designer of record shall contact the installation ATO early in the design process, obtain any and all AT requirements which are more stringent than the UFC 4-010-01 minimum AT requirements, and document the response in the design analysis or work plan. The designer of record will mitigate the aggressor's tactics to the appropriate level of protection utilizing the guidance provided in the Security Engineering Facilities Design Manual. For antiterrorism requirements greater than the minimum standards per UFC 4-010-01, the USACE Protective Design Center Mandatory Center of Expertise shall be consulted.

5.12.3 Coordination of AT with other security requirements.

The designer of record shall coordinate the design for AT requirements with the physical and electronic security requirements for the project.

5.12.4 Submittal requirements.

The technical content requirements for submittals containing facilities or structures that utilize protective construction to mitigate terrorist tactics effects to an acceptable level are provided in paragraphs 3.2, 3.3, or 3.4.

5.13 MEDICAL FACILITIES

5.13.1 Governing Criteria.

Medical construction projects follow different criteria and project delivery stages than other MILCON projects; design and construction criteria and procedures for all new construction and renovation of military medical facilities are provided in UFC-4-510-01. The UFC is a comprehensive guide to planning/programming, design, construction, and commissioning of military medical facilities, including laboratory and veterinary facilities. It is specifically applicable to MILCON. For OMA and SRM medical facility work, the UFC itself states that its technical criteria are required "when considered feasible and economical". Customarily, the MRR program requires conformance to the UFC on all of its contracts. The UFC contains provisions for both design-bid-build and design-build methods of project delivery. All SOWs and PWSs for design or design-build of military medical facilities must include this UFC as required criteria.

5.13.2 Medical Facilities Center of Expertise and Standardization (MX).

The U.S. Army Corps of Engineers Medical Facilities Center of Expertise and Standardization (MX) provides leadership responsibility for design acquisition strategy and concept design development of DoDM and MILCON funded projects, with continued technical oversight and direction during final design and construction execution in all areas of the medically unique aspects of assigned projects.

The MX supports all USACE District-led Project Delivery Teams (PDTs) in the technical medically unique areas of project management, acquisition strategy formulation, criteria compliance, design review, and technical support during construction. These support the Defense Health Agency's (DHA) facilities mission serving the Military Health System (MHS).

5.13.2.1 MX Principal Products/Services

As a mandatory center, the MX provides medical technical expertise to the Corps. This expertise is shown as we execute four mission essential tasks.

a. Provide oversight of medically unique technical areas of projects by delivering detailed design review at all stages. The MX's mission in this role is to: be subject matter experts for interpretation of medical unique standards, criteria, specifications and guidance; assist acquisition strategy initiation and A/E selection; be USACE's primary liaison between geographic districts and the Using Military Departments' Office of the Surgeon General on all medically unique project technical matters; and to be USACE's technical liaison with academia, code bodies, testing & standards setting jurisdictions, and professional associations. The MX's role in this regard is distinct from that of the geographic Districts, who are responsible for overall design review for the project as a whole and in particular for non-medically unique aspects of the project. The key function in this regard is to review plans and specifications for medical MILCON projects: the process is described in the swim lane flowcharts in Appendix C. The MX charter describes the medically unique technical disciplines as mechanical engineering (HVAC, plumbing, medical gasses), communications engineering (low voltage systems such as code blue and nurse call), fire protection engineering (including life safety design), electrical engineering (especially critical power generation and distribution), and architecture (including floor planning and building envelope integrity).

b. Prepare project unique Medical Design Instructions (MDI). With this mission essential task, the MX assures medical technical consistency across the enterprise program. We provide unique Project Management process guidance to district that: establishes acquisition alternatives; defines DHA criteria and unique medical standards linked to the Surgeons functional program instructions; provides design guidance to the A/E; establishes design/ submittal requirements and DHA required milestones for approvals; and, incorporates our unique Lessons Learned. While the final content and level of detail in a Medical Facility design ultimately results in the same level of detail and content of a traditional MILCON design, the process for generating a medical facility design differs greatly from a traditional MILCON design approach in some areas. Designers and A-Es should adhere to the

UFC requirements for design development and design production of medical facility drawings and specifications. Request for proposals in DB contracts, Performance work statements, and scopes or work for A-E contracts should contain all of the medical unique design submittal requirements contained in the UFC and MDIs. The key function in this regard is the creation of the MDI: the process is described in the swim lane flowcharts in Appendix C.

c. Proactive involvement in construction issue resolution including change orders. With this mission essential task, the MX assists the geographic districts execute construction activities to ensure the Corps delivers World Class facilities to the MHS. Through a combination of remote and on-site engagement, we ensure criteria and procedures for new construction and renovations of medical facilities are provided IAW UFC-4-510-01. Just as important is verification of these criteria and methods, the garnering and dissemination of lessons learned, and the collection of evidence in support of design and construction best practices. The most technical action in this suite of activities is delivery of the actual construction services: the process is described in the swim lane flowcharts in Appendix C.

d. Serve as technical subject matter experts (SMEs) on medical facilities issues to customers, geographic Districts, installations, A/Es and construction contractors, and other PDT members. This role could be project-specific or could be related to overall program issues.

5.13.3 Customer Interaction.

5.13.3.1 As the MX's formal representatives to the PDT, Project are responsible for engaging the geographic District directly. They will engage in project and product AARs, receive the comments for customer surveys, and interact in multiple informal situations. Process integrity, lessons learned and best practices shared in these forums will be shared immediately with the rest of the MX staff, who will deliberate and make changes as necessary.

5.13.3.2 Project Engineers, through their PDT interactions and professional committee memberships will inform the process with criteria and code impacts.

5.13.3.3 The former HA/PPMD is undergoing a two-year phased transition to a new organization, DHA. In that period, there will be changes in the MHS business process that the MX will be engaged in, either by helping to influence or by being required to respond to. Those changes will inform the MX business process and quality management system and will be incorporated as necessary.

5.13.4 Non-MILCON projects for military customers.

This category includes O&M-funded, SRM-funded and services projects; typical USAESCH programs falling in this category include MRR, OMEE, IO&T, and medical furniture. The specific criteria and deliverables in non-MILCON projects are detailed in UFC 4-510-01 as described in para. 5.13.1 above. The UFC does make an exception for work that is not "considered feasible and economical" to comply with UFC

requirements, but this should be a rare case and should have a detailed justification documented in the project files.

5.13.5 Non-military customers

Specific criteria and submittal requirements for medical facilities for non-military customers (such as Department of Veterans' Affairs) must be developed early in the project life cycle (for example, in the design charrette or project scoping meeting) and clearly described in the contract documents. The goal, similar to nonmedical projects, is to thoroughly understand the customer's requirements and applicable policy and criteria, and enable a technically sound, cost effective approach to be implemented to meet those requirements. Contract documents should make the Government's expectations for project goals and quality crystal clear.

5.14 LOW IMPACT DEVELOPMENT (LID).

The strategy of low impact development shall be in accordance with UFC 3-210-10, Low Impact Development. This UFC provides technical criteria, technical requirements, and references for the planning and design of applicable projects to comply with stormwater requirements under Section 438 of the Energy Independence and Security Act (EISA) enacted in December 2007.

5.15 SYSTEMS ENGINEERING.

5.15.1 Purpose And Applicability.

Systems Engineering (SE) is a process that integrates the technical effort within a managed project to transform an operational need, or user's requirement, into a description of systems performance parameters and systems configuration. This chapter provides guidance on activities which integrate the technical and managerial processes required to optimize the performance of a facility in its stated purpose or mission. When implemented early in the design process, systems engineering ensures that the total system is efficient, cost effective, operable, reliable, and maintainable. System Security Engineering (SSE) is a subset of the Systems Engineering process. The SSE Process establishes and defines activities conducted in a broader systems engineering technical effort where there are other competing and conflicting risk concerns that must also be satisfied. In addition to a fully integrated engineering effort and an established definition of system or equipment operating parameters, the customer also gains these benefits: (1) the design is conducted on a total system basis which incorporates other requirements; (2) all interfaces are compatible, i.e., system-to-system, system-to- facility, facility-to-facility, supporting equipment-to-facilities; (3) a means is provided for evaluating changes which affect the overall system performance, effectiveness, schedule and cost; (4) a framework of coherent system requirements exists that will be used as performance, design, and test criteria, further, these criteria serve as source data for specifications, tests, contract work statements, and facility documentation; (5) the technical performance is measured for timely assessment of high risk areas/problems; and (6) a means of documenting technical decisions made during the course of the program is available to managers. When specified in the contract, SE must be implemented according to the requirements defined in this chapter.

5.15.2 Systems Engineering Management Plan (SEMP).

The Systems Engineering Management Plan (SEMP) covers all systems engineering program elements and development of an SE data base to support project design, construction, test and evaluation, start-up, and acceptance through operation and

maintenance. The SEMP is developed during the planning and programming phase of a program or project. The system engineer should engage the security engineer or an IA professional to develop the SEMP to ensure security requirements, references, and testing measures are adequately addressed. An SEMP identifies each specific systems engineering task with a separate task schedule. SEMP's also identify an SE organization within the overall project organization, staffed to the extent necessary to accomplish the system engineering tasks identified in the SEMP. The SE organization will include personnel who are experienced in the management and implementation of a SEMP and whose prime responsibilities are the performance of systems engineering tasks. The plan will also include resumes of key personnel. The SEMP is implemented during criteria development and supports all phases of design.

5.15.3 Systems Engineering Elements.

The SE process can be divided into four areas to explain its functions: (1) Analysis, (2) Product Assurance, (3) Integrated Logistic Support, and (4) Configuration Management. The designer may be required to incorporate many of these elements and specific sub elements into the design process and the construction phase prior to the time the facility is released for beneficial occupancy. Each of these elements will be examined in the following paragraphs to determine how they affect system performance.

5.15.4 Systems Analysis.

Systems analysis includes analysis of the design of complex and high performance facilities, electromechanical systems, associated real property, and documentation during criteria development, construction, initial site activation, operation, and lay-away phases. Systems analysis entails the use of elementary design review techniques; advances in state of the art in all sciences, engineering, and associated fields; and approved engineering practices and standards to ensure functional efficiency and completeness of facilities. The analysis produces engineering data that identifies and specifies the configuration and use of all system elements and their effectiveness in achieving the performance parameters. The analysis verifies that all facility systems perform in accordance with the customer's functional requirements.

5.15.4.1 Requirements Analysis. The designers using SE program plans provided by USAESCH will develop a system requirements analysis. This analysis will be conducted in order to establish project-specific SE plans, goals, and methods necessary to manage critical engineering design aspects. A requirements analysis, when provided for in the SOW or PWS, will be completed prior to the start of the design.

5.15.4.2 Systems Operations and Maintenance Analysis. A systems operations and maintenance analysis (O&MA) may be performed, when appropriate to the complexity of the project, to identify project requirements for site operations and maintenance. The analysis will serve as a basis for documentation planning (O&M manuals), logistics support, personnel requirements, and training functions. The systems O&M analysis will be completed prior to the start of the design.

5.15.4.3 Concept Design Review Submittals. All analyses will be initiated either before design begins or by the time of the concept review conference. The Project Development Brochure, a requirements analysis, and the systems O&M analysis will be completed prior to the start of the design. The LCCA and an outline hazards analysis will be submitted with

the project design analysis at the concept review conference.

5.15.4.4 Intermediate Design Review Submittals. No formal SE deliverables are called for at the intermediate submittal stage but SE products will be further developed and updated as the design matures.

5.15.4.5 Final Design Review Submittals. The hazards analysis and all other analyses reviewed during the concept or intermediate review conference will be updated, reflecting any review comments. The final life cycle cost analysis will be included in the design analyses submittal.

5.15.5 Product Assurance.

This element includes technical management and program execution activities that affect equipment availability, performance, and system effectiveness. This process identifies the measures that reduce the risks and unknowns associated with critical areas of the program and selects the corrective measures that can be implemented.

5.15.5.1 Reliability/Availability/Maintainability (RAM). This analysis will be performed by designers using quantitative goals established in the criteria. The designer will translate these goals for reliability and maintainability into qualitative design requirements to preserve the integrity of the system, to meet production goals, and to achieve safety and information security requirements. This analysis should be part of an interactive process of continually assessing and improving the design. Its objectives should be translated into quantifiable and verifiable contractual terms and allocated through the design hierarchy. RAM analysis will be applied only to critical/high cost systems, or to systems considered especially significant to personnel and equipment safety.

5.15.5.2 Human Factors Engineering (HFE). Designers will consider HFE requirements during the design phase to ensure that the man-machine operational philosophy and interface requirements are established for all program phases. The HFE program will comply with MIL-STD-1472. Designs and Specifications. To be safe as well as usable, facilities, equipment, and operations must be adapted to the limitations of the people who use them.

5.15.5.3 Standardization. Standardization is a design-related process that ensures that common equipment, modules, and components are incorporated into the design to achieve the greatest possible economic and operational benefits. The interchange-ability provided through standardization is used during a complex project to reduce stocks of repair parts, reduce logistics requirements, reduce provisioning costs, simplify operations and maintenance instructions, and improve system reliability and maintainability. Standardization will include only those equipment items that are high cost, critical, and that require long lead-time when replacements are ordered. Standardization will use item-type control methods for equipment identification and categorizing. A Government review during the concept and final design phases will determine the degree of implementation of the standardization program. The program will comply with the requirements of DOD 4120.24.

5.15.5.4 Construction Safety

a. Administration of the safety program on each construction project rests with the constructing USACE district and its parent division or designated QA agent. The designer will ensure that adequate safety and occupational health provisions in accordance with OSHA (29 CFR 1910 and 1926 as applicable), and EM 385-1-1, are included in the contract requirements and cover all hazardous situations expected to arise during construction.

b. Safety Surveys/Audits. Surveys will be made periodically by the Design Agency, USACE constructing district, and installation safety and engineering personnel to assess contractor safety provisions during construction for compliance with the contractual requirements.

c. Prefinal Inspections. Districts will include provisions for evaluating safety in all prefinal inspections of completed facilities and systems.

5.15.5.5 Commissioning**.**

The commissioning process is a quality process for achieving, validating, and documenting that a facility and its systems have been planned, designed, constructed, secured, installed, tested, and, as a result, is capable of operating and being maintained in conformity with the design intent. If the project includes an Automated Information System (AIS) it will require adherence to the site's Authority to Connect (ATC) process. The ATC process is to ensure testing of data transfer, video reception, or other forms of data communication as required by the control system to a front end or another enclave. Further, the customer will not consider the project to be completed until the site's connection approval authority concurs that the system is ready for site acceptance. If a customer IA office is not involved in the project, assistance by USACECH IA support should be arranged to ensure any systems installed have been configured in accordance with the baseline and accepted IA controls.

All projects with HVAC related work must include and comply with guide specification UFGS – 23 08 00.00 10 Commissioning of HVAC Systems. Commissioning shall be performed in accordance with ACG Commissioning Guideline, NEBB Commissioning Standard, or SMACNA 1429. The Commissioning Firm shall be a subcontractor of the prime Contractor and shall be financially and corporately independent of all other subcontractors. The Commissioning Firm shall report to and be paid by the prime Contractor. The specification shall include a requirement to submit a Commissioning Plan; and a Commissioning Report consisting of completed Pre-Functional Performance Test Checklists and completed Functional Performance Tests as one package.

In addition to commissioning requirements for HVAC Systems described in the preceding paragraph, there may be a requirement for commissioning of the following systems depending on complexity, reliability, customer requirements, and magnitude: Building Automation Systems (BAS), Lighting Control Systems and interface with daylighting, domestic hot water systems, fuel handling systems, and renewable energy generation systems. Other systems not listed here may also require commissioning. Typically a specification must be developed to include industry standards on commissioning for the specific system, certification requirements for the commissioning agent, detailed prefunctional performance checklists, detailed functional performance checklists, and commissioning plan/report requirements.

The specification should address the following goals of the commissioning process:

- Verify and document that equipment is installed and started per manufacturer's recommendations, industry accepted minimum standards, and the Contract Documents.
- Verify and document that equipment and systems receive complete operational checkout by the installing contractors.
- Verify and document equipment and system performance.
- Verify the completeness of Operations and Maintenance materials.
- Ensure that the operating personnel are adequately trained on the operation and maintenance of the building equipment.

Requirements for Commissioning must be clearly defined in the contract. There can be a significant cost associated with commissioning.

5.15.5.6 Concept Design Review Submittals**.** The designer will submit a final RAM analysis, a listing of the standardized equipment and components, and an outline format of the systems safety analysis.

5.15.5.7 Intermediate Design Review Submittals**.** The systems safety analysis will be completed and submitted. A draft of the QA plan will be provided.

5.15.5.8 Final Design Review Submittals**.** Submittals will include:

a. Final list of standardized equipment and components complete and sufficient enough to initiate the procurement of the listed items.

b. Quality assurance plan.

c. Hazard tracking log, indicating residual risks and all existing hazards.

5.15.6 Integrated Logistics Support (ILS).

The ILS process provides an avenue through which management and analysis actions are combined to ensure effective and economical support of all systems and equipment at all levels of maintenance during the programmed life cycle. In addition, ILS is also a planning function used by the technical management elements and tangible support elements to provide the ILS concept objectives. For projects that USAESCH has design/support responsibilities, the designer will develop and define the logistics and maintenance concepts; the maintenance levels for performing scheduled and corrective maintenance; and the procedures for identifying, selecting, procuring, storing, and handling of parts, maintenance equipment, and support materials.

5.15.6.1 ILS Objectives

a. Early Consideration. Early consideration of support requirements in design and development of new projects is required.

b. Improved Support. Improved maintenance support and reduced skill requirements.

c. Balance of Support Elements. Optimum balance among support elements. (This can be achieved by possible tradeoffs.)

d. In-Stock Support. Provisions for in-stock support elements.

e. Life Cycle Cost. Minimum life cycle cost for support.

5.15.6.2 ILS Subelements.

a. Supply and Maintenance Concept. When directed by the contract, the designer will develop a maintenance concept for performing scheduled and corrective maintenance.

b. Provisioning. Designers will make provisions in the equipment specifications for obtaining the Recommended Repair Parts List and necessary technical logistics data in order to support facility system effectiveness. From this information, provisioning recommendations will be made. Designers will define the selection and allocation of repair parts and other support items to the various categories of maintenance based on maintenance allocation and the computation of quantitative requirements for repair parts.

c. Equipment Identification. All equipment specified and installed for each project will be identified by a noun designator and a consecutive numbering method, generally referred to as a tag number. For example, the tag number is made of a designator equipment code for items in the system and an assigned sequential item number. For systems with instrumentation and control, the Instrumentation Society of America listing will be the standard for establishing the equipment identifiers.

d. Master Equipment List (MEL). The MEL is a listing of all end-items of equipment (including, if applicable, software and firmware) within each project that are significant to operations, maintenance, and provisioning. When required by the contract, the MEL will be computerized. See ER 25-345-1 for specific guidance on MEL preparation. To provide a uniform listing, the designer will use the systems/equipment identification procedure in generation breakdown order as the basis for MEL structuring.

e. Operation and Maintenance Documentation (O&M). The designer, when directed by the contract, will prepare design O&M documentation in accordance with ER 25-345-1 and, where applicable, DoD/NIST Information Assurance control requirements. When required, the designer will also perform an O&M analysis to determine requirements for O&M documentation for electromechanical or other operational systems. The designer will also identify O&M logistics data to be provided by vendors and will include these data in the technical and special provisions of the procured equipment and construction specifications. Design O&M documentation will be updated and finalized by the designer or construction contractor or others in accordance with ER 25-345-1 for use during the facility operational phase.

f. Training Program Plan. When directed as a program requirement, designer will develop training requirements in accordance with ER 25-345-1.

g. Scheduling. Two schedules are required. A Level I schedule is an overview schedule which displays systems engineering requirements as they relate to program phases. The Level II schedule depicts the

milestones for each SE element. For systems that include Information Technology, milestones for certification, testing, accreditation, and connectivity will be included in the schedule. The designer will submit these schedules as required by the contract. When required to do so, each contractor will prepare in actual calendar time his own detailed schedules (bar charts/CPM/NAS charts) with respect to all SE activities for his area(s) of involvement.

5.15.6.3 Concept Design Review Submittals. The designer will submit a draft:

- Design master equipment list
- Technical concept narratives
- Training and skills analysis
- O&M documentation specification
- Training requirements specification

5.15.6.4 Intermediate Design Review Submittals. The concept submittals will be updated to reflect any progress/changes.

5.15.6.5 Final Design Review Submittals. Comments from the O&M concept design review and any other review(s) will be incorporated and the documents updated in the final design review submittals. The final design review submittals will be submitted according to the schedule established by the contract and will incorporate any review comments made during prior review conferences.

5.15.7 Configuration Management (CM).

This SE element applies the technical and administrative direction and surveillance during the project to properly identify and control changes to the project's baselines (i.e., criteria B/L, Design B/L and Construction B/L) design. It also provides the administrative process to record and report changes to the configurations of systems, equipment, and facilities. These changes are monitored by a Configuration Control Board. The design criteria will be provided by the Design Agency, which will establish responsibilities, requirements, and procedures for implementing CM throughout the project's designated phases (i.e., Design, Construction, Systemizations Operations Closure). Projects designated for CM will require a CM plan. The CM plan will be developed by the designer. The CM plan will be tailored to the project. Ideally, the CM plan should be submitted before the designated phase for CM design starts.

5.16 VALUE ENGINEERING.

Value Management (VM)/Value Engineering (VE) is an organized effort to analyze a system and its functions so as to achieve the required functions at the lowest total cost. VM/VE seeks the highest value for a project by balancing resources and quality. The VM/VE process emphasizes the use of multi-disciplinary teams and their resulting synergy, using a functional analysis approach for decision making as specified by Engineering Regulation (ER) 11-1-321, Change 1 (or current), and the SAVE International's 6 Phase Value Methodology. In USAESCH, the VE Officer, located in ISPM Directorate, coordinates, advises, and, in some cases, conducts the VE effort. ED supports these efforts by providing technical subject matter experts and cost engineering

expertise to participate on VE Study Teams, and by vetting submitted Value Engineering Change Proposals (VECPs) generated by the Contractor, after award of a contract, against functional, operational, and technical requirements.

5.17 SYSTEMS SAFETY.

5.17.1 Facility System Safety.

Facility System Safety is defined to incorporate systems safety engineering and management practices into a facility life cycle process used in the conceptual phase, planning stages, construction of facilities, and facility reduction (demolition). The FASS program has been structured to concentrate USACE on elimination and control of hazards in the criteria development and design of facilities. Further, FASS is structured to emphasize hazards that are not covered by codes and standards. The FASS program is designed to incorporate system safety into the facility design process as prescribed in AR 385-16, System Safety Engineering and Management and Military Standard 882E Standard Practice System Safety. To overcome these problems, the FASS process examines the specifics of the hazards involved, the level of risk, and the potential effectiveness of existing codes and standards. Following this discovery and analysis process, a decision is made to eliminate or reduce the risk through the use of controls set forth in codes and standards, specially designed controls, or a mix of both control types. When required by the contract documents, or when determined to be appropriate by the designer (with KO concurrence if applicable), hazards analysis will be performed on the facility and process equipment in accordance with AR 385-16 and MIL-STD 882.

5.17.2 Explosives Safety.

Explosives safety policy is to provide the maximum possible protection to people and property from the potential damaging effects of DoD military munitions (explosive and chemical) and to minimize exposures consistent with safe and efficient operations (i.e., expose the minimum number of people for the minimum time to the minimum amount of explosives or chemical agents).

5.17.2.1 Explosives Safety Site Plans (ESSP)

Explosives safety site planning is the composite risk management process associated with explosives/toxic chemical activities to ensure the minimum risk to personnel, equipment, and assets, while meeting mission requirements. The damage or injury potential of explosions is determined by the separation distance between potential explosion sites (PES) and exposed sites (ES); the ability of the PES to suppress blast overpressure, primary and secondary fragments; and the ability of the ES to resist explosion effects. Explosives safety site planning is the process of conducting and documenting an assessment of new and/or existing facilities and missions involving Ammunition and Explosives (AE), or non-AE related facilities occurring within the quantity distance (QD) arcs created by other AE operations and storage. Planning for the proper location and construction of ammunition and explosives (AE) facilities and surrounding facilities exposed to AE facilities is a key element of the explosives/toxic chemical site planning process. Sometimes this planning involves utilizing both distance and protective construction. For customized protective construction design related to explosives safety see paragraph 5.10.1.1. The DOR is encouraged to utilize definitive and standard protective construction facilities approved by the Department of Defense Explosives Safety Board. These facilities drawings can be located on the Whole Building Design Guide at http://www.wbdg.org/design/ammo_magazines.php. Design

completion is required for definitive designs. The DOR shall site adapt the DDESB standards to accommodate the characteristics of the project site without changing any blast elements of the design. USAESCH Structural branch should be contacted when site adapt designs for these DDESB approved standards are used in a project to ensure key structural elements are not altered.

An ESSP describes in text and graphics the relationship among proposed potential explosive site/toxic chemical sites, related facilities, and unrelated personnel and facilities. It also contains a description of the construction specifications for the facilities and the specifications and placement of required auxiliary equipment such as dividing walls, LPS, or utility service lines or conduits. It is submitted to the appropriate Service and Department of Defense Explosives Safety Board (DDESB) for approval of the particulars of the plan from an explosives safety perspective per guidance in the applicable references above.

In general, construction of new and/or modifications to existing facilities with missions involving Ammunition and Explosives (AE), or non-AE related facilities occurring within the quantity distance (QD) arcs created by other AE operations and storage require an ESSP. See the respective Service's regulations for when an ESSP is or is not required.

DoD regulations do not allow the actual construction of a new facility, modification of an existing facility, or use of an unapproved site until the DDESB final ESSP approval is received at the installation. For a compressed time line, the Army will allow contract award or site preparations activities if there is a DDESB approved preliminary ESSP at the installation. See each Service's explosives safety regulations related to their respective policies on projects with compressed schedules. For projects requiring an ESSP, the DB product delivery method is not recommended if there is a custom design (non-DoD approved standard facility or structure) required to mitigate explosives effects unless the DB project schedule allows for final DDESB approval before construction begins.

a. ESSP Development, Coordination, Content, Submission and Approval

The development, submission and approval of an ESSP shall adhere to the requirements of DoD 6055.09-M, the respective Services' explosives safety standards/manuals and USACE engineering manual contained in the references above.

An ESSP can be submitted in two submittals (preliminary and final) if warranted by the project time line. A preliminary ESSP is used for new construction or changed footprint of existing structures and approves the physical location and siting of the planned facility based on the explosives safety standards. This approval, submitted at the parametric (10%) to concept (35%) completion stage, reduces the risk of wasted design effort while proceeding to design completion and submittal of the final ESSP. The final ESSP can be submitted at the project intermediate (65%) completion stage if the explosives safety elements (such as protective construction, lightning protection system, and grounding) represent the pre-final (95%) completion stage.

(1) Development

DDESB approved automated site planning software (ESS or ASHS) is to be used in most cases to perform the quantity distance analysis for the various combinations of PESs and ESs. In some isolated cases, the Services and DDESB allows use of non-automated methods for quantity distance analysis. The Contractor will request approval from the Government to use non-automated methods for quantity distance analysis.

(2) Coordination

Early coordination is crucial and essential for a properly prepared ESSP. All proposed AE projects must be coordinated with the Installation Master Plan (IMP) to properly coordinate and assess the impact on other ongoing and future construction projects and plans. The development of an ESSP requires installation-level coordination to include, at a minimum, personnel representing master planning, facility engineering, safety office, fire department, security officer, environmental office, quality assurance specialist ammunition surveillance (QASAS), and the installation tenant conducting the AE operation/storage. If the application of explosives safety requirements to the project is not clearly understood, it is advisable to leverage the expertise of Services' subject matter experts.

(3) Content

The ESSP must include all the information needed for the reviewer to determine if the explosives safety requirements are meet. The ESSP should be prepared considering the personnel reviewing the ESSP may not be familiar with the base or operation, including unique terminology, and do not know the mission or specific circumstances. Each ESSP varies in content. Major components of the content of an ESSP are an installation map, site location map, quantity distance analysis (generally a printout of DDESB approved software), quantity distance map, list of all facilities inside the inhabited building distance (IBD) arc with a description of each, a description of the intending operations and the supporting facilities, occupancy limit of the facilities, detailed drawings and engineering analysis (protective construction and lightning protecting and grounding details), risk assessments and acceptance of risk (at the appropriate level). The content of a preliminary and final ESSP shall be as detailed and complete as required by DoD 6055.09-M, the respective Services' explosives safety standards/manuals and USACE engineering manual referenced above.

(4) Submission and Approval

The project schedule should allow 180 days for ESSP approval after it is has reached the respective Service's explosive safety center. The ESSP is submitted for review and approval through command channels to the Service's explosives safety centers and DDESB. A request for review and approval memorandum accompanies the ESSP up through the command channels. If an expedited review is warranted, the request with detailed justification should be included in the memorandum. For approval, a typical ESSP submittal staffing for the Army is: Installation – higher headquarters – US Army Technical Center for Explosives Safety (USATCES) – DDESB. Questions related to the ESSP content are generally asked back through the chain of command, but the owner of the ESSP may be contacted directly by the Services or DDESB. Once approved, the ESSP is routed back to the Installation in reverse of the staffing shown above.

5.17.2.2 Explosives Safety Submission (ESS) Explosives Site Plan (ESP) and After Action Report (AAR)

Explosives Safety Submissions and Explosives Site Plans and their Amendments/Corrections are prepared for the purpose of providing site specific explosives safety specifications for execution of the selected response alternative(s) for Munitions and Explosives of Concern (MEC) removal operations, removal and/or disassembly operations, or intrusive investigations of explosively contaminated sites managed under the Military Munitions Response Program. DoD regulations do not allow intrusive activities on any site without a DDESB approved ESS or ESP, unless the

document needs to be expedited. In such an instance, the PM may provide documented justification to the Directorate of Environmental and Munitions Center of Expertise – Military Munitions Division (EMM) for obtaining Interim Approval from the USATCES. An After Action Report serves as documentation that the explosives aspects of the selected response have been completed per the approved ESS after a Removal Action is completed. Below are the definitions of the documents that are included under this Section.

a. Definitions

(1) ESS: A documented plan approved by the USAESCH, the USATCES, and the DDESB that provides the site-specific safety specifications for execution of the selected response alternative(s) for MEC removal operations or removal and/or disassembly operations of explosively contaminated buildings and/or equipment.

(2) ESP: A document approved by the USAESCH, the USATCES and the DDESB that provides the site-specific safety specifications for execution of MEC investigations.

(3) No DoD Action Indicated (NDAI) or No Further Action (NOFA) ESS: A documented plan approved by the USAESCH, the USATCES and the DDESB that provides the site-specific information such as the site identification, site location, and justification for the decision of NDAI or NOFA at any Military Munitions Response (MMR) site.

(4) Time Critical Removal Action (TCRA) ESS: An abbreviated ESS submitted for expedited approval by the USAESCH, the USATCES and the DDESB for execution of the selected response alternative(s) for MEC removal operations or removal and/or disassembly operations of explosively contaminated buildings and/or equipment.

b. After Action Report (AAR): A report approved by the USAESCH and provided to the USATCES and the DDESB that documents that the explosives aspects of the selected response have been completed per the approved ESS. In most cases, a “Statement of MEC Removal” or “Statement of Munitions Response MEC Removal Actions” will fulfill the requirements in accordance with the DoD 6055.09-M.

c. Coordination

In order to provide a quality product, early coordination is crucial and essential for an ESS, ESP or AAR. It is the responsibility of the PM to coordinate for a meeting/discussions before document preparation. In addition, the PM shall start the ESS/ESP process early enough to allow a minimum of 60 days for document generation and the review/approval process prior to the beginning of field work.

For all in-house written documents, attendees shall include the PDT, ESS Team (EDS-O), Environmental Center and Munitions Center of Expertise - Military Munitions (EMM) personnel, and appropriate Contractor personnel if necessary. The purpose of the meeting will be to discuss the site-specific aspects and safety requirements of the project that must be addressed within the document. Sufficient documentation pertinent to the site needs to be provided by the PM and/or TM to the document preparer prior to the meeting so that it may be reviewed beforehand.

For all Contractor-written documents, a meeting is also necessary. However, it is not a requirement to include the ESS Team, or the EMM in the meeting for document preparation planning.

For Active Installations, ensuring that all team members are involved in a meeting with the Installation in order to receive sufficient site/project specific information that may not be contained in project documentation.

d. Content

These documents consist of information required by DoD 6055.09M and the applicable references in Appendix A include but are not limited to:

- applicable site history and current site conditions,
- terrain or climate affecting the procedures of Military Munitions Response Actions (MMRA),
- past, current and future land use,
- MEC expected at the site including any historical MEC information from previous MMRA,
- site-specific start and end dates
- organizations involved in the MMRA (both government and contractor)
- engineering controls (EC) to be used during intrusive work,
- allowable geophysical detection instruments,
- demolition methods including EC to be used for demolition,
- methods for storing or obtaining donor explosives for demolition,
- location(s) and Quantity-Distances (Q-D) for magazines used to store donor explosives or recovered MEC,
- Minimum Separation Distances (MSDs) to be used during all field activities based on munition specific calculations in accordance with DoD Explosives Safety Board (DDESB) Technical Paper 16 (TP 16),
- maps of the site showing the location of the site, the work area, all MSDs for the work area, and all inhabited buildings and/or public traffic routes within the MSDs for the work area.

In the event that the ESS or ESP is being generated by the USAESCH, the contractor is the entity responsible (as required by the task order) for:

- Providing ArcGIS and electronic data files as required by the contract for use in preparation of the ESS/ESP or Amendment.
- Providing site-specific input in regards to specific techniques, equipment, personnel, and other pertinent information that may apply to the response effort.

e. Submission and Approval

The project schedule should allow 60 days for in-house document preparation (unless a shorter period is agreed to on a case-by-case basis), and 4 weeks for approval from the

DDESB. For TCRA Actions, a shorter suspense may be negotiated on a case-by-case basis. For contractor-prepared documents, the schedule should allow 14 days for the purpose of reviewing the document content for compliance with the requirements of the 6055.09-M and the other applicable references listed in Appendix A. For approval, a typical ESS, ESP, or AAR, submittal review chain is: PDT and ESS Team – Installation (if applicable) - EMM – USATCES – DDESB. A request for review and approval memorandum from the EMM accompanies the ESS, ESP or AAR up through the command channels. Questions related to the document content are generally asked back through the chain of command, but the owner of the document may be contacted directly by the Services or DDESB. Once approved, the ESS, ESP or AAR is routed back to the PM in reverse of the staffing shown above.

In the event that there is a need for expediting approval, the PM is responsible for providing a request for USATCES Interim Approval with justification (i.e. TCRA, dangerous site, political pressure or inordinate cost to the project if not started by a certain date).

5.18 PREPARATION OF LIFE CYCLE COST ESTIMATES AND OTHER COST PRODUCTS

5.18.1 Purpose and Applicability.

This chapter provides requirements for preparing life cycle cost estimates and general studies for cost related products. A programmatic life cycle cost analysis (LCCA) is defined as a study of the costs and benefits associated with owning and operating military facilities or components throughout the functional life (concept through retirement) of the facility. The objective of the analysis is to select the most economical alternative, in terms of initial cost and operations and maintenance costs, from two or more candidate alternatives that satisfy a particular design requirement. In this approach, design decisions are based on total LCC rather than first (investment) cost alone which leads to more effective cost allocation.

5.18.2 Engineer/Analyst Qualifications.

Life Cycle cost Analyses and other cost studies will be prepared by individuals trained and competent in the disciplines required. This may or may not be an engineer as many of the methods used in life cycle and other studies are used by both engineering and economics/finance. If the study is to be produced by the Cost Branch then the approval process will follow the PIL Letter. If the study is done outside of Cost Branch then Cost Branch will review if requested. Other studies will be reviewed and approved by the standard USAESCH methodology (branch Chief for technical review and System Division Chief for final review).

5.18.3 Development of the Life Cycle Cost or Study.

All Life cycle analyses will be developed in accordance with OMB circular A-94 unless there is a variation required by the technical needs of the study (i.e. a nontypical study may be from the viewpoint of someone other than the taxpayer or the base). If a variation is required this variation should be acknowledged in the report for the Life Cycle and approval should be obtained from the branch chief of the group producing the report prior to preparation of the report. Budgetary life cycles done in accordance with some software program may not require a written study, most others will. If a written report is required then all life cycles and all studies should address the following:

- The scope of the effort.

- The assumptions made
- The data used
- The derivation of that data if it was altered or modified in any way
- A prime analysis should be described and why it is prime should be addressed
- All drivers of the analysis should be identified
- A sensitivity analysis should be performed on each driver of the analysis.

5.18.4 Report Format.

While all reports will have their peculiarities a typical format could be:

- Executive summary
- Introduction
- Assumptions and reference requirements
- Scope
- Data and data derivation
- Results and description of prime analysis
- Sensitivity Analysis
- Conclusions

5.18.4.1

a. Requirements, Standards, and Guidelines. A programmatic LCCA will be performed if required by the contract. Basic standards and guidelines for the conduct of LCC studies are contained in AR 11-18 for general design applications and in reference h, 10 CFR 436A for special applications, (e.g., solar energy, wastewater treatment, etc.). Supplemental standards and guidelines that extend the above directives for Corps of Engineers use are contained in DOD 5000.4M.

b. LCC Methodology. Although DOD policy requires routine application of LCC during design, the scope of LCC will vary from project to project to ensure the study effort is cost effective. Duplication of studies and those situations where the potential savings resulting from the study are less than the cost of the study will be avoided. An interdisciplinary approach will be used to ensure that alternates chosen, whether system, subsystem, or component, will be compatible on a total system basis. The use of this LCC technique will require effort in the design phase beyond that required by the Energy Conservation and Life Cycle Cost Design Analysis specified in chapter 1. The technique will be used to evaluate the cost advantages of alternates that have the greatest potential to improve quality and/or functional efficiency of a system at equal LCC, to lessen the LCC at no loss in quality or functional efficiency, or to improve quality and functional efficiency and also reduce LCC. The LCC analysis will be initiated as early as possible in the project lifecycle and will be scheduled and

accomplished at a date sufficient to allow the study to guide the design. Alternatives that have a significant impact on the overall cost and that do not conflict with the design directive will be considered. These should include products and methods that may not be cited in current criteria. Component alternatives must be compatible with the system being designed.

c. CEHNC-EDS will furnish the guidance on items selected for study, data required, and how the data will be presented.

d. Cost Data. For engineering and design study life cycle costs the initial construction costs for each alternate will be developed in the conventional manner. Maintenance, operating, and custodial costs for the various alternates which must be considered will be obtained from the best available sources, i.e., facilities engineers, manufacturers, utility companies, and maintenance firms. When the required data has been assembled, USAESCH will make the calculations necessary to determine the LCC of each alternate. For programmatic life cycle reports, the latest unit cost and the latest factors from the PAX newsletter will be used to develop the programmatic life cycle.

5.18.5 Cost Engineering Support to Planning and Programming

5.18.5.1 DD Form 1391 Development and Review.

Huntsville Center cost branch develops 1391 budgetary estimates and reviews 1391s developed by others for many customers. When developing the 1391 for a customer, the cost engineer will utilize MII, Means or PACES depending upon the level of detail available from the design charrette and whether a Project Development Report has been developed for the project. Reviewing the 1391 generally involves the validation of the Primary Facilities and Support Facilities scope and unit cost. For standard MILCON facilities, the latest PAX Newsletter is used to validate square foot costs. Additional guidance and information above and beyond what is in the PAX Newsletter may be provided by USACE or other personnel that developed the 1391. All assumptions utilized for the review must be documented and when the cost is above the allowable PAX newsletter cost, then a rationale shall be provided as to why the PAX newsletter cost is non-representative. Other data may be used to provide more clarity for the 1391 cost including historical information for similar projects or site knowledge about where the project is located (there may be local market conditions that are not envisioned by the PAX newsletter, Means, MII or PACES. The cost escalation factor, location factor, acquisition strategy/percentage, exchange rate, SIOH percentage, contingency percentage, sustainability/special energy measures, information systems costs, low impact development, demolition and antiterrorism measures are also validated.

5.18.5.2 ENG Form 3086 Review and Development of Unit Cost.

All 3086 reviews will be in accordance with the latest PAX Newsletter. Additional guidance may be provided at the time by USACE and IMCOM personnel responsible for the review. Dependent upon the circumstances of the 3086 itself and the 1391 providing information to the 3086, the reviewer may have to engage other technical personnel to support in the development of certain portions of the 3086 (particularly the supporting facilities). While the unit costs shown in the PAX newsletter are very valuable, they shall not be followed blindly. The Review must be able to make engineering judgments and to work with other engineers and technical personnel to ensure that the final 3086 form is

as accurate as can be made given the information available and the time constraints for the development of the 3086. At a minimum the engineer doing the review and development will ensure that the Project Development Report has been reviewed, the 1391 has been reviewed plus any supporting documents for either of these documents and will ensure that the unit cost guidance from the 1391 has been addressed and is utilized in developing the final unit cost for the 3086.

5.18.6 Other Cost Products.

There are many other cost products that arise occasionally, including statistical models, detailed labor models, trade off studies, Monte Carlo simulations among many others. All of these models will have their design requirements and the cost engineer responsible for developing this product will ensure that all design constraints are addressed. Typically a report will be required and that report will show not only the final product, but all assumptions made in order to produce the final product and all design constraints should be specifically addressed as met or not met and how they were met or not met. Most cost products will require a sensitivity analysis showing the impact of the significant design parameters. All cost products should have a separate quality check for accuracy of the mathematics and when feasible a quality check for the logic of the design criteria and assumptions made.

5.19 INFORMATION ASSURANCE AND INFORMATION TECHNOLOGY

Information Assurance (IA) is comprised of the measures that protect and defend information and information systems by ensuring their availability, integrity, authentication, confidentiality, and non-repudiation. These measures include providing for restoration of information systems by incorporating protection, detection, and reaction capabilities.

Information Technology (IT) defines a process for developing a system that includes information assurance and the security requirements for the hardware and software components in the system. An IT solution addresses problems and installs, configures, troubleshoots, and provides maintenance and training in response to customer requirements or inquiries, and installs, configures, troubleshoots, and maintains server and or configurations (hardware and software) and network equipment in support of systems fielded or in development.

5.19.1 References.

IA and IT personnel will utilize the following general criteria for the use and development of IA and IT requirements in USAESCH. The requirements found in these references are applicable to all USAESCH projects/programs that have an Information Technology component and store or transfer data. Data content and structure must be maintained in a secure manner in compliance with the referenced rules, regulations and policies.

- Army Regulation (AR) 25-1, Army Information Technology;
- Army Regulation (AR) 25-2, Information Assurance;
- Air Force Instruction 33-210, Air Force Certification and Accreditation (C&A) Program (AFCAP)
- Engineering Technical Letter (ETL) 11-1: Civil Engineer Industrial Control System Information Assurance Compliance

- Department of the Navy (DON) DIACAP Handbook v1.0;
- Navy eMASS User Guides
- NIST SP - 800-30 rev1; Guide for Conducting Risk Assessments
- United States Marine Corps Enterprise Cybersecurity Directive 018 Marine Corps Certification and Accreditation Process
- The Federal Information Security Management Act (FISMA)
- Committee National Security Systems, Policy No. 11;
- Federal Information Processing Standards;
- Defense Information Systems Agency (DISA) Secure Technical Implementation Guides (STIGs)
- DoD Directive 8500.1, Information Assurance;
- DoD Instruction 8500.2, Information Assurance Implementation;
- DoD Instruction 8510.01, DoD Information Assurance Certification and Accreditation Process (DIACAP)
- DoD 8570.01-M Information Assurance Workforce Improvement Program

5.19.2 IA in the Project Life Cycle.

For programs/projects determined to have IA requirements, IA is considered at each stage of the project life cycle.

5.19.2.1 During Planning Phase:

IA professionals should participate early in project development to help identify IA requirements and define IA controls at system planning phases, including planning charrettes, DD Form 1391 development and review, design charrettes and when developing acquisition requirements and contract documents. Some customers may fund USAESCH to go beyond providing an accreditable system and request USAESCH complete the entire Certification and Accreditation (C&A) process on their behalf. In these cases, the contractor(s) may, depending on the level of services the client requires, participate in Certificate of Networthiness (CoN), Interim Authority to Operate (IATO) and/or Authority to Operate (ATO) activities.

5.19.2.2 During Design Phase:

System Identification Profile (SIP) and System Registration with IACORA: Contractor(s) should have all of the system documentation to include diagrams and information ready to release for review.

a. DIACAP Implementation Plan (DIP) and Control Mapping: An existing DIP may be used if available; however, full review of the DIP is required in order to ensure the latest IA requirements are fully addressed and satisfied.

b. DoD Information Assurance Certification and Accreditation Process (DIACAP) Package and Artifacts: Contractor provides IA documentation and artifacts for review. A gap analysis is performed to identify any shortfalls created by new IA requirements or requirements

that have changed.

5.19.2.3 During the System Installation or Execution Phase:

The following artifacts are DIACAP Package supporting documents that are required to be developed to support the accreditation of the system and connectivity to the Army network.

- Configuration Control Board Charter & meeting minutes
- Configuration Management Plan and Processes
- Disaster Recovery Plan
- Continuity of Operations, Contingency Plan
- Incident Response Plan
- Information System Security Policy (Plan)
- Physical Security Plan
- IA Training Plan
- Acceptable Use Policy
- System design documentation / System Architecture / Functional Architecture / System Interfaces Functional Architecture: The Functional Architecture will include the following:
    - Logical diagram (include accreditation boundary)
    - Network Diagram
        - Data flows (Ports, Protocols, and Services or PPS)
        - External Interfaces
        - Type of data exchange
        - Protection mechanism
    - Firewall Rule base
- Hardware / Software Inventory List
- DIACAP Technical Readiness Review.
- Performance Verification Testing

5.19.3 IT in the Project Life Cycle.

For programs/projects determined to have IT requirements, IT is considered at each stage of the project life cycle.

5.19.3.1 During Planning Phase:

IT professionals should participate early in project development to help identify IT requirements and controls during system planning phases, including planning charrettes, DD Form 1391 development and review, design charrettes and when developing acquisition requirements and contract documents.

5.19.3.2 During Design Phase:

The contractor should be required to prepare a project schedule, as part of their proposal, for the entire period of the delivery order commencing with the award date and ending on final system acceptance. Depending on specific project requirements, contractors shall provide design drawings for government review and acceptance. All drawings will be created in accordance with the drafting standards provided by ISEC-FDED and the Tri-Services Spatial Data Standards (SDS). Types of design drawings include:

Note: Telecommunication designs shall be rendered and stamped by a Registered Communications Distribution Designer (RCDD) in accordance with UFC 3-580-01.

a. Outside Plant (OSP): The level of details on the OSP drawing shall include, but not be limited to, the number and size of ducts installed, maintenance hole locations, and cable tags for all cables installed by this project.

b. Maintenance Hole: Maintenance hole butterfly drawings shall include, but not be limited to, the cables, splice cases, ground rods, ground cables, and ducts installed by this project. Cable shall be tagged on the drawings with cable identification. The contractor shall coordinate with the Government regarding the cabling numbering format plan.

c. Inside Plant: Inside Plant (IN) drawings shall include, but not be limited to, new equipment, new cable paths, new power components/circuits, and new grounding system components.

d. Rack Face Elevations: The level of detail in the Rack Face Elevations shall, at a minimum, include what manufacturer and model of equipment is installed, how it is equipped, patch panels, cable management and other equipment installed. Port quantities per switch/patch panel shall be detailed; including VLANs and individual port level configuration. . Existing equipment can be represented with text defining the manufacturer and model in an appropriately sized box.

e. Network Diagram: Network diagrams shall depict both logical and physical topology.

5.19.3.3 During the System Installation or Execution Phase:

The contractor provides as-built drawings of the installed communications infrastructure upgrade for review and acceptance. All as-built drawings will be created in accordance with the drafting standards provided by ISEC-FDED and the Tri-Services Spatial Data Standards (SDS). Throughout the installation process, the contractor shall maintain an up to date, redline, copy of all changes made to the original project design drawings. The contractor shall, upon completion of the final subsystem acceptance test, furnish redlined drawings depicting the actual installation and final network configuration for the types of drawings specified in design phase plus Plant-In-Place Drawings (PIPD): The contractor provides an updated version of the site PIPDs that includes all work installed under this project as depicted on the redline drawings.

5.20 RENOVATIONS/RETROFITS/ADDITIONS

5.20.1 Assessment of Customer’s Needs.

The first step is to develop and understand the customer’s functional and operational requirements. Where an Army Standard or similar requirements document governs the

particular space, the designer should attempt to comply with those requirements to the extent possible, given the size and shape constraints of the existing space. The designer should also strive to integrate the new work with existing/adjoining features to provide a unified whole. Schedule/phasing and other restrictions on the contractor's activities must also be established at this time. As a minimum, a site visit to verify existing conditions and discuss needs with the facility users is desirable. A full-fledged design charrette with the customer, users, other stakeholders, and key design disciplines may be required depending on the complexity of the project.

5.20.2 Site Investigations

5.20.2.1 Existing utilities.

Establish locations of tie-in points and capacities of existing utilities such as power, water, sewer, natural gas, telecommunications.etc. Establish requirements for coordinating outages to facilitate tie-in of new utilities to existing. Verify points of contact for each utility at the installation (or third-party provider if utilities have been privatized).

5.20.2.2 Condition assessment of features to remain.

Structural; exterior building envelope; roof; mechanical, electrical and plumbing systems are examples of elements that must be checked to assess the need for repairs or replacement to meet the needs of the new construction.

5.20.2.3 Environmental issues.

Examples of environmental issues to be investigated and addressed include mold, radon, hazardous/toxic waste (HTW), asbestos and other regulated materials, unexploded ordnance, and NEPA documentation (if required).

5.20.2.4 Installation requirements.

Coordinate with the installation fire marshal and Directorate of Public Works/Base Civil Engineer for any special fire protection/life safety issues, architectural preferences, environmental/ordnance issues, etc.

5.20.3 Design Considerations

5.20.3.1 Code issues.

Typically the space to be renovated was designed and built years ago and is not compliant with current building codes. Items to be considered and addressed include barrier-free design, life safety, fire protection, energy usage targets, and sustainability. Per UFC 1-200-01, use IBC Chapter 34, except as modified by UFC 1-200-01, for requirements for the alteration, repair, addition and change of occupancy of existing buildings and structures.

5.20.3.2 Seismic Evaluation.

Use IBC Chapter 34 with UFC 3-310-04 for seismic evaluation and seismic rehabilitation of existing buildings.

5.20.3.3 Anti-terrorism.

UFC 4-010-01 has specific thresholds that, when triggered, mandate incorporation of anti-terrorism measures into renovation projects. Additions, being new construction, naturally are subject to applicable portions of UFC 4-010-01.

5.20.3.4 Historic Preservation.

Buildings listed, or eligible or potentially eligible for listing, as historic under the provisions of the National Historic Preservation Act pose special challenges for renovations and additions. Maintaining the existing historic character and distinctive materials, features, spaces, and spatial relationships is fundamental. AR 200-1 discusses requirements for historic preservation and disposal. Coordination with the State Historic Preservation Officer (SHPO) may be required.

5.20.4 Coordination/phasing.

Coordination of renovation activities with other construction and user activities will usually be required, and will require inserting specific completion dates or phasing requirements into the contract. When the facilities to be renovated cannot be completely vacated during construction, clearly specify the arrangements (both in work schedule and sharing of space) for accommodating user equipment and personnel during construction. If the customer has systems or functions that can only be interrupted for limited periods, or not at all, clearly describe these requirements in the PWS. Any restrictions on methods of work (such as limitations on noise, dust, hot work, etc), must be clearly described. If tenants are to be moved to swing space during construction, document applicable work requirements for the contractor in terms of providing the swing space, facilitating the movement to and from the swing space, and schedule (when the space to be renovated will be available to the contractor for physical work, and when it must be ready for beneficial reoccupancy by the tenants.)

5.21 UMCS SITE SURVEY/FEASIBILITY STUDY

Site Survey: Perform a site conditions survey to validate the type and quantities of system equipment and verify existing site conditions. Provide a written report noting all identified functional controls deficiencies (actual equipment failure as well as controller failure to execute designed sequences of operation), discrepancies in the documented site conditions and a cost estimate to correct the deficiencies. Assess the cyber security posture of specified systems with respect to current Information Assurance criteria and the Risk Management Framework. Feasibility study: Conduct an investigation into the specifics of buildings, systems, controls, and network connectivity with respect to the implementation of direct digital controls and programming that save energy. Provide a recommendation of the level of control implementation based on an expected payback of the initial investment. Deliverables will be per the requirements of paragraph 3.2 and 3.3 and further defined in the specific task order requirements.

5.22 DESIGN MANUAL CHANGE PROCEDURE.

From time to time, issues will come to light requiring changes to this manual. Any person recognizing the need for such a change is encouraged to document the proposed change on the form in Appendix F and submit it to his/her immediate supervisor for approval. Supervisors will promptly assess all such suggested changes, and forward to the Chief of Design with their recommendations for approval/disapproval. Contractor personnel are likewise encouraged to submit suggested changes, working in conjunction with the relevant technical POC on their project. Once a year, or more often if required for urgent changes, the Chief of Design will evaluate the collected recommendations for change and assign responsibility for implementing accepted recommendations; a revised Manual will be posted to the ED SharePoint site.

APPENDICES

APPENDIX A CONSOLIDATED REFERENCE LIST

FEDERAL CRITERIA

ABA Architectural Barriers Act of 1968, 42 USC 4151

ADA Americans with Disabilities Act of 1990, 42 USC 12181

EPACT05 Energy Policy Act of 2005

EISA 07 Energy Independence and Security Act

FISMA Federal Information Security Management Act, 44 USC 3541

NEPA National Environmental Policy Act of 1969 (NEPA)

PL 106-554 Consolidated Appropriations Act of 2001

RCRA Resource Conservation and Recovery Act

Design and Construction of Public Buildings to Accommodate Physically Handicapped, 42 USC Chapter 51

Executive Order (EO) 13514, Federal Leadership in Environmental, Energy, and Economic Performance,

Homeland Security Presidential Directive 12 (HSPD-12): Policy for a Common Identification Standard for Federal Employees and Contractors10 CFR 436A Code of Federal Regulations, Title 10 (Energy), Part 436, Subpart A (10 CFR 436A), Methodology and Procedures for Life Cycle Cost Analysis

29 CFR Part 36 ADA, Standards for Accessible Design

29 CFR 1910 and 1926 Occupational Safety and Health Act Standards, Title 29, Code of Federal Regulations, Parts 1910 and 1926

Federal Information Processing Standards

GPO Style Manual

Metric Guide for Federal Construction, 1st Ed.

MUTCD Manual on Uniform Traffic Control Devices, U.S. Dept. of Transportation

OMB Circular A-94

NISTIR 85-3273-27 Energy Price Indices and Discount Factors for Life Cycle Cost Analysis

ATF Pub 5400.7 Alcohol, Tobacco, and Firearms (ATF) Federal Explosives Law and Regulations

Committee on National Security Systems, Policy No. 11

DEPARTMENT OF DEFENSE (DOD) AND OTHER SERVICES CRITERIA

DDESB TP-16 DoD Explosive Safety Board Technical Paper 16

DFARS Subpart 246.2 Contract Quality Requirements

DoD 6055.09-M DoD Ammunition and Explosives Safety Standards

DoD Instruction (DoDI) 2000.16 DoD Antiterrorism (AT) Standards

DoDD 3020.40 Defense Critical Infrastructure Program (DCIP)

DOD 4120.24-M Defense Standardization Program (DSP): Policies, and Procedures

DoDD 4630.05 Interoperability and Supportability of Information Technology (IT) and National Security Systems (NSS)

DoDI 4630.09 Wireless Communications Waveform Development and Management

DoDI 4715.15 Environmental Quality Systems

DOD 5000.4M Cost Analysis Guidance and Procedures

DoDM 5100.76 Physical Security of Sensitive Conventional Arms, Ammunition and Explosives

DoDD 5105.19 Defense Information Systems Agency (DISA)

DoDM 5200.01v1-v4 Classified Information

DoDD 5200.2-R Personnel Security Program

DoDD 5205.02 Operations Security (OPSEC) Program

DoD Regulation 5200.08 Physical Security Program

DoDD 5210.41 Security Policy for Protecting Nuclear Weapons

DoDD 5210.63 DoD Procedures for Security of Nuclear Reactors and Special Nuclear Materials (SNM)

DoDI 5210.65 Minimum Security Standards for Safequarding Chemical Agents

DODD 5220.22 National Industrial Security Program

DoDD 5220.22-M National Industrial Security Program Operating Manual (NISPOM)

DoDD 5230.09 Clearance of DoD Information for Public Release

DoDD 8100.1 Global Information Grid Overarching Policy

DoDD 8100.2 Use of Commercial Wireless Devices, Services, and Technologies in the Department of Defense (DoD) Global Information Grid (GIG)

DoDD 8320.02 Data Sharing in a Net-Centric Department of Defense

DoDD 8500.1 Information Assurance;

DoDI 8500.2 Information Assurance Implementation;

DoDI 8510.01 DoD Information Assurance Certification and Accreditation Process (DIACAP)

DoDD 8521.02E Department of Defense Biometrics

DoD 8570.01-M Information Assurance Workforce Improvement Program

DOD O-2000.12H Department of Defense Antiterrorism Handbook

Defense Information Systems Agency (DISA) Secure Technical Implementation Guides (STIGs)

DTIC ADA 427785 Uniform Federal Policy for Quality Assurance Project Plans

EIA/IS 632 and ISO 15288 Systems and Software Engineering

Intelligence Community Directive (ICD) 705 Sensitive Compartmented Information Facilities

MIL-HDBK-759C Human Engineering Design GuidelinesMIL-STD-101 Color Code for Pipelines and for Compressed Gas Cylinders

MIL-STD-881 Work Breakdown Structure

MIL-STD-882E Standard Practice for System Safety

MIL-STD-1472F Human Engineering

AF MAN 91-201 Explosives Safety Standards

AF Instruction 31-101 Integrated Defense

AF Instruction 33-210 Air Force Certification and Accreditation (C&A) Program (AFCAP)

Engineering Technical Letter (ETL) 11-1: Civil Engineer Industrial Control System Information Assurance Compliance

Department of the Navy (DON) DIACAP Handbook v1.0

US Navy Chief of Naval Operations Instructions 5530.14E Navy Physical Security and Law Enforcement Program

NAVSEA OP 5 Volume 1 Ammunition and Explosives Safety Ashore

Navy eMASS User Guides

Explosives Safety Siting (ESS) Software

Assessment System for Hazard Surveys (ASHS)

United States Marine Corps Enterprise Cybersecurity Directive 018 Marine Corps Certification and Accreditation Process

US Marine Corps Order 5530.14A Marine Corps Physical Security Program Manual

ARMY REGULATIONS (AR) AND PAMPHLETS (PAM)

AR 11-18 The Cost and Economic Analysis and Program

AR 25-1 Army Information Technology

AR 25-2 Information Assurance

AR 25-30 The Army Publishing Program

AR 190-13 The Army Physical Security Program

AR 190-16 Physical Security

AR 380-5 Department of the Army, Information Security

AR 380–381 Security Special Access Programs (SAPs) and Sensitive Activities Headquarters

AR 200-1 Environmental Protection and Enhancement

AR 385-10	The Army Safety Program
AR 385-16	System Safety Engineering and Management
AR 420-1	Army Facilities Management
AR 415-18	Military Construction, Responsibilities
AMC-R 385-100	Army Materiel Command Safety Manual
DA PAM 25-30	Consolidated Index of Army Publications and Forms
DA PAM 385-16	System Safety Engineering and Management Guide
DA PAM 385-64	Ammunition and Explosives Safety Standards'
DA PAM 385-65	Explosives and Chemical Site Plan Development and Submission'
DA PAM 415-3	Economic Analysis: Descriptions and Methods

UNIFIED FACILITIES CRITERIA (UFC)

UFC 1-200-01	General Building Requirements
UFC 1-200-02	High Performance and Sustainable Building Requirements
UFC 1-300-02	Unified Facilities Guide Specifications (UFGS) Format Standard
UFC 1-300-07A	Design Build Technical Requirements
UFC 3-101-01	Architecture
UFC 3-102-10	Interior Design
UFC 3-210-10	Low Impact Development
UFC 3-220-01	Geotechnical Engineering
UFC 3-230-01	Water Storage, Distribution, And Transmission
UFC 3-230-03	Water Treatment
UFC 3-240-01	Wastewater Collection
UFC 3-240-02	Domestic Wastewater Treatment
UFC 3-240-05A	Solid Waste Incineration
UFC 3-240-10A	Sanitary Landfill
UFC 3-301-01	Structural Engineering
UFC 3-310-04	Seismic Design of Buildings
UFC 3-340-02	Structures to Resist the Effects of Accidental Explosions
UFC 3-350-03AN Effects	Weapons Effects: Designing Facilities to Resist Nuclear Weapon
UFC 3-350-04AN	Structures: Designing Facilities to Resist Nuclear Weapon Effects
UFC 3-350-05AN Weapon Effects	Shock Isolation Systems: Designing Facilities to Resist Nuclear

UFC 3-350-06AN	Air Entrapment, Fasteners, Penetration Protection, Hydraulic-Surge Protection Devices and EMP Protective Devices: Designing Facilities to Resist Nuclear Weapon Effects
UFC 3-350-07AN	Hardness Verification: Designing Facilities to Resist Nuclear Weapon Effects
UFC 3-350-08AN	Facilities Support Systems: Designing Facilities to Resist Nuclear Weapon Effects
UFC 3-350-09AN	Illustrative Examples: Designing Facilities to Resist Nuclear Weapon Effects
UFC 3-350-010AN	Facilities System Engineering: Designing Facilities to Resist Nuclear Weapon Effects
UFC 3-400-01	Energy Conservation
UFC 3-400-02,	Engineering Weather Data
UFC 3-410-01FA	Heating, Ventilating, and Air-Conditioning
UFC 3-410-02A	Heating, Ventilating, and Air-Conditioning (HVAC) Control Systems
UFC 3-410-03FA	Heating, Ventilating, and Air Conditioning of Hardened Installations
UFC 3-420-01	Plumbing
UFC 3-420-02FA	Compressed Air
UFC 3-430-04FA	High Temperature Water Heating Systems
UFC 3-430-09	Exterior Mechanical Utility Distribution
UFC 3-450-01	Noise and Vibration Control
UFC 3-450-02	Power Plant Acoustics
UFC 3-460-01	Petroleum Fuel Facilities
UFC 3-470-01	Lonworks Utility Monitoring and Control System
UFC 3-501-01	Electrical Engineeering
UFC 3-520-01	Interior Electrical Systems
UFC 3-530-01	Design: Interior and Exterior Lighting and Controls
UFC 3-550-01	Electrical Power Supply and Distribution
UFC 3-570-02A	Cathodic Protection
UFC 3-575-01	Lightning and Static Electricity Protection
UFC 3-580-01	Telecommunications Building Cabling Systems
UFC 3-600-01	Fire Protection Engineering For Facilities
UFC 3-700-02A	Construction Cost Estimates
UFC 4-010-01	Anti-Terrorism/Force Protection

UFC 4-010-02 (FOUO)	DoD Minimum Antiterrorism Standoff Distances for Buildings
UFC 4-020-01	DoD Security Engineering Facilities Planning Manual
UFC 4-020-02	Security Engineering: Concept Design
UFC 4-020-03	Security Engineering: Final Design
UFC 4-021-01	Mass Notification Systems
UFC 4-021-02	Electronic Security System
UFC 4-022-02	Selection and Application of Vehicle Barriers
UFC 4-030-1	Sustainable Development
UFC 4-420-01	Ammunition and Explosives Storage Magazines
UFC-4-510-01	Design: Medical Military Facilities
UFC 4-711-01	Family Housing
UFC 4-721-01A	Barracks Upgrade Program

ENGINEER REGULATIONS (ER)

ER 11-1-321	Value Engineering
ER 25-345-1	Systems Operations and Maintenance Documentation
ER 415-1-10	Contractor Submittal Procedures
ER 415-1-11	BCOES
ER 415-345-38	Transfer and Warranties
ER 1110-1-12	Quality Management
ER 1110-1-263	Chemical Data Quality Management for Hazardous Toxic, Radioactive Waste Remedial Activities
ER 1110-1-1300	Cost Engineering Policy and General Requirements
ER 1110-1-8152	Professional Registration and Signature on Design
ER 1110-1-8155	Specifications
ER 1110-1-8156	Policies, Guidance, and Requirements for Geospatial Data and Systems
ER 1110-3-1300	Military Programs Cost Engineering
ER 1110-345-100	Design Policy for Military Construction
ER 1110-345-122	Interior Design
ER 1110-345-700	Design Analyses, Drawings, and Specifications

ENGINEER MANUALS (EM)

EM 385-1-1	Safety and Health Requirements Manual

EM 385-1-97 Explosives Safety and Health Requirement Manual

EM 1110-1-1004 Geodetic and Control Surveying

EM 1110-1-1005 Control and Topographic Surveying

EM 1110-1-1804 Geotechnical Investigations

EM 1110-1-2909 Geospatial Data and Systems

EM 1110-1-4008 Liquid Process Piping

EM 1110-1-4009 Military Munitions Response Actions

OTHER USACE GUIDANCE

DG 1110-3-122 USACE Design Guide for Interiors

Engineering Construction Bulletin (ECB) 2008-1 Sustainable Design and Development (SDD)

ECB 2002-13 Design Charrette Guidance for Army Military Construction (MILCON) Programs

ECB 2013-5 Continuity of the High Performance Energy and Sustainability Policy

Engineering Pamphlet (EP) 715-1-7 Architect-Engineer Contracting

EP 1110-1-8 Construction Equipment Ownership and Operating Expense Schedule

Parametric Cost Estimating manual for PACES software and MII construction software

ERDC/ITL TR-12-X A/E/C CADD Standard, release 5.0

ERDC/ITL TR-12-1 CAD Drafting Standard

Spatial Data Standard for Facilities, Infrastructure, and Environment (SDSFIE version 2.5) https://tsc.wes.army.mil/products/

SDS Facility Management Standard (SDSFMS)

Procurement Instruction Letter (PIL) 2012-03

PAX Newsletter

INDUSTRY STANDARDS

AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI/ASQ E4 Section 5 (part A) and Section 6 (part B)

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE/SEI 7 Minimum Design Loads for Buildings and Other Structures

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B31.1, Power Piping

ASME B31.2, Fuel Gas Piping

ASME B31.3, Process Piping

ASME B31.4 Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids

ASME B31.5, Refrigerant Piping and Heat Transfer Components

ASME B31.8, Gas Transmission and Distribution Piping Systems

ASME B31.9 Building Services Piping

ASME Boiler and Pressure Vessel Code, and Interpretation

- Section I: Power Boilers
- Section II: Material Specifications
- Section IV: Heating Boilers
- Section V: Nondestructive Examination
- Section VIII: Pressure Vessels
- Section IX: Welding and Brazing Qualifications
- Section X: Fiberglass-Reinforced Pressure Vessel

INSTITUTE OF ELECTRICAL AND ELECTRONIC ENGINEERS (IEEE) PUBLICATIONS

IEEE C2 National Electrical Safety Code, (IEEE C2)

ILLUMINATING ENGINEERING SOCIETY OF NORTH AMERICA (IES)

IESNA G-1-03 Guideline for Security Lighting for People, Property, and Public Spaces

IESNA The IESNA LIGHTING HANDBOOK, (9^{th} Edition)

INSTRUMENTATION SOCIETY OF AMERICA (ISA)

ISA S5.1 Instrumentation Symbols and Identification

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC International Building Code

MANUFACTURERS STANDARDIZATION SOCIETY (MSS)

SP-58, Pipe Hangers and Supports - Materials, Design and Manufacture

SP-69, Pipe Hangers and Supports - Selection and Application

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA) STANDARDS

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) CODES AND STANDARDS

NFPA 70 National Electrical Code

NFPA 72 National Fire Alarm Code

NFPA 72 H National Fire Alarm and Signaling Code Handbook

NFPA 101 Life Safety Code

NFPA 101A Guide on Alternative Approaches to Life Safety

NFPA 101B Code for Means of Egress for Buildings and Structures

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY

ICSSC RP8/ NIST GCR 11-917-12, Standards of Seismic Safety for Existing Federally Owned and Leased Buildings

FIPS 199 Standards for Security Categorization of Federal Information and Information Systems

FIPS 200 Minimum Security Requirements for Federal Information and Information Systems

FIPS 201-2 Personal Identity Verification (PIV) of Federal Employees and Contractors

SP - 800-30 rev1 Guide for Conducting Risk Assessments

APPENDIX B STANDARD OPERATING PROCEDURE FOR AMENDMENT AND CHANGE ORDER PREPARATION

B-1 PURPOSE AND APPLICABILITY.

The Standard Operating Procedure (SOP) outlined herein will be followed in preparing drawings and specifications for amendments and change orders. The data contained in this appendix should be used in combination with data contained in Chapter 3 and the A/E/C CAD Standards to provide a standardized, uniform, and usable way to record revisions to contract construction drawings. The engineering practices and techniques contained in this appendix will be used by all personnel and are applicable to all projects advertised by the US Army Corps of Engineers, Huntsville Center.

B-1.1 Amendments And Change Orders.

All revisions will be limited to only those drawing and specification changes required to accomplish the approved Engineering Change Proposal (ECP), Amendment, or other design instruction. This limitation does not restrict the designer or draftsperson from relocating a dimension, note, or detail in order to accomplish the revision at its proper location. Revisions on all affected sheets will be completed for all elements of a proposed amendment or change order before issuing the revised documents to bidders or contractors; similarly, the drawings will not show in any form additional revisions which will be included in a subsequent amendment or change order.

B-1.2 Narrative Of Specifications And Drawing Changes.

A general description of changes on each specification and drawing will be furnished the architectural and project specifications branches for incorporation into amendments and/or change orders. This narrative will be converted into a continuation sheet for CTs standard form. The continuation sheet will start out as Page 2 and will describe all additions to bidding documents or contract documents.

B-1.3 Drafting Method.

All contract construction dra wings will be revised on the source computer-aided drafting CAD files and the updates will be formatted for electronic solicitation. Manual drafting will only be used in emergency field or extenu ating circumstances and will be scanned into adobe acrobat .PDF format and delivered IAW contract requirements.

B-1.4 Specifications.

The format of specification c hanges will follow paragraph 3.2.14, Project Specifications. All changes must be summarized for the CT Continuation Sheet

B-2 RECORD COPY.

The files for amendment or change order and the source files will be provided in accordance with contract requirements.

B-3 IDENTIFYING REVISIONS.

All drawing revisions will be identified by a delta symbol and, unless otherwise directed, each revision with appropriate delta symbol will be encircled with a cloud. To the extent practical, the cloud should highlight only specific revisions. (Refer to figures B-1 and B-2 for examples.)

B-3.1 Deltas.

a. Place a delta symbol (∆) adjacent to each revision. The symbol need only be large enough to contain a 3.0 mm (1/8-inch) high numeral. Where revisions are general, or can be conveniently grouped in a cloud, use only a single delta.

b. Inside the delta, insert the number which represents the number of times this sheet has been revised. Begin sequential numbering with one (1). The revision number inside the delta has no relationship to the amendment or change order number.

c. As a subscript or superscript to the right of the delta, place a number of sequential order beginning with 2. This represents the number of individual changes that are clouded to accommodate the new revision.

d. For those single amendment or change orders that incorporate multiple ECPs, a subscript number will be placed below the delta to identify the specific ECP number prompting the revision.

B-3.2 Cloud.

Encircle each change or group of changes, including the delta, with a cloud. The Clouds are required to focus attention on the revised areas on the sheet. If the change(s) to a detail become extensive and require a complete review to make a satisfactory analysis, the whole detail will be encircled and draw only one delta.

B-3.3 Recording Revisions.

All drawing revisions will be recorded in the Revision Area above the title block. The Revision Area will be posted as follows:

B-3.4 Symbol Column.

Place a delta with the appropriate revision number for the sheet in the first column. Indicate the total number of deltas/clouded areas which appear elsewhere on the sheet for the particular revision to the right of the delta as a subscript or superscript. A new sheet added to the package will be posed as Revision 1. Prior revision history will be included on the redrawn sheet. The original sheet will be labeled “superseded”.

B-3.5 Description Column.

The amendment number (e.g. “AN-1”) or change order number (e.g. “CO-AA”) must come first. For amendments, simply add the phrase “Revised to Accompany Amendment.” If portions of the changes include revisions due to ECP’s not previously included in the project drawings, add “including ECP….” When appropriate, the word “Revised” should be changed to “Redrawn” or “Sheet Added”. For change orders, identify the work by ECP number and add a very brief description (not exceeding two lines) of the change(s) to the drawing. If a more detailed description is necessary, add a

revision schedule elsewhere on the drawing.

B-3.6 Date Column.

The date will be the scheduled date for the introduction of the entire amendment or change order. This date will be determined by the Government. The same date will be posted on all revised sheets.

B-3.7 Approval.

Each drawing will be initialed by the Branch Chief (or other designated person) responsible for that discipline.

B-3.8 Border Identification.

The word(s) “AMENDMENT” OR “CHANGE ORDER” will be lettered in the space between the border and trim lines under the “sheet reference number” space of the title block. The number of the amendment or change order will be immediately to the right. All lettering and numerals will be in accordance with the A/E/C CAD Standards.

B-4 DRAWING INDEX SHEETS

B-4.1 Index Sheets.

Index sheets are normally the responsibility of the Architectural Branch and will be revised by that office. Index sheets will be revised after receipt of all revised drawings for the particular amendment or change order. Drawings from the design disciplines will, when applicable, include the original of any drawing to be deleted with a note to that effect clipped to it.

B-4.2 Posting.

Drawings revised for each amendment or change order will be posted on an applicable drawing index sheet. The index sheet will be counted and posted as a revised drawing. In the split revision column opposite the applicable drawing numbers, the revision number of each revised drawing will be entered in the first column portion. In the second column portion, the amendment number (AN- #) or change order number (CO-#) will be entered. Prior revision postings will not be changed, except as necessary for the current posting. Entries in the revision column will not be deleted or clouded.

B-4.3 New and Deleted Sheets.

New sheets added by the amendment or change order will have their File Numbers, Sheet Reference Numbers, and Titles added, their revision columns posted as Revision 1, and identified with the current change. Deleted drawings will be identified by removal of the Sheet Reference Number and prior Revision Number. The word “Deleted” will be substituted for the sheet title and the current amendment or change order number will be posted in the revision column. Cloud the changes described in this paragraph and all other changes to the drawing index.

B-4.4 Recording.

Recording of revisions and border identification will be as previously described; however,

ECP's will not be identified. The description will be limited to the amendment number, or change order number, and the words "sheet(s) revised", "sheet(s) added", "sheet(s) deleted," or applicable combination to reflect all changes except those to the index sheet itself.

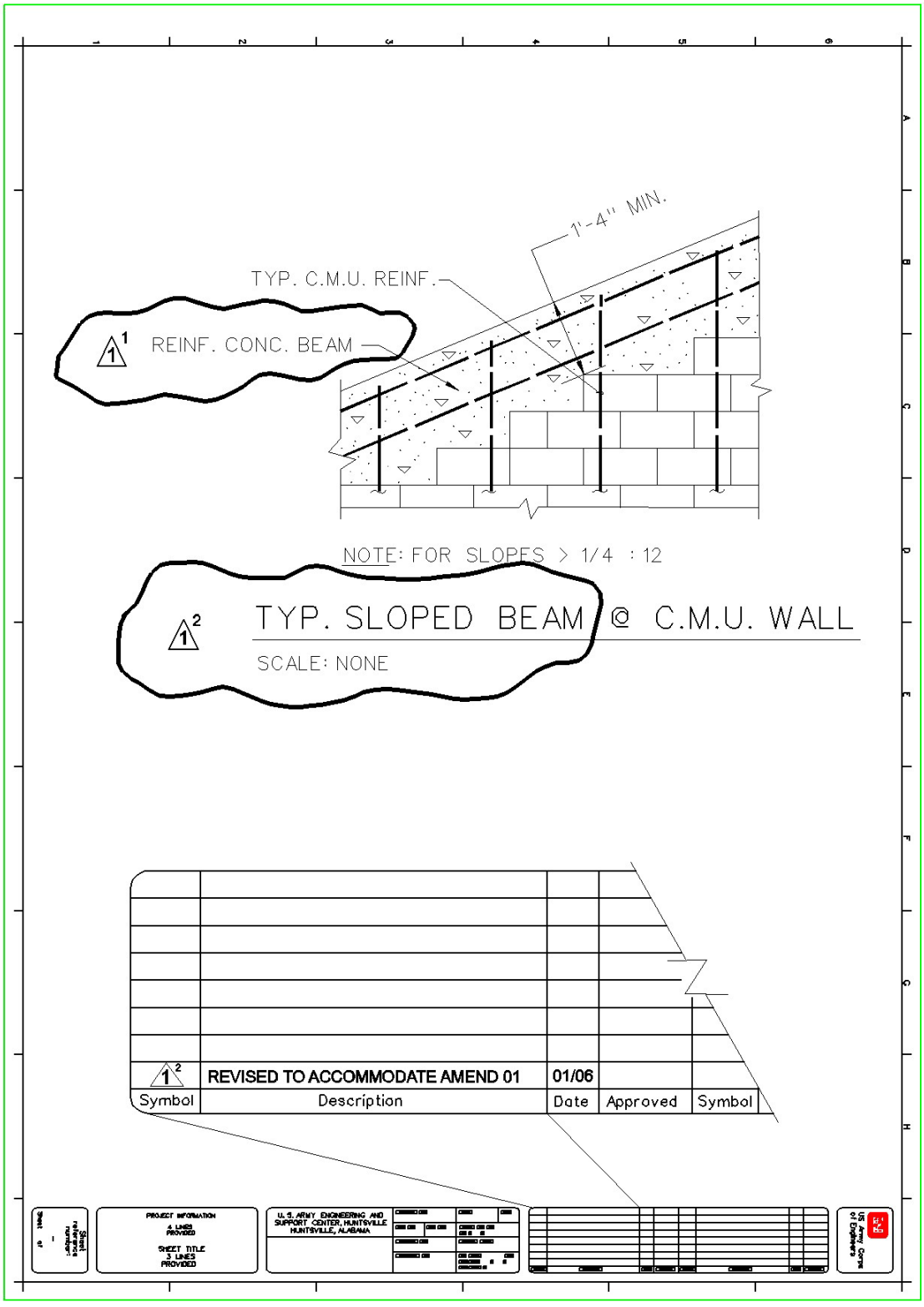

1'-4" MIN.
TYP. C.M.U. REINF.
1 1
REINF. CONC. BEAM
NOTE: FOR SLOPES > 1/4 : 12
1 2
TYP. SLOPED BEAM @ C.M.U. WALL
SCALE: NONE
1 2
REVISED TO ACCOMMODATE AMEND 01
01/06
Symbol
Description
Date
Approved
Symbol
PROJECT INFORMATION
4 LINES PROVIDED
SHEET TITLE
3 LINES PROVIDED
U. S. ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

Figure B-1

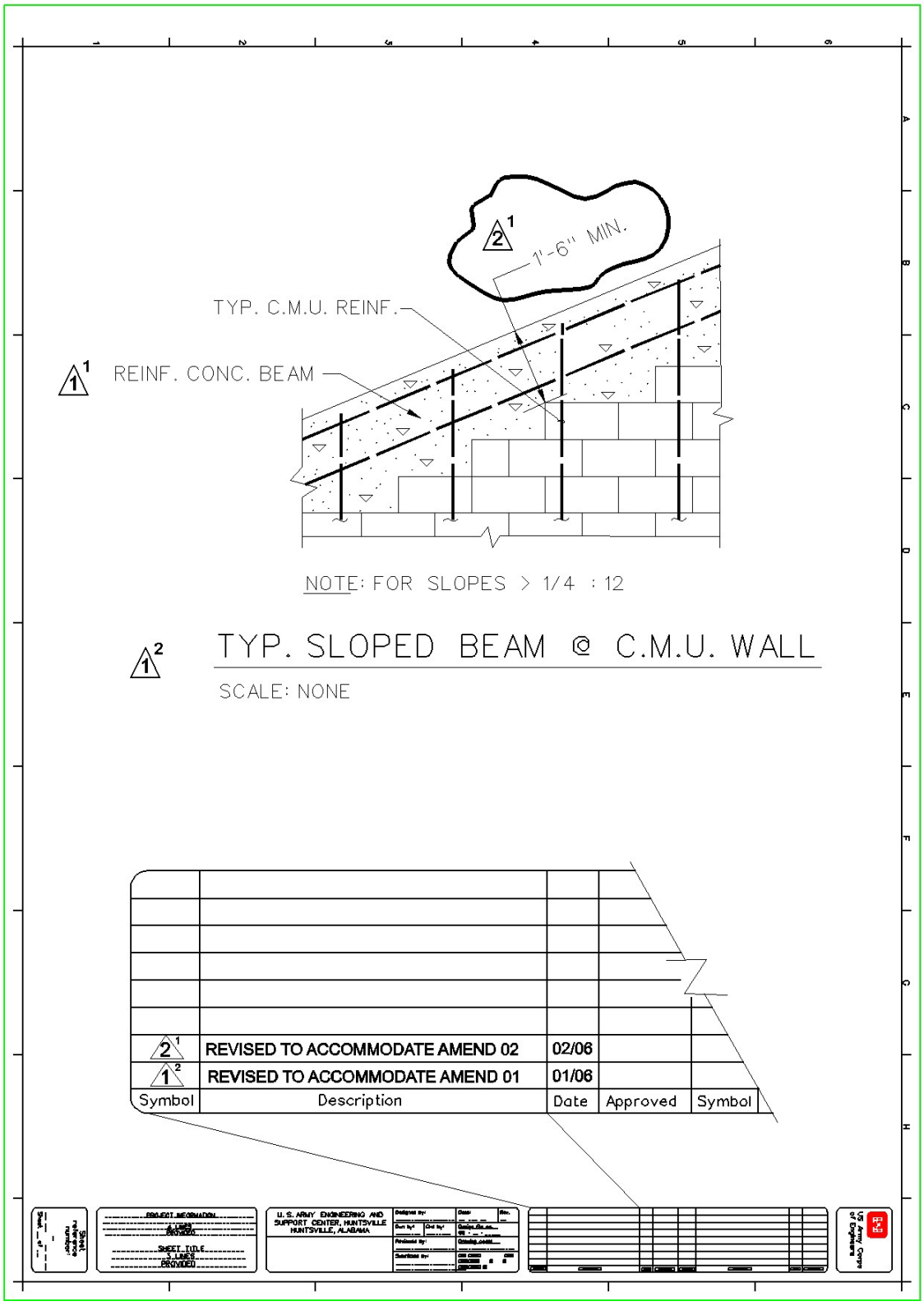

1'-6" MIN.
TYP. C.M.U. REINF.
REINF. CONC. BEAM
NOTE: FOR SLOPES > 1/4 : 12
TYP. SLOPED BEAM @ C.M.U. WALL
SCALE: NONE
2 1 REVISED TO ACCOMMODATE AMEND 02 02/06
1 2 REVISED TO ACCOMMODATE AMEND 01 01/06
Symbol Description Date Approved Symbol
U.S. ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE HUNTSVILLE, ALABAMA

Figure B-2

APPENDIX C PROCESS FLOW CHARTS

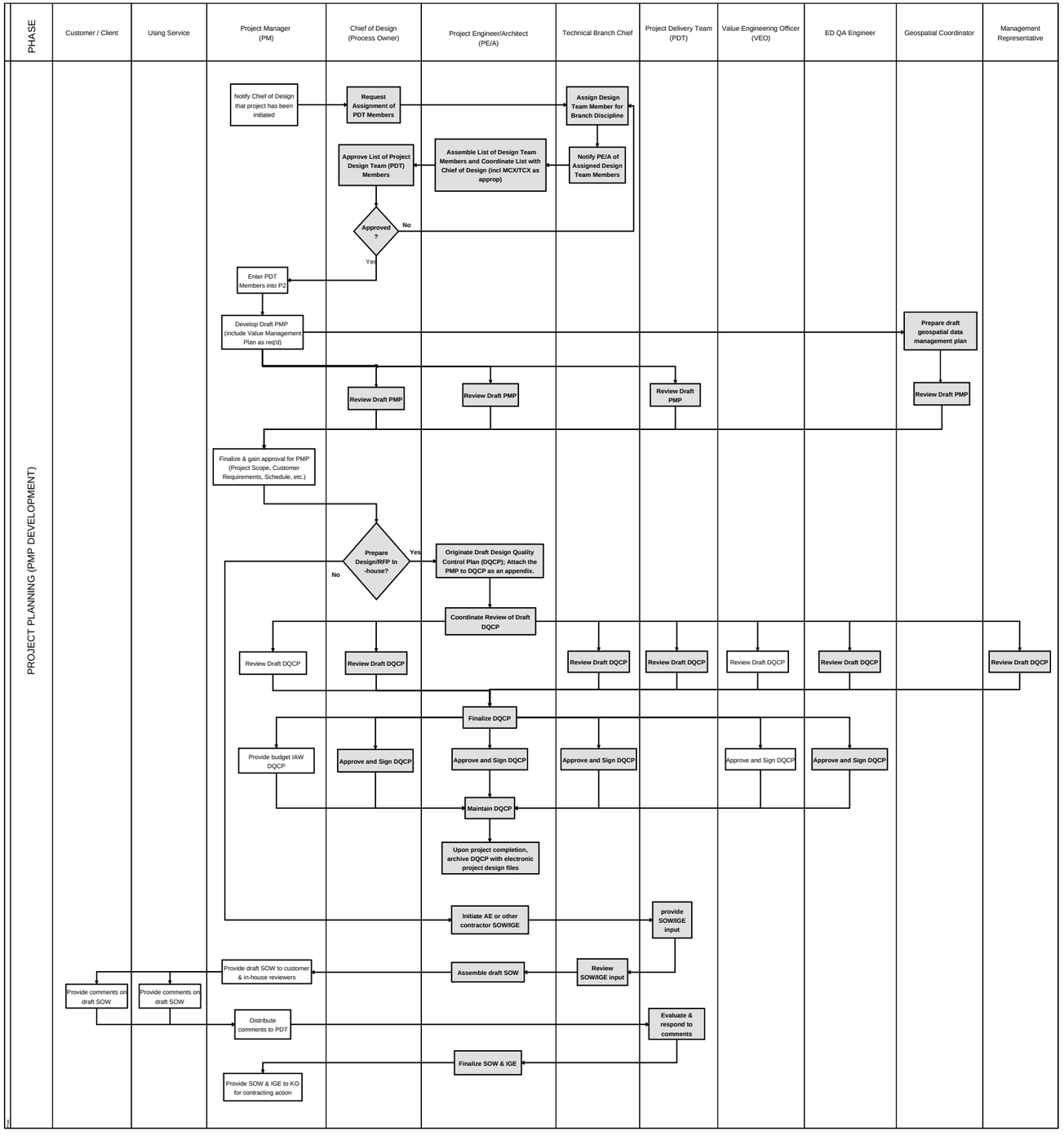
Appendix C
Swimlane Flow Chart Key

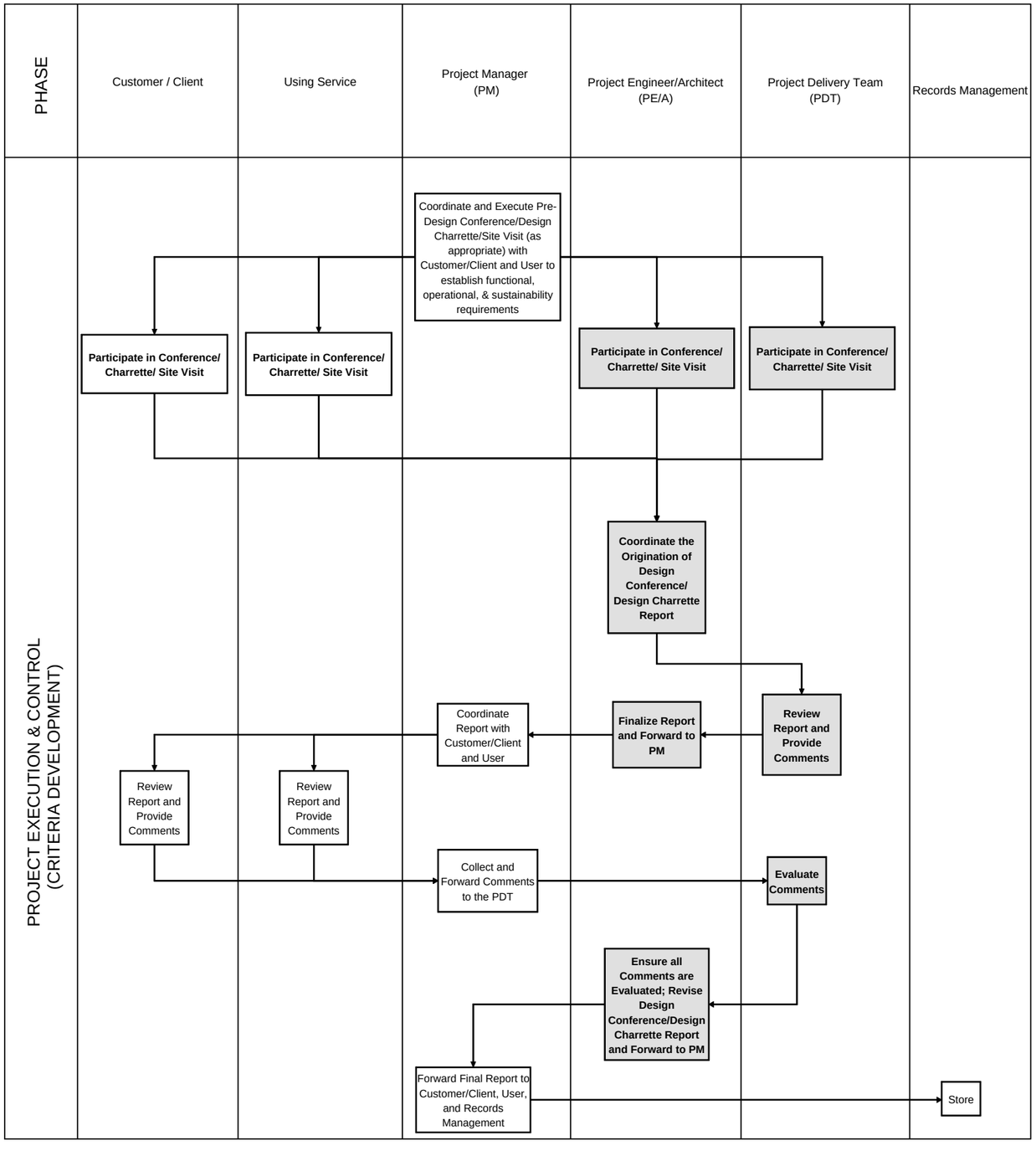
<table>
<tr><td rowspan="2">Technical Products Leading to Delivery of a Physical Product (e.g. construction, renovation, demolition, environmental remediation, etc)</td><td rowspan="2">Delivery Method</td><td rowspan="2">Project Initiation</td><td colspan="2">Project Planning</td><td colspan="6">Project Execution and Control</td><td rowspan="2">Pre-Award</td><td rowspan="2">Post-Award</td></tr>
<tr><td>PMP Development</td><td>Criteria Development</td><td>Site Surveys</td><td>Preliminary Design</td><td>Concept / Draft Design</td><td>Intermediate Design</td><td>PreFinal Design</td><td>Final Design</td></tr>
<tr><td rowspan="4">Technical Products Leading to Delivery of a Physical Product (e.g. construction, renovation, demolition, environmental remediation, etc)</td><td>In-house DBB</td><td rowspan="5">App. C.1
(not used; see ISPM project management guidance)</td><td rowspan="5">App. C.2
Assign PDT, prepare DQCP or AE SOW/ PWS & estimate</td><td>App. C.3.1
Conduct design charrette, prepare charrette rpt</td><td rowspan="5">App. C.4
Site Permits, Surveys, and Investigations</td><td rowspan="4">App. C.5
Parametric Design (applies to MILCON projects receiving a code 3 directive)</td><td>App. C.6.1
Concept Design</td><td>App. C.7
Intermediate Design</td><td>App. C.8
Prefinal Design</td><td>App. C.9.1
Final Design</td><td rowspan="4">App. C.10.0
Prep (or Coord w/ DOR) RFI response/ Amendment</td><td>App. C.11.1
post-award process</td></tr>
<tr><td>AE DBB (or other RFP prepared by AE)</td><td>App. C.3.2
Participate in contractor-led charrette</td><td colspan="4">App. C.6.2
Review Technical Submittal
(note: this process applies to review of any submittal received from a contractor, regardless of PMBP phase or delivery method)</td><td>App. C.11.2
Coord RFI response/ contract mod w/ DOR</td></tr>
<tr><td>DB (RFP prepared in-house)</td><td>App. C.3.1
Conduct design charrette, prep charrette rpt</td><td rowspan="2">App. C.6.3
Draft SOW/PWS/RFP</td><td rowspan="2">App. C.9.2
Final SOW/PWS/RFP Prep IGE</td><td rowspan="2">App. C.11.1
“post-award” process</td></tr>
<tr><td>Work Plan (RFP prepared in-house)</td><td>App. C.3.1
Conduct site visit, document customer req’ts</td><td>NA</td></tr>
<tr><td>Technical Products not Involving an immediate physical product (e.g. studies, investigations, Explosive Safety Site Plans, etc)</td><td>Work done by AE</td><td>App. C.3.2
Participate in contractor-led site visit</td><td>NA</td><td colspan="3">App. C.6.2
Technical Submittal Review
(note: this process applies to review of any submittal received from a contractor, regardless of PMBP phase or delivery method)</td><td>NA</td><td>NA</td></tr>
<tr><td></td><td>Work done in-house</td><td>App. C.3.1
Conduct site visit, document customer req’ts</td><td>NA</td><td>App. C.6.4
Prepare Draft Document</td><td>App. C.9.3
Prepare Final Document</td><td>NA</td><td>NA</td></tr>
<tr><td>Medical MILCON</td><td>All</td><td>NA</td><td colspan="2">App. C.3.3
Medical MILCON overall process</td><td>NA</td><td colspan="5">App. C.6.5
Medical MILCON Technical Submittal Review</td><td>App. C.3.3
Medical MILCON overall process</td></tr>
</table>

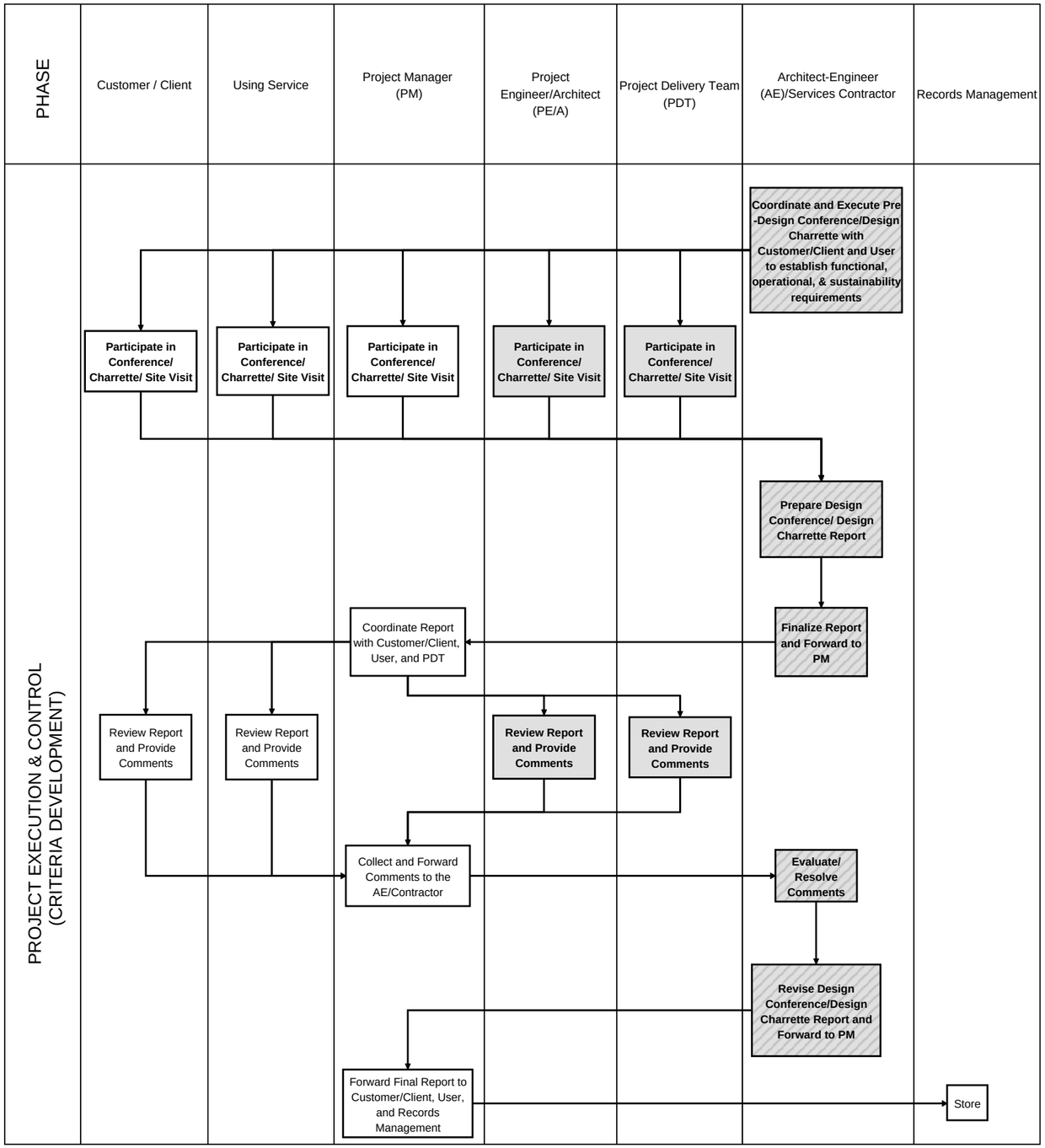
Notes:

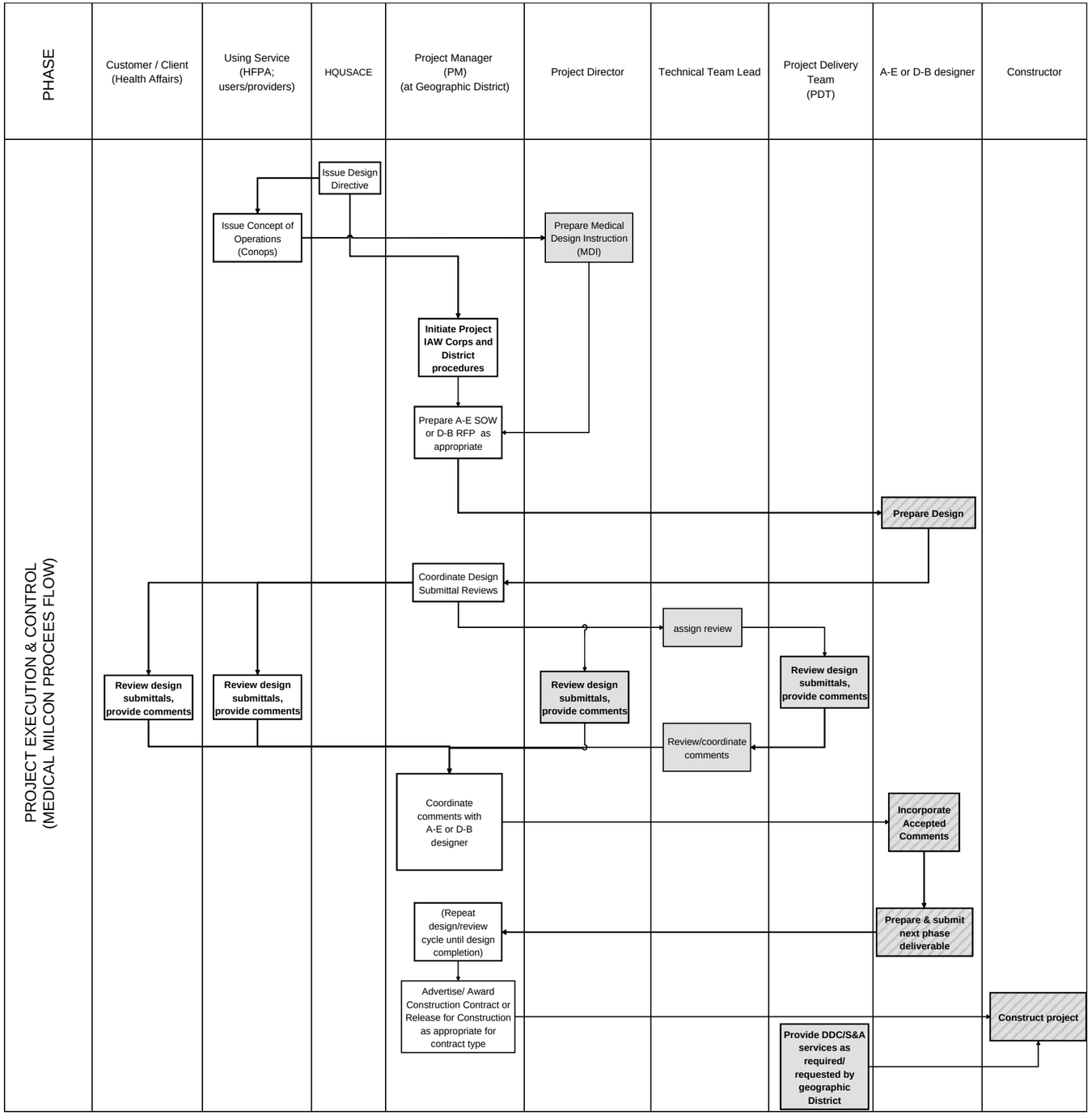
1. This key is organized by PMBP phase and delivery method. Phases are intended to cover each part of a project's life cycle. The delivery methods include: in-house design-bid-build (DBB); DBB prepared by AE; Design-build (DB), including Work Plans requiring the stamp of a registered professional; and Work Plans not requiring the stamp of a registered professional. The second group of rows describe technical products (for example, studies, investigations, etc.) which may in the long term lead to physical construction/renovation/demolition etc, but are not in themselves sufficient to award a contract for such work. Medical MILCON projects, regardless of delivery method, follow the procedures in the bottom row.
2. The processes included in this Appendix are intended to cover every technical product or service provided by ED, regardless of program, and represent the norm of how we do business. Variations are permissible for individual projects or programs, subject to approval and documentation in the appropriate Program or Project Management Plan or Design Quality Control Plan. Approval will be documented by signature of the appropriate PE/A, who will consult ED management as required.
3. These flow charts are not intended to supersede regulatory or other higher-level guidance. If conflicts are discovered, please notify your supervisor and the program PE/A for short-term resolution, and the Chief of Design for correction of this manual.
4. Legend:
    a. ED task
    b. AE or services contractor task
    c. task for customer or HNC outside of ED

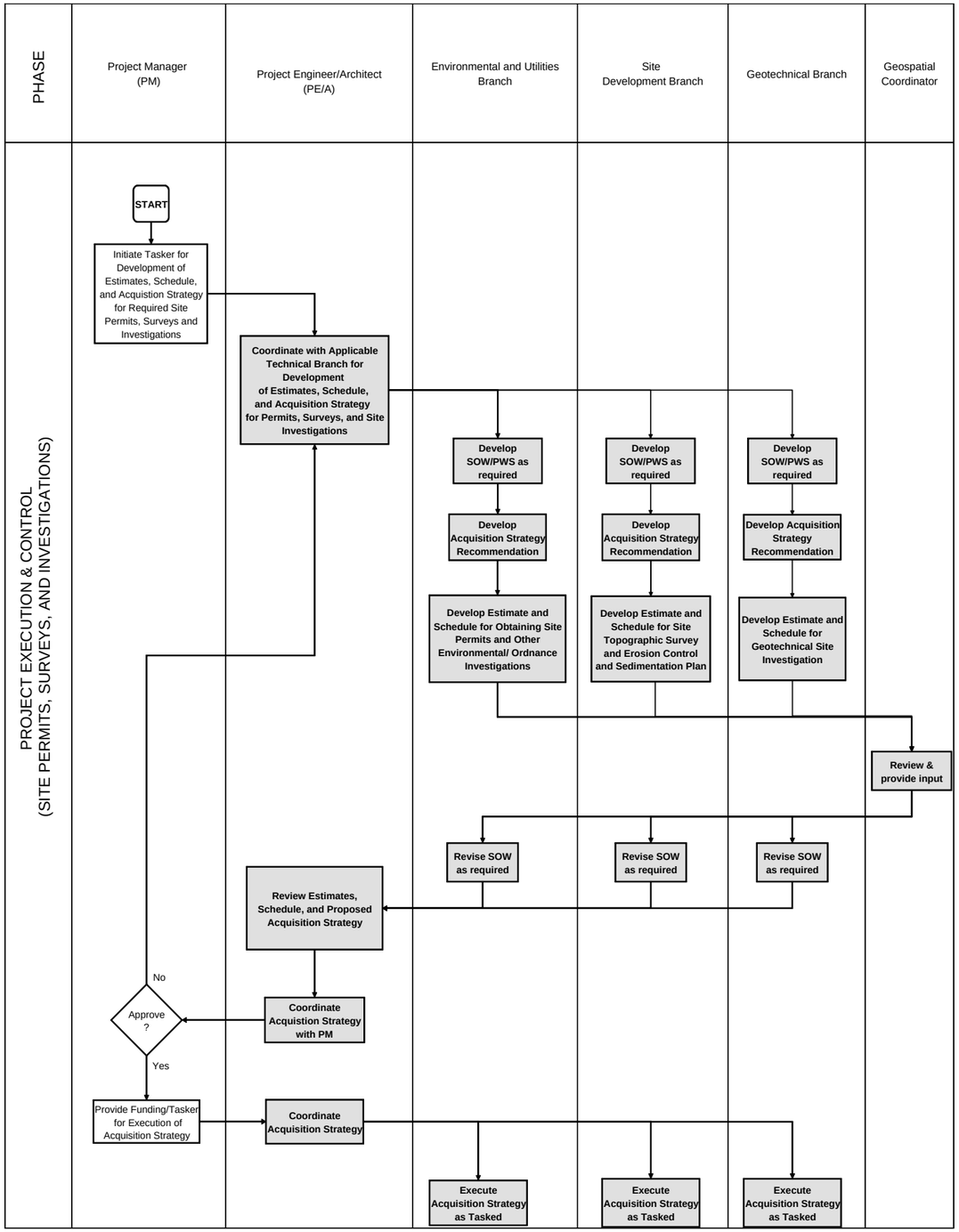
SWIMLANE	PROJECT PLANNING	PROJECT EXECUTION & CONTROL													PRE-AWARD	POST-AWARD	POST-AWARD (AE)
		CRITERIA DEVELOPMENT (IN-HOUSE)	CRITERIA DEVELOPMENT (AE)	SITE PERMITS, SURVEYS, AND INVESTIGATIONS	PARAMETRIC DESIGN	CONCEPT DESIGN SUBMITTAL	TECHNICAL SUBMITTAL REVIEW	DRAFT SOW / PWS / RFP	DRAFT STUDY OR OTHER TECHNICAL DOCUMENT	INTERMEDIATE DESIGN SUBMITTAL	PRE-FINAL DESIGN SUBMITTAL	FINAL DESIGN SUBMITTAL	FINAL SOW / PWS / RFP	FINAL STUDY OR TECHNICAL DOCUMENT			
	C.2	C.3.1	C.3.2	C.4	C.5	C.6.1	C.6.2	C.6.3	C.6.4	C.7	C.8	C.9.1	C.9.2	C.9.3	C.10	C.11.1	C.11.2
STATE AND LOCAL GOVERNMENTS	X																X
NON-DOD STAKEHOLDERS						X		X	X	X		X	X	X		X	
OTHER DOD STAKEHOLDERS									X					X			
CUSTOMER / CLIENT		X	X		X	X	X	X	X	X		X	X	X	X	X	X
POTENTIAL BIDDERS															X		
CONSTRUCTION CONTRACTOR																X	X
CONTRACTING OFFICER (KO)															X	X	X
LOCAL GEOGRAPHIC CORPS DISTRICT						X		X				X	X				
GEOGRAPHIC DISTRICT PROJECT MANAGER					X												
USING SERVICE	X	X	X		X	X	X	X		X		X	X			X	X
RESIDENT ENGINEER (RE) OR OTHER FIELD QA																X	X
PROJECT MANAGER (PM)	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X
CHIEF OF DESIGN	X										X	X					
TECHNICAL MANAGER	X		X						X								
PROJECT ENGINEER / ARCHITECT (PE/A)		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
TECHNICAL BRANCH CHIEF	X					X	X	X	X	X	X	X	X	X	X	X	
PROJECT DELIVERY TEAM (PDT)	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
ENVIRONMENTAL AND UTILITIES BRANCH				X													
SITE DEVELOPMENT BRANCH				X													
GEOTECHNICAL BRANCH				X													
VALUE ENGINEERING OFFICER (VEO)	X					X		X					X			X	X
VALUE ENGINEERING STUDY TEAM						X		X					X				
ED QA ENGINEER	X																
COST ENGINEERING BRANCH						X		X		X	X	X	X	X	X	X	X
ITR TEAM LEADER											X	X		X			
INDEPENDENT TECHNICAL REVIEW (ITR) TEAM											X	X		X			
GEOSPATIAL COORDINATOR	X			X				X	X				X	X			
MANAGEMENT REPRESENTATIVE	X																
DIRECTOR OF ENGINEERING (ED)	X											X	X	X		X	
DIRECTORATE OF CONTACTING (CT)															X		
RECORDS MANAGEMENT		X			X	X		X	X	X	X			X		X	X
COMMANDER																X	X
ACSIM / HQ USACE					X												
HNC PLANNING & PROGRAMMING CX					X												
CENTER OF STANDARDIZATION (COS)					X												
CONTRACTOR OR OTHER NON-HNC DOCUMENT PREPARER							X										

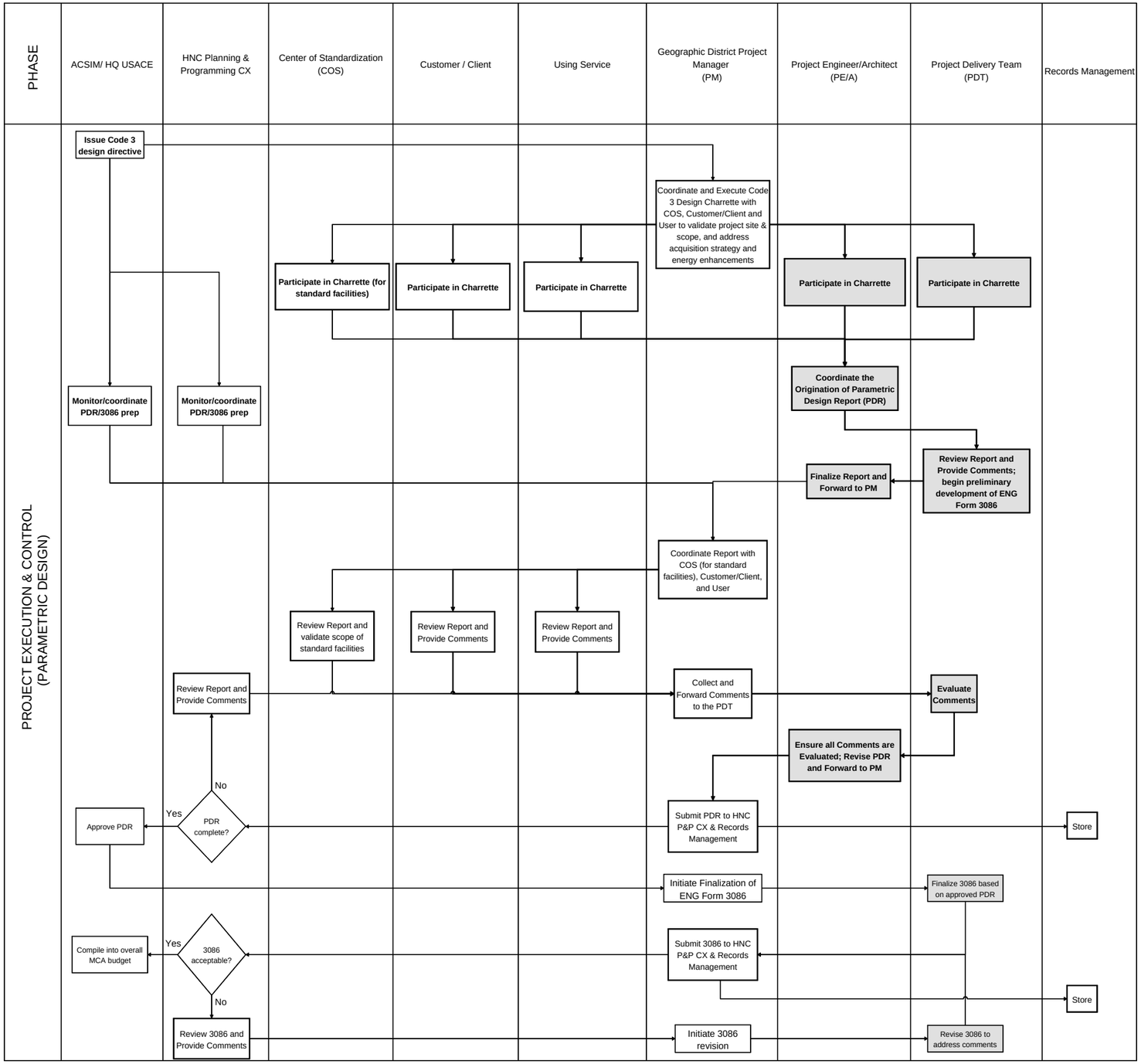

PHASE
Customer / Client
Using Service
Project Manager (PM)
Chief of Design (Process Owner)
Project Engineer/Architect (PE/A)
Technical Branch Chief
Project Delivery Team (PDT)
Value Engineering Officer (VEO)
ED QA Engineer
Geospatial Coordinator
Management Representative
PROJECT PLANNING (PMP DEVELOPMENT)
Notify Chief of Design that project has been initiated
Request Assignment of PDT Members
Assign Design Team Member for Branch Discipline
Approve List of Project Design Team (PDT) Members
Assemble List of Design Team Members and Coordinate List with Chief of Design (incl MCX/TCX as approp)
Notify PE/A of Assigned Design Team Members
Approved ?
No
Yes
Enter PDT Members into P2
Develop Draft PMP (include Value Management Plan as req'd)
Prepare draft geospatial data management plan
Review Draft PMP
Review Draft PMP
Review Draft PMP
Review Draft PMP
Finalize & gain approval for PMP (Project Scope, Customer Requirements, Schedule, etc.)
Prepare Design/RFP In -house?
Yes
No
Originate Draft Design Quality Control Plan (DQCP); Attach the PMP to DQCP as an appendix.
Coordinate Review of Draft DQCP
Review Draft DQCP
Review Draft DQCP
Review Draft DQCP
Review Draft DQCP
Review Draft DQCP
Review Draft DQCP
Review Draft DQCP
Finalize DQCP
Provide budget IAW DQCP
Approve and Sign DQCP
Approve and Sign DQCP
Approve and Sign DQCP
Approve and Sign DQCP
Approve and Sign DQCP
Maintain DQCP
Upon project completion, archive DQCP with electronic project design files
Initiate AE or other contractor SOW/IGE
provide SOW/IGE input
Provide draft SOW to customer & in-house reviewers
Assemble draft SOW
Review SOW/IGE input
Provide comments on draft SOW
Provide comments on draft SOW
Distribute comments to PDT
Evaluate & respond to comments
Finalize SOW & IGE
Provide SOW & IGE to KO for contracting action

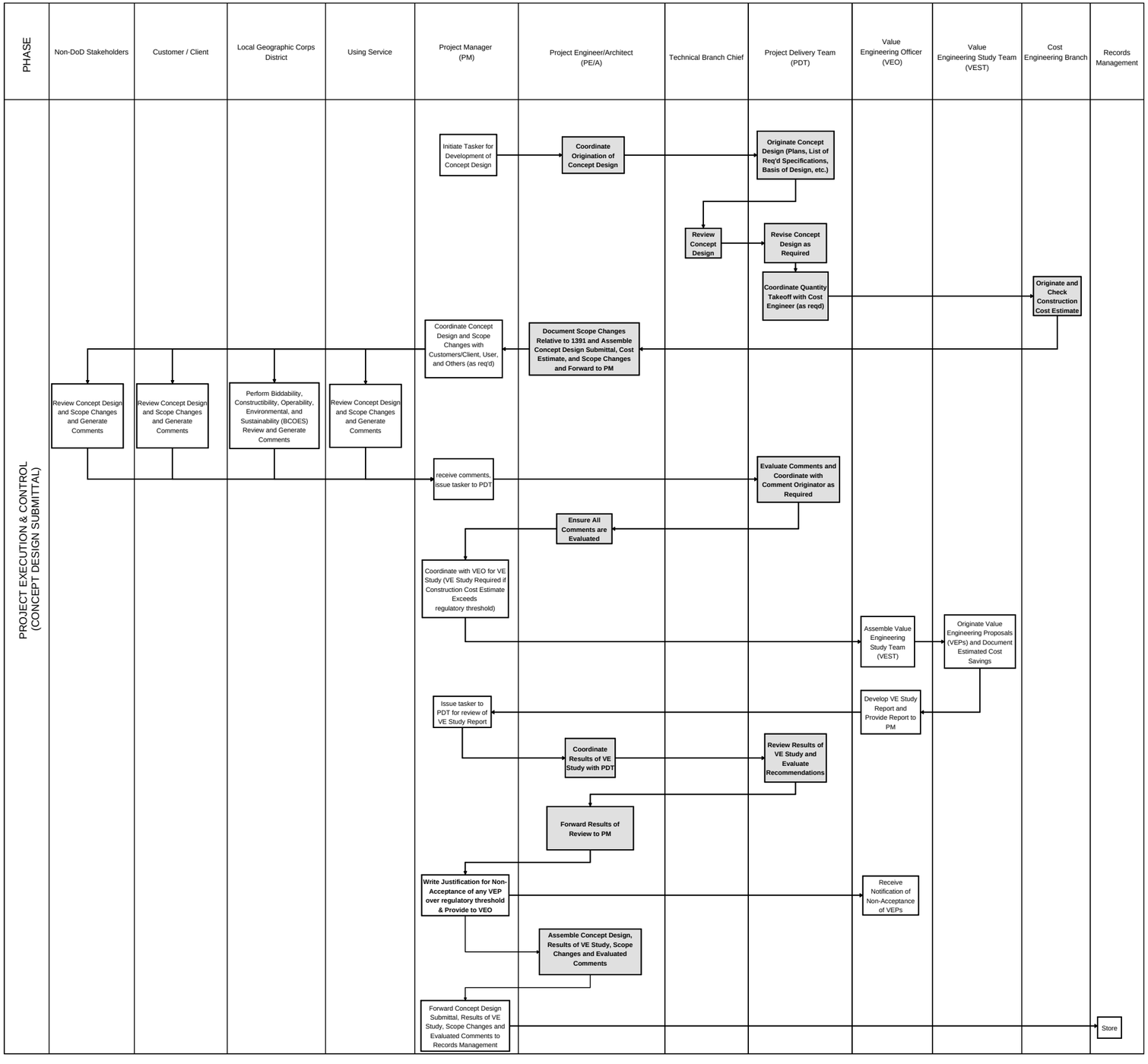

PHASE
Customer / Client
Using Service
Project Manager (PM)
Project Engineer/Architect (PE/A)
Project Delivery Team (PDT)
Records Management
PROJECT EXECUTION & CONTROL (CRITERIA DEVELOPMENT)
Coordinate and Execute Pre-Design Conference/Design Charrette/Site Visit (as appropriate) with Customer/Client and User to establish functional, operational, & sustainability requirements
Participate in Conference/ Charrette/ Site Visit
Participate in Conference/ Charrette/ Site Visit
Participate in Conference/ Charrette/ Site Visit
Participate in Conference/ Charrette/ Site Visit
Coordinate the Origination of Design Conference/ Design Charrette Report
Review Report and Provide Comments
Finalize Report and Forward to PM
Coordinate Report with Customer/Client and User
Review Report and Provide Comments
Review Report and Provide Comments
Collect and Forward Comments to the PDT
Evaluate Comments
Ensure all Comments are Evaluated; Revise Design Conference/Design Charrette Report and Forward to PM
Forward Final Report to Customer/Client, User, and Records Management
Store

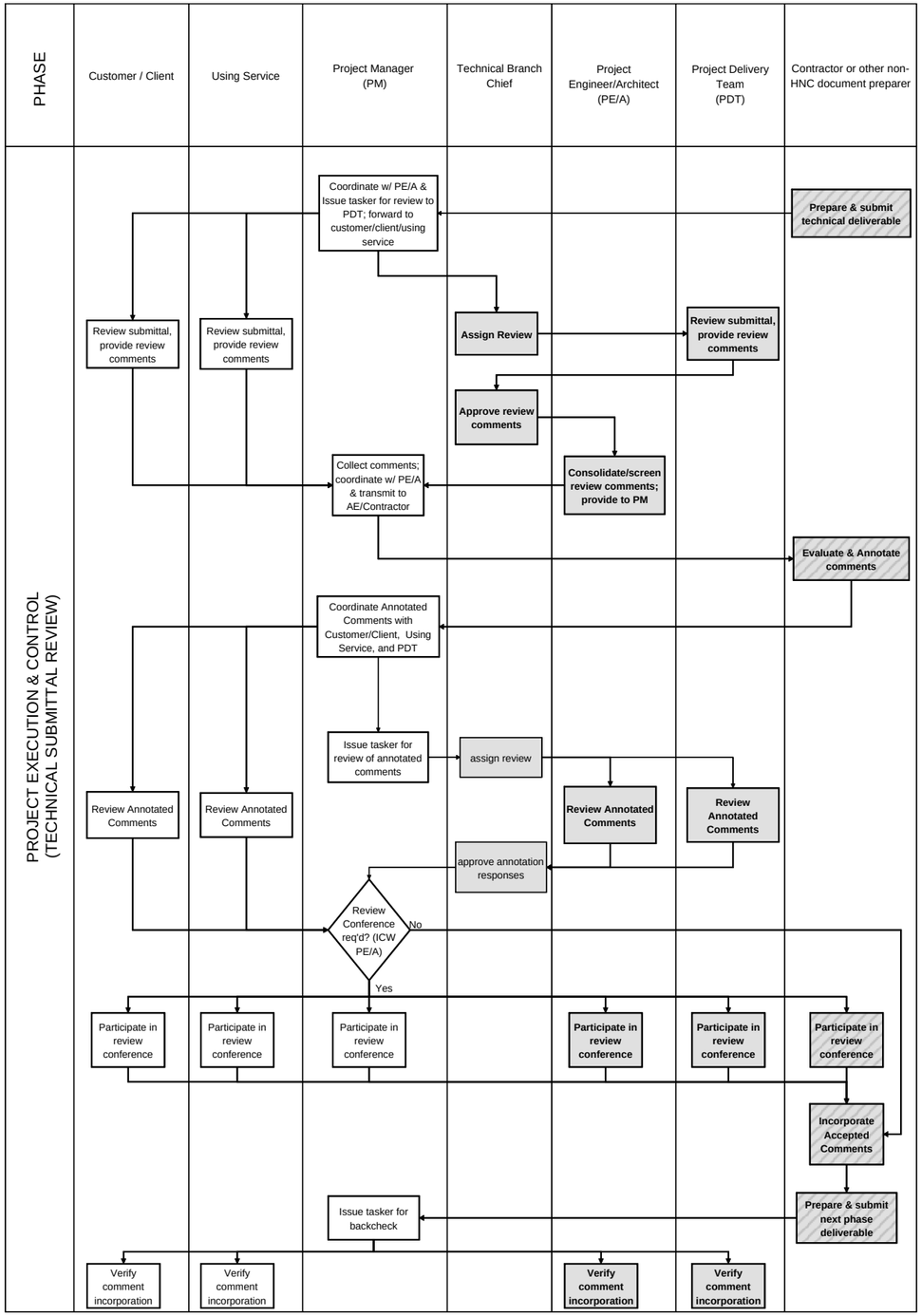

PHASE
Customer / Client
Using Service
Project Manager (PM)
Project Engineer/Architect (PE/A)
Project Delivery Team (PDT)
Architect-Engineer (AE)/Services Contractor
Records Management
PROJECT EXECUTION & CONTROL (CRITERIA DEVELOPMENT)
Coordinate and Execute Pre-Design Conference/Design Charrette with Customer/Client and User to establish functional, operational, & sustainability requirements
Participate in Conference/ Charrette/ Site Visit
Participate in Conference/ Charrette/ Site Visit
Participate in Conference/ Charrette/ Site Visit
Participate in Conference/ Charrette/ Site Visit
Participate in Conference/ Charrette/ Site Visit
Prepare Design Conference/ Design Charrette Report
Finalize Report and Forward to PM
Coordinate Report with Customer/Client, User, and PDT
Review Report and Provide Comments
Review Report and Provide Comments
Review Report and Provide Comments
Review Report and Provide Comments
Collect and Forward Comments to the AE/Contractor
Evaluate/ Resolve Comments
Revise Design Conference/Design Charrette Report and Forward to PM
Forward Final Report to Customer/Client, User, and Records Management
Store

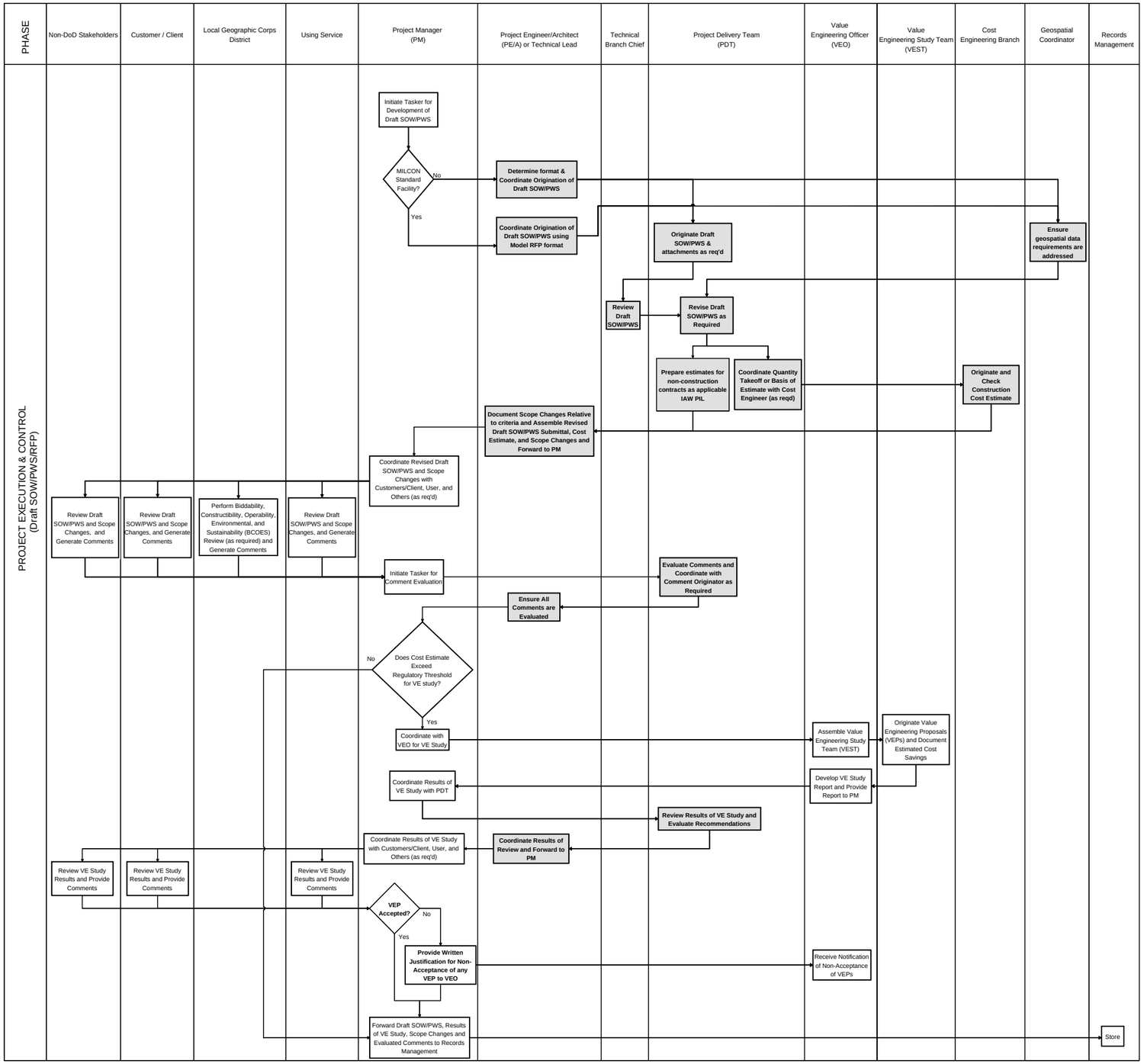

PHASE
Customer / Client (Health Affairs)
Using Service (HFPA; users/providers)
HQUSACE
Project Manager (PM) (at Geographic District)
Project Director
Technical Team Lead
Project Delivery Team (PDT)
A-E or D-B designer
Constructor
PROJECT EXECUTION & CONTROL (MEDICAL MILCON PROCEES FLOW)
Issue Design Directive
Issue Concept of Operations (Conops)
Prepare Medical Design Instruction (MDI)
Initiate Project IAW Corps and District procedures
Prepare A-E SOW or D-B RFP as appropriate
Prepare Design
Coordinate Design Submittal Reviews
assign review
Review design submittals, provide comments
Review design submittals, provide comments
Review design submittals, provide comments
Review design submittals, provide comments
Review/coordinate comments
Coordinate comments with A-E or D-B designer
Incorporate Accepted Comments
(Repeat design/review cycle until design completion)
Prepare & submit next phase deliverable
Advertise/ Award Construction Contract or Release for Construction as appropriate for contract type
Construct project
Provide DDC/S&A services as required/ requested by geographic District

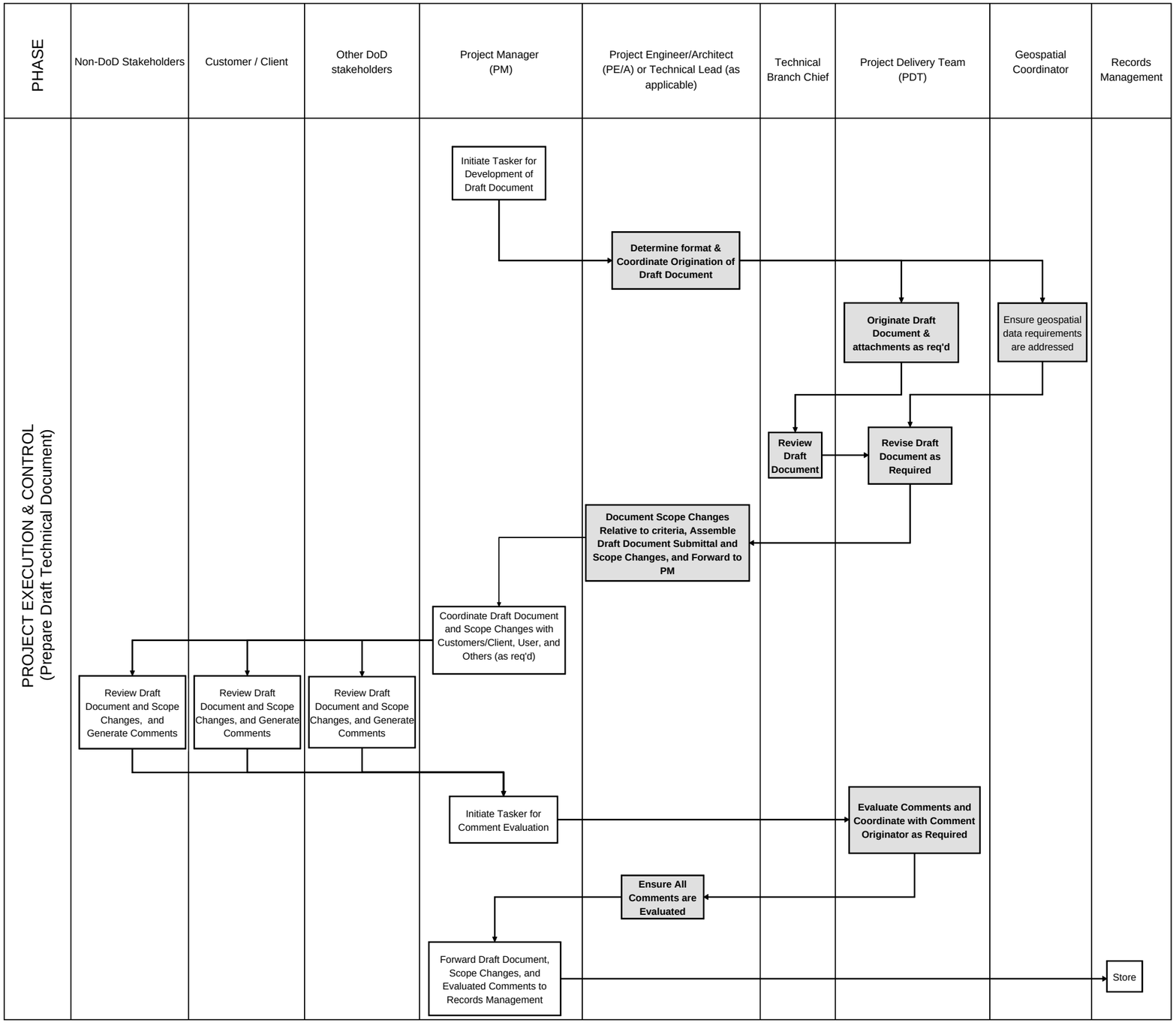

PHASE
PROJECT EXECUTION & CONTROL
(SITE PERMITS, SURVEYS, AND INVESTIGATIONS)
Project Manager (PM)
Project Engineer/Architect (PE/A)
Environmental and Utilities Branch
Site Development Branch
Geotechnical Branch
Geospatial Coordinator
START
Initiate Tasker for Development of Estimates, Schedule, and Acquistion Strategy for Required Site Permits, Surveys and Investigations
Coordinate with Applicable Technical Branch for Development of Estimates, Schedule, and Acquisition Strategy for Permits, Surveys, and Site Investigations
Develop SOW/PWS as required
Develop Acquisition Strategy Recommendation
Develop Estimate and Schedule for Obtaining Site Permits and Other Environmental/ Ordnance Investigations
Develop SOW/PWS as required
Develop Acquisition Strategy Recommendation
Develop Estimate and Schedule for Site Topographic Survey and Erosion Control and Sedimentation Plan
Develop SOW/PWS as required
Develop Acquisition Strategy Recommendation
Develop Estimate and Schedule for Geotechnical Site Investigation
Review & provide input
Revise SOW as required
Revise SOW as required
Revise SOW as required
Review Estimates, Schedule, and Proposed Acquisition Strategy
Coordinate Acquistion Strategy with PM
No
Approve ?
Yes
Provide Funding/Tasker for Execution of Acquisition Strategy
Coordinate Acquisition Strategy
Execute Acquisition Strategy as Tasked
Execute Acquisition Strategy as Tasked
Execute Acquisition Strategy as Tasked

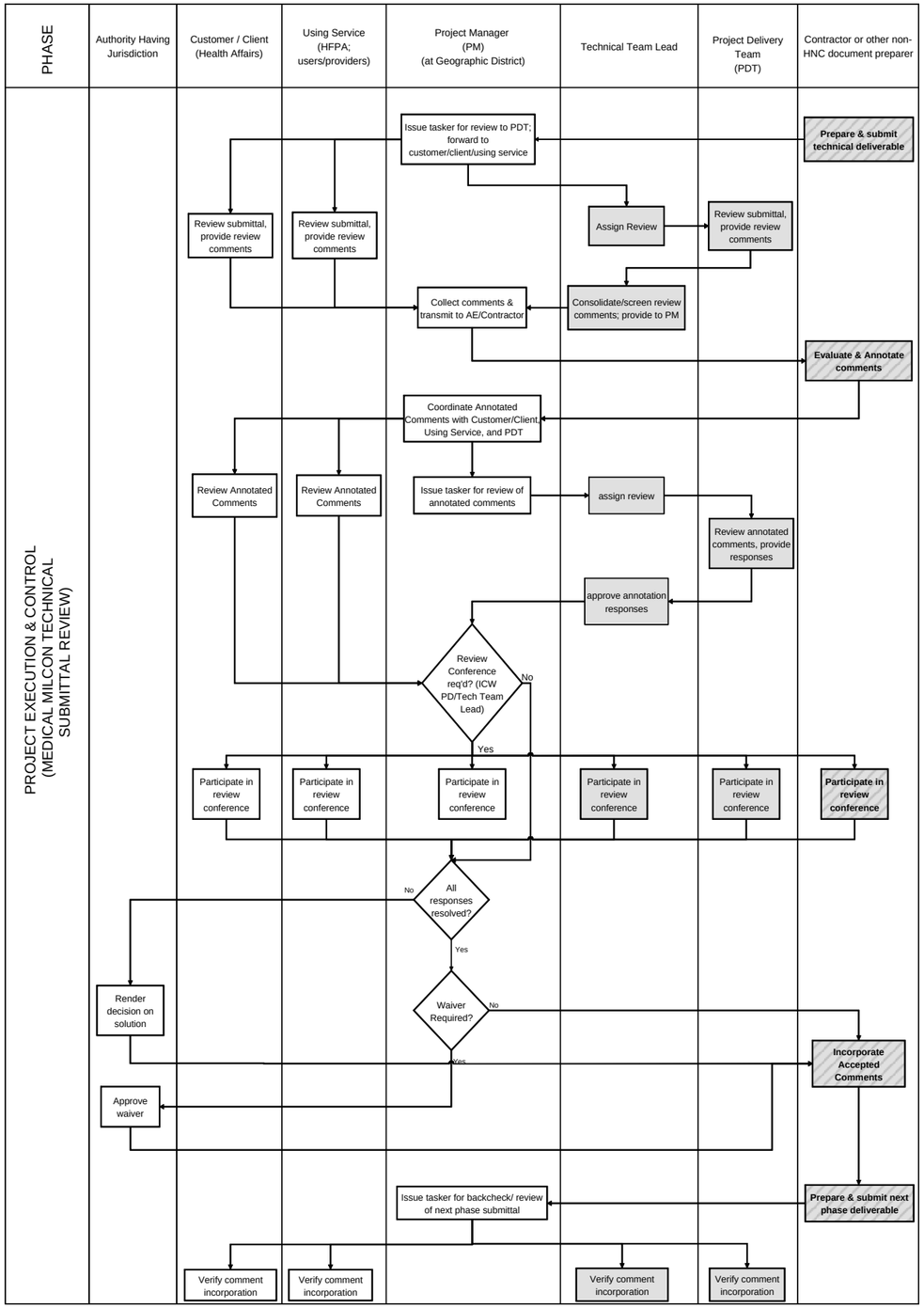

PHASE
ACSIM/ HQ USACE
HNC Planning & Programming CX
Center of Standardization (COS)
Customer / Client
Using Service
Geographic District Project Manager (PM)
Project Engineer/Architect (PE/A)
Project Delivery Team (PDT)
Records Management
PROJECT EXECUTION & CONTROL (PARAMETRIC DESIGN)
Issue Code 3 design directive
Coordinate and Execute Code 3 Design Charrette with COS, Customer/Client and User to validate project site & scope, and address acquisition strategy and energy enhancements
Participate in Charrette (for standard facilities)
Participate in Charrette
Participate in Charrette
Participate in Charrette
Participate in Charrette
Monitor/coordinate PDR/3086 prep
Monitor/coordinate PDR/3086 prep
Coordinate the Origination of Parametric Design Report (PDR)
Review Report and Provide Comments; begin preliminary development of ENG Form 3086
Finalize Report and Forward to PM
Coordinate Report with COS (for standard facilities), Customer/Client, and User
Review Report and validate scope of standard facilities
Review Report and Provide Comments
Review Report and Provide Comments
Review Report and Provide Comments
Collect and Forward Comments to the PDT
Evaluate Comments
Ensure all Comments are Evaluated; Revise PDR and Forward to PM
No
Yes
PDR complete?
Approve PDR
Submit PDR to HNC P&P CX & Records Management
Store
Initiate Finalization of ENG Form 3086
Finalize 3086 based on approved PDR
Yes
3086 acceptable?
Compile into overall MCA budget
Submit 3086 to HNC P&P CX & Records Management
Store
No
Review 3086 and Provide Comments
Initiate 3086 revision
Revise 3086 to address comments

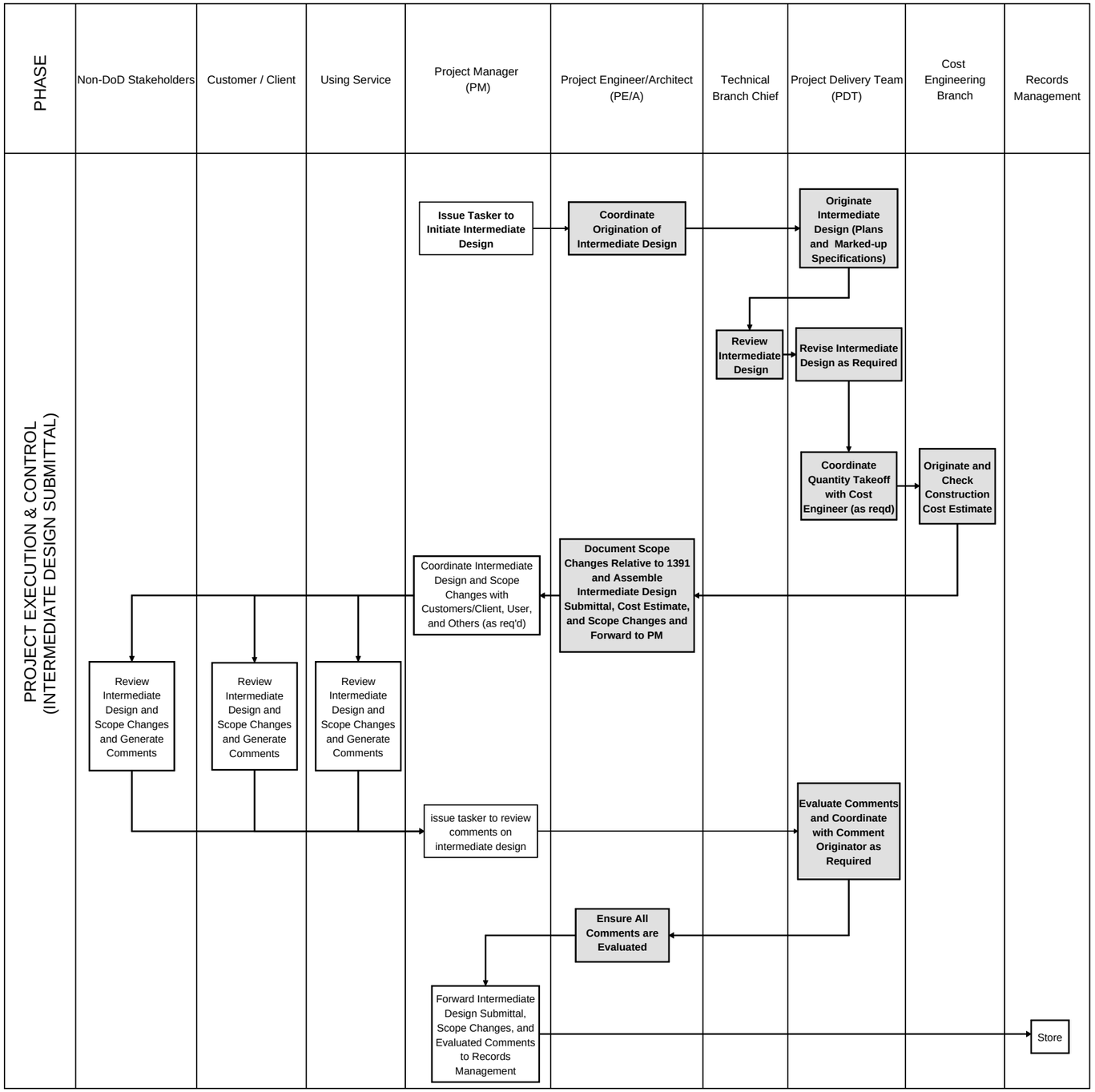

PHASE
Non-DoD Stakeholders
Customer / Client
Local Geographic Corps District
Using Service
Project Manager (PM)
Project Engineer/Architect (PE/A)
Technical Branch Chief
Project Delivery Team (PDT)
Value Engineering Officer (VEO)
Value Engineering Study Team (VEST)
Cost Engineering Branch
Records Management
PROJECT EXECUTION & CONTROL (CONCEPT DESIGN SUBMITTAL)
Initiate Tasker for Development of Concept Design
Coordinate Origination of Concept Design
Originate Concept Design (Plans, List of Req'd Specifications, Basis of Design, etc.)
Review Concept Design
Revise Concept Design as Required
Coordinate Quantity Takeoff with Cost Engineer (as reqd)
Originate and Check Construction Cost Estimate
Coordinate Concept Design and Scope Changes with Customers/Client, User, and Others (as req'd)
Document Scope Changes Relative to 1391 and Assemble Concept Design Submittal, Cost Estimate, and Scope Changes and Forward to PM
Review Concept Design and Scope Changes and Generate Comments
Review Concept Design and Scope Changes and Generate Comments
Perform Biddability, Constructibility, Operability, Environmental, and Sustainability (BCOES) Review and Generate Comments
Review Concept Design and Scope Changes and Generate Comments
receive comments, issue tasker to PDT
Evaluate Comments and Coordinate with Comment Originator as Required
Ensure All Comments are Evaluated
Coordinate with VEO for VE Study (VE Study Required if Construction Cost Estimate Exceeds regulatory threshold)
Assemble Value Engineering Study Team (VEST)
Originate Value Engineering Proposals (VEPs) and Document Estimated Cost Savings
Issue tasker to PDT for review of VE Study Report
Develop VE Study Report and Provide Report to PM
Coordinate Results of VE Study with PDT
Review Results of VE Study and Evaluate Recommendations
Forward Results of Review to PM
Write Justification for Non-Acceptance of any VEP over regulatory threshold & Provide to VEO
Receive Notification of Non-Acceptance of VEPs
Assemble Concept Design, Results of VE Study, Scope Changes and Evaluated Comments
Forward Concept Design Submittal, Results of VE Study, Scope Changes and Evaluated Comments to Records Management
Store

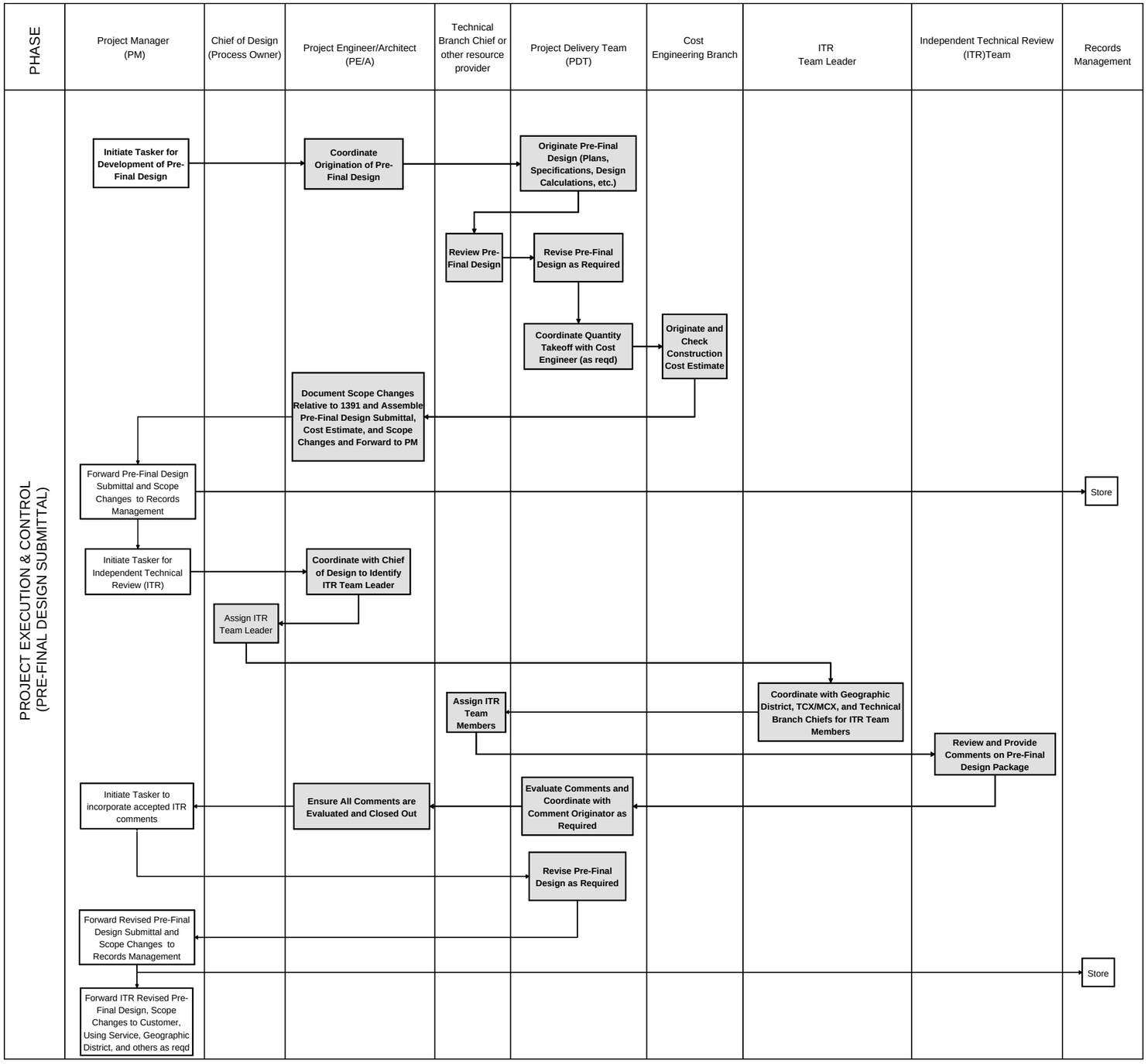

PHASE
Customer / Client
Using Service
Project Manager (PM)
Technical Branch Chief
Project Engineer/Architect (PE/A)
Project Delivery Team (PDT)
Contractor or other non-HNC document preparer
PROJECT EXECUTION & CONTROL (TECHNICAL SUBMITTAL REVIEW)
Coordinate w/ PE/A & Issue tasker for review to PDT; forward to customer/client/using service
Prepare & submit technical deliverable
Review submittal, provide review comments
Review submittal, provide review comments
Assign Review
Review submittal, provide review comments
Approve review comments
Collect comments; coordinate w/ PE/A & transmit to AE/Contractor
Consolidate/screen review comments; provide to PM
Evaluate & Annotate comments
Coordinate Annotated Comments with Customer/Client, Using Service, and PDT
Issue tasker for review of annotated comments
assign review
Review Annotated Comments
Review Annotated Comments
Review Annotated Comments
Review Annotated Comments
approve annotation responses
Review Conference req'd? (ICW PE/A)
No
Yes
Participate in review conference
Participate in review conference
Participate in review conference
Participate in review conference
Participate in review conference
Participate in review conference
Incorporate Accepted Comments
Issue tasker for backcheck
Prepare & submit next phase deliverable
Verify comment incorporation
Verify comment incorporation
Verify comment incorporation
Verify comment incorporation

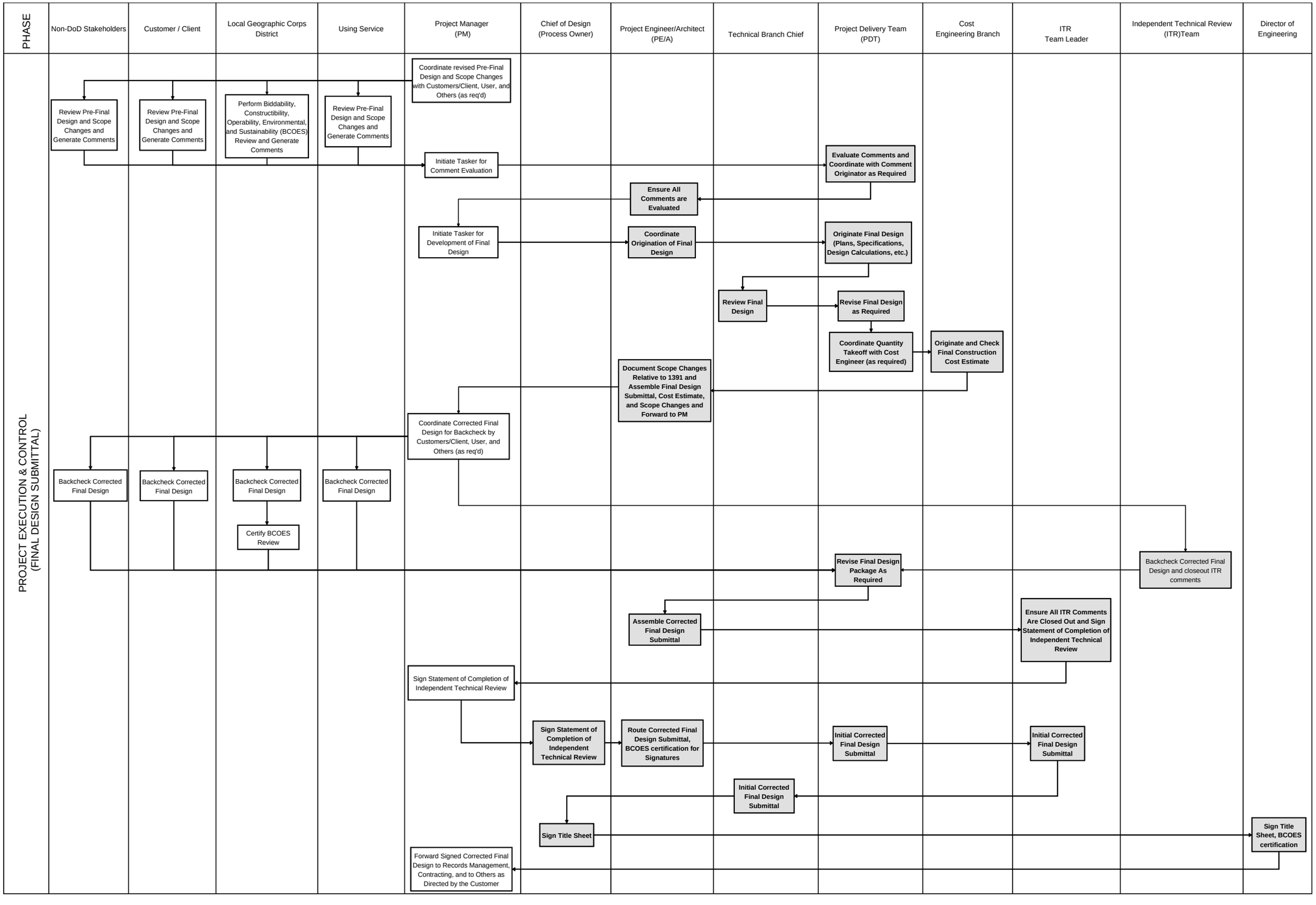

PHASE
PROJECT EXECUTION & CONTROL (Draft SOW/PWS/RFP)
Non-DoD Stakeholders
Customer / Client
Local Geographic Corps District
Using Service
Project Manager (PM)
Project Engineer/Architect (PE/A) or Technical Lead
Technical Branch Chief
Project Delivery Team (PDT)
Value Engineering Officer (VEO)
Value Engineering Study Team (VEST)
Cost Engineering Branch
Geospatial Coordinator
Records Management
Initiate Tasker for Development of Draft SOW/PWS
MILCON Standard Facility?
No
Yes
Determine format & Coordinate Origination of Draft SOW/PWS
Coordinate Origination of Draft SOW/PWS using Model RFP format
Originate Draft SOW/PWS & attachments as req'd
Ensure geospatial data requirements are addressed
Review Draft SOW/PWS
Revise Draft SOW/PWS as Required
Prepare estimates for non-construction contracts as applicable IAW PIL
Coordinate Quantity Takeoff or Basis of Estimate with Cost Engineer (as reqd)
Originate and Check Construction Cost Estimate
Document Scope Changes Relative to criteria and Assemble Revised Draft SOW/PWS Submittal, Cost Estimate, and Scope Changes and Forward to PM
Coordinate Revised Draft SOW/PWS and Scope Changes with Customers/Client, User, and Others (as req'd)
Review Draft SOW/PWS and Scope Changes, and Generate Comments
Review Draft SOW/PWS and Scope Changes, and Generate Comments
Perform Biddability, Constructibility, Operability, Environmental, and Sustainability (BCOES) Review (as required) and Generate Comments
Review Draft SOW/PWS and Scope Changes, and Generate Comments
Initiate Tasker for Comment Evaluation
Evaluate Comments and Coordinate with Comment Originator as Required
Ensure All Comments are Evaluated
Does Cost Estimate Exceed Regulatory Threshold for VE study?
No
Yes
Coordinate with VEO for VE Study
Assemble Value Engineering Study Team (VEST)
Originate Value Engineering Proposals (VEPs) and Document Estimated Cost Savings
Develop VE Study Report and Provide Report to PM
Coordinate Results of VE Study with PDT
Review Results of VE Study and Evaluate Recommendations
Coordinate Results of Review and Forward to PM
Coordinate Results of VE Study with Customers/Client, User, and Others (as req'd)
Review VE Study Results and Provide Comments
Review VE Study Results and Provide Comments
Review VE Study Results and Provide Comments
VEP Accepted?
No
Yes
Provide Written Justification for Non-Acceptance of any VEP to VEO
Receive Notification of Non-Acceptance of VEPs
Forward Draft SOW/PWS, Results of VE Study, Scope Changes and Evaluated Comments to Records Management
Store

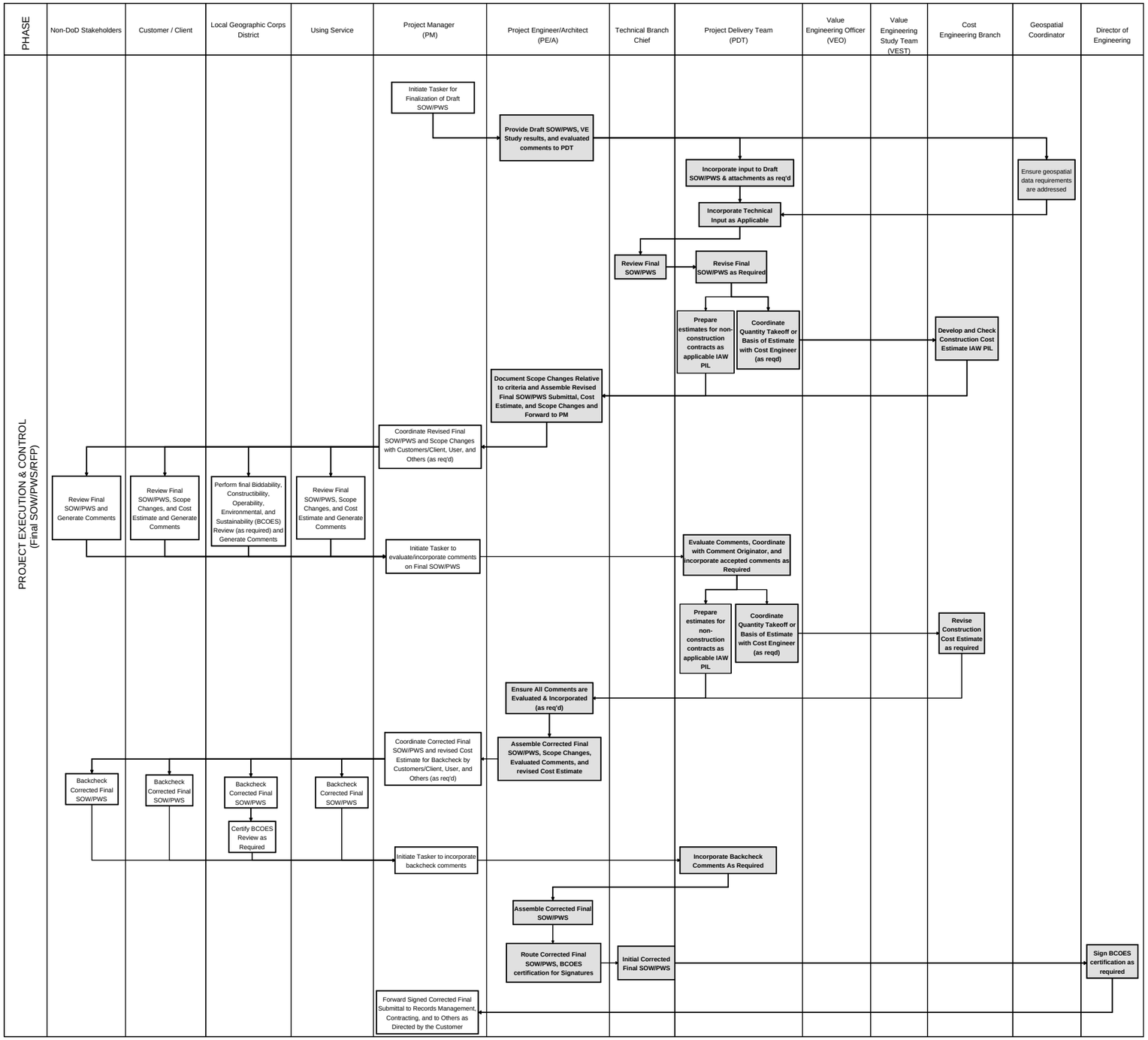

PHASE
Non-DoD Stakeholders
Customer / Client
Other DoD stakeholders
Project Manager (PM)
Project Engineer/Architect (PE/A) or Technical Lead (as applicable)
Technical Branch Chief
Project Delivery Team (PDT)
Geospatial Coordinator
Records Management
PROJECT EXECUTION & CONTROL (Prepare Draft Technical Document)
Initiate Tasker for Development of Draft Document
Determine format & Coordinate Origination of Draft Document
Originate Draft Document & attachments as req'd
Ensure geospatial data requirements are addressed
Review Draft Document
Revise Draft Document as Required
Document Scope Changes Relative to criteria, Assemble Draft Document Submittal and Scope Changes, and Forward to PM
Coordinate Draft Document and Scope Changes with Customers/Client, User, and Others (as req'd)
Review Draft Document and Scope Changes, and Generate Comments
Review Draft Document and Scope Changes, and Generate Comments
Review Draft Document and Scope Changes, and Generate Comments
Initiate Tasker for Comment Evaluation
Evaluate Comments and Coordinate with Comment Originator as Required
Ensure All Comments are Evaluated
Forward Draft Document, Scope Changes, and Evaluated Comments to Records Management
Store

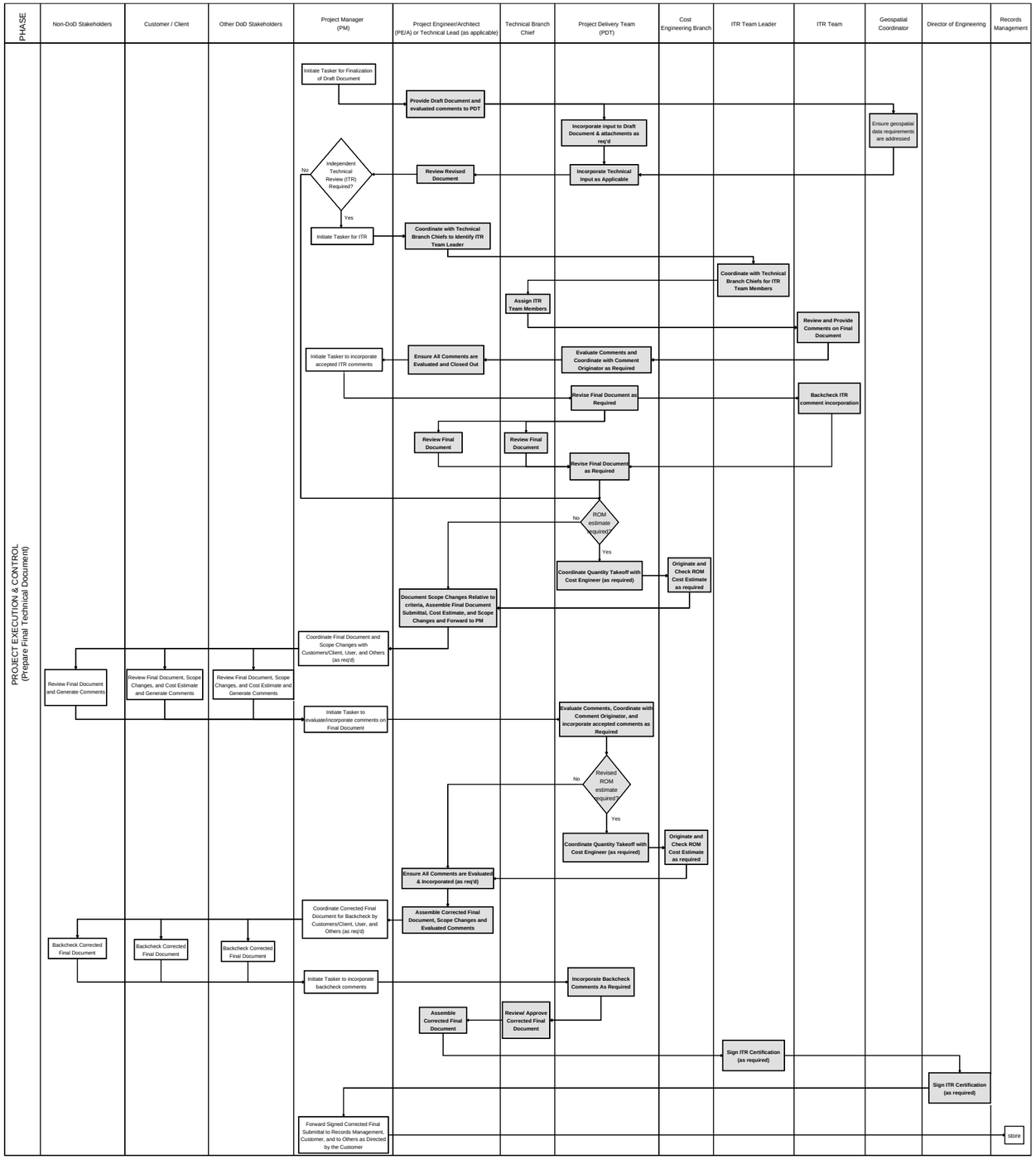

PHASE
Authority Having Jurisdiction
Customer / Client (Health Affairs)
Using Service (HFPA; users/providers)
Project Manager (PM) (at Geographic District)
Technical Team Lead
Project Delivery Team (PDT)
Contractor or other non-HNC document preparer
PROJECT EXECUTION & CONTROL (MEDICAL MILCON TECHNICAL SUBMITTAL REVIEW)
Issue tasker for review to PDT; forward to customer/client/using service
Prepare & submit technical deliverable
Review submittal, provide review comments
Review submittal, provide review comments
Assign Review
Review submittal, provide review comments
Collect comments & transmit to AE/Contractor
Consolidate/screen review comments; provide to PM
Evaluate & Annotate comments
Coordinate Annotated Comments with Customer/Client, Using Service, and PDT
Review Annotated Comments
Review Annotated Comments
Issue tasker for review of annotated comments
assign review
Review annotated comments, provide responses
approve annotation responses
Review Conference req'd? (ICW PD/Tech Team Lead)
No
Yes
Participate in review conference
Participate in review conference
Participate in review conference
Participate in review conference
Participate in review conference
Participate in review conference
All responses resolved?
No
Yes
Waiver Required?
No
Yes
Render decision on solution
Incorporate Accepted Comments
Approve waiver
Issue tasker for backcheck/ review of next phase submittal
Prepare & submit next phase deliverable
Verify comment incorporation
Verify comment incorporation
Verify comment incorporation
Verify comment incorporation

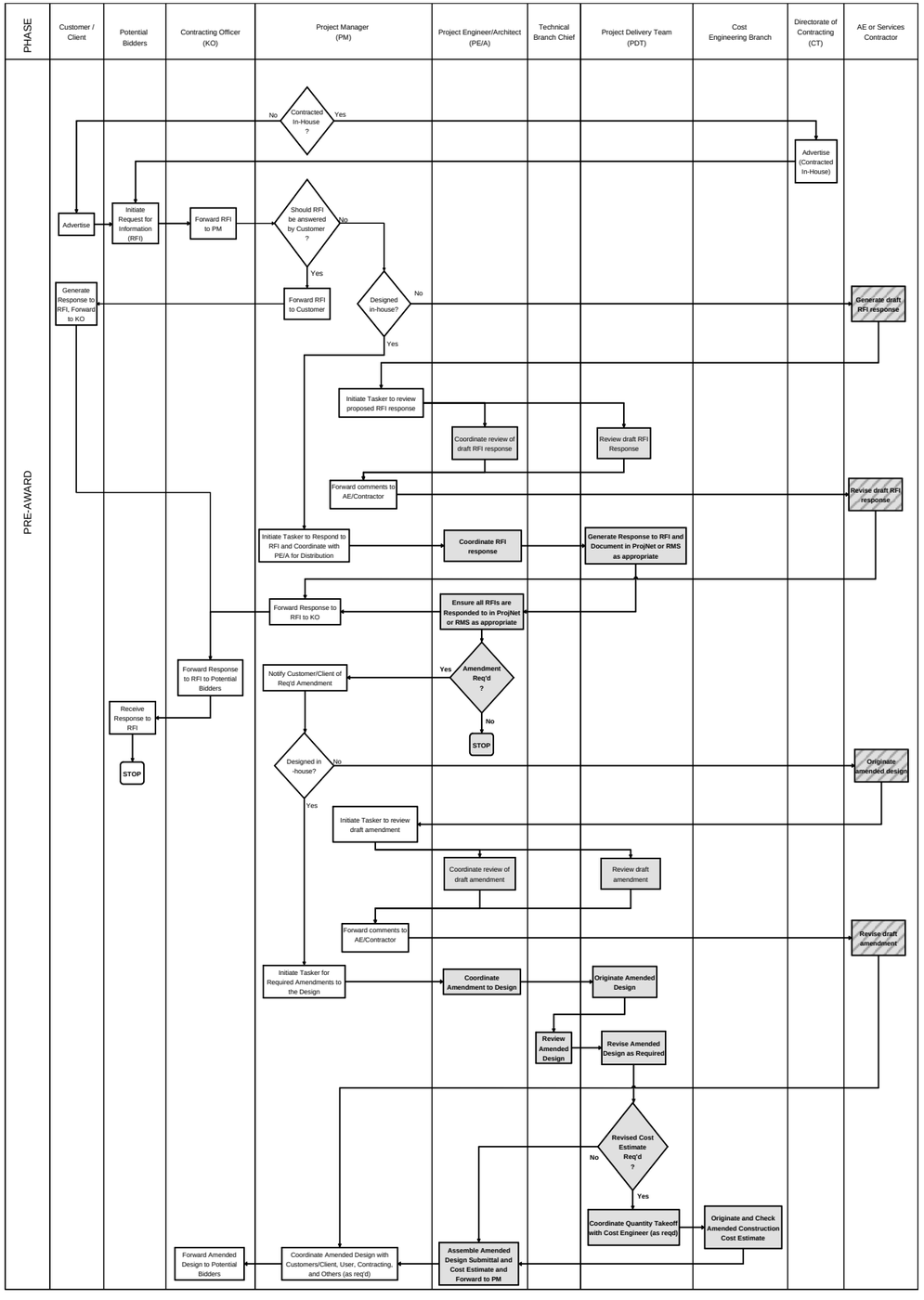

PHASE
Non-DoD Stakeholders
Customer / Client
Using Service
Project Manager (PM)
Project Engineer/Architect (PE/A)
Technical Branch Chief
Project Delivery Team (PDT)
Cost Engineering Branch
Records Management
PROJECT EXECUTION & CONTROL
(INTERMEDIATE DESIGN SUBMITTAL)
Issue Tasker to Initiate Intermediate Design
Coordinate Origination of Intermediate Design
Originate Intermediate Design (Plans and Marked-up Specifications)
Review Intermediate Design
Revise Intermediate Design as Required
Coordinate Quantity Takeoff with Cost Engineer (as reqd)
Originate and Check Construction Cost Estimate
Document Scope Changes Relative to 1391 and Assemble Intermediate Design Submittal, Cost Estimate, and Scope Changes and Forward to PM
Coordinate Intermediate Design and Scope Changes with Customers/Client, User, and Others (as req'd)
Review Intermediate Design and Scope Changes and Generate Comments
Review Intermediate Design and Scope Changes and Generate Comments
Review Intermediate Design and Scope Changes and Generate Comments
issue tasker to review comments on intermediate design
Evaluate Comments and Coordinate with Comment Originator as Required
Ensure All Comments are Evaluated
Forward Intermediate Design Submittal, Scope Changes, and Evaluated Comments to Records Management
Store

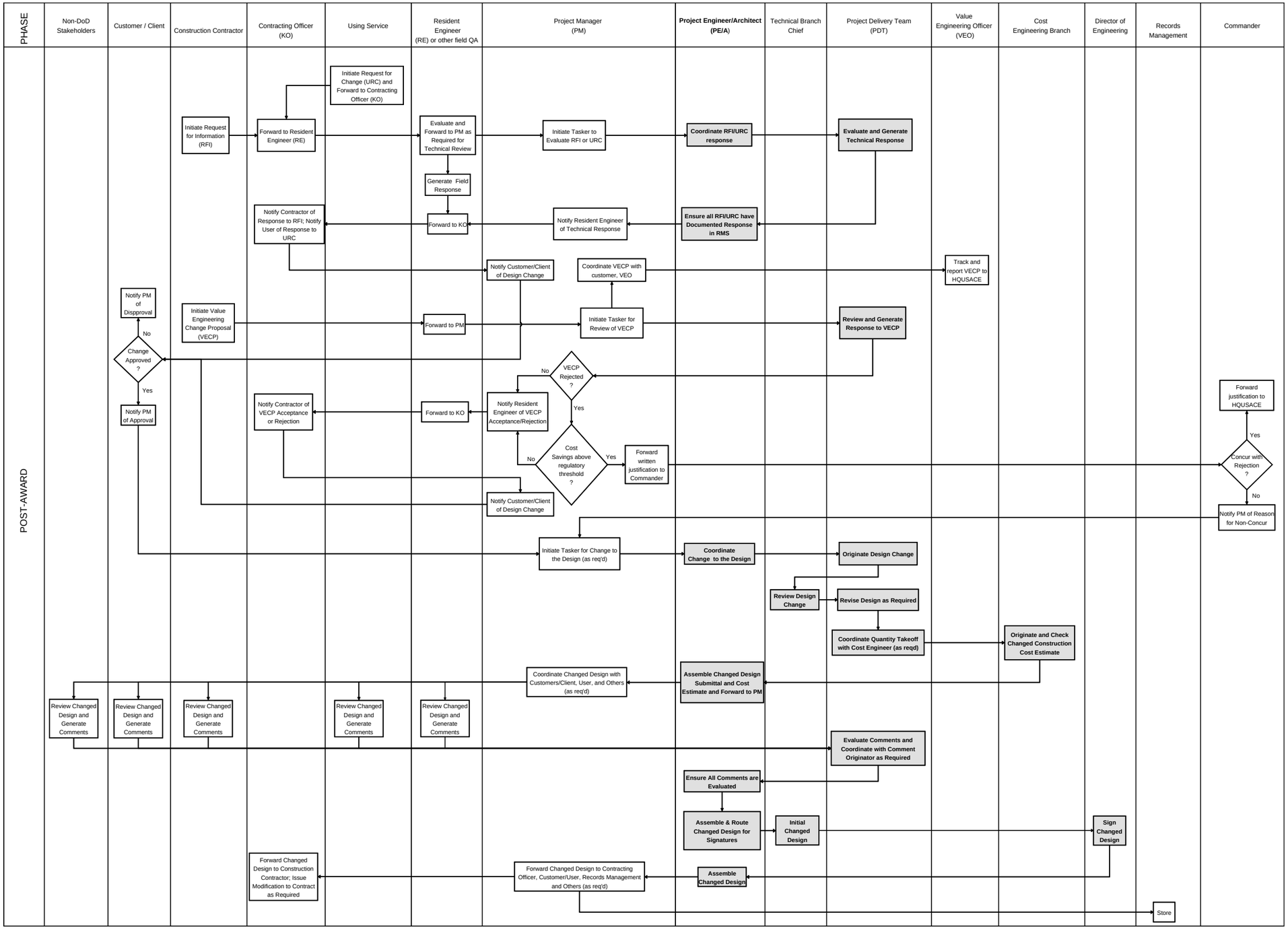

PHASE
Project Manager (PM)
Chief of Design (Process Owner)
Project Engineer/Architect (PE/A)
Technical Branch Chief or other resource provider
Project Delivery Team (PDT)
Cost Engineering Branch
ITR Team Leader
Independent Technical Review (ITR)Team
Records Management
PROJECT EXECUTION & CONTROL (PRE-FINAL DESIGN SUBMITTAL)
Initiate Tasker for Development of Pre-Final Design
Coordinate Origination of Pre-Final Design
Originate Pre-Final Design (Plans, Specifications, Design Calculations, etc.)
Review Pre-Final Design
Revise Pre-Final Design as Required
Coordinate Quantity Takeoff with Cost Engineer (as reqd)
Originate and Check Construction Cost Estimate
Document Scope Changes Relative to 1391 and Assemble Pre-Final Design Submittal, Cost Estimate, and Scope Changes and Forward to PM
Forward Pre-Final Design Submittal and Scope Changes to Records Management
Store
Initiate Tasker for Independent Technical Review (ITR)
Coordinate with Chief of Design to Identify ITR Team Leader
Assign ITR Team Leader
Assign ITR Team Members
Coordinate with Geographic District, TCX/MCX, and Technical Branch Chiefs for ITR Team Members
Review and Provide Comments on Pre-Final Design Package
Initiate Tasker to incorporate accepted ITR comments
Ensure All Comments are Evaluated and Closed Out
Evaluate Comments and Coordinate with Comment Originator as Required
Revise Pre-Final Design as Required
Forward Revised Pre-Final Design Submittal and Scope Changes to Records Management
Store
Forward ITR Revised Pre-Final Design, Scope Changes to Customer, Using Service, Geographic District, and others as reqd

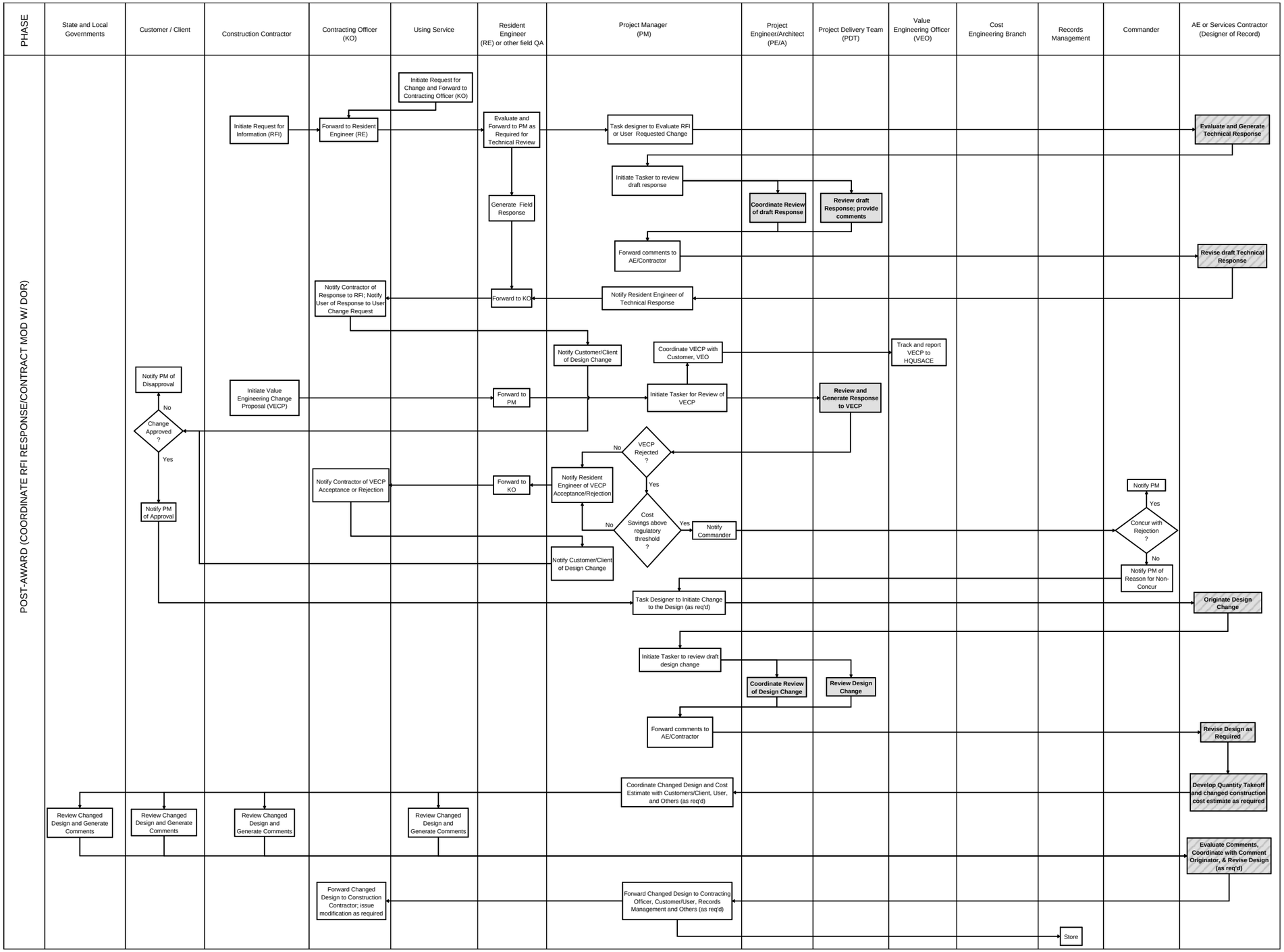

PHASE
Non-DoD Stakeholders
Customer / Client
Local Geographic Corps District
Using Service
Project Manager (PM)
Chief of Design (Process Owner)
Project Engineer/Architect (PE/A)
Technical Branch Chief
Project Delivery Team (PDT)
Cost Engineering Branch
ITR Team Leader
Independent Technical Review (ITR)Team
Director of Engineering
PROJECT EXECUTION & CONTROL (FINAL DESIGN SUBMITTAL)
Coordinate revised Pre-Final Design and Scope Changes with Customers/Client, User, and Others (as req'd)
Review Pre-Final Design and Scope Changes and Generate Comments
Review Pre-Final Design and Scope Changes and Generate Comments
Perform Biddability, Constructibility, Operability, Environmental, and Sustainability (BCOES) Review and Generate Comments
Review Pre-Final Design and Scope Changes and Generate Comments
Initiate Tasker for Comment Evaluation
Evaluate Comments and Coordinate with Comment Originator as Required
Ensure All Comments are Evaluated
Initiate Tasker for Development of Final Design
Coordinate Origination of Final Design
Originate Final Design (Plans, Specifications, Design Calculations, etc.)
Review Final Design
Revise Final Design as Required
Coordinate Quantity Takeoff with Cost Engineer (as required)
Originate and Check Final Construction Cost Estimate
Document Scope Changes Relative to 1391 and Assemble Final Design Submittal, Cost Estimate, and Scope Changes and Forward to PM
Coordinate Corrected Final Design for Backcheck by Customers/Client, User, and Others (as req'd)
Backcheck Corrected Final Design
Backcheck Corrected Final Design
Backcheck Corrected Final Design
Certify BCOES Review
Backcheck Corrected Final Design
Revise Final Design Package As Required
Backcheck Corrected Final Design and closeout ITR comments
Assemble Corrected Final Design Submittal
Ensure All ITR Comments Are Closed Out and Sign Statement of Completion of Independent Technical Review
Sign Statement of Completion of Independent Technical Review
Sign Statement of Completion of Independent Technical Review
Route Corrected Final Design Submittal, BCOES certification for Signatures
Initial Corrected Final Design Submittal
Initial Corrected Final Design Submittal
Initial Corrected Final Design Submittal
Sign Title Sheet
Sign Title Sheet, BCOES certification
Forward Signed Corrected Final Design to Records Management, Contracting, and to Others as Directed by the Customer


PHASE
Non-DoD Stakeholders
Customer / Client
Local Geographic Corps District
Using Service
Project Manager (PM)
Project Engineer/Architect (PE/A)
Technical Branch Chief
Project Delivery Team (PDT)
Value Engineering Officer (VEO)
Value Engineering Study Team (VEST)
Cost Engineering Branch
Geospatial Coordinator
Director of Engineering
PROJECT EXECUTION & CONTROL (Final SOW/PWS/RFP)
Initiate Tasker for Finalization of Draft SOW/PWS
Provide Draft SOW/PWS, VE Study results, and evaluated comments to PDT
Incorporate input to Draft SOW/PWS & attachments as req'd
Ensure geospatial data requirements are addressed
Incorporate Technical Input as Applicable
Review Final SOW/PWS
Revise Final SOW/PWS as Required
Prepare estimates for non-construction contracts as applicable IAW PIL
Coordinate Quantity Takeoff or Basis of Estimate with Cost Engineer (as reqd)
Develop and Check Construction Cost Estimate IAW PIL
Document Scope Changes Relative to criteria and Assemble Revised Final SOW/PWS Submittal, Cost Estimate, and Scope Changes and Forward to PM
Coordinate Revised Final SOW/PWS and Scope Changes with Customers/Client, User, and Others (as req'd)
Review Final SOW/PWS and Generate Comments
Review Final SOW/PWS, Scope Changes, and Cost Estimate and Generate Comments
Perform final Biddability, Constructibility, Operability, Environmental, and Sustainability (BCOES) Review (as required) and Generate Comments
Review Final SOW/PWS, Scope Changes, and Cost Estimate and Generate Comments
Initiate Tasker to evaluate/incorporate comments on Final SOW/PWS
Evaluate Comments, Coordinate with Comment Originator, and Incorporate accepted comments as Required
Prepare estimates for non-construction contracts as applicable IAW PIL
Coordinate Quantity Takeoff or Basis of Estimate with Cost Engineer (as reqd)
Revise Construction Cost Estimate as required
Ensure All Comments are Evaluated & Incorporated (as req'd)
Assemble Corrected Final SOW/PWS, Scope Changes, Evaluated Comments, and revised Cost Estimate
Coordinate Corrected Final SOW/PWS and revised Cost Estimate for Backcheck by Customers/Client, User, and Others (as req'd)
Backcheck Corrected Final SOW/PWS
Backcheck Corrected Final SOW/PWS
Backcheck Corrected Final SOW/PWS
Backcheck Corrected Final SOW/PWS
Certify BCOES Review as Required
Initiate Tasker to incorporate backcheck comments
Incorporate Backcheck Comments As Required
Assemble Corrected Final SOW/PWS
Route Corrected Final SOW/PWS, BCOES certification for Signatures
Initial Corrected Final SOW/PWS
Sign BCOES certification as required
Forward Signed Corrected Final Submittal to Records Management, Contracting, and to Others as Directed by the Customer


PHASE
PROJECT EXECUTION & CONTROL
(Prepare Final Technical Document)
Non-DoD Stakeholders
Customer / Client
Other DoD Stakeholders
Project Manager (PM)
Project Engineer/Architect (PE/A) or Technical Lead (as applicable)
Technical Branch Chief
Project Delivery Team (PDT)
Cost Engineering Branch
ITR Team Leader
ITR Team
Geospatial Coordinator
Director of Engineering
Records Management
Initiate Tasker for Finalization of Draft Document
Provide Draft Document and evaluated comments to PDT
Incorporate input to Draft Document & attachments as req'd
Ensure geospatial data requirements are addressed
Independent Technical Review (ITR) Required?
No
Review Revised Document
Incorporate Technical Input as Applicable
Yes
Initiate Tasker for ITR
Coordinate with Technical Branch Chiefs to Identify ITR Team Leader
Coordinate with Technical Branch Chiefs for ITR Team Members
Assign ITR Team Members
Review and Provide Comments on Final Document
Initiate Tasker to incorporate accepted ITR comments
Ensure All Comments are Evaluated and Closed Out
Evaluate Comments and Coordinate with Comment Originator as Required
Revise Final Document as Required
Backcheck ITR comment incorporation
Review Final Document
Review Final Document
Revise Final Document as Required
ROM estimate required
No
Yes
Coordinate Quantity Takeoff with Cost Engineer (as required)
Originate and Check ROM Cost Estimate as required
Document Scope Changes Relative to criteria, Assemble Final Document Submittal, Cost Estimate, and Scope Changes and Forward to PM
Coordinate Final Document and Scope Changes with Customers/Client, User, and Others (as req'd)
Review Final Document and Generate Comments
Review Final Document, Scope Changes, and Cost Estimate and Generate Comments
Review Final Document, Scope Changes, and Cost Estimate and Generate Comments
Initiate Tasker to Evaluate/Incorporate comments on Final Document
Evaluate Comments, Coordinate with Comment Originator, and incorporate accepted comments as Required
Revised ROM estimate required
No
Yes
Coordinate Quantity Takeoff with Cost Engineer (as required)
Originate and Check ROM Cost Estimate as required
Ensure All Comments are Evaluated & Incorporated (as req'd)
Assemble Corrected Final Document, Scope Changes and Evaluated Comments
Coordinate Corrected Final Document for Backcheck by Customers/Client, User, and Others (as req'd)
Backcheck Corrected Final Document
Backcheck Corrected Final Document
Backcheck Corrected Final Document
Initiate Tasker to incorporate backcheck comments
Incorporate Backcheck Comments As Required
Assemble Corrected Final Document
Review/ Approve Corrected Final Document
Sign ITR Certification (as required)
Sign ITR Certification (as required)
Forward Signed Corrected Final Submittal to Records Management, Customer, and to Others as Directed by the Customer
store


PHASE
PRE-AWARD
Customer / Client
Potential Bidders
Contracting Officer (KO)
Project Manager (PM)
Project Engineer/Architect (PE/A)
Technical Branch Chief
Project Delivery Team (PDT)
Cost Engineering Branch
Directorate of Contracting (CT)
AE or Services Contractor
Contracted In-House ?
No
Yes
Advertise (Contracted In-House)
Advertise
Initiate Request for Information (RFI)
Forward RFI to PM
Should RFI be answered by Customer ?
No
Yes
Forward RFI to Customer
Designed in-house?
No
Yes
Generate Response to RFI, Forward to KO
Generate draft RFI response
Initiate Tasker to review proposed RFI response
Coordinate review of draft RFI response
Review draft RFI Response
Forward comments to AE/Contractor
Revise draft RFI response
Initiate Tasker to Respond to RFI and Coordinate with PE/A for Distribution
Coordinate RFI response
Generate Response to RFI and Document in ProjNet or RMS as appropriate
Forward Response to RFI to KO
Ensure all RFIs are Responded to in ProjNet or RMS as appropriate
Forward Response to RFI to Potential Bidders
Amendment Req'd ?
Yes
No
STOP
Notify Customer/Client of Req'd Amendment
Receive Response to RFI
STOP
Designed in -house?
No
Yes
Originate amended design
Initiate Tasker to review draft amendment
Coordinate review of draft amendment
Review draft amendment
Forward comments to AE/Contractor
Revise draft amendment
Initiate Tasker for Required Amendments to the Design
Coordinate Amendment to Design
Originate Amended Design
Review Amended Design
Revise Amended Design as Required
Revised Cost Estimate Req'd ?
No
Yes
Coordinate Quantity Takeoff with Cost Engineer (as reqd)
Originate and Check Amended Construction Cost Estimate
Forward Amended Design to Potential Bidders
Coordinate Amended Design with Customers/Client, User, Contracting, and Others (as req'd)
Assemble Amended Design Submittal and Cost Estimate and Forward to PM


PHASE
Non-DoD Stakeholders
Customer / Client
Construction Contractor
Contracting Officer (KO)
Using Service
Resident Engineer (RE) or other field QA
Project Manager (PM)
Project Engineer/Architect (PE/A)
Technical Branch Chief
Project Delivery Team (PDT)
Value Engineering Officer (VEO)
Cost Engineering Branch
Director of Engineering
Records Management
Commander
POST-AWARD
Initiate Request for Change (URC) and Forward to Contracting Officer (KO)
Initiate Request for Information (RFI)
Forward to Resident Engineer (RE)
Evaluate and Forward to PM as Required for Technical Review
Initiate Tasker to Evaluate RFI or URC
Coordinate RFI/URC response
Evaluate and Generate Technical Response
Generate Field Response
Notify Contractor of Response to RFI; Notify User of Response to URC
Forward to KO
Notify Resident Engineer of Technical Response
Ensure all RFI/URC have Documented Response in RMS
Notify Customer/Client of Design Change
Coordinate VECP with customer, VEO
Track and report VECP to HQUSACE
Notify PM of Disproval
Initiate Value Engineering Change Proposal (VECP)
Forward to PM
Initiate Tasker for Review of VECP
Review and Generate Response to VECP
No
Change Approved ?
Yes
VECP Rejected ?
Notify PM of Approval
Notify Contractor of VECP Acceptance or Rejection
Forward to KO
Notify Resident Engineer of VECP Acceptance/Rejection
No
Cost Savings above regulatory threshold ?
Yes
Forward written justification to Commander
Forward justification to HQUSACE
Yes
Concur with Rejection ?
No
Notify PM of Reason for Non-Concur
Notify Customer/Client of Design Change
Initiate Tasker for Change to the Design (as req'd)
Coordinate Change to the Design
Originate Design Change
Review Design Change
Revise Design as Required
Coordinate Quantity Takeoff with Cost Engineer (as reqd)
Originate and Check Changed Construction Cost Estimate
Coordinate Changed Design with Customers/Client, User, and Others (as req'd)
Assemble Changed Design Submittal and Cost Estimate and Forward to PM
Review Changed Design and Generate Comments
Review Changed Design and Generate Comments
Review Changed Design and Generate Comments
Review Changed Design and Generate Comments
Review Changed Design and Generate Comments
Evaluate Comments and Coordinate with Comment Originator as Required
Ensure All Comments are Evaluated
Assemble & Route Changed Design for Signatures
Initial Changed Design
Sign Changed Design
Forward Changed Design to Construction Contractor; Issue Modification to Contract as Required
Forward Changed Design to Contracting Officer, Customer/User, Records Management and Others (as req'd)
Assemble Changed Design
Store


PHASE
POST-AWARD (COORDINATE RFI RESPONSE/CONTRACT MOD W/ DOR)
State and Local Governments
Customer / Client
Construction Contractor
Contracting Officer (KO)
Using Service
Resident Engineer (RE) or other field QA
Project Manager (PM)
Project Engineer/Architect (PE/A)
Project Delivery Team (PDT)
Value Engineering Officer (VEO)
Cost Engineering Branch
Records Management
Commander
AE or Services Contractor (Designer of Record)
Initiate Request for Change and Forward to Contracting Officer (KO)
Initiate Request for Information (RFI)
Forward to Resident Engineer (RE)
Evaluate and Forward to PM as Required for Technical Review
Task designer to Evaluate RFI or User Requested Change
Evaluate and Generate Technical Response
Initiate Tasker to review draft response
Coordinate Review of draft Response
Review draft Response; provide comments
Generate Field Response
Forward comments to AE/Contractor
Revise draft Technical Response
Notify Contractor of Response to RFI; Notify User of Response to User Change Request
Forward to KO
Notify Resident Engineer of Technical Response
Notify Customer/Client of Design Change
Coordinate VECP with Customer, VEO
Track and report VECP to HQUSACE
Notify PM of Disapproval
Initiate Value Engineering Change Proposal (VECP)
Forward to PM
Initiate Tasker for Review of VECP
Review and Generate Response to VECP
No
Change Approved ?
Yes
No
VECP Rejected ?
Yes
Notify Contractor of VECP Acceptance or Rejection
Forward to KO
Notify Resident Engineer of VECP Acceptance/Rejection
Notify PM
Yes
Concur with Rejection ?
No
Notify PM of Approval
No
Cost Savings above regulatory threshold ?
Yes
Notify Commander
Notify PM of Reason for Non-Concur
Notify Customer/Client of Design Change
Task Designer to Initiate Change to the Design (as req'd)
Originate Design Change
Initiate Tasker to review draft design change
Coordinate Review of Design Change
Review Design Change
Forward comments to AE/Contractor
Revise Design as Required
Coordinate Changed Design and Cost Estimate with Customers/Client, User, and Others (as req'd)
Develop Quantity Takeoff and changed construction cost estimate as required
Review Changed Design and Generate Comments
Review Changed Design and Generate Comments
Review Changed Design and Generate Comments
Review Changed Design and Generate Comments
Evaluate Comments, Coordinate with Comment Originator, & Revise Design (as req'd)
Forward Changed Design to Construction Contractor; issue modification as required
Forward Changed Design to Contracting Officer, Customer/User, Records Management and Others (as req'd)
Store

APPENDIX D SAMPLE CERTIFICATIONS

APPENDIX D.1

STATEMENT OF TECHNICAL REVIEW

COMPLETION OF INDEPENDENT TECHNICAL REVIEW

The Huntsville Center has completed the (type of product) of (project name and location).

Notice is hereby given that an independent technical review, that is appropriate to the level of risk and complexity inherent in the project, has been conducted as defined in the Design Quality Control Plan. During the independent technical review, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This verification included review of assumptions; methods, procedures, and material used in analyses; alternatives evaluated; the appropriateness of data used and level obtained; and reasonableness of the result, including whether the product meets the customer's needs consistent with the law and existing Corps policy. The independent technical review was accomplished by a team established in accordance with ER 1110-1-12. All comments resulting from the independent technical review have been resolved and no outstanding issues remain.

_____ _____

Technical Review Team Leader Date

_____ _____

Technical Manager Date

CERTIFICATION OF INDEPENDENT TECHNICAL REVIEW

Significant concerns and the explanation of the resolution are as follows:

(Describe the major technical concerns, possible impact, and resolution.)

As noted above, all concerns resulting from the independent technical review of the project have been fully resolved.

_____ _____

Director of Engineering Date

Appendix D.2

Biddability, Constructability, Operability, Environmental, Sustainability (BCOES) Review Certification

Name of Project/Project Number:
_____/_____

Phase of Type of Project: _____

Certification Date: _____

I (PM) certify that the Value Engineering process as required by ER 11-1-321 (Change 1 or latest version), Army Programs Value Engineering has been completed for this procurement action. I certify compliance with Public Law 99-662 (33 USC 2288) and OMB Circular A-131. A VE study was (completed/waived) on _____ by the appropriate authority. All rejected VE proposals indicating potential savings of over $1,000,000 have been resolved with approval of the MSC Commander.

_____
_____

Project Manager (dd/mm/yr) Value Engineering Officer (dd/mm/yr)

The Bid or RFP package has been reviewed for Biddability, Constructability, Operability, Environmental and Sustainability (BCOES) requirements in accordance with ER 415-1-11. The undersigned certify that all appropriate BCOES review comments have either been incorporated into the Bid or RFP Package or otherwise satisfactorily resolved. Comments, evaluations, and backchecks are documented in DrChecks.

_____
_____

Engineering Directorate (dd/mm/yr) Local Customer Rep/HNC Rep (dd/mm/yr)

_____

Installation Support Directorate (dd/mm/yr)

APPENDIX E SAMPLE SCOPE OF WORK OUTLINE

E-1 OUTLINE FOR DEVELOPING A STATEMENT OF WORK (SOW)

This document provides an outline for preparing a specific SOW. Please be aware that there may be sections in this outline that may not need to be included in your program's SOW. The following information should be included in all SOWs: an introduction and a brief background for the project under which this SOW will be issued; the scope of the effort, and specific objectives to be achieved; a list of the most significant reference items relevant to the project; requirements that define precisely what is needed in terms of tasks to be performed and deliverables to be produced; and Progress and compliance to detail reporting requirements for the project. Additional areas that may be included are; transmittal/ delivery/accessibility provisions, security requirements, or other requirements specific to your program. Attachments, if any, should follow the last section.

1. INTRODUCTION AND OVERVIEW

This statement of work will be issued under contract [name of contract and contract number]. Briefly describe the project and its relationship to your program mission.

1.1 BACKGROUND

Write a brief narrative describing how this project "came to be".

1.2 SCOPE OF WORK

Begin with a narrative paragraph describing the scope of work covered by this SOW.

When applicable, include an overall hierarchy of the work being performed; it can be in form of a Work Breakdown Structure (WBS).

1.3 OBJECTIVES

List the specific objectives for this SOW in bullet form. Be sure they are consistent with the scope and fit within the WBS, if provided.

1.4 PERIOD OF PERFORMANCE

This section identifies the period of performance for the funding to be obligated under this action. If this action is for incremental funding, then the projected total period of performance to project completion, should also be included.

1.5 PROJECTED COST

If this action represents incremental or partial funding, list the total estimated cost for this Task Order, from this action to completion. Consider providing the Programmed Amount for design-build projects.

2. REFERENCES

All applicable documents referenced in this SOW are listed below. Where appropriate, a brief annotation should be provided to indicate the relevance of the document.

Reference any specific requirements with regard to the use of these documents in performing the work under this SOW.

3. REQUIREMENTS

This section defines the requirements in terms of tasks to be performed, the end results/deliverables to be achieved, and the schedule of key dates. Important compliance requirements should be included with the task descriptions and deliverables.

3.1 TASKS

The tasks to be performed under this contract shall be described in discrete functional areas, or subtasks, with each work area described clearly and completely. The Tasks description must provide sufficient detail that any contractor can understand the requirements, the methodology, and the outcomes and deliverables under the task.

Conduct the following tasks:

List the tasks (no. and name) in sequential order by phase (if applicable). Provide sufficient level of detail to enable the prospective contractor to plan personnel utilization and other requirements with maximum efficiency.

- Desired Methodology
- Illustrations/Drawings/Diagrams, if any
- Specifications
- Data/Property/Facilities
- Level-of-Effort
- Place/Travel

3.2 END RESULTS/DELIVERABLES

This section describes the products and tangible end results that are expected from each task contained in the previous section, the date each deliverable is due, and the government acceptance criteria.

3.2.1 List of Deliverables by Task

For large efforts, deliverables may be divided by subtask. The following table provides a complete listing of the required deliverables by task. The table includes, Task No. and Name, End Result/Deliverable, Tool for creating it, Acceptance Criteria, and Intended Use, as applicable.

Task	End Result/Deliverable	Schedule/Milestone

3.3 SCHEDULES/MILESTONES

Maintain a single project schedule from which various project reports shall be produced.

The following reports shall be provided:

3.3.1 Who Does What When Report

The "Who does what when" report shall be provided by the contractor with the initial submission, and again following negotiations. This report will be used by the Government to assess the adequacy of the resources proposed by the contractor to accomplish the SOW.

3.4 OTHER CONSIDERATIONS

Include here any other relevant information for the performance of the SOW that does not fit elsewhere.

4. PROGRESS/COMPLIANCE

The Government requires the following from contractors in order to monitor progress and ensure compliance:

- Weekly Status Report
- Weekly Meetings
- Monthly Progress Report
- Project Management Team (PMT) Meetings
- Program Reviews
- Outlines and Drafts

5. TRANSMITTAL/DELIVERY/ACCESSIBILITY

The contractor shall provide [x] hard copies of each deliverable and one electronic version.

6. NOTES

If for reasons of clarity or brevity previous sections need further amplification, use this section for that purpose and for all other information that does not logically fit into previous sections. The information designed to assist in determining the applicability of the specification and the selection of appropriate type, grade, or class of the product or service.

Preparer Note: For Design-Build Requests for Proposal the List of Deliverables by Task, Schedules/Milestones, Who Does What When Report, Other Considerations, Progress/Compliance, and Transmittal/Delivery/Accessibility should be included as applicable Division 01 UFGS tailored for DESIGN-BUILD.

APPENDIX F DESIGN MANUAL CHANGE RECOMMENDATION FORMS

Appendix F.1

Design Manual Change Recommendation Form

HNC Engineering Design Manual Change Recommendation Form						
Chapter and Paragraph number Impacted:						
Urgency:		Critical (Implement immediately)		Normal (Implement at next periodic update)		
Type of Change:		Reference Update		Process/requirement change		
Name:		**Office/ Agency:**		**Date Submitted:**		
Email:			**Phone Number:**			
1. Current Description (include Document pages as applicable)						
2. Problem						
3. Change Recommendation (Include specific wording for suggested change)						
4. Benefit						
This section to be completed by analyzing/reviewing Official (CEHNC Branch Chief)						
Name:		**Office/ Agency:**		**Date Received:**		
Email:		**Phone Number:**		**Date Completed:**		
Recommended Action			**Approve**		**Disapprove**	

Analyzing/Reviewing Official's Comments					
This section to be completed by Validating Official (CEHNC-ED Chief of Design)					
Name:		**Office/ Agency:**		**Date Received:**	
Email:		**Phone Number:**		**Date Completed:**	
	Approved	**Implementation Assigned to:**			**Disapproved**
Validating Official's Comments					
This section to be completed by Implementing Official					
Name:		**Office/ Agency:**		**Date Received:**	
Email:		**Phone Number:**		**Date Completed:**	
Action Taken:					
Implementing Official's Comments					
Change Recommendation Tracking Number:					

Appendix F.2

Design Manual Change Recommendation Register

Change Number	Paragraph Number	Submitter Name	Date Submitted	Approved ? (Yes or No, with date)	Implementation Assigned to: (Name)	Action completed (Date)

APPENDIX G GENERAL PROJECT INFORMATION

(By Project Leader)

(To be completed prior to forwarding to designer for completion)

1. Project Name:
2. Project Number: (P-No, SP-No, ESR-NO, Other)
3. Contract Number: N68711 -
4. Contract Type: IFB RFP DESBLD Other
5. Estimated Construction Cost (ECC) $
6. A-E Firm:
7. Point of Contact:
8. Phone Number: ( )
9. Area Focus Team (AFT)
10. Project Leader:
11. Phone Number: ( )
12. Contract Specialist:
13. Phone Number: ( )
14. ROICC:
15. Phone Number: ( )

PROJECT INFORMATION FORM

INFORMATION REQUIRED FOR CONTRACTS

(TO BE COMPLETED BY THE DESIGNER or A-E DESIGNER)

I. *INSTRUCTIONS TO BIDDERS/PROPOSERS*

1. Does project include unit prices? Yes No

If yes, include the following and coordinate with specification section:

a. Lump sum for all work not covered in the unit price items listed below:

$

b. Unit price per for

$ Per x = $

c. Unit price per for

$ Per x = $

Total Price Base Bid Item 0001 $

2. Are there also Additive or Deductive Bid items? Yes No

What are the additive or deductive bid item(s):

If yes, coordinate with Contracts, as this requires Contracting Officer approval.

Coordinated: Not Applicable Yes No

3. Reference to FAC 5252.214-9301, Notice To Bidders

Does the project include additive bid items? Yes No

If yes, include the following (May be included as an attachment):

(i) Base Bid Item 0001 shall be the entire work complete in accordance with the drawings and specifications, but not including work indicated or specified to be provided under any of the other bid items.

(ii) Additive Bid Items 0001AA shall be the addition of the following, complete in accordance with the requirements specified hereinafter:

(iii) Additive Bid Items 0001AB shall be the addition of the following, complete in accordance with the requirements specified hereinafter:

4. Reference FAR 52.236.27, Pre-Bid Site Visitation

(Coordinate with Project Leader and Contracting Officer)

Will a Pre-Bid site visitation be required? Yes No

If yes, complete the following:

(a) Point Of Contact:

(b) Telephone Number ( )

(c) Special Security requirements:

(d) Other special requirements:

5. Reference to FAR 52.217-7, Option for Increased Quantity Separately Priced Line Item.

Will this project have "Option" items? Yes No

If yes, requires Contracting Officer's permission. (Coordinate with the Project Leader and Contracting Officer)

If yes, complete the following (May be included as an attachment):

(i) Option Item 0001 shall be the addition of the following, complete in accordance with the requirements specified hereinafter:

(ii) Option Item 0002 shall be the addition of the following, complete in accordance with the requirements specified hereinafter:

How long of a period, in days, will the option to award be for?

Also, will the option item affect the construction period of the contract?

Yes No

If so, explain (Take into consideration the effect of it being awarded (1) with the original bid, (2) at any time during the specified option period, or (3) at the end of the specified option period):

6. Reference FAR 52.236-4, Physical Data

Is physical data (e.g. test borings, hydrographic, weather conditions data, etc.) to be furnished or made available to offerors Yes No

If yes, fill in applicable data:

a. The indications of physical conditions on the drawings and in the specifications are the result of site investigations.

Insert description of investigative methods used, such as surveys, auger borings, test pits, probing, test tunnels, etc.)

b. Weather conditions:

(insert a summary of weather records and warnings)

c. Transportation facilities:

(insert a summary of transportation facilities providing access to and from the site, including information about their availability and limitations)

d. Insert other pertinent information:

7. Pre-Proposal Conference (Design/Build).

Is a pre-proposal conference to be scheduled? Yes No

If yes, complete the following:

a. Scheduled for (day) Date

b. Location:

c. Point of Contact:

d. Telephone Number: ( )

8. FAR 52.252-3, Alterations In Solicitations

(Consult with Project Leader, and/or Contracting Officer if this information is required or if there will be any special conditions for proposals)

a. Will technical proposals be in several parts? Yes No

If yes describe

b. Will costs be separated from technical requirements? Yes No

c. Will proposal require an administrative breakdown? Yes No

d. Will proposal require an Organization breakdown? Yes No

e. Are instructions on how to breakdown costs required? Yes No

f. Will there be specific or special format for submissions? Yes No

If yes to any item above, attach description.

II. *INFORMATION FOR EVALUATION SECTION 00202*

1. "Source Selection." If this project is an RFP and is using evaluation of bids for selection, complete this section.

"EVALUATION FACTORS FOR AWARD."

III. *INFORMATION FOR SECTION 00452*

1. Reference FAR 52.223-4, Recovered Material Certification

Does this contract specify the use of Recovered Materials? (i.e. materials that have been collected or recovered from solid waste per FAR 23.402)

Yes No

If yes, describe.

IV. *INFORMATION FOR SECTION 00102*

1. A-E edits entire section "List of Drawings" in SPECSINTACT and submits it complete at the 1 00% and final submittal.

Section 00102 included: Yes No

V. *INFORMATION FOR SECTION 00710 OR 00720*

1. Reference DFARS 252.210-7000, Brand Name or Equal

Does the project include any Brand Name or Equal statements? Yes No

If yes, requires prior approval by a Level One Contracting Officer.

Provide the following:

Description:

Spec Section and/or Dwg. No.:

Spec Para. or Drawing View:

Obtain copy of justification form from PL. Will require approval of a Level One Contracting Officer. Attach completed form.

2. Reference FAR 52.211-10 Commencement, Prosecution, and Completion of Work and Alternate I

a. Complete the entire work ready for use not later than _____ calendar days after notice to proceed.

b. Phasing sequence as follows:

3. Reference FAR 52.223-3, Hazardous Material Identification and Material Safety

Data

Will this contract require delivery of hazardous material that will remain in place when the project is completed which the station requires Material Safety Data Sheets? Yes No

a. Location of hazardous material:

b. Material Safety Data Sheet information:

4. Reference FAR 52.225-5, Buy America ACT - Construction Materials

Does the project have any exemptions to the Buy America ACT? Yes No

Prior approval is required for an exemption. If yes, fill in table below:

Description:

Spec Section or Drawing No.:

Spec Paragraph or Drawing View:

5. Does this project specify any Class I Ozone Depleting Substance (ODS)?

Yes No

Attach memorandum for contract file verifying the specification has been reviewed for these substances. When there is no alternative to using ODS, provide technical certification that no other product is available to meet requirements. Some products do have waivers, coordinate with the Project Leader. Use of these products requires the Contracting Officer's approval.

VI. ***INFORMATION FOR SECTION 00711 OR 00721***

1. Reference FAR 52.236-14, FAC 5252.236-9304, and FAC 5252.236-9305

a. Are utilities furnished by the Government or the Contractor? Yes No

b. Will there be any cost to the Contractor for utilities furnished by the Government?

Yes No

If yes, complete the following:

Electric $ per

Water $ per

Gas $ per

Other:_____ $ per

VII. ***INFORMATION REQUIRED BY SECTION 00830***

1. In what city, county, state, and on which base is the project located?

Complete the following:

a. City

b. County

c. State

d. Base

VIII. *SOFTWARE AND COMPUTER REQUIREMENTS*

1. Reference Computer Data and Software Clause, DOD FARS 52.227-7013, and Data

Requirements Clause, DOD FAR 52.227-7031

Does this project require any computer software? Yes No

If yes, complete the following:

Purpose:

Description:

Specification Section:

Project may require completion of Form DD Form 1423, Contract Data, and DD Form

1664, Data Item Description, may be required. Consult with Project Leader and Contracting Officer. RFPs require the use of DD Form 1423.

If these forms are required, complete and attach.

2. Computer Hardware

Does this project require any computer hardware? Yes No

If yes, complete the following:

Purpose:

Description:

Specification Section:

May require review by Counsel and/or Information Systems Support, ADP services, for any special requirements. Coordinate with PL, Contracting Officer, and user.

IX. *PROPRIETARY PRODUCTS*

1. Does this project specify any proprietary items either directly or indirectly?

Yes No

If yes, complete the following:

Indicate where these items can be found in the drawings and specifications.

Description:

Spec Section or Drawing No.

Spec Paragraph or Drawing View:

Obtain copy of justification form from PL. Will require approval of a level one Contracting Officer. Attach the completed form.

X. *Government Furnished Equipment* Yes No

If yes, please identify equipment:

Indicate where these items can be found on the drawing and specifications